SAP HANA Solutions on Flash
based on Cascade Lake Processors

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SAP SME
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* All SAP customers needs to move to HANA by 2025
SAP Customer Concerns Before Optane DC

Do I have to go to a bigger server to accommodate my HANA memory footprint?
* HANA Memory to socket ratio rule with DDR4 memory

Can I use 2 socket or 4 socket server and reduce my TCO.
* Avoiding 8 socket and bigger servers

I can move some of my data to warm tier but that project is going to take some time and I don’t have fund for it.
* Using solution as Dynamic Tiering (Warm tier) to reduce in memory database size
Intel Processors with Optane DC

- **Cisco M1/M2 Servers (EOLed)**: Thurley Platform
- **Cisco M3 Servers (EOLed)**: Romley Platform
- **Cisco M4 Servers**
- **Cisco M5 Servers**: Purley Platform

**Microarchitecture**
- **Nehalem**: 45nm, New Microarchitecture
- **Westmere**: 32nm, New Processor Technology
- **Sandy Bridge**: 32nm, New Microarchitecture
- **Ivy Bridge**: 22nm, New Processor Technology
- **Haswell**: 22nm, New Microarchitecture
- **Broadwell**: 14nm, New Processor Technology
- **Skylake**: 14nm, New Microarchitecture
- **Cascade Lake**: 14nm, New Processor Technology
- **Purley Platform**: 14nm, New Microarchitecture

**Memory**
- **DDR3 Memory**: Up to 1866 MHz
- **DDR4 Memory**:
  - 2400 MHz, 3DPC = up to 1866 MHz
  - 2933 MHz, 2DPC

**PCIe**
- **PCIe 3.0**: 36 lanes per CPU
- **PCIe 3.0**: 40 lanes per CPU
- **PCIe 3.0**: 40 lanes per CPU
- **PCIe**: 48 lanes per CPU

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Raw Component Performance Comparison
REIMAGINING THE DATA CENTER MEMORY AND STORAGE HIERARCHY

- Improving memory capacity
- Improving SSD performance
- Delivering efficient and scalable storage

HOT
WARM
COLD
Two Functional Modes – App Direct and Memory

**App Direct Mode:** Both DCPMM and DRAM capacity counts towards CPU Tiering

**Memory Mode:** DRAM as cache. Only DCPMM capacity counts towards CPU Tiering

**Mix Mode:** DRAM as cache. Only DCPMM capacity counts towards CPU Tiering

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### Example: For Illustration Purposes Only

<table>
<thead>
<tr>
<th></th>
<th>Legacy (DRAM)</th>
<th>DRAM + AppDirect (AD)</th>
<th>Memory Mode (MM)</th>
<th>Mixed Mode (MM+AD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2S DRAM Capacity</strong></td>
<td>768GB (24x32)</td>
<td>384GB (12x32)</td>
<td>384GB (12x32)</td>
<td>384GB (12x32)</td>
</tr>
<tr>
<td><strong>2S DCPMM DIMM Capacity</strong></td>
<td>NA</td>
<td>1.5TB (12x128)</td>
<td>1.5TB (12x128)</td>
<td>1.5TB (12x128)</td>
</tr>
<tr>
<td><strong>What OS Sees</strong></td>
<td>768GB (24x32)</td>
<td>384GB (12x32) + 1.5TB (12x128)</td>
<td>1.5TB (12x128)</td>
<td>1.28TB (10x128) + 256GB (2x128)</td>
</tr>
<tr>
<td><strong>Persistent</strong></td>
<td>NA</td>
<td>1.5TB (12x128)</td>
<td>NA</td>
<td>256GB (2x128, if 1/6th cap is AD)</td>
</tr>
</tbody>
</table>
## Skylake and Cascade Lake Balanced DDR4 Memory Configurations

