

# eBook - Informations about Operating Systems

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<a href="#">AIX Operating System (Unix)</a>	Internet: <a href="#">AIX Operating System (Unix)</a>
<a href="#">AmigaOS Operating System</a>	Internet: <a href="#">AmigaOS Operating System</a>
<a href="#">Android operating system</a>	Internet: <a href="#">Android operating system</a>
<a href="#">Aperios Operating System</a>	Internet: <a href="#">Aperios Operating System</a>
<a href="#">AtheOS Operating System</a>	Internet: <a href="#">AtheOS Operating System</a>
<a href="#">BelA Operating System</a>	Internet: <a href="#">BelA Operating System</a>
<a href="#">BeOS Operating System</a>	Internet: <a href="#">BeOS Operating System</a>
<a href="#">BSD/OS Operating System</a>	Internet: <a href="#">BSD/OS Operating System</a>
<a href="#">CP/M, DR-DOS Operating System</a>	Internet: <a href="#">CP/M, DR-DOS Operating System</a>
<a href="#">Darwin Operating System</a>	Internet: <a href="#">Darwin Operating System</a>
<a href="#">Debian Linux Operating System</a>	Internet: <a href="#">Debian Linux Operating System</a>
<a href="#">eComStation Operating System</a>	Internet: <a href="#">eComStation Operating System</a>
<a href="#">Symbian (EPOC) Operating System</a>	Internet: <a href="#">Symbian (EPOC) Operating System</a>
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<a href="#">Haiku Operating System</a>	Internet: <a href="#">Haiku Operating System</a>
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<a href="#">Red Hat Linux Operating System</a>	Internet: <a href="#">Red Hat Linux Operating System</a>
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Knowledge, Kernel of Operating Systems

Internet: [Knowledge, Kernel of Operating Systems](#)

Knowledge, Platform

Internet: [Knowledge, Platform](#)

Knowledge, References

Internet: [Knowledge, References](#)

Basic knowledge about Operating Systems

Internet: [Basic knowledge about Operating Systems](#)

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**AIX 4.3** AIX is the first 64-bit UNIX that becomes from the NSA in the USA the TCSEC C2 certificate, with modifications it corresponds also the TCSEC B1. AIX 4.3 can run on 64-Bit CPUs binarily 32-Bit programs and 64-Bit programs. The TCP/IP stack and the I/O system were continued to optimize on high efficiency. Up to 128 non removable disks can be combined into a logical group. OpenGL GLX 1.3 and graPHICS extensions make an increased application performance and better handling of large graphic models possible. NIS+, Java support and numerous system management Tools supplement this AIX release.

## Compatibility

Except for special exceptions applications for AIX version 4.1 or 4.2 run also under AIX 4.3- without new compilation. A condition for it are: RS/6000 POWER-, POWER2 and PowerPC-based models. Applications that use some X11R5 server extension (like the Windowmanager), are only executable under AIX version 4.3. Applications that where compiled with specific POWER2 or other PowerPC compiling options, are executable also only with such CPUs. The downward compatibility is reduced in so far that compiled applications on AIX 4.x are not compatible to the older releases of AIX. 64-Bit applications, which were provided on 32-Bit systems under AIX 4.3, can be used on 64-Bit AIX 4.3 systems without problems.

## Areas of application

Applicable on workstation to supercomputers and cluster systems; eBusiness, Intranet, Extranet, enterprise-critical applications

## Structure information

- support for up to 12 CPUs for each computer system
- 32-Bit or 64-Bit Kernel
- support for 64-Bit hardware
- HACMP, High Availability cluster multi-processing
- supports the safety stages C2 and optionally B1 #1
- IBM eNetwork LDAP directory support

**#1** E3/F-C2/B1: these safety stages are published by the Federal Office for security in the information technology for the certified employment in government authorities.

## System environment

- Korn Shell
- Supports JFS and JFS2 file system
- CDE and Motif as graphic surface
- PowerPC architecture

**Monterey** The project Monterey is an association of Intel, IBM and SCO to port AIX to the IA-64 and x86 32-bit architecture, it offers a common platform for SCO and AIX applications and shall be suitable for clusters in the combine of up to 32 nodes. The previous maximum workable file size of 1 tbyte shall be increased up to 8 tbyte. The new operating system shall consist of AIX to 90%, the other share will contain technology of UnixWare and PTX UNIX. Intel will provide server manufacturers with this version, IBM integrates the operating system into the own RS/6000 line and supports the version for PowerPC further. Monterey was started at the end of October 1998 and came in May 2001 to the market. The operating system has been sold only in a low quantity (32 pieces) and it gave difficulties with the Itanium processor so that IBM cancelled Monterey at the end of the year 2002.

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**AIX 5L**AIX (Advanced Interactive eXecutive) is the operating system developed by IBM, to meet the high requirements for the enterprise employment. In addition handling particularly large applications and the scaling ability belong to this high requirements. AIX 5L has the ability to segment programs in memory in 8 x 256 MByte parts, with AIX 5L 5.1 up to 10 x 256 MByte parts and with AIX 5L 5.2, 5.3 up to 13 x 256 MByte parts. AIX was designed for the employment for workstations (for instance the RS/6000 line) to supercomputers (RS/6000 FR) too. AIX is related to the Unix system V and BSD 4.3 operating system. It supported distinguished different platforms and possesses high binary compatibility to the most diverse program formats. AIX 5L is also for the employment on servers of the product series of IBM S80 intended and supported likewise Linux applications. IBM offers among other things support and enterprise solutions approximately around AIX.

**AIX 5L version 5.2**Since the beginning of October 2002 the version 5.2 is available. Contained are now also functions, which admits so far only from Maynframes. The dynamic Partitionierung (LPAR) permits the enterprise of up to 16 virtual servers on a server. During operation resources can be assigned or taken off to each virtual server dynamically such as CCU, memory and I/O cards - without reboot or shutdown of the running server. This makes it possible to react individually to the requirements from customers and to adapt flexibly all resources. With the Keyed Capacity Upgrade on Demand (CUoD) for the p670 and p690 server it is possible to increase the number of CPUs for higher performance during operation. With the function of dynamic processor saving can be assigned reserved processors automatically as replacement for failed processors. Thus a sudden performance loss is prevented and the full availability for the enterprise employment is guaranteed.

For AIX 5L an extension and a bonus pack are free of charge available, with the additive of a broad number of applications and Tools. The data recovery is provided by a data mirror software. For enterprise critical applications that need some remote Backup, the software HAGEO (high availability geographic cluster) and GeoRM (Geographic remote Mirror) is available. This software makes it possible to fall back on errors to backup server with automatic resynchronization of the data in real time by mirroring of the data. For the administration of the functions the hardware management CONSOLE (HMC) and HMC recovery software is used for the LPAR control and cluster management. By the IBM cluster systems management (CSM) a central control together for cluster 1600 and cluster 1350 systems as well as possible for distributed server from the pSerie. It does not count whether Linux and/or AIX are used in a network - over those Web-based system managers surface who can be served easily let themselves be served both operating systems.

**AIX 5L version 5.3**AIX 5L version 5.3 was published together with IBM of eServer p5 series in August 2004. It offers one in the comparison to the previous version further technology for self management of the operating system on POWER5 servers. Mayn strength of AIX 5L is handling of high system resources and communication services by the **IBM virtualization engine**, improved physical system utilization of available resources to the previous version by Micro- Partitioning and virtual processors, memory, RAM and network adapters.

The **Dynamic the Logical Partitioning** (LPAR), available since version 5.2, makes flexible handling possible with virtual servers on a physical server. With the extended scaling system resources such as processors and RAM can be assigned and revoked to the virtual servers, without affecting or restart of the running server installation. Micro Partitioning extends this flexibility in POWER5-Systemen by dispatching of processor performance from a system partition in 1/10 steps to correspond the tweaking permitted even the increase or lowering in 1/100 steps for optimally the enterprise requirements. Several LPARs can divide a resource pool

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automatically depending to the requirement from the virtual servers by balancing the processor performance without interruptions for the LPARs.

AIX 5L V5.3 makes it possible to measure and log the resource utilization in a divided server infrastructure during a certain period. A user can be assigned (virtual) to a server installation. This is important for the user to profit thereby from the business model on demand to book exactly the performance which is necessary and pays for it accordingly. This makes an accounting of achievements and the planning for the provided capacities possible. Noted are the system processes, transactions in the file system, processor utilization, RAM and network utilization.

AIX 5L V5.2 introduced already **Capacity on Demand (CoD)**, to AIX 5L V5.3 this technology was continued to improve. Selected IBM eServer like p5, i5 and models from the pSeries used this feature to belong to the best scalable and most flexible servers in ranking. An example of use would be, if an enterprise pays a certain resources package, which however for a sudden treatment of masses of orders is not sufficient any longer. In this Case with CoD was automatically more resources such as processor performance and network bandwidth during the high load assigned.

This operating system is completely compatible to 32-bit and 64-bit applications, these can be even running at the same time. At the same time can be used the multithreading of all POWER5 processors available in the server symmetrically. Supporting applications can reach a higher level of the system utilization and data flow. AIX 5L supports inspired from many features such as high reliability, availability, self healing and independent configurations from Mainframes. This guarantees highest availability for enterprise-critical applications. If nevertheless appears an error the operating system used his logging functions to log the current condition of the hardware and software. The dynamic reconfiguration permits the exchange of processors and RAM in POWER5 to servers without interruption of current applications in LPARs.

The service **Update Management Assistant (SUMA)** makes the definition of guidelines possible, the assistant service provide the operating system with automatically updates and files from the IBM support for download. Programmers profit in this AIX version from the POSIX real-time application programming interface for simpler porting of software.

The new NFSv4 Access Control List (ACL) safety minutes for the file systems JFS2 and GPFS (general parallel file system) offers higher security and efficiency. Extended filter rules support network security and notice break-in attempts in the network data traffic. The gnome desktop 2.4 is for the first time also as user interface available. The maximum number of ethernet devices has been increased from 1024 to unlimited (ent0, ...). The system protocols the activities of up to 32,767 registered users. For users and user groups the name length was increased from formerly 8 up to 255 text characters. The JFS2 file system is offering Quota and Shrink functions now.

On August 4th, 2006 IBM published AIX 5L 5.3 an update for System p5 server. Unusual feature of the p5 server is his co. processor 4764 for the cryptography to use safety on hardware level.

The **AIXpert** (Enterprise Security Management Tool) is a hardening tool to increase the safety of the network and operating system. The AIX LDAP client supports Active Directory now. The Common Boot Image Management offers new features and functions. **SUMA** (System Update Management Assistant) supports the download of service packs or Technology level updates. Parallel dump makes the use of several processors possible to reduce the time duration during the system dump. All data areas in the Kernel are protected by the

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definition as No-Execute area.

- Kernel stack overflow detection
- NDAF - Enhanced NFSv4 Administration
- improved Performance Tools
- enhancement of commands and network characteristics
- Virtual I/O Server V1.3

AIX 5L v5.3 was certified according to the UNIX 03 standard at 2006-11-23.

**AIX 6** IBM started his public beta programme for Aix 6 at the 2007-07-12. This is a important step in compare in previous product politics because the new Aix 6 beta can be download and test for free by everyone. The new version scheme breaks off with "Aix 5 l" because Linux is established in meanwhile on POWER systems and no more separate name is necessary. AIX 6 runs on PPC970, Power4, Power5 and Power6 processors, programmes of the versions 5.x are binary compatible without recompilation. The new operating system release takes full advance of the technical potential of the POWER6 hardware in *p system* systems. The completed version shall be ready in the 4th quarter 2007.

Aix 6.1 shall contain beside others the following programme functions.

- Live Application Mobility: relocate applications between servers without restart
- Workload Partitions: software based virtualization function to consolidate multiple partitions within a single AIX image
- Role Based Access Control: improved security and manageability by associating resources with a role allowing users management of specific AIX resources
- AIX Security Expert enhancements
- Name Resolver Caching Daemon
- System Director Console for AIX: direct access to the System Management Interface Tool (SMIT) in a Web browser
- Security: Role Based Access Control
- Security: Trusted AIX 6, extended security capabilities with multi-level security for critical government and private industry security requirements
- Security: Encrypting Filesystem, IBM Journaled Filesystem Extended (JFS2)
- Security: SECURE BY DEFAULT, only the minimal number of services is installed

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**AmigaOS** Amiga Inc. was founded in 1982. The Amiga was developed first as game console, the Amiga designed from his mental father Jay Miner represent a complete computer. The hardware basis was developed and marketed self.

Amiga was introduced for the first time on January 4th, 1984. Amiga Inc. was bought up by Commodore completely in September 1985 and presented the Amiga 1000 ready for sale. He was excellently designed for multimedia tasks like music and video handling with 4,096 colours, stereo Sound, video chip, synthetic text to voice conversion, 16 colours were (EGA) standard in the PC area at that time. In the famous BOING! technology Demo one red whitely checked Ball encouraged in 3D to sound samples in a virtual space. This Demo became famous and the ball got bound closely to Amiga as a trademark since this. Commodore decided to license the already existing operating system TRIPOS (TRIVial Portable Operating System) of MetaComCo in 1984 and to create a new user interface by developer.

The video screen resolution in the first Amiga computers with the OCS (original chip set) could be configured from 320x256 to 736 x566 pixel in the PAL mode and 320x200 to 736 x482 pixel (Overscan) in the NTSC mode. The video screen resolution was individually adaptable to the monitor with the Overscan method up to the limit. In principle, the represented colour palette was defined out of 4096 colours. The video screen with LowRes or HiRes was represented with 16 colours, 32 colours, in the EHB mode with 32 genuine colours and 32 colours with lesser brightness. In the HAM6 mode the screen display was supported by 4096 colours. The OCS was taken off by the ECS (Enhanced chip set) in later Amiga models since 1988. This extended the possible resolutions from 1280x256 to 1440x566 pixel in the PAL mode and 1280x200 to 1440x482 pixel (Overscan) with SuperHires in the NTSC mode but only with up to 64 genuine colours. The successor of the ECS was the AGA chip set which was used in Amiga models as of 1992. The applied colour palette was defined out of 16.7 mio. colours. All resolutions could be represented now with 256 colours, in the HAM8 even with 262,144 colours. Furthermore the EHB mode was supported (colour number doubled by brightness difference).

Because of failed management and from bad sales figures Amiga Inc. were acquired by ESCOM in 1995, after long negotiations with numerous competitors and the bankruptcy manager for approximately 12 million dollar. One year later ESCOM came to obviously by miscalculation and to fast Expansion into bankruptcy. ComTech still acquired ESCOM in the same year. 1997 were sold the Amiga section including the rights to Gateway 2000. In the year 2000 Gateway sold again the rights from Amiga in large parts to the enterprise Amino, which thereupon was named as Amiga Inc..

The Amiga OS needs only small hardware requirements and runs on Amiga hardware with a Motorola 68K CCU. Since 1997 exists extensions with PowerPC 603e and 604e-CPU's. Amiga OS is controlled by preemptive multitasking, in the 512-kByte Rome chip (Kickstart) resides the entire OS core. As GUI Workbench is used. The Amigas of the series of 1985 to 1991 could represent 4096 different color, of it however only a fraction (8 to 16) simultaneously. Since 1991 (AGA Chipsatz) there is simultaneous 16 million colors, of it 4096 at the same time. Optionally for a long time the Amiga can be upgraded with a graphic card, since 1998 also with 3D-accelerator. The internal file system is FFS.

**PEGASOS / MorphOS** the computer system PEGASOS was developed and sold by the company Bplan (before Phase5) in the Bundle with the Amiga compatible operating system MorphOS. Amiga OS 4 does not run on Pegasos and MorphOS doesn't run on the AmigaOne. More about [MorphOS](#).



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**Update 2002:** With the new developed platform AmigaOne of Eyetech is an efficient computer with PowerPC CPU available which should be bundled with Amiga OS 4 of Hyperion after his completion.

**Update January 2004:** The AmigaOne is now available with a pre-release of Amiga OS, alternatively with PPC G3 or G4 CPU. **Amiga OS 4.0** contains compared with Amiga OS 3.9 the following novelties. The operating system Kernel is called Exec SG (Second generation), which became increased performance by removal of the weak points and the complete portation of the source code from the 68k architecture to Power PC. An emulator made it further possible to execute of 68k programs in the interpreted mode for compatibility or in the JIT mode for maximum performance. System-critical memory ranges have now protected areas, SMP, Multithreading and separate address ranges (still deactivated) are partly supported now. The addressing range is complete virtual, i.e. it can be larger than available RAM, the paging on a non removable disk is also possible. The API gets more than 50 new functions, TCP/IP and PPP driver was completely revised. The Amiga file system FFS2 was improved.

**Update: 15.03.2004** According to the press release from Amiga Inc., Amiga OS is now sold to KMOS Inc. with all rights, source code and versions by Amiga OS. Amiga Inc. wants to concentrate from now on on the mobile market. Amiga Inc. acquired in addition the company Capacity network from Finland, which is specialized in data storage solutions. With this added know-how Amiga Inc. wants to develop an extended and secured Amiga OS for mobile devices. KMOS continued the developing at Amiga OS 4.0 and the hardware without breaking of existing contracts with Hyperion or other partner companies. Amiga Inc. keeps the rights to the Amiga name and the intellectual property.

The final release of AmigaOS 4.0 was published by Hyperion Entertainment at the 2006-12-24. A preview version was already available in May 2004. The memory management was overworked and the compatibility and performance of the 680x0 emulator were improved. USB devices are now supported directly by the operating system. Unfortunately, Eyetech has given up the production of the AmigaOne because of bankruptcy of a supplier.

## **Characteristics** - simplified the patching of system functions

- supports additional data types by "Plugins" for graphic, text, audio, video,... formats (since OS 3.x)
- audio output with integrated LowPass filter (LED)
- Deflcons, freely definable icon for every file, not only after file extension (third party software)
- since AmigaOS 1.0 automatic hardware detection, plug n play (Autoconfig)
- dual playfield mode for several graphic planes (games)
- voice output also with accents, enthusiasm and mouth movements
- since version 2.x AmigaOS has also memory protection with Enforcer or CyberGuard (with MMU) third party software

*This information area was friendly supported by Martin Baute, you can find more information about Amiga OS on the Website "Bielefeld Amiga Users and Developers" in german at [www.baud.de](http://www.baud.de).*

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Version: September 3, 2016 | Download: [www.operating-system.org](http://www.operating-system.org)

**Android OS** The android platform was founded by Google and offers on the base the Linux kernel 2.6 a uniform interface for mobile equipment and programmes. Through this it is easily to port and is programmed in Java. After the conversion into the own binary program format Dalvik (.dex) it is not compatible to Java any more. Advantage is the faster execution and the lower memory footprint of programmes than in pure Java. Every Dalvik application is executed in a Dalvik VM of its own. Applications can access all equipment functions. This makes it possible for the programmer to make innovative programmes which offers the user high value by the combination of all sorts of data sources with the equipment functions.

The Eclipse IDE with an official plugin is used for the development. The operating system Android for Smartphones is supported by the Open Handset Alliance. Including more than 30 communication provider, equipment and semiconductor manufacturers as well as software companies. Because Android is an open platform in the meaning of the software and product development the source code shall be available completely at a later time and is in opposite with the market leading closed operating systems Symbian, Palm OS and Windows Mobile.

## **Android include C/C++ function libraries used by different parts of the operating system.**

Surface manager for 2D and 3D even overlay display  
System C library, specialized for Linux-based devices (BSD implementation)  
SGL, 2D graphic system  
3D libraries, based on OpenGL ES 1.0 APIs with hardware or software accelerated 3D display  
Media libraries for playback and record of audio, graphic and video formats (MPEG4, H.264, MP3, AAC, AMR, JPG, PNG)  
LibWebCore, Android internet browser  
FreeType, for representing of bitmap and vector fonts  
SQLite, an efficient and slim relational database for all applications

The Android SDK is available for Linux, MacOS and Windows. It contains an emulator with the surface of Android to try applications. After unpacking the SDK the emulator can be found in the subdirectory "oolsemulator.exe" that shows a HTC Smartphone with keyboard.

Standard programs for e-mail, SMS, contacts, calendar, road maps, internet browser and others are preinstalled.

The first Google Android Developer Challenge (ADC) started in April 2008 for engaged programmers to realize and present ideas. Approximately 1,800 programmes were submitted and 20 honoured with a price money under the best 50. Part of the best applications are for example cab4me by combination of Google Maps, GPS signal and a database to send a taxi in the simplest mode by click to the current position on the map. Or GoCart which reads the bar code of goods with the mobile telephone camera and looks over onlineshops and registered shops in the circumference for the best price.

Google creates a sales platform for Smarthone applications with Android Market. At first the market place is provided free of charge. The first Android mobile telephone comes from the taiwanese manufacturer HTC with the T-Mobile G1 smartphone starting at October 22nd, 2008 in the USA and at the beginning of 2009 in Germany. The Android Market was renamed in Google Play on 6th March 2012.

The market research group Gartner, Inc. released a press news about the worldwide market share of smartphone ventors and operating systems on 19th August 2016. In the 2nd quarter 2016, 296.9 million Android units have been sold, this represents a market share of 86.2%. The Android operating system increased his share, in 2nd quarter 2015 the market share was 82.2% with 271.6 million units sold.

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**Aperios** The proprietary real time operating system Aperios was developed by Sony for entertainment robots like the autonomous dog Aibo (Artificial Intelligence Robot). The development time lasted for about 5 years, the first model hit the market in 1999. The Aibo robot is equipped with a MIPS of 64-bits RISC processor (100 MHz) and 8 MByte DRAM main memory. The color video camera with a resolution of 180,000 pixels as well as the audio input and output interfaces make an orientation possible. Altogether 18 engines control the movability of the new mechanical domestic animal for the entertainment market. A battery provides electrical power for 90 minutes, till now he still can not charge itself. The hardware is built up on the Open-R architecture and the operating system reacts to the signals of the sensors in real time. Aperios is optimized for high transfer rates of audio and video streams.

Originally Aperios was used for TV set top boxes like the Plus Media Station in Japan which offered the user interactive services like Internet, video On-Demand and games.

The AIBO ERS-7 came for approx. € 2,000 onto the market in the year 2003 and has a 64-bit RISC processor (MIPS R7000) with 576 mhz and 64 mbyte SDRAM as well as a W-LAN device for a wireless Internet connection. The integrated digital camera has CMOS sensors with a resolution of 350,000 pixels. Like the first model it had a temperature sensor, infrared sensor, acceleration sensor, pressure sensor and vibration sensor. The electrostatic sensor for increased interactivity of the robot was added newly.

The production of the AIBO models was discontinued in March 2006.

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**AtheOS** AtheOS is a new operating system developed by Kurt Skauen under the GPL licence. It does not have any true text mode but terminal emulators are possible. Up till now it is available only for x86 processors, SMP and multithreading are supported. Besides UNIX characteristics it supports POSIX to large parts and builds up on a new user interface and a new designed file system. The 64-bit file system AFS has journaling functions. The monolithic kernel was modularized designed. UNIX related applications like bash and CLI tools were ported, AtheOS itself is programmed in C++. Both desktop systems and web servers are intended purpose by the TCP/IP support.

In meanwhile everything points to the shut down of the AtheOS project, perhaps it is developed further in the future. After all, since the last release have passed several years and the original website [www.atheos.cx](http://www.atheos.cx) has changed the owner since a long time.

**Syllable** Syllable is a fork from the AtheOS project to meet other design goals and was started in September 2002. It is leaded by former AtheOS developers and uses ideas of the BeOS API. Syllable 0.5.6 was published on 19. April, 2005. The audio/video support was improved in this version, the burning of CD-RWs with the Cdrtools 2.1 is possible now. Syllable is compatible to the POSIX standard too, the kernel was extended by many functions and supports ACPI. The support of USB has been added, the GNU C library was updated. In comparison with the pre-released version problems with the installation process were removed. An upgrade which eliminates a couple of bugs was published for version 0.5.6 a on 17. June, 2005. Version 0.6.0 followed on 13. December 2005, with improvement at the ATA device driver, video driver, at the Kernel and many more.

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**BeIA** BeIA (Be Internet Appliances) is a software platform which offers particularly simple access to Internet applications. It is based on BeOS and was scale-downed strongly. BeIA differentiates from BeOS by the platform independence and the specialization for multimedia and Internet applications for devices like web pads, settop or Internet boxes. Applications are surfing in the internet, audio streaming, video playback and e-mail communication. The system boots particularly fast, was developed for the x86 and PowerPC architecture and needs at least 8 mbyte fixed storage (harddisk, CompactFlash) as well as 32 mbyte RAM. BeIA was licensed for a small selection of devices of Sony, Compaq and Qubit.

Sony presented a product named eVilla on the base of BeIA 1.0 for internet access. Sony released a press report on 30th August, 2001 that this product is not continued any more because of the low market success.

**eVilla hardware** 15" display: 14" visible, portrait FD Trinitron® CRT display (800x1024)

CPU: Geode GX1R (266 MHz), graphic: Geode CS5530A

24 mbyte flash ROM, 64-mbyte DRAM

V.90 modem

Audio: AC97 codec, Built-in stereo Speakers; Memory Stick media slot

Keyboard/Mouse ports: 2 x PS/2

2 x USB ports for USB printers and ZIP drives

Power consumption: 120 VAC, 50-60 hz, 2.0 A, 110 W (maximum)

Size (W-H-D): 300 mm x 411 mm x 402 mm

Weight: 14.3 kg

Compact keyboard with 71 keys

Scroll Mouse; ISP Service: eVilla online service (powered by EarthLink)

**eVilla software** e-mail communication for up to 4 users

Internet browser Opera 4.0

Real player

Macromedia Flash 4.0

Staff Java Plugin

Support SSL2 and SSL3 for connections

File viewer for PDF, pure ASCII text and HTML includet

Graphic file formats: JPEG, progressive JPEG, GIF, PNG

Audio file formats: MP3, WAV, MIDI, AU, AIFF, real audio

Video file formats: MPEG 1, Real video

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**BeOS** BeOS was originally developed by the company Be with the former Apple coworker Jean-Louis Gasseè for its own type of computer, the BeBox. It contains 2 power PC CPUs and was equipped with maximally with 256 Mbyte of RAM. BeOS is written from scratch and does not contain obsolete operating system design concepts. Designed as a single user operating system BeOS unfolds his optimal efficiency on multi-processor systems with several parallel running programs through its modern multi-thread based structure. BeOS basically does not run other applications that are not developed for this operating system. This operating system is only available in English, French and Japanese languages.

With the new version 5.0 BeOS is at the first time free of charge for private use and was named "Personal Edition". This version can be used exactly the same as the "Pro Edition" as single OS or started from any Windows partition. However the free variant is limited to a 512 MByte virtual partition in one image file for the operating system installation and further files. For network employment are a large amount of applications available.

**Update: August 2001:** By the assumption of Palm Inc. for 11 million dollar BeOS is not any longer commercially developed. The BeOS Community and some BeOS developers keeps the support for the future.

**Update: March 2002:** The BeOS Online website is a good start to download BeOS software or the BeOS 5.0 private edition which was downloaded world-wide by several sources about 1 million time. Based on the approved source code of the BeOS Personal Edition 5 the BeOS Developer edition 1.0 was developed, which contains current drivers and is further maintained by the BeOS Online team. In December 2002 the BeOS Developer Edition 1.1 was published.

**OpenBeOS (OBOS)** has been founded in 2001 as the official successor of BeOS as open source project. Since 2004, the operating system is continued under the name [Haiku](#).

Another project is the commercial [Zeta](#) distribution from the company yellowTAB, later magnussoft. It is an evolved version of BeOS PE with source code from the OpenBeOS project. This operating system has not been continued since April 2007.

BlueEyedOS copies the features and the user interface from open source software. BeOS APIs were written again, so the BeOS programs remains to be executable. This operating system is based on the Linux Kernel and the XFree86 server for graphic functions. You can download on [www.blueeyedos.com](http://www.blueeyedos.com) the demo version as an ISO image.

The Beos derivative eB-OS (Extender Beos Operating System) is based on the latest BeOS Personal Edition 5.0.3, current Haiku code, parts of BeOSMax 3.1, BeOS Developer edition 2.1 as well as drivers and applications from [www.bebits.com](http://www.bebits.com). The last version is eB-OS 1.1 beta on bootable CD-ROM.

**Field of Application** BeOS is designed for handling large amounts of data. Therefore it is suitable outstanding for Multimedia applications such as video and audio processing as well as Raytracing. By its structural short response time of 250 microseconds between individual Threads it is particularly suitable for time-critical tasks like the recording of videos in real time. The access to files takes under 10 milliseconds, depending on the used hardware. BeOS is capable to use Plug&Play devices, after the installation of new hardware the appropriate driver must be copied only in "/boot/home/config/" and the device is now useable. The object-oriented Design allows it to activate new drivers without complete restart. During the loading only

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the depending media modul is restarted in few seconds.

## Area of application

support POSIX

CLI: bash Shell, GUI: Tracker

JFS support

Read/Write FAT16/32, Read ext2fs and NTFS/5, HFS, UDF(DVD) and ISO-9660(CD)

optimized for the web, integrated GNU compiler

OpenGL is supported

Microkernel

preemptive multitasking

Internal Client-Server architecture

Server: Services of the operating system

Clients: applications, which use the operating system services

protected memory areas

virtual memory

Object-oriented Design

Max. file size 18 millionen TByte

Pervasive multi-threading architecture (operating system is divided into small threads which profit optimally from several CPUs)

## System Environment

x86 CPUs or PowerPC (up to release 5.03)

needs at least 32MByte RAM

64-Bit operating system

supports 64-Bit JFS file system, R/W HFS, VFAT, FAT

Symmetrical multi-processing (SMP)

Multi-processor support (up to 16 CPUs)

not designed as network server or multi-user support

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**BSD/OS from BSDi** The Berkeley Software Design Inc. offers the commercial operating system BSD/OS for x86 compatible computer. BSD/OS descended of BSD Net/2 (1991) and is licensed under the BSD software license. It is cheap, reliable, offers high accuracy and performance. BSD/OS is compatible for POSIX and use the file system FFS (Fast File System). Field of applications are web hosting, e-mail server, Dial-Up server, proxy and DNS, router, firewall, Load Balancing and many further network services.

Update March 2000 BSDi merges with Walnut Creek CDROM, the main distributor of FreeBSD and Slackware Linux.

Update April 2001 Wind River Systems, Inc. takes over the operating system BSD/OS and the FreeBSD business from BSDi. The sale shall be completed until the end of April this year. BSDi renamed in iXsystems, Inc. and focus his energy on the hardware business with Internet servers and cluster in future. iXsystems becomes licenses to use BSD/OS and access to development tools of Wind River.

Update Jan. 2002 Wind River transfers the FreeBSD business with all customers and employees in this area to FreeBSD Mall, Inc. and concentrates on BSD/OS, vxWorks and Linux software solutions now. Already in October 2001 Wind River cancelled the financial support of FreeBSD.

Update Dec. 2003 Wind River stops the further development and the support for BSD/OS Internet Server Edition (ISE). The support for customers and the publication of bug fixes shall only be guaranteed up to Dec., 31. 2004.



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**CP/M, DR-DOS** Gary A. Kildall developed for the company Intel the PL/M programming language for the Intel 8008, derived of PL/I in 1973. In the same year he developed the operating system CP/M (Control Program for Microprocessors) in PL/M. It was the first operating system for Intel based computers. The strengths of CP/M are the high portability on all sorts of hardware configurations. Base functions were programmed hardware-independently, depending on the aimed platform the special feature were only programmed additionally.

Kildall set up with his wife Dorothy McEwen the company DR Inc. (Digital Research Incorporation) in 1976. At first CP/M was designed by DR only as a pure file manager program for 8-bit x86 computer and sold by Intel. In 1976 there was a CP/M Bios for Intel 8080 computers. At this time CP/M was the dominating operating system on the market and used by the most computer manufacturers on theyre computers to. In 1981 dozens of computer machine types competed under various operating systems like CP/M in numerous variations. Additional there were proprietary operating systems and UNIX variations. This year the operating system was used approximately on 200,000 microcomputers in more than 3,000 different configurations. CP/M was used in 1985 worldwide approximately 4 million times in different versions. CP/M was renamed to DR DOS after few other releases in 1988.

CP/M was available in many different versions for numerous application purposes. Technical further advancements of processors and the trend towards multi-user systems also were included in the development. MP/M II brought additional commands, multi-user ability with programs like CONSOLE, DISKRESET, SPOOL, SHED and ATTACH. CP/M plus (CP/M 3.0) could address 1 mbyte of main memorie by segmentation the memory areas, harddisk storage up to 16 mbyte was also possible. CP/M 86 managed max. 1 mbyte main memorie without segmentation and stood into competition with MS DOS. CP/M 68 K was designed for 68 K RISC CPUs and not able for multi-user or multitasking.

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**Darwin** Darwin is the from Apple named operating system core for Mac OS X. Darwin is Mac OS X without the user interface. The BSD Unix and Mach 3.0 based Kernel connects since the first release in 1999 characteristics of the booth worlds Apple and UNIX. Mac OS X has beside the Mac OS predecessor his origin in the know how of NeXT technology, taken over by Apple in 1997. NeXT has developed the OPENSTEP operating system which was the further development of NEXTSTEP which in turn is based on 4.3 BSD. Apple supports actively the BSD community, because Darwin is compatibly with the FreeBSD distribution as a reference and takes advance of much open source projects. Mac OS X merge therefore the efficiency and stability of UNIX (protected memory area) with the simple usability of Mac OS. Hexley the platypus is the mascot of the operating system Darwin.

Affected by the open source concept developers of Apple and the open source community work together for the PowerPC and x86 operating system version. Modifications and further developments flow back to the public, after a free registration the source code can be downloaded from the Apple web site. It can not be excluded that Darwin with his operating system core xnu splits up into independent distribution. All developed applications for the Darwin system core work also under Mac OS X, except for special Mac OS X applications which do not run directly under Darwin. Standard format for executable applications in Darwin is Mach-O. Support for the primarily by Linux program used .ELF format is not possible at present, but Linux applications can be ported.

**Architecture** By the related UNIX design Mac OS X profits from the protected memory area and established preemptive multitasking. The Kernel consists of 5 components. Includet are the Mach Mikrokernel with the BSD subsystem, file system, network ability and the I/O Kit. The file system supports file names with up to 255 characters and unicode. The Mach Micro kernel cares about the resource management like processor performance, scheduler, memory protection and the communication between the system layers. The core is enclosed by a specified version of the 4.4 BSD-Lite2 Kernel and userland. This contains POSIX APIs and abstracts the file system and the network communication. The BSD Kernel takes care for the administration of system processes and security policies and threading of program parts for Mac OS X. The I/O Kit introduced with Darwin is a object-oriented development software which provides the ressources for the development of driver software with the support of SMP and preemptive multitasking.

The project OpenDarwin was founded in 2002 with the goal to provide a development environment for the Mac OS X source code and to develop a Darwin derivat. The new created community is a test platform for bug fixes as well as new functions for Mac Os X and Darwin that Apple integrate into the official source code.

At 2006-07-25 the OpenDarwin Core Team and the Administrators announced the termination of this project on their website. Quote: "Over the past few years, OpenDarwin has become a mere hosting facility for Mac OS X related projects. The original notions of developing the Mac OS X and Darwin sources has not panned out. Availability of sources, interaction with Apple representatives, difficulty building and tracking sources, and a lack of interest from the community have all contributed to this."

PureDarwin was launched in 2007 as new project to bring Darwin closer to open source enthusiasts and developers. Every enthusiast can access the documentation, learn, modify and distribute Darwin. One of the goals is to provide a bootable ISO-file of Darwin 10.x and Darwin 9.x.

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**Debian GNU/Linux** The Debian GNU /Linux Project team is a special one under the distributors since it does not pursue any commercial targets. Since the foundation by Ian Murdock on 16th August 1993 Debian is cared by voluntary developers and supported by the FSF. Ian Murdock conducted the team to 1996. The name Debian gets together from Deb for Ian Murdock's Wife Debra and his first name together. Only software which was published completely under the GPL flows into the Debian distribution. Developed in Germany the main area lies more in Europe. Specified versions exist for Intel x86 and ARM systems. As unusual feature a format of one's own is used for the installation by software packages (Deb), just like the packet format RPM it resolves the dependences automatically, though according after another principle. The GUI Gnomes become preferred as standard. Up till now only a simple text mode for the installation is available. Debian has got synonymous for quality and stability. The code names as of release 1.1 are from figures from the digital cartoon film Toy Story.

Ian Murdock set up a new company with Bruce Perens named Progeny Linux Systems in 2001. It is target to develop a network solution based on Debian GNU/Linux named Linux NOW (Network of Workstations). Linux NOW shall merge the advantages of efficient, flexible and scalable workstation with centralized solutions that are simply to be administered.

The networked systems then form one single, smooth system with the advantages of those two worlds. A software product that uses this technique is the web-based Linux Platform Manager which accelerates the construction, administration and the test of distributions.

Debian GNU/Linux 4.0 supports altogether 11 processor architectures, the software KDE 3.5.5 a, gnomes 2.14 and Xfce 4.4 were updated. The graphic interface for the installation was replaced and is available in 58 languages. At the installation also cryptographic software can be selected from more than 18,000 programmes. The compatibility with the FHS 2.3 and the LSB 3.1 is granted to.

Ian Murdock changed to the company Sun in March 2007 and ended the business activity of Progeny Linux Systems to the end of 2007-04-30. His new work area is the coordination and strategic orientation of the business for Solaris to keep pace with Linux.

The next stable release was Debian GNU/Linux 5.0 (Lenny) of 14 February 2009. For the first time, there is a graphical Debian installer. The hardware detection has been further improved. The configuration-free X-Server is included in version 7.3. Gnome is installed as standard desktop. The network setup is even easier with the Network Manager.

A distribution based on Debian is Knoppix (Knoppers UNIX) from Klaus Knopper. It is a directly bootable live system from CD-ROM or DVD media. Knoppix is installable also on a fixed disk, e.g. it is suitable for a productive desktop system or also as a Rescue system. Knoppix 4.0 bases on Debian GNU/Linux 3.1 and was released on the event "Linux Tag 2005" on 06-22-2005. As a user surface KDE 3.4.1 and gnomes 2.8 can be chosen. By the cloop data compression over 9 gigabytes of software on a single layer DVD and to 2 GByte on a CD-ROM are possible. Knoppix based distributions are Freeduc, Kanotix, Quantian, Paipix, SymphonyOS und DSL (Damn Small Linux). Knoppix 5.1.0 was released on 2006-12-30.

Ubuntu Linux is a well-known Debian distribution, on 20th October 2004 was the first release of Ubuntu 4.10. More about [Ubuntu Linux](#).

BeatriX is based on Ubuntu, and therefore also supports Debian and Ubuntu packages. This distribution by

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Steven Watsky has been discontinued in 2005. More about [BeatriX](#).

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**eComStation** Serenity Systems licensed the operating system OS/2 at the end of 2000. The software is sold under the product name eComStation. The license provides no access to the OS/2 source code. The first release came out in 2001 and was based on Convenience Pak 1 of OS/2, supplemented with useful third party software.

eComStation 1.1 based on OS/2 4.52 has been published on 2003-05-24. Interested customers can choose between the basic system with few standard programs, or the extended version with additional programs. The user interface has been improved and there are new driver added. There is also an optional upgrade for SMP support up to 64 processors and the function as a server, based on OS/2 Warp Server for e-business. NTFS formatted drives can now be used with read-only access. The German version of eComStation 1.1 followed in September 2009.

In December 2004 the operating eComStation 1.2 was released. Now it is possible to use up to 4 GB of RAM. New hardware is better supported and the installer have been updated.

eComStation 2.0 has been finished as final version after a long developing period in May 2010. You can select between the file systems HPFS and JFS for the installation of the operating system. HPFS supports up to 64 GB volume size and 2 GB file size and the modern JFS up to 2 TB volume and file size. The installer program does now much better support the use in virtual machines like Virtual PC.

The support for hardware devices has been extended and improved. Including HDA Audio, USB devices, ACPI and modern multi-core processors like Intel Core Duo, Core2 Duo and AMD 64 X2. The Panorama VESA video driver extends the compatibility to even more graphics cards. WiFi and network cards are now much better covered with included drivers. Network connections with Samba protocol can be now easier configured via the graphical user interface EVFS.

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**EPOC** EPOC is the operating system of Symbian, formerly software house of Psion. Symbian has licensed Symbian OS to companies which are big players in the market of High Technology mobile telephones.

Included are Motorola, Nokia, Samsung, Siemens and Sony Ericsson. Handhelds with SymbianOS from Psion are the 5mx Pro, Revo, Revo Plus, netBook and others.

Symbian, EPOC, the Symbian logo and Symbian Developer Network logo are registered trademarks of the Symbian Ltd. Symbian was founded in June 1998 as a private and independent company. Partners of this company are Ericsson, Nokia, Motorola and Psion. Different reference designs like Quartz, Crystal and Pearl correspond to a standard implementation for the requirements of different sorts of device types. In the year 2000 Sony and Sanyo became new licensee for the Symbian OS, in the same year the first Symbian OS Smartphone Ericsson R380 was introduced. In 2001 Fujitsu joined the licensee, the Nokia 7650 and Nokia 9210 Communicators are introduced. In 2002 Sendo also licenses Symbian OS, Siemens becomes a shareholder of Symbian.

Symbian OS united mobile telephone functions with the efficiency of a computer. It is suitable as a platform for the development of applications and services in the mobile area. Symbian OS bases on a microkernel and supports multitasking as well as multithreading. The operating system is object-oriented and consists of components. The user interface is flexible, the number of supported protocols gets almost increased with new releases. Alone in the year 2005 about 35 million devices was sold with a Symbian OS.

## Field of Application

Wireless embedded devices like telephones

Development of applications

## Abilities

TCP/IP, WAP, GSM, Bluetooth, IrDA, serial

EPOC C++, Java, WML, HTML

security standards like SSL, HTTPS, WTLS

Symbian OS 8.0 includes improved Java and multimedia framework functions to make acceleration of applications possible. Symbian OS supports equipment with only one processor for telephony and the operating system by his new realtime function now. The support of the UMTS and STDIO standard enlarge the range of application of the operating system. Remote maintenance makes it also possible to access storage cards in the SD format.

Symbian OS 9.1 contains the communication protocols TCP/IP, WAP 2.0, IrDA, Bluetooth, USB, GPRS and UMTS. For international use the unicode standard 3.0 is supported.

Symbian OS 9.3 has native WLAN support, USB 2.0 and new Push techniques and WCDMA (Wideband Code Division Multiple Access) as well as HSDPA (High Speed Downlink Packet Access). Symbian OS can smoothly submit VoIP conversations held in the WLAN to the mobile phone network with the new support for Unlimited Mobile Access (UMA). With the improved memory management the operating system shall run applications considerably faster.

The operating system is binarily compatibly to programmes for Symbian OS v9.1. New function is the update of the firmware without cables (FOTA).

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## Symbian OS 9.5

- optimized energy consumption and 20 - 30 % fewer RAM needed
- reduced start up time of the operating system and applications
- standard support for digital TV
- new functions for digital camera
- SQL database and POSIX interfaces for easy porting of desktop/server applications
- automatic change between WiFi and 3G nets

Nokia bought Symbian Limited with the purchase of shares that does not belong to Nokia already in 2008-06-24. The acquisition include shares of approx. 52% for approx. 264 million EUR. Nokia creates a foundation to provide the operating system as an open software platform. Sony Ericsson and Motorola bring UIQ to the foundation, DOCOMO contributes MOAP(S) for the 3G network. Together with teh user interface S60 of Nokia a common platform shall be created. It is planned to publish SymbianOS under the Eclipse Public License 1.0 (EPL) in the 1st six months of 2009 as open source operating system.

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**FreeBSD** In November 1993 Jordan Hubbard started the FreeBSD project, in which he took source code from the 386BSD. At present, FreeBSD is developed by about 200 developers which pass modifications on the source code to a central team which in line are responsible for the next release. FreeBSD bases on 4.4 BSD Lite release for x86 computers of March 1994 and has his strengths in the network area. FreeBSD has proved itself in use everywhere where large amounts of data are transferred. The text based installation program makes the individual customization for the planned use possible. FreeBSD is developed in three branches: CURRENT contains latest features in the development, STABLE contains tested source code and RELEASE is the published version which only is updated for bug fixes. According to Netcraft were 2.5 million servers installations counted with FreeBSD in 2004.

