

CASE STUDY – OS/2 WARP

COURSE CODE : 19CSE103

COURSE NAME: OPERATING SYSTEMS

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MEMORY MANAGEMENT:-

- Memory management is the functionality of an operating system which handles or manages primary memory and moves processes back and forth between main memory and disk during execution.
- Memory management keeps track of each and every memory location, regardless of either it is allocated to some process or it is free.
- It checks how much memory is to be allocated to process. It decides which process will get memory at what time. It tracks whenever some memory gets freed or unallocated and correspondingly it updates.

Process Address space:

- The process address space is the set of logical addresses that a process references in its code.
- The O.S takes care of mapping the logical addresses to physical addresses at the time of memory allocation to the program.

There are three types:

- (i) Symbolic address, (ii) Relative address,
- (iii) Physical address.

(i) Symbolic address:-

The addresses used in a source code. The variable names, constants, and instruction labels are the basic elements of the symbolic address.

(ii) Relative address:-

At the time of compilation, a compiler converts symbolic address into relative addresses.

(iii) Physical address:-

The loader generates these addresses at the time when a program is loaded into main memory.

→ Different types of Memory management in windows 10:-

i) Page file system

ii) Pre fetch

iii) Super fetch.

iv) Ready Boost.

1) Page file System:-

→ When the amount of memory in use by all the running processes exceeds the amount of RAM available in the system, the OS will begin pages of memory out of RAM and temporarily storing them on the hard disk and freeing them RAM for the other uses.

→ When the running processes needs to access the memory that has been temporarily moved to page file, the OS locates the page and returns it to the RAM.

→ The moving memory pages is returned to swapping and paging file is often returned to the swap file. Because the pages of memory are kept intact as they stored on the hard disk.

Prefetch:

Prefetch helps to reduce the problem of overhead while swapping pages between memory, RAM, page files. Under this system the O.S loads key pieces of data and code from disk into memory before its actually needed.

Cache manager monitors the data being moved b/w the disk and RAM and virtual memory applications are loaded. The cache manager constructs a map of directories and files that were referenced for each process. The cache manager will intercept every process that is about to be loaded and will check to see if there is a corresponding map. Once this prefetch is completed, the cache manager will allow the application to continue loading. Due to this, the program finds majority of the files and data already available in the memory. This reduces the disk access and allows the process to load and execute much faster.

Superfetch:-

Superfetch is one step ahead of Prefetch. In addition, Superfetch also constructs profiles of the applications, that we use. These profiles include information about when and how often you use your application. Superfetch keeps track of the application in your profile and notes any prefetched data you moved out of the page. As soon as it is done, Superfetch will pull the prefetched data back into the memory. Thus whenever we want the prefetched data will be available in the memory and we can quickly pick up where we left.

Ready Boost:-

To improve Superfetch, Microsoft took advantage of the large capacity USB flash drives which are widely available, relatively inexpensive and efficient and faster than hard disks.

Ready boost creates a cache file on the USB flash drive that Superfetch uses to store files copies of its map files - it also stores the same data on the hard disk. That way, if you remove USB flash drive from computer, Superfetch can still function as it just gets from the hard disk.

ADVANCED FEATURES

(i) User Interface & Desktop :-

A new iteration of Start menu is being used, with a list of places and other options on left side and files representing applications on right. Configuring the start menu can be made through settings in the personalisation group. A new feature called Task View displays all opened windows and allows user to switch between multiple workspaces.

Windowed apps now allows universal apps, which previously could be used only in full-screen, can now be used in self-contained windows, similar to other programs. Programmed windows can now be snapped to quadrants of screen by dragging them to the corner. When a window is snapped to one side of screen, task view appears and the user is prompted to choose a second window to fill unused side of the screen, called as snap assist. Action center which displays notification and settings toggle. It is accessed by clicking an icon in the notification area. Notifications can be synced across many devices.

Supports two UI modes :-
(i) Optimized for mouse and keyboard.
(ii) Tablet mode best for touchscreen.

(ii) System security :-

Windows system incorporates multi-factor authentication technology based upon standards developed by Fast Identity Online (FIDO) Alliance. The operating system includes improved support for Bio-metric

authentication through windows hello platform. Devices with infrared illumination camera allows user to login with iris & facial recognition. Devices with supported readers allows user to login with fingerprint recognition. Credentials are now stored locally and protected by various layers of asymmetric encryptions. In addition to biometric authentication, windows hello supports authentication with PIN. By default, size of PIN must be a 4-Digit number, but it also allows more complex pin's of any size. However pin is not a simpler password. In addition, weak passwords can be cracked via rainbow tables. Trusted platform module (TPM) chip generates a asymmetric key pair for your pin to be resilient to brute-force attack. It offers additional security features; admins can set-up policy to automatically encrypt sensitive data and block applications selectively from accessing encrypted data.

