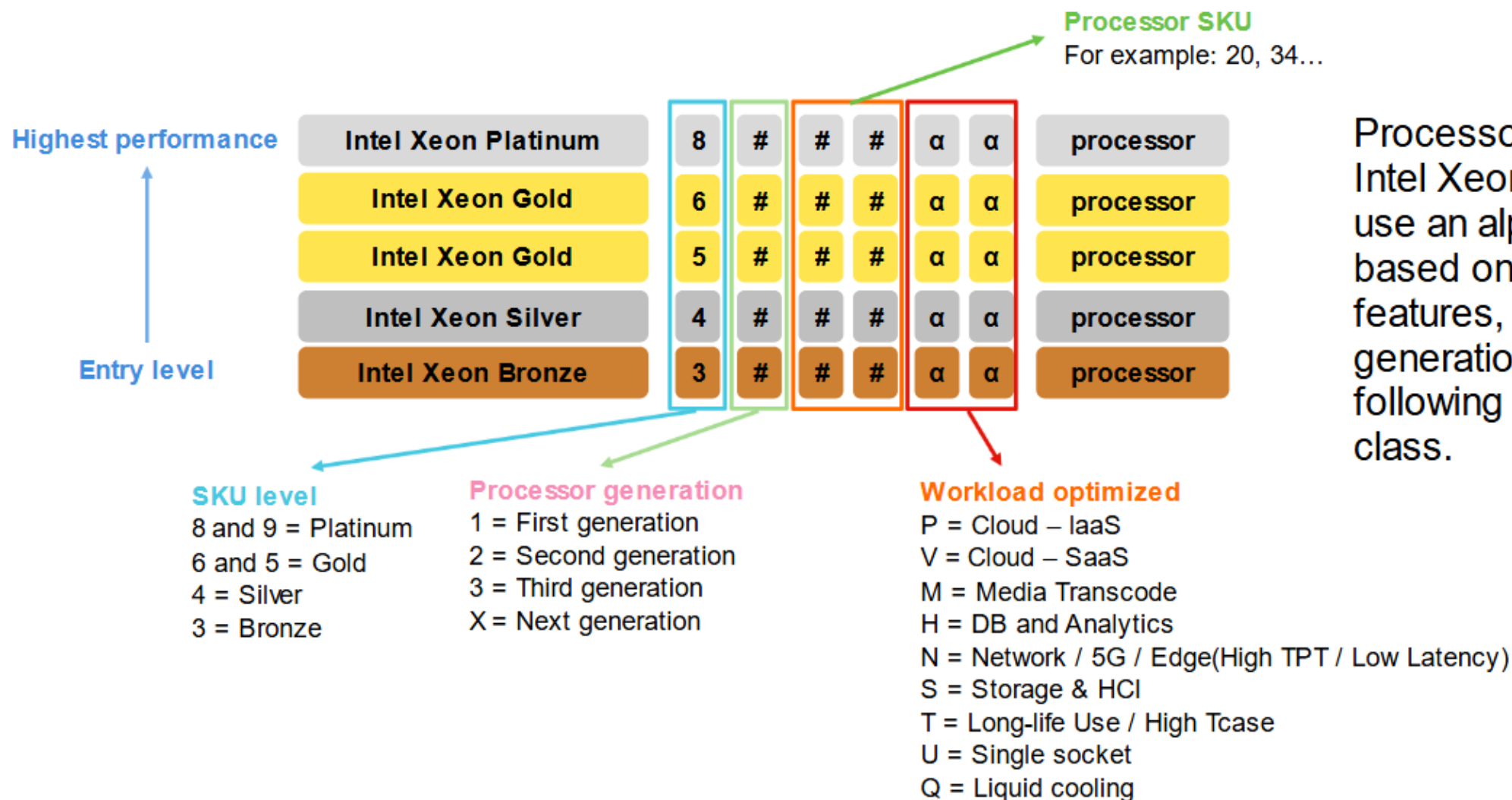# Next Generation Intel Xeon Scalable processor features and configurations

Product features and configuration

Lenovo

# Intel Xeon Scalable processor naming rules

**Processor SKU**
For example: 20, 34…

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Intel Xeon Platinum | 8 | # | # | # | α | α | processor |
| Intel Xeon Gold | 6 | # | # | # | α | α | processor |
| Intel Xeon Gold | 5 | # | # | # | α | α | processor |
| Intel Xeon Silver | 4 | # | # | # | α | α | processor |
| Intel Xeon Bronze | 3 | # | # | # | α | α | processor |

**Highest performance**

**Entry level**

Processor numbers for the Intel Xeon Scalable platform use an alphanumeric scheme based on performance, features, processor generation, and options, following the brand and its class.

