

# **IBM Power Systems Facts and Features:**

# Scale-out Systems with POWER9® Processor Technology



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IBM® Power Systems™ servers using IBM POWER8® processors are described in a separate Facts and Features report dated February 2018 (POB03046-USEN).

IBM® Power Systems™ servers and IBM BladeCenter® blade servers using IBM POWER7® and POWER7+® processors are described in a separate Facts and Features report dated July 2013 (POB03022-USEN-28).

IBM Power Systems servers and IBM BladeCenter® blade servers using IBM POWER6® and POWER6+™ processors are described in a separate Facts and Features report dated April 2010 (POB03004-USEN-14).

These notes apply to the description tables for the pages which follow:

Υ	Standard / Supported
Optional	Optionally Available / Supported
N/A or – n/a	Not Available / Supported or Not Applicable
SOD	Statement of General Direction announced
SLES	SUSE Linux Enterprise Server
RHEL	Red Hat Enterprise Linux
A	CoD capabilities include: Capacity Upgrade on Demand option – permanent processor or memory activation, Elastic Capacity on Demand – temporary processor or memory activation by the day, Utility Capacity on Demand – temporary processor activation by the minute, and Trial Capacity on Demand.
В	Withdraw from marketing date generally true world wide, but there may be specific countries exceptions
а	For IBM Manufacturing processes, one x8 PCIe slots must contain an Ethernet LAN. The adapter is available for client use.
b	Use of expanded function storage backplane uses one PCIe slot in 2U servers and optionally uses a PCIe slot in 4U servers
С	Backplane provides dual high performance SAS controllers with 1.8 GB write cache expanded up to 7.2 GB with compression plus Easy Tier function plus two SAS ports for running an EXP24S drawer. 4-core S814 or 1-core S812 do not support the attachment of an EXP24S to these ports
d	Full benchmark results are located at <a href="mailto:ibm.com/systems/power/hardware/reports/system-perf.html">ibm.com/systems/power/hardware/reports/system-perf.html</a>
е	Option is supported on IBM i only through VIOS.
f	For simplicity in calculating maximum and consistently describing the max across the Scale-out Servers, the 12-bay backplane is assumed. A higher max with the expanded function backplane is possible.
g	USB-2 ports have limited client usage compared to USB-3 ports. Clients can use a USB-2 port to communicate with a UPS
h	4-core Power S814 max capacity disk drive supported in system unit is 600 GB.
j	Not available in PowerKVM environment
k	Maximum memory for 4.1GHz S822 and S822L is 512 GB unless water cooling is used.
m	Except one predefined configuration (8-Core #EHJW) has only 32 GB
n	The 4.1 GHz S822 requires water cooling to attain full rPerf values. With air cooling SMT8 is not supported reducing the rPerf values about 8 percent. Also the memory maximum is 50 pecent lower.
0	Values for 64-, 96- and 128-core servers measured as multiples of 32-core partitions. Values for 96-, 144- and 192-core servers measured as multiples of 48-core partitions. Values for 80-, 120-, and 160-core servers measured as multiples of 40-core partitions.
р	When no GPU installed
q	Slot total shown are all available PCIe slots for client use. PCIe slots in the system unit used to attach a PCIe Gen3 I/O drawer are excluded from total. Note one x8 PCIe slots must contain an Ethernet LAN available for client use
r	Can convert E850C/E870C/E880C Elastic CoD processor days to IBM SoftLayer resources. Can convert E870C/E880C mobile processor activations to IBM SoftLayer resources
s	On Power S822, max size of 2-cores per IBM i partition prior to firmware 860, max of 4-cores with FW 860. Multiple IBM i partitions supported. The software tier is on P10.
t	HMC Applications as a Service is a technology preview as of October 2016. It is a Statement of Direction. All IBM SODs are subject to change without notice.

For additional connectivity information, please reference the IBM Sales Manual for more information on I/O features and adapters.

# Why Power Systems?

IBM is leading the Cognitive and Cloud space— Integrated Cloud capabilities in POWER9 go in line with IBMs cloud strategy and enable to connect current enterprise data with Cloud based AI or Analytics offerings like Watson. IBM gives you best in class on premise Cloud deployment possibilities with this announcement in addition to the off-premise portfolio already maintained. And we're applying that innovation to cognitive infrastructure, helping our customers on their journey to AI.