The name of devices like fixed storage disks in the "/dev" directory following a scheme of its own. So e.g. the first partition is described as ad0s1 on the first IDE fixed disk, ad0s2 is the second partition. Installation of ported system software and packages or update of installed programs can made easily over a software list. In every port descriptions are the latest updates included which can be installed by an freely eligible installation medium like CVS (Concurrent Versions System). If the user prefer already compiled programs, he can use the binaries. About 8,000 programs are available for FreeBSD by now. FreeBSD stands under the BSD license, is free usably and freely copyable as long as the copyright notes remains with the BSD licence.

For FreeBSD are security extensions under the project name TrustedBSD available which correspond to the B1 security level. Access Control Lists (ACL) and Mandatory Access Control (MAC) are only few of those.

## Field of Application

Database server  
Internet, intranet and file server  
Internet client

## Structure Information

proven TCP/IP stack  
preemptive multitasking  
monolithic kernel

## System Environment

X-Windows  
multi-user ability  
max. 4 CPUs  
File system: ufs  
32-bit Intel, 64-bit UltraSPARC, alpha (experimental)  
Read/Write: FAT, ISO9660, NTFS

## Strenghts

runs transparently and stable  
Portability  
binary compatible: DOS, SCO UNIX, BSDI, NetBSD, Linux and 386BSD  
NFS performance

In the version FreeBSD 5.3 of 11-05-2004 was besides security and bug fixes the hardware support mainly



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improved and extended. Techniques like ACPI, Bluetooth, Firewire, Serial ATA, USB 2.0 and Wireless LAN are supported completely now. Support for the FAT32 file system was improved and software like KDE 3.3.0, Gnome 2.6.2 and Mozilla 1.7.2 taken to the newest stand.

FreeBSD 6.1 was completed on May 8th, 2006, it offers an automatic configuration of Bluetooth devices now, increased stability of the file system as well as new drivers and updated software packages.

FreeBSD 7.0 was published for several computer architectures on February 27th, 2008. The greatest improvements concern the strongly increased performance and SMP scaling ability. The new process scheduler ULE with improved performance and response time can optionally be used beside the default 4BSD scheduler. The implementation of the jemalloc memory management functions is revised, the ported file system tmpfs from NetBSD can be used. Tmpfs is designed to run completely in memory and handles resources very efficiently. WLAN (802.11) was optimized together with TCP. FreeBSD 7 contains the updated components X.Org 7.3, KDE 3.5.8, GNOME 2.20.2 and GNU C compiler 4.2.1, besides further program updates.

## FreeBSD derivate

The DragonFly BSD project has split up in the year 2003 from the FreeBSD 4.x operating system line to let flow the newest innovations and techniques in this new derivative. The project of Matthew Dillon released the version 1.0(a) in July 2004. This Release contains a new messaging API, a revised I/O model, kernel threads and interrupt preemption. In a next version the package administration and threading model shall be improved. Release 1.2.0 of this operating system was published in 04-08-2005. The network subsystem and the TCP stack was improved, IPv6 and NFS version 3 were included. New device drivers were added, the support of USB was improved. DragonFly BSD 1.4 was published at the 2006-01-08, the used standard compiler is GCC 3.4 now.

It is target of the EkkoBSD project to create an operating system based on FreeBSD which is simple and safe to configure. Special value is attached to a democratic project control with open mind for new ways of thinking. EkkoBSD was terminated in the middle of July 2004, thankfull words to the involved members was released on the web site for conclusion.

The derivative PC-BSD bases on FreeBSD and was published for x86 computers with the version 0.5 beta in April 2005. A graphical installation process, the automatic hardware detection and the integrated KDE surface are parts of the special features. The developers of PC-BSD have set themselves the goal to offer a particularly user friendly system for beginners in the home and office area which isn't reached by previous BSD derivatives. PC-BSD 0.7.5 beta was released in June 2005. The source code was published under the BSD licence, numerous bugs became eliminated and single graphical details improved. PC-BSD 1.0 was brought out at the end of April 2006, it based on FreeBSD 6.0 and the new KDE 3.5.2 interface. More than 50 languages are supported, the installation of software was improved and the automatic hardware recognition extended. A month later PC-BSD 1.1 came out, it based on FreeBSD 6.1, KDE 3.5.2 and X.org 6.9. In July 2006 PC-BSD 1.2 appeared with the progressive FreeBSD ULE scheduler, optimized for Intel 686 processors. For common graphics cards the 3D hardware acceleration is supported.

PicoBSD is called the FreeBSD derivative which fits on one single floppy disk. It bases on FreeBSD 3.0 and needs very few hardware resources. A 386 processor with at least 8 mbyte RAM is enough to set up a router,

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firewall or a Dial-in Server. The current version 0.41 was already published in October 1998. With the Development Kit available every interested one can create his own specified version of PicoBSD.

The aims of DesktopBSD as a FreeBSD derivative are a stable distribution with the simple use of applications with the KDE interface. BSD shall get accessible for simple users with that better. The installation simplified by programmes and configuration of certain tasks. DesktopBSD 1.0 with KDE 3.5.1, new functions and bug fixes appeared in March 2006.

DesktopBSD 1.6 was published on January 9th, 2008 as 32 bit and 64 bit version and is based on FreeBSD 6. The operating system supports several processors and includes the new versions of KDE 3.5.8, X.Org 7.3 and many others.

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**Gentoo Linux** Gentoo was founded by Daniel Robbins in the year 2001. The first version 1.0 has been published in March 2002. Gentoo offers a special and powerful installation program named Portage. This installs the programs or the source code after the package selection, optionally from the Internet, a high-speed Internet connection is recommendable. Advantages are the use of always most current software as well as the special customization and optimization on the existing hardware and the field of application. Portage takes care of it automatically. The software must be compiled at every installation, there are no precompiled software packages as in the case of other distributions. A speed advantage at modern processors of 20% compared with software compiled normally is possible. Gentoo Linux is usable on the x86, PowerPC, UltraSparc and alpha architecture. Gentoo Linux 1.4 (08-05-2003) is based on the new gcc 3.2 and current Linux Kernel 2.4.19, over 4,000 software packages can be chosen.

D. Robbins decided to take distance in April 2004 of his roll as boss developer at Gentoo. On 23th May 2005 D. Robbins changed to Microsoft, before he transferred all rights and intellectual property at the Gentoo project to the charitable Gentoo-Foundation.

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**Haiku** OpenBeOS (OBOS) is the new founded project on 18 August 2001 for the official continuation of BeOS as open source project. Not Shared Source of BeOS is rewritten to avoid licensed source code. Michael Phipps announced at the event WalterCon 2004 on 2004.06.19 the renaming of OpenBeOS in Haiku. Objectives of this project are the creation of a desktop operating system that requires no administration, is easy to use and has open source code. High Performance will be possible on older computers, even with complex applications. Only the BeOS modules Tracker as a file manager and the Deskbar as program menu has been adopted. All other components of the operating system are designed themselves or open source software.

As a development platform, Linux and BSD derivatives are used in future. Primary platform is the x86 32-bit and PowerPC architecture, SMP is supported. The first release of Haiku will be fully binary compatible for BeOS Release 5 (R5), offer advanced features and ease of use, containing numerous other improvements. A later release of this operating system will be support multi-user, 64-bit processors and use the new file system FutureHaikuFileSystem.

The minimum hardware requirements for Haiku are at least a Pentium II CPU 400 MHz with 128 MB of memory and 1 GB of free disk space. The operating system is mostly suitable for users and developers.

The third pre-release Haiku R1 (Alpha 3) was published in June 2011. About 800 bugs has been fixed since the previous alpha release. According to the official release notes, general improvements in stability and product features has been implemented.

Read and write performance for various file systems like btrfs, exFAT, ext2, ext3, ext4, NTFS, UDF and others were improved. The hardware support has been enhanced for technologies like IO-APIC, ACPI, video drivers, network drivers and USB. Support for PAE inside of the kernel allows physical memory beyond 4 GB now.

The Media Kit support for decoding and encoding for audio and video file formats has been improved. Email communication with IMAP is also supported by the mail system now.

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**HP-UX** HP-UX is based on the UNIX System V Release 4 and was designed by HP for the RISC architecture of Motorola. It is a pure server operating system with high availability and flexible memory and security management.

HP-UX is equipped with a variety of tools for use in enterprises for the monitoring (costs, work load) as well as for the logging and visualization. Next to the base version there is a Enterprise Edition with resource management and the Mission Critical Edition for companies with enterprise critical applications for highest availability and security. This operating system has a built-in host intrusion detection (H-IDS). This operating system is used for content servers, web server, dedicated server, databases or also for cluster systems. The VUE (Visual User Environment) and CDE are available as a GUI, the last named is the standard GUI since the HP-UX version 10.20. HP develops HP-UX 11i version 4 and plans HP-UX 11i version 5 as a longer-term goal. HP-UX 11i version 3 still shall be ready in autumn 2006. The PA-RISC platform shall be cancelled to 2012, the migration to Itanium HP systems becomes accomplished.

HP-UX 11i version 3 (Release February, 2007) offers at average an 35 percent higher performance on Itanium systems than the previous HP-UX version. Improvements in the security management, integrated Multi-Pathing for the access to the same storage system with redundant controllers and the parallel use of HP certified operating systems are part of the innovations. A combined cluster can be created with the help of the Serviceguard and Integrity Virtual Machines. HP-UX can adress 100 Petabyte (100,000 TByte) of memory.

- Operating system for 32-bit and 64-bit systems
- File system and max. file size up to 2 tbyte
- max. 256 gbyte RAM addressable
- File systems: VxFS, JFS, HFS, LIF, ohne Format: FAT, UFS, BFFS, NFS
- SMP capable up to 128 CPUs
- Software development: Java (ported), C/C++, Fortran 90, COBOL, Perl
- EAL4-CAPP certify #1
- TCSEC-2 certify #2

#1 Evaluation Assurance Level 4, Controlled Access Protection Profile

#2 Trusted Computer System Evaluation Criteria Class C2 (without ACLs and boot authentication)

- PA-RISC (cancelled), Itanium and Alpha Systems
- HP9000/500 Server Familie, up to 7 CPUs
- HP9000/300 Workstation Family
- HP9000/400 Family (Apollo)

File structure of HP-UX

- / Root directory
- /dev Device files
- /etc Configuration files
- /export File sharing
- /home Contains the user directory
- /lost+found
- /mnt Mount directory
- /net NFS mount directory
- /opt, /var/opt Additional software

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/sbin System programs  
/stand Kernel directory  
/tmp Temporary files  
/usr Application programs  
/lib Libraries  
/var Various files, some logging files

**Tru64 UNIX** This UNIX derivative of the company DIGITAL was developed for the alpha platform. Originally it resulted from the operating system OSF/1 out and is also called DUNIX (DIGITAL UNIX). It is used on alpha servers and HP TruCluster servers. Tru64 UNIX was certified for the security level C2 and supports ACL.

- 64-bit operating system
- File system and max. file size up to 16 tbyte
- up to 256 gbyte RAM addressable
- need at least 128 mbyte RAM, 1 gbyte harddisk storage
- based on the Mach 2.5 Kernel design, BSD 4.3/4.4 technology and UNIX system V
- AdvFS file system (Advanced File System) with journaling function - up to 256 Data medias for each AdvFS domain, up to 231 files
- File systems AdvFS, UFS, NFS, MFS, ISO 9660, UDF
- SMP support
- X11 R6.5 Window manager, CDE 1.0 user interface with Motif 1.2
- SVID (System V Interface Definition )
- Administration with SysMan tools in Java, X11, Curses or CLI interface
- Remote Installation Service (RIS )
- IPv6, IPsec, TCP/IP, SNMP, DHCP, PPP, ONC 4.2, DNS, NTP
- ATM 3.0/3.1, Slow-, Fast-, gigabit ethernet, FDDI, token ring
- LPD printing manager
- Windows 2000 single Sign-On with Kerberos, LDAP technology
- X/Open UNIX 98, UNIX 98 workstation, CDE certified
- Multithreading, Shared Libraries
- POSIX, C, Bourne and Korn Shell

File structure of Tru64 Unix

/ Root directory  
/dev, /devices Device files  
/etc Configuration files  
/home, /usr/users Contains the user directory  
/lost+found  
/mnt Mount directory  
/opt, /usr/opt, /var/opt Additional software  
/sbin System programs  
/vmunix, /subsys, /sys Kernel directory  
/tmp Temporary files

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/usr Application programs  
/usr/lib, /usr/shlib Libraries  
/var Various files, some logging files  
/cluster Specific files for Cluster membership

**OpenVMS** VMS (Virtual Memory System) was designed in 1976 especially for 32-bit computers and used on VAX computer as well as the PDP-11. There also is a 64-bit version of the operating system for alpha systems. DIGITAL (DEC, Digital Equipment Corporation) were founded by Ken Olsen on 25. Octobers 1977. PDP system as well as the VAX and VMS architecture lasts never developed without DIGITAL. It is used for mainframes, servers and clusters and in the desktop area too. With Ultrix DIGITAL had a BSD based UNIX. In the 80s DIGITAL has placed itself as No.2 behind IBM. OpenVMS is used at most in the application area of health service, CPU production, stock exchanges and lotteries. 1996 were counted about 500,000 installations with OpenVMS. The complete technology was taken by Compaq in 1998, HP took the company Compaq and thus also OpenVMS in 2002.

- SMP, multitasking, multiprocessing, multi-user
- Alpha systems, VAX, Intel Itanium (since OpenVMS 8.0)
- POSIX standard
- consists of code of the programming languages like Ada, DEC C, Fortran, DEC C++, and others
- max. 32 CPU per system up to 96 systems in a cluster
- DCL Shell as CLI, X-11 and MOTIF GUI
- TCP/IP protocol
- File system: ODS-2, ISO 9660 (Read), FAT (R/W), NFS and SMB
- File system supports Record Management Services (RMS)
- Java Development Kit
- Netscape Fasttrack Web Server

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**GNU/Hurd** The GNU (Gnu is not Unix) initiative of the Free Software Foundation was founded in 1984 by Richard Stallman and has the goal to providing free software and a free operating system kernel. Together with software from the GNU project it shall form a complete free operating system. Different servers which stand for the file system, network and other functions are based on the Mach Mikrokernel. The first (test) release since the beginning of the development of the GNU Hurd Kernel was in August 1996. The completion of version 1.0 was planned for the 1st quarter in 2003.

- Till now only for the 32-bit x86 architecture
- Licensed under the GPL licence
- Built up completely modularly
- Look & feel like Unix - but doesn't based on Unix!
- Emulate a Unix environment by POSIX Wrapper, compatibly
- Offers ANSI C development environment
- Mach Microkernel
- Only base functions like scheduling run directly in the Kernel
- File systems (proc, ext2fs, ufs) and network services (auth) runs in Userland
- Supports multi-threading



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**Inferno** Inferno was developed as a successor of the operating system Plan 9 with the help of Dennis Ritchie and Ken Thompson as well as different one employees in the Bell Labs computing Sciences research centre in New Jersey, USA starting in 1995. Before Plan 9, D. Ritchie and K. Thompson have already developed the UNIX operating system. Inferno is an independent, standalone and scaling capable network operating system but can also be used on Host operating systems like Windows NT/2000/XP, FreeBSD, Irix, Linux, MacOSX, Plan9 and Solaris. Supported architectures are Intel x86 (386 or higher), Intel XScale, IBM PowerPC, ARM StrongARM (ARM and Thumb) as well as Sun SPARC. The system software needs at least 1 mb RAM and ROM, supports dynamic modules, unicode and is available with source code and an licensing agreement. Applications can easy access hardware devices like Audio, Ethernet, Graphic, touch screen, USB and also WLAN (802.11 b). Inferno is available as a plug-in for Internet Explorer 4.x or higher too.

Inferno is optimally suitable for distributed, architecture independent network applications e.g. Internet terminals. The Kernel with a preemptive scheduler was programmed in C, the higher layers and shared dynamic libraries for applications are written in Limbo. A complete development environment with programmable Shell, UNIX similar tools and a Web browser is enclosed. The programming under Limbo is syntactically similar to C. With specialization on the construction of network applications the Limbo compiler makes an independent source code for all sorts of architectures. This source code is interpreted during the runtime of the Inferno Virtual Machine or JIT (just in time) compiled for performance reasons before.

The Styx protocol shows all resources as a file over protected communication in the file system, no matter whether this resource are locally or remote. Part of this are storage drives, processes, services and network connections. With namespaces all resources and services are stored in an unique addressed name for applications. These pass on to the real resource names. The defined namespace is useable from every network client or also transferable to several servers. Safety is realized by the level of data connections, the control of resources and system integrity over different mechanisms. Supported algorithms are IDEA, 56 bit DES, 40-, 128- and 256 bit RC4 encoding as well as MD4, MD5 and SHA hash functions.

In 1996 Vita Nuova was founded in York, England of Lucent technology (part of Bell Labs). The name "Vita Nuova" means as much as "new life". The new enterprise cares about the sale, support and the development of the commercial operating system inferno exclusively. In addition, it is the one and only Plan 9 distributor. The change of the firm name in Vita Nuova Holdings Limited was on March 1st, 2000.

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**IRIX** SGI uses the industry standard UNIX to create its own operating system IRIX. Thus a basis for Hightech computing and graphic computing was created. IRIX is compatible with the UNIX system V Release 4 and is compatible to the standard UNIX 95. Therefore it supports among other things POSIX and is year 2000 compatibly. IRIX is used on special workstations by sgi like the Octane, Onyx, Iris and many other systems.

SGI struggled financially as companies like Sun Microsystems, Hewlett-Packard, Dell and IBM also got active on the market for High performance computing. As a reaction SGI published the end of the product support of IRIX and MIPS systems for the 2006-12-29. Furthermore SGI wants to grant support for customers about additional agreements until December 2013. The reorientation concentrates on Itanium servers and workstation systems of the Altix line with the Linux operating system.

## Field of Application

- From workstations up to supercomputers
- Visualization
- Simulation
- Film animations
- Natural science

## System Environment

- only for MIPS/SGI systems
- scalable up to 512 CPUs and 1 TByte of RAM in one system
- 16 GByte RAM
- 64-Bit, 32-Bit on older systems
- XFS file system
- 4dwm window manager
- Supports the EFS, HFS and FAT file system
- GUI was named IRIX Interactive Desktop

**IRIX 6.1** This new version is based on the 64-bit operating system IRIX 6.0.1 and is downward compatible. It unfolded his full performance on R8000 chip sets with 6 operations per processor cycle, 64-bit processing and compatibility to older 32-bit and 64-bit MIPS processors.

## Functions:

- 64-bit virtual address space of 1 TByte for each 64-bit user process (R8000)
- Large physical memory of 16 GByte (R8000)
- Large file size of 1 TByte at first release (R8000)
- Large file system size of 1 TByte at first release (R8000)
- Millions of files per directory (R8000)
- Supports up to 18 R8000 processors per POWER CHALLENGE or POWER Onyx system
- New XFS file system for high-performance
- New N32 software developers kit
- New networking and system administration features (based on IRIX 5.3)
- POSIX 1003.1 Specification
- Complies with the X/Open Portability Guide, Issue 3 (XPG3), including support for I18N and L10N
- Nearly all binaries built on IRIX 5 can be run under IRIX 6

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- Network: 64-bit NFSv3 for faster data transfers and distributed 64-bit addressing
- Network: Parallel TCP/IPx for higher parallel networking throughput
- Network: IRIXpro(TM)
- Network: Performance CoPilot(TM)

Support on the systems:

- POWER CHALLENGE, POWER Onyx, POWER Indigo2 and other recent Silicon Graphics systems

### **IRIX 6.2** Functions:

- Advanced 3D Internet/multimedia user and developer desktop environment
- 1 TB virtual memory addressing, 9 TB files, 18 TB partitions on 64-bit platforms
- 32-bit ABI compatibility with IRIX 5 applications, recompile for full performance on R4x00/R5000/R8000/R10000 systems
- Complete software environment for industry-leading graphics workstations and high-performance supercomputer, database, and network servers
- X/Open Base 95 Profile branding from the X/Open Company Ltd.
- POSIX 1003.1 certification
- Supported filesystems are EFS, XFS, Network Filesystem (NFS), ISO 9660 (CDFS), DOS (floppy only), swap, /proc Filesystem

Support on the systems:

- Crimson, Indy, Indigo R4000, Indigo2, POWER Indigo2, Onyx, POWER Onyx, Challenge, POWER CHALLENGE

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**JavaOS** JavaSoft is a subsidiary enterprise of Sun Microsystems and developed JavaOS (code name Kona) which was introduced to the public at the end of May 1996 at the JavaOne developer conference. JavaOS has clearly a different one system structure than typical desktop or server operating systems. JavaOS is very compact and was designed especially for embedded devices to be able to execute Java applications on this directly. It needs neither a file system nor virtual memory, concept conditionally it supports only a programming language at the execution and does not have his own system calls. It boots independently, supports a password protected login, own device drivers, has its own window system and API and can execute several Java applets at the same time. JavaSoft has granted licences to more than 25 manufacturers, to this companies belongs Oracle Corp., Acer Inc., Xerox, Toshiba Corp. and Nokia which will use the JavaOS in her products. IBM and Sun announce the cooperation for JavaOS for Business at the end of March 1998.

Update: November 2001

Savaje Technologies offers JavaOS with the Espial Escape browser for handhelds in Java. The operating system called SavaJe XETM is especially designed to run Java 2 applications (J2SE) on handhelds and embedded devices. The Espial Escape browser is a fast and safe program for enterprise applications even for complex web pages.

## Field of Application

- Execution of java applications
- JavaOS for NC (Network CLients), use on Thin clients without fixed disk
- JavaOS for Consumer is optimized for networked consumer products like navigation systems or handhelds, Settop Boxes, WebPhones
- Browse on the Internet with the HotJava™ browser

## Structure information

- Platform independent
- supports 32-bit up to 128-bit operating systems, depending on used platform
- Microkernel
- needs low resources, 256 kbytes of RAM and 512 kbytes of ROM, for Internet application 4 mbyte RAM and 3 mbyte ROM
- small and efficient
- works with an Host-system or standalone
- HotJava as a window system installable

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**Linux From Scratch** The Linux From Scratch project was founded by Gerard Beekmans to develop an instruction guide for the installation of a Linux installation from scratch with GNU/Linux and additional software in 1998. This is very usefull if existing Linux distributions do not meet the requirements for the planned field of application. You can imagine it like a public development process of a distribution at which one takes part himself. With this project there is the possibility for the experienced user to build a own user defined Linux distribution and to gain more knowledge in this operating system. On the project website you get informed about the current development state and help over the mailing list and newsgroup.

LFS provides the detailed installation instruction with the download addresses for the necessary software packages as well as some scripts and important patches for the installation. The software packages are in source code and must be compiled first. An existing development environment is needed for this, also a already running Linux system with all necessary development applications. The Debian GNU/Linux in version 3.0 r0 (Woody) distribution of 2002/20/07 has to be a particularly suitable development environment proved after several tests and many LFS installation starts for LFS 4.1. After the update of few programs to the needed versions the installation proceeded without errors. Since December 2005 a LiveCD also has released where you can install LFS on the PC without a preinstalled LFS development environment. With the ALFS (Automated Linux From Scratch) Projekt many of the installation steps can be automated and simplified.

If the LFS installation was completed, you can make further customizations and installation of a graphical surface on this base. BLFS (Beyond Linux From Scratch) exactly starts there and leads in an instruction guide through the further installation process for the use of LFS as a desktop, server or office system.

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**Lindows Company** Michael Robertson had announced the beginning of an ambitious project in August 2001. He was a CEO at MP3.com before. The operating system LindowsOS shall unite many advantages of Linux and Windows after the first completion. Programs of both Windows and Linux can be installed and executed easily. LindowsOS is a derivative of the Xandros distribution which based on Debian GNU/Linux, makes the execution of Windows programs by the smooth integration of the Wine project easily possible. One of broader advantages is the installation simply held, there are only less user details needed to install LindowsOS. With an agreement with WAL-MART Lindows has found a sales partner who offers a cheap PC system with preinstalled LindowsOS.

**LindowsOS** Lindows merged the stability of a Linux derivative with the usability and characteristics which one would rather assign to a Windows operating system. LindowsOS goes one step further. With the procedure named Click-N-Run programs or upgrades can be installed with one single mouse click. The costs for the software subscription amount are EUR 99 for 12 months. Registered users could choose at the beginning from more than 1,000 applications, in meanwhile this number has increased to over 2,400 programs in the year 2006. No licence is needed for the private use on several PCs.

- zero Mayntenance
- containing plug-and-play abilities for USB 1.0, USB 2.0 devices
- improved driver software support particularly for multimedia devices
- blocks Advertisements and Spam from the Internet

In the legal controversy about the word similarity of the name Lindows to Microsoft Windows the opponents agreed about the renaming of Lindows in Linspire. The software product, logos as well as the website from Lindows was switched over to the changed naming in the period from April to the end of October 2004. In response Microsoft assured the payment of 20 million dollars and a time limited use of Windows Media components the distribution Linspire. For this Linspire put down the counter legal suit against the word mark for Windows.

To the innovations of Linspire 5.0 of 2005/16/03 belongs the Kernel 2.6.10, KDE 3.3, X-Server 6.8.2, the Reiser4 file system and improved support for Notebooks with Intel Centrino and AMD PowerNow technology. The new user interface and the extended CNR technology have flowed into this version with more than 1,200 improvements altogether.

Linspire announced the publication of a Linspire based pure open source distribution named Freespire on 2006/24/04. The project is supported by the Community. No version was published for download till now.

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**Development of Linux** 1986 Linus (Benedict) Torvalds programmed its own driver for its floppy controller. He learned intensively hardware programming and became better knowledge about his Sinclair computer with Q-DOS. Additionally he provided his own programmer Tools. When 1991 the 386-Intel PC became modern, he got one PC to learn about the programming of 386 CPUs. As operating system the Unix derivate MINIX was used, he has know Unix already since 1990 from its university. Minix was developed by Andrew Tanenbaum as learning system and was particularly used at universities. The written book from A. Tanenbaum "Operating Systems: Design and Implementation" is about operating system concepts and Minix, which became the favourite book from Torvalds. The source code of Minix is open source, any modifications are bound to the license conditions.

Because he did not find the provided terminal emulator program in Minix acceptable, he began his project to code his own and better terminal emulator with more functions on hardware level. In addition he programmed his own drivers for the data medium access and the file system and others in assembler. With these functions the software becomes the ability to upload and download from the Internet. In the line of the development terminal program got more and more functions so he made the decision to enhance it to a operating system. Its operating system was derivated from concepts of Minix but completely written from scratch beginning at the Kernel. After long programming evenings it was so far. On 17th September 1991 the operating system Freax version 0.01 was finished, as development environment was used still the MINIX for 386 CPUs. It contained already the GNU Shell bash and the GNU C-compiler GCC from Richard Stallman, which counts to the standard programs for the meantime named operating system Linux. Because Linux profits particularly from the GNU software pool, it is generally called GNU/Linux.

After approximately 6 months Freax was renamed in Linux. Already on 3th July 1991 he had asked for the POSIX standards in the minix-newsgroup, he presented on 25th August 1991 his project in public and asked for suggestions for further functions and extensions. The source code was made freely accessible by ftp. To communicate with other programmers and interested people he used the Maylinglist "Linux-activists@niksula.hut.fi" and the newsgroup "comp.os.minix" for contact and progress messages. Later its own Maylinglist and forums were created. In the line of the development he received wished postcards from all over the world with thankfuly words. The project has got a strong self-dynamic in the InterNet and was maintained by the community. The rights at the brand name Linux was transferred after a legal incident to Linus Torvalds and later distributed on several persons to ensure the further development and to avoid a "takeover by enemys". The symbol figure "Tux the penguin" was selected because Torvalds was bitten by a penguin in a Finnish zoo. The self-willed animal had impressed him in such a way, which it gave to its operating system this guidance figure. At the beginning Linux doesn` t contain any installation script or graphical installation menu. To make the installation from Linux easier and automated Owen LeBlanc from the Manchester Computing Centre published the MCC Interim release, this was the key for the automated installation of today's distributions.

File structure (first level) of Linux and derivatives

/ - Root-Directory

/bin - system tools

/boot - kernel, bootmanager

/cdrom - Mount-Point for CD-ROM drives (optional)

/dev - device files

/etc - configuration files

/floppy - Mount-Point for floppy drive(optional)

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/home - user directory  
/lib - shared Libraries  
/mnt - mount Verzeichnis  
/opt - additional software, GUI  
/proc - system informations  
/root - root user directory  
/sbin - system programs for root  
/tmp - temporary files  
/usr - applications for the GUI, source code (kernel)  
/var - various files, log files

Small reference of shell commands

mount - Mounts a filesystem  
umount - Unmounts a filesystem  
fdisk - Used to create or delete of partitions on a hard drive  
hdparm - Get/set various hard disk geometry parameters  
rm - Remove files  
ls - List the contents of every subdirectory  
dir - List the current directory content  
cd - Change the current directory  
dd - Bit based disk or data copy  
ps - shows active processes  
df - Shows the free space of any filesystem  
find - Search for a file  
mkdir - Make a directory  
mv - Move or rename a file  
vi - Editor with a command mode and text mode  
killall - Kill processes by name  
ifconfig - Configure a network interface  
netstat - Information about the network connections  
mc - File manager with visual shell

The advantages of a free development and distribution are among other things in the user orientation because no unnecessary features are integrated that nobody does need. That is done via the dynamic development process, which select principle from 1.000 current ideas the most necessary features out that taken up to the official system core. In order to meet all requirements, the Kernel series of 2.2.x (max. 2 GByte RAM addressably) exists beside the newer 2.4.x (max. 64 GByte RAM addressably) in coexistence. By the dynamic development a rigid marketing plan that rules about the release date is unimportant. In addition new versions are only published with proven reliability and are not determined if the schedule points to the best sales favorable time. While Linux 0.01 with the most fundamental components and instructions consisted of 10.000 code lines, the source code increased now in version of 2.4.9 to approximately 3.7 million code lines including many hardware drivers. Linux regards the specifications from system V and BSD Unix programs.



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Some operating system companies use the open development to add new characteristics into the open source operating system as example the file system support XFS by SGI. Linux and related operating systems are only possible through the work of the InterNet Community that contains the support of developers world-wide and increasingly development support by IT companies. Therefore there are so-called developer kernel releases with odd version number like 2.3 and stable releases with straight numbers like 2.4 for the stable use for user and employment in companys. Matthias Ettrich announced the project Kool Desktop Environment (KDE) in the Usenet posting of October 14th, 1996. The GUI library Qt by Trolltech is used for the development. The first KDE main release happens in July 1998, the second release in October 2000, the thirth release in April 2002. The KDE desktop is besides gnome one of the most used user interfaces.

According to estimations there is at the beginning of 2001 at least 10 million Linux user world-wide, tendency strongly rising. Since about 1997/1998 Linux is regarded strengthened by the IT industry as alternative operating system. In the years 2000/2001 the assumption is expressed, that Linux can also replace the existing commercial Unix variants gradually and wins further agreements. In the heterogeneous network Linux co-operates by the native support of network protocols with Macintosh, Novell and Windows.

The General Public License version 1 was founded 1989 of Richard M. Stallmann. The GPL version 2 was written by the Free Software Foundation in 1991, since then the Linux Kernel is put under this licence. The final GPL version 3 came out on 2007-06-29. The license model GPL that Linux underlies, offers to the developer extensive liberties and spreads transfers of technology because the knowledge is open. By the open development code audits constantly improve the quality of the source code. By code sighting from various developers the software security is increased and the further development doesn't depend on probritary manufacturer. Many Linux derivatives are available on the Websites of the Distributors and projects with ftp or HTTP for free Download at no costs. By redundant Mirror servers the operating systems are available in ISO images around the world.

## Goals

- Create a better MINIX than MINIX (he was dissatisfied with MINIX)
- Unix derivated operating system for personal computer
- Open Source development
- Programming together with developers from around the world
- User centric development

Linus Torvalds worked from March 1997 till June 2003 for the chip manufacturer Transmeta Corporate in California, well known for the Crusoe processor. He left the company for the OSDL (Open Source Development Lab) to focus on the future development of the Linux Kernel 2.6.x and moved to Portland, Oregon. The OSDL and the Free Standards Group joined together to the Linux Foundation in January 2007. Linus Torvalds is still active maintainer and the main Linux kernel developer since 1991.

**Distributors** A Distributor is usually a developer team that takes advance from the Linux system core (Kernel) to offer a installation-able software package. Beside the individually adaptable system core numerous additional applications, driver and assistant are included, which can be installed and configured with the own installation andsetup routine comfortably. Those distributions are made available on the Internet as ISO image or to buy cheap on CD-ROM or DVD medias. The taken money is needed for the developers and the support. Often Linux distributor companies are actively in other open source projects too.

In order to install a Linux distribution they exists different ways of installation. The booting of the installation

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routine from CD-ROM after the El-Torito standard, DVD, floppy disk (in the meantime rather rare), by network or ftp server after the boot procedure are supported directly. From the large and big offerers of Linux distributions profit small distributors which are aligned to very special operational areas, like data Recovery or software-routers.

Debian

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30. May 2002: For the first time several large Distributoren united to a large community (see News note). Under the name UnitedLinux was created a common basis for the uniform development of a Linux distribution. Elements of it are guidelines of the Linux standard base. All participants of the partnership let its experiences in the business area and technical knowledge flow together to rise up the market share in the server range. Final desktop versions for customers are provided by each distributor separately. To the Comdex in November 2002 the initiators presented the finished version 1.0 together. United Linux 1.0 is thereby LSB 1.2 and Open18N conform and also valid for future versions as standard. The Linux Standard Base 3.1 was published at 2006-06-21. This definition sets new guidelines for desktop applications, a own software development kit (SDK) and the certification for products to the LSB 3.1.

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**Mac System Software** Mac OS was named by the company Apple as "Mac System Software" in the beginning, a specially designed operating system only for 68K first Motorola processors. With own Macintosh hardware, Mac OS takes up a special role in the world of desktop systems. The first version was "System 1" and appeared bundled with the Mac in 1984. The classic desktop is designed as a single user operating system and almost completely hides the full path to files and directories. The graphic representation is reduced to the essence. Overall the interface is very easy to use and does not need the right mouse button for user interaction. Mac OS does not include a command line interface.

Starting with System 3.0, the used filesystem HFS was used officially, which does not differ between uppercase and lowercase letters. System 5.0 was the first release to run several programs with the integrated MultiFinder at the same time. The operating system was programmed up to system 6.0 mostly in assembler and partially in Pascal and used a 24-bit addressing mode. Cooperative Multi-tasking could optionally be enabled in System 6. System 7.0 first supported 32-bit addressing. Thus allow the operating system can use more memory and more powerful programs. Since 1994 System 7.5 supported for the first time the PowerPC architecture and is optimized with the following Mac OS versions further on this architecture. With System software 7.6 the name was changed to Mac OS in January 1997.

The optimization of the operating system to the hardware has the disadvantage that the system software can not be installed on every Mac. Application compatibility to the Mac systems may also vary with each version.

2006 MacOS X was presented for the first time publicly on x86 hardware, Apple allows the use of Mac OS X only on specific intel-Macintosh systems. According to Steve Jobs Mac OS X have been developed since 2000 internally parallel for Intel and PowerPC processors. The version of Mac OS X 10.6.0 raised the optimization to Intel-based processors further, the new operating system is no longer available for PowerPC Macintosh or pure 32-bit intel processors. In return the user receives a pure 64-bit operating system optimized for performance on multiple processors. Even the GPU computing power itself can be used with specific applications.

The selection of software is focused on the creative industry and enables such as the professional graphic, audio and video editing. Office applications such as MacWrite, Microsoft Office, OpenOffice and 3D games are also available. The choice of browsers is large with iCab, Microsoft Internet Explorer, Netscape, Opera and Mozilla Firefox. Stuffit is the standard software for file compression.

**System 6 (Mac OS)** Mac system software 6 came onto the market in 1988. It requires 1 MB RAM and can address up to 8 MB. The file system can organize hard disks up to 2 GByte with 65,536 files. Optionally applications run with the multi Finder in cooperative multitasking. For word processing are programs such as WriteNow, MacWrite II, and Microsoft Word 4.0 available.

**System 7 (Mac OS)** The system 7 was first available in May 1991. The new operating system needed 2 MB RAM, optionally it can be switched to 32-bit depending from the used hardware. Cooperative multitasking is now enabled by default, the addressable memory is no longer limited to 8 MB. In addition virtual memory can be enabled.

New is the direct support of networks with file exchange, AppleScript as scripting language and display of colors. Balloons provide help for the user to use the interface. With aliases are icon links to files possible, regardless of the storage location locally or from the network. The TrueType fonts are scalable to any size.

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The System Software 7.5 appeared in 1994 and requires at least 4 MB RAM. It was running both on 68k-Macs and Power Macintosh. In September 1996, the update System 7.5.5 includes all available bug fixes, Open Transport 1.1.2, current Ethernet driver and support for storage drive volumes up to 4 GB. With release 7.6 the company Apple changed the name for the operating system from System Software to Mac OS in 1997. At the 31. January 1999 Apple gave the Mac system software 7.5.3 public as free download.

Mac OS 7.6 can be installed on every Mac compatible computer, which contains at least a 68030 processor and supports 32-bit addressing. The 24-bit addressing is no longer supported. Performance is improved in the area of virtual memory and memory management. QuickTime version 2.5 offers better image quality and benefits of multiple processors.

On systems with 68040 or PowerPC processors partitions can be used of up to 2 TByte, systems with 68030 processor remain limited to 4 GB. Check of the disk after a system crash requires now much less time.

**Mac OS 8** Mac OS 8 by Apple appeared in July 1997. As minimum requirements are specified a 68040 or PowerPC processor, 32 MB RAM and 120 MB of free disk space. The CTRL key is used to display a specific context menu for different actions. Finder in version 8 is now multithreaded and does no longer breaks other applications during the copy of files. The starting time of the operating system and applications is been reduced. As standard the browser software Microsoft Internet Explorer 3.0 and Netscape Navigator 3.0 are included. Inside of a TCP/IP network can shared files and printers accessed.

With Mac OS 8.1 the filesystem HFS+ is included by default. Now informations are stored more efficiently on the file system and does less waste disk space in comparison of HFS. The limit of the partition size is depending on your hardware, the maximum size is now 2 TByte for all Quadra and PowerMac systems. The file system can handle up to 2 billion files with a current file size of up to 2 GB. PC Exchange 2.2 allows users the mount of DOS and Windows drives on your desktop. The supported file systems include FAT12, FAT16, FAT32, VFAT.

Mac OS 8.5 further optimized the stability and speed of the operating system, Sherlock is extended for full-text search in local files and Internet search wizard for the first time. Mac systems with 68k processors are no longer compatible with this version. The throughput in Ethernet networks has been increased, AppleScript is now up to 5 x faster than the previous version. The graphical display is accelerated by new QuickDraw routines. Copying files has become faster and increase the disk throughput. A tool for system maintaining detects and fixes errors on the file system automated. The "Apple System Profiler" creates comprehensive reports about the used hardware and software.

Following applications are included in current version: Finder 8.5 QuickTime Pro 3, Open Transport 2, Internet Explorer 4.01, Outlook Express 4.01, Netscape Navigator 4.0.5, Mac OS Runtime for Java 2.0 and File Exchange 3.

Mac OS 8.6 requires 250 MB free disk space and 24 MB RAM. A new kernel is included which improves performance and added support for the PowerPC G4 processor. The ability of multitasking and multiprocessing has been optimized further and enhanced with new features.

UDF 1.5.2 allows reading and storing data to DVD-RAM and read of DVD-ROM media.

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**Mac OS 9** The operating system Mac OS 9 has been developed under the name Sonata and released to the 23. October 1999. The installation requires 32 MB RAM with virtual memory and a PowerPC 601 processor or higher. For models with G3 processor are at least 64 MB RAM recommended for optimal performance. The first G4 and iMac systems until summer 2000 are supported. The free disk storage should be 150 up to 400 MB depending on the installation type.

50 new features are added in comparison to the previous version. This includes support for multiple users with password and access management for files and settings. The login is available through authentication by voice. Files can be stored encrypted. The operating system can automatically update itself via the Internet. You can back up all personal passwords with a master password. The integrated search engine Sherlock 2 is extended with language and search templates. The first version "Carbon" API is available for new applications.

The following applications are included in current version: Finder 9.0, Mac OS Runtime for Java 2.1.4, Apple data security 2.0 and Open Transport 2.5.

**Mac OS X** Different technologies like the Mach Kernel, NEXTSTEP and tools from NetBSD and FreeBSD found influence in Mac OS X to merge the previous Apple technology with UNIX features. The operating system core Darwin is open source and can be used also on x86 computers standalone. Mac OS X works with preemptive multi-tasking and includes beside the new GUI Aqua the classic GUI from Mac OS 9.

Mac OS X 10.0 came out in March 2001. To install are 128 MB RAM (256 MB RAM starting from Mac OS X 10.3.9) and 1.5 GB hard disk space (3.0 GByte starting from Mac OS X 10.2) provided. Mac OS X 10.5 requires at least 512 MB RAM and 9 GByte of free disk space.

- 32-bit or 64-bit processing
- SMP with up to 32 CPUs
- needs a PowerPC G3, G4 or G5
- POSIX compatible
- HFS+ file system

## Field of Application

- digital photography
- 2-D and 3-D animations
- video processing, streaming
- audio processing
- platform for DTP, web design
- office applications

## Structure Information

- supports QuickTime/VR
- monolithic Kernel
- Read/Write FAT, FAT32, ISO9660, UDF
- well proven TCP/IP Stack
- graphical user interaction with the finder
- graphical representation by Quickdraw
- central password administration (Keychain)

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Considerable performance and comfort improvements were carried out in version Mac OS X 10.1. The surface reacts quicker at user interaction, the system start was accelerated and the OpenGL performance increased noticeable.

Mac OS X 10.3 has now a GUI in metallic scheme and the optimized Finder. The use and access in heterogeneous networks was further simplified. Files can be provided with etiquettes, the compression format ZIP is now directly supported. 12 million MacOS X user were counted in October 2004.

According to Apple Mac OS X 10.4 brings more than 200 new features. Features are the fast, system-wide and index-based search function named Spotlight, the Dashboard for easy access to small programmes (Widgets), the Automator for the simplified composition of Applescripts for the automation of tasks. The Web browser Safari in version 2.0 now contained RSS support, the QuickTime software was updated to version 7 with support for the H.264 video codec. Further novelty is the delivery at a DVD medium, an installation of CD-ROM is no longer possible.

First since the 10th January 2006 is MacOS X 10.4.4 next to the PowerPC version available for Intel based Macs. On the 6. June 2005 Steve jobs announced at the WWDC the switch to Intel processors. As further details became known that Apple had developed Mac OS X since 2000 internally also for the Intel platform.

Apple released the successor MacOS X 10.5, Leopard at the 26.10.2007. With more than 300 innovations MacOS offers the user an enhanced user interface with virtual desktops, a fast file preview and Dock with 3D effect. The Finder was revised, the expansion "Boot Camp" for the installation of Windows on Intel-Macs is an official component now. As a file system ZFS is optionally available. For the surfing on the Internet the Apple Safari 3 Web browser is included. Backups can be made, managed and restored in a simple way with "Time Machine". Time Machine makes every hour the day automatically a file backup and every day a snapshot for the duration of a complete month. Lost files are recovered easily over the display of a dynamic time line of those snapshot. The security of the operating system and applications is improved by 11 enhancements. This are beside others the application-based firewall, signed applications, the use of ASLR (Address Space Layout Randomization) and Sandboxing for applications.

Open Group certified MacOS X 10.5 according to the standard UNIX 03 in November 2007. MacOS X is the first free BSD derivative with such certificate to bear the name UNIX officially. The certification guarantees the use of UNIX standard implementations to porting UNIX applications easily.

The first update with bug fixes was released with Mac OS X 10.5.1 by Apple on November 15th, 2007. It contains general bug fixes for the operating system to improve stability, better compatibility and safety. Mac OS X 10.5.2 came with 125 bug fixes and smaller optimizations on January 24th, 2008.

Mac OS X 10.6 is a Mac computer with Intel Core 2 Duo processor with at least 1 GB memory and 5 GB free space ahead. This operating system no longer exists as PowerPC execution. Apple placed the focus development on performance and stability. It supports up to 16 TByte memory, it is optimized for multi core processors, and is a pure 64-bit operating system. With the technology OpenCL graphics processor can speed up in specific applications calculations.

