

OPERATING SYSTEM - SERVICES

An OS provides services to both the USERS & to the PROGRAMS.

o It provides an environment to execute.

o It provides users the services to execute the programs in a convenient manner.

following are a few common services provided by an OS -

o Program execution.

o I/O operations.

o File system manipulation.

o Communication.

o Error detection.

o Resource allocation

o Protection.

## X PROGRAM EXECUTION

Os handle many kinds of activities from user programs to system programs like printer spooler, name servers, file servers etc. Each of these activities is encapsulated as a process.

A process includes the complete execution context (code to execute, data to manipulate, registers, Os resource in use).

following are the major activities of an OS with respect to PROGRAM MANAGEMENT

- o Loads program into MEMORY.
- o Executes the Program.
- o Handles program's execution.
- o Provides a mechanism for process Synchronization.
- o Provides a mechanism for process communication.
- o Provides a mechanism for deadlock handling.

## I/O OPERATION :

An I/O Subsystem comprises of I/O devices and their corresponding driver S/w.

Drivers hide the peculiarities of specific H/w devices from the Users.

66 An OS manages the communication b/w the user & device drivers.

→ An I/O operation means read or write operation with any file or any specific I/O device.

→ OS provides the access to the required I/O device when required.

## FILE MANIPULATION :

A file represents a collection of related information.

Computers can store files on the disk (Secondary Storage) for long term storage purpose.

Example of storage media includes magnetic Tapes, magnetic Disks, optical Disks (CD, DVD, Blu-ray Disk)

each of these media has its own properties like Speed, capacity, data transfer rate and data access methods.

A file system is normally organized into

directories for easy navigation and usage.

These directories may contain files and other directions.

Following are the major activities of an OS w.r.t. File Management

→ Program needs to READ a file or WRITE a file.

→ The OS gives the permission to the program for operation on file.

→ Permission varies from read-only, read-write, denied and so on.

→ OS provides an interface to the user to create File/delete File.

→ OS provides an interface to the user to create/delete Directories.

→ OS provides an interface to create the backup of file System.

## Communication :-

In case of distributed Systems which are a collection of processors that do not share memory, peripheral devices (I/o devices) or a clock, the OS manages communications b/w all the processes.

Multiple processes communicate with one another through communication lines in the n/w.

The OS handles routing strategies, & the problems of contention and security.

Following are the major activities of an OS wrt. Communications:-

- Two Processes often require data to be transferred b/w them.
- Both the processes can be on one computer or on different computers but are connected.
- Communication may be implemented by two methods, either by Shared memory or by message Passing.

## ERROR HANDLING :

Errors can occur anytime and anywhere.

An error may occur in CPU, in I/O or in Memory H/w.

FOLLOWING ARE THE MAJOR ACTIVITIES OF AN OS ~~at~~. ERROR HANDLING —

- The OS constantly checks for possible errors.
- The OS takes an appropriate action to ensure correct and consistent computing.

## RESOURCE MANAGEMENT —

In case of multi-user or multi tasking environment, resources such as main memory, CPU cycles and files storage are to be allocated to each user or job.

FOLLOWING ARE THE MAJOR ACTIVITIES OF AN OS ~~at~~ R.M.—

→ The OS manages all kind of resources using Scheduler.

→ CPU Scheduling algorithms are used for better utilization of CPU.

## Protection —

considering a Computer System having multiple users and concurrent execution of multiple processes, the various processes must be protected from each other's activities —

• Protection refers to a mechanism or a way to control the access of programs, processes or users to the resources defined by a computer system.

FOLLOWING ARE THE MAJOR ACTIVITIES OF AN OS w.r.t. PROTECTION

- The OS ensures that all access to the system resources is controlled.
- The OS ensures that external I/O devices are protected from invalid access attempts.
- The OS provides authentication features for each user by means of passwords.

→ Operating System

NOTE —

new skillset gained notes related to previous

previous skillset to previous form the one  
from the new learning of how memory works

The Operating System operates either in  
Kernel mode or User mode

Compilers and editors run in User Mode.

whereas operating System code

run in Kernel Mode

## Topic → User Operating System Interface .

\* two fundamental approaches for users to interface with the OS -

### 1) CLI ( Command Line Interface or Command Interpreter )

It allows users to directly enter commands that are to be performed by the OS.

### 2) GUI ( Graphical User Interface )

It allows the user to interface with the operating system via a graphical User Interface or GUI .

Batch Based Interface

#### CLI :-

- Some OS include the command Interpreter in the kernel.
- others such as Windows & Unix, treat the command interpreter a special program.
- On Some Systems with multiple command interpreter to choose from, the interpreter are known as { Shells }.

Eg:- Bourne Shell .  
C shell .

Bourne Again Shell .

Windows — CMD  
[ command prompt ]

LINUX — Terminal .

Ex —

### Task

- creating a file
- deleting a file
- copying a file
- moving a file
- Renaming a file
- executing a file

I.  
approach

creating  
a file

Command Interpreter having code contained in  
itself for CREATING A FILE  
you just have to enter the command.

II  
approach

Task

creating  
a file

Command  
Interpreter

call

Program

that have  
code to CREATE  
a file.

Linux Mint →

Performing a Task

open Terminal

> **Ctrl + Alt + T**

USER NAME—HOSTNAME ~ \$ |

How to create a directory ↗

Step 1. > Check present directory (location)

Command - **"pwd"** print working directory.

↗ Press Enter

Step 2 > Change directory (location)

Command - **"cd"**

change directory

↗ cd Desktop/

Step 3

CREATE A directory  
Command - **"mkdir"**

make directory

mkdir Myfile1  
press enter.

Step 4

To see the contents of current  
directory  
Command - **"ls"**

list.

ls  
press enter.

## Step 5 - To delete a directory

command

" rm -rf Myfile "

remove

filename which  
you want to  
delete.

## Windows Terminal

Start > Run > cmd

C:\ Users\ Host> |

### Step 1 Change the directory

cd Desktop

prev enter

### Step 2 Create a directory

mkdir Myfile

prev enter

### Step 3. To See the Content of Current directory

Command = dir

prev enter

ls

### Step 4 - To delete a directory

Command = rmdir

Ex: rmdir Myfile

prev  
enter

# All Ping Command Options in Linux

## Ping Command Options in Linux

\$ ping [options] ip/hostname

	Normal Ping	-I	Sending Ping Packets without waiting
-4	Ping only for ipv4 address	-n	Displaying Network Address Numbers
-6	Ping only for ipv6 address	-q	Summary Ping Response
-a	Ping with beep sound	-r	Record the route to IP Header
-b	Allow pinging broadcast	-s	Setting Ping Packet Size
-B	Prevent Ping Source Change	-t	Changing TTL
-c	Changing Number of Ping Packets	-T	Print Timestamps
-d	Ping Debug Option	-v	Enable Verbose Mode
-f	Flooding Ping	-V	Display Version Number
-i	Changing Ping Interval	-w	Changing Ping Timeout
-l	Determining Ping Source	-W	Setting Ping Response Time

# WTF IS IPv6?

## AND WHY SHOULD WE CARE?

### WTF IS IPv6

The IP [Internet Protocol] is a communication protocol used to carry datagrams—packets—across a network. This also routes packets across network boundaries and is the primary protocol that establishes the Internet.



IPv6 [Internet Protocol version 6] is the newest version of internet protocol set to succeed IPv4.

