

Operational Distinctions Between Linux and Windows

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ABSTRACT

Today in a computer era there are two most used operating systems i.e. Windows and Linux. Windows is famous for its easy to use interface. Linux, on the other hand provides a ton of inbuilt functionalities to automatize task. To understand which one is superior we are going to compare them on grounds of kernel architectural differences, memory management, respective file systems and CPU scheduling task. These are standard bench-marks on which we are contrasting the internal working of an operating system. Linux and Windows vary in price, viewpoint and adaptability, with both in quest to stabilize in their present flaws.

Keywords: Operating System, Linux, Windows, Kernel Architecture.

I. INTRODUCTION

Linux being a free and open source operating system fascinates many users. Due to its free availability many people review the source code and share their views on the problem faced by them, so if you face any problem in most of the cases its solution can be found easily on internet. Many organizations also provide online paid assistance for problems of Linux. With its command line interface Linux provides an alter-native to do tasks if its graphical user interface fails. On the other hand Windows is licensed by Microsoft Corporation which is responsible for its operation. They regularly send security patches to keep system updated and secure from various attacks.

The researcher tries to differentiate Linux and Windows on the foundation of an operating system.

II. COMPARISON BETWEEN LINUX AND WINDOWS

A. Kernel Structure

Linux focuses more on executing efficiency and Windows pay more attention to convenient use. Linux uses a monolithic kernel operating system where as

Windows uses microkernel operating system. The architecture of Linux (Fig 1) and Windows (Fig 2) is shown below. The services provided by monolithic kernel are more modular so it allows dynamic loading i.e. modules can be added at run time and also it employs both user services and kernel services under same address space[2].

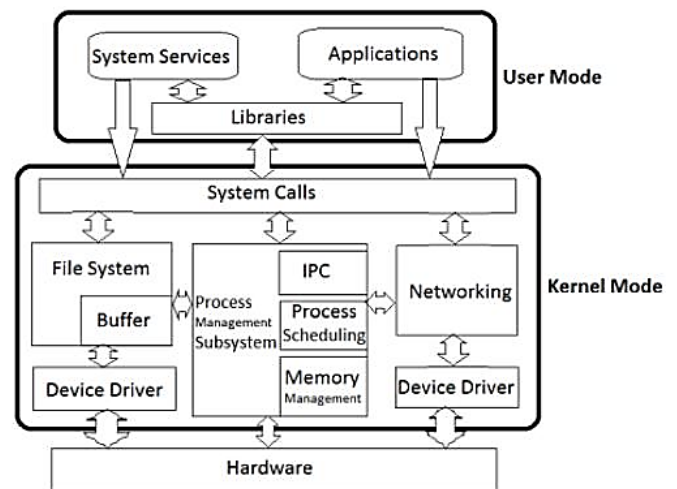


Figure 1. Monolithic Kernel Architecture

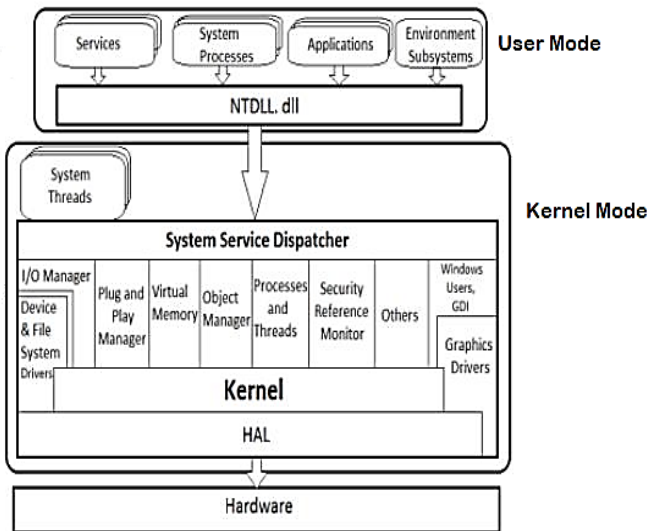


Figure 2. Micro Kernel Architecture

while the services provided by microkernel are more cohesive into kernel and it is more portable, secure, reliable. It implements user services and kernel services in different address space[2].

B. CPU Scheduling

An ideal operating system should have maximum CPU utilization obtained with multiprogramming. To achieve this Linux uses Completely Fair Scheduler (tries to give equal share of CPU to every process)[3].The Linux CFS scheduler delivers an effective algorithm for choosing which task to run next. Each run able task is placed in a red-black tree which is a balanced binary search tree whose nodes are chosen by the value of vruntime(which is the amount of time a process has spent in the processor).

