IBM Power runs SAP S/4HANA faster

More powerful. More flexible. More simple.

SAP HANA x IBM POWER8 to empower your business transformation

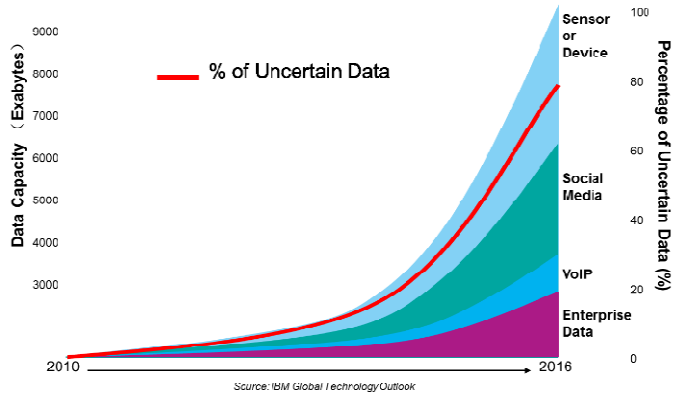
PETER LEE

Distinguished Engineer

Systems Hardware, IBM Greater China Group

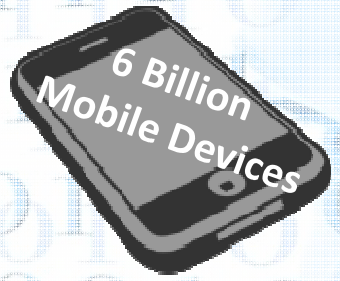
Digital Transformation in the Era of Big Data

Volume



Over 50 Microprocessors built-in ever Automobile

Variety

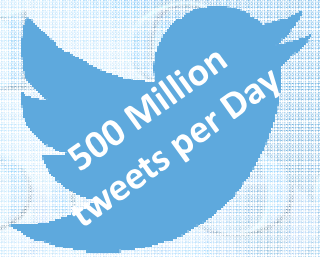


Over 50 Million Smart Meters installed in US

Velocity

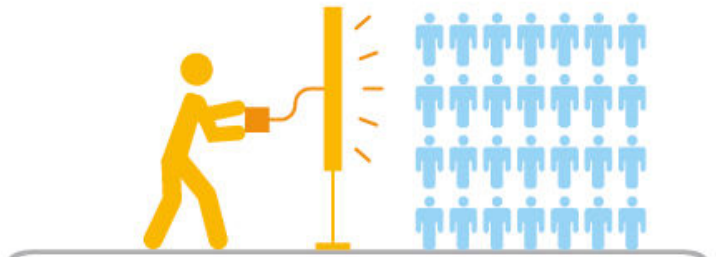
Internet of Things

By the end of 2016, there will be 19 Billion Network Connections



Digital Transformation influences Different Industries

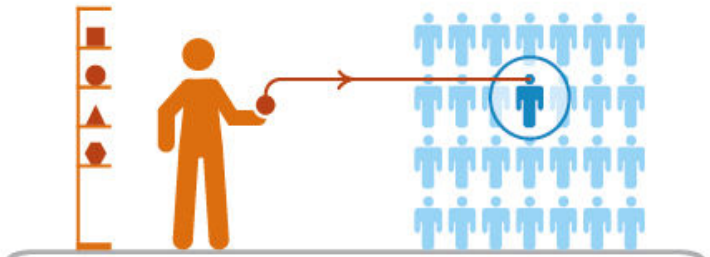
FROM TO



Audiences

Content metrics

Broad content targeting to generic viewers



Individuals

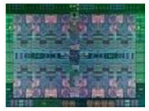
Consumer centric

Smarter, more individualized customer experiences

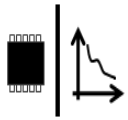
SAP HANA on IBM Power Overview

In-Memory Database on IBM POWER

Hardware Innovation



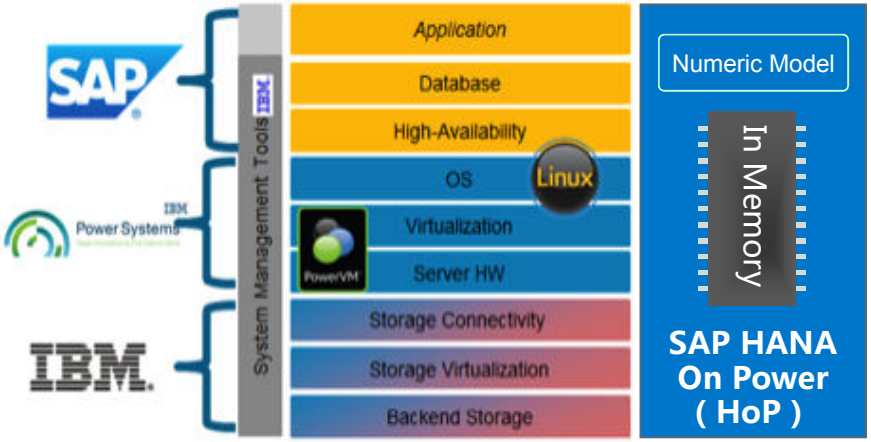
POWER8 12 Core CPU
High Memory Bandwidth
Enterprise RAS



Huge Memory Capacity
Advanced I/O Technology
Highly Efficient SMT8

Software Innovation

- Column Store
- Data Compression
- MPP
- Aggregation
- Delta Merge Operation



- IBM & SAP innovate together to support In-Memory DB for Enterprise
- SAP HANA explores advantages of IBM POWER8 performance, Memory Bandwidth, Scale-up, Virtualization & Enterprise RAS capabilities
- HANA on Power offers SAP HANA database and other SAP ERP solution for our clients

IBM POWER8 Servers certifies for SAP HANA

Including SAP BW on HANA, SAP HANA for SAP Business Suite, SAP S/4 HANA

Power S822
Power S822L
- 80 x POWER8
- 1TB RAM

Power S824
Power S824L
- 24 x POWER8
- 2TB RAM

Power E850
- 48 x POWER8
- 4TB RAM**

Power E870
- 80 x POWER8
- 16TB RAM

Power E880
- 192 x POWER8
- 32TB RAM

4X
threads per core vs. x86
(Max.1536 Threads)

4X
memory bandwidth vs. x86
(Max. 32TB RAM Capacity)

4X
cache per core vs. x86
(Max. 230MB Cache per Socket)

Processor
Flexibility & High Speed

Memory
Huge capacity for In Memory DB & Insight

Buffer
Sustainable Data Flow for Faster Response

Sustained Data Flow

High IO Bandwidth

Parallel Processing

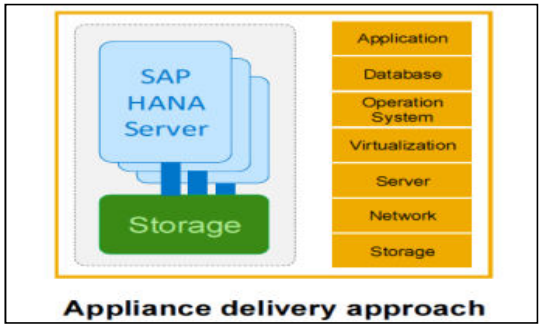
Flash for High Speed Applications

Huge Memory

SAP HANA Tailored Datacenter Integration (TDI) Certification

x86 Servers only certified as HANA Appliance

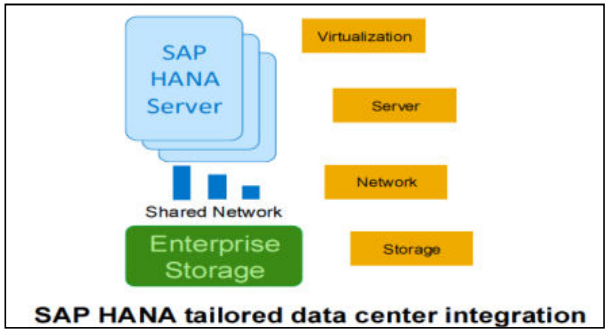
Fast Implementation
Support provided by SAP