IBM aligns cutting-edge innovation with enterprise dependability—IBM has over 105 years of aligning continuous innovation with our customers' business needs.

The POWER9 Scale Out family will be the first set of entry servers that will come completely cloud enabled out of the box with integrated PowerVM Enterprise capabilities. In addition, POWER9 introduces dynamic clocking that continuously optimizes processor frequency for maximum performance and throughput. In combination with the new memory footprint of up to 4TB, IBM now provides systems to clients that are unmatched in memory scaling as well as memory per core for data centric and in-memory workloads. The S924, S914 and S922 will be delivered with a temporary PowerVM license that will enable current POWER7 and POWER8 customers to smoothly migrate to POWER9 using Live Partition Mobility. The POWER9 servers have built in security and are ready for current and future security threats.

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# **Summary of IBM Power System Features**

Product Line	IBM Power S914	IBM Power S924	IBM Power S922	IBM Power L922 PowerVM
MTM	9009-41A	9009-42A	9009-22A	9008-22L
System packaging	19" rack drawer (4U) & Tower	19" rack drawer (4U)	19" rack drawer (2U)	19" rack drawer (2U)
AIX	AIX Vers and Servi     AIX Vers and Servi     AIX Vers and Servi service ex and Servi availabilit     AIX Vers and Servi availabilit  AIX Vers and Servi     AIX Vers Service P     AIX Vers Service P	ion 7.2 with the 7200 ce Pack 7200-02-02-1 ion 7.1 with the 7100 ce Pack 7100-05-02-1 ion 6.1 with the 6100 ce Pack 6100-09-11-1 ctension required) ion 7.2 with the 7200 ce Pack 7200-01-04-1 ty May 4, 2018) ion 7.2 with the 7200 ce Pack 7200-00-06-1 ty May 4, 2018) ion 7.1 with the 7100 ce Pack 7100-04-06-1 ty May 4, 2018)  X operating system V ion 7.2 with the 7200 ce Pack 7200-01-01-1 ion 7.2 with the 7200 ce Pack 7200-02-01-1 ion 7.2 with the 7200 ce Pack 7200-01-01-1 ion 7.1 with the 7100 ce Pack 7100-05-01-1 ion 7.1 with the 7100-ack 7100-04-01-1543 ion 6.1 with the 6100-	-02 Technology Level 810, or later -05 Technology Level 810, or later -09 Technology Level 810, or later (AIX 6.1) -01 Technology Level 806, or later (planned) -00 Technology Level 806, or later (planned) -04 Technology Level 806, or later (planned) -04 Technology Level 806, or later (planned) -04 Technology Level 806, or later (planned) -05 Technology Level -05 Technology Level -05 Technology Level -06 Technology Level -07 Technology Level -08 Technology Level -09 Technology Level	N/A

