



Virtualizing & Security for SAP HANA Deployments Why Infrastructure Matters

Brett Murphy

A blue-tinted photograph of a city skyline at night, featuring several illuminated skyscrapers and a prominent tower with a glowing spherical top. The scene is viewed from a distance, showing a parking lot and some lower buildings in the foreground.

April
28
2023

Trusted Advisor

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Client Executive



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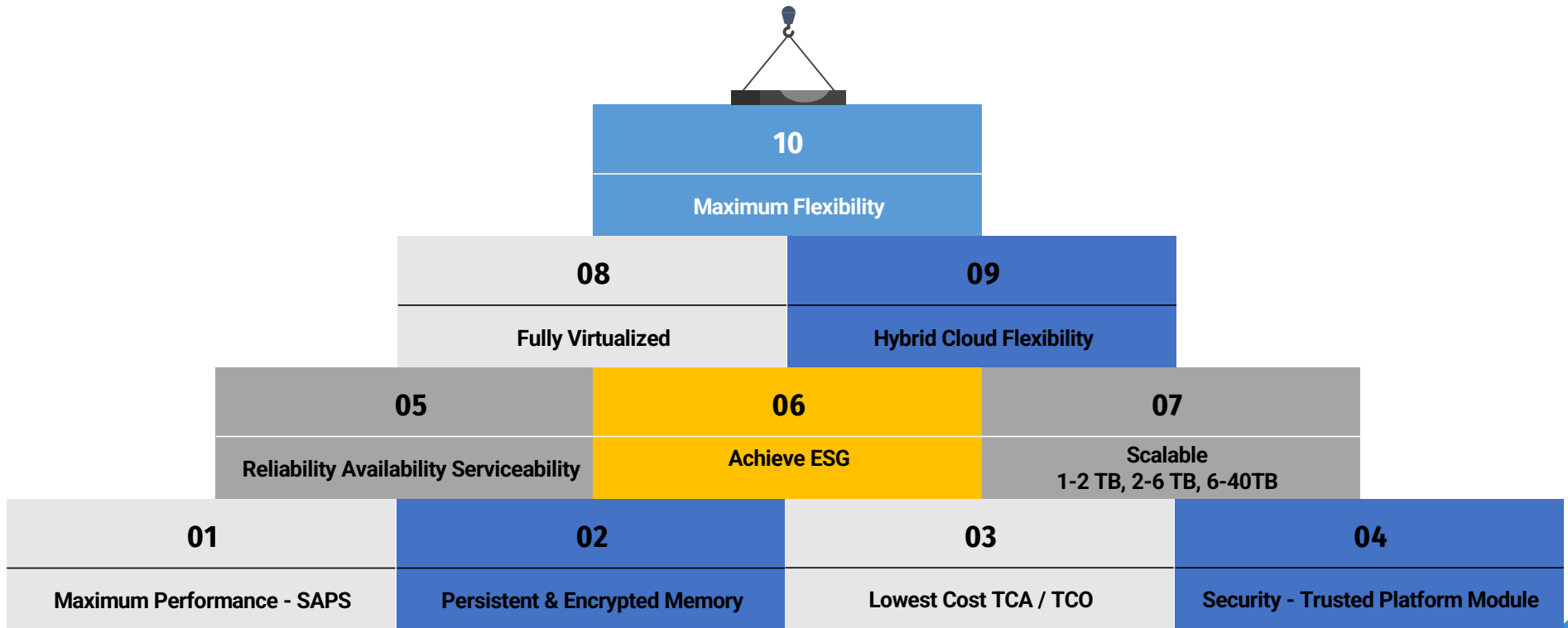


Passionate evangelist for Enterprise Compute, Storage & Software technologies. Recognized specialist in software cost reduction and competitive selling. Focus over the past 12 years has been on Architecture & Solution Design for clients running large, complex ERP environments.

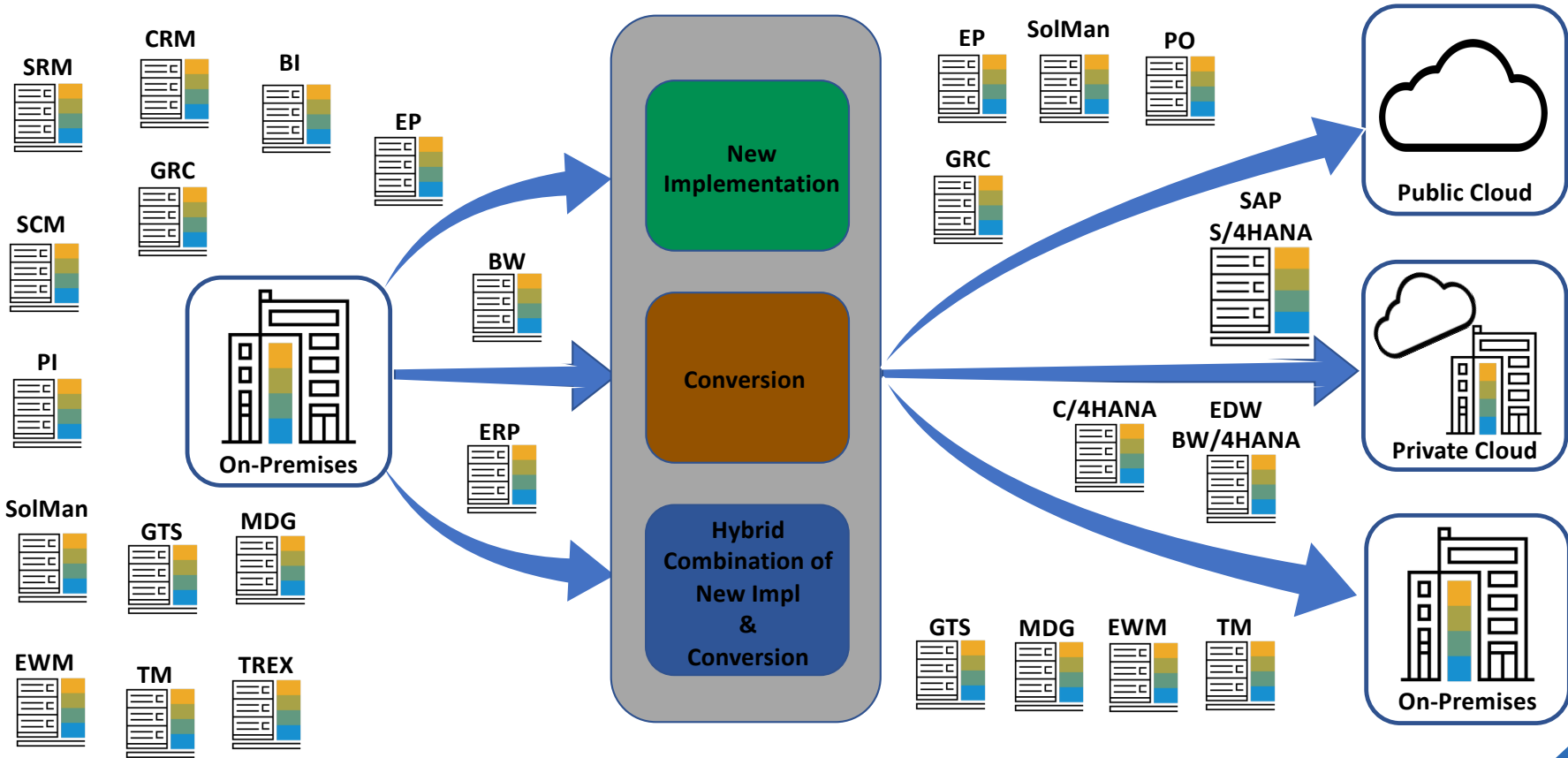
<https://www.linkedin.com/in/murphy-brett/>



What is a Desirable End State

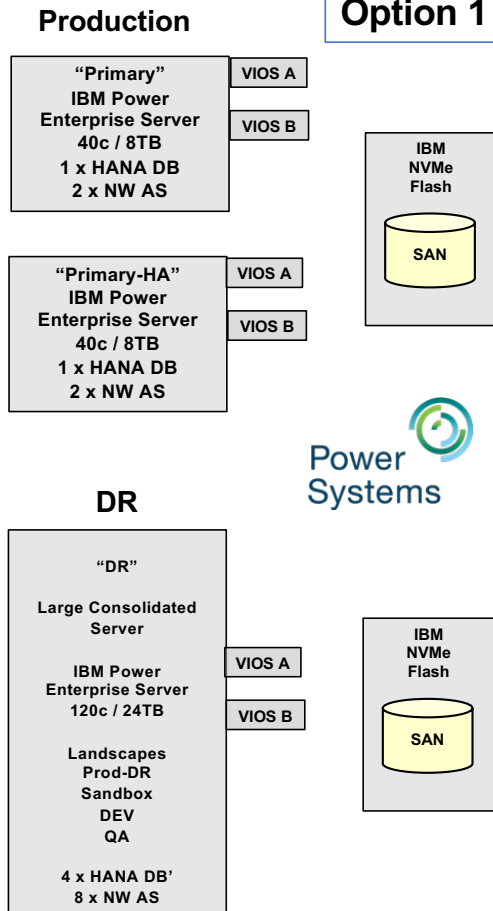


SAP Big Picture



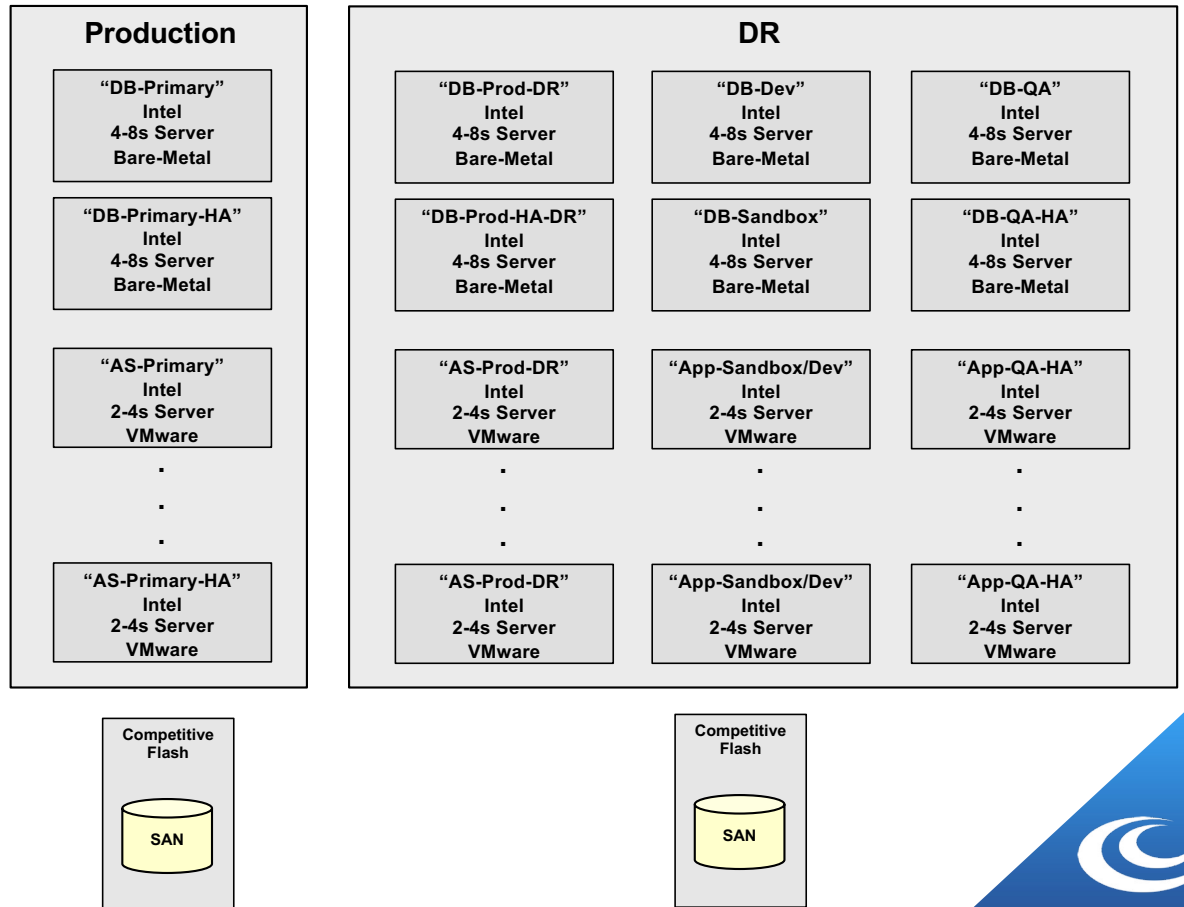
Client Considering 2 Options

Option 1



Option 2

This Intel/Storage solution was 35% more than POWER!



IBM Power

Visit us: <https://www.ibm.com/it-infrastructure/power>
Watch "The Legacy and Future of IBM POWER with IBM POWER10"

SAP HANA EXCELLENCE



Best SAP Performance

2.7x

Per core performance of 8-socket E1080 two-tier SAP SD benchmark compared to best x86 8-socket HPE Superdome Flex



Largest Customers

45

of America's top 50 largest revenue generating companies are active Power customers



Most Reliable

>= 99.9999%

Availability rating in ITIC survey of 1,200 corporations across 28 vertical markets



SAP on Power

40TB

Largest certified Memory instance



SAP on Power

>4,500

SAP HANA on Power customers



Highly Secure

<0.013%

Security vulnerabilities in PowerVM hypervisor compared to VMware



SAP on Power

16 LPARs

Highest # of production virtual partitions



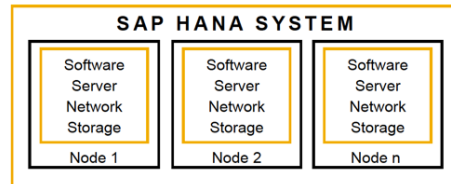
SAP on Power

>70

SAP HANA on Power Public References

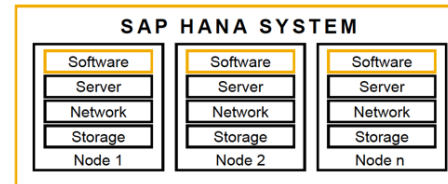
Two deployment options to choose from

Appliance



All-in one box certified partners
(1,100+ configurations – 64GB to 24TB)

Tailored Data Center Integration

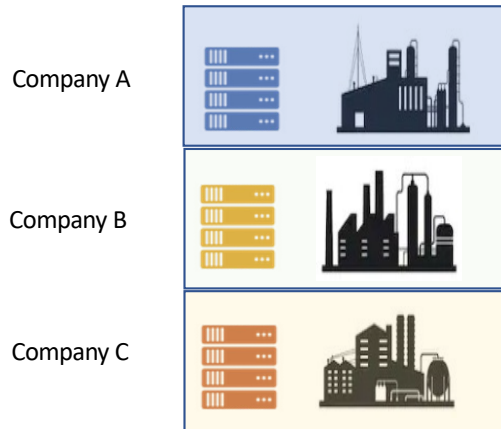


Choice of components that meet SAP requirements from different vendors

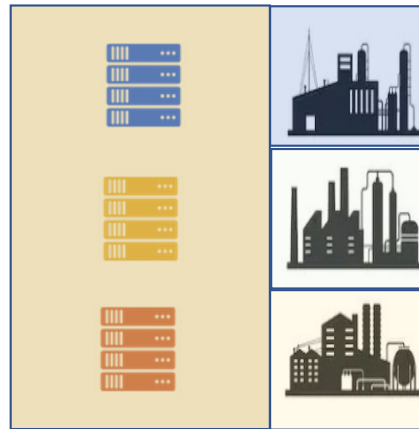


Consistency Matter?

On-Premises



Private Cloud



Public Cloud



=>

Bare Metal



*

Bare Metal



*

*

Bare Metal



GCP KVM
 Azure Mod-Hyper-V
 AWS Nitro



=>



IBM Power for SAP: Specifications for every SAP workload scenario



IBM Power – TDI On-Premises

IBM Cloud – Power Virtual Machine

**IBM Power Server,
certified for SAP
NetWeaver HANA**



**IBM Power Virtual
Server, certified for
SAP NetWeaver HANA**

32TB scale-up
SAP S/4HANA



22.5TB scale-up
SAP S/4HANA

40TB scale-up
SAP BW/4HANA



22.5TB scale-up
SAP BW/4HANA

512TB scale-out
SAP BW/4HANA (16
nodes)



115.2TB scale-out
SAP BW/4HANA (8 nodes)

995,050 SAPS
120 cores
Benchmark *world record 8-
socket result*



907,820 SAPS
160 cores
Benchmark *world record
across all Cloud IaaS*

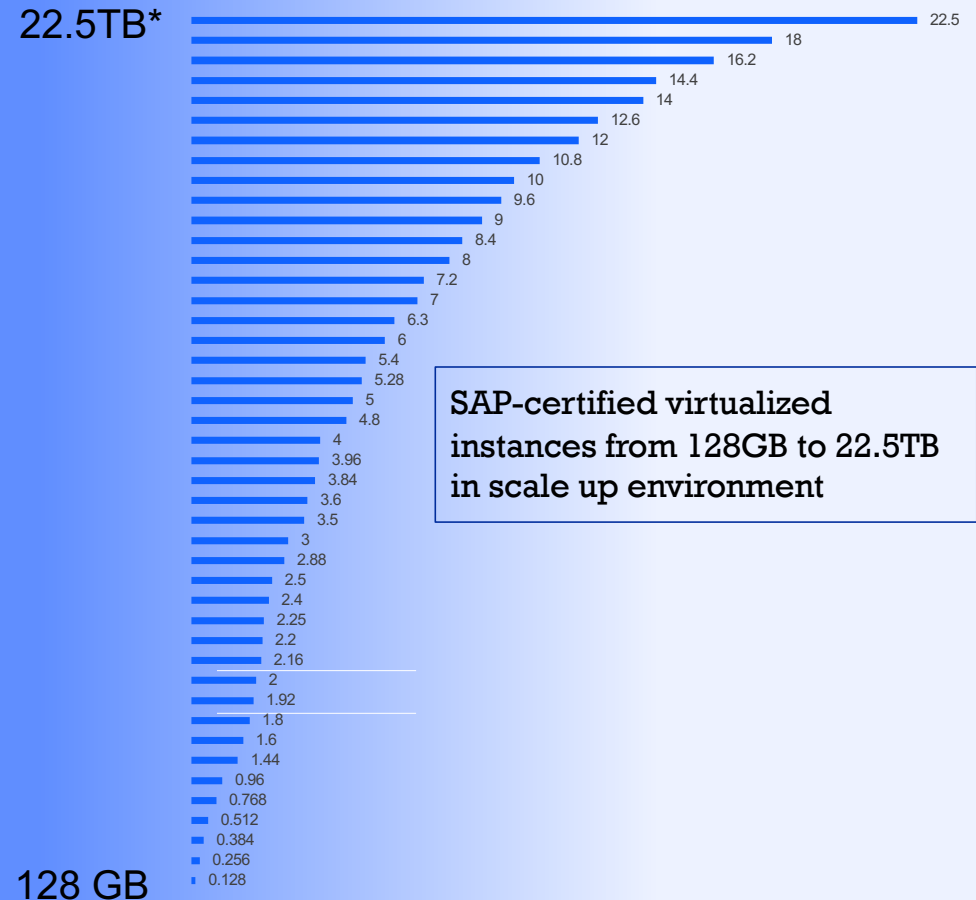


Flexibility with SAP-certified virtual instances on Power

- Only SAP-certified IaaS environment on Power
- Simply management and rapidly migrate from on-prem to cloud with consistent architecture
- Only cloud that offers SAP-certified virtualized instances from 128GB to 22.5TB that offers unparalleled flexibility
 - Dynamically change capacity (memory and cores) without shutting down applications
 - Scale without overprovisioning in 44 granular increments from 128GB to 22.5TB to 22.5TB
- World record SAPS performance benchmark for IaaS environment

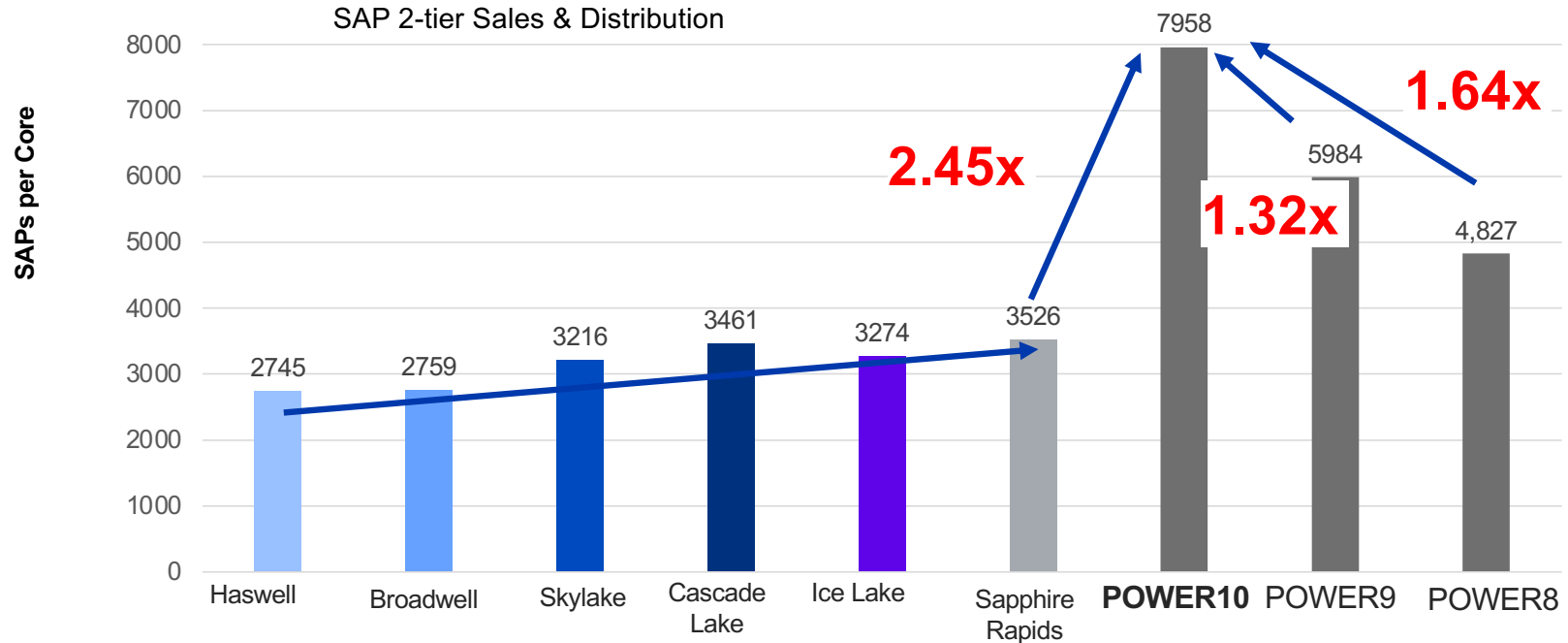
<https://www.sap.com/dmc/exp/2014-09-02-hana-hardware/enEN/#/solutions?filters=iaas;v:ca15;v:ca2;v:ca14;v:ca12>

IBM Power Systems Virtual Server



SAP SD Benchmarks

Power Systems continuously improves per core performance



- **World record 8-socket performance**
- **More performance per core**
 - **4X vs 16-socket Intel¹**
 - **2.7X vs 8-socket Intel²**

Source: <https://www.sap.com/dmc/exp/2018-benchmark-directory/#/sd>

1. Google Cloud Platform; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5 (cloud); Intel Xeon Platinum 8280L 2.7 GHz, 16p/448c/896t, 157,000 SD benchmark users (892,270 SAPS), running Windows Server 2019 and Microsoft SQL Server 2017, Certification # 2021008.
2. HPE Superdome Flex; two-tier SAP SD standard application benchmark running SAP ERP 6.0 EHP5; Intel Xeon Platinum 8380H 2.9 GHz, 8p/224c/448t, 122,300 SD benchmark users (670,830 SAPS), Windows Server 2016 and Microsoft SQL Server 2012, Certification # 2021006.

2023 Clear Technologies Confidential



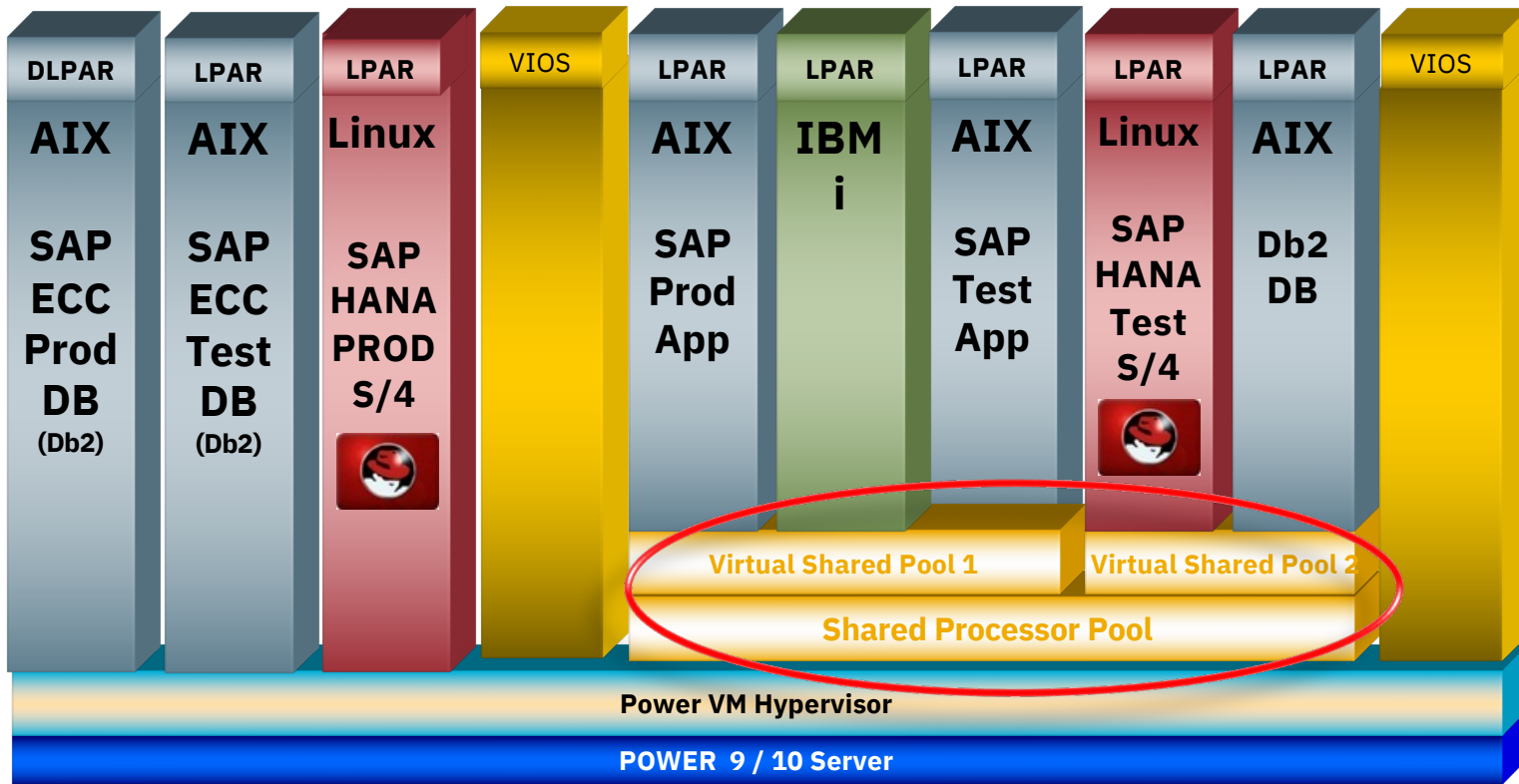
Infrastructure Granularity

LPAR	LPAR Details	Memory in GB	Cores
1	HANA OLAP L	22,528	78
2	HANA OLAP S	14,336	40
3	HANA OLAP S	1,200	5.0
4	HANA OLAP M	1,440	8.0
5	HANA OLTP1 High Priority	12,288	36
6	HANA OLTP2 Low Priority	960	4.0
7	App-Server 1	320	8.0
8	App-Server 2	320	8.0
9	App-Server 3	320	8.0
10	App-Server 4	320	8.0
11	test1	128	2.0
12	test2	512	2.0
13	test3	256	4.0
14	test4	128	4.0
15	demo	256	5.0
	Total Resources Required	55,042	220

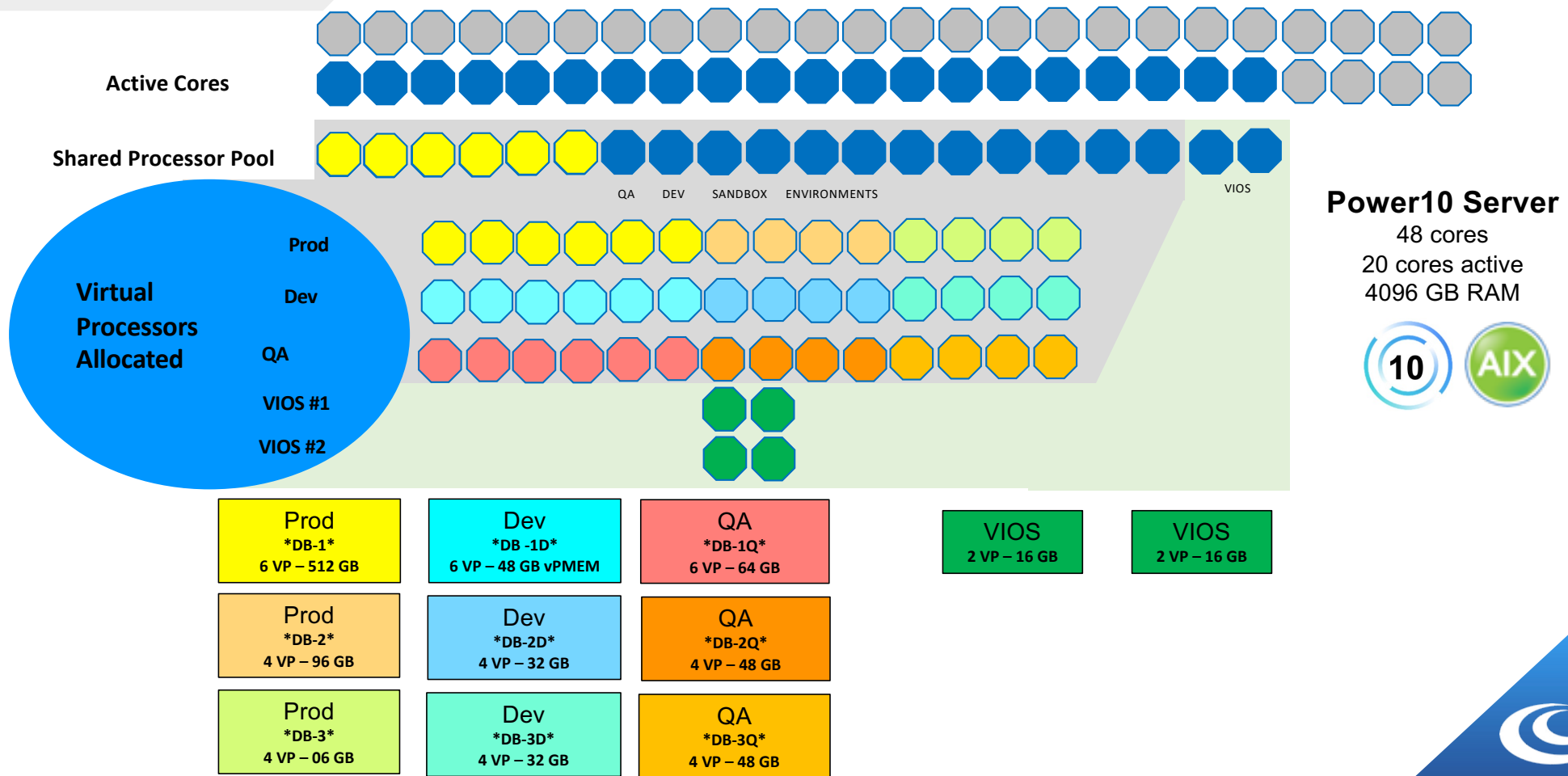
*Acts the same ...
Behaves the same ...
On-Premises &
Hybrid Cloud!*



Secret Sauce - PowerVM



IBM Power Flexibility



Power10 Server

48 cores
20 cores active
4096 GB RAM



What's the 'Virtualization' Difference

x86

SAP Support for VMware is very restrictive

- Production HANA VM CPU Sizing Options:
 - Minimum ½ Socket (½ socket HANA VMs can only share the other ½ socket with other HANA VM's)
 - Next size up is 1 Full Socket
 - Then 2 Socket
 - *CPU granularity beyond one socket on x86 is in full socket increments!*
 - CPU's MUST be set to Dedicated mode
- Memory allocation could result in stranded CPU capacity.
- SAP supports up to 12TB of memory in a VM, or 24TB bare metal.
- VMware Restricts Performance
 - SAP recommends 15% buffer for CPU due to VMware overhead
 - Vmware virtual network latency increases as CPU utilization increases - <https://kb.vmware.com/s/article/83957>

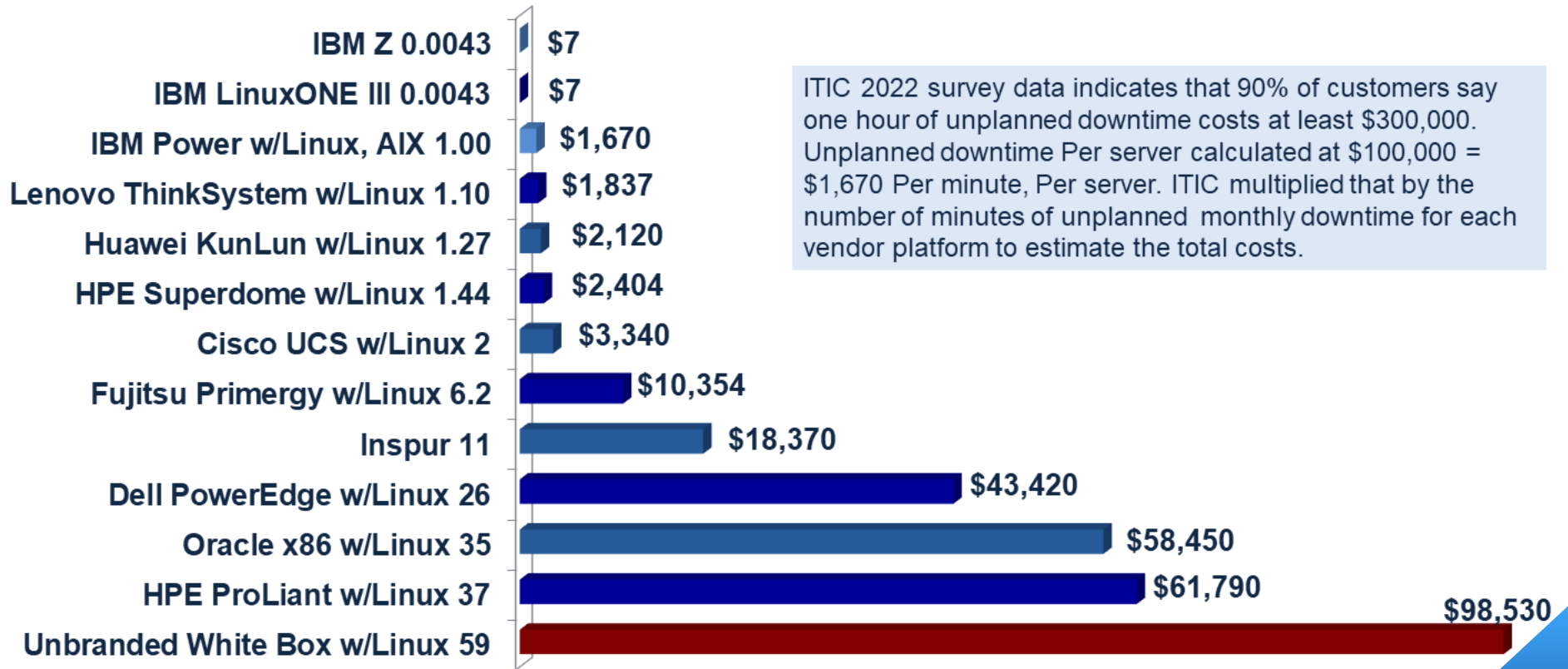
Power

SAP Supports nearly every feature of PowerVM

- Production HANA VM CPU Sizing Options:
 - Minimum 4 Virtual Processors
 - Can increase Entitlement in increments of .01
 - There are no restrictions on socket boundaries
 - CPU's can be shared across all other VM's on the system – over commitment is supported
 - Dynamic add/remove of CPU is supported without reboot
- Memory Size is not tied to sockets, cores, or system architecture. Any combination of CPU + Memory is supported as long as the assignments are greater than the minimum requirements of 4 Virtual Processors and 128GB of RAM. Memory minimum is the same as on x86.
- Can increase/decrease memory in 1GB increments without downtime
- SAP supports up to 40TB of memory in a VM
- PowerVM does not introduce additional CPU overhead
 - SAP does not have a buffer recommendation when using PowerVM



Monthly Cost Unplanned Downtime Per Server/Per minute, Assuming Cost of \$100K Hourly in August 2022



ITIC 2022 survey data indicates that 90% of customers say one hour of unplanned downtime costs at least \$300,000. Unplanned downtime Per server calculated at \$100,000 = \$1,670 Per minute, Per server. ITIC multiplied that by the number of minutes of unplanned monthly downtime for each vendor platform to estimate the total costs.



IBM Power RAS

Processor:

- Processor Instruction Retry
- Dynamic deallocation of cores for predictive errors
- L2/L3 Cache ECC protection with cache line-delete
- CRC checking with retry, lane sparing, and 1/2 bandwidth mode for processor-to-processor fabric busses
- Architecture for persistent guarding of failed elements

Memory (Differential DIMM – DDIMM):

- Full x4 chipkill corrections, can survive 3 chipkills, leveraging memory ECC and spare DRAMs without memory bandwidth performance loss
- Dynamic row repair allows for fixing certain DRAM fails without taking the memory/system down
- Uses fewer signals than ISDIMMs which means lower chance for bus failure
- CRC protection with OMI bus retry
- Operational with up to 4 OMI lane failures
- Redundant on-board Power Management IC (PMIC) to handle single phase errors
- Redundant temperature sensor
- Hypervisor Memory Mirroring

Other:

- First Failure Data Capture
- Power & Cooling redundancy
- Redundant System Clocks
- Redundant Service Processors
- Trusted Platform Module (TPM) for secure Boot
- Hot Plug & Repair I/O adapters (PCIe GEN5)
- Passive node to node cabling for reliability and ease of repair



What's Different

Reliability – Enhanced availability through redundancy and enterprise memory

Scalability – Support up to 40TB memory in a single instance

Flexibility – Adjust sizing on the fly with no downtime

Performance – World record benchmarks and 2X+ memory bandwidth

Virtualization – Fully supported on Power with no performance impact

Security – Built-in Security extend to Storage

What's The Same

SAP Itself – SAP Code does not change across platforms

Operating System – RedHat or SUSE

Management Tools – Chef, Ansible, OpenStack, and more!

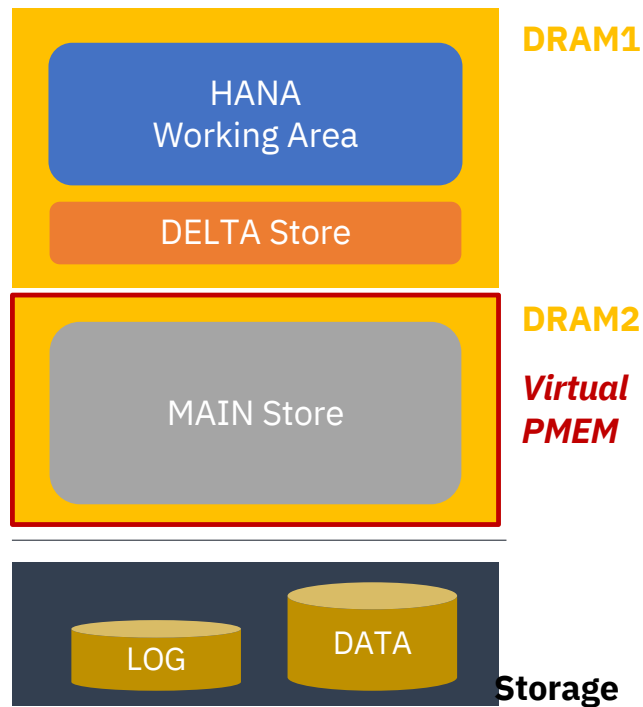
Application / Database Skills



IBM Power PMEM

How it will work

- DRAM is split into two regions DRAM1 & DRAM2
- Data in DRAM2 are preserved across HANA, OS, and LPAR restarts, i.e. it is *virtually persistent*.
- DRAM2 is advertised as PMEM device (standard Linux i/f exploited by HANA)
- DRAM2 region is initialized with Main region when used for the first time
- Restart of HANA or Linux do **not** require main region to be re-loaded from storage into memory
- Storage is used for data persistency; changes to database continuously logged to LOG volume



Client Value

- Fast Restart of SAP HANA environment in case of planned and unplanned downtime
- Applicable to >90 % of maintenance scenarios*
- No additional cost
- No impact on runtime performance or latency

* According to survey with large POWER customers.



PMEM Advantages

**Faster SAP HANA
restart**

**Improves shutdown
time**

Maximize uptime

**Preserves runtime
performance**

NUMA aware PMEM

Continue to get faster insights

Virtualization enabled

**Change PMEM
allocation on demand**

Improved flexibility

***Available at no additional cost on
Power Systems servers!***



Memory Flexibility

Memory

Displays properties of the running logical partition that is using dedicated or shared memory. You can assign the required amount of dedicated or shared memory to the logical partition. [Learn More](#) →

Memory Mode: Dedicated

Installed Memory

Total : 48.0 GB
Available : 3.25 GB

Memory Allocation

Maximum(GB) 12
Allocated(GB) 11
Minimum(GB)

Options

You can use the Force option to change the processor and memory value, or the physical I/O configuration for an AIX, Linux, or VIOS partition that are in running state and that does not have an RMC connection to the management console. Before saving the configuration, you must save the configuration and not a description for the current operation.

SAP HANA now supports changing the memory size without restarting SAP HANA

DLPAR Memory **add** and **remove** on the HMC allows you to change the **memory** allocated to an LPAR **dynamically** in the range of Min and Max as defined in the LPAR profile without restarting the LPAR

See SAP Note [3114051](#) for more details

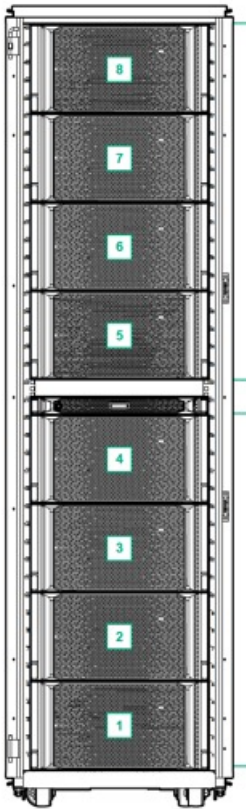
IBM "Dynamic LPAR" (DLPAR) operation to add memory to or remove memory from a running LPAR on POWER9

- LPARs must use HANA 2.0 SPS05 revision 52 (or newer) and SLES 15 SP2 or RHEL 8.3
- Use a DLPAR operation to adjust memory if you immediately need more memory to fulfill a critical business task, and shutting down the SAP HANA system is not possible.

- When adding or removing memory permanently to or from an LPAR it is required to verify the sizing of the target configuration to ensure it still satisfies the workload requirements for that LPAR. If the new configuration does not satisfy the workload demand, then corrective actions need to be taken.

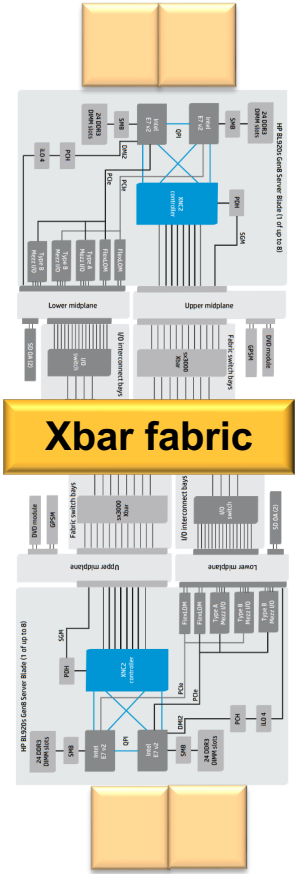
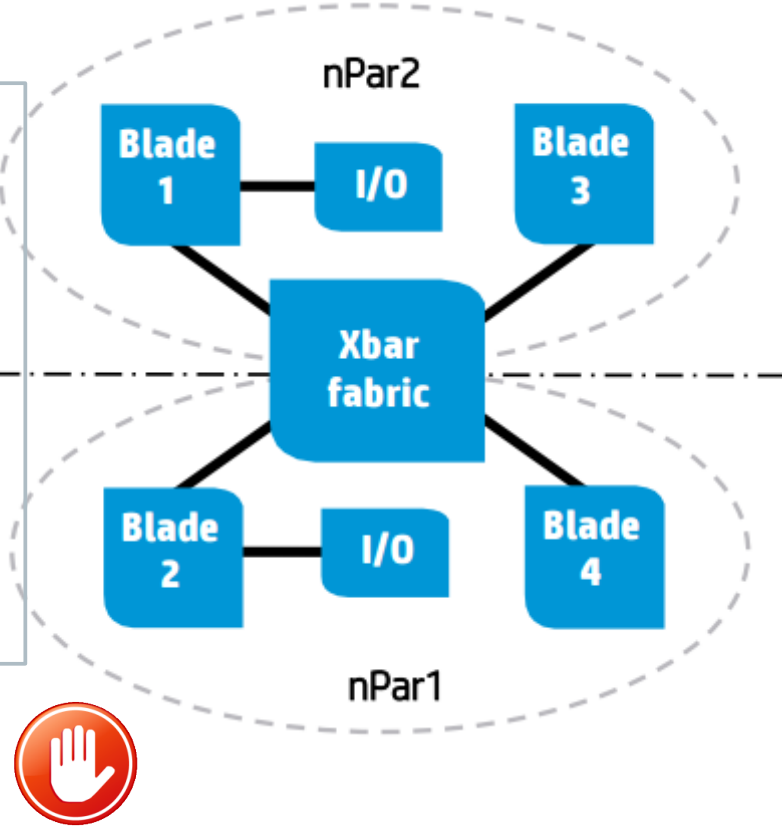


HPE SuperDome Flex In-Flexibility



HPE nPAR:

- Electrical Isolation - not a hypervisor
- They are NOT granular: Smallest Partition: 1 Blade / 2 Sockets / 48 DIMMS
- All server blades in a partition must be identical
- HPE Superdome X and Superdome Flex support multiple nPartitions of 2, 3, 4, or 8 sockets
- Changes require reboot of the nPAR



Source: HP Integrity Superdome X User Service Guide



What Issues Most Negatively Impact Reliability & Cause Downtime for Server hardware, Server OS in 2022? (Select all that apply)



Nation State Actors and their Proxies Capable of **Cyber Warfare**

Your Cyber Warfare Threat

Russian Intelligence Services Conducting Cyber Warfare

GRU
Main Directorate of
the General Staff of
the Armed Forces



<https://en.wikipedia.org/wiki/GRU>

SVR
Foreign Intelligence
Service



[https://en.wikipedia.org/wiki/Foreign_Intelligence_Service_\(Russia\)](https://en.wikipedia.org/wiki/Foreign_Intelligence_Service_(Russia))

FSB
Federal Security
Service



https://en.wikipedia.org/wiki/Federal_Security_Service

Russian Trained and Supported Proxies Conducting Cyber Warfare

The Cooming Project *XakNet* *MUMMY SPIDER*

SALTY SPIDER *SCULLY SPIDER* *SMOKEY SPIDER*
WIZARD SPIDER

Killnet

<https://en.wikipedia.org/wiki/Killnet>

Partial List Only

Sandworm

[https://en.wikipedia.org/wiki/Sandworm_\(hacker_group\)](https://en.wikipedia.org/wiki/Sandworm_(hacker_group))

Your Cyber Warfare Threat

Chinese Intelligence Services Conducting Cyber Warfare

PLA Unit 61398



https://en.wikipedia.org/wiki/PLA_Unit_61398

PLA Unit 61486



https://en.wikipedia.org/wiki/PLA_Unit_61486

MSS
Ministry of State
Security



[https://en.wikipedia.org/wiki/Ministry_of_State_Security_\(China\)](https://en.wikipedia.org/wiki/Ministry_of_State_Security_(China))

Chinese Trained and Supported Proxies Conducting Cyber Warfare

Double Dragon

[https://en.wikipedia.org/wiki/Double_Dragon_\(hacking_group\)](https://en.wikipedia.org/wiki/Double_Dragon_(hacking_group))

Hafnium

[https://en.wikipedia.org/wiki/Hafnium_\(group\)](https://en.wikipedia.org/wiki/Hafnium_(group))

Honker Union

https://en.wikipedia.org/wiki/Honker_Union

Network Crack Program Hacker Group (NCPH Group)

https://en.wikipedia.org/wiki/Network_Crack_Program_Hacker_Group

Partial List Only

Your Cyber Warfare Threat

North Korean Intelligence