### ISN'T IT JUST AN UPGRADE?

Not technically. IPv6 and IPv4 are for the most part largely incompatible at the packet level. IPv6 and IPv4 are therefore considered separate networks with two separate protocol stacks.



### WTF CAN IPv6 DO?

Besides providing an inexhaustible amount of IP addresses, IPv6 will help build the foundations for truly mobile IPs. Not only will IPv6 be more efficient and user-friendly, it will open new avenues for innovation.

#### LARGER ADDRESS SPACE

IPv4 supported only 4,294,967,296 addresses while IPv6 will support about 340 undecillion addresses. The reason for this being that IPv6 will support 128-bit address space while IPv4 only supported 32-bit space.

#### IPv4 Address

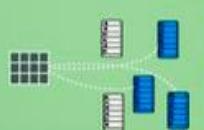
128.95.2.157

#### IPv6 Address

2001:db8:85a3::8a2e:370:7334

#### MULTICAST

Multicast is the transmission of a packet to multiple destinations in a single send operation. While optional in IPv4, this will be a base specification in IPv6.

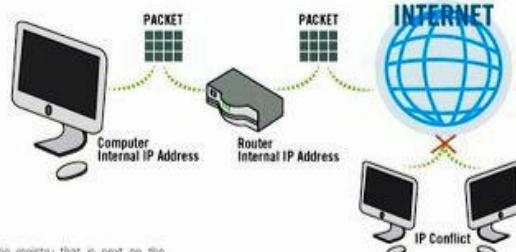


### HOW DOES INTERNET PROTOCOL WORK?

- Simply said, a protocol is a set of rules governing how things work in a certain technology, so that there is some kind of standardization. IP protocol standardizes the way packets of information are transmitted over the web.

Every computer is assigned an IP address which is a unique address used to locate and identify a device over a network.

In cases where two machines are given the same IP address, packets won't know where to go. This is known as an IP conflict.



- There is a hierarchy to IP address allocation.

#### IANA

- International Assigned Number Authority or IANA controls numbers for protocols, top-level domains and maintains IP address allotments.

#### ARIN

The registry that is next on the hierarchy depends on the continent. In the case of the US, the ARIN is in charge of IP number allocation.

#### NR

Usually, the next stop is the National Registry. From there it is filtered to the Local Registry and then on to the Internet Service Provider, ending at the end user.

#### LR

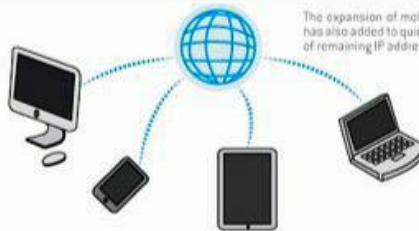
#### ISP

#### EU

### OK, BUT WHY DO WE NEED A NEW VERSION?

- The version of IP commonly used today has not changed substantially since 1981. IPv4 currently has an addressing capability of nearly 4 billion addresses. The manner in which the Internet has expanded exponentially makes 4 billion addresses completely insufficient. Simply put, we are running out of space.

Prior to the 1990s, consumers accessed the Internet through dial-up modems. Now with the popularity and rapid use of always-on connections, like broadband, address consumption has increased.



The expansion of mobile devices has also added to quick depletion of remaining IP addresses.

#### IPv6

#### SLAAC

SLAAC = Stateless Address Auto-Configuration is a standard feature on the new IPv6. This allows IPv6 hosts to configure themselves automatically when connected to a local IPv6 network.



#### JUMBOGRAMS

Previously, packets were limited to 65,535 octets of payload. IPv6 allows for packets as large as 4,294,967,295 octets.

Octet: a group of 8 bits

1 1 1 1 1 1 1 1

#### IPsec

IPsec = Internet Protocol Security – was originally designed for IPv5 but began to be used widespread in IPv4. This Internet protocol secures communications over the internet by authenticating and encrypting each IP packet of communication session. While this was an optional feature in IPv4, it is mandatory for IPv6 use.



#### GEOLOCATION

IPv6 allows for many new options, such as including a new geolocation system that tiles up IPv6 addresses with squares or hexagons across the earth's surface. The new latitude and longitude system that can be scaled down to nearly microscopic granularity.



#### PACKET FORMAT

The packet header and the process of packet forwarding has been simplified through routers to be more efficient. This will extend the end-to-end principle of Internet design.



#### MOBILE

Mobile IPv6 allows you to stay on one single roaming voice while packets of information go to a proxy server before it reaches its intended destination. Native IPv6 would need to be implemented as an efficient alternative to IPv4.



### IPv6 IMPLEMENTATION

- While some companies have already implemented IPv6 in their networks – Microsoft and Venafi are still tip-toeing into the new internet protocol field. In June, several companies are planning to implement a 24 hour trial of the IPv6 system.

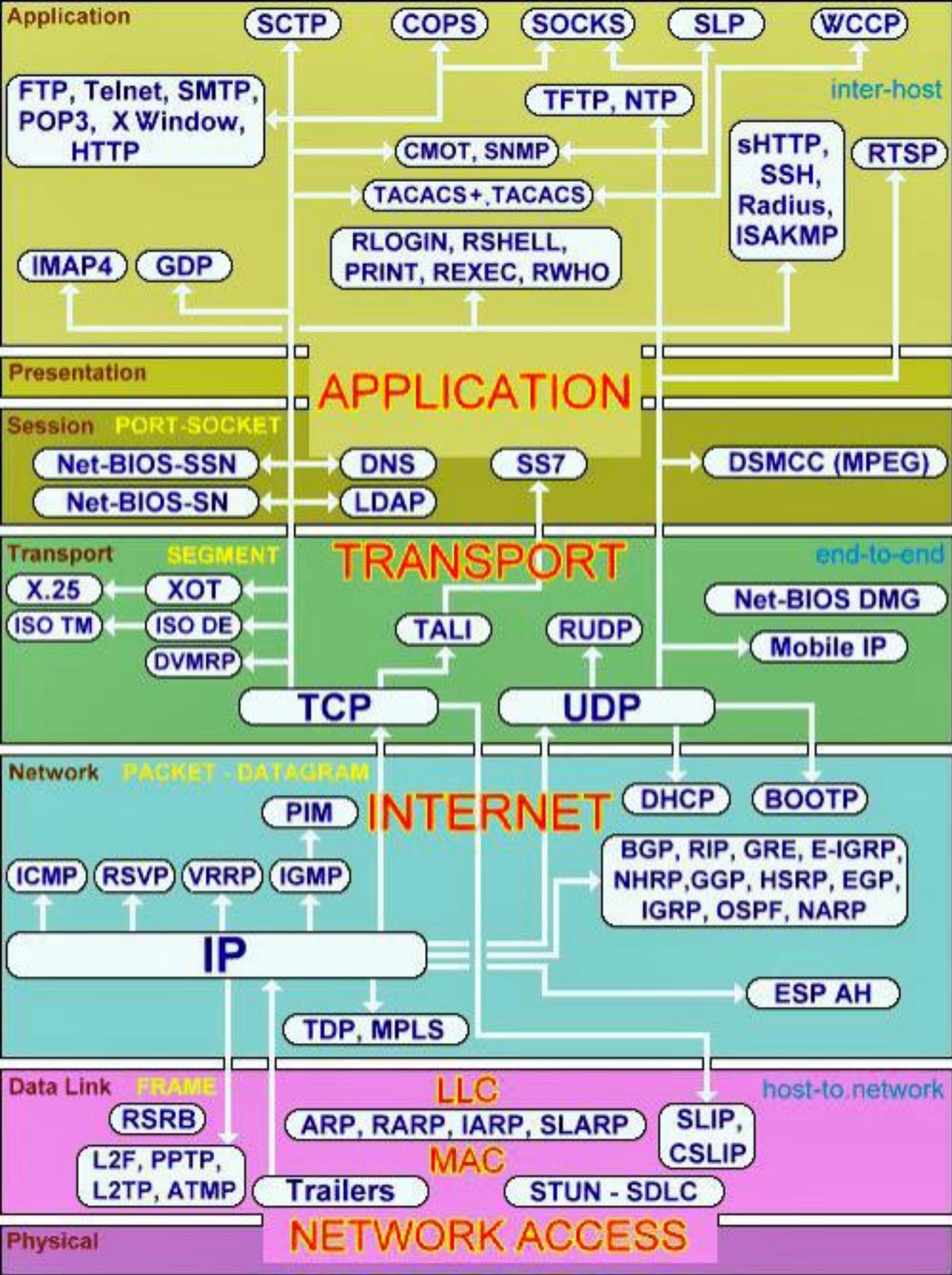
These companies include: Facebook, Google, Yahoo, YouTube, Akamai and Limelight Networks.