**SKU level**
8 and 9 = Platinum
6 and 5 = Gold
4 = Silver
3 = Bronze

**Processor generation**
1 = First generation
2 = Second generation
3 = Third generation
X = Next generation

**Workload optimized**
P = Cloud – IaaS
V = Cloud – SaaS
M = Media Transcode
H = DB and Analytics
N = Network / 5G / Edge(High TPT / Low Latency)
S = Storage & HCI
T = Long-life Use / High Tcase
U = Single socket
Q = Liquid cooling

Lenovo

# Processor SKUs

**Platinum-8xxx**

+ 4 UPI @ 16 GT/s
+ SGX up to 512 GB on selected SKUs

**Gold-6xxx**

+ DDR5 @ 4800 MT/s (1DPC) and 4400 MT/s (2DPC)

**Gold-5xxx**

+ DDR5 @ 4400 MT/s (1DPC & 2DPC)
+ 3 UPI @ 16 GT/s
+ Intel Optane persistent memory module
+ Intel Speed Select Tech
+ Advanced RAS
+ SGX up to 128 GB

**Sliver-4xxx**

+ 2-Socket Scalability
+ 2 UPI @ 16 GT/s
+ 80 Lanes PCIe 5.0 / Compute Express Link (CXL)
+ Intel AVX-512
+ Intel Hyper-Treading and Turbo Boost
+ Intel DL Boost – Advanced Matrix Extensions (AMX)

**Bronze-3xxx**

• 1-Socket only
• DDR5 @ 4000 MT/s (1 & 2 DPC)
• 80 Lanes PCIe 4.0
• Intel AVX-512
• Standard RAS
• 1 Intel Data Streaming Accelerator (DSA) Device
• SGX up to 64 GB max enclave size



intel XEON PLATINUM

Platinum-8xxx:

| 56C 2.0/3.0 | 350W | 8480+ |
| 52C 2.0/3.0 | 350W | 8470 |
| 48C 2.1/3.0 | 350W | 8468 |
| 40C 2.0/2.8 | 300W | 8460Y+ |
| 36C 2.1/2.8 | 300W | |
| 36C 2.0/2.8 | 300W | 8452Y |
| 32C 2.3/2.9 | 300W | |
| 32C 1.9/2.5 | 270W | |
| 24C 2.1/2.5 | 250W | |

intel XEON GOLD

Gold-6xxx:

Future MCC Update

| 32C 1.9/2.6 | 270W* | 6430 |

intel XEON GOLD

Gold-5xxx:

Future MCC Update

intel XEON SILVER

Silver-4xxx:

Future MCC Update

# Sapphire Rapids die packages

- According to the different requirements for the number of cores, there are two classes: Extreme core count (XCC) and medium core count (MCC).

- Due to the increase in the number of cores on the Xeon SP, Intel has upgraded the original XCC and MCC. XCC can now support up to 60 cores, and MCC can support up to 32 cores.



**XCC**

Max counts:
- 60 active cores
- 5x16 PCIe Gen5/CXL ports (+2 not ported out)
- 1x8 Gen3 DMI
- 8ch of DDR5 memory
- 4 Intel UPI links
- 4 Intel QAT/DLB/DSA
- 4 tiles connected using MDF over Intel Embedded Multi-die Interconnect Bridge (EMIB)

