Unit-V

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Session Meta Data

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Revision History

Date of Revision	Details	Version Number

Session Objectives

- ❖ Need for Multicore Processors
- ❖ Multicore Architecture
- ❖ Multicore processors Advantages and Disadvantages
- ❖ Multicore Processor Applications
- ❖ Limitations of Single core systems

MCA

- Why we need ever-increasing performance!
- Why we're building parallel systems
- Why we need to write parallel programs.

Why we need ever-increasing performance

- Computational power is increasing, but so are our computation problems and needs.

- Problems we never dreamt of have been solved because of past increases, such as decoding the human genome.

- More complex problems are still waiting to be solved.

Changing times

- From 1986 – 2002, microprocessors were speeding like a rocket, increasing in performance an average of 50% per year.
- Since then, it’s dropped to about 20% increase per year.

Why we're building parallel systems

- Up to now, performance increases have been attributable to increasing density of transistors.

- But there are inherent problems.

Limitations of Single core …

- Smaller transistors = faster processors.
- Faster processors = increased power consumption.
- Increased power consumption = increased heat.
- Increased heat = unreliable processors.

Limitations of Single core…

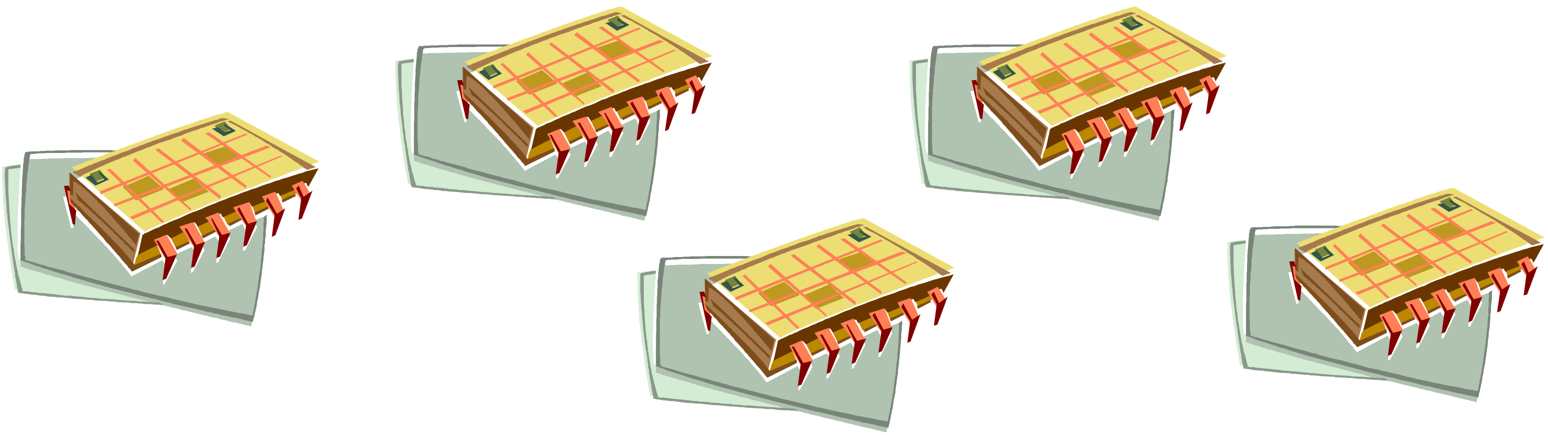
- A simple Thump rule is that
  - For every 1% rise in the clock frequency you will see 3% rise in the power consumption
  - Thus the heat dissipation also increases.
  - Leads to unreliable systems.

Why Multicores ?

- Difficult to make single core clock frequency higher
- Many new applications are multithreaded
- General trend in Computer Architecture is shift toward more parallelism

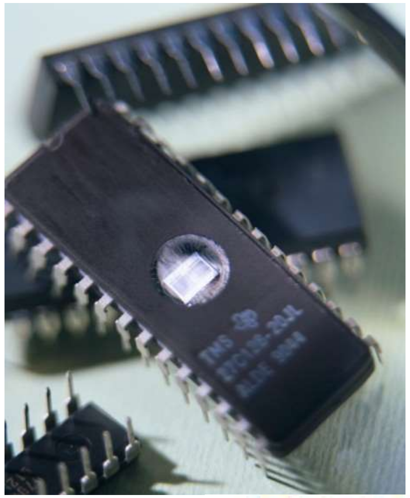
Multicore Processors

- Instead of designing and building faster microprocessors, put multiple processors on a single integrated circuit.



Multicore Processors

- Move away from single-core systems to multicore processors.
- “core” = central processing unit (CPU)
- Introducing parallelism!!!



