Chapter 12: Multiprocessor Architectures

Lesson 07:

Distributed Shared Memory Systems

Objective

- To understand distributed shared memory architectures of multiprocessor systems

Shared memory systems

Memory Organization in Multiprocessors

- Shared memory— the memory system handles inter-processor communication by allowing all processors to see data written by any processor

- Message-passing systems— communicate through explicit messages

Meeting bandwidth demand in large multiprocessor systems

- As the number of processors grows, it becomes impossible for a centralized memory system to meet the bandwidth needs of the processors,

- Distributed memory system necessity

# Meeting bandwidth demand in large multiprocessor systems en

- Distributed memory systems also used when the latency of the network long enough

- Using a centralized memory system would make memory latencies unacceptably long, even if a centralized memory system could meet the bandwidth needs of the processors

Distributed shard memory: Loosely coupled architecture

Distributed memory system architecture

- Each processor has its own memory system, which it can access directly

- To obtain data that is stored in some other processor's memory, a processor must communicate with that to request the data

Distributed Memory Architecture
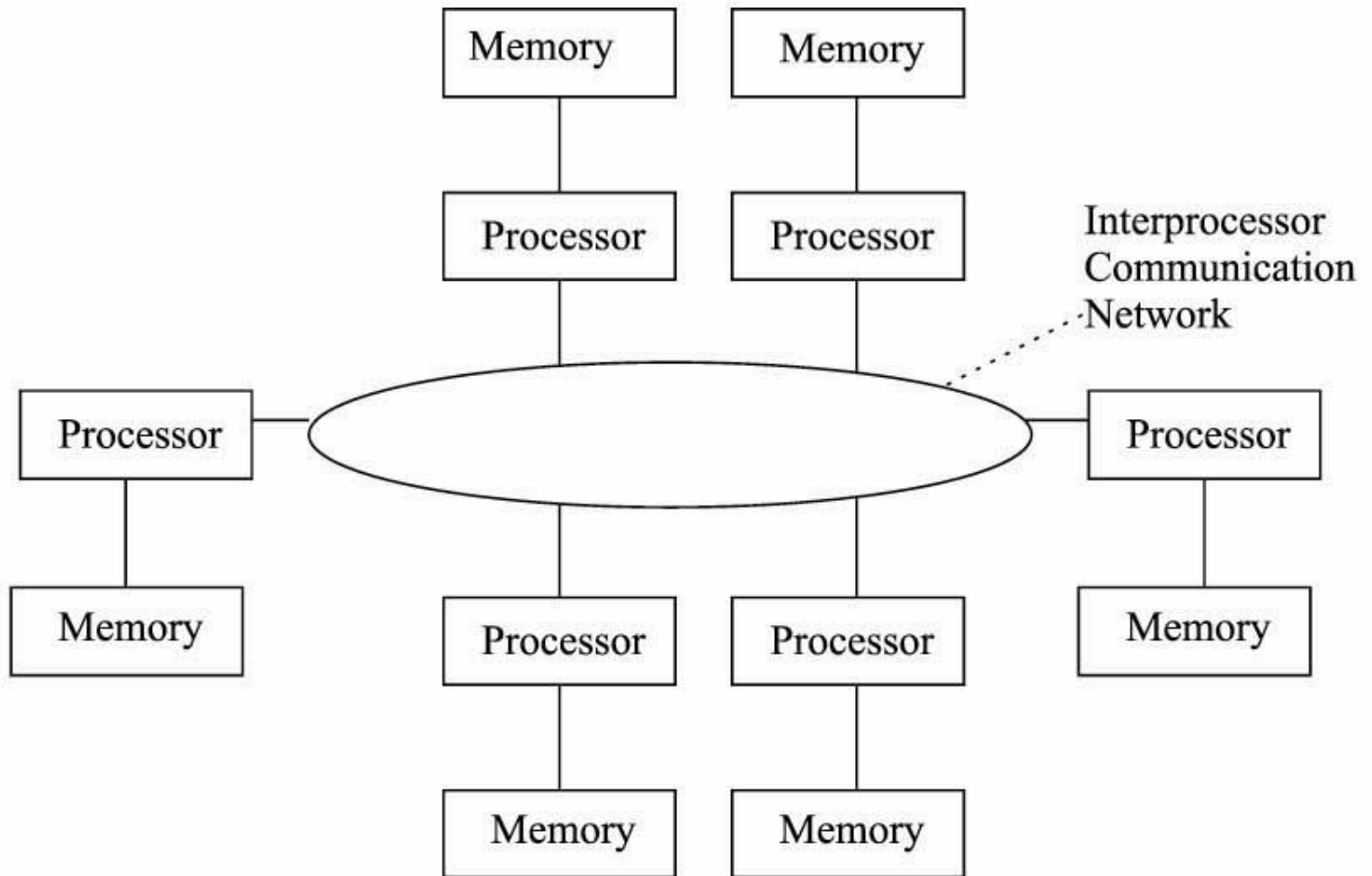
Advantage of Distributed memory systems

- Each processor has its own local memory system

- More total bandwidth in the memory system than in a centralized memory system

Advantage of Distributed memory systems

- The latency to complete a memory request is lower─ each processor's memory is located physically close to it

Disadvantage

- Only some of the data in the memory is directly accessible by each processor, since a processor can only read and write its local memory system

Accessing data in another processor's memory

- Requires communication through the network and leads to the *coherence* problem─ major source of complexity in shared-memory systems

Two or more copies of a given datum

- Possible that could exist in different processors' memories

- Leads to different processors having different values for the same variable

Solution

- Message-passing systems do not have as much of a problem with coherence as shared-memory systems, because they do not allow processors to read and write data contained in other processors' memories

Shared-memory systems

- Communication is implicit, rather than explicit

- The system performs any interprocessor communication required to make memory operations visible on all of the processors

Shared-memory systems

- Shared memory systems provide a single address space that all of the processors can read and write

- When a processor writes a location in the address space, any subsequent reads of that location by any processor sees the result of the write

Summary

We Learnt

- Distributed Shared memory

- Need for communication in case of distributed memory

End of Lesson 07 on
Distributed Shared Memory Systems