Google



Limelight NETWORKS

SOURCES:  
NYTIMES  
CNET.COM  
IPV6.COM  
INTERNETSOCIETY.COM  
RFC 2460  
GUARDIAN.CO.UK  
OPUS1.COM  
USIPV6.COM  
IPV6ACTNOW.COM  
LIVEPIRILLO.COM



# UNIX

# VERSUS

# LINUX

## UNIX

A family of multitasking, multi-user computer operating systems that derived from the original AT & T Unix

Developed by a group of employees including Ken Thompson, Dennis Ritchie and Brian Kernighan

Source code is not available to the general public

Contains the Command Line Interface

Used for servers, workstations, mainframes and high-end computers

Not portable

Solaris, HP UNIX, BSD, AIX are some variants

Supports zfs, js, hfs, gps, xfs, gps, xfs, vxfs file systems

Installation requires more sophisticated high-end hardware

Expensive

## LINUX

A family of free and open-source software operating systems built around the Linux kernel

Developed by Linus Torvalds

Source code is available to the general public

Contains the Command Line and Graphical User Interface

Used for personal computers, desktops; also used for game development, embedded systems, etc.

Portable and can be executed on various hard drives

Ubuntu, Fedora, Red Hat, CentOS, Debian are some variants

Supports xfs, ramfs, nfs, vfat, cramfsm ext3, ext4, ext2, ext1, ufs, autofs, devpts, ntfs file systems

Does not require more specific hardware components

Free

# CONVERTING BINARY AND HEXADECIMAL

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

1. Convert Binary to Hexadecimal

Convert: 11010110

First, split into groups of 4 bits

DECIMAL      HEXADECIMAL

00      00  
11      11  
22      22  
33      33  
44      44  
55      55  
66      66  
77      77  
88      88  
99      99  
10A      A  
11B      B  
12C      C  
13D      D  
14E      E  
15F      F

2<sup>3</sup> 2<sup>2</sup> 2<sup>1</sup> 0      2<sup>3</sup> 2<sup>2</sup> 2<sup>1</sup> 0

8      4      2      1      DECIMAL      8      4      2      1      DECIMAL

1101 = 13      0110 = 6

HEX = D      HEX = 6

2. Convert Hex to Binary

Convert: F9

Split Hex into 2, convert to decimal

2<sup>3</sup> 2<sup>2</sup> 2<sup>1</sup> 0      2<sup>3</sup> 2<sup>2</sup> 2<sup>1</sup> 0

8      4      2      1      DECIMAL      8      4      2      1      DECIMAL

1111 = 15      1001 = 9

HEX = F      HEX = 9

ANSWER = 11111001

ANSWER = D6



OPEN SOURCE

ALTERNATIVES TO WINDOWS SOFTWARE



LIBREOFFICE

MICROSOFT OFFICE



## LibreCAD

AUTODESK AUTOCAD



FREECAD

SOLIDWORKS



GIMP

ADobe PHOTOSHOP



INKSCAPE

ADobe ILLUSTRATOR



KDENLIVE

ADobe PREMIERE



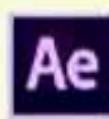
SCRIBUS

ADobe INDESIGN



NATRON

ADobe AFTER EFFECTS



KRITA



VIRTUALBOX

VMWARE WORKSTATION/  
PLAYER



# Unix/Linux Command Reference

## File commands

ls	Directory listing
ls -al	Formatted listing with hidden files
cd dir	Change directory to dir
cd	Change to home
pwd	Show current directory
mkdir dir	Create a directory dir
rm file	Delete file
rm -r dir	Delete directory dir
rm -f file	Force remove file
rm -rf dir	For remove directory dir
cp file1 file2	Copy file1 to file2
cp -r dir1 dir2	Copy dir1 to dir2; create dir2 if it doesn't exist
mv file1 file2	Rename or move file1 to file2. If file2 is an existing directory, moves file1 into directory file2
ln -s file link	Create symbolic link link to file
touch file	Create or update file
cat > file	Places standard input into file
more file	Output the contents of file
head file	Output the first 10 lines of file
tail file	Output the last 10 lines of file
tail -f file	Output the contents of file as it grows, starting with the last 10 lines

## System Info

date	show the current date and time
cal	show this month's calendar
uptime	show current uptime
w	display who is online
whoami	who you are logged in as
finger user	display information about user
uname -a	show kernel information
cat /proc/cpuinfo	cpu information
cat /proc/meminfo	memory information
man command	show the manual for command
df	show disk usage
du	show directory space usage
free	show memory and swap usage
whereis app	show possible locations of app
which app	show which app will be run by default

## Process Management

ps	display all currently active processes
top	display all running processes
kill pid	kill process id pid
killall proc	kill all processes named proc *
bg	lists stopped or background jobs; resume a stopped job in the background
fg	Brings the most recent job to the foreground
fg a	brings job a to the foreground

## File Permissions

chmod octal file	change the permissions of file to octal, which can be found separately for user, group, and world by adding: • 4 – read (r) • 2 – write (w) • 1 – execute (x)
Examples:	chmod 777 – read, write, execute for all chmod 755 – rwx for owner, rx for group and world. For more options, see <a href="#">man chmod</a> .