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**Mandriva (Mandrake Linux)** MandrakeSoft was founded in France in 1998. With the distribution Mandrake Linux based on Linux and configuration tools of its own as well as specified KDE surface the target was put to be installable as simply as possible operably and without problems. RPM is used as a packet format for software, one recognizes the precompiled software by the code contained in the package name, "mdk", for Mandrake Linux. It is available as a desktop and server version.

Test: July 2003

The installation of Mandrake proceeds uncomplicatedly. By dialog procedures the system is established, the kind of installation can with or without surfaces, development, console tools as well as server applications be selected comfortably. As a typical workstation with Open Office the installation uses approx. 1.1 GByte storage space, as complete server installation 490 MByte and as a development environment only 370 MByte. If one selects all components, the setup installs 1.7 GByte of the 3 CD-ROMs. As a booting manager lilo is installed, after the graphical booting procedure the first-time assistant enabling the configuration of the GUI and the e-mail client.

Update March 2004, Mandrakelinux 10.0 Community Release: The ISO images of the three CDs be able to download or to send by an ISO distributor on CD-ROM at mail. obtained are the Kernel 2.6.3, XFree86 4.3, GCC 3.3.2 and glibc 2.3.3. You can choice between the KDE 3.2, gnomes 2.4.2 and IceWM 1.2.13 desktop. Standard applications are the web suite Mozilla 1.6 and Open Office 1.1. Details of the control centre became improved, software tools for the DVD burning and for the network set up were revised.

From the fusion of Mandrakesoft and Conectiva was Mandriva formed. Mandrakesoft published the take-over of the Linux enterprise Conectiva leading in Brazil and Latin America on 24-2-2005. This strengthens the know how of Mandrakesoft in the area of research and development. The strengths of Conectiva were broad Linux software solutions for big firms, enterprises and authorities in whole Latin America. Mandrakesoft purchases all shares of Conectiva for about 1.8 million euros in shares.

Mandriva published his new Linux distribution Mandriva limited edition 2005 on 04-13-05. Processors with dual core are supported now and besides 32 bits also 64 bit processors. The contained applications for the web became improved as others like GCC 3.4.3, OpenOffice.org 1.1.4 and MySQL 4.1.11 are part of the installation package with better hardware suport too. The Linux Kernel 2.6.11.6, KDE 3.3.2 and gnomes 2.8.3 are up to date.

The agreement between Mandriva and Lycoris to take on values in the form of patents and enterprise parts was published on 06-15-2005. The founder of Lycoris, Joseph Cheek, changes to Mandriva. A new and better Linux product shall arise for the desktop and the development of desktop technologies be accelerated by the acquisition. Lycoris has developed special customizations of his Lycoris desktop/LX distribution for Tablet and Pocket PCs. Both distributions shall unify into a common product.

Mandriva Linux 2007 is available in 3 versions. The Discovery Pack is designed for beginners, Powerpack is aimed to to the advanced user and Powerpack+ for SOHO user. The GNOME 2.16 or KDE 3.5.4 desktop can be used on AIGLX and Xgl with 3D functions. A complete DVD video player is available with LinDVD, with Cedega of TransGaming PC Windows games are playable.

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**MenuetOS** The 32-bit operating system MenuetOS was programmed by Ville Turjanmaa with assembler. It is a new, graphical real time multitasking operating system which is programmed by several developers. The file systems FAT12 and FAT32 are supported. MenuetOS fits comfortably on one single floppy disk. Support for Multi-Threading, multi-processors and simple TCP/IP was added during development, a assembler is already included for developing own applications.

With Menuet64 0.59 beta from February 2007, the first variant for 64 bit processors was available. Programmed in 100% assembler, the execution of 64-bit and 32-bit applications is possible. The operating system offers a color depth of 16 million colors with up to 1280x1024 pixel screen resolution. In comparison to the 32-bit version the source code is closed for the public.

With the Menuet32 version 0.80 up to 0.89, the user interface and network functions were improved and support for USB 2.0 devices added. The 32-bit version is very few maintained since last version 0.85A in August 2007. For several reasons a part of the MenuetOS developers forked to KolibriOS in 2004 to continue the development of the 32-bit operating system as open source.

No matter which operating system you choose, both projects are still under development.



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**Minix** Minix was programmed by the computer scientist Andrew Tanenbaum as a teaching operating system for x86 computer. It is related to the AT&T UNIX, however it does not contain any licence requiring source code of UNIX so that it is free of charge to be used and sold. In January 1987 Minix was made public for the first time and the users discussed about it in newsgroups in the Usenet. Minix 3.1 was downloaded 75.000 times as an ISO image of interested users in the first 2 months after the release.

MINIX 3. x can be used for embedded devices also and for further applications where the GPL is too strict. The operating system offers very high reliability. The porting to the ARM7 and PPC architecture are in development. On the porting of the X Window Server is also worked.

## Structure information

- MINIX 2.0 for 16bit/32bit systems
- supports multi-threading

## System environment

- about 200 console programs
- up to 3 simultaneous user
- can use 16 mbyte RAM on Intel 286 and up to 4 gbyte RAM with 386 CPUs or better

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**MorphOS** Originally the MorphOS project was started to port AmigaOS from the 68k CISC architecture to the more current PowerPC RISC architecture in 1999. However, it came to that in the further project course, the MorphOS got an independent development with own hardware and not been based on AmigaOS or its hardware. The members of the MorphOS project already had knowledge in the hardware development. Fastlane (SCSI controller), CyberStorm (first 68060 CPU board), CyberVision64 graphic boards and the PowerPC architecture. These are very good condition for use of MorphOS on the Pegasus, a computer with PowerPC G3 or G4 processor and modern microATX mainboard.

MorphOS offers highly optimized and object-oriented code, contains the quark microkernel, needs few RAM and can emulate the 68K CPU through a fast JIT (Just In Time) compiler. MorphOS is not certified as RTOS, however it offers a very short reaction time. The source code is partly closed source and open source. As a file system FFS (Fast File System) or this more reliable and faster SFS (Smart File System) can be used. The USB Stack is called Poseidon and is very efficient. MOSNet is called the TCP/IP Stack and is developed in pure PPC source code. In this project flows components of the AROS (Amiga Research Operating System) project, MorphOS is compatibly to AmigaOS programs. USB devices are supported and 3D games can be played with this operating system too. As desktop Ambient is used which is similar to the concept of the Amiga Desktop Workbench. The icons of the user interface can be scaled freely in real time, the MUI (Magic User Interface) provides round forms and opacity effects. By the multi-threading Ambient reacts at any time, the desktop does not freeze at the user input if the accessed network is not obtainable. The colour representation in true colour, visual effects and the transparent display with alpha colour channel are supported. Files and data storage devices are accessed with 64-bits of computing precision, nothing therefore is in the way for the use of large files and fixed storage disks. The Kaya Audio Player supports files with Ogg Vorbis and MP3 format, with the VoyagerPPC you can surf in the Internet.

Since the 2004/15/11 has to be read under the MorphOS website that maybe unpaid salary demands of members of the previous developer team and other project related persons against the company Genesi exists. Until the payment shall not be published any new release. Genesi has given a statement after that which denies these demands and the not licensed sale of MorphOS. Genesi further supports the external development of MorphOS 1.5 if the development project plan and time schedule for this is named. By the public announcement of the demands new partnerships of Genesi with companies were prevented.

The MorphOS desktop Ambient has been put under the GPL on 2005/22/01 and is available in source code under sourceforge for free [download](#).

MorphOS in the version 1.4.5 was published in April 2005. A free [test version of MorphOS](#) was published for Amiga systems with PowerUP extension to the 5-year MorphOS jubiliaeum in August 2005. This test version can become a full version after registration.

The operating system MorphOS 2.4 released in October 2009 supports the hardware Pegasos 1 and 2, Efika 5200B and Mac mini G4.

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**Windows Automotive** Windows CE for Automotives (WCEfA) based on Windows CE, adapted for the specific requirements of the automotive industry for use in motor vehicles. This requirements are parallel access to the hardware, more stringent standards to the stability, security and response times. It supports a variety of processor architectures. Car manufacturers like for example Ford, Fiat and Kia integrate this operating system into different car models for offering services such as navigation, entertainment, communications and more.

32-bit real-time operating Kernel with protected memory areas short boot times supports .NET based on Windows CE voice controlled software various web services Win32 API, SAPI v5.0 (Speech API) High performance graphic support, DirectX® API and GDI subsystem DirectShow API supports Windows Media audio, MP3 and DVD driver diversion-control extended error report system, information collection for the diagnosis APM (Advanced Power Management) process monitoring transaction save file system (TFAT) Bluetooth 1.1, IPv6, IEEE 802.11 and 802.1x Messenger RTC/SIP client, VoIP, IEEE 1394 and MOST support Internet Explorer web browser

Windows Automotive 5.0 based on the Windows CE 5.0 operating system. By AUITK (Automotive User Interface Toolkit), the user interface can be efficiently adapted to the particular vehicle model. The Automotive System Toolkit (AST) provides the tools to optimize the performance by CPU management, diagnostics and fault monitoring.

Microsoft Auto 3.0 based on the Windows Embedded CE 6.0. It offers voice-based interaction with the user, the use of USB storage media, locating by GPS and secure updates of the operating system and software. Mobile devices can be connected via Bluetooth.

It is used for the technologies of Ford SYNC, Fiat Blue&Me and Fiat Blue&Me MAP. Ford SYNC since autumn 2007, a build-in communication and entertainment system for 12 different car models from Ford, Mercury and Lincoln. From end of 2009, Ford plans to equip all car models with SYNC. As hardware an Advanced RISC Machine (ARM) 11 processor, 64 MB RAM and 256 MB of flash memory is used. The USB port can be used to install updates of the device support.

Fiat use Microsoft Auto for the Blue&Me infotainment system and Blue&Me MAP navigation system. With the additional program EcoDrive the driver can even record his driving behavior onto a USB stick and evaluate it later for economical reasons on the computer.

Microsoft Auto 3.1 setzt auf das aktualisierte Betriebssystem Windows Embedded CE 6.0 R2. Es enthält ein neues Sicherheitsmodell für Anwendungen und das Betriebssystem. Die Signierung von Programmcode soll die Ausführung von unsignierten Programmen verhindern. Die Entwicklungs-Tools umfassen den Platform Builder 6.0, Visual Studio 2005, Microsoft Auto 3.1 Platform Development Kit und die Referenz-Hardware.

Reference hardware:

CPU: Freescale i.MX31, 16/32 bit RISC processor, with each 16 KB instruction and data cache 128 KB second level cache Security controller, including secure RAM and security Monitor 256 MByte NAND Flash 8/16 Bit 64 MB DDRAM 100 Mbit/s Ethernet interface USB 2.0 interface, High-Speed up to 480 Mbit/s Bluetooth 2.0 compatible

Microsoft Auto 4.0 based on Windows Embedded CE 6.0 R2. The operating system is supporting Intel iA86, SH4-based processor (SH7785), Freescale i.MX 31 and i.MX 35, Texas Instruments Jacinto and a variety of other processors which use ARM v4, SH4 and x86 instructions.

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**DOS (Disk Operating System)** In July 1980 IBM assigned Microsoft to develop a 16-bit operating system for the personal computer for the fee of 186,000 dollars. Although the company Digital Research of Gary Kildall already had with CP/M 86 such a 16-bit version, but by circumstances no contract has been established with IBM. Microsoft did not have yet any operating system, Microsoft licensed CP/M from Digital Research in November 1977 for 50,000 dollars. Since Microsoft could not sell licenses, a corresponding agreement with the company Seattle Computer Products was reached for QDOS. QDOS is a 16-bit clone of CP/M and was finished by Tim Paterson in April 1980. At first Microsoft licensed QDOS for 25,000 dollars. After a licence agreement with IBM was signed, Bill Gates bought QDOS for 50,000 dollars in July 1981. How proved this was a very lucrative business. IBM delivered it on all IBM computers as PC DOS for the first time on the IBM 5150 PC, for all other ones the name MS-DOS was for OEM partner. MS DOS 1.0 consists of about 4,000 lines assembler code.

The command interpreter is integrated in the file `command.com` with the internal commands for MS-DOS. Together with the file `io.sys` for simple device routines like the access to the monitor, keyboard, fixed storage disks and interfaces as well as the booting code these form the base operating system. DOS works very hardware near.

MS-DOS was wide spread in 1982 when 50 companies licensed MS-DOS. Software and hardware manufacturers build on this binary standard at this time. In 1983, the success of the PC system was clear the desire for a graphical surface was rising. Microsoft corresponded to the trend and announced a graphical user interface named Windows in 1983. Many other systems lost her market relevance at this time. In 1984 the number of PC and MS-DOS resellers increased to over 200. IBM published the AT computer in August, this one should refine the market for personal computer with MS-DOS 3.0/3.1. MS-DOS is already spread worldwide on Intel x86 computers in 1985. The easy extendibility of the computer by numerous plug-in cards of third party manufacturers, relatively low acquisition costs and a strongly growing amount of applications was a reason for it.

1988 was MS-DOS established and had reached measured on the market share a monopoly in the DOS market. The number of the MS-DOS installations grew worldwide to about 60 million and surpassed all other systems with that amount. Almost every software company offered standard applications like word processing, calculation or also special solutions like measurement tools, CAD (Computer Aided Design) or image processing for MS-DOS. The PC manufacturers designed her systems compatible to MS-DOS except for few manufacturers.

MS-DOS 5.0 allows the use of the High Memory and Upper Memory Area for DOS itself, TSR programs and drivers. The most important new external commands in this version are `DOSKEY`, `DOSSHELL`, `EDIT`, `EMM386` and `LOADHIGH`. `UNDELETE` can recover deleted files, `UNFORMAT` can undo the format of floppy disks. 2.88 mb floppy disk drives from IBM are now supported. The BASIC interpreter was improved in detail.

Update: With the release of Windows 95 up to Windows ME MS-DOS has only a minory roll. It is installed for compatibility reasons for MS-DOS programs and makes Windows 95 up to ME start able. DOS programs being executed in the DOS box or directly in MS DOS before Windows start. Today it finds application for boot disks or similar purposes.

Small reference of internal DOS commands  
`del`, erase - delete files

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rd, rmdir - delete directories  
dir - show content of directories  
cd, chdir - change current directory  
cls - clear the screen  
md, mkdir - create a directory  
copy - copy of one or several files  
ren, rename - rename of files or directories  
type - shows the content of text files  
set - shows the DOS environment variables or defines a new one  
ver - shows the DOS version number  
vol - shows the name of the storage drive

Small reference of external DOS commands

attrib - shows the attributes of files or set one of those  
fdisk - partitioning or modify of the hard disk  
move - move of files  
mem - shows the occupancy of working memory  
tree - shows the directory structure  
format - format of storage drives

Field of Application

- booting system for storage media
- File management
- For single user systems only
- Network client (NetBEUI, IPX/SPX, TCP/IP)
- batch processing

Structure information

- 16-bit operating system, (formerly 8-bit)
- Single tasking
- command interpreter for internal and external commands
- external driver software imbedding for periphery devices possible

System environment

- minimum: 512 kbytes RAM, 5 mbyte harddisk storage (depends on version for full installation)
- FAT file system
- executable with every x86 compatible CPU
- low RAM and fixed storage disk needs

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**MVS, OS/390, z/OS operating system** MVS (Multiple Virtual Storage) is the operating system which is developed by IBM in the sixties and supports POSIX. MVS was developed further from MVT operating system and extended by many functions like the use of virtual memory. It is used in IBM mainframes like the system /370 and system /390, needs low hardware requirements and convinces by a high stability in long-term operating mode. It primarily was used for providing of resources for terminal connections. JCL (Job Control Language) is used for the Batch processing, within zOS TSO/E (Time Sharing Option/Extended) serves the receipt of orders. As a dialog application ISPF (Interactive System Productivity Facility) helps at the development of the own programming and documentation of dialog and batch applications. At the beginning it was a 16-bit operating system and was developed further for the 32-bit of processing. With the version MVS/ESA the addressability for RAM and hard disk storage was extended. After the renaming of MVS into OS/390 the TCP/IP support was added into the release. This operating system now is called z/OS and his special char "z" at the beginning of "z/OS" stands for the good suitability of IBM servers of the zSerie like the z900. Now it is offering 64-bit addressing of memory too.

With the Hercules open source software it is possibly to emulate an IBM mainframe. Last update was with version 3.03 in December 2005, the emulator runs under different operating systems.

### Abbreviations

MFT = Multiprogramming with fixed number tasks

MVT = Multiprogramming with variable number tasks

SVS = Single Virtual Storage

MVS/XA = MVS with extended architecture

MVS/ESA = MVS with enterprise system architecture

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**NetBSD** NetBSD is a UNIX derivative and is descended directly from the Berkeley Networking Release 2 (BSD Net/2) and was published for the first time in March 1993. NetBSD was provided for several platforms from the beginning and got that way to the Atari, Amiga, Mac, PC and other platforms. The strengths are besides the UNIX relationship in the platform general application of a stable operating system in research and development areas. Moreover, it is compatible for POSIX and stands under the BSD licence. NetBSD supports cross-compiling to compile the source code of any platform also for other. One of the 4 co-founders of the NetBSD project warned on 200608-30 in an open e-mail to the NetBSD users that NetBSD is threatened to get irrelevant.

NetBSD supports in Version 1.6.1 11 different CPU families in 17 different system architectures as like x86, SPARC, 68K, VAX, Alpha and PowerPC. There are further 12 different platforms, which only are offered as source code. Altogether, 52 different system architectures are supported now. Depending on the processor NetBSD is useable with 32-bit or 64-bit processing. No SMP is supported till now, the mode shall be integrated in a later version.

Compared with Linux, NetBSD is primarily different in the system structure and the console programs. About a binary emulation applications also programmed for Linux in ELF format can be used. Especially for NetBSD the graphic server XFree86 4.2.0, GNU C compiler gcc 2.95.3 and further applications where adapted. The latest version of the user interface KDE 3 can just be compiled for NetBSD. As a file system UFS or better LFS is used. LDAP authentication and also NDS are supported for ethernet.

Compared to the previous version 1.5 new supported Platforms where added, the performance of the file system was improved, the Pipe and the PPPoE implementation is now integrated into the Kernel. For use on modern hardware becomes now support for USB 2.0 and IrDA. By several code audits the security of the operating system was further improved. Further details for the modifications and bug fixes are in the release announcement to NetBSD 1.6 readable.

On December, 09. 2004 was introduced the Version 2.0. This version has speed improvements onto the file systems and the memory management as well as new supported hardware platforms and devices. NetBSD runs now on 54 different hardware platforms and offers POSIX-Threads as well as balanced multiprocessing (SMP), ACPI and energy management for some systems like i386, SPARC and PowerPC.

NetBSD 2.1 was published at 2005-11-02. The support for much new devices was added and hundreds of bug fixes included.

NetBSD 3.0 brought greater improvements in the stability, efficiency and improved the network component and safety in the release at 2005-12-23. New device drivers and two new platforms provide a broader support. NetBSD 3.0.1 was published at 2006-07-24. It contains the first critical security related update of the NetBSD 3.0 main branch. Also NetBSD 3.0.2 brought the second critical security update at 2006-11-04 and with release NetBSD 3.1 also new features.

The new version NetBSD 4.0 shows up on 2007-12-19. The virtual Machine Xen v3, support of Bluetooth and different energy management functions are contained in it like Enhanced Speedstep and PowerNow. Many device drivers are added, the support of embedded Platforms with ARM, PowerPC and MIPS processors was enlarged. Altogether, NetBSD is available in binary form for 51 different systems.

In April 2009 NetBSD 5.0 was finished. The long period between the previous release have been used to

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improve the performance and scalability. The use of multiprocessor systems is also supported by the improved threading subsystem. As an X-server, X.Org X11 is now used instead of XFree86. The ACPI power management can now be used on many laptops. The number of device drivers was increased.



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**NetWare** Novell developed with NetWare a network operating system that no complex and overweighted GUI needs for use on servers. Novell provides simple but powerful text-based menus on the command line for the configuration since the first NetWare release. The administration of resources like printers, files and users is possible with a client and a graphical window system and granted administrator rights. Since NetWare 6 no more client is necessary for this, the configuration can be done completely on the server.

NetWare needs only low hardware requirements and has memory protection. It protects single processes from each other and is very stable through this in operation. Virtual memory is used reliably. By IFS file systems can be exchanged. This operating system is used for all sorts of fields of application. Use as a directory service, Internet server, Intranet server, file server or also application server is part of it.

The first release of NetWare was 1983 for the operating system DOS. In 2005 the current version of the network operating system Open Enterprise Server was published in different variants. Either with NetWare 6.5 kernel or Linux kernel of the Suse Enterprise 9 server, no matter which variant is used the same services are available.

**NetWare 3.0** With the version NetWare 3.0 the 32-bit performance of the Intel 386 CPUs could already be used fully. The following versions 3.1 and 3.11 eliminated many bugs from the main release. NetWare 3.11 had great popularity in companies and worked very reliable and stable. NetWare can respectively manage at most 32 TByte harddisk storages for at most 64 Volumes per servers. Novell cancelled the support for the version 3.2 in the year 2002.

## NetWare 5.0

Structure information

- 64 mbyte RAM, 550 mbyte fixed storage disks are minimal
- SMP up to 32 CPUs, ASMP
- Monolithic kernel
- preemptive multitasking
- integrated Java applications and development tools (JVM)
- 32-bit operating system
- 64-bit file system NSS (Novell Storage Services)

System environment

- graphical installation
- TCP/IP is standard protocol now (before IPX/SPX)
- Program format is NLM (NetWare Loadable Module)
- Configuration over Novell Client32 possible
- Web optimized, offers network management
- JavaScript and VB Script support
- Reads FAT16 partitions
- Server connects different platforms
- Maximum size of Volumes: 8 terabyte with NSS
- New network functions like WAN Traffic manager
- DHCP and DNS integrated in NDS 8

## NetWare 5.1

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- Application platform for internet & intranet applications
- *NDS 8*, Novell Directory Services, efficient database model
- supports NFS (Network file system), AFP (Apple Filing Protocol)
- optimized for the services of Microsoft Office 2000
- supports the web publishing (NetWare Netpublisher optional)
- *NetWare Enterprise Web server 3.6* with Frontpage support or Apache web server
- Novell International Cryptographic Infrastructure modul, 56-bit encryption, 128-bits optional
- NetWare client for Windows 2000, planned for Mac and Linux
- uniform user administration for different platforms
- use as a *FTP server*
- *NetWare Management Portal*, Administration of network installations over a browser
- Cluster services upgradeable as Add-On
- Hardware requirements for the full installation: 512 mbyte RAM, 2 gbyte harddisk storage

## NetWare 6.0

- Cluster services integrated, up to 32 NetWareserver in one system group
- Console One as a NetWare management program
- NFA (Native File Access) replaces the NetWare client, access from different platforms possibly, supported:
- CIFS (Computer Internet File System) for Windows Clients
- AFP (Appletalk Filing Protocol) for Mac Clients
- NIS/NFS for Unix Clients
- FTP (File Transfer Protocol) for data exchange
- NSS 3.0 (Novell Storage Services), up to 8 tbyte harddisk storage, 64-bit processing depth
- Mirroring of NSS partitions with Raid 0 and Raid 1, use of virtual partitions, Storage Pools, up to 255 Logical Volumes
- I-Folder for virtual work directories and synchronization tasks (with comparison by-bits), with I-Folder client by HTTP(S), Blowfish (128-bits)
- I-Print is further development of NDPS (Novell Distributed Print services), inclusive Drive Map for graphical location plan
- IPP (Internet Printing Protocol) for control of printers over the Internet
- Minimum: Pentium II or AMD K7 (Server class), 256 mbyte RAM, DOS partition with 200 mbyte of size, 2 gbyte for sys Volume

## NetWare 6.5

- support for Mac, Windows and UNIX networks
- modul-based Installation, server profiles for App, DNS, Print, ...
- Browser based administration and control
- E-Directory, formerly NDS (as like Active Directory of Microsoft)
- simplified Administration and use of network resources
- Virtual Office portal, remote access to working environment
- counts on OpenSource solutions, MySQL is integrated
- Minimum: Pentium II or comparable, 512 mbyte RAM, 200 mbyte start partition and 2 gbyte for system partition

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**NewDeal 3.0** NewDeal is a further development of the PC/GEOS operating system (1990 from Geoworks) and is offered with a number of included programs. GEOS (Graphical Environment Object System) was developed before by Berkeley Softworks as 8-bit operating system for 8-bit computers like the Commodore C64 or also C128 which brought a high market acceptance under the users. Not least by the surface with Drag & Drop which one followed it by the Apple Macintosh graphically was a cheap alternative to the acquisition of a Macintosh. Popular standard applications are among others GeoPaint, GeoWrite, GeoCalc, GeoFile, GeoSpell as well as GeoPublish.

Geoworks assigned all rights of GEOS to NewDeal Inc.. It was developed for desktop systems with 386/486 CPU. It needs an existing DOS installation and can only be used with DOS applications/driver software or programs written especially for the NewDeal operating system. It supports TCP/IP as well as IPX by himself and is Internet capable with the PPP (Point-to-Point-Protocol) service. It uses cooperative multi-Tasking and reminds from the look & Feel with Motif or NewUI to the Windows 95 surface.

Long file names are saved and managed by an internal database, VFAT from Windows is not supported till now. Most important applications are contained in the software package, like the visual programming environment NewBASIC for creating of own NewDeal applications and Office applications. Standard driver software for graphic and sound devices are already contained.

The company NewDeal had published news on her website last in November 2000, a new financing should save the enterprise. Unfortunately, this failed in January 2001, all employees had to be dismissed a month later therefore.

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**NEXTSTEP** NeXT Computer Inc. is named the company that was set up by Steve Jobs in 1985. Steve Jobs was previous at Apple and made independently with the company NeXT. The company NeXT was taken by Apple completely for 400 million dollars later. The developed operating system NEXTSTEP is UNIX related and also contains parts of the BSD and the Mach Kernel, therefore it is compatibly to BSD (4.2 BSD release). In 1990 the first web server and client in the CERN was set up on a NeXTStep system available. NeXTStep was used on special computers, x86 CPUs and Motorola CPUs were supported.

The concept of the bundle of the computer system "Cube" and operating system was given up and the operating system was sold separately in 1993. Another software product of NeXT was WebObjects for the construction of websites. In February 1997 Apple completed the take-over of the company NeXT and developed Mac OS 8 and the following operating systems with the technology of NEXTSTEP. OPENSTEP is the successor of NEXTSTEP with the OpenStep API independent of the operating system. Rhapsody was the code name for the new operating system of Apple with BSD 4.4 and OPENSTEP technology.

## Field of Application

- Server, use in networks
- Application development
- System administration

## Structure information

- File system is UFS
- Mach 2.5 based Kernel
- preemptive multitasking
- DPS (Display Post Script) interface
- does not support multi-processors
- object-oriented operating system

## System environment

- runs with x86 CPUs, RISC CPUs
- With SoftPC 4.0 the execution of Windows programs is possible

*Screenshot Source: Thomas McCarthy*

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**OpenBSD** OpenBSD is descended from NetBSD 1.0 (1994) and split in October 1995 through Theo de Raadt in an independent distribution. Leading figure of this operating system is a fish named Puffy. OpenBSD is regarded as the safest open source operating system and stands under the BSD licence. By "Secure by Default" and code audits OpenBSD had a secure base. All unimportant services are in the standard installation deactivated. This project started with an effortful, systematic source code audit by different techniques in summer of the year 1996. This way thousands of security related errors and other software errors in the source code were discovered and cleared in acceptable time. To hold the high security demand, 6 to 12 members in a team continue to search and fix new security gaps often before these arise or become known. The name of devices like hard disks in the "/dev" directory follows a scheme of its own. E.g. the first partition on the first IDE hard disk is described as wd0a, the second partition is named wd0b.

It was announced at the 2003-04-17 that the development of OpenBSD is not promoted by the Defense Advanced Research Projects Agency (DARPA) any more. Few days later the financial support also was stopped by representatives of the University of Pennsylvania for the project, the annual developer convention Hackathon must get by on that without paid accommodations for the participants. The financing lie now again only on donations and sales of CD-ROM and merchandizing articles.

The OpenBSD team also developed OpenSSH, a free variant of the known protocol. OpenBSD is used as operating system for services preferentially in the network and is available for many platforms. The software variety is expandable by the optional binary compatibility to SVR4, (inclusive Solaris), IBCS2 Binaries, Linux, FreeBSD and BSD/OS.

## OpenBSD release 3.6

There were the SMP support for i386 and AMD64 systems, new hardware drivers, support of USB 2.0 as well as numerous security and bug fixes.

## OpenBSD release 3.7

Numerous bug fixes and security corrections were made as well as improvements at the hardware support in this new release. There is the gcc in version 3.3.5 now, as X-Window server version 6.8.2 of X.org is used for the display of the user interface and alternative XFree86 3.3.6. New supported hardware platforms are the Zaurus PDAs and the workstation O2 of SGI (64-bit, MIPS).

## OpenBSD release 3.8

- new drivers for network cards, SCSI and RAID controller
- UDF file format for DVD,
- functions like malloc and libc new programmed
- optimized NFS efficiency

## OpenBSD release 4.1

- supported hardware platforms enhanced and improved, version for Landisk systems with SH4 CPUs, SPARC64 support for UltraSPARC III improved
- support improved for USB controllers, network drivers, hard disc controllers and mobile devices
- update of the software OpenSSH 4.6, DNS-Server Bind 9.3.4 and X.org 6.9.0

The complete foundation of the OpenBSD foundation in Canada was announced at 2007-07-25. The purpose is the support of the OpenBSD projects with connected projects like OpenSSH, OpenBGPD, OpenNTPD and

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OpenCVS.

MirOS BSD is a derivative of OpenBSD. His origin is located in the Patchkit developed by Thorsten Glaser with the name BSD-mirabile for OpenBSD. The first release was on 2002/11/10. The Patchkit evolved into an independent operating system distribution. Few persons work on this project till now. It exists already ported source code for the x86 and SPARC platform, further portings are planned. In contrast to OpenBSD MirOS was facilitated about rare used code. As language only English is supported, there is no support for NLS (National Language Support). Where it is appropriate, many code was included in the project by FreeBSD and less code of NetBSD. A frequent synchronization takes place with the OpenBSD source code, with the NetBSD code less frequently. MiroOS is designed as an operating system for the field of the communications servers, router and developer desktop till now.

emBSD raised from the OpenBSD project and was optimized particularly to a low installation size. This operating system is primary suitably as router and firewall. It needs not once a fixed disk, a CompactFlash card with 32 mbyte storage space. Version 1.0 was released in March 2001, Version 1.1 few months later in May 2001.

Anonym.OS is an OpenBSD 3.8 distribution on a live CD particularly for the anonymous and encrypted internet access. After the boot from CD-ROM only a couple of questions about the internet access must be answered before the Internet connection is made. As applications the Firefox internet browser as well as a e-mail and Instant Messaging program are available. The operating system was hardened against attacks and secured by removed unnecessary files and services. The kernel became patched for security, many encrypted Internet protocols are supported. The data traffic as well as contents is filtered and about the anonymization service gate transported. To protect the operating system on the base, the network fingerprint was changed to hide the real installed operating system. It is recognized as a Windows XP operating system with SP1. The idea for this project comes from Taylor Banks in March 2005. The members of kaos.theory introduced this live CD officially on the hackers Convention ShmooCon in January 2006.

OliveBSD is an OpenBSD live CD of Gabriel Paderni. The first version was published on 2006/18/02 and released as an ISO image for the download. This distribution contains only the most important application programs and build on the slim window manager IceWM. The Mozilla Thunderbird e-mail client and Firefox browser are included. Gimp provides the image processing and XMMS to play various multimedia files.

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**OS/2 Warp** Main characteristics of OS/2 (Operating System 2) are primarily the simple and powerful user interface WPS (Workplace Shell), stability and technology lead in the earlier years of OS/2. The user interface is built up completely object-oriented.

OS/2 of IBM does not have to be compared with DOS or Windows extensions any more since the version 2.0. This new version corresponded to a new operating system generation, which has the potential to use the full performance of a 32-bit CPU, developed only by IBM. Up to version 1.3 IBM had cooperated in development with Microsoft. The beta version was tested by 30,000 voluntary. It was made under the slogan to create a "Better DOS than DOS" with success. Much programs for DOS and Windows (3.x, Win32s) are executed faster under OS/2 than in the original operating environment.

The project Odin has the destination to execute Win32 programs (Windows 9.x and Windows NT) in OS/2 Warp natively. This happens by conversion of the .EXE and .DLL files into the OS/2 format or about adjustment of the programcode copy in the memory as in the case of OS/2 programs. Said more exactly, the PE (Portable Executable) Win32 binary format get converted into the OS/2 LX binarily (linear eXecutable) format.

A special project is the operating system eComStation developed by Serenty Systems. The last version of the OS/2 operating system was modified, enhanced and taken to the newest technical level, the user interface also was improved.

**OS/2 Warp 4 and 4.5** OS/2 Warp 4 was released by IBM in 1996. Because of the long-lasting support by IBM this operating system is holded up to date through service releases and newer hardware drivers to use OS/2 on current computer systems.

Until May 2001 the service release 15 and the Device Driver Pack 2 [0] are free of charge. With this update the system version 4.0 (rev. 9.023) was upgraded to version 4.5 (rev. 14.096 c\_W4). After this release IBM grants newer updates only in context of the software subscription with costs. Furthermore free of charge are additions and driver software to support new fixed disk controllers as well as ATAPI devices. Indispensable are the driver software of Daniela Engert [1] which completely replace the IBM standard driver software. With this new drivers large FAT 32 partitions are accessable without problems and the drives operates now in the DMA mode instead of the much slower PIO mode.

The original installation media consists of one boot and two installation floppy disks, one operating system CD-ROM with bonus pack, one application sampler CD-ROM and one driver software CD for older hardware like ISA boards. However, you will need only the boot disk, the operating system CD-ROM and more current installation floppy disks [2] for booting on current PCs.

By the updates you got year 2000 support, new hardware devices, support for large fixed disks up to 502 GByte by the 48-bits of LBA addressing (before at most 4.3 or 8.4 GByte), memory of more than 1 GByte (instead of only 64 MByte), USB devices, faster graphics display and SMP support. FAT 16 partitions are limited to a maximum size of 2.1 GByte, HPFS partitions are recognized up to a size of 64 GByte. It is recommended to upgrade to a newer Kernel like from 11/2003 [3] and the MTRR management [4] supported by Intel P6/AMD K7. With the IFS there can be added the driver to support FAT 32 and ext2fs support. To use sound cards from Creative Labs there exists a ported Open source driver [6], support for current graphics boards comes with the Display Doctor 7.07 in the IBM special edition [7] of SciTech. This is a lite version from

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the full driver software licensed for IBM to provide it to all OS/2 users for free. If the correct driver software for the available graphics board isn't contained, only a general driver software is used with only slowest standard functions to provide the highest compatibility for all unknown graphics boards. But if you don't use OS/2 as platform to play games you will not be able to state any performance deficits. Otherwise the always current full version of SciTech remains indispensable.

The internet access was established with a standard 56K modem with standard AT instructions. The contained Web browser is too old for modern use of the web and should be replaced by an alternative and more current browser. Otherwise many websites are not displayed correctly. If the file size does not matter you can download the Mozilla (approx. 14 MByte) or Opera browser (approx. 5 MByte) for OS/2.

To play sound files the PM123 player and MMAudio pack offers its services for media access. The audio format MP3 is supported directly, support for OGG Vorbis and FLAC is also available as Plugin. Video files in the AVI and MPEG format are played best with the Warpmedia player. This also offers DivX support but only for the expired DivX format in version 3.11. Maybe it exists a codec that makes it also possible to view current DivX videos.

With the Odin project there exists a Win32 emulator which makes the use of Windows programs under OS/2 possible through different ways. Comparably with Wine under Linux, only a fraction of all applications for Windows are supported.

PC Konfiguration  
OS/2 Warp release 4.0 (rev. 9.023, original version 1994)  
OS/2 Warp release 4.5 (rev. 14.096c\_W4, incl. updates up to 2003)  
AMD Athlon XP 2600+ without extended features  
supports MTRR management  
1024 MByte RAM  
64 MByte recognized  
complete utilizable  
Seagate 80 GByte and 120 GByte harddisk  
drivenot utilizable, PIO mode  
complete utilizable, DMA mode  
Geforce 4-TI-4200 Graphiccard  
640x480 with 16 colours  
up to 1600x1200 with 16 Mio. colours  
Soundblaster 512 PCI soundcard  
not utilizable  
complete utilizable  
ELSA Microlink 56K Modem  
complete utilizable  
complete utilizable

## Installation

With the use of the newer setup floppy disks as mentioned large harddisks are utilizable and the desired partition can be selected for the installation. This must be selected as a start partition (C) and marked as installation destination. If you don't take care about this, data loss in the just active partition can happen. OS/2 Warp 4 is established in this example as the 3rd primary partition with 2.0 GB of size. The booting manager is installed only in this one. As filesystem you should certainly choose HPFS to make long file names possible and avoid installation aborts by too short file names.

[0] Hobbes large OS/2 archive [hobbes.nmsu.edu](http://hobbes.nmsu.edu), the service and device Driver pack should be downloaded from here since the installation process was simplified

[1] Daniela Engert: danidasd144.zip (EIDE driver from 11/2001), daniatapi0315.zip (ATAPI driver from 01/2004), danis506r168.zip (chipset driver from 03/2004) can be obtained at Hobbes OS/2 archive; FAT-32 support from [fat32.netlabs.org](http://fat32.netlabs.org)

[2] newer installation floppy disks from 04/2002 at [warpdoctor.org](http://warpdoctor.org)

[3] OS/2 Warp Kernel from 11/2003, w41103.zip

[4] P6K7MTRR ver.0.08a from 06/2002, p6k7mtrr\_v008a.zip

[5] ext2fs driver from [hobbes.nmsu.edu](http://hobbes.nmsu.edu)

[6] SoundBlaster Live! OS/2 Audio driver version 0.81, sbliveos2-081b.zip



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[7] Graphic driver SciTech SNAP Graphics for OS/2, 01r1064.exe from Hobbes OS/2 archive or as trial version from [scitechsoft.com](http://scitechsoft.com)

Serenity Systems licensed OS/2 at the end of 2000 and distribute the operating system under the product name [eComStation](http://eComStation.com).

IBM has released in March 2005 the news to guarantee the payed support of OS/2 for registered customers until 12-31-2006 and the ending of the sale of OS/2 products on 12-23-05. After this dates no further support of OS/2 is planned. The number of OS/2 installations was estimated to 500,000 in 2004.

## Field of Application

A few small firms, customers

Communications and transaction server in the banks and insurance branch

Other existing important big firms<

## Structure information

OS/2, MS-DOS and 16-Bit Windows applications

WPS (Workplace Shell) with a powerful scripting language

Monolithic Kernel

Preemptives multi-tasking

1 to 64 CPU system

32-bit operating system

## System environment

Supports HPFS, JFS

Optimized for web applications; reads FAT16 file system with tools for network management

Reads with shareware solutions FAT32, VFAT, NTFS, ext2fs, HFS

Connect different platforms in OS/2 Server Edition

## Features

Very stable, protected processes from each other

Interchangeable file systems by Installable File Systems

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## Operating system projects

### AllIOS/Alliance OS

The Alliance Operating system Project had choose the target since 1998 to create a new stable operating system which is based on the Stanford Caching Kernel Model. Originally this project has split from the Freedows project. Modifications at the source code were published last in March 2001. The project was stopped in meanwhile.

### AMX

The real time operating system AMX is from the company Kadak. It is used where everywhere there it depends on time critical reaction times. The medical area, telecommunication, control of industrial plants, data acquisition, automation and space-travel belongs to the fields of application. For embedded devices AMX is the basis of PalmOS version earlier than 5. AMX is available for different architectures and was used for the first time in 1980.

#### Features:

- compact structure
- short response times
- interruption of processes after priority
- preemptive, priority controlled task planner

#### AMX kernel variants:

- AMX 86, operates with or without MS-DOS and BIOS
- AMX 386/ET, 80386, 80486, Pentium processors
- AMX 68000, 680x0 and 683xx processors
- AMX CFire, ColdFire processors
- AMX PPC32, PowerPC processors
- AMX 4-ARM, ARM, StrongARM and XScale processors
- AMX 4-Thumb, ARM7TDMI and other Thumb processors
- AMX MA32, MIPS32 processors

AROS (Amiga research Operating system) has the target, to become a compatible operating system to AmigaOS 3.1 on the x86 platform and to port for other platforms. The project started at the end of 1995. Many improvements flow into the development, the source code was put under the APL licence which is derived from the Mozilla Public License.

CRUX is a Linux distribution which define itself from other distributions by a slim basic installation. Applications for the same task were reduced on two different programs. Current software from the GNU software pool flows together with the latest Linux kernel into new releases. Different optimized versions exist for modern x86 processors.

The version CRUX 2.1 was published in April 2005, version CRUX 2.2 one year later.

The Freedows project plans to release a open source operating system under the GPL only for the x86 platform. Freedows shall emulate different operating systems and be compatible to applications, such as for Windows or Linux. No version was published till now, the content of the Freedows website were not updated any more for a long time. This project was stopped in 2002.

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LynxOS is a real time operating system with short latencies. It is particularly suitable for time-critical applications, the performance can be increased linearly by additional hardware. LynxOS is binary compatible to Linux and supports network applications and the POSIX Standard. With version 4.0 a performance increase of 30% was reached opposite to the pre-version.

Micrium with his  $\mu$ C/OS-II real time kernel supports preemptive multitasking and finds his use on micro controllers and embedded systems. The " $\mu$ C/GUI" allows the design of user interfaces and with " $\mu$ C/FS" a high-speed and efficient file system is available.

Miray  $\mu$ OS supports several processor families and was designed for embedded systems. The efficient real time Microkernel Sphere SP 2.0 is offered currently. The version  $\mu$ OS 0.98 was released in July 2003.

Mungi is a single address space operating system (SASOS) on a 64-bit base. It is open source and is released under the GPL licence. By the SASOS design it differs from typical operating system structures. The sourcecode of the version 1.2 was published in September 2002.

Microware OS-9 was developed by the company RadiSys Corporation. It is a modularly built up real time OS for small devices and has preemptive multitasking. It can dynamically assign resources to preferred processes. Applications use the shared libraries, the file system is built up hierarchically. OS-9 can be operated without harddisk storage, it manages the system modules directly in the memory. This operating system does not allow programs direct hardware access by his architecture. The MGR Window Manager is used as user interface with X-Window. OS-9 supports processors of the architectures m68k, ARM/StrongARM, IXP1200, MIPS, PowerPC, SPARC, SuperH and x86/Pentium.

PaulOS was designed by Paul Sheer for small devices which shall be used for application development. It supports 16-bit, 32-bit and 64-bit processors. The file system follows the POSIX standard. Applications are executed in the single threading procedure with a very low latency. Many network applications were ported by Linux and come by the TCP stack from BSD and is used for example as mini-web server. The version 1.3.1 was published in April 2005.

PROLOGUE is a pure text oriented multitasking and multi-user operating system for x86 CPUs. Originally it was developed by Honeywell BULL as a very stable working environment for industry software as used by human doctors or workers. Successor of PROLOGUE is the operating system TWIN Server.

TinyOS 1.0 bases on a component model which can be adapted flexibly to embedded devices. It is designed for minimal hardware requirements.

TriangleOS in the current version 0.0.3 of 30-4-2003 was developed by Wim Cool. It was programmed in C and assembler on the x86 platform with network abilities. For the version 0.0.5 a new Virtual file & Database System as well as a new user interface is researched.

v2os 0.64c is an assembler operating system which is freely developed. v2os is still in development, provided applications already demonstrate the abilities.

brickOS (formerly legOS) (last review: July 2003) is a open source operating system for robots from the Lego

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Mindstorm Kits. It supports all RSX subsystems, preemptive multitasking, infrared technique and the dynamic memory management as well as the dynamic load of programs and driver software.

Visopsys is developed since 1997, is open source and an independent development. The user interface is kept simple and functional. The version 0.62 was published in April 2006.

## Linux distributions

The Linux distribution Yellow Dog is created by the company Terra Soft. It was the first commercial Distribution for Apple G4 systems in 1999, followed of the support for the Playstation 3 of Sony for the first time in 2006. Terra released the updated Yellow Dog Linux version 5.0.1 in May 2007. This software based on the Fedora Core and uses the Enlightenment Window Manager E17. It contains more than 500 updated programs, new is the support for WLAN.

