Power10 Briefing

July 21, 2022

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Distinguished Engineer

IBM **Power** Systems

IBM Power

Engineered for agility

Modernize with a frictionless hybrid cloud experience

Respond faster to business demands

with efficient scaling and consistent pay-for-use consumption across public and private clouds

Protect data from core to cloud

using memory encryption at the processor level designed to support end-to-end security across public and private clouds without impacting performance

Streamline insights and automation

by running AI inferencing directly in core and leveraging Watson services in IBM Cloud

Maximize availability and reliability

with built-in advanced recovery and self-healing for infrastructure redundancy and disaster recovery in IBM Cloud

IBM Power10
Scalable, sustainable compute

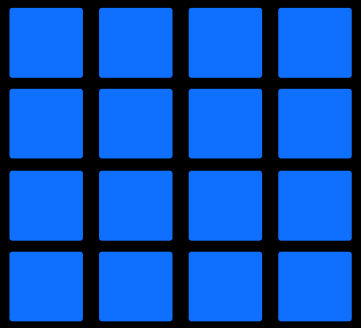
Same work → Less infrastructure → Smaller carbon footprint

52% lower energy consumption for the same workload in Power E1080 vs Power E880C*

33% lower energy consumption for the same workload in Power E1080 vs Power E980*

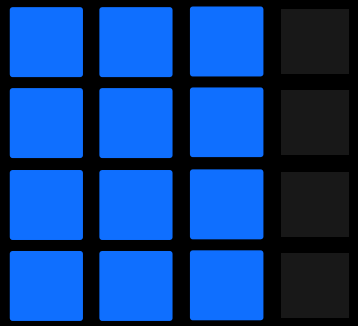
Reduce carbon footprint with Power10

IBM Power8



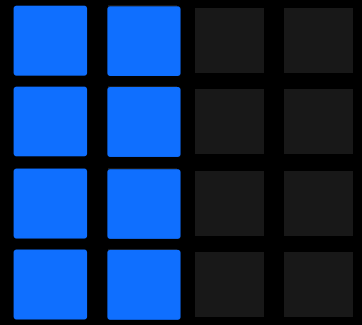
10,376 watts

IBM Power9



7,478 watts

IBM Power10



~5,000 watts

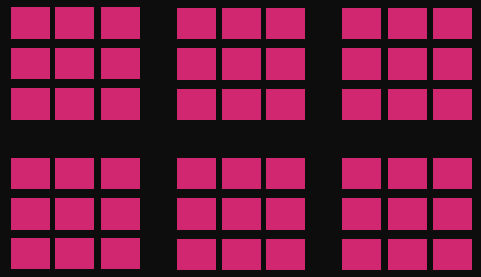
* Power8 (12c) is 3679 rPerf @ 16,600 Watts (0.22 rPerf/Watt), Power10 (15c) is 7998 rPerf @ 17,320 Watts (0.46 rPerf/Watt); 0.46 / 0.22 = 2.06 more rPerf/Watt, delivering 2X energy efficiency
Power9 (12c) IS 5081 rPerf @ 16,520 Watts (0.31 rPerf/Watt), Power10 (15c) is 7998 rPerf @ 17,320 Watts (0.46 rPerf/Watt); 0.46 / 0.31 = 1.48 more rPerf/Watt

Same work, fewer resources, smaller carbon footprint

Customer example

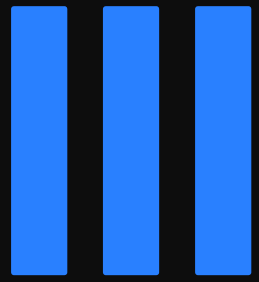
Previous customer environment:

126 Intel Oracle Database servers



Consolidated environment:

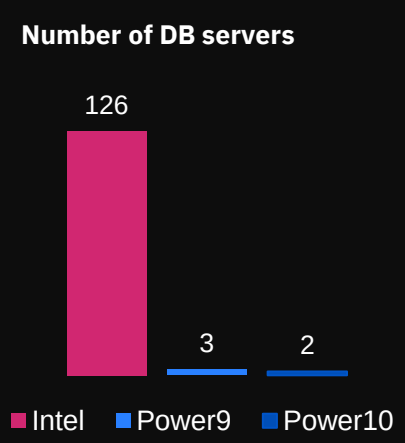
3 Power E980's

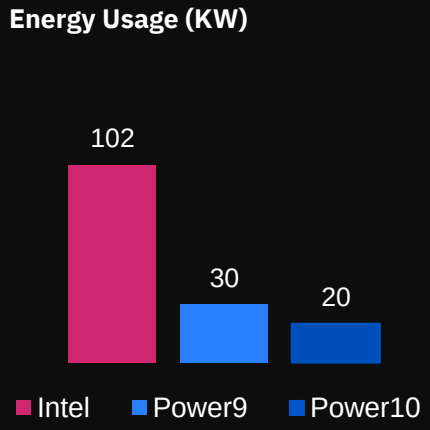


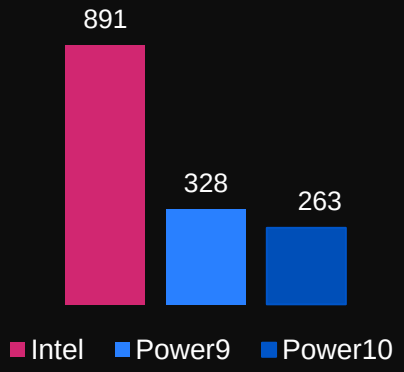
Projected consolidation:

2 Power E1080's

Benefits achieved with consolidation







Red Hat OpenShift & IBM Cloud Paks on Power

Efficient Scaling

4.1X more containerized throughput per core than x86 running Red Hat OpenShift*

Persistent Security and Reliability

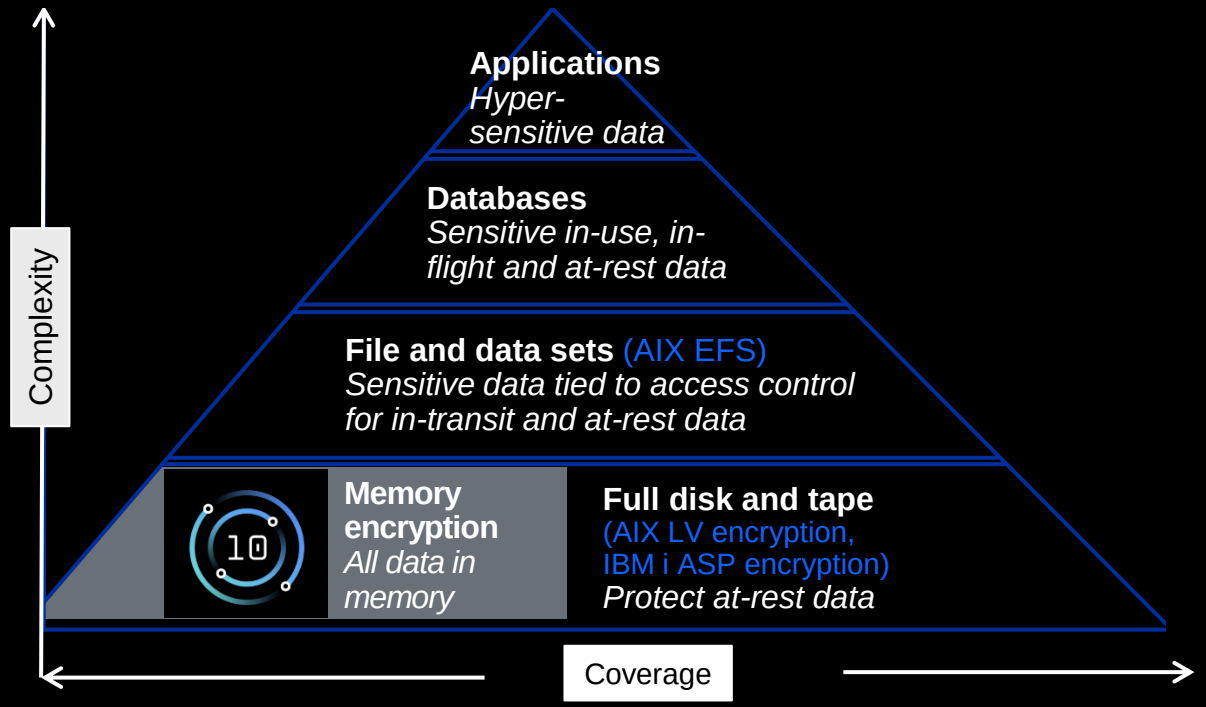
- Most secure workload isolation
- Advanced data protection
- Platform integrity

Optimize Utilization

- Automated core allocation across worker nodes
- Gain performance and TCO advantages co-locating AIX, IBM i and Red Hat OpenShift environments
- Instant scaling, pay per use consumption

*Based on IBM internal testing of Red Hat OpenShift Container Platform 4.8.2 worker nodes running 80 pods each with 10 users using the Daytrader7 workload (https://github.com/WASdev/sample.daytrader7/releases/tag/v1.4) accessing AIX Db2 databases. Average cpu utilization for the OCP worker nodes is > 95%. Comparison: Power E1080 running OCP accessing AIX Db2 on an S922 versus OCP on Cascade Lake accessing AIX Db2 on the same S922. Valid as of 8/26/2021 and conducted under laboratory conditions. Individual result can vary based on workload size, use of storage subsystems & other conditions. IBM Power E1080 (40 cores/3.8 GHz/2 TB memory) in maximum performance mode, 25 Gb two-port SRIOV adapter, 1 x 16Gbs FCA, with PowerVM. Competitive system: Intel(R) Xeon(R) Gold 6248 CPU (Cascade Lake) in performance mode, 40 cores/3.9GHz/512GB memory), 25Gb two-port SRIOV adapter, 1 x 16Gbps FCA, RHEL 8.4 KVM.

Protect Data:
End to end security with full stack encryption



Transparent memory encryption with:

- No additional management setup
- No performance impact

Blazing fast hardware-accelerated encryption compared to Power9

- 2.5x faster AES crypto performance per core[1]
- 4x crypto engines in every core

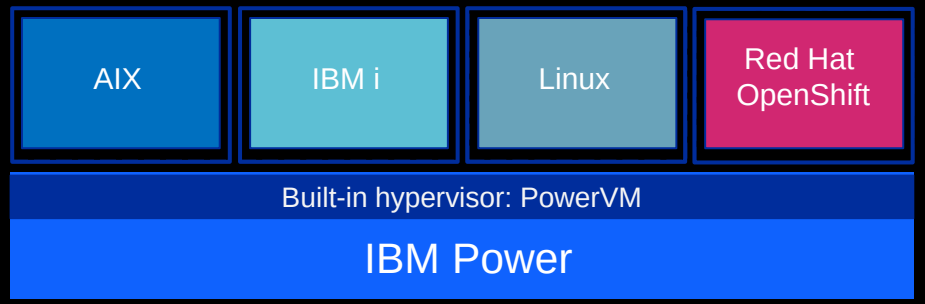
Stay ahead of current and future threats with support for:

- Quantum-safe cryptography
- Fully homomorphic encryption

1. AES-256 in both GCM and XTS modes runs about 2.5 times faster per core when comparing Power10 E1080 (15-core modules) vs. Power9 E980 (12-core modules) according to preliminary measurements obtained on RHEL Linux 8.4 and the OpenSSL 1.1.1g library

Confidential Computing: Isolation and Integrity

Most secure multi-tenant cloud environment with order of magnitude lower CVEs vs x86 hypervisors



Enhanced CPU isolation from Service Processors

- Limit CPU resources accessible by BMC/FSP
- Creates separate domains between service processor and CPU

Performance enhanced side channel avoidance

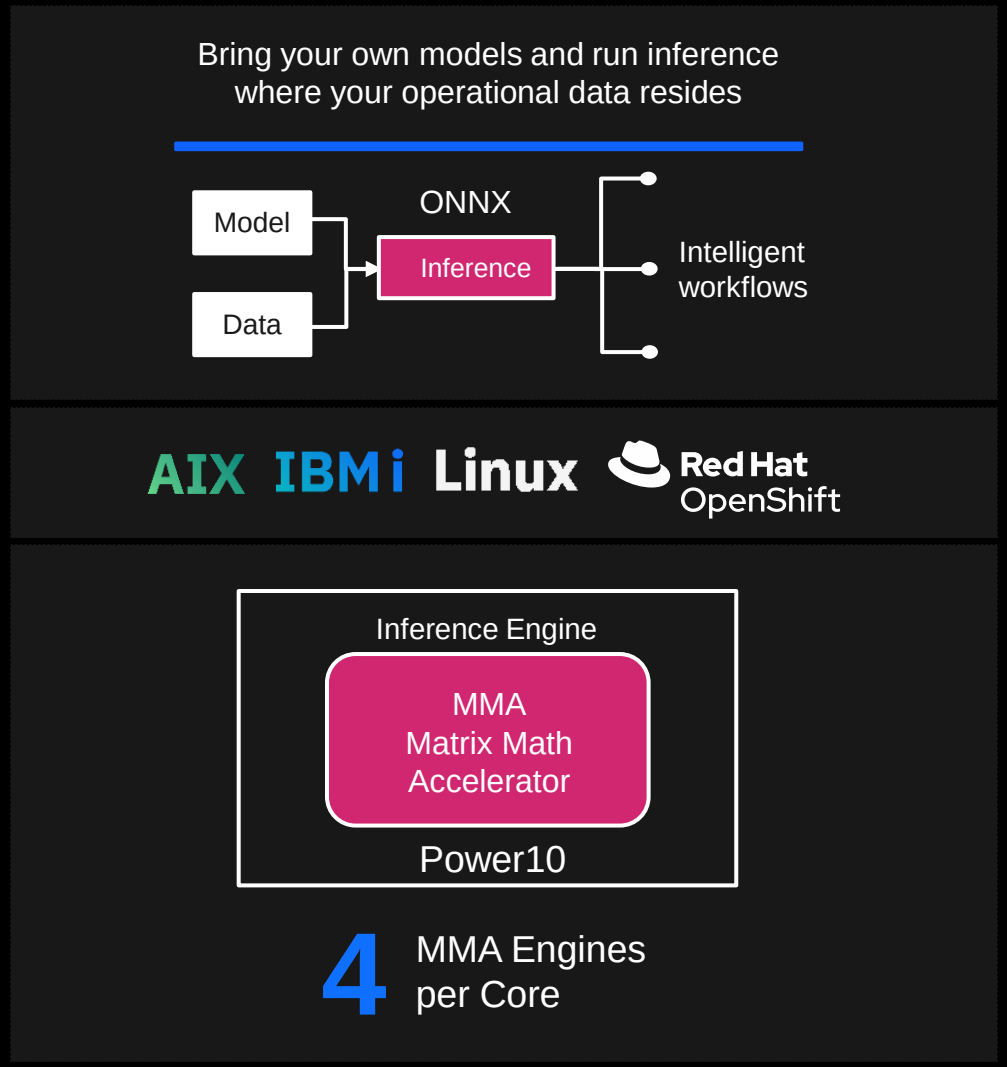
- Protect against data leakage
- Enhanced handling of automatic thread isolation from speculation-based attacks

Protect Integrity of Return Stack against Return-Oriented-Programming attacks

- New in-core hardware architecture with low hardware footprint and standard-based cryptography

Secure and Trusted boot for host and guest LPARs

In-core AI inferencing and machine learning



5X

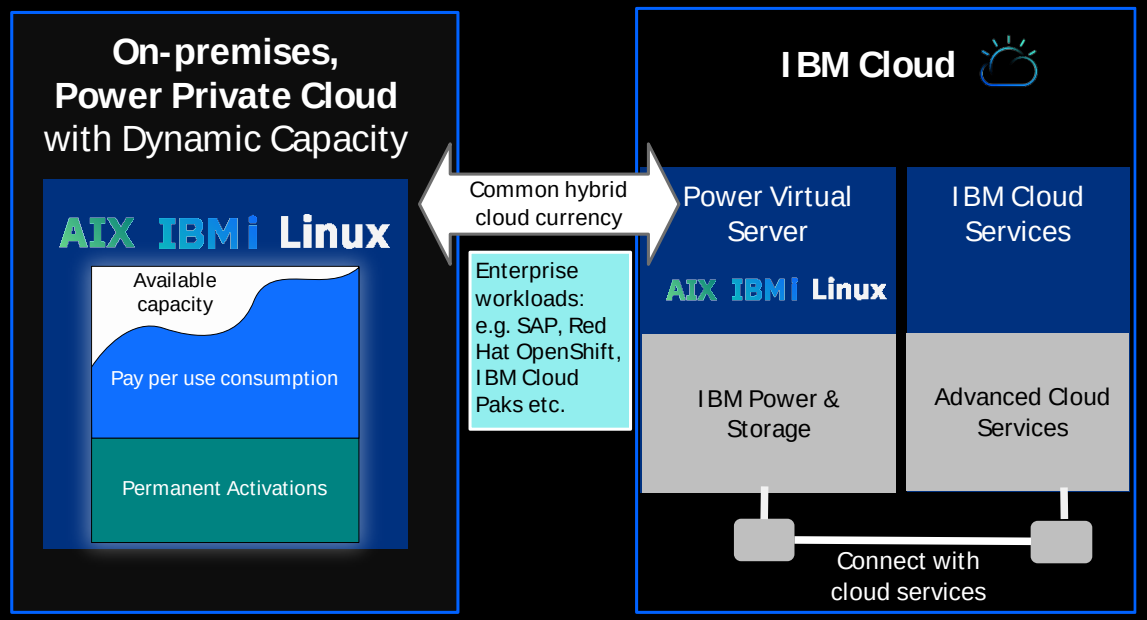
Faster AI inferencing per socket over Power E980*

- Perform in-core AI inferencing and ML where data resides
- Provides alternative to using separate GPU systems
- Train AI models anywhere, deploy on Power without changes for AI; with high RAS
- Support for popular libraries, AI frameworks and ONNX runtime

* 5x improvement in per socket inferencing throughput for large size 32b floating point inferencing models from Power9 E980 (12-core modules) to Power10 E1080 (15-core modules). Based on IBM testing using PyTorch, OpenBLAS on the same BERT Large with SQuAD v1.1 data set

IBM Power approach to frictionless hybrid cloud

Consistent experience for elastic computing across the IT environment



- Consistent and compatible IT architecture – no additional middleware or application refactoring required
- Extend workloads across on-premises and Power Virtual Server
- Consistent management and automation services across hybrid & heterogeneous architectures
- Common hybrid cloud currency for pay-per-use consumption

IBM Power

Infrastructure built for business with hybrid cloud agility

Consume Infrastructure-as-a-Service

Flexibility in deployment, management, and payment options

IBM Power

Business continuity and agility

Designed for the most challenging business requirements

- Leadership performance and scale
- Industry-leading availability
- Flexibility & agility
- End-to-end security from the processor to virtualization and OS

Power Private Cloud with Dynamic Capacity

Pay only for what you use

Cloud capabilities on-prem. with advanced monitoring

- Flexible consumption options with built-in cost optimization
  - 20-30% lower TCO
  - ~ 50% lower TCA
- Simple agility to respond to business demands
- Cloud-based monitoring, metering by the minute
  - Including RHEL and OCP
- Power10 and POWER9 can co-exist in the same pool

Power Virtual Server with IBM Cloud

Extend to public cloud

Red Hat OpenShift

Same mission-critical infrastructure as on-prem, for Dev/Test, HA/DR, modernization

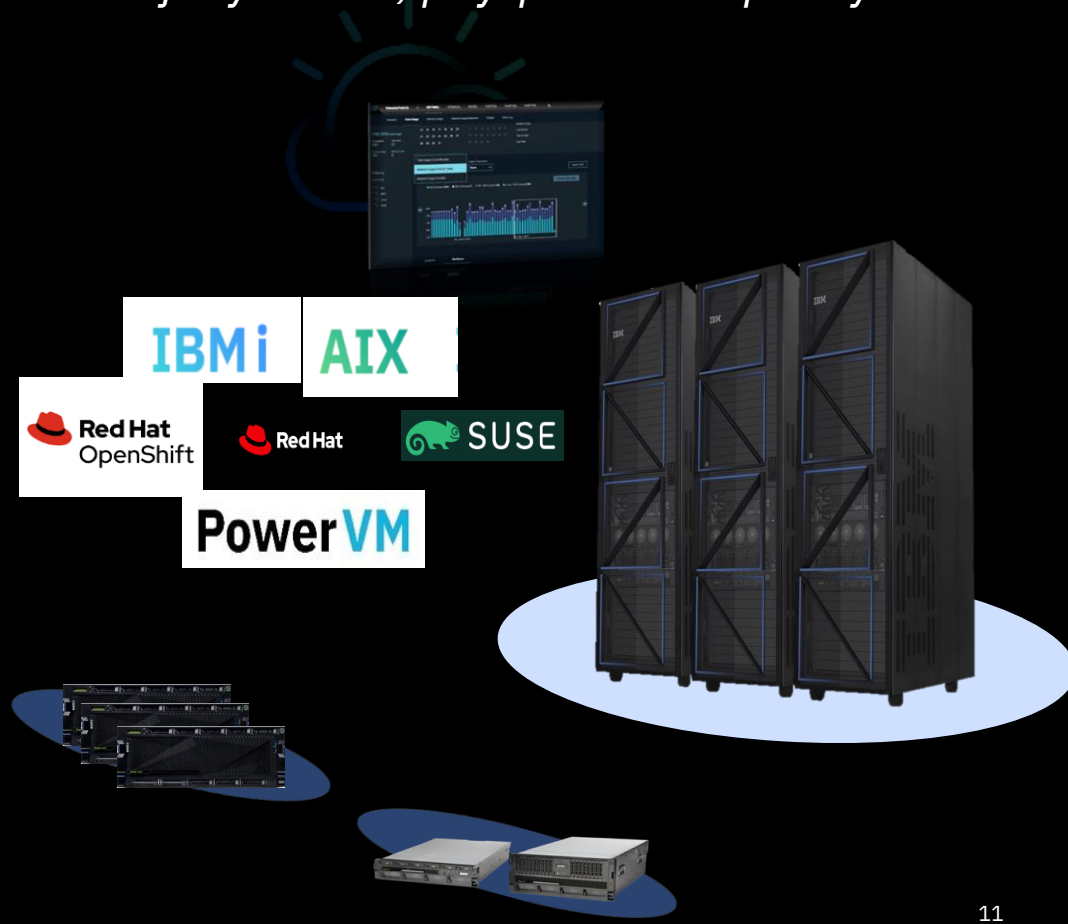
- VM-as-a-Service
- Consistent architecture to on-prem infrastructure
- AIX, IBM i and Linux
- Access to other cloud services
- Global footprint
- Quick access to OpenShift to accelerate app modernization