**MCC**

Max counts:
- 32 active cores
- 5x16 PCIe Gen5/CXL Ports
- 8ch of DDR5 memory
- 3 Intel UPI links
- 2 Intel QAT/DLB
- 1 Intel DSA
- Single monolithic die
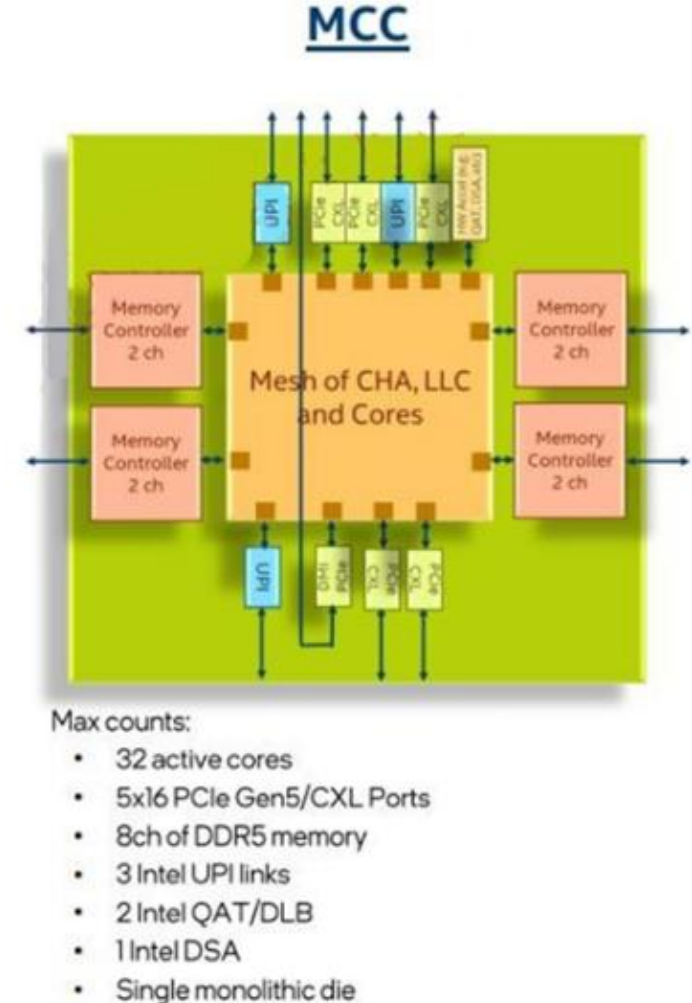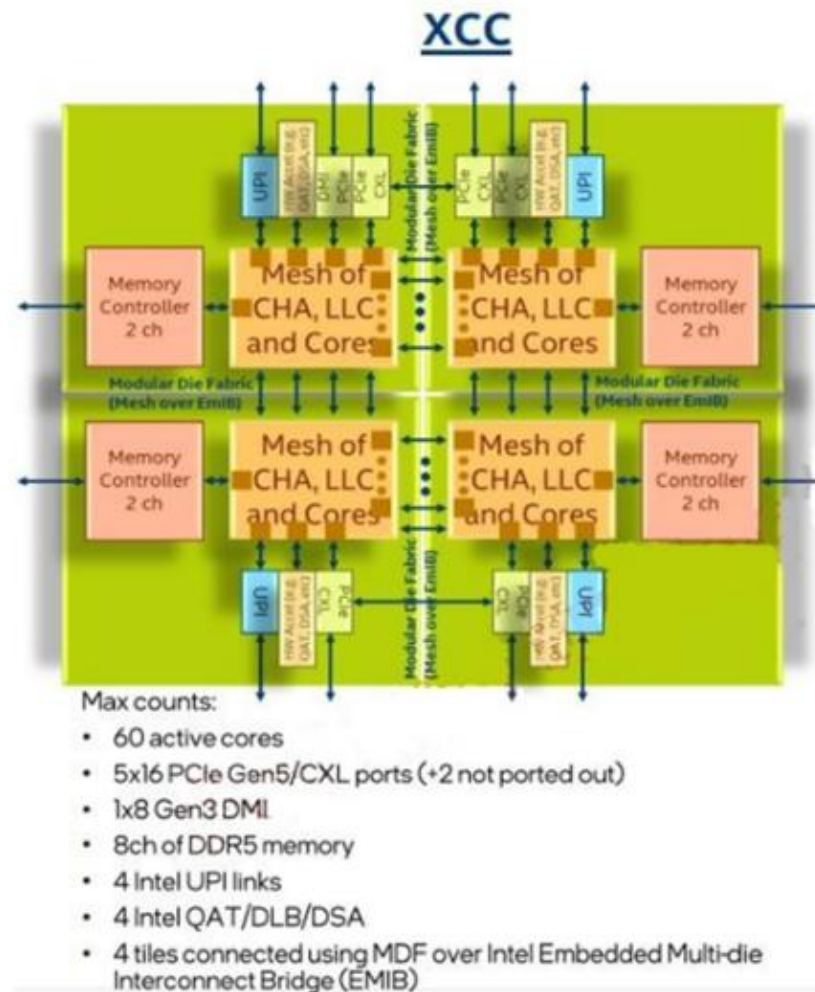
# Processor SKU summary