Turbolinux The distribution based on Red Hat has her main field of application in Asia. Since the foundation of Turbolinux Inc. 1992 the supply was supplemented with commercial products and services. Turbolinux has strongly developed and established himself by the extended support of large IT enterprises. Since the beginning Turbolinux gives great importance to the internationalization of the software and is primarily in the industry on servers, but also on workstation. As a graphical surface were installed up to version 6.0 gnomes as a standard included, the following versions set as standard the KDE desktop. RPM is used primarily as installation format.

With Turbolinux version 11 the manufacturer Turbolinux walks along new ways. The international version takes compatibility to Windows applications and supports the ActiveDirectory service. KDE or Xfce are available as a user interface, with CyberLink PowerDVD a commercial DVD player software is enclosed. With the progression desktop for Turbolinux the user will be able to migrate automatically data like e-mails and Office files from an existing Windows installation for Turbolinux. Contained is also the Kernel 2.6.12, X.org 6.8.2, GCC 3.4.3, Glibc 2.3.5 and RPM 4.4.2.

Turbolinux: date / version

1998 June / Turbolinux 1.0 (kyoto), Kernel 2.2.9  
1999 May / Turbolinux 2.0 (okinawa), Kernel 2.2.13  
1999 Juni / Turbolinux 3.0 (karatsu), Kernel 2.2.14  
1999 Aug. / Turbolinux 4.0 (--), Kernel 2.2.15  
2000 März / Turbolinux 4.2 (--), Kernel 2.2.17  
2001 Aug. / Turbolinux 6.0 (--), Kernel 2.4.3  
2001 Nov. / Turbolinux 7.0 (monza), Kernel 2.4.8  
2002 May / Turbolinux 7.0S (esprit), Kernel 2.4.18  
2002 Juli / Turbolinux 8.0 (silverstone), Kernel 2.4.19, gcc 3.2  
2002 Okt. / Turbolinux 8.0S (vitamin), gcc 2.96, Kernel 2.4.18  
2003 Okt. / Turbolinux 10D  
2004 May / Turbolinux 10F  
2004 Okt. / Turbolinux 10S  
2006 May / Turbolinux 11

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Lycoris Desktop/LX Lycoris was founded in the year 2000 and resided in Redmond/Washington. Based on Linux the Lycoris Desktop/LX has his strengths primarily in the simplified installation and user guidance, at the boot process only a small line of text indicates the consoles Shell.

Current version: build 75 (beta) test: July 2003

The installation routine of Lycoris desktop/LX (amethyst, beta) is a instant set up, no package selection or details for the application area are allowed. At least 850 MByte of free hard disk space are therefore needed. The installation turns out very simple, according to detail of used hardware (mouse, keyboard, network, printer,...) starts the installation and at the same time a card game. Windowmanager is KDE 2.2.2, the Linux Kernel version 2.4.20 is used, the booting manager is grub that can boot other system partitions too. After the restart the system is established and a detailed ShockwaveFlash presentation starts with the english speaking introduction into the Lycoris Desktop/LX. The DMA mode was already activated at all drives. Different problems have been noticed because of the beta status, in the final version they are maybe solved.

- nvidia graphics board doesn't use 3D support
- Sound is palyed with noise and interruptions
- DVD playback isn't reliably

On 09-13-04 Lycoris gave his Linux distribution Desktop/LX in version 1.4 free for release. The new Linux Kernel 2.4.27 and KDE 3.2.3 are contained.

FAUmachine FAUmachine (formerly UMLinux) is open source and runs completely in the user mode (not privileged CPU mode) of Linux. It can access directly the hardware and is transparently for use to the host. The main memory is provided virtually in a protected area. Depending on resources many UMLinux systems can run at the same time.

Caldera Open Linux Caldera, Inc. was founded in October 1994 by Bryan Sparks and taken over in January 1995 as a society. In summer 1998 Caldera Inc. has founded two subsidiary firms. Caldera Systems, Inc. responsible for the development and sale of Linux based Linux products in his main area on the PC market for desktop and servers computers like OpenLinux and Caldera Thin Clients Inc. with focus at solutions for Thin clients and the market for Embedded Systems like Embedix (embedded Linux OS) and DR DOS. In July 1999 the second named company was renamed to Lineo, Inc..

Renaming in August 2002 in SCO Group, now offers UnixWare and OpenServer products from the product take-over of SCO.

Corel Linux / Xandros Corel Linux OS based on the Debian distribution this one has found worldwide big encouragement. The Linux division of Corel was sold to the Startup enterprise Xandros, inclusive of the developers in August 2001. Xandros has his headquarter in Ottawa, Canada. Still this year (2002) Xandros wants to publish the Xandros desktop OS 1.0 in a Standard, Deluxe and Server Edition. Unusual feature opposite other distributions is the integrated CrossOver Office, a special customization of the Wine project for the use of Microsoft Office 97/2000. The Xandros Professional desktop 4.0 appeared in November 2006. The standard file system is ext3 now, with CrossOver Microsoft Office can be used, the programmes Open Office 2.0.3, Firefox 2.0 were updated and the search tool Beagle is new.

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## Operating systems for cars

Operating systems in automobiles are used for all sorts of control and security purposes. For example the air conditioner, instrument panel, anti-lock braking system, airbags, comfort functions are connected to the CAN bus. The car manufacturers need high demands on such operating systems. In Germany these software must primarily be OSEK certified if they are in relation with the CAN bus. OSEK or OSEK/VDX is such a specification for distributed control units and the API. Many important companies like BMW, Daimler Chrysler, Siemens, Motorola, Infineon, Mercedes Benz and still many more are involved in this specification which was suggested as an ISO standard.

OSEK/VDX 2.2.1 specification (16-01-2003)

- for the first time version 1.0 published on 11-2-1995
- defines multitasking behaviour and API for system services in C
- for distributed 1 processor systems
- real time requirements
- interrupt and task behaviour
- minimal hardware requirements
- scalability
- portability
- resources management
- error handling, application and system errors

## Operating systems of the Eighties

EOS is an operating system developed in Germany, was written in the programming language C and has compared to CP/M 3.1 more commands.

Eumel (Extendable Multi User Microprocessor Elan System) was spread a little and was developed by the GMD (Society for Mathematics and Data processing) and the "Hochschulrechenzentrum Bielefeld" (University in Germany/Bielefeld). It is designed as an multiuser system and contains the programming language Elan (Elementary Language).

Famos (Microcomputer Systems Inc.) was only little spread on the market like PDOS and was used for multiuser systems. PDOS had the markable feature, that it was developed for processors of the series MC 6800 and TI 9900 and is designed especially for realtime applications.

Oasis runs on different embedded computers for business independent and business specific application software. It was developed by Phase One Systems Inc., the abbreviation stands for Online Application System Interactive Software. Oasis runs on 8-bit and 16-bit processors like the Z80, 8088, 8086, 68000. It was used for singleuser and multiuser systems.

Prologue is based on the in 1975 developed operating system BAL and was developed in France. It was developed more for customers of multiuser systems, software and system solution companys which wanted more advanced application solutions. The Prologue architecture contains different layers which guarantee the greatest measure in portability at different hardware configurations. The system core "Nueleus" of the operating system was programmed mainly in assemblers, however the source code also partly consists of "C" and "BAL". The availability of the programming language BAL (Business Application Language) increases the

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value of this operating system. Many commands for data communications, file and database management, graphic and more became directly integrated so additional routines are no longer necessarily.

System informations:

- real multiuser and multitasking operating system
- runs on Intel 8086/8088 computers
- can manage up to eight workplaces
- up to 1 (one) mbyte RAM, at least 128 kbytes
- can manage storage devices with at most 512 mbyte per drive
- needs 60-70 kbytes of RAM- dynamic memory management
- time controlled program flow
- spooling function for printers
- supports index sequential access (ISAM) to harddisk storage devices
- supports the programming language Dialogue II (similar to dBaselll)

**Operating systems produced for VEB Robotron** The personal computers "AC A 7100" from the DDR (German Democratic Republic) VEB (Nationally-owned company) Kombinat (compareable with a company) Robotron was delivered with the basic equipment K1710 monitor with the model number K 7229.22 as well as the keyboard K 7637.9X for special working tasks. With the port of CAD/CAM periphery it also was used for technical drawings. There was even the possibility of the remote power on and a integrated fan and power failure detection.

- 16-bit processing depth
- modular computer design
- individually expandable
- up to 768 kbytes of RAM, 560 ns access time
- 32 kbytes permanent storage in the EPROM
- installation of 5"1/4 harddisk storage disks with 10 mbyte possible
- support for K 5600.20 5"1/4 floppy disks
- CPU description: K 1810 WM 86,5 MHz- extendable by a Co-processor
- up to 1 mbyte memory addressing
- system bus clock frequency: 9,832 MHz

SCP 1700 (Single User Control Program)

- floppy disk oriented singleuser system
- use as a terminal or in the local area network
- preferred use for the development of programs and office automation
- modular design
- control program loader LDSCP for transient commands in the CMD format- control program SCPX (file SCP.SYS)
- including standard software (like word processing)
- delivered with the compilers FORTRAN77, C, Pascal, MODULA-2, COBOL
- with the program interpreter BASIC
- graphic extension SCP-GX by GIOS (graphics input/output system) and GDOS (graphic device operating system)

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## MUTOS 1700

- Time-sharing operating system- UNIX derivated
- / root file system structure
- powerfull Shell with programming similar statements
- for different computer platforms
- writte mostly in C
- utility programs like cp (copies), cmp (compare), mkdir (creates directory), rm (deletes files or directories)
- field of application was the development of software or scientific computing

## BOS 1810

- real time operating system
- multitasking with priority control
- modular design
- object oriented design
- field of application is the development of software
- contains already necessary device drivers
- included file access control with right assignment
- error treatment by validity tests
- condition controls with rule definition of exceptions
- dynamic RAM assignment
- interactive adaptation to the user with configuration profiles

## Object types:

- Task (active individual program)
- Jobs (passive, separate of single applications to others)
- mailboxes (information exchange between tasks)
- semaphores (integer, affected the status of tasks to active/inactive)
- segments
- Connections



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**Palm Computing** The company Palm Computing was founded by Jeff Hawkins in 1992 and Donna Dubinsky was appointed as CEO. At first Palm develops the applications software for numerous handheld models. Palm Computing can be defined as a pioneer in the market of mobile and cordless small computers. With the self developed operating system PalmOS® for handhelds it is possible to have permanently important data handy and mobile available. PalmOS works as a personal assistant for the information management. From more than 7,000 applications in April 2001 the number has increased to more than 18,000 in July 2003. The combination of PalmOS with a handheld makes the intuitive and simple operation possible at high battery runtime. Because PalmOS resides in a ROM, the hardware reset puts the PDA into the origin status, all modifications and after installed applications are removed from that battery buffered non-persistent memory. PalmOS has a flexible, open architecture, the maximum resolution on the monochrome LCD are only 160x160 pixels.

Palm was bought in June 1996 of U.S.-Robotics. The first Palm Pilot was released in March 1996. In May 1997 the 3Com Corp. acquire the company U.S. Robotics with Palm Computing. The Palm III organizer is introduced to the public in March 1998. Palm OS 3.x uses features of the AMX kernel of the company Kadak. Because of licence conditions only singletasking is possible for applications. To solve this restriction, Palm OS 5.x uses the own developed Kernel MCK with the ability of multitasking for applications.

Jeff Hawkins and Donna Dubinsky leave 3Com corporation in November 1998 and set up the company Handspring, Inc. which becomes a licensee of 3Coms Palm OS. In March 2000 the company Palm Inc. is founded by 3Com as an independent subsidiary firm, main field of enterprise is the development of Palm OS based PDA devices. The market share of Palm OS was 65 percent in 2000 (source: Gartner). Important business and technology partners are for example Handspring, IBM, Kyocera, Sony, Samsung and Symbol Technologies. Handheld models with DragonBall or ARM CPUs (supported since PalmOS 4.0) are the Palm IIIe, IIIx, IIIxe, IIIc, V, Vx and m100.

The foundation of the subsidiary Palm was completed successfully at the beginning of 2002. The company Palm was renamed in PalmSource (Inc.) in May 2002. PalmOS was ready for further device manufacturers for independently licensing. The device manufacturer Palm Solutions announced in June 2003 to take over the company Handspring. Palm had completed the take-over of Handspring in August 2003 and renamed for the area of hardware to PalmOne and for software and PalmOS to PalmSource. Mayn investor at PalmSource is Sony. PalmSource buys China MobileSoft (CMS) in January 2005.

Update July 2003: Till now, Palm OS was sold almost 30 million times, more than 260,000 developers support PalmOS and applications. New handheld models are the Zire 71, Tungsten C and Tungsten T with an ARM9 CPU.

The worldwide sales of PDA devices in quantities spread out as follows in comparison of the previous year to the 1st quarter 2004 (source: Gartner).

Palm OS fell from 49% (1Q03) to 41% (1Q04), Windows CE got itself of 37% by 3%, devices with RIM (Research In Motion) increased from 3% to 15%. Devices with Linux stayed approximately constantly with 2%, other operating systems fell from 9% to 2%.

Number of Developers (estimated, Source: Palm)

1998, Dec. 3,500

1999, June 13,700

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2000, March 41,000  
2000, April 65,000  
2000, Sept. 100,000  
2001, Jan. 140,000  
2001, 170,000  
2003, 260,000  
2004, 300,000

- (a) Button for contrast control
- (b) On-/Off button and Lighting
- (c) Display
- (d) Holder for the pen
- (e) Write range with the system symbols,  
Application Launcher, Menu, Calculator and Search
- (f) Key field and scroll button

The Palm computer had a sensitive display area which serves at the same time for the representation. By the key field the direct access to the calendar, address book, task list and notices is possible. To install new programs (file format \*.prc) a PC with installed Palm desktop software is required, which is used to install the programs about the Hotsync process. The synchronisation of the notes and dates for example between the PC and Palm happens the same time, the deinstallation of programs can be done directly in PalmOS.

PalmSource belongs to the Japanese software provider Access since September 2005. Palm OS is renamed in Garnet OS on January 25th, 2007, old equipment with a Palm OS and new equipment of Access are indicated by the logo "Access Powered". Till now, the version 6 of Palm OS was not successful.

GarnetOS supports different screen resolutions like 160x160 to 320x480 pixel in grey color or 16-bit colour depth. Wireless connections, IrDA, Bluetooth and WLAN are available for data interchange. The architecture based on 32-bit ARM 4T processors, the 16-bit ARM version is also supported. Executing of 68k applications allows the Pace (Palm Application Compatibility Environment) utility.

This operating system needs at least 4 mbyte flash ROM and 1 mbyte RAM to work. The GarnetOS covers less than 300 kbytes of RAM and can manage up to 128 mbyte RAM.

The PalmOS successor "Access Linux Platform" (ALP) was published in the version 1.0 in February 2007. ALP consists of the Linux operating system, a GTK+ Toolkit and the emulation layer "Access Garnet of Virtual Machine" to execute applications for PalmOS and GarnetOS.

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**Plan 9** Plan 9 was developed into the AT&T Bell Laboratories since 1985. In 1989 it had achieved the stability to replace UNIX into the Bell Labs. Ken Thompson which had played a part years before in the development of UNIX also worked on this project. With project 9 the disadvantages of Unix should be eliminated and put a new measure of accuracy, economy and efficiency. Normal microcomputers serve as hardware base. It was programmed in strict ISO/ANSI C. Plan 9 was ported for the Intel 386 (or higher), MIPS, Alpha, and PowerPC architecture. This operating system is not designed for the end-user, it shows new design concepts and technologies and disposed of very few drivers, commercial applications are missing.

The concept intends to delegate functions on the computers in the network efficiently. Like this it is possible to mirror processes on other computers to provide fault tolerance at failed systems. Office tasks are solved so on modest terminals, the resources for this come from a central server in the network. Even the subdivision can go so far that a server for the file sharing (FileStorage), one for the printers, one for applications and one is delegated for the computer performance (Computing Power).

Plan9 is a progressive multi-user operating system which is developed further as open source and does not build up on UNIX source code. It is optimized for the use in networks and is suitable for particularly all sorts of hardware platforms in distributed networks. By the isolation of the services on different servers a higher accuracy is given opposite to all-in-one solutions. The store of files on a File server is possible but not the execute of possible harming programs.

The Plan 9 Logo represents a rabbit which was drawn by Renée French. The name was elected from the science fiction movie "Plan 9 From Outer Space".

In Plan 9 useful schemes were taken by UNIX. This includes the organisation of the file system and the access to devices within the file structure. The file system and connection protocol "9 P" makes the access to resources of other computer systems possible. User defined views of the resource structure (Name Space) are possible. Project 9 got new compilers, library files (Libraries) and applications programmed. Older UNIX tools are or completely new programmed or has been omitted. Followed the bash Shell, Rc is used as specified command line interpreter. The portability as well as the file and access rights from Unix were revised and taken in project 9. One of the special abilities from the GUI 8 1/2 is a provided text-based and graphical interface for the local and remote login. Rio is the window manager. Plan9 is multi-processor capable, accelerated graphic rendering is not possible.

You can download Plan 9 from the Plan 9 website of Bell Labs after the accept of the licence as an 60 mbyte file archive together with a special boot disk. The disadvantage of Plan 9 is the limited hardware support. Project 9 is a trademark of Lucent Technologies, a subsidiary enterprise of AT&T. The development department of plan 9 was dissolved by Bell Labs in October 2005. The company Vita Nuova used in Inferno the 9P protocol.

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**QNX** QNX is a real time operating system designed for critical tasks. Developed by QNX Software Systems it has a structure similar to UNIX and is compatible to POSIX. With an API Wrapper it supports software for Linux, the source code was opened by QNX partly. His strengths are the development of software, control of industrial roboters and embedded devices. By the real time ability of QNX the Neutrino Kernel allows with a pentium III the controlled reaction time (interrupt processing) of 0.55  $\mu$  sec in which events can be registered. For comparison purposes: Windows NT 4.0 and other time-sharing operating systems react to events only after approx. 10 ms. The GUI with the name photon was introduced for the first time in version QNX 4.x. Before the window manager was named "QNX Windows" and "X Windows". Among other things the reaction behaviour of the GUI was improved.

With the error tolerance, preemptive multitasking and the runtime memory protection it forms a stable base for many application purposes. Up till now the internet access with an ISDN card or a software modem is not supported yet. The simple user interface and low hardware requirements makes QNX interesting also for private use. For the private use QNX is free of charge usable and is ready for download on the QNX website. The also available QNX Moment Development Suite made it possible to develop applications for QNX.

QNX provided the Momentics Development Suite 2.2.0 with the operating system QNX Neutrino Kernel 6.3.0 for the evaluation on the website on June, 03. 2004. Till now, the new operating system can not downloaded separately. The use of the development software Momentics is restricted to a 30 day trial version. There also is a version for the installation of the Momentics IDE under Windows, Linux and Solaris. It contains a Clustering framework for the development of network based applications for transparent distributed processing. The software tools also were improved, Eclipse 2.1.2 and the GCC 3.3.1 are contained currently. QNX Neutrino supports now per default the representation of 3D pictures, multi-layer user interfaces and the view of the desktop on several monitors. The QNX Voyager Web browser supports SSL 3.0, HTML 4.01, XHTML 1.1, WAP 2.0, WML 1.3 and CSS now. This browser can scale and specify the website for small displays automatically. Now included are the SCTP (stream control transmission Protocol), IP Filtering and NAT for networks.

The company QNX started to publish the source code of the QNX Neutrino Kernel over a Community portal of its own under a commercial licence in September 2007. Further components will follow that builds up on the QNX operating system. The release followed the source code for the implemented file systems FAT, EXT2, QNX4 and QNX6 as well as others in August 2008.

## Field of application

- Embedded systems
- network area, internet client
- Development of applications with Photon Application Builder (PhAB)
- Engine control, Measuring data evaluation in real time
- Settop boxes

## Structure information

- POSIX support
- Neutrino microkernel
- Protected memory areas
- preemptive multitasking
- Photon microGUI

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## System environment

- x86 processors, SMP up to 8 CPUs
- fs-QNX file system as image file on a FAT or own partition

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## ReactOS

A couple of persons decided at the 1996-01-23 to create a completely new operating system which can execute Windows applications. At first this project was called FreeWin95 and some start-up problems. In 1998 the nearly given up project was reanimated by the new project manager Jason Filby and renamed in ReactOS. The aim definition of ReactOS is to become a Windows NT/XP compatible operating system. Both applications and drivers are included. Even further subsystems like Java operating system, OS/2 and DOS shall be integrated later. ReactOS is still in alpha development and protected as OpenSource by the GPL (GNU General Public License).

With the release of ReactOS 0.3.0 (alpha) applications like OpenOffice, Nero Burning ROM, WinRAR and Unreal Tournament already run with this operating system. The temporary stop of development of ReactOS was announced at 2006-01-27. Cause is the suspicion of source code smuggled in by reverse engineering of Microsoft Windows. The facts are cleared by code audit and newly programmed if required. To prevent similar situations in future, new guidelines for developer were specified.

The compatibility has been improved further in the ReactOS version 0.3.4 ( alpha) for the Windows 2003 operating system. Used files from the Wine project are up to date, new equipment drivers and the support of SSE/SSE2 processor functions are added. The user interface is reacting by different optimizations now faster. Still more Windows applications are running under ReactOS now, with the revision of the RPC and IDL technology also more complex applications like Microsoft Office in future versions.

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**Red Flag Linux** Red Flag Software Co., Ltd. was founded of the software research institute "Chinese Academy of Sciences" and NewMargin venture capital in June 2000. Red Flag Software maintains business relations with IBM, Intel, HP, Oracle and other companys. Red Flag aimed at the implementation of buildings for training, technological support and point of sales in China and later worldwide. In several server variants they exists currently the Function Server, Database Server, Cluster Server and Webmail Server in version 3.0.

Red Flag came in an alliance with Miracle and Oracle for the Asian Linux at the beginning of January 2004. This shall guarantee an free alternative operating systems for servers and desktops. The server software shall be certified in the Oracle China Development centre. South Korea, Japan and China announced already in September 2003 to create an alternative for Windows. With the certification of users both the involved companies and the customers can profit.

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**Red Hat** The company Red Hat with company headquarters in the USA North Carolina was founded 1994 by Bob Young and Marc Ewing. From the beginning the open source operating system has played a high role for the enterprise concept. The field of application reached from miniature devices over work stations up to server systems on Intel x86, Dec alpha and Sun SPARC systems. One strengthens of Red Hat Linux is the application in InterNet and Intranet. Extensive support, training and training offers as well as the broad support of IT companies carry to the growth of Red Hat constantly. Red Hat reached with his Linux distribution about 15 % by the gross income, a majority income is realized by competent services like the Redhat network - RHN. With the software package format RPM, Red Hat has set a standard which many distributions followed.

1998: Partnerships with Intel and Netscape

1999: Partnerships with SAP, Oracle, IBM, Compaq, Dell and Novell

The Fedora project is one of Red Hat approved Consumer version of the Linux distribution Red Hat Linux. This open source project is sponsored by Red Hat, but lies independently in administration of the Linux Community. In May 2004 the Fedora core 2 for the x86-64 and i386 architecture was published, used the Linux Kernel 2.6, the new X-server of X.org and the extended access protection SELinux in the Kernel.

With the new Fedora Linux core 4 the contained software was brought up to date. GCC 4.0, gnomes 2.10, KDE 3.4, OpenOffice 2.0 beta, the development environment Eclipse 3.1 and the universal document viewer Evince 0.2.1 belongs to this software now. Beside the x86 32-Bit and x86 64-Bit architecture is now Fedora also installable on power PC systems. The global file system (GFS) in version 6.1 is used for Cluster systems, Xen 2 creates a virtual environment for guest systems. For the minimum installation are 620 MByte up to 7 GByte (everything to install) free storage space needed. Fedora Linux Core 5 contains new graphic tools for the software management, the GNOME 2.14 and KDE 3.5 desktop and the standard Web browser Firefox 1.5. The Linux Kernel is updated on version 2.6.16, Apache Server 2.2, X.org X11R7.0, GCC 4.1 and SELinux were revised.

The printing system was completely revised in Fedora Linux Core 6 and based on CUPS 1.2. Fedora Core 6 builds the basis for Red Hat Enterprise Linux 5 (RHEL). This release is without any commercial software like Java, NTFS support, flash, MP3 codec and DVD software player for encoded DVDs. Graphic drivers of ATI and Nvidia are also missing. The software was updated, for the installation the X server X.org 7.1, GNOME 2.16, KDE 3.5.4, Firefox 1.5.0.6, Thunderbird 1.5.0.5, OpenOffice.org 2.0.4, Apache web server 2.2.3, MySQL 5.0.22, PHP 5.1.6 and the free .Net implementation Mono 1.1.17.1 can be selected.

In February 2006 the Red Hat Enterprise Linux (RHEL) version 4 operating system was certified for safety according to the Common-Criteria EAL4+.

CentOS, the Community ENTerprise Operating System, is based on Red Hat Enterprise Linux (RHEL) operating system and is a liberal and free alternative to RHEL. Contained are the gnome and KDE desktop.



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**RISC OS** The Reduced Instruction Set Computer operating system was first used in Acorn Archimedes computers in 1987. Acorn Computers Ltd. developed her own 32-bit RISC processor, the Acorn Risc Machine (ARM), to fulfil her needs. ARM processors do not need an active fan because they have a very little power assumption in opposite to x86 processors and a much lower thermal heating.

RISC OS needs only a ROM and is protected from data damage (e.g. by viruses) reliably. Compared with most other operating systems this is a special feature. To upgrade the operating system the OS ROMs got simply replaced, newer RISC OS Computers have FlashROMs and can be upgraded to the newest stand without hardware interaction.

Pace Micro Technology plc is owner of RISC OS latest since 1999 and has handed over the further development to the company RISCOS Ltd. by now. This firm develops new software releases. Within the last 13 years RISC OS was developed intensively and is used in leading computer models of Castle Technology, RiscStation and MicroDigital.

The fields of application of RISC OS lie obviously in the graphic industry, word processing and the education market. Numerous ported programming languages are available for the development of new applications. An ambitious project pursues [www.explan.co.uk](http://www.explan.co.uk) with high economic computers and RISC OS for use in developing countries. A9home is a good example of the energy-saving and compact design of a complete computer. The energy consumption is covered with 2 to 3 watt. A 400 MHz Samsung ARM9 processor is used, 128 mbyte SDRAM, 8 mbyte VRAM and a 40 GByte hard disk drive.

Update: 2003-04-07

Castle Technology Ltd. takes over Pace Micro Technology plc. with the whole RISC OS technology. In addition, Castle came in a joint venture with Tematic Ltd. to develop an embedded version of RISC OS.

Update 2007-05-19

The company Castle Technology published first parts of the source code of RISC OS 5.12 for ARM architecture on the web site [www.riscosopen.org](http://www.riscosopen.org), this is protected by a own shared source licence.

**System Features** RISC OS is a special and efficient operating system. Many hardware and software functions became differently in comparison with Mac OS/Apple Mac or Windows/IBM PC, however, this does not derive direct disadvantages. Driver software for extensions are integrated in the ROM and can be tied by Plug & play in the operating system. In the daily usage it behaves very stably since it was tested extensively and has proved itself worldwide. Not at least the narrow coupling of the operating system to the computer provides the perfect cooperation. If nevertheless once an application should crash, it can be removed from memory without complete system crash.

The source code was written manually in large parts and optimized for the ARM. RISC OS needs only 4 MB of storage in the ROM, the extension with a fixed disk as well as creating of virtual RAM disks is possible. Moreover, to protect the system, the CMOS RAM and the fixed disk can be protected by a password to avoid changes. The booting procedure after a cold start takes fewer than 30 seconds. You can select between the BBC BASIC mode, desktop mode and command line as Shell.

RISC OS is modularized and supports software modules which can be added to the system. The multitasking GUI has been standard for the RISC OS for 13 years because of the very user friendly and effectively in this

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daily use. With the-bitmap optimized printing manager makes very good print results, character fonts are smoothed with anti-aliasing. Standard applications on every RISC OS are Edit for word processing, Paint for-bitmap pictures and Draw for vector pictures which are based on up to 24-bit color resolution.

16-bit Sound support are included as well as the native support of long file names. The file management allows storing of arbitrary many files in directories. Special character like "/ ! \$ Dollar %" are useable for file names without restrictions. With a 3-key mouse they can be made versatile interactions on the desktop possible, so e.g. menus are invoked comfortably with the middle mouse button in all windows. The windows and the desktop supports general Drag & Drop just like the clipboard applies to the complete system. RISC OS is flexible, the complete system configurations can be done on the command line.

Compact applications like EasiWriter Professional+, comparably with Microsoft Word, needs only 1,101 Kbyte of storage and 860 Kbyte of RAM. Temporary files are never needed and created. Moreover, RISC OS supports DPMS (Display Power Management Signalling) and offers with the built-in programming language BBC BASIC the own ARM assembler. The simple TCP/IP support opens the Internet to the user.

## Characteristics

- Browser with HTML 3.2, CSS, SVG, JavaScript, Flash
- Supports FAT, ADFS, ISO9660, further FS are reloadable
- 26-bit addressing prevents the use of newer 32-bit CPUs
- Virtual memory addressing only by additional software
- dynamic storage management
- Microkernel, modularized code blocks
- only cooperative multitasking
- manages files after type not after extension
- no multithreading possible
- only few games available
- no Unicode support

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**SkyOS** The SkyOS operating system was initiated by Robert Szeleney in 1996. SkyOS was programmed entirely newly for the x86 architecture. The first version 0.1 which consisted of a 16-bit kernel and a very simple user interface was published on 1997-12-15. The version 5.0 beta was available in March 2005. In meanwhile SkyOS supports multitasking, multithreading, SMP, virtual memory, memory protection and Internet abilities. The built-in GUI named SkyGI has got very flexible and efficient. Only some of the features are alpha blending, transparent windows, shades, window animations, OpenGL rendered windows, anti-aliasing and hardware acceleration. The Unicode interface can be adapted for any native language. The used file system is called SkyFS. It belongs to the 64-bit file systems with journaling functions and supports extended attributes, indices and inquiries. Moreover, it supports all FAT file systems, BFS (BeOS), Ext2/Ext3 and the ISO9660 CD-ROM format.

SkyOS is suitable for playing all sorts of media files like videos, DVD, Audio CD and MP3 files. The ISS (Integrated Sound System) is also suitable for the development of complex audio applications. It plays several audio streams without restrictions, can adjust the sampling rate and use effect filters. The operating system provides the Web browser SkyKruzer, a porting of KHTML, to surf in the WWW. Further popular applications are AbiWord, GIMP, the GNU Compiler Collection, Pearl, VideoLan and much more.

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**Slackware** On 17 July 1993 Patrick Volkerding announced the completion of Slackware version 1.0 in the newsgroup comp.os.linux, interested could download by ftp the installation packages. From the beginning the public Linux standard was considered. As package format for programs TGZ of archives are used, the preferential surface is KDE. It exist only a text-based Setup. Slackware was ported for Sparc, alpha and x86 of systems. Slackware addresses itself to the experienced user and developers.

Slackware version 12.0 contains the Linux kernel 2.6.21.5 and as graphic interface KDE 3.5.7. The slighter window manager Xfce 4.4.1 can alternatively be used. The operating system offers complete support for encrypted network connections with OpenSSL, OpenSSH, OpenVPN and GnuPG. The hardware support is enlarged by PCMCIA, CardBus, USB, IEEE 1394 (FireWire) and ACPI.

The 1 CD-ROM distribution Zenwalk Linux profits from the simplicity and stability of the Slackware distribution. As a slim desktop alternative it puts the main emphasis on it most current stable software releases an application per field of application and installation profiles for use as a development platform, desktop or multimedia. The simple network administration tool netpkg is contained.

12.2005 Zenwalk Linux 2.0.1

09.2006 Zenwalk Linux 3.0

11.2006 Zenwalk Linux 4.0

01.2007 Zenwalk Linux 4.2

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**Solaris 8** Solaris is the UNIX-based operating system of Sun Microsystems with roots in the BSD operating system family. Up to the version 3.x this operating system was called SunOS, this name was kept into the internal release information of current Solaris versions. The first version of SunOS was published in 1982. With the version 4.0 the new product name Solaris was introduced for SunOS releases as of 1989. The operating system Solaris 2.0 (SunOS 5.0) basing on the UNIX system V release 4 was published in July 1992.

The installation package of Solaris 8 (SunOS 5.8) is delivered on several CDs which include the operating system, applications and the documentation. With the Solaris Webstart 3.0 Installer Solaris can be installed comfortably on a prepared harddisk partition with at least 2 gbyte of free space. The Installer divides the partition into one boot partition (10 mbyte of size) and the Solaris System area inclusive swap area.

The Primary boot subsystem VSN 2.0 proceeds after the Installation as a booting manager. After the booting procedure the CDE or optionally OpenWindow system is available as a GUI. Solaris fulfils the Open Group Unix98 specification. With the available Solaris Security Toolkit application it is possible to made specific protection settings for Solaris.

## Field of Application

- CAD (computer aided design) applications
- Stable system for databases, data centre
- Intranet server as well as Internet or file server, Internet client

## Structure information

- Multi-processor capable of up to 8 CPUs (Kernel limited to 21 CPUs)
- UNIX derivat
- Realtime OS (timing up to 1 nanosecond)
- 64-bit operating system (UltraSparc), 32-bit on x86, (Intel)
- Monolithic Kernel

## System Environment

- Optional CDE 1.4 or OpenWindows 6.4.1
- SPARC platform and Intel processors, PowerPC
- supports new hardware technologies like USB, FireWire, SCSI, Hot Plug, ACPI
- Scalability: more than of 4 gbyte RAM, max. 64 CPUs
- File system: UFS (0x83), logging of all writing processes, protection against inconsistencies
- Read/Write: FAT, FAT32, ISO9660
- Java support, Perl integrated for CGI programming among others

## Strength

- Support LDAP authentication and NDS
- Supports automatic and dynamic reconfiguration of hardware devices
- Cover various Internet and intranet applications like DNA, Senmail, IPv6, IPsec
- High Internet Security

**Solaris 9** The supported languages (39) and local special features (162) were refined in this operating system release. At first the projects of Sun intended only to deliver new operating system releases for SPARC platform of their own. Because of the resistance from the public Sun supports x86 architecture now anyway

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furthermore. The download of the SPARC variant was possible at first, the x86 variant followed later. At first the download of Solaris/x86 was bounded with a small fee and since December 2003 without charge.

The compatibility was improved to Linux in Solaris 9, standard libraries for Linux applications are installed now too. Security characteristic became extended, the new Resource manager tool with CLI and GUI as well as one new directory server where added. The file system was improved and extended with the SVM (Solaris Volume manager). New libraries were added for multithreading and the installation and configuration got improved. The execution of java applications with the Java Virtual Machine is accelerated by the new libraries now. As a desktop you can choose between the CDE (Common Desktop Environment) or Gnome 2.0 desktop

With the Live Upgrade Software patches or system modifications can be done without interruption of the running Solaris or his applications. To this the modifications are made in a second partition and Solaris installation and taken over at the next reboot in the main installation. After Solaris 9 8/03 this integration happens automatically.

In Solaris 9 4/03 the maximum file size was increased from 1 tbyte to up to 16 tbytes. The system administration tool of SunMC 3.5 was revised, as a Web browser Netscape 7.0 is contained.

**Solaris 10** On 16-11-2004 became officially Solaris 10 for the x86 and SPARC architecture introduced and was ready for download on January 31st, 2005. It is delivered with programs for autodiagnostic and self-healing tasks. Programs for Solaris 9 can further be used in this new release. The operating system was changed to 64-bit and supports NFS 4.0 now, the IP-Stack was improved and improved with a new threading procedure. The effective forwarding of network traffic for 10 gbit and beyond per second is possible. Executing several instances of an operating system by virtualization on a common hardware base can be done with the technology Solaris Zones. In the project Janus the ability was developed for this operating system to be able to execute Linux applications after the recommends of the Linux standard base without new compiling. Planned for this release, this feature is not activated yet for Solaris.

The new file system ZFS (Zettabyte File System) contains an integrated volume manager and support for logical Volumes which can be greater than 1 terabyte, however, this feature is not available in this Solaris release yet. The 128-bit file system called Dynamic File System (DFS) has self-healing and self-managing files with a maximum size of 2128 bytes. The data files are mirrored permanently, checks all data blocks to faults by hash sums and repairs the copy or the original as well as if necessary the data storage. This happens transparently in second fractions without disrupted application software in the productive working mode. With ZFS practically unlimitedly big partitions and files are possible, the storage can be extended dynamically. A data block can be up to 128 kbytes of size, the size of the data blocks can vary. The compression rate makes it possible that files assumes only 50% to 33% of storage space.

The service DTrace (Dynamic Tracing) tracks down performance bottlenecks at the execution of network applications, the fault manager provides a better stability and is part of the foresight and self healing concept which analyse errors in ahead and perhaps even clear the fault. To this the data are checked in the Kernel at 30,000 test points and a report created at negative signs for the administrator within less minutes. With this powerful tool it is possible to recognize problems earlier which was often before not or only heavily to trace back.

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With the technology Grid Container the administrator can set up disk partitions for every user so as if he works with an operating system of his own. Several users can share the system without disturb of the running applications. The system utilization is used considerably better and thousands of services/applications are managed better without large additional processor expenses. If necessary, services or applications can be provided to other users also about a network and separated from each other.

Solaris 10 1/06 supports the SPARC, x86 and x64 architecture. As boot loader is grub used. The speed was optimized and it offers support for iSCSI and 10-gbit ethernet. Solaris 10 6/06 is the first official release of the Zettabyte file system (ZFS), supports SATA controllers and contains Xorg 6.9.

The project Open Solaris was started officially in January 2005, a part of the source code was published. The work was started with support of Sun in a working group with 140 international subscribers for the disclosure of Solaris source code already in September 2004. The Solaris kernel as well as the system libraries followed in June 2005. In the course of the next months larger parts of the distribution followed under the CDDL (Common Development and Distribution License). The necessary patents also were provided to the Community under the CDDL. OpenSolaris does not see itself as a ready ready final user product or complete distribution. It rather offers the code base with developer tools for an operating system as well as the infrastructure for the communications under the developers. The ZFS (Zettabyte file system) is integrated since the OpenSolaris build 27a.

Solaris express 6/05 (Nevada build 15) was published on June 21st, 2005. Sun provides under the concept of the Software Express program new monthly public Solaris releases for the Community. Furthermore the use of this operating system is free for private users, the commercial use is charged with \$ 99 for a year. The Solaris Express releases for x86/SPARC almost based on the latest OpenSolaris release, special worth is attached to a stable release. About a web interface bugs can be reported and bug fixes followed up. JDS can alternatively be used as GUI.

Solaris was certified with Trusted Extensions after Common Criteria in July 2008. Solaris 10 version 11/06 for the platforms x86/64 and SPARC reached the certification in Common Criteria EAL4+. For the first time the graphical user interface Gnome was also audited.

## Solaris derivate

Shortly after the publication of OpenSolaris Jörg Schilling announced his own distribution SchilliX 0.1 on 17-6-2005 for the download. It consists entirely of Open source software and was supplemented with the GCC. The live CD offers the installation on USB-sticks or fixed disk. A graphical interface shall be integrated later in a next release of this developer related distribution. SchilliX 0.5.1 which contains for the first time a graphical interface and based on OpenSolaris Nevada build 35 was published on March 2nd, 2006.

The BeleniX distribution was derived from the OpenSolaris project as a live CD. The source of the choosen name BeleniX is the sungod Belenos from Celtic mythology. The first public release of this Community developed project was BeleniX 0.1 in 4-10-2005. The version 0.3 was published on 18-12-2005, as a user interface Xfce 4.2.0 is used.

The operating system NexentaOS consists of the OpenSolaris Kernel and Solaris runtime files. The unusual feature lies in the connection of Solaris with Linux technology. For this operating system only free software is used from the GNU Debian project. Gnome is the preferred GUI, further software like the Apache HTTP

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server, mySQL and the Mozilla Firefox browser are also contained. On 22-2-2006 the 3rd alpha version of NexentaOS (code name elatte) was published.



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**SuSE** SuSE GmbH (society for software and system development) is a daughter enterprise of SuSE Linux AG. SuSE was founded on 2-9-1992 of Burchard Steinbild, Hubert Mantel, Thomas Fehr and Roland Dyrhoff and offers a Linux distribution of its own in the European area. Additional Programs and IT services like support and trainings are offered. SuSE cooperates closely with other IT companies, SuSE Linux was certified for the Oracle 9 I database already in 2001. A green chameleon serves as symbol figure. The SuSE Linux distribution defines itself from the current Linux kernel, the X Window system and the KDE interface as standard GUI. Software can be installed over precompiled packages in the .RPM format. Driver software and applications are permanently renewed and kept on the newest stand.

SuSE Linux has taken a high value in Germany/Europe. The first distribution was published in 1996 and the latest published versions can be used in the private area, or commercial area for servers. Support and services are offered for companies and private users. There are additional special software products like firewall and mail servers von SuSE.

- SuSE Linux Personal
- SuSE Linux Professional
- SuSE Office Desktop
- SuSE Enterprise Server

## Other services

- SuSE Linux Business Solutions
- SuSE Linux Enterprise Platform
- SuSE Linux eMayl Server II
- SuSE Linux Groupware Server with Lotus Domino
- SuSE Linux Enterprise Server for S/390

*This list does not lay any claim to completeness*

## Field of Application

Server operating system, Internet server, firewall, web server, mail server, database server, from embedded systems up to large computers and cluster systems usable USB, PCMCIA, IEEE 1394, AGP and DVD are better supported now; SCSI was programmed partly new

## Structure information

Monolithic kernel, capable for modules

Hardware is used through symbolic interfaces

Read/Write access: FAT, FAT32, UFS, (FreeBSD, only read), HPFS, NTFS read only

## System Environment

Intel (x86), PowerPC, Alpha, Motorola 68 K, SPARC, UltraSparc, ARM, MIPS, SuperH (RISC CPU of Hitachi)

Till now 32-bit on Intel, 64-bit on UltraSparc and Alpha systems as well as Intel 64-bit architectur

- Time sharing system
- RAM support: up to 64 gbyte
- Partition size: up to 2 tbyte
- File size is theoretically 16 tbyte
- Graphical interfaces like KDE2 and Gnome
- Real multi-user ability

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## Strengths

- faultless run time behavior
- Support for LDAP authentication and NDS
- High stability and performance in networks
- network features, fulfilled as first operating system completely the valid standards IPv4/IPv6
- Ported databases of Oracle, Informix, Sybase, IBM, Inprise, SAP
- High security by file system and access restrictions
- Large number of Users, extensive documentation
- Very high customization ability and hardware optimization

## Version 7.1

Split up into a client and server installation by own Personal and Professional Edition. The Personal Edition is aimed to beginners and home users, the Professional Edition with 2,000 optional programs and server applications rather for advanced and professional users. The SuSE operating system is available besides x86 CPUs also for PowerPC and Alpha. SuSE Linux can be installed by 6 CDs or 1 DVD, about 1,800 programs are contained for an wide field of application. The complete full installation takes about 6.5 gbyte harddisk storage space.

Novell announced the take-over of the company SuSE Linux on 4-11-2003.

Suse Linux 10.1 exclusively uses open source software and is available for systems with x86, x64 and PowerPC processors. The integration of the virtualization solution Xen 3.0.2 and the safety enhancement AppArmor was improved. Assistants watch the behaviour of an application and can create an AppArmor profile from this. With Xgl 3D effects come onto the desktop. This release is used for Suse Linux Enterprise Server (SLES) and Suse Linux Enterprise Desktop (SLED) as a code base.

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**Ubuntu Linux** The first release by Ubuntu Linux was introduced on 10-20-2004. Ubuntu 4.10 bases on Debian and contains the gnomes desktop per default. Ubuntu is an African word that is standing translated in english for humanity. It is free and shared around the world, only the professional support costs money. There are ported versions for the x86, x86 64 and PowerPC architecture. New releases shall appear twice a year. The next release in April 2005 was Ubuntu 5.04.

