

Architecture – On-Chip Memory, Bus-Based Multiprocessors, Ring-Based Multiprocessors

What is Distributed Shared Memory?

DSM is a type of service that manages the memory across multiple nodes so that applications that are running will have the illusion that they are running on shared memory. DSM is used to make inter-process communication transparent to end-users. **DSM** is supported in hardware and software.

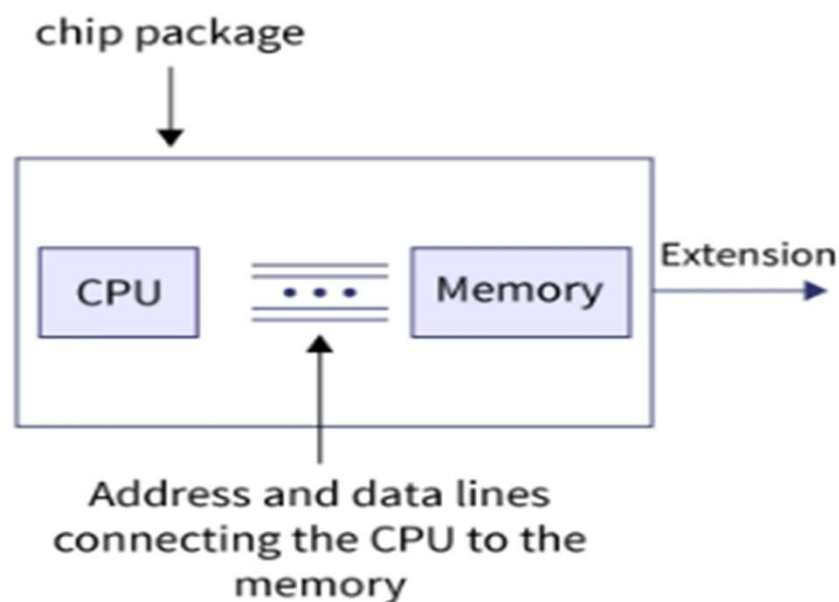
Types of Distributed Shared Memory

Distributed shared memory(DSM) can be classified as:

1. On-Chip Memory
1. Bus-Based Multiprocessors
2. Ring-Based Multiprocessors
3. Switched Multiprocessor

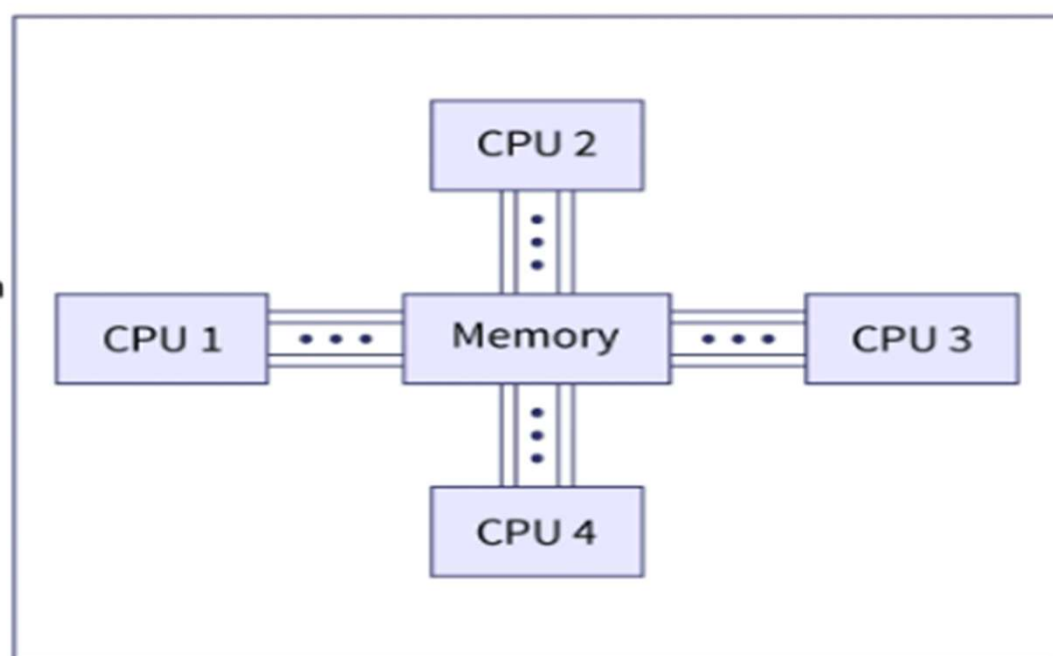
1. On-Chip Memory:

- The CPU portion of the chip has data also.
- The address lines are directly connected to the CPU memory so that memory can be accessed easily.
- It is expensive.
- Its construction is complicated.
- It is widely used in automobiles, appliances, and toys.



A single-chip computer

Extension

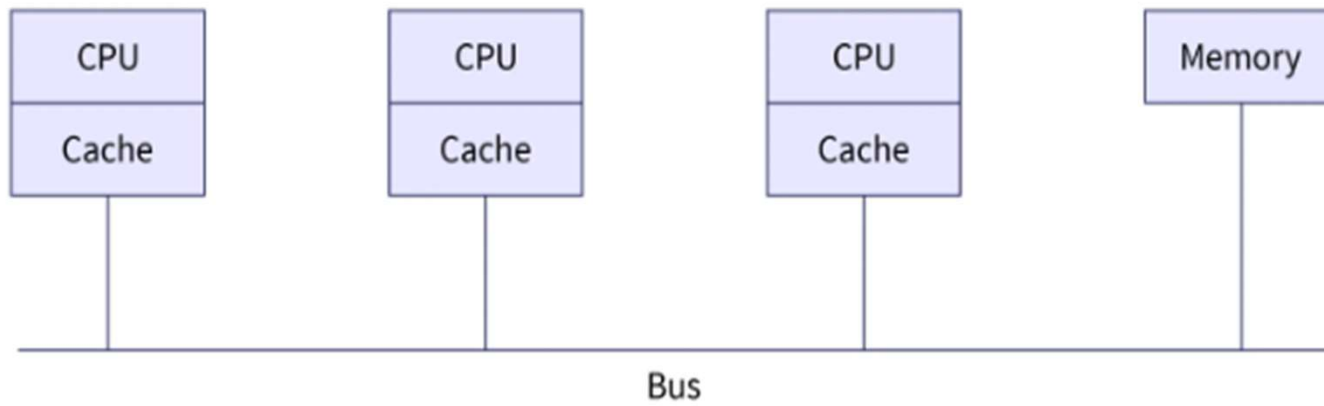


A hypothetical shared-memory multiprocessor

2. Bus-Based Multiprocessors:

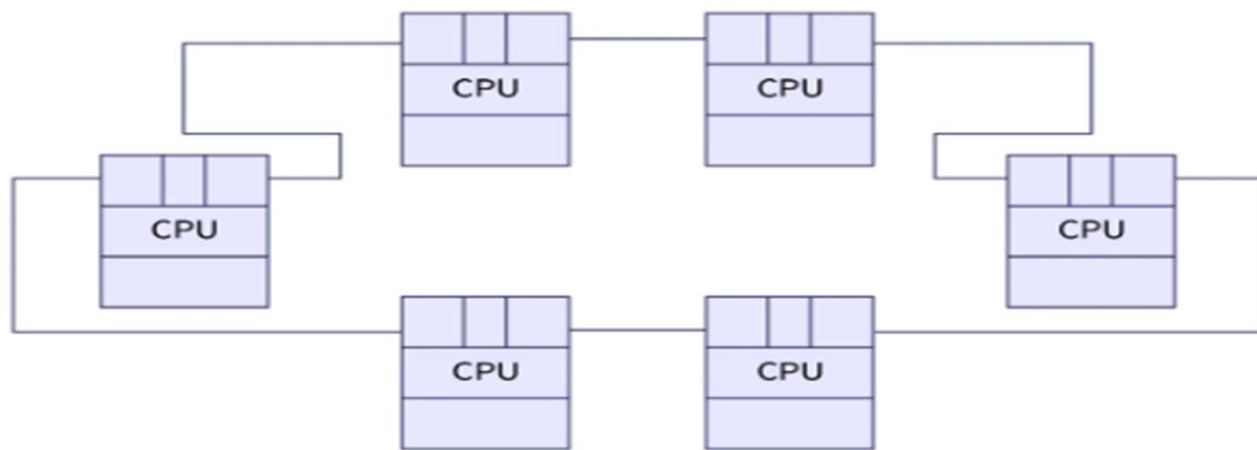
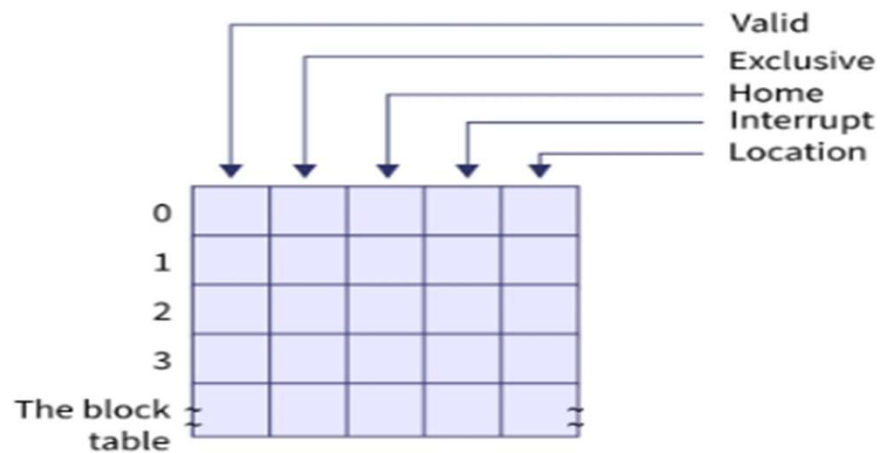
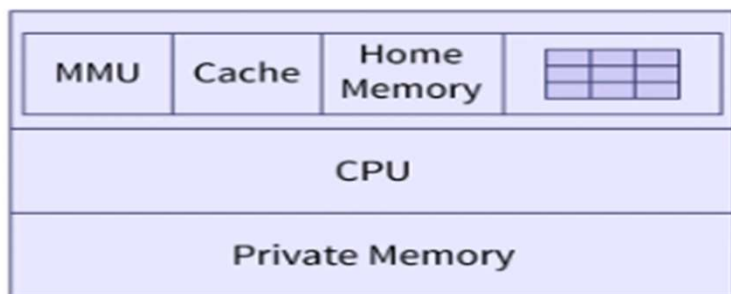
- In this, **the multiprocessor**, with its caches, is connected to the main memory through a shared bus.
- The processor has its cache.
- With the help of the cache, the network traffic is reduced.
- To prevent the two CPUs from accessing the same memory simultaneously, we use different prevention algorithms.
- From the fig, we can see only a single bus is there, so the bus becomes overloaded.

A multiprocessor with caching



3. Ring-Based Multiprocessors

- The single address space is divided into a private and a shared part.
- The private part is further divided into regions so that each machine has its stack for unshared data.
- The shared part is common to all.
- Shared memory is divided into 32-bit units. It is a unit for transferring data between machines.
- There is no global centralised memory.
- These are also known as **moments**.



This diagram shows a distributed shared memory system with multiple CPUs.

Top Left: Each CPU unit has:

MMU (Memory Management Unit): Manages memory access.

Cache: Stores frequently used data close to the CPU.

Home Memory: A part of memory shared across the system.

Private Memory: Memory used only by this CPU.

Top Right (Block Table):

A table to track data blocks, with fields for:

Valid: If data is valid.

Exclusive: If only one CPU can access it.

Home: Original memory location.

Interrupt: Signaling mechanism.

Location: Where data is currently stored.

Bottom (Ring Network of CPUs):

CPUs are connected in a ring network, allowing them to communicate directly with neighboring CPUs in a loop structure.