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An Introduction to Cloud Computing

What is Cloud Computing?
Cloud computing is an umbrella term used to refer to Internet based development and services. The cloud is a metaphor for the Internet. A number of characteristics define cloud data, applications services and infrastructure:

- Remotely hosted: Services or data are hosted on someone else's infrastructure.
- Ubiquitous: Services or data are available from anywhere.
- Commodified: The result is a utility computing model similar to traditional that of traditional utilities, like gas and electricity. You pay for what you would like.

Software as a Service (SaaS)
SaaS is a model of software deployment where an application is hosted as a service provided to customers across the Internet. SaaS is generally used to refer to business software rather than consumer software, which falls under Web 2.0. By removing the need to install and run an application on a user's own computer it is seen as a way for businesses to get the same benefits as commercial software with smaller cost outlay. Saas also alleviates the burden of software maintenance and support but users relinquish control over software versions and requirements. The other terms that are used in this sphere include *Platform as a Service* (PaaS) and *Infrastructure as a Service* (IaaS).

Cloud Storage

Several large Web companies (such as Amazon and Google) are now exploiting the fact that they have data storage capacity which can be hired out to others. This approach, known as 'cloud storage' allows data stored remotely to be temporarily cached on desktop computers, mobile phones or other Internet-linked devices. Amazon's Elastic Compute Cloud (EC^2) and Simple Storage Solution (S3) are well known examples.

Data Cloud

Cloud Services can also be used to hold structured data. There has been some discussion of this being a potentially useful notion possibly aligned with the Semantic Web , though concerns, such as this resulting in data becoming undifferentiated , have been raised.

Opportunities and Challenges
The use of the cloud provides a number of opportunities:

- It enables services to be used without any understanding of their infrastructure.
- Cloud computing works using economies of scale. It lowers the outlay expense for start up companies, as they would no longer need to buy their own software or servers. Cost would be by on-demand pricing. Vendors and Service providers claim costs by establishing an ongoing revenue stream.
- Data and services are stored remotely but accessible from 'anywhere'.

In parallel there has been backlash against cloud computing:

- Use of cloud computing means dependence on others and that could possibly limit flexibility and innovation. The 'others' are likely become the bigger Internet companies like Google and IBM who may monopolise the market. Some argue that this use of supercomputers is a return to the time of mainframe computing that the PC was a reaction against.
- Security could prove to be a big issue. It is still unclear how safe outsourced data is and when using these services ownership of data is not always clear.
- There are also issues relating to policy and access. If your data is stored abroad whose FOI policy do you adhere to? What happens if the remote server goes down? How will you then access files? There have been cases of users being locked out of accounts and losing access to data.

The Future

Many of the activities loosely grouped together under cloud computing have already been happening and centralised computing activity is not a new phenomena: Grid Computing was the last research-led centralised approach. However there are concerns that the mainstream adoption of cloud computing could cause many problems for users. Whether these worries are grounded or not has yet to be seen.

-FROM V. VIJAYALAKSHMI
2/3 MCA II SEM.

PARALLEL PROCESSING

Originally, the computer has been viewed as a sequential machine. Most computer programming languages require the programmer to specify algorithms as sequence of instruction. Processor executes programs by executing machine instructions in a sequence and on at a time. Each instruction is executed in a sequence of operations (fetch instruction, fetch operands, perform operation store result.) It is observed that, at the micro operation level, multiple control signals are generated at the same time. Instruction pipelining, at least to the extent of overlapping fetch and execute operations, has been around for long time. By looking into these phenomenon's, researcher has look into the matter whether some operations can be performed in parallel or not.

As computer technology has evolved, and as the cost of computer hardware has dropped, computer designers have sought more and more opportunities for parallelism, usual to enhance performance and, in some cases, to increase availability. The taxonomy first introduced by Flynn is still the most common way of categorizing systems with parallel processing capability. Flynn proposed the following categories of computer system:

- **Single instruction, multiple data (SIMD)** system: A single machine instruction controls the simultaneous execution of a number of processing elements on a lockstep basis. Each processing element has an associated data memory, so that each instruction is executed on a different set of data by the different processors. Vector and array processors fall into this category
- **Multiple instruction, single data (MISD)** system A sequence of data is transmitted to a set of processors, each of which executes a different instruction sequence. This structure has never been implemented.
- **Multiple instruction, multiple data (MIMD)** stream: A set of processors simultaneously execute different instruction sequences on different data sets. SMPs, clusters, and NUMA systems fits into this category.