At the beginning of July 2005, the multi-millionaire Mark Shuttleworth founded the Ubuntu Foundation with an initial budget of 10 million U.S. dollars. This foundation shall guarantee the long-term development of the distribution and the support, for example the main developers were hired in fulltime. The Ubuntu 6.10 desktop edition and server edition was ready in October 2006, Ubuntu 7.04 for desktop and servers appeared in April 2007. In the new version there is a tool for the migration of Windows settings, the network component and support for multimedia was improved.

Kubuntu, Edubuntu, Xubuntu and Beatrix are derivative distributions of Ubuntu. Edubuntu was published for the first time on 13 October 2005, Xubuntu in 2006 and Kubuntu on 24th April 2008 with the version 8.04.

BeatriX is based on Ubuntu and also supports Debian and Ubuntu software packages. It was design objective to manage Linux distribution to be used a compact and simple. This distribution is a slim Linux system which can started live from CD-ROM and uses less than 190 MByte storage on this. The version 2005.1 of 01-28-2005 contains the Linux Kernel 2.6.7, the gnomes desktop 2.8, Open Office, the Firefox browser and other popular application programs. Mid-2005, the Beatrix distribution of Steven Watsky has been discontinued.

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**UNICOS** UNICOS is the standard operating system for VSMP (Cray Vector Symmetric multi-processor) computers and established since 1985. It was derived from the UNIX System V, a far common and well ported operating system programmed in C. The UNICOS system also was affected by the 4th generation of BSD and extended by super computing abilities to provide high performance to support the science and development market. UNICOS is the first 64 bit implementation of UNIX and a UNIX similar file system. UNICOS system offers a stable base from small servers up to gigantic computer plants.

Photos: Cray Inc.

## Characteristics

The UNICOS system makes extremely flexible and robust calculating machines with support of the following hard and software characteristics possible:

### Parallel processing

The UNICOS system is the first high performance UNIX based operating system which supports SMP.

### Multi-processor and multi-threading operating system

The UNICOS system is scalable on more than 32 processors. Cray aims at a small CPU percentage for the consumption of system processes, also in the greatest and the most extensive configuration.

### High performance I/O bandwidth and capacity.

UNICOS I/O scales with the number of processors in the system. The standard UNIX was modified around a file system for up to 8 tbyte to support large files. The support of several devices in a system, multiple types of fixed disks and memory devices in a file system (for build in memory solutions) and the file storage strategy with the used algorithm were specified. Cache support is available for physical devices in addition to the file system. Through this a high efficiency is made possible for some devices and file systems. The UNICOS system allows combining of buffered and direct access to I/O devices without integrity loss of the data which are not natural for the devices of other systems. For Cray is performance not acceptable without data integrity

### Low waiting times for I/O processes

The I/O path by the UNICOS system is high optimized. As much as possible user data transmittings are finished directly to reduce the need for temporary buffering and copying actions. The UNICOS system created asynchronous I/O for UNIX systems. Many interfaces are designed for the flexible programming to check I/O processes. The UNICOS system contains an optimized path for asynchronous I/O to avoid extra controls or background processes which reduce the total performance. The UNICOS system facilitates I/O in the direct access for the user in most cases as a standard.

### Great product extensions

The Batch support is made possible by the *NQE/NQS* subsystem which is designed completely as a multi-system for the evaluation and control of the jobs. The interaction of many users jobs and processes of a mixed batch and interactive system is protected by job and processing limitations. These limits are made possible by an easy to use administration menu with the name User Database (UDB). Together with the file system and Quotas it allows the flexible control over users and user groups.

The fairly configured usage planner ensured the safe allocation of resources for users and processes in the

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two areas batch and interaction mode is possible. Previous planned dates of the mixed processing, that is Batch and interactive mode, is supported by administrative control possibilities .

Extension for the system availability around the processing (for example, checkpoint and restart) can be executed automatically for the support of batch and interactive process recovery. Redundant devices like mirrored fixed harddisks and alternative ways guarantee the fault-tolerant operation. Online diagnoses and ability allowing the control of development problems as CPU error detection and speed reductions.

Multilevel Security (MLS) features like security logging, ACL control, security level and classifications ensure the privacy without influencing of the performance. Settings for the restriction of operator and administrator privileges are possible. Both is a necessary for MLS security and solves a deficit which was recognized by the community.

User accounts were improved for the UNICOS system to guarantee the correctness. On a UNIX system a user can pay for computing time that he has not consumed and is not usual for him. UNICOS system accounts create very detailed recordings for requirements like cost control for computing time and performance analyses.

UNICOS contains an excellent support for tape drives and everything necessary for large systems with multi-volumes and control abilities which are base requirements in a computing centre. Products like the REELlibrarian (CRL) Band Library Management Package and the Cray Data Migration Facility (DMF) are in addition supported for completely transparently data backup to tapes and for automatic or manual recovery.

UNICOS supports the execution of a program on several processors by multitasking. It is the first that contains several function-related interfaces for multitasking and also supports the standard POSIX to protect previous investments in software applications. The UNICOS system supports also the high speed control of thread changes under an application and planned controls to ensure the defined CPU time and resources by the administrator.

The UNIX-based development environment contains a number of applications like Compiler, Loader, Debugger and performance tools.

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**Unix Open Group** Open Group resulted from the association of X/Open Company Ltd. and Open Source Foundation in 1996. It is a neutral, international Consortium with more than 200 members. The IT DialTone initiative worries about to guarantee that the Internet remains open in the core to save the worldwide security and reliability. Open Group cooperated in the field of research and development in open technologies and specifications to guarantee the compatibility to commercial products by individual tests and new proceedings.

UNIX is a registered trademark of Open Group since 1994.

The nine sponsors of Open Group are Digital Equipment Corporation, Hewlett Packard, Siemens Nixdorf, Fujitsu Limited Inc., Hitachi Limited, IBM Corporation, NCR Corporation, Novell Inc. and Sun Microsystems Inc. Open Group certifies the UNIX system variants of manufacturers, whether this are UNIX 95 respectively UNIX 98 compatible. Per default included are Java VM support, 64-bit code, CDE GUI, conformal Threads, network support, standard protocols and services.

**Unix family** As 1965 was, the 3rd generation of the calculating machines with integrated circuits in use were, at first offline mutli program program operating systems (e.g. IBM system/360) are used. This generation was later replaced by improved online time-sharing operating systems. Important tasks were the automated batch processing of jobs in the spooler which replaced the batch based systems as of 1969. One of the first Time-sharing representative was CTTS from the MIT, which was reprogrammed together with Bell Labs and general Electric to MULTICS. MULTICS was built up to complexly and programmed in the language PL/1 so it was given up later. Ken Thompson developed in 1971 (Bell Labs) an assembler version slimmed down of MULTICS, which was named first UNICS (1969) and later UNIX (plural is Unices). Dennis Ritchie pleased UNIX, but only not the assembler programming. Thompson developed from BCPL (a simplification of CPL) the programming language B which was reprogrammed of Ritchie to the language C. Thompson and Ritchie then programmed together UNIX newly in C in 1974.

The mother company of Bell Labs, AT&T was not allowed to get in into the computer business because of monopoly regulations, at first the source code of UNIX was distributed free of charge because of this. For the derivatives another name had to be used as UNIX because of the protected trademark. After a restructuring this changed and AT&T offered the UNIX System III as of 1981 itself. UNIX was developed further by Bell Laboratorien and Westerns Electric and achieved increasing popularity by his high customization ability on microcomputers of the upper performance category. It had more than 200 console commands and extensive utility programs in C. With the high portability programs are portable to different calculating machine types like m86k architecture without many modifications.

In meanwhile the Berkeley university and DARPA had accepted the UNIX concept and it fundamentally changed and separated in 1978 to BSD-UNIX. BSD-UNIX supports unlike the AT&T-UNIX paging, TCP/IP and a huge number of standard software tools. The POSIX standard was created to prevent the split up of this two UNIX variants. But IBM, DEC and HP thought, AT&T would come off with it too well and founded a own standard named OSF. After that AT&T also answered with a standard UI of its own. The companies finally decided to develop a UNIX version of their own for himself.

A. Tanenbaum criticized the increasing complexity of UNIX and designed a UNIX derivative of his own named MINIX in 1984 which can be used as a teaching system. Inspired by Minix the student Linus Torvalds developed an operating system of his own as of August 1991. He programmed from scratch the Kernel, later with strongly growing number of programmers an extensive operating environment with the name Linux. By the

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more than 30 years constant further development operating systems related to UNIX can count on high technological progress as well as the proved performance, stability and security. Different companies have created a own UNIX related operating system according to her needs. These are Solaris of Sun Microsystems, HP-UX of Hewlett-Packard, AIX of IBM and Tru64 UNIX (formerly digital UNIX of DEC) of Compaq.

AIX

[Read Article](#)

[Screenshot Gallery](#)Solaris

[Read Article](#)

[Screenshot Gallery](#)Unixware

[Read Article](#)

[Screenshot Gallery](#)IRIX

[Read Article](#)

[Screenshot Gallery](#)

Characteristics

Things in common can be stated at all UNIX versions and derivatives. These are listed in detail followingly but do not have to apply to all varations in the full range.

- File structure, device files, mount points
- Absolute multi tasking
- Absolute multi user abilities
- Portability to other platforms
- Many (portable) UNIX programs
  - Common library files for application software (shared, static)
- Microkernel
- CLI (Command Line Interface) with a very high number of programs
- The high technical stand of the operating system design, the network implementation
- High support by companies, the Internet Community for further development, bug fixes
- Several operation interfaces (CDE, OpenLook, KDE, Gnome, FVWM 95 )
- High market share in science, research, development and education area
- Support by software manufacturers or external support companies
- High configuring, individual depending on the field of application

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**UnixWare 7** UnixWare has a monolithic kernel and stands out for reliability, stability and scalability. Depending on application purpose gives installations and licences for the Data Center, Enterprise, Departmental, Business, Messaging and Base Edition. Servers with UnixWare were offered by Compaq Computer Corp. in 1997. In the same year UnixWare 7.0.1 on the CeBIT got a prize as the best operating system.

With SCO Merge of PLATINUM Solutions, Inc. brings UnixWare a virtual environment for DOS and Windows 3.11/95. Periphery devices are only restrictedly available for Host system in SCO Merge. Windows is supported in version 95 and higher in the current version. Extensive tools, the enclosed Fasttrack web server and Webtop make UnixWare interesting also for a Cluster system. Visionfs is part of Tarantella by Caldera since the take-over of SCO.

SCO started the SCO Free UNIX action with a free licence for not commercial users in August 1996. OpenServer 5.0.4 and UnixWare 2.1.2 operating system were offered at delivery costs, the action was stopped after UnixWare 7.1.1 at the end of 1999.

Update: The OpenServer and UnixWare technology has been part of Caldera since February 2001 which renamed this business division in SCO Group.

Update May 2004: UnixWare version 7.1.4 is published, primarily smaller and middle enterprises are target group. Server applications are File and Print services, mail server, DHCP, web server, firewall, proxy server as well as relational databases. The Small Business Edition supports 1 user (B), 1 CPU (C) and up to 1 gbyte main memory (A).

- Base Edition 1 (B), 1 (C), 2 GByte (A)
- Business Edition 10 (B), 4 (C), 4 GByte (A)
- Departmental Edition 25 (B), 4 (C), 8 GByte (A)
- Enterprise Edition 50 (B), 6 (C), 16 GByte (A)
- Datacenter Edition 150 (B), 8 (C), 32 GByte (A)

## Hardware support

- Intel Xeon Hyperthreading architecture
- improved USB and USB 2.0 printer support
- improved PCI serial and IDE driver software support for ATA devices with more than 128 gbyte

## Extended security and network services

- VPN support, IPsec (secure IP) Protokoll
- updated Network Time Protocol (NTP) server
- pluggable Authentication moduls (Pam) & Name Service Switch (NSS) support
- updated SSL and SSH components

## New supported application

- Java 2 SE version 1.4.2 runtime environment
- MySQL 3.23.49 and PostgreSQL 7.4.2
- Soap & XML toolkits for the development of web services
- native UnixWare version of the Mozilla 1.2.1 browser



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## SCOx of web services Components

- Apache 2.0.49 web server
- Tomcat App server 4.1.30
- Perl 5.8.3
- PHP 4.3.5

## Network, email and administration

- Samba 3.0
- sendmail 8.12.9
- Emergency Recovery support for IDE, USB and SCSI writer
- improved SCOAdmin DNS manager
- improved SCOAdmin Storage management

## Standard components

- SCO Adv. File & Print Server 4.0.1
- SCO VisionFS 3.0, integration in Windows network, access to shares
- SCO TermLite 1.0.7
- Java Developer Kit 1.1.7b
- SCO Merge 4.1.1, virtual environment for DOS and Windows 95
- SCO online help
- Netscape Fasttrack Web server and Netscape browser 4.61
- Novell NetWare services 4.10 a
- The Webtop package 1.3, remote administration of the system
- LKP (Linux Kernel Personality Technology), use of Linux programs possible
- LAE (Linux application emulator)
- SCO "Skunkware"

## Installation

- textbased and menu controlled installation
- different HBA (host bus adapter), IDE, SCSI, RAID, Hot Plug
- fine grained licensed program
- IPX/SPX, TCP/IP, NFS
- CDE desktop
- scoadmin (administration)
- X11 graphic server
- pkgadd for a manual installation
- /etc/vfstab for Mount points
- Online help about <http://localhost:8458/> reachable
- Remote administration about <http://localhost/webtop/> possible

## System environment

- dynamic Kernel
- Intel 32-bit, 64-bit
- 64-bit of operating system
- vxfs, Veritas advanced journaling file system
- 128 gbyte to 1 tbyte partitions

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- up to 64 gbyte RAM
  - SMP to 32 CPUs
  - about 32 HBAs (bus systems) possible
- EAFS, Extended Acer® fast file system, standard file system  
AFS, Acer fast file system, was Standard file system of UnixWare until 1991  
HTFS, High Throughput file system up to 1 tbyte partition  
DTFS, Compression file system
- Read/Write: s5, ufs, sfs (Secure file system), FAT, ISO9660

## File structure of UnixWare 7

/ Root directory  
/bck  
/bin System tools  
/ccs  
/CD-ROM\_1 Mount point for CD-ROM  
/config  
/dev Device files  
/dev/swap Paging area  
/dev/dump Dump of the RAM at system crash  
/Disk\_A Mount point for floppy  
/etc Configuration files  
/export  
/home User directory for user account  
/home2  
/install  
/lib Libraries  
/mnt Mount directory  
/opt Additional software  
/proc System informations  
/sbin System programs  
/share  
/shlib  
/stand Boot file system  
/system  
/tmp Directory for temporary files  
/u95  
/unix  
/usr Application programs  
/var Installation and administration data

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**VxWorks** Wind River is specialized in real time operating systems and offers with the operating system VxWorks an optimal development system for embedded operating systems. The multitasking and real time kernel "wind" offers a POSIX extension and network functions.

VxWorks is used in the Rover robots conceived for geological purposes at NASA, as in the case of the Pathfinder mission to Mars. A Rover robot was used successfully with VxWorks in 1997 too. The RTOS controlled even the Lander, the transport unit for the Spirit named Rover and provided the communications to earth.

On February 23rd, 2004 the in 1981 founded company Wind River introduced the improved VxWorks 6.0. VxWorks was used for the development of the embedded operating system of the two Rovers Spirit and Opportunity in the Mars investigation in June/July 2003. The software controlled the hardware and provided the reliability and autonomy. The VxWorks RTOS was ported for the against radioactive radiation harden RAD6000 32-bit processor. The operating system managed the antenna for the reception and sending of data, provided the coordination with the star scanner, the supervision of the functions and the safe data storage.

In August 2006 Boing used the operating system Linux in the U.S. Navy military aeroplane P-8A. Wind River delivered the developer environment Carrier-Grade Linux, the aeroplane prototype shall be ready in 2009.

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**Windows 1.0** Microsoft supplied Windows 1.0 on 5 floppy disks for a comparatively cheap price a complete software for many tasks without additional software. The MS-DOS executive makes file system actions possible like start of applications and copying and deletion of files and folders. The input of the parameters with the correct syntax is removed from the user and queries is easy done over dialogues to ask about all relevant data for the desired action. The user interface can be served with one computer mouse, alternatively are keyboard combinations useable. Over icons and pull-down menus actions can be selected. As minimum requirement is DOS 2.0, two floppy disk drives and 256 KByte of main memories presupposed. A fixed storage disk drive accelerates the use of several applications.

As default applications Paint, Calc, Write, Calendar, Notepad, Cardfile and a terminal emulator are provided. The Spooler ensures the printing of files in the background and the clipboard for data exchange between different programs. The window size of applications is individually resizeable and with several open windows the available place on the surface is optimally filled out. With suitable graphic card a screen resolution of 640x350 pixels is possible with 16 colors. Cooperative multitasking run several applications at the same time. With the Program information editor you can comfortably create configuration files in the PIF format for existing programs. These PIF files provides settings as the necessary memory, the data folder, necessary parameters and which interfaces the program uses.

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**Windows 2000 Professional** Microsoft released this new Windows version 5.0, Build 2195 in February 2000. It is the desktop operating system of the new Windows 2000 platform for x86 architecture and be completed by the versions Windows 2000 Server, Windows 2000 Advanced Server and Windows 2000 Datacenter Server. As a minimum requirement for the installation a Pentium processor, 32 mbyte main memory and 650 mbyte of free hard disk storage are needed. Microsoft had planned to develop also a operating system version for the Alpha architecture, the plans were stopped after an announcement of Compaq. Compaq restricted the support to Windows NT 4.0 with service pack 6 and not higher at 1999-08-25. Microsoft stopped the development plans for the Windows 2000 32-bit of Alpha version after that.

Windows 2000 unites defined roughly the user-friendliness, plug & play and USB device support of Windows 98 and the safety and stability of the Windows NT family. The update to this new operating system is possible from Windows 95, 98 and Windows NT 3.51, 4.0. It is a multitasking, multiprocessing operating system and supports up to 2 processors of the x86 32-bit and 64 bit architecture with SMP. Threads or processes can choose between the available processors. Beside the complete revision new features and many improvements are integrated. The result is high compatibility, simplified administration, increased hardware support with over 7,000 devices, file administration and extended security functions. Applications for Windows 9x are only supported restrictedly. The installation is possible from CD-ROM or over the network from a file server. The virtual addressable storage is 4 gbyte and is managed by the Virtual Memory manager (VMM). VMM assigns the addressable storage on the actually available physical memory and the memory page file (pagefile.sys) on hard disk.

The field of application of this operating system is suitable as a single user computer or as a client in company networks. The operating system is enhanced with the game interface DirectX 7.0, the Internet Explorer 5.0 made access to the Internet possible. Windows 2000 authenticates the user first at the access to files, printers or other computers. Networks are supported with the protocols TCP/IP, NWLink and AppleTalk. Windows 2000 supports the data interchange in decentralised working groups and central domains.

Furthermore the Registry consists as in Windows NT 4.0 before of the system files SAM, SECURITY, SOFTWARE and SYSTEM. The hierarchical database saves information of the hardware and applications as well as configuration settings. The following [basic services](#) are in Windows 2000 Prof. installed. The SFC (System File Protection) offers protection from overwrite of Windows system files. It is possible to create hardware profiles for different hardware configurations with the settings of all devices and services. NTFS is used as file system in the new version 5. The specification of user rights is possible for files and directories on file system level, file compression in real time, disk storage quotas (Quotas) and encrypting with EFS (Encrypting File System) can also be used. At the specification of rights the Access Control List (ACL) is stored with every file and every directory. The compression and encoding exclude each other, only one of the options on the same object can be used. Furthermore the FAT/FAT32 file system is supported.

Windows 2000 Prof. is also suitable for mobile use on notebook computers. With the complete support of the technologies APM and ACPI an effective energy management and thus lower electricity consumption is possible. With the Suspend to Disk function the computer can be put into a power saving mode and is in the same condition as before after short reactivation time. An assistant supports the user at the administration of the network connections, with use of VPN (Virtual Private Network) and IPSec (Internet Protocol Security) secure mobile access to company networks is possible. The printer administration was simplified with an assistant.

2004-02-13 announced Microsoft that parts of the source code of Windows 2000 has leaked on the Internet.

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The source code appeared illegally in peer-to-peer file sharing networks, Microsoft said to use the full law to protect the stolen property.

2003-06-25 the Service Pack 4 eliminates 675 bugs appeared since the last service pack. New is the support for USB 2.0 device connections.

- unattended installation of the operating system via script possible
- different options for Windows start like "safe mode" and "last as good known configuration"
- booting from the Windows 2000 CD-ROM offers repair of the operating system or recovery console
- supports the display of the desktop on up to 10 monitors
- task planner for time controlled executing of programmes
- utilities for hard disk like defragmentation and check on disk errors
- event viewer for protocolling of application, security and system events
- backup tool for data safety and recovery
- Microsoft Management Console (MMC), administration of the local or remote computer, expandable by SnapIns
- support for local and predefined user accounts, domain user accounts
- ActiveDirectory directory service available if client is member in Windows 2000 domain
- New protocols for a secure authentication in the network are EAP, RADIUS, IPSec, L2TP and BAP

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**Windows 3.0** It is a 16-bit operating system that needs a preinstalled DOS like MS-DOS. In May 1990 Windows 3.0 came onto the market as graphical operating system extension for DOS in the languages German, English and French. The main advantage, unlike DOS, is the simultaneous execution of DOS and Windows programs in a graphical user interface. Virtual machines allow the simultaneous execution of several DOS applications in a separate 8086/8088 environment. Applications are running in cooperative multitasking and can now use up to 16 Mbytes of RAM.

The user control during the graphical installation is made via keyboard and mouse. The Program Manager provides management and launching applications through icons and windows. The Control Panel is used to manage the associated hardware and software management. Applications such as Windows Write, PC Paintbrush, Terminal, Calendar, etc. are included in the operating system. The Print Manager manages both the LAN as well as locally connected printer. The printed document corresponds to the document on the screen after the WYSIWYG method.

Windows 3.0 has a GDI (Graphics Display Interface), an API (Application Program Interface) for programmer and supports DDE (Dynamic Data Exchange) and OLE (Object Linking and Embedding). The central clipboard for copying and cutting text, images and objects to any application is accessible via a separate application.

The operating system is optimized for 286 and 386 processors. With 286 processors, only the Standard and Real Modes are available. In Standard Mode you can use up to 16 MB memory with XMS. The Real Mode allows the use of a maximum of 640 Kbytes of RAM (additional memory available with EMS) and run DOS applications in full screen without protected memory and multitasking. The Enhanced Mode is only available for 386 processor and requires more conventional memory. It provides additional multitasking for DOS applications with their own virtual instances with adjustable priority (time slice) and the use of virtual memory with a swap file.

## Minimum Requirements:

- 80286 or higher processor with 10 MHz
- 1 MB RAM
- 6 MB free hard disk drive space
- 5 1/4 or 3 1/2 inch floppy drive
- CGA, EGA, VGA or compatible graphic card
- MS-DOS 3.1 or PC-DOS 3.1 preinstalled
- Optionally mouse, modem

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**Windows 3.11** The successor of Windows 3.10 was Windows 3.11 for Workgroups (WfW) with network abilities for use as a client in an network. The operating systems supports now beside Netbeui for the first time TCP/IP too. WFW could combine and show up to 25 computers in a working group. DOS drivers remains resistant after the Windows start. The system can be specified over the following configuration files: WIN.INI, SYSTEM.INI and PROGMAN.INI, the Registry has no great importance and only a minor meaning.

With the extension Win32s published later, also few 32-bit applications designed for Windows 95 could be executed now, last version of Win32s was 1.30c of February 1996. With "Video for Windows" (VfW) the multimedia ability got updated. The minimum hardware requirements for use of Windows 3.x are 2 mbyte RAM and 15 mbyte free harddisk storage.

## Area of application

- private users
- Office use
- network client

## Structure information

- cooperative multitasking
- 32-bit addressing in protected mode (with 386 CPU or better)
- 16-bit operating system
- File size up to 2 gbyte
- File system is FAT16

## Features

- high compatibility to DOS
- low ressource requiered
- difficult network configuration
- limited security

Microsoft announced for the 01.11.2008 to take Windows 3.11 of the market definitely. The operating system manufacturer offered licences for equipment manufacturers till now. The support was already terminated at the end of 2001.



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**Windows 95** The new Windows operating system with the internal version 4.0 is the successor of Windows 3.11 and brings a completely new design of the interface and of the kernel with it. 32-bit applications are supported fully, DOS applications can also virtually be used now in a DOS box, furthermore 16-bits of programs are supported. Windows 95 to ME still needs DOS for the loading up program and for the DOS box. New hardware is comfortably recognized by plug and play, the memory management was developed further considerably.

Important part of Windows 95 is the Registry now, which is responsible for the system behaviour like file assoziation, program parameter, driver software, system configuration and others. The Registry consists of the files system.dat and user.dat, these are located in the Windows directory. The files system.ini and win.ini are less important but are necessary for the system start furthermore. For user profiles one user.dat is placed in each user directory and loaded upon login of the user for the individual user settings.

DOS driver software are no longer necessary in compare to Windows 3.x by now, the driver software model was changed and the hardware is used through virtual device drivers (\*.VxD) directly under Windows.

## Area of application

- private users
- PC Games
- Office application
- network client

## Structure information

- 32-bit operating system, with 16-bit code
- up to 512 mbyte RAM adressable
- file size up to 4 gbyte

## System environment

- Shell is "Explorer.exe", optional is the Program Manager "Progman.exe" from Windows 3.1 included
- Minimal hardware requierements: 4 mbyte RAM, 50 mbyte harddisk storage
- Integration of the Internet Explorer 3.0
- supports now FAT32 (since Version B), FAT16, VFAT
- preemptive multitasking for 32-bit programs
- cooperative multitasking for 16-bit programs
- ACPI Power save mode partly supported (except suspend to disk)
- x86 and compatible processors

## Features

- plug and play, high number of device drivers
- high compatibility to DOS, Windows 3.x
- high number of software
- no multiprocessing
- low local/network security
- old system architecture (16-bit software compatibility)
- badly scalable

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**Windows 98** Microsoft announced with this new system software Version 4.10 the revised version of Windows 95. The operating system Windows 98 contains as innovation mainly detail improvements and bug fixes. The hardware component is enhanced with USB support improved and the operation of several monitors is possible now. Windows 98 is prepared for DVD movies, for the view of DVD Movies a separate software must be installed.

The update to the newest Windows Release is supported if Windows 3. x or Windows 95 is already installed.

As a file system for the installation of Windows 98 FAT32 is recommended. If the access to other file systems is needed are tools of third party manufacturers required which usually offer a free software with read access. Such tools are available for NTFS and the Linux file system ext2. For the professional file system NTFS exists a driver of Sysinternals which is integrated after the installation in the operating system. For the successful installation system files are needed by Windows NT.

Windows 98 can be updated to DirectX 9.0 and the Internet Explorer 6.

## Features

- extended support for the connection to networks
- integrated Internet Explorer 4.0
- web optimized, networking through VPN
- Internet Connection Sharing (ICS)

## Area of application

- home user
- PC Games
- Office use
- network client

## Structure informations

- 32-bit operating system, with 16 Bit Code
- up to 512 mbyte RAM adressable
- File size up to 4 gbyte

## System environment

- Minimum Hardware Requierements: 16 mbyte RAM, 300 mbyte harddisk storage
- Active Desktop for the Web integration in Windows
- New driver model WDM (Win32 Driver Model), developed for the same driver base for Windows NT and 98 in 1996
- Task planer, time controlled start from programs
- Mayntenance assistant, harddisk maintains
- game interface DirectX 5.0
- multi monitoring Support (up to 4)
- File system FAT16, better use FAT32, access to NTFS and Linux ext2 file system with 3rd party tools
- preemptive multitasking for 32-bit applications
- cooperative multitasking for 16-bit programs
- ACPI Power save mode partly supported (except of Suspend to Disk)
- x86 CPUs and compatible

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## Features

- integrated ICM (Image Color Management)
- Plug and play, support for modern hardware like USB, Firewire IEEE 1394
- high compatibility to DOS, Windows 3.x and limited NT
- very high number of software and device drivers

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**Windows CE** In 1995, Microsoft started the development of the new operating system called Windows CE under the code name Pegasus. The graphical user interface and usability has similarities with Windows 95 and has been designed especially for embedded devices. The application programming interface (API) contains a subset of the Win32 API used for Windows on personal computers. At the beginning, Handheld PCs and Personal Digital Assistants (PDAs) are supported with the processor architectures as MIPS 3000/4000, SuperH of Hitachi and Intel x86. The 32-bit operating system has a limit of up to 32 processes with up to 32 MB virtual memory for each process. The minimum requirements are stated as 4 MB ROM and 2 MB RAM.

Windows CE 1.0 has been presented at the COMDEX, Las Vegas in November 1996. One of the first devices for Windows CE was HP 300 LX and available at the market on 16th November 1996. The operating system is not sold separately and always tied to the device unit delivered by the original equipment manufactures. The resolution of the touch screen is 640x240 pixel and corresponds to the half-VGA resolution. Data can be synchronized between mobile device and desktop computer with the "Handheld PC Explorer" software. Although the localization in German was planned, the first Version of Windows CE was only available in English.

At the beginning there have been speculations about what "CE" is standing for. Interpretations like "Compact Edition" and also "Consumer Electronics" was spread. Microsoft declared later that "CE" is not an abbreviation but represents more the rules of orientation during the development to create an new operating system that is more "Compact", "Connectable", "Compatible", an "Companion," and "Efficient".

Windows CE 2.0 came in October 1997 with the first devices on the market. The operating system can now be designed modular by the device manufacturers itself. TrueType fonts improving now the appearance of characters on the screen with a display of 640x480 pixel full VGA resolution and 24-bit color depth. The manageable memory can now be up to 4 MB. The software "Handheld PC Explorer" was renamed to ActiveSync. The operating system is also available in German now.

The update Windows CE 2.10 in July 1998 allows the use of TCP/IP and the file system FAT32. With the modular file wrapper can be incorporated up to 256 different file systems. The RAM can now be up to 16 MB. The new command line processor allows in this release for the first time the use of commands without a graphical user interface. An infrared port and USB controller increases the scope.

Pocket PC 2003 or Windows Mobile 2003 has a real-time kernel and is based on the Windows CE. NET 4.2 kernel. The features of the XScale CPU are now fully available and use the advanced commands of the ARM v5 architecture. The Pocket Media Player can now play videos in Windows Media 9 format. A WLAN stack was added and the setup of the connections was made easier.

Windows Mobile 2003 SE from March, 25. 2004 for Pocket PCs can switch over the display contents between the portrait and landscape format and displays up to 480 x 640 pixels. The start menu was changed light and the handwriting recognizer software Transcriber is controllable with Shortcuts now. The Internet Explorer converts web pages to a adapted format for better view on small displays.

Windows Mobile 5.0 was finished on May 5th, 2005. It is used in Pocket PCs, Smartphones and compact Media Players. Important innovations in this release are the support of Persistent Storage to prevent a data loss at a low battery usage and the revised mobile Office with Word, Excel and Powerpoint. The Windows Media player was updated to version 10 and the sync software ActiveSync to version 4.0. With Direct3Dmobile

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a new standard API was created for a simplified programming of 3D applications and games for PDAs.

Windows Embedded CE 6.0 was introduced in the year 2006. It offers a revised kernel architecture of the operating system, up to 32,000 parallel processes can be executed. A virtual addressable range of 2 gbyte is possible for every process. The multimedia capabilities have been expanded and now support HD-DVD, DVD (MPEG-2), UDF 2.5, multi-channel audio and much more. The compatibility to existing Windows CE applications and drivers are kept. Microsoft published the whole source code of the kernel within the own Shared Source Initiative.

Microsoft announced at the "CTIA Wireless" Windows Mobile 6.1 in April 2008. This new release is to be easier for the access to messages and to configure. The integrated web browser supports Adobes Flash, Microsoft Silverlight and the video codec H.264. Functions for Smartphones have been improved.

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**Windows® Family** Microsoft has began at 1981 with MSDOS 1.0 to develop operating systems for computers. One year ahead Microsoft has worked in cooperation on the Unix derivative operating system XENIX OS for different computer platforms, this OS field however was transferred to SCO in 1984. With Windows 1.0 were added in 1985 beside DOS a second OS line, which was meant first for single workplaces for Consumer (Home edition) and later with added network support.

The third product line was started with MS OS/2 1.0 in 1987. The professional edition was for server applications and network clients designed. In February 1989 the development of Windows NT started (NT = New Technology), the first version was published with Windows NT 3.1 in July 1993. Up to 200 developers had programmed at the same time on the approx. 6 million code lines. While MS-DOS was programmed nearly completely in assembler, Windows NT also consists of source code of the programming language C. Up to 450 developers were involved at the operating system Windows NT 3.51 which was released in May 1995. To record times up to 800 developers worked on the successor Windows NT 4.0 for the release in July 1996. Windows 2000 was the ambitious project following on this, up to 1.400 developer worked on the 29 million code lines. The development costs amounted to about 1 billion dollar. Altogether 5.000 developers worked on the 50 million code lines of assemblers, C and C++, for the Windows Server 2003 operating system with release in April 2003. The development of operating system versions for the MIPS, PowerPC and alpha architecture became gradually cancelled up to the market release of Windows 2000. This was also involved by the lacking driver and software support for these platforms.

With Windows CE 1.0 a new product line for small devices (PDAs) was created in 1996.

The former splitting into Consumer and Business Windows Edition is to be united with Windows XP (alias Whistler) again and continued in this product line. Thus is void for the first time the condition of MSDOS, which need even Windows 95 to ME for the system start. Directly with all Windows versions so far the drive assembly marking with the letters [A to Z] whereby the maximally managable number on 26 is limited, excluded mounted network directories.

Windows 1.0

[Read Article](#)

[Screenshot Gallery](#)Windows 3.11

[Read Article](#)

[Screenshot Gallery](#)Windows 95

[Read Article](#)

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[Screenshot Gallery](#)Windows NT 4.0

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[Screenshot Gallery](#)

**Driver models** MSDOS contains simplest hardware drivers for the access to harddisks, floppy disk drives, file system, serial and parallel interfaces, which do not correspond to todays modern hardware. As example color printers can be used to print text by commandline instruction but aren't controllable in print quality or color. Hardware drivers can be loaded only statically and are active also without use loaded up to the restart.

- only 16-bit material mode driver
- only direct hardware access possible (caused by the single tasking system)

With Windows 3.x uniform interfaces were made available for the first time for applications and drivers. Driver formats of Windows 3.x are 386, drv and dll files.

Under Windows 95 to ME are a large amount of drivers from Windows 3.11 applicable, however that slows down the 16-bit driver by the frequent access changes between real mode into the protected mode for 32-bit driver.

In addition the new driver format vxd, which runs completely in the protect mode, comes with the ability to be loaded dynamic at requirement, depending on the driver type. New function for Windows is the Plug&Play support of hardware devices, standard drivers are attached to the operating system. The WDM driver model is provided for the standardization of drivers for Windows 98 and following operating systems, so far only for devices at the USB or Firewire channel.

Windows NT makes the setup of device services possible, alternatively with manual or automatic start or the complete deactivation of the service. The driver format vdd (Virtual Device Drivers) is available since Windows NT. The drivers are depending upon type separated in the user mode, in the Kernel mode with direct hardware access or also as virtual device drivers (VDD) of the operating system core.

2006 should be the next Windows Version Vista with the code name "Longhorn" available. All Windows Editions should be based on the same core and were extended by specific modules depending on the field of application, language and hardware.

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**Windows 10** Windows 10 has been developed under the project name "Threshold" as successor of Windows 8.1. During development, the operating system was called Windows 9 but dropped by Microsoft for no official reason. This is the last Windows version according to Microsoft. This means that the major version number 10 will be kept, independent from the number of updates in future.

Microsoft offers a free upgrade from Windows 7 SP1 and Windows 8.1 within the first year since the release. The upgrade is performed after confirmation of the user. All of the necessary files for the upgrade have been downloaded through the automatic update before. You can install the operating system later on the same computer and the license will be activated automatically. Otherwise you can activate Windows 10 during the setup with a valid Windows 7 or Windows 8 license code.

Microsoft is forcing the registration with an online Microsoft account but you can still use a local user account. Many features will be limited or not useable without online activation, for example Cortana, OneDrive, OneNote and the AppStore. The operating system transmits many telemetry data to Microsoft. The transfer of data can be configured in privacy settings in control panel but not deactivated completely.

The minimum requirements for the computer are moderat. A processor with 1 GHz, 1 GByte (32-bit) and 2 GByte (64-bit) main memory are sufficient. The free disk space on the hard disk should be at least 16 GByte (32-Bit) and 20 GByte (64-Bit). The graphic card should support DirectX 9 with WDDM 1.0 drivers at a resolution of at least 800 x 600 pixel. The driver model is the same and drivers for the most common hardware are included.

The operating system has been designed for various different computers. Windows 10 is suitable for server, desktop computer, notebooks, tablets and Windows-Phones. The development of Apps has been simplified for use on computers and mobile devices. Microsoft offers Windows versions for different fields of application:

- Windows 10 Home
- Windows 10 Pro
- Windows 10 Enterprise
- Windows 10 Education
- Windows 10 Mobile
- Windows 10 Mobile Enterprise
- Windows 10 IoT Core
- Windows Server 2016
- Windows 10 for XBOX One

Windows 10 updates are delivered continuously on availability. A fixed weekly patch day become dispensable therefore. The point of time for updates can be configured in different rings but not disabled completely. The available rings to configure the update behaviour depends on the Windows version.

- Ring 1, "Fast": Receive pre-releases of new functions
- Ring 2, "Slow": Receive pre-releases of new functions delayed
- Ring 3, "Standard": Receive new functions at final release
- Ring 4 and Ring 5: Receive new functions delayed (Pro-, Enterprise- und Education Version)
- Ring 6, "Long Term Servicing Branch": Receive only security updates automatically, new functions after release by the administrator (Windows 10 Enterprise only)



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## Standard Features of Windows 10

- Secure Boot with UEFI-Firmware version 2.3.1 and higher
- Windows Hello for biometric user authentication
- DirectX 12 support
- Support for multiple monitors
- Support of Headup-Displays like Hololens
- Revised power management
- Startmenu classic or fullscreen
- Cortana allows the search by voice commands and keyboard input
- File version history and system restore
- Optimized for touch screens
- Faster boot process and wake up from sleep mode
- Bitlocker encryption
- Virtualization technology Hyper-V
- Support for up to 4 virtual desktops
- Revised Action Center
- Windows Explorer allows direkt mounting of ISO and VHD files as virtual drive
- Classic and new control panel
- Burn files directly to CD and DVD
- Compress and decompress ZIP files
- Integration of OneDrive as central online storage
- Edge Internet Browser
- Windows Defender integrated
- New PowerShell 5.0
- Revised parental control (Microsoft Family)
- Windows Media Player 12.0
- Revised App Store
- Skype-App, Video-App, Karten-App, Kalender-App, Mail-App
- Contacts-App, Messaging-App, Info-Manager OneNote

Windows Hello is able to identify the user by biometric characteristics. This can be done with the face, iris and fingerprint. The authentication data is stored on the local computer only according to microsoft. Requirement for Windows Hello is special hardware, for example a camera with infrared light for the face and iris identification.

The new browser Edge with the new HTML rendering-engine is the successor of Microsoft Internet Explorer. Internet Explorer 11 is still included for compatibility but the further development has been discontinued.

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**Windows 7** Microsoft has worked under the code name Windows 7 on the successor of Windows Vista since approximately August 2007. The new operating system is based on Windows Vista and comes with new programme functions and improvements in detail. Steve Ballmer talked with a keynote onto the Gartner Symposium IT 2008 on October 16th, 2008, that Windows 7 one Windows Vista is but with numerous improvements. It shall be release after 2.5 years development time as a new Windows major release. The version number is not increased to 7.0 but to 6.1 for compatibility reasons. Through this Microsoft wants to prevent problems with programmes which checks the version number. Microsoft introduced the first Windows 7 test release with the build 6801 on the Professional Developer Conference in Los Angeles on October 28th, 2008.

Basic data of Windows 7:

64 bit and 32 bit version Kernel is based on "MinWin", introduced by Eric Traut in October 2007 new graphic system improved language and handwriting recognition, useable over touch screen new user interface new program menues, with a recent list of the latests file and program functions used Windows XP mode (Windows 7 Professional or higher)

The first Windows 7 Release Candidate build 7100 appeared on April 21st, 2009. The operating system can be tested for 30 days without product activation. Microsoft refer as minimum requirements a computer with 1 ghz CPU, 1 gbyte main memory, 16 gbyte free storage and a DirectX 9 graphics card with a WDDM 1.0 driver or higher. Microsoft cooperates closely with Intel so that Windows 7 can use Hyper-threading still better.

The Release Candidate contains the Windows Media Player 12, Internet Explorer 8 and the Windows Defender 6.1. Optionally the Windows XP Mode (XPM) can be downloaded from the Microsoft web site for testing purpose. This promises users of Windows 7 Professional and higher to start some older productive Windows XP applications directly from the Windows 7 desktop. To this an configured, virtual image of Windows XP is installed with Windows Virtual PC. Requirement for the hardware virtualization is a computer with Intel-VT or AMD-V processor. Otherwise the XPM will not start. For a fast working are 2 gbyte of main memory and additional 15 gbyte of free hard disk storage recommended.

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**Windows 8** The successor of Windows 7 will support beside of the 32 bit and 64 bit Intel and AMD SoC (system-on-a-chip) architectures also ARM for a widest possible range of form factors on the market. NVIDIA, Qualcomm and Texas Instruments are working on different SoC designs based on the ARM architecture:

- Snapdragon ARM system from Qualcomm
- OMAP ARM system from Texas Instruments
- Tegra ARM system from NVIDIA with main focus to high-performance graphic

Microsoft is porting basic-applications like the Internet Explorer and Office applications to the new platform. They are native ARM applications for Windows 8.

At the D9 conference of May 31 till June 2, 2011 in California Microsoft unveil the recent development state of the new Windows user interface. The whole interface is useable over touch screen but also still with keyboard and mouse. A few aspects are e.g. the tile-based start screen for launch of applications as replacement of the existing Windows Start menu. Live notifications from applications are also shown as tiles. Switching between running apps is done fluid and the resize and snap of application windows is convenient possible. As an alternative to Metro remains the familiar desktop interface of Windows 7 but with restrictions. The previously known Start menu was removed for example.

On 14th September 2011, Microsoft released the first Windows 8 Developer Preview (build 6.2.8102) for free public download. As a downloadable ISO image in DVD format, x86, x64 and x64 version including development tools are available.

## Windows 8 Metro style user interface

The new Metro-surface with the tile-based look based on the new Windows runtime (WinRT) which works as an asynchronous API. Applications for Metro can be programmed in Javascript, C++, C# and Visual Basic. Best usability of Metro is only possible with a multi-touch screen.

One of the strengths of WinRT is the easy scalability of apps on mobile 7-inch display, large desktop monitors up to giant-screen installations.

The design doesnt includes anymore some of Windows Aero user interface known effects such as transparency, gradients and shadows. The window elements are flat, compact and reduced to a few colors. Rounded corners are a thing of the past.

High performance and frame rates for apps is done over the increased use of hardware acceleration depending on CPU and GPU and DirectX 11.1 support.

Apps that are not running in the foreground are paused through Windows 8 to consume no processing power until the application is reactivated.

## Minimum hardware requirements

1 GHz 32-bit processor (x86) or 64-bit processor (x64)

1 GB RAM (32-bit) or 2 GB RAM (64-bit)

16 GB available hard disk space (32-bit) or 20 GB (64-bit)

DirectX 9 graphics device with WDDM 1.0 or higher

A screen that supports multi-touch, screen resolution of 1024 X 768 or greater

USB 2.0 interface

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Changes at a glance

New user interface Metro style

Internet Explorer 10

DirectX 11.1

Windows Rollback

Windows Defender improved

Authentication by password or gestures

User profile can be synchronized online between multiple computers

Task Manager has been simplified

Improved dialog for file transfers

Mount of .vhd- und .iso-files directly possible

integrated automatic backup (File History)

Integration of Windows Store for Apps

Integration of SkyDrive to use storage in the Cloud

Integration of Xbox Live

Messenger to connect to various social media networks

virtualization Technology Hyper-V (only for 64-Bit-editions)

Windows Recovery Environment (WinRE)

Support for Secure Boot with UEFI ab Version 2.3.1

Windows 8 Versions

Windows 8 for end users

Windows 8 Pro for professional customers and business

Windows 8 Enterprise for companies

Windows RT for computers with ARM-Architecture

Windows Server 2012 (with new file system ReFS)

The various versions are complemented with variant "N" without pre-installed Windows Media Player for the European region.

