Main differences

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Roadmap

- History
- Market Share
- Similarities
- DDR Memory Evolution
- Differences
History

- DDR RAM was first introduced to allow data transfers on each edge of the memory clock.
- Keep up with the data rates required by modern processors.
• DDR and DDR2 memories are now obsolete

• DDR3 is currently being replaced by DDR4
Similarities

- STTL interface, but with different voltage supply
- Based on SDRAM
DDR memories evolution
CAS Latency

- DDR → 3 (nb of cycles)
- DDR2 → 5 (nb of cycles)
- DDR3 → 7 (nb of cycles)
- Higher CAS latency != longer wait time
- Need to refer to the clock period
  - DDR2-800 CL5 → 12.5ns (5*2.5ns)
  - DDR3-1333 CL7 → 10.5 ns (7*1.5ns).
Prefetch

- DDR: 2-bit prefetch
  DDR2: 4 bits prefetch
  DDR3: 8 bits prefetch

- The clock at the exterior of the memory is not the one operating internally

- Same transfer rate does not mean same internal speed higher number of bits for the I/O buffer => reduce internal speed of the memory
On-die/Off-die Termination

**ODT**
- improves signal environment
- reduces discontinuities
- enhanced signal performance
- higher data rates
- reduces number of components and signal line on mother board
- lower costs and complexity
- increase reliability
Packaging

- DDR: TSOP 2
- DDR2 and DDR3: Ball Grid Array
Physical aspect

Key notch

Number of pins:

<table>
<thead>
<tr>
<th>Memory module</th>
<th>Number of pins</th>
</tr>
</thead>
<tbody>
<tr>
<td>DDR</td>
<td>184</td>
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<tr>
<td>DDR2</td>
<td>240</td>
</tr>
<tr>
<td>DDR3</td>
<td>240</td>
</tr>
</tbody>
</table>
Conclusion

• Different technologies have enhanced the DDR memory

• They are based on the same bit cells

• New memory technologies could replace them
Bibliography

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