Appliance delivery approach

IBM POWER support HANA TDI Certification

More Flexibility
Save IT budget and existing investment



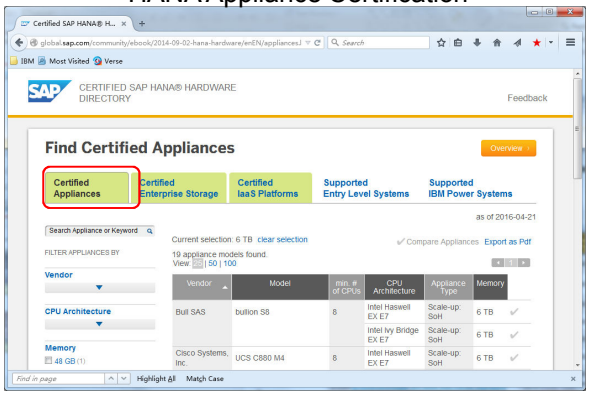
SAP HANA tailored data center integration

	HANA Appliance Certified Servers	HANA TDI Certified Servers
Solution Characteristics	Vendors need to provided fixed hardware and OS configurations that are certified for SAP Hana	Client could leverage any certified server, certified storage to build SAP Hana systems freely
Performance	Fixed internal disk configuration which is inflexible	Create better Price/Performance systems via flexible combination of configuration
Systems Optimization	Fixed hardware configuration does not allow tuning & optimization at hardware level	Server and Storage hardware could be flexibly configured to achieve application optimization
Data Backup	Network backup that may hit performance or stability issues	Support both LAN Free Backup (recommended) or Network Backup
Software Compatibility	Certified Integrated platform without compatibility issue	Certified Systems without any compatibility issue

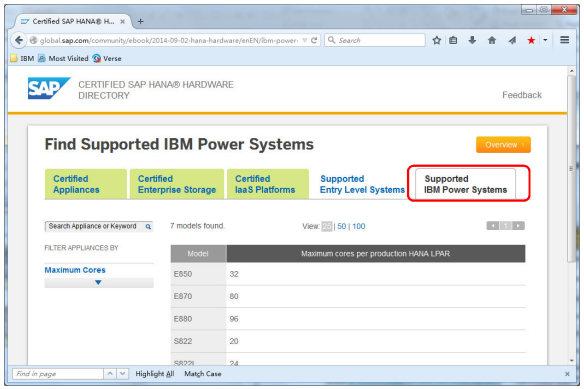
2133369 - SAP HANA on IBM Power Systems: Central Release Note SAP Note 1976729 - Application Component Hierarchy for SAP HANA

SAP HANA TDI versus Appliance Certification

Only Specific Server Configuration could receive HANA Appliance Certification



IBM POWER8 TDI Certification allow Flexible Expansion and Investment Protection

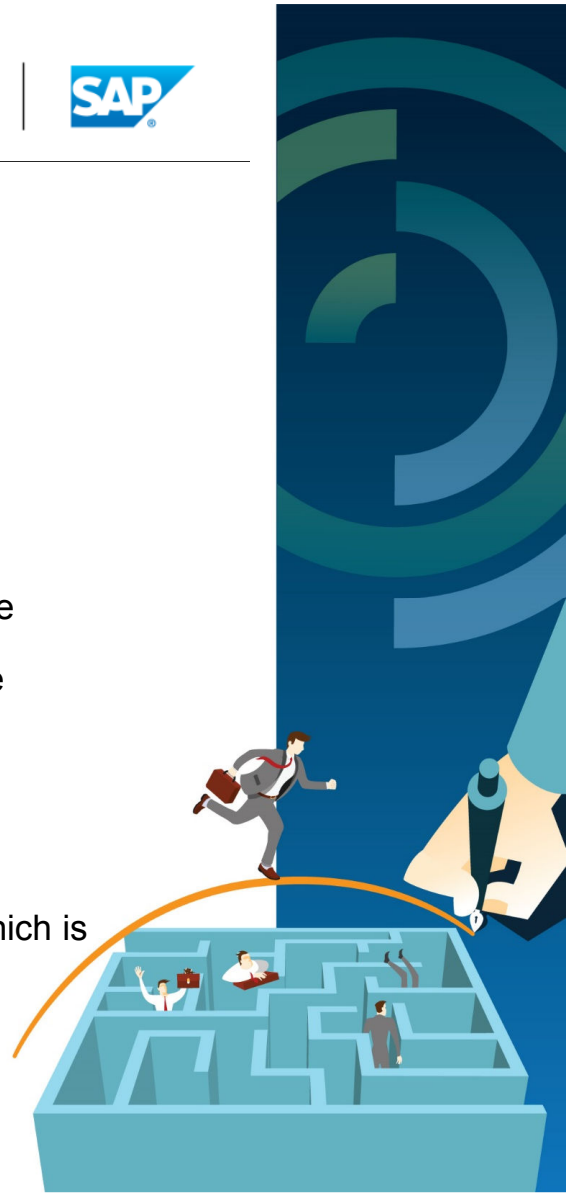


IBM Power Systems	Nodes / Sockets	Cores and GHz per System	Maximal Memory GB per System	Maximal Cores per System	MIN Cores per LPAR Production (Non-Production: 2)	MAX Cores per HANA LPAR	BW HANA Memory in GB LPAR / Ratio C/M	Business Suite HANA Memory in GB per LPAR / Ratio C/M
S822	1 node 2 sockets	3.89 GHz (6) | 6 or 12 3.42 GHz (10) | 10 or 20 4.15 GHz (8) | 8 or 16	1024	20	8	20	640 / 1:32	1024 / 1:96
S822L	1 node 2 sockets	3.42 GHz (10) | 20 3.02 GHz (12) | 24 4.15 GHz (8) | 16	1024	24	8	24	768 / 1:32	1024 / 1:96
S824	1 node 2 sockets	3.89 GHz (6) | 6 or 12 4.15 GHz (8) | 8 or 16 3.52 GHz (12) | 24	2048	24	8	24	768 / 1:32	2048 / 1:96
S824L	1 node 2 sockets	4.15 GHz (8) | 8 or 16 3.52 GHz (12) | 24	2048	24	8	24	768 / 1:32	2048 / 1:96
E850	1 node 4 sockets	3.7 GHz (8) | 32 3.35 GHz (10) | 40 3.3 GHz (12) | 48	2048 4096**	48	8	32	1000 /1:32	2048 / 1:96 3072**/ 1:96
E870	1 or 2 nodes 4 sockets per node	4.02 GHz (8) | 64 4.19 GHz (10) | 80	16384*	80	8	80	4000 / 1:50	7680 / 1:96
E880	1,2 or 4 nodes 4 sockets per node	4.35 GHz (8) | 128 4.19 GHz (10) | 160 *) 4.02 GHz (12) | 192	32768*	192	8	96	4800 / 1:50	9216 / 1:96

