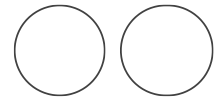# Comparative Case Study of Windows, Mac, and the Linux/Unix Operating Systems

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An operating system can be defined as a system **of** software that creates an interactive interface between a computer user and the computer hardware. It is an extended machine that hides the messy details that must be performed and presents computer users with a virtual machine that is easy to utilize. It is a resource manager where each program gets time with the resource, space on the resource, and utilizes the computer hardware in an efficient manner (Silberschatz et al., 2008)

Computer operating systems evolved in the years the 1940s - 1950s with the first-generation computers, which were developed without an operating system but rather programs were written in machine language for a particular task is simple mathematical calculations. These were followed by the second-generation computers in 1955 – 1965 with the first operating system, GMOS, i.e., based on a single stream batch processing system. developed by IBM for the IBM computers. GMOS operates in a way that all similar tasks are gathered in batches and then submitted to the operating system using a punch card to complete all the tasks in a computing machine. The operating system could be cleaned after completing one task and then proceed to read and initiate the next task. (Tanenbaum, 2009) These tasks were tedious and prompted for a new operating system that could execute multiple tasks in a single computer program in the years 1965s – 1980s and in the same year personal computers were developed though were very expensive and the earlier operating system in the fourth generation i.e. 1980 to present day included Microsoft windows operating systems first released in 1975 by Microsoft (Stallings, 2005), Macintosh Operating System (Mac OS) was designed in 1984 by Apple Inc to be installed and operated on the Apple Macintosh series of computers (Guterl, 1984), Linux operating system created in the early 1990s. (Xiao et al., 2017).

Comparison between Windows, Mac, and the Linux/Unix Operating Systems

	Windows Operating System	Macintosh Operating system	Linux Operating system
Operability	- Developed by Microsoft Inc - Designed for PC of all companies. - Provides users with a simple system to operate though takes long to install. - Support is free of charge - Highly easy to use among all the available OS.	- Developed by Apple Inc and launched in 2001 - Designed for only Apple mac computers. - Software is free of charge. - Easy to use but not as Windows OS	- Developed by Linus Torvalds and launched in 1991. - Can be used on any computing device. - Support is provided at a fee. - Requires technical know-how to use Linux OS thus complicated to use
Features	- Proprietary but less expensive compared to Mac OS. - Files management. Supported file systems are NTFS, FAT, ISO 9660, UDF, HFS+, FATX and HFS. - Update management is Windows Update. - MSI or custom installer package management. - Plug & Play. There is no need to install drivers for any external devices.	- Proprietary software and very costly. - File management. Supported file systems are HFS+, APFS, HFS, UFS, AFP, ISO 9660, FAT, UDF, NFS, SMBFS, NTFS, FTP, WebDAV and ZFS. - Update management is Software Update. - macOS installer package management	- Freeware and Open Source OS - Runs on a variety of hardware from PCs to Macs. - Update management depends on the distribution. - File management. The supported file systems are ext2, ext3, ext4, btrfs, ReiserFS, FAT, ISO 9660, UDF and NFS. - Managing package depends on the distribution.

Comparing existing Operating Systems

Security	- Less secure as compared to Linux and Mac OS.	- Secure but not as compared to Linux OS.	- Very Secure among all OS.
Performance	- Very slow due to pre-installed Applications like one drive that takes.	- Very fast due to its streamlined user interface and several free productivity applications but not as compared to the Linux OS	- Very fast among all operating system and highly reliable.

Comparing existing Operating Systems

Windows Operating System

This is an operating developed and marketed by Microsoft Windows. It is called a Windows operating system because every task everyone wants is done in its window and additionally, every task or program has its window in which that task occurs. (Stallings, 2005). Its features include Ease of use, Performance Monitor, Plug and Play, file management, and based on MS-DOS. Windows operating systems include Windows 95, windows 98, windows XP, Windows 7, Windows 10, and the recently released Windows 11 each having several editions for example professional, education, enterprise, and many more supporting both x86 and x64 processors' architecture, these provide users with great Graphical User interface i.e., GUI that most programmers prefer on their career domain. (Krogh, 2017).

Windows version images extracted from the official website of Microsoft

Advantages of Windows Operating Systems

- **Ease of use**. Microsoft Windows is easier to use than any other operating system

- **Software**. Primarily, the Microsoft Windows operating system has the largest users of the remaining two operating systems, therefore, more software programs, utilities, and games are available for Windows across the internet. 98% of the gaming software is compatible with Windows.

- **Hardware**. Because the Windows operating system has the largest number of users and broader driver support compared to other operating systems, all hardware manufacturers support Microsoft Windows.

- **Development**. Windows operating systems provide developers with a great platform for developing Windows-based applications as compared to Linux and Mac OS because they support Windows applications. (Krogh, 2017)

Disadvantages of using Windows Operating systems

- **The cost of Windows operating systems**. Windows is expensive is each license is estimated between $50.00 to $100.00 as compared to Linux which is free software and open source and the Macintosh Operating system only comes with Mac PCs.

- **Security**. Windows operating system is more viruses and other attacks when compared to Linux and Mac OS.

- **Reliability.** The Windows operating system is not reliable as it requires one to repeatedly reboot the computer for normal operations otherwise, there is a high likelihood of hang-up of the system.