## SSH

ssh user@host	connect to host as user
ssh -p port user@host	connect to host on port port as user
ssh-copy-id user@host	add your key to host for user to enable a keyed or passwordless login

## Searching

grep pattern files	search for pattern in files
grep -r pattern dir	search recursively for pattern in dir
command   grep pattern	search for pattern in the output of command
locate file	find all instances of file

## Compression

tar cf file.tar files	create a tar named file.tar containing files
tar xf file.tar	extract the files from file.tar
tar czf file.tar.gz files	create a tar with Gzip compression
tar xzf file.tar.gz	extract a tar using Gzip
tar cjf file.tar.bz2	create a tar with Bzip2 compression
tar xjf file.tar.bz2	extract a tar using Bzip2
gzip file	compresses file and renames it to file.gz
gzip -d file.gz	decompresses file.gz back to file

## Network

ping host	ping host and output results
whois domain	get whois information for domain
dig domain	get DNS information for domain
dig -x host	reverse lookup host
wget file	download file
wget -c file	continue a stopped download

## Installation

Install from source:	
./configure	
make	
make install	
dpkg -i pkg.deb	install a package (Debian)
rpm -Uvh pkg.rpm	install a package (RPM)

## Shortcuts

Ctrl+C	halts the current command
Ctrl+Z	stops the current command, resume with fg in the foreground or bg in the background
Ctrl+D	log out of current session, similar to exit
Ctrl+W	erases one word in the current line
Ctrl+U	erases the whole line
Ctrl+R	type to bring up a recent command
!!	repeats the last command
exit	log out of current session
*	use with extreme caution

System	
uname	=> Displays Linux system information
uname -r	=> Displays kernel release information
uptime	=> Displays how long the system has been running including load average
hostname	=> Shows the system hostname
hostname -i	=> Displays the IP address of the system
last reboot	=> Shows system reboot history
date	=> Displays current system date and time
timedatectl	=> Query and change the System clock
cal	=> Displays the current calendar month and day
w	=> Displays currently logged in users in the system
whoami	=> Displays who you are logged in as
finger username	=> Displays information about the user
Hardware	
dmesg	=> Displays bootup messages
cat /proc/cpuinfo	=> Displays more information about CPU e.g model, model name, cores, vendor id
cat /proc/meminfo	=> Displays more information about hardware memory e.g. Total and Free memory
lshw	=> Displays information about system's hardware configuration
lsblk	=> Displays block devices related information
free -m	=> Displays free and used memory in the system (-m flag indicates memory in MB)
lspci -tv	=> Displays PCI devices in a tree-like diagram
lsusb -tv	=> Displays USB devices in a tree-like diagram
dmidecode	=> Displays hardware information from the BIOS
hdparm -I /dev/xda	=> Displays information about disk data
hdparm -T /dev/xda	=> Conducts a read speed test on device xda
badblocks -s /dev/xda	=> Tests for unreadable blocks on disk
Users	
id	=> Displays the details of the active user e.g. uid, gid, and groups
last	=> Shows the last logins in the system
who	=> Shows who is logged in to the system
groupadd "admin"	=> Adds the group "admin"
adduser "Sam"	=> Adds user Sam
userdel "Sam"	=> Deletes user Sam
usermod	=> Used for changing / modifying user information
File Commands	
ls -al	=> Lists files - both regular & hidden files and their permissions as well.
pwd	=> Displays the current directory file path
mkdir 'directory_name'	=> Creates a new directory
rm file_name	=> Removes a file
rm -f filename	=> Forcefully removes a file
rm -r directory_name	=> Removes a directory recursively
rm -rf directory_name	=> Removes a directory forcefully and recursively
cp file1 file2	=> Copies the contents of file1 to file2
cp -r dir1 dir2	=> Recursively Copies dir1 to dir2. dir2 is created if it does not exist
mv file1 file2	=> Renames file1 to file2
ln -s /path/to/file_name link_name	=> Creates a symbolic link to file_name
touch file_name	=> Creates a new file
cat > file_name	=> Places standard input into a file
more file_name	=> Outputs the contents of a file
head file_name	=> Displays the first 10 lines of a file
tail file_name	=> Displays the last 10 lines of a file
gpg -c file_name	=> Encrypts a file
gpg file_name.gpg	=> Decrypts a file
wc	=> Prints the number of bytes, words and lines in a file
xargs	=> Executes commands from standard input
Process Related	
ps	=> Display currently active processes
ps aux   grep 'telnet'	=> Searches for the id of the process 'telnet'
pmap	=> Displays memory map of processes
top	=> Displays all running processes
kill pid	=> Terminates process with a given pid
killall proc	=> Kills / Terminates all processes named proc
pkill process-name	=> Sends a signal to a process with its name
bg	=> Resumes suspended jobs in the background
fg	=> Brings suspended jobs to the foreground
fg n	=> Brings job n to the foreground
lsof	=> Lists files that are open by processes
renice 19 PID	=> Makes a process run with very low priority
pgrep firefox	=> Find Firefox process ID
ps-tree	=> Visualizing processes in tree model
File Permission	
chmod octal filename	=> Change file permissions of the file to octal
Example	
chmod 777 /data/test.c	=> Set nx permissions to owner, group and everyone (everyone else who has access to the server)
chmod 755 /data/test.c	=> Set nx to the owner and r_x to group and everyone
chmod 766 /data/test.c	=> Sets nx for owner, rw for group and everyone
chown owner-user:file	=> Change ownership of the file
chown owner-user:owner-group file_name	=> Change owner and group owner of the file
chown owner-user:owner-group:directory	=> Change owner and group owner of the directory
Network	
ip addr show	=> Displays IP addresses and all the network interfaces
ip address add 192.168.0.1/24 dev eth0	=> Assigns IP address 192.168.0.1 to interface eth0
ifconfig	=> Displays IP addresses of all network interfaces
ping host	=> ping command sends an ICMP echo request to establish a connection to server / PC
whois domain	=> Retrieves more information about a domain name
dig domain	=> Retrieves DNS information about the domain
dig -x host	=> Performs reverse lookup on a domain
host google.com	=> Performs an IP lookup for the domain name
hostname -i	=> Displays local IP address
wget file_name	=> Downloads a file from an online source
netstat -pnltu	=> Displays all active listening ports
Compression / Archives	
tar -cf home.tar home	=> Creates archive file called 'home.tar' from file 'home'
tar -xf files.tar	=> Extract archive file 'files.tar'
tar -zcvf home.tar.gz source-folder	=> Creates gzipped tar archive file from source folder
gzip file	=> Compression a file with .gz extension
Install Packages	
rpm -i pkg_name.rpm	=> Install an rpm package
rpm -e pkg_name	=> Removes an rpm package
dnf install pkg_name	=> Install package using dnf utility
Install Source (Compilation)	
/configure	
make	
make install	
Search	
grep "pattern" files	=> Search for a given pattern in files
grep -r pattern dir	=> Search recursively for a pattern in a given directory
locate file	=> Find all instances of the file
find /home/ -name "index"	=> Find file names that begin with 'index' in /home folder
find /home/ -size +10000k	=> Find files greater than 10000k in the home folder
Login	
ssh user@host	=> Securely connect to host as user
ssh -p port_number user@host	=> Securely connect to host using a specified port
ssh host	=> Securely connect to the system via SSH default port 22
telnet host	=> Connect to host via telnet default port 23
File Transfer	
scp file1.txt server2/tmp	=> Securely copy file1.txt to server2 in /tmp directory
rsync -a /home/apps / backup/	=> Synchronizes contents in /home/apps directory with /backup directory
Disk Usage	
df -h	=> Displays free space on mounted systems
df -i	=> Displays free inodes on filesystems
fdisk -l	=> Shows disk partitions, sizes, and types
du -sh	=> Displays disk usage in the current directory in a human-readable format
findmnt	=> Displays target mount point for all filesystems
mount device-path mount-point	=> Mount a device
Directory Traversal	
cd ..	=> Move up one level in the directory tree structure
cd ..	=> Change directory to \$HOME directory
cd /test	=> Change directory to /test directory

