**TYPES OF OPERATING SYSTEMS**

* **SINGLE PROCESSOR SYSTEMS**

1. There is one main CPU capable of executing a general purpose instruction set, including instructions from user processes.
2. There are device specific processors such as disk, keyboard and graphics controller (graphic card); they come in the form general purpose processors such as input output processors.
3. All these are special purpose processors that runs limited instructions and do not run user processes. They are sometimes managed by operating system.

A disk controller microprocessor receives a sequence of requests from the main CPU and implements its own disk queue and scheduling algorithm.

1. In some cases, the processors are built into hardware and are low level processors. Even operating system cannot communicate with these processors. They do their jobs autonomously.

* **CLUSTERED OPERATING SYSTEM**

1. They are composed of two or more individual systems coupled together.
2. Clustering is usually used to provide high availability services; i.e. service will continue even if one or more systems in the cluster fail.
3. Clustered systems share storage and are closely linked via LAN.
4. Clustered software’s run on cluster boards.

Each node can monitor one or more of the other (over LAN).

1. If monitored machine fails, monitoring machine can take the ownership of its storage and restart the applications that were running on the failed machine.

**Types of Clustered Operating Systems with LAN**

1. ASYMMETRIC CLUSTERING

One machine is in hot standby mode while other is running applications. The hot stand by host machine does nothing but monitor the active server. If the running server fails hot stand by machine host becomes the active server.

1. SYMMETRIC CLUSTERING

Two or more hosts are running applications, and are monitoring each other.

Note: Symmetric mode is more efficient as it uses all the available hardware. It does require more than one app available to run.

**Types of Clustered Operating Systems with WAN**

1. PARALLEL CLUSTERS

They allow multiple hosts to access the same data on the shared storage, because most operating system lack support for simultaneous data access by multiple hosts.

Example: ORACLE parallel server is a Version of ORACLES database.

System must also supply access control and locking to ensure that no conflicting operations occur. This functions are known as DISTRIBUTED LOCK MANAGER.

1. CLUSTERING OVER WAN

* **HAND-HELD SYSTEMS**

They are the pocket sized computers which process information, signals, graphics, audio, video and exchanges them with another device.

Example: Smart phones, PDA’s (personal digital assistants).

Their size varies from 3 to 5 inches in height and width.

**Advantages**

1. Less cost
2. Less weight and size
3. Less heat generation
4. More reliability

**Disadvantages**

1. Less speed
2. Small size
3. Input/ output system (memory issue or less memory is available)

* **REAL TIME OPERATING SYSTEM**

1. They are used in embedded systems (large), i.e. from car engines and manufacturing robots to DVD’s and micro-wave ovens. It is defined as data processing systems in which the time interval required to process and respond to inputs is so small that it controls the environment.
2. RESPONSE TIME: time taken by the system to respond to an input and display of required updated information is called response time.
3. They are used when there are rigid time requirements on the operation of a processor or the flow of data and real time systems can be used as a control device in that application.
4. It must have:
5. Well defined constraints.
6. Fixed time constraints.

**Types of Real Time Operating System**

1. HARD REAL TIME SYSTEM:

They guarantee that critical tasks complete on time. Secondary storage is limited or missing and the data is stored in ROM. In these systems, virtual memory is almost never found.

1. SOFT REAL TIME SYSTEM:

They are less restrictive. A critical real time task gets priority over other tasks and retains priority until it completes.

Example: multi-media and virtual reality.

* **DISTRIBUTED OPERATING SYSTEM**

1. It is a collection of physically separate, possibly heterogeneous, computer systems that are networked to provide the users with access to various resources that system contains.
2. Access to shared resources increases computation speed, functionality, data availability and reliability.
3. Processors communicate with one another through various communication lines (high speed buses or telephone lines).
4. They are also called loosely coupled systems.
5. They depend on network for their functionality.
6. Networks may vary by the protocols used, distance between the nodes and transport media (TCP/ IP).
7. Networks are characterised on the basis of the distance between their nodes like WAN (Wide Access Network), LAN (Local Access Network), MAN (Metropolitan Access Network).

**Advantages**

1. Speed up the exchange of data with one another via e-mail.
2. Better service to customers.
3. Reduction of the load on host computer
4. Reduction of delays in data processing.
5. If one side fails in a distributed system, the remaining sites will continue to operate.
6. Increased reliability, availability and functionality of the system.

* **MAIN FRAME OPERATING SYSTEM**

They tackle many commercial and scientific applications.