IBM i		IBM i 7.3 TR4, 7.2	N/A	
		(IBM i requires VIOS ir		
Linux – RedHat BE			RHEL 7.4 BE	
Linux – RedHat LE			RHEL 7.4 LE	
Linux – SuSE LE		SLES 12 SP2 LE	, SLES 12 SP3 LE, SLES	S 11 SP4
Limina I Ibaanka I E		Ubuntu 16.04.2	LE LTS → Ubuntu 16.04	.3 LTS
Linux – Ubuntu LE		Ubunt	u 18.04 LE LTS (2Q18)	
PowerVM		Yes		Yes
Ubuntu KVM 17.10/OPAL		Ņ		No
Anchor CCIN	562E	562F	563A	563C
Processor Socket	1S	1S upgradable or 2S	1S upgradable or 2S	1S upgradable or 2S
Number of SCM Allowed	1	1 or 2	1 or 2	1 or 2
Typical Processor options GHZ (cores/socket)   # of cores	2.3 to 3.8 GHz (1)   4 (1)   6 2.8 to 3.8 GHz (1)   8	3.8 to 4.0 GHz (2)   8 3.5 to 3.9 GHz (2)   10 3.4 to 3.9 GHz (2)   12	2.8 to 3.8 GHz (2)   4 3.4 to 3.9 GHz (2)   8 2.9 to 3.8 GHz (2)   10	3.4 to 3.9 GHz (2)   8 2.9 to 3.8 GHz (2)   10 2.7 to 3.8 GHz (2)   12
Memory DIMM Slots	16	32	32	32
Memory DIMM Size	16, 32, 64GB in 8c and 6c 16, 32GB in 4c		16, 32, 64, 128G	В
Memory - Min	2x16 GB	2x16 GB / CPU	2x16 GB / CPU	2x16 GB / CPU
Memory - Max	1024 GB	4096 GB	4096 GB	4096 GB
Memory Bandwidth (max)	170 GB/s	340 GB/s	340 GB/s	340 GB/s
Memory Speeds		:	   2666 MHz DDR4   2400 MHz DDR4   2133 MHz DDR4	
AME	Yes	Yes	Yes	Yes
AMM	No	No	No	No
Transactional Memory	Yes	Yes	Yes	Yes
Storage - default	EJ1C x 1 - RAID 0,10,5,6 card - RDX Bay - Backplane: 12 SFF		EJ1F x 1 - RAID 0,10,5,6 card -Backplane: 8 SFF	

Product Line	IBM Power S914	IBM Power S924	IBM Power S922	IBM Power L922 PowerVM
Storage – Split Disk	EJC1 + EJ1E		EJ1F + EJ1H	
(optional)	- Two JBOD RAII	D 0,10,5,6 cards	- Two JBOD RAID 0,10,5,6 cards	
	- Backplane 6 + 6	6 SFF drive bays	- Backplane: 4+4 SFF	drive bays
	- RDX Bay			
Storage – High Function	EJ1D		EJ1G	
RAID (optional)	- Two RAID 0,1	0,5,6,5T2, 6T2,	- One RAID 0,10,5,6	card
	10T2 cards		- Backplane: 8 SFF	
	- Backplane: 18	SFF	- Ontional rear SAS n	ort for external disk enclosure
	or		Optional real 6/10 p	ort for external disk endosare
	- 1 RDX Bay			
	- Backplane: 12 S	SFF		
	- Optional rear S	AS port for		
	external disk en	nclosure		
Storage	EJ1C x 1		EJ1F x 1	
1 NVMe & 1 default SAS	- Card plugs into	C49	- Card plugs into C49	
RAID (optional)	- EC59 NVMe ca	- EC59 NVMe card plugs into		ugs into C50
	C50		(1 or 2 ES14 M.2 modules on each NVMe card)	
	(1 or 2 EC14 M.2 mo NVMe card)	odules on each		
Storage	EC59 x 1		EC59 x 1	
1 NVMe or 2 NVMe cards	- NVMe card (plu	ıg into C49),	- NVMe card (plug into C49),	
(optional)	or		or	
	EC59 x 2		EC59 x 2	
	- NVMe cards (C	49 and C50)	- NVMe cards (C49 a	nd C50)
	(1 or 2 EC14 M.2 NVMe card)	modules on each	(1 or 2 EC14 M.2 modu	ales on each NVMe card)
HDD/SSD Concurrent Maintenance			Yes	
Internal DVD-RAM			No	
External stand-alone USB DVD -RAM			Yes	
7226-1U3 Media drawer			Yes	
	1S4U Tower:			
	Mandatory			
LCD Op Panel w/ AIX	1S4U Rack: Defaults to "On"  Defaults to "On"  Defaults to "On"			
or Linux	in the configurator	Defaults to "On	n option to deselect this feature	
	with an option to			
	deselect this feature			

LCD Op Panel w/ IBMi	Mandatory		N/A
C2 – PCIe G4 x8 slot with x16 connector	Not available	Yes, FHHL	Yes, LP HL
C3 – PCIe G4 x16 slot	Not available	Yes, FHHL	Yes, LP
C4 – PCIe G4 x16 slot	Not available	Yes, FHHL	Yes, LP HL
C5 – PCIe G3 x8 slot	Yes, FHHL	Yes, FHHL	Location of rear USB 3.0 connector