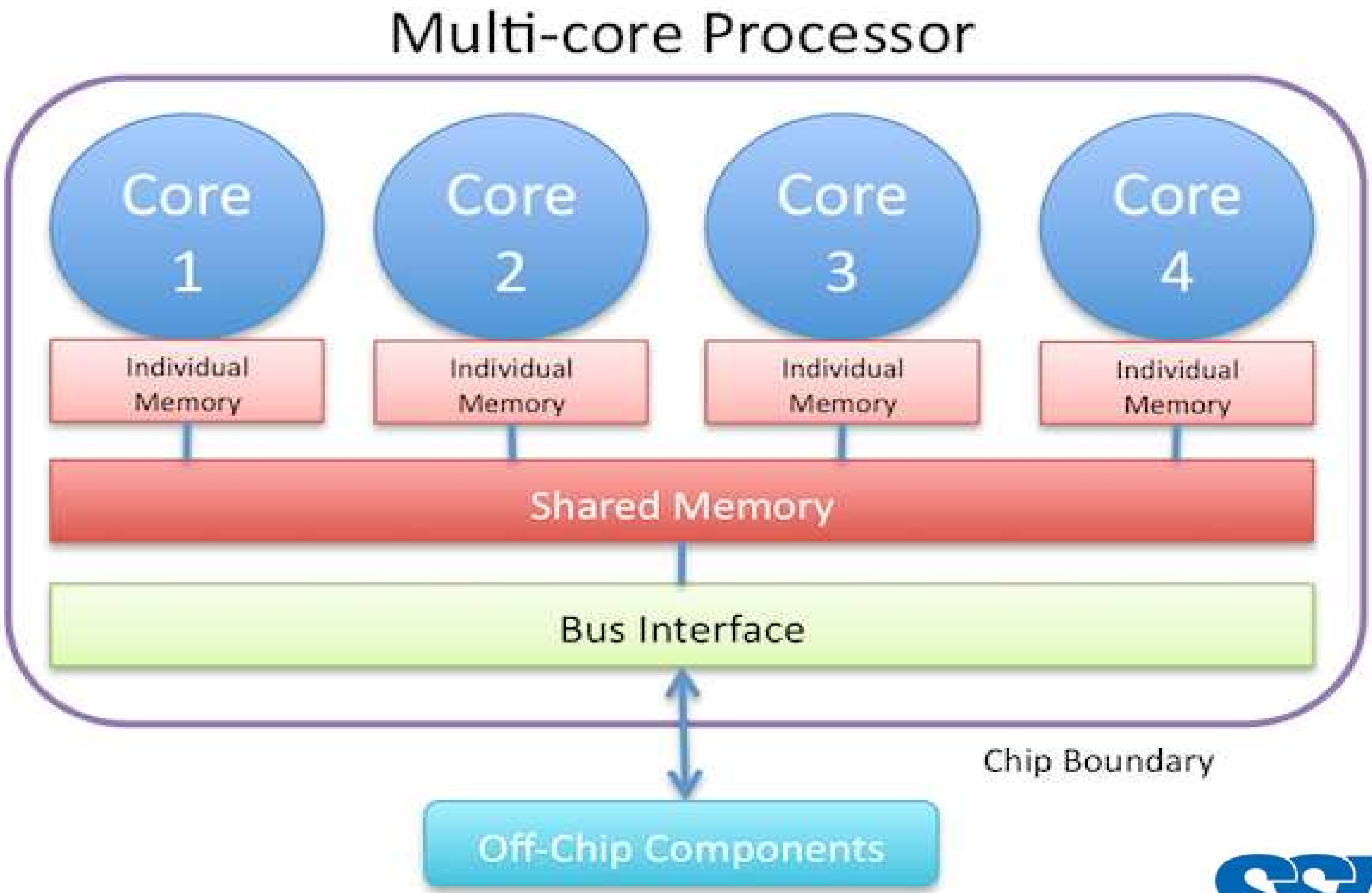
Multicore Architectures …

- Multi-core is a design in which a single physical processor contains the core logic of more than one processor.
- It's a special kind of Multiprocessor.
- All processors are on the same chip

Multicore Architectures…

- Multicore processors are MIMD
- Different cores executes different threads (Multiple Instructions) ,operates on different parts of memory(Multiple Data)
- Multicore is a Shared Memory Multiprocessors. All cores share the same memory.

Multicore Architectures…



Multicore Architectures…

- contain two or more distinct cores in the same physical package
- each core has its own execution pipeline
- each core has the resources required to run without blocking resources needed by the other software threads.
- core design enables two or more cores to run at somewhat slower speeds and at much lower temperatures

Multicore Architectures

- combined throughput of these cores delivers processing power greater than the maximum available today on single-core processors and at a much lower level of power consumption
- Ex: 16 core MIT RAW processor operates at 425 MHz can perform 100 time the number of operations per second than Intel Pentium-3 with 600MHz.

