Université IBM i 2017

17 et 18 mai – IBM Client Center de Bois-Colombes

S4 – Les évolutions IBM Power Systems 2016-2017

Mercredi 17 mai – 14h00-15h30

Jean-Luc Bonhommet – IBM

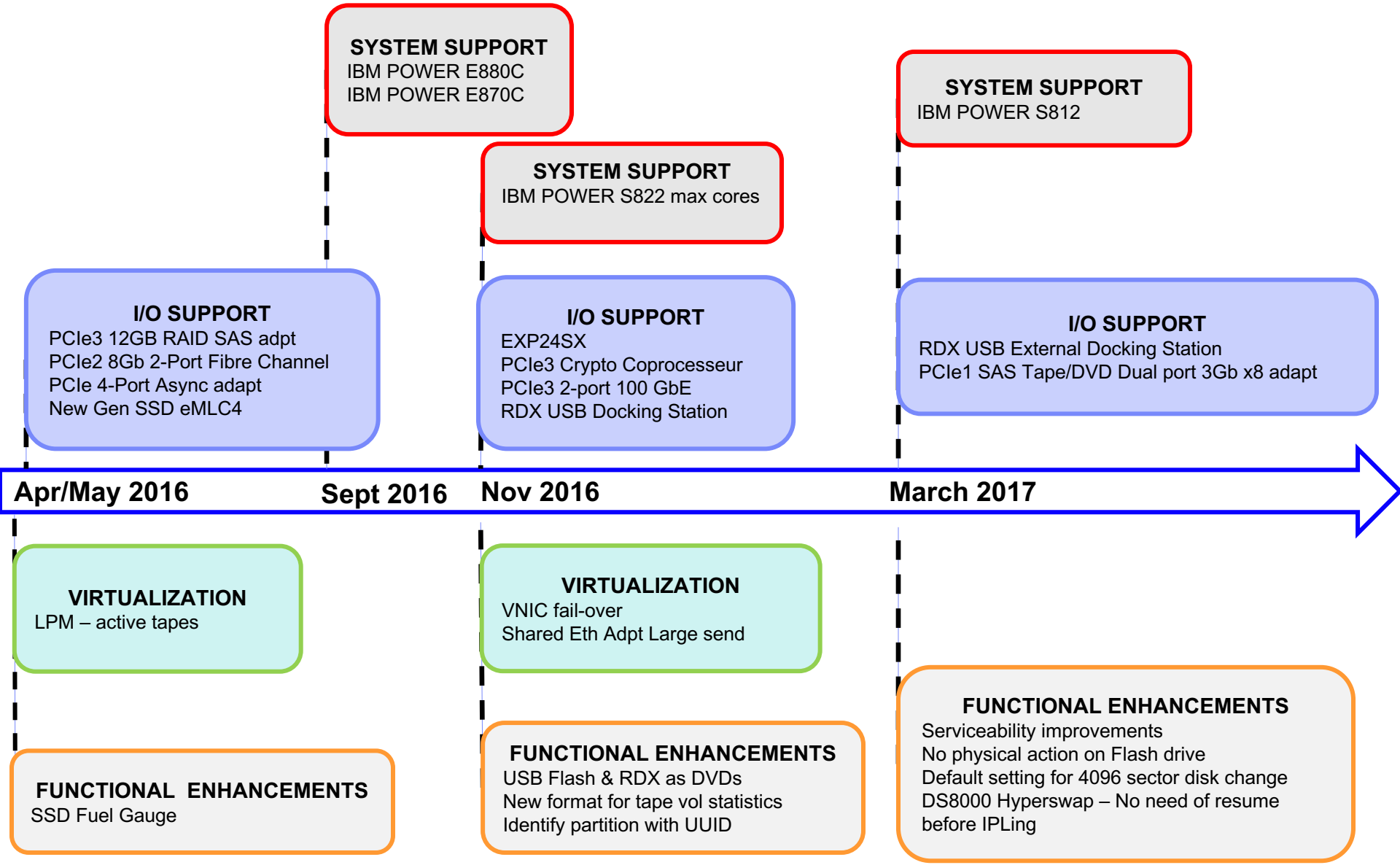
AGENDA

- POWER8 2016-2017 Announcements for IBM i
  - DDR4 memory
  - Platform support for IBM i
  - I/O support for IBM i
  - Virtualization
  - Additional Enhancements
  - GDR support for IBM i
- Cloud solutions announcements for IBM i
- POWER9

POWER Announcements 2016-2017

Power Systems

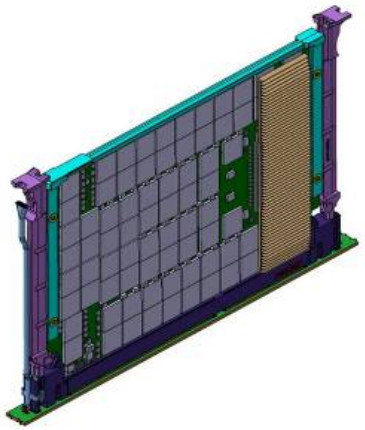
Hardware & Firmware support



DDR4 MEMORY

DDR4 Memory

- Same 1600 MHz as DDR3 = same performance
- Same RAS (reliability, availability, serviceability)
- Some energy savings -- 0-to-30%
- Same config/plugging rules as DDR3 except:
  - No mixing DDR3 and DDR4 *
  - FW 860 required for newest DDR4 features



* E870C, E870, E880C, E880 can mix on a multi-node server, but can not mix in the same system node.

Maximum memory on POWER SYSTEMS

Models	Ann Date	DDR4	DDR3
E870/E880	Jan 2016	8 TB per node	4 TB per node
S824	Oct 2016	2 TB	2 TB
S814	Oct 2016	1 TB	1 TB
S822	Oct 2016	1 TB	1 TB
S812	Oct 2016	64GB	64 GB

Platform support

Platform support summary

POWER Platform support	IBM i 7.3	IBM i 7,2
Enhancements from September 2016		
IBM POWER 880C	Base	TR4
IBM POWER 870C	Base	TR4
Enhancements from November 2016		
IBM Power S822 model 8284-22A increases max cores	TR1	TR5
NovaLink support for SR-IOV configurations	N/A	N/A
Enhancements from March 2017		
IBM Power S812 model 8284-21A	TR2	TR6

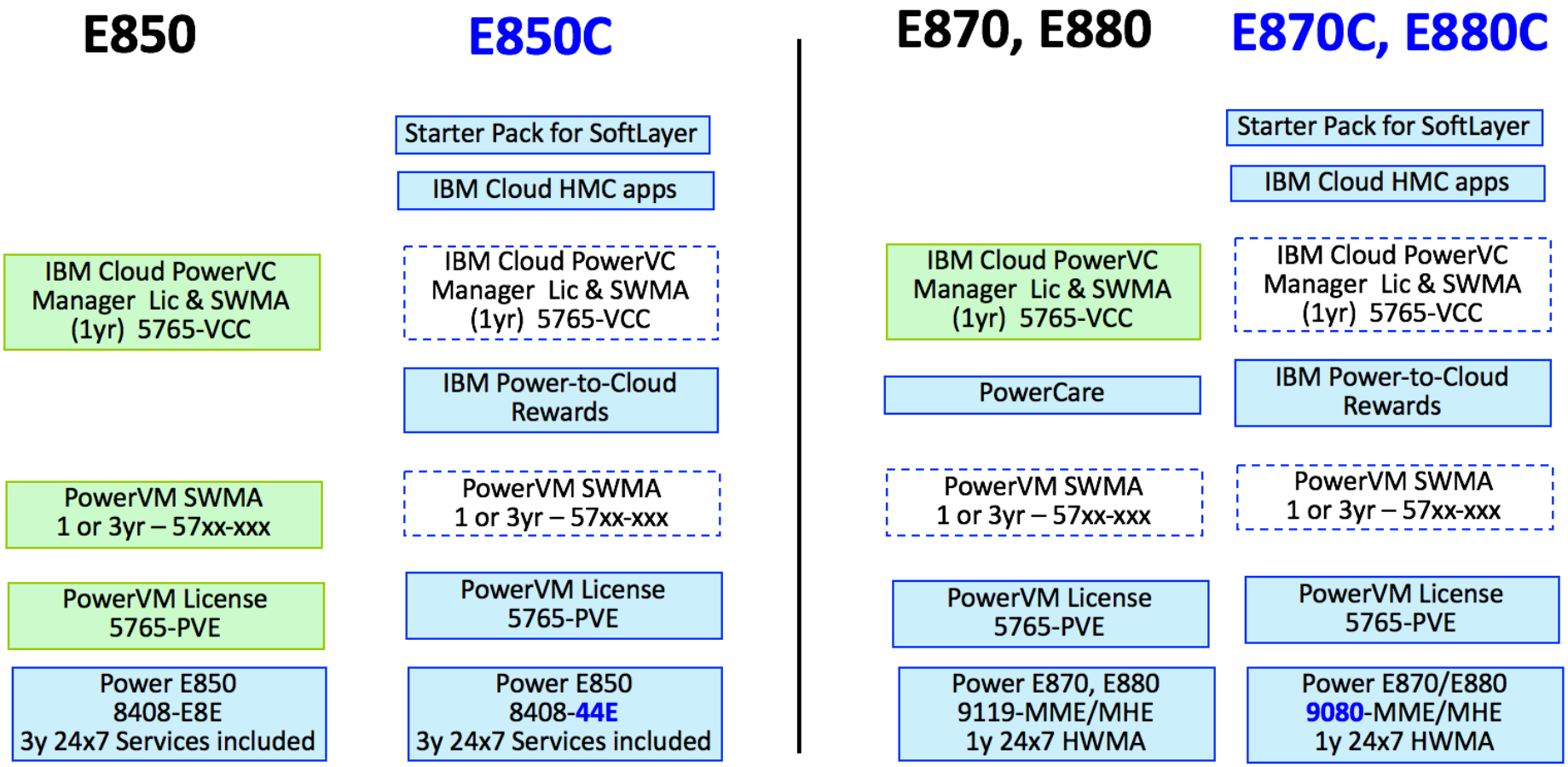
Power E870C and E880C Hardware – Sept 2016

- New Cloud-enabled offering with new capabilities, new offerings, new pricing and new flexibility compared to E870/E880 offered in the beginning of 2016.

- Physically POWER8 hardware leverages existing E870 and E880 technology.

  Pricing improvements included
  - Processor cores or activations
  - Memory
  - Capacity on Demand – processors & memory

Power Enterprise Cloud Models – What's Included



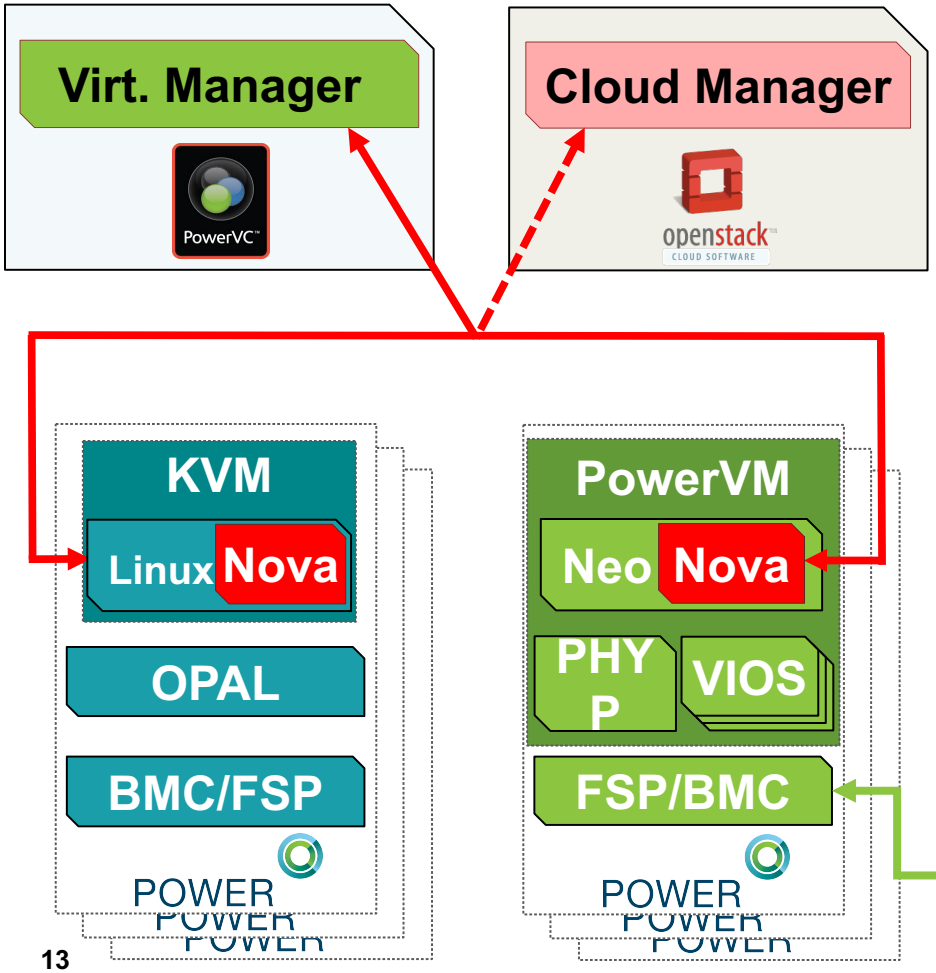
E850, E870, E880 will be withdrawn on July 17, 2017

Expanded IBM i Partition Max cores on S822 – Nov 16

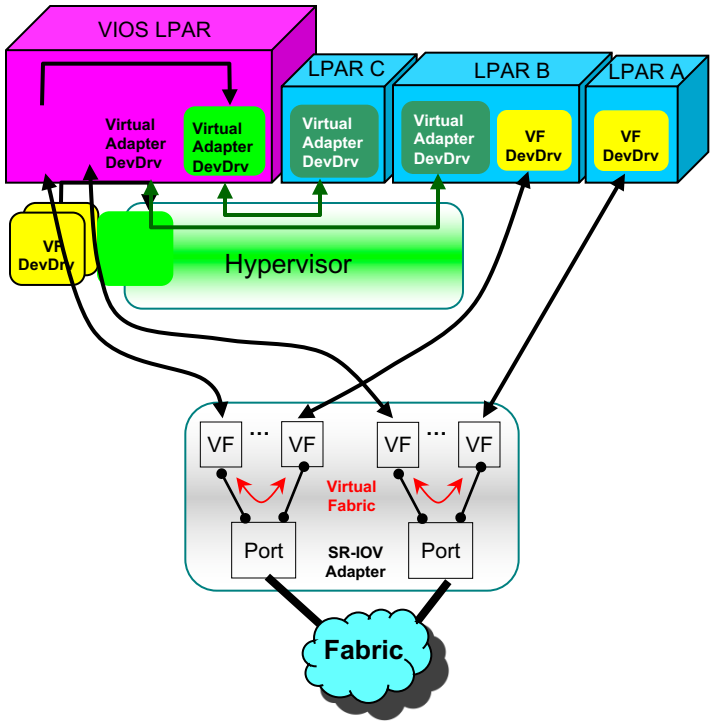
- Previously up to 2-cores per partition IBM i 7.2 TR3 or IBM i TR11 or later
- Now up to 4-cores per partition FW 860 or later
  No change to all virtualized I/O or to P10 software tier

NovaLink support for SR-IOV configurations – Nov 16

Novalink



IO Adapter Virtualization with SR-IOV



Share Ethernet adapters with LPARs

IBM Power S812 model 8284-21A – March 2017

8284-21A

– Entry price server

- 1-core server for IBM i
- 4-core server for AIX

– Single partition
– no virtualization
– no Linux partition
– Simpler memory & I/O options

Power S812 1-core entry server

8284-21A

CPW = 9880

	Power System S812
POWER8 Processor	3.02 GHz
Cores	1
Maximum Memory	64 GB
System unit PCIe slots	6* PCIe Gen3 (low profile)
"Base" Ethernet PCIe adapter	4-port 1 Gbt required
SAS bays in system unit	8 SFF-3 bays
Integrated write cache	Optional (Strongly urged for HDD)
Bay for DVD in system unit	Yes
Bay for tape in system unit	No
Bay for RDX in System unit	No
VIOS or PowerVM	No
HMC	Single partition, rarely needed
Max number of partitions	1
PCIe Gen3 I/O Drawer	No
EXP24S or EXP24SX	No
Footprint	2U in rack
IBM i tier	P05 max 25 users
IBM i prerequisite	7.2 TR6 or 7.3 TR2 or later
Dual power supply	900W = 110V or 220V

25 users max: number of concurrent users been authentified on IBM i. IBM profiles doesn't count.