With the MIMD organization, the processors are general purpose; each is able to process all of the instructions necessary to perform the appropriate data transformation.

<u>Further MIMD can be subdivided into two main categories:</u>

- **Symmetric multiprocessor (SMP)**: In an SMP, multiple processors share a single memory or a pool of memory by means of a shared bus or other interconnection mechanism. A distinguish feature is that the memory access time to any region of memory is approximately the same for each processor.
- **Nonuniform memory access (NUMA)**: The memory access time to different regions of memory may differ for a NUMA processor.

The design issues relating to SMPs and NUMA are complex, involving issues relating to physical organization, interconnection structures, inter processor communication, operating system design, and application software techniques.

<u>Symmetric Multiprocessors:</u>A symmetric multiprocessor (SMP) can be defined as a standalone computer system with the following characteristic:

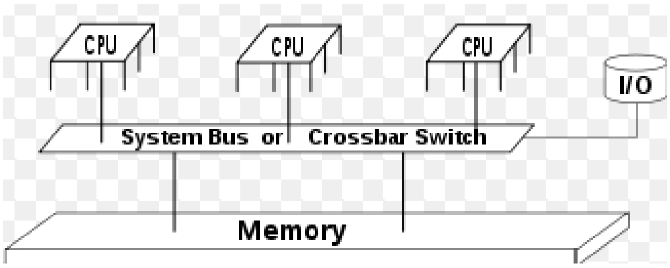
1. There are two or more similar processor of comparable capability.
2. These processors share the same main memory and facilities and are interconnected by a bus or other internal connection scheme.
3. All processors share access to devices, either through the same channels or through different channels that provide paths to the same device.

4. All processors can perform the same functions.
5. The system is controlled by an integrated operating system that provides interaction between processors and their programs at the job, task, file and data element levels.

The operating system of a SMP schedules processors or thread across all of the processors. SMP has potential advantages over uniprocessor architecture:

- Performance: A system with multiple processors will perform in a better way than one with a single processor of the same type if the task can be organized in such a manner that some portion of the work done can be done in parallel.
- Availability: Since all the processors can perform the same function in a systematic multiprocessor, the failure of a single processor does not stop the machine. Instead, the system can continue to function at reduce performance level.
- Incremental growth: A user can enhance the performance of a system by adding an additional processor.
- Sealing: Vendors can offer a range of product with different price and performance characteristics based on number of processors configured in the system.

Organization: The organization of a multiprocessor system is shown in the figure:



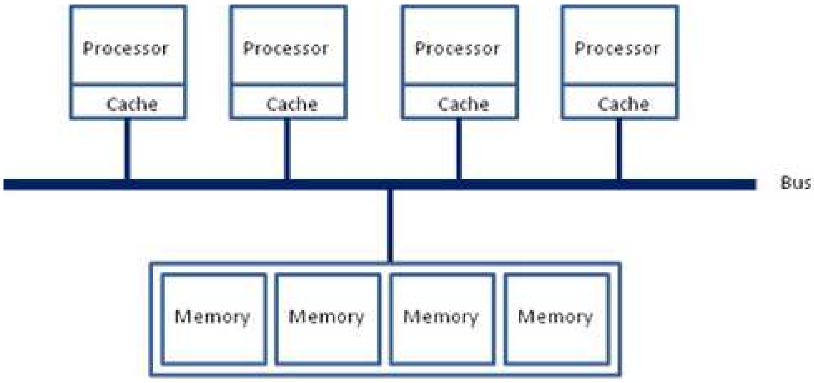
- There are two or more processors. Each processor is self sufficient, including a control unit, ALU, registers and cache.
- Each processor has access to a shared main memory and the πo devices through an interconnection network.
- The processor can communicate with each other through memory (messages and status information left in common data areas).
- It may also be possible for processors to exchange signal directly.
- The memory is often organized so that multiple simultaneous accesses to separate blocks of memory are possible.
- In some configurations each processor may also have its own private main memory and πo channels in addition to the resources.

The organization of multiprocessor system can be classified as follows:

- Time shared or common bus
- Multiport memory
- Central control unit.