Advantages

- Occupies less space on PCB
- Higher throughput
- Consume less power
- Cache coherency can be greatly improved
- Performs more operations/sec with less frequency

Disadvantages

- Maximizing the utilization of the computing resources provided by multi-core processors requires adjustments both to the operating system (OS) support and to existing application software

- They are more difficult to manage thermally than lower-density single-chip designs

Multicore applications

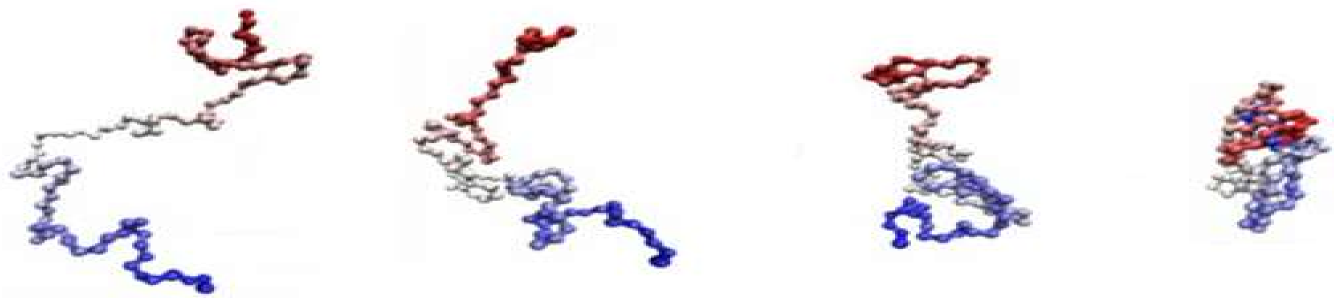
- Data base servers
- Web servers
- Compilers
- Multimedia Applications
- Scientific Applications
- General applications with TLP as opposed to ILP
- Downloading s/w while running Anti virus s/w
- Editing photo while recording TV show.

Climate modeling

- To understand climate change:
  - we need far more accurate computer models
  - models that include interactions between the atmosphere, the oceans, solid land, and the ice caps at the poles.

Protein folding

- To analyze the protein structures:
  - ability to study configurations of complex molecules such as protein
  - misfolded proteins may be involved in diseases such as Parkinson's, and Alzheimer's etc.



Drug discovery

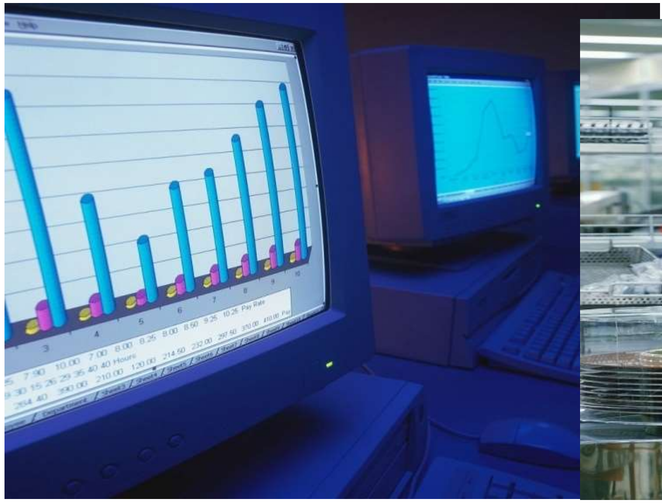
- increased computational power can be used in research into new medical treatments.
- devise alternative treatments by careful analysis of the genomes of the individuals for whom the known treatment is ineffective.

Energy Research

- Increased computational power will make it possible to program much more detailed models of technologies such as wind turbines, solar cells, and batteries.
- may provide the information needed to construct far more efficient clean energy sources

Data analysis

- The quantity of data stored worldwide doubles every two years.
- The vast majority of it is largely useless unless it's analyzed
- Ex: knowing the sequence of nucleotides in human DNA is, by itself, of little use.
- Understanding how this sequence affects development and how it can cause disease requires extensive analysis.



Multicore applications

Data base servers
•Web servers
•Compilers
•Multimedia Applications
•Scientific Applications
•General applications with TLP as opposed to ILP
–Downloading s/w while running Anti virus s/w
–Editing photo while recording TV show.

Outline

- To discuss about
  - ❖ Need for Multicore Systems
  - ❖ Multicore Architecture
  - ❖ Advantages and Disadvantages
  - ❖ Applications

• Summary

- Multicore Processors
- Advantages & Disadvantages
- Applications

References

Thank you