

# Université IBM i 2018

16 et 17 mai

IBM Client Center Paris



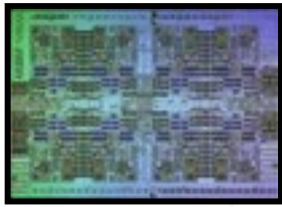
## S14 – Les nouveaux serveurs POWER9 pour IBM i

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# An Acceleration Superhighway: POWER 9 is IBM's Latest Processor

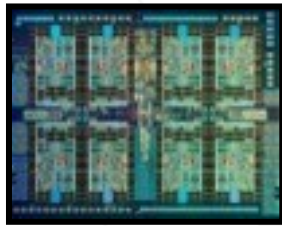


**POWER7**  
45 nm

## Enterprise

- 8 Cores
- SMT4
- eDRAM L3 Cache

**1H10**

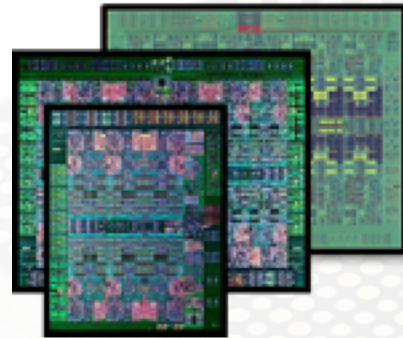


**POWER7+**  
32 nm

## Enterprise

- 2.5x Larger L3 cache
- On-die acceleration
- Zero-power core idle state

**2H12**

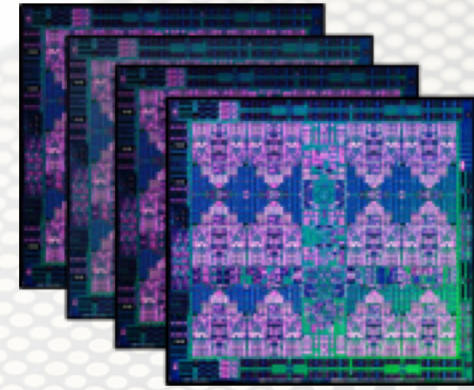


**POWER8 Family**  
22nm

## Enterprise & Big Data Optimized

- Up to 12 Cores
- SMT8
- CAPI Acceleration
- High Bandwidth GPU Attach

**1H14 – 2H16**



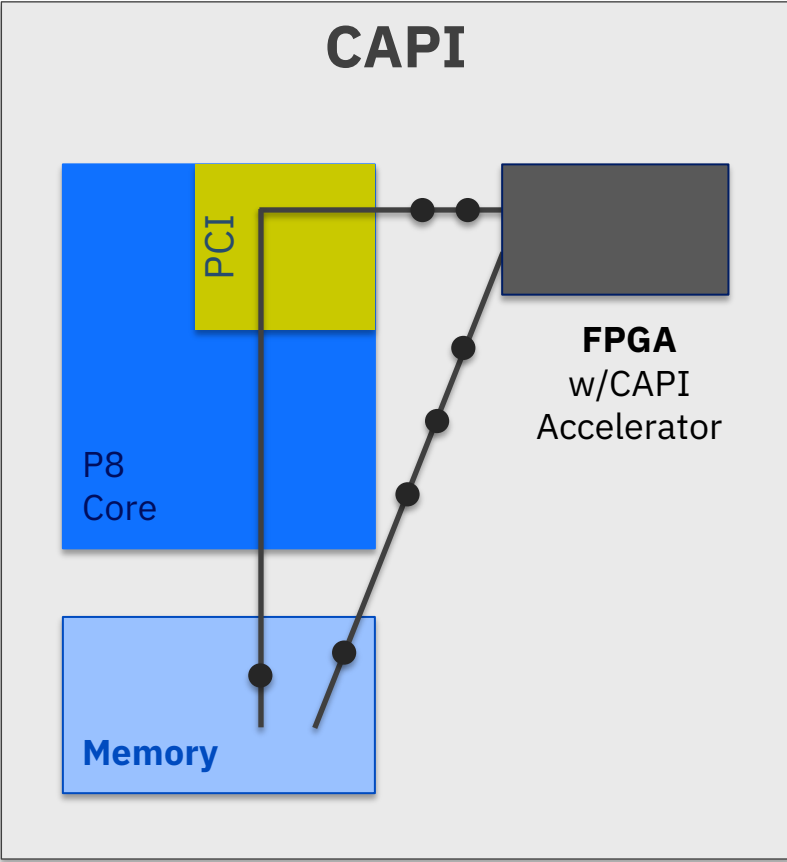
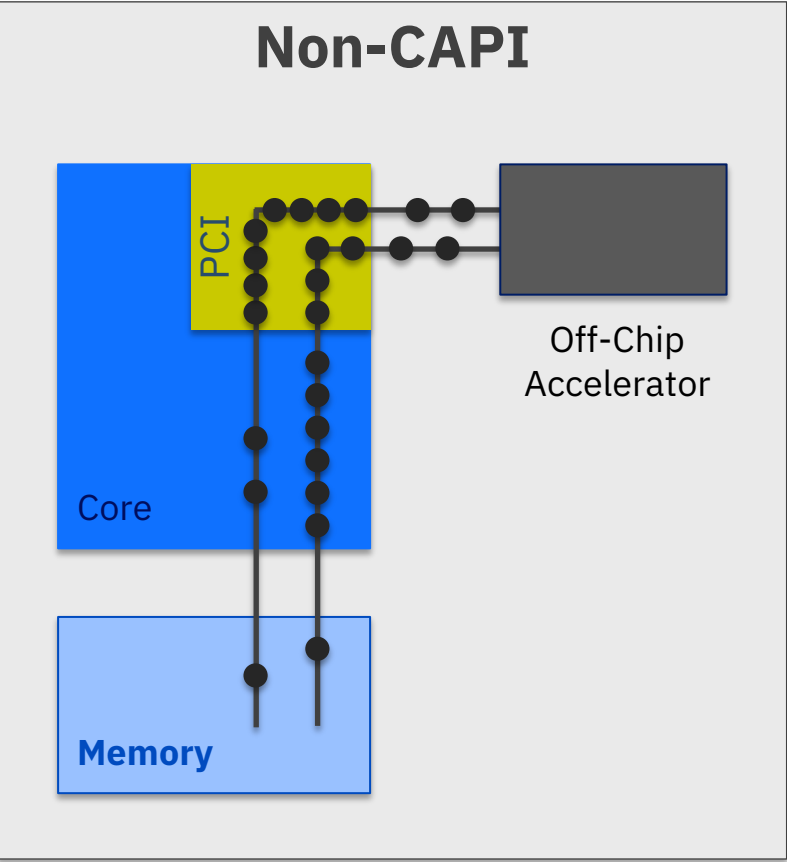
**POWER9 Family**  
14nm

## Built for the Cognitive Era

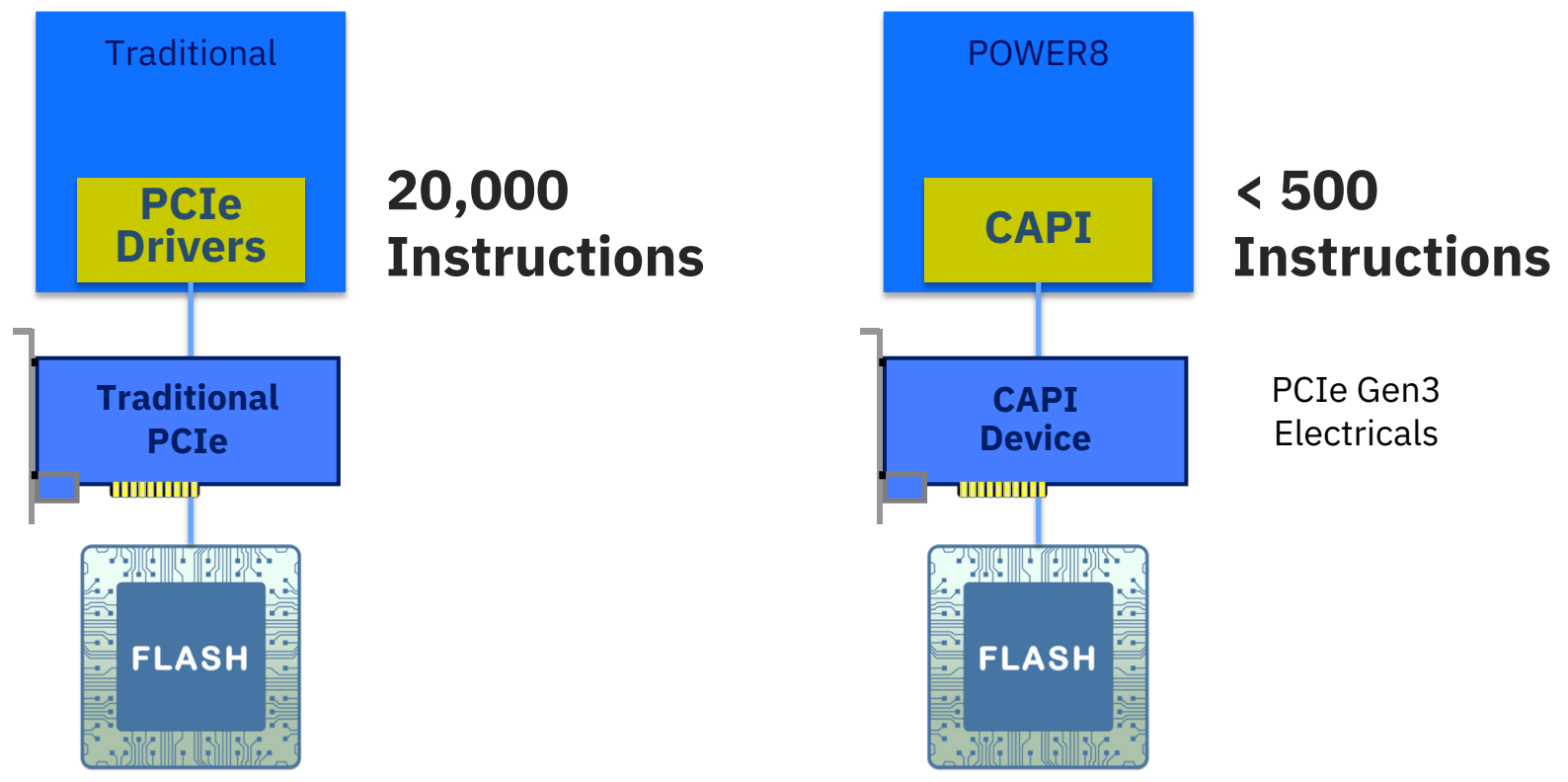
- Only processor with NVLink, PCIe Gen 4 advanced IO interfaces and coherence
- Premier Platform for Accelerated Computing
- Processor Family with Scale-Up and Scale-Out Optimized Silicon

**2H17 – 2H18+**

# Coherent Accelerator Processor Interface



# CAPI Lowers Flash Latency

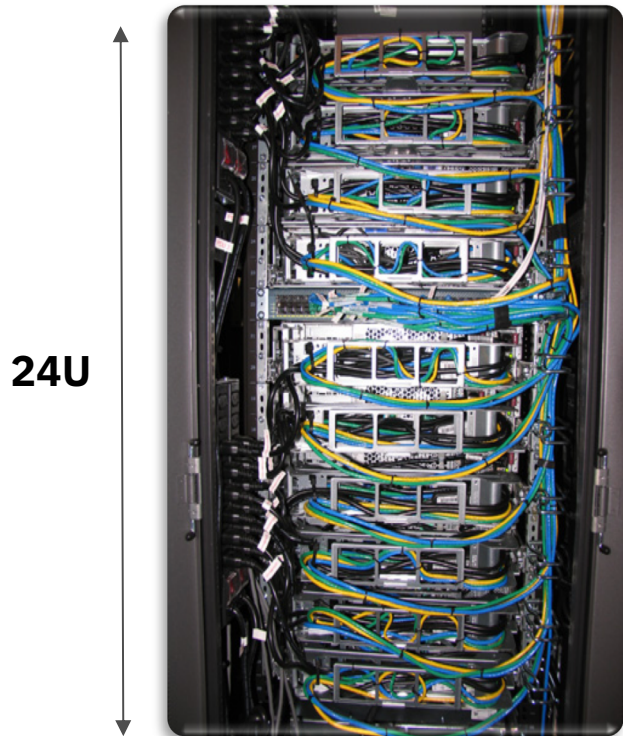


# “Data Engine for NoSQL” with 40TB CAPI-attached flash



**24:1** server consolidation  
**3x** lower cost per user

Before: NoSQL in memory (x86)



**24 servers – 512 GB / node**

*Less is More*

**24:1** physical server =  
**6x** less rack space  
**12x** less energy  
**3x** lower cost per user  
*Less complexity*  
*More efficiency*

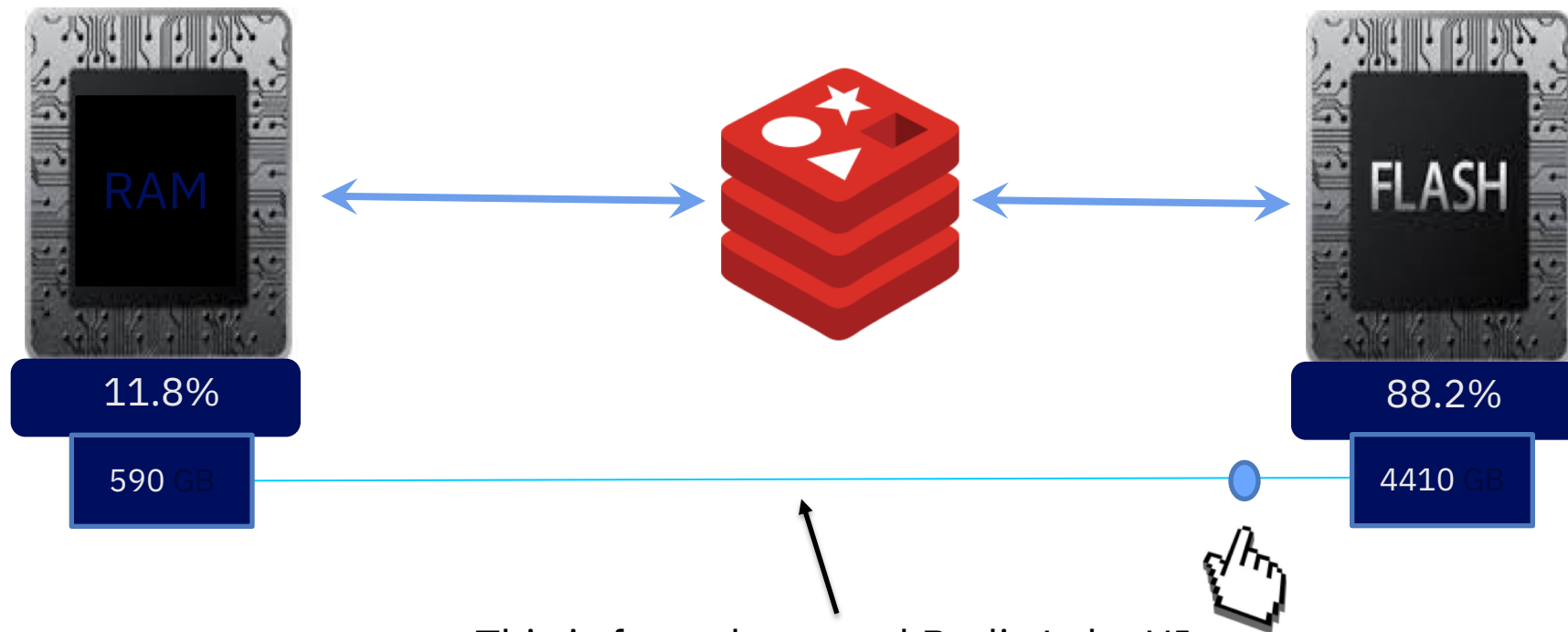


CAPI Flash allows redis to access up to **40TB** at very low latency, in a “in-memory” manner.