*) GA 03/2016 http://www.ibm.com/vrm/newsletter_10576_9004036_303982_email_DYN_1IN/bgrf106563707 **) Statement of Direction: available in 2016

SAP HANA x IBM POWER Value Propositions

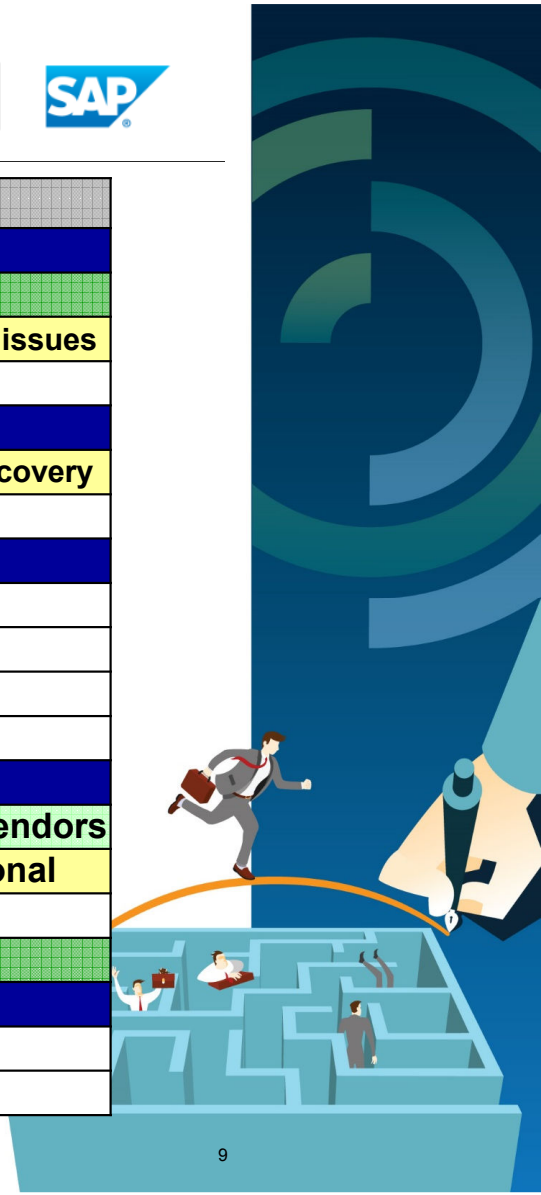
- **Better Resiliency**
  - Enterprise class platform for mission critical SAP HANA application, especially Memory Enhancement
  - SAP HANA requires 30x to 40x memory capacity of server, IBM POWER offers large memory capacity with ChipKill™ Memory RAS protection
  - IBM POWER built-in FFDC fault detection, isolation and recovery features to improve systems stability which is better than x86 platform
- **Higher Performance**
  - Deliver better SAP Hana performance with less processor counts and data center space requirement
  - Offers max. 4x Memory Bandwidth, SMT8 Simultaneous Multi-Threading, ensure stable performance for SAP HANA, even under Delta Merge operations
- **More Flexibility**
  - IBM POWER Virtualization is certified for SAP Production Environment. It offers strong isolation which allows consolidation of Production, QA, Testing, Dev or DR workloads
  - IBM PowerVM is industry leading virtualization technology is built-in at systems level which is highly secured and highly efficient
  - IBM POWER offers Capacity on Demand (CoD) to handle dynamic workload



Better Resiliency for Mission Critical SAP Application

	IBM POWER	x86
Application/Partition RAS		
Live Partition Mobility	Yes	Yes
Live Application Mobility	Yes	Yes, support issues
Partition Availability priority	Yes	No
System RAS		
OS independent First Failure Data Capture	Yes	EX – MCA Recovery
Memory Keys (including OS exploitation)	Yes	No
Processor RAS		
Processor Instruction Retry	Yes	No
Alternate Processor Recovery	Yes	No
Dynamic Processor Deallocation	Yes	No
Dynamic Processor Sparing	Yes	No
Memory RAS		
Chipkill™	Yes	Yes, some vendors
Survives Double Memory Failures	Yes	Yes, optional
Selective Memory Mirroring	Yes	No
Redundant Memory	Yes	Yes
I/O RAS		
Extended Error Handling	Yes	No
I/O Adapter Isolation (PI-Bus and TCEs)	Yes	No

See the following URLs for addition details: http://www-03.ibm.com/systems/migratetoibm/systems/power/availability.html
http://www-03.ibm.com/systems/migratetoibm/systems/power/virtualization.html

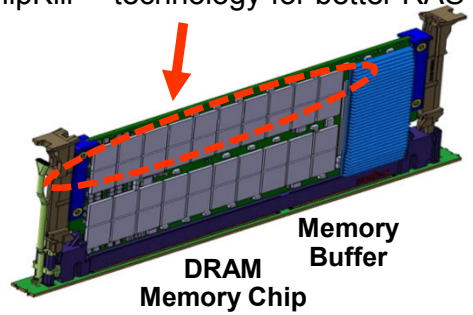


IBM POWER8 with Unique Memory RAS Feature

- Power Memory Enterprise RAS Design
  - ECC memory word written across DIMM pairs
  - Spare DRAM per rank
  - Chip Self-Healed with Redundancy
  - Industry First Hypervisor Mirroring (Active Memory Mirroring) Capability
  - Industry First Anti-Sulphur Resistor to prevent against corrosive problem
- Memory Bus RAS Design
  - CRC retry and bus retraining
  - Dynamic spare bit line
  - “On-the-fly” lane isolation/repair
- Unique Memory Buffer Design
  - Designed & built by IBM
  - UE Error handling and CRC retry
  - DRAM interface is ECC protected
  - Provide 16MB Memory Buffer per Memory Card

IBM Power Memory Card

IBM Power E880 / E870 / E850 server built with 10 Memory Chips per Rank and with ChipKill™ technology for better RAS



Typical x86 Memory Card

8 or 9 Memory Chips per Memory DIMM

Enhancement to Protect Against Soft Error

- First Failure Data Capture (FFDC)
  - More Checkers and Innovative Fault Isolation Registers built-in CPU and systems to capture or protect against soft error

✓ POWER4 Data Protection

- ECC in L2/L3 caches
- Chipkill™ correction for memory

✓ POWER5 Systems Bus Protection

- Improved some soft error issues by adding ECC to certain busses (e.g. fabric)

✓ POWER6 Instruction Retry

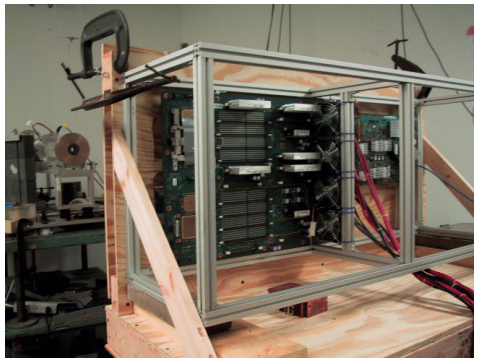
- Improved soft error recovery for Core Logic with ***Processor Instruction retry, Alternate Processor Recovery,*** and processor contained checkstops