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**Windows ME** The Windows Millennium Edition operating system is the successor of Windows 98 SE with some selected features of Windows 2000. The system core consists of a few parts of source code from Windows 2000. MS-DOS is furthermore necessary for the system start, DOS driver software are not used under Windows any more.

In opposite with the predecessor Windows 98 new features were added. Now it is possible to create compressed folders who moreover let themselves be encoded (screenshots 3-4). The search function from Windows 2000 was integrated into the Windows ME Explorer, the stability was improved. The Windows Registry was extended by 1 file for performance reasons. The Registry file Classes.dat is loaded only on demand, System.dat and User.dat are loaded statically. For any logged in user the respective User.dat is loaded from the profile directory like since Windows 95. Benchmarks between Windows ME and Windows 2000 with current games has shown that Windows ME has with suitably hardware and driver software a slightly higher benchmark result. The sales started on September 14th, 2000.

## Area of application

- PC Games
- private users
- network client, Internet connection sharing

## Structure informations

- supports ACPI, Idle states for computer
- integrated Internet Explorer 5.5
- monolithic kernel
- preemptive multitasking
- System file protection and system recovery
- automated system processes
- universal Plug and Play (UPnP)

## System Environment

- Minimum Hardware requirements: 32 mbyte RAM, 500 mbyte of free harddisk storage
- up to 512 mbyte RAM adressable
- FAT-16 or FAT-32 File system
- x86 and compatible processors

## Features

- simplified network setup in opposition to the predecessor
- increased Stability with system recovery and system file protection
- no 16-bit program code
- Compatibility problems with software for Win9x and driver software
- no common use of Windows 2000 WDM driver software with Windows ME

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**Windows NT 3.1 Workstation** In May 1993 the first Windows NT (New Technology) version 3.1 came as a Workstation (Client) and Advanced Server operating system for Intel x86 and RISC architecture to the market. It is the indirect successor to Windows 3.0 and OS/2 2.0 in the new NT product line for high demands on stability. It allows 32-bit applications and makes them available each up to 2 GB of virtual memory. The protected memory area ensures the stability of Windows NT if an application has a crash. To protect against power outages, the use of a UPS is supported. The operating system is suitable as a network client and in the office. The system structure is based on a micro-kernel with support for up to 2 CPUs and can address a maximum of 64 MB of RAM. The file systems NTFS, HPFS and FAT-16 are fully supported. This version of Windows does not support Plug and Play.

Minimum requirement of hardware is at least an Intel 386 microprocessor with 25 MHz, 12 MB of RAM and a hard drive with 75 MB of free disk space. For the RISC architecture is suitable for example one Mips R4000 processor, at least 16 MB of RAM and 92 MB free hard disk space.

**Windows NT 3.1 Advanced Server** The first Windows NT Server operating system was introduced in July 1993. The system requires at minimum a 486 processor with 25 MHz, 16 MB RAM and 90 MB hard disk space. For a RISC-based system are 16 MB RAM with 110 MB of free hard disk capacity recommended. The scalability is increased to up to 4 processors, and each application can be served with up to 4 GB of virtual memory. The manageable disk storage can now span multiple terabytes. The operating system is based on the Client-Server concept and adds support for various RAID levels. The networking capabilities allow the Global Network Login for access to network-wide resources, providing of Connectivity Services for Macintosh and RAS as well as integration into existing network structures.

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**Windows NT 4.0 Workstation** The operating system Windows New Technology in the current version 4.0 of July 1996 was developed further considerably to the predecessor NT 3.51. The user interface of Windows 95 was united and revised with the stability and accuracy of Windows NT and integrated into this new version. The complete graphic engine, user, GDI and graphic driver software were transferred by the user mode into the kernel mode. Through this an improvement in the performance has happen opposite the earlier versions. Standards from the UNIX world like TCP/IP protocols and Posix Guidelines are also included. Windows NT does not allow direct access to the hardware and controls all accesses. Only with special graphics boards and specified driver software approximately the overlay mode is possible for the faster playback of videos.

Windows NT is available in a Server Edition (up to 4 CPUs) in a Workstation Version (up to 2 CPUs) and Enterprise Server Edition (up to 8 CPUs). There in addition are the Windows NT Server 4.0 Terminal Edition. The Registry is fully responsible for the user settings, system configuration, hardware and software settings and others. Other configuration files play only a minor role opposite to previous NT versions and of course Windows 9x. The Registry is therefore far bigger. The files used for the Registry are NTUSER.DAT from the respective user directory, default (standard user profile), system (hardware configuration), software (installed programs), Security (control of the access list) and Sam (user account and passwords), in the directory "C:/Winnt/system32/config/".

Minimum Requirements:

- 486 CPU or RISC-based CPU, such as Alpha, MIPS or PowerPC
- 16 MB RAM
- 110 MB free hard disk space
- VGA or SVGA compatible graphics card
- CD-ROM drive

Update: August, 23. 1997 With the Internet Explorer 4.0 the Active Desktop is offered as an extension for the installation. It is possible with that to act like in a browser in the Windows Explorer and the desktop can display web objects. The start bar is extended by the integration of own tool bars for the quick start. The user interface looks through this more modern like in Windows 98.

Update: August, 07. 1998 Last DirectX release in the version 6.0 for Windows NT. DirectX3D and DirectSound are supported only emulated.

Update: November, 19. 1999 With the 35 mbyte great Service Pack 6.0 Windows NT 4.0 is taken to the newest stand. All bug fixes were integrated in relation with the turn of the year 2000, euro currency support and security updates. The NTFS driver software was revised and supports now except for EFS and Quotas, NTFS 5.0 harddisk storages from Windows 2000. There are no updates for the MDAC and Internet Explorer included.

Update: July, 26. 2001 The 14.5 mbyte great and last Security Rollup Package (SRP) is published. All Patches are contained that was released since the Service Pack 6a.

Area of application

- Network Client
- Server

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- Office use for office programs

## Structure informations

- Microkernel
- Platforms: Intel x86, Alpha, on MIPS and PowerPC only very little common
- multi-processor capable (up to 4 CPUs)
- good port to other platforms by a changed HAL

## System environment

- Time-Sharing system
- File systems: NTFS, FAT-16
- Protocols: NetBEUI, TCP/IP, IPX/SPX, DLC, AppleTalk

## Features

- stable system
- Systemlog for events
- High performance at Office applications
- High security with current Service Packs
- bad integration of newest hardware
- no Plug and Play
- no ACPI or direct USB support



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**Windows NT Server 4.0** This operating system contains the functionality of Windows NT Workstation 4.0. The software has been optimized for use as a server and supports up to 4 processors. The FAT and NTFS file systems are still supported and even HPFS, in case you upgrade from Windows NT Server 3.51.

Microsoft recommends the following order before the installation of Option Pack: Install Windows NT Server 4.0, Service Pack 3, Internet Explorer 4.01 and then the Option Pack.

Minimum Requirements x86:

- Intel 486/33 MHz or higher
- 16 MB RAM
- 125 MB free hard disk space
- VGA or SVGA compatible graphics card
- CD-ROM drive

Minimum Requirements RISC:

- ALPHA, MIPS, or PPC
- 16 MB RAM
- 160 MB free hard disk space
- VGA or SVGA compatible graphics card
- CD-ROM drive

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**Windows Server 2003** The operating system was published as a successor of Windows server 2000 in April 2003. Windows Server 2003 carries the internal version number 5.2. The 32-bit version of the Datacenter Edition of Windows Server 2003 can supported by the Physical Address Extension (PAE) up to 32 processors and 64 gbyte RAM in a server. This operating system is used on IBM servers of the series x445 and x455, for example. The following [services](#) are started after the installation of Windows Server 2003 Enterprise Edition.

Microsoft introduced the 64-bit versions of Windows XP and Windows Server 2003 on the WinHEC 2005 event in Seattle in April 2005. The service pack 1 for Windows Server 2003 is already integrated, the operating system is available in the variants Standard, Enterprise and Datacenter edition. The advantages in the 64 bit variant lie in the architecture obtained security functions for the increase of the safety in the running operating system on hardware level. The Patch Guard is a function for the protection of the system components from applications be able to destabilize the system. For the addressing of the main memory at present are used only 40-bits for a virtual addressable storage of 16-tbyte. The compatibility to existing 32-bit applications remains unchanged.

## Windows Server 2003 Web Edition

- service for the delivery and store of web pages
- till 2 CPU and 2 gbyte RAM supported
- supports .NET framework, IIS 6, ASP.NET, Network Load Balancing, IPv6, Distributed file system (Dfs), Encrypting File System (EFS), Shadow Copy Restore, print services for Unix
- can not be used as domain controller

## Windows Server 2003 Standard Edition

- intended purpose for small till medium-sized enterprises
- till 2 CPU and 4 gbyte RAM supported
- supports the services of the Web Edition, extended by enterprise UDDI services, Internet Authentication Services (IAS), removable and remote storage, Fax service, services for Macintosh, Remote Installation Services (RIS), Windows Media Services (WMS), Public Key Infrastructure (PKI), Certificate Services, Smart Card support and Terminal Services

## Windows Server 2003 Enterprise Edition

- designed for high requirements
- at least 550 mhz processor, 256 mbyte RAM, 2 gbyte free storage
- up to 8 processors and 32 gbyte RAM
- support for 8-nodes combined cluster
- also as 64-bit version available
- supports the services of the Standard Edition, extended by Metadirectory Services Support (MMS), Terminal Services Session Directory functions, support for hot-add memory and Non-Uniform memory access (NUMA)
- Server functions are the role as a file server, print server, application server (for IIS 6.0, ASP.NET), mail server (for POP3, SMTP), terminal server, RAS/VPN server, domain controller for Active directory, DNS server, DHCP server, Streaming Media server, WINS server

## Windows Server 2003 Datacenter Edition

- intended purpose for highest performance, availability and scalability
- up to 32 processors and 64 gbyte RAM

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- up to 8 node combined cluster
- also as 64-bits version available
- same services of the Enterprise Edition but without Metadirectory Services Support (MMS) and Internet Connection Firewall, supports Datacenter Program (DCP)

The Service Pack 1 (SP1) was published at the end of March 2005 and improved the reliability and safety of the operating system with light increased performance. Functions which are already in the Service Pack 2 for Windows XP contained find the way to server operating systems now. The Windows firewall is installed (deactivated), the Internet Explorer extended by the pop-up blocker and the Automatic Update can be activated optionally. With the Data Execution Prevention (DEP) is the executing of programme code in not privileged memory areas prevented. The Security Configuration Wizard (SCW) helps at the configuration of safety guidelines with queries.

In February 2006 the functions extended Windows servers 2003 R2 came on the market. With this second version the administration of local and remote resources gets more efficient. Moreover, it offers a scalable web platform and harmonizes with existing UNIX systems in the network. The Windows Servers 2003 R2 Datacenter Edition and Enterprise Edition offer a more dynamic licensing model for the customers to be able to profit better from the server virtualization. The replication services were revised and can simplify the file exchange with other servers. The Active Directory Application Mode (ADAM) is integrated directly now for for a light weight directory service for network applications. The Active Directory Federation Services connects directory services with each other about web services. The services for UNIX (SfU) provide the interoperability with existing Linux/UNIX systems. The .NET runtime 2.0 is included.

The Service Pack 2 (SP2) for Windows Server 2003 was released at the end of March 2007. Contained are new functions and patches for the operating system. The Microsoft Management Console (MMC) offers new and improved command line tools in the new version. The performance with SQL servers and use of Windows virtualization was improved. The secure Wireless Protected Access 2 (WPA2) is supported now. The Scalable Networking Pack (SNP) offers an efficient scalability of network based applications.

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**Windows Server 2008** This new Server operating system bases on source code of the Windows Vista Kernel and carries the internal version number 6.0, build 6001. The successor of Windows server 2003 was developed under the code name "Longhorn". The operating system Windows Server 2008 from Microsoft shall further increase the reliability and flexibility in the server environment. This happens by interesting functions, efficient tools and the implementation of innovatively security features. The known Aero interface of Windows Vista was left out. A existing server installation with Windows Server 2003 or Windows Server 2008 Release Candidate is capable for an upgrade. It is recommended to have at least a 2 ghz processor, 2 gb RAM and 40 gb of free storage on the hard disk. A new special feature which was never available before in a Windows operating system is beside the option Complete Installation the Server Core Installation without the Windows user interface only with a command line. The administration is possible completely in booth variants, but the core installation is limited to 8 server roles. Hyper-V presupposes a x64 processor of AMD or Intel with virtualization technology and offers a installable virtualization solution during or optionally after the installation. Several instances of operating systems like Windows and Linux can be executed at the same time on a computer with that.

The 4 main versions of Windows Server 2008 are different in the versions for 32 bit and 64 bit systems. For Itanium based computer systems (IA-64) Microsoft offers an optimized version as Web Server and Application Server. The functional range varies depending on variant and covers up to 17 server roles.

Windows Server 2008 Standard supports up to 4 GB RAM in the 32-bit version and 32 GB RAM in the 64-bit version. The operating system supports up to 4 processors. 12 server roles are complete supported, 4 partial and Active Directory Federation Services (ADFS) are not supported.

Windows Server 2008 Enterprise supports up to 64 GB RAM in the 32-bit version and 2 TB RAM in the 64-bit version. The operating system supports up to 8 processors. As field of application this server platform is recommended for the securing of business critical applications in Clusters. All server roles are supported.

Windows Server 2008 Datacenter supports up to 64 GB RAM in the 32-bit version and 2 TB RAM in the 64-bit version. The operating system supports depending on hardware up to 64 processors. As field of application this server platform is recommended for Computer Centres and Clusters. The replace of working memory and processors is possible without shutdown of the running operating system. All server roles are supported.

Windows Web Server 2008 supports up to 4 GB RAM in the 32-bit version and 32 GB RAM in the 64-bit version. As field of application this server platform is recommended for Web Server and supports only this server role.

Product features of Windows Server 2008 (depending on version):

Hyper-V, Windows Server Virtualization PowerShell new command line SMB 2.0 for faster file and printer access User Interface like Windows Server 2003 "Bitlocker" for the complete encoding of the hard disk Windows SharePoint Services 3.0 IIS 7.0 Webserver RODC (Read Only Domain Controller) NAP (Network Access Protection) to isolate unsafe clients WDS (Windows Deployment Services) WSRM (Windows System Resource Manager) Windows Server Backup NLB (Network Load Balancing)

The Windows Vista Service Pack 2 of 26th, 2009 brings the operating system up-to-date. In addition to the bug fixes, the Hyper-V virtualization solution is now an integral part of the operating system. With Windows Server 2008 Standard, an additional instance is already included in the license, even unlimited in the Windows Server

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2008 Datacenter. The options for authentication over WebDAV redirector were increased and energy management improved. Backward compatibility to legacy terminal server of license keys with 512 bytes in size is now ensured. Older license keys of Citrix applications can now be also used to work on Windows Server 2008 Terminal Server.

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**Windows Vista** Microsoft published the new product name Vista for this new Windows Version on an event in the USA/Atlanta on 21-07-2005. This Windows Version was known under the development name Longhorn before. The installation of Vista is based on WIM (Windows Imaging format), a file-based Image Format. It compresses the contained files and can be used for the installation on several platforms from the same Image. The image on the DVD contains a pre-installation of the system directories of Windows in the Windows Imaging (.WIM) file and adapts to the hardware configuration. With the User State Migration Toolkit the user defined settings can be imported of Windows 2000 and Windows XP. An advantage of WIM images is the easy integration of new drivers and updates, the LZX compression provides the smallest file size and XPress compression the fastest compression. The installation DVD of Windows Vista already contains about 16,000 drivers, the Windows update offers further 14,000 drivers for supported hardware. There is no licence key during the Windows Vista installation necessary, in this case it start with a 30 days trial license. After this time period the activation of the operating system is inevitably with the Internet Explorer, after the start-up Windows opens only this window for activation. Windows Vista contains DRM technology for the playback of protected multimedia files.

Windows Vista (Windows version 6.0) contains the new user interface Aero. The start menu has a round start button without text now. New characteristics are three-dimensional effects, the transparent representation and freely scalable symbols. To see all visual features a graphiccard with DirectX 9.0 support is required. The known interface of Windows XP can be activated alternatively. The PC should at least contain a processor with 2 ghz, 512 mbyte RAM and at least 10 GByte of free harddisk storage.

Developer take advance from the new graphic interface WPF (Windows Presentation Foundation) for the component-based development of 2D and 3D applications, WPF was designed under the code name Avalon. This framework supports the use of vector graphic for better scaling of applications on the display screen.

For better Security Microsoft has integrated useful functions. The automatic update of the operating system provides the installation of new patches. When required the function UAC (User Account Control) asks the user whether it shall unlock unlimited user rights for the execution of a program. InfoCards makes the automated log-on and register of login informations for web pages possible. Windows Defender extends Windows by an spyware/malware protection, the Windows Firewall monitors connections which are incoming and outgoing.

The performance is for a shorter reactivation time of Windows with the active programmes after a cold start of the PC improved by Windows SuperFetch. Windows ReadyBoost provides an additional working memory on USB flash devices and can be combined with SuperFetch. The USB flash storage has much faster access times than hard disks.

Preinstalled Programs by Microsoft were updated. The Internet Explorer 7 contains a Phishing Filter opposite to the previous version and supports Tabbed Browsing. The navigation in the Windows Explorer was revised, the address bar is equipped with single-line option fields displays for faster navigation in the directories on the file system. The search after files is possible with the use of many filters. Outlook Express was renamed in Windows Mail and got version 7.0 now. The functions of the Windows Media Player 11 and Windows Movie Maker were refined.

Microsoft announced the product versions for Windows Vista on 2006-02-26. Altogether there are 6 versions which are different in product functions and price. The same characteristic is the maximum support of 4 gbyte

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RAM for all 32-bit versions. For Windows Vista 64-bit and Home Basic are already 8 gbyte supported, Home Premium 16-gbyte, for the business variants and Vista Ultimate more than 128 gbyte RAM.

The Windows Vista Starter Edition is targeted to technological developing countries at a low price and fewer program functions. Only the Vista Basic graphical interface and 32-bit version is available, the number of simultaneously executable applications is limited to 3. Windows Vista Home Basic for private users contains only the simple user interface and comes without different new effects of the Aero interface. A new function is the content and access control with protection of children and young people for the restricted use of Windows and display of web sites. The next higher version is Windows Vista Home Premium which can also show the new Windows Aero interface. Aero offers a simpler search for files in the audio and video format. Additional functions belongs to the Windows Media Center to convert the computer into a multimedia player. The field of application is enhanced by the Windows Tablet PC technique like hand character recognition, support of digital pins and finger touch recognition. The storage medium DVD can be described over the integrated burning function with data, the authoring software helps at the creation of own films.

The Basic version for enterprise use forms the Windows Vista Business edition. The Windows Aero user interface can be activated, Windows Tablet PC technique like hand character recognition is also included. The administration of many documents is improved, file encrypting and the Encrypting File System (EFS) are important security extensions. For mobile use are designed the PC to PC synchronization and other mobile functions. The domain logon and group guidelines is part of the network component. Data security is provided by the image based backup. Windows Vista Enterprise has the same functions as the Business Edition and contains in addition Windows BitLocker for hard disk encrypting and Virtual PC Express for the compatibility to older Windows applications by the creation of a virtual environment. The subsystem for UNIX allows the execute of UNIX applications without porting. Windows Vista Ultimate contains all features of the other versions but is the most expensive Edition.

Microsoft published the first Service Pack for Windows Vista in March 2008. It is distributed over the automatic Windows Update one month later. If Vista is not activated the further use is possibly now without restrictions, but message windows remember the missing activation. Major changes are the support of UEFI, DirectX 10.1, the new file system exFAT for flash storage and optimizations of the performance. The use of network drives, handling of large pictures as well as file operations is faster done now. Device drivers were updated and the API of the kernel protection for Windows 64 bit is opened now for security service providers. The installation of Windows updates is accelerated and the number of UAC reports with directories reduced.

In July 2008 different analysts like Forrester, King Research and others reported that many big enterprises want not to migrate from Windows XP to Windows Vista but to wait for the successor Windows 7. From 2.300 enterprises work after a survey less then 10% with Vista (Forrester). Possible reasons are problems with the compatibility of existing applications and scarce investments for IT with other priorities.

Microsoft published at the 26.05.2009 the second service pack for Windows Vista for the download. The download size is depending of the chosen language and architecture with at least 302 MByte, via automatic update at least with 43 MByte. The Service Pack 1 is required for installation. The installation packages exist separately for 32-bit, 64-bit and IA64 processor architectures. 836 issues became fixed for Windows Vista is and Server 2008. The most important changes include:

improved program compatibility  
improved power management  
Windows Search 4.0  
Support for 64-bit CPU VIA Technologies  
Burning Blu-ray media  
Improved support for eSATA drives  
Bluetooth stereo headphones now

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possibleRSS feed sidebar improved in performance and response timesLimit of 10 half open, outgoing TCP connections removed



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**Windows XP** The Windows eXPerience operating system is available as home and professional edition and are similar suitable for the use on standalone computers. The home edition is suitable for user which worked with Windows 9x/ME till now and don't need special network or security features in their environment. If the user have used Windows NT/2000 private, in business or both, the Professional Edition is not only with a view of the administration optimally. Microsoft already encloses 10,000 drivers on the installation media of Windows XP, about the Windows update further more 2,000 drivers are available.

The Professional Edition of Windows XP has more network features than the Home Edition. An update of Windows 9 x/ME is possible, with Windows NT/2000 only the Professional Edition can be used for update. Optional FAT32 and NTFS are available as a file system for the installation partition.

Windows XP (Windows version 5.1) becomes a predecessor of Windows 9x/ME as well as Windows NT/2000 and is available for 32-bits CPUs in the following versions:

- Embedded
- Home Edition (1 CPU) for private user (Oct. 2001)
- Professional Edition (2 CPU) for business user (Oct. 2001)
- Media Center (1 CPU) especially for multimedia devices (Nov. 2002)
- Tablet PC Edition especially for Tablet PCs (Nov. 2002)
- Server Edition (4 CPU)
- Advanced Server (8 CPU), also 64-bit Intel CPUs
- Microsoft Windows Fundamentals for Legacy PCs (July 2007)

A 64-bit version of Windows XP was announced officially of Microsoft in April 2003. The RC2 was available in February 2005. Windows XP Professional x64 was published in April 2005. At most 16 gbyte RAM are utilizably with that, the virtual address range enlarges to 16 tbyte.

Same will be the product activation at all versions, which is needed at every new installation or extensive upgrade of the PC devices. Company customers can use an so-called Corporated version by a special licensing option without this product activation.

As the most visual innovation the revised Windows interface with the new design is well done, the design called Luna (as of beta 2428) can display window elements in high colour. The return to the interface as of Windows 2000 is further possible. The representation and organisation of the central registry is quit the same as used in Windows 2000.

Standard features of Windows XP - Home and Professional

Fast user switching

Network assistant

Remote control for the diagnosis (Remote assistant)

Simplified user interface

Windows Media Player

Internet Explorer 6.0

Windows Movie Maker

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Special features of Windows XP - Professional Edition

ASR - Automated System Recovery

Create of offline files

Backup/recovery function

User guidelines (Policies)

User administration (limited in Home Edition)

File system encrypting (only for NTFS)

Integration of the PC in a domain

Integration of dynamic data storage

Use as a terminal service client

Use as a NetWare-Client

Remote connection (desktop sharing)

Use of multiple monitors

EFS support in the file system

Send and received Fax support

SMP (use of more than one processor)

The graphic device interface (GDI) in the version GDI+ can take advantage of gamma correction and 3D interfaces in high colour depth. Windows XP is more based on HTML than previous versions. The system control was designed complete in HTML. With the new CD-R/CD-RW software it is possible to create easy and simple CDs. The Windows terminal service makes the access to an shared Windows XP desktop with a terminal client like the VNC solution.

With the new introduced multi-user function, users are now able to run their applications in the background even if the user signs off and another user is logging on to Windows. If the previous user returns he can continue his work after that without having to once more start the recent documents or applications.

The Service Pack 2 (SP2) for Windows XP needs about 900 mbyte of free storage space. Another system modification is the Security Center, which shows the status and settings of the firewall, automatic updates and one additional anti virus program. The new memory function "data execution prevention" protects software code in the memory in front of manipulation like the insert of malicious program code to be executed (also called No Execute or NX), the protection works only with 64-bit processors. The improved firewall now can detect waitign ports for connections and the definition of exception rules for various network services.

The browser was extended by a pop-up blocker, the file execution protection (as well for Outlook Express) with informations about the used download zone was revised generally. Downloaded programs inherit the zone information of the browser and warn before the execution from Internet files as well as with the NTFS file system also before executing on local partitions.

Microsoft showed the naming for a Windows without Windows Media player on March 28, 2005. It is called Windows XP Home Edition N and Windows XP Professional Edition N on the market. Microsoft followed with this change the demands of to the EU-Kommission for a better competition between further software houses which offers a own media player like Realplayer, QuickTime and Winamp. There is no price difference to the standard Windows versions.

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Windows XP support has ended

Microsoft announced the end of technical support and security updates for Windows XP on 8th April, 2014. The upgrade to a recent operating system is recommended, not only for safety reasons. Also recommended for technical support of new applications as well as for recent driver support by hardware manufacturer.

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**Zeta** Another project is the commercial Zeta distribution developed by the company yellowTAB, this is an official successor of the BeOS Personal Edition with source code from the OpenBeOS project. The Zeta distribution was called at the beginning BeOS NG (new generation). yellowTAB was founded in Germany, Stuttgart by 10 persons. This company acquired the license from Palm to use and develop the BeOS source code. Yellowtab engages itself also in Eastern Asia and Latin America for the sale and marketing. Zeta was located for the German and English market and is planned in the variants Home -, Developer and Deluxe edition.

Zeta 1.2 was released in April 2006. New in this release is the enhanced support for SATA devices, new audio/video codecs (MP3, Ogg Vorbis, XviD), additional graphic and printer driver. The interface was redesigned, the in past release required activation was removed. The software publisher magnussoft takes over the YellowTab zeta operating system with May 2006 and provides the worldwide distribution and further development exclusively. The managing director Bernd Korz also changes to magnussoft, YellowTab is in the insolvency. The updated Zeta 1.21 live CD from 2006-09-25 is limited in the sense that no programmes can be installed and no files can be stored. The web site from YellowTAB was taken finally away from the server on November 24th, 2006. New releases of Zeta operating system shall be named with magnussoft ZETA. The property rights at the BeOS source code in Zeta lie further at the company Access.

Magnussoft Deutschland GmbH stops the sale of the products magnussoft Zeta 1.21 and magnussoft Zeta 1.5 update on 2007-04-05. Access Co. Ltd. gave a statement according to which neither YellowTAB GmbH nor Magnussoft Deutschland GmbH are or were entitled to the sale of the product Zeta. Due to the arisen uncertainty about the legal position Magnussoft Deutschland GmbH takes distance of the further sales until the clarification of the facts. Till now the exact licensing agreement between Mr. Korz and Access Co. Ltd. is unknown, at present it is not guaranteed that rights of third parties at parts of Zeta are not violated.

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**Apple Company** Apple computer was founded by Steve Jobs with 21 years and Stephen G. Wozniak with 26 years in Palo Alto/California in 1976. As many other company legends in the USA everything started in a garage where the technique freaks developed and produced the first operating Apple I computer circuit board. The first buyer of 50 Apple I circuit boards was Paul Terrel, owner of the Byte shop for computer systems. Steve Wozniak is an engineer, Steve Jobs a businessman. Steve Wozniak therefore put the first computers together, he had gained experience at Hewlett-Packard with the construction of pocket calculators and a computer with keyboard and coloured monitor screen. Steve Jobs concentrated on the business part.

The Apple I stood for 666.66 dollars in the Byte shops for sale as of May 1976. With "Byte into an Apple" (an explanation: "Byte" is 8-bits which sounds like-bite) the sales advertisement advertised "the first cheap microcomputer system with display screen port and 8 kilobytes of RAM on one single PC board". With this sales advertisement, such a statement, the layout was also born for today's Apple logo, the rainbow colored apple with-bite. After further development the Apple II came in 1977, the successor Apple III 1980 to the shops. The Apple III was presented on the National Computer Conference (NCC) in California on 1980-05-19, the Sophisticated Operating System is developed as closed source and has a monolithic kernel. The hardware consists of a 2 mhz 8 bit MOS CPU, 2 kbyte of ROM and 128 kbyte of main memory on board. Apple was one of the first commercial pioneers which offered with Lisa Computer and Lisa OS an operating system with a graphical user interface together with symbols and menus in 1983. Lisa set at this time the features which are standard today, a graphic user interface with the mouse for the operation. As standard applications are LisaCalc (calculation program), LisaGraph for presentation graphic, LisaDraw (drawing program), LisaWrite for the text processing, LisaProject for the net plan method, LisaList as file management system and LisaTerminal included.

The operating system Apple ProDOS 1.0 based on SOS was published in October 1983. ProDOS was split off in ProDOS 8 and ProDOS 16 for 8 bits and 16 bits processors later. On January 24th, 1984 the success started with the Macintosh's computers at his market preview by Steve Jobs. The synthetic voice output of a text was euphorically taken by the audience at the public preview of the performance features. With the provocative commercial spot "1984" the leader position of IBM is symbolically broken by an athletic woman through a thrown hammer. Within three months over 70,000 systems were sold. The continual improvements of the operating system by Apple increased the superiority in the area of graphic and simple user interface. The MAC (Mouse Activated Computer) was introduced in 1986, the GS/OS (graphic and Sound OS) took ProDOS 16 off, the new graphical 16 bit system increased the efficiency considerably. The booting procedure, the storage disk access and the start time of programmes was much faster now.

After an internal controversy over the enterprise leadership of Apple Steve left the company and founded with other employees the company NeXT in 1985. In 1986 NeXT took the company Pixar Animation Studios which was specialized in computer animations. Animated cartoons like Toy Story (1995), A Bug's Life (1998) and Toy Story 2 (1999) were made come true. In 1987 the extended Mac II was presented which was sold in a month 50,000 times. Apple presented the POSIX compatible UNIX with A/UX in 1988. At first it based on 4.2 BSD and AT&T UNIX System V Release 2, it was derived from 4.3 BSD and more current System V versions later. The last version was published with A/UX 3.1.1 in 1995. Mac OS was in competition by the market presence of Windows 3.0. Apple introduced new technologies like multitasking and added functions in the areas of multimedia, communications, speech recognition and video as well as fax/modem. Apple published his first PowerBook notebook computer with high market success in 1991. The product Newton, a personal digitally assistant was published in 1993 which did not really gain acceptance on the market. The last model was named MP2100 and was delivered with Newton OS 2.1 in 1997. Preemptive multitasking and energy

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saving management.

Companies like AT&T and Kodak were visited with the offer to buy Apple without success in 1993. A offer for the take-over by IBM and later Sun failed. Soon afterwards Apple went to an alliance with IBM and Motorola and published for the first time the PowerPC processor in 1994. The platform was switched over from Motorola to PowerPC processors and used for the Macintosh. The improved efficiency was rewarded by high market acceptance. In 1995 there was a hard time for Apple when Microsoft Windows 95 was released. The profits declined drastically in 1996 and Apple wrote red numbers for a short time, but could recover soon afterwards. Apple surprised the public with the take-over of NeXT for 400 million dollars in winter 1996. Steve Jobs returned to Apple. The take-over of Be was in the conversation before but because of the failed agreement for the selling price it did not happen. The entry offer of Apple was 50 million U.S. dollars. Be still demanded the 5.5-fold of the first Apple offer as the last amount.

In the first quarter of 1997 Apple had to accept losses again, this time about 720 million dollars. Steve Jobs got temporary appointed as CEO again and improved the market situation. On the MacWorld in Boston Jobs spokes about his plans to make Apple successfully again. It started an aggressive advertising campaign with the same company Chiat/Day which had already produced the film "1984". Apple started the operating system project Rhapsody which was possible by the purchase of NeXT software Inc. including NeXTSTEP. Steve Jobs agreed to an alliance with Microsoft which brought 150 million dollars (for voiceless Apple shares) and provided the development of programs by Microsoft within the next 5 years such as Office. Apple accepted the Internet Explorer as a standard in Mac OS os as well as Microsofts Java implementation instead of Suns original.

Apple has recovered again and presented the new Power Mac G3 in 1997. This is like his predecessor faster than comparable Intel processors. Soon afterwards followed the PowerBook G3 and versions of the exotic iMac with transparent cases and compact form. With the new design for computers and the case style Apple disclosed himself new customers for which a normal grey colored PC with all the wires doesn't fits in the living room. Apple continued the work on Rhapsody and united it with Mac OS into Mac OS X. It has a high technology stand and is extremely stable and efficient. The BSD related kernel Darwin was integrated smoothly and provides standard UNIX applications as well. Apple changed his enterprise strategy by the official Open Source support in 1999 which has become an essential part of Apple by now.

Update 06-01-2004 On the Macworld EXPO in San Francisco Steve Jobs in his opening speech public that Mac OS X is used by 9.3 million users which are altogether 40 percent of all installed Mac OS operating systems. In meanwhile 10,000 native applications are for Mac OS X available.

In January 2005 Apple released the Mac mini to the market. The computer system is offered without display screen, keyboard or mouse depending on the system model starting from € 489. The particularly small dimensions of 16.51 cm x 5.08 cm x 16.51 cm (WxHxD) and his low weight of less than 1.4 kg are an unusual feature. Furthermore are included: G4 CPU with 1.25 ghz, DVD ROM/CD-RW drive, 256 mbyte DDR-SDRAM, ATI Radeon 9200 graphic board, 10/100 base-T ethernet, 56-K modem, DVI/VGA port, USB 2.0, FireWire 400, audio output, Mac OS X 10.3 and other software.

At the beginning of the WWDC (Worldwide Developers Conference) 2005 Steve Jobs published the change to

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the Intel x86 platform. Reasons for the change was that Apple is dissatisfied with IBM as a supplier for PowerPC CPUs because these are not available in 3 ghz and faster variants. The change is started in the middle of 2006 and shall be completed by the end of 2007. At this time Intel x86 CPUs surpass the processor performance per watt the one of PowerPC CPUs by lengths.

An interesting detail in the talk of Steve Jobs was that since the introduction of Mac OS X in the year 2000 a x86 version was compiled by Apple internally parallel to every release. Apple provides the software XCode 2.1 for the porting of PowerPC applications to the new platform for developer. With XCode created Mac software have a large part of the available software. For applications these could be ported not or only heavily, the emulator Rosetta helps at the execution of PowerPC applications on the x86 architecture. Of course this has losses in the execution speed as consequence.

So no one with an x86 PC can use Mac OS X in future, this operating system shall be only operational with mainboards and chip sets of Apple mentioned as Mactel systems. Mac computers and Mac OS shall remain inseparable. Mac OS X 10.3 is used by approx. 14 million users. Mac OS X 10.5 (leopard) shall appear at the end of 2006.

- Newton PDA and Newton operating system
- PageMaker (Publisher Software)
- Apple Quicktime
- iTunes
- iDVD
- iMovie2
- AppleWorks
- DVD Studio Pro
- Final Cut Pro
- Sophisticated Operating System (SOS)
- Mac OS X
- A/UX
- ProDOS
- iPod, released in Oct., closed source operating system from Pixo (Pixo kernel)

*This list does not lay any claim to completeness. Thumbnail pictures are not true to scale. Source: Apple*

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**AT&T Company History** AT&T can look back at a long history and numerous innovations. Named as American Telephone & Telegraph Corporation developed the founders Alexander Graham Bell the telephone in 1875. Gardiner Hubbard and Thomas Sander financed the enterprise. They founded Bell Telephone company together in 1879. AT&T has his business fields in the complete previous company history in the communication and electronic industry. The computer business line joined later. Since they reached a monopoly, they had to open the market opposite other providers. The number of the telephone companies of 1 climbed through this to about 6,000 between 1894 and 1904. The number of the telephones rose on 3,317,000 from 285,000. 1984 became the AT&T group by the U.S Department of Justice split up. The enterprise shrank to 1/3 of his original size with that. The name Bell only still was allowed to be used by Bell Labs and AT&T International. It formed:

- AT & T Communications Division, market area for Telephone connections
- Western Electric Co., production of telephones, telecommunication equipment, new electrical products
- Bell Laboratories, research and development in the telecommunication and computer area
- AT&T information Systems, before American Bell, marketing
- AT&T International, for worldwide activities of the group outside the the USA

Different researches and developments were advanced to Bell Labs in 1969. Dennis Ritchie developed the programming language C and later Bjarne Stroustrup C++ these have a high value up to this day. Another project with Ken Thompson and Dennis Ritchie dealt with the development of one single user system which can take standalone tasks after the time sharing principle. Starting out from the multiuser operating system Multix resulted UNICS respectively UNIX which had at least a considerable technology lead in the field of the operating systems for the next 30 years. Advantage of the single user system is, that UNIX is used on usual microcomputers, PCs and on the Internet. The first UNIX version was published under the name UNIX time sharing system V1 in November 1971.

A restructuring which provided 3 separate companies took place at AT&T on September 20th, 1995.

- NCR, computer manufacturer, independent as of January 1st, 1997
- AT&T, communication & services with AT&T WorldNet® service
- Lucent Technologies, before Bell Laboratories, systems and accessories, Network Systems

Lucent Technologies proceeded independently as of end Spetember 1996 and provided the sale of public switching equipment, software for network operators and cable TV enterprises. The enterprise devision of Business Communications Systems (till now Global Business Communications Systems), the division Consumer Products for communication equipment for final consumers was taken over too.

A renewed restructuring was announced in October 2000 into 4 separate companies: AT&T Broadband, AT&T Wireless, AT&T Business and AT&T Consumer.

## Products

- Invention of the telephone
- Invention the solar battery
- Development of C (Dennis Ritchie) & C++ (Bjarne Stroustrup)
- Development of UNIX®

*This list does not lay any claim to completeness*

## Development



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- 1882take-over of Western Electric Company for a improved production
- 1899AT&T took Bell System and built up the telephone network
- 1913for the first time are Transatlantic connections possible
- 1913AT&T were obligated to open the telephone network for other companys
- 1950development of the solar cell by Bell Labs
- 1969development of C and UNIX
- 1974AT&T (American Telephone and Telegraph Co.) and her daughter companies Western Electric Co. and Bell Telephone Laboratories, worldwide installation of 300 million telephones
- 1983AT&T developer Bjarne Stroustrup develops the first version of C++. OOP (object oriented programming)
- Agreement on the common further development of the operating system "UNIX System V" with Intel Corp., Motorola Inc. and National Semiconductor, standard operating system for microprocessors created
- 1991AT&T takes computer manufacturer NCR for 7.3 billion dollars
- 1994AT&T takes McCaw Cellular for 11.5 billion dollars

*This list does not lay any claim to completeness*

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**Company Be Inc.** The company Be Incorporated was founded of Jean-Louis Gassée with a couple of developers after his work in the Apple development department in 1990.

The BeBox was the first product of the new company, which was introduced officially in 1995 but did not bring the desired success. The BeBox was not compatible to the existing computing system types such as the IBM PC. It was operated with 2 PowerPC processors. In 1996 a BeOS version was for the first time introduced for the Mac which should serve as an innovation source for Apple. But the negotiations turned into nothing and Apple decided in favour of NeXT. The BeBox was abandoned because of the low sales at the beginning of 1997 so that as of now the work concentrated on BeOS for the x86 architecture. It was the reason for the development of BeOS to create a modern and efficient multimedia platform which is not based on an old system structure and completely new.

BeOS was used primarily in the area of multimedia by software developer and users whereupon the first PC version was introduced for the first time for x86 processors in August 1997, few times later for the Mac too.

The first BeBox model contains two PowerPC 603 CPUs with 66 MHz, up to 8 x 32 mbyte main memory SIMM module, IDE and SCSI ports, 3 x PCI and 5 x ISA card slots.

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**BSD Development** BSD stands for Berkeley Software Distribution and was developed by the University of California at Berkeley. BSD is one of the main branches shared from the AT&T UNIX v6 in 1978. The code was developed further and partly replaced. In the course of the time BSD forked in 4 distributions. The splitting-off took place to the second BSD line (3 BSD) between 1979 and 1980. From this BSD Net/2 in 1991 and from this the first BSDi in 1992 were formed. The second fork was to 386-BSD in 1992 which became finally to FreeBSD 1.0 in 1993. Direct successor of BSD Net/2 was NetBSD in April 1993. OpenBSD was created of NetBSD in 1995.

As symbol figure a BSD Daemon was chosen, drawn by Marshall Kirk McKusick. Walnut Creek is the main supplier of CDROM distributions with FreeBSD and has established for the Daemon the name Chuck, beastie is another name and shall represent not a devil but an daemon.

The EuroBSDCon is a yearly developer convention to exchange informations about BSD related topics. The first convention took place in UK/Brighton, the second EuroBSDCon was given in Amsterdam in November 2002, the third in Germany/Karlsruhe in 2004, the fourth at the University of Basel in Switzerland in 2005 with more than 220 exhibitors from 27 countries and topics like development and BSD on embedded devices. The fifth EuroBSDCon took place in Milan in November 2006.

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**Cray Company history** Since 1951 Seymour Cray (1925-09-28 to 1996-09-05) was mainly and with great engagement engaged in the development of high-performance computers. The main field during the development of such complex systems is on the integration of new technology, the physical construction and continuous increase of the performance. Seymour Cray worked before at the company Control Data Corporation (CDC) founded by William C. Norris in 1957. Seymour Cray designed the CDC 6600 computer system there. Seymour Cray founded his own company Cray Research in 1972, supported financially by CDC.

In 1989 Cray leaves the research institute Cray Research and founds the Cray Computer Corp. in Colorado. There he developed another Cray supercomputers like the Cray C90. Cray started again a company named with his initials as SRC Computer where his last project Cray 5 is developed. Seymour Cray went into history as "father of supercomputing". Jim Rottsolek led now this company as president and CEO. He had co-founded the Tera company in 1987. Peter J. Ungaro led the company Cray since 2005.

The field of applications for supercomputer is enormous. It is be the simulation of productional processes, vehicles, research of material deformations, the observation of global climate changes, bio chemical reactions and process, computing of molecules or complex data structures - everywhere in science and development all of the available performance is needed.

Each new Cray supercomputer generation was developed further. So a own cooling system with the name Freon was designed in order to derive the high thermal power of the components. The development of the design of Cray supercomputers is just as noteworthy. Some models are built up like a ring and almost are enclosed in the outer ring of a seat group. With the Cray XMS system Cray has designed her first mini-supercomputer which was taken off by the more powerfull Cray J90 later. The Cray Y-MP system has reached a total performance of up to 2.3 GFLOP together with several CPUs and each 333 MFLOP in 1988. In 1993 Cray Research introduces her first massive parallel system (MPP), the Cray T3D supercomputer. The first cordless supercomputer was introduced with Cray T90 in 1994.

SGI bought the company Cray Research for 740 million dollars in February 1996. SGI hived off the Cray Research enterprise division in August 1999. This enterprise division was sold from SGI to Tera under heavy financial loss in March 2000. Cray research was renamed in Cray Inc. Some patents of Cray remain at SGI. In 2004 the startup enterprise OctigaBay Systems Corp. with experiences in High performance computing was bought by Cray. The design is optimized on MPP and does not have any performance bottlenecks like typical in other systems. With the take-over the Cray XD1 system was published later with the new technique.

## Operating Systems

- UNICOS: scalable Microkernel operating system for small servers up to supercomputers
- UNICOS/mk: scalable Microkernel operating system for strongly parallel computer systems like Cluster
- UNICOS/lc: developed for complex applications, can scale up to 30,000 processors, consists of a Microkernel for the computing nodes and an operating system for the service nodes, cluster file system with transfer rates of up to 100 gbyte/s

On 2009-03-18 Cray published the new midrange supercomputer XT5m for massively parallel processing (MPP).

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**Digital Research** Gary Kildall founded the company Digital Research (DR) in 1976. Many hardware manufacturers licensed CP/M for her computers a year later. In 1981 IBM contact DR to license a suitable operating system. Because of an wrong decision it did not came to a contract so IBM consulted Bill Gates. CP/M failed in the competition with the DOS variant of Microsoft. Digital Research reacted to the market situation and released an MS-DOS compatible CP/M version in 1988. But the business income decreased. Gary Kildall sold Digital Research to Novell for 120 million dollars in July 1991, DR-DOS was renamed to Novell DOS. Gary Kildall dies on July 11th, 1994.