Product Line	IBM Power S914	IBM Power S924	IBM Power S922	IBM Power L922 PowerVM	
C6 – PCIe G3 x8 slot with	Yes, FHHL	Yes, FHHL	Yes	, LP HL	
x16 connector		rnal SAS ports with			
C7 – PCIe G3 x8 slot	Yes, FHHL	Yes, FHHL	Yes	, LP HL	
C8 – PCIe G4 x8 slot with x16 connector	Yes, FHHL	Yes, FHHL	Yes	, LP HL	
C9 – PCIe G4 x16 slot	Yes, FHHL	Yes, FHHL	Yes	, LP HL	
C10 – PCIe G3 x8 slot	Yes, FHHL	Yes, FHHL	Location of 1 external S	SAS port with SAS adapter	
C11 – PCIe G3 x8 slot	Yes, FHHL	Yes, FHHL	Yes	, LP HL	
C12 – PCIe G3 x8 slot with x16 connector	Yes, FHHL	Yes, FHHL	Yes, LP HL		
PCIe Slot EEH		11	Yes		
PCIe Slot Concurrent Maintenance		Yes			
25 GB/s Ports	T5, T6	T5, T6, T7, T8	T5, T	r6, T7, T8	
PCIe 75W Capable Slot	С9	C3, C4, C9	C3	, C4, C9	
CAPI2.0 via PCIe G4 Slot	C8, C9	C3, C4, C8, C9	C3, C	<sup>2</sup> 4, C8, C9	
CAPI 2.0 Adapter – Concurrent Maintenance		<u>                                     </u>	No		
I/O Expansion Drawer	Yes	Yes		Yes	
Support	(½ drawer max)	(1.5 drawer max)	(1 dra	wer max)	
PCIe Slots for Cable card	С9	C9, C4, C3	C	19, C4	
PCIe Cable Card Attached to I/O Expansion Drawer	EJ08	EJ08	EJ05 (double wide card)		
CEC to IO Drawer Cable – Lanes Sparing		"	Yes (1 lane sparing)		
PCIe Cable Card – Concurrent Maintenance		Yes			

Product Line	IBM Power S914	IBM Power S924	IBM Power S922	IBM Power L922 PowerVM	
Host external USB (USB3.0)	1 front and 2 rear		2 front and 2 rear	2 front and 2 rear	
Host internal USB (USB3.0)	1 for internal	RDX dock			
System Management Interface		2 rear HM	C GbE ports, NovaLink and P	PowerVC	
Native IO		2 rear U	SB2.0 ports for FSP, 1 Serial	port	
Blower & Fan – Concurrent Maintenance			Yes		
Redundant Cooling			Yes		
Power Supply Rating			Platinum 80+		
Power Supply – Concurrent Maintenance	Yes				
Power Supply 900W AC 100-127 VAC input or 200-240 VAC input	4 900W PS always required per Tower 1S4U system Note: 4 PS configured as 2+2 PS	Not supported	No	ot supported	
Power Supply 1400W AC 200-240 VAC input	2 1400W PS for Rack 1S4U Model	4 1400W PS always required per 2S4U system Note: 4 PS configured as 2+2 PS	2 1400W PS always required per system  Note: 2 PS configured as 1+1 PS		
Service Interface		Ligl	ht-path Op-panel & FRU LED	<b>9</b> S	
FCC			Class A		
Environmental	ASHRAE A3 5-40C, 20-80% RH, 3050m max				

Product Line	IBM Power S914	IBM Power S924	IBM Power S922	IBM Power L922 PowerVM		
Acoustical Category	Attended Data Center Category  1B - Rack 8c  6.5 Bels Idle  6.5 Bels operating	Unattended Data Center Category 1A -Rack 7.0 Bels Idle 7.0 Bels operating	6.7	ta Center Category 1A  Bels Idle els operating		
	General Business Category 2E – Tower & 2D for Rack (4c, 6c) 5.5 Bels Idle 5.8 Bels operating					
Acoustics: Noise Hazard	Tower  8.5 Bels LwAd /  9.5 Bels LwAd  Rack  7.5 Bels LwAd /  8.5 Bels LwAd	7.5 Bels LwAd / 8.5 Bels LwAd		Bels LwAd / Bels LwAd		
Weight (max) Dimensions	Tower 4U: L:751.7	Fower 4U: L:751.7mm (814.7mm-included front rotatable door) x W:182.4mm (328.5mm-included stand) x H:486.1mm (522mm-included handle)  Rack 4U: 427.5W x 173H x 750.5D mm  Rack 2U: 427.5W x 86.5H x 747.5D mm				