**1 server + 40 TB In Memory DB**

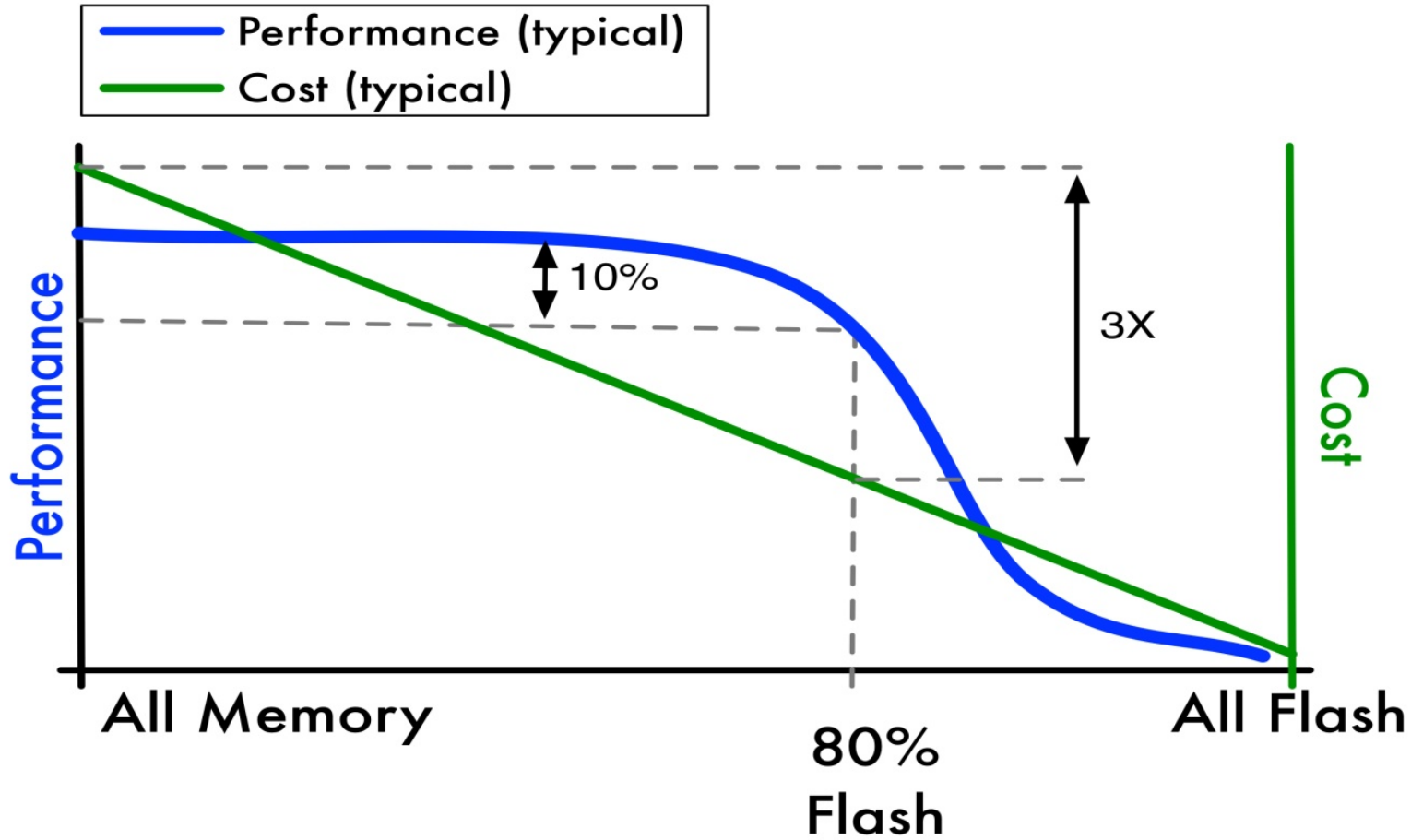
# Redis on Flash - a new concept

Flash used as RAM extender and not as a persistent storage



This is from the actual Redis Labs UI

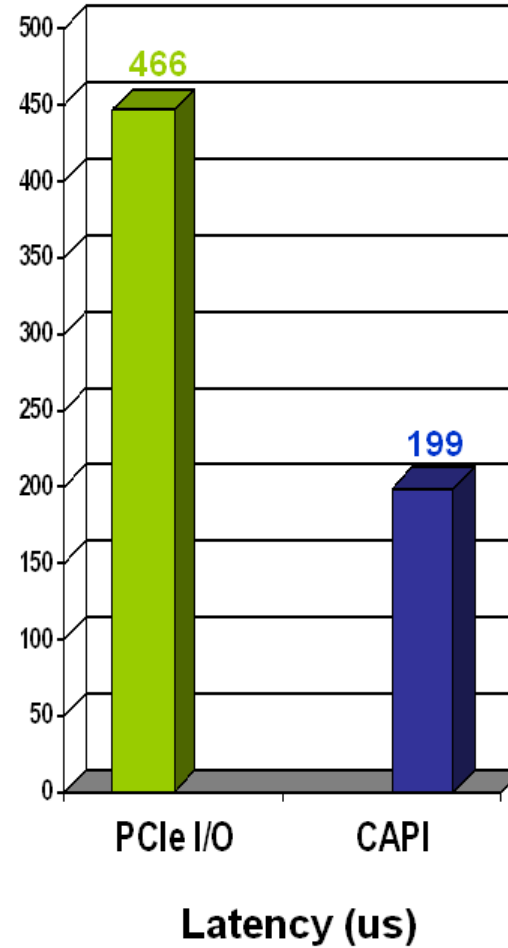
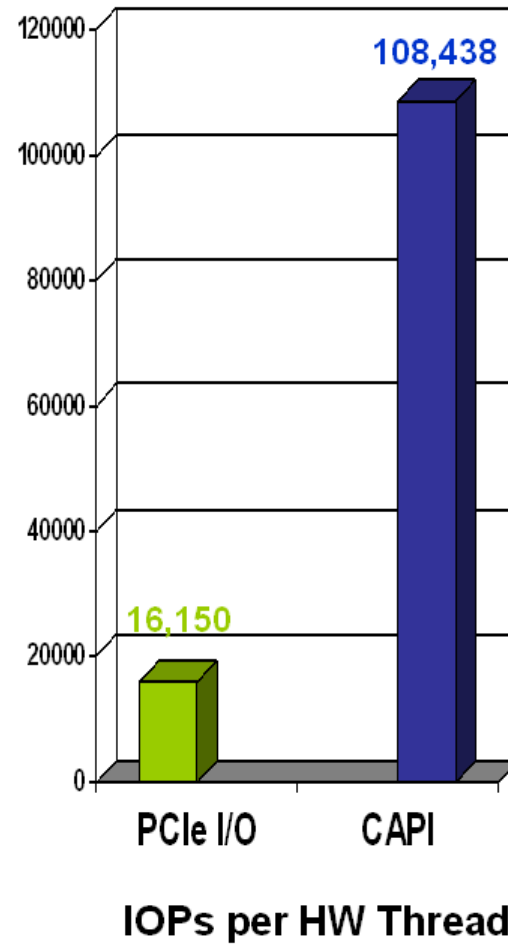
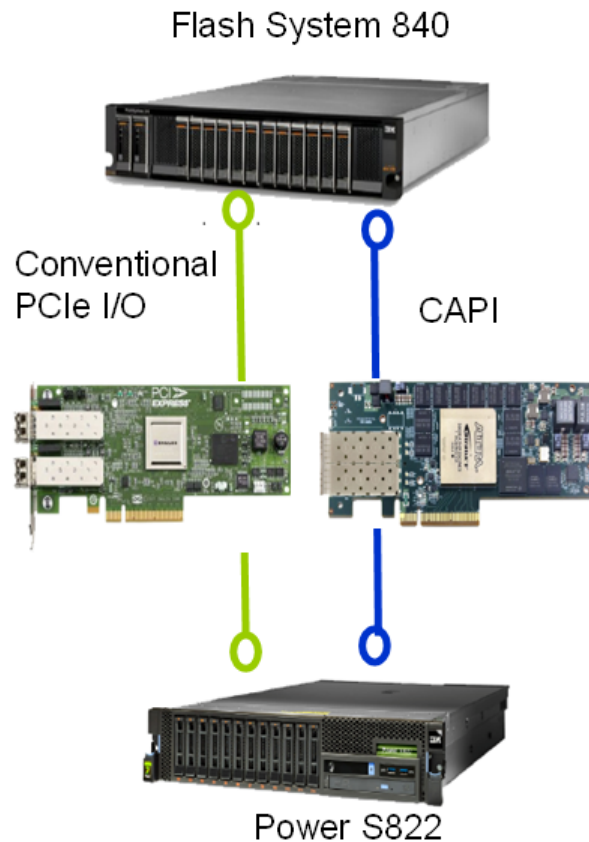
# Value to RedisLabs Users



# Demonstrating the Value of CAPI Attachment

## IBM Data Engine for NoSQL

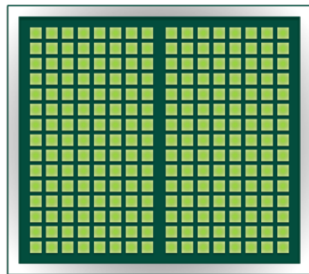
Identical hardware with 2 different paths to data



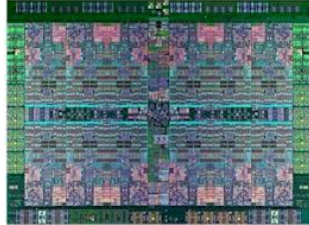


# Power Systems and NVIDIA GPUs

NVIDIA GPU



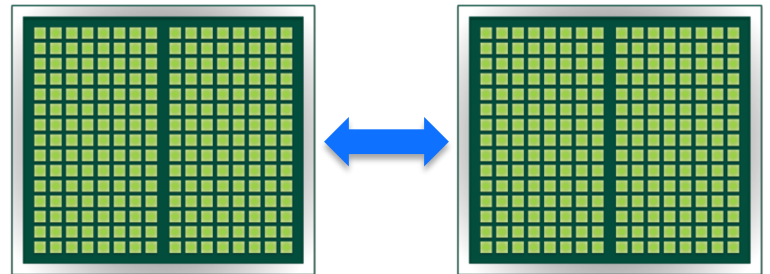
PCIe x16  
32 GB/s



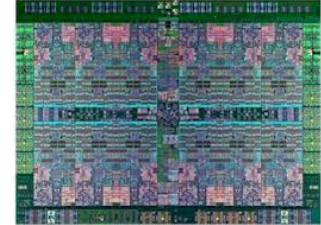
POWER8

2015

NVIDIA GPU with NVLink



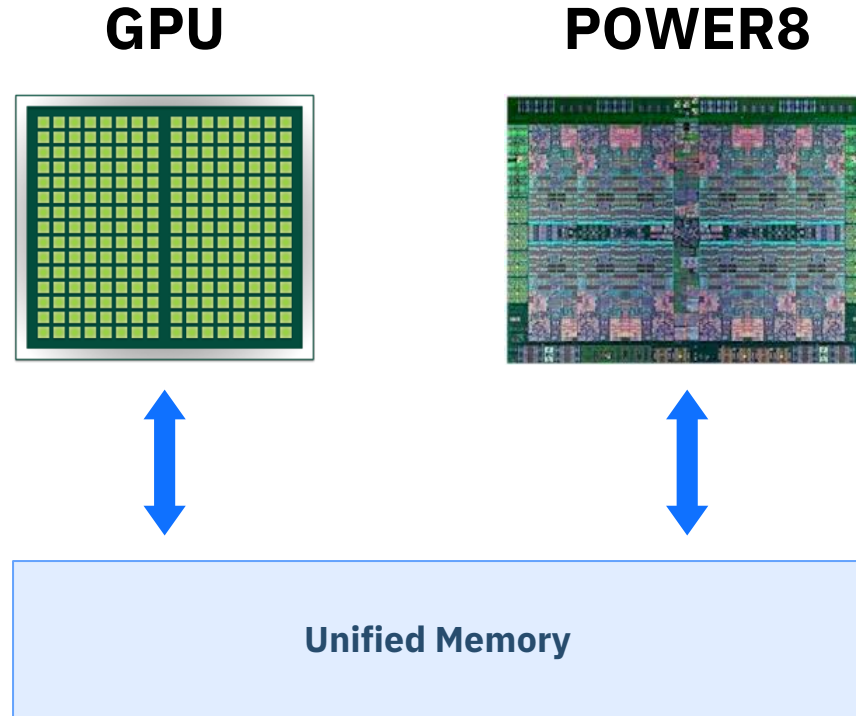
All Links  
80 GB/s



POWER8  
with NVLink

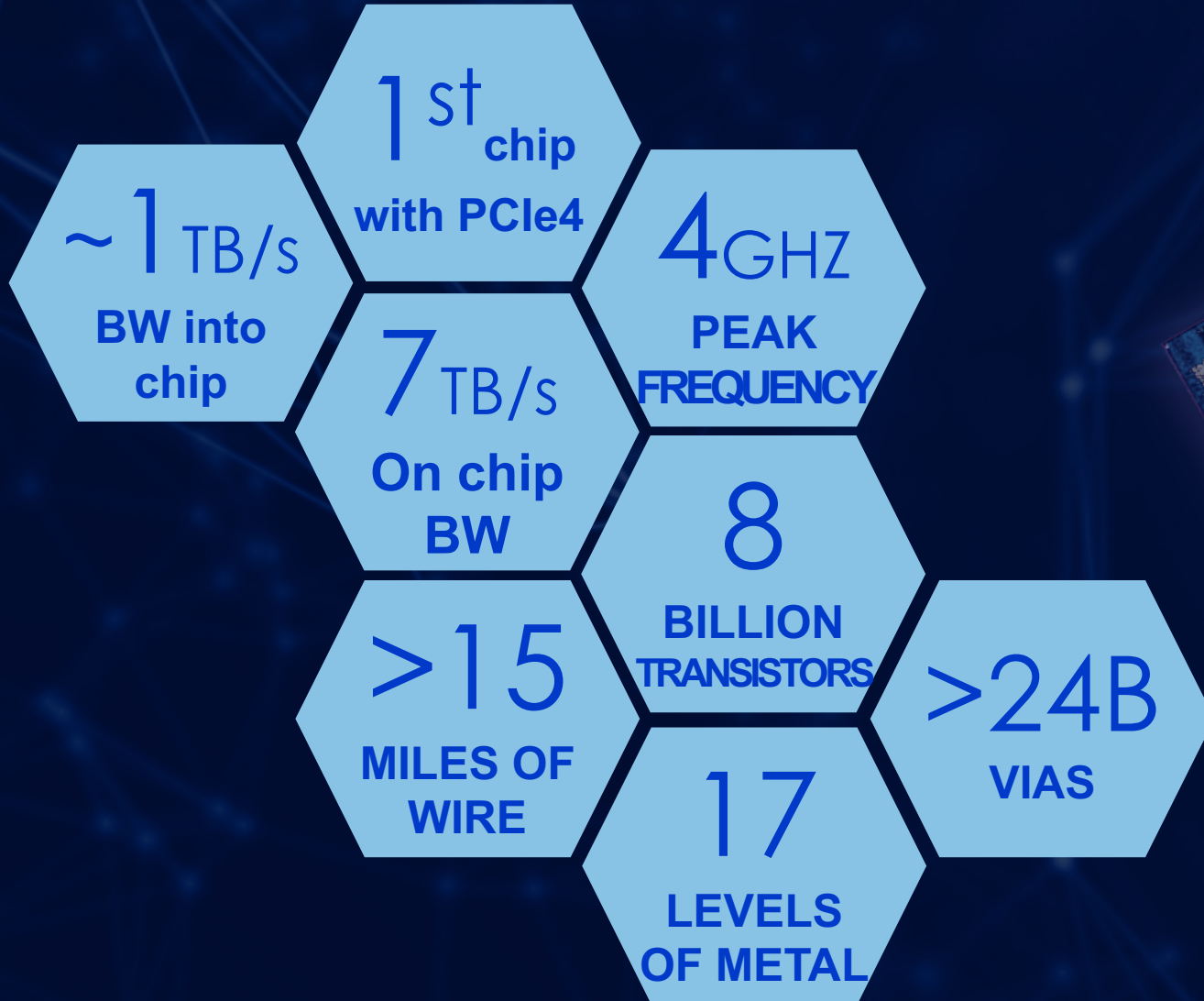
2016

# NVIDIA Pascal P100 Unified Memory



- Data transparently migrated between GPU and POWER8 memory
- Single 49-bit virtual address space
- Accelerated by NVLink

# The new POWER9 processor



1.5x

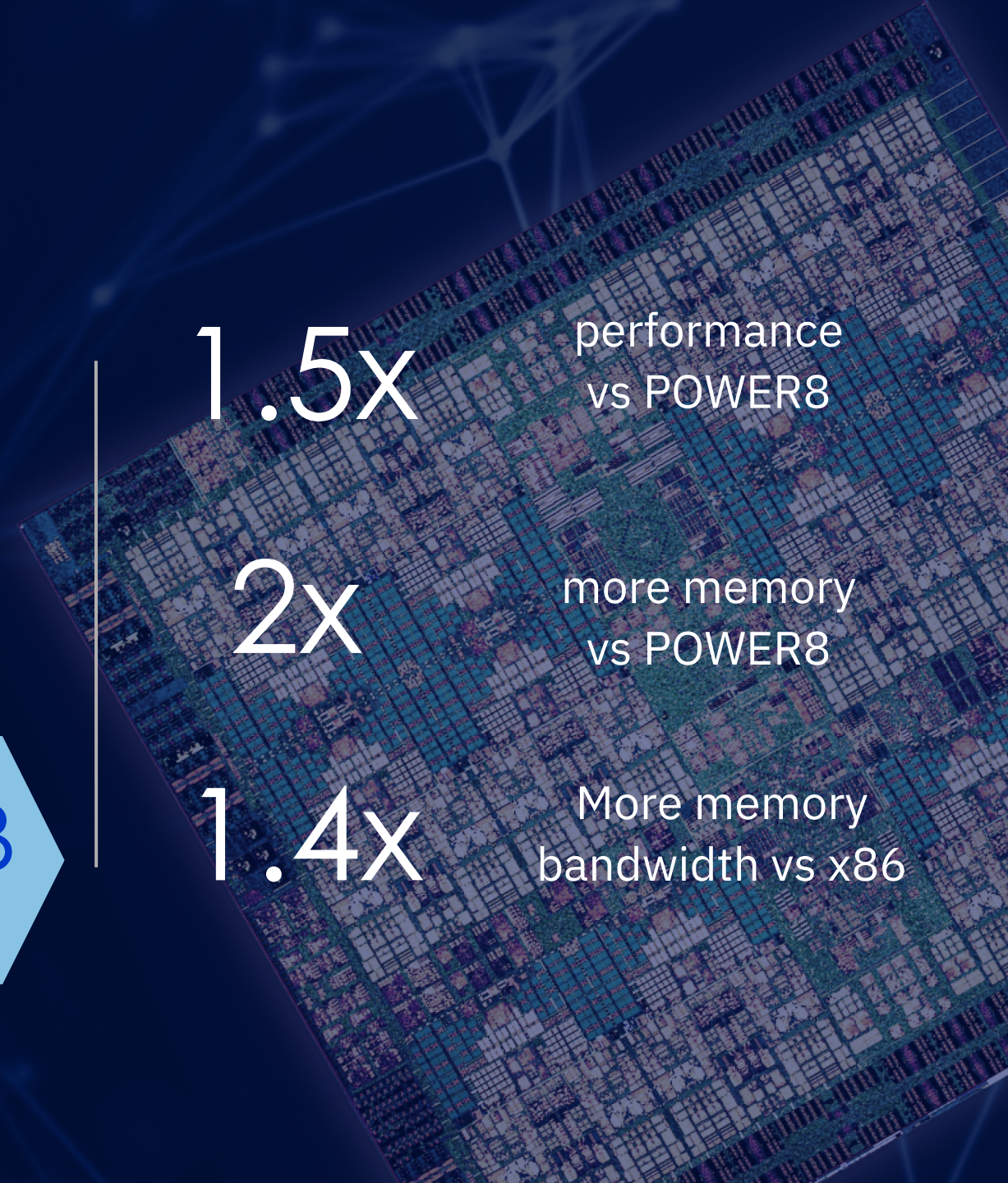
performance  
vs POWER8

2x

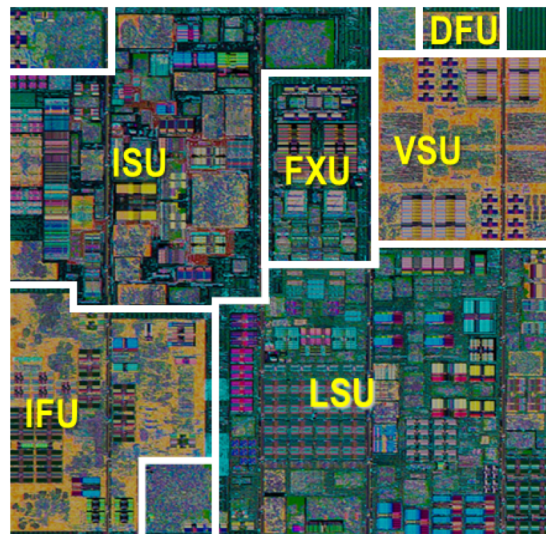
more memory  
vs POWER8

1.4x

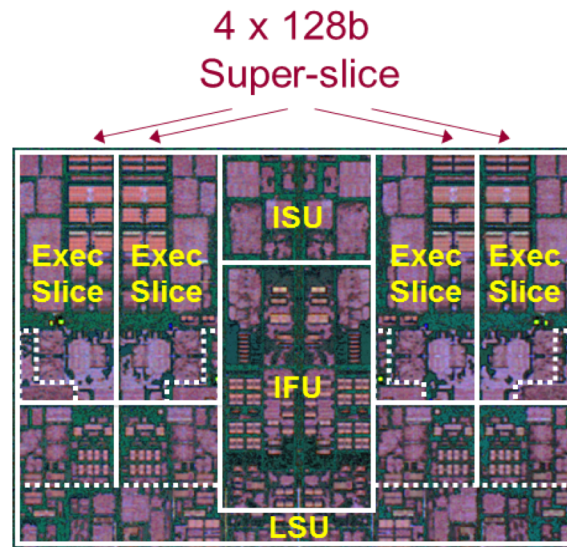
More memory  
bandwidth vs x86



# POWER9 Processor

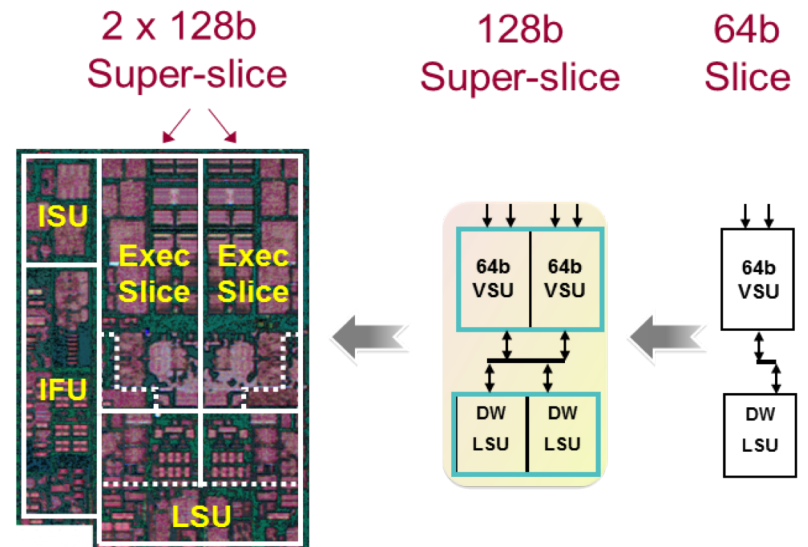


POWER8 SMT8 Core



POWER9 SMT8 Core

## Modular Execution Slices



POWER9 SMT4 Core

The core consists primarily of the following six units: instruction fetch unit (IFU), instruction sequencing unit (ISU), load-store unit (LSU), fixed-point unit (FXU), vector and scalar unit (VSU) and decimal floating point unit (DFU)