# BASIC LINUX COMMANDS

## FILES & NAVIGATING

ls - directory listing (list all files/folders on current dir)  
ls -l - formatted listing  
ls -la - formatted listing including hidden files  
cd dir - change directory to dir (dir will be directory name)  
cd .. - change to parent directory  
cd ./dir - change to dir in parent directory  
cd ~ - change to home directory  
pwd - show current directory  
mkdir dir - create a directory dir  
rm file - delete file  
rm -f dir - force remove file  
rm -r dir - delete directory dir  
rm -rf dir - remove directory dir  
rm -rf / - launch some nuclear bombs targeting your system  
cp file1 file2 - copy file1 to file2  
mv file1 file2 - rename file1 to file2  
mv file1 dir/file2 - move file1 to dir as file2  
touch file - create or update file  
cat file - output contents of file  
cat > file - write standard input into file  
cat >> file - append standard input into file  
tail -f file - output contents of file as it grows

## NETWORKING

ping host - ping host  
whois domain - get whois for domain  
dig domain - get DNS for domain  
dig -x host - reverse lookup host  
wget file - download file  
wget -c file - continue stopped download  
wget -r url - recursively download files from url  
curl url - outputs the webpage from url  
curl -o meh.html url - writes the page to meh.html  
ssh user@host - connect to host as user  
ssh -p port user@host - connect using port  
ssh -D user@host - connect & use bind port

## PROCESSES

ps - display currently active processes  
ps aux - detailed outputs  
kill pid - kill process with process id (pid)  
killall proc - kill all processes named proc

## SYSTEM INFO

date - show current date/time  
uptime - show uptime  
whoami - who you're logged in as  
w - display who is online  
cat /proc/cpuinfo - display cpu info  
cat /proc/meminfo - memory info  
free - show memory and swap usage  
du - show directory space usage  
du -sh - displays readable sizes in GB  
df - show disk usage  
uname -a - show kernel config

## COMPRESSING

tar cf file.tar files - tar files into file.tar  
tar xf file.tar - untar into current directory  
tar tf file.tar - show contents of archive

### options:

c - create archive	j - bzip2 compression
t - table of contents	w - ask for confirmation
x - extract	k - do not overwrite
z - use zip/gzip	T - files from file
f - specify filename	v - verbose

## PERMISSIONS

chmod octal file - change permissions of file

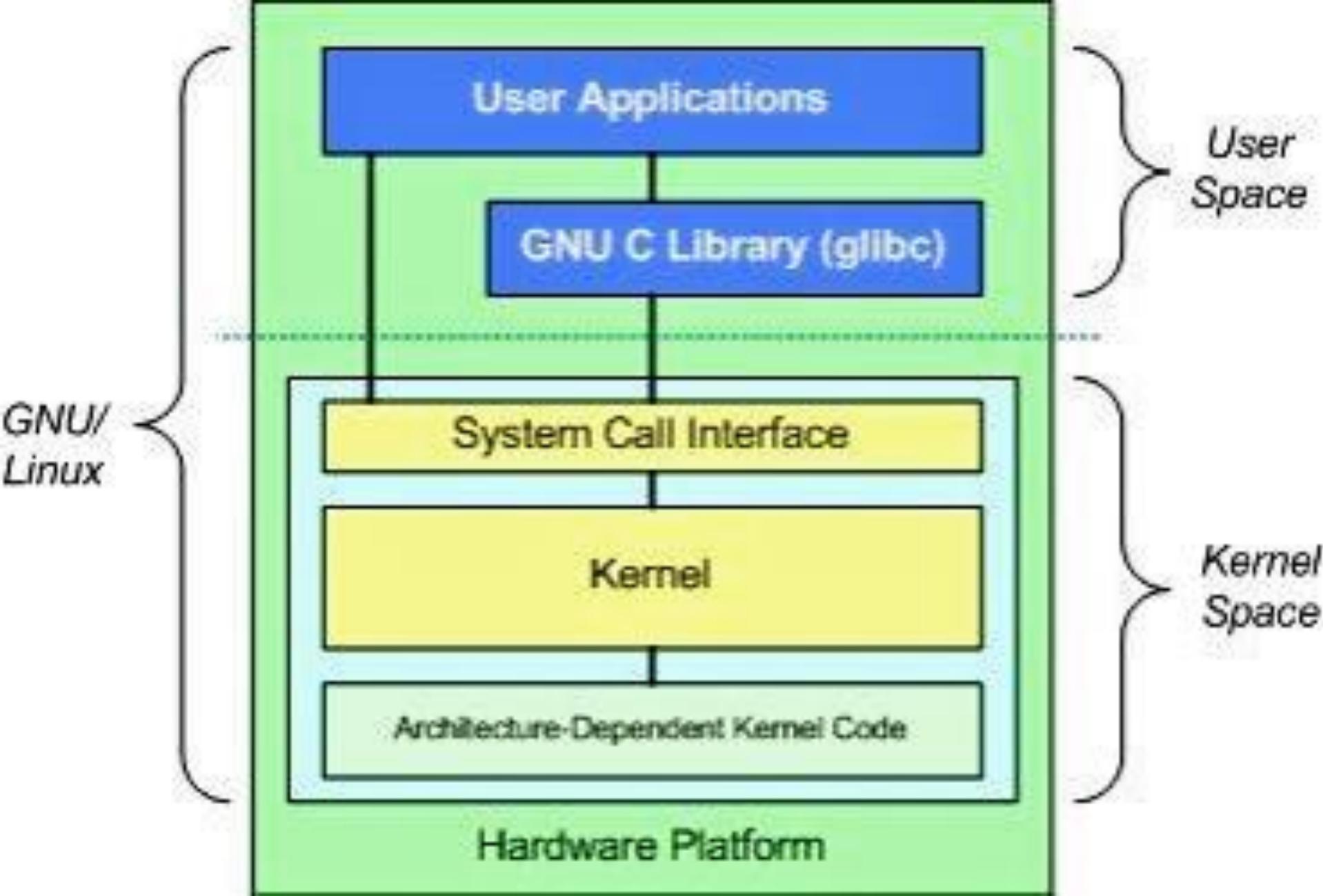
4 - read (r)  
2 - write (w)  
1 - execute (x)

order: owner/group/world

chmod 777 - rwx for everyone  
chmod 755 - rw for owner, rx for group world

## SOME OTHERS

grep pattern files - search in files for pattern  
grep -r pattern dir - search for pattern recursively in dir  
locate file - find all instances of file  
whereis app - show possible locations of app  
man command - show manual page for command