## **Server I/O SAS Enclosure Units**

Drawer	Server Attachment	PCIe Slots per Drawer	SAS Bays per Drawer	Available to order	Drawer Footprint
EXP12SX (#ESLL / #ELLL)	Via SAS	0	12 LFF-1 SAS	Υ	19" rack 2U
EXP24SX (#ESLS / #ELLS)	Via SAS	0	24 SFF- 2 SAS	Υ	19" rack 2U

## **Server I/O Drawer Attachment**

Server Drawer	Power S914 8-core	Power S924 24-core	Power S922 20-core	Power L922 24-core
EXP12SX	Max 28	Max 28	Max 28	Max 28
EXP24SX	Max 28	Max 28	Max 28	Max 28

#### EXP12SX/EXP24SX/EXP24S storage enclosure notes:

• The maximum drawer attachment is shown above per type of drawer. But it is also a "combined" server maximum. For example, if the maximum shown above is for 28 drawers, it would be combined total of EXP12SX and EXP24SX

which would be 28. It would not be 28+28 for a combined total of 56.

- The EXP12SX and EXP24SX are designed for 12Gb throughput.
- The EXP12SX and EXP24SX are attached to PCle3 SAS adapters or to integrated POWER8 SAS controllers. They are not attached to older PCle SAS adapters.
- The EXP12SX supports large capacity 3.5-inch (LFF) disk drives which are 7200 rpm. 4k byte sector drives are supported. SSD's are not supported. Big data applications are its primary usage.
- The EXP12SX is not supported by IBM i.
- The EXP24SX supports 2.5-inch (SFF) SSD and 10k/15k rpm disk drives.
   4k and 5xx byte sector drives are supported.
- A Power S914, S924, S922, and L922 Scale-out server has a maximum of 15 storage enclosures if only a system unit is used. The maximum of 28 requires one or more PCIe Gen3 I/O Drawer to be present.
- A maximum of 16 storage enclosures can be attached to one PCIe Gen3 I/O drawer due to cable management considerations

For additional connectivity information, please reference the IBM Sales Manual for more information on I/O features and adapters.

#### **Physical Planning Characteristics**

Note: More comprehensive information may be found in the IBM Site and Hardware Planning document at <a href="https://www.ibm.com/support/knowledgecenter/POWER9/p9hdx/POWER9welcome.htm">https://www.ibm.com/support/knowledgecenter/POWER9/p9hdx/POWER9/p9hdx/POWER9welcome.htm</a>. Plus, additional summary information can be found in the IBM Sales Manual for each server at <a href="https://www.ibm.com/support/knowledgecenter/Power8/p9hdx/Power8/pwelcome.htm">https://www.ibm.com/support/knowledgecenter/Power8/p9hdx/Power8/pehdx/Power8/pwelcome.htm</a>. Plus, additional summary information can be found in the IBM Sales Manual for each server at <a href="https://www.ibm.com/support/knowledgecenter/Power8/pphdx/Power8/pwelcome.htm">https://www.ibm.com/support/knowledgecenter/Power8/pphdx/Power8/pphdx/Power8/pwelcome.htm</a>. Plus, additional summary information can be found in the IBM Sales Manual for each server at <a href="https://www.ibm.com/support/knowledgecenter/Power8/pphdx/Power8/power8/pphdx/Power8/pphdx

Racks	7014-T00 or #0551	7014-T42 or #0553	7965-S42	7965-94Y Slim Rack
	36U	42U	42U	42U
Height				
Inches	71.0 – 75.8	79.3	79.5	78.8
Millimeters	1804 – 1926	2015	2020	2002
Width (can vary depending on use of side panels	s)			
Inches	24.5 – 25.4	24.5 - 25.4	23.6	23.6
Millimeters	623 - 644	623 – 644	600	600
Depth (can vary depending on door options se	lected)			
Inches	41.0 – 45.2	41.0 - 45.2	42.1 – 48.5	43.1 – 48.2
Millimeters	1042 – 1098	1043 – 1098	1070 - 1231	1095 - 1224