# Targeted Implementations

## SMP scalability / Memory subsystem

### Scale-Out – 2 Socket Optimized

#### Robust 2 socket SMP system

#### Direct Memory Attach

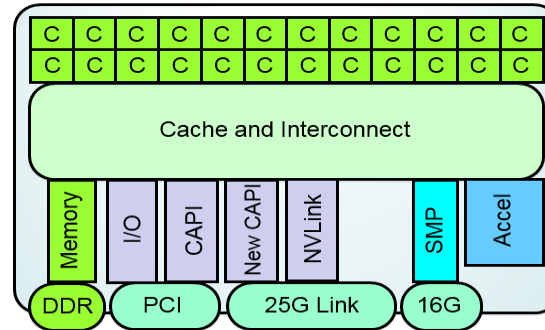
- Up to 8 DDR4 ports
- Commodity packaging form factor

### Scale-Up – Multi-Socket Optimized

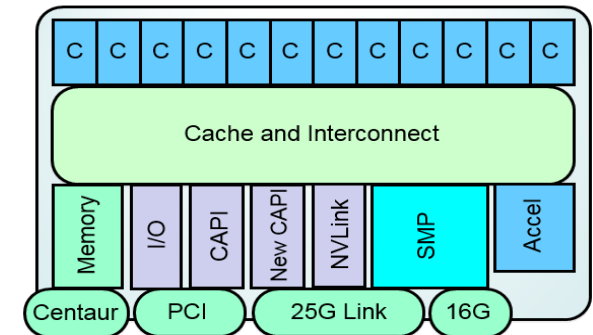
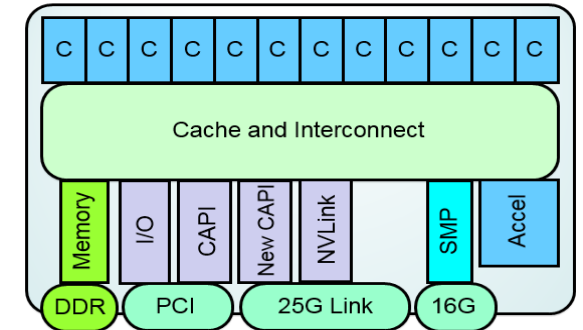
#### Scalable System Topology / Capacity

- Large multi-socket
- Buffered Memory Attach
- 8 Buffered channels

Up to 24 Cores / Chip / socket  
max of 4 threads per core  
Linux Ecosystem Optimized

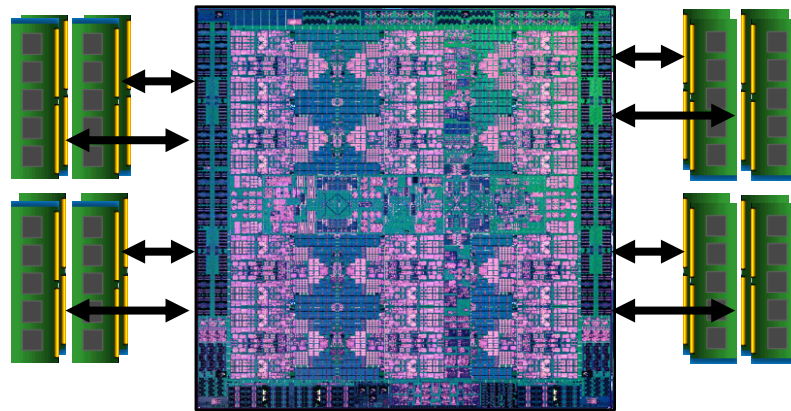


Up to 12 Cores / Chip / socket  
max of 8 threads per core  
PowerVM Ecosystem Continuity



# Two Memory Architectures

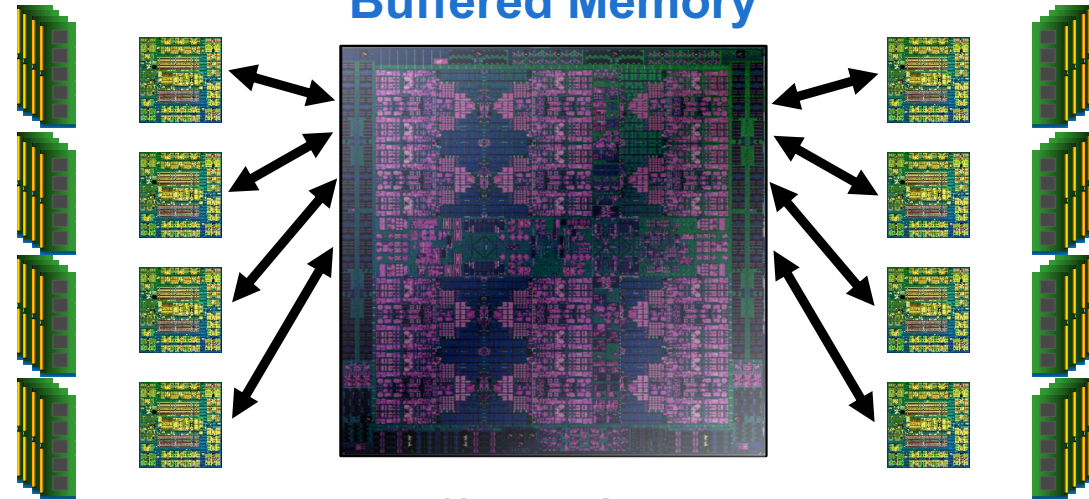
## Scale Out Direct Attach Memory



### 8 Direct DDR4 Ports

- Up to 170 GB/s of bandwidth
- Low latency access
- Commodity packaging form factor
- Adaptive 64B / 128B reads
- Simplified Design Point

## Scale Up Buffered Memory



### 8 Buffered Channels

- Up to 230 GB/s of bandwidth
- Extreme capacity – up to 8TB / socket
- Superior RAS with chip kill and lane sparing (HE)
- Compatible with POWER8 system memory
- Agnostic interface for alternate memory innovations

# POWER9 – Data Capacity & Throughput

**Big Caches for Massively Parallel Compute and Heterogeneous Interaction**

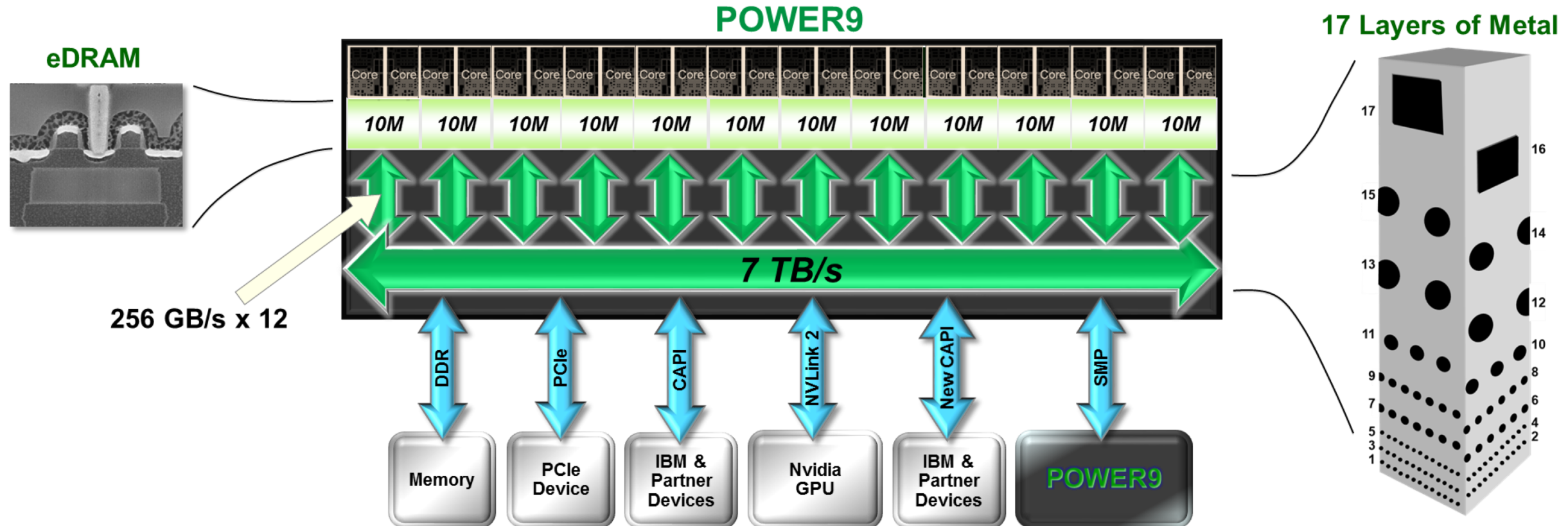
**Extreme Switching Bandwidth for the Most Demanding Compute and Accelerated Workloads**

## L3 Cache: 120 MB Shared Capacity NUCA Cache

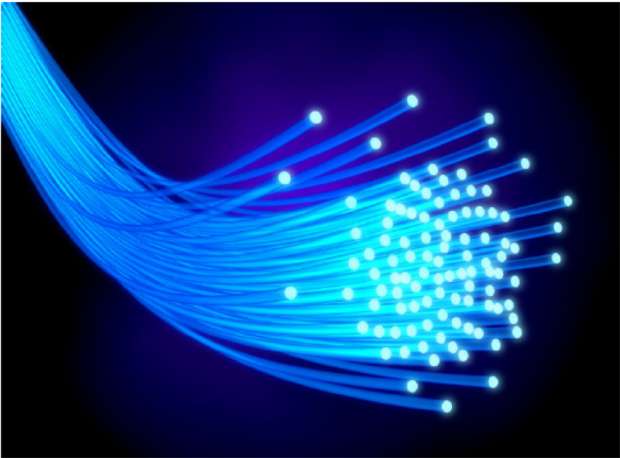
- 10 MB Capacity + 512k L2 per SMT8 Core
- Enhanced Replacement with Reuse & Data-Type Awareness  
12 x 20 way associativity

## High-Throughput On-Chip Fabric

- Over 7 TB/s On-chip Switch
- Move Data in/out at 256 GB/s per SMT8 Core



# Modular Constructs → High-speed 25 Gb/s Signaling



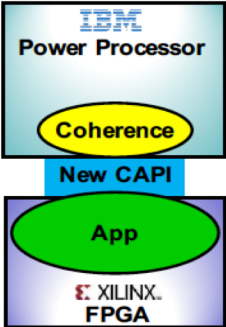
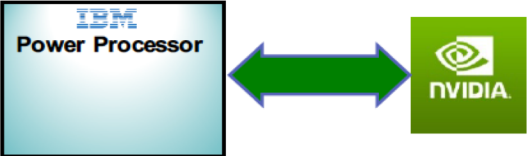
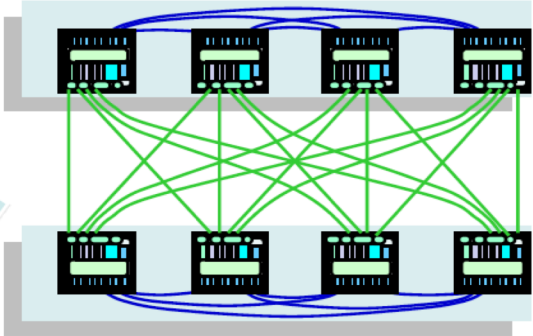
Utilize Best-of-Breed  
25 Gb/s Optical-Style  
Signaling Technology

Multi-Drawer SMP Interconnect

NVLINK 2 GPU Accelerator Attach

Open CAPI Accelerator Attach

Flexible & Modular  
Packaging  
Infrastructure

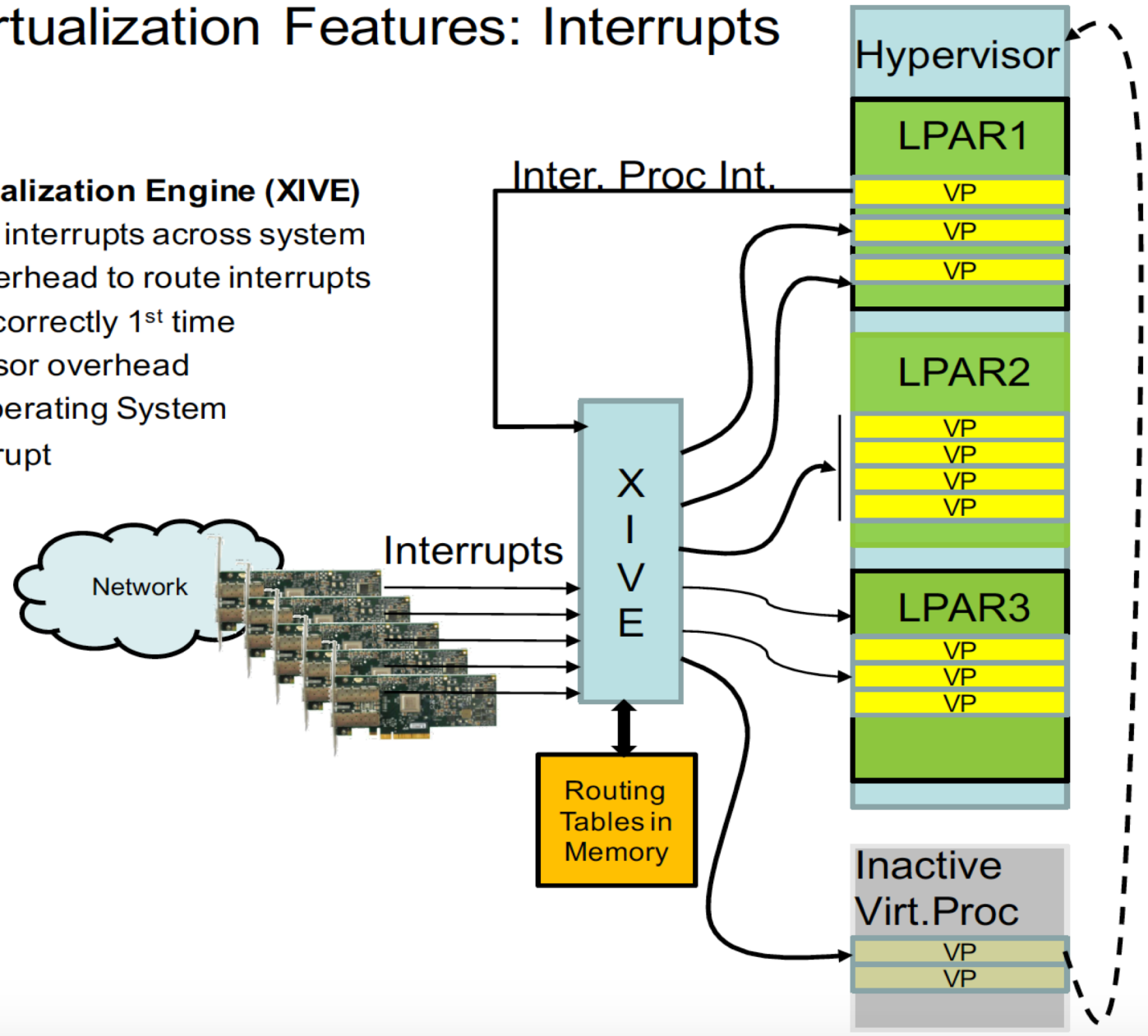




# Platform Virtualization Features: Interrupts

## New External Interrupt Virtualization Engine (XIVE)

- Prior processors distributed interrupts across system
  - Significant Software overhead to route interrupts
- New XIVE hardware routes correctly 1<sup>st</sup> time
  - Eliminates host processor overhead
  - Directly target guest Operating System
  - Enable User level Interrupt



# Seamless CPU and Accelerator Interaction

coherent memory sharing  
enhanced virtual address translation

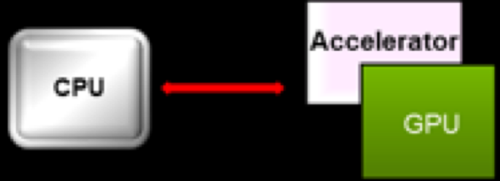


# Broader Application of Heterogeneous Compute

designed for efficient programming models  
accelerate complex AI & analytic apps

“vanilla”

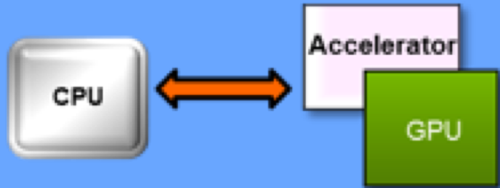
# Others



PCIe Gen3

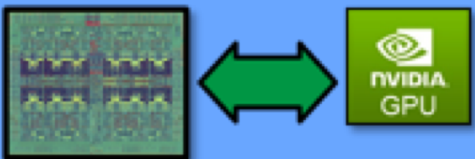
extreme CPU and Accelerator bandwidth

2x



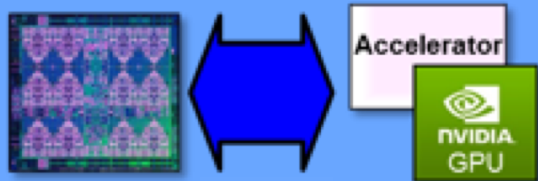
PCIe Gen4

5x



POWER8  
with NVLink 1.0

7-10x



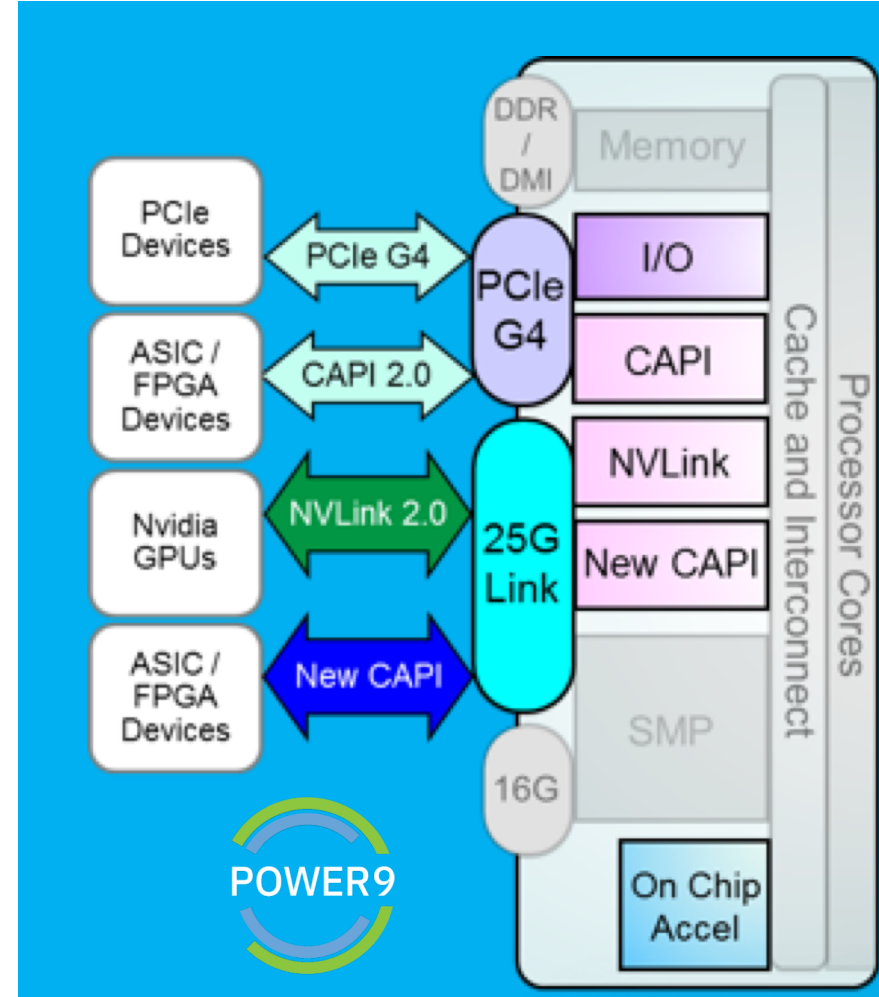
POWER9 with 25G  
Link + NVLink 2.0


## State of the Art I/O and Acceleration Attachment Signaling


- PCIe Gen 4 x 48 lanes – 192 GB/s duplex bandwidth
- 25G Link x 48 lanes – 300 GB/s duplex bandwidth