(iii) Command Line :-

Windows console windows (both for powershell and legacy command prompt) can now be resized without any restrictions. Full screen mode can be enabled by pressing alt+enter, and can use standard keyboard shortcuts. The new update added windows system for linux, which allows installation of a user space environment from supported Linux distributions. The subsystem translates Linux system calls into windows NT kernel. The environment can execute Bash-shell and 64-bit command line programs, assuming supporting software is installed.

(iv) Storage Requirements :-

To reduce the storage footprint of the operating system, windows automatically compresses system files. The system can reduce the storage foot-print by approximately 1.5 GB for 32-bit system and 2.6 GB for 64-bit system. The refresh and reset functions use runtime system files instead, making a separate recovery patch redundant allowing patches and updates to remain installed and future reducing storage footprint by 12GB.



(v) Multimedia and Gaming :-

Windows is greater integrated with X-box ecosystem. It allows user to control and play games from X-box one console over local network. Windows comes along with Direct-X it aims at providing "Console-level efficiently" with "Closer to metal" access to hardware resources, and reduce CPU and graphic drivers overhead. Hologram was introduced for windows 10, is a set of technologies that enables 3D imaging and hologram projection. Hololens is helpful in hologramming. Hololens is a new holographic computer that requires hand-gestures and voice-commands for use. Project Spartan is now working on new browser compatible with modern web and built for windows family. It allows sharing and makes discovery, getting things done online like typing on web-pages easy.

Disk Scheduling :-

- Windows uses Shortest seek time first (SSTF) for disk scheduling

Shortest seek time first :-

Tracks which are closer to current disk head position should be serviced first in order to minimize the seek operations.

Advantages:-

1. Better performance than FCFS scheduling algorithm.
2. It provides better throughput.
3. Used in Batch processing.
4. It has less average response and waiting time.

Disadvantages:-

1. It may cause starvation for some requests.
2. Switching direction on the frequent basis slows the working of the algorithm.
3. It is the most optimal algorithm.

Following is the implementation of SSTF Disk Scheduling Algorithm :-

Input :-

size of queue = 8

Queue = 98, 183, 37, 122, 14, 124, 65, 67

head position = 53

- Seek time = 235
- Avg. seek time = 29.5

SHORTEST SEEK TIME FIRST

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Code:

```
#include<stdio.h>
#include<conio.h>
#include<math.h>
void main()
{
    int queue[100],t[100],head,seek=0,n,i,j,temp;
    float avg;
    printf("Enter the size of Queue\t");
    scanf("%d",&n);
    printf("Enter the Queue\t");
    for(i=0;i<n;i++)
    {
        scanf("%d",&queue[i]);
    }
    printf("Enter the initial head position\t");
    scanf("%d",&head);
    for(i=1;i<n;i++)
    t[i]=abs(head-queue[i]);
    for(i=0;i<n;i++)
    {
        for(j=i+1;j<n;j++)
        {
            if(t[i]>t[j])
            {
                temp=t[i];
                t[i]=t[j];
                t[j]=temp;
                temp=queue[i];
                queue[i]=queue[j];
                queue[j]=temp;
            }
        }
    }
    for(i=1;i<n-1;i++)
    {
        seek=seek+abs(head-queue[i]);
        head=queue[i];
    }
    printf("\nTotal Seek Time is%d\t",seek);
    avg=seek/(float)n;
    printf("\nAverage Seek Time is %f\t",avg);
    getch();
}
```

Output:

```
C:\Users\RAVELLA ABHINAV\OneDrive\Desktop\lab0705\disk.exe
Enter the size of Queue 8
Enter the Queue 98 183 37 122 14 124 65 67
Enter the initial head position 53

Total Seek Time is177
Average Seek Time is 22.125000
```

About Linux:

when Linus Torvald, a university student who wrote Linux as a Project shared his kernel with friends. he had no idea how useful it would become. Neither did Bill Gates, young university dropout, realize the software revolution he would bring about when he wrote basic for an Attn computer. These operating systems have taken over the world today. Accounting for the largest number of devices active today.

Development model:

Linux: → Linux was released on the internet in the year 1991 when it was created. written in C, the Kernel could be ported to different architectures unlike most operating systems of those days which were written in assembly, specific to one architecture. As a result from its earliest days, the linux kernel has been a group effort and has developed into a complete unix solution today. while initial development focussed on the kernel and core services. now a days more effort is put into developing interfaces and applications to make use of the kernel. As of the time of writing the latest stable version of kernel in linux is 5.12.5.

Windows: → Microsoft windows was developed by the microsoft corporation and it centered around.

the graphical interface. In fact windows started out as as a graphical add on to the then popular MS-DOS in the year 1985 and went through multiple iterations becoming less reliant and eventually replacing MS-DOS. with the introduction of the NT (New Technology) kernel and windows 2000/XP, windows became a standard operating system with iterations named Vista, 7, 8, 8.1 and 10.