* 5 PCIe slots when SAS backplane with write cache used

I/O support

Terminology for type of configuration

- **Native**
  - Adapter own and managed by IBM i
- **VIOS**
  - Adapter owned and managed by VIOS and not seen by IBM i
- **iVirt**
  - Adapter own by VIOS but virtualized to IBM i
    - Example: Fibre Channel card owned by VIOS and use by IBM i via NPIV

IO support summary

IBM i I/O Support	Type of Configuration (Native, VIOS, iVirt, All)	IBM i 7.3	IBM i 7.2	IBM i 7.1
Enhancements from April / May 2016 (below)				
PCIe3 12GB Cache RAID PLUS SAS Adapter	All	Base	TR 4	--
PCIe2 8Gb 2-Port Fibre Channel Adapter	VIOS	Base	TR 4	RS-710-S
PCIe 4-Port Async EIA-232 Adapter	Native	Base	TR 4	RS-710-S
1.9TB Read Intensive SAS 4k SFF-2 SSD (IBM i)	Native, iVirt	Base	TR 4	-
1.9TB Read Intensive SAS 4k SFF-2 SSD	VIOS	Base	TR 4	-
1.9TB Read Intensive SAS 4k SFF-3 SSD (IBM i)	Native, iVirt	Base	TR 4	-
1.9TB Read Intensive SAS 4k SFF-3 SSD	VIOS	Base	TR 4	-

Power Systems

IO support summary

IBM i I/O Support	Type of Configuration (Native, VIOS, iVirt, All)	IBM i 7.3	IBM i 7.2	IBM i 7.1
Enhancements from April / May 2016 (below)				
387GB SFF-2 SSD 5xx eMLC4 for IBM i	Native, iVirt	Base	TR 4	RS-710-S
387GB SFF-2 SSD 5xx eMLC4	VIOS	Base	TR 4	RS-710-S
775GB SFF-2 SSD 5xx eMLC4 for IBM i	Native, iVirt	Base	TR 4	RS-710-S
775GB SFF-2 SSD 5xx eMLC4	VIOS	Base	TR 4	RS-710-S
387GB SFF-3 SSD 5xx eMLC4 for IBM i	Native, iVirt	Base	TR 4	RS-710-S
387GB SFF-3 SSD 5xx eMLC4	VIOS	Base	TR 4	RS-710-S
775GB SFF-3 SSD 5xx eMLC4 for IBM i	Native, iVirt	Base	TR 4	RS-710-S
775GB SFF-3 SSD 5xx eMLC4	VIOS	Base	TR 4	RS-710-S

Power Systems

IO support summary

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387GB SFF-2 SSD 4k eMLC4	VIOS	Base	TR 4	RS-710-S
775GB SFF-2 SSD 4k eMLC4 for IBM i	Native, iVirt	Base	TR 4	RS-710-S
775GB SFF-2 SSD 4k eMLC4	VIOS	Base	TR 4	RS-710-S
1.55TB SFF-2 SSD 4k eMLC4 for IBM i	Native, iVirt	Base	TR 4	-
1.55TB SFF-2 SSD 4k eMLC4	VIOS	Base	TR 4	-
387GB SFF-3 SSD 4k eMLC4 for IBM i	Native, iVirt	Base	TR 4	RS-710-S
387GB SFF-3 SSD 4k eMLC4	VIOS	Base	TR 4	RS-710-S

Power Systems

IO support summary

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775GB SFF-3 SSD 4k eMLC4 for IBM i	Native, iVirt	Base	TR 4	RS-710-S
775GB SFF-3 SSD 4k eMLC4	VIOS	Base	TR 4	RS-710-S
1.55TB SFF-3 SSD 4k eMLC4 for IBM i	Native, iVirt	Base	TR 4	-
1.55TB SFF-3 SSD 4k eMLC4	VIOS	Base	TR 4	-
387GB 1.8" SAS 5xx SSD eMLC4 for IBM i	Native, iVirt	Base	TR 4	RS-710-S
387GB 1.8" SAS 5xx SSD eMLC4	VIOS	Base	TR 4	RS-710-S
387GB 1.8" SAS 4k SSD eMLC4 for IBM i	Native, iVirt	Base	TR 4	RS-710-S
387GB 1.8" SAS 4k SSD eMLC4	VIOS	Base	TR 4	RS-710-S

Power Systems

IO support summary

IBM i I/O Support	Type of Configuration (Native, VIOS, iVirt, All)	IBM i 7.3	IBM i 7.2	IBM i 7.1
Enhancements from April / May 2016 (below)				
775GB 1.8" SAS 5xx SSD eMLC4 for IBM i	Native, iVirt	Base	TR 4	RS-710-S
775GB 1.8" SAS 5xx SSD eMLC4	VIOS	Base	TR 4	RS-710-S
775GB 1.8" SAS 4k SSD eMLC4 for IBM i	Native, iVirt	Base	TR 4	RS-710-S
775GB 1.8" SAS 4k SSD eMLC4	VIOS	Base	TR 4	RS-710-S
Tape Library TS4500 R3	All	Base	TR 3	TR 11

Power Systems

IO support summary

IBM i I/O Support	Type of Configuration (Native, VIOS, iVirt, All)	IBM i 7.3	IBM i 7.2	IBM i 7.1
Enhancements from November 2016 (below)				
EXP24SX SAS Storage Enclosure	All	TR 1	TR 5	N/A
PCIe3 Crypto Coprocessor 4767	Native	TR 1	TR 5	N/A
PCIe3 2-port 100 GbE	VIOS	TR 1	TR 5	N/A
RDX USB Top Mount Docking Station	All	TR 1	TR 5	N/A
Enhancements from March 2017 (below)				
RDX USB External Docking Station	All	TR 2	TR 6	TR 11 + MF63266
PCIe1 SAS tape/DVD Dual-port 3 Gb x8	All	Base	Base	TR 8

FlashSystem supported with IBM i

FS840

IBM i 7.2 TR2 and later

Direct Attach – NPIV - ~~vSCSI~~

FS900

IBM i 7.2 TR2 and later

No Support for IBM i 7.1

FlashSystem

- Direct attach
  - ✓ requires 8Gbps to 8Gbps or 16 Gbps to 16Gbps.
  - ✓ The protocol on 8Gb ports must be configured as FC-AL, 16Gb ports must be configured as FC-P2P or Automatic.
- NPIV requires VIOS 2.2.3.4 or later
- Flash System 1.2.0.11 or later firmware
- All volumes must be created utilizing the command line interface with a blocksize of 4096.
- FS840 or FS900 may be still be attached utilizing SVC or Storwize with IBM i 7.1 TR8 or later

New PCIe3 12GB Cache RAID PLUS SAS Adapter (#EJ14)

Annc 12/04/2016
GA 27/05/2016

- Next iteration of PCIe3 SAS technology – follow-on to #EJ0L
- Up to 1.6M read IOPS, Up to 360k write IOPS, Up to 878k mixed IOPs (70-30) *

- Compared to existing #EJ0L SAS adapter announced 2014:
  - More processing power on card
  - Up to 100% more write IOPS
  - Up to 50% more SSDs supported -- max 72 vs 48
  - Same number of HDDs supported -- max 96
  - Same 12GB write cache
  - Same price !!!
- Supported on POWER8 servers in full high PCIe slots
- AIX, IBM i, Linux, VIOS

* performance can vary greatly depending on workload and environment

Prices are based on USA list prices and are subject to change. Reseller prices may vary.

PCIe3 12GB Cache RAID PLUS SAS Adapter Details

Same adapter feature name as #EJ0L except for “PLUS”

Same configuration considerations as with existing #EJ0L adapter

- Same plugging in pairs of #EJ14 - for redundancy and performance
  Physically #EJ14 and #EJ0L look a lot alike – do not pair one #EJ0L with one #EJ14
- Same 4-port x8 PCIe adapter with 3GB physical cache effectively providing up to 12GB with compression
- Same no batteries (uses flash memory to protect cache)
- Same AA SAS cables connect two adapters together for cross awareness
- Same HD YO and X SAS cables used
- Same – can run SSD and/or HDD – but not on the same port
- Same EasyTier function for AIX/Linux/VIOS

#EJ14

For more detail:

- 12 April 2016 announcement letter for details
- Knowledge Center
- Techdoc by Sue Baker / John Hock – target May refresh

Supported on POWER8 servers in full high PCIe slots

- System units S814 (6-,8-core), S824, S824L, E850
- PCIe Gen3 I/O drawer on POWER8 servers
- AIX 7.2 TL0 SP2 & 7.1 TL4 & SP2 & 7.1 TL3 SP7* & 6.1 TL9 SP7 or later (* planned Sept 2016)
- IBM i 7.2 TR4 & 7.3 or later
- Linux: Red Hat Enterprise Linux; SUSE Linux Enterprise Linux; Ubuntu
- VIOS 2.2.4.20 or later

New PCIe2 2-port 8Gb Fibre Channel Adapter

Annc 12/4/2016
GA 27/5/2016

- Price savings
- Choice

2-port 8Gb FC cards	Existing #5735 / #5273	New #EN0F / #EN0G
Two 8Gb ports	same	same
Overall performance	essentially same	essentially same
RAS	same	same
SR Optical Cabling	same	same
Manufacturer source	Emulex	QLogic
Devices supported	See SSIC	See SSIC Some older devices not tested
OS support	AIX, IBM i, Linux	AIX, Linux IBM i thru VIOS
Server support	POWER8 and earlier	POWER8
List price	$3,499	$3,099

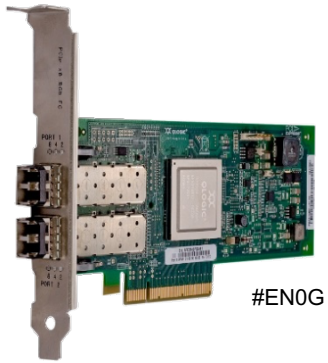
Save 11%

Prices are based on USA list prices on S824 and are subject to change. Reseller prices may vary. Prices on other models may vary

PCIe2 2-port 8Gb Fibre Channel Adapter Details

- Price savings
- Choice

- #EN0F = low profile
- #EN0G = full high
- CCIN 578D



#EN0G

	Existing #5735 / #5273	New #EN0F / #EN0G
Two 8Gb ports	same	same
Overall performance	Based on IBM testing of available workloads, there were a couple workloads with modest differences, but essentially the same overall performance was observed.	
RAS	same	same
SR Optical Cabling	same	same
Manufacturer source	Emulex LPe12002	QLogic QLE2562 HBA
Devices supported	See SSIC #5735/5273 have been shipping since 2008 and a number of earlier hardware devices and levels are supported. #EN0F/EN0G tested with all current IBM primary devices or are in the process of being tested/supported. See SSIC for latest.	
OS support	All levels of AIX, IBM i, Linux supported on that server	AIX 6.1, 7.1, 7.2 Linux No native IBM i --use VIOS
NPIV support	Through VIOS all levels supported on that server	Through VIOS 2.2.4.2 or later
Servers supported	POWER6, POWER7, POWER8	POWER8
Adapter driver	IBM provides adapter drivers for AIX and IBM i and VIOS. Linux provided through that distribution.	

PCIe 4-port Async Adapter Adding IBM i Support

Ann 12/4/2016
GA 27/5/2016

- Existing adapter supporting AIX and Linux for years.
  - Low Profile: #5277 PCIe LP 4-Port Async EIA-232 Adapter
  - Full High : #5785 4 Port Async EIA-232 PCIe Adapter

- Same Async function as 2-port Async adapters #5289/#5290/#EN27/#EN28/#EN29
- IBM Facsimile Support for i V5R8 or later (previously named Fax/400) supported

- Higher price for 4-port adapter vs 2-port adapter, but can save a PCIe slot
  - 4-port list = $ 699 2-port list = $ 198

- Support with IBM i 7.3 or later; or IBM i 7.2 TR4 or later; or IBM i 7.1 plus PTFs

- Additional 2-port Async adapter background:
  - #2893/2894 withdrawn from marketing (EN13/EN14 Bisync announced for withdrawal)
  - #5289/5290: not supported on POWER8 - withdrawn from marketing
  - #EN27/EN28: supported on POWER8 and POWER7 – withdrawn from marketing
  - #EN29: IBM i only, full-high only – not withdrawn yet, but anticipate will withdraw in a few months
- Alternative to Async adapter: WAN over LAN with IBM i 7.2 base

Prices are based on USA list prices on S824 and are subject to change. Reseller prices may vary.

New Generation SAS SSD - 2.5” & 1.8”

Now more than ever – select SSD vs HDD

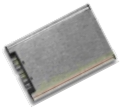
eMLC4   RI

2.5-inch (SFF)

EXPAND & REFRESH existing offering

Big price performance improvement

New “read intensive” (RI) drive

 eMLC4

1.8-inch

EXPAND & REFRESH existing offering

Big price performance improvement

Price performance statements are based on USA list prices and are subject to change.

Power SAS SSD: Expand, Refresh, Re-price

EXPAND & REFRESH SAS SSD

- 2.5-inch (SFF)
  - Refresh 387GB and 775GB
  - Add 1.55TB - better $/GB, better footprint efficiency
  - Add 1.9TB Read Intensive - Lowest $ / TB ever
- 1.8-inch
  - Refresh 387GB
  - Add 775GB - better $/GB, better footprint efficiency

Price example 1: **-33%**

- 2.5-inch (SFF) SSD 387GB
  - eMLC3 price $3,588
  - New eMLC4 4k price $2,399
- **PLUS** large maint savings after warranty

Price example 2: **-70%**

- Read Intensive
  - eMLC3 price/GB (775GB) $8 / GB (not RI)
  - New RI price (1.9TB) $2.4 / GB
- **AND** more cost effective maint after warranty

Prices are USA list prices on an S824 and are subject to change. Reseller prices may vary.

Now more than ever – select SSD vs HDD

Example on Power S824 assuming five-year life and assuming 24x7x4 maintenance after 3 year warranty -- Choosing disk or high endurance SSD

DISK: 14 drives @ 139/146GB RAID-5 = ~1.8TB usable space, but only 50% utilized because buying arms vs capacity .

Total list price = $6,972

eMLC3 SSD: 4 drives @ 387GB RAID-5 = ~1.15TB usable space.

Total list price = $16,080

Over 2X price difference - challenging discussion unless I/O performance needs push toward SSD

DISK: 14 drives @ 139/146GB RAID-5 = ~1.8TB usable space, but only 50% utilized because buying arms vs capacity .

Total list price = $6,972

eMLC4 SSD: 4 drives @ 387GB RAID-5 = ~1.15TB usable space.

Total list price = $10,100

Much more affordable. Only 45% more for much higher IOPS capable drives, lower latency, energy/heat savings, less noise, smaller footprint (fewer bays used).

Prices are USA planned list prices on an S824 and are subject to change. Reseller prices may vary.
Performance note – dropping from 14 disk to 4 SSD will probably work well for many clients, but ignoring even capacity considerations, there may be scenarios where more SSD are required or scenarios where fewer SSD can be used. The "fewer" scenario is less likely for IBM i.

eMLC4 Sector Size Pricing Difference

eMLC3 5xx and 4k priced the same

New eMLC4, 4k is better price

528-byte = 5xx 4224-byte = 4k

4k prerequisites

- POWER8 system (not POWER7)
- PCIe3 SAS adapter – or POWER system unit SAS bay
- Proper OS software level

Can not mix 5xx and 4k in same array

eMLC3 vs eMLC4 Price example 4k

- 2.5-inch (SFF) SSD 387GB
  - eMLC3 4k price $3,588
  - New eMLC4 4k price $2,399

-33%

- **PLUS** large maint savings after warranty

eMLC3 vs eMLC4 Price example 5xx

- 2.5-inch (SFF) SSD 387GB
  - eMLC3 5xx price $3,588
  - New eMLC4 5xx price $2,649

-25%

- **PLUS** large maint savings after warranty

Prices are USA list prices on an S824 and are subject to change. Reseller prices may vary.

Refresh All Power SSD – and Add New SSD options

POWER8 servers *(not LC line)* ***EXPANSION & REFRESH***

- 2.5-inch SSD for all OS
  - Refresh 387GB and 775GB - ~33% 4k price reduction + bigger maintenance price reduction
  - Add 1.55TB - better $/GB, better footprint efficiency
  - Add 1.9TB Read Intensive - Lowest $ / TB ever
- 1.8-in SSD for all OS (only on 2-socket Scale-out and E850)
  - Refresh 387GB - ~33% price reduction + bigger maintenance price reduction
  - Add 775GB - better $/GB, better footprint efficiency

POWER7* servers:

REFRESH

- 2.5-inch 387GB and 775GB SSD
  - Up to ~25% 5xx price improvement + maint improve
  - Support in EXP24S I/O drawer run by existing PCIe2/PCIe3 SAS adapters

* "C" and "D" models and model 795. Other "B" models not supported

Price performance statements are based on USA list prices and are subject to change.

2.5-inch eMLC4 SSD

Annc 12/4/2016
GA 27/5/2016

- Write & Read intensive
- 387GB (refresh), 775GB (refresh), & 1,550GB (new) capacity
- Supported by all OS -- AIX, IBM i, Linux
- eMLC4 sector formatting pricing 4k = lower price
- Improved performance over eMLC3
- Placed in POWER8 System units (SFF-3) or in EXP24S I/O drawer (SFF-2)

eMLC3 today 2.5" 4k or 5xx
387GB $3588 + $48+ maint
775GB $6200 + $84+ maint

Biggest reductions
~ 33% price
~ 50% price+maint

Big reduction
~25% price
~40% price+maint

eMLC4 new 2.5" 4k — POWER8
387GB $2399 + $14+ maint
775GB $4199 + $25+ maint
1.55TB $7999 + $48+ maint

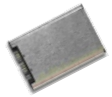
eMLC4 new 2.5" 5xx — POWER8 POWER7
387GB $2649 + $14+ maint
775GB $4449 + $25+ maint

Prices are based on USA list prices on S824 and are subject to change. Reseller prices may vary. Prices on other models may vary.
Warranty differences between server models and coverage chosen impact size of maintenance savings.
Maint price shown is for S824 monthly 9x5 NBD coverage. The "+" behind the number is a reminder many clients buy additional coverage.

1.8-inch eMLC4 SSD

Annc 12/4/2016
GA 27/5/2016

- Write & Read intensive
- 387GB (refresh), 775GB (new) capacity
- Supported by all OS -- AIX, IBM i, Linux
- eMLC4 Sector formatting pricing 4k byte = lower price
- Improved performance over eMLC3
- Placed in 2-socket POWER8 Scale-out with high function backplane or in E850 system unit



eMLC3 today 1.8" 5xx
387GB $3588 + $48+ maint

Biggest reductions
~ 33% price
~ 50% price+maint

eMLC4 new 1.8" 4k POWER8
387GB $2399 + $14+ maint
775GB $4199 + $25+ maint

Big reduction
~25% price
~40% price+maint

eMLC4 new 1.8" 5xx POWER8
387GB $2649 + $14+ maint
775GB $4449 + $25+ maint

Prices are based on USA list prices on S824 and are subject to change. Reseller prices may vary. Prices on other models may vary.
Warranty differences between server models and coverage chosen impact size of maintenance savings.
Maint price shown is for S824 monthly 9x5 NBD coverage. The "+" behind the number is a reminder many clients buy additional coverage.