Power Private Cloud with *Shared Utility Capacity*

Cloud-like agility and economics with leadership business continuity and security

- ✓ Aggregate capacity consumption across systems and datacenters and pay for use
- ✓ Optimize resource utilization to reduce compute capacity costs by 20-30% with seamless, multi-system resource sharing
- ✓ Shift spend to OpEx: Lower initial system purchase by over 50% and access fully-active standby resource as pay-per-use capacity, by the minute
- ✓ Real time & historical usage monitoring and analysis via the Cloud Management Console

Seamless, multi-system resource sharing & fully-active, pay-per-use capacity



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Power Private Cloud with *Shared Utility Capacity*

Cloud-like agility and economics with leadership business continuity and security

2021 Enhancements

- *Up to 48 systems and 2,000 VMs per pool*
- *Flexibility to allocate a Capacity Credits to multiple pools*
- *Interoperate & share Power9 & Power10 in a pool*
- *Investment transition offering for P9 to P10*
- *Expanded OS support to SUSE & Red Hat Linux*

Planned for 2022*

- *OpenShift Container Platform as Base/Metered Capacity*
- *Enable "post-pay" monthly invoicing of usage*
- *Support for Power10 Midrange & Scale-out systems*

Seamless, multi-system resource sharing & fully-active, pay-per-use capacity

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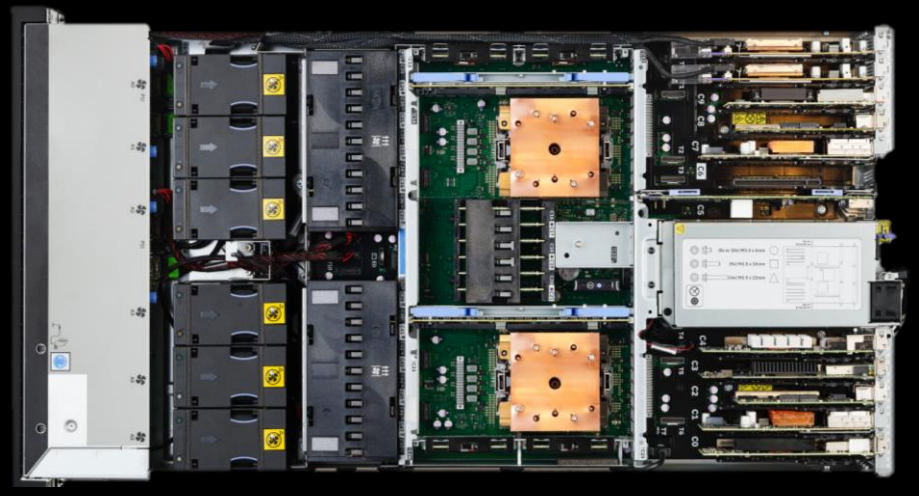
Power10 Memory Technologies

New Differential DIMM Technology (DDIMM)

Moving from Industry Standard to Differential DIMMs in Power10

New Open Memory Interface (OMI)

Providing higher bandwidth and flexibility for future memory technologies



2X better memory RAS than industry standard DIMMs[1]

2.4X higher memory bandwidth than Power9 Scaleout memory bandwidth

DDR4 running at up to 3200 Mbps data rate provides 409 GB/s peak memory bandwidth per socket

Transparent memory encryption with no additional management setup and no performance impact

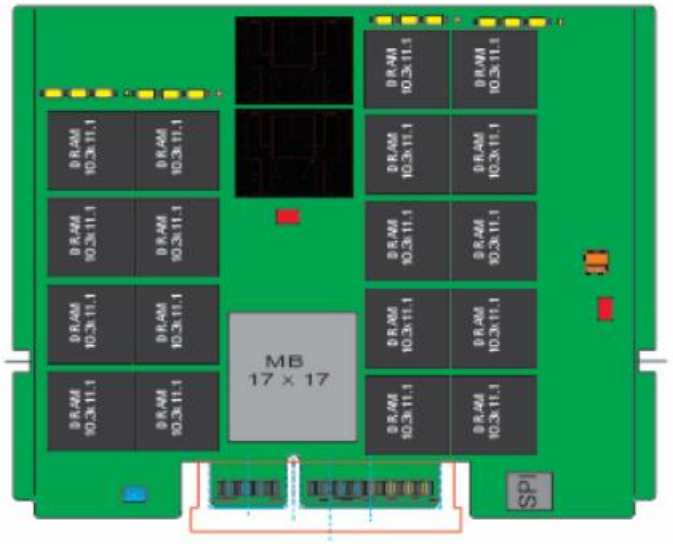
Chipkill technology with advanced ECC protects from memory chip failure - plus spare

Active Memory Mirroring (AMM) feature supported - Mirrors hypervisor memory to provide resiliency from uncorrectable memory errors

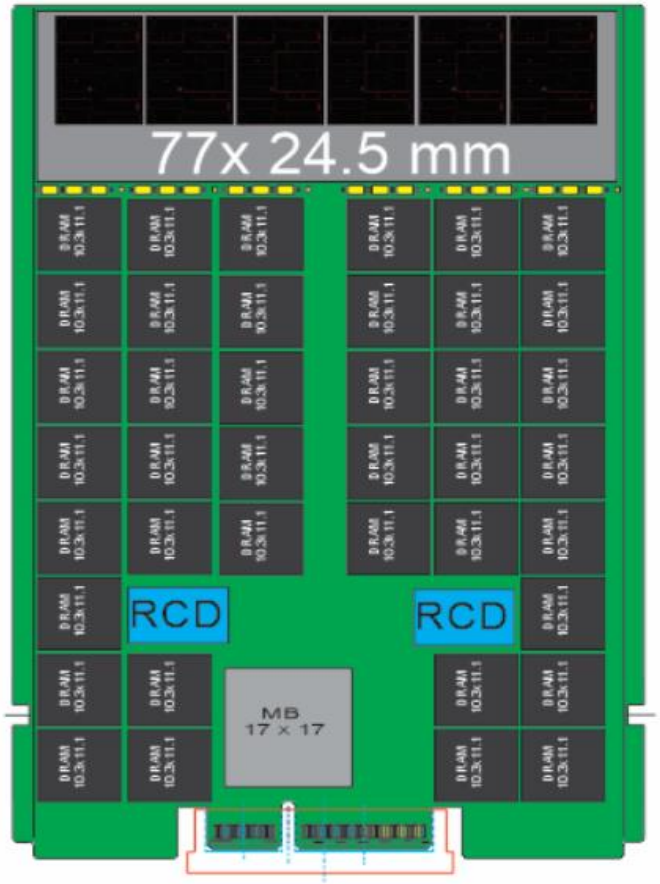
[1] Based on IBM's internal analysis of the IBM product failure rate of DDIMMS vs Industry Standard-DIMMs

New Power10 Memory Technology

2U DDIMM



4U DDIMM



- ✓ **Significant Memory Bandwidth increase over prior generation**
  - 409 GB/s per socket compared to 230 GB/s on Power9 Enterprise
  - 409 GB/s per socket compared to 170 GB/s on Power9 Scale Out servers
  - Utilizes cost effective DDR4 DRAM at 3200 Mbps to outperform competitors using higher cost DDR5 technology
- ✓ **Designed for High Reliability**
  - 4U DDIMM can survive 3 DRAM chipkills with additional spare DRAM per rank
  - Voltage Regulator on DIMM provides better isolation for regulator fails
  - 4U DDIMM provides redundant voltage regulation (N+1)
  - Dynamic DRAM Row Repair enables surviving certain DRAM fails without taking memory/system down

Power10 Roadmap

AIX IBMi Linux

3Q 2021

High-end Enterprise System

3Q 2022

Announce: July 12
GA: July 22

Scale-out Systems

Up to 48 cores and
2 TB of memory

Enterprise Midrange System

Up to 96 cores and
8 TB of memory

4Q 2022

Scale-out Systems Update

Up to 48 cores and
8 TB of memory

Enterprise Midrange System Update

Up to 96 cores and
16 TB of memory

- Max memory configurations available
- FW 1030 with function enhancements

Introducing: IBM Power E1080

First of the Power10 family

>1.5X More throughput than the most powerful server in the industry (Power E980)

Up to 240 Power10 cores
- 25% more then Power9
- 20-30% more performance per core
- Improved sustainability (Same energy and space footprint)
- Enhanced security
- Integrated AI Inferencing acceleration

Up to 64 TB of new high speed OMI Memory

PCIe Gen5 ready

IBM Power E1080 – rPerf

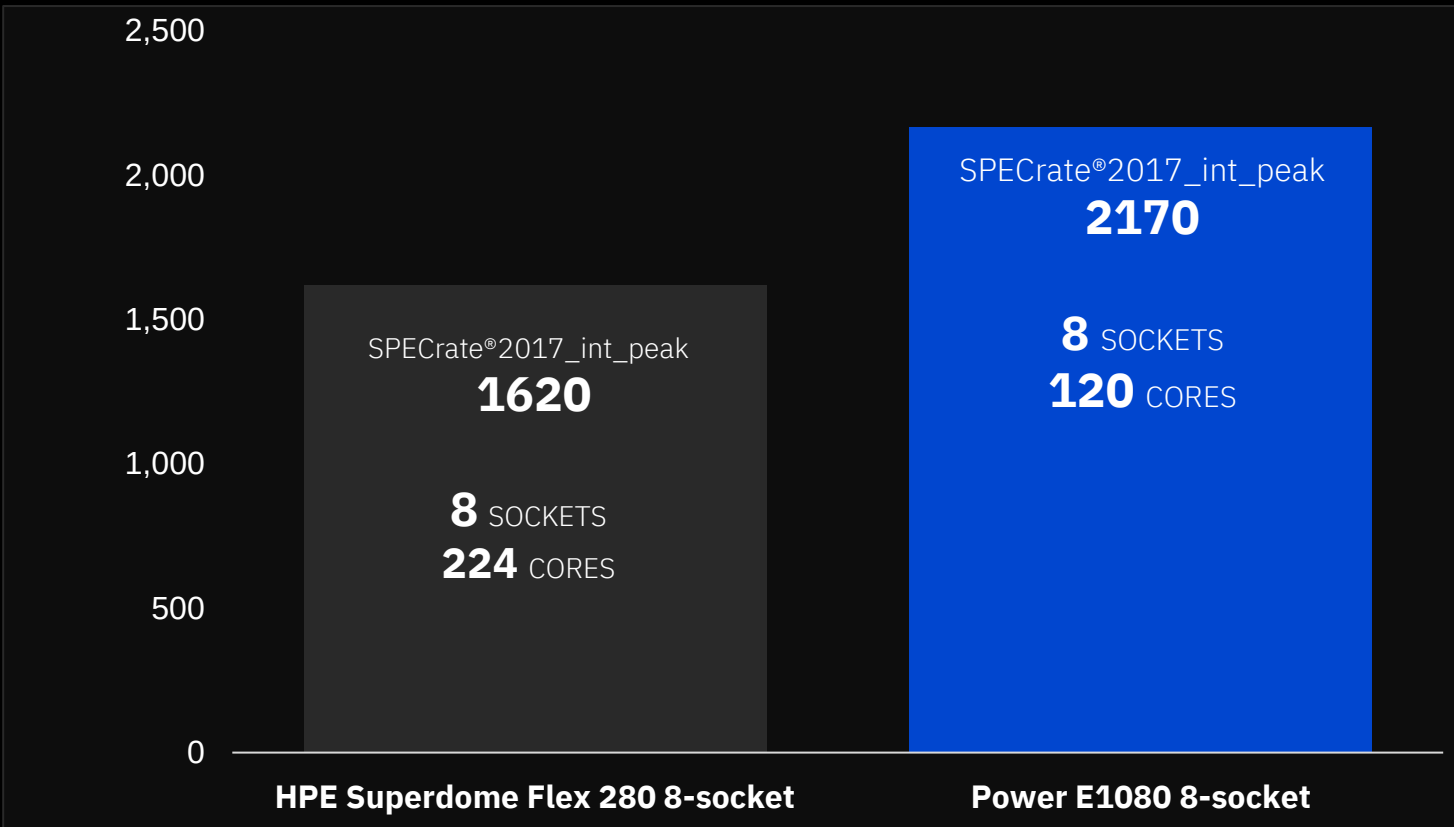
Published rPerf performance results for SMT8 based E1080 systems with 15c, 12c, 10c processor options

Power E1080 rPerf (SMT8)					
E1080 Offerings	**Maximum Cores**	**1-node / 4-sockets**	**2-node / 8-sockets**	**3-node / 12-sockets**	**4-node / 16-sockets**
E1080 / 15c	240-core	2000	3999	5999	7999
E1080 / 12c	192-core	1681	3361	5042	6722
E1080 / 10c	160-core	1367	2734	4100	5467

P10 to P9 System	rPerf Ratio
E1080 48c / E980 48c	1680.6 / 1,270.2 = **1.32**
E1080 60c / E980 48c	1999.7 / 1,270.2 = **1.57**

Full report available at:
https://www.ibm.com/downloads/cas/K90RQOW8

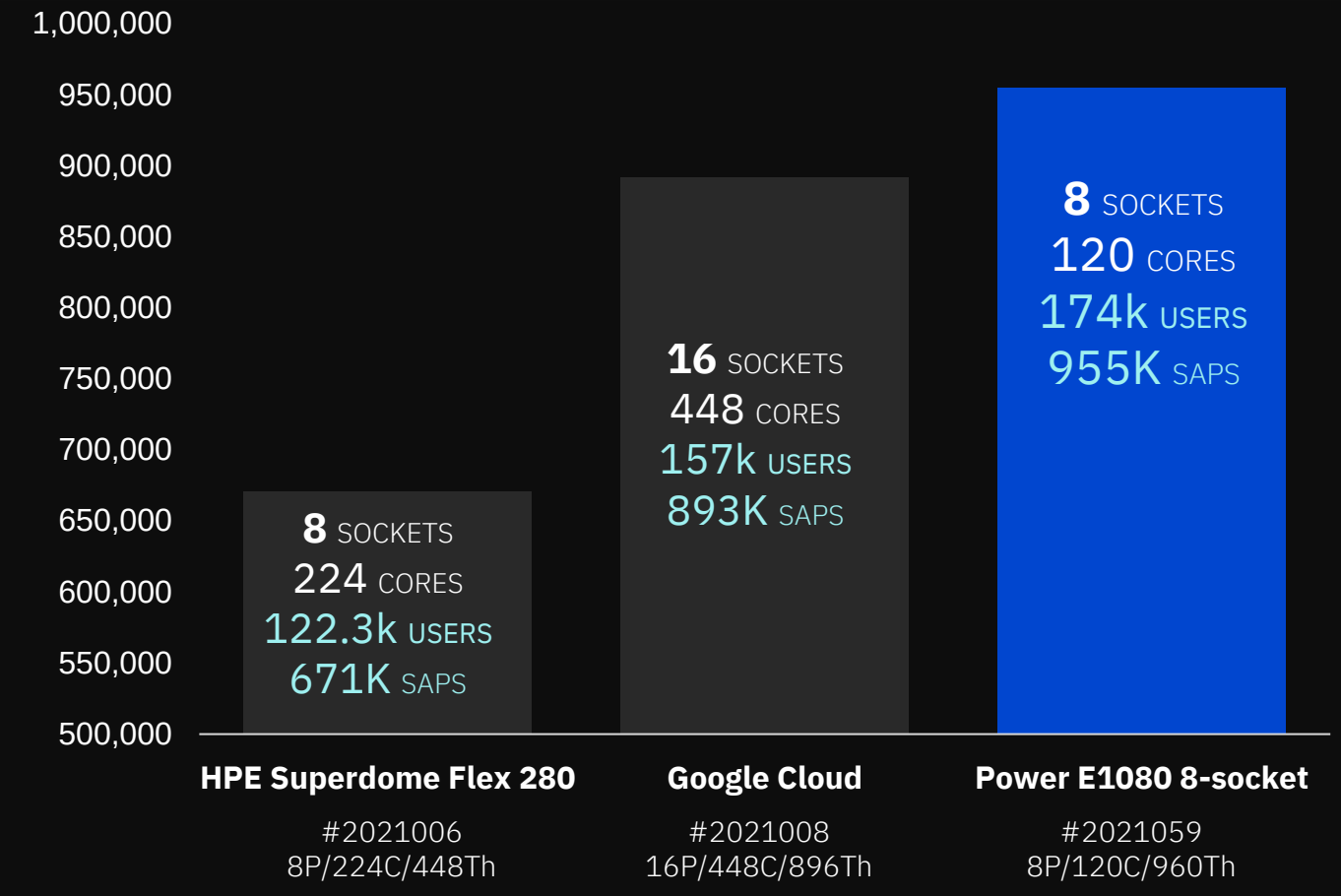
IBM Power E1080 sets world record 8-socket single server SPEC CPU 2017 benchmark result[1]



- World record 8-socket performance
  - SPECrate®2017_int_peak
    - 2170 vs. 1620
  - SPECrate®2017_int_base
    - 1700 vs. 1570
  - 2.5X more performance per core
  - 1.3X more performance per socket
- Power E1080 servers scale to 16 sockets

1. Comparison based on single 8-socket systems (IBM Power E1080 3.55 - 4 GHz, 120 core, AIX and Superdome Flex 280 2.90 GHz, Intel Xeon Platinum 8380H) using published results at www.spec.org/cpu2017/results/ as of 02 September 2021. SPEC® and the benchmark names SPECrate®2017_int_base and SPECrate®2017_int_peak are registered trademarks of the Standard Performance Evaluation Corporation. For more information about SPEC CPU 2017, see www. http:/spec.org/cpu2017/.

IBM Power E1080 sets world record 8-socket two-tier SAP SD standard application benchmark result[1]



- World record 8-socket performance
  - 955,050 vs 670,830 SAPS
  - 174,000 vs 122,300 users
  - More performance per core
    - 4X vs 16-socket Intel[2]
    - 2.7X vs 8-socket Intel[4]
- The most flexible and reliable SAP HANA platform[5]
- Power E1080 servers scale to 16 sockets

100 SAPS = 2,000 fully business processed order line items per hour

1. IBM Power E1080; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5; Power10 3.55-4.0 GHz processor, 4,096 GB memory, 8p/120c/960t, 174,000 SD benchmark users (955,050 SAPS), AIX 7.2, DB2 11.5 . Certification # 2021059. All results can be found at sap.com/benchmark Valid as of 8/27/21
2. Google Cloud Platform; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5 (cloud); Intel Xeon Platinum 8280L 2.7 GHz, 16p/448c/896t, 157,000 SD benchmark users (892,270 SAPS), running Windows Server 2019 and Microsoft SQL Server 2017, Certification # 2021008.
3. HPE Superdome Flex; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5; Intel Xeon Platinum 8280L 2.7 GHz, 16p/448c/896t, 152,508 SD benchmark users (877,050 SAPS), running Windows Server 2019 and Microsoft SQL Server 2019, Certification # 2020029.
4. HPE Superdome Flex; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5; Intel Xeon Platinum 8380H 2.9 GHz, 8p/224c/448t, 122,300 SD benchmark users (670,830 SAPS), Windows Server 2016 and Microsoft SQL Server 2012, Certification # 2021006.
5. Ranked most reliable server in its category for 12th year by ITIC . Flexible: Only platform that runs AIX, IBM i, Linux OS'es while supporting the ability to run 16 SAP HANA production environment in a single server

75% less infrastructure than POWER8
67% less the infrastructure than POWER9

Relatively the same GREFs

E880

25M

E980

23M

E1080

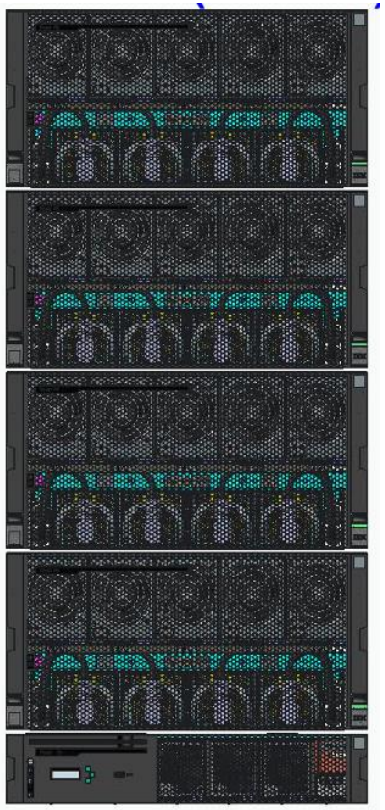
>21M

A single node of a Power E1080 system delivers 21.4M GREFs using only 60 Power processor cores.

This results in significant infrastructure savings, up to 75% less hardware, and an improvement in cooling, energy usage, and data center floorspace.