In 1983 Gary Kildall developed the graphical operating system interface GEM (Graphics Environment Manager) which stood in the beginning in competition to Microsoft Windows 3.x. However, Windows gained more and more acceptance on the market.

In July 1996 Caldera buys the DRI technology of Novell with all rights, Novell DOS is called OpenDOS now. Caldera published the source code for DR-DOS in September 1996 and GEM, Caldera hived off the operating system division in 1998 to the subsidiary firm Lineo which was called Caldera Thin Clients Inc. before. The marketed embedded Linux Embedix which is based on OpenLinux. DeviceLogics takes on all DR-DOS sources and rights in October 2002.

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**Hewlett-Packard Company** Bill Hewlett and Dave Packard founded HP (Hewlett-Packard) in 1939. At the beginning oscillographs were produced and commercialized. HP became a share company in August 1947 and achieved 851,287 dollars sales volume in the same financial year with 111 employees. It was already 5.5 million dollars sales volume 215 employees in 1951, 20.3 million dollars sales volume and 901 employees in 1956. Motivated by the success HP went to stock exchange in 1957. Hewlett-Packard consists of 4 main business fields and one research facility, the HP Labs. This Lab is available for all business fields and advances the development.

- Enterprise Systems Group (ESG)

Key technology, components for enterprise IT infrastructure, storage systems, servers, management software and special solutions

- Imaging and Printing Group (IPG)

Printer and graphic solutions for enterprises and private users, printer devices, all in one devices, digital picture equipment like cameras and scanners with accessories

- Hewlett-Packard Services (HPS)

worldwide active IT service team for a comprehensive support

- Personal Systems Group (PSG)

economic PC solutions as well as equipment for enterprises and private users, desktop systems, notebook computers, workstation, thin clients, handhelds and PDAs

Product names

- HP-UX

- HP server

- DeskJet devices (ink printers), LaserJet devices, (laser printer)

- HP OpenView

- HP-UX for PA-RISC and Itanium systems

Since beginning of the year 2000 Carleton S. Fiorina leads in the position as CEO and executive board chairmen the company Hewlett-Packard. The perhaps biggest process in the company history was when HP merged with the Compaq computer Corp. at the beginning of May 2002. The former managing director Michael Capellas of the Compaq Corp. is new president at HP. The operating system HP-UX shall profit from the operating system Tru64. HP agrees to a contract with Red Flag Linux, the dominating Linux distributor in the Chinese language area, for development and evaluation of software in China in September 2003.

Carly Fiorina withdrawn from her position as CEO on 9-2-2005. As reason she indicated differences in the top management about the further strategy of the enterprise. For example already before the take-over of Compaq there were differences with Walter Hewlett. As a successor Mark Hurd was elected on 30-3-2005. He was the head of the board of the company NCR Corp. before it. HP announced the sale of the 1 millionth Linux server since 1998 in the middle of June 2005. HP still placed itself as market leader at the sales volume since already 7 years in front of IBM.

The CEO of Sun Scott McNeally suggested Mark Hurd in an open letter on March 1st, 2006 to unite the operating systems HP-UX and Solaris. McNeally gave as argument that Solaris is a non proprietary operating system also for computer of other manufacturers. Solaris supports beside SPARC server the x86 and x64 platform too. Solaris 10 is therefore the ideal operating system for the Xeon and Opteron servers of HP who were delivered with Windows, Linux or Netware till now. There have been with over four millions of Solaris 10 more licences sold in 2005 than HP has sold with HP-UX in the complete company history. Mark Hurd rejected

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Version: September 3, 2016 | Download: [www.operating-system.org](http://www.operating-system.org)

this suggestion.

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**IBM Company History** IBM Corp. was founded with the name Computing Tabulating Recording Co.(CTR) in New York on June 15th, 1911 after the union of the companies Tabulating Machine Corp., Computing Scale Corp. and the International Time Recording Company. CTR was then renamed in International Business Machines in 1924. IBM developed Sequel in 1974 and got renamed 2 years later to SQL (Structured Query Language), the publications about the Relation model of E. F. Codd's was the basis for this development.

In 1975 IBM had for the first time produced a PC (personal computer), the model was called 5100 and introduced the term PC. IBM presented the IBM 5150 PC with Intel 8088, PC DOS 1.0 and 63 watt of power supply in New York on August 12th, 1981. The successor IBM 5160 PC XT was introduced in March 1983, the power supply offers up to 135 watts, contained a floppy disk drive and 10 mbyte hard disk. At the end of 1981 the PC was successful with IBM DOS / MS-DOS on the market, becomes a industry standard and made computers for a broad range of customers interesting for purchase. IBM introduced the PC-AT (advanced technology) standard in 1984, the further developed PC-ATX standard followed soon. In 1988 a common project was founded with Microsoft to develop a successor of OS/2 1.x. The project aim was called OS/2 3.0, the cooperation was ended in 1991. IBM developed the 32 bit of OS/2 2.0 further, Microsoft follows with this "New Technology" operating system own aims to support step by step the platforms x86, Alpha, MIPS and PowerPC. NT shall contain technology of OS/2 1.x, Win32 and build up on a rudimentary Posix subsystem. The own developed database management system is named DB2 and was used by many millions of users worldwide in August 2000.

The cost for the development of the operating system OS/360 was 50 million dollars and it has more than 220,000 lines of code. The operating system OS/400 were renamed since release V5R3 to i5/OS. E.g. This OS is used for example on the eServer i5 with PowerPC processors. The new IBM System /360 is a more efficient computer system as previous IBM computers which is different built up. The hardware components (like the card reader) were interchangeable and the software can operate on all models of the product family. The development of System 360 cost 5 billion dollars and employed in record times over 50,000 employees. This computer was manufactured for the first time with an assembly line.

IBM ports middleware products for HP servers with HP-UX. Such software belongs to the WebSphere, Rational, Tivoli and Lotus product line to provide better solutions for common customers from the finance sector.

IBM published the 7th generation of the S/390 computer under the name eServer zSeries 900 at the beginning of October 2000. The newly developed operating system zOS was adapted on this line and had virtualization technology especially to adapt the efficiency of the complete system to the current requirements in the regular business. For the zSeries Linux is alternatively offered as operating system. The UNIX server RS/6000 scalable up to supercomputer is replaced by the pSeries in future.

The biggest IT company of the world is IBM and shows not only with an 1 billion U.S. dollar financing his great engagement in Linux technology. IBM splits up to the main enterprises IBM Corporation (USA) and IBM Deutschland GmbH, branch offices can be found around the world. Because of the blue IBM logo it gets synonymous for IBM as "big blue".

## Business fields

- Global Financing (IT financing institute)
- Global Services (business and technology consulting)



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- Microelectronic and hard disks, storage systems
- Pervasive computing (cordless computer technology )
- Research and development (patent) more than 24 development labs in the world, 115.000 employees in this field
- Notebook computer & server market, incl. mainframes
- IBM ThinkPad notebook computer
- eServer series, ASCI White supercomputer (Accelerated Strategic computing initiative)
- AS/400 server series, announced at 1988-06-21, 20 years later still at over 245.000 company customers in use
- S/390 server series
- more than 65 strategy partners (Baan, SAP)

## Software products

- WebSphere application server
- DB2 universal database
- WebSphere personalization for Multiplatforms
- content manager for Multiplatforms
- WebSphere home page builder
- Small business suite for Linux
- e-collaboration
- e-learning
- e-Knowledge management
- ViaVoice speech recognition
- VisualAge for Java
- Lotus ASP Solution Pack
- MVS/370 - OS/360, OS/390, OS/400
- z/OS (formerly OS/390 )
- i5/OS (formerly OS/400 )
- OS/2 operating system (Operating system 2)

*This list does not lay any claim to completeness. Updated: January 2001, photo source: IBM*

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**Microsoft Company** Paul Allen and Bill Gates went to the same school and founded the company Traf-O-Data together in 1971 for the production of small computers with an Intel CPU for the measure of car traffic. They got a contract at MITS (Micro Instrumentation und Telemetry Systems) to provide BASIC for the Altair. In 1974 they designed the programming language BASIC for the Altair 8080 as Lakeside Programmers Group. Fortran and COBOL also were programmed for the Altair and the BASIC interpreter was ported for the TRS 80 from Tandy. The company Micro-Soft was founded in summer of 1975 to develop software for the IBM PC and port the programming language BASIC. Later followed beginning from 1977 Fortran and assembler, COBOL in 1978 and Pascal 1980. In 1978 Microsoft licensed a development licence for UNIX from AT&T. Because AT&T had protected the name of the operating system UNIX, Microsoft named the UNIX variant of her own as Xenix.

1980 the enterprise moves with now 38 employees to Seattle and reaches 8 million U.S. dollars sales volume. IBM searched for his microcomputers for an operating system which fits for the mass market. At first IBM consulted Digital Research without success and after that to Microsoft which had been strengthened by Steve Ballmer in meanwhile in organisation and finances. But Microsoft had no own operating system and bought therefore Q-DOS from Seattle Computer Products for 50,000 U.S. dollars. IBM licensed it under the name MS-DOS. The IBM PC became an overwhelming success. The sales volume and profit of Microsoft increased further in consequence this one. Bill Gates got a contract with SCO to bring out a UNIX variant for the IBM PCs. First with publication of 80286 processor this turned out well and Xenix was possible. Microsoft cared primarily about the OEM business and SCO was responsible for the customization and improvement of the UNIX derivative. In July 1987 Microsoft bought the company Forethought and integrated the software under the name Powerpoint into the own office applications. Since 1994 the slogan "Where Do You Want to Go Today?" was spread by advertizing.

Originally Windows used a monolithic kernel but was later changed to the micro kernel. Comparable under the different Windows versions is the uniform program interface in Visual C with largely uniform usability. Windows profits from an enormously high number of free and shareware of other developers. The Windows and general software development is controlled by Microsoft and follows one defined roadmap, the product life cycle is limited and updates as well as support for one fix time period availably. The support is realized directly by Microsoft or certified partner companies. The successful enterprise has the primary objective to offer operating systems in the form of Windows for customers(end-user), professional and server area (enterprise). The business model of Microsoft offers the same platform for end-users and enterprises with standard implementations for software developer.

At the final release the Windows .NET servers (Windows Server 2003) shall be available as a Web server version, standard server, enterprise as well as data center version. The enterprise and data center version being also designed for 64 bit on the Intel Itanium. For the information exchange the open standards XML (Extensible Markup Language), SOAP (XML based protocol of information in the web which is for the exchange structured and standardized) and UDDI (Universal Discovery Description and Integration) are included. In January 2002 Bill Gates announced in an internal mail the start of the "Trustworthy Computing" initiative. The central concept of Peter Biddle imagines a combination from hardware and software which provides a new security architecture with the project name palladium (renamed in NGSCB later). Well known manufacturers like Intel and AMD already support this initiative and work on the realization together. Important points are the secure communication between all hardware components, an integrated firewall, hidden memory areas for applications, encrypted files, proved signatures as well as different authorization and authentication services and DRM (Digital Rights Management). This concept needs a completely different

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computer design, the encoding and decoding shall be guaranteed by a co-processor. Windows with the code name Longhorn shall contain this technology and approximately come on the market in 2004. Microsoft gained about 7.8 billion dollars profit at a sales volume of 28.4 billion dollars in 2002. Microsoft has at the end of the year 2003 more than 49 billion dollars in cash plus company shares and investments. The market success of Microsoft products is guaranteed by long-term announcements, early available beta versions for programmers and professionals as well as marketing. Microsoft announced the consolidation of the previous 7 lines of business areas into 3 divisions in September 2005: Business division (formerly Information Worker, Microsoft Business Solutions), Entertainment & Devices (formerly Home and Entertainment, Embedded Devices) and Products & Services (formerly Windows Client, Server & Tools, MSN). Microsoft cancelled the support for Windows 98/SE/ME on July 11th, 2006, now there are no new updates or security fixes more available.

Bill Gates announced at the 2006-06-15 to draw back himself of the daily work and his leading role of Microsoft as of July 2008. For a smooth transition Ray Ozzie (Chief Software Architect) and Craig Mundie (Chief Research and Strategy Officer) already take main responsibilities of Bill Gates. Bill Gates talked in his last official speech on the Consumer Electronics Show (CES) 2008 to finish his main activity at Microsoft. Starting from July 2008 Bill Gates wants to be attended with his wife Melinda Gates to the Bill & Melinda Gates Foundation and for Microsoft only in the function as a chairman and adviser in central issues.

Microsoft reached an agreement together to improve the maintenance and cooperation of the different operating systems with several Linux distributors. The contract includes licence agreements, the work on the format exchange between OpenXML as well as Open Document format (ODF), and partly two-way safety against patent claims. Included companies are Xandros (since June 2006), Novell (Nov. 2006), Linspire (June 2007) and TurboLinux (Oct. 2007).

Microsoft works on a completely other operating system philosophy than Windows for quite a long time. The Singularity Project is build up from scratch for reliability. For this goal the programming tools has necessarily to be made adapted for the new system architecture. Under the development name Singularity all programmes shall run in isolated processes.

## Software titles

- Visual BASIC, programming language
- Visual-C++, programming language
- Visual-J ++, programming language
- Visual FoxPro, programming language
- Office 2000 with the individual applications Word, Excel, Access, Powerpoint
- Project 2000, planning of projects
- Exchange server, e-mail service
- SQL server, database service
- Front page, HTML program
- Publisher, Website manager
- PhotoDraw, pixel based image processing
- Encarta 2000, knowledge dictionary
- Internet Explorer, Internet browser
- DirectX, software interface for 3D games
- Host integration server 2000
- Site server 3.0
- BackOffice server 4.5

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Version: September 3, 2016 | Download: [www.operating-system.org](http://www.operating-system.org)

- ODBC 3.0
- Proxy server 2.0
- Internet Security and Acceleration (ISA) server
- Systems Management server
- SNA server
- Internet Information server (IIS)
- Microsoft Bob (1992)
- Services for UNIX (SFU)
- Windows operating systems
- Microsoft Works (1986)
- Singularity operating system (in Research)

*This list does not lay any claim to completeness*

## History of Microsoft

April 4th, 1975 foundation of Micro-Soft corporation by William H. Gates III and Paul G. Allen in New Mexico.

Novembers 26th, 1976 the term Microsoft is registered as a brand name.

Novembers 29th, 1979 in Belgium the first branch office in Europe is founded, the main business place was transferred to Washington.

June 25th, 1981 foundation of Microsoft Inc. with Bill Gates as presidents and Paul Allen as an Executive vice-president. Microsoft employs 128 employees and reached a sales volume of 16 million dollars in the year.

August 12th, 1981 IBM released the first PC and delivers it with Microsoft's 16 bit operating system MS-DOS 1.0.

September 29th 1983 subscribers of the professional journal "PCWorld" get a free disk with the demo version of Microsoft Word.

November 10th, 1983 announcement of Microsoft Windows, the extension of MS DOS with a graphical user interface.

January 24th, 1984 market introduction of the Macintosh by Apple. Microsoft becomes one of the leading providers of software for the Macintosh.

Novembers 20th, 1985 Microsoft Windows is released to the market . By the few available software, the market acceptance remains little at first.

February 26th, 1986 moving of the main business place to Redmond in Washington.

March 13th, 1986 stock exchange start of Microsoft. The first quotation amounts to 21 dollars and reaches 28 dollars at the end of the first trading day.

May 22nd, 1990 Windows 3.0 is published.

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July 25th, 1990 Microsoft celebrates the 15-year existence and the reaching of the first sales billion.

August 30th, 1990 the Microsoft Consulting Services is founded to support important global customers at the use of Microsoft software.

May 24th, 1993 introduction of Windows NT.

Novembers 14th, 1994 start of an international advertising campaign with this slogan: "Where do you want to go today?".

August 24th, 1995 worldwide introduction of Windows 95. Within the first 4 days Windows 95 is sold to about one million times.

November 27th, 1995 publication of the Internet Explorer 2.0 for Windows 95.

Decembers 7th, 1995 Bill Gates commits Microsoft to strengthened engagement in the Internet area.

June 25th, 1998 worldwide introduction of Windows 98.

13.01.2000 in the evening showed Bill Gates his resignation from the executive board chairmanship of the company Microsoft. Steve Ballmer who has a position as a president since 1998 takes his job as a Chief Executive Officer (CEO). Gates remains active and is working as Chief Software Architect further in the chairmanship of the supervisory board.

February 17th, 2000 worldwide introduction of Windows 2000.

June 22nd, 2000 Microsoft introduces the concept of the Microsoft .NET platform, a new generation of Internet software and services. With the support of XML new and dynamic networking possibilities are created and data can be converted arbitrarily into other formats and layout's.

25-10-2001 publication of Windows XP operating system.

7-11-2002 publication of the Tablet PC.

June 24th, 2002 "Trustworthy Computing" initiative is started , security concept *palladium* (later NGSCB) is introduced

April 2003 Windows .NET servers are ready.

December 2003 Other companys can license the FAT file system

*Source: Microsoft*

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**Novell Company** Novell has his roots in the a computer manufacturer Novell Data Systems in 1979. In January 1983, this company was renamed to Novell Inc. with the new target to develop and commercialize software and hardware for use in networks. Raymond J. Noorda and the company Safeguard Scientific were involved in this process. The operating system NetWare was for the first time introduced in 1983. Novell developed his own network protocol IPX/SPX. In January 1993 Novell purchases UNIX system technology with the take over of the UNIX Systems Laboratories (USL) of AT&T, in 1995 Novell sells UNIX rights and source code to SCO and introduces UnixWare 2 as well as WordPerfect 6.1 for Windows. Once, Novell had planned to create a common base with SuperNOS from UnixWare and NetWare.

4,500 employees worldwide work for Novell, meanwhile a worldwide leading provider of infrastructure products for the eBusiness. Novell can refer to an installed basis of about 4.5 million NetWare servers and approx. 90 million users in the year 2005. Novell GroupWise has an installed base of about 22 million users worldwide. More than 68 million users use the NDS eDirectory. More than 27,000 specialized service partners and more than 400,000 certified technicians provide the product sales and customer services.

In April 2003 Novell published the plan also to provide all previous Netware services for Linux with complete technical support worldwide. Netware and Linux Kernel then support the same Network services. Novell purchased the company Ximian in August 2003 which one provided a Linux distribution of the same name and has developed the open source software Mono and Red Carpet. Ximian was founded in 1999. Ximian was founded in 1999. Novell announced the take-over of the company [SuSE Linux](#) on 4th November 2003. For 210 million U.S. dollars the SuSE Linux distribution as well as the service supply is part of the new portfolio. Both enterprises shall be integrated completely in January 2004, the support contracts existing between IBM and SuSE Linux for SuSE Linux on IBM's eServer products and others are taken over. Netware will continue to exist besides SuSE Linux and get developed further. Novell started with his engagement for Linux already in the year 2000 and ported the eDirectory technology for Linux. Novell announced the publication of the Open Enterprise Server 1.0 at the Brainshare meeting in March 2004. This operating system combines the SuSE Linux Enterprise Server 9 and Netware 7. Further news was the migration of all desktop installations in the company to Linux until the end of the year. Open Office shall from now on be used as main application. The setup tool YaST and iFolder technology are declared together to free software now.

Novell published in March 2005 the message that 75% of the company computers have been switched over to Linux and Open Office till now. The Linux Desktop 10 planned for the next year shall represent a clear simplification for the users and an alternative to Windows and other Linux distributions.

**Partner Firms** AOL, Cisco, Compaq, Dell, Fujitsu, Siemens, HP, IBM, Intel, NAI, Atos Origin, Sun  
*This enumeration does not lay any claim to completeness.*

**Software-** Novell NDS eDirectory

- leading directory service worldwide
- platform independently
- manages more than 1 billion objects
- Novell DirXML
- solution for the synchronization of information
- process triggering by events
- Novell iChain
- security and administration infrastructure for eBusiness

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- controlled and authorized access to network resources
- fine grained access controls
- integrated cache
- central logon and service server
- Novell Portal Services
- portal provides the data after the login
- individual design of the virtual work place
- Novell Account Management
- based on NDS eDirectory
- eliminates redundant authorization for the use of different platforms
- central administration by administrator
- Novell [Single Sign-on](#)
- protected applications with a password
- automated process for the password input in the background
- Novell Bordermanager Enterprise Edition
- comprehensive security in the Internet/intranet area
- central control and administration of the internet access
- firewall services, VPN functionality, authentication services, Caching
- Novell GroupWise
- universal mailbox
- supports default browsers
- supports important standards like SMTP/MIME, POP3, LDAP, NNTP, IMAP
- RemoteClient or WebAccess for independent access
- ZENworks for Desktops
- desktop management
- construction of user and group policies
- software distribution
- Helpdesk function
- extensive hard and software inventory
- ZENworks for Servers
- server administration
- central directory based administration
- B2B data sharing
- management console
- control by defined rules

*This list does not lay any claim to completeness.*

*Source: Information from the CeBIT in 2001 (Novell)*

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**PDA and Smartphone** There are other requirements on the operating system for mobile devices like PDAs or smartphones as for the operating on a PC. The operating system usually takes over the tasks of the BIOS and has to be designed to run on processors with low clock frequency and few main memory. Various techniques to save energy and short reaction times are high demands on the design of the operating system. PDAs (Personal Digital Assistant) are small portable computers which can accomplish quite certain tasks and take on the role of a personal assistant. They usually consist of a ROM for the operating system and RAM from 2 to 32 mbyte and above, a docking station to power loading and the data synchronization as well as pen and/or keyboard for the character input. Other expressions for PDAs are handheld, pen computer or palmtop. Market leader is PalmOS with the greatest market share (75% according to IDC, June 2000), EPOC and Windows CE with the smallest market share. There also are models like the PowerPlay III PDA with Linux as operating system, Motorola A760 or the Sharp Zaurus SL-5500.

Typical task fields for PDAs are e-mail, WAP, text writing, date manager, calculating machines and the access to the world wide web alternatively with IrDA or special modem. The data synchronization is particularly important with the PC to load new software serially, by USB or infrared. Depending on model and equipment of a Smartphone the data interchange and internet access is available over IrDA, UMTS, Bluetooth and WLAN. The view of photos, play of music and video files (WAV, WMA, AAC, MP3, MPEG4, 3GP file formats) with stereo sound, an integrated digital camera as well as USB connection also are made useable by the operating system. For the telephony the devices offers Tri band (900 MHz, 1800 MHz, 1900 MHz) into the mobile telephone network. The user can made input with his speech, a touch screen and the keyboard. The displays support high-resolution colour rendition with resolutions of approximately 640x480 pixels, processors with more than 500 MHz of clock frequency, ROM with 128 mbyte and main memory of 64 mbyte. Motorola offers mobile telephone models with Symbian OS, Linux or Windows as the operating system.

Apple had released his own first PDA model Newton in 1991 on the market with NewtonOS as operating system. But the great market success failed to appear and the device was abandoned. Hewlett Packard His published her first PDA model named HP 95 LX on April 23rd, 1991. As software MS DOS 3.22 and Lotus Notes 1-2-3 was used. The memory was equipped with 512 kbytes RAM and 1 mbyte ROM. The LCD display was 248 x 128 pixel in size. HP released the PDA model 620 LX in 1998 which is equipped with Windows CE 2.0 and 16 mbyte of RAM. The LCD display makes 256 colours possible and features a microphone and soundspeaker.

Apple Macintosh owners can exchange data with the Palm. Office documents of a PC must be converted into a compatible format at the PDA before the use.

PowerPlay III PDA  
(2001, Linux DA O/S)

Palm m100  
(2000, Palm OS 3.5)



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HP Jornada 545  
(2001, Windows CE 3.0)

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**SCO Company History** SCO (Santa Cruz Operation) was founded in 1979 of the both brothers Doug and Larry Michels who developed the UNIX derivative SCO UNIX for Intel computers. The enterprise went to stock exchange 1993 under the name SCOC. SCO bought all rights at the AT&T UNIX source code as well as UnixWare 2 of Novell in 1995 which purchased the UNIX source code together with the technology and rights by AT&T at the operating system UnixWare before. Novell takes about 17% of the SCO shares, SCO licenses the network technology from Novell in return and HP develops a 64 bit version of UNIX.

1999 had SCO sales offices in approximately 80 countries. SCO showed the next company plan at the "Forum 2000" after the sale of the UNIX business to the Linux company Caldera. The left business division of SCO was renamed in Tarantella Incorporated. The line of business is aligned to the development and sale of the web middleware Tarantella. Caldera split up into the SCO Group for the complete UnixWare and Open Server operating system business. Caldera purchases all rights by the take-over at the operating system UnixWare and the associated applications with exclusive right for sale of the older Open Server system. SCO ensured further the license income which flow in the Tarantella division. About 800 employees of SCO shall change to Caldera Inc. As a selling price 7 million dollars cash as well as 28 percent of the shares, which are about 17.5 million share certificates, from this are 2 million share certificates from a reserve for employee options. In addition, the Caldera investor "The Canopy Group" has agreed to grant a credit of another 18 million dollars for SCO.

Caldera plans the disclosure of the source code of UnixWare. But copyrights of AT&T, Novell, Tandem, Compaq and SCO are still parts of it. The time for the release isn't published yet. Currently (July 2003) is the SCO Open Server 5.0.7 with enhanced hardware support and USB 2.0 support the latest release.

The SCO Group took the company IBM to court for 3 billion dollars compensation in March 2003 because of injury of an intellectual property from the former common project Monterey. It is all about more exactly that SCO has basic rights at the UNIX source code and Linux relies on UNIX architecture and APIs own copyright claims are injured. SCO wants to prove this by facts of the source code transfer between UNIX and Linux. In August 2003 IBM answered with a countersuit for reason, SCO has hurt the GPL by the Linux distribution of her own and loosed possible copyright claims through this. SCO has taken licence fees for the use of Linux which is forbidden by GPL.

Several companies were included in this court process as plaintiff or defendants. The legal discussion lasts without a clearing judgement in meanwhile for more than 3 years.

## Software Products

- SCO Open desktop 3.0
- SCO Linux 4.0 Client & Server, LSB 1.2, Kernel 2.4.19 (Jan. 2003)
- Tarantella
- UnixWare
- Open Server (with JavaT of Virtual Machine)
- Enterprise System, Host System, Internet FastStart System, Desktop System

## Company History

Short info 1979 - 1986

1979 SCO is founded by Doug and Larry Michels to port UNIX® and offer consulting.

# eBook - Informations about Operating Systems

Version: September 3, 2016 | Download: [www.operating-system.org](http://www.operating-system.org)

1983 SCO delivers the first UNIX system (called SCO XENIX system V) for Intel 8086 and 8088 CPUs. It makes the reliable use in enterprises possible and is designed for critical enterprise applications.

1984 SCO has created himself an two ways sales model to be able to offer his operating systems worldwide. SCO works together with computer manufacturers, resellers and application developers to serve the market with SCO server software for intel CPU systems.

1985 SCO delivers SCO XENIX 286 for Intel CPU 80286 systems. SCO XENIX 286 is compatible to older applications of the pre-versions.

1986 SCO purchases parts of Logica Ltd. in England, the first European headquarters is founded.

Short info 1987

SCO invites computer manufactures and software developer to the "386 summit" in San Francisco, the first meeting of these people for insights into the new Era of the 32-bit Intel platform. In the same year SCO released XENIX 386, the first UNIX and 32-bit operating system for x86 systems with GUI.

Short info 1989

SCO publishes SCO UNIX system V/386, the first product which one was licensed from AT&T to use the UNIX system trademark. The SCO Open Desktop is coming out too.

Short info 1990 - 1996

SCO purchases HCR, foundation of a branch office in Canada. SCO delivers SCO MPX the first software package for the new Intel multi-processor architecture

1992 SCO publishes the SCO OpenServer family of the operating system. SCO version 4 (UNIX System V release 3.2) for computer with 386s or 486s CPU by Intel is released. The multi-processor extension SCO MPG allows the use of up to 30 CPUs in a system now.

1993 SCO takes IXI Limited, an established development centre.

1994 SCO purchases Visionware

1995 SCO provides the first commercial Web browser IXI Mosaic which was licensed from NCSA too. SCO purchases the UNIX technology of Novell and also takes over the UnixWare 2 operating system.

1996 SCO founds first initiative of computer sellers to establish a standard UNIX system for Intel systems in enterprises. The campaign was called "Big E initiative".

Short info 1997

SCO published the network software Tarantella which supports the central administration and guide server-based applications about the network. SCO delivers the first Cluster solution for Intel-based servers.

Short info 1998

SCO delivers the UnixWare 7 operating system, a progressive server operating system for Intel CPUs. It consists of parts of the two UNIX derivatives UnixWare and Open Server. Altogether 4 variants are offered: Enterprise, Application/Database, Mail/Messaging and Intranet. SCO founded the "Data Center Initiative" to

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Version: September 3, 2016 | Download: [www.operating-system.org](http://www.operating-system.org)

create a standard UNIX system for in data centre environments.

SCO and IBM developed a high performance UNIX system for the Intel IA-32 and IA-64 architecture in Project Monterey with the support of Intel. As a result a single production line arises for IA-32, IA-64 and IBM CPU systems from entry server up to large enterprise environments. SCO delivers UnixWare for intel "Merced" (BL2) CPU, the first stable UNIX system developer platform for Intel IA-64 CPU "Itanium".

Short info 1999

SCO publishes UnixWare 7.1 with the Webtop software (Tarantella Technology) and a new enterprise and data-centre version. UnixWare 7 of NonStop® Cluster software for Intel CPUs is released. SMP systems also can contain at most 8 CPUs, max. 64 gbyte RAM are addressably. Clusters can consist of a combine of up to six computer machines. SCO publishes different open source initiatives. SCO announces Tarantella Enterprise II which allows the high-speed network access to Windows 2000 and Windows NT 4.0 applications also about the Internet. The Remote Desktop Protocol (RDP) of Microsoft will be used.

*(Source: SCO)*

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**SGI Company History** Silicon Graphics, Inc. is founded by 8 persons in 1982. SGI is manufacturer of workstations, servers and also sells supercomputers and clusters for effortful graphical computing. SGI has his headquarters in Mountain View, California and is leaded by Rick Beluzzo as CEO. Specialized in virtual 3D representation and animation with it was possible with SGI technique and IRIX to create movies like Jurassic Park, Final Fantasy - The Spirits Within and Ice Age.

The Altix series was introduced in 2003 and shall be able to manage up to 2048 CPUs and 16 tbyte main memory in a cluster in the maximum upgrade stage. As an operating system can beside IRIX also be used the SUSE Linux Enterprise Server for servers and super cluster systems. For example SGI sells Altix 3000 servers with 64 Itanium 2 64-bit processors of Intel. The full equipped system costs about 1.1 million U.S. dollars. Altix 350 servers with 4 to 16 Itanium 2 64-bit processors are new from the factory to have for a amount of about 21,000 U.S. dollars. Altix systems can be integrated by the NUMA architecture as nodes in Cluster or as single devices modular extended. Soon, a model with up to 128 CPUs also shall be available. The SGI Altix 4700 servers support SuSE Linux enterprise server 9 and Red Hat Enterprise Linux 4.

## Company Timeline

1982 Silicon Graphics is founded

1983 First graphical terminal solution (IRIS® 1000 )

1984 First workstation

1986 Start on the stock exchange of Silicon Graphics

1991 IRIX 4.0 operating system published

1992 MIPS Computer Systems Inc. was taken over for 200 million dollars and separated to the subsidiary company MIPS Technologies

1993 Contract with Time Warner for the development of new technologies, completion of a contract with Nintendo for the development of the N64 game console

1994 Foundation of Silicon Studio, Inc. for the digital and interactive media market

1995 Take-over of Alias Research Inc. and Wavefront Inc. which are summarized to the subsidiary company Alias/Wavefront

1996 Fusion with Cray Research (supercomputer), new SGI product is the visualization computer Onyx 2 with SMP. Establishment of VRML 2.0 as a 3D-Internet standard

1997 Release of the Octane POWER workstation, purchase of the company ParaGraph International (3D internet software), sales volume of 3.7 billion dollars, 79 million dollars profit, approx. 10,500 employees (of this 7,700 in the USA) and 42 branch offices worldwide. Manufacturing facilities in Mountain View and Sunnyvale (California), Chippewa Falls (Wisconsin) as well as Cortaillod (Switzerland).

1998 IRIX 6.5 published

Short info of 1999

- Bob Bishop becomes Chief Executive Officer
- SGI separates from MIPS
- Silicon Graphics names himself in SGI

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- SGI installs Linux Cluster with 128 CPUs
- SGI builds Linux Cluster with intel IA-64 processors

Short info of 2000

- SGI cooperates with VA Linux and Nvidia
- SGI separates from Cray
- Compiler for IA 64 as open source
- Linux Cluster with SMP servers

Short info of 2001

- Internet server for e-commerce published
- SGI Origin 3800 system supercomputer with 1,024 CPUs and 512 CPUs is used for the clima research by NASA
- SGI released his developed XFS file system

Short info of 2004

SGI sells the company Alia with the 3D-Software Maya

Short info of 2005

- dropping sales and profits
- SGI shares are taken out from the stock exchange because of to low sales volume

Short info of 2006

- Dennis McKenna becomes the new CEO
- SGI applies for creditor protection
- the reorganization is announced to strengthen the enterprise and improve the financial situation

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**Sun Company** Sun Microsystems, Inc. was founded by Scott McNealy, Bill Joy, Vinod Khosla and Andy Bechtolsheim in the Californian Silicon Valley on 1982-02-24. Sun Microsystems GmbH was set up in 1984 in Munich, sales offices are established in Ratingen, Berlin, Hamburg and Stuttgart. The same year NFS (Network File System) from Sun is introduced and free licensed to other companies.

The first workstation of Sun is the Sun-1 with SunOS as operating system. The Motorola CPU was clocked with 6 MHz, the RAM was 1 mbyte and the hard disk was equipped with 60 mbyte. In 1983 the successor Sun-2 appeared with 10 MHz CPU, up to 7 mbyte RAM and supported one large hard disk up to 380 mbyte. In 1985 the Sun-3 serie was equipped with CPUs of up to 25 MHz and up to 32 mbyte of RAM. The first Sun-4 models were published with the own SPARC V7 RISC architecture in 1987. In 1989 Sun's SPARC station 1 was available for less than 9,000 dollars and overhauled the performance of previous desktop systems with 12.5 MIPS. Solaris 2 of SunSoft was published in 1991, the first revised version based on UNIX SVR4 and for Intel x86 systems. In 1994 the first 64-bit Ultra-SPARC processor and 1995 the first Java specification released.

AOL and Sun form 1998 a strategic partnership, Sun introduces the specification for Java 2. Solaris 7 is published as new 64-bit operating system environment for network computing. A renewed benchmark record is obtained for SAP System R/3 on Sun enterprise 10000 servers. Sun is a worldwide leading UNIX server provider after sold quantities, the HPC 10000 server has a top position in supercomputing. A cooperation between BULL AG and Sun Microsystems GmbH is agreed. Sun announces extensive educational consulting services and created a new competence centre for network computing technologies.

Sun gives the specification for the Jiro platform for a platform independent memory management free in 1999, Novells NDS eDirectory is available for the Sun platform now. Sun Solaris runs on 64-bit Itanium processor of Intel and Sun reached a new world record at the TPC-C benchmark. Sun gets the SAP Award of Excellence 1999 and got the 100th order for the Sun enterprise 10000 high performance server in Germany.

In the year 2000 Sun is confirmed as a market leader in the UNIX server market, Sun Cluster 3.0 sets standards in the management of complex networks. The StarOffice source code with about 9,000,000 lines of code is now freely accessible. The Solaris 8 source code is also available under a restrictive licence for research and development. The Sun StorEdge T3 system scales up to 169 terabyte of hard disk storage, Sun delivers the fastest Java platform for Linux. The first workstation with Ultra SPARC III CPU is released. Sun takes the company Cobalt Networks. A new version of the Java 2 platform is introduced and Solaris 8 is worldwide available now.

With an annual sales volume of 18.3 billion U.S. dollars Sun is already 2001 represented in over 170 countries with about 37,500 employees worldwide. Sun Microsystems GmbH with approx. 1,800 employees achieved a sales volume of 2.338 billion DM unlike the previous year with only 1.766 billion DM in this financial year. Sun is the leading manufacturer of UNIX workstation and servers (sources: Dataquest, IDC). Sun Systems are the most successful platform for relational databases under UNIX as well as for use of SAP R/3 under UNIX. Sun is a leading provider of technologies in numerous application areas like in the development of electronic, the mechanical construction, in the software engineering, at the print and online media as well as in the telecommunication sector and the finance economy. According to the numbers published by Gartner Dataquest (Q1/2001) Sun Microsystems is the no.1 in the U.S. UNIX server market and worldwide no. 2 in the total market for servers of all operating systems. Sun increased his market share by 19 percent this year and keeps a market share of 32 percent now. Sun workstation reached worldwide with estimated 432 million dollars sales volume 20 percent market share (Q1/2001) of all sold workstations including NT and UNIX

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systems (IDC 05/01). Sun announced the new clustering solution for supercomputing environments and reached a benchmark record result for midframe systems. Sun sponsors 8 million lines of source code for SunSource.net, Sun introduces JXTA. The new Sun Fire product line with UltraSPARC-III processors is starting from the Sun Fire 3800 (up to 8 CPUs and 64 gbyte RAM) to the Sun Fire 6800 (up to 24 CPUs and 192 gbyte RAM) available. The new Sun Fire server obtains a benchmark record with the Oracle e-business suite. The Sun Blade 100 is the first 64 bit UNIX workstation for DM 3,000, Sun ONE Webtop becomes establishedly as technology for open web services.

In response to the .NET strategy of Microsoft Sun puts in 2002 on the ONE (Open Network environment) strategy. With the LX50 server you can use Sun Linux 5.0 based on Red Hat Linux and Solaris 8.0 as an operating system. On both operating systems MySQL, the Java 2 Standard Edition (J2SE), the Apache Web server, Sun Grid Engine and further components are usably.

In March 2003 Sun announced the cancel of the own Linux distribution, but for this Sun supports selected standard Linux distributions. The "Orion" initiative which shall guarantee the faultless execution of Linux programs for Solaris was started at the same time. Sun and Microsoft announced a better cooperation at the beginning of April 2004. The settlement of all legal disputes is included. In return Microsoft pays 1.95 billion U.S. dollars to Sun. Scott McNealy and Steve Ballmer met each other to spoke around the further common approach. They assured themselves of the mutual payment of licence fees for the use of patents and techniques. Target shall be the lowering of the development and research costs. This agreement shall not have influence on the competition of the two enterprises in the economy. Sun showed the take-over of the company Tarantella for about 25 million U.S. dollars on May 10th, 2005. The transaction shall be completed in the 1st quarter 2006. Tt the beginning of July 2005 the plan became known to publish the own Java Desktop System (JDS) in source code also. It is based on the gnome desktop and the SuSE Linux distribution. JDS shall become the standard interface for Solaris and shall replace the meanwhile out-dated CDE user interface in the further course. Sun differs with that from his Linux/JDS initiative for an alternative to Windows and concentrates his resources on OpenSolaris/JDS now.

2005 Sun publishes the 128-bit file system ZFS for Solaris, the processor UltraSPARC T1 also is introduced. The Solaris kernel and important libraries are published as open source for the OpenSolaris project. Solaris 10 is licensed within 2 months about 1 million times for x86 and SPARC systems, Sun presents the 3D desktop Looking Glass on the CeBIT in 2005.

2006 the x86 server systems Fire X4600 with Opteron processors, the Storage server X4500 and Sun Blade 8000 are introduced. The mySAP business suite and SAP NetWeaver for x64 Sun Solaris 10 operating system are available now. Sun publishes completely the design documents for UltraSPARC architecture. The dual processor workstation Ultra 40 with Opteron CPUs as well as Ultra 45 with UltraSPARC-III CPUs hit the market now. Java got open source.

## Business fields

- Network Computing (network computer systems)
- Sun workstation, Ultra workstation
- Sun Ray Thin client, Sun Ray product family
- Sun enterprise server, server family
- Network Storage, Sun StorEdge storage systems
- NetraT Internet server
- Chip components, periphery devices



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- Network components

## Software products & services

- JavaOS
- Java desktop system (Linux distribution)
- Java technology, "Write Once, run Anywhere"
- Java 2 Standard Edition (J2SE)
- Jini Technology, "The network is the computer"
- Sun ONE (Open Network Environment)
- Sun ONE Forte for Java and Forte fusion
- Sun ONE Webtop
- Firewall SunScreen
- Sun Chilli!Soft ASP web server
- Star Office 7.0 as a complete office suit
- Open Office 1.1 as a complete office suit
- Sun Solaris operating system
- Sun system availability service
- Sun professional services
- Internet security solutions
- 8 million lines of source code released on SunSource.net
- Forte for Java Release 3.0
- Sun Cluster 3.0 software (for Oracle 9i real application cluster)

*This list does not lay any claim to completeness.*

# eBook - Informations about Operating Systems

Version: September 3, 2016 | Download: [www.operating-system.org](http://www.operating-system.org)

**Glossary** Here you find the term explanation supplementing to the most important terms related with operating systems.

*ACPI Advanced Configuration Power Interface* stands for energy functions to make it at example possible to connect or remove a laptop computer to the docking station without restart. The OnNow energy saving function can shift an ACPI compatible computer to sleep mode and back to normal mode. Suspend to disk is another mode which awakes the computer from the sleep mode in short time to recover the last running operating system state. Modern mainboards supports the power on of the computer about keyboard input and other interfaces in the BIOS.

The API, *Application Program Interface* serves as standardized programming interface between operating systems and programs. Example is the Win32c API in Windows 95 and Windows 98 SE which is partly also compatible with 32-bit Windows programs of Windows NT.

AppleTalk is the standard network protocol of Macintosh computers for the common access to files and printers.

BASIC The Beginner's All-purpose Symbolic Instruction Code is a simple programming language for realtime interpreted programs by the BASIC interpreter.

The Desktop is the essential component of a graphical user interface of a operating position for the function as work desk. The user has comparatively as well access to his documents and tools like on a real work desk.

GUI The Graphical User Interface was invented as method by research and publications of Dr. V. Bush in 1945 and described as simply access to informations with a graphical interface on computers. At that time, the design model Memex could not be built. With the development of the mouse in the sixties as a pointing equipment for computer it was for the first time possible to use graphical user interfaces efficiently. PARC (Palo Alto Research Centre) started with the first developments of this technique with personal computers at Xerox in the seventies. In the same time period Xerox published the first personal computer with graphical interface and overlaid windows, Xerox Alto was mainly used in education facilities. With the Xerox Star type 8010 the first computer came onto the market with graphical user interface and ethernet connection for the commercial use in 1981. In 1985 the Star technology became transfered into the project Elixir Desktop, a GUI for the PC. Apple used a GUI with the computer system "Lisa" in 1983. The GUI Visi On was released by Visi Corp PC especially for the IBM PC in 1984, Digital Research offered at the same time GEM for Intel/DOS systems. Few time later the X Window System was born at the MIT for UNIX related operating systems

IPX/SPX (Internetwork Packet eXchange, Sequenced Packet Exchange) is needed for the communication with older Novell NetWare servers up to version 4.x, after that as optional protocol for data transmission. It is a particularly efficient network protocol and designed for smaller networks.

Multi-Tasking serves for the almost parallel and time limited execute of program parts in an arbitrary number. This happens by the management of the operating system with the grant and revoke of system resources. Inside fast time switches in milli-seconds or with real time operating systems in nano-seconds the access is regulated.

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Computer systems with multi-processors contains at least 2 CPUs. Through this the computer power rises almost proportionally with the number of processors. A part of the performance is needed for the management of the process allocation to coordinate the simultaneous access at shared memory. The operating system is able to distribute the computing load on several processors, named as SMP (symmetrical multi-processing). These processes can be executed parallel at the same time. Condition is the use of especially SMP optimized software. Examples of supporting operating systems are BeOS, Linux and Windows NT/2000 in the corresponding version depending on supported processor number.

The multi-user ability of a operating system makes it possible to let login and work several users at one computer at the same time. The resources of a multi-user system can be used fully.

NetBEUI (NetBIOS Extended User Interface) is a network protocol developed by Microsoft which stands out primarily due to his performance for small networks but cannot be routed in networks.

