Scratchpad Memory

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Computer Architecture

- “Key of computer architecture is to get the correct operands”
Memory Hierarchy

- Motivation:
  - Memory access time vs. Memory size
  - Memory access pattern
- Use large memory to store more data
- Use small memory for fast access
Memory Hierarchy ≠ Cache

- Cache is one way of realizing memory hierarchy
## Scratchpad Memory vs. Cache

<table>
<thead>
<tr>
<th>Cache</th>
<th>Scratchpad Memory</th>
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<tbody>
<tr>
<td>• Larger</td>
<td>• Smaller</td>
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<tr>
<td>• Store a copy of the next level cache</td>
<td>• Store part of the data that requires fast access</td>
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<tr>
<td>• Mapping (same address)</td>
<td>• Moving (dedicated address)</td>
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<tr>
<td>• Hit/Miss</td>
<td>• Only Hit</td>
</tr>
<tr>
<td>• Unpredictable access time</td>
<td>• Controlled by software or compiler</td>
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<tr>
<td>• Runtime control</td>
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</table>
Scratched Memory Control

- Content Control
  - By special instructions
- Data Transfer
  - Direct Memory Access (DMA)
- Data Assignment
  - Identify “critical” data
  - With known access pattern
- Hybrid System
Scratchpad Memory Example

for i=1:1024
    for j=1:1024
        level=intensity[i][j];
        hist[level]=hist[level]+1;
    end
end