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Conceptual Analysis of optimization strategies in Operating System (Windows and Unix) in the current IT Trend from 2015 TO 2023

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Abstract: *Varieties of operating systems (OS) have emerged over the years having different features and functionalities. Understanding the functionalities of each operating system guides users' decisions about the OS to install on their computers. In view of this, the conceptual analysis of different OS is needed to provide details on the similarities and difference in recent types of OS vis-à-vis their strengths and weaknesses. This paper focus on the conceptual analysis of Windows and unix operating system. Windows and unix are more popular, user-friendly, easy to use and allow more application program than other OS. It is because they are affordable, secure, reliable and compatible. This study provide optimization strategies of windows and unix operating system in current IT trend in the last ten years. Optimizing the operating system of a computer helps ensure that it operates at its best and can handle demanding tasks efficiently, providing an optimal computing experience regardless of the hardware capabilities.*

Keywords: *operating system, optimization, windows, unix*

Introduction

The operating system is one of the major foundations of technology today, and just as other devices are being developed constantly, the operating system is also being developed constantly to be able to handle all the new applications and programs that are being developed with every new release, (Aaron, Floyd and Sandra, 2020). Operating system OS is basically an application program that serves as an interface to coordinate different resources of computer. An operating system processes raw system and user input and responds by allocating and managing tasks and internal system resources as a service to users and programs of the system. Silberschatz, Galvin and Gagne (2009) simply put, an operating system can be defined as a set of programs implemented either in software or firmware (hardwired instructions on chips usually in ROM) or both that makes the hardware usable. The main functions of operating system are memory management where its memory manager checks the validity if each memory space request, processor management where its processor manager decides how to allocate the central processing unit, device management where it monitors, channels and controls every device, file management where it keeps track of all files in the system, and network management where it provides a convenient way for users to share resources and controls how users accesses resources. Most commonly used operating systems are windows based operating system and Unix based operating systems (McHoes, and Flynn, 2011). Most operating systems come with an application

that provides an interface to the OS managed resources. These applications have had command line interpreters as a basic user interface, but more recently have been implemented as a graphical user interface (GUI) for ease of operation. Operating Systems themselves, have no user interfaces, and the user of an OS is an application, not a person, (Mudiraj, 2013). The operating system forms a platform for other system software and for application software. Windows, Linux, unix and Mac OS are some of the most popular operating system.

Windows operating system is a computer program that manages all computer resources and provides services to applications that run on top of it, (Idris and Aliyu 2022). This operating system was developed by Microsoft and released in 1985 under the name Windows 1.0. Since then, the Windows operating system has continued to evolve and become one of the most popular operating systems in the world. The Windows operating system is designed to run on various types of hardware, including desktops, laptops, servers, and mobile devices. Windows uses a graphical user interface (GUI) that allows users to interact with the computer through icons, buttons, and visual menus, rather than using text commands like other operating systems, (Hossein 2023). Windows also has many features such as multitasking capability, which allows several applications to run simultaneously, as well as plug-and-play capability that makes it easy for users to connect additional devices such as printers, scanners, and cameras. The Windows operating system has undergone incredible evolution since it was first launched in 1985. Each version of Windows offers different improvements and fixes, and this operating system remains one of the most popular in the world to this day.

UNIX is an operating system which was first developed in the 1960s, and has been under constant development ever since. By operating system, we mean the suite of programs which make the computer work, (Hossein 2023). It is a stable, multi-user, multi-tasking system for servers, desktops and laptops. UNIX operating system comes with a Command Line Interface (CLI).. However, knowledge of UNIX is required for operations which aren't covered by a graphical program, or for when there is no windows interface available, for example, in a telnet session. There are many different versions of UNIX, although they share common similarities. The most popular varieties of UNIX are Sun Solaris, Linux, and Mac OS.. The UNIX operating system is made up of three parts; the kernel, the shell and the programs.