✓ POWER7 Active Memory Mirror

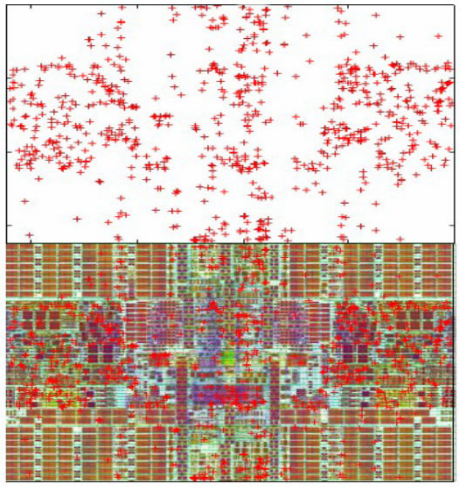
- Improved overall resilience in ASIC design including techniques such as Stacked Latches
- Improved Memory Bus ability to handle soft errors

✓ POWER8 Predictive Memory Protection

- Dynamic Substitution of Unused memory for predictive memory faults
- L2 cache column repair
- Memory buffer replay



High Energy Proton Tests to generate Soft Errors & Verify Protection Features

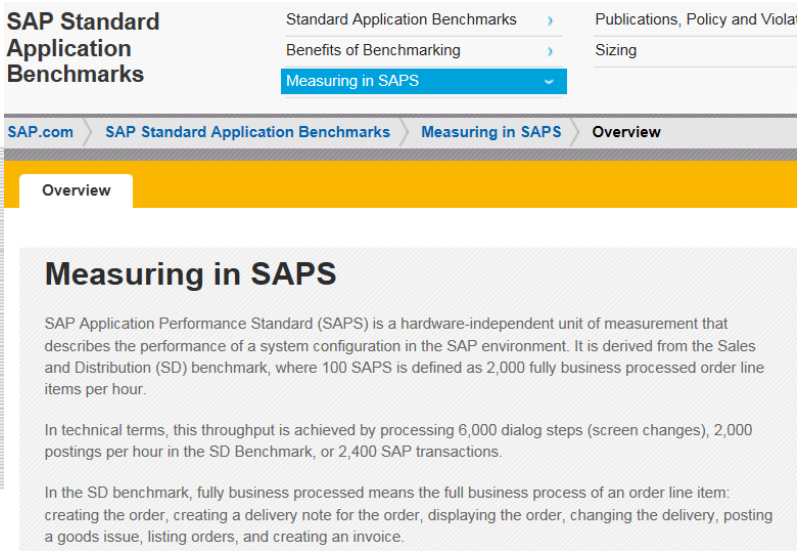


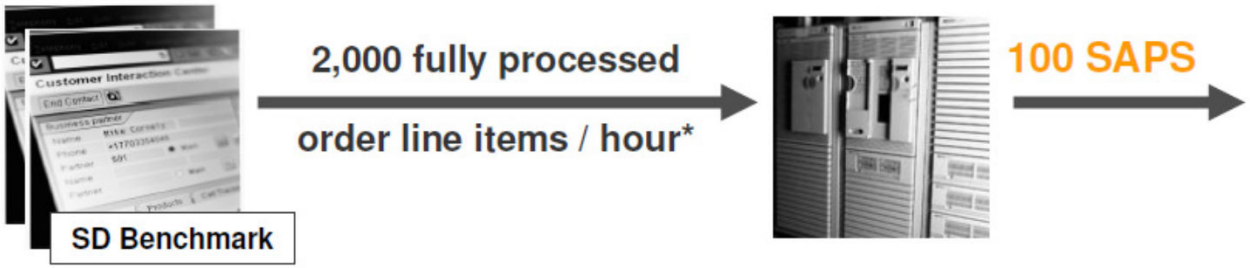
Performance Leadership : SAP Sizing based on SAPS

Definition

SAPS

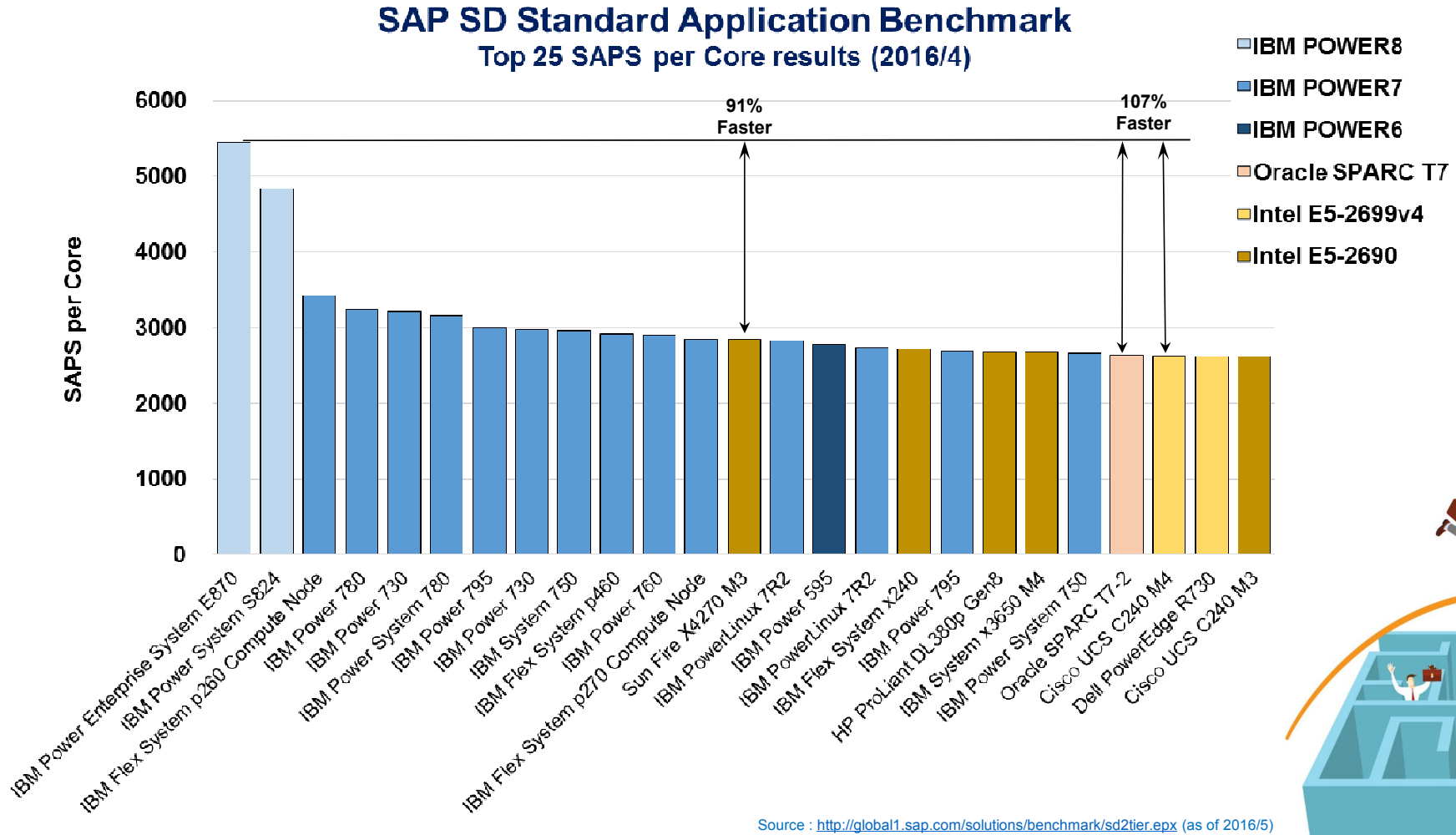
S AP
A pplication Benchmark
P erformance
S tandard