Power E1080 Highlights

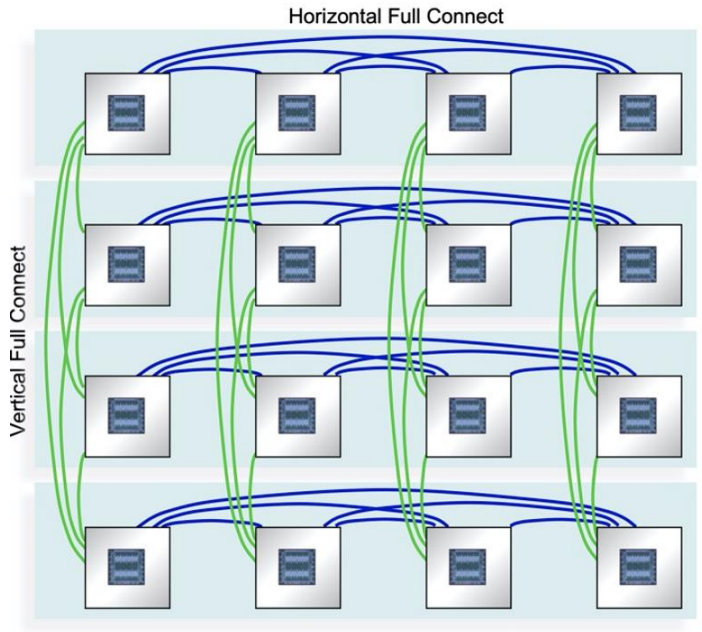
- ✓ Modular Scalable Design – Up to four 5U CEC drawers + 2U Control Unit
- ✓ Max of 240 POWER10 SMT8 cores (10, 12, 15 core offerings, SCM package)
- ✓ Enhanced Workload Optimized Frequency for Power10
- ✓ Up to 64TB total memory (16TB per drawer)
- ✓ New OMI DDIMMs that provide increased memory bandwidth of 409 GB/s per socket
- ✓ Main Memory Encryption for added Security
- ✓ Support for Capacity on Demand and Enterprise Pools 2.0
- ✓ Eight PCIe slots per drawer that are Blindswap with GEN5 support
- ✓ Faster non-Active SMP Cables with concurrent repair and improved fault isolation
- ✓ Ports available for future support of Memory Inception/Clustering
- ✓ Internal Storage - 4 NVMe Flash 7mm U.2 Bays per drawer
- ✓ Secure and Trusted Boot with Redundant TPM modules
- ✓ Up to 16 I/O Expansion Drawers (4 Drawers per CEC Drawer)
- ✓ 2U System Control Unit Drawer



Power E1080 – Processor Subsystem Highlights

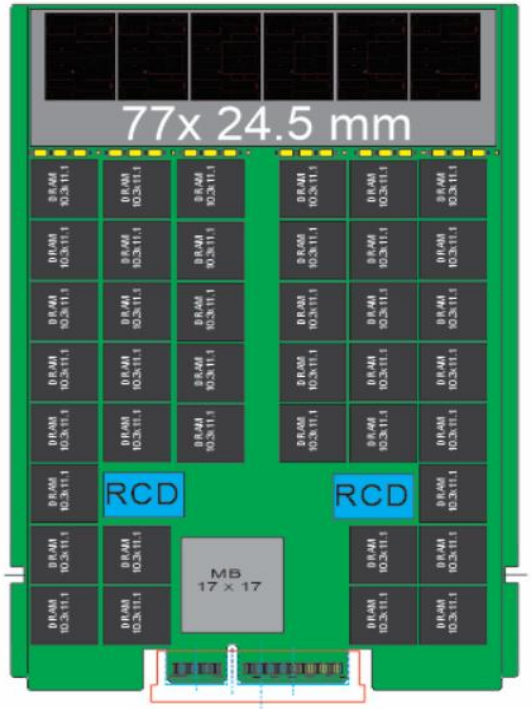
- ✓ 16-socket 2-hop topology, four sockets der drawer
- ✓ Max of 240 SMT8 cores
- ✓ Three processor offerings
  - 15 core – Provides maximum system throughput & core density
  - 12 core – Provides maximum core and thread performance
  - 10 core – Provides entry price/performance offering
- ✓ Enhanced Workload Optimized Frequency for max performance
  - Max frequency achievable without reducing cores
  - Frequency boost for Ambient temperatures below 27C
  - Sampling rate improved to 500us (was 4ms)
- ✓ Improved processor-to-processor fabric interconnect
  - Increased SMP fabric interconnect bus frequency - 32Gb/s
  - Non-active SMP cables for node-to-node connections

	Feature Code	Number of Cores	Max Performance Mode Freq Range *
E1080	EDP4	15 core	3.55 to 4.00 GHz (max)
	EDP3	12 core	3.60 to 4.15 GHz (max)
	EDP2	10 core	3.65 to 3.90 GHz (max)

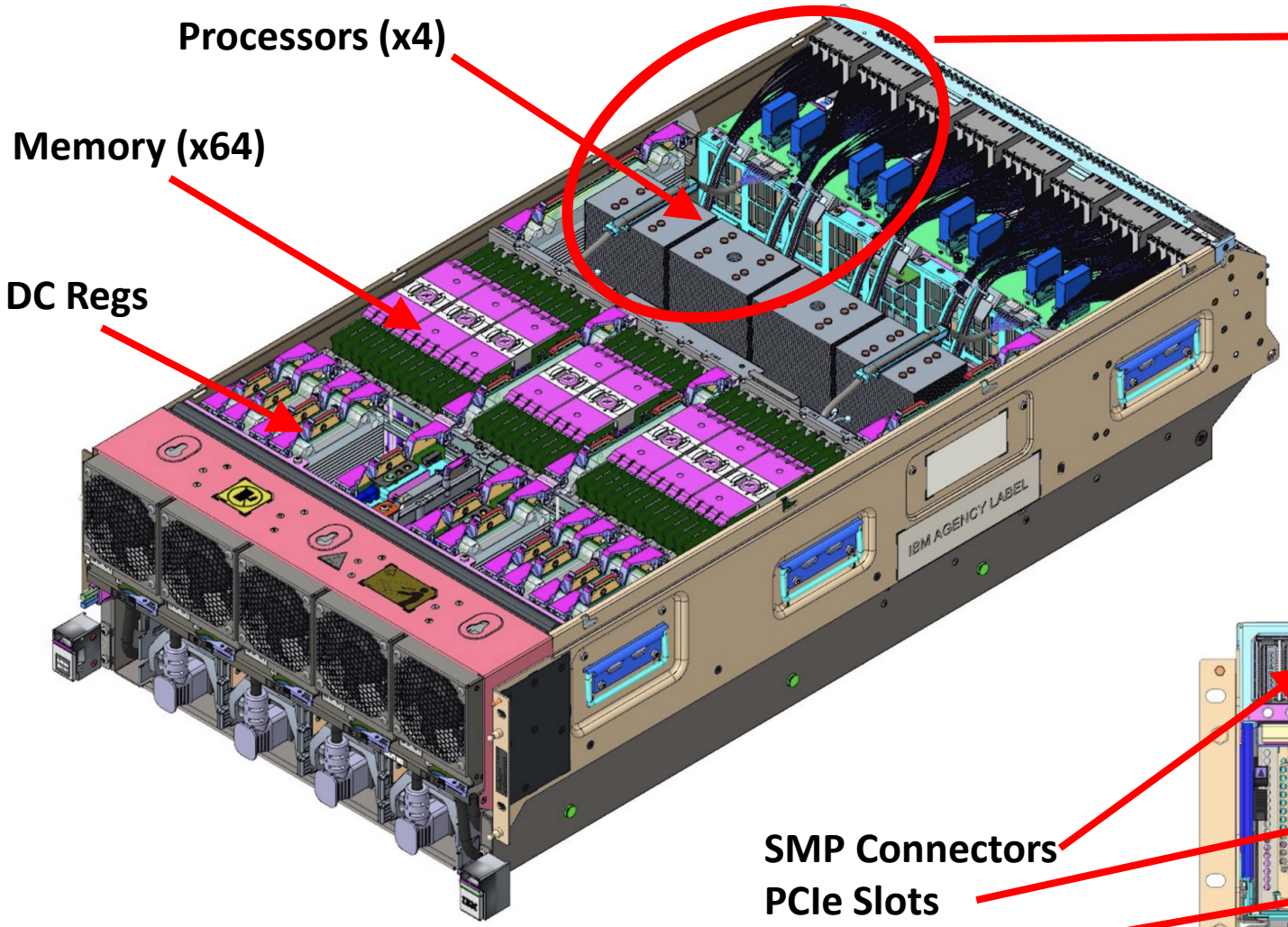


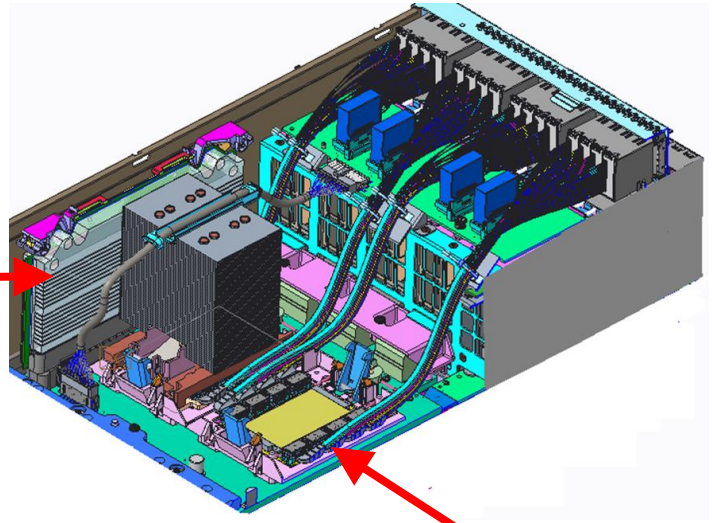
Power E1080 – Memory Subsystem Highlights

- ✓ New OMI (Open Memory Interface)
- ✓ New buffered Differential DIMMs - DDIMMs
- ✓ 16 DDIMM slots per socket – 64 DDIMMs per drawer
- ✓ 4U DDIMMs - Enterprise buffer, N+1 regulation, and spare dram support
- ✓ DDIMM Offerings
  - 32GB DDIMM (DDR4 @ 3200 Mbps) – 409 GB/s peak bandwidth
  - 64GB DDIMM (DDR4 @ 3200 Mbps) – 409 GB/s peak bandwidth
  - 128GB DDIMM (DDR4 @ 2933 Mbps) – 375 GB/s peak bandwidth
  - 256GB DDIMM (DDR4 @ 2933 Mbps) – 375 GB/s peak bandwidth
- ✓ Planned migration support of DDIMMs into future P11 systems



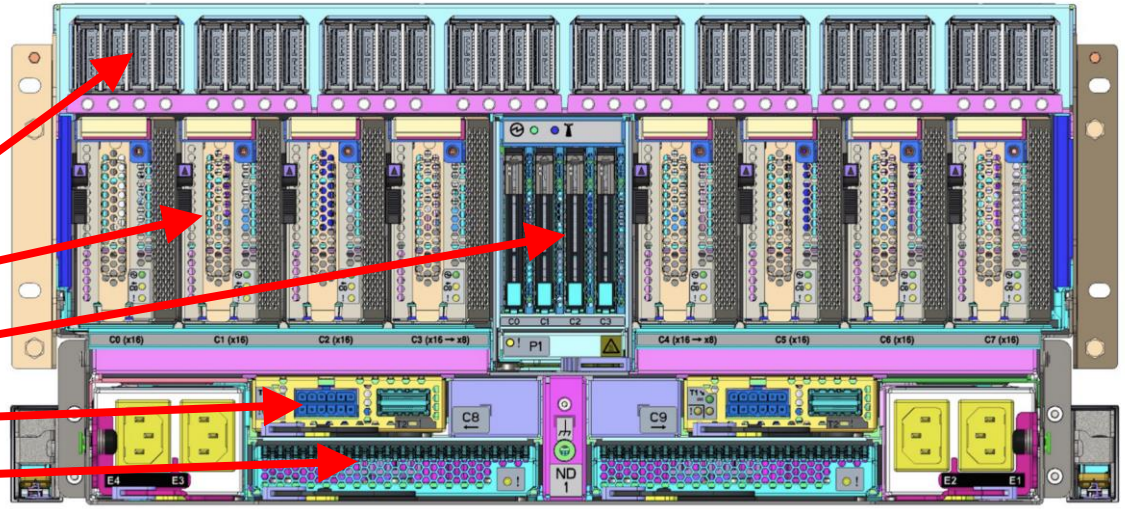
Power E1080 System Views





New CPU Package w/ cable conn
Enables Non-active SMP cables

Rear View

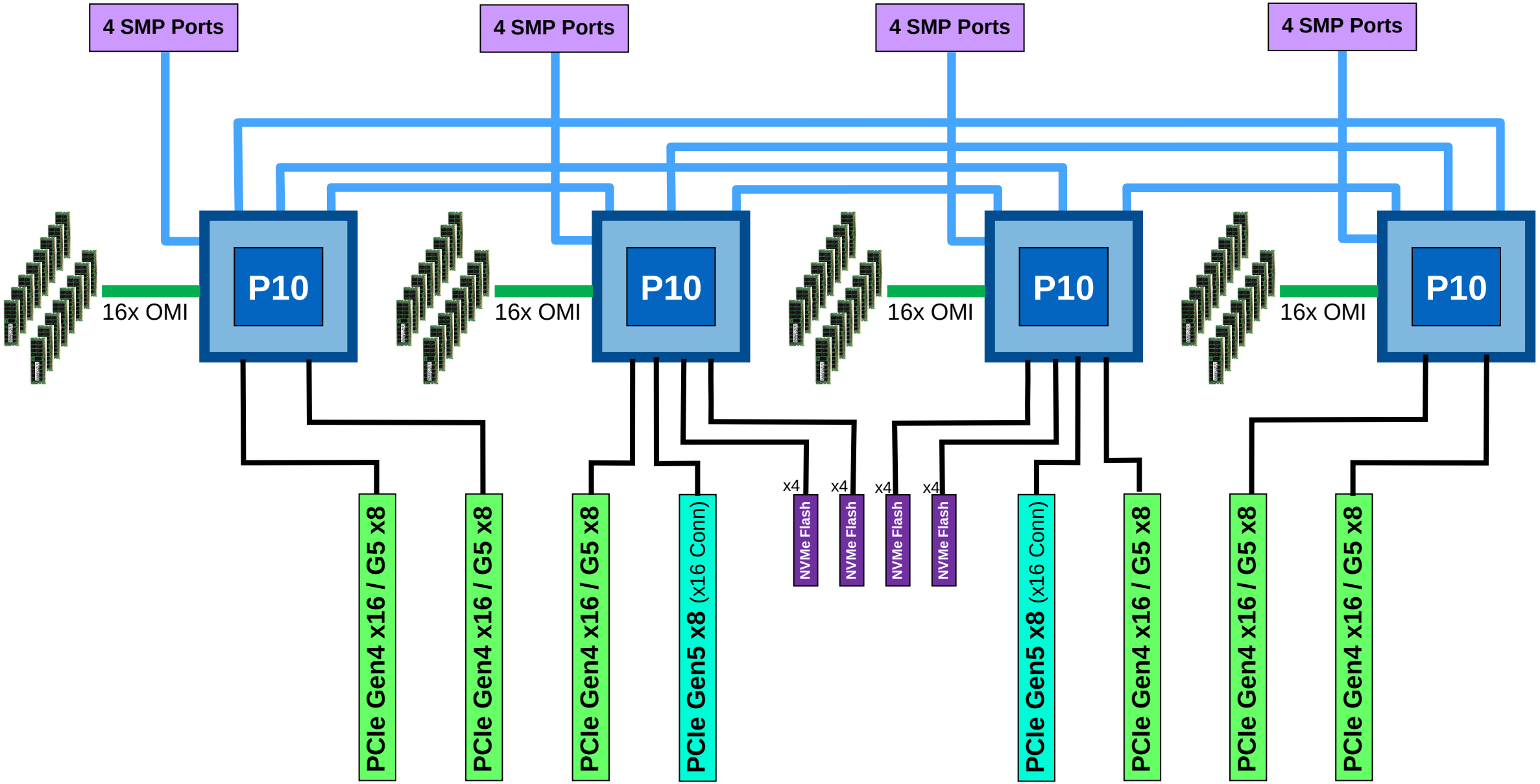


New Power10 System Fault Isolation Technique

TDR (Time Domain Reflectometry)

- Provides a method to isolate which part of the processor fabric path is at fault
- Based on proven technology from IBM Z

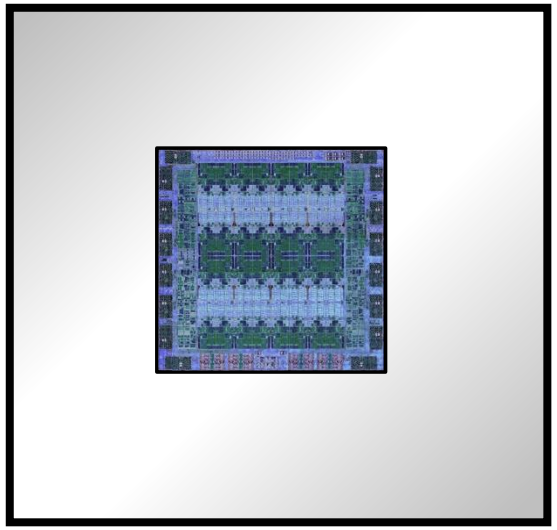
Power E1080 Server Architecture



High End Comparison

Features	POWER8	POWER9	POWER10
Processor Offerings	8, 10, 12	6, 8, 10, 11, 12	10, 12, 15
Maximum Cores	Up to 192 cores	Up to 192 cores	Up to 240 cores
Maximum Memory	32TB	64TB	64TB
DIMM Type/DIMM slots count	Up to 128 DDR4 CDIMMs	Up to 128 DDR4 CDIMMs	Up to 256 DDR4 DDIMMs
Memory Bandwidth	230 GB/sec / socket	230 GB/sec / socket	409 GB/sec / socket
PCIe slots	8 PCIe slots / drawer GEN3	8 PCIe slots / drawer GEN4	8 PCIe slots / dwr GEN5 capable
I/O Drawer Expansion	Yes	Yes	Yes
Acceleration Ports	Yes (CAPI 1.0)	Yes (CAPI 2.0 + OpenCAPI)	Yes (OpenCAPI & Mem Inception)
PCIe Hot Plug Support	Yes, Blindswap	Yes, Blindswap	Yes, Blindswap
IO bandwidth	256 GB/sec	545 GB/sec	576 GB/sec
Integrated I/O		USB 3.0	
Internal Storage Bays		4 NVMe Bays / dwr GEN3 7mm	4 NVMe Bays / dwr GEN4 7mm
SMP Drawer Fabric	6.4 Gb/s	25 Gb/s	32 Gb/s
RAS		SMP Cable Conc Repair	SMP Cable Conc Repair SMP Cable TDR Fault Isolation
Security		Secure and Trusted Boot	Secure and Trusted Boot Encrypted Memory

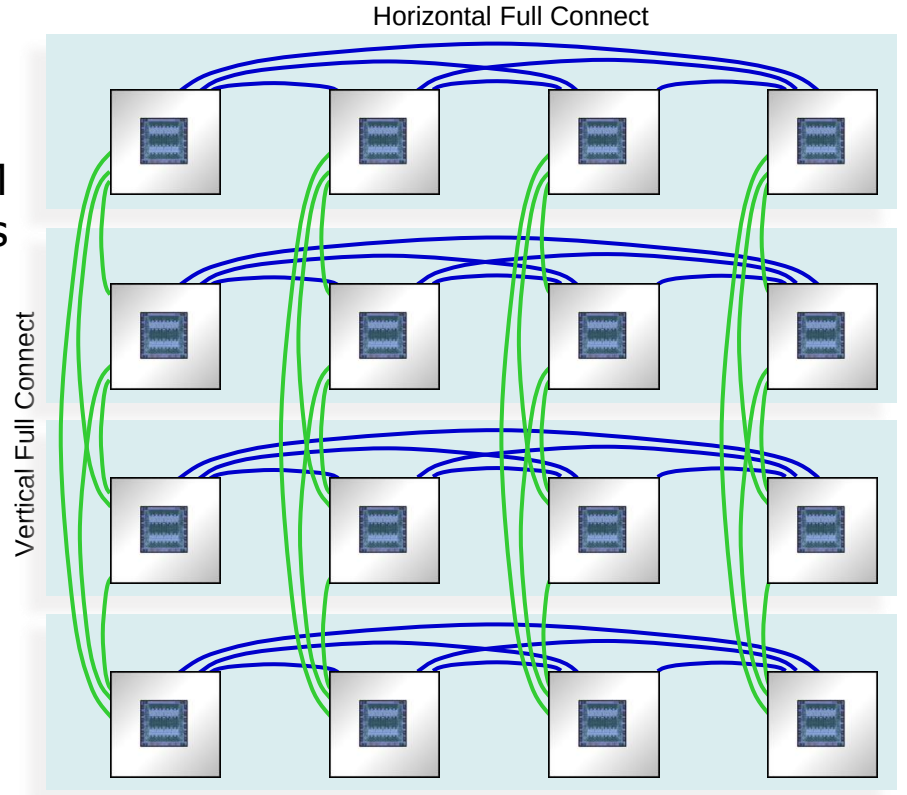
Power10 Package Offerings: SCM & DCM

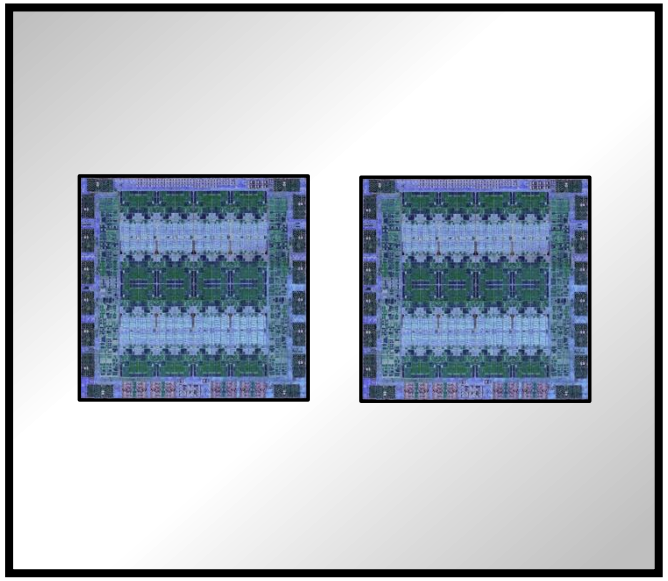


Single-Chip Module Focus:

- Enterprise Core Strength
  - 1.3x POWER9
- Enterprise Scale-Up System
  - 1.5x POWER9
  - Large AIX / IBM i / SAP Hana
- Package used in E1080 server