## Robust Accelerated Compute Options with OPEN standards

- On-Chip Acceleration – GZip x1, 842 Compression x2, AES/SHA x2
- CAPI 2.0 – 4x bandwidth of POWER8 using *PCIe Gen 4*
- OpenCAPI – High bandwidth, low latency and open interface using *25G Link*
- NVLink 2.0 – Next generation GPU ↔ CPU bandwidth and integration



 extreme processor / accelerator bandwidth and reduced latency

 coherent memory and virtual addressing capability for all accelerators

 openPOWER community enablement robust accelerated compute options

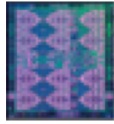
**POWER9**  
**Premier**  
**Acceleration**  
**Platform**

# POWER9 Family roadmap

- ✓ More performance and scale via POWER9 processors
- ✓ More Memory capacity for in-memory DB
- ✓ Reduce latency and improve throughput with enhanced I/O support
  - PCIe Gen4
  - Integrated NVMe Flash (bootable)
- ✓ High-bandwidth (25Gb/s) links for GPU/OpenCAPI acceleration

## 2017

Robust 2-socket SMP  
Direct memory attach



&  
HSDC



AC922



## 2018

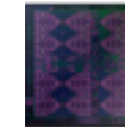
Scale Out 2-socket SMP  
Direct memory attach



2-socket  
Entry SOR



2-socket LC  
Infrastructure



4-socket  
Midrange



4- to 16-socket  
Modular High-end

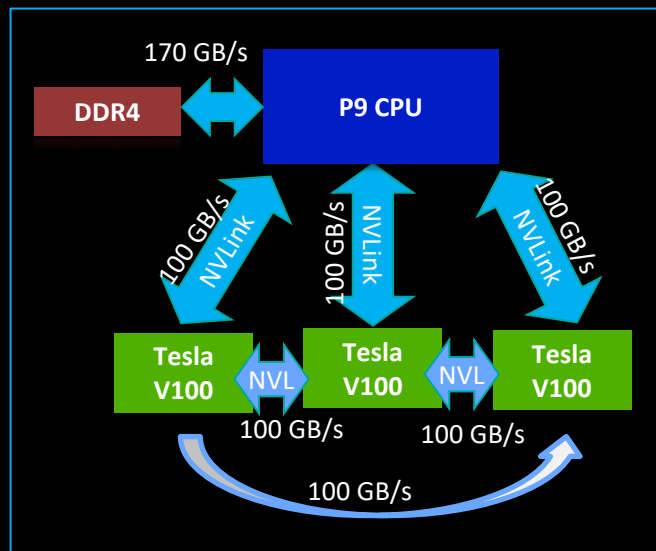
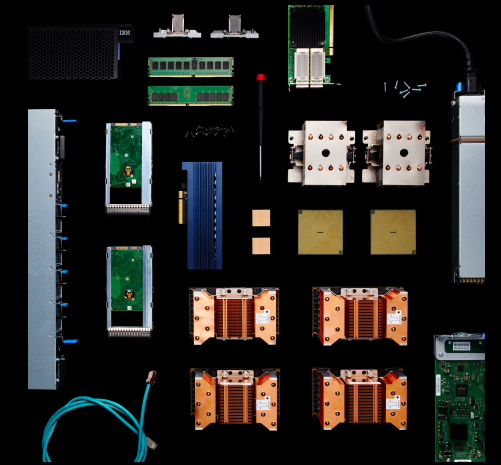


# AC922: Specs for AI, HPC, and HPDA

Unprecedented performance and application gains with the 2nd generation NVLink integrated into the NEW P9 processor delivering advanced IO capabilities not available on x86 based systems

**2<sup>nd</sup> Generation CPU - GPU NVLink:** ~5X the CPU-GPU bandwidth compared to x86; ~2x NVLink 1.0

**Introducing Coherence:** Focus on what to accelerate, not how... game changing simplification of programming



## General AC922 Details:

- 2-socket, 2U
- Up to 40/44 cores (Air/water up to 3.1GHz)
- Up to 2 TB memory (16 DIMMs)
- 340GB/sec memory bandwidth
- 4 PCIe slots (2x16, 1x4, 1x8/x8 shared IB)
- Up to 6 integrated NVIDIA V100 with NVLink GPUs

## Configuration System Details for 4Q GA

MTM: 8335-GTG - Specific 4Q Feature Availability:

- 1.6 TB NVMe high performance storage adapter
- 2 SFF SATA: HDD (Max 4TB); SSD (Max 7.68TB)
- IO: EDR InfiniBand, Quad ENET (2x1/2x10 GB), Quad ENET (4x1 GB), 100 GB ENET
- RHEL 7.4 for P9
- Air cooled only version available (max 4 GPU's)

A rich configuration of AC922 will be available with a new MTM (8335-GTH) in 2Q'18 offering expanded OS (Ubuntu), full IO including and a water cooled option

# Small Server Enterprise

Announce February 13, 2018

GA March 20, 2018

Scale Out for AIX, IBM I, and Linux			Built for HANA		Optimized for Linux
S922 9009-22A	S914 9009-41A	S924 9009-42A	H922 9223-22H	H924 9223-42H	L922 9008-22L
<ul style="list-style-type: none"> <li>• 1,2-socket, 2U</li> <li>• 4, 8,10 cores/skt</li> <li>• 32 IS DIMM slots</li> <li>• 4TB memory</li> </ul>	<ul style="list-style-type: none"> <li>• 1-s, 4U &amp; Tower</li> <li>• 4,6,8 cores/skt</li> <li>• 16 IS DIMM slots</li> <li>• 1TB memory</li> <li>• Internal RDX Media</li> </ul>	<ul style="list-style-type: none"> <li>• 2-socket, 4U</li> <li>• 8,10,12 cores/skt</li> <li>• 32 IS DIMM slots</li> <li>• 4TB memory</li> <li>• Internal RDX Media</li> </ul>	<ul style="list-style-type: none"> <li>• 1,2-socket, 2U</li> <li>• 4, 8,10 cores/skt</li> <li>• 32 IS DIMM slots</li> <li>• 4TB memory</li> </ul>	<ul style="list-style-type: none"> <li>• 2-socket, 4U</li> <li>• 8,10,12 cores/skt</li> <li>• 32 IS DIMM slots</li> <li>• 4TB memory</li> <li>• Internal RDX Media</li> </ul>	<ul style="list-style-type: none"> <li>• 1,2-socket, 2U</li> <li>• 8,10,12 cores/skt</li> <li>• 32 IS DIMM slots</li> <li>• 4TB memory</li> </ul>
<ul style="list-style-type: none"> <li>• PowerVM</li> </ul>	<ul style="list-style-type: none"> <li>• PowerVM</li> </ul>	<ul style="list-style-type: none"> <li>• PowerVM</li> </ul>	<ul style="list-style-type: none"> <li>• PowerVM</li> <li>• AIX, IBM I up to 25%</li> <li>• Linux</li> </ul>	<ul style="list-style-type: none"> <li>• PowerVM</li> <li>• AIX, IBM I up to 25%</li> <li>• Linux</li> </ul>	<ul style="list-style-type: none"> <li>• PowerVM</li> </ul>
<b>Technology Leadership</b>	<ul style="list-style-type: none"> <li>• Cloud enabled - Embedded virtualization capabilities with PowerVM</li> <li>• Up to 4TB In 2 socket - DDR4 Industry Standard memory RDIMMs</li> <li>• High Speed 25Gb/s external ports – one per socket</li> <li>• 2 Internal NVMe Flash boot adapters</li> <li>• Embedded Analytics and Algorithms on the chip help run POWER9 at an always optimized frequency</li> </ul>				

# Introducing POWER9

## Future Forward Infrastructure

### Cloud and AI ready

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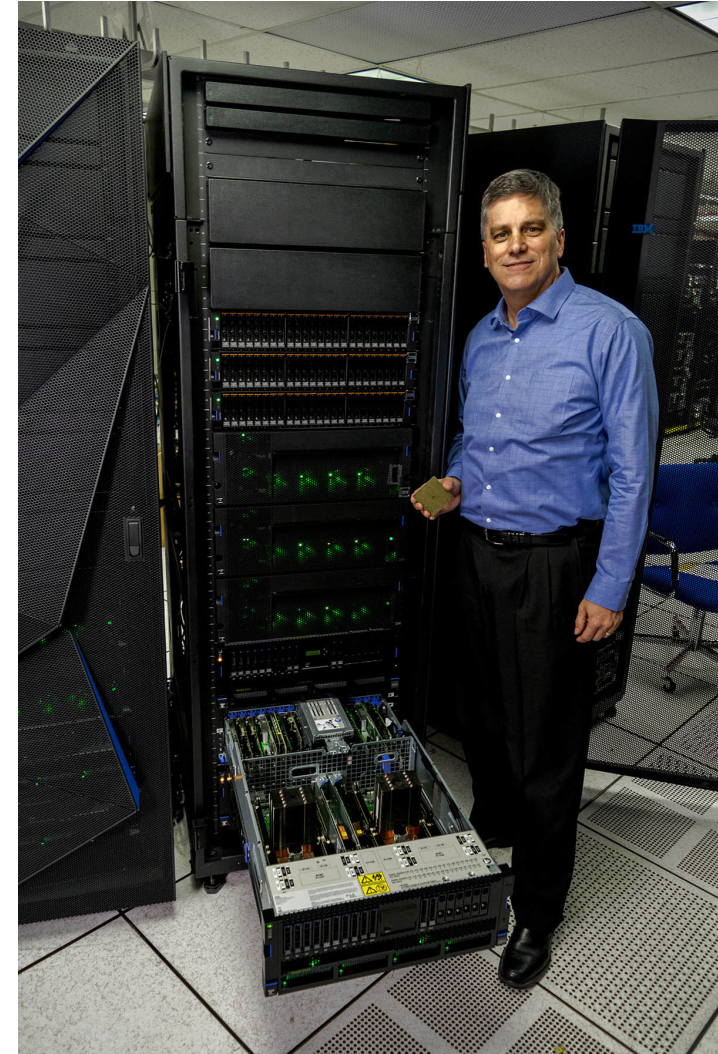
### Designed for mission critical data & workloads

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### Industry-leading performance and value

- Delivers up to 1.5X performance vs POWER8\*
- 4 TB in 2-sockets
- 1<sup>st</sup> with PCIe Gen4
- 25 GB/s links for acceleration

\* Based on IBM internal testing & projections as of 2.5.18; Initial testing indicates relative performance ratios between 1.2 to 1.5X for POWER8 to POWER9.



# Cloud Everywhere. On Premises, Hybrid or Multi-Cloud

## Cloud Enabled on every PowerVM-based system

built on  
**PowerVC**   
Cloud Manager



**PowerVM**

- PowerVM is built-in (included at no additional cost)
- PowerVC pre-selected on every order to speed private cloud deployment
- Upgradeable to PowerVC for Software Defined Infrastructure
- Deploy IBM Cloud Private seamlessly to leverage container-based workloads

- Rapid provisioning of workloads
- Improved availability and automated workload recovery
- Simplified maintenance and migration / technology upgrades
- Dynamic infrastructure optimization
- Multi-cloud support with simplified workload transfers
- Upward integration into heterogeneous cloud orchestrators
- VM and Linux container-based application management



# Ready for AI: Connecting your business to the future



The art of fine seating

- 100+ Offers 100+ seating frames, fabrics and finishes
- Wanted to help customers visualize possible combinations
- Created a 3D configurator with open source software on IBM® i
- Inspires customers to create their ideal designs
- 50% 50% faster deliveries, as configurator accelerates manufacturing
- Will use IBM Watson® cognitive technology to help consumers find their preferred fabric



## The most integrated data platform for business

- Integrated Database (Db2 for i)
- Integrated Web Services

## Modern, Open Source applications development

- Python, Node.JS, Ruby
- PHP
- Mobile Application Development



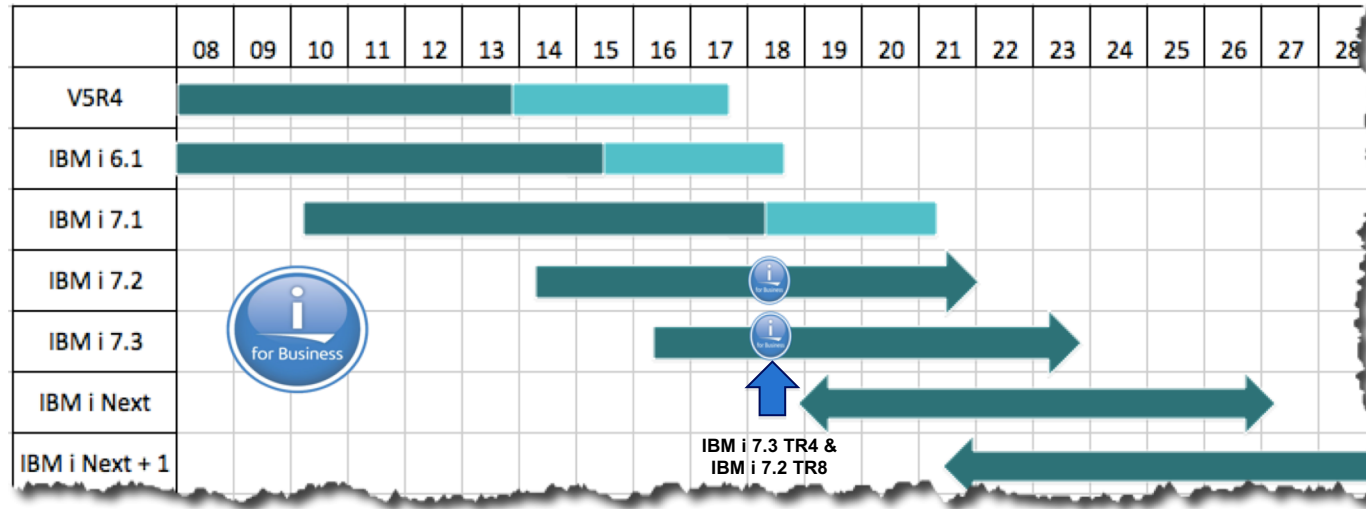
Data Connect  
IBM Db2 for i

## Secure Connectors to Watson for AI

- Data Connect for Db2 for i
- SQL
- Python, Node.JS
- Free form RPG



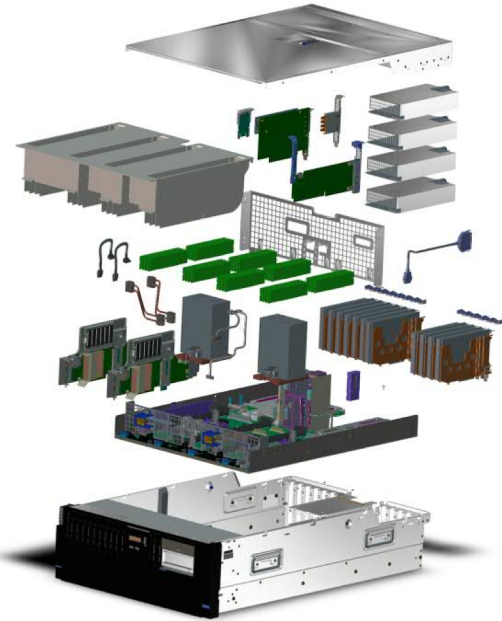
# 10+ years roadmap for IBM i



## IBM i Highlights

- POWER9 exploitation
- Expanding the secure-ability of IBM i with TLS, secure APIs, logs for SIEM solutions
- Expanded Install Options – installation process using USB 3.0 media
- Encryption and compression for cloud storage
- Increasing Productivity of Developers & Administrators

# POWER9 Server Highlights



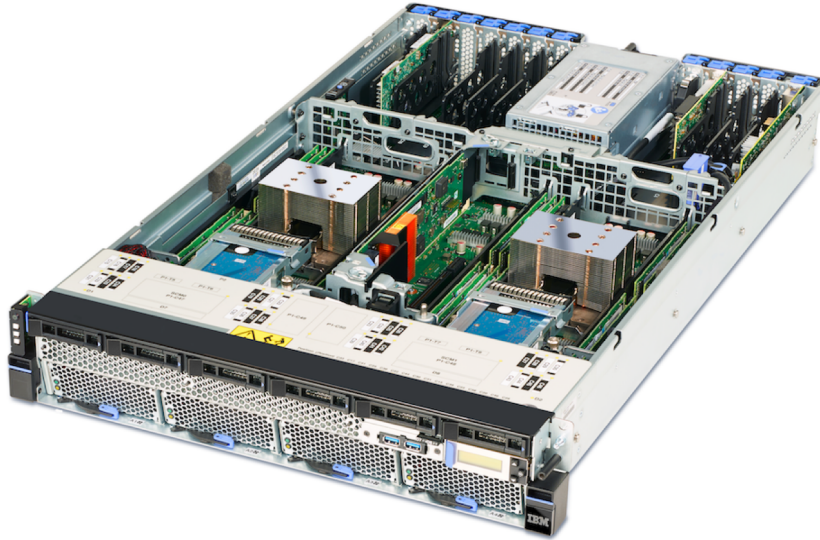
- Full Portfolio refresh planned (2017 and 2018)
- CPU Single Chip Module packaging
  - Eliminates SW licensing issues associated with Dual Chip Module designs
  - Lowers latency for CPU to CPU transfers due to simpler CPU fabric topology
- Up to 4x increased CPU fabric bandwidth for max scalability
- Embedded Analytics and Algorithms on the chip help run POWER9 at an always optimized dynamic frequency
- Increased Memory capacities over POWER8
- Leveraging IS RDIMMs to provide more competitive offerings in 2-socket space
- Increased I/O bandwidth with PCIe GEN4 Slots and future PCIe GEN4 Expansion Drawer
- 25Gb ports for High Speed GPU/OpenCAPI acceleration
- Integrated NVMe Flash device support
- Basic form factors and power requirements remain the same

