SOMAIYA
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Multiprocessing enhances system performance by allowing multiple processors to handle task separately. It is critical for efficiently managing large and complex workloads.

The Different types are:

i) Symmetric Multiprocessing
ii) Asymmetric Multiprocessing
iii) Massively parallel Multiprocessing.
iv) Non - Uniform Memory access
v) Clustered Multiprocessing

lets understand this further below as follows:

Symmetric Multiprocessing:

widely used architecture where two or more identical processors share memory and I/O Devices.

Advantages:

All CPU's in SMP are connected via a shared memory bus with cache coherance protocols ensuring consistency accross processors. Additional processors can be added to boost performance.

Challenges:

Resource utilisation is inefficient as slave processors may remain idle while waiting for the master, if master crashes the system stops functioning.
It is used in embedded systems ~~where~~ like signal processing devices where specific tasks are assigned to dedicated processors.

2) Massively parallel processing

Used for large scale computations involving hundreds of thousands of processors of its own memory connected via high speed network.

Architecture:

Each processor has its own memory and runs its own operating system communicating through message passing, it is highly scalable.

Advantages

Highly scalable and fault tolerant as each processor operates independently, ideal for large datasets and complex computations.

~~Application~~: **challenges**

Requires special parallel programming techniques and communication between processors can introduce latency.

Application:

Widely used in high performance computing environment such as scientific simulations, weather ~~forec~~ forecasts etc.

~~3) Non-Uniform Memory acc~~

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3) Non Uniform memory access

Memory is divided into regions and each region has faster access to its local memory compared to remote memory.

Architecture:

It is grouped into nodes and processors have quick access to ~~tocal~~ local nodes memory. Access to memory in other nodes is slower. Uses Intel Quickpath Interconnect (QPI) to ~~tile~~ link processors and memory.

Advantages.

Improves performance by reducing memory contention and keeping data close to processors ~~along~~ using it. More scalability is possible.

Challenges.

Requires careful memory management and applications must be NUMA - aware to optimize performance. Performance can vary depending on how memory is allocated and accessed.

Application:

Used in Enterprise servers, large scale databases and systems where memory access patterns can be optimize for performance.

4) ~~Asymmetric~~ Clustered Multiprocessing:

Involves connecting multiple independent systems into a single cluster. Each node operates independently but shares workload across the cluster with a very high speed network.

Architecture:

Each node has its own processor memory and OS. Nodes communicate through high speed network with cluster management can x made using commodity hardware.

Advantage:

Provide redundancy ensuring that if one fails, others can take over the workload. They are scalable with additional nodes increasing system capacity.

Challenges:

~~Managi~~ Managing cluster is complex, requiring specialised software to handle task Distribution and fault tolerance Network bottleneck ~~and~~ can limit performance.

Application: used in Data centres, scientific research.

Conclusion: Multiprocessing is crucial in modern computing each different configuration has its own set of advantage disadvantage and application.
Understanding configurations help us understand balance of system performance scalability cost and ~~ma~~ meeting demands of diverse computing ~~netwo~~ environments.