Up to 16 SCM Sockets

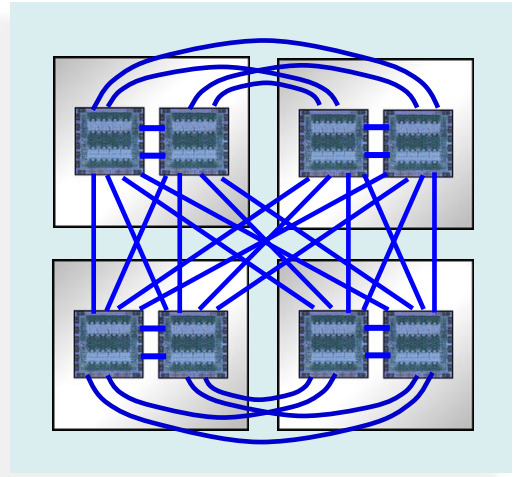




Dual-Chip Module Focus:

- Throughput / Density / Cloud
  - Up to 3x POWER9
- Package used in E1050, S10xx servers

Up to 4 DCM Sockets



IBM Power10 E1050

9043-MRX

Power E1050 – Delivering unprecedented 4-socket performance

5

World Record Benchmarks

Representing industry recognized enterprise workloads

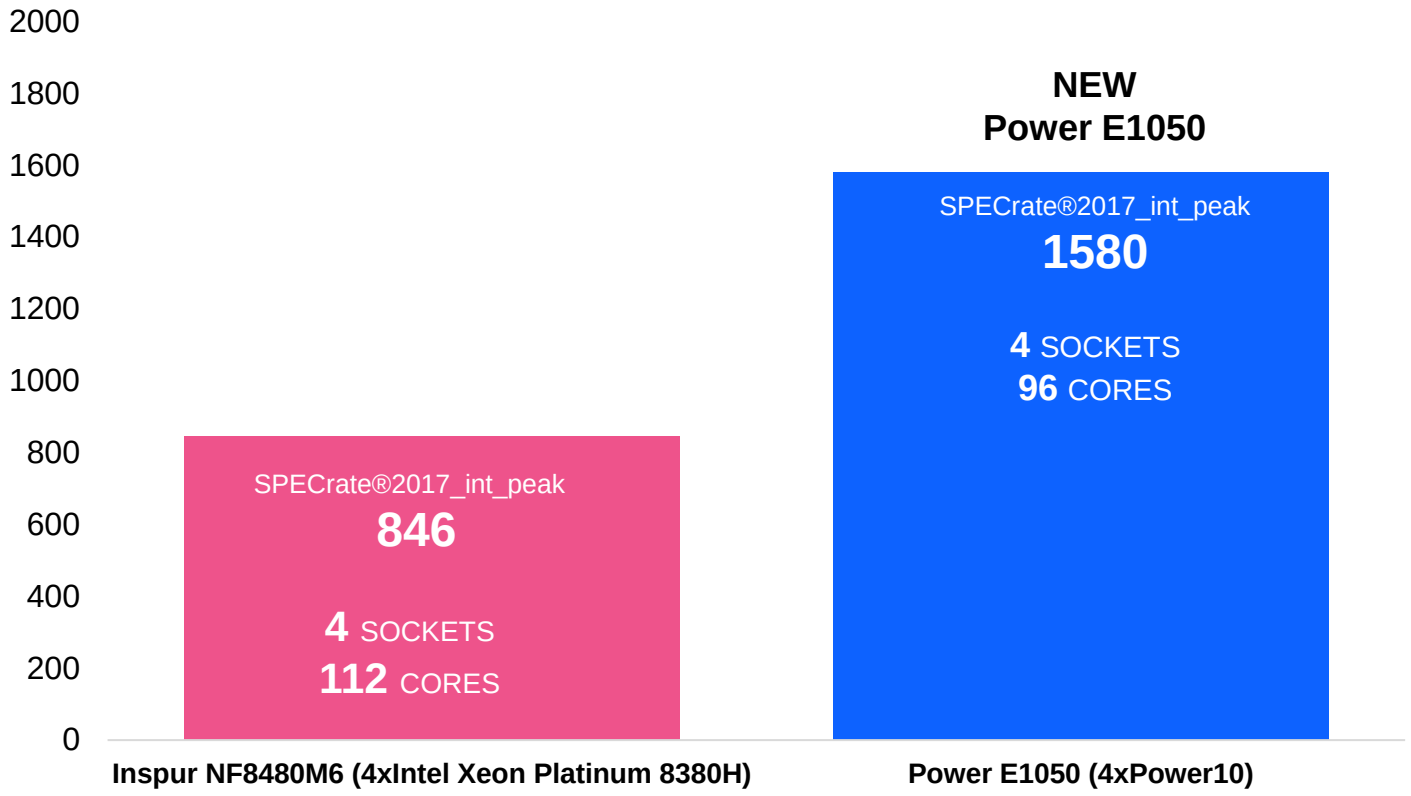
Compute – SPEC CPU 2017
- SPECrate®2017_int_base
- SPECrate®2017_int_peak

Java – SPECjbb2015-MultiJVM
- max-jOPS
- critical-jOPS

SAP – Two-tier SAP SD Standard Application
- Users (SAPS)

IBM Power E1050 – Respond faster to business demands

World record 4-socket SPEC CPU 2017 benchmark result[1]

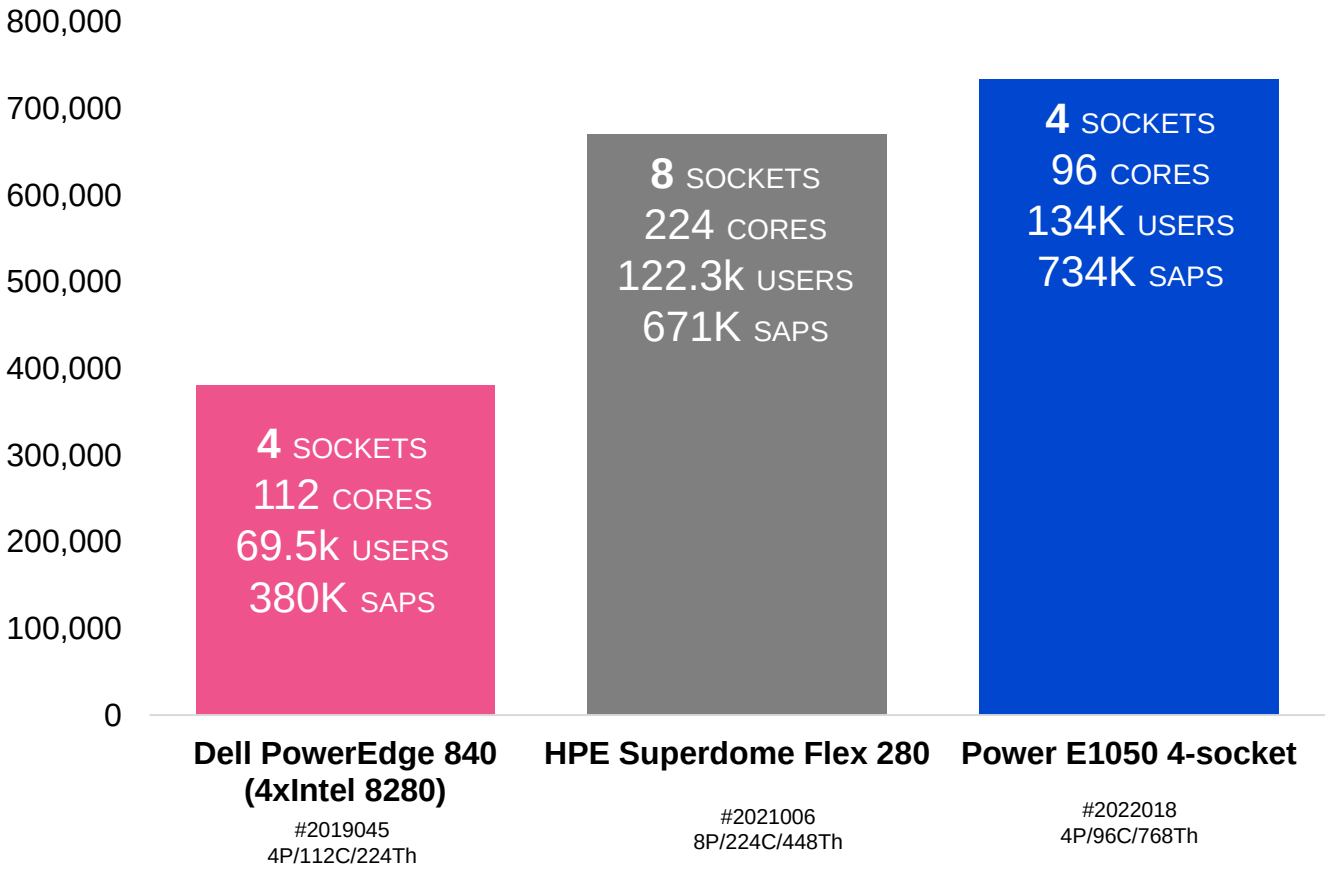


- SPECrate®2017_int_peak
  - 1580 vs. 846
- SPECrate®2017_int_base
  - 1220 vs. 814
- 2.2X more performance per core
- 1.9X more performance per system

1. Comparison based on best performing 4-socket systems (IBM Power E1050 3.15-3.9 GHz, 96 core and Inspur NF8480M6 2.90 GHz, Intel Xeon Platinum 8380H) using published results at https://www.spec.org/cpu2017/results/rint2017.html as of 30 June 2022. SPEC® and the benchmark names SPECrate®2017_int_base and SPECrate®2017_int_peak are registered trademarks of the Standard Performance Evaluation Corporation. For more information about SPEC CPU 2017, see www. http:/spec.org/cpu2017

IBM Power E1050

World Record 4-socket two-tier SAP SD standard application benchmark result[1]



- World record 4-socket performance
  - 734,050 vs 380,280 SAPS*
  - 134,000 vs 69,500 users
  - More performance per core
    - 2.6X vs 8-socket Intel[4]
    - 2.3X vs 4-socket Intel[3]
- The most flexible and reliable SAP HANA platform[5]

*Note: 100 SAPS = 2,000 fully business processed order line items per hour

1. All results can be found at sap.com/benchmark and are valid as of July 7, 2022
2. IBM Power E1050; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5; Power10 2.95 GHz processor, 4,096 GB memory, 4p/96c/768t, 134,016 SD benchmark users, 736,420 SAPS, AIX 7.3, DB2 11.5, Certification # 2022018.
3. Dell EMC PowerEdge 840; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5; Intel Xeon Platinum 8280 2.7 GHz, 4p/112c/224t, 69,500 SD benchmark users (380,280 SAPS), SUSE Linux Enterprise Server 12 and SAP ASE 16, Certification # 2019045.
4. HPE Superdome Flex; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5; Intel Xeon Platinum 8380H 2.9 GHz, 8p/224c/448t, 122,300 SD benchmark users (670,830 SAPS), Windows Server 2016 and Microsoft SQL Server 2012, Certification # 2021006.
5. Ranked most reliable server in its category for 12th year by ITIC . Flexible: Only platform that runs AIX, IBM i, Linux OS'es while supporting the ability to run 16 SAP HANA production environment in a single server

IBM Power E1050 Highlights

- 4U Server – 19” Rack Enclosure
- **NEW!** Power10 DCM processor w/ 12, 18, or 24 cores/socket, delivers up to 96 cores
- **NEW!** 1-Hop flat CPU interconnect for maximum scalability and efficiency
- **NEW!** 64 DDIMM slots that provide up to 16TB max memory capacity* (GA: 8TB)
- **NEW!** Main Memory Encryption for added security
- Active Memory Mirroring support to reduce unplanned outages
- **NEW!** Eleven PCIe slots (8 are GEN5 capable), all slots are concurrently maintainable
- **NEW!** Up to 10 NVMe U.2 Flash Bays provides up to 64 TB of internal storage
- Secure and Trusted Boot with TPM module
- Supports external PCIe I/O Expansion Drawer
- Supports external SAS Storage Expansion Drawer
- **NEW!** Titanium power supplies to meet EU Efficiency Directives
- **NEW!** Enterprise BMC managed (eBMC)
- Flexible Consumption with Capacity on Demand and Power Enterprise Pools 2.0
- Built-in PowerVM virtualization
- Cloud Management Console
- Power Cloud Rewards
- **NEW!** Standard 3 Year Warranty with Power Expert Care

* Planned support after initial GA

E1050 processor options

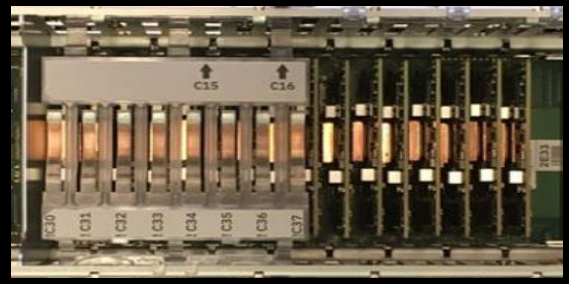
- DCM (Dual Chip Module) Design, 1-hop topology, 32Gbs X-bus
- Three processor module offerings available (SMT8 cores)
- Processor frequencies dynamic by default: Set to Max Performance Mode
- Enhanced Workload Optimized Frequency for optimum performance
  - Max frequency achievable without reducing cores
  - Frequency boost for Ambient temperatures below 27C°/81F°
  - Sampling increased to 500us time interval (was 4ms)
- Improved processor to processor interconnect
  - 2x increase in data signaling rate
  - Increased number of fabric interconnect buses

E1050 Feature Code	Processor SMT8 Cores	Maximum system cores	Typical Frequency Range	Socket Options	
EPEU	12 cores	48 cores	3.36 to 4.00 GHz	2, 3, 4	Max core/thread Performance offering
EPEV	18 cores	72 cores	3.20 to 4.00 GHz	2, 3, 4	Balance performance and scale
EPGW	24 cores	96 cores	2.95 to 3.90 Ghz	2, 3, 4	Scale and max throughput offering
EHC8	24 cores	96 cores	2.95 to 3.90 Ghz	2, 3, 4	Healthcare Solution Edition (NA ONLY)
EHKV					Tracking for SAP HANA support*

*IBM intends to support SAP HANA on the Power E1050 (9043-MRX) in production mode following certification of the environment

E1050 memory options

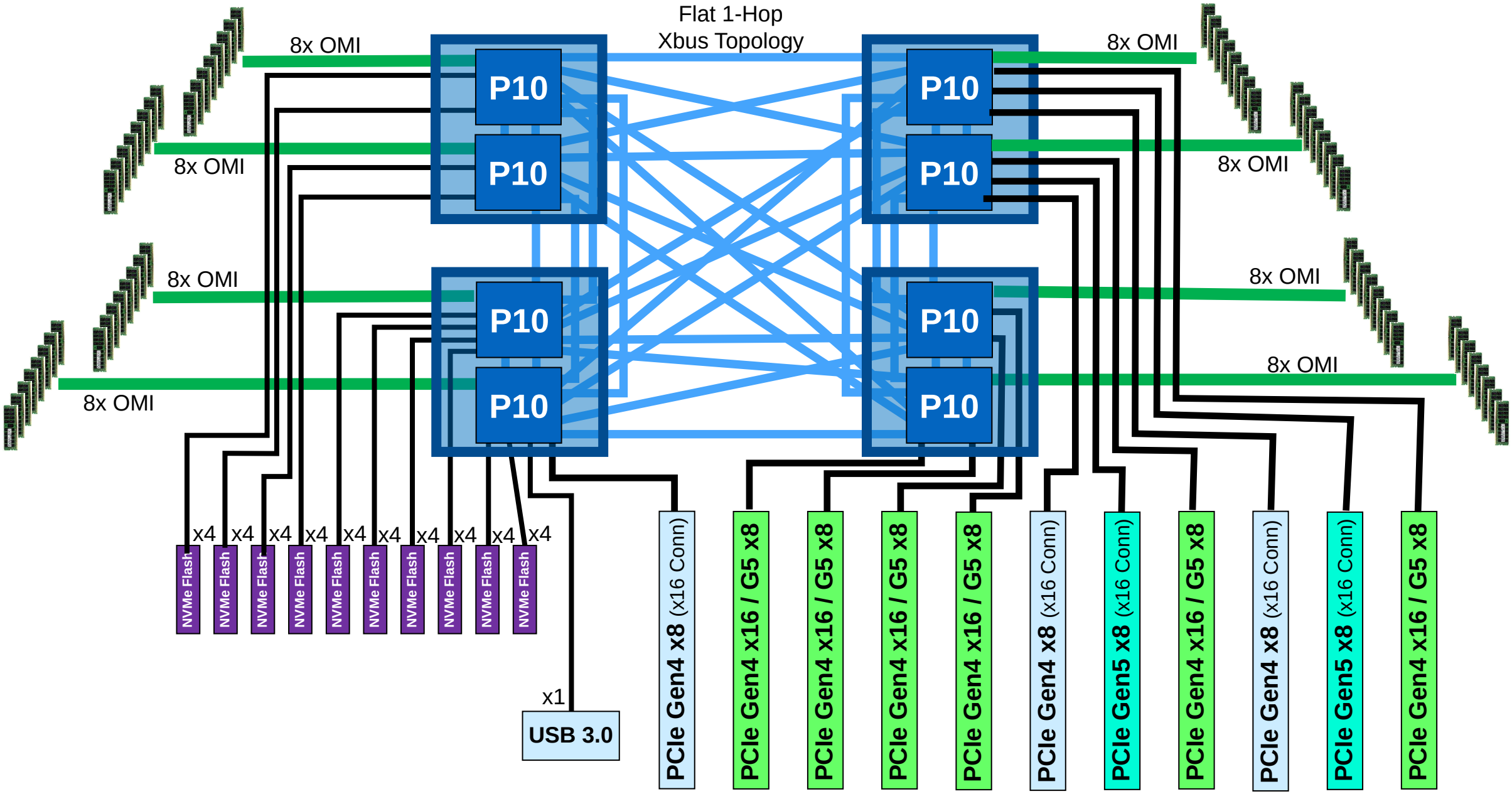
- **NEW!** Enterprise class 4U DDIMMs with enhanced Reliability, Availability and Serviceability (RAS)
- High bandwidth buffered memory architecture
- Up to 409 GB/s peak memory bandwidth per socket
- DDR4 based DDIMMs
- 16 DDIMM slots per socket, 64 DDIMM slots total
- Maximum memory capacity 16TB* (GA: 8TB)
- DDIMM plug rules per socket
  - Minimum config is 4x DDIMMs per socket. Minimum of 256GB or 50% of installed memory must be activated
  - All DDIMMs behind a module socket must be the same size and speed
- Active Memory Mirroring feature supported - Mirrors hypervisor memory to provide resiliency from uncorrectable memory errors



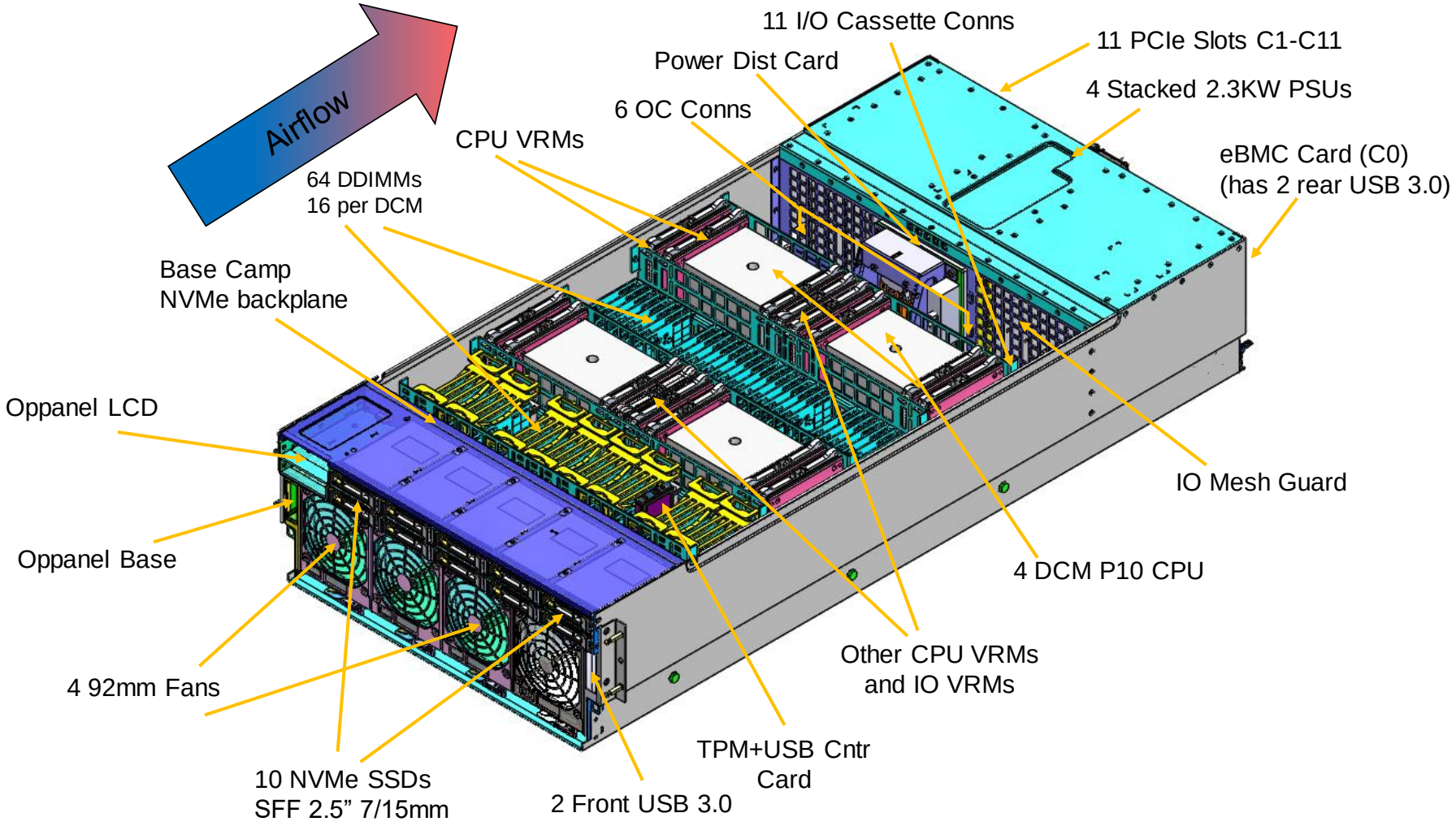
E1050 Feature Code	DIMM Size	DRAM Speed	Memory Bandwidth	
EM75	64GB (2X32GB) 4U DDIMM	3200 MHz	409 GB/s	
EM76	128GB (2X64GB) 4U DDIMM	3200 MHz	409 GB/s	
EM77	256GB (2X128GB) 4U DDIMM	2933 MHz	375 GB/s	
EM7J*	512GB (2X256GB) 4U DDIMM	2933 MHz	375 GB/s	Available 4Q2022
EM81	Active Memory Mirroring (AMM)			Optional Feature