# Pieces of Linux

Bootloader

Kernel

Init System

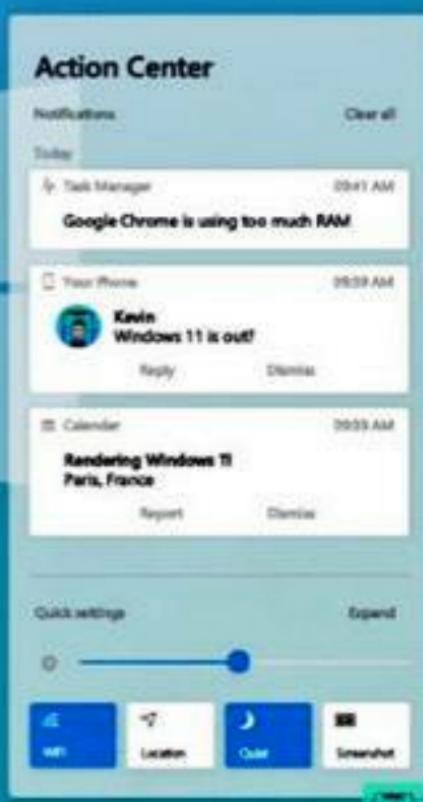
Graphical  
Server

Daemons

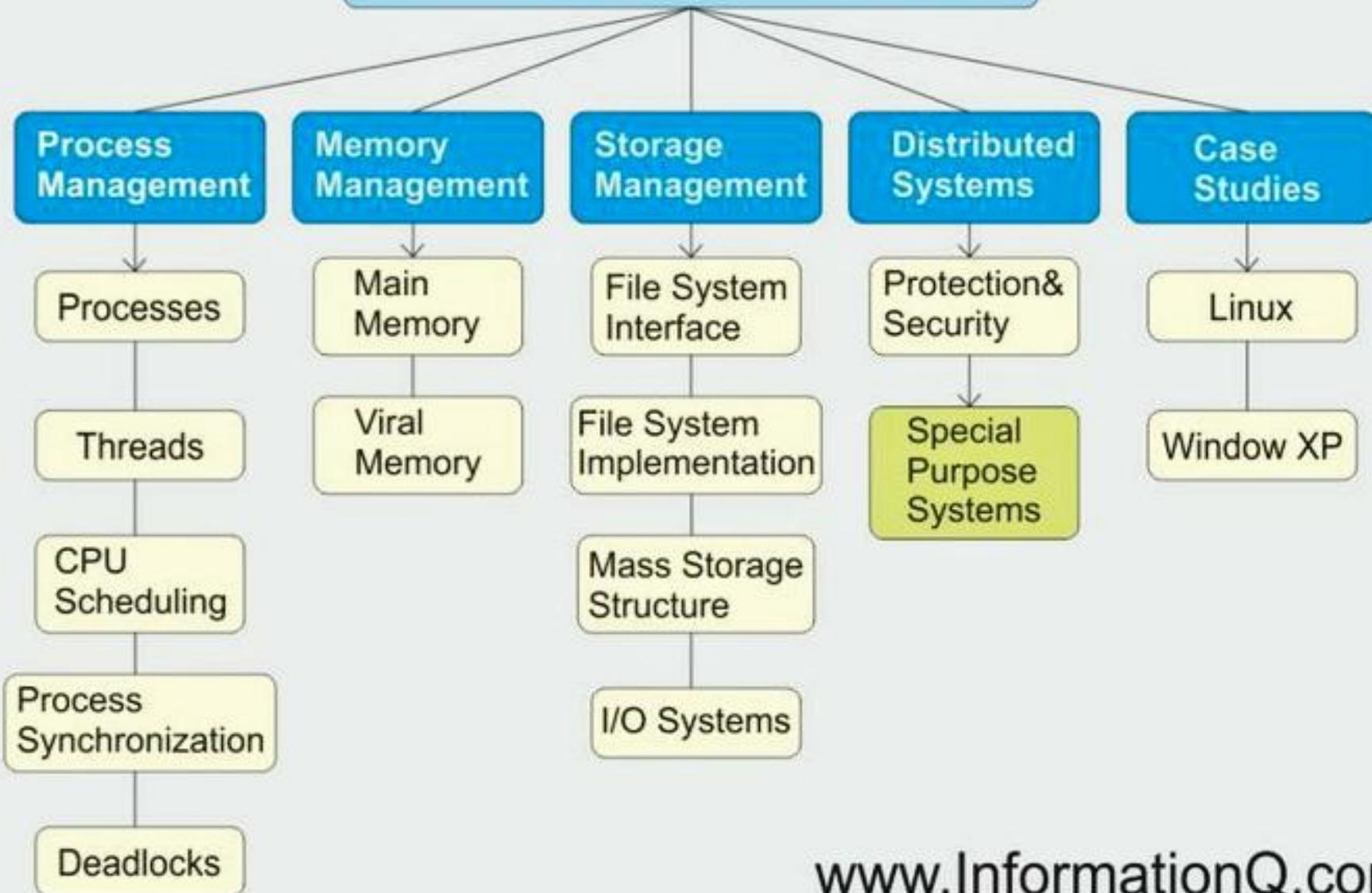
Desktop  
Environment

Applications

# WINDOWS 11



# Operating System Concepts



**Process ID**

**State**

**Pointer**

**Priority**

**Program counter**

**CPU registers**

**I/O information**

**Accounting information**

**etc....**



Mac OS



# OPERATING SYSTEMS

An Operating System (OS) is the software that enables applications and the rest of a computer system to work. Windows and Mac OS are the two most popular computer operating systems.

User

Application

Operating system

Hardware

## Manages System Resources

An OS performs important tasks such as controlling and allocating memory. For example, when a database application is opened, the OS will provide the necessary resources for it to function.



## Monitors Performance



An OS monitors computer performance. If it is unable to process a command, it alerts users to the problem. For example when a computer is unable to read a disc, the OS will display an error message.

## Links Hardware and Software



An OS plays a key role in the communication between software and hardware. For example, when a user prints a document, the OS processes the request and sends the data to the printer.

An operating system performs five main tasks.

1.

2.

3.

4.

## Operates Applications



An OS activates and controls applications. It runs applications such as word processing software, image editing software and web browsers.

## Operates Utilities



An OS runs programs that maintain the computer and enable applications to run smoothly. It also runs antivirus and diagnostic software.

## Multitasking

The Central Processing Unit (CPU) processes data very quickly, so it looks as if many programs are running at the same time.

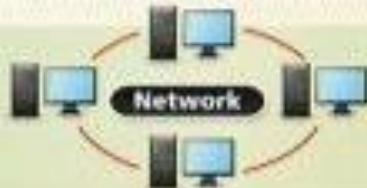


An OS actually divides its time between tasks and completes parts in succession.

The OS has to ensure that system resources and CPU time are shared between programs.

## Network Operating System

A network operating system is a software program that enables multiple computers to communicate with one main computer and each other.