This work will focus on the timeline of Microsoft's Windows operating system and unix operating system and how the company has improved its operating systems in the last ten years. Microsoft started with the Microsoft Disk Operating System or DOS. This was developed for international Business Machine-compatible computer for personal use. The early versions of the Disk Operating System were fairly simple until further version become more complex and incorporated other feature of operating systems. This was first developed in 1981 called the MS-DOS. Four years later, the first version of the Windows Operating System was introduced to the public, (Aaron et al 2020). Each updated version of operating system comes with new menu designs and ideally a better performance than the previous versions due to better optimization. Optimization of operating system is the process of improving the performance, security, and reliability and stability, resource management, energy efficiency , file management, memory management etc. of an operating system (OS) by tweaking its settings, removing unnecessary files, updating drivers, and installing patches, (Linkedin 2024). Operating system should be optimized after installing the operating system to update it to the latest version. This will ensure that the OS have the most recent features, bug fixes, and security patches. Updating the system

can also improve its compatibility with other software and hardware. To update the system, the built-in update tool can be used or visit the official website of the operating system provider. Optimization strategy is a set of steps implemented by a company to improve operations, reduce costs and streamline activities. IT optimization can be implemented at any time. These strategies involve the effective use of antivirus applications, database management, software updates, and upgrades, amongst others.

Overview of Windows Operating System

The Windows Operating System (OS) is one of the most popular and widely used operating systems in the world. Developed by Microsoft Corporation, Windows Operating System has become the go-to choice for both personal and business computing, (Akinlolu, Adedoyin, Adedokun and Olikayode 2020). It is designed to provide users with a user-friendly interface to interact with their computers. The first version of the Windows Operating System was introduced in 1985, and since then, it has undergone many updates and upgrades. Windows Operating System is compatible with a wide range of hardware and software applications, making it a popular choice for both personal and business computing. It has a built-in security system to protect the computer from malware and viruses and provides a comprehensive file management system that makes it easy for users to organize and access their files. Windows Operating System also allows users to run multiple applications simultaneously, making it easy to work on multiple tasks at the same time (Akinlolu *et al.* 2020).

Features of the Windows Operating System

Control Panel: The control Panel is a centralized location within Windows where users can manage various system settings, including security and privacy, display, hardware and sound, and programs. It provides users with access to a range of tools and settings, making it easy to customize the Windows experience.

Internet Browser: An Internet Browser is a software application that allows users to access and browse the Internet. Windows provides a built-in internet browser called Microsoft Edge, which includes features such as tabbed browsing, search suggestions, and web notes.

File Explorer: File Explorer is a file management tool that allows users to browse, open, and manage files and folders on their computers. It provides a user-friendly interface for users to view and manage files and includes features such as search, copy, move, and delete.

Taskbar: Taskbar is a horizontal bar that appears at the bottom of the Windows desktop. It provides quick access to frequently used applications and displays open windows and programs. The taskbar also includes system icons such as volume, network, and battery status.

Microsoft Paint: Microsoft Paint is a graphics editing software that allows users to create and edit images. It provides users with basic drawing tools such as a pencil, brush, and eraser, and allows users to add shapes, text, and images to their designs.

Start Menu: Start Menu is a menu that appears when users click the Start button on the Windows taskbar. It provides access to frequently used applications, settings, and files, and includes a search bar that allows users to quickly find files and applications.

Task Manager: Task Manager is a system tool that allows users to view and manage running applications and processes. It provides users with information about CPU and memory usage and allows users to end unresponsive programs and processes.

Disk Cleanup: Disk Cleanup is a system tool that allows users to free up space on their hard drives by removing unnecessary files and data. It scans the system for temporary files, cache, and other unnecessary data, and provides users with the option to remove them.
Cortana: Cortana is a virtual assistant software that allows users to interact with their computers using voice commands. It provides users with access to information, and reminders, and can perform tasks such as sending emails and setting reminders.

Various Versions of Windows Operating System
The major versions of the Windows Operating System (PrepByte Blog 2023). Windows based operating system development approach can be defined as systematic where any version can be termed as an improvement of the various version either to cater for its deficiencies or due to introduction or improvement of technology.

Windows 1.0: This was the first version of the Windows Operating System, released in 1985. It was a graphical user interface (GUI) for MS-DOS and included features such as a calculator, calendar, and notepad.

Windows 2.0: This version was released in 1987, and introduced features such as support for VGA graphics, keyboard shortcuts, and improved memory management.

Windows 3.0: This version was released in 1990, and was the first widely successful version of the Windows Operating System. It introduced features such as Program Manager, and File Manager, and improved support for graphics and multimedia.

Windows 95: This version was released in 1995, and was a major milestone for Windows. It introduced the Start menu, taskbar, and support for plug-and-play devices. It also included the Internet Explorer web browser.

