CHAPTER 4: CACHE MEMORY

**Kompetensi Dasar**

Mahasiswa memiliki pengetahuan mengenai internal dan external memory.

**Agenda**
- Computer Memory System Overview
- Cache Memory Principles
- Elements of Cache Design

**4.1 Computer Memory System Overview**

<table>
<thead>
<tr>
<th>Location</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal (e.g. processor registers, main memory, cache)</td>
<td>Access time</td>
</tr>
<tr>
<td>External (e.g. optical disks, magnetic disks, tapes)</td>
<td>Cycle time</td>
</tr>
</tbody>
</table>

**Karakteristik Sistem Memori**

- Physical Type
- Physical Characteristics
- Memory modules
- Organization
- Cache Memory Systems

4.2 Cache Memory

- Single Cache

4.2 Cache Memory (Cont...)

Three Level Cache Organization

- REVIEW -

CHAPTER 3: CACHE MEMORY

4.3 Element of Cache Design

### Cache Addresses

- **Logical**
- **Physical**

### Cache Size

- **Direct**
- **Associative**
- **Set Associative**

### Mapping Function

- **Write Policy**
  - Write through
  - Write back
  - Write once

### Replacement Algorithm

- Least recently used (LRU)
- First in first out (FIFO)
- Least recently used (LRU)
- Random

---

**Logical Cache**

- Processor
- MMU
- Main memory
- Cache

**Physical Cache**

- Processor
- MMU
- Physical address
- Cache
- Data
- Main memory

---

**Cache Size**

- Larger the number of gates involved in addressing the cache, slightly slower
4.3 Element of Cache Design (Cont...)

Mapping Function

- **Direct Mapping**
  - First m blocks of main memory map to one block of cache.
  - Cache block size is b.

- **Associative Mapping**
  - Multiple blocks of main memory map to one block of cache.
  - Cache block size is b.

**Set-Assosiative Mapping**

- Each block is associated with a set number.
- Blocks are mapped to cache based on set number.

Sources:
4.3 Element of Cache Design (Cont...)

Replacement Algorithms

1. Least Recently Used (LRU)
2. First In First Out (FIFO)
3. Least Frequently Used (LFU)
4. Random

Line Size

1. As the block size increases from very small to larger sizes, the hit ratio will at first increase because of the principle of locality.
2. As the block size increases, more useful data are brought into the cache. The hit ratio will begin to decrease.

Number of Caches

1. Multilevel Cache

Number of Caches

2. SPLIT CACHE vs UNIFIED CACHE
- REVIEW -

CHAPTER 4: CACHE MEMORY

PART 2: THE COMPUTER SYSTEM

CHAPTER 4: CACHE MEMORY

- THANK YOU -