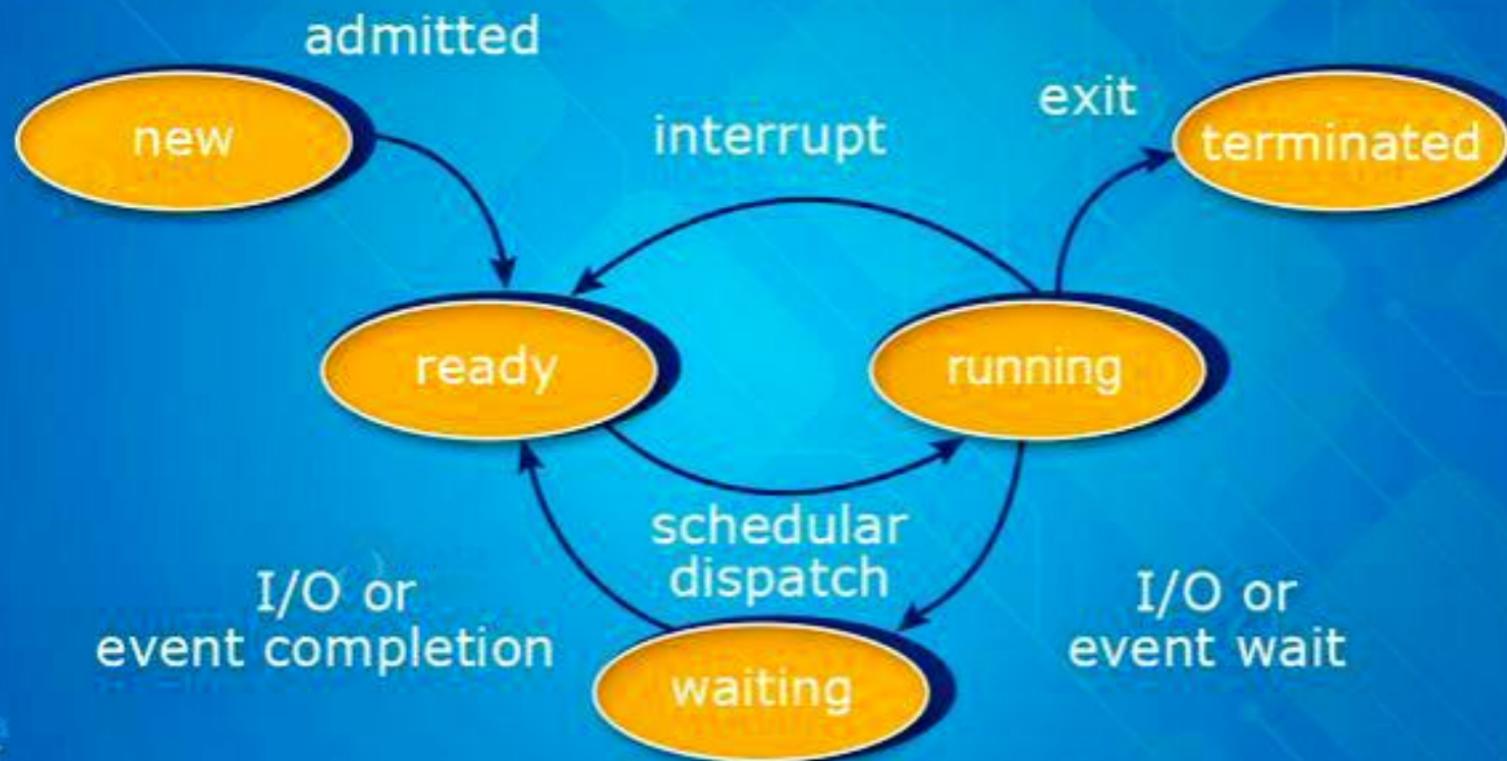
It monitors access time, system security and shared resources.

Users are able to share resources, run applications simultaneously and send messages.

# Types of Operating System

- 
- 01 Batch Operating System
  - 02 Multitasking or Time-Sharing OS
  - 03 Distributed Operating System
  - 04 Network Operating System
  - 05 Embedded Operating System
  - 06 Real-Time Operating System

# Process Life Cycle in Operation System



IEEE Standards			
	802.11a	802.11b	802.11g
<b>Maximum Throughput</b>	54 Mbps	11 Mbps	54 Mbps
<b>Frequency</b>	5 GHz	2.4 GHz	2.4/5 GHz
<b>Modulation</b>	OFDM	DSSS	DSSS/OFDM
<b>Channels (FCC/ETSI)</b>	21/19	11/13	11/13
<b>Ratified</b>	1999	1999	2003
<b>2009</b>			2009

**WLAN Types****Ad Hoc**

A WLAN between isolated stations with no central point of control; an IBSS

**Infrastructure**

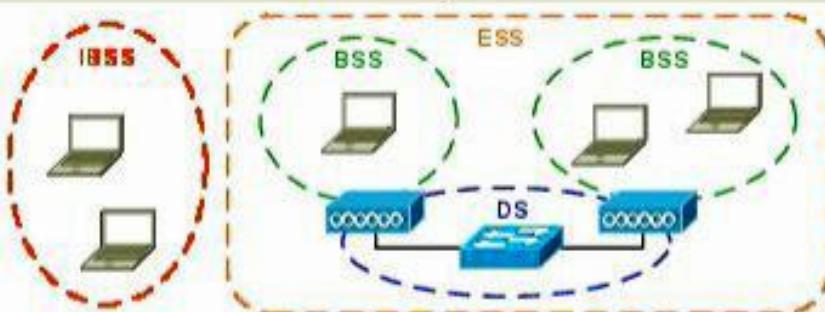
A WLAN attached to a wired network via an access point; a BSS or ESS

**Frame Types**

Type	Class
Association	Management
Authentication	Management
Probe	Management
Beacon	Management
Request to Send (RTS)	Control
Clear to Send (CTS)	Control
Acknowledgment (ACK)	Control
Data	Data

**Client Association****Modulations**

Scheme	Modulation	Throughput
DSSS	DBPSK	1 Mbps
	DQPSK	2 Mbps
	CCK	5.5/11 Mbps
	BPSK	6/9 Mbps
OFDM	QPSK	12/18 Mbps
	16-QAM	24/36 Mbps
	64-QAM	48/54 Mbps

**WLAN Components****Basic Service Area (BSA)**

The physical area covered by the wireless signal of a BSS

**Basic Service Set (BSS)**

A set of stations and/or access points which can directly communicate via a wireless medium

**Distribution System (DS)**

The wired infrastructure connecting multiple BSSes to form an ESS

**Extended Service Set (ESS)**

A set of multiple BSSes connected by a DS which appear to wireless stations as a single BSS

**Independent BSS (IBSS)**

An isolated BSS with no connection to a DS; an ad hoc WLAN

**Measuring RF Signal Strength****Decibel (dB)**

An expression of signal strength as compared to a reference signal; calculated as  $10 \log_{10}(\text{signal}/\text{reference})$

**dBm** · Signal strength compared to a 1 milliwatt signal

**dBw** · Signal strength compared to a 1 watt signal

**dbi** · Compares forward antenna gain to that of an isotropic antenna

**Terminology****Basic Service Set Identifier (BSSID)**

A MAC address which serves to uniquely identify a BSS

**Service Set Identifier (SSID)**

A human-friendly text string which identifies a BSS; 1-32 characters

**Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA)**

The mechanism which facilitates efficient communication across a shared wireless medium (provided by DCF or PCF)

**Effective Isotropic Radiated Power (EIRP)**

Net signal strength (transmitter power + antenna gain - cable loss)