- **Utility and gaming Software Cost**. The broad software available for the Windows operating is not for free, a large number of the existing software costs not less than $100.00 for a one-time license. (Carpenter, 2011)

Linux

This was initially built by Linus Torvalds at the University of Helsinki in 1991. It is a Unix-like, Kernel-based, fully memory-protected, multitasking operating system. Features of Linux include Free Software that anyone can download, an Open Source Operating System that is every programmer can modify to develop his/her distribution, and running on a wide range of hardware from PCs to Macs.(Bokhari, 1995). Linux being a free and open source operating system presents numerous distributions from desktop to enterprise environments overtime with several features for different users that include Linux

Ubuntu, Linux Debian, RedHat Enterprise Linux, Kali Linux, Gentoo Linux, Linux Mint, CentOS, Arch Linux, OpenSUSE and many more.(Lux.Org, 2017).

Linux Distribution Pictures extracted from

Advantages of Linux Operating Systems

- **Low cost**: Linux is an open source and free software, therefore, there is no need to purchase a license to utilize a given distribution on the computer. Its licenses are based on the GNU General Public License and all utility software can be downloaded freely at any time.

- **Stability**. It is very stable and you don't have to reboot periodically to maintain performance

- **Flexibility**. The Linux operating system operates both in embedded system applications, desktop applications as well as enterprise server application thus presenting high performance and flexibility across different platforms.

- **Security**. Linux is the most secure operating system and is less prone to viruses, It's security features without the consideration of antivirus or spyware. (Stallings & Paul, 2012)

Disadvantages of Linux Operating System

- **Understanding**: Linux OS requires technical know-how to utilize effectively. Therefore, for one to become familiar with Linux OS, a lot of patience and desire to read and explore about its operations and architecture is a must

- **Gaming and Utility Software**: Linux has a limited selection of both utility and gaming software available on the market as compared to both Windows and Mac OS

- **Ease of use**: Previously, Linux has improved its interface by integrating both the Command Line interface (i.e., CLI) and the Graphical user Interface (i.e., GUI), observed as an effort to improve ease of use however, windows is much easier.

- **Hardware**: Linux doesn't support all computing hardware devices available due to limited driver support. (Lux.Org, 2017)

Macintosh Operating Systems

This is a series of graphical user interface-based operating systems developed in 11984 and marketed by Apple Inc. only for their Macintosh line of computer systems. Macintosh operating systems.(Guterl, 1984). Macintosh Operating Systems presents numerous versions for both Mac OS and Mac OSX which include OS X 10 beta: Kodiak - 13 September 2000, OS X 10.0: Cheetah - 24 March 2001, OS X 10.1: Puma - 25 September 2001, OS X 10.2: Jaguar - 24 August 2002, OS X 10.3 Panther (Pinot) - 24 October 2003, OS X 10.4 Tiger (Merlot) - 29 April 2005, [OS X 10.4.4 Tiger (Chardonnay)], OS X 10.5 Leopard (Chablis) - 26 October 2007, OS X 10.6 Snow Leopard - 28 August 2009, OS X 10.7 Lion (Barolo) - 20 July

2011, OS X 10.8 Mountain Lion (Zinfandel) - 25 July 2012, OS X 10.9 Mavericks (Cabernet) - 22 October 2013, OS X 10.10: Yosemite (Syrah) - 16 October 2014, OS X 10.11: El Capitan (Gala) - 30 September 2015, and many more (Karen, 2021).

Advantages of Mac Operating system.

- **Fewer virus attacks**. Mac OS is the 2nd used operating system with less percentage of active users therefore, it has the least virus attacks compared to Windows operating systems.
- **Good customer support**. Mac OS provides its users with great response from its support team, engineers, and community forum as compared to Windows and Linux Operating systems.
- **Performance and long life**. Mac OS and Mac computers are developed by Apple Inc thus its hardware communication is very efficient which improves performance and the Mac Computers have a longer lifespan compared to any other computer on the market.
- **Consistent GUI for all the Mac OS versions**. Mac OS feels comfortable while using Mac OS as all its versions present a similar graphical user interface i.e., GUI as found on Apple computing devices like iPhones and tablets.
- **Pre-installed default apps**. Mac OS comes with powerful utility applications that is iCloud, iPhoto, and iMovie which don't affect the system performance as observed with Windows OS, windows OS comes with numerous applications like OneDrive and Internet explorer which slows down the computer performance speed.
- **File System Support for other operating systems**. Mac OS supports both the NTFS and FAT file systems of the Windows operating, a feature not common in other operating systems available on the market.

Disadvantages of the Mac Operating System

- **Cost**. Mac OS is very expensive among all the available operating systems on the market.
- **Gaming and Utility software**. Mac OS has less gaming software available and most developers have a higher preference for making games for Windows OS because of the large number of users using Windows OS, in addition, Mac computers have very minimal graphics capability to support graphics games.
- **Hardware customization**. If the Mac computer gets serious problems that require replacement, one has to simply buy a new computer instead because Mac computers do not support changing its computing hardware parts like the processors and graphics cards and
- **File System**. The file system of Mac Operating systems cannot be read by the Windows operating system but the Mac Operating systems can read Windows file system that is NTFS and FAT and for one to do so a third-party software in Windows must be installed. (Guterl, 1984)

Conclusion

In conclusion, therefore, there is no operating system which is really better, the choice is up to you. If you're new to the computing world or a gamer, then the only choice available is the Windows operating system due to the interactive GUI and ease of use i.e., click and drag. Computer Programmers might

prefer Linux while video/graphics producers will probably tend toward Macintosh Operating System. The best option is probably to try each Operating system and see which is best for you.

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