Windows 98: This version was released in 1998, and included improvements to the Start menu and taskbar, as well as support for USB devices.

Windows 2000: This version was released in 2000, and was designed for business use. It included features such as Active Directory, improved network support, and support for the NTFS file system.

Windows XP: This version was released in 2001, and was a major overhaul of the Windows interface. It introduced a new visual style, improved performance, and support for wireless networks.

Windows Vista: This version was released in 2006, and included a new interface called Aero, as well as improved security features.

Windows 7: This version was released in 2009, and included improvements to the Start menu, taskbar, and Aero interface. It also introduced new features such as Jump Lists and Libraries.

Windows 8: This version was released in 2012, and was designed for touchscreens and tablets. It introduced the Start screen, as well as new apps and features such as Charms and Snap.

Windows 10: This version was released in 2015. It includes a redesigned Start menu, support for virtual desktops, and new apps and features such as Cortana and the Edge browser. Each version of the Windows Operating System has brought new features, improvements, and changes. Windows 10 Home is designed for home users and includes basic features such as Windows Defender, Cortana, and the Start menu. Windows 10 Pro is designed for business users and includes additional features such as Remote Desktop, BitLocker, and Hyper-V.

Windows 11: It is the latest version of the Windows operating system, released by Microsoft in October 2021. It builds upon the foundation of Windows 10, with a focus on enhancing the user experience and improving performance and security. Each version of the Windows Operating System has brought new features, improvements, and changes. The Windows operating system has evolved over the years to become one of the most widely used operating systems in the world, with a range of features and functionalities that cater to the needs of different users. From its intuitive graphical user interface to its command-line interface, Windows offers a variety of options for users to interact with the system.

Overview of UNIX Operating System

The Unix operating system is a set of programs that act as a link between the computer and the user. It is the computer programs that allocate the system resources and coordinate all the details of the computer's internals is called the operating system or the kernel,(Ames 2020). Users communicate with the kernel through a program known as the shell. The shell is a command line interpreter; it translates commands entered by the user and converts them into a language that is understood by the kernel, (Kranthi 2018). Unix was originally developed in 1969 by a group of AT&T employees Ken Thompson, Dennis Ritchie, Douglas McIlroy, and Joe Ossanna at Bell Labs, (Dr Akshay 2005).Several people can use a Unix computer at the same time; hence Unix is called a multiuser system .A user can also run multiple programs at the same time; hence Unix is a multitasking environment. This operating system is very popular among the scientific, engineering, and academic due to its most appreciated features like flexibility, portability, network capabilities, etc. (Kranthi 2018).

The Unix operating system has several key feature that distinguish it from other operating systems, (Dr Akshay, 2005). These features include:

Command Line Interface (CLI): Unix is known for its powerful command line interface, which allows users to perform a wide range of tasks using textual commands. The CLI provides a flexible and efficient way to interact with the operating system.

Multi-user Support: Unix is designed to support multiple users simultaneously. It allows multiple users to log in and use the system at the same time, with each user having their own files, directories, and permissions.

Multi-tasking: Unix supports multi-tasking, which means that multiple programs can run concurrently on the system. This allows users to switch between different tasks and improves the overall efficiency of the system.

Portability: Unix is designed to be portable across different hardware platforms. This means that it can be installed and run on various types of computers, making it a popular choice for organizations with diverse hardware environments.

Shell Scripting: Unix provides a powerful shell scripting language, which allows users to automate tasks and create custom commands. This makes it easier to manage complex tasks and improve productivity.

File and Directory Structure: Unix has a hierarchical file and directory structure, with all files and directories organized under a single root directory. This structure makes it easy to manage and locate files on the system.

Security: Unix provides robust security features, including user authentication, access controls, and encryption. These features help protect the system from unauthorized access and ensure the confidentiality and integrity of data.

Network Support: Unix provides strong support for networking, allowing systems to communicate and share resources with each other. This makes it a popular choice for organizations with distributed computing environments.

Open Source: Many versions of Unix, such as Linux, are open-source, which means that the source code is freely available for modification and distribution. This allows developers to contribute to the ongoing development and improvement of the operating system.