Time shared Bus:

Time shared bus is the simplest mechanism for constructing a multiprocessor system. The bus consists of control, address and data lines. The block diagram is shown in the figure



The following features are provided in time-shared bus organization:

- Addressing: It must be possible to distinguish modules on the bus to determine the source and destination of data
- Arbitration: Any πo module can temporarily function as "master". A mechanism is provided to arbitrate competing request for bus control, using some sort of priority scheme.
- Time shearing: when one module is controlling the bus, other modules are locked out and if necessary suspend operation until bus access in achieved.

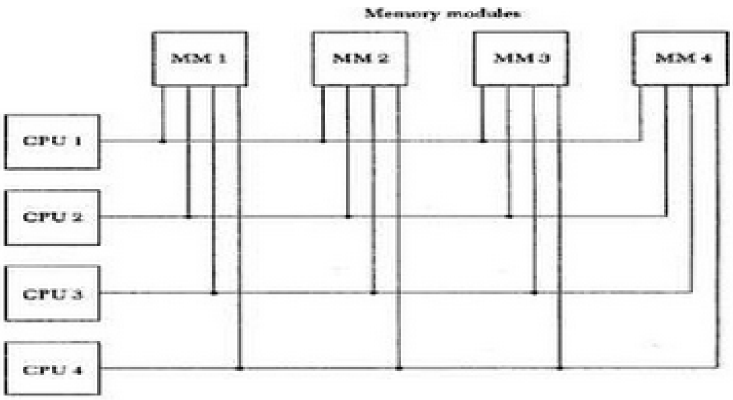
The bus organization has several advantages compared with other approaches:

- Simplicity: This is the simplest approach to multiprocessor organization. The physical interface and the addressing, arbitration and time sharing logic of each processor remain the same as in a single processor system.
- Flexibility: It is generally easy to expand the system by attaching more processor to the bus.
- Reliability: The bus is essentially a passive medium and the failure of any attached device should not cause failure of the whole system.

The main drawback to the bus organization is performance. Thus, the speed of the system is limited by the bus cycle time.

To improve performance, each processor can be equipped with local cache memory. The use of cache leads to a new problem which is known as cache coherence problem. Each local cache contains an image of a portion of main memory. If a word is altered in one cache, it may invalidate a word in another cache. To prevent this, the other processors must perform an update in its local cache.

Multiport Memory: The multiport memory approach allows the direct, independent access of main memory modules by each processor and πo module. The multiport memory system is shown in the figure

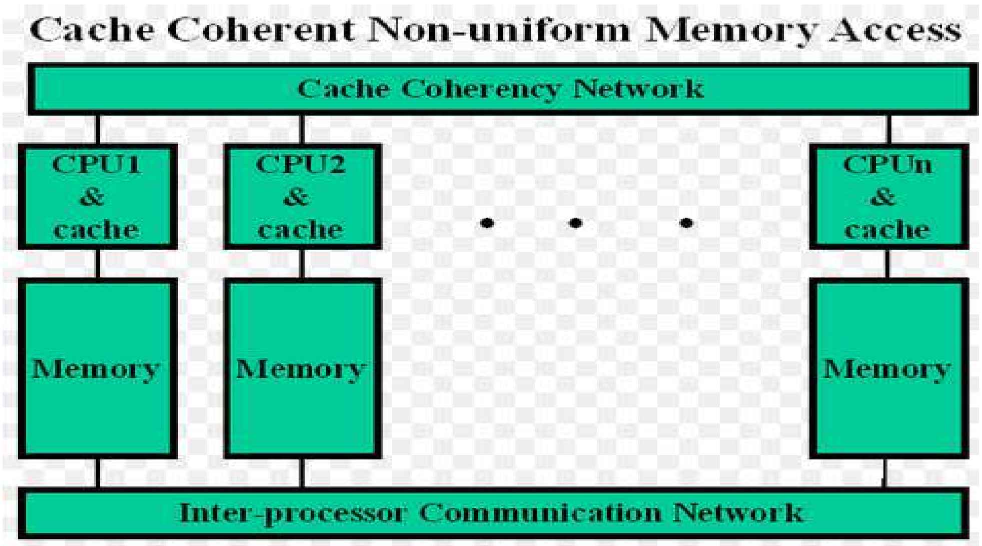


The multiport memory approach is more complex than the bus approach, requiring a fair amount of logic to be added to the memory system. Logic associated with memory is required for resolving conflict. The method often used to resolve conflicts is to assign permanently designated priorities to each memory port.