2.5-inch 1.9TB Read Intensive SSD

Annc 12/4/2016
GA 27/5/2016

- Read intensive: lowest $/GB on Power … must manage use (fuel gauge introduced)
- First general purpose Read Intensive (RI) for Power – commonly used in industry
- Supported by all OS -- AIX, IBM i, Linux
- 4k byte sectors (no 5xx byte)
- Good read performance – write performance up to 70% slower than eMLC4 SSD
- Placed in POWER8 System units (SFF-3) or in EXP24S I/O drawer (SFF-2)
- Actual capacity 1,860GB – rounded up to 1.9TB in name

eMLC4 SSD 2.5" 4k
775GB $4199 → ~$5.4 / GB
1.55TB $7999 → ~$5.2 / GB

~ 55% lower

Previous eMLC3 SSD 2.5"
775GB $6200 → ~$8/GB

~ 70% lower
Plus maint save

1.9TB RI new 2.5" SSD POWER8
4k
1.9TB $4399 → ~$2.4 / GB

Prices are based on USA list prices on S824 and are subject to change. Reseller prices may vary. Prices on other models may vary.
Warranty differences between server models and coverage chosen impact size of maintenance savings

1.9TB Read Intensive SSD Insights

"Worn out" is not "Broken"

		Broken	Worn out
Read Intensive 1.9TB SSD	IBM replace under warranty	Yes	Yes
	IBM replace after warranty under maint contract	Yes	No
eMLC2 / eMLC3 / eMLC4 SSD such as 387GB or 775GB	IBM replace under warranty	Yes	Yes
	IBM replace after warranty under maint contract	Yes	Yes

- Write intensive workloads can "wear out" the drive -- watch your fuel gauge to monitor usage
  - Approximately 3,394 TB of data can be written to drive, but may be somewhat larger
  - Drive Write Per Day (DWPD) rating of "1"
- Use RI SSD when you are confident your write workload is reasonable

Fuel Gauge for 1.9TB RI SSD

- **The following example specific to IBM i , but other OS are similar**
- **SSD Fuel Gauge lists usage statistics and service information for Read Intensive SSDs**

- **See** www.ibm.com/developerworks/ibmi/techupdates/hw/issdfuelgauge

- **Information provided for each RI SSD:**
  - **Resource name**
  - **Location code**
  - **Part number**
  - **Drive serial number**
  - **Drive firmware level**
  - **Number of bytes written to SSD**
  - **Number of written bytes supported**
  - **Life remaining gauge**
  - **PFA trip (Predictive Failure Analysis warning has been logged)**
  - **Power on days**

```
1. Resource name: DMP088
   Location code: U5887.001.G46A027-P1-D24
   Part Number: 00LY371
   Serial Number: STYAL696
   Firmware Level: 50A5
   Number of bytes written to SSD: 191618 GB
   Number of written bytes supported: 3588096 GB
   Life Remaining Gauge: 96%
   PFA trip (Predictive Failure Analysis warning has been logged): No
   Power on days: 158
```

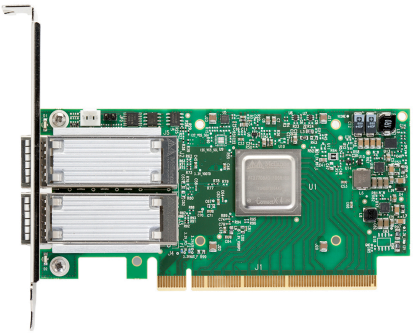
New EXP24SX SAS Storage Enclosure (#ESLS)

- POWER8 servers
- Supported by existing 6Gb PCIe3 SAS adapters (#EJ0L, #EJ14, #EJ0J)
- Same disk and SSD as in existing EXP24S – same carrier/tray, feat code
- 4k byte sector ONLY (no 5xx byte sector in 2016)
- Can mix with existing EXP24S drawer on same PCIe3 SAS adapter
- New 12Gb capable SAS cabling

New PCIe Cryptographic Adapter 4767 (#EJ33)

- Supported on POWER8 servers
- IBM i 7.2 or 7.3 or later
- FW 860 or later
- Dedicated mode (no VIOS – like existing adapter)
- Can mix with existing PCIe Crypto cards – binary compatibility
- Shipping for months on System z …. There known as 4767-002

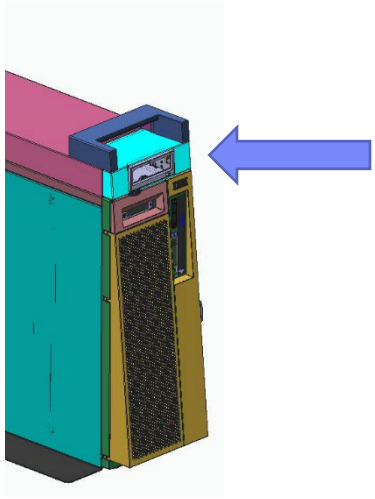
PCIe3 2-port 100Gb Ethernet Adapter (#EC3M/#EC3L)



- For POWER8 x16 PCIe slots
- Ethernet NIC & RoCE adapter (VIOS only supports NIC)
- IBM i support through VIOS

- Alternative to existing 40Gb adapter (#EC3A/#EC3B)
- Note that actually driving through put takes a lot of cores, plus virtualization adds some overhead – so “don’t expect 100Gb in practical, actual usage”

Entry Power S814 Enhancement -- Top mount RDX docking Station #EUA3



9 Dec 2016 GA

- Integrated entry save/restore
- For factory-shipped tower configuration (4-core or 6-core)
  - No field MES
  - No 8-core S814 (no such thing)
- USB RDX docking station firmly mounted on top tower.
  - Adds about 5 cm (2 in) to height of tower
- Rear two USB ports removed from server due to internal RDX USB cabling
  - These ports provide power to RDX and signal
- Front USB port remains available for client use
- Equivalent function/performance to #EU04 or #EU03 docking station

- AIX, IBM i, Linux

External RDX Docking Station (#EUA4)

- #EUA4 is follow-on product to #EU04 – entry save/restore option
- Same performance, same application functionality
- New #EUA4 to be available WW *
- #EU04 withdrawn in multiple countries due to certification shortfalls

PCIe1 SAS Tape/DVD Dual-port 3Gb x8 (#EJ1P/#EJ1N)

- PCIe Generation 1
- Used to attach older external tape drives & removable media that do not attach via newer adapter.
- Only on POWER8 systems
- Poor performance if attach disks with RAID protection

Virtualization

IBM i virtualization support summary

IBM i Virtualization Support	Configuration (Native, VIOS, iVirt)	IBM i 7.3	IBM i 7.2	IBM i 7.1
---- Enhancements from April / May 2016 (below) ----				
Live Partition Mobility - Support for active tapes	VIOS		Base	TR 4
---- Enhancements from Nov 2016 (below) ----				
vNIC fail-over	VIOS	TR 1	TR 5	N/A
Shared Ethernet Adapter (SEA) large send	VIOS	TR 1	TR 5	N/A

LPM support for active Tape drive

- Movement of an IBM i partition from one server to another while a tape drive is actively in use
- The tape device may be in the midst of a tape operation, such as save or restore, while the partition is moving to the target server, and it will continue to operate seamlessly during that move
- A remaining restriction is that the tape drive or tape library Vary On operation may fail during the move to another server. If a tape Vary On fails due to an LPM operation, just retry the Vary On
- Tape & tape library devices supported
  - Fibre Channel LTO5 and newer drives in the 7226 enclosure
  - TS3100/TS3200 (3573) with LTO5 and newer Fibre Channel drives
  - TS3310 (3576) with LTO5 and newer Fibre Channel drives
  - TS3500/TS4500 with LTO5 and newer, and 3592-E07 and newer Fibre Channel drives
  - ProtecTIER® virtual tape library, code level 3.3.5.1 or newer

vNIC Fail-over & SEA improvements

- SR-IOV vNIC Fail-over
  - Provides automated fail-over for SR-IOV network configurations
- Shared Ethernet Adapter (SEA) performance improvements
  - IBM i configurations with Virtual I/O Server (VIOS)
  - Leverage large send architecture
  - Performance gain varies, but should be especially useful for 10 Gb Ethernet

Additional Enhancements

Additional Enhancements

IBM i Functional Enhancements	IBM i 7.3	IBM i 7.2
-------- Enhancements from April and May 2016 (below) ---		
SSD Fuel Gauge	Base	TR 4
HyperSwap for DS8000 IASPs		
-------- Enhancements from November 2016 (below) ---		
Containers make USB Flash and RDX look like a stack of DVDs	TR 1	TR 5
New format for tape volume statistics	TR 1	NA
Identifying a partition with a UUID	TR 1	TR 5

Additional Enhancements

IBM i Functional Enhancements	IBM i 7.3	IBM i 7.2
-------- Enhancements from March 2017 (below) ---		
Serviceability improvements for severe errors	TR 2	TR 6
Flash drive no longer requires a physical pull or push when exported	TR 2	TR 6
Default setting for 4096 sector disk has been changed	TR 2	TR 6
DS8000 HyperSwap disks no longer require resume of normal replication before IPLing	TR 2	TR 6

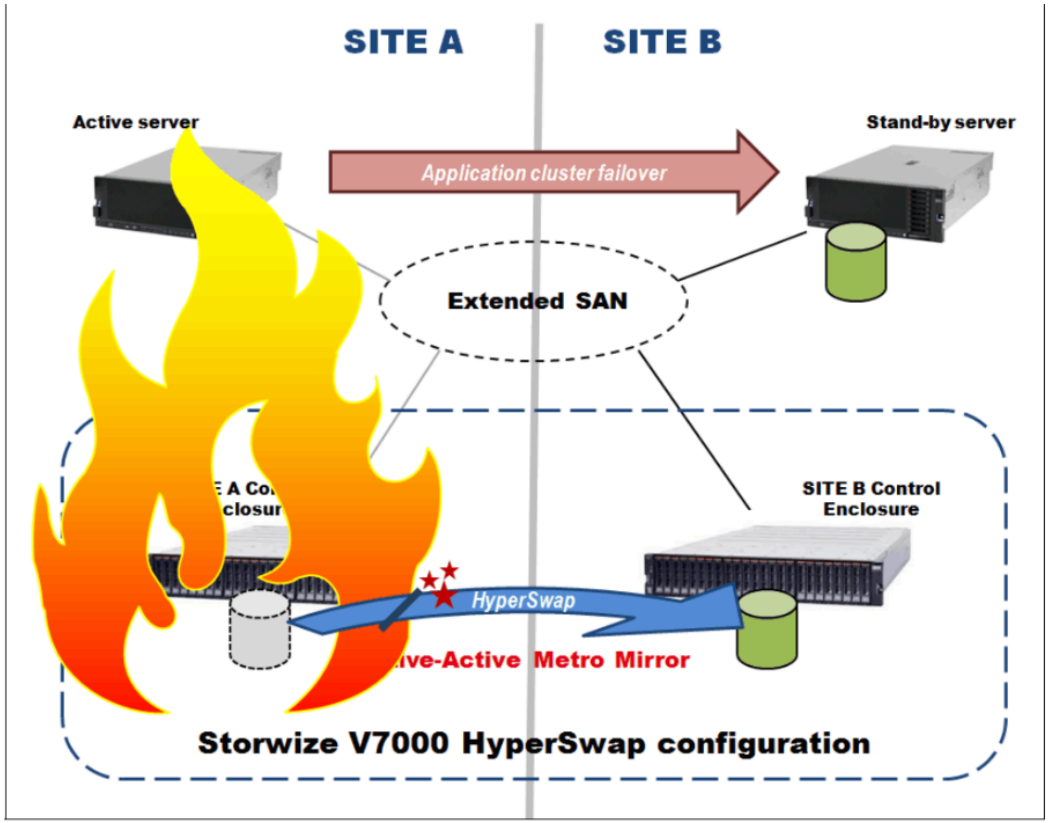
IBM i 7.3 TR2 & IBM i 7.2 TR6 was announced Feb 14 and GA March 17, 2017

PowerHA for i – HyperSwap for DS8000 IASPs

- IASP replication plus HyperSwap
- HyperSwap relationships can be configured for SYSBAS logical units only, IASP logical units only, or both
- HyperSwap for ‘near-zero’ downtime storage planned and unplanned outages
- PowerHA vary off/on of IASP for OS planned/unplanned outage, disaster recovery
- Available via 7.2 PTF

SVC & Storwize Hyperswap with LUN Level Switching

- PowerHA for V7R2 & V7R3 support Hyperswap with IASP.



Fuel Gauge for 1.9TB RI SSD

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- **SSD Fuel Gauge lists usage statistics and service information for Read Intensive SSDs**

- **See** www.ibm.com/developerworks/ibmi/techupdates/hw/issdfuelgauge (available April)

- **Information provided for each RI SSD:**
  - **Resource name**
  - **Location code**
  - **Part number**
  - **Drive serial number**
  - **Drive firmware level**
  - **Number of bytes written to SSD**
  - **Number of written bytes supported**
  - **Life remaining gauge**
  - **PFA trip (Predictive Failure Analysis warning has been logged)**
  - **Power on days**