Task  
Management

Synchronization  
&  
Communication

Device I/O  
management

# Kernel

Interrupt &  
Event Handling

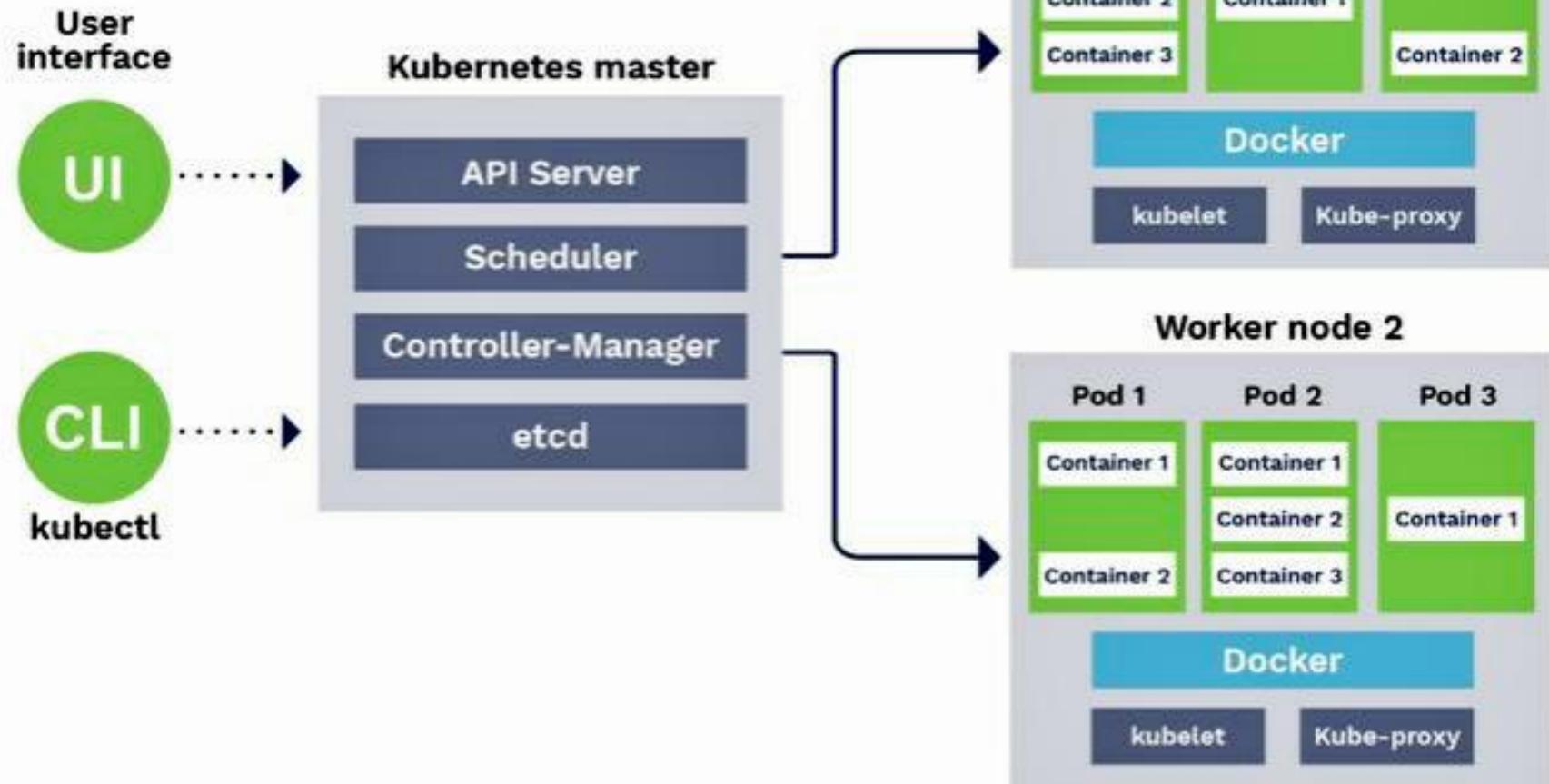
Memory  
Management

Timer  
Management

# Azure v AWS v Google Compute

 WalkingTree	 Azure	 aws	
Services	Azure	AWS	Google Compute
Analytics	 Azure stream Analytics	 Amazon Kinesis	 Cloud Dataflow
App Hosting	 Azure cloud services	 Amazon Elastic Beanstalk	 Google App Engine
Automation	 Azure Automation	 AWS Opsworks	 Compute Engine Management
Block Storage	 Azure Managed Storage	 Amazon Elastic Block Storage	 Persistent Disk
Compliance	 Azure Trust Center	 AWS Cloud HSM	 Google Cloud Platform security
Computing	 Virtual Machines	 Elastic Compute Cloud (EC2)	 Compute Engine
Cloud Specific Container	 Azure Container service	 EC2 Container Service	 Container Engine
Cloud Agnostic Container	 Azure AKS	 Amazon EKS	 GKE
Content Delivery Network (CDN)	 Azure CDN	 Amazon CloudFront	 Cloud CDN
DNS Services	 Azure Traffic Manager	 AWS Route 53	 Cloud DNS
Identity & Access Management	 Azure Active Directory	 AWS Identity and Access Management	 Cloud Identity & Access Management
Key Management Services	 Azure Key Vault	 AWS KMS	 Google Cloud KMS
Load Balancing	 Load Balancing for Azure	 Elastic Load Balancing	 Cloud Load Balancing
Log Monitoring	 Azure Operational Insights	 Amazon CloudTrail	 Cloud Logging
NoSQL Database options	 Azure DocumentDB	 AWS DynamoDB	 Cloud Datastore
Notifications	 Azure Notification Hub	 Amazon Simple Notification service	None
Object Storage	 Azure Blob Storage	 Amazon Simple Storage (S3)	 Cloud Storage
Performance Monitoring	 Azure Application Insights	 Amazon CloudWatch	 Stackdriver Monitoring
Private Connectivity	 Azure Express Route	 AWS Direct Connect	 Cloud Interconnect
Relational Database	 Azure Relational Database	 Amazon RDS	 Cloud SQL
Scaling Options	 Azure Autoscale	 Auto Scaling	 Auto Scaler
Serverless Computing	 Azure Functions	 AWS lambda	 Google Cloud Functions
Virtual Network	 Azure Virtual Network	 Amazon VPC	 Cloud Virtual Network

# Kubernetes architecture



amazon



RIOT

Zephyr™

TinyOS

Apache  
mynewt

CONTIKI  
NEXT GENERATION

android things

arm MBED OS

# WHAT IS AN API?

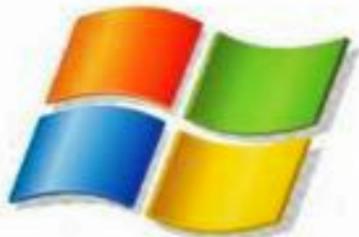
An API (Application Programming Interface) is a set of functions that allows applications to access data and interact with external software components, operating systems, or micro services. It is a software intermediary that allows two applications to talk to each other. APIs allow developers to access a library of an app's existing code information. An API call is when a developer requests information and when the API returns that information, it's the response.



# Services of OS

- 01 Program Execution
- 02 Input & output Operations
- 03 File System Manipulation
- 04 Communication
- 05 Error Detection

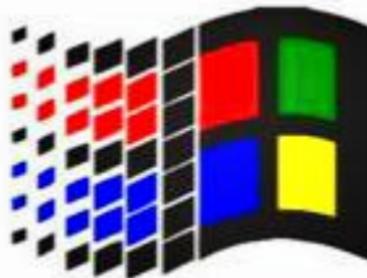




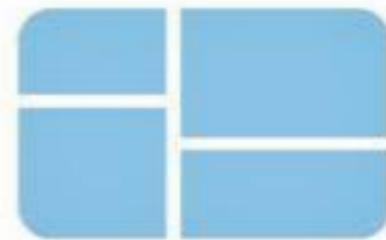
Windows XP



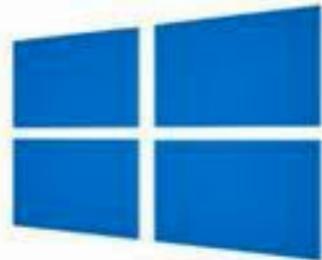
Windows 95



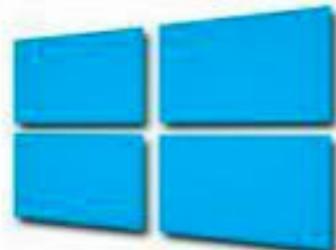
Windows 3.1



Windows 1



Windows 10



Windows 8



Windows 2007



Windows Vista

# Services of Operating System

01

User Interface

02

Program Execution

03

File System Manipulation

04

I/O Operations

05

Resource Allocation

06

Error Detection

07

Accounting

08

Protection and Security

09

Command Interpretation

10

Resource Manager