Platform Support

Linux: Linux being open source and easily portable, runs on a variety of different platforms ranging from antiquated 16 bit cpus to the ARM based Apple M1 soc. This versatility has been given linux a strong foothold in the enterprise market as linux can be adapted to run on almost every platform, including super computers and real time computers.

windows: The latest versions of windows are available on 3 system architectures, x86-64, x64 and ARM64 architectures. The ARM version cannot be purchased independently but is bundled with microsoft manufactured, surface book pros. and run x86

programs through an emulation layer. windows is natively developed for 32 bit and 64 bit platforms x86 and AMD64 respectively.

STRUCTURE)

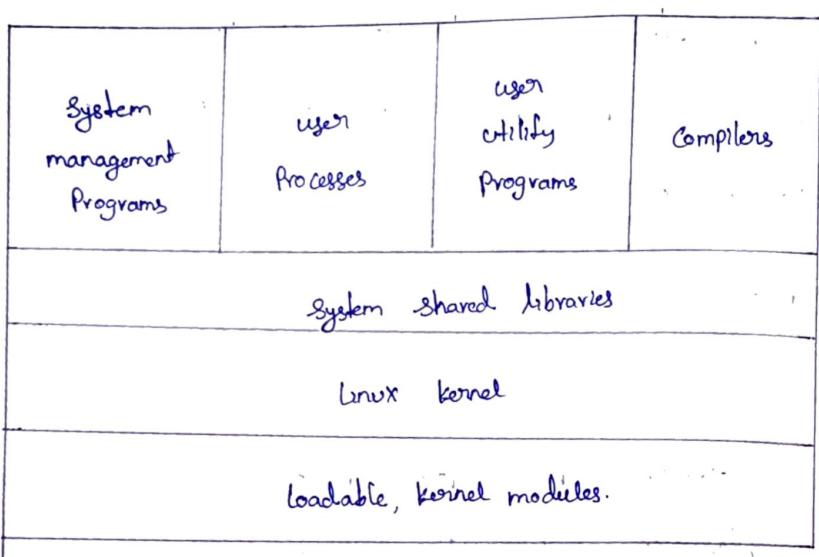
Linux) Linux is a traditional monolithic kernel it is a multitasking pre-emptive operating system. Networking and filesystem management. Features closely mirror that of UNIX operation systems. It contains the following major components.

- 1) Kernel
- 2) System Libraries
- 3) System Utilities.

Kernels) Responsible for maintaining important abstractions, including virtual memory and process.

Libraries) Standard set of functions through which applications interact with the kernel. This offers the user level application interface as well as other privilege levels.

Utilities) Programs that do individual, special management tasks. Some utilities known as daemons run permanently performing important functions like networking and logging.



- * When programs run in user mode whereas kernel operating runs in a privileged mode called the kernel mode.
- * User utilities manage operations like files, networking and UI. Linux offers shells for user interaction, graphical and command-line.
- * Then the hypervisor splits resources into normal world and secure world (VT1 and VT2). This helps to improve system security as secure protected components now need not be given high privileges to maintain the protection. This is risky as if it's compromised system security is compromised.
- * Resource management, paging, scheduling and other kernel operations are handled by the regular kernel.

* Linux has many options for interfaces in the form of different text shell options like fish, bash and zsh. All these options can be installed and configured on all linux distribution.

windows:

Microsoft windows was initially conceived as a proprietary extension to ms-dos. has always had only one paradigm from the very beginning. There is a start menu, where programs, systems controls and shortcuts to file folders can be found. There is a desktop, and a taskbar. And no scope for customization, newer versions have brought in UI changes like Aero, Metro and Fluent design. And it is marketed mostly as a user friendly operating system aimed at beginners and power users alike. Hence it dominates the pc space, with over 90% market share.

* The architecture of windows is a layered system of modules operating at specific privileged levels. The hardware is completely abstracted from most of the os through the HAL (Hardware Abstraction Layer) and Hyper-v hypervisor.

* Even though there is a windows server edition build specifically for servers only about 20% of all servers use windows as of April 2021.

* window managers like openbox, awesome and i3, and full blown Desktop Environments like Gnome, plasma, XFCE and Budgie. All the options are very good.

Boot manager

Linux : Linux has many boot options like grub, syslinux and grefind boot manager. It equally supports both Bios and UEFI booting. Grub the popular boot loader can also be configured to load to other operating systems like windows.

Windows : To boot windows, microsoft uses a boot manager called BootMGR (windows boot manager). It does not see or allow the booting of any other operating system. By default, BootMGR runs off the UEFI interface and not the legacy BIOS system.