**Types of Main Frame Operating System**

1. BATCH SYSTEMS
2. User of this system do not interact with computer directly.
3. Each user prepares his job on an offline device like postcards and submit it to the computer operator.
4. To speed up processing, jobs with similar needs are batched together and run as a group.

**Disadvantages**

1. Lack of interaction between user and job.
2. CPU is often idle, because of speed of input/ output devices is slower than CPU.
3. Difficult to provide desired functionality.
4. TIME SHARING
5. CPU executes multiple jobs by switching among them, but the switches occur so frequently that the users can interact with each program while it is running. This system provides immediate results.
6. Allows many users to share computers simultaneously. It uses both CPU scheduling and multi-programming to provide each user with small portion of time sharing computer.

**Advantages**

1. Quick response.
2. Avoid duplication of software.
3. Reduce CPU idle time.

**Disadvantages**

1. Data communication problem.
2. Reliability.
3. Question of security and integrity of user programs and data.
4. MULTI PROGRAMMING
5. Operating system keeps several jobs in memory simultaneously. This set of jobs is a subset of jobs kept in job pool since the number of jobs then can be kept simultaneously in memory is usually much smaller than the number of jobs that can be in the job pool. In the meantime, operating system picks and begins to execute one of the jobs in memory.
6. It is the first instance where the operating system must make decisions for the users.
7. It increases CPU utilization by organising jobs so that CPU always has one to execute.
8. Multiple jobs running concurrently require that their ability to affect one another be limited in all phases of operating system, including process scheduling, disk storage and memory management.

* **DESKTOP SYSTEM**

1. They are the personal computers.
2. These are designed for regular use at single location.
3. These systems opt for maximising user convenience and responsiveness.

Example: Microsoft Windows, Apple, Macintosh.

**Advantages**

1. Development of operating system for main frames.
2. Hardware’s cost for micro-computers are sufficiently low.
3. CPU utilization is no longer a prime concern.
4. File protection was the major concern for PC’s as the exchange/ access of files between computers made it easy for malicious programs to destroy data on PC’s. this malicious data is called VIRUS.

* **MULTI-PROCESSOR SYSTEMS**

They are also known as parallel systems or tightly coupled systems.

**Advantages**

1. Increased Throughput

Throughput: the speed up ratio with ‘N’ processors is not N, however; rather, it is less than N. when multiple processors co-operate on a task, a certain amount of overhead is incurred in keeping all the parts working correctly.

This overhead, plus contention for shared resources, lowers the expected gain from additional processors.

1. Economy of Scale

Multi-processor systems cost less than multiple single processor systems, because they can share peripherals, storage and power supply. If several programs operate on the same data, it is cheaper to store those data on one disk and to have all the processors share them, then to have many computers with local disks and many copies of same data.

1. Increased Reliability

If functions are distributed properly among several processes, then the failure of one processor will not halt the system, only slow it down.

Example: if there are10 total processes out of which 1 fails then only 9 left. Therefore, the system gets slower by 10%.

GRACEFUL DEGRADATION: The ability to provide service proportional to the level of surviving hardware is called graceful degradation.

FAULT TOLERANT: Systems that go beyond graceful degradation are fault tolerant, because they can suffer a failure of any single component and still continue operation. Note that fault tolerance requires a mechanism to allow the failure to be detected, diagnosed, and, if possible, corrected.

**Types of Multi-Processor Systems**

1. ASYMMETRIC SYSTEM

Each processor is assigned a specific task. This scheme follows master slave relationship. Master processors schedules and allocates work to slave processors.

1. SYMMETRIC SYSTEM (SMP)

Each processor performs all tasks within operating system. It means all processors are pears; no master slave relationship exists between processors.

Example: Solaris, a commercial version of UNIX.

CPU

CPU

CPU

MEMORY

The benefit of this model is that many processes can run simultaneously i.e. N processes can run if there are N CPU’s without causing significant deterioration of performance. It will allow processes and resources such as memory to be shared dynamically among the various processes. All modern operating systems including Windows, MAC and LINUX, now provide support for SMP.

Therefore: The difference between asymmetric and SMP may result from either hardware or software.

Example: SUN’s operating system SunOS Version 4 provided asymmetric multi-processing, whereas Version 5 is symmetric on some hardware.

CORE’s: These are the multi-processor chips that includes multiple cores on a single chip.

BLADE SERVERS: They are multi-processor boards, I/O boards and networking boards are placed in the same chassis. The difference between this system and traditional system is that each blade processor board boots independently and runs its own operating system. Some blade server boards are multi-processor as well.