# POWER9 Scale Out family



<b>L922</b> 9008-22L	<b>S922</b> 9009-22A	<b>S914</b> 9009-41A	<b>S924</b> 9009-42A	<b>H922</b> 9223-22H	<b>H924</b> 9223-42H
<ul style="list-style-type: none"> <li>• 1,2-socket, 2U</li> <li>• 8,10,12 cores/ socket</li> <li>• 32 IS RDIMM slots</li> <li>• 4TB memory</li> <li>• 4 CAPI 2.0 Slots</li> </ul> <ul style="list-style-type: none"> <li>• Linux only</li> <li>• PowerVM</li> <li>• KVM (GA2)</li> </ul>	<ul style="list-style-type: none"> <li>• 1,2-socket, 2U</li> <li>• 4, 8,10 cores/ socket</li> <li>• 32 IS RDIMM slots</li> <li>• 4TB memory</li> <li>• 4 CAPI 2.0 Slots</li> </ul> <ul style="list-style-type: none"> <li>• AIX, IBM i, &amp; Linux</li> <li>• PowerVM</li> </ul>	<ul style="list-style-type: none"> <li>• 1-socket, 4U &amp; Tower</li> <li>• 4,6,8 cores/ socket</li> <li>• 16 IS RDIMM slots</li> <li>• 1TB memory</li> <li>• 2 CAPI 2.0 Slots</li> <li>• Internal RDX Media</li> </ul> <ul style="list-style-type: none"> <li>• AIX, IBM i, Linux</li> <li>• PowerVM</li> </ul>	<ul style="list-style-type: none"> <li>• 2-socket, 4U</li> <li>• 8,10,12 cores/ socket</li> <li>• 32 IS RDIMM slots</li> <li>• 4TB memory</li> <li>• 4 CAPI 2.0 slots</li> <li>• Internal RDX Media</li> </ul> <ul style="list-style-type: none"> <li>• AIX, IBM i, Linux</li> <li>• PowerVM</li> </ul>	<ul style="list-style-type: none"> <li>• 1,2-socket, 2U</li> <li>• 4, 8,10 cores/ socket</li> <li>• 32 IS RDIMM slots</li> <li>• 4TB memory</li> <li>• 4 CAPI 2.0 Slots</li> </ul> <ul style="list-style-type: none"> <li>• AIX, IBM i up to 25%</li> <li>• Linux</li> <li>• PowerVM</li> </ul>	<ul style="list-style-type: none"> <li>• 2-socket, 4U</li> <li>• 8,10,12 cores/ socket</li> <li>• 32 IS RDIMM slots</li> <li>• 4TB memory</li> <li>• 4 CAPI 2.0 slots</li> <li>• Internal RDX Media</li> </ul> <ul style="list-style-type: none"> <li>• AIX, IBM i up to 25%</li> <li>• Linux</li> <li>• PowerVM</li> </ul>
<b>Technology Leadership</b>	<ul style="list-style-type: none"> <li>• <b>Cloud enabled - Embedded virtualization capabilities with PowerVM</b></li> <li>• <b>Up to 4TB in 2 socket - DDR4 Industry Standard memory RDIMMs</b></li> <li>• <b>High Speed 25Gb/s external ports – one per socket</b></li> <li>• <b>2 Internal NVMe Flash boot adapters</b></li> <li>• <b>Embedded Analytics and Algorithms on the chip help run POWER9 at an always optimized frequency</b></li> </ul>				

# The new L922



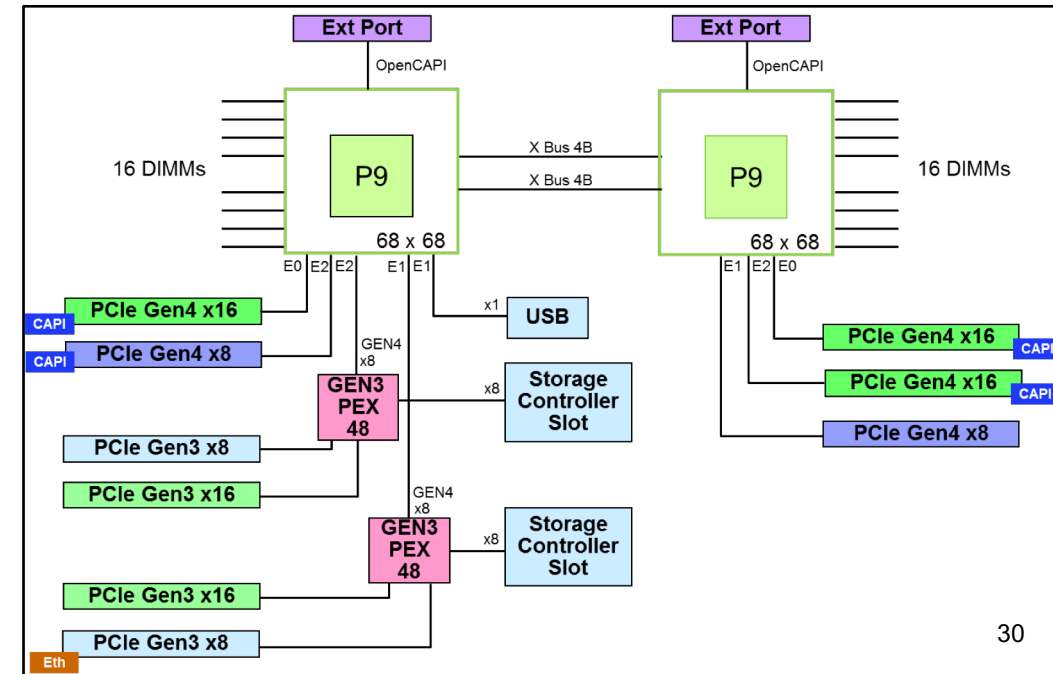
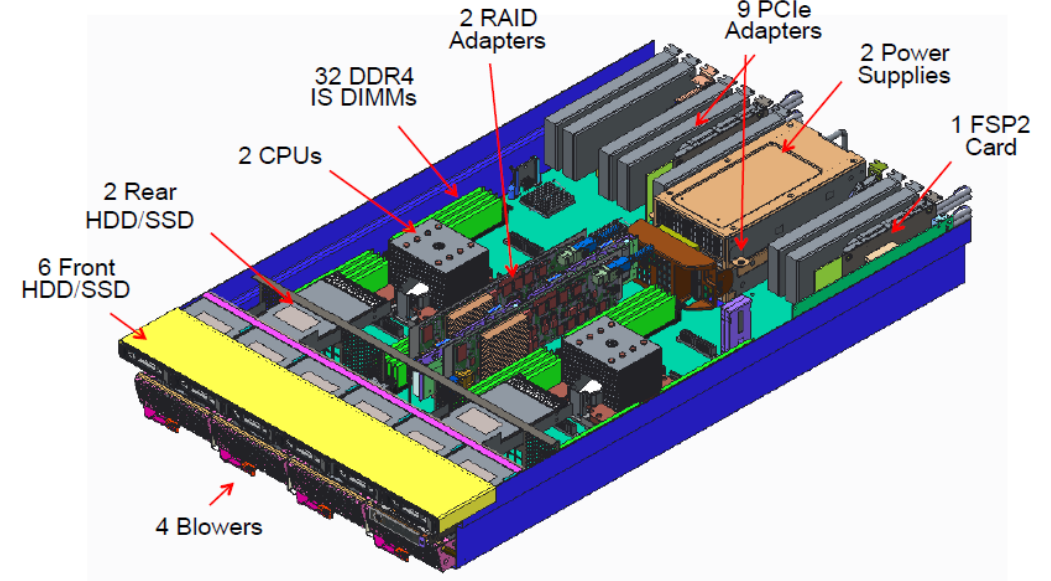
- 1,2-socket, 2U
- 8,10,12 cores/skt
- 3,4 / 2,9 / 2,7 GHz CPU speed nominal
- 3,9 / 3,8 / 3,8 GHz CPU speed ultra
- 32 IS RDIMM slots
- 4TB memory
- 4 CAPI 2.0 Slots
  
- Linux
- PowerVM

In the Scale Out Server family, the L922 is designed to meet highest performance and security for Linux workloads in a dense form factor with a memory footprint of up to 4TB which is industry leading in the 2 socket market compared to x86

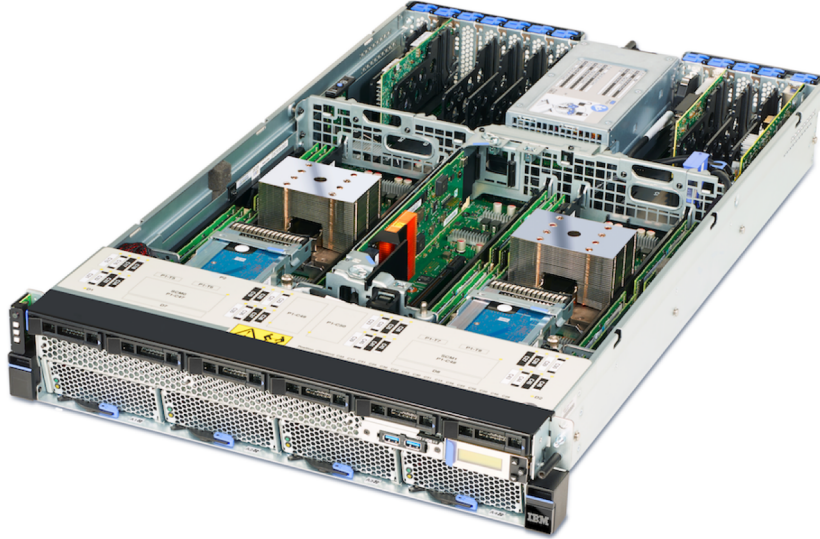
# POWER9 2U Scale Out Server

L922 9008-22L

- ✓ 2U server - 19" Rack enclosure
- ✓ POWER9 Scale-Out SMT8 processor (Up to 12 cores per socket)
- ✓ Up to 4TB Total DDR4 Industry Standard memory RDIMMs
  - 340 GB/s total system memory bandwidth
  - 32 IS RDIMM slots (no risers)
- ✓ 9 PCIe Gen3/Gen4 slots, Low Profile (2-sockets populated)
  - Five PCIe GEN4 slots (4 CAPI 2.0 enabled)
  - Four PCIe GEN3 slots (1 reserved for Ethernet adapter)
- ✓ Two High Speed 25Gb/s external ports
- ✓ 8 SFF (2.5") bay option (6 are front accessible)
- ✓ Two internal storage controller slots
  - Single or Split backplane or Single RAID write cache support
  - Future support for 12Gb IBM storage controller cards
  - 2 Internal NVMe Flash boot adapters (two M.2 devices per card)
- ✓ No internal DVD
- ✓ First GA is PowerVM Linux Only (No bare metal)



# The new S922/ H922



- 1,2-socket, 2U
- 4, 8,10 cores/skt
- 2,8 / 3,4 / 2,9 GHz CPU speed Nominal
- 3,8 / 3,9 / 3,8 GHz CPU speed Ultra
- 32 IS RDIMM slots
- 4TB memory
- 4 CAPI 2.0 Slots
  
- AIX, IBM i, & Linux
- PowerVM

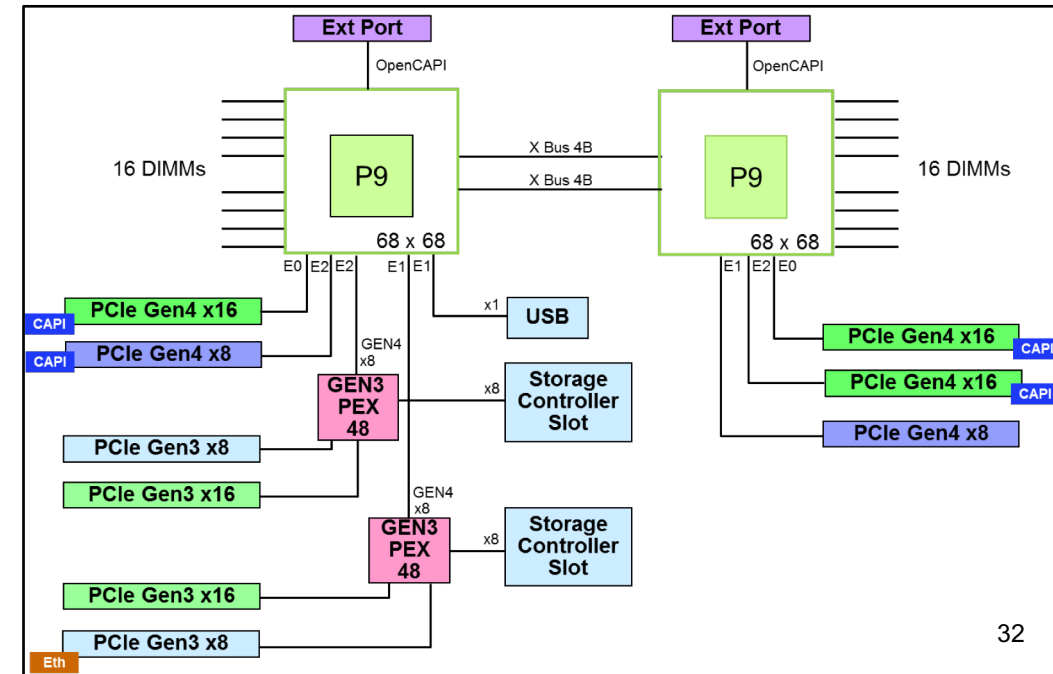
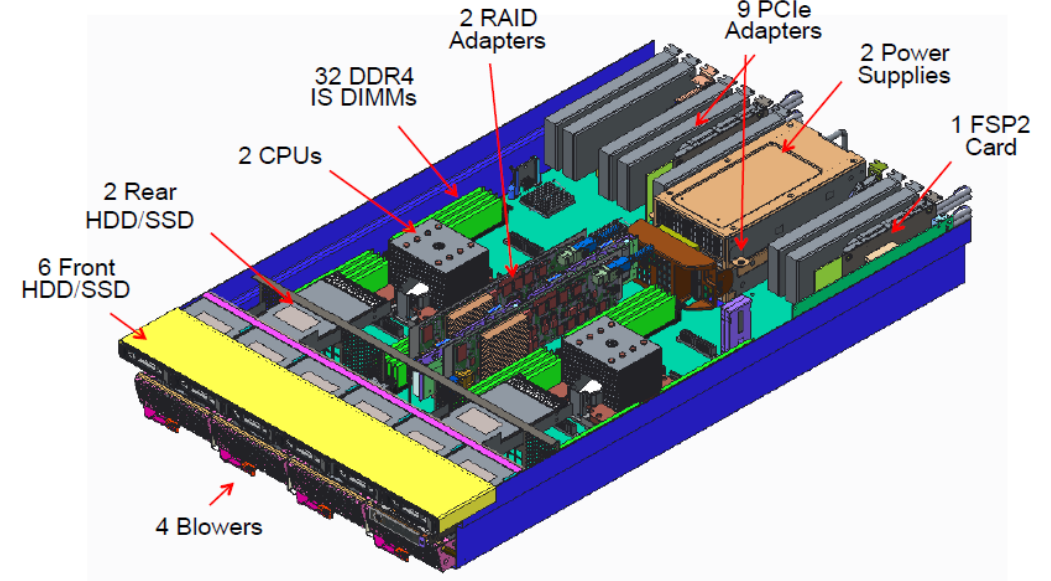
In the Scale Out Server family, the S922 is designed to meet highest performance and security in a dense form factor with a memory footprint of up to 4TB which is industry leading in the 2 socket market compared to x86 platforms

# POWER9 2U Scale Out Server

S922 9009-22A

H922 9223-22H

- ✓ 2U server - 19" Rack enclosure
- ✓ POWER9 Scale-Out SMT8 processor (Up to 10 cores per socket)
- ✓ Up to 4TB Total DDR4 Industry Standard memory RDIMMs
  - Up to 340 GB/s total system memory bandwidth
  - 32 IS RDIMM slots (no risers)
- ✓ 9 PCIe Gen3/Gen4 slots, Low Profile (2-sockets populated)
  - Five PCIe GEN4 slots (4 CAPI 2.0 enabled)
  - Four PCIe GEN3 slots (1 reserved for Ethernet adapter)
- ✓ Two High Speed 25Gb/s external ports
- ✓ 8 SFF (2.5") bay option (6 are front accessible)
- ✓ Two internal storage controller slots
  - Single or Split backplane or Single RAID write cache support
  - 2 Internal NVMe Flash boot adapters (two M.2 devices per card)
- ✓ No internal DVD
- ✓ I/O Expansion Drawer Support
- ✓ H922 supports up to 25% IBM i / AIX cores





# S922 / H922 Processor Offering

- ✓ SCM Design – Single Chip Module
- ✓ Three processor offerings available (SMT8 cores)
  - 10-core processor (maximum throughput)
  - 8-core processor (maximum core performance)
  - 4-core processor (minimum entry price)

Feature Code	Processor SMT8 Cores	Typical Frequency Range	IBM i P Group
EP19	10 cores	2.9 to 3.8 GHz (max)	P10 **
EP18	8 cores	3.4 to 3.9 GHz (max)	P10 **
EP16	4 cores	2.8 to 3.8 GHz (max)	Not Supported

- ✓ Single processor configs supported
- ✓ EP16 4-Core feature limited to single socket config only
- ✓ EP16 4-Core feature does not support External I/O Expansion or External Disk Expansion
- ✓ Processor frequencies dynamic by default, set to Maximum Performance Mode