## Warranty<sup>1</sup> / Installation

Warranty Service Levels	Power S914	Power S924	Power S922	Power L922
24x7 with two hour service objective <sup>2</sup>	Optional	Optional	Optional	Optional
24x7 with four hour service objective	Optional	Optional	Optional	Optional
9x5 with four hour service objective	Optional	Optional	Optional	Optional
9x5 next-business-day	Standard <sup>6</sup>	Standard <sup>3</sup>	Standard <sup>3</sup>	Standard <sup>3</sup>
Warranty Period	3 years	3 years	3 years	3 years
Server install <sup>4</sup>	CSU	CSU	CSU	CSU

- 1. These warranty terms and conditions are for the United States and may be different in other countries. Consult your local IBM representative or IBM Business Partner for country-specific information.
- 2. Available in selected cities.
- 3. Mandatory Customer Replaceable Unit (CRU) or Limited On-site service depending on the feature code. With an upgrade to a higher support service level, the mandatory CRU features become optional CRU.
- 4. CSU = Customer Set Up, IBI = Installation by IBM For server hardware only. Note for IBI severs, server feature codes such as an EXP24S I/O drawer or PCIe Gen3 I/O drawer or PCIe adapter or disk drive are installed by the IBM service representative as part of the normal warranty/maintenance coverage. Optionally a client may choose to install CSU features without an IBM service representative.
- 5. System is provided with a one year standard warranty 9x5 NBD. For your convenience, IBM has provided an upgrade to 24x7 coverage PLUS two additional years of extended warranty services (varies by country).
- 6. Mandatory Customer Replaceable Unit (CRU). With an upgrade to a higher support service level, mandatory CRU becomes optional CRU.

**Power S Class Servers Software Support** 

Power Systems Software	Power S914 8-core	Power S924 12-core	Power S922 10-core	Power L922 PowerVM	
Software Tier	Small	Small	Small	Small	
PowerVM™					
PowerVM Linux Edition	Supported	Supported	Supported	Supported	
PowerVM Standard and Enterprise Editions	Supported	Supported	Supported	Supported	
PowerKVM	N/A	N/A	N/A	N/A	
AIX ***					
AIX 6.1 *	Supported	Supported	Supported	Supported	
AIX 7.1 *	Supported	Supported	Supported	Supported	
AIX 7.2 *	Supported	Supported	Supported	Supported	
IBM i					
IBM i Software Tier	N/A	N/A	N/A	N/A	
IBM i 7.1 TR8 *	N/A	N/A	N/A	N/A	
IBM i 7.2 *	Supported	Supported	Supported	Supported	
IBM i 7.3 *	Supported	Supported	Supported	Supported	
Linux					
Red Hat Enterprise Linux 6.6 *(BE)	N/A	N/A	N/A	N/A	
Red Hat Enterprise Linux 7.1(LE and BE)	N/A	N/A	N/A	N/A	
RedHat Enterprise Linux 7.4 (LE and BE)	Supported	Supported	Supported	Supported	
SUSE Linux Enterprise Server 11 (BE) 12(LE)	Supported	Supported	Supported	Supported	
Ubuntu 16.04.4 LTS	Supported	Supported	Supported	Supported	
PowerHA™					
PowerHA SystemMirror for AIX 6.1 <sup>2</sup> Standard and Enterprise Editions	Supported	Supported	Supported	Supported	
PowerHA SystemMirror for AIX 7 <sup>2</sup> Standard Edition	Supported	Supported	Supported	Supported	
PowerHA SystemMirror for IBM i Version7 Standard and Enterprise Editions	Supported	Supported	Supported	Supported	

<sup>\*\*\*</sup> See <a href="www.ibm.com/support/docview.wss?uid=ssm1platformaix">www.ibm.com/support/docview.wss?uid=ssm1platformaix</a> to determine specific Technology Level and Service Pack requirements 1 – Note that AIX 6.1 and AIX 7.1 Express Edition may be used for partitions of up to 4 cores and 8 GB of memory per core.