* Planned support after initial GA

Power E1050 Server Architecture



Power E1050 System



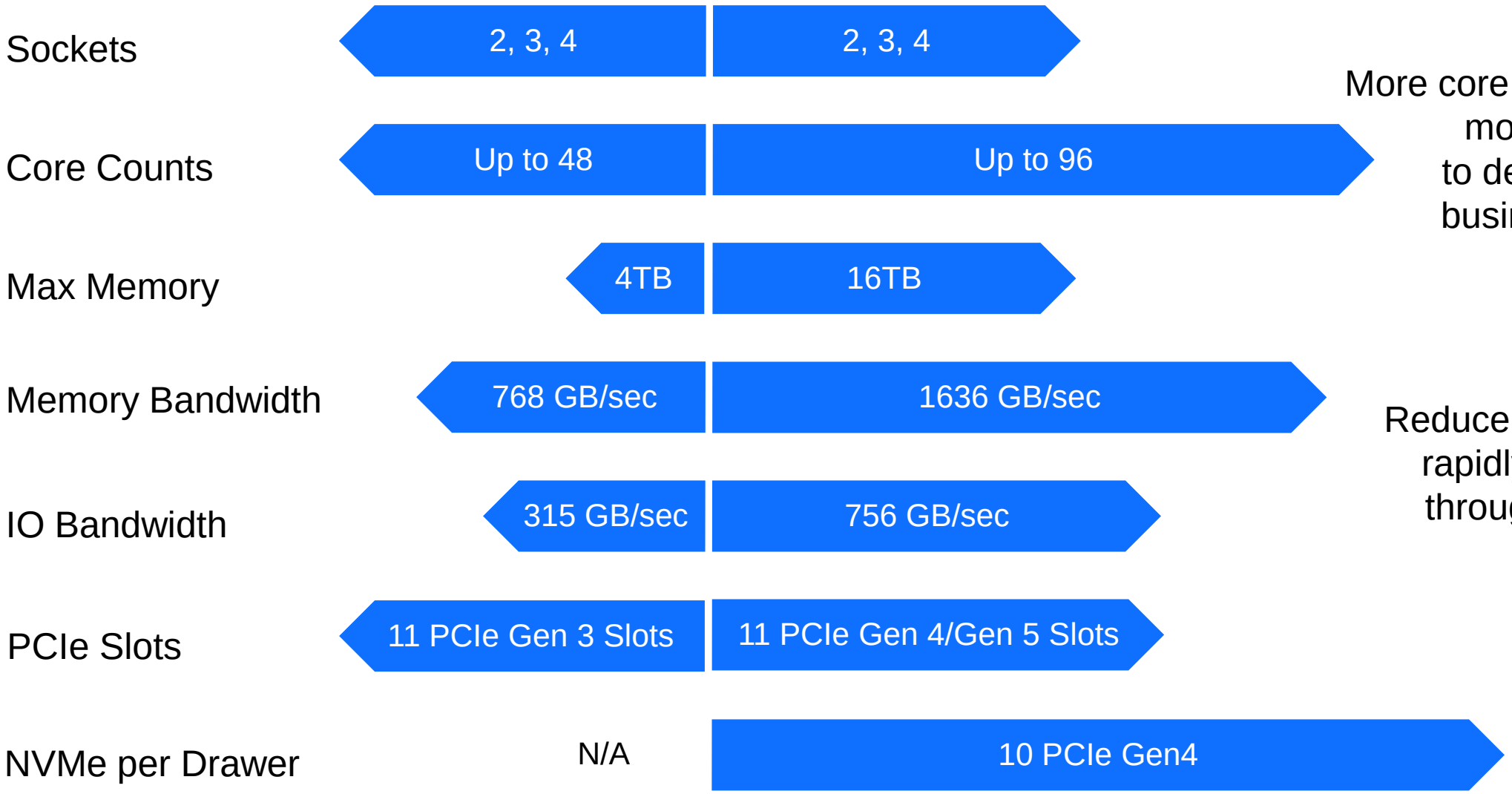
07-14-2020

Performance – E950 vs. E1050

Faster and more powerful cores to deliver quicker business insights

Reduce time to value by rapidly moving data through the system

Performance – E850C vs. E1050



More core that are faster and more powerful to deliver quicker business insights

Reduce time to value by rapidly moving data through the system

Power10 Scale-Out Systems

Entry Systems

- Up to 16 cores and 2TB memory footprints
- Up to 32% perf/price increase vs. P9
- Fully active, static servers
- Lower technical requirements and competitive deals

Enhanced Performance & Scale

- Up to 48 cores and 8TB memory footprints
- Up to 50% perf/price increase and 1.4x more system performance vs. P9
- Dynamic Capacity consumption with CUoD and PEP2.0
- Value-driven solutions and higher technical standards

S1014

9105-41B

- 1-socket, 4U
- Up to 8 cores per system
- 4, 8 SMT8 cores/socket
- 8 DDIMM slots
- 1 TB memory* (GA: 512GB)
- 5 PCIe FHHL slots (4 Gen5 capable)
- 16 NVMe U.2 bays
- Max of 102.4 TB of internal storage
- Optional Internal RDX Media Bay
- Rack and Tower form factors

S1022s

9105-22B

- 1,2-socket, 2U
- Up to 16 cores per system
- 4, 8 SMT8 cores/socket
- 16 DDIMM slots
- 2 TB memory* (GA: 1TB)
- 10 PCIe HHHL slots (8 Gen5 capable)
- 8 NVMe U.2 bays
- Max of 51.2 TB of internal storage

S1022 & L1022

9105-22A / 9786-22H

- 1,2-socket, 2U
- Up to 40 cores per system
- 12, 16, 20 SMT8 cores/socket
- 32 DDIMM slots
- 4 TB memory* (GA: 2TB)
- 10 PCIe HHHL slots (8 Gen5 capable)
- 8 NVMe U.2 bays
- Max of 51.2 TB of internal storage
- L1022: max 25% of cores with other OS

S1024 & L1024

9105-42A / 9786-42H

- 1,2-socket, 4U
- Up to 48 cores per system
- 12, 16, 24 SMT8 cores/socket
- 32 DDIMM slots
- 8 TB memory* (GA: 2TB)
- 10 PCIe FHHL slots (8 Gen5 capable)
- 16 U.2 NVMe bays
- Max of 102.4 TB of internal storage
- Optional Internal RDX Media Bay
- L1024: max 25% of cores with other OS

AIX IBM i Linux Red Hat OpenShift

All PowerVM based servers

* Planned support after initial general availability

IBM Power10 S1024 & L1024

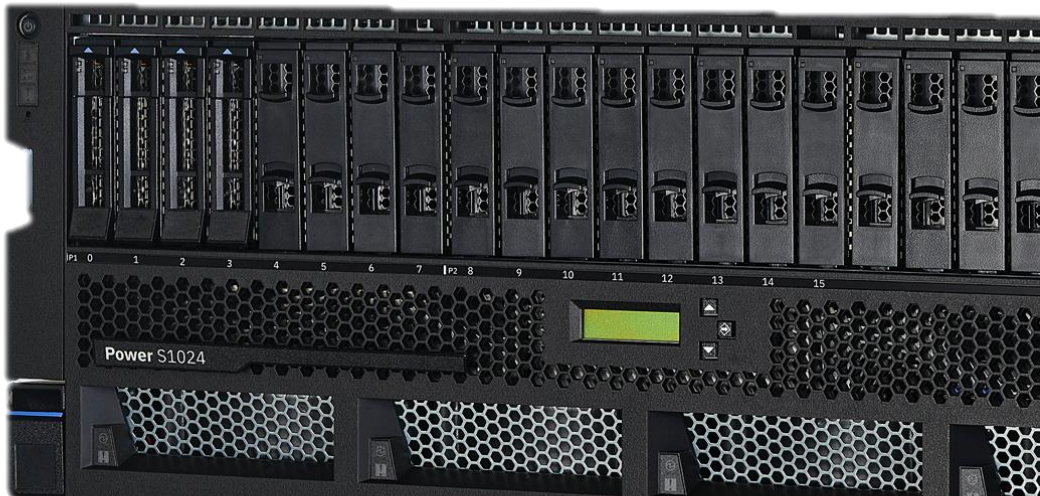
9105-42A / 9786-42H

IBM Power10 S1024 & L1024 Highlights

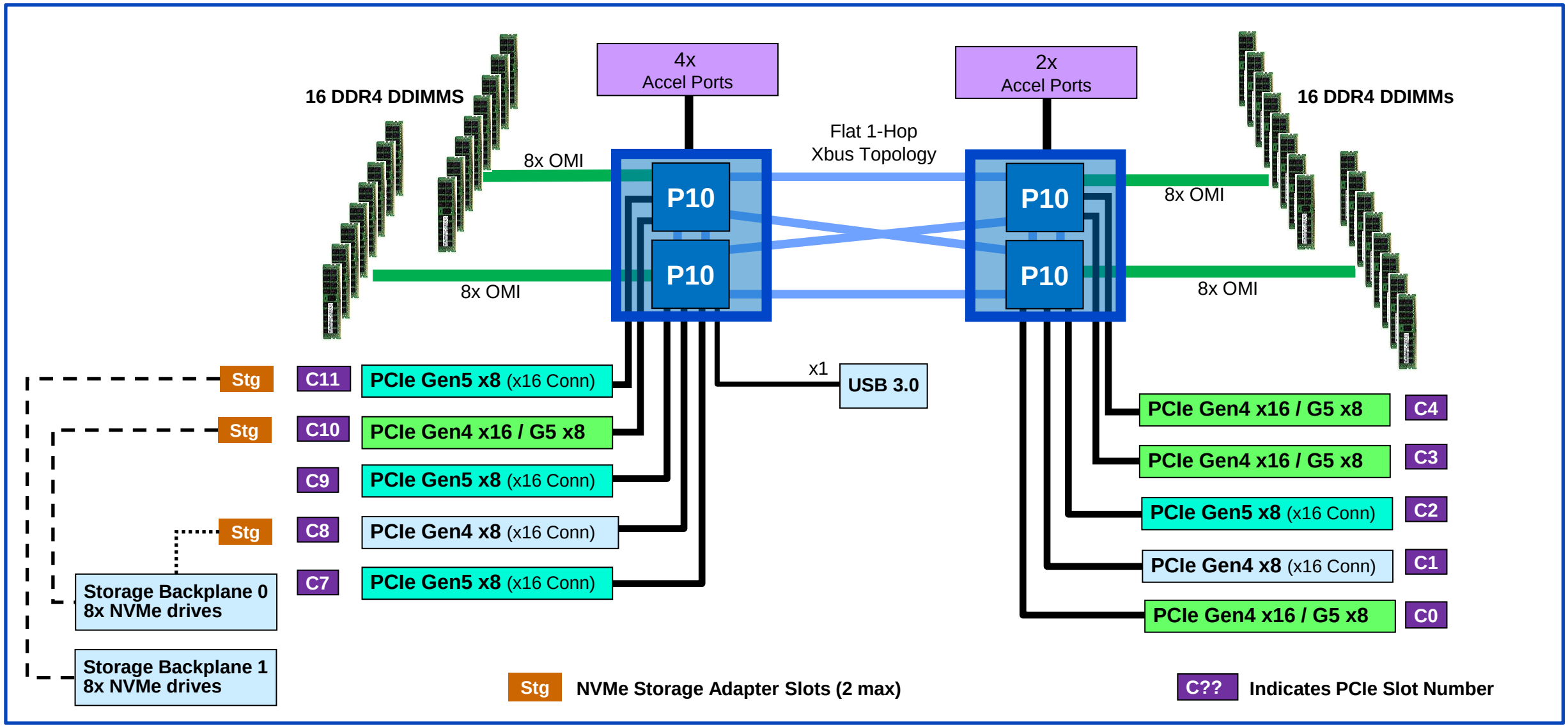
- ✓ Power10 processors with 12, 24, 32, or 48 total cores per server
- ✓ 1-Hop flat CPU interconnect for maximum scalability
- ✓ 32 DDIMM slots that provide up to 8TB max memory capacity* (GA: 2TB)
- ✓ Main memory encryption for added security
- ✓ Active memory mirroring support to reduce unplanned outages
- ✓ Shared Capacity Utility support
- ✓ Ten PCIe FHHL slots (8 are GEN5 capable), all slots are concurrently maintainable
- ✓ Up to 16 NVMe U.2 Flash Bays provides up to 102.4 TB of storage
- ✓ Secure and Trusted Boot with TPM module
- ✓ Supports external PCIe I/O Expansion Drawer
- ✓ Supports external SAS Storage Expansion Drawer
- ✓ Titanium power supplies to meet EU Efficiency Directives
- ✓ Enterprise BMC managed

* Planned support after initial GA

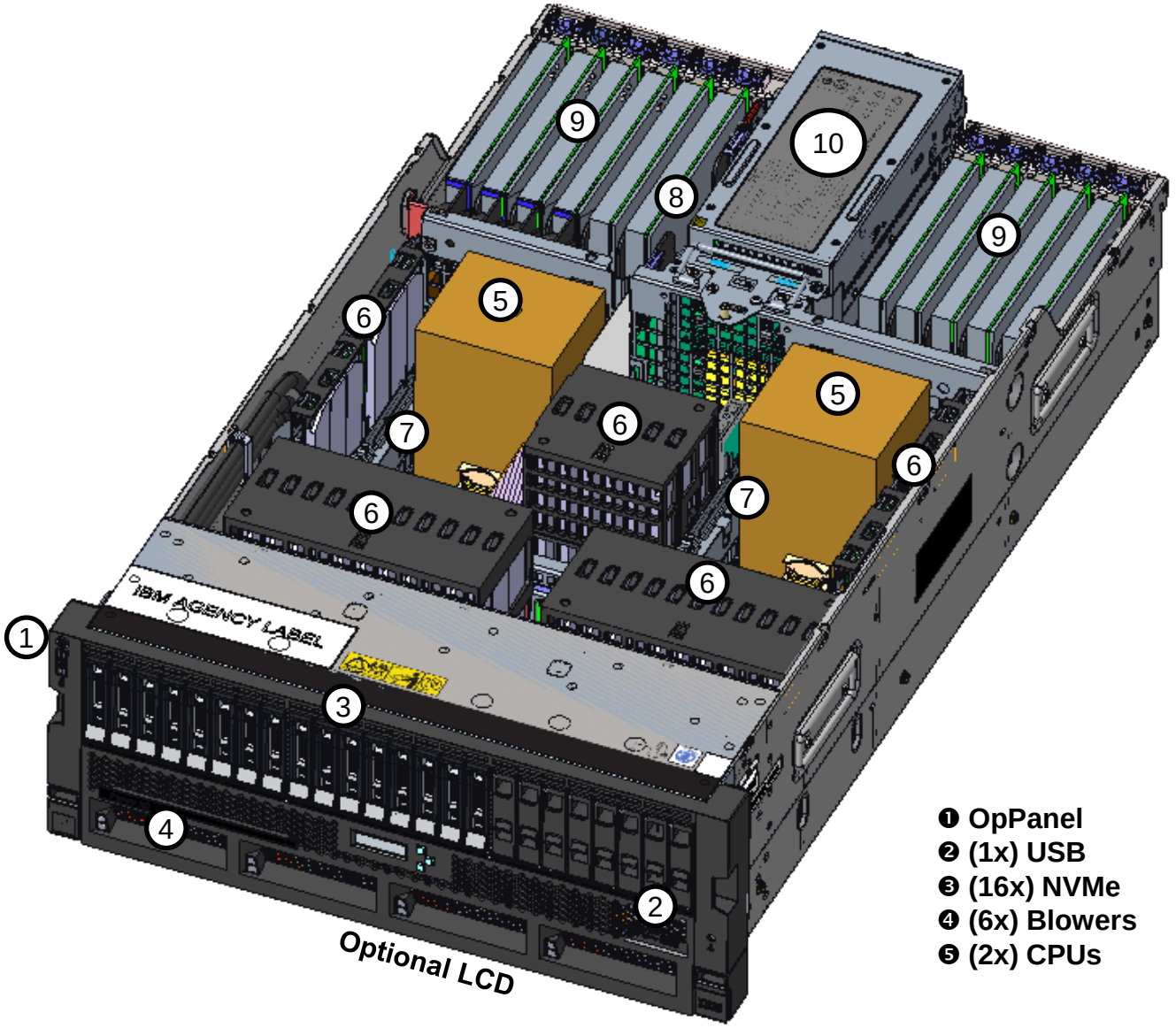
9105-42A / 9786-42H



S1024 & L1024 Server Architecture



S1024 & L1024 System Design



❶ OpPanel	❻ (32x) DDIMMs
❷ (1x) USB	❼ (2x) CPU VRMs
❸ (16x) NVMe	❽ eBMC
❹ (6x) Blowers	❾ (10x) FHHL PCIe
❺ (2x) CPUs	❿ (4x) PSUs

S1024 & L1024 Processors Options

- Three processor module offerings are available (SMT8 cores)
- Single processor module configuration is supported for the 12-core processor offering
- Processor frequencies dynamic by default: Set to Max Performance Mode
- Enhanced Workload Optimized Frequency for optimum performance
  - Max frequency achievable without reducing cores
  - Frequency boost for Ambient temperatures below 27C°/81F°
  - Sampling increased to 500us time interval (was 4ms)
- Improved processor to processor interconnect
  - 2x increase in data signaling rate
  - Increased number of fabric interconnect buses

S1024 Feature Code	L1024 Feature Code	Processor SMT8 Cores	Maximum system cores	Typical Frequency Range	Minimum Quantity	IBM i P Group	
EPGD	EPGK	24 cores	48 cores	2.75 to 3.90 Ghz	2	P30	Max throughput offering
EPGC	EPGJ	16 cores	32 cores	3.10 to 4.00 GHz	2	P30	
EPGM	EPGN	12 cores	24 cores	3.40 to 4.00 GHz	1	P20	Max core/thread performance offering

S1024 & L1024 Memory Options

- High bandwidth buffered memory architecture
- Up to 409 GB/s peak memory bandwidth per socket
- DDR4 based DDIMMs
- 16 DDIMM slots per socket, 32 DDIMM slots total
- Maximum memory capacity 8TB (2TB at initial GA)
- DDIMM plug rules per socket
  - Minimum config is 2x DDIMMs per socket
  - All DDIMMs behind a module socket must be the same type
  - 2U and 4U DDIMMs cannot be mixed in the same system
- **NEW!** Active Memory Mirroring feature supported - Mirrors hypervisor memory to provide resiliency from uncorrectable memory errors

S1024 Feature Code	L1024 Feature Code	DIMM Size	DRAM Speed	Memory Bandwidth per socket	
EM6N	EM7N	16GB 2U DDIMM	3200 MHz	409 GB/s	
EM6W	EM7W	32GB 2U DDIMM	3200 MHz	409 GB/s	
EM6X	EM7X	64GB 2U DDIMM	3200 MHz	409 GB/s	
EM6Y	EM7Y	128GB 2U DDIMM	2666 MHz	341 GB/s	Available 4Q2022
EM78	EM7F	256GB 4U DDIMM	2933 MHz	375 GB/s	Available 4Q2022
EM8G	EM8G	Active Memory Mirroring (AMM)			Add-on Feature

S1024 & L1024 Storage Options

Internal Storage Options

- All internal storage is PCIe NVMe (no SAS)
- General PCIe slots (C10/C8, C11) support NVMe JBOF card and are cabled to NVMe backplane
- Max of 16 NVMe U.2 drives supported

S1024 / L1024 Internal Storage Options

FC	Description
EJ1Y	NVMe JBOF Card with U.2 8-Pak Backplane
EUA0	RDX Docking Station

S1024 / L1024 External Storage Options

FC / MTM	Description
ESLS	19” Disk Expansion Drawer 24 SFF Gen2-Carrier Bays
EUA5	USB DVD w/ Cable
7226-1U3	19” Media Drawer with 2 bays
TBD	NVMe drawer 24 U.2 Bays (Future GA)

Supported Media Overview

- **NVMe U.2 devices**
  - 0.8TB 4K U.2 7mm 18W PCIe Gen4 Mainstream
  - 0.8TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 1.6TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 3.2TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 6.4TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class

- **RDX Disk Cartridge**
  - 320GB Disk Cartdrige (EU08)
  - 500GB Disk Cartridge (1107)
  - 1TB Disk Cartridge (EU01)
  - 1.5TB Disk Cartridge (EU15)
  - 2TB Disk Cartridge (EU2T)