\*\* P10 group limits IBM i partitions to a max of 4 cores

# The new S914



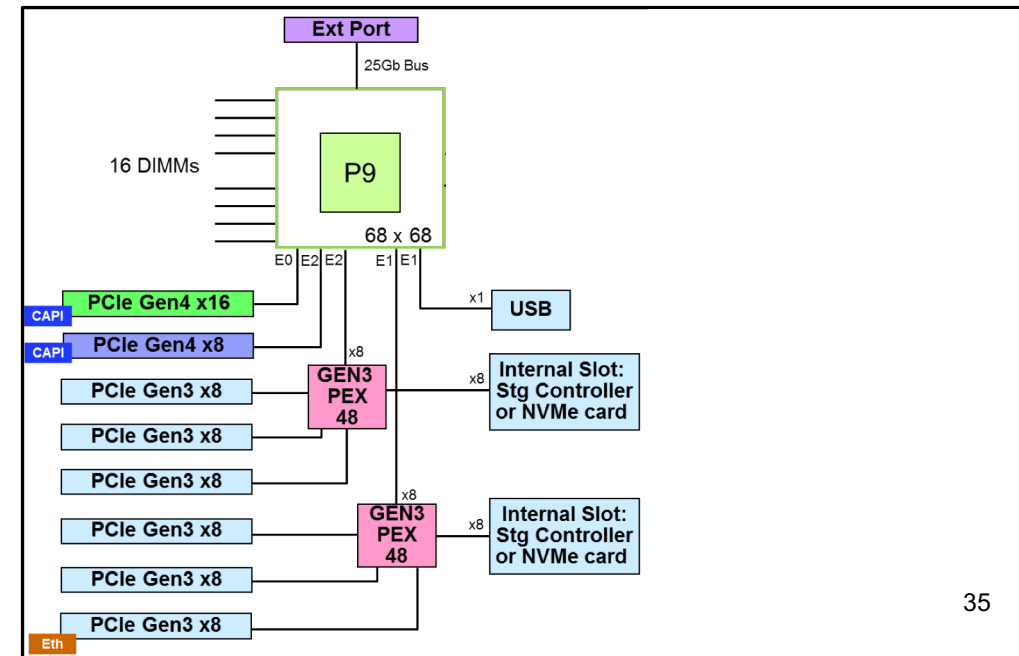
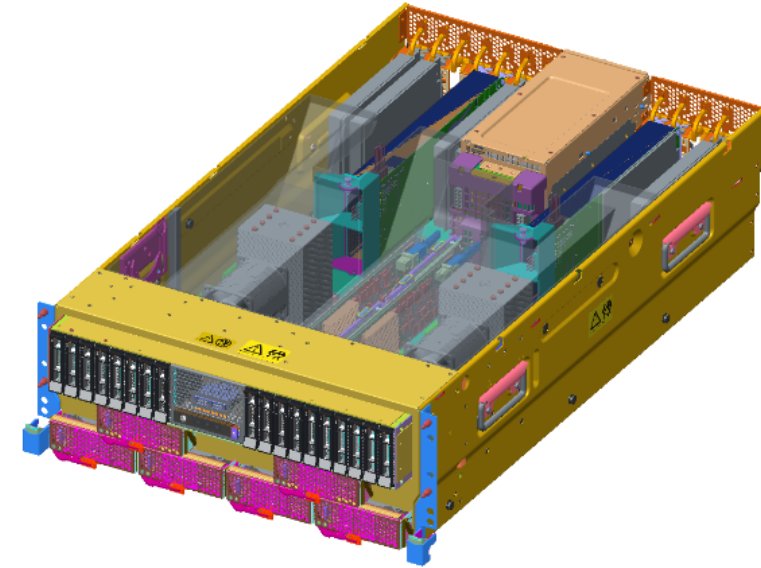
- 1-socket, 4U Rack & Tower
  - 4,6,8 cores, 1 socket
  - 2,3 / 2,3 / 2,8 GHz CPU speed nominal
  - 3,8 / 3,8 / 3,8 GHz CPU speed ultra
  - 16 IS RDIMM slots
  - 1TB memory
  - 2 CAPI 2.0 Slots
  - Internal RDX Media
- 
- AIX, IBM i, Linux
  - PowerVM

The S914 is the price attractive entry offering into the POWER9 family of servers. Industry leading integrated security and reliability as well cloud enabled out of the box with integrated PowerVM technology

# POWER9 4U Scale Out Server

S914 9009-41A

- ✓ 4U server - 19" Rack enclosure
- ✓ POWER9 Scale-Out SMT8 processor (4-core, 6-core, 8-core offerings)
- ✓ Up to 1TB Total DDR4 Industry Standard memory RDIMMs
  - Up to 170 GB/s total system memory bandwidth
  - 16 IS RDIMM slots (no risers)
  - 4-core offering limited to 64GB max memory
- ✓ 8 PCIe Gen3/Gen4 slots, Full Height, Half Length
  - Two PCIe GEN4 slots (CAPI 2.0 enabled)
  - Six PCIe GEN3 slots (1 reserved for Ethernet adapter)
- ✓ High Speed 25Gb/s port for OpenCAPI / GPU Acceleration
- ✓ 12 or 18 SFF (2.5") bay options
- ✓ Two internal storage controller slots
  - Single or Split backplane or Dual RAID write cache support
  - 2 Internal NVMe Flash boot adapters (two M.2 devices per card)
- ✓ Internal RDX Media Bay
- ✓ I/O Expansion Drawer support (for 6,8 core offerings)
- ✓ No internal DVD



# S914 Processor Highlights

- ✓ SCM Design – Single Chip Module
- ✓ Three processor offerings available (SMT8 cores)
  - 8-core processor (maximum throughput)
  - 6-core processor
  - 4-core processor (minimum entry price)

<b>Feature Code</b>	<b>Processor SMT8 Cores</b>	<b>Typical Frequency Range</b>	<b>IBM i P Group</b>
EP12	8 cores	2.8 to 3.8 GHz (max)	P10
EP11	6 cores	2.3 to 3.8 GHz (max)	P10
EP10	4 cores	2.3 to 3.8 GHz (max)	P05

- ✓ Processor frequencies dynamic by default: Set to Dynamic Performance Mode

# The new S924 / H924



- 2-socket, 4U
  - 8,10,12 cores/skt
  - 3,8 / 3,5 / 3,4 GHz CPU speed nominal
  - 4 / 3,9 / 3,9 GHz CPU speed ultra
  - 32 IS RDIMM slots
  - 4TB memory
  - 4 CAPI 2.0 slots
  - Internal RDX Media
- 
- AIX, IBM i, Linux
  - PowerVM

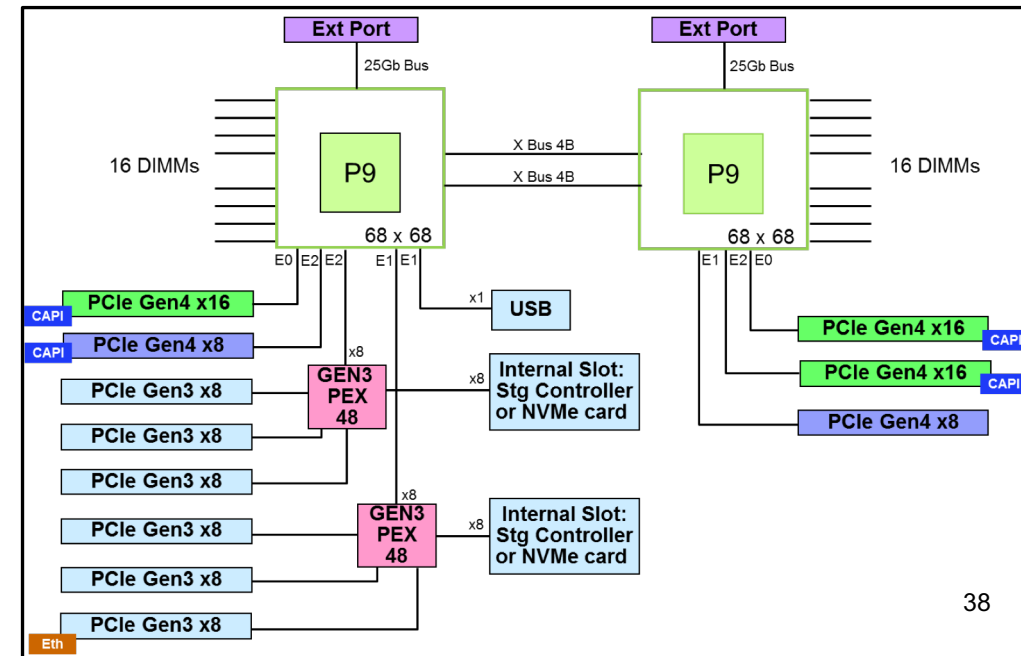
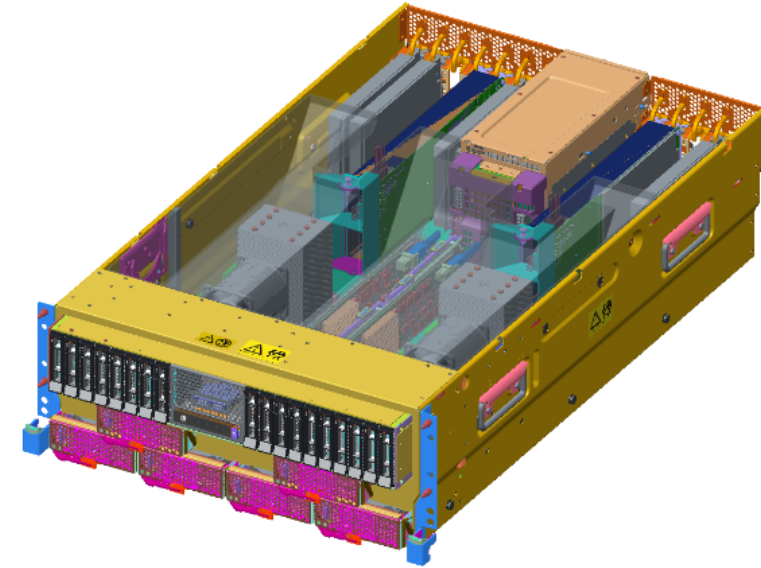
In the Scale Out Server family, the S924 is designed to meet highest performance and security with a memory footprint of up to 4TB which is industry leading in the 2 socket market compared to x86 platforms

# POWER9 4U Scale Out Server

S924 9008-42A

H924 9223-42H

- ✓ 4U server - 19" Rack enclosure
- ✓ POWER9 Scale-Out SMT8 processor (12-core, 10-core, 8-core offerings)
- ✓ Up to 4TB Total DDR4 Industry Standard memory RDIMMs
  - Up to 340 GB/s total system memory bandwidth
  - 32 IS RDIMM slots (no risers)
- ✓ 11 PCIe Gen3/Gen4 slots, Full Height, Half Length (2-sockets populated)
  - Five PCIe GEN4 slots (4 CAPI 2.0 enabled)
  - Six PCIe GEN3 slots (1 reserved for Ethernet adapter)
- ✓ 2 High Speed 25Gb/s ports for OpenCAPI / GPU Acceleration
- ✓ 12 or 18 SFF (2.5") bay options
- ✓ Two internal storage controller slots
  - Single or Split backplane or Dual RAID write cache support
  - 2 Internal NVMe Flash boot adapters (two M.2 devices per card)
- ✓ Internal RDX Media Bay
- ✓ I/O Expansion Drawer support
- ✓ H924 supports up to 25% IBM i / AIX cores
- ✓ No internal DVD



# S924 / H924 Processor Highlights

- ✓ SCM Design – Single Chip Module
- ✓ Three processor offerings available (SMT8 cores)
  - 12-core processor (maximum throughput)
  - 10-core processor
  - 8-core processor (maximum core performance)

Feature Code	Processor SMT8 Cores	Typical Frequency Range	IBM i P Group
EP1G	12 cores	3.4 to 3.9 Ghz (max)	P20
EP1F	10 cores	3.5 to 3.9 GHz (max)	P20
EP1E	8 cores	3.8 to 4.0 GHz (max)	P20

- ✓ Single processor config supported for 8 and 10-core processor offerings
- ✓ Processor frequencies dynamic by default: Set to Max Performance Mode
- ✓ Increased processor to processor fabric interconnect
  - Two 16Gb/s X-Bus fabric connect between CPUs

# Unleash POWER9 on SAP HANA with H922 and H924

- 2-socket 4TB systems for SAP HANA\*
  - Excellent competitor in 2-socket space
  - Attractively priced systems for Linux-minded clients
    - S922/S924 can also run SAP HANA for clients requiring a higher % of AIX, IBM i cores
- Highly flexible systems with best in class virtualization
  - Consolidate workloads to reduce data center footprint
  - High utilization through mixed workloads with production SAP HANA, traditional, and non-production SAP running side-by-side



\*IBM intends to support SAP HANA on the IBM Power System H922 (9223-22H) in production mode, with the following Linux operating systems, following near term certification of the environment.

- Red Hat Enterprise Linux for SAP with Red Hat Enterprise Linux 7 for Power LE version 7.4
- SUSE Linux Enterprise Server for SAP with SUSE Linux Enterprise Server 12 SP3



# POWER9 M.2 NVMe support – S922 & S924

## **S922/S924 has two internal direct attach storage connectors**

### **Connector support either:**

- NVMe carrier card & attaches two 400 GB M.2 NVMe drives
- SAS controller requiring DASD backplane (like POWER8)
- You can mix an NVMe card and a SAS card
- Not socket dependent

### **M.2 NVMe on POWER9 on S922/S924**

- A maximum of four x M.2 NVMe drives
- Will be higher performance than SAS DASD in backplane
- Will not support concurrent maintenance (unlike SAS drives)
- Will have a write endurance of 1 drive write per day
- Intended primarily to store and boot OS (AIX / VIOS / Linux) images
- Each NVMe drives device → separate PCIe endpoint assign to different LPARs
- NVMe drives may be assigned to the VIOS and virtualized to client OS



# POWER9 Power Management Modes

## ➤ Static Power Save Mode

## ➤ Static Nominal Mode

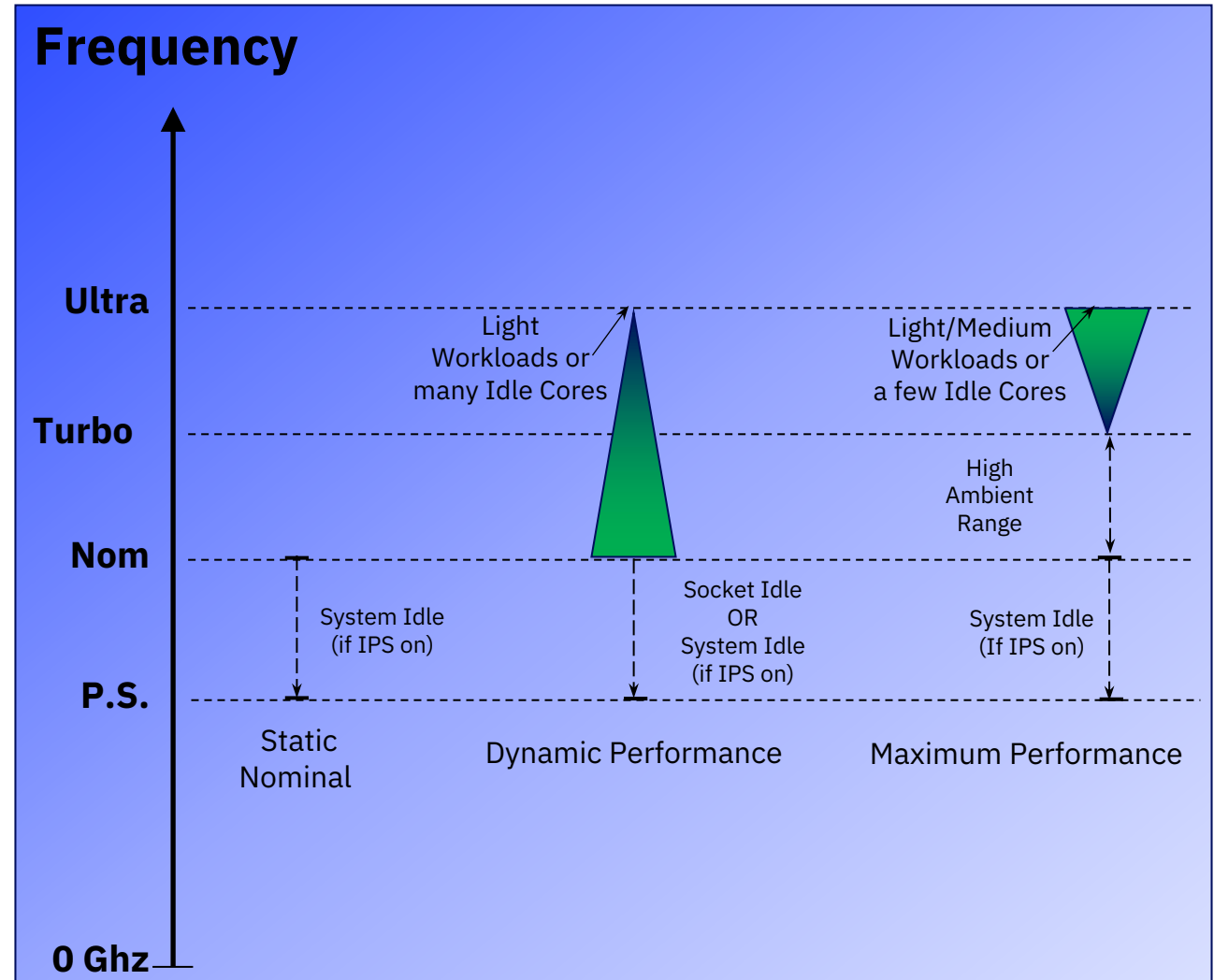
- Idle Power Saver (IPS) can be on or off

## ➤ Dynamic Performance Mode

- Workloads run at highest frequency possible
- Max Workload/Max Cores runs  $\geq$  nominal in all environments
- CPU managed to Nominal power draw
- Idle Power Saver (IPS) can be on or off

## ➤ Maximum Performance Mode

- Workloads run at highest frequency possible
- Max Workload/Max Cores runs  $\geq$  turbo in favorable environments
- CPU managed to Turbo power draw level – Higher acoustics
- Idle Power Saver (IPS) can be on or off



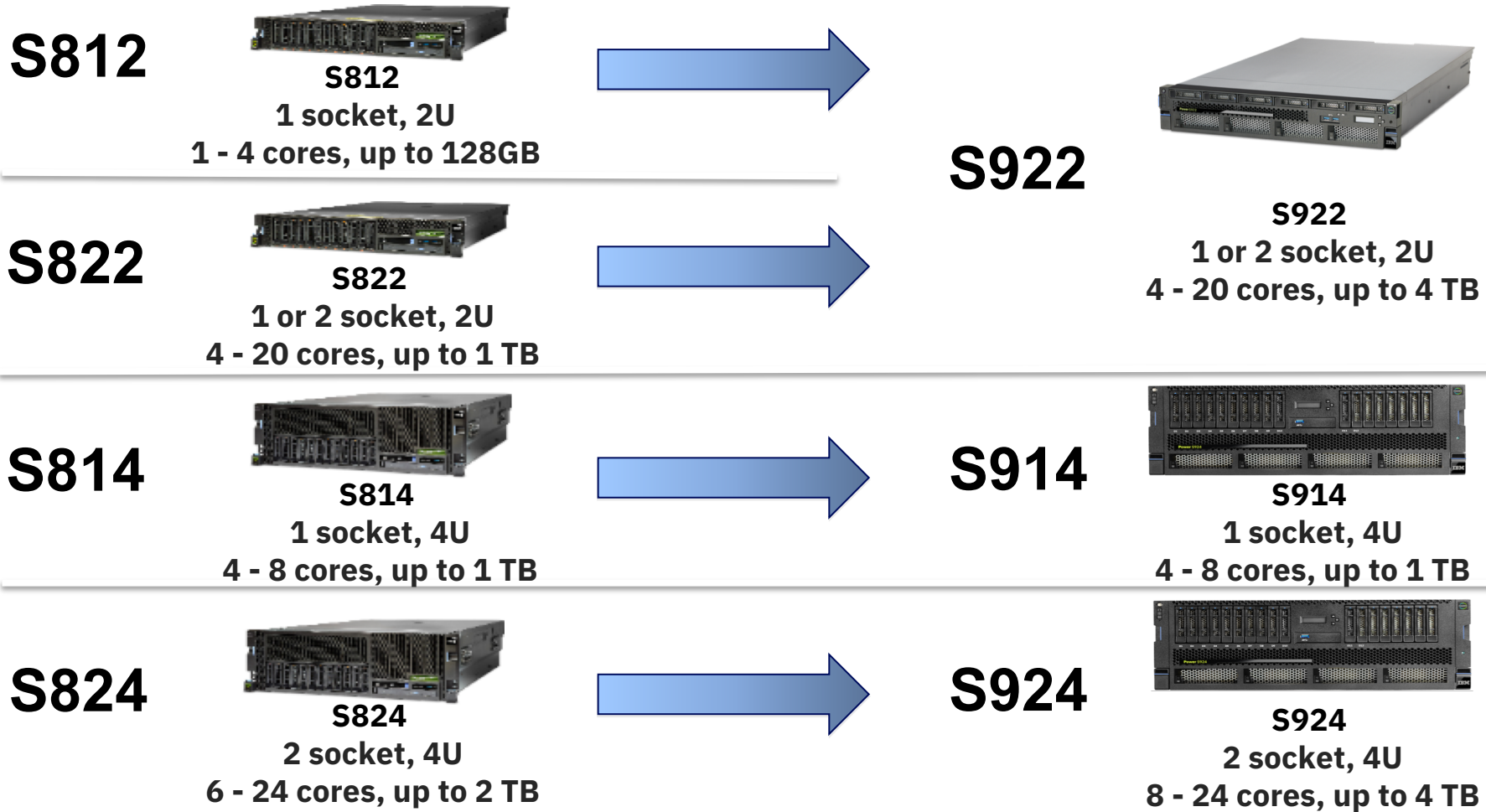
# Scale Out Frequencies

	Default Mode	Feature Code	Num of Cores	Static Nominal Frequency	Dynamic Perf Freq Range	Max Performance Typical Freq Range
S924/H92 4	Max Performance	EP1G	12 cores	2.75 Ghz	2.75 to 3.9 Ghz (max)	3.4 to 3.9 Ghz (max)
		EP1F	10 cores	2.9 Ghz	2.9 to 3.9 GHz (max)	3.5 to 3.9 GHz (max)
		EP1E	8 cores	3.3 Ghz	3.3 to 4.0 GHz (max)	3.8 to 4.0 GHz (max)
S914	Dynamic Performance	EP12	8 cores	2.8 Ghz	2.8 to 3.8 GHz (max)	3.15 to 3.8 GHz (max)
		EP11	6 cores	2.3 Ghz	2.3 to 3.8 GHz (max)	2.8 to 3.8 GHz (max)
		EP10	4 cores	2.3Ghz	2.3 to 3.8 GHz (max)	2.8 to 3.8 GHz (max)
S922/H92 2	Max Performance	EP19	10 cores	2.5 Ghz	2.5 to 3.8 GHz (max)	2.9 to 3.8 GHz (max)
		EP18	8 cores	3.0 Ghz	3.0 to 3.9 GHz (max)	3.4 to 3.9 GHz (max)
		EP16	4 cores	2.3 Ghz	2.3 to 3.8 GHz (max)	2.8 to 3.8 GHz (max)
L922	Max Performance	ELPX	12 cores	2.3 Ghz	2.3 to 3.8 GHz (max)	2.7 to 3.8 GHz (max)
		EPPW	10 cores	2.5 Ghz	2.5 to 3.8 GHz (max)	2.9 to 3.8 GHz (max)
		ELPV	8 cores	3.0 Ghz	3.0 to 3.9 GHz (max)	3.4 to 3.9 GHz (max)