Versions of Unix Operating System

There are many different versions of the Unix operating system, Kranthi (2018) and some of the most notable ones include:

i. UNIX System III: Released in 1981, this version was developed by AT&T and was the first commercial version of unix.
ii. UNIX System IV: Released in 1982, this version included several improvements and new features, such as support for larger file systems.
iii. unix System V: Released in 1983, this version became the standard for Unix and was widely adopted by many organizations. It included several new features, such as support for multitasking and networking. The latest version of the certification standard for unix is unix V7, which is aligned with the Single UNIX Specification Version 4, 2018 Edition. This standard is maintained by the Open Group, an organization that promotes open standards and interoperability in the IT industry
iv. UNIX System V Release 2: Released in 1984, this version included further improvements and bug fixes.
v. UNIX System V Release 3.0: Released in 1986, this version included support for larger memory configurations and improved performance.

vi. UNIX System V Release 3.2: Released in 1987, this version included additional improvements and new features, such as support for distributed computing.
vii. Solaris (oracle): Released in 1993 by Sun Microsystems, which was later acquired by Oracle Corporation. Solaris is a unix-based operating system designed for enterprise-level servers, workstations, and data centers, (Bill 2001).
viii. UnixWare 1.1: Released in 1993, this version was developed by SCO and was based on Unix System V.
ix. UnixWare 1.1.1: Released in 1994, this version included several bug fixes and performance improvements.
x. UnixWare 2.0: Released in 1995, this version included support for symmetric multiprocessing and other new features.
xi. UnixWare 2.1: Released in 1996, this version included additional features and improvements, such as support for Java.

The latest version of the certification standard for Unix is UNIX V7, which is aligned with the Single UNIX Specification Version 4, 2018 Edition. This standard is maintained by the Open Group, an organization that promotes open standards and interoperability in the IT industry

These versions of unix represent some of the major milestones in the evolution of the operating system. unix has continued to evolve, with new versions and variants being developed by various organizations over the years. Other unix based operating systems are Linux (1991), Mac OS X (2001), BSD (1993), AIX (1986), FreeBSD (1993), HP-UX (1984), NetBSD (1993), OpenBSD (1995), IRIX (1987). Keep in mind that many of these Unix-based operating systems have undergone significant changes and improvements over the years, with new versions and updates being released regularly. For example, Linux has many distributions, including Ubuntu, Debian, and Fedora, each with its own release schedule and version numbers,(Ritchie and Thompson 2017).

Reasons for Optimization of Operating Systems

(According to Aniket and Laxmi 2016), Optimizing computers is important, even with powerful processors and large memory capacities, for several reasons:

Performance: While modern computers have powerful hardware, inefficient software or misconfigured settings can still lead to sluggish performance. Optimization helps improve the overall speed and responsiveness of the system, ensuring efficient utilization of resources.

Resource Management: Optimization techniques help manage system resources effectively. By optimizing processes, memory allocation, and background tasks, you can prevent resource bottlenecks, reduce unnecessary resource consumption, and avoid system slowdowns.

Energy Efficiency: Optimization can contribute to energy efficiency by minimizing the workload on the hardware components. When unnecessary processes and tasks are eliminated or streamlined, it can result in reduced power consumption, which is beneficial for both environmental sustainability and extending battery life in laptops and mobile devices.

Stability and Reliability: Optimizing a computer helps identify and rectify issues that may cause system crashes, freezes, or errors. By maintaining system stability and reliability, you can minimize unexpected disruptions and ensure a smooth computing experience.

Security: Optimizing your computer involves keeping software and firmware up to date, including security patches and bug fixes. Regular updates help protect your system against vulnerabilities and security threats, ensuring a safer computing environment.
Storage Efficiency: Optimization techniques like disk cleanup, defragmentation, and file organization can help maximize the available storage space on your computer. Removing unnecessary files, organizing data, and compressing files can free up disk space and improve storage efficiency.

User Experience: Optimizing a computer leads to an enhanced user experience. Faster startup times, quicker application launches, and seamless multitasking contribute to increased productivity and satisfaction.

Latest trends in optimizing operating system

According to (Kaihirii 2024),the current trend in operating system optimization are:
Cloud-based optimization: One of the most prominent trends in optimizing OS is the utilization of cloud-based services and tools. These can help you monitor, analyze, and improve your OS performance remotely and automatically. This cloud-based optimization offers several benefits, such as scalability, flexibility, reliability, and cost-effectiveness. For instance, leveraging the power of the cloud to run complex tasks and processes which would otherwise consume local resources can improve OS performance. Additionally, real-time data and insights on OS performance can be accessed to identify potential issues and opportunities for improvement. Automatic updates, patches, and fixes can also be implemented to enhance security and stability. Finally, cloud-based optimization tools can help optimize OS settings, configurations, and parameters according to individual needs and preferences.