Non-uniform Memory Access(NUMA)

In NUMA architecture, all processors have access to all parts of main memory using loads and stores. The memory access time of a processor differs depending on which region of main memory is accessed. The last statement is true for all processors; however, for different processors, which memory regions are slower and which are faster differ.

A NUMA system in which cache coherence is maintained among the cache of the various processors is known as cache-cohence NUMA (CC-NUMA). A typical cc-NUMA organization is shown in the figure.



There are multiple independent nodes, each of which is, in effect, an SMP organization.Each node contains multiple processors, each with its own $L1$ and $L2$ caches, plus main memory.

The node is the basic building block of the overall CC NUMA organization. The nodes are interconnected by means of some communication facility, which could be a switching mechanism a ring, or some other networking facility. Each node in the CC-NUMA system includes some main memory. From the point of view of the processors, there is only a single addressable memory, with each location having a unique-wide address. When a processor initiates a memory access, if the requested memory location is not in the processors cache, then the $L2$ cache initiates a fetch operation. If the desired line is in the local portion of the main memory, the line is fetch across the local bus.

If the desired line is in a remote portion of the main memory, then an automatic request is send out to fetch that line across the interconnection network, deliver it to the local bus, and then deliver it to the requesting cache on that bus. All of this activity is atomic and transparent to the processors and its cache.

In this configuration, cache coherence is a control concern. For that each node must maintain some sort of directory that gives it an identification of the location of various portion of memory and also cache status information.

-FROM M. SRAVANI
2/3 MCA II SEM.

GREAT PEOPLE IN INORMATION TECHNOLOGY

Satya Nadella

Satya Nadella

Born	Satya Narayana Nadella January 6, 1967 (age 47)[1] Ananthapuram, Andhra Pradesh,India
Residence	Washington, US
Ethnicity	Indian
Citizenship	United States[5]
Education	B.E., M.S., M.B.A.
Alma mater	Manipal Institute of Technology(B.E.) University of Wisconsin–Milwaukee (M.S.) University of Chicago Booth School of Business (M.B.A.)
Occupation	CEO of Microsoft
Employer	Microsoft
Salary	$84 million (Per annum base)[6]
Religion	Hinduism
Spouse(s)	Anupama Nadella

N. R. Narayana Murthy
CBE

Born	20 August 1946 (age 68)[1] Mysore, Kingdom of Mysore(now, Karnataka), India
Alma mater	University of Mysore IIT Kanpur
Occupation	Executive Chairman, Infosys
Salary	₹1 (1.6¢ US)(per annum)[2]
Net worth	$1.8 billion (September 2014)[3]
Spouse(s)	Sudha Murthy
Children	2[4]

BUILD YOUR VOCABULORY

- FROM: V. B. MURTHY,
Assoc. Professor

1. **placate** = appease, to soothe
   use = Outraged minority groups will not be placated by promises of future improvements
2. **perturbation** = agitation, disturbance
   use = Perturbations in the orbit of the planet Uranus led to the discovery of Neptune
3. **considered** = well thought out, contemplated
   use = It is my considered opinion
4. **scenario** = plot outline, screenplay
   use = There are several possible scenarios
5. **inevitable** = Unavoidable, predestined
   use = an inevitable war
6. **hydrophobia** = fear of water
   use = *
7. **apprehend** = arrest
   use = police apprehended the thief
8. **indemnity** = insurance, compensate against loss
   use = city will indemnify all home owners
9. **facility** = skill, aptitude, ease in doing something
   use = His facility for languages is astounding
10. **malevolent** = causing evil or harm to others
    use = I could feel his malevolent gaze
11. **upshot** = result
    use = The upshot of the discussions is that
12. **incite** = foment, provoke
    use = he incited racial hatred
13. **balm** = soothing ointment, soothing, healing influence
    use = a new skin balm
14. **babble** = to talk foolishly or murmur
    use = he was just babbling
15. **rebuke** = criticize
    use = He received a stern rebuke from the manager
16. **parable** = allegory
    use = the wise man told parables
17. **anthrax** = disease
    use = anthrax virus
18. **becoming** = proper
    use = That's a most becoming dress
19. **aggrieved** = unjustly injured
    use = He felt aggrieved at not being chosen for the team
20. **dissolution** = disintegration
    use = the assembly was dissolved