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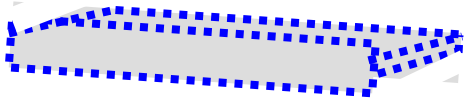
1. Resource name: DMP088
   Location code: U5887.001.G46A027-P1-D24
   Part Number: 00LY371
   Serial Number: STYAL696
   Firmware Level: 50A5
   Number of bytes written to SSD: 191618 GB
   Number of written bytes supported: 3588096 GB
   Life Remaining Gauge: 96%
   PFA trip (Predictive Failure Analysis warning has been logged): No
   Power on days: 158
```

New HMC Options

- Refreshed rack-mounted HMC
  - For POWER6 and later servers
  - 7042-CR9 --- follow-on to CR8

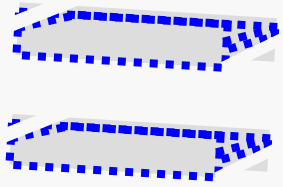
- New HMC virtual appliance (vHMC)
  - For POWER6, POWER7, POWER8 servers
  - Same functionality as traditional HMC (version 8)
  - Runs as virtual machine on x86 server



Options for attachment to a server

One or two HMCs

One vHMC and one HMC



One or two vHMCs

7042-CR9 HMC Details

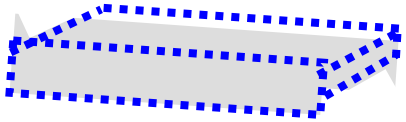
- For POWER6 and later servers
- 7042-CR9 --- follow-on to 7042-CR8
- Normal technology refresh
- Similar price to CR8

- Refreshed rack-mounted HMC
  - 2.4GHz Intel Xeon Processor
  - 16GB to 192GB memory (#EM20 16GB feature code)
    - Most clients expected to use 16GB or 32GB for HMC
  - One or optionally two 500GB SATA disk drives
    - Second drive allows RAID1 mirroring protection (recommended/defaulted)
    - Support any two of the eight physical hot-plug SFF bays (max 2 supported)
  - DVD-RAM
  - Four integrated Ethernet ports
  - Six USB ports
  - One PCIe slot
  - One or two power supplies (two recommended for hot-plug redundancy)
  - 1U (1 EIA)
  - Like CR8, does not offer an internal or external modem (or support one)

- HMC code level 8.4.0 or later
- 1U (1EA) rails included with CR9 (no separate feature code)

HMC Virtual Appliance Details

- IBM Virtual HMC Complete Software offering
  - License plus software maintenance
  - PID – 5765-HMV
  - Approximately $3k price including 1 year SW maint



- Virtual HMC Runs
  - On x86 Hardware (provided by client)
  - Under KVM or VMware virtualization (provided by client)
- New vHMC Complete Software offering
  - Activation engine – provides configuration on first boot
  - Accept License, locale, network, SSH, NTP
- Manages any POWER6 or later Power servers
- Version 8 HMC firmware
- Can be used with or without hardware HMCs

Optical Containers Make USB Flash Look Like a Stack of DVDs

IBM i 7.3 TR 1

IBM i 7.2 TR 5

Scenario	Prior handling	New option	Benefit
Creating Optical Image Catalogs	Create only on disk (IFS)	Store Image catalog into QOPT file system on USB device	Makes data on USB media look like stack of DVDs
Use USB Flash drive to download PTFs	Not possible – instead stored image on disk in IBM i LPAR and added it to image catalog or burned it to DVD	Download ISO image of PTFs onto PC at office, move it to USB Flash drive, apply PTFs directly from Flash drive	Easy portability of PTFs
Storing image catalogs	Had to use expensive DASD and virtual media	Store image on USB Flash Drive. BP or ISV could take a USB Flash Drive to a customer site	USB is less expensive and more portable
Back-ups with RDX media	Incremental saves in separate directories, followed by deletes for re-use, resulted in file fragmentation & performance degradation	Partition RDX media into multiple virtual disks to allow multiple incremental saves	Allows RDX media to be leveraged for nightly back-ups, weekly back-ups, etc. ** Although these virtual disk images cannot be used for D-mode IPL, they are very useful for restoring data after IPL.

Resources link

- IBM i – Hardware & Firmware enhancements
  - https://www.ibm.com/developerworks/community/wikis/home?lang=en#!/wiki/IBM%20i%20Technology%20Updates/page/Hardware%20and%20Firmware

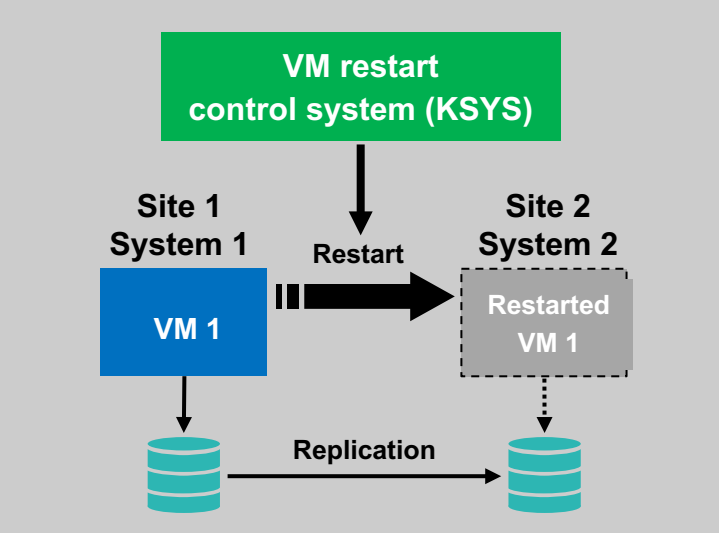
GDR for Power Systems

Geographically Dispersed Resiliency

What is the Geographically Dispersed Resiliency (GDR) for Power Systems DR solution?

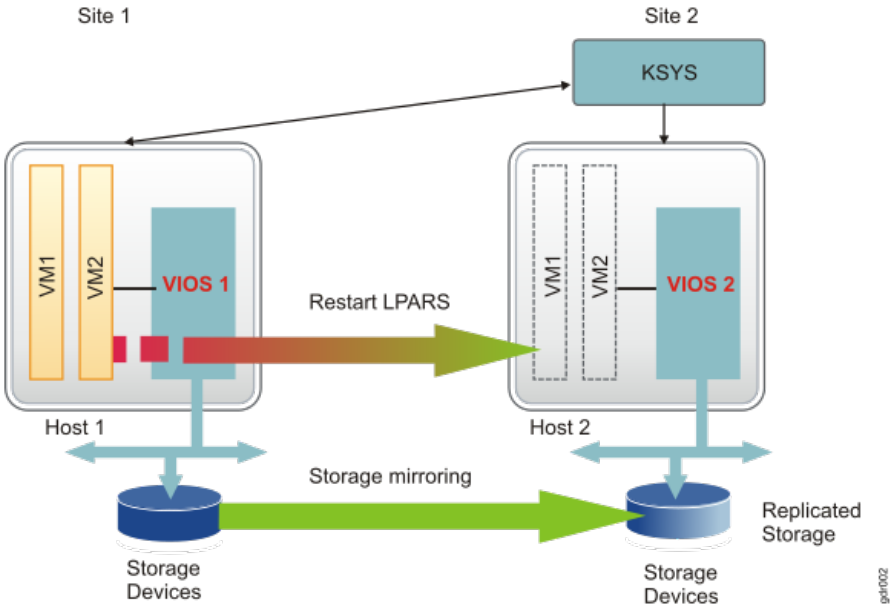
A simplified way to manage DR

- Automated DR management
- Improved economics by eliminating the need for hardware and software resources at the backup site
- Easier deployment for disaster recovery operations; unlike clustering or middleware replication technologies, VM restart technology has no operating system or middleware dependencies.



- Support for IBM POWER7® and POWER8® Systems
- Support for heterogeneous guest OSs
  - AIX
  - Red Hat
  - SUSE
  - Ubuntu
  - **IBM i with GDR v1.1 SP1 (Ann May 9 – GA June 23)**

GDR for Power Systems – how it works



- The storage subsystem at the backup host is prepared and mapped to VIOS and then VM1 and VM2 are booted up
- VMs from site 1 are now restarted on the backup host in site 2