* 6,000 dialog steps and 2,000 postings *or* 2,400 SAP transactions

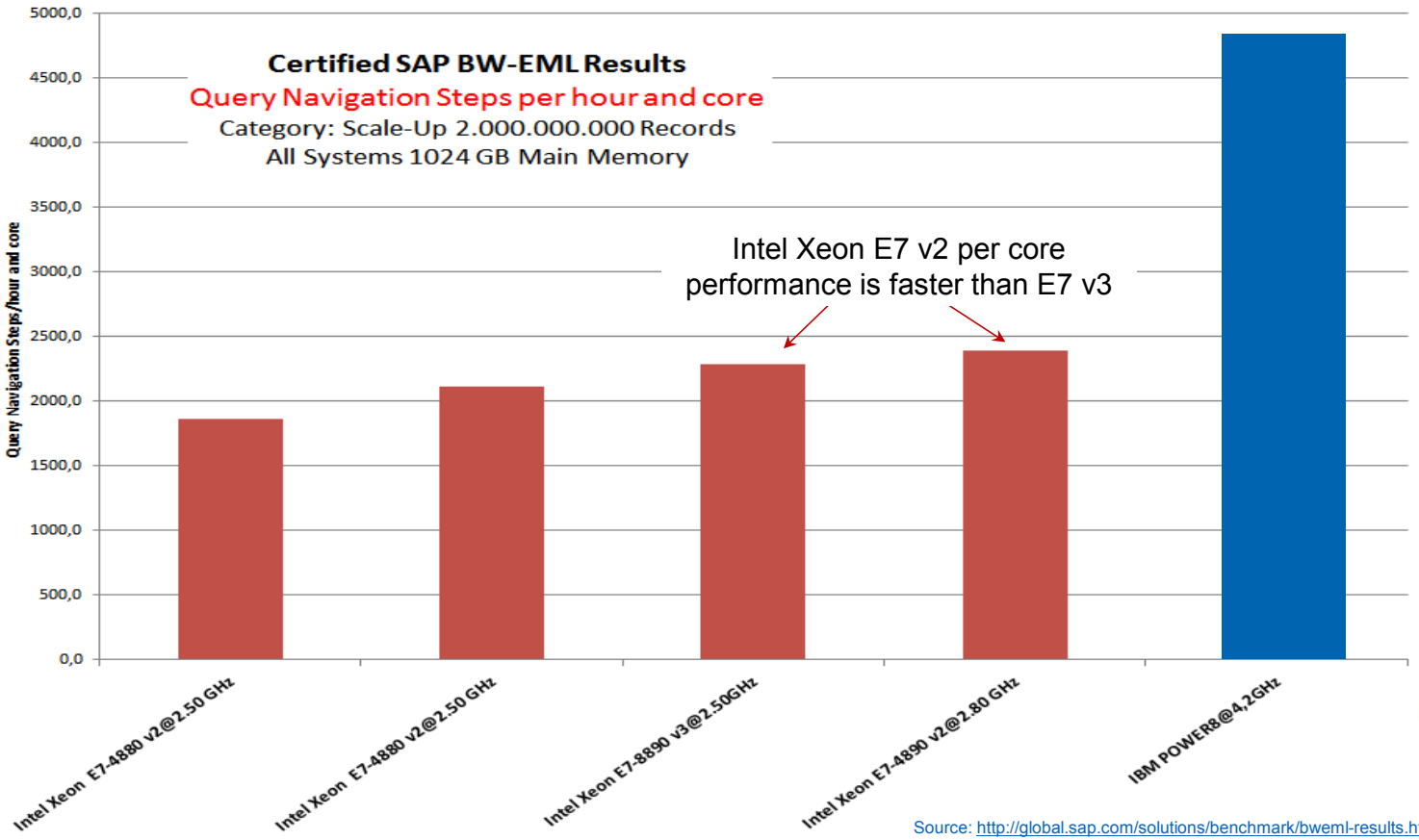
IBM POWER8 is leading in SAP per Core Performance



Source : http://global1.sap.com/solutions/benchmark/sd2tier.epx (as of 2016/5)

IBM POWER8 is leading in SAP per Core Performance

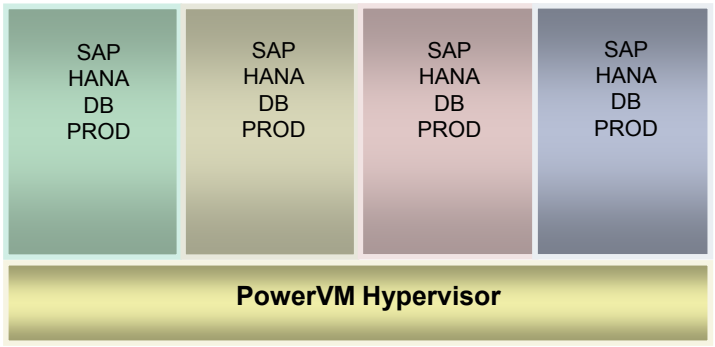
- Faster Single Core deliver Faster Application Response Time
- Single Core performance improves single thread or batch application
- IBM POWER8 is a better for those applications that need faster response



Source: http://global.sap.com/solutions/benchmark/bweml-results.htm

Flexibility : SAP HANA supports PowerVM for Production

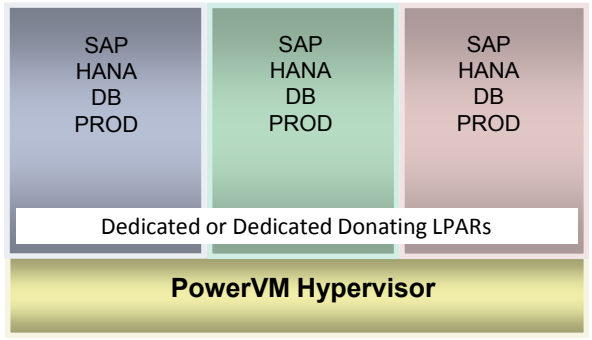
IBM Power E870 / E880 Server
Max. 4 Partitions for SAP HANA Production Environment



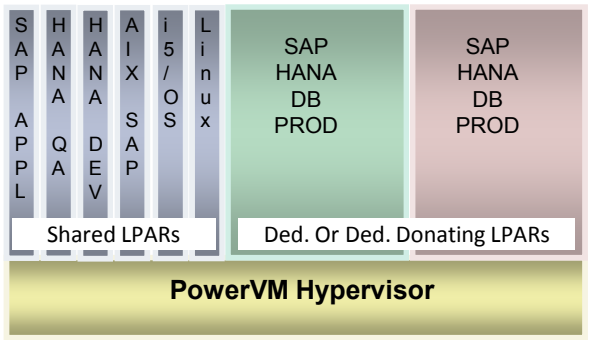
SAP HANA production environment could be run on IBM PowerVM virtualization technology for better integration and flexibility versus every x86 server could only run SINGLE HANA Production environment. Examples of virtualization features are :