16 NVMe U.2 15mm Bays/

S1024 & L1024 PCIe Slots

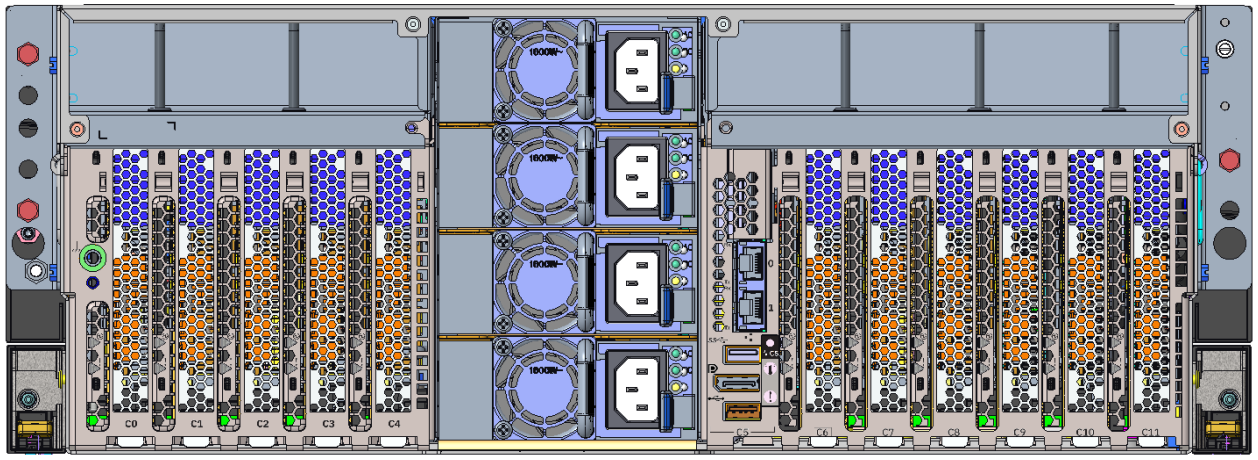
Internal PCIe Slot Summary

Slot	Attributes	Note
C0	PCIe Gen4 x16 or Gen5 x8 (EJ2A* slot)	2nd Power10 Socket
C1	PCIe Gen4 x8 (x16 Conn)	
C2	PCIe Gen5 x8 (x16 Conn)	
C3	PCIe Gen4 x16 or Gen5 x8 (EJ2A* slot)	
C4	PCIe Gen4 x16 or Gen5 x8 (EJ2A* slot)	
C5	eBMC Card	
C6	OpenCAPI only	1st Power10 Socket
C7	PCIe Gen5 x8 (x16 Conn)	
C8	PCIe Gen4 x8 (x16 Conn) **	
C9	PCIe Gen5 x8 (x16 Conn)	
C10	PCIe Gen4 x16 or Gen5 x8 (EJ2A* slot) **	
C11	PCIe Gen5 x8 (x16 Conn) **	

*EJ2A – I/O Expansion Adapter
** Support NVMe JBOF card

- All PCIe Slots are Concurrently Maintainable
- Full Height, Half Length PCIe form factor

Default Ethernet FC: EC2U 2x1GbE BaseT SFP



External PCIe Expansion Summary

Num of CPUs	Max num of I/O Exp Drawers (EMX0)	Max num of I/O Fanout Modules (EMXH)	Total PCIe Slots
1	1	1	10
2	2	4	30

No support for EJ08, EJ05, EJ1R, EJ20, EMXF/EMXG/ELMG

2-sockets 4U Scale-Out Systems Comparison

In the Scale-Out Server family, the S1024 is designed to meet highest performance and security with an industry leading memory bandwidth and a memory footprint of up to 8TB in the 2-sockets market

	S924 & H924 MTM: 9009-42G / 9223-42S	S1024 & L1024 MTM: 9105-42A / 9786-42H
Processor Module Offerings	8, 10, 11, 12 Power9 Cores	12, 16, 24 Power10 Cores
Processor Interconnect	2x4B @ 16 Gbps	4x2B @ 32 Gbps
Memory Channels per System	16 DDR4 RDIMM Channels	32 OMI Channels
Memory Bandwidth per System (peak)	340 GB/s	818 GB/s w/ 16, 32, 64GB DDIMM
DIMMs per System	32 IS DIMMs	32 DDIMMs
Memory Capacity per System (max)	4 TB	8 TB (4Q22 GA)
Acceleration Ports	4 ports @ 25 Gbps (OpenCAPI)	6 ports @ 25 Gbps
PCIe Lanes per System (max)	84 PCIe G4 lanes @ 16 Gbps	128 PCIe G4 lanes @ 16 Gbps
PCIe Slots per System	5 PCIe x16 G4 slots 6 PCIe x8 G4 slots	4 PCIe G4 x16 or G5 x8 slots 4 PCIe G5 x8 slots 2 PCIe G4 x8 slots
Slots for Internal Storage Cntlr	Dedicated	General Purpose
Internal Storage	18 SAS HDD/SSD or 4 NVMe U.2	16 NVMe U.2
I/O Expansion Drawers (max)	1.5	2
Service Processor	FSP	Enterprise BMC (eBMC)
RAS		Active Memory Mirroring Support
Security		Main Memory Encryption

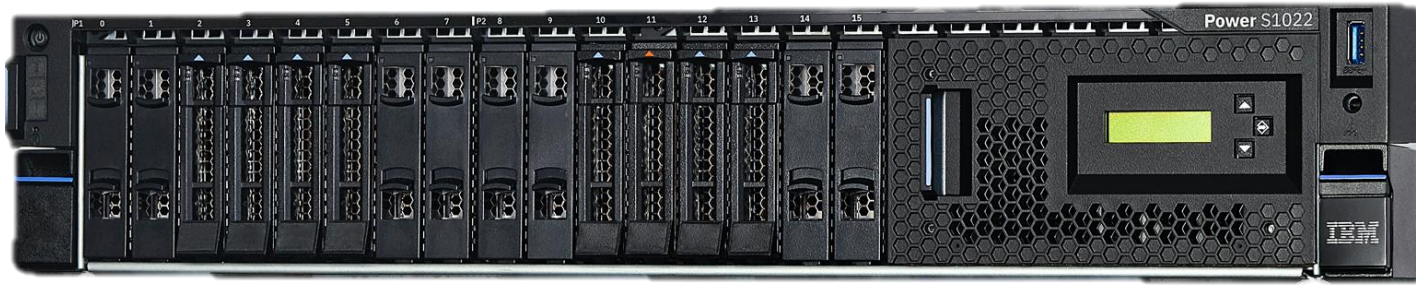
IBM Power10 S1022 & L1022

9105-22A / 9786-22H

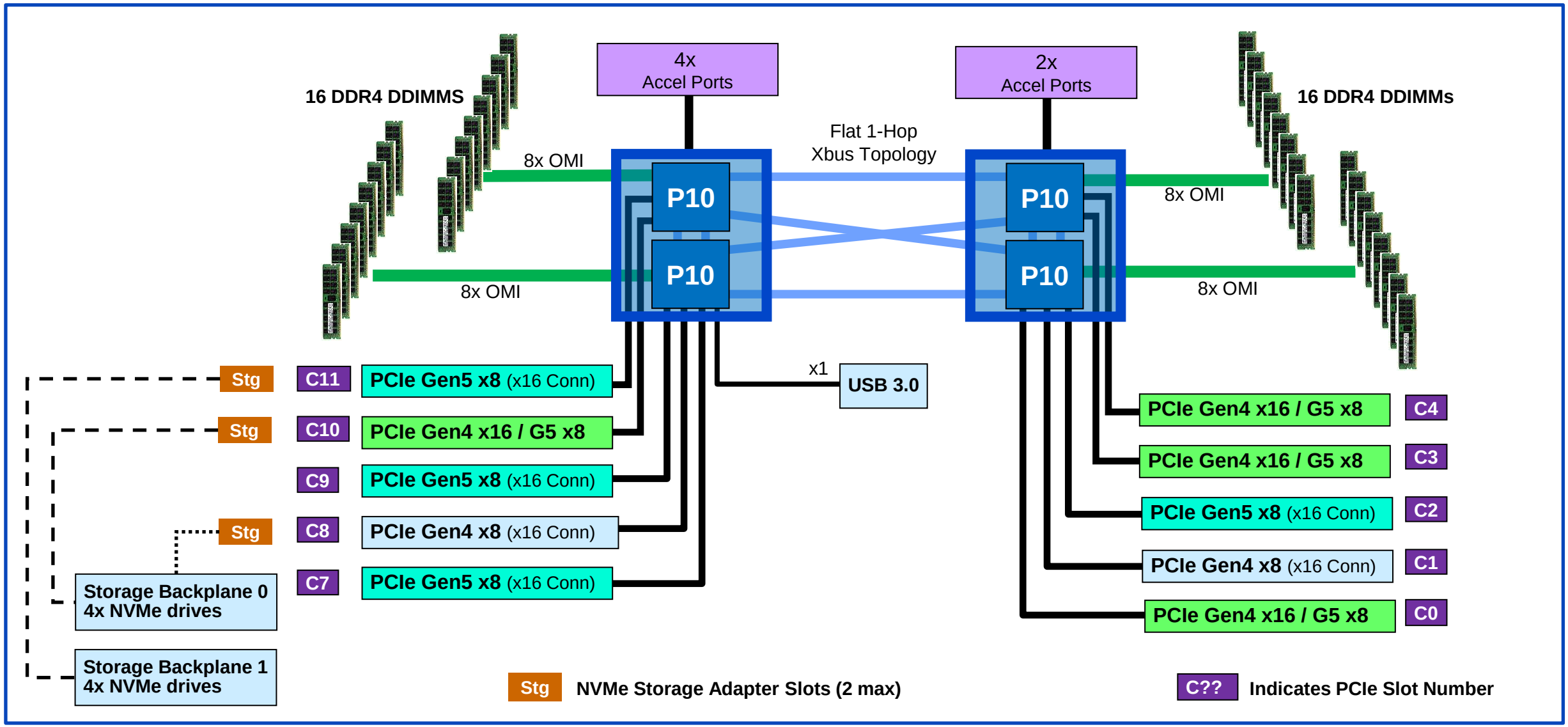
IBM Power10 S1022 & L1022 Highlights

- ✓ Power10 processors with 12, 24, 32, or 40 total cores per server
- ✓ 1-Hop flat CPU interconnect for maximum scalability
- ✓ 32 DDIMM slots that provide up to 4TB max memory capacity* (GA: 2TB)
- ✓ Main memory encryption for added security
- ✓ Active memory mirroring support to reduce unplanned outages
- ✓ Shared Capacity Utility support
- ✓ Ten PCIe HHHL slots (8 are GEN5 capable), all slots are concurrently maintainable
- ✓ Up to 8 NVMe U.2 Flash Bays provide up to 51.2 TB of storage
- ✓ Secure and Trusted Boot with TPM module
- ✓ Supports external PCIe I/O Expansion Drawer
- ✓ Supports external SAS Storage Expansion Drawer
- ✓ Titanium power supplies to meet EU Efficiency Directives
  - ✓2x 220 VAC with C14 inlet
- ✓ Enterprise BMC managed

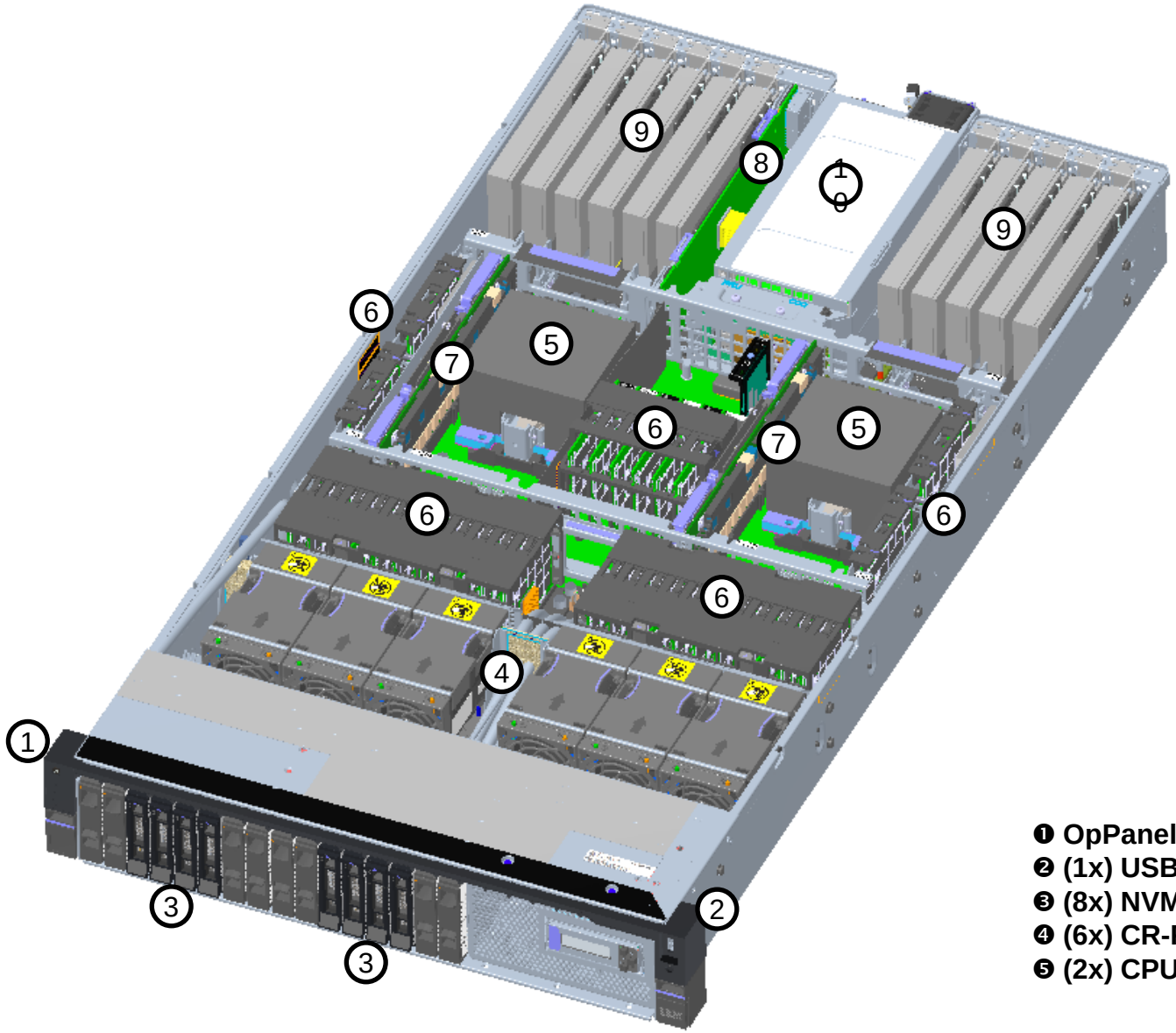
* Planned support after initial GA



S1022 & L1022 Server Architecture



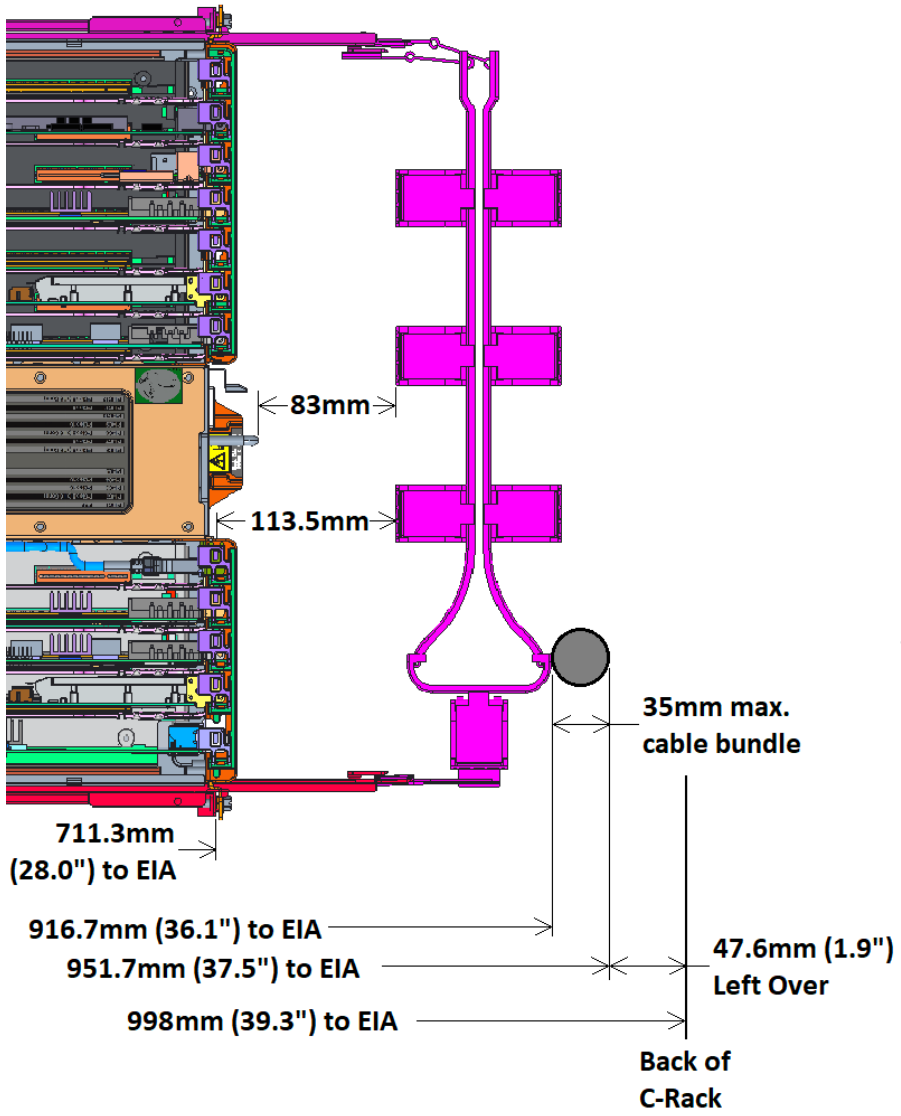
S1022 & L1022 System Design



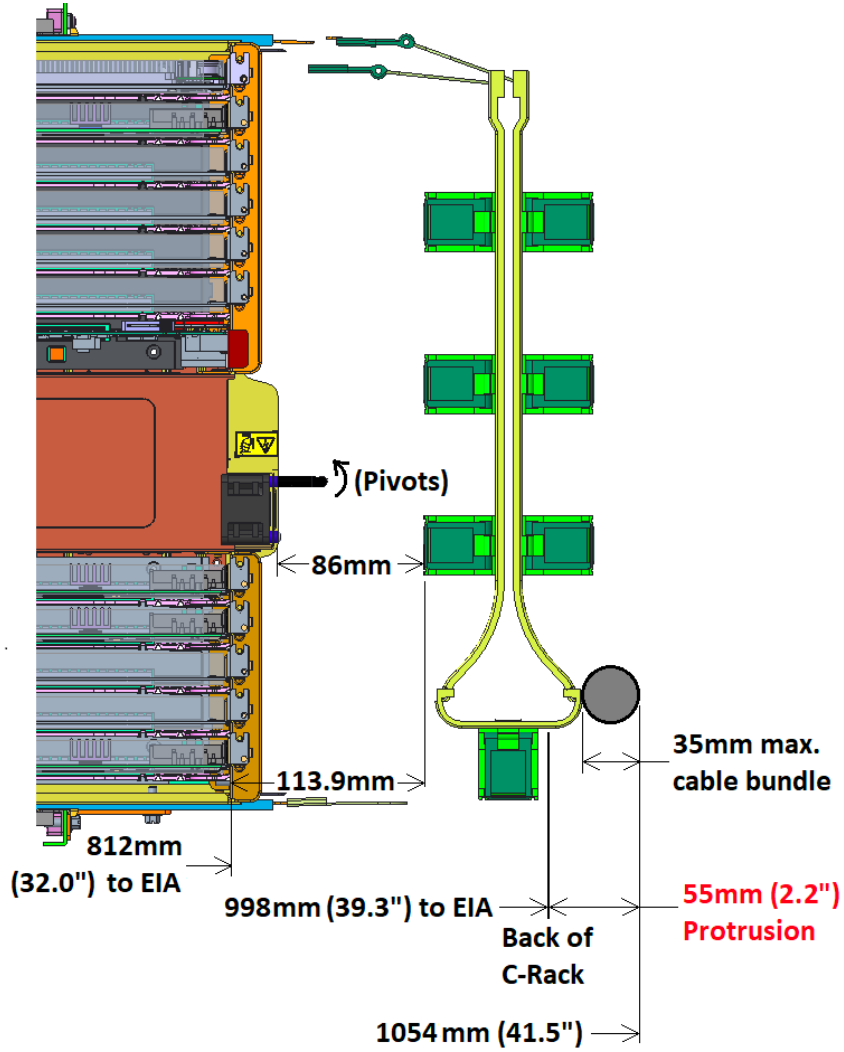
❶ OpPanel
❷ (1x) USB
❸ (8x) NVMe
❹ (6x) CR-Fans
❺ (2x) CPUs
❻ (32x) DDIMMs
❼ (2x) CPU VRMs
❽ eBMC
❾ (10x) LP PCIe
❿ (2x) PSUs

S1022, S1022s and L1022 Depth Details

S922, H922



S1022, S1022s and L1022



- In line with market trends, the Power10 2-socket 2U (2S2U) systems have a total of 32” depth, which makes it 4” longer than the previous 2U systems
- Check what rack is used at the customer site. There are no standards for rack depth. The information included here is specific to the IBM rack.
- Options for installing in the IBM Rack 7965-S42 (#ECR0)
  - Install rack extenders
  - Do not install the cable management arm
  - Do not install the rear rack door
- The S1014 and S1024 systems have the same depth as previous 4U models

S1022 & L1022 Processor Options

- Three processor module offerings are available (SMT8 cores)
- Single processor module configuration is supported for the 12-core processor offering
- Processor frequencies dynamic by default: Set to Max Performance Mode
- Enhanced Workload Optimized Frequency for optimum performance
  - Max frequency achievable without reducing cores
  - Frequency boost for Ambient temperatures below 27C°/81F°
  - Sampling increased to 500us time interval (was 4ms)
- Improved processor to processor interconnect
  - 2x increase in data signaling rate
  - Increased number of fabric interconnect buses
- Multiple IBM i partitions are supported, and each partition can have up to four cores (VIOS required)

S1022 Feature Code	L1022 Feature Code	Processor SMT8 Cores	Maximum system cores	Typical Frequency Range	Minimum Quantity	IBM i P Group	
EPGA	EPGH	20 cores	40 cores	2.45 to 3.90 GHz	2	P10	Max throughput offering
EPG8	EPGF	16 cores	32 cores	2.75 to 4.00 GHz	2	P10	
EPG9	EPGG	12 cores	24 cores	2.90 to 4.00 GHz	1	P10	Max core/thread performance offering