- The underlying mechanism that enables this to happen is the KSYS orchestrator at site 2
- From a customer perspective, this operation is accomplished with a single command

Power Systems

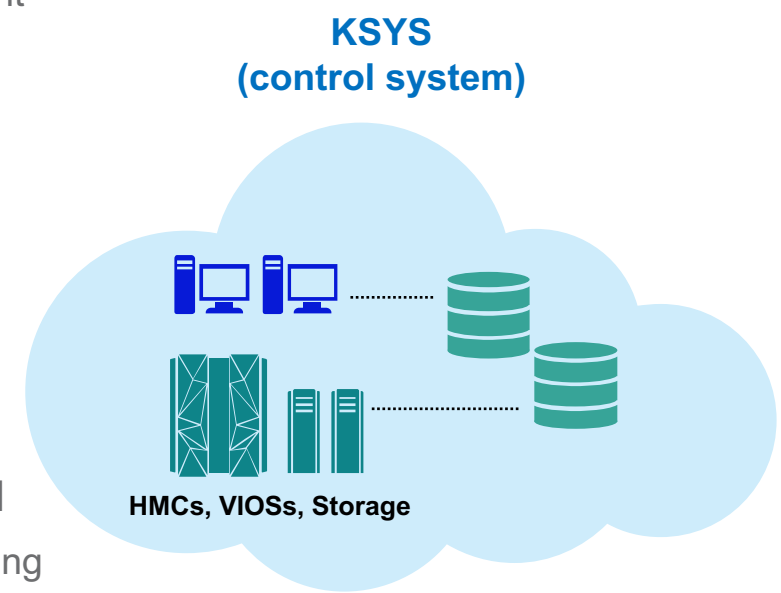
GDR helps to optimize your business continuity plan.

Automation

- A more reliable, consistent recovery time
- Help in reducing or eliminating human intervention and errors

Capacity management

- Cross-site or intrasite CPU and memory adjustments before DR
- Power Systems enterprise pool exploitation



Single point of control

- Centralized status reporting
- Centralized administration through a hardware management console (HMC) facilitating functions such as centralized live partition mobility (LPM) initiations and more
- Single command-based administration

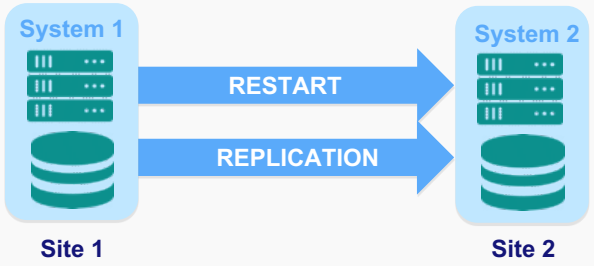
Validation

- Daily verification across sites for issues such as missing mirrors and more
- Email alerts to administrators
- Facilitation of regular testing for repeatable results

GDR for Power – disaster recovery made simple

GDR for Power (Client datacenters)

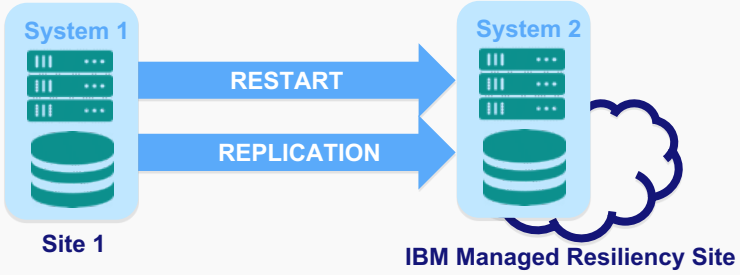
- Automates disaster recovery operations
- Restart VMs at a secondary site
- Single point of control for ease of management
- Co-exists with PowerHA, PowerVC and LPM environments
- E870/E880 capacity back up (CBU) for significant savings



Support for heterogeneous guest operating systems:
AIX, RedHat, SUSE, Ubuntu (IBM i 2017)
EMC Storage support initially, additional storage options in 2017

IBM DRaaS (IBM hosted, available in 2017)

- IBM managed and/or hosted resiliency services
- Reduce total cost of ownership by reducing infrastructure costs
- Faster, agile recovery, using a managed cloud in your private, hybrid or public cloud environment
- Continuous monitoring by IBM insures that your disaster recovery environment is always ready



All plans subject to change at the discretion of IBM

DRaaS in the IBM cloud provides Automated Disaster Recovery management, Economics of eliminating redundant software resources, and is Easy to deploy

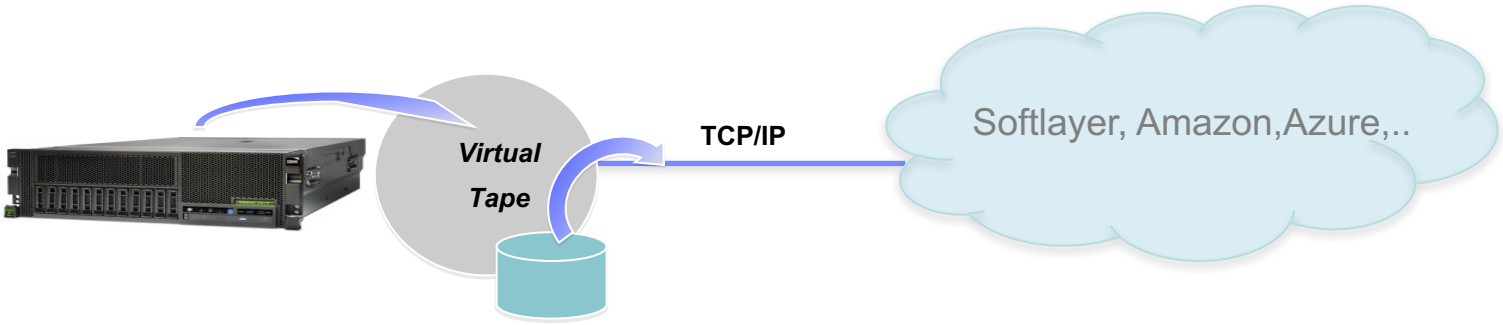
statement of direction;
As part of the Resiliency portfolio IBM will look to continue the integration of GDR into our Disaster Recovery as a Service offering providing increased value to our client base. IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products or services is intended to outline our general direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products or services is not a commitment, promise, or legal obligation to deliver any material, code, functionality, or service. Information about potential future products or services may not be incorporated into any contract. The development, release, and timing of any future services or features or functionality described for our products remain at our sole discretion.

Cloud Solutions Announcements

IBM i Cloud Solutions announcement

- **Cloud Storage solution for i**
  - Ann. October 11th 2016 / GA October 28th 2016
- **IBM Cloud Management Console for Power Systems**
  - Announcement & GA May 9th 2017
- **IBM PowerVC v1.3.3**
  - Announcement May 9 / GA June 23 2017

Cloud Storage Solutions for i



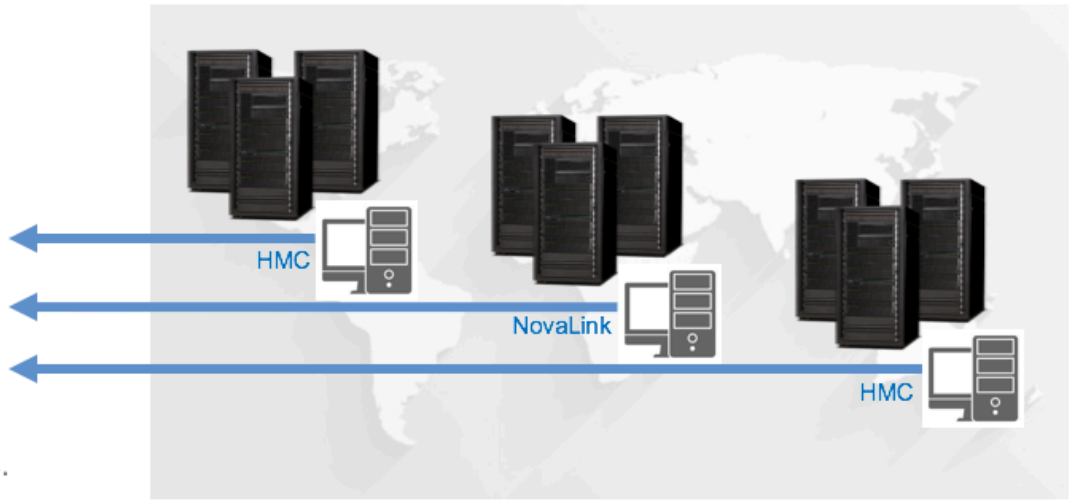
- Cloud Storage Solutions for i is an API that enables deployment of IBM i data to a public cloud
  - Initially targeted for customers with under 1 Tbyte of data
  - Initial public cloud provider: Softlayer
- Initial product offering will feature
  - Turn-key BRMS setup and run with virtual tape management
  - Security via VPN
- Auto save and synchronize files in the IBM i IFS directory (future plan)
  - Roll your own backup/recovery (bandwidth considerations)

IBM Cloud Management Console for POWER Systems

IBM Cloud Management Console for Power Systems

Cloud-based micro-services that can be accessed securely, anytime, anywhere for your complete enterprise

As data centers scale out and up, there's an increasing need for a complete view of the infrastructure.



Inventory Aggregation
- Power Systems, HMCs, LPARs, etc.
- Health and State
- Hardware Inventory
- Resource Groups

Logging and Auditing
- Log Aggregation
- Telemetry

Performance Monitoring
- Aggregated views across Enterprise
- Energy Monitoring
- OS Metrics

With a roadmap to include features like:
- Predictive trends in performance and auditing
- Capacity On Demand compliance monitoring and billing
- Software Defined Environments topology

HMC 8.8.6 SP1 (May)
PowerVM NovaLink V1.0.0.6

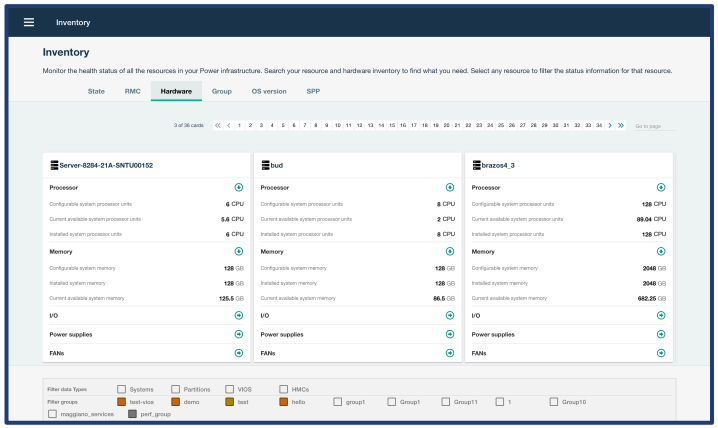
Ann May 9th
GA May 9th

Power Systems

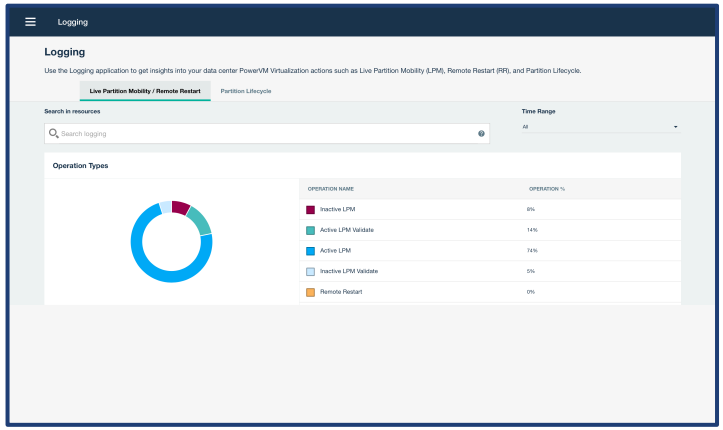
for Business

Current Applications Available

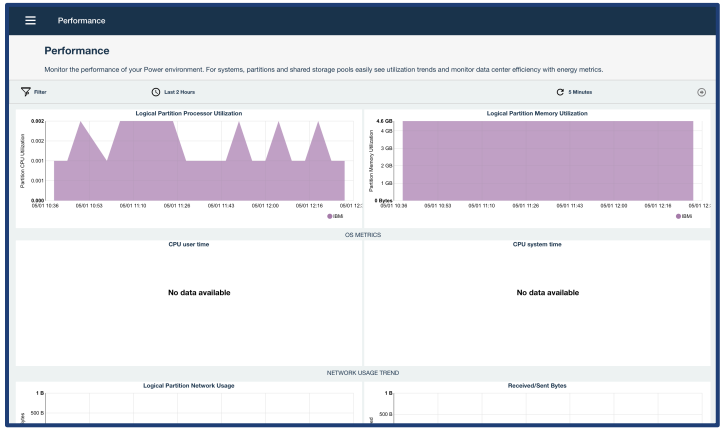