Comparison with Linux

Threads :-

Linux:-

The Linux kernel does not provide any special scheduling semantics (or) data structures to represent threads. It is treated as a process that shares certain resources with other processes. Each thread has a unique task-struct and appears to the kernel as a normal process.

→ This approach to threads contrasts greatly with operating systems such as Microsoft Windows, Sun Solaris and etc. which has explicit kernel support for threads. The name "light weight process" sums up the difference in how Linux and other operating systems deal with threads. To these other operating systems, threads are an abstraction to provide a lighter, quicker execution unit than a heavy process. To Linux, they are simply a method of sharing resources between processes.

Microsoft windows:

They have explicit kernel support for threads. There are several reasons this operating system's applications create threads in addition to the default initial thread. As we discussed in the above paragraph that threads in windows are to provide a lighter and quicker execution time, the process with a user-interface typically creates threads to execute work, so that the main thread remains responsive to user input and windowing commands, and application that want to take advantage of multi processor.

Scheduling:

Linux:

From Version 2.6 to 2.6.2.3, The kernel used on O(1) Scheduler. The Completely fair Scheduler is the name of task scheduler, which was merged (merged) into the 2.6.33 release of Linux kernel. It handles CPU resource allocation for executing Process and aims to maximize overall CPU utilization while maximizing interactive performance. It uses red-black trees instead of queues.

→ Linux uses two separate process scheduling algorithms

- Time-sharing algorithm
- Preemptive scheduling among multiple threads.

→ Normal process scheduling uses a prioritized, preemptive credit-based policy

- Scheduler always chooses process with most credits to run.
- On each timer interrupt one credit is deducted until zero is reached at which time the process is preempted

Windows:-

- It is used as non-Breemptive Scheduler in the Post versions. It completely relied on the Program to End (Q) tell the OS that it didn't need processor. This is named Co-operative multitasking.
- NT-Based version of windows use a CPU scheduler based on multilevel feedback queue, with 32 Priority. It is intended to meet the following design requirements for multimode Systems:
- Give Preference to short Jobs
 - Give Preference to I/O bound Process
 - quickly establish nature of a Process and Schedule the process accordingly.
- All Processes receives priority boost after a wait event, but Processes with a keyboard I/O wait experience receives a longer boost than those experienced a disk I/O wait.

Memory Management:

Cinux :

It uses linked lists as its memory management data structure. It maintains a list of vm-area-structs and whenever a page has to be found then this list will be searched. It records the range of address, protection mode and direction in which it grows. If number of entries become more than 32 linked list will be turned into a tree.

- Linux uses demand Paging with non Pre-Paging. It will not swap a page into the main memory unless there is significant need of the page. In Linux, instead of swapping in a whole process the pager swaps only necessary pages into memory.
- It thus avoids reading pages that will not be used, this decreases swap time and amount of physical memory.
- Linux uses (LRU) as its page replacement algorithm. LRU can be expanded as least recently used. The page that is not used for long period of time is selected as victim and replaced.

Windows:

Memory management in windows uses Tree data structure. Each node of a tree is called virtual address descriptors. VAD marks each node as free, committed or reserved. Committed nodes are those nodes that are currently being used. Free nodes are unused nodes. Reserved nodes cannot be used until reservation is lifted off.

- Windows uses cluster demand Paging. Pages are brought in memory when they are needed. instead of bringing pages one by one, eight pages are brought in memory simultaneously. It makes use of working set models. (amount of memory that is currently assigned to process).
- Windows uses FIFO as its page replacement algorithm FIFO (first in first out). The oldest page is chosen from replacement. It suffers from belady's anomaly.

File systems :

Cinux :

Cinux supports more than 12 file systems. with nfs technology when cinux is linked, the default file system option need to be specified. other file systems can be called dynamically depending on requirements. Ext file systems is one among those 12 options and is most popular.

→ This file system assumes the disk begin with a boot block and then the disk is created from a series of other block groups (which are numbered sequentially)

Cinux supports the following file types :

- ① Directory : This is simply a list of names.
- ② ordinary file : This is a file containing data (or) executable
- ③ Symbolic Link : This file is link to another file.
- ④ Named Pipe : This is a common channel b/w two (or) more Process for data exchange.

Windows :

It supports number of file systems • including the file allocation table (FAT), But developers of also designed a new file system, the work file system named NTFs, which is intended to meet high end requirements of work stations and servers.

NTFs is very flexible & powerful built on simple file system model. The notable features of NTFs include security, Recoverability, large disks & files multiple data streams.

NTFs file structure : It makes use of following disk storage concepts.

① sector : The smallest physical storage unit on the disk. The data size is in a power of 2 & is almost 512.

② cluster : one or more contiguous sectors. The cluster size in sectors is a power of 2.

③ volume : A logical portion on a disk, consisting of one or more clusters and used by a file system to allocate space. A volume contains of file system information. remaining on the volume that can be allocated to files.