## 2S PERFORMANCE GENERAL PURPOSE

| SKU | CORES | BASE (GHz) | ALL CORE TURBO (GHz) | Max TURBO (GHz) | CACHE (MB) | TDP (Watts) | CLM (Base/Turbo) | Maximum Scalability | DDR5 Memory Speed | UPI Links Enabled | Default DSA Devices | Default QAT Devices | Default DLB Devices | Default IAA Devices | Intel SGX Enclave Capacity (Per Processor) | On Demand capabilities enabled |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8480+ | 56 | 2.0 | 3.0 | 3.8 | 105 | 350 | 1.4/3.8 | 2S | 4800 | 1 | 1 | 1 | 1 | 1 | 512GB | ✓ |
| 8470 | 52 | 2.0 | 3.0 | 3.8 | 105 | 350 | 1.4/2.5 | 2S | 4800 | 4 | 1 | 0 | 0 | 0 | 512GB | ✓ |
| 8468 | 48 | 2.1 | 3.0 | 3.8 | 105 | 350 | 1.4/2.5 | 2S | 4800 | 4 | 1 | 0 | 0 | 0 | 512GB | ✓ |
| 8460Y+ | 40 | 2.0 | 2.8 | 3.7 | 105 | 300 | 1.4/2.4 | 2S | 4800 | 4 | 1 | 1 | 1 | 1 | 128GB | ✓ |

Future MCC update

## 2S MAINLINE GENERAL PURPOSE

| 8452Y | 36 | 2.0 | 2.8 | 3.2 | 67.5 | 300 | 1.4/2.4 | 2S | 4800 | 4 | 1 | 0 | 0 | 0 | 128GB | ✓ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6430 | 32 | 1.9 | 2.6 | 3.4 | 60 | 270 | 1.4/2.4 | 2S | 4400 | 3 | 1 | 0 | 0 | 0 | 128GB | ✓ |

Future MCC update

## LIQUID COOLED GENERAL PURPOSE (-Q)

| 8470Q | 52 | 2.1 | 3.2 | 3.8 | 105 | 350 | 1.4/2.5 | 2S | 4800 | 4 | 1 | 0 | 0 | 0 | 512GB | ✓ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Future MCC update

## SINGLE SOCKET GENERAL PURPOSE (-U)

| 6414U | 32 | 2.0 | 2.6 | 3.4 | 60 | 250 | 1.4/2.2 | 1S | 4800 | 4 | 1 | 0 | 0 | 0 | 128GB | ✓ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Future MCC update

## LONG-LIFE USE (IOT) GENERAL PURPOSE (-T)*

Future MCC update

## IMDB/ANALYTICS/VIRTUALIZATION OPTIMIZED (-H) – SOCKET SCALABLE

| SKU | CORES | BASE (GHz) | ALL CORE TURBO (GHz) | Max TURBO (GHz) | CACHE (MB) | TDP (Watts) | CLM (Base/Turbo) | Maximum Scalability | DDR5 Memory Speed | UPI Links Enabled | Default DSA Devices | Default QAT Devices | Default DLB Devices | Default IAA Devices | Intel SGX Enclave Capacity (Per Processor) | On Demand capabilities enabled |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8490H | 60 | 1.9 | 2.9 | 3.5 | 112.5 | 350 | 1.4/2.5 | 8S | 4800 | 4 | 4 | 4 | 4 | 4 | 512GB | |
| 8468H | 48 | 2.1 | 3.0 | 3.8 | 105 | 330 | 1.4/2.5 | 8S | 4800 | 4 | 4 | 0 | 0 | 4 | 512GB | |
| 8460H | 40 | 2.2 | 3.1 | 3.8 | 105 | 330 | 1.4/2.5 | 8S | 4800 | 4 | 4 | 0 | 0 | 4 | 512GB | |
| 8454H | 32 | 2.1 | 2.7 | 3.4 | 82.5 | 270 | 1.4/2.4 | 8S | 4800 | 4 | 4 | 4 | 4 | 4 | 512GB | |
| 8450H | 28 | 2.3 | 2.6 | 3.5 | 75 | 250 | 1.4/2.3 | 8S | 4800 | 4 | 4 | 0 | 0 | 4 | 512GB | |
| 8444H | 16 | 2.3 | 3.2 | 4.0 | 45 | 270 | 1.4/2.5 | 8S | 4800 | 4 | 4 | 0 | 0 | 4 | 512GB | |

Future MCC update

## 5G / NETWORKING OPTIMIZED (-N)*

| 8470N | 52 | 1.7 | 2.7 | 3.6 | 97.5 | 300 | 1.8/2.4 | 2S | 4800 | 3 | 4 | 4 | 4 | 0 | 128GB | ✓ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8471N | 52 | 1.8 | 2.8 | 3.6 | 97.5 | 300 | 1.8/2.4 | 1S | 4800 | 0 | 4 | 4 | 4 | 0 | 128GB | ✓ |