<sup>2 -</sup> PowerHA SystemMirror for AIX 6.1 is supported on AIX 5.3,AIX 6.1 and AIX 7.1. PowerHA SystemMirror for AIX 7 is supported with both AIX

<sup>3 –</sup> P05 and P10 require user entitlements and includes 5250 Enterprise Enablement capability. P20 does not have user entitlements and 5250 Enterprise Enablement is ordered as an optional hardware feature code.

<sup>4.</sup> When no GPU installed

<sup>5.</sup> There is a maximum of two cores per IBM i partition on a S822 server. Multiple IBM i partitions on a server are supported. IBM i 7.1 TR11 or 7.2 TR3 or or 7.3 or later is required. Also note all I/O is virtualized through VIOS, there is no "native" non-VIOS I/O.

#### **Performance Notes**

The performance information contained herein is current as of the date of this document. All performance benchmark values and estimates are provided "AS IS" and no warranties or guarantees are expressed or implied by IBM. Buyers should consult other sources of information, including system benchmarks, to evaluate the performance of a system they are considering.

rPerf (Relative Performance) is an estimate of commercial processing performance relative to other IBM UNIX® systems. It is derived from an IBM analytical model which uses characteristics from IBM internal workloads, TPC and SPEC benchmarks. The rPerf model is not intended to represent any specific public benchmark results and should not be reasonably used in that way. The model simulates some of the system operations such as CPU, cache and memory. However, the model does not simulate disk or network I/O operations.

rPerf estimates are calculated based on systems with the latest levels of AIX and other pertinent software at the time of system announcement. Actual performance will vary based on application and configuration specifics. The IBM eServer™ pSeries® 640 is the baseline reference system and has a value of 1.0. Although rPerf may be used to approximate relative IBM UNIX commercial processing performance, actual system performance may vary and is dependent upon many factors including system hardware configuration and software design and configuration. Variations in incremental system performance may be observed in commercial workloads due to changes in the underlying system architecture. For additional information about rPerf, contact your local IBM office or an IBM authorized reseller.

All POWER8 and POWER9 rPerf and CPW results in this document reflect performance with firmware and Operating System updates to mitigate Common Vulnerabilities and Exposures issue numbers CVE-2017-5715, CVE-2017-5753 and CVE-2017-5754 known as Spectre and Meltdown.

Commercial Processing Workload (CPW) is a relative measure of performance of systems running the IBM i operating system. Performance in client environments may vary. The value is based on maximum configurations. For a complete description Please refer to the "IBM Power Systems Performance Capabilities Reference - IBM i operating system" at the following Web site of CPW and the CPW rating for IBM Power Systems: www.ibm.com/systems/power/software/i/management/performance/resources.html

All performance estimates are provided "AS IS" and no warranties or guarantees are expressed or implied by IBM. Buyers should consult other sources of information including system benchmarks and application sizing guides to evaluate the performance of a system they are considering buying. Actual system performance may vary and is dependent upon many factors including system hardware configuration and software design and configuration. IBM recommends application-oriented testing for performance predictions. Additional information about the performance benchmarks, values and systems tested is available from your IBM marketing representative or IBM Authorized Reseller or access the following on the Web:

SPEC – <a href="http://www.spec.org">http://www.spec.org</a>
TPC – <a href="http://www.tpc.org">http://www.tpc.org</a>

#### More information

Contact your IBM sales representative or IBM Business Partner

Access the Power Systems Products and Services page on IBM's World Wide Web server at <a href="ibm.com/systems/power">ibm.com/systems/power</a> and then select the appropriate hardware or software option

Product announcement letters and Sales Manual containing more details on hardware and software offerings are available at <a href="ibm.com/common/ssi">ibm.com/common/ssi</a>

More detailed benchmark and performance information is available at

<u>ibm.com</u>/systems/p/hardware/benchmarks , <u>ibm.com</u>/systems/p/hardware/system\_perf.html and at <u>ibm.com</u>/systems/i/solutions/perfmgmt/resource.html .



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