PDA The Personal Digital Assistant as a small, handy digitally equipment takes over the functions of a memo pad and also for Internet services like WAP and e-mail. Even word processing and other applications are mobile usable.

POSIX The Portable Operating System for unIX specification serves the uniform use of the API and the development of compatible programs under different operating systems. It made it easier to port and run UNIX applications on different operating systems like Windows NT and others. Also under the different UNIX derivatives a uniform standard was created to protect in-house developments of individually companies. In addition, it guarantees the protection of done investments because applications remain transferably.

The Protected Mode is supported by all x86 processors since Intel 286. With this mode memory can be addressed up to 4 gbyte. The processing bandwidth is 32-Bit, for compatibility reasons 16-Bit programs can be executed furthermore too. For this a virtual engine is required for the use of real mode programs like MS DOS programs under Windows 9 x/NT, which provides a exclusive 16-Bit environment.

Real mode is an operating mode which was supported before the Intel 286 CPU as the only available mode. It makes the absolute access to working memory and hardware possible. This mode can address up to 1 mbyte RAM, the processing bandwidth is 16-Bit. Example of one real mode operating system is MS-DOS without an Extender. With the Intel 286 CPU the protected mode become introduced, which makes a controlled access to the resources and memory protection possible.

The TCP/IP (Transmission Control Protocol, Internet Protocol) is the standard network protocol for the internet and large companies. Since 1982 it has replaced the previous protocol NCP (Network Control Protocol). At the moment with version 4 it supports a 32-Bit address range and in the near future with TCP/IP version 6 a bigger address range with 128-Bit address range.

Thread To accelerate programs on normal computers and multi-processor systems parallelizable program code is distributed in so-called Threads, which can be passed on several CPUs or executed with little deferred time on one CPU. Through this the simultaneous write and printing of one or different documents within an application is made possible.

A Driver is a software which is allocated as software layer between the hardware layer and the application or operating system. Besides the communication between driver software as in the case of a file system

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encryption these can also be purely virtual. File systems, network protocols, RAM disk and the DOS box are such virtual devices under Windows. As a rule, driver software are primarily developed further with improved efficiency over the time often seen for mainboard chipsets. New characteristics like TwinView for graphics cards or a lower processor load for hard disks operations in the DMA mode are practicable.

So that an application can access the hardware about the API a call is send to the operating system. After check after permission of the request to the hardware driver the connection to the driver software is made. The direct communication between application and driver software to the hardware is considerably faster than indirect about system calls but carried out without supervisory authority or special protection. About the indirect call to the operating system and interfaces bugs are heavily to trace for the user. Unclear remains most whether the bug was caused itself by the application, the operating system or the driver software. Applications are usable by the uniform driver software interface with considerably lower overhead on a broader hardware basis. The applications has not t oinclude self programmed device drivers to use the hardware equipment. Driver software developers for hardware procducts can just do concentrate her work to the hardware communication under compliance of the operating system to driver software interface communication without the need of special adaptation to single programs. By the different interfaces of driver software for a platform like PowerPC to x86 cannot be ported without adapted source code to another operating systems (like Windows 9x driver for Windows NT), except the source code supports the same mechanism. It remains supplementary to mention that the special customization of applications to single hardware components further is made and definitely makes sense in some areas to reduce the bug vulnerability, obtain the highest possible performance or simply increase the stability. Examples are the optimize of older programs for the Pentium 4 instruction set support or the MacOS with closely developed applications by the same company as Apple. [  
*Also see [Windows device driver models](#) ]*

WDM The Win32 Driver model was designed in 1996 of Microsoft to create a uniform standard for all future Windows driver software. Hardware manufacturers use these interface between application and kernel around to develop compatible driver software for the hardware, graphic card drivers excepted. As advantages have to be called new extensions like plug & play and the energy management for Windows NT 4.0. The uniform driver software for Windows 98 and Windows 2000 as well as a near system imbedding provide better performance and stability. The development overhead is lowered by the standard.

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**File systems** File systems are needed to store files and directories organized to any data storage media. Read and write accesses on the file system are realized by the driver software. Worldwide exists more than 100 different file systems and partition types with different features. Additionally are network file systems which exist only within net environments and make the data access independent from the platform on protocol layer possible. The file systems for parallel computing also belong to the network field. Examples of such are GPFS (General Parallel File System) of IBM for the operating system AIX, PVFS (Parallel Virtual File System) for Linux Cluster or also the GFS (Global File System) to name only a few.

[BFS](#) | [ext2](#) | [FAT 12,16,32](#) | [HFS](#) | [HPFS](#) | [ReiserFS](#) | [NFS](#) | [NTFS](#)  
[fs-QNX](#) | [IFS](#) | [NFS](#) | [SMB](#) |

**BFS *Be file system*** The Be file system (BFS) is a 64-Bit file system which was also like BeOS designed for the multithread ability. With the journaling function all file system accesses are stored in a kind of database which offers high performance for the access to attributes of files and directories. If a error occurred, inconsistencies can be avoided or cleared. Even incomplete data storage processes can be undone. A great unusual feature is the file type identification. It is not fixed on the file extension but about the MIME attribute which is used also for the marking of e-mails. About the definition of the MIME type with an application the file can be opened in BeOS. If the file type is not assigned, BeOS fetches the file extension and signed it to an MIME type.  
- Partition size max. 2<sup>64</sup> bytes (approx. 18 trillions gbyte)

**ext2-fs *Extended filesystem*** ext2 is the extended file system of Rémy Card. It can be described as the standard file system for the Linux operating system. The file names can contain up to 255 characters, the maximum size for a partition with kernel 2.2 are at 2 gbyte.

This file system is organized that to each file exists an information file (inode) which contains everything except for the filename. So the access rights, file size, position and the occupied file blocks are noticed. In meanwhile the 3th version of the ext file system is used with many improvements in the area of design and performance.

**FAT 12/16/32 *File Allocation Table*** FAT file systems are built up with a simply structure and include an additional copy of the file allocation table in the first mbyte on the data storage media. At damage to the main table this can be corrected by the second copy, on condition that the first mbyte starting at sector 0 was not deleted. The access to FAT partitions is supported by most operating systems as a standard. This file system uses only very low resources, only the high slack space with to big cluster of formatted storage devices is a disadvantage. File names are generally stored in capital letters, a differentiation distinction of small and capital letters is not made under Windows operating systems. FAT file systems supports only few attributes. These are R, H, S, A: Read-only, Hidden, System and Archive.

The number of at most addressable Clusters in bit with the FAT file system is described by the 2-digit number. From this the following details are shown:

Features	FAT 12	FAT 16	FAT 32
max. file size:	32 mbyte	2,048 mbyte	4,096 mbyte
max. partition size:	32 mbyte	2,048 mbyte (DOS)	4,096 mbyte (NT)
max. number of files:	4096	65,536	approx. 4.2 mio.

FAT 12 Was used for the first time for 180 kbytes floppy disks in 1976. The idea and basics for this file system origin from Tim Patterson, the technique was bought up 1976 of Bill Gates. For the file name at most 8

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characters and 3 characters for the extension are possible.

FAT 32 is the successor of FAT 12 for hard disks. This revised version allows partition sizes of up to 8 terabytes now. Formatting more than 32 gbyte big FAT32 partitions is not possible in Windows 2000 and Windows XP directly. Opposite to FAT 16 FAT 32 uses smaller clusters which leads to a better use of storage and less slack space. By the a little risen administration overhead it is usable with at least 90 mhz at the approximately same performance at the same combatibiliy. File names are not restricted to the 8.3 scheme any more.

HFS *Hierarchical Filesystem* HFS is the standard file system for Macintosh computer. It is the successor of the MFS (Macintosh file system) file system. A partition can be formatted with up to 65,535 Cluster (16 bit), the cluster size varies according to the size of the partition. File names can consist of up to 31 characters, the maximum file size is 2 gbyte. The successor is called HFS+ and records all accesses to the file system in a journal for a higher data security. The file name can consist of up to 255 unicode character now. The file system can address clusters with 32-Bit and supports a maximum file size of 8 exabyte (263 byte).

HPFS *High Performance File System* This file system was developed together by IBM and Microsoft around the year 1985. At first it was used in OS/2 1.2 and Microsoft LAN Server. The idea arose from the insufficient abilities of the FAT file system for use on servers and networks, like missing file access rights. HPFS has a considerably more progressive method to manage files and directories and avoid the fragmentation largely. By the order in B-trees objects can be located much faster. The object table is in addition also located in the middle of the partition to increase the data security and minimise the seek time. Own attributes like informations about the origin of a file can be defined. In 1991 the cooperation on OS/2 by Microsoft was quit which led between IBM and Microsoft to a break. New sales partner for OS/2 since then was Apple.

ReiserFS ReiserFS belongs to the journaling file systems. With his administration structure built up like a database any logged change can be undone. All accesses to the file system are included and provides moreover the consistency of data also at a sudden power failure. The check on file consistency is very fast. Linux, HP-UX, AIX and OS/2 used this file system it optional and take advance of the high performance, reliability and fast access time speed at the storage of large amounts of data. It cooperates also reliably with the different RAID levels in the software mode.

NTFS *New Technology File System* This file system is used since the first Windows NT version. It has design concepts of HPFS inherited. The administration takes place directly at sectors area and makes a better storage usage possible. To the administration of the sectors and files the MFT (Master File Table) comes to use. It belongs to the journaling file systems which take down and supervise every modification. If a process is not finished completely, the original status is restored. With NTFS single files and folders can be signed with rights. The partition size can be up to 2 64 byte, file names with up to 255 unicode characters are possible. A transparent compression of files and directories is supported and offers a transaction administration of every access by indizies. Attributes of stored objects are Read, Write, Execute, Delete, Owner, Permission and Compressed.

NTFS features (since Windows XP)

- Revised functions of the pre-version
- Encryption of the file system with EFS
- Data storage quotas (*taken by UNIX, disk quotas*)

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- Provision points (*taken by UNIX, mount points*)
- Supervision of the path of distributed links
- Transparent compression of files with a low data density
- Modification journal for file operations

**fs-QNX QNX Filesystem** This file system is very efficient and has an extremely robust design. The file allocation table is a bitmap which prevents data losses and simplifies a recovery by signatures (control structures). It is like the QNX 4 file system, contains POSIX features and supports multi-threading. File names can consist of up to 48 characters.

**iFS Internet File System** The Oracle iFS stores files in an Oracle 9i database, but can manage also external files and include it in the general use and administration of files in the network as well as the extensive search function. The access is also possible over different protocols like HTTP, SMB, FTP and SMTP. All functions can be used only over the special Oracle software. Additional features like management of different file versions and XML support counts to the strengths of this file system. The customization ability and conversion of documents as well as e-mails are also noteworthy. The read and write of files within the database is generally slower than at pure file servers. In return the search function leads considerably faster at great archives to a result.

**NFS Network Filesystem** Sun Microsystems developed this distributed file system protocol to make the file access over several computers possible. With this network file system directory entries of different computers can be exchanged in the local network. It is the standard file system of computers in UNIX networks for the data access.

**SMB Server Message Block** This network protocol make it possible to access the exported directories of a computer with NetBIOS and TCP/IP support, it is indirect also an file system. Windows for example offers this functionality as of the version 3.11 (Workgroups) if a TCP/IP-stack is installed. Homogeneous Windows networks but also heterogeneous networks which consist of UNIX or related operating systems and Windows computers are main fields of use.

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**Developer of Operating Systems** The software developers of the operating systems are listed on this page. The screenshots are a snapshot from the design and theme of the respective companies in 2003. Besides the screenshot of the website the company description and the developed system software is shown. If available, there is a link to the article of the operating system. A detailed description from the companies can be chosen over the right navigation column.

Apple computer was founded by Steve Jobs with 21 years and Stephen G. Wozniak with 26 years in Palo Alto/California in 1976.

[Review Mac OS X](#)

Sophisticated Operating System

A/UX

ProDOS

(Website Screenshot from 2003)

AT&T can look back at a long history and numerous innovations. Named as American Telephone & Telegraph Corporation developed the founders Alexander Graham Bell the telephone in 1875.

[Review UNIX](#)

(Website Screenshot from 2003)

The company Be Incorporated was founded of Jean-Louis Gassée with a couple of developers after his work in the Apple development department in 1990. By the assumption of Palm Inc. for 11 million dollar BeOS is not any longer commercially developed in August 2001. The BeOS Community and some BeOS developers keeps the support for the future.

[Review BeOS](#)

[Review BeIA](#)

(Website Screenshot from 2003)

Cray Research, Inc. was founded in 1972 by Seymour Cray (28-9-1925 to 5-9-1996) at the age of 47 years. Since 1951 he was mainly and with great engagement engaged in the development of high performance calculating machines. In 1989 Cray leaves the research institute Cray Research and founds the Cray Computer Corp. in Colorado.

[Review UNICOS](#)

(Website Screenshot from 2003)

In November 1993 Jordan Hubbard started the FreeBSD project, in which he took source code from the 386BSD.

[Review FreeBSD](#)

DragonFly BSD

ekkoBSD

PC-BSD

PicoBSD

(Website Screenshot from 2003)

Bill Hewlett and Dave Packard founded HP (Hewlett-Packard) in 1939. At the beginning oscillographs were produced and commercialized.

[Review HP-UX](#)

(Website Screenshot from 2003)

IBM Corp. was founded with the name Computing Tabulating Recording Co.(CTR) in New York on June 15th, 1911. CTR was then renamed in International Business Machines in 1924.

OS/360

[Review AIX](#)



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## [Review MVS](#)

### [Review OS/2](#)

(Website Screenshot from 2003)

Linus (Benedict) Torvalds developed the operating system Linux. Its operating system was derived from concepts of Minix but completely written from scratch. On 17th September 1991 the operating system Freax version 0.01 was finished. It contained already the GNU Shell bash and the GNU C-compiler GCC from Richard Stallman, which counts to the standard programs for the meantime named operating system Linux.

### [Review GNU/Linux](#)

(Website Screenshot from 2003)

Michael Robertson had announced the beginning of an ambitious project in August 2001. Programs of both Windows and Linux can be installed and executed easily. In the legal controversy about the word similarity of the name Lindows to Microsoft Windows the opponents agreed about the renaming of Lindows in Linspire.

### [Review Freespire Linux](#)

#### [Linspire \(LindowsOS\)](#)

(Website Screenshot from 2003)

MandrakeSoft was founded in France in 1998. From the fusion of Mandrakesoft and Conectiva was Mandriva formed. Mandrakesoft published the take-over of the Linux enterprise Conectiva leading in Brazil and Latin America on 24-2-2005.

### [Review Mandriva Linux](#)

#### [\(Mandrake Linux\)](#)

(Website Screenshot from 2003)

Paul Allen and Bill of Gate went to the same school and founded the company Traf-O-Data for the manufacture of small computer systems for the logging of car traffic in 1971. Both founded later the company Micro-Soft in 1975 to develop software and porting programming languages for the IBM PC.

XENIX (Koproduktion mit SCO)

### [Review MS-DOS](#)

### [Review OS/2, with IBM](#)

### [Review Windows operating systems](#)

(Website Screenshot from 2003)

Minix was programmed by the computer scientist Andrew Tanenbaum as a teaching operating system for x86 computer.

### [Review MINIX](#)

(Website Screenshot from 2003)

NetBSD is a UNIX derivative and is descended directly from the Berkeley Networking Release 2 (BSD Net/2) and was published for the first time in March 1993.

### [Review NetBSD](#)

(Website Screenshot from 2003)

Novell has his roots in the a computer manufacturer Novell Data Systems in 1979. In January 1983, this company was renamed to Novell Inc. with the new target to develop and commercialize software and hardware for use in networks.

### [Review NetWare](#)

### [Review SuSE Linux, OpenSuSE](#)

(Website Screenshot from 2003)

OpenBSD is descended from NetBSD 1.0 (1994) and split in October 1995 through Theo de Raadt in an independent distribution.

### [Review OpenBSD](#)

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MirOS BSD

emBSD

Anonym.OS

OliveBSD

(Website Screenshot from 2003)

Jeff Hawkins founded the company Palm Computing in 1992 and appointed Donna Dubinsky as CEO. Palm developed first application software for numerous Handheld models. Since september 2005 PalmSource belongs to the Japanese software provider Access. On 25 January 2007 Palm OS was renamed in Garnet OS and old devices with Palm OS and new devices of Access has the Logo "Access Powered".

[Review PalmOS, GarnetOS](#)

(Website Screenshot from 2003)

QNX is a real time operating system designed for critical tasks. Developed by QNX Software Systems it has a structure similar to UNIX and is compatible to POSIX.

[Review QNX](#)

(Website Screenshot from 2003)

In 1996 a small group of persons had decided to create a completely new operating system that can execute Windows applications.

[Review ReactOS](#)

(Website Screenshot from 2003)

The company Red Hat with company headquarters in the USA North Carolina was founded 1994 by Bob Young and Marc Ewing. From the beginning the open source operating system has played a high role for the enterprise concept.

[Review Red Hat Linux](#)

Fedora Linux

CentOS

(Website Screenshot from 2003)

The Reduced Instruction Set Computer operating system was first used in Acorn Archimedes computers in 1987.

[Review RISC OS](#)

(Website Screenshot from 2003)

SCO (Santa Cruz Operation) was founded in 1979 of the both brothers Doug and Larry Michels who developed the UNIX derivative SCO UNIX for Intel computers. SCO showed the next company plan at the "Forum 2000" after the sale of the UNIX business to the Linux company Caldera. Caldera split up into the SCO Group for the complete UnixWare and Open Server operating system business.

[Review UnixWare](#)

(Website Screenshot from 2003)

Silicon Graphics, Inc. is founded by 8 persons in 1982. SGI is manufacturer of workstations, servers and also sells supercomputers and clusters for effortful graphical computing. SGI has his headquarters in Mountain View, California and is leaded by Rick Beluzzo as CEO.

[Review IRIX](#)

(Website Screenshot from 2003)

Sun Microsystems, Inc. was founded by Andreas of Bechtolsheim, Vinod Khosla, Bill Joy and Scott McNealy in the Californian Silicon Valley in 1982. Sun Microsystems GmbH was set up in 1984 in Munich, sales offices are established in Ratingen, Berlin, Hamburg and Stuttgart.

[Review Java OS](#)

[Review Solaris](#)

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(Website Screenshot from 2003)

SuSE GmbH (society for software and system development) is a daughter enterprise of SuSE Linux AG. SuSE was founded on 2-9-1992 of Burchard Steinbild, Hubert Mantel, Thomas Fehr and Roland Dyroff and offers a Linux distribution of its own in the European area. Novell announced the take-over of the company SuSE Linux on 4th November 2003.

[Review SuSE Linux](#)

(Website Screenshot from 2003)

EPOC is the operating system of Symbian, formerly software house of Psion. Symbian has licensed Symbian OS to companies which are big players in the market of High Technology mobile telephones. Symbian, EPOC, the Symbian logo and Symbian Developer Network logo are registered trademarks of the Symbian Ltd.

[Review EPOC, Symbian OS](#)

(Website Screenshot from 2003)

yellowTAB was founded in Germany, Stuttgart by 10 persons. This company acquired the license from Palm to use and develop the BeOS source code. The software publisher magnussoft takes over the YellowTab Zeta operating system starting from May 2006 and provides exclusively the world-wide distribution and development. YellowTab is in the insolvency.

[Review Zeta, BeOS derivative](#)

(Website Screenshot from 2003)

## Operating system core

**Microkernel** A microkernel is generally built up strongly modularized. The actual system core cares about the communication channels (message passing) between the user mode modules for the functional tasks. The kernel contains the most important functions like the process administration (tasks and threads), scheduler, virtual memory management and interprocess communication (IPC). The kernel is programmed most in the standard languages like C or C++. Another advantage is the porting to other platforms such as small embedded devices. Particularly his scaling ability makes it to the first choice for massive parallel designed systems. This core structure is typical of BeOS and Minix for example. Real time operating systems have to be easily realized with a microkernel because it is relatively kept small by the only most necessary functions. Example of it is the QNX operating system.

Summarized the advantages lie in the flexibility, compact size, clear organisation and easier scalability. The disadvantages have an effect on a slight delay by the additional overhead for the system calls and effortful programming of the communication channels.

The Carnegie Mellon University developed one microkernel from 1985 to 1994, this one is find in many operating systems up to this day. The project Mach created this reference core design. The concept was used in NeXT OS, OSF/1, OS/2 and many others more. Most implementations differ from the typical Mach kernel design. The kernel in NeXTStep provides different extensions. IBM already uses the version 3.0 of the Mach microkernel for her Workplace OS. Another abstraction of the reference is the Windows NT kernel, the so-called Executive who represents a mixture of microkernel architecture and the layer model.

**Monolithic kernel** The monolithic kernel represents one single executable file with all close system components united. Drivers, process-, memory- and file system management are located together in one great kernel. Driver modules can be loaded dynamically in a limited way such as network or SCSI driver software. Typical operating systems are MS-DOS, Multics, UNIX and Linux. The kernel runs in privileged kernel mode of the CPU, single components can be paged into modules such as driver software like in the Linux operating system.

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**Platforms** There exists different hardware platforms on which operating systems are only useable if they are ported or designed for the especially platform. Depending on processor architecture there are designed after the RISC or CISC scheme. Even both architectures are united in some CPU types as hybrids.

RISC systems are optimized on a small instruction set for the processing of machine code and can execute different applications faster than CISC based systems. Programs can be designed only in assembler, but can be accelerated with instruction reduction because many code lines are needed for simple procedures. CISC systems have a complex instruction set to cover a broad application field as possible. Programs for the CISC design can be developed in higher programming languages but often can be accelerated with faster processors or special instruction sets such as 3DNow!, MMX, SSE, SSE2 in the CPU. Programs can be developed with fewer instruction lines.

## RISC (Reduced Instruction Set Computer)

Alpha DIGITAL (DEC, Digital Equipment Corporation) developed the alpha architecture inspired from the MIPS and ARM design. From the beginning high value was attached to highest performance and 64-Bit processing breadth. Before DIGITAL gain experience with the CVAX, Rigel and NVAX chips. More than 1,000 alpha systems had DIGITAL delivered to software developer in September 1992. On February 25th, 1992 DIGITAL introduced worldwide the first 64-Bit architecture, the AlphaChip and DECchip 21064 with 150 mhz clock frequency. A new computer line of Alpha AXP systems with workstations, mainframes and server models were announced in November 1992.

The bus protocol EV-6 of Alpha was licensed for the K7 processor (Slot A) of AMD. Functionalities also are from the alpha architecture taken and united with the Intel architecture for Intel 64-Bit processors.

ARM The ARM (Acorn RISC Machine) RISC processor reference was designed by the company Acorn Ltd. in 1983. The first ready reference design was called ARM v1 and manufactured with less than 25,000 transistors in 1985. The first RISC processor fit for use with the ARM v2 design followed in 1986. He was designed so clearly that only 30,000 integrated transistors were needed. Advantage of a small number of transistors are a less electric assumption (less than 1 watt), less energy dissipation and thus less thermal heat than CISC based processors. The company Advanced RISC Machines Ltd. was found by a joint venture of Acorn, Apple and VLSI Tech with one common development team in November 1990. A professed target is to develop new and more efficient RISC processors. The cooperation is was so successfully that in consequence ARM is translated with Advanced RISC Machine. DEC licensed the ARM design and released the StrongARM processor with 233 mhz and a electric assumption of 1 watt on the market. ARM CPUs are used in most electronic equipment and embedded systems but also in full-function computer systems like RISC OS.

Currently since October 2001 the 32-bit ARM v6 design with 35,000 transistors is used with downward compatibly to ARM v5, contains a SIMD extension and has a considerably more efficient instruction processing. The ARM v10 was the reference design with one FPU from 1998. The ARM11 architecture is applied on the ARM v6 design and is used in the wide field of wireless technique in equipment for final consumers, networks and motorcars. The ARM11 is designed for a clock frequency of 350 mhz to more than 1 ghz. (July 2005)

MIPS The first MIPS processor was developed by researchers at the Stanford University in 1984, the basics for it were already created in 1981. Basic idea is to execute instructions within the instruction line if possible

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without breaks. Per executed instruction only one clock frequency shall be necessary.

MIPS architecture was commercialized of MIPS Computers Systems Inc. MIPS is the acronym for Microprocessor without Interlocked Pipeline Stages. These processors are used in embedded devices, handhelds, Internet routers or also in sgi workstations. MIPS CPUs have a 5-stage instruction line to execute several instructions at the same time. In 1992 MIPS Computer Systems was taken by SGI, the MIPS architecture is developed further.

*MIPS CPU - Versions*  
Date Versions  
1985 R2000, supports up to 4 Co-CPU's  
1988 R3000, 32 kbyte cache each for Instructions and Data, SMP support  
1991 R4000, 64-Bit CPU, FPU is integral part of the CPU now, only 8-kbyte Cache each for Instructions and Data  
1993 R4400, 16-kbyte Cache each for Instructions and Data, optional with 1 mbyte external L2-cache supported  
1997 R5000, 32-kbyte cache each for Instructions and Data, optimized graphic and FPU performance  
1994 R8000, works with two R4000+ ALU units superscalar on a chip, FPU external  
1995 R10000, works with two R8000 ALU units and two simplified FPU units on a chip  
1997 R12000  
1997 R14000, up to 600 mhz, 200 mhz front side bus  
1997 R16000, up to 700 mhz, 64-kbyte cache each for Instructions and Data, up to 8 mbyte L2-cache

PowerPC In 1928 the Galvin Manufacturing Corporation was founded by Paul V. Galvin. At first radios were produced, for the first time also with electrical power connection. With the brand name Motorola car radios were sold at first, because of the high commercial success the whole company renamed in Motorola Inc. in 1947. In 1959 his son Robert W. Galvin took the company which was market leader in the area of electronics and communication meanwhile. In the middle of the seventies the company aligned her business field to high tech electronics and became market leader in mobile telephones at the end of the eighties. After the take-over of General Instrument Corporation Motorola also got market leader for cable modems and settop terminals. The business field extends last to cordless equipment, broadband accesses for the Internet and the development of embedded computer chips for network communication devices, individual solutions, working groups, car and house applications. Motorola established his RISC CPU 68000 (also called m68k, 68k) and the 88000 (also called m88k, 88k). The cooperation between Apple, IBM and Motorola results in the common processor MCP601 on the market in 1992. The PowerPC processor was used in the Apple Macintosh, IBM computers, and embedded devices. With the MPC620 a 64-Bit variant also appeared for the first time. Apple uses currently the MPC970 as G5 for the Macintosh computer. PowerPC CPUs are used by IBM for example in system/370, system/390 and since short time in z/series computer systems.

SPARC Dave Patterson designed the draft for the RISC architecture and prepared the way for the SPARC architecture (Scalable Processor ARChitecture). Technicians of Sun Microsystems defined in derivation of the RISC concept the SPARC architecture in 1984. The first SPARC processor was shown the world in 1986, it was an 32-Bit SPARC 86900 "Sunrise" processor with 16 mhz and operated a Sun-4/260 workstation. In 1989 the potential of this technique was recognized and the company SPARC International was created. The defined Goal was to supervise the success of SPARC and to advance the development. SPARC International published the SPARC v7 design in 1986 and introduced it to the software developers. SPARC v8 was extended by hardware computings for multiplication and division in 1990. As well around MMU functions and for 128-Bit Floating point computations. In 1990 over 35 SPARC implementations of companies like Ross Technology with HyperSPARC, Fujitsu with SPARC lite and Sun with SuperSPARC and microSPARC are available. SPARC v9 was published in 1993, the support of 64-Bit addressing and data types was new. Processors of Sun with UltraSPARC and Fujitsu with SPARC64 were references.

SPARC processors became an industry standard and are used on a broad range of systems. Included are

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Servers, workstations, laptop computers, storage systems, network switches, settop boxes and digital cameras. Already at the development a high value was attached to scalability. There are SPARC systems with more than 100 CPUs per system today available.

## CISC = Complex Instruction Set Computer

Intel processors Intel (Integrated Electronics) was founded by Gordon E. Moore and Robert Noyce in 1968. Intel also produces beside of processors network components and mainboards with a chip set of her own. USB (Universal Serial Bus) was introduced for the first time on the Comdex in 1996. The number of transistors "doubles" every 18 to 24 months after an statement from Gordon E. Moore, till now it always made come true. The first Intel processor was the 4004 followed by the 8088. First with the 286 the x86 architecture achieve a breakthrough. Before operating systems like MS-DOS worked only in real mode, were at the max. 1 mbyte RAM without Extender got addressed. Since the 386 the protected mode was possible which makes the addressing of up to 4 gbyte RAM on the side of the hardware possible. Booth CPU modes are not compatible to each other, for real mode programs like MS DOS programs a virtual engine is loaded under protected mode operating systems like Windows 9x/NT. With the Pentium MMX a special instruction unit was integrated for the first time, followed by ISSE with Pentium 2 and ISSE2 with Pentium 4 especially for the acceleration of multimedia applications.

*Discount for Intel CPUs*

CPU12/1997	12/1998	Discount	Pentium MMX, 233 MHz	660,-	DM220,-	DM-67 %	
Pentium II, 266 MHz	1.150,-	DM360,-	DM-69 %	Pentium II, 300 MHz	1.700,-	DM380,-	DM-78 %
CPU11/1999	11/2000	Discount	Pentium MMX, 233 MHz	119,-	DM129,-	DM+8 %	
Pentium III, 500 MHz	509,-	DM399,-	DM-21 %	Pentium III, 700 MHz	1.699,-	DM519,-	DM-69 %
CPU11/2001	*11/2002	Discount	Celeron, 1,2 GHz	153,-	EUR60,-	EUR-61 %	
Pentium III, 1,2 GHz	383,-	EUR154,-	EUR-60 %	Pentium IV, 2,0 GHz	613,-	EUR209,-	EUR-66 %

\*Final consumer prices converted for better comparison in euro

Intel sold in 2003 his 1 Billionth processor and employs about 78,000 people in 40 countries. Intel leads in the area of processors for PC with approx. 80% market share. Intel introduced a new name scheme for his processors in June 2004. Intel is now moving from the sales argument of processor frequency like AMD too. A three-digit number is classifying the performance now. The pentium M with Dothan core as well as the Pentium 4 Extreme Edition counts to the 700s class. The 500s class contains the Mobil and desktop version of the Pentium 4, the 300s class belongs to the Celeron M and Celeron D processors. The Performace can be compared only within a class but not generally over all classes.

Further companies like Cyrix, Rise and IDT built x86 compatible processors for the PC market. VIA took the company Cyrix Technology and were with AMD and Transmeta the only competitors in the year 2003. Mayn share in the x86 market has Intel, followed by AMD, VIA and Transmeta with the particularly power saving Crusoe CPU for mobile devices.

*Intel processors*

Date	Version	1972	4004	1979	8086, 29,100 trans.	1981	8088	1982	186, 55,000 trans.	1982	286, 134,100 trans.	1985	386, 275,000 trans., 1,5 µm - 1,0 µm	Manufacturing	1989	486, 1.2 Mio. trans., 1,0 µm - 0,6 µm	Manufacturing	1993	Pentium was released, 3.2 Mio. trans., 0,8 µm - 0,35 µm	Manufacturing	1997	Pentium, 4.5 Mio. trans. including MMX	1997	Pentium II, 512 kbyte L2-cache, 38.5 Mio. trans., 0,35 µm - 0,25 µm	Manufacturing	1999	Pentium III, 40.5 Mio. trans., including MMX, SSE	2002	Pentium 4, 55 Mio. Trans., 0,18 µm - 0,13 µm	Manufacturing, 2005	Successor Pentium D with MMX, SSE, SSE2, SSE3, EM64T
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AMD processors AMD (Advanced Micro Devices) was founded in 1969 and developed at first flash memory. In 1979 AMD got into the microprocessor market and licensed the 8088 and 8086 CPU design from Intel. In 1986 Intel terminated the licence agreement with AMD whereupon the 80386 and 80486 design was rebuild and sold as a cheap alternative. In 1995 AMD purchased the company NexGen Inc. and the Nx586 CPU design which was like that one of the Intel Pentium. This technology flowed into the AMD K5 for the socket 7. With the AMD-K6 the extension 3DNow! was introduced especially for multimedia applications and the MMX instruction set was licensed from Intel. With the AMD K7 (Athlon) the Die size was been extended by ISSE. The AMD K8 is a 64-Bit CPU with own integrated memory controller.

*AMD processors*

Date	Version
1997	K6
1998	K6-2 3DNow!, 9.3 Mio. trans.
1999	K6-3 3DNow!, with 400 and 450 mhz, 256 kbyte L2 cache, 21.3 Mio. trans.
1999	K7, Athlon, MMX, 3Dnow!, 22 Mio. trans., since 2001 Athlon XP with SSE
2003	K8, Athlon 64, Cool and Quiet, NX-Bit



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[productsdb.riscos.com](http://productsdb.riscos.com), RISC OS Informations

AIX® "From Strength to Strength" - A summary of upgrade benefits 1999, AIX Versions Informations

edv aspekte 01/87 (GDR)

Workstation computer A7100 with BOS 1810, Mutos 1700 or SCP 1700

Website from [Heise Zeitschriften Verlag GmbH & Co. KG](#)

(formerly Heinz HEISE Verlag), among others publisher of [c't](#), [IX](#) und [Telepolis](#)

IX12/98 "Der große Sprung" Solaris 7: die 64-Bit-Ausgabe

IX05/00 "Novell zieht mit" NetWare 5.1: Im Zeichen der Verzeichnisdienste

c't20/98 "Bevolution - BeOS 3.2: bessere Hardware-Unterstützung, [...]"

c't21/99 "Apples Neunte: MacOS 9"

c't13/00 "[...], Die Microsoft Saga, das Urteil und die Folgen"

"Welches Windows für wen? Auswahlhilfe für die aktuellen Windows-Versionen"

c't24/00 "Anpfiß- Whistler - der Nachfolger für Windows ME und 2000"

"Multimedia in der Hand - Kaufberatung: Welcher Personal Digital Assistant für wen?"

c't21/01 "Mac OS X 10.1"

c't21/02 "Desktop Offensive (Redhat 8.0 und SuSE Linux 8.1)"

[Ziff-Davis Verlag](#), publisher of [PC professional](#), [PC Direkt](#), u.a.

PC professionell 02/95 Special Betriebssysteme

PC professionell09/99 "Hoffnungsvolle Konkurrenz"

PC professionell01/00 "Das beste Desktop-Betriebssystem (Windows 2000)"

PC professionell11/01 "Special: Windows illegal" (Anm.: Review aktueller BS)

PC professionell02/02 Novell NetWare 6.0

PC professionell11/03 Novell Netware 6.5

PC Direkt07/98 "Windows 98- das ist neu!"

[Vogel Verlag](#), publisher of [CHIP](#), u.a.

CHIP5/99 "Alternativen zu Windows"

CHIP 11/99 "Der Linux Test- 7 Pakete auf dem Prüfstand"

[DATA Becker Verlag](#), publisher of [PC INTERN](#), [PC Praxis](#), u.a.

PC INTERN1/00 "Windows vs. Windows"

PC Praxis7/98 "Windows 98: Richtig Umsteigen!"

PC Praxis 4/99 "Linux für Einsteiger"

[WEKA Verlag](#), publisher of [PC Magazin](#), [PCgo!](#), [Go!Linux](#), u.a.

PC Magazin04/99 Basic knowledge: Driver architecture

PC Magazin 10/99 "Unter die Lupe genommen" Basic knowledge: Windows 98 SE

PC Magazin 01/01 "NeueTricks Für Spezialisten" file system NTFS 5.0

# eBook - Informations about Operating Systems

Version: September 3, 2016 | Download: [www.operating-system.org](http://www.operating-system.org)

**Basic knowledge** How did the [web sites of the companies](#) look like earlier?

Which operating systems are there for the [PDA](#)?

Where can I find the [glossary](#) about operating systems?

What are [file systems](#) and how different are these?

What is the [operating system core](#) or so called kernel?

What is a RISC/CISC architecture or [Platform](#)?

Where can I find some [references](#) for information purposes?

**Operating System** To understand better how an operating system linked between the hardware and the application programs the following layer model is helpful. Since the time-sharing era of the operating systems the process and the resource allocation become controlled themselves. The general structure of an operating system is appropriate described as follows: *"The more software layers of the hardware surround, the better the application variety and interface can be optimized to the user. By these abstraction layers a computer gets only right useable for the user."*

This model is built up purely schematically, for comparison purposes the following operating system models are compareable:

[BeOS](#) | [JavaOS](#) | [Linux](#) | [OS/2](#) | [Solaris](#)  
[Windows 98](#) | [Windows CE](#) | [Windows NT](#) | [Windows XP](#)  
[Windows Server 2003](#)

Hardware Depending on design concept programs the hardware access is allowed directly or only over additional layers. Over additional layers the performance is reduced a little and in contrast in the context of direct access the performance arised.

Layer 1: HAL (Hardware Abstraction Layer) The Hal makes the use on a hardware platform possible for which the especially processor architecture is designed. Architectures are the x86, alpha, PowerPC or SPARC. If the porting of the operating system for other platforms is in the foreground, the Hal has a central role for the porting.

Layer 2: File system, drivers Important tasks of the operating system is the representation of several file systems which is practicable realized virtually over corresponding [driver](#). Additional functions like encrypting or compression are also included. Driver software for standard components like keyboard, LPT or COM interfaces are supported directly by the operating system rudimentarily like in DOS for example. Modern operating systems have standard driver software included for most hardware components. The manufacturers provide driver software of their own for extended functions and optimal performance for her hardware.

Layer 3: Management The management layer provides the smooth process of system processes by cooperative, präemptives or real time multitasking. Depending on priority the operating system assigns CPU time, memory and I/O accesses to the process.

Layer 4: System interface (kernel) The system interface separates the operating system core of the API, frequently it serves also as separation mark of the CPU mode of the privileged ring 0 of the kernel.

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Layer 5: API (Application Program Interface) With software interfaces like the Win32 API different programs use unlocked operating system functions like copy or open dialog for file transfers. These are provided to all programs uniformly with parameters about standard application instructions. Remote data transmission services for example.

Libraries Libraries provides the operating system and applications ready to use program parts for simplified access to different functions. By libraries (.dll, .OCX, ...) developers can use frequently required functions without having to invent these for the application newly.

Applications Application programs use the resources and device time allocated by the operating system for use. The user interacts with the computer over appropriate input and output devices.

**Executable programs** Files that contain by operating systems executable program code can be recognized by the file ending (Windows) and under some operating systems directly by the file format (UNIX and derivatives). Files with the file extension \*.com are obviously for DOS, \*.exe applications can be 16-bit, 32-bit or also for 64-bit Windows operating systems be applicable. Before Windows 95 there are only 16-bit applications (with a Win32 extension also few 32-bit applications), since Windows 95 for booth 16-bit and and 32-bit programs. There then still is the newer \*.msi file format of Microsoft which contains the program and the assisting installation script in especially packed text form. Parts of the program code are paged out also in \*.dll files, the depending "part of the application" takes advance of it and execute in the context of the application the code from the DLL file. Under Windows the Visual BASIC files and the .NET framework are example of it.

Behind the file format \*.rpm for Linux, an established standard by Red Hat for software with an integrated installation routine, can contain only the source code of an application or in compiled form especially for a distribution. This can be recognized on abbreviations like "src" for source code or "mdk" for a Mandrake Linux distribution. The applications are ELF-Binaries without file extension, about the file header and the file attribute "executably" a runnable application for the user depending on assigned file rights.

The \*.pkg format is used under BeOS for files with one own installation routine.

**Market shares of the operating systems** To obtain a summary of the market shares in the server and desktop area of the operating systems different market research firms accomplished analyses. The results are presented in the public media and afterwards only to the client or the paying customer. From the following sources informations about the market shares of operating systems can be gathered. The market researchers based up her results on interviews and sales numbers by the manufacturer, the number of operating systems that are can freely copied are not ascertainable thereby. Only the sales figures of the commercial Linux distributors are taken into the reports. It has to be examined if multiple installations on a desktop PC and virtual operating system installations on servers were counted too. So the studies are based upon estimated values. Studys of IDC and Gartner which have the same topic often differs from each other depending on the used method at the elevation of the numbers.

The company [IDC](http://www.idc.com) (International Data Corporation) with headquarter in the USA is a daughter enterprise of the IDG (International Data Group Inc.) and was founded in 1964 and has worldwide offices. IDC creates reports for current numbers of market shares by operating systems and about many other information fields. IDC creates forecasts about the future development and determines current market numbers from the sales figures

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of the manufacturer and interviews. Since 1979 exists the enterprise [Gartner](#) which has also his headquarter in the USA and is represented worldwide. Gartner creates market analyses especially for the IT area and supports his customers at the decision finding in special questions by the making of detailed reports. There still is the company [Netcraft](#) since 1995 next to the formerly named two enterprises with headquarters in England which is especially specialized in the Internet area. Netcraft provides publicly information about the used operating systems on servers besides to other information areas on the Internet. It has to considered that Netcraft taken into account only the first checked URL of a web site for the operating system determination. Entry pages can run in enterprises on another server like for load balancing as the interlinked enterprise web site and differs often in the operating system. Maybe one server is counted multiple times because it is hosting several web presences with that operating system. For security reasons maybe the operating system identification is different from the real used operating system to cover the correct operating system up and provide false information to a possible attacker.

Netcraft has pointed out the portions of Linux distributions in a [news of 12/05/2005](#) on web servers. Red Hat reached up to 34% followed by Debian with 25% and the greatest growth, Fedora 16%, SuSE 11%, cobalt 7%, gentoo 3%, Mandriva and Centos comes with 3 % each.

IDC published the proportionate sales of the servers operating systems for the 1st quarter 2005 in a [press release](#) on 26-5-2005. In the total turnover of 12.1 billion U.S. dollars 4.2 billion U.S. dollars are assigned to Windows and UNIX servers each, with Linux servers were had a turnover of 1.2 billion U.S. dollars. 2.5 billion U.S. dollars are assigned to other servers operating systems.

IDC has published a [study \(PDF for download\)](#) which was accomplished in the job of the [OSDL](#). Examined was the development of the operating system Linux in the desktop and server market. As a result it came out that Linux has established itself and the sales volume related to Linux will increase to 2008 in the software market to about 35.7 billion U.S. dollars and obtain approximately a share of 28% in the server market. The sold number shall reach 17 million Linux installations at new and upgraded PCs in the desktop market in the year 2008. Altogether it shall reach in the desktop and server area 42.6 million Linux installations at all.

Netcraft had released a news on 12-7-2004 with the current numbers of the Linux distributions on web servers. The number of active web sites for Linux amounted to 2,944.979 in the sum, Linux Red Hat comes up to about 49.8%, Cobalt on 20.3%, Debian 15.9%, SuSE 11.8%, Mandrake 1.3% and gentoo on 1.0%.

[heise online](#) published the report on 8-10-2003 [Microsoft-Betriebssysteme dominieren weiter](#) (Microsoft operating systems are dominate further) with the following information. In the year 2002 121 million licences were sold in the desktop area. These divide Windows with estimated 93.8 %, Mac OS with 2,9 %, Linux with 2,8 % and other operating systems with 0,5 %. On the 5.7 million server operating systems sold 55.1 % been allotted to Windows operating systems, to Linux 23.1 %, Unix with 11 % and Novell Netware 9.9 %.

IDC published the figures of the market shares for the year 2001. The Microsoft Windows operating systems came os 2.2%, Linux on 2.1%, up to 93.2%, Mac in the sales figures in the desktop market. Microsoft obtained a quota of 49%, Linux 22.4%, NetWare 11.7%, UNIX 11.6%, in the server market.

IDC published the figures of the market shares in March 2001 for the year 2000. The Microsoft Windows operating systems (95/98/NT/2000/ME) came in the sales numbers in the desktop market up to 93,2%, Mac OS to 4%, Linux on about 2%. Microsoft obtained a share in the server market of 42%, Linux 27%.

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With the determination of the operating systems on which a Website and not only the hostname is really hosted, Netcraft released in one [news of June 2000](#) the following numbers. The number of active web sites amounted to 7,727.817, Linux 29.99%, Microsoft 28.32%, other operating systems 23.59%, Solaris 16.33%, 1.76% unknown.

IDC published the figures of the operating systems sold in the market for the current year in December 1998. In the server market Windows NT achieved 36%, Linux 17%, Novell Netware 24%, UNIX derivatives 23%.