IBM Cloud Management Console is a ***platform***. Because of this, these are the first apps that are available, but there is a roadmap of continuous development – which means continuous value delivered directly to the client.



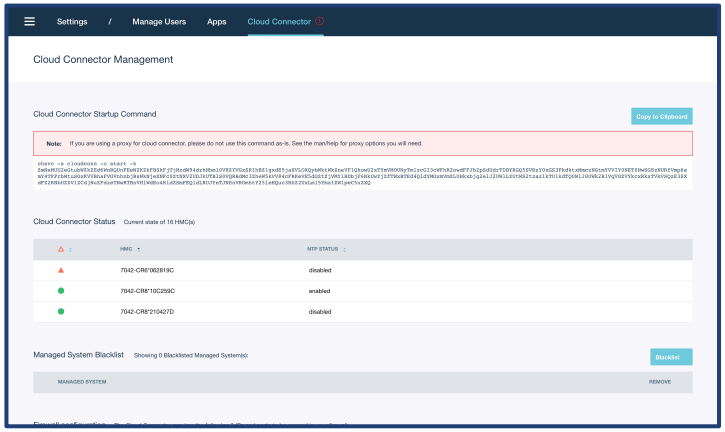
Monitor the health status of all the resources in your Power infrastructure. Search your resource and hardware inventory to find what you need.



Insights into your data center PowerVM Virtualization actions such as Live Partition Mobility (LPM), Remote Restart (RR), and Partition Lifecycle.



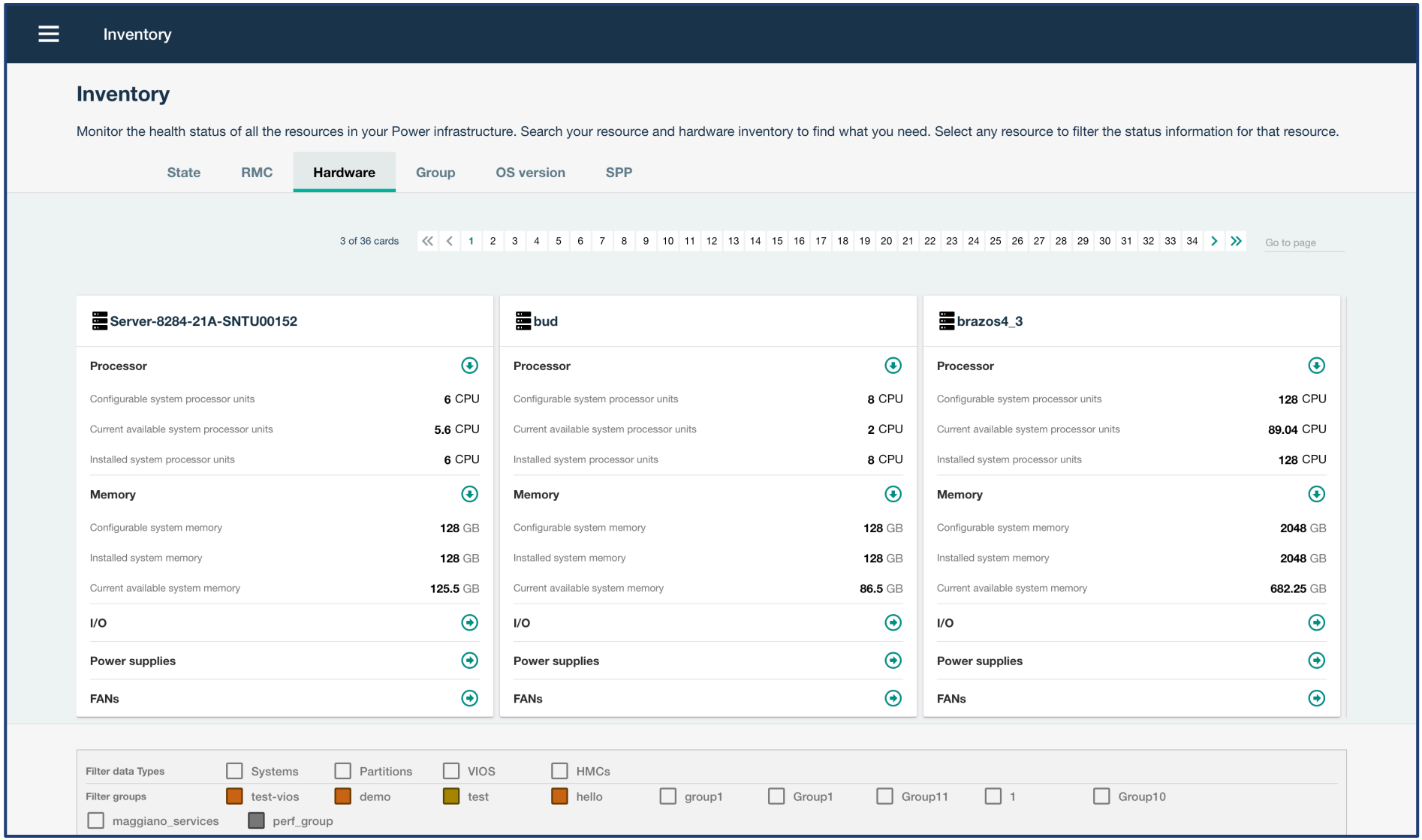
Monitor the performance of your Power environment. For systems, partitions and shared storage pools easily see utilization trends and monitor data center efficiency with energy metrics.



Manage user access by application, disable whole apps, manage blacklisted systems and firewall configurations

Power Systems

Inventory Application



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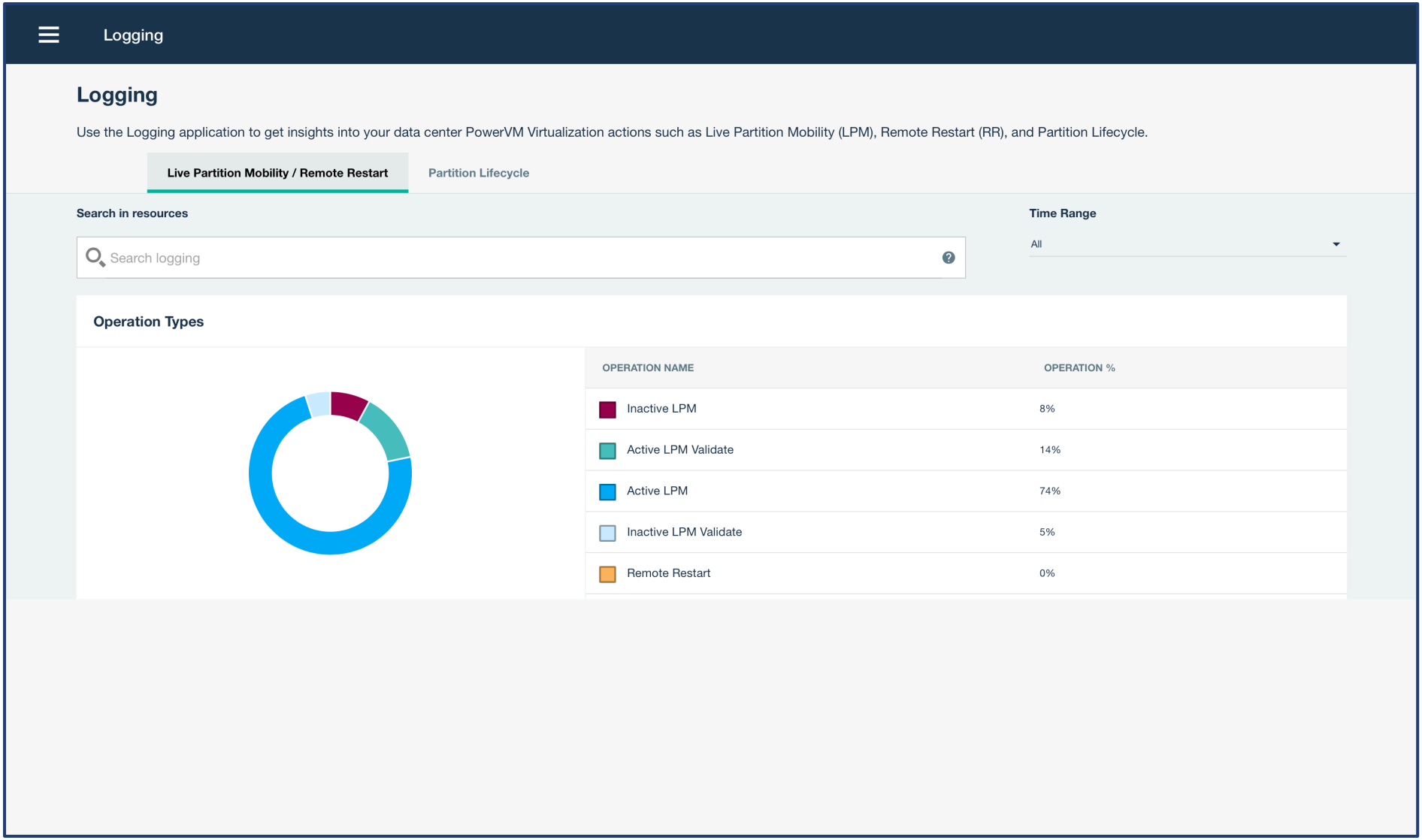
Power Systems

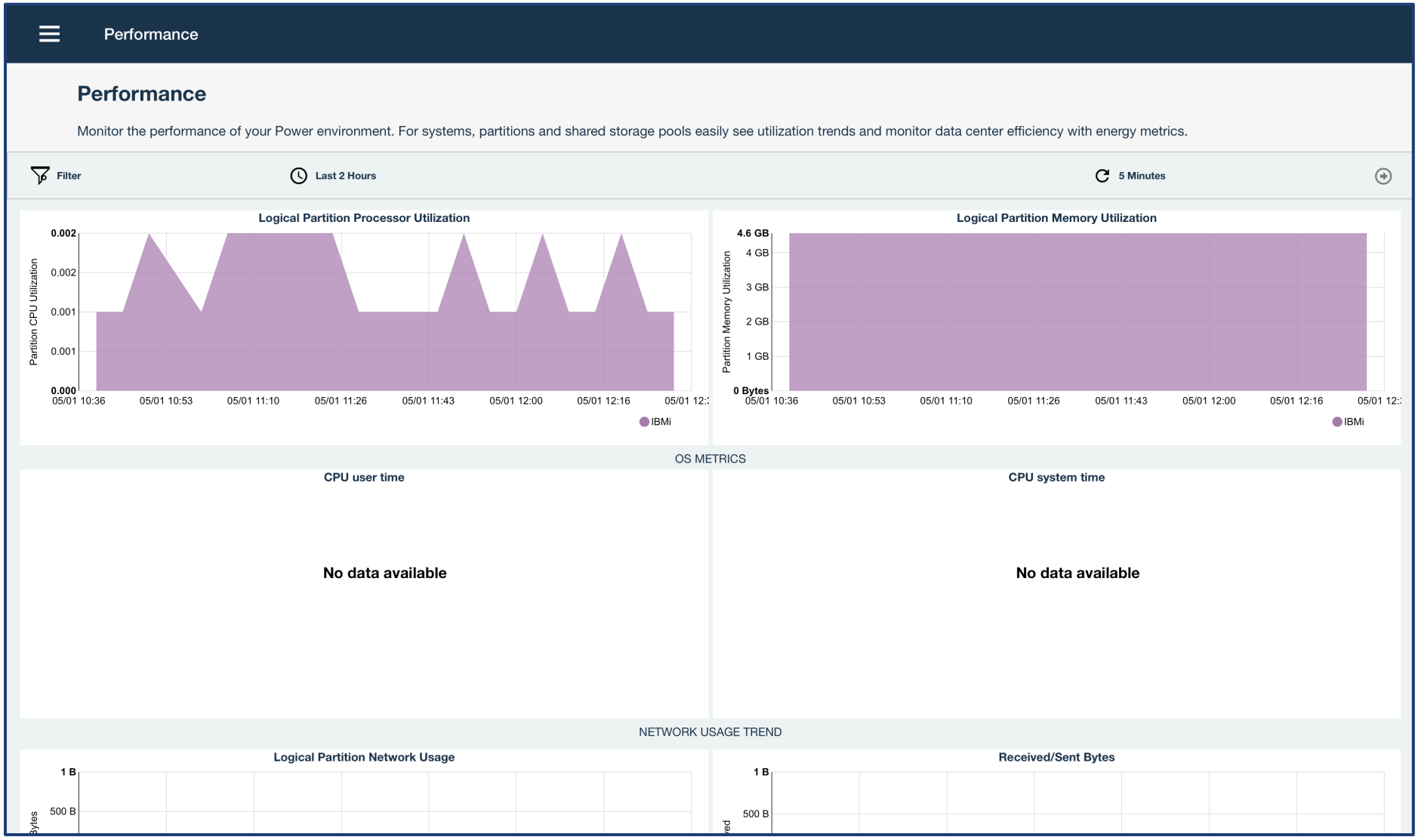
Logging Applications



Insights into your data center PowerVM Virtualization actions such as Live Partition Mobility (LPM), Remote Restart (RR), and Partition Lifecycle.

Power Systems

Performance Applications



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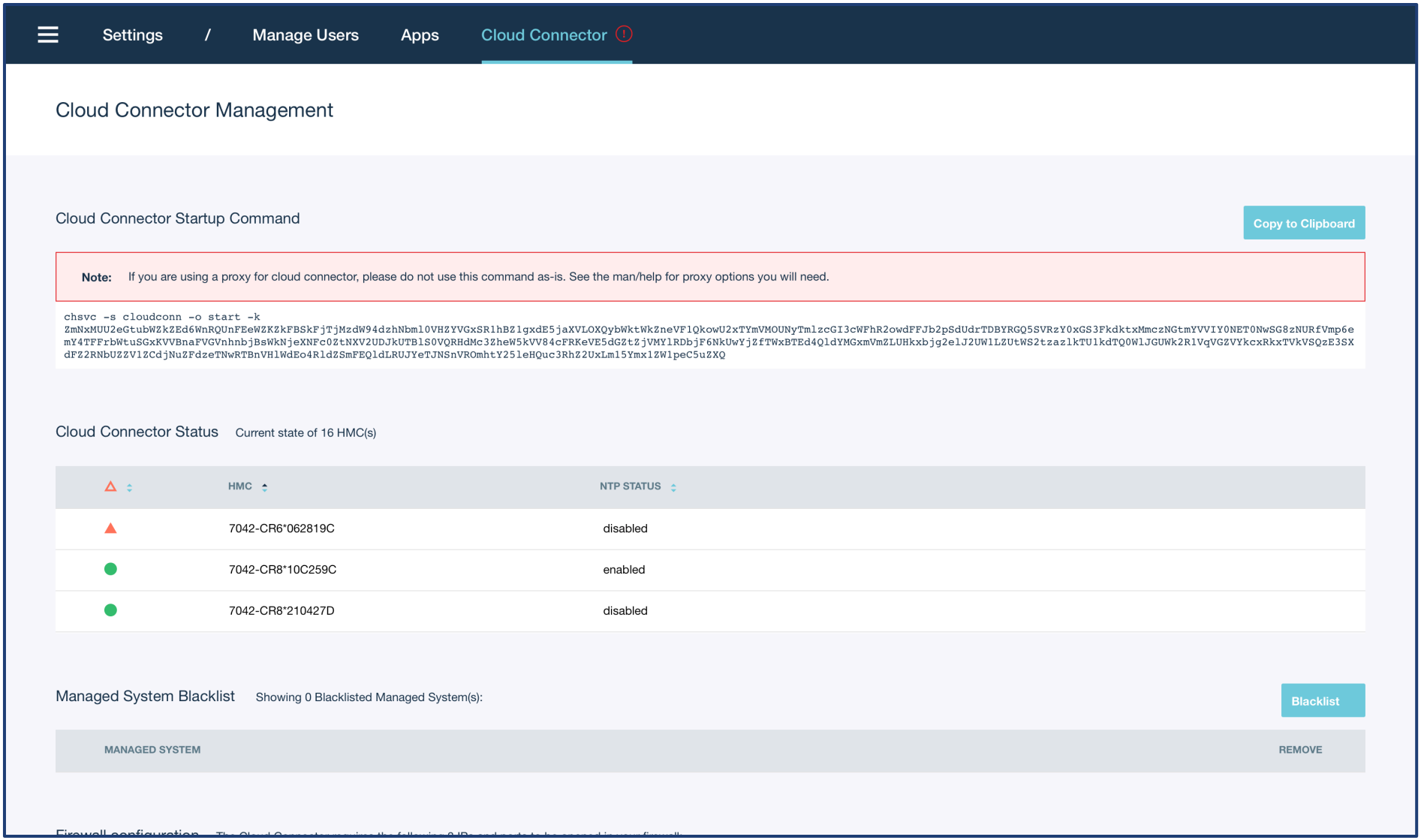
Power Systems

Cloud Connector Management



Manage user access by application, disable whole apps, manage blacklisted systems and firewall configurations

Power Systems

PowerVC v1.3.3 - Simplifying Management for Private Cloud Deployment

PowerVC

Key Dates: Announce: **May 9**
GA: **June 23**

- ✓ ***Usability improvements in the Cloud Self-Service Portal***
- ✓ ***New GA support for PowerVM Software Defined Networking***
- ✓ ***Enhanced support for new storage configurations***
- ✓ ***Dynamic Resource Optimizer support for Enterprise Pool mobile memory balancing***

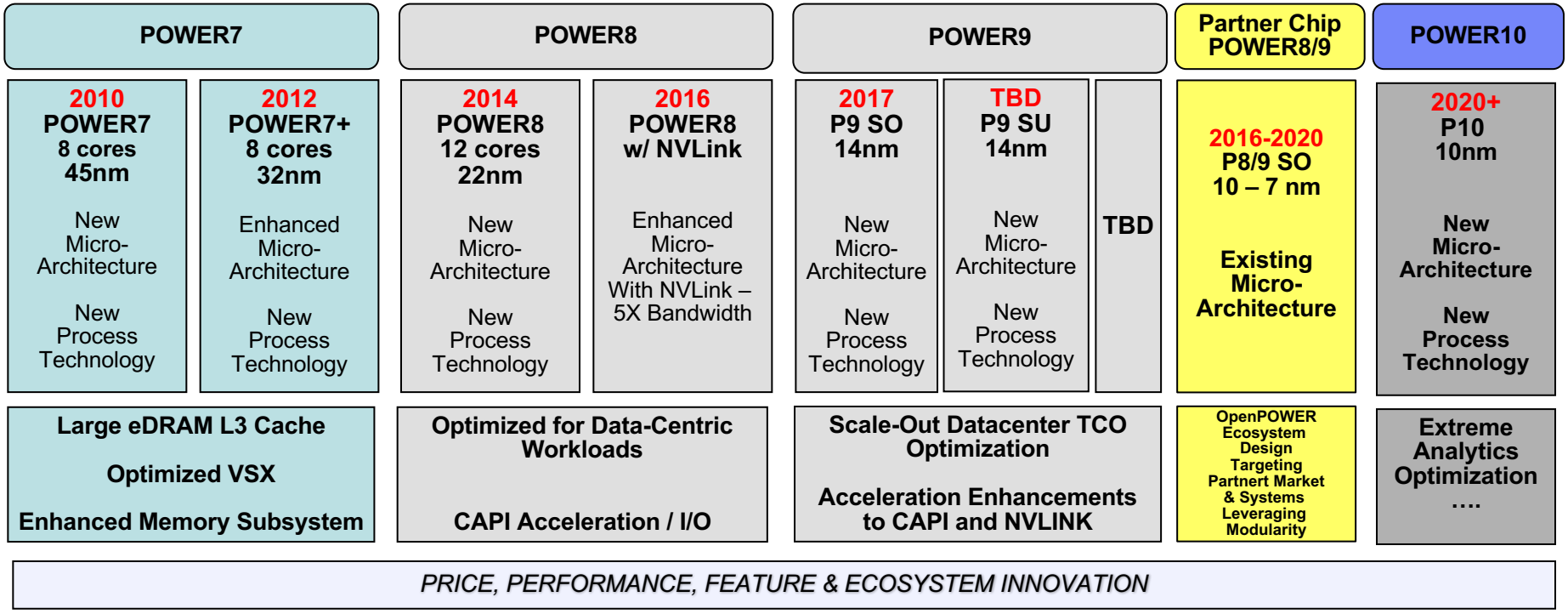
What's New / Key Features

- Self-service cloud improvements
  - New UI for cloud admins which simplifies policy management
  - New Project-level quotas which provide finer control over tenants usage
  - New email alerts for cloud admins for provisioning requests
  - Improved metering data with more detail on resource usage by tenant
- Management of PowerVM Open I/O based software defined networks which includes VXLANs and external IP addresses
- Brocade virtual fabric support
- Reference architecture to enable HA configurations for the PowerVC management server
- Dynamic Resource Optimizer can now balance Enterprise Pools mobile memory for NovaLink configurations
- Improved usability now allows renaming VMs in the PowerVC console
- Support for deploying VMs with 1/20th of a core granularity

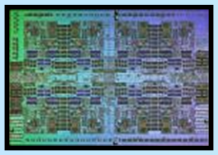
IBM POWER 9

Roadmap POWER Processors

Power Systems invested in the future with promising Roadmap POWER8 and POWER9



POWER Processor Technology Roadmap

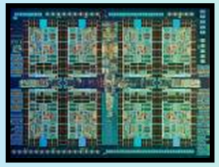


POWER7
45 nm

Enterprise

- 8 Cores
- SMT4
- eDRAM L3 Cache

1H10

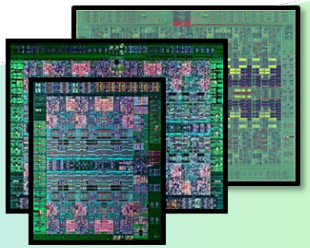


POWER7+
32 nm

Enterprise

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

2H12

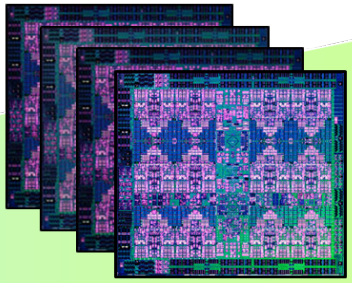


POWER8 Family
22nm

Enterprise & Big Data Optimized

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

1H14 – 2H16



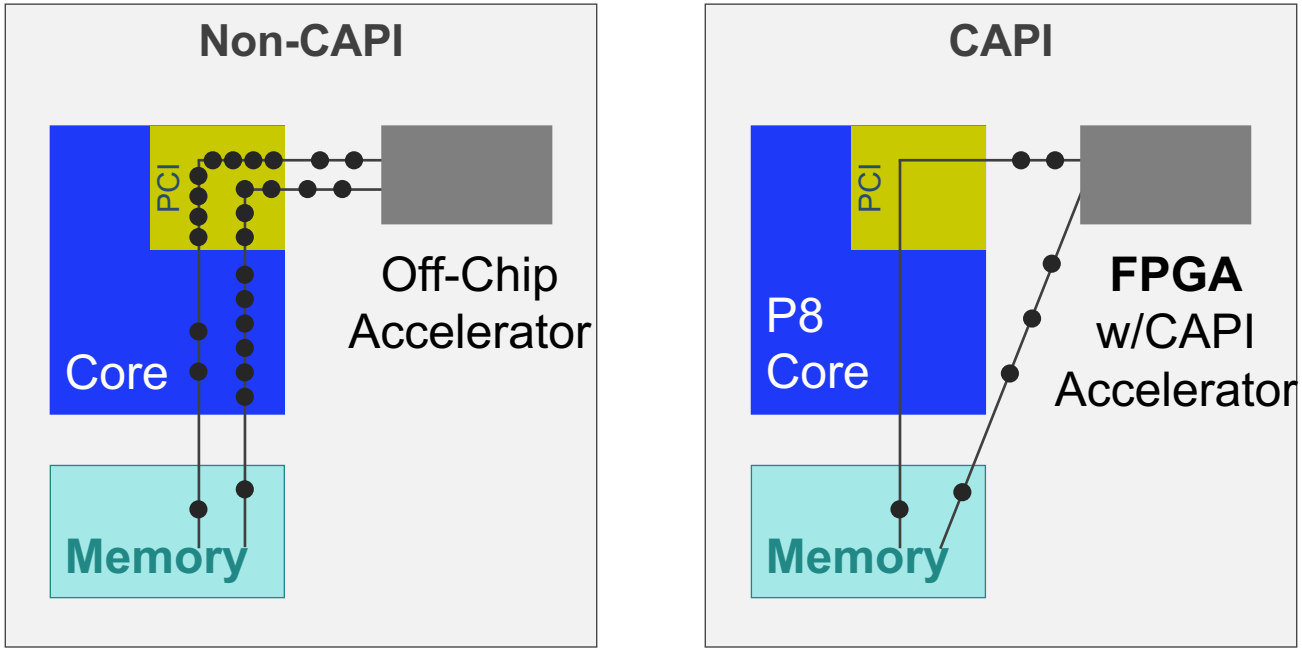
POWER9 Family
14nm

Built for the Cognitive Era

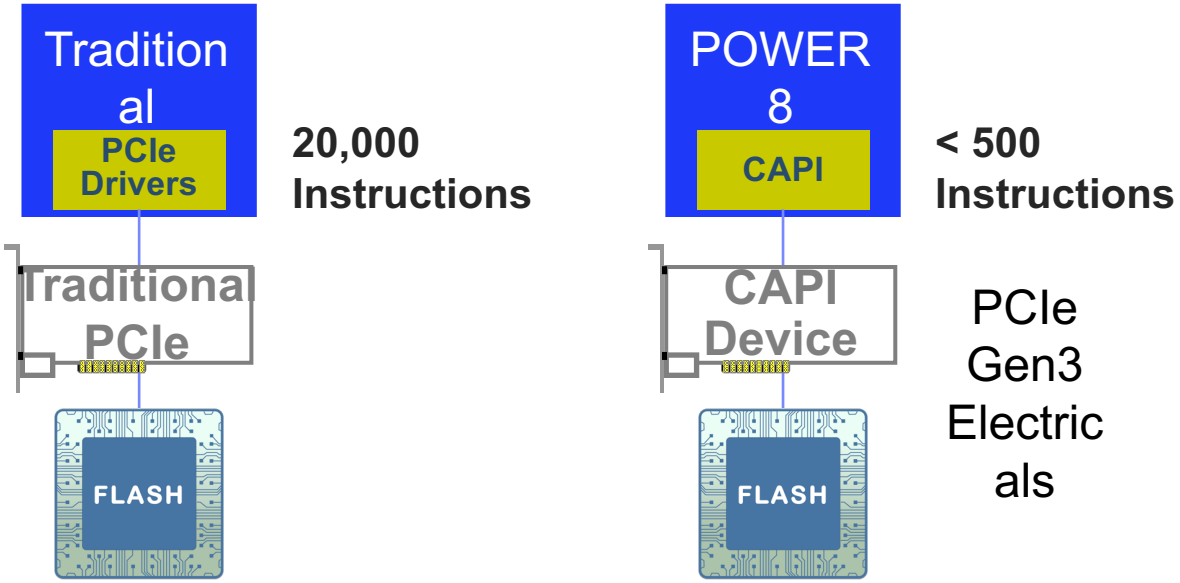
- Enhanced Core and Chip Architecture Optimized for Emerging Workloads
- Processor Family with Scale-Up and Scale-Out Optimized Silicon
- Premier Platform for Accelerated Computing

2H17 – 2H18+

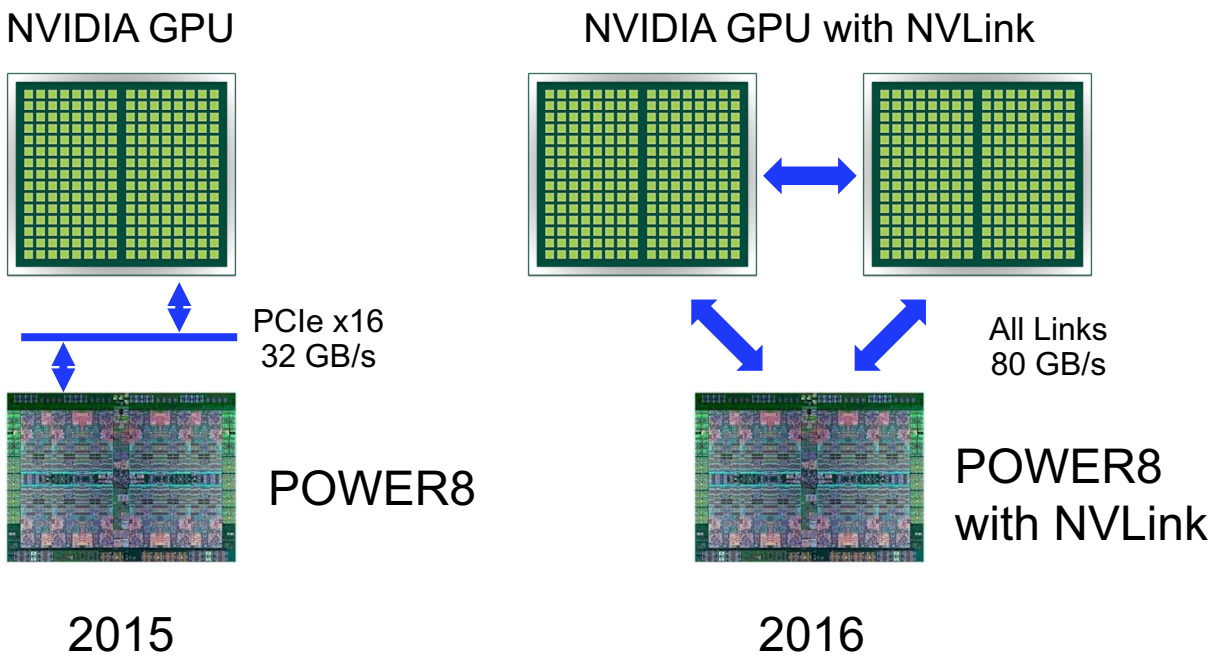
Coherent Accelerator Processor Interface



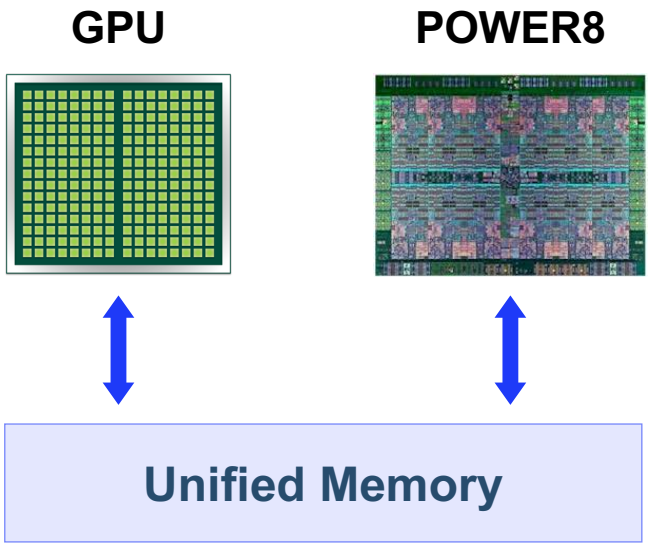
CAPI Lowers Flash Latency



Power Systems and NVIDIA GPUs



NVIDIA Pascal P100 Unified Memory



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

POWER9 Family – Deep Workload Optimizations

Emerging Analytics, AI, Cognitive
- New core for stronger thread performance
- Delivers 2x compute resource per socket
- Built for acceleration – OpenPOWER solution enablement

Technical / HPC
- Highest bandwidth GPU attach
- Advanced GPU/CPU interaction and memory sharing
- High bandwidth direct attach memory

Cloud / HSDC
- Power / Packaging / Cost optimizations for a range of platforms
- Superior virtualization features: security, power management, QoS, interrupt
- State of the art IO technology for network and storage performance

Enterprise
- Large, flat, Scale-Up Systems
- Buffered memory for maximum capacity
- Leading RAS
- Improved caching

POWER9 Processor – Common Features

