

Computer Architecture

Assignment5

Difference between Single-core vs Multi-core

- Single-core processors have only one physical processor and can execute one instruction at a time(Intel Pentium 4).
- Multi-core processor have multiple physical processors, which allows handle multiple instructions simultaneously(Intel Core i7, AMD Ryzen).
- A single-core processor has less power than a multi-core processor with a higher clock frequency.
- Multi-core processors allow you to achieve greater efficiency with less energy consumption than single-core processors.
- Multi-core processors provide a high level of parallelism or multiprocessing.

Cache Coherence Problem

- The Cache Coherence Problem is the problem of correcting shared data that turned out to be multiplied and distributed between caches of different processors at the time of their processing.
- Example: if one of processor changes the value of a shared variable, its values in the caches of other processors turn out to be invalid.

Snooping Based Cache Coherence

- Snoop-based cache coherence is a mechanism that maintains the consistency of data in multiple caches on shared memory systems.
- How it works: Each cache controller monitors the shared bus for transactions that may affect its cached data. Controllers take appropriate actions based on observed bus transactions so that all caches have a consistency view of shared memory.
- Simple to implement.
- Effective for systems with a small number of processors.

Directory Based Cache Coherence

- Directory-based cache coherence is a type of caching mechanism where directories are used to manage caches instead of using bus snooping.
- How it works: a directory maintains a record of which caches hold a copy of each memory block. When a core accesses a block, it consults the directory to determine if the data is in another cache and whether it is update.
- Scales well with many cores.
- Reduces unnecessary invalidations or updates.