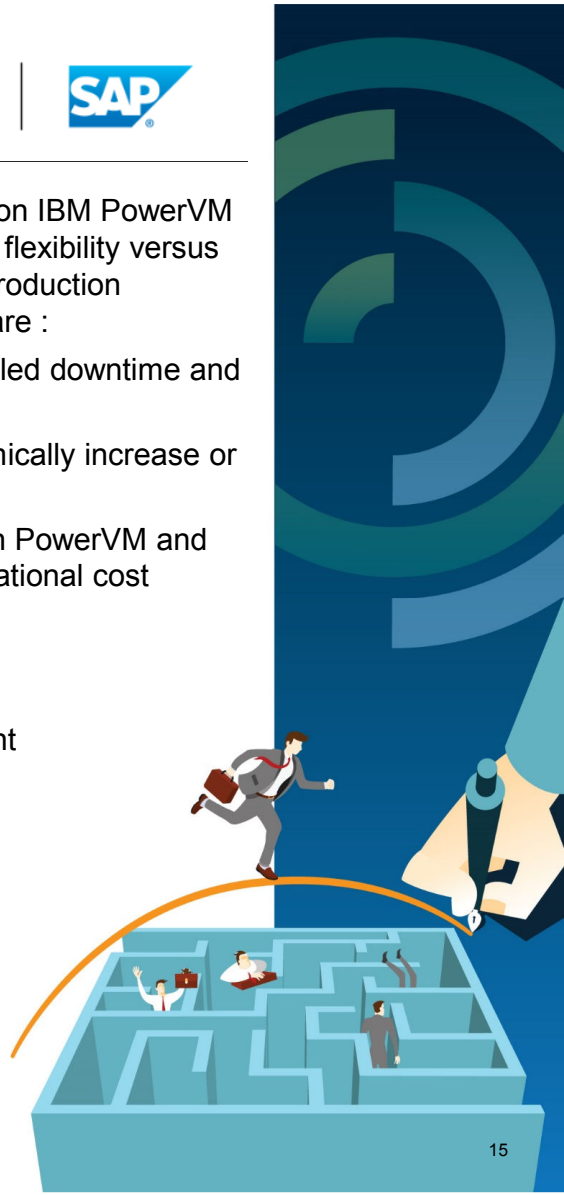
- **Live Partition Mobility (LPM)** to reduce scheduled downtime and service interruption during server upgrade
- **Capacity Upgrade on Demand (CoD)** to dynamically increase or reduce CPU or Memory resource
- **Private Cloud Management Platform** based on PowerVM and PowerVC to improve efficiency and reduce operational cost
- POWER7+ for Testing / Development platform

IBM Power E850 / S8XX / S822L Server
Max. 3 Partitions for SAP HANA Production Environment



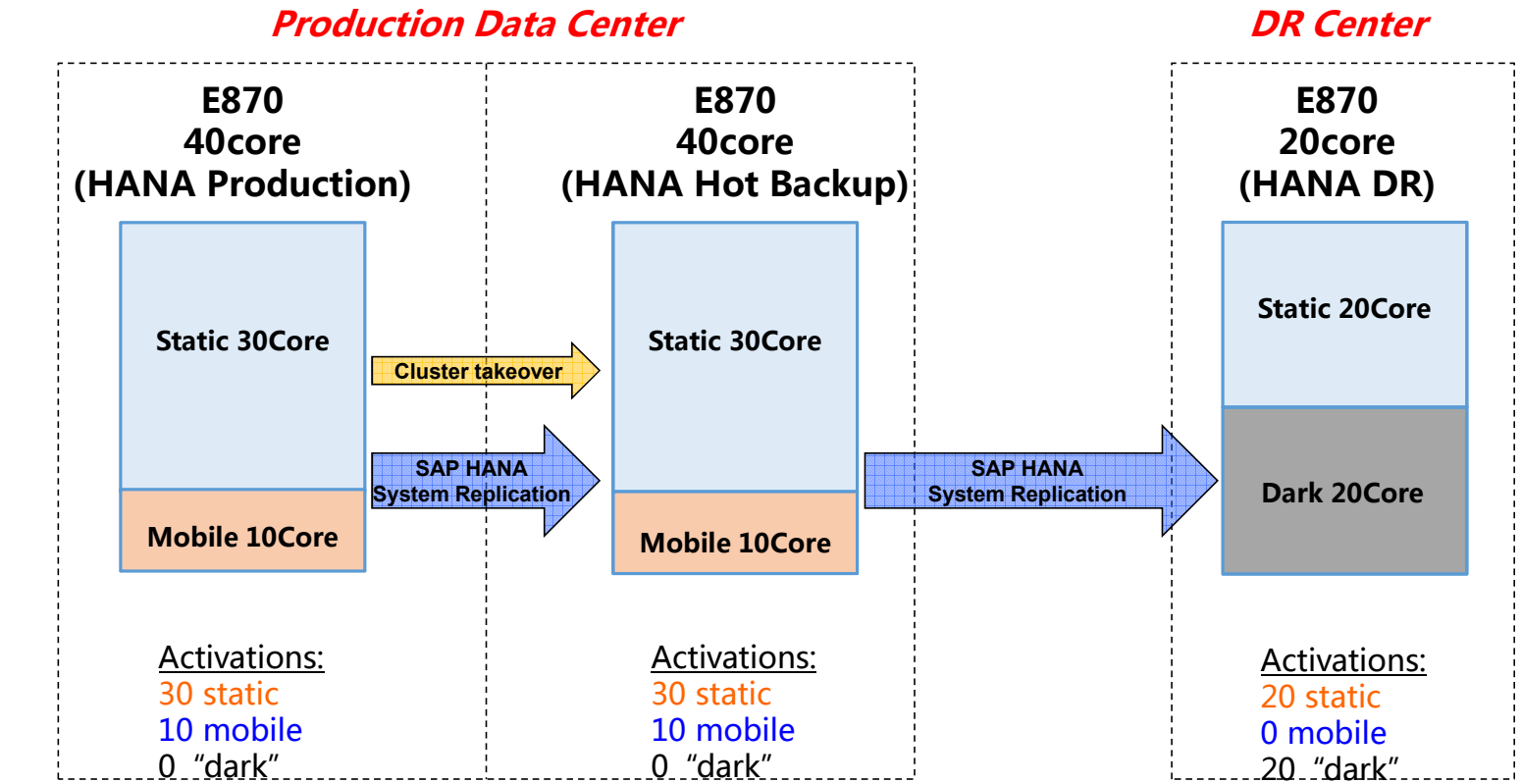
IBM Power Systems Server
Partitions for SAP HANA Dev / Testing Envrionment