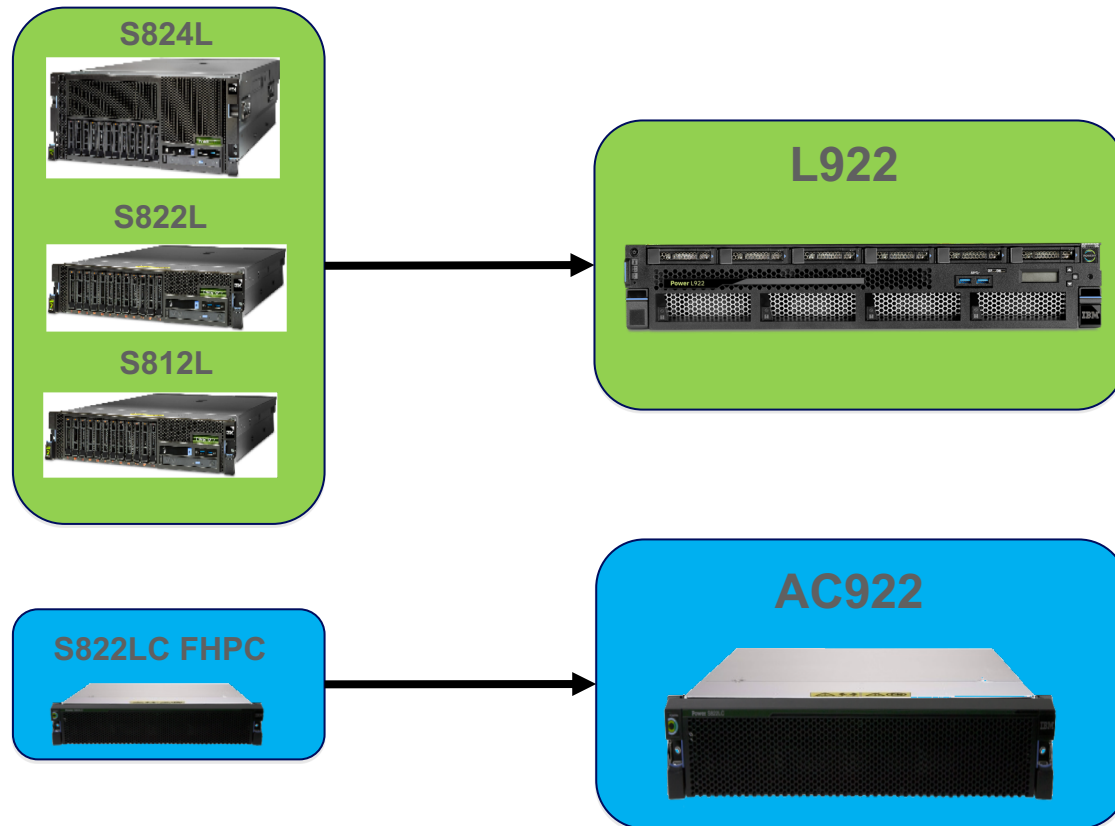
Note 1: Frequencies outlined in Red reflect the default mode (i.e. frequency range) for that particular system

Note 2: In order to reach maximum frequency, some cores may need to be turned off

# Scale Out Portfolio Transition



# Linux Portfolio Transition






- Highest performance CPU server in the Linux portfolio
- Highest RAS server in the Linux market
- Industry leading utilization in with PowerVM
- Industry leading platform for acceleration
- Incorporates 2<sup>nd</sup> generation NVLink between CPU-GPU
- Up to 6 total Volta GPUs
- Primary workloads include AI, HPC

# Comparison

	POWER9	POWER8
<b>Form Factor</b>	2U / 4U	2U / 4U
	Rack & Tower	Rack & Tower
<b>CPU</b>	2U - 190W / 225W 4U - 225W / 300W	2U - 190W / 225W 4U - 225W / 260W
	12 cores (SMT8) or 24 cores (SMT4)	12 cores (SMT8)
	74 GB/s - Fabric BW	38.4 GB/s - Fabric BW
<b>Memory</b>	4TB	2TB
	170 GB/s socket	192 GB/s socket
	IS RDIMMs	CDIMMs
<b>I/O</b>	PCIe – GEN3/4 80 GB/s peak BW	PCIe GEN3 (48 lanes) 48GB/s peak BW
	Max total 26 PCIe Slots (Server + Drawers)	Max total 31 PCIe Slots (Server + Drawers)
	4 CAPI Slots (one x8 and 3 x16)	4 CAPI Slots (x16)
	2U – 8 SFF Bays 4U – 12 / 18 SFF Bays	2U – 12 / 8 SFF Bays 4U – 12 / 18 SFF Bays
	4 internal NVMe M.2 boot devices	Not available
	6Gb SAS	6Gb SAS
<b>RAS</b>	2U – Single & Dual RAID Write Cache 4U – Dual Raid Write Cache	2U - Dual RAID Write Cache 4U - Dual RAID Write Cache

# IBM Operating System Plans for POWER9



Power Systems	 redhat	 ubuntu <small>Supported by Canonical</small>	 SUSE	AIX	AIX	AIX	AIX	IBM i	IBM i	IBM i
	7.4	16.04.4	12SP3	5.3	6.1	7.1	7.2	7.1	7.2	7.3
POWER9	✓	✓	✓		✓	✓	✓		✓	✓
POWER8	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

# Software Stack Support

- VIOS 2.2.4, 2.2.5, 2.2.6
- AIX 7.2 TL2 SP2
- AIX 7.2 TL0 SP6, TL1 SP4 (P8 Compatibility Mode)
- AIX 7.1 TL4 SP6, TL5 SP2 (P8 Compatibility Mode)
- AIX 6.1 TL9 (P7 Compatibility Mode)
- IBM i 7.3 TR4
- IBM i 7.2 TR8
- Ubuntu 16.04.4 LTS (P8 Compatibility Mode)
- RedHat RHEL 7.4 LE (P8 Compatibility Mode)
- SuSE SLES 11 SP4 (P8 Compatibility Mode)
- SuSE SLES 12 SP3



# Compatible Mode Architecture

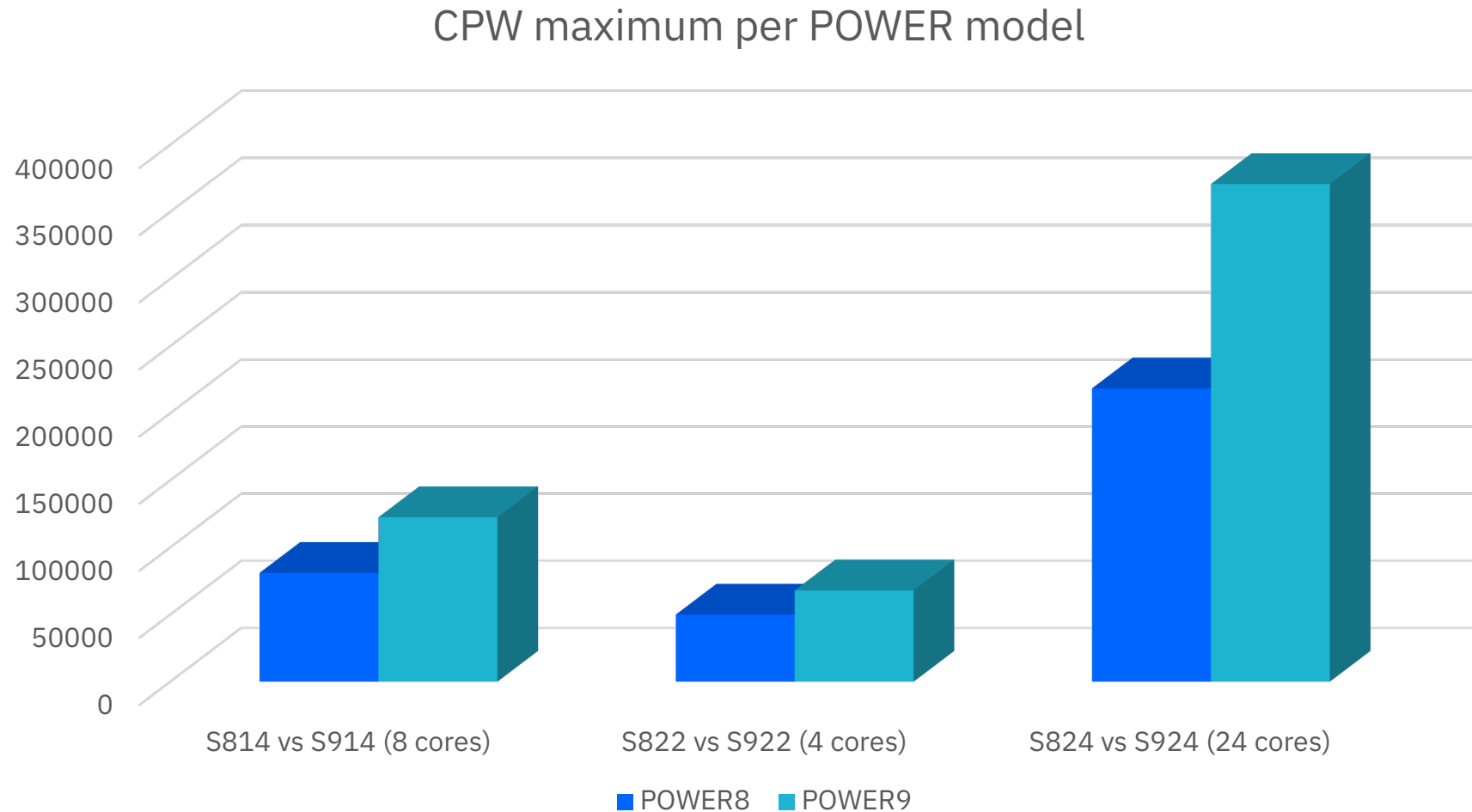


P7 MODE	P8 MODE	P9 BASE MODE	P9 MODE
4-Thread SMT	8-Thread SMT	8-Thread SMT, fused core optimization	8-Thread SMT, fused core optimization
VSX (Vector Scalar Extension)	VSX2, In-Core Encryption Acceleration	VSX3, In-Core Encryption Acceleration, string, video encode, quad floating point	VSX3, In-Core Encryption Acceleration, string, video encode, quad floating point
64-core / 256-thread Scaling 256-core / 1024-thread Scaling	192-core / 768-thread Scaling	192-core / 1536-thread Scaling Atomic Memory Operations	192-core / 1536-thread Scaling Atomic Memory Operations
P7+ : AME compression acceleration and Encryption acceleration	AME compression acceleration and Encryption acceleration	AME compression acceleration and Encryption acceleration	AME compression acceleration and Encryption acceleration, <b>direct user-mode Gzip acceleration</b>
MMU Support	Software Effective to Virtual address translation	Hardware Effective to Virtual address translation (in memory segment tables)	Hardware Effective to Virtual address translation (in memory segment tables)
Hypervisor Interrupt Virtualization	Hypervisor Interrupt Virtualization	Hypervisor Interrupt Virtualization	<b>External Interrupt Virtualization Engine (OS/Hypervisor bypass)</b>

## Staged support of I/O adapters:

- GA1 (at 3/20) – 66% of all adapters are supported, adapters with the highest usage within the systems have been selected
- GA2 (at later point in 2018) – rest of the I/O adapters will be supported
- With the move to POWER9, some adapters will no longer be supported
- Details on supported and non supported adapters can be found in the backup

# Power9 maximum IBM i CPW



# IBM i CPW POWER8 vs POWER9 Scale-Out Models

Description		POWER8					POWER9					Net Increase		
Model	Cores	Model	Cores	GHz	CPW	CPW/ Core	Model	Cores	GHz	CPW	CPW/ Core	CPW Total	CPW/ Core	% Increase
S_14	4	S814	4	3.02	37,440	9,360	S914	4	2.3 – 3.8	52,500	13,125	15,060	3,765	40.2%
S_14	6	S814	6	3.02	56,400	9,400	S914	6	2.3 – 3.8	78,500	13,083	22,100	3,683	39.2%
S_14	8	S814	8	3.72	81,050	10,131	S914	8	2.8 – 3.8	122,500	15,313	41,450	5,181	51.1%
S_22	4	S822	4	4.15	49,960	12,490	S922	4	3.4 – 3.9	68,000	17,000	18,040	4,510	36.1%
S_22	4	S822	4	3.42	42,470	10,618	S922	4	2.9 – 3.8	60,000	15,000	17,530	4,383	41.3%
S_24	6	S824	6	3.89	68,250	11,375	<i>No Comparable Make/Model</i>					<i>No Comparable Make/Model</i>		
S_24	8	S824	8	4.15	89,580	11,198	S924	8	3.8 – 4.0	145,500	18,188	55,920	6,990	62.4%
S_24	10	<i>No Comparable Make/Model</i>					S924	10	3.5 – 3.9	174,500	17,450	<i>No Comparable Make/Model</i>		
S_24	12	S824	12	3.89	123,240	10,270	<i>No Comparable Make/Model</i>					<i>No Comparable Make/Model</i>		
S_24	16	S824	16	4.15	164,470	10,279	S924	16	3.8 – 4.0	268,500	16,781	104,030	6,502	63.3%
S_24	20	<i>No Comparable Make/Model</i>					S924	20	3.5 – 3.9	318,000	15,900	<i>No Comparable Make/Model</i>		
S_24	24	S824	24	3.52	218,510	9,105	S924	24	3.4 – 3.9	370,700	15,446	152,190	6,341	69.6%

# MEMORY DIMMS COMPARISON POWER8 vs POWER9

Feature	Capacity GB	Price	Cots/GB	Percent Change P9 DDR4 vs P8 DDR4	Percent Change P9 DDR4 vs P8 DDR3
<b>POWER9 S914, S922, S924 DDR4</b>					
#EM62	16	\$556	\$34,75	-59,65	-55,52
#EM63	32	\$1 060	\$33,13	-49,64	-37,65
#EM64	64	\$2 427	\$37,92	-43,08	-42,89
#EM65	128	\$8 887	\$69,43	15,67	-16,36
<b>POWER8 S812,S814,S822,S824 DDR4</b>					
#EM91	16	\$1 378	\$86,13	\$10,2	
#EM92	32	\$2 105	\$65,78	\$23,8	
#EM93	64	\$4 264	\$66,63	\$0,3	
#EM94	128	\$7 683	\$60,02	-\$27,7	
<b>POWER8 S812,S814,S822,S824 DDR3</b>					
#EM8B	16	\$1 250	\$78,13		
#EM8C	32	\$1 700	\$53,13		
#EM8D	64	\$4 250	\$66,41		
#EM8E	128	\$10 625	\$83,01		

Memory DIMMs cost may vary. Based on U.S list price

# Statement of Direction\* for transition to high-end POWER9 systems

*IBM intends to offer clients with Power E870, E870C, E880, E880C systems the following capabilities that are designed to provide a smoother migration path to the POWER9-based systems when they become available:*

- IBM plans to offer system upgrades from Power E870, E870C, E880, E880C systems to the next generation POWER9 systems that will maintain the serial number of the existing POWER8 system.
- IBM intends to deliver the capability for the next generation high-end system with POWER9 processors to participate in the same Power Enterprise Pool with Power E870, E880, or E870C/E880C systems.
- IBM plans to offer the ability for new Mobile Processor and Memory activation features, initially purchased on a POWER8 system, to be eligible to convert and migrate to a POWER9-based system at no additional charge (subject to terms and conditions).

*\*Announced July 5<sup>th</sup>, 2017*

*IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code or functionality.*

# Hardware Management Console HMC V9

# HMC Version Format Today – V8 R870 M1

## V(ersion)

- Power family
  - ex. POWER8

## R(elease)

- Corresponding firmware release
  - ex. 860
- Must be greater than or equal to the level this HMC is managing

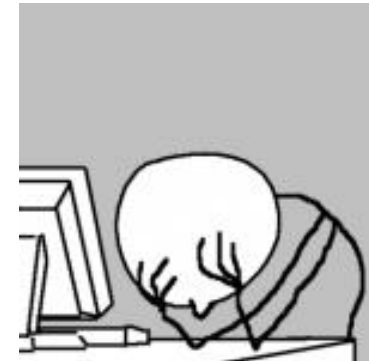
## M(aintenance)

- aka Service Pack
  - ex. SP1

## F(ix)

- Not currently used

- A release is supported for two years
  - This includes Service Packs and PTFs
  - There are four to five releases in support concurrently at any given point in time. Providing support for all these releases has proved challenging for IBM, and **clients have perhaps experienced some unfortunate quality escapes.**
- Many clients have strict processes and procedures in place that prevent upgrading to a new release in cadence with when IBM GAs it.
  - It's not always possible to obtain the latest functional fixes and enhancements as they're typically issued on the latest release stream.
- **From the perspective of security alone in how often, and with what severity, vulnerabilities are disclosed, the above two points are proving to be more and more of an issue.**





# HMC Version Format Tomorrow – V9 R1 M910

## V(ersion)

- Power family
  - ex. POWER9

## R(elease)

- Only increment on major revisions
  - ex. base OS upgrade
  - much less frequency than today

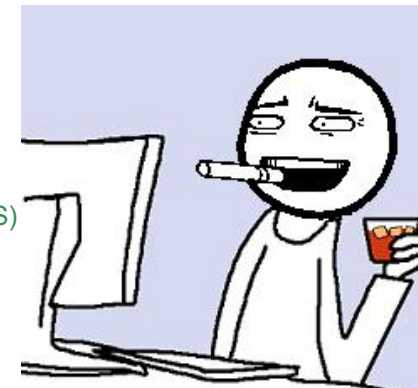
## M(aintenance)

- Corresponding firmware release
  - ex. 910
- Must be greater than or equal to the level this HMC is managing
- Last digit indicates Service Pack

## F(ix)

- aka PTF
- lshmc output will show “MH” mapping

- A release is supported for two years, same as today.
- Maintenance releases will be supported until they're superseded by the next subsequent maintenance level
- The cadence with new firmware releases and Power system models will remain unchanged.
  - Rather than receiving a new HMC release, (more often than not) there will be a new HMC maintenance level.
  - When there's no new firmware or Power system model, there can still be a new HMC maintenance level.
- Less releases allow freedom to update to the latest maintenance level without worrying about stack (VIOS, firmware, OS) compliance.
- Easier to stay current with functional fixes and enhancements. IBM can focus mostly on the current release (because there will be less releases) and making sure each maintenance level is delivered with increased quality.