AI-powered optimization: Another trend in optimizing OS is the use of artificial intelligence (AI) and machine learning (ML) to enable smart and adaptive optimization that can learn from your OS behavior and performance and provide you with personalized and proactive solutions. AI-powered optimization can offer accuracy, efficiency, and innovation, allowing you to detect and diagnose OS performance issues, predict and prevent OS performance degradation, optimize resource allocation, and explore new possibilities for improving your OS performance. In other words, AI-powered optimization can ensure your OS availability, reliability, responsiveness, productivity, and functionality.
3 User-centric optimization: A third trend in optimizing OS performance is the focus on user-centric optimization that can help you deliver the best user experience and satisfaction for your OS users. User-centric optimization can provide benefits such as engagement, loyalty, and feedback. For example, you can use it to understand user needs, expectations, and preferences to tailor your OS performance and features accordingly. Additionally, you can measure and improve user satisfaction and retention rates to ensure your OS value and relevance. Furthermore, you can collect and analyze user feedback and suggestions to incorporate them into your improvement plans. Engaging with your users and providing them with support, guidance, and education on how to use your OS effectively is also beneficial. Optimizing OS performance is a continuous process that requires you to stay up to date with the latest trends and techniques that can help you reach your goals. By following these trends, you can optimize your OS performance in a way that meets your needs and those of your users.

Optimization Strategies of Window Operating System in the Current it Trend between 2015 to 2023

During the period between 2015 and 2023, Microsoft implemented several optimization strategies in the Windows operating system to align with current IT trends,(Goran, Josip and Bojan 2020), such as cloud computing, cybersecurity, and artificial intelligence. Some of these optimization strategies include: (Windows Server 2016)

Windows Optimizations for Cloud Computing: In 2016 Microsoft optimized Windows 10 for better integration with its cloud services, such as Azure and Office 365, allowing for better management and synchronization of data across multiple devices.

Windows Security Optimizations: In 2017, Microsoft introduced several security optimizations in Windows 10, including Windows Defender Advanced Threat Protection (ATP) for better threat detection and mitigation, and Windows Hello for improved user authentication.

Windows Optimizations for Artificial Intelligence: In 2023, Microsoft optimized Windows 10 for better integration with AI services, such as Cortana and Microsoft Azure AI, allowing for improved user experiences and more intelligent system behaviors.

Windows Optimizations for Virtual Reality: In 2016, Microsoft optimized Windows 10 for better support of virtual reality (VR) technologies, such as Windows Mixed Reality, allowing for more immersive experiences and improved performance.

Windows Optimizations for Hybrid Work: In 2015, Microsoft introduced Windows 11 with several optimizations for hybrid work environments, such as improved multitasking, better support for remote collaboration, and enhanced security features.

Windows Optimizations for Gaming: In 2015, Microsoft optimized Windows 11 for better gaming performance, including support for DirectX 12 Ultimate, improved graphics, and better integration with Xbox services.