New Core Microarchitecture

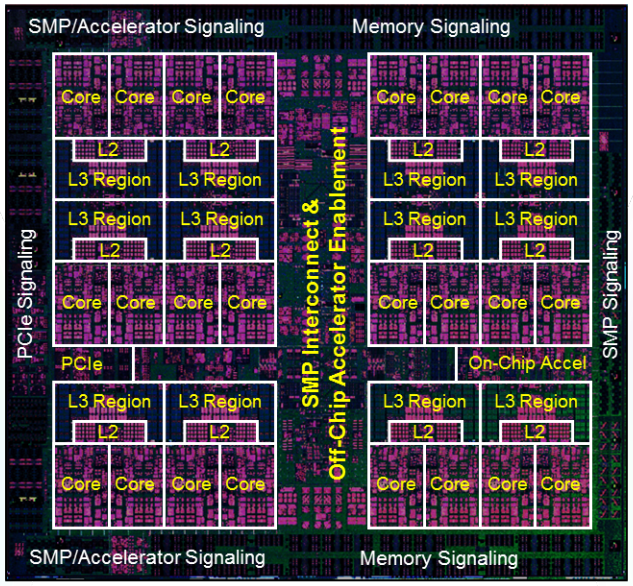
- Stronger thread performance
- Efficient agile pipeline
- POWER ISA v3.0

Enhanced Cache Hierarchy

- 120MB NUCA L3 architecture
- 12 x 20-way associative regions
- Advanced replacement policies
- Fed by 7 TB/s on-chip bandwidth

Cloud + Virtualization Innovation

- Quality of service assists
- New interrupt architecture
- Workload optimized frequency
- Hardware enforced trusted execution



14nm finFET Semiconductor Process

- Improved device performance and reduced energy
- 17 layer metal stack and eDRAM
- 8.0 billion transistors

Leadership Hardware Acceleration Platform

- Enhanced on-chip acceleration
- Nvidia NVLink 2.0: High bandwidth, advanced new features
- CAPI 2.0: Coherent accelerator and storage attach (PCIe G4)
- New CAPI: Improved latency and bandwidth, open interface

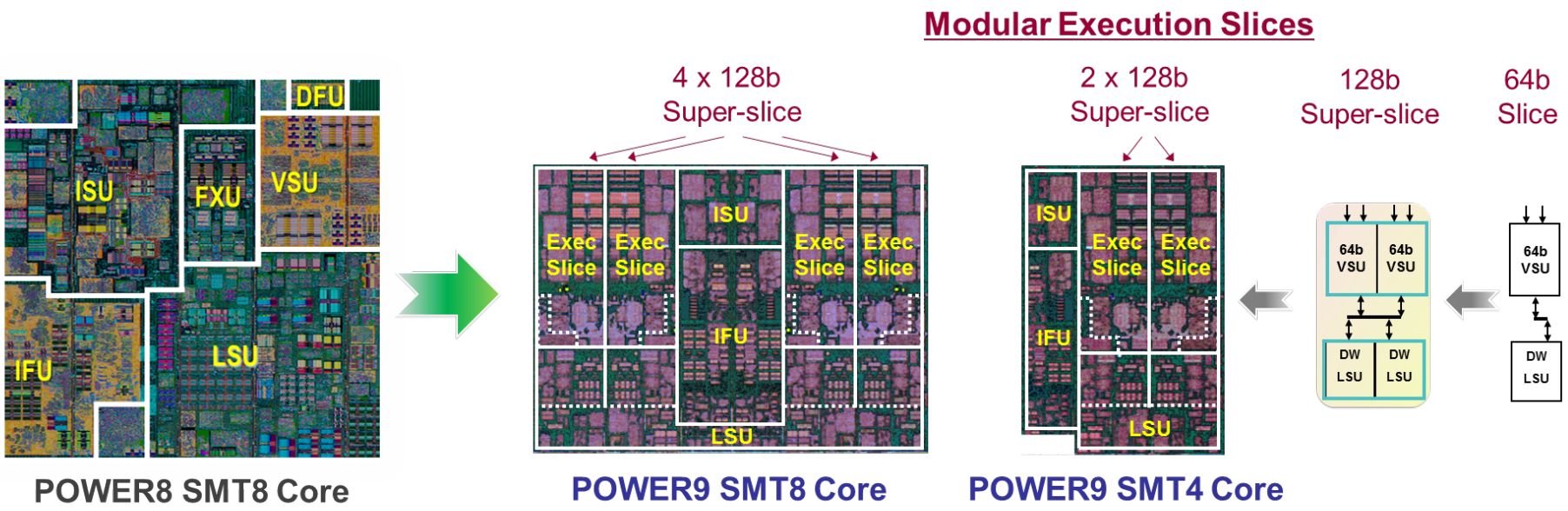
State of the Art I/O Subsystem

- PCIe Gen4 – 48 lanes

High Bandwidth Signaling Technology

- 16 Gb/s interface
  - Local SMP
- 25 Gb/s interface – 25G Link
  - Accelerator, remote SMP

POWER9 Core Execution Slice Microarchitecture



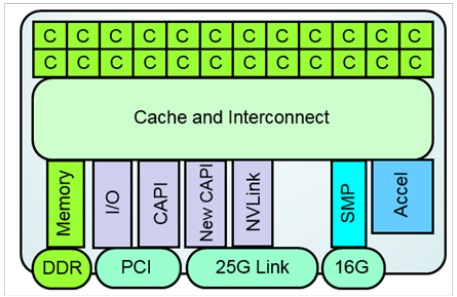
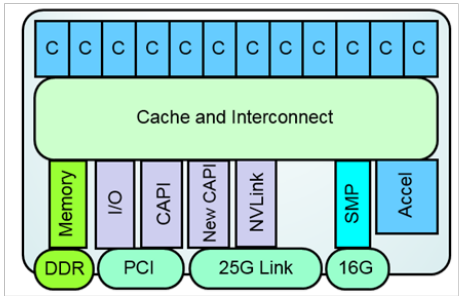
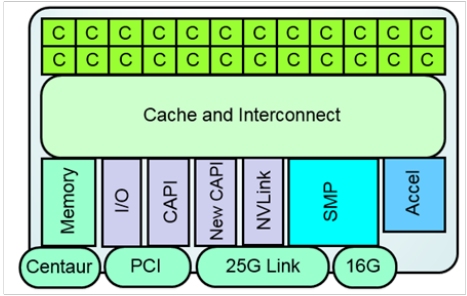
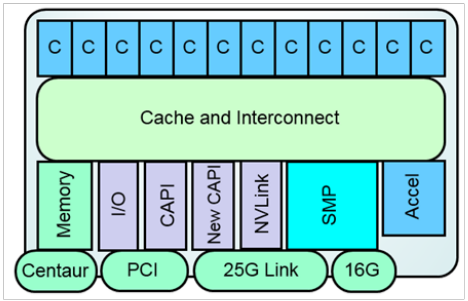
Re-factored Core Provides Improved Efficiency & Workload Alignment

- Enhanced pipeline efficiency with modular execution and intelligent pipeline control
- Increased pipeline utilization with symmetric data-type engines: Fixed, Float, 128b, SIMD
- Shared compute resource optimizes data-type interchange

POWER9 Processor Family

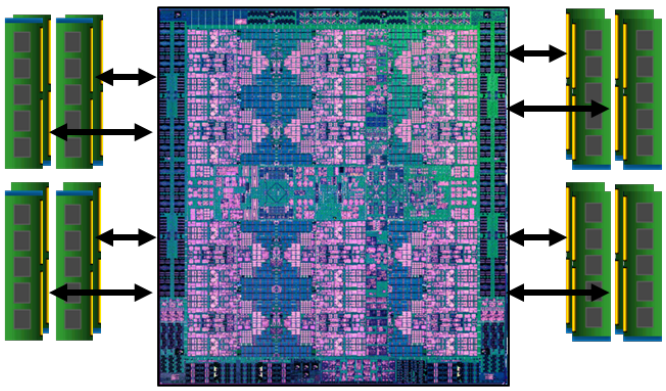
Four targeted implementations

Core Count / Size

SMP scalability / Memory subsystem	SMT4 Core 24 SMT4 Cores / Chip Linux Ecosystem Optimized	SMT8 Core 12 SMT8 Cores / Chip PowerVM Ecosystem Continuity
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 • Additional lanes of 25G Link (96 total) Buffered Memory Attach • 8 Buffered channels		

POWER9 – Dual Memory Subsystems

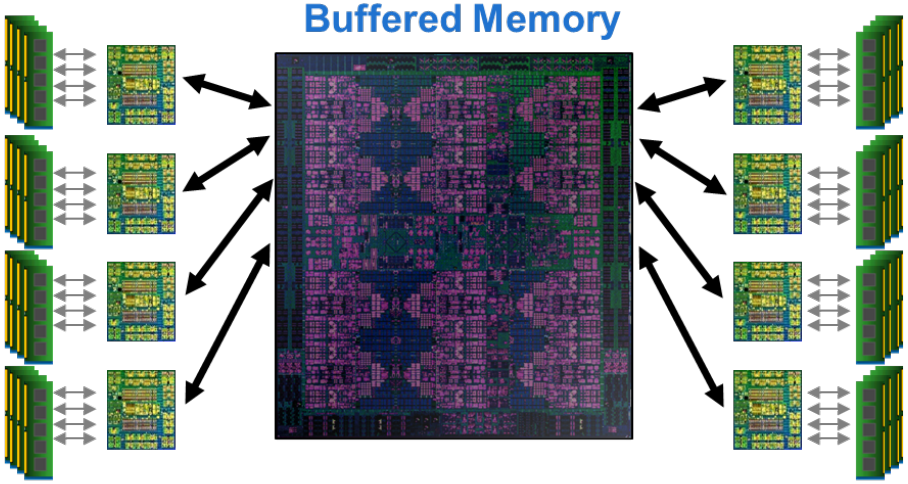
Scale Out
Direct Attach Memory



8 Direct DDR4 Ports

- Up to 120 GB/s of sustained bandwidth
- Low latency access
- Commodity packaging form factor
- Adaptive 64B / 128B reads

Scale Up
Buffered Memory



8 Buffered Channels

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

New POWER9 Cores

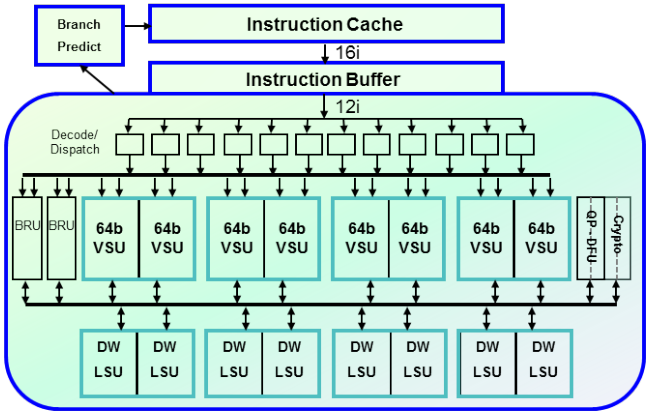
Optimized for Stronger Thread Performance and Efficiency

- Increased execution bandwidth efficiency for a range of workloads including commercial, cognitive and analytics
- Sophisticated instruction scheduling and branch prediction for unoptimized applications and interpretive languages
- Adaptive features for improved efficiency and performance especially in lower memory bandwidth systems

Available with SMT8 or SMT4 Cores

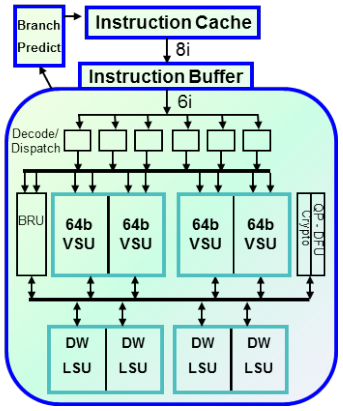
8 or 4 threaded core built from modular execution slices

POWER9 SMT8 Core
- PowerVM Ecosystem Continuity
- Strongest Thread
- Optimized for Large Partitions



SMT8 Core

POWER9 SMT4 Core
- Linux Ecosystem Focus
- Core Count / Socket
- Virtualization Granularity



SMT4 Core

POWER9 Core Pipeline Efficiency

Shorter Pipelines with Reduced Disruption

Improved application performance for modern codes

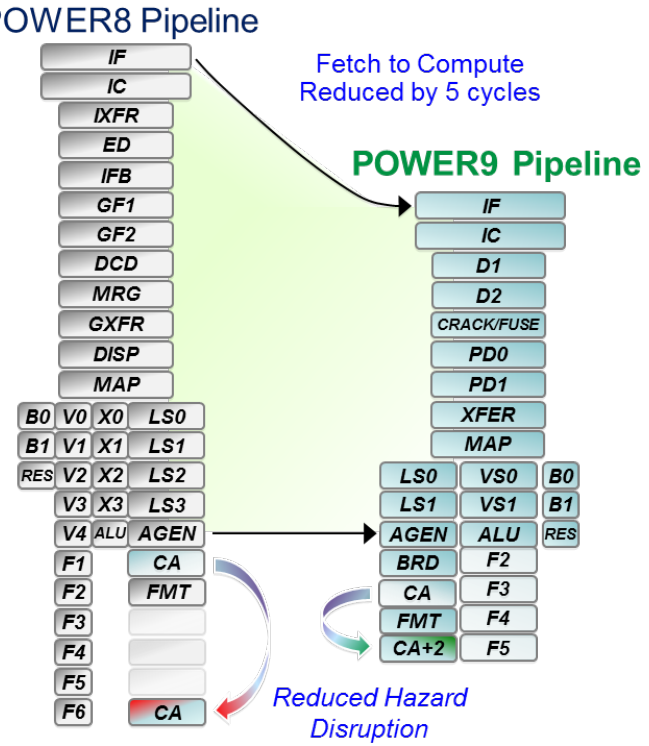
- **Shorten fetch to compute by 5 cycles**
- **Advanced branch prediction**

Higher performance and pipeline utilization

- **Improved instruction management**
  - Removed instruction grouping and reduced cracking
  - Enhanced instruction fusion
  - Complete up to 128 (64 – SMT4 Core) instructions per cycle

Reduced latency and improved scalability

- **Local pipe control of load/store operations**
  - Improved hazard avoidance
  - Local recycles – reduced hazard disruption
  - Improved lock management



POWER9 – Core Compute

SMT4 Core Resources

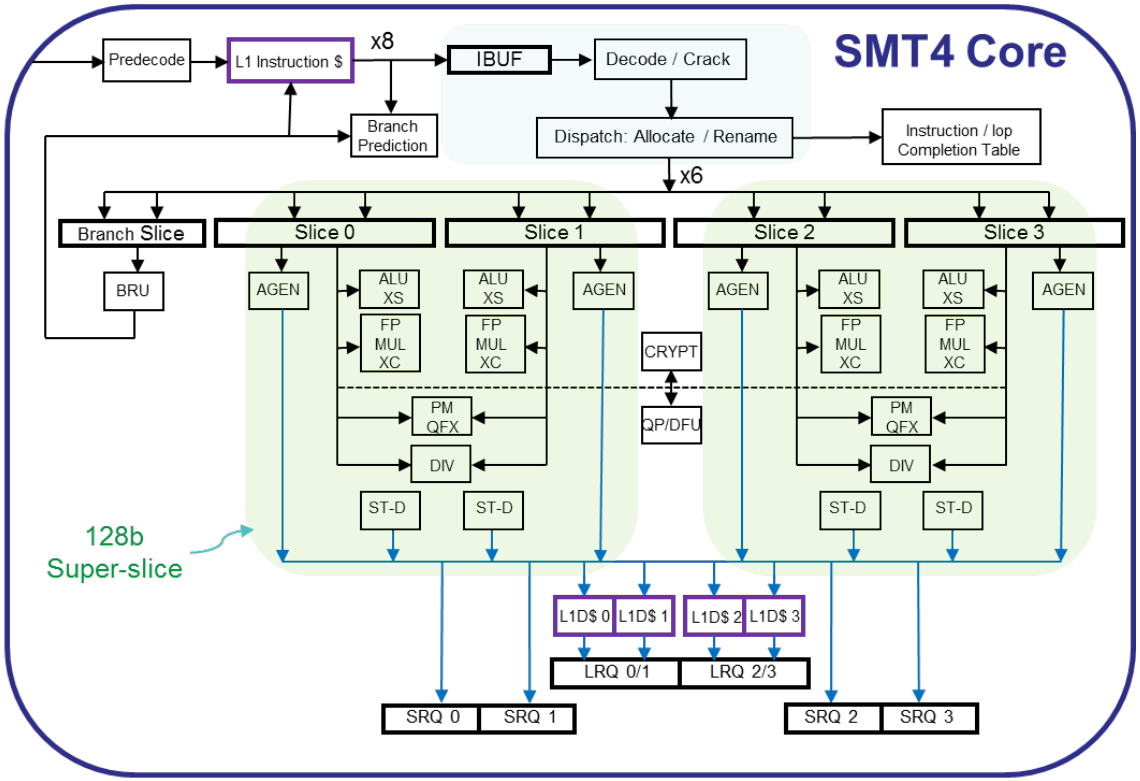
Fetch / Branch
- 32kB, 8-way Instruction Cache
- 8 fetch, 6 decode
- 1x branch execution

Slices issue VSU and AGEN
- 4x scalar-64b / 2x vector-128b
- 4x load/store AGEN

Vector Scalar Unit (VSU) Pipes
- 4x ALU + Simple (64b)
- 4x FP + FX-MUL + Complex (64b)
- 2x Permute (128b)
- 2x Quad Fixed (128b)
- 2x Fixed Divide (64b)
- 1x Quad FP & Decimal FP
- 1x Cryptography

Load Store Unit (LSU) Slices
- 32kB, 8-way Data Cache
- Up to 4 DW load or store

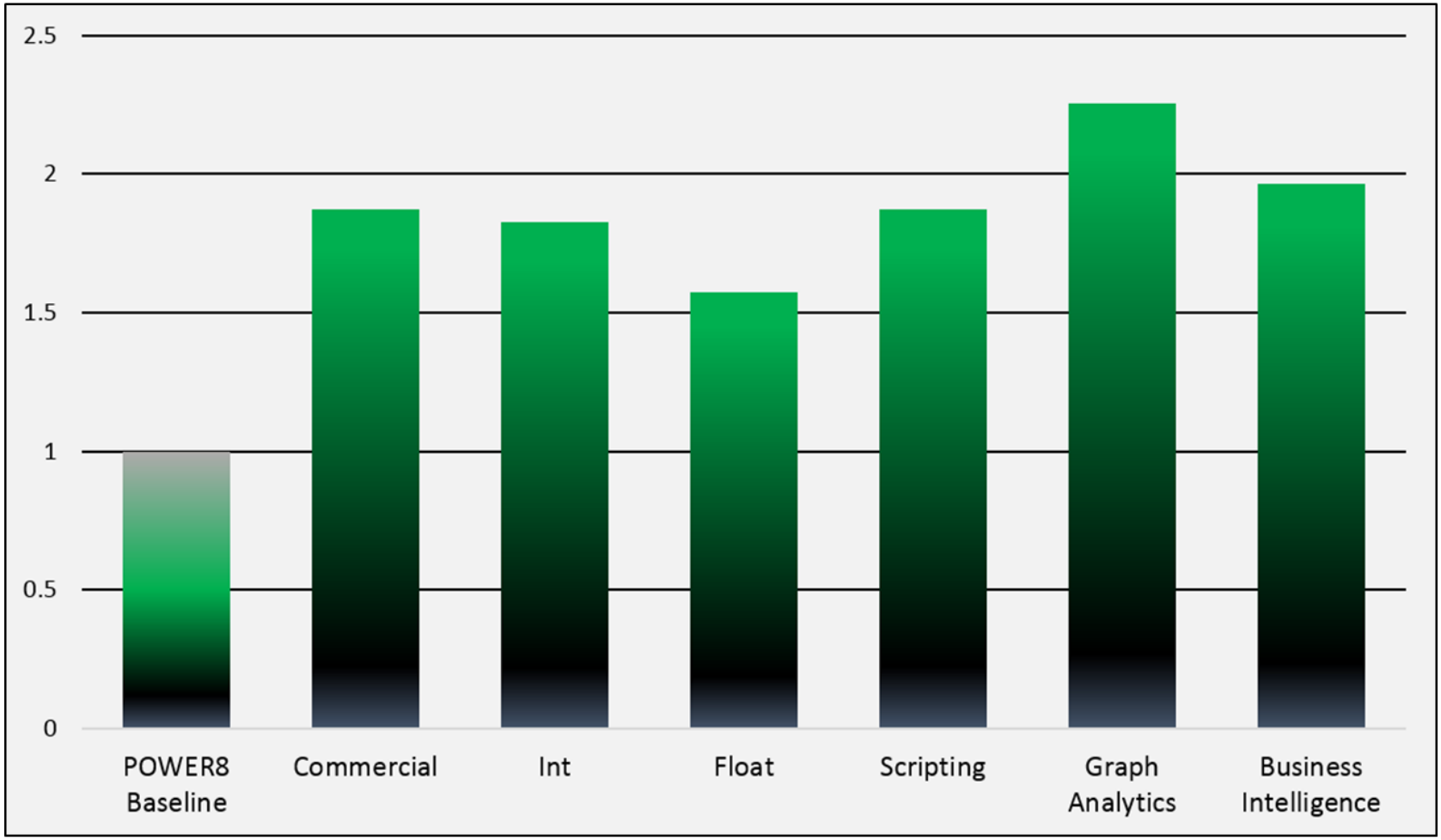
Symmetric Engines Per Data-Type for Higher Performance on Diverse Workloads



Efficient Cores Deliver 2x Compute Resource per Socket

POWER9 – CPU Core Performance

Socket Performance



Scale-Out configuration @ constant frequency

POWER ISA v3.0

New Instruction Set Architecture Implemented on POWER9