Future MCC update

## CLOUD OPTIMIZED IaaS (-P) / SaaS (-V) / Media (-M)

| 8468V | 48 | 2.4 | 2.9 | 3.8 | 97.5 | 330 | 1.4/2.5 | 2S | 4800 | 3 | 1 | 1 | 1 | 1 | 128GB | ✓ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8458P | 44 | 2.7 | 3.2 | 3.8 | 82.5 | 350 | 1.4/2.5 | 2S | 4800 | 3 | 1 | 1 | 1 | 1 | 512GB | ✓ |
| 8461V | 48 | 2.2 | 2.8 | 3.7 | 97.5 | 300 | 1.4/2.4 | 1S | 4800 | 0 | 1 | 1 | 1 | 1 | 128GB | ✓ |
| 6441V | 44 | 2.1 | 2.6 | 3.5 | 82.5 | 270 | 1.4/2.3 | 1S | 4800 | 0 | 1 | 0 | 0 | 1 | 128GB | ✓ |

Future MCC update

## STORAGE & HYPERCONVERGED INFRASTRUCTURE (HCI) OPTIMIZED (-S)

| 6454S | 32 | 2.2 | 2.8 | 3.4 | 60 | 270 | 1.4/2.4 | 2S | 4800 | 4 | 4 | 4 | 4 | 0 | 128GB | ✓ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

Future MCC update

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# Intel Ultra Path Interconnect (UPI) 2.0

Sapphire Rapids processors will support Ultra Path Interconnect (Intel UPI 2.0), the next-generation multi-processor interconnect technology. The features of this technology include:

- Increased bandwidth and speed to support a balanced platform with a higher performance CPU, DDR5 memory, and PCIe 5.0 devices

- Increased lane width – x24 instead of x20 in the previous generation

- Support for both ac and dc coupling – only dc coupling was supported in the previous generation

- Support for speeds of up to 16 GT/s on Sapphire Rapids processors

- Support for speeds of up to 20 GT/s for a future Eagle Stream generation processor



DDR5 DIMMs
DDR5/Intel® Optane™ persistent memory
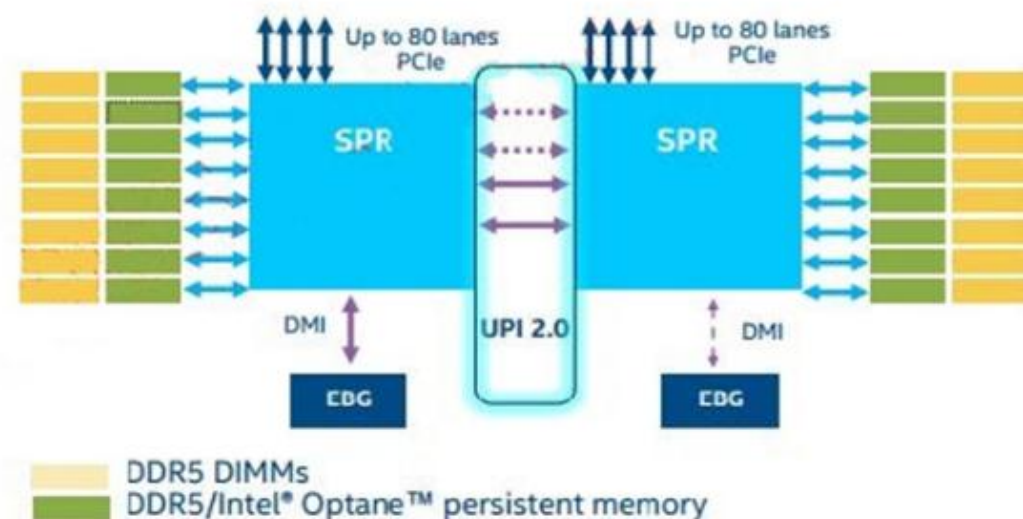
**Platform support for UPI**
**1S No UPI links**
**2S Up to 4 UPI links**
**4S Up to 3 UPI Links**
**8S 4 UPI Links through performance**
**optimized topology only**

# PCIe 5.0 support

| PCIe architecture | Raw bit rate | Interconnect bandwidth | Bandwidth lane direction | Total bandwidth for x16 links |
|---|---|---|---|---|
| PCIe 5.0 | 32 GT/s | 32 Gb/s | 4 GB/s | 128 GB/s |
| PCIe 4.0 | 16 GT/s | 16 Gb/s | 2 GB/s | 64 GB/s |

- PCIe 5.0 has double the I/O bandwidth of PCIe 4.0
- PCIe 5.0 provides the highest throughput between the CPU and device
- PCIe 5.0 provides foundational bandwidth, electricals, and CEM slots for Compute eXpress Link (CXL)
- PCIe 5.0 maintains backward compatibility with PCIe 4.0, 3.x, 2.x, and 1.x
- The total channel insertion loss budget is 36 dB