# HMC V9 R1.910 Highlights

## Server Management

- Support for 914, 922, and 924 systems
- **No POWER6 support**
- Custom DHCP ranges

## Virtualization Management

- Mobility
  - **Automatic VIOS data collection upon abort**
  - **Override for page table size & affinity loss to preserve SAP HANA workload performance across migrations**
  - Maintain resource roles across migrations
- Remote Restart override to use LPAR's minimum resources
- SR-IOV
  - **Max capacity / bandwidth setting**
  - Enable / disable SR-IOV logical port
- Enhanced UI
  - Cleanup disk mappings on LPAR deletion
  - Add multiple LPAR veth adapters on the same virtual network
  - Improve progress messages during System Template deployment
  - Add multiple physical volumes to an LPAR at once
  - Persist user preferences (ex. column width)
  - Copy WWPNs to Clipboard
- Templates
  - support for VIOS rules

## Console Management

- **vHMC-on-Power support for MPIO**
- display NTP status
- HMC NPS survey option
- FFDC logging enhancements
- Language Translation Update

# Questions ?



**Jean-Luc Bonhommet**  
*Jeanluc\_bonhommet@fr.ibm.com*

***New Technology Introduction***  
***IBM POWER Systems***  
***IBM Client Center Montpellier***  
***France***



**Merci de votre attention**

**N'oubliez pas de remplir  
le questionnaire  
de satisfaction !**

**IBM**

# Scale Out I/O to migrate from POWER8 to POWER9 at Announce (GA1)

Category	Feature Code	Marketing Name
ROCE	EC3M	PCIe3 100GbE RoCE Dual Port x16 CX4
ROCE	EC3L	PCIe3 100GbE RoCE Dual Port x16 CX4
LAN	5899	PCIe2 4-port 1GbE Adapter
LAN	5260	PCIe2 LP 4-port 1GbE Adapter
LAN	EL4L	1Gb E'NET(UTP) 4-Port Adptr, PCIE-x4/SHORT, LOW-PROFILE CAPABLE
LAN	EL4M	1Gb E'NET(UTP) 4-Port Adptr, PCIE-x4/SHORT/ LP
LAN	EN0S	PCIe2 4-Port (10Gb+1GbE) SR+RJ45 Adapter
LAN	EN0T	PCIe2 LP 4-Port (10Gb+1GbE) SR+RJ45 Adapter
LAN	EN0U	PCIe2 4-port (10Gb+1GbE) Copper SFP+RJ45 Adapter
LAN	EN0V	PCIe2 LP 4-port (10Gb+1GbE) Copper SFP+RJ45 Adapter
LAN	EN0W	PCIe2 2-port 10/1GbE BaseT RJ45 Adapter
LAN	EN0X	PCIe2 LP 2-port 10/1GbE BaseT RJ45 Adapter
LAN	EL55	PCIe-Gen2/Gen3 10GBase-T
LAN	EL3Z	PCIe-Gen2/Gen3 10GBase-T
LAN	EN15	PCIe G3 x8 4x10 4-Port Ethernet SR Optical HP
CNA	EN0H	PCIe2 4-port (10Gb FCoE & 1GbE) SR&RJ4 - SR (FCoE not supported on P9)
CNA	EN0J	PCIe2 LP 4-port (10Gb FCoE & 1GbE) SR&RJ4 SR (FCoE not supported on P9)
CNA	EL56	PCIe2 4-port(10Gb FCoE & 1GbE) SR&RJ45 (FCoE not supported on P9)
CNA	EL38	PCIe2 LP 4-port(10Gb FCoE & 1GbE) SR&RJ45 (FCoE not supported on P9)
CNA	EN0K	PCIe2 4-port (10Gb FCoE & 1GbE) SFP+Copper&RJ4 (FCoE not supported on P9)
CNA	EN0L	PCIe2 LP 4-port (10Gb FCoE & 1GbE) SFP+Copper&RJ4 (FCoE not supported on P9)
CNA	EL57	PCIe2 4-port (10Gb FCoE & 1GbE) Copper&RJ45 (FCoE not supported on P9)
CNA	EL3C	PCIe2 LP 4-port (10Gb FCoE & 1GbE) Copper&RJ45 (FCoE not supported on P9)
Fibre Channel	5735	8 Gigabit PCI Express Dual Port Fibre Channel Adapter
Fibre Channel	5273	PCIe LP 8Gb 2-Port Fibre Channel Adapter
Fibre Channel	EL58	PCI-E 8x 8Gb Fibre Channel, 2 port (4x - GEN 2)
Fibre Channel	EL2N	PCI-E 8x 8Gb Fibre Channel, 2 port (4x - GEN 2)
Fibre Channel	5729	PCIe2 8Gb 4-port Fibre Channel Adapter

Category	Feature Code	Marketing Name
Fibre Channel	EN0Y	PCIe2 LP 8Gb 4-port Fibre Channel Adapter
Fibre Channel	EN0A	PCIe2 16Gb 2-port Fibre Channel Adapter
Fibre Channel	EN0B	PCIe2 LP 16Gb 2-port Fibre Channel Adapter
Fibre Channel	EL5B	PCIe2 LP 16Gb 2-port Fibre Channel Adapter
Fibre Channel	EL43	PCIe2 LP 16Gb 2-port Fibre Channel Adapter
SAS	EJ14	PCIe3 12GB CACHE RAID SAS 4 ADAPTER QUAD PORT 6Gb WITH ADVANCED FEATURES
SAS	EJ0J	PCIe3 RAID SAS Adapter Quad-port 6Gb
SAS	EJ0M	PCIe3 RAID SAS quad-port 6 Gb LP Adapter
SAS	EL59	PCIe3 RAID SAS ADAPTER QUAD PORT 6Gb x8 HP
SAS	EL3B	PCIe3 RAID SAS ADAPTER QUAD PORT 6Gb x8 LP
SAS	EJ10	PCIe3 4 x8 SAS Port Adapter (Tape/DVD)
SAS	EJ11	PCIe3 LP 4 x8 SAS Port Adapter (Tape/DVD)
SAS	EL60	PCIe3 RAID SAS Removable Media QUAD PORT 6Gb x8 LP
WAN	5785	4 Port Async EIA-232 PCIe Adapter
WAN	EN13	PCIe 1-port Bisync Adapter
Encryption	EJ33	PCIe3 Crpto Coprocessor BSC-Gen3 4767 (Supported in EMX0 Only)
Graphics	5748	POWER GXT145 PCI Express Graphics Accelerator
Graphics	5269	PCIe LP POWER GXT145 Graphics Accelerator
Bus Expansion	EJ08	PCIe3 Optical Cable Adapter for 4U CEC (Bear Mountain attach to EMX0)
Bus Expansion	EJ05	PCIe3 Optical Cable Adapter for PCIe3 Expansion Drawer (Bear Paw attach to EMX0 (double wide adapter))
Drawer	ESLL	EXP12SX SAS Storage Enclosure
Drawer	ELLL	EXP12SX SAS Storage Enclosure
Drawer	ESLS	EXP24SX SAS Storage Enclosure
Drawer	ELLS	EXP24SX SAS Storage Enclosure
Drawer	EMX0	PCIe Gen3 I/O Expansion Drawer (19" PCIe G3 4U I/O Expansion Drawer)
Drawer	ELMX	PCIe Gen3 I/O Expansion Drawer (19" PCIe G3 4U I/O Expansion Drawer)
Drawer	EMXF	PCIe3 6-Slot Fanout Module for PCIe3 Expansion Drawer (Fan Out Module (max 2 per EMX0; 2 HP x16 and 4 HP x8 Slots))
Drawer	ELMF	PCIe3 6-Slot Fanout Module for PCIe3 Expansion Drawer (Fan Out Module (max 2 per EMX0; 2 HP x16 and 4 HP x8 Slots))

# Scale Out I/O to migrate from POWER8 to POWER9 at GA2

Category	Feature Code	Marketing Name
IB	EC3T	PCIe3 LP 1-port 100Gb EDR IB Adapter x16
IB	EC3U	PCIe3 1-port 100Gb EDR IB Adapter x16
IB	EC3E	PCIe3 LP 2-port 100Gb EDR IB Adapter x16
IB	EC3F	PCIe3 2-port 100Gb EDR IB Adapter x16
ROCE	EC3B	PCIe3 2-Port 40 GbE NIC RoCE QSFP+ Adapter
ROCE	EC3A	PCIe3 LP 2-Port 40 GbE NIC RoCE QSFP+ Adapter
ROCE	EC38	PCIe3 2-port 10GbE NIC&RoCE SFP+ Copper Adapter
ROCE	EC37	PCIe3 LP 2-port 10GbE NIC&RoCE SFP+ Copper Adapter
ROCE	EL53	PCIe3 2-port 10GbE NIC&RoCE SFP+ Copper Adapter
ROCE	EL3X	PCIe3 LP 2-port 10GbE NIC&RoCE SFP+ Copper Adapter
ROCE	EC2N	PCIe3 2-port 10GbE NIC&RoCE SR Adapter
ROCE	EC2M	PCIe3 LP 2-port 10GbE NIC&RoCE SR Adapter
ROCE	EL54	PCIe3 2-port 10GbE NIC&RoCE SR Adapter
ROCE	EL40	PCIe3 LP 2-port 10GbE NIC&RoCE SR Adapter
LAN	5768	2-Port Gigabit Ethernet-SX PCI Express Adapter
LAN	5274	PCIe LP 2-Port 1GbE SX Adapter
LAN	EN17	PCIe G3 x8 4x10 4-Port Ethernet SFP+ HP
CNA	EN0M	PCIe2 4-port (10Gb FCoE & 1GbE) LR&RJ45 Adapter (FCoE not supported on P9)
CNA	EN0N	PCIe2 LP 4-port (10Gb FCoE & 1GbE) LR&RJ45 Adapter (FCoE not supported on P9)
Fibre Channel	EN12	PCIe2 8Gb 4-port Fibre Channel Adapter
Fibre Channel	EN0G	PCIe2 8Gb 2-Port Fibre Channel Adapter
Fibre Channel	EN0F	PCIe2 LP 8Gb 2-Port Fibre Channel Adapter
SAS	EJ0L	PCIe3 12GB Cache RAID SAS Adapter Quad-port 6Gb
WAN	5277	PCIe LP 4-Port Async EIA-232 Adapter
WAN	2893	PCIe 2-Line WAN w/Modem
USB	EC46	PCIe2 4-Port USB 3.0 Adapter
USB	EC45	PCIe2 LP 4-Port USB 3.0 Adapter
Encryption	EJ27	PCIe Crypto Coprocessor No BSC 4765-001
Encryption	EJ28	PCIe Crypto Coprocessor No BSC 4765-001
Encryption	EJ32	PCIe3 Crpto Coprocessor No BSC 4767
Graphics	EC42	PCIe2 3D Graphics Adapter x1
Graphics	EC41	PCIe2 LP 3D Graphics Adapter x1
Graphics	EC51	3D GRAPHICS ADPTR + CBL, PCIe3 X16/SHORT/LP
Drawer	5887	EXP24S SFF Gen2-bay Drawer (19" SAS 6Gbs 24 GEN2-S DISK BAYS)
Drawer	EL1S	EXP24S SFF Gen2-bay Drawer (19" SAS (6Gbs) DASD DRWR, 2U, 24 GEN2-S DISK BAYS)

# Scale Out I/O not migrating from POWER8 to POWER9

Category	Feature Code	Marketing Name
IB	5285	PCIe2 2-Port 4X IB QDR Adapter 40Gb
IB	5283	PCIe2 LP 2-Port 4X IB QDR Adapter 40Gb
IB	EC33	PCIe3 2-port 56Gb FDR IB Adapter x16
IB	EC32	PCIe3 LP 2-port 56Gb FDR IB Adapter x16
IB	EL50	PCIe3 2-port 56Gb FDR IB Adapter x16
IB	EL3D	PCIe3 LP 2-port 56Gb FDR IB Adapter x16
ROCE	EC28	PCIe2 2-Port 10GbE RoCE SFP+ Adapter (Cu)
ROCE	EC27	PCIe2 LP 2-Port 10GbE RoCE SFP+ Adapter (Cu)
ROCE	EL27	PCIe2 LP 2-Port 10GbE RoCE SFP+ Adapter (Cu)
ROCE	EC30	PCIe2 2-Port 10GbE RoCE SR Adapter
ROCE	EC29	PCIe2 LP 2-Port 10GbE RoCE SR Adapter (Optical)
ROCE	EL2Z	PCIe2 LP 2-Port 10GbE RoCE SR Adapter (Optical)
ROCE	EC3H	PCIe3 2-port 10GbE NIC&RoCE SFP+ Copper Adapter
ROCE	EC3G	PCIe3 LP 2-port 10GbE NIC&RoCE SFP+ Copper Adapter
ROCE	EL41	PCIe3 LP 2-port 10GbE NIC&RoCE SFP+ Copper Adapter
ROCE	EC2Q	PCIe3 2-port 10GbE NIC&RoCE SR Adapter
ROCE	EC2P	PCIe3 LP 2-port 10GbE NIC&RoCE SR Adapter
ROCE	EL42	PCIe3 LP 2-port 10GbE NIC&RoCE SR Adapter
LAN	5767	2-Port 10/100/1000 Base-TX Ethernet PCI Express Adapter
LAN	5281	PCIe LP 2-Port 1GbE TX Adapter
LAN	5772	10 Gigabit Ethernet-LR PCI Express Adapter
LAN	5717	4-Port 10/100/1000 Base-TX PCI Express Adapter
LAN	5271	PCIe LP 4-Port 10/100/1000 Base-TX Ethernet Adapter
LAN	5287	PCIe2 2-port 10GbE SR Adapter
LAN	5284	PCIe2 LP 2-port 10GbE SR Adapter
LAN	EL2P	PCI-E GEN2 2-port 10GbE SR Adapter - LP
LAN	5769	10 Gigabit Ethernet-SR PCI Express Adapter
LAN	5275	PCIe LP 10GbE SR 1-port Adapter
LAN	5744	PCIe2 4-Port 10GbE&1GbE SR&RJ45 Adapter
LAN	5280	PCIe2 LP 4-Port 10GbE&1GbE SR&RJ45 Adapter
LAN	EC2J	PCIe2 2-port 10GbE SFN6122F Adapter
LAN	EC2G	PCIe2 LP 2-port 10GbE SFN6122F Adapter

Category	Feature Code	Marketing Name
LAN	EL39	2-Port 10GbE OpenOnload PCIe 2.0 LP Adapter
CNA	5708	10-Gb FCoE PCIe Dual Port Adapter
CNA	5270	PCIe LP 10Gb FCoE 2-port Adapter
Fibre Channel	5774	4 Gigabit PCI Express Dual Port Fibre Channel Adapter
Fibre Channel	5276	PCIe LP 4Gb 2-Port Fibre Channel Adapter
Fibre Channel	EL09	PCI-E 4x 4Gb Fibre Channel, 2 port - low profile
SAS	5901	PCIe Dual-x4 SAS Adapter
SAS	5278	PCIe LP 2-x4-port SAS Adapter 3Gb
SAS	EL10	PCI-E 8x SAS Storage Controller - low profile
SAS	5805	PCIe 380MB Cache Dual - x4 3Gb SAS RAID Adapter
SAS	5913	PCIe2 1.8GB Cache RAID SAS Adapter Tri-port 6Gb
SAS	ESA3	PCIe2 1.8GB Cache RAID SAS Adapter Tri-port 6Gb CR
SAS	EL3W	PCIe3 x8 cache SAS RAID internal adapter 6 Gb
SAS	EL65	PCIe3 SAS Tape/DVD Adapter Quad-port 6Gb x8
SSD	EC54	PCIe3 LP 1.6TB NVMe Flash Adapter
SSD	EC55	PCIe3 1.6TB NVMe Flash Adapter
SSD	EC56	PCIe3 LP 3.2TB NVMe Flash Adapter
SSD	EC57	PCIe3 3.2TB NVMe Flash Adapter
SSD	EJ1K	PCIe3 FPGA FLASH ACCELERATOR ADAPTER W/2 FLASH SOCKETS, x8 CAPI CAPABLE LOW PROFILE HALF LENGTH
SSD	ES13	960GB FLASH MODULE FOR FLASH GT #EJ1K (LINUX ONLY)
WAN	2894	PCIe 2-Line WAN w/Modem CIM
WAN	EN14	PCIe 1-port Bisync Adapter CIM
WAN	EN27	PCIe 2-port Async EIA-232 Adapter
WAN	EN28	PCIe 2-port Async EIA-232 LP Adapter
WAN	EN29	PCIe 2-port Async EIA-232 Adapter
Encryption	4807	PCIe Crypto Coprocessor No BSC 4765-001
Accelerator	EJ12	PCIe3 FPGA Accelerator Adapter
Accelerator	EJ13	PCIe3 LP FPGA Accelerator Adapter
Accelerator	EJ16	PCIe3 LP CAPI Accelerator Adapter
Accelerator	EJ1A	CAPI Compression Accelerator Adapter
Accelerator	EJ1B	CAPI Compression Accelerator LP Adapter
Accelerator	EJ17	PCIe3 Full High CAPI FlashSystem Accelerator Adapter
Accelerator	EJ18	PCIe3 LP CAPI FlashSystem Accelerator Adapter
GPUs	EC47	Compute Intensive Accelerator
GPUs	EC4B	PCIe gen3 x16 GPU FH



# New 19" Rack 7965-S42



**GA 4Q17**

**POWER8 &  
POWER9**

	<b>S42</b>	<b>T42</b>	<b>94Y</b>
42U	Yes	Yes	Yes
<b>600mm Wide (datacenter floor tile)</b>	Yes	No	Yes
<b>Ship Loaded from Factory</b>	Yes	Yes	No
Flat surface for mounting H2O Manifolds and Strip PDUs	Yes	No	Yes
1200mm Depth (rack w/ covers)	1070+130cvrs	1016+cvrs	1040 + cvrs
Rear door heat exchanger	Yes	Yes	Yes
# Vertical, 1U Pockets	4	4	6
Height Reduction – fit standard doorways	Yes	Yes	No
Back cable depth (mm)	280	246	261
<b>Earthquake certified</b>	Yes – 45lbs / EIA	Yes – 35 lbs/ EIA	No