Broader data type support
- 128-bit IEEE 754 Quad-Precision Float – Full width quad-precision for financial and security applications
- Expanded BCD and 128b Decimal Integer – For database and native analytics
- Half-Precision Float Conversion – Optimized for accelerator bandwidth and data exchange

Support Emerging Algorithms
- Enhanced Arithmetic and SIMD
- Random Number Generation Instruction

POWER

Accelerate Emerging Workloads
- Memory Atomics – For high scale data-centric applications
- Hardware Assisted Garbage Collection – Optimize response time of interpretive languages

Cloud Optimization
- Enhanced Translation Architecture – Optimized for Linux
- New Interrupt Architecture – Automated partition routing for extreme virtualization
- Enhanced Accelerator Virtualization
- Hardware Enforced Trusted Execution

Energy & Frequency Management
- POWER9 Workload Optimized Frequency – Manage energy between threads and cores with reduced wakeup latency

POWER9 – Data Capacity & Throughput

Big Caches for Massively Parallel Compute and Heterogeneous Interaction

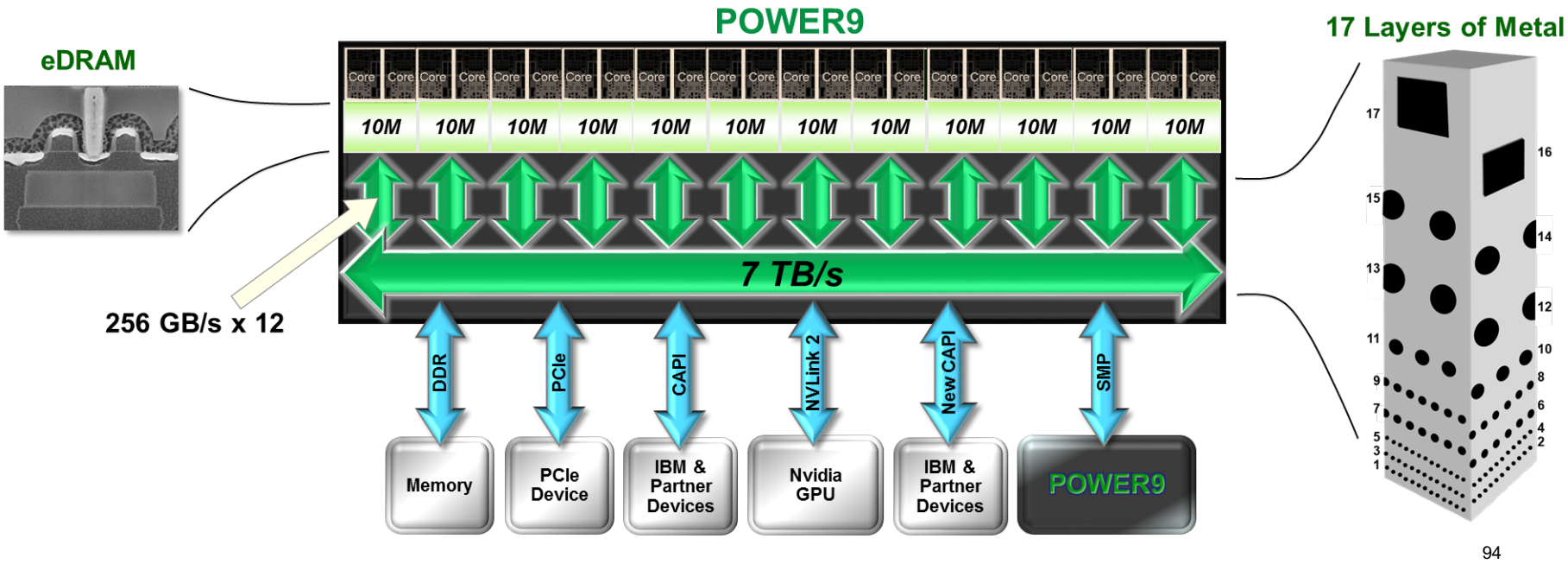
L3 Cache: 120 MB Shared Capacity NUCA Cache

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

Extreme Switching Bandwidth for the Most Demanding Compute and Accelerated Workloads

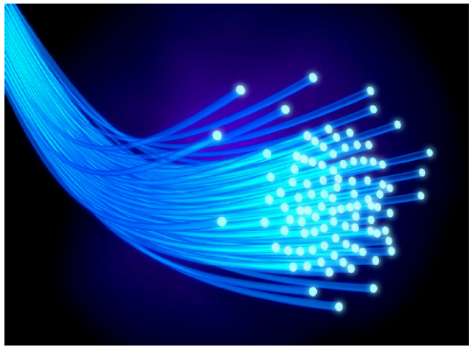
High-Throughput On-Chip Fabric

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

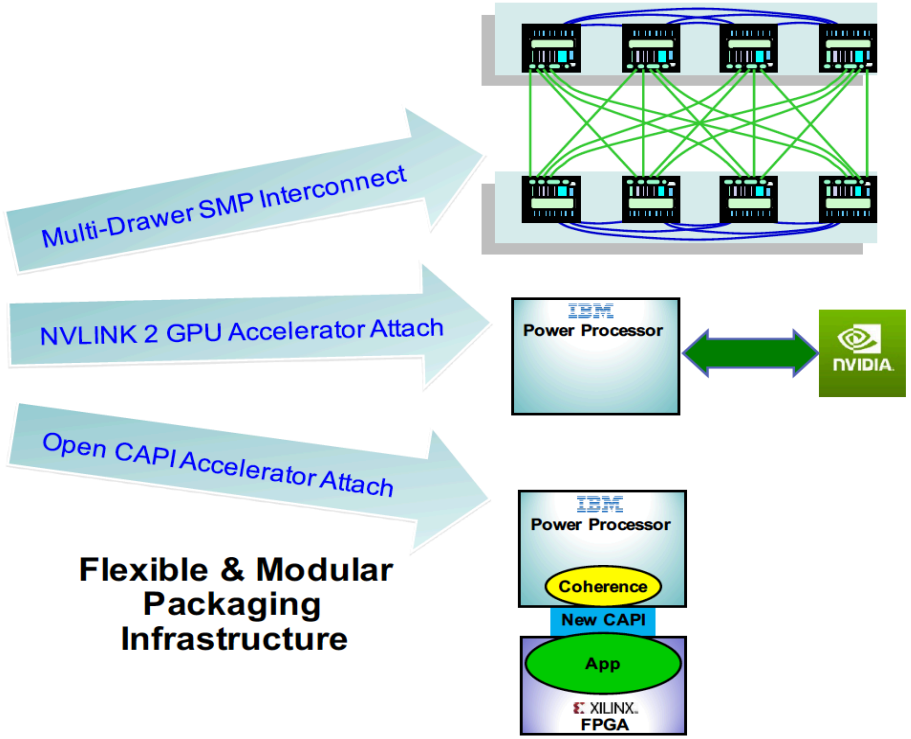


High-speed 25G

Modular Constructs → High-speed 25 Gb/s Signaling

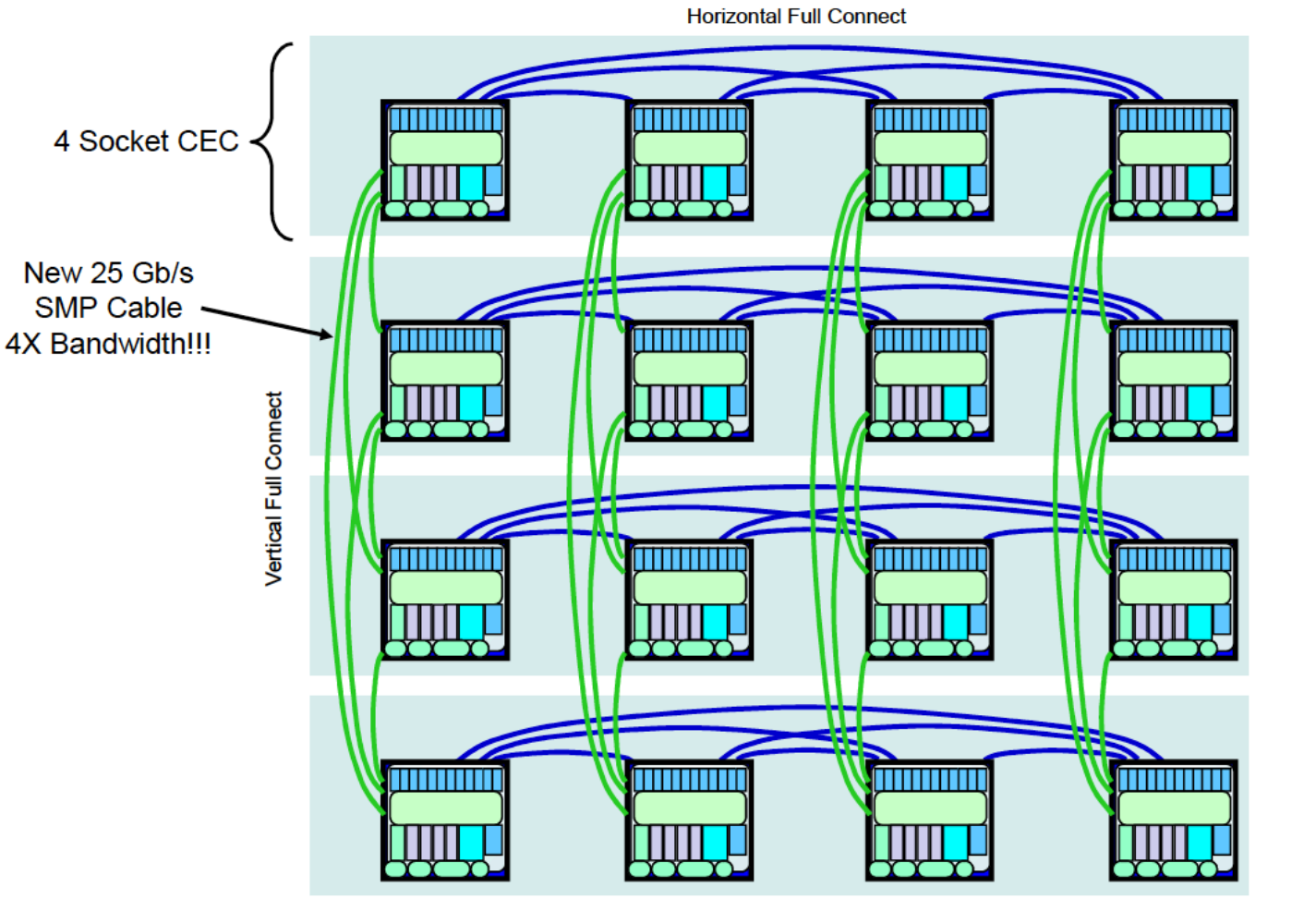


Utilize Best-of-Breed 25 Gb/s Optical-Style Signaling Technology



Flexible & Modular Packaging Infrastructure

High-speed 25G

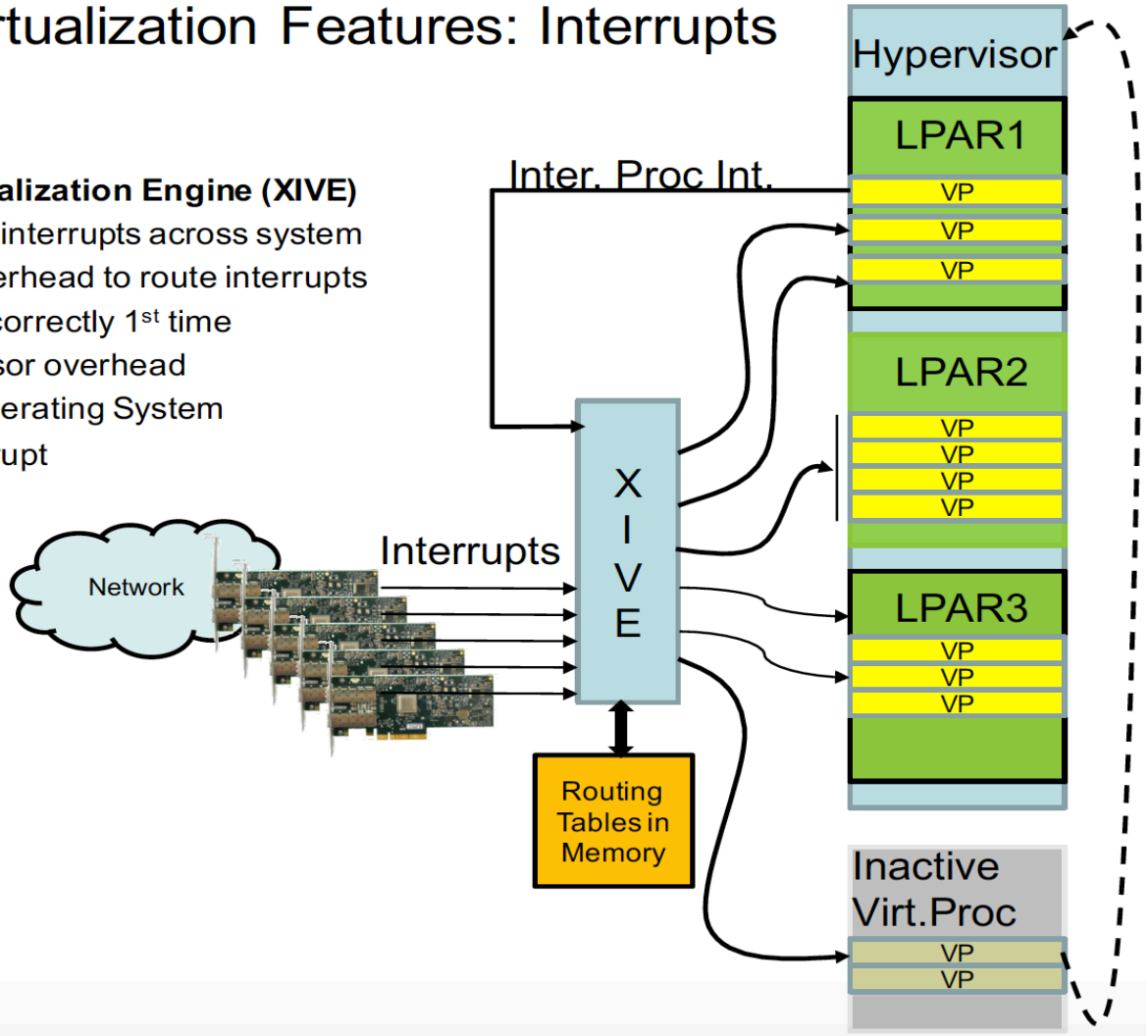


XIVE – External Interrupt Virtualization Engine

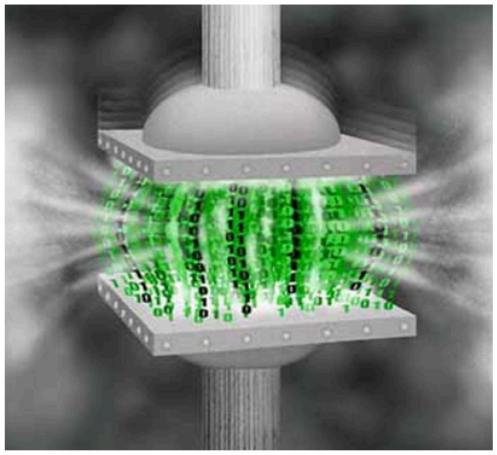
Platform Virtualization Features: Interrupts

New External Interrupt Virtualization Engine (XIVE)

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



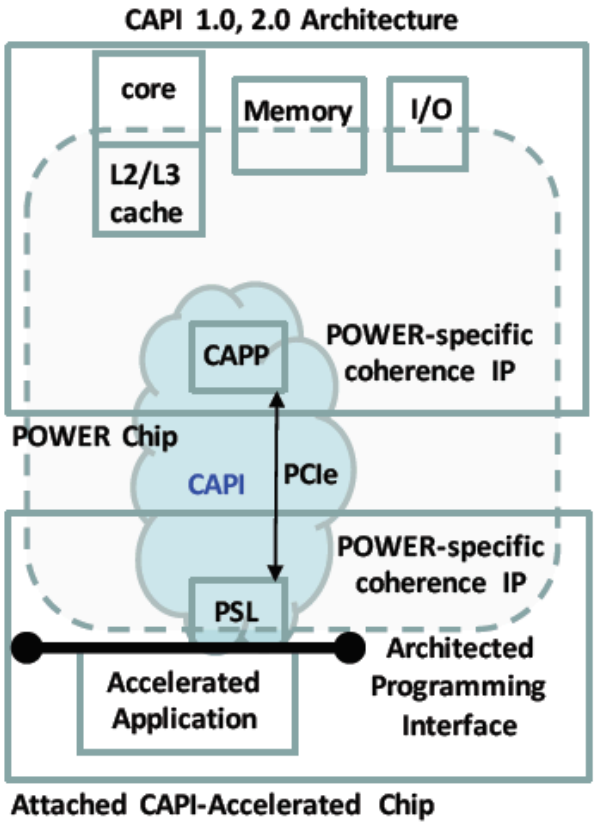
Platform Virtualization Features: Accelerators

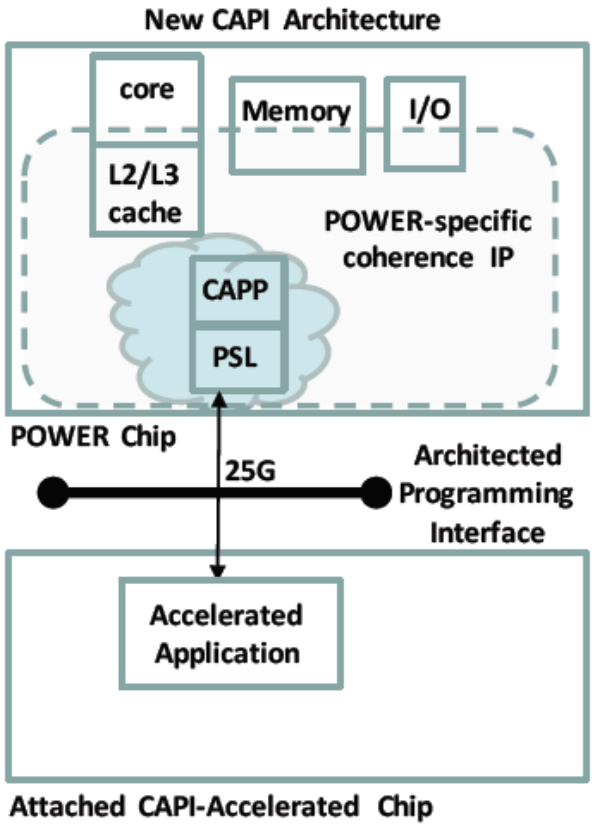


On-Processor Accelerators

- Virtualized: User mode invocation (No Hypervisor Calls)
- Industry Standard GZIP Compression / Decompression
- AES Cryptography Support
- True Random Number Generation
- Data Mover

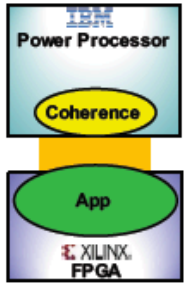
Open Innovation Interfaces: Open CAPI





Open Industry Coherent Attach

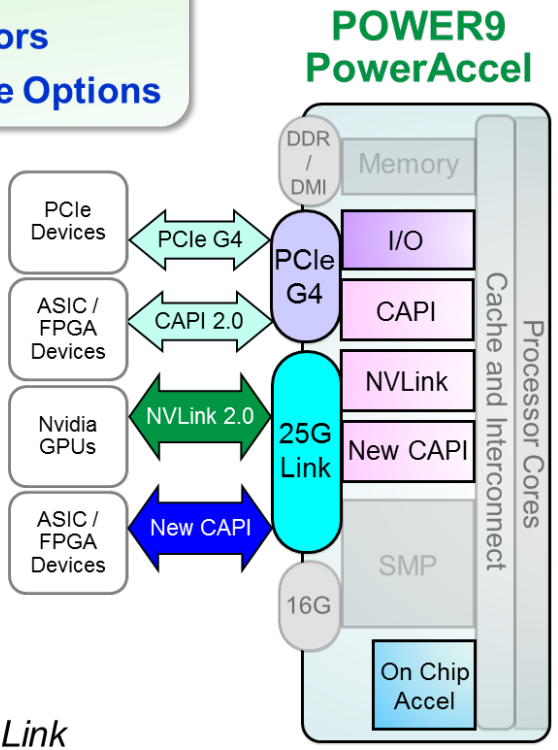
- Latency / Bandwidth Improvement
- Removes Overhead from Attach Silicon
- Eliminates "Von-Neumann Bottleneck"
- FPGA / Parallel Compute Optimized
- Network/Memory/Storage Innovation



POWER9 – Premier Acceleration Platform

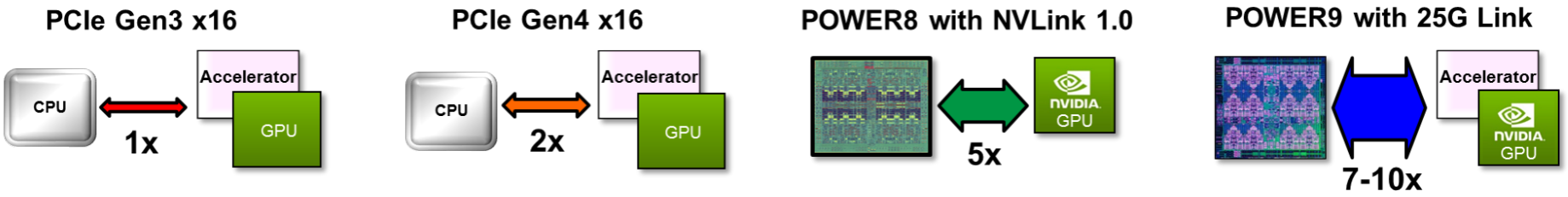
- **Extreme Processor / Accelerator Bandwidth and Reduced Latency**
- **Coherent Memory and Virtual Addressing Capability for all Accelerators**
- **OpenPOWER Community Enablement – Robust Accelerated Compute Options**

- **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*
  - **NVLink 2.0** – Next generation of GPU/CPU bandwidth and integration
  - **New CAPI** – High bandwidth, low latency and open interface using *25G Link*



POWER9 – Ideal for Acceleration

Extreme CPU/Accelerator Bandwidth



Increased Performance / Features / Acceleration Opportunity

Seamless CPU/Accelerator Interaction

- Coherent memory sharing
- Enhanced virtual address translation
- Data interaction with reduced SW & HW overhead

Broader Application of Heterogeneous Compute

- Designed for efficient programming models
- Accelerate complex analytic / cognitive applications

POWER9 – Ecosystem Enablement

OpenPOWER™

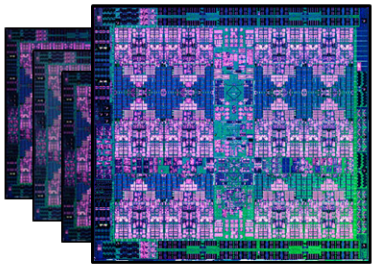
Foundation

- Accelerating Open Innovation
- Grown from 5 to over 200 members in less than 3 years

POWER9: Engineered for OpenPOWER Application

- Built for a Broad Range of Deployments and Platforms
- Open and Flexible Solutions
- Ideal for Developers

POWER9 Processor



Built for the Cognitive Era

OpenPOWER™

Enhanced Core and Chip Architecture for Emerging Workloads

- New Core Optimized for Emerging Algorithms to Interpret and Reason
- Bandwidth, Scale, and Capacity, to Ingest and Analyze

Processor Family with Scale-Out and Scale-Up Optimized Silicon

- Enabling a Range of Platform Optimizations – from HSDC Clusters to Enterprise Class Systems
- Extreme Virtualization Capabilities for the Cloud

Premier Acceleration Platform

- Heterogeneous Compute Options to Enable New Application Paradigms
- State of the Art I/O
- Engineered to be Open

Questions ?

Jean-Luc Bonhommet
Jeanluc_bonhommet@fr.ibm.com

New Technology Introduction
POWER Systems & IBM i
IBM Client Center Montpellier
France