S1022 & L1022 Memory Options

- High bandwidth buffered memory architecture
- Up to 409 GB/s peak memory bandwidth per socket
- DDR4 DDIMMs
- 16 DDIMM slots per socket, 32 DDIMM slots total
- Maximum memory capacity 4TB (2TB at initial GA)
- DDIMM plug rules per socket
  - Minimum config is 2x DDIMMs per socket
  - All DDIMMs behind a module socket must be the same type
- Active Memory Mirroring feature supported - Mirrors hypervisor memory to provide resiliency from uncorrectable memory errors

S1022 Feature Code	L1022 Feature Code	DIMM Size	DRAM Speed	Memory Bandwidth per socket	
EM6N	EM7N	16GB 2U DDIMM	3200 MHz	409 GB/s	
EM6W	EM7W	32GB 2U DDIMM	3200 MHz	409 GB/s	
EM6X	EM7X	64GB 2U DDIMM	3200 MHz	409 GB/s	
EM6Y	EM7Y	128GB 2U DDIMM	2666 MHz	341 GB/s	Available 4Q2022
EM8G	EM8G	Active Memory Mirroring (AMM)			Add-on Feature

S1022 & L1022 Storage Options

Internal Storage Options

- All internal storage is PCIe NVMe (no SAS)
- General PCIe slots (C10/C8, C11) support NVMe JBOF card and are cabled to NVMe backplane
- Max of 8 NVMe U.2 drives supported

S1022 / L1022 Internal Storage Options

FC	Description
EJ1X	NVMe JBOF Card with U.2 4-Pak Backplane

S1022 / L1022 External Storage Options

FC / MTM	Description
ESLS	19” Disk Expansion Drawer 24 SFF Gen2-Carrier Bays
EUA5	USB DVD w/ Cable
7226-1U3	19” Media Drawer with 2 bays
TBD	NVMe drawer 24 U.2 Bays (Future GA)

Supported Media Overview

- **NVMe U.2 devices**
  - 0.8TB 4K U.2 7mm 18W PCIe Gen4 Mainstream
  - 0.8TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 1.6TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 3.2TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 6.4TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class

8 NVMe U.2 15mm Bays

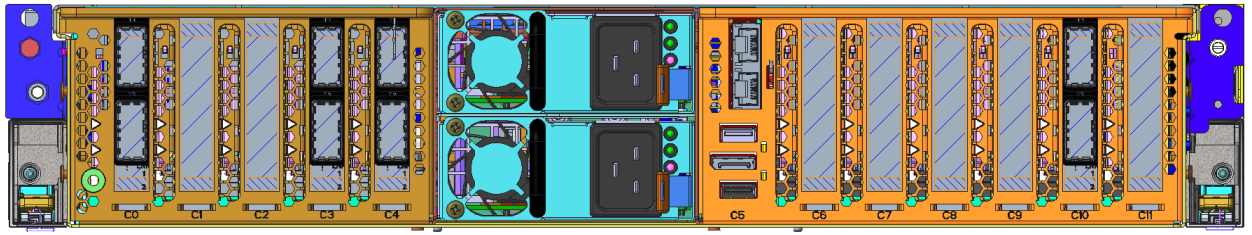
S1022 & L1022 PCIe Slots

Internal PCIe Slot Summary

Slot	Attributes	Note
C0	PCIe Gen4 x16 or Gen5 x8 (EJ24 slot)	2nd Power10 Socket
C1	PCIe Gen4 x8 (x16 Conn)	
C2	PCIe Gen5 x8 (x16 Conn)	
C3	PCIe Gen4 x16 or Gen5 x8 (EJ24 slot)	
C4	PCIe Gen4 x16 or Gen5 x8 (EJ24 slot)	
C5	eBMC Card	
C6	OpenCAPI only	1st Power10 Socket
C7	PCIe Gen5 x8 (x16 Conn)	
C8	PCIe Gen4 x8 (x16 Conn) **	
C9	PCIe Gen5 x8 (x16 Conn)	
C10	PCIe Gen4 x16 or Gen5 x8 (EJ24* slot) **	
C11	PCIe Gen5 x8 (x16 Conn) **	

*EJ24 – I/O Expansion Adapter
** Support NVMe JBOF card

Default Ethernet FC: EC2T 2x1GbE BaseT SFP



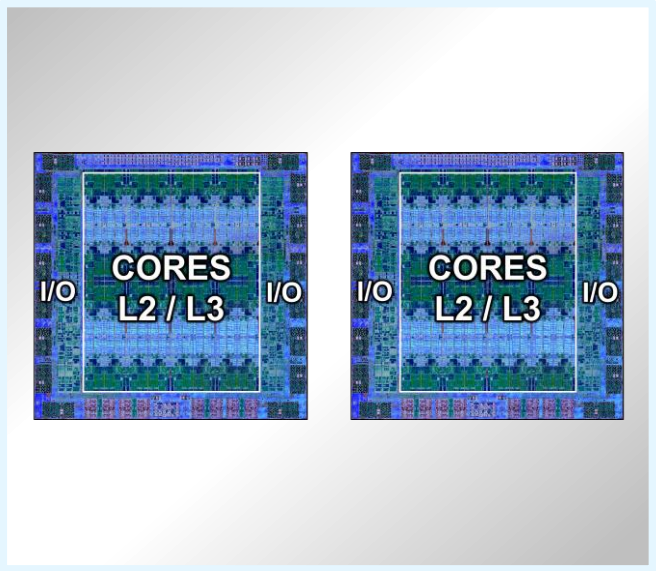
- All PCIe Slots are Concurrently Maintainable
- Half Height, Half Length PCIe form factor

External PCIe Expansion Summary

Num of CPUs	Max num of I/O Exp Drawers (EMX0)	Max num of I/O Fanout Modules (EMXH)	Total PCIe Slots
1	1	1	10
2	2	4	30

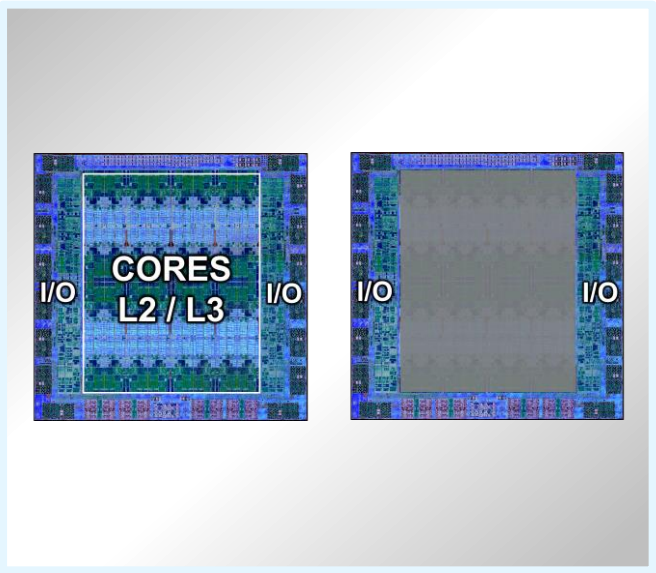
No support for EJ08, EJ05, EJ1R, EJ20, EMXF/EMXG/ELMG

Power10 Scale Out Processors: DCM and “SC-DCM”



DCM - Dual-Chip Module

- Enables full range of offerings
- Provides up to 30 cores per socket
- 16 OMI Memory channels (8 per chip)
- 64 PCIe lanes
- Used on S1024, L1024, S1022, L1022



eSCM – Single Chip DCM

- One die with compute, memory and I/O
- Second die adds I/O only
- Enables low cost processor offerings
- Up to 8 cores per socket
- 8 OMI Memory channels
- 64 PCIe lanes
- Used on S1022s and S1014

IBM Power10 S1022s

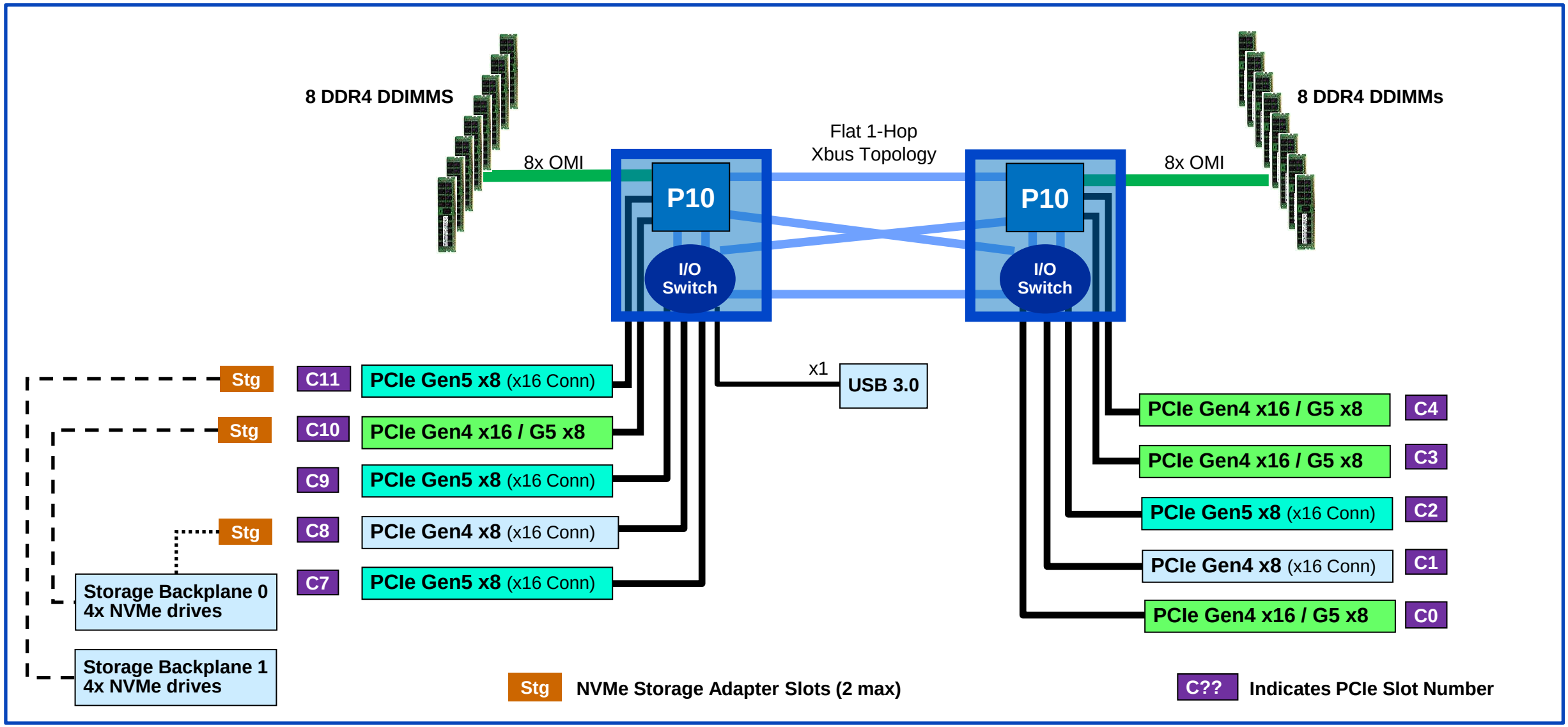
9105-22B

IBM Power10 S1022s Highlights

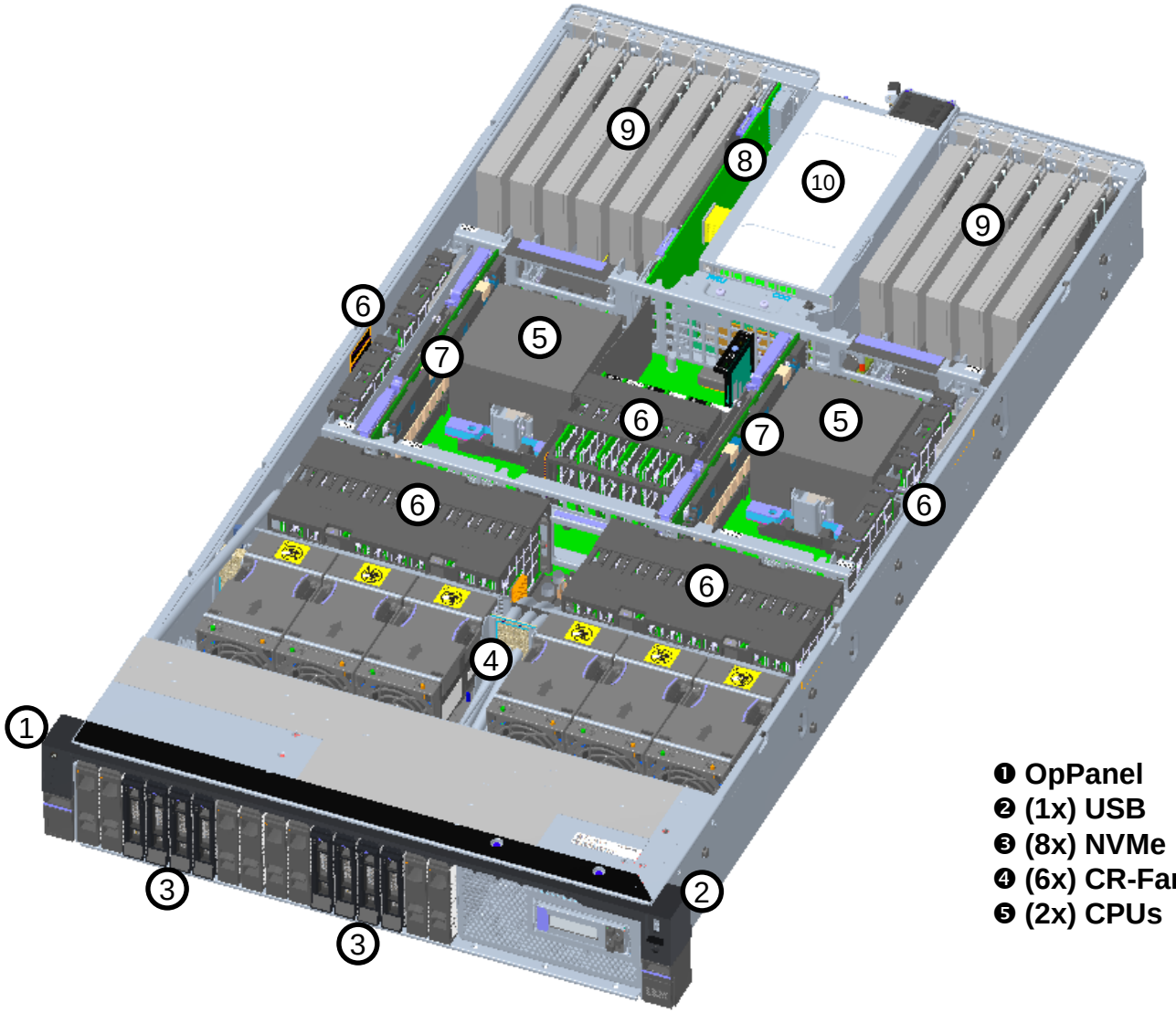
- ✓ Power10 processors with 4, 8, or 16 total cores per server
- ✓ 1-Hop flat CPU interconnect for maximum scalability
- ✓ 16 DDIMM slots that provide up to 2TB max memory capacity* (GA: 1TB)
- ✓ Main memory encryption for added security
- ✓ Active memory mirroring support to reduce unplanned outages
- ✓ Ten PCIe HHHL slots (8 are GEN5 capable), all slots are concurrently maintainable
- ✓ Up to 8 NVMe U.2 Flash Bays provide up to 51.2 TB of storage
- ✓ Secure and Trusted Boot with TPM module
- ✓ Supports external PCIe I/O Expansion Drawer
- ✓ Supports external SAS Storage Expansion Drawer
- ✓ Titanium power supplies to meet EU Efficiency Directives
- ✓ Enterprise BMC managed

* Planned support after initial GA

S1022s Server Architecture



S1022s System Design



❶ OpPanel
❷ (1x) USB
❸ (8x) NVMe
❹ (6x) CR-Fans
❺ (2x) CPUs
❻ (32x) DDIMMs
❼ (2x) CPU VRMs
❽ eBMC
❾ (10x) LP PCIe
❿ (2x) PSUs

S1022s Processor Options

- Two processor offerings available (SMT8 cores)
- Single processor config supported for all processor offerings
- Processor frequencies dynamic by default: Set to Max Performance Mode
- Enhanced Workload Optimized Frequency for optimum performance
  - Max frequency achievable without reducing cores
  - Frequency boost for Ambient temperatures below 27C°/81F°
  - Sampling increased to 500us time interval (was 4ms)
- Improved processor to processor interconnect
  - 2x increase in data signaling rate
  - Increased number of fabric interconnect buses
- Multiple IBM i partitions are supported, and each partition can have up to four cores (VIOS required)
  - 4-cores not supported for IBM i in S1022s

S1022s Feature Code	Processor SMT8 Cores	Maximum system cores	Typical Frequency Range	Minimum Quantity	IBM i P Group
EPGQ	8 cores	16 cores	3.00 to 3.90 GHz	1	P10
EPGR	4 cores	4 cores	3.00 to 3.90 GHz	1	N/A

S1022s Memory Options

- High bandwidth buffered memory architecture
- Up to 409 GB/s peak memory bandwidth per socket
- DDR4 DDIMMs
- 8 DDIMM slots per socket, 16 DDIMM slots total
- Maximum memory capacity 2TB (1TB at initial GA)
- DDIMM plug rules per socket
  - Minimum config is 2x DDIMMs per socket
  - All DDIMMs behind a module socket must be the same type
- Active Memory Mirroring feature supported - Mirrors hypervisor memory to provide resiliency from uncorrectable memory errors

Feature Code	DIMM Size	DRAM Speed	Memory Bandwidth per socket	
EM6N	16GB 2U DDIMM	3200 MHz	204 GB/s	
EM6W	32GB 2U DDIMM	3200 MHz	204 GB/s	
EM6X	64GB 2U DDIMM	3200 MHz	204 GB/s	
EM6Y	128GB 2U DDIMM	2666 MHz	170 GB/s	Available 4Q2022
EM8G	Active Memory Mirroring (AMM)			Add-on Feature

S1022s Storage Options

Internal Storage Options

- All internal storage is PCIe NVMe (no SAS)
- General PCIe slots (C10/C8, C11) support NVMe JBOF card and are cabled to NVMe backplane
- Max of 8 NVMe U.2 drives supported

S1022s Internal Storage Options

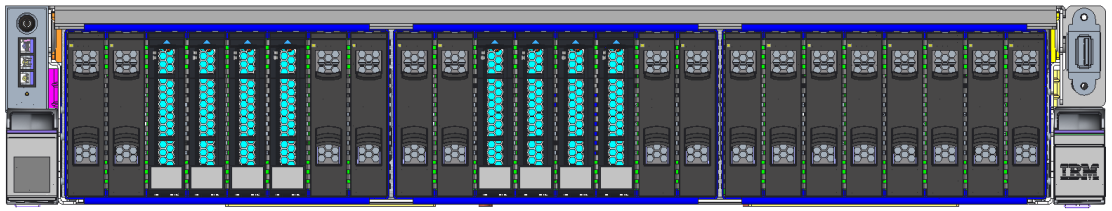
FC	Description
EJ1X	NVMe JBOF Card with U.2 4-Pak Backplane

S1022s External Storage Options

FC / MTM	Description
ESLS	19” Disk Expansion Drawer 24 SFF Gen2-Carrier Bays
EUA5	USB DVD w/ Cable
7226-1U3	19” Media Drawer with 2 bays
TBD	NVMe drawer 24 U.2 Bays (Future GA)

Supported Media Overview

- **NVMe U.2 devices**
  - 0.8TB 4K U.2 7mm 18W PCIe Gen4 Mainstream
  - 0.8TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 1.6TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 3.2TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 6.4TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class



8 NVMe U.2 15mm Bays

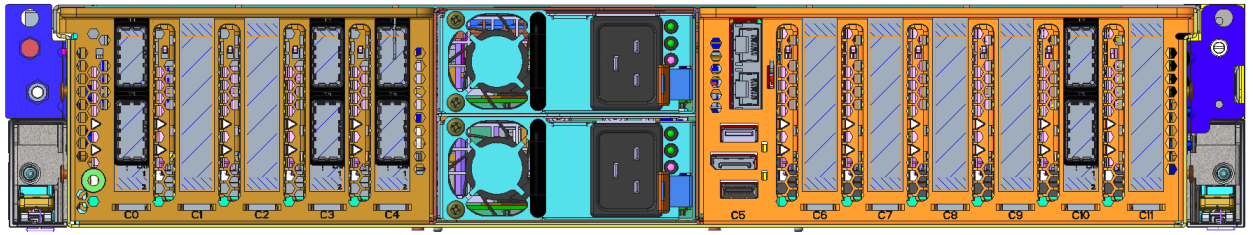
S1022s PCIe Slots

Internal PCIe Slot Summary

Slot	Attributes	Note
C0	PCIe Gen4 x16 or Gen5 x8 (EJ24* slot)	2nd Power10 Socket
C1	PCIe Gen4 x8 (x16 Conn)	
C2	PCIe Gen5 x8 (x16 Conn)	
C3	PCIe Gen4 x16 or Gen5 x8 (EJ24 slot)	
C4	PCIe Gen4 x16 or Gen5 x8 (EJ24 slot)	
C5	eBMC Card	
C6	N/A	1st Power10 Socket
C7	PCIe Gen5 x8 (x16 Conn)	
C8	PCIe Gen4 x8 (x16 Conn) **	
C9	PCIe Gen5 x8 (x16 Conn)	
C10	PCIe Gen4 x16 or Gen5 x8 (EJ24* slot) **	
C11	PCIe Gen5 x8 (x16 Conn) **	

*EJ24 – I/O Expansion Adapter
** Support NVMe JBOF card

Default Ethernet FC: EC2T/EC2U 2x1GbE BaseT SFP



- All PCIe Slots are Concurrently Maintainable
- Half Height, Half Length PCIe form factor

External PCIe Expansion Summary

Num of CPUs	Max num of I/O Exp Drawers (EMX0)	Max num of I/O Fanout Modules (EMXH)	Total PCIe Slots
1	1	1	10
2	2	4	30

No support for EJ08, EJ05, EJ1R, EJ20, EMXF/EMXG/ELMG

2-sockets 2U Scale-Out Systems Comparison

In the Scale-Out Server family, the 2U systems are designed to meet highest performance and security in a dense form factor with industry leading memory bandwidth in the 2-sockets market

	S922 & H922 MTMs: 9009-22G / 9223-22S	S1022s MTMs: 9105-22B	S1022 & L1022 MTMs: 9105-22A / 9786-22H
Processor Module Offerings	4, 8, 10, 11 Power9 Cores	4, 8, Power10 Cores	12, 16, 20 Power10 Cores
Processor Interconnect	2x4B @ 16 Gbps	4x2B @ 32 Gbps	4x2B @ 32 Gbps
Memory Channels per System	16 DDR4 RDIMM Channels	16 OMI Channels	32 OMI Channels
Memory Bandwidth per System (peak)	340 GB/s	408 GB/s w/ 16, 32, 64GB DDIMM	818 GB/s w/ 16, 32, 64GB DDIMM
DIMMs per System	32 IS DIMMs	16 DDIMMs	32 DDIMMs
Memory Capacity per System (max)	4 TB	2TB (Post GA)	4TB (Post GA)
Acceleration Ports	4 ports @ 25 Gbps (OpenCAPI)	Not available	6 ports @ 25 Gbps
PCIe Lanes per System (max)	84 PCIe G4 lanes @ 16 Gbps	128 PCIe G4 lanes @ 16 Gbps	128 PCIe G4 lanes @ 16 Gbps
PCIe Slots per System	5 PCIe x16 G4 slots 6 PCIe x8 G4 slots	4 PCIe G4 x16 or G5 x8 slots 4 PCIe G5 x8 slots 2 PCIe G4 x8 slots	4 PCIe G4 x16 or G5 x8 slots 4 PCIe G5 x8 slots 2 PCIe G4 x8 slots
Slots for Internal Storage Controller	Dedicated	General Purpose	General Purpose
Internal Storage	8 SAS HDD/SSD or 4 NVMe U.2	8 NVMe U.2	8 NVMe U.2
I/O Expansion Drawers (max)	1.5	2	2
Service Processor	FSP	Enterprise BMC (eBMC)	Enterprise BMC (eBMC)
RAS		Active Memory Mirroring Support	Active Memory Mirroring Support
Security		Main Memory Encryption	Main Memory Encryption

* Enable future support for Accelerator technologies.