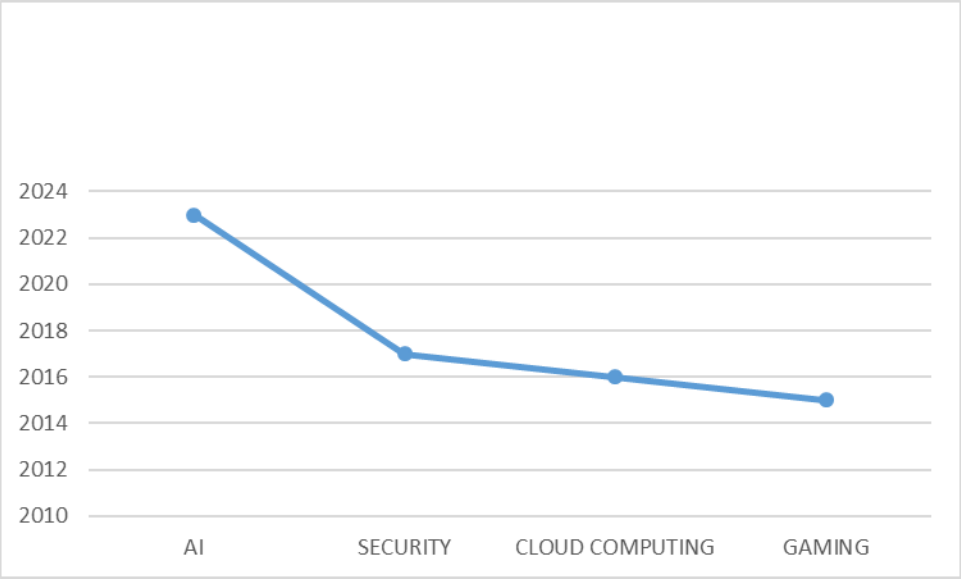

Figure 1: A graph showing optimization strategies of windows operating system between 2015 and 2023

In this graph, the x-axis represents level of optimization in Windows operating system strategies, while the y-axis represents the years from 2015 to 2023. The stacked areas depict the relative emphasis on AI, Security, Cloud Computing, and Gaming over time.

AI: The optimization strategy related to AI has grown significantly, reflecting Windows' increased focus on artificial intelligence and machine learning capabilities.

Security: Security optimization has consistently been a priority for Windows, ensuring protection against cyber threats and improving system integrity.

Cloud Computing: Windows has shown a steady emphasis on cloud computing optimization, aligning with the industry's shift toward cloud-based solutions. This graph helps illustrate the shifting priorities and trends in Windows operating system optimization strategies in response to the evolving IT landscape.

Optimization Strategies of Unix Operating System in Current it Trend Between 2015 To 2023

Different Unix-based operating systems implemented various optimization strategies between 2015 and 2023 to align with current IT trends, including:

AI Integration: In 2020, Unix-based operating systems have been optimized to support AI frameworks and libraries, making it easier for developers to create and deploy AI applications. This includes support for popular AI frameworks like Tensor Flow, PyTorch, and Keras, as well as languages like Python and R.

Machine Learning and Deep Learning: In 2018, With the increasing importance of machine learning (ML) and deep learning (DL), Unix-based systems have been optimized to handle large datasets and perform complex computations efficiently. This includes support for GPU acceleration, distributed computing, and optimized libraries for ML and DL workloads.

Cloud and Virtualization Support: In 2016, Unix-based operating systems were optimized for cloud computing and virtualization environments. This included better support for containerization technologies like Docker, Kubernetes, and LXC, as well as improvements in virtual machine management, network virtualization, and cloud-native application development.

Kernel Improvements: In 2017**,** The Linux kernel has undergone significant optimization during this period to enhance system performance. Improvements include better support for multi-core CPUs, improved memory management, and more efficient scheduling algorithms

Security Enhancements: In 2020**,** With increasing cybersecurity threats, Unix-based operating systems focused on optimizing security features. This included improvements in SELinux, AppArmor, and grsecurity for better access control, as well as advancements in firewalls, encryption, and secure boot processes.

Gaming: In 2019, Unix based OS released Proton 4.2, significantly improving Linux gaming performance and compatibility with Windows-based games.