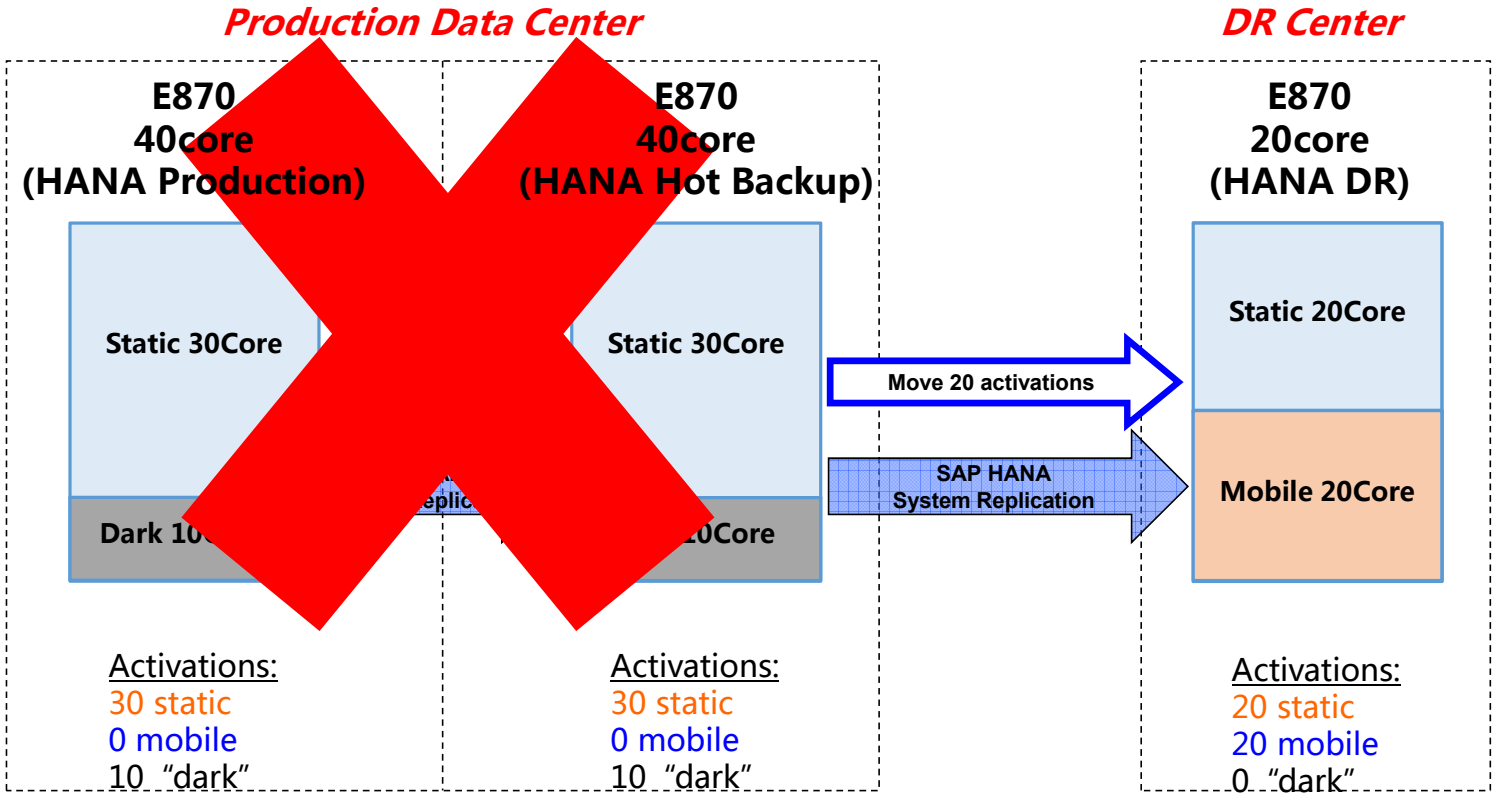


http://service.sap.com/sap/support/notes/2230704

SAP HANA DR Solution with POWER Enterprise Pool



SAP HANA DR Solution with POWER Enterprise Pool



Long Term Partnership between SAP & IBM

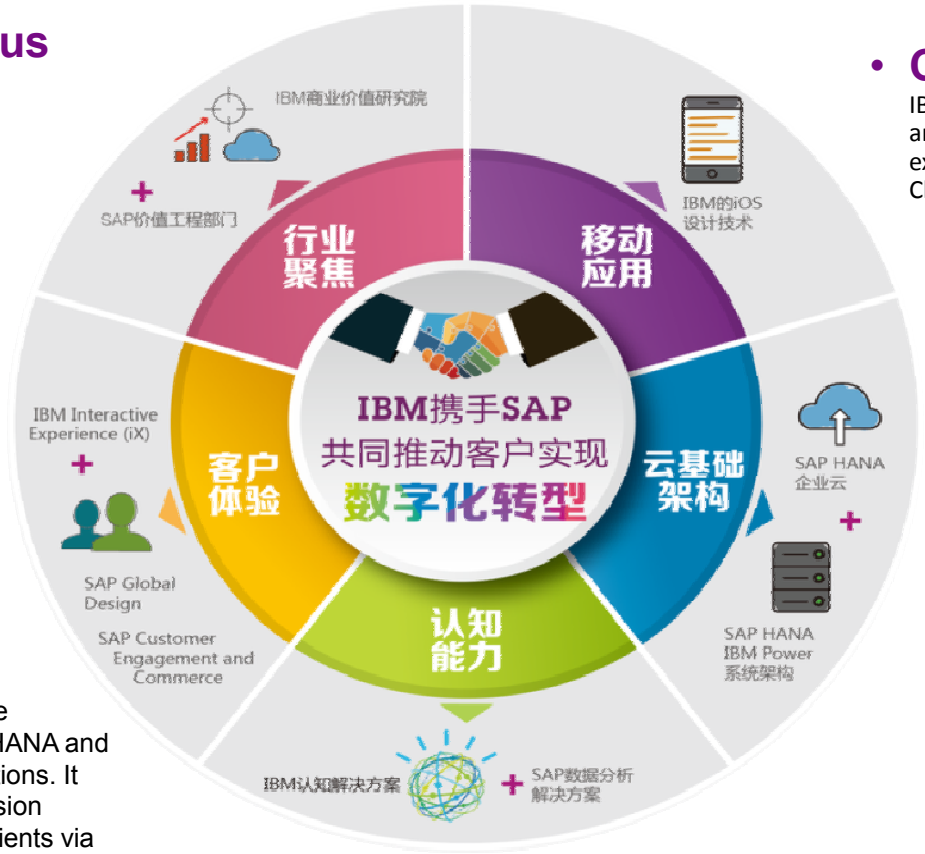
- IBM is one of the BEST SAP Partner who has received 31 SAP Pinnace Awards ever since 2002, more than any other Partners.
- IBM was the First SAP Development Partner since 1972, IBM has over 12,750 consultants and has helped over 12,000 clients to implement SAP systems with our best practices worldwide
- IBM developed our technology and products to better support SAP, e.g. POWER processor technology, Virtualization Technology, Cloud Computing Technology, Flash Array Technology, Capacity on Demand, GPFS Parallel Filesystem, DB2 HA-DR, PureScale, Monitoring solution, Backup solution etc.