IBM Power10 S1014

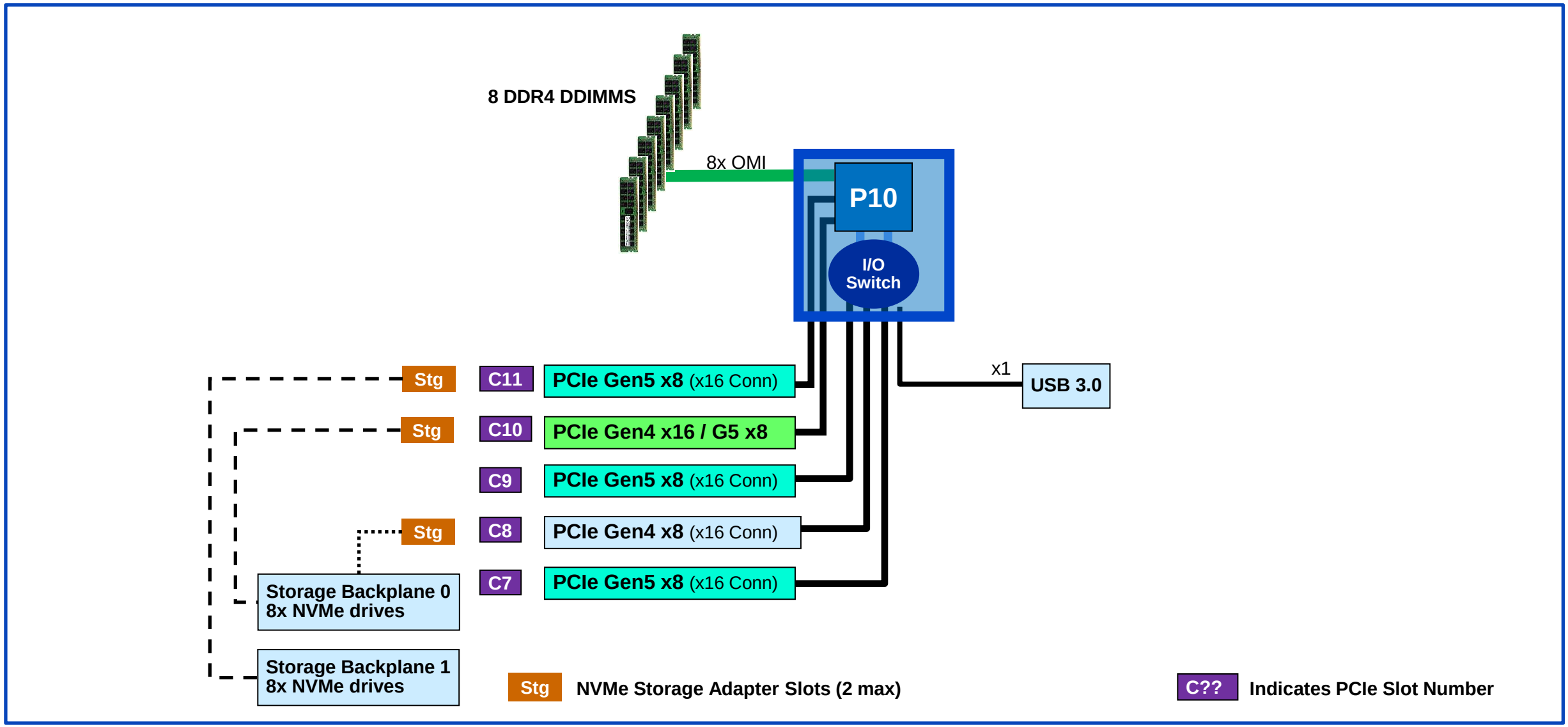
9105-41B

IBM Power10 S1014 Highlights

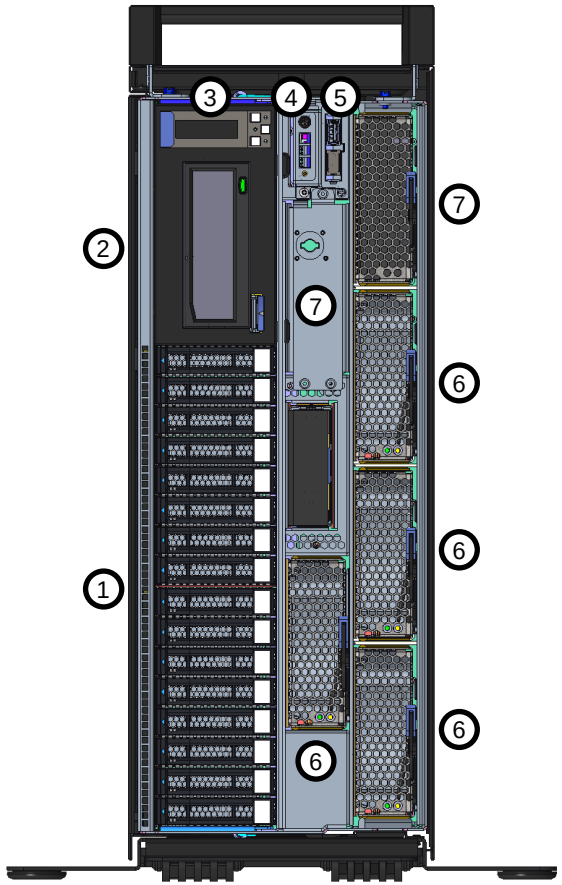
- ✓ Rack and Tower form factors
- ✓ Power10 processors with 4 or 8 cores per server
- ✓ 8 DDIMM slots that provide up to 1TB max memory capacity* (GA: 512GB)
- ✓ Main memory encryption for added security
- ✓ Five PCIe FHHL slots (4 are GEN5 capable), all slots are concurrently maintainable
- ✓ Up to 16 NVMe U.2 Flash Bays provide up to 102.4 TB of storage
- ✓ Secure and Trusted Boot with TPM module
- ✓ Supports external PCIe I/O Expansion Drawer
- ✓ Supports external SAS Storage Expansion Drawer
- ✓ Titanium power supplies to meet EU Efficiency Directives
  - ✓ 2x 220 VAC (rack only) or 4x 1200W 110 VAC with C14 inlet
- ✓ Enterprise BMC managed

* Planned support after initial GA

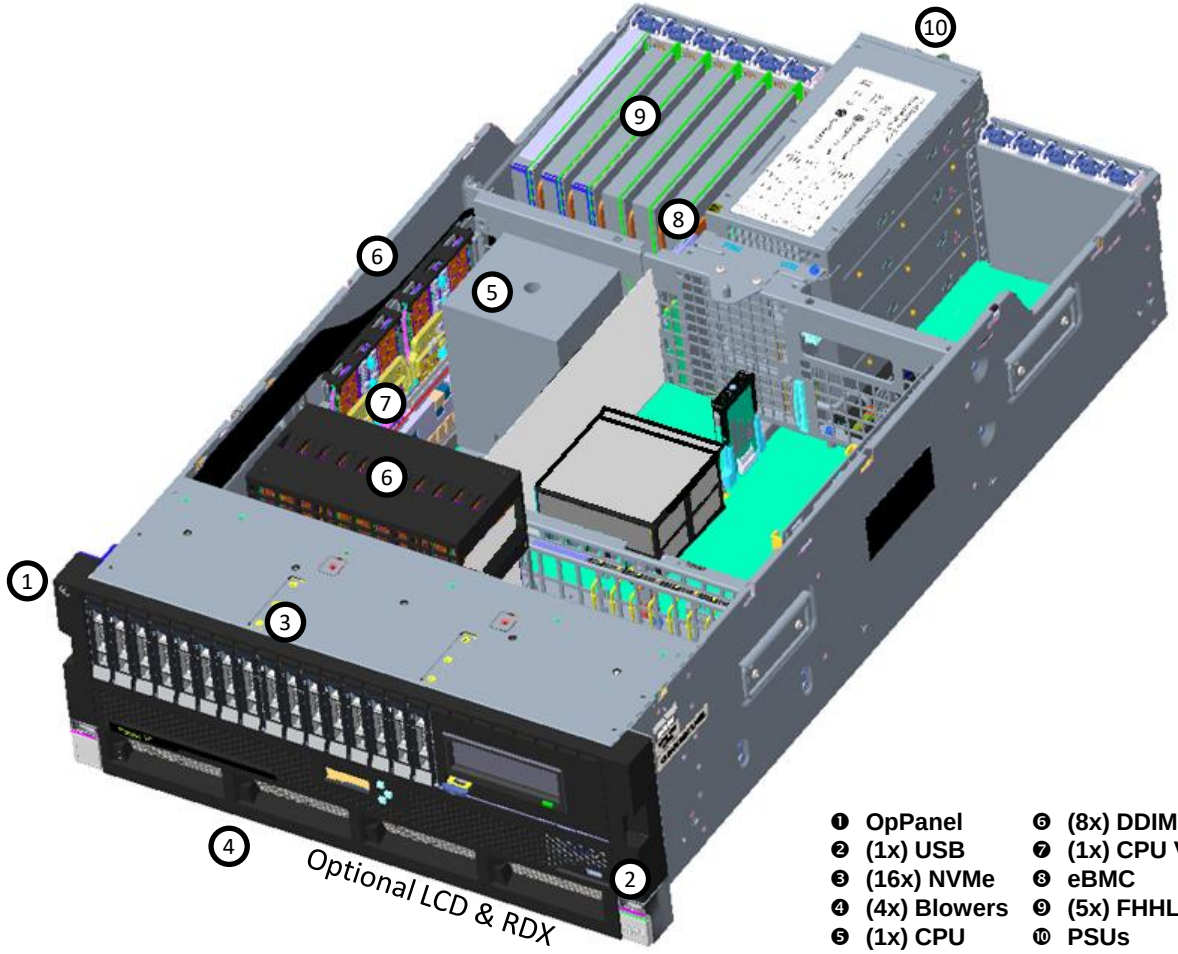
S1014 Server Architecture



S1014 System Design



❶ (16x) NVMe
❷ (Optional) RDX
❸ LCD
❹ OpPanel
❺ (1x) Front USB
❻ (4x) Blowers
❼ Fillers (no blowers)



❶ OpPanel
❷ (1x) USB
❸ (16x) NVMe
❹ (4x) Blowers
❺ (1x) CPU
❻ (8x) DDIMMs
❼ (1x) CPU VRM
❽ eBMC
❾ (5x) FHHL PCIe
❿ PSUs

S1014 Processors Options

- Two processor module offerings available (SMT8 cores)
- Processor module frequencies dynamic by default: Set to Max Performance Mode
- Enhanced Workload Optimized Frequency for optimum performance
  - Max frequency achievable without reducing cores
  - Frequency boost for Ambient temperatures below 27C°/81F°
  - Sampling increased to 500us time interval (was 4ms)

S1014 Feature Code	Processor SMT8 Cores	Typical Frequency Range	IBM i P Group
EPG2	8 cores	3.00 to 3.90 GHz	P10
EPG0	4 cores	3.00 to 3.90 GHz	P05

S1014 Memory Options

- High bandwidth buffered memory architecture
- Up to 204 GB/s peak memory bandwidth
- DDR4 DDIMMs
- 8 DDIMM slots
- Maximum memory capacity 1TB (0.5TB at initial GA)
- DDIMM plug rules
  - Minimum config is 2x DDIMMs
  - All DDIMMs behind a module socket must be the same type

Feature Code	DIMM Size	DRAM Speed	Memory Bandwidth	
EM6N	16GB 2U DDIMM	3200 MHz	409 GB/s	
EM6W	32GB 2U DDIMM	3200 MHz	409 GB/s	
EM6X	64GB 2U DDIMM	3200 MHz	409 GB/s	
EM6Y	128GB 2U DDIMM	2666 MHz	341 GB/s	Available Post GA

S1014 Internal Storage Options

Internal Storage Options

- All internal storage is PCIe NVMe (no SAS)
- General PCIe slots (C10/C8, C11) support NVMe JBOF card and are cabled to NVMe backplane
- Max of 16 NVMe U.2 drives supported

S1014 Internal Storage Options

FC	Description
EJ1Y	NVMe JBOF Card with U.2 8-Pak Backplane
EUA0	RDX Docking Station

S1014 External Storage Options

FC / MTM	Description
ESLS	19” Disk Expansion Drawer 24 SFF Gen2-Carrier Bays (rack only)
EUA5	USB DVD w/ Cable
7226-1U3	19” Media Drawer with 2 bays (rack only)
TBD	NVMe drawer 24 U.2 Bays (Future GA) (rack only)

Supported Media Overview

- **NVMe U.2 devices**
  - 0.8TB 4K U.2 7mm 18W PCIe Gen4 Mainstream
  - 0.8TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 1.6TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 3.2TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class
  - 6.4TB 4K U.2 15mm 18W PCIe Gen4 Enterprise Class

- **RDX Disk Cartridge**
  - 320GB Disk Cartdrige (EU08)
  - 500GB Disk Cartridge (1107)
  - 1TB Disk Cartridge (EU01)
  - 1.5TB Disk Cartridge (EU15)
  - 2TB Disk Cartridge (EU2T)

16 NVMe U.2 15mm Bays

S1014 PCIe Slots

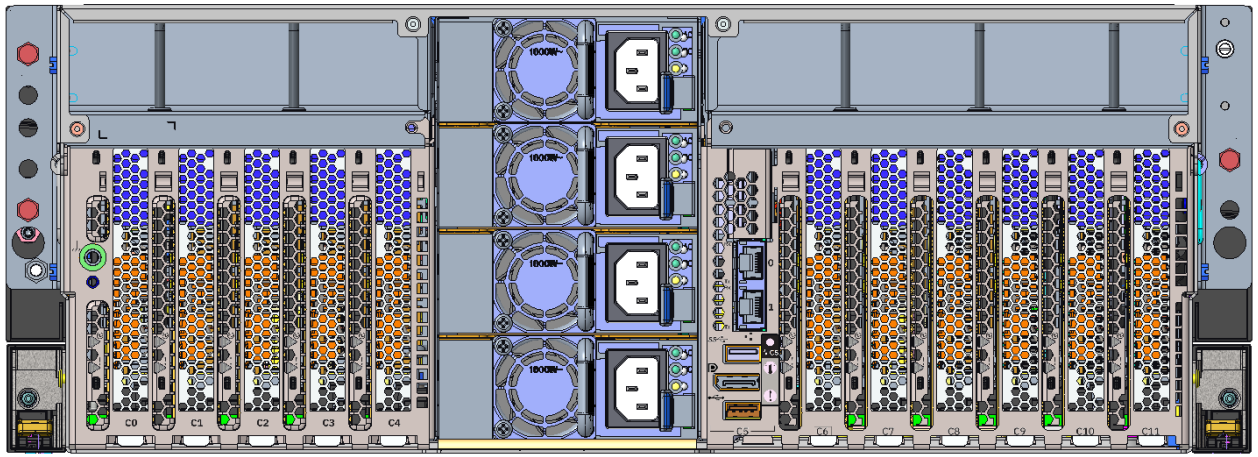
Internal PCIe Slot Summary

Slot	Attributes	Note
C5	eBMC Card	
C6	N/A	1st Power10 Socket
C7	PCIe Gen5 x8 (x16 Conn)	
C8	PCIe Gen4 x8 (x16 Conn) **	
C9	PCIe Gen5 x8 (x16 Conn)	
C10	PCIe Gen4 x16 or Gen5 x8 (EJ2A* slot) **	
C11	PCIe Gen5 x8 (x16 Conn) **	

*EJ2A – I/O Expansion Adapter (rack only)
** Support NVMe JBOF card

- All PCIe Slots are Concurrently Maintainable
- Full Height, Half Length PCIe form factor

Default Ethernet FC: 5899 4x1GbE BaseT



External PCIe Expansion Summary

Num of CPUs	Max num of I/O Exp Drawers (EMX0)	Max num of I/O Fanout Modules (EMXH)	Total PCIe Slots
1	0.5	1	10

No support for EJ08, EJ05, EJ1R, EJ20, EMXF/EMXG/ELMG

1-socket 4U Scale-Out Systems Comparison

The S1014 is the price attractive entry offering into the Power10 family of servers. Industry leading integrated security and reliability as well cloud enabled out of the box with integrated PowerVM technology

	S914 MTM: 9009-41G	S1014 MTM: 9105-41B
Processor Module Offerings	4, 6, 8 Power9 Cores	4, 8 Power10 Cores
Memory Channels per System	8 DDR4 RDIMM Channels	8 OMI Channels
Memory Bandwidth per System (peak)	170 GB/s	204 GB/s 16, 32, 64GB DIMMs
DIMMs per System	16 IS DIMMs	8 DDIMMs
Memory Capacity per System (max)	1 TB	1 TB (Post GA)
PCIe Lanes per System (max)	42 PCIe G4 lanes @ 16 Gbps	64 PCIe G4 lanes @ 16 Gbps
PCIe Slots per System	3 PCIe x16 G4 slots 5 PCIe x8 G4 slots	2 PCIe G4 x16 or G5 x8 slots 3 PCIe G5 x8 slots 1 PCIe G4 x8 slots
Slots for Internal Storage	Dedicated	General Purpose
Drives (max)	18 SAS HDD/SSD or 4 NVMe U.2	16 NVMe U.2
RDX	1	1
MEX IO Drawer (max)	0.5	0.5
Service Processor	FSP	Enterprise BMC (eBMC)
Security		Main Memory Encryption

OS Support

Planned OS support AIX IBM i Linux OpenShift

OS	AIX			IBM i					Linux						OpenShift (RHEL CoreOS)		
Power Platform	AIX 7.1	AIX 7.2	AIX 7.3	IBM i 7.1	IBM i 7.2	IBM i 7.3	IBM i 7.4	IBM i 7.5	RHEL 8.2	RHEL 8.4	RHEL 8.6	RHEL 9	SLES 12	SLES 15	OCP 4.9	OCP 4.10	OCP 4.11
Power E1080	TL5 SP5 (Virtual IO only)	TL5 SP1 TL4 SP1	TL0 SP1			TR11	TR5		**				SP5	SP3 *SP4			Aug ‘22
Power E1050	TL5 SP6 (Virtual IO only)	TL5 SP1 TL4 SP2	TL0 SP1							3Q22	3Q22	3Q22		SP3 *SP4			Aug ‘22
Power S1014, S1022, S1024	TL5 SP6 (Virtual IO only)	TL5 SP1 TL4 SP2	TL0 SP1			TR11	TR5			3Q22	3Q22	3Q22		SP3 *SP4			Aug ‘22
POWER9 S914, S922, H922, S924, H924, E980 E950				Note S922, E980 only									SP3	SP3 *SP4			Aug ‘22

Not Supported | Supported in P8 Mode | Supported in P9 Mode | Supported in P10 Mode

- SLES 15 SP4 when GA

*** Red Hat BU approval required*

- Releases supporting Power10 mode will also support Power9

Power10-based systems support AIX, IBM i, Linux, and Red Hat OpenShift

Updated: May 2022

AIX Flexibility with Power10

	AIX 7.1 TL5	AIX 7.2 TL5		AIX 7.3 TL0		
	P8 mode	**P8 mode**	**P9 mode**	**P8 mode**	**P9 mode**	**P10 mode**
I/O (**V**irtual, **P**hysical)	V	V and P	V and P	V and P	V and P	V and P
Max HW threads per LPAR	1024	1536	1536	1920	1920	1920
Max RAM per LPAR (TB)	16	32	32	32	32	32
SMT default	8	8	8	8	8	8
HW GZIP enabled	No	No	Yes	No	Yes	Yes
XIVE support	No	No	Yes	No	Yes	Yes
Power10 MMA support	No	No	No	No	No	Yes
P10 optimized memcpy	No	No	No	No	No	Yes

- Realize the benefits of Power10 with the flexibility to choose your AIX version and processor mode
- Move to AIX 7.3 for new possibilities in workload scale, infrastructure optimization, security, and accelerated AI

Thank You