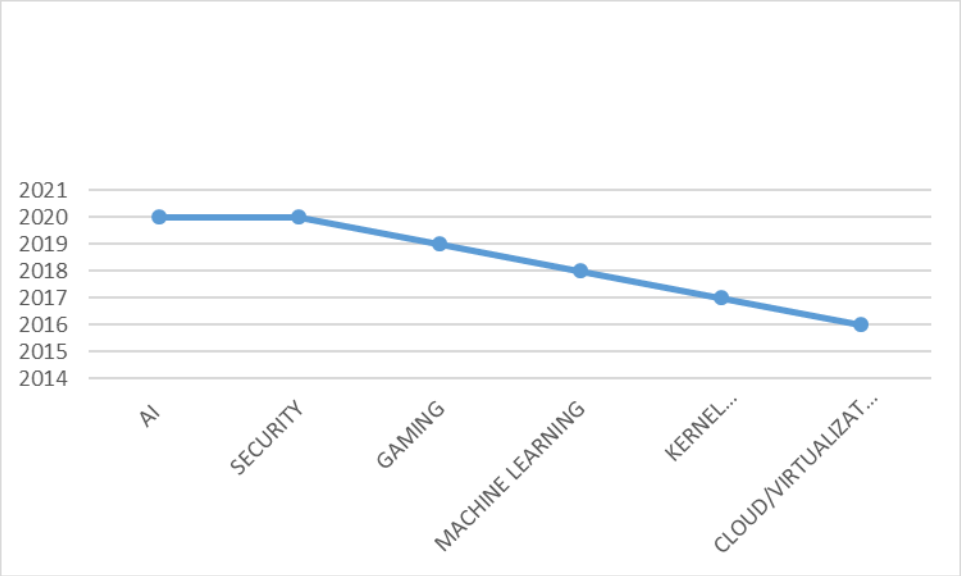

Figure 2: A graph Showing Optimization strategies of Unix operating system between 2015 and 2023

In this graph, the x-axis represents the level of optimization strategies in Unix operating system, while the y-axis represents the years from 2015 to 2023. The stacked areas depict the relative emphasis on AI, Security, Gaming, Machine Learning, Kernel improvement, and Cloud Virtualization over time.

Artificial Intelligence (AI): The optimization strategy related to AI has grown significantly, reflecting Unix's increased focus on artificial intelligence and machine learning capabilities.

Security: Security optimization has remained a consistent priority for unix, ensuring protection against cyber threats and improving system integrity.

Cloud Computing: Unix operating systems have optimized their cloud computing capabilities to work seamlessly with cloud platforms and services, aligning with the IT industry's shift toward cloud-based solutions. This graph helps illustrate the evolving priorities and trends in unix operating system optimization strategies as they respond to changing user needs and emerging IT trends.

Comparison of Optimization Strategies of Windows and Unix Operating System

To compare the improvements of operating system based on optimization strategies employed by windows and unix operating systems between 2015and 2023. These systems have undergone various improvements in different areas, including memory management, file systems, security, performance, and more,(Barbra Dozier 2013).

FACTORS	WINDOWS OS	UNIX OS
Performance:	Windows introduced a new memory compression feature, which reduces memory usage by compressing memory	Unix introduced Kernel optimizations for performance, Improved

	pages instead of swapping them to the disk. Continuous improvements in performance with updates	support for multi-core CPUs
File System	Windows has continued to optimize the NTFS file system, improving its performance and security. With the release of Windows 10, the company introduced the Resilient File System (ReFS), which provides increased reliability and scalability.	Unix-based systems have adopted modern file systems like Ext4 and APFS, which improve performance, reliability, and security. These file systems employ copy-on-write and snapshot features for better data integrity
Power Management	The Power Throttling feature in Windows 10 improves battery life by intelligently detecting which applications require power and which ones can be optimized	Unix based ensures advanced power management for devices using tools like power top and udev rules
Security	Windows has made significant strides in improving system security. Windows 10 introduced Windows Hello for biometric authentication, and the Windows Defender Advanced Threat Protection (ATP) for real-time monitoring of system security. Window ensures Security enhancements with each release	Unix improves Kernel-level security features such as SELinux, AppArmor, and grsecurity for access control. **:** It has implemented improvements in security with the Linux Security Modules.
Process management	Window Improved process scheduling and resource management	Unix-based systems have implemented efficient process management techniques, like the Completely Fair Scheduler (CFS) in Linux, to optimize CPU usage. Unix ensured Advanced process management with tools like ps and kill security
Memory Management:	Window Improved memory management with each release. Also Memory compression and swapping.	Unix-based systems have continued to optimize memory management with features like Kernel Same page Merging (KSM) and Transparent Huge Pages

		(THP) to improve memory efficiency.

Conclusion

The Windows operating system exemplifies a relentless commitment to innovation and adaptability. Its journey from the early stages to the sophisticated Windows 11 has been marked by overcoming challenges, integrating user-centric features, and achieving significant milestones. Unix is an operating system that was developed in the 1960s and has been in use ever since. These Unix-based operating systems have undergone significant changes and improvements over the years, with new versions and updates being released regularly.

Both Windows and Unix have optimized their operating system in current IT trend by introducing new features and improving existing ones. With the constant development of technology today, the companies that develop the operating systems for these devices must keep up with the optimization of new devices so that the companies can max out the market's user experience.

As the IT industry continues to evolve, we can expect further optimization strategies in response to emerging trends. The evolution of cloud computing, artificial intelligence (AI), security, and user interface design have driven improvements in performance, security, memory management, file management, power management and accessibility across both operating system platforms.

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