<table>
<thead>
<tr>
<th>Controller #</th>
<th>Channel #</th>
<th>Skylake Memory Configuration</th>
<th>Capacity (GB) per CPU</th>
<th>Capacity (GB) with #CPUs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1DPC</td>
<td></td>
<td>16GB DIMM</td>
<td>16</td>
<td>384</td>
</tr>
<tr>
<td>2DPC</td>
<td>1DPC</td>
<td>16GB DIMM</td>
<td>16</td>
<td>768</td>
</tr>
<tr>
<td></td>
<td>1DPC</td>
<td>16/32G mix</td>
<td>32</td>
<td>1536</td>
</tr>
<tr>
<td></td>
<td>1DPC</td>
<td>32GB DIMM</td>
<td>32</td>
<td>2304</td>
</tr>
<tr>
<td></td>
<td>1DPC</td>
<td>64GB DIMM</td>
<td>64</td>
<td>3072</td>
</tr>
<tr>
<td></td>
<td>1DPC</td>
<td>32/64G mix</td>
<td>32</td>
<td>4608</td>
</tr>
<tr>
<td></td>
<td>1DPC</td>
<td>64GB DIMM</td>
<td>64</td>
<td>6144</td>
</tr>
<tr>
<td></td>
<td>1DPC</td>
<td>128GB DIMM</td>
<td>128</td>
<td>9216</td>
</tr>
</tbody>
</table>

Notes:

1. Only use Cisco UCS validated DIMMs
2. All DIMMs must be same technology, i.e. LRDIMM, RDIMM, SD3, etc
3. Only adjacent sized DIMMs can be used, e.g. 32G/64G, 64G/128G. Cannot use 16G/64G DIMMs
4. Must have either 6 or 12 DIMMs per CPU, with every DIMM channel filled
5. Observe Intel requirements, including DIMM ranking, etc.
# Cascade Lake memory config

<table>
<thead>
<tr>
<th>Controller #</th>
<th>Channel #</th>
<th>DIMM slot #</th>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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</thead>
<tbody>
<tr>
<td><strong>2DPC 128GB AEP + 32GB DRAM</strong></td>
<td>2DPC 128GB AEP + 64GB DRAM</td>
<td>2DPC 128GB AEP + 128GB DRAM</td>
<td>2DPC 256GB AEP + 64GB DRAM</td>
<td>2DPC 128GB AEP + 256GB DRAM</td>
<td>2DPC 256GB AEP + 128GB DRAM</td>
<td>2DPC 256GB AEP + 256GB DRAM</td>
<td>2DPC 512GB AEP + 128GB DRAM</td>
<td>2DPC 512GB AEP + 256GB DRAM</td>
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<td></td>
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</tr>
<tr>
<td>CPU Type</td>
<td>Capacity (GB) per CPU</td>
<td>Capacity (GB) with #CPUs</td>
<td>DDR/AEP ratio</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
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</tbody>
</table>

'= Supported configurations

'= not supported

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What’s New in SAP HANA 2.0 SPS03: Persistence

- Non-volatile Memory

- HANA 2.0 SPS 03 supports persistent memory, e.g., based on Intels Optane DC memory technology.
  - DIMM form-factor, replacing DRAM.
  - Column Store Main is placed on persistent memory

- Affects more than 95% of persisted data in most SAP HANA systems. About 95 percent of data in main and it is 10–20x compressed
  - Significantly lower restart times. Column store does not have to be loaded at startup.
  - Lower TCO than DRAM.
  - No changes to the persistence layer.
Memory Configuration

Example: 2 sockets, largest DRAM and largest PMEM configurations

Actual configuration and ratios between DRAM, PMEM and CPU depend on application sizing.
What’s New in SAP HANA 2.0 SPS03: Persistence

Non-Volatile Memory

- Column Store Main is placed on persistent memory
- Affects more than 95% of persisted data in most SAP HANA systems
- About 95% of data in main and it is 10-20x compressed
- Significantly lower restart times. Column store does not have to be loaded at startup.

Faster starts help ensure business continuity and service-level agreements

4-MINUTE average SAP HANA® 2.0 SPS 3.0 index server start time using Intel® Optane™ DC persistent memory—a 12.5x decrease compared to DRAM alone

Use of Intel® Optane™ DC with Extension Node

Extension node now uses Intel® Optane™ DC instead of disk.

Benefit
- No disk loading/unloading to RAM.
- Expected significant speed benefit when accessing tiered/cold data.
- Backup and restore is exactly the same. Failover node can support the extension node.

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Intel Optane DC PMEM Configuration Rules

- A sizing exercise is required to properly configure the server(s).
- All system board memory slots must be fully populated (no half loads)
- Must be equal number of DDR & PMEM per CPU socket
- **SAP HANA only supports DDR/PMEM capacity ratios of 2:1, 1:1, 1:2, and 1:4.**
- App Direct is only mode supported
- No half load CPU systems – It has to be fully populated
How can SAP HANA benefit from OptaneDC

- Lower Platform TCO
- Restarts up to 12.5x faster
- Increased memory capacity