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# High Bandwidth Memory (HBM) support

- There are three HBM modes:
  - HBM only mode: Runs exclusively using HBM memory
    Can only be used if workloads can fit into the 64 GB of HBM
    memory capacity
  - Flat mode: HBM and DDR memory are a contiguous
    addressable space
  - Cache mode: HBM is used as a cache for the DDR5 memory
    It offers accelerated performance
  - Memory mode is selected during boot with the BIOS menu
- HBM is only available on Platinum and Gold CPUs



**Platinum-8xxx**

+ Four UPIs @ 16 GT/s
+ SGX up to 512 GB

**Gold-6xxx**

- 64 GB HBM2e
- Eight channels of DDR5 @ 4800 (1DPC) and 4400 (2DPC)
- Two-socket Scalability
- Up to three UPIs @ 16 GT/s
- Intel AVX-512 (2 FMAs)
- Intel DL Boost – Advanced Matrix Extensions (AMX)
- Intel Turbo Boost & Hyper-Treading
- Intel Data Streaming Accelerator (DSA), four devices
- Advanced RAS
- SGX up to 128 GB

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# Sapphire Rapids plus High Bandwidth Memory modes

- **HBM only**
  - HBM only provides best performance when workloads fit into the 64 GB capacity
  - No software changes or DDR required
  - The internal memory bandwidth is higher than external
  - No support for SGX or MKTME

- **Flat**
  - DDR can be added for workloads needing a capacity greater than 64 GB
  - HBM and DDR are exposed as separate regions
  - Software updates are needed to optimize performance
  - Better performance than Cache mode
  - SGX and MKTME is supported in the DDR region

- **Cache**
  - Cache mode provides improved performance when workloads need more than 64 GB of capacity
  - No change to software required
  - HBM caches DDR (symmetric DDR population required)
  - No support for SGX or MKTME



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# DDR5 memory support

Eagle Stream will be Intel's first platform to support DDR5 memory, which provides the features listed below:

- Higher speeds – up to 4800 MT/s (1DPC) / 4400 MT/s (2DPC) on Sapphire Rapids 5600 MT/s (1DPC) / 4800 MT/s (2DPC) on Emerald Rapids
- Full DRAM equalization support (DFE) for high-speed margin headroom
- VR on DIMM (VRoD) architecture for improved power delivery and DRAM yields
- Improved I/O performance with a sideband bus I3C architecture
- Power saving performance improvements over DDR4 DIMM architecture

VRoD (PMIC)

DDR5 DRAM

Data Buffer (DB)

Register (RCD)

SPD/Hub (I3C)

Temp Sensor

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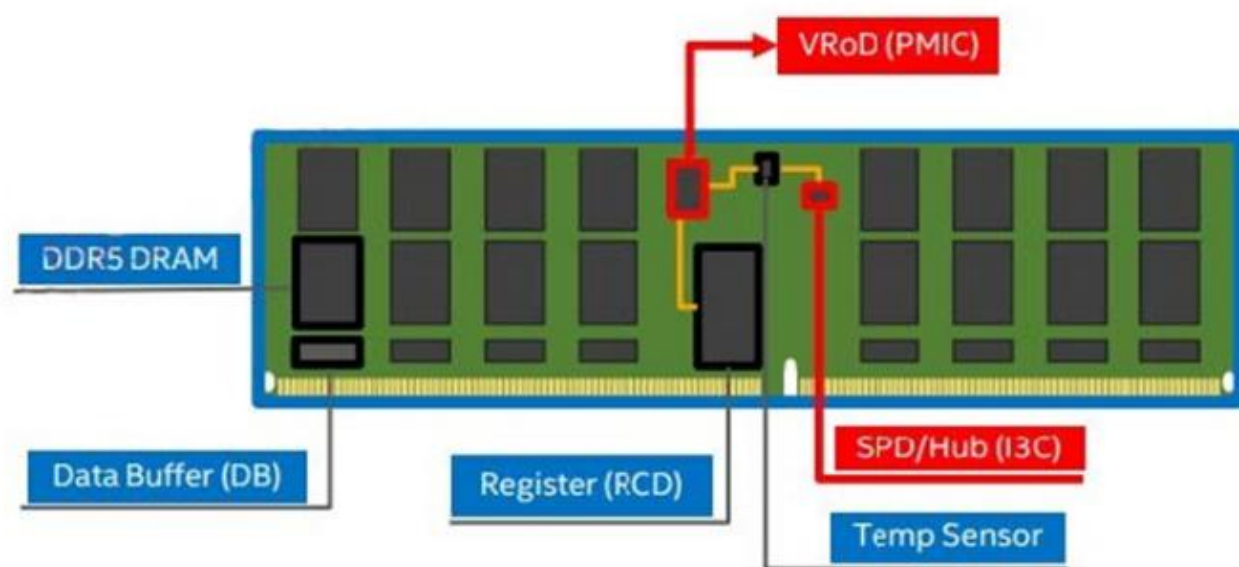
# Sapphire Rapids-SP memory support