SAP Partner GLOBAL TECHNOLOGY | SAP Partner GLOBAL SOFTWARE | SAP Partner GLOBAL SERVICES | SAP Partner GLOBAL HOSTING | SAP Gold Partner GLOBAL RESELLER

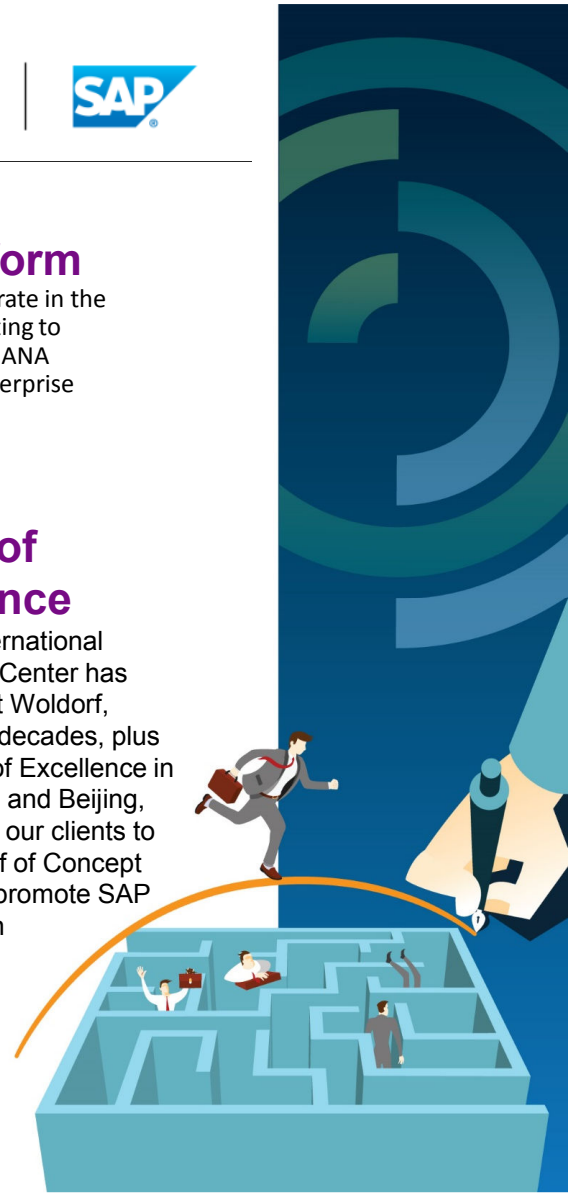
IBM SAP International Competence Center
ISICC
... combining our strengths

IBM & SAP help clients to achieve Digital Transformation

- **Industry Focus**
  Digital Transformation Roadmap for different industries and C-Level leaders
- **Client Experience**
  IBM & SAP create tailor made experience via IBM Interactive Experience (IX) Centers Worldwide
- **Cognitive Capability**
  IBM will offer Cognitive capability to SAP S/4HANA and Line of Business Solutions. It could offer better decision support or insight to clients via Cognitive API



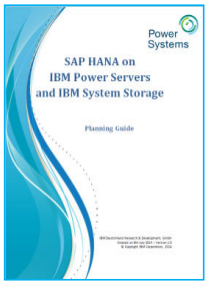
- **Cloud Platform**
  IBM & SAP will cooperate in the area of Cloud Computing to expand existing SAP HANA Cloud Services for Enterprise
- **Center of Excellence**
  IBM SAP International Competency Center has been setup at Woldorf, Germany for decades, plus SAP Center of Excellence in Austin, Texas and Beijing, China to help our clients to conduct Proof of Concept Tests and to promote SAP Hana solution



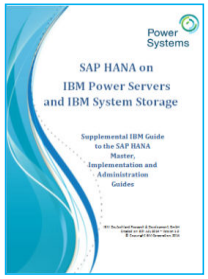
SAP HANA on IBM POWER Reference Material

IBM and SAP has prepared many technical document for SAP HANA on Power planning, implementation and operations, e.g.:

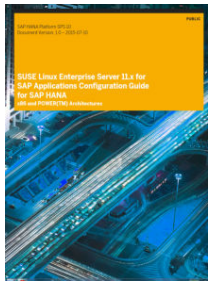
- ✓ Planning Guide
  http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP102502
  - features process/support/service guidance
- ✓ SAP Note 2055470
  - HANA on POWER planning and installation specifics
- ✓ SAP Note 2133369
  SAP HANA on Power: Central Release Note
- ✓ IBM Supplemental HoP Implementation Guide
  - Being created now
- ✓ SLES 11.x for SAP Applications Configuration Guide for SAP HANA (x86 and POWER)
- ✓ Administration/Troubleshooting Guide
  - Future plan
  - Includes best practices from customer production sites

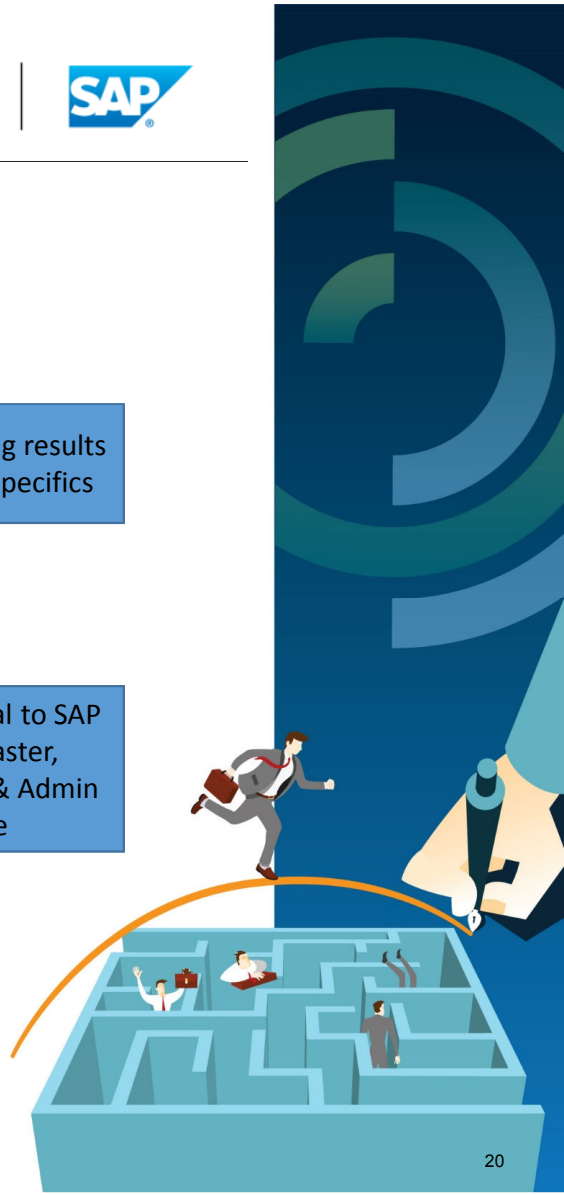


Map SAP Sizing results to IBM HoP specifics



Supplemental to SAP HANA Master, Installation & Admin Guide





Conclusions

SAP HANA demands Better Hardware Platform

- Memory Database required memory with high bandwidth and better RAS
- Scale-up capability and RAS design are most critical to SAP Hana application, especially SAP Business Suite and S/4 HANA could only be installed on single server with vertical scale-up capability for future expansion; while only SAP BW on HANA could support scale-out;

Value Propositions of IBM POWER8 Server platform

- **Better Resiliency** : Unique RAS features for mission critical SAP environment
- **High Performance :** Faster CPU Clock Frequency and Better Single Core performance for more responsive application and business results
- **More Flexibility :** SAP Hana production platform can run on IBM Virtualization platform for better flexibility and system utiliziation

SAP SAP HANA x IBM POWER8 is the best platform to empower business transformation