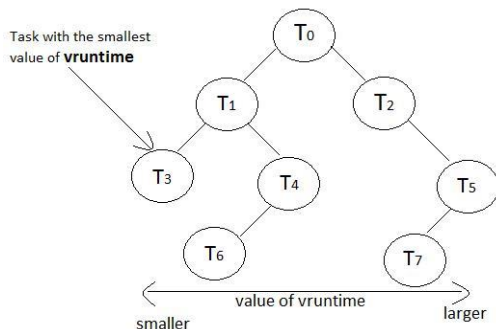


Figure 3. Binary tree with vruntime of different processes as nodes

When a task becomes run able, it is added to the tree. If a task on the tree is interrupted, it is removed from tree. So, task that have less processing time are on the left side, and task which have more processing time are on right side of the tree. The left most node has minimum value, so CFS scheduler determines that it is the task with highest priority[4].

Windows utilizes priority based pre-emptive scheduler. A priority is associated with each process. The CPU is allocated to the process with the highest priority. Real time threads can pre-empt non real time threads. Queue for each priority is maintained.

Win32 API identifies several priority classes to which a process can belong –

REALTIME_PRIORITY_CLASS, ABOVE_NORMAL_PRIORITY_CLASS, NORMAL_PRIORITY_CLASS, BELOW_NORMAL_PRIORITY_CLASS, IDLE_PRIORITY_CLASS. [4]

C. Memory Management

1)Data Structure: Windows uses tree data structure [6]. The Virtual Address Descriptor (VAD) tree is used to describe memory range used by a process. When a process is given a memory its entry is made in the VAD tree. The tree is a self-balancing binary tree, on any node the memory address on its left are in lower range to the memory address in node and its right has a higher range. [5]

Linux uses linked list data structure [6]. It maintains a list of vm_area_structs which is a contiguous memory area in a given interval [7]. This list is searched when-ever a page is to be found. It also records the associated process address space in mm_struct and a pointer to next virtual memory areas. If number of blocks in list becomes more than 32, Linux converts linked list into a tree. Linux uses data structure depending upon the situation. [6]

2) Paging: Windows uses cluster demand paging.

In Windows pages are brought into main memory only when they are needed. Eight pages are brought together concurrently instead of bringing one page at a time. Windows uses working set model which is the amount of memory currently assigned to the process. It contains the pages which are in the main memory. [6]

Linux uses demand paging with no pre paging.

Linux uses lazy swapper which never swaps entire process in one go instead it brings only those pages into main memory which are necessary. This saves the physical memory as well as the time which would have been needed to swap in the unnecessary pages. Now to distinguish between the pages which are in the main memory and which are on disk a valid and invalid bit is maintained. If the page is in the main memory then the bit is made valid and when the page is on disk the bit is made invalid.[6]

3) Page Replacement: Windows uses FIFO.

In First in First out Page Replacement Algorithm (FIFO) whenever a new page is brought and the size of the buffer is full then the oldest page is replaced with the new page. Page fault rate may increase when we increase number of frames. It is not very effective and sometimes it behaves abnormally. This behaviour is called Belady's anomaly.

Linux uses LRU.

Least Recently Used Page Replacement Algorithm (LRU) replaces the page which has been in the buffer and is not used for a long period of time. That page is selected as a victim page and is replaced with the new page.

D. File System

1) Drive Letters: Windows shows partitions and devices as drive letters. Whether you have multiple hard drives, multiple partitions on the same hard

drive, or a removable device, each file system is accessible under its own drive letter.

Linux doesn't have drive letters. In Linux, everything is under "/" – the root directory. All the directories come under root directory. It forms a tree structure in which the root is "/"[8].

2) Directory Structure: In Windows if you install a program then all its files can be found in a single folder. In Linux it is not so. Here, the binary file of a program is in /usr/bin/, the libraries in /usr/lib and its configuration file in /etc/[8]

3) Case Sensitivity: The Windows file system isn't case sensitive. It treats file name **FILE** and **file** as same, so it treats these names as the same file.

Linux's file system is case sensitive.[8] On Linux you could have files named file, File, and FILE in the same folder. This shows that Linux's file system is case sensitive.

4) Backslashes vs. Forward Slashes: Windows uses backslash. [8] For example, the path to a user directory on Windows is: -C:\Users\name

Linux uses forward slash. The path to a user home directory is: -/home/name

III CONCLUSION

This study suggests that both Linux and Windows show great dissimilarities in their internal functioning. The architectural difference suggests that the Linux architecture is friendlier to the administrators and coders who can add their own modules in the operating system whereas the users who want more reliable and secure operating system can opt for Windows. The scheduling and memory management capabilities of Linux are better as compared to that of Windows. But the file system used in Windows is easier to access. So a basic user

who use computer for entertainment and basic utility work should opt for Windows whereas the users who want to explore deep and code more should opt for Linux.

III. WEB REFERENCES

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