- Sapphire Rapids-SP processors support both 1DPC and 2DPC configurations. They also support RDIMM and 3DS RDIMM.
- LRDIMM and 3DS LRDIMM are not supported.

| Type | Ranks Per DIMM and Data Width | DIMM Capacity (GB) | Speed (MT/s) ; Voltage (V); DIMM Per Channel (DPC) | |
|---|---|---|---|---|
| | | | 1DPC* | 2DPC |
| | | 16 Gb | 1.1V | |
| RDIMM | SRx8 (RC D) | 16 GB | 4800 | 4400 |
| | SRx4 (RC C) | 32 GB | | |
| | SRx4 (RC F) 9x4 | 32 GB | | |
| | DRx8 (RC E) | 32 GB | | |
| | DRx4 (RC A) | 64 GB | | |
| | DRx4(RC B) 9x4 | 64 GB | | |
| RDIMM-3DS | (4R/8R) x4 (RC A) | 2H- 128 GB 4H- 256 GB | | |
| LRDIMM / LRDIMM-3DS | NA | NA | Not Supported | Not Supported |

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# DC Persistent Memory third generation

The ThinkSystem V3 also supports Intel's third-generation 300 Series Optane DC Persistent Memory (PMem). Optane PMems will still be available in 128 GB, 256 GB, and 512 GB modules, and they will also run at speeds of up to 4800 MT/s. In the ThinkSystem V3, PMems support two, four, and eight-socket configurations. They also support App Direct Mode, Memory Mode, and Mixed Mode.

The upper figure shown below is the PMem 300 Series module, and the lower figure is a standard DIMM.
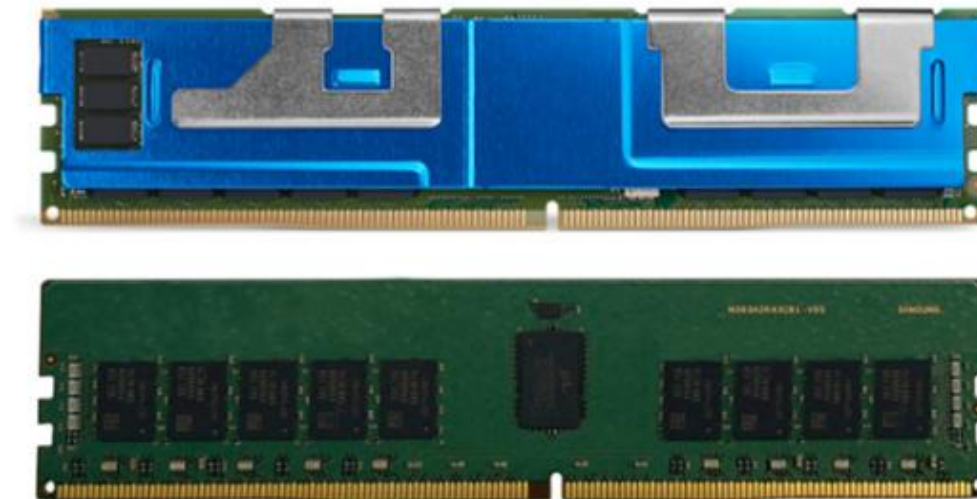


**Note:** For more information about Intel Optane Persistent Memory, refer to course ES51965 - Introducing the Intel Optane DC persistent memory module.

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# Intel Optane PMem support

Scroll down for more information

| Intel Optane PMem Family | Intel Optane PMem 100 series Apache Pass | Intel Optane PMem 200 series Barlow Pass | | Intel Optane PMem 300 series Crow Pass |
|---|---|---|---|---|
| Intel Xeon SP | Purely 2S/4S/8S Cascade Lake six channel DDR4 | Whitley 2S Ice Lake eight channel DDR4 | Cedar Island 4S Cooper Lake six channel DDR4 | Eagle Stream 2S/4S/8S Sapphire Rapids, Emerald Rapids eight channel DDR5 |
| PMem SKU Capacity & Total Platform PMem Capacity | 128 GB, 256 GB, 512 GB 3 TB per socket | 128 GB, 256 GB, 512 GB 4 TB per socket | 128 GB, 256 GB, 512 GB 3 TB per socket | 128 GB, 256 GB, 512 GB 4 TB per socket |
| Interface | DDR-T | DDR-T | | DDR-T2 |
| Speeds | Up to 2666 MT/s | Up to 3200 MT/s | Up to 2666 MT/s | 4000 to 4800 MT/s |
| Media Controller | Elk Valley | Barlow Valley | | Crow Valley |
| TDP Power | 18 watts | 15 watts | | 15 watts |
| Security | AES-256 encryption | AES-256 encryption | | FIPS140-3 level 2 compliance |
| Data Persistence in Power Failure event | ADR | ADR, eADR (optional) | | ADR, FastADR (optional) |
| 2R1W Random Bandwidth | 1 GB/s | 1.21 GB/s | | 3-4 GB/s |
| 2R1W Sequential | 4 GB/s | 4.83 GB/s | | 6-8 GB/s |

# Intel Optane PMem support

Scroll down for more information

| Intel Optane PMem Family | Intel Optane PMem 100 series Apache Pass | Intel Optane PMem 200 series Barlow Pass | | Intel Optane PMem 300 series Crow Pass |
|---|---|---|---|---|
| Speeds | Up to 2666 MT/s | Up to 3200 MT/s | Up to 2666 MT/s | 1600 to 4800 MT/s |
| Media Controller | Elk Valley | Barlow Valley | | Crow Valley |
| TDP Power | 18 watts | 15 watts | | 15 watts |
| Security | AES-256 encryption | AES-256 encryption | | FIPS140-3 level 2 compliance |
| Data Persistence in Power Failure event | ADR | ADR, eADR (optional) | | ADR, FastADR (optional) |
| 2R1W Random Bandwidth | 1 GB/s | 1.21 GB/s | | 3-4 GB/s |
| 2R1W Sequential Bandwidth | 4 GB/s | 4.83 GB/s | | 6-8 GB/s |
| Intel Memory Bandwidth Boost | N/A | Up to 25% opportunistic bandwidth increase | | Up to 30% opportunistic bandwidth increase |
| Operating Modes | App Direct (AD) Memory Mode (MM) Mixed Mode (AD+MM) | App Direct (AD) Memory Mode (MM) | App Direct (AD) only | App Direct (AD) Memory Mode (MM) Mixed Mode (AD+MM) |

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# Memory installation rules

Memory modules must be installed in a specific order based on the memory configuration and the number of processors and memory modules installed in the server. Each server has its own installation rules, and servicers should always check the memory installation rules for individual ThinkSystem servers.

The procedure:

1.  Go to the ThinkSystem Documentation Information Center website.

2.  Select the ThinkSytem portfolio in the left column. In this example, **ThinkSystem rack servers** has been selected.

3.  Select a machine type. In this example, **ThinkSystem SR850 V2 Types 7D31, 7D32** has been selected.

4.  Select **Server hardware setup ➔ Install server hardware options in the server ➔ Install a memory module ➔ Memory module installation rules and order**.

# Intel Virtual RAID on CPU

Intel Virtual RAID on CPU (VROC) provides an enterprise RAID solution on platforms that support Intel Volume Management Device (VMD). Intel VMD provides support for RAID on PCIe NVMe SSDs.

Intel VROC, combined with Intel RSTe and VMD, allows bootable RAID on PCIe NVMe SSDs directly attached to the CPU PCIe lanes.

Two types of VROCs are supported on the Lenovo ThinkSystem V3:

• Onboard SATA ports with software RAID support (Intel VROC SATA RAID, formerly known as Intel RSTe)

• Onboard NVMe ports with software RAID support (Intel VROC NVMe RAID)

– Standard: Intel VROC (VMD NVMe RAID), supports Intel SSDs only

– Premium (requires an FoD key): Intel VROC (VMD NVMe RAID), which enables RAID support for non-Intel NVMe SSDs

For more information about VROC, refer to course ES51780C Servicing the ThinkSystem storage controllers

For specifications of the supported RAID adapters and HBAs, refer to Lenovo ThinkSystem RAID Adapter and HBA Reference

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# Summary

This course enabled you to:
- Identify the differences between the 3rd Generation and Next Generation Intel Xeon Scalable processors
- Describe the features of the Next Generation Intel Xeon Scalable processor in ThinkSystem V3 servers
- Describe the Intel Xeon Scalable processor naming rules
- Describe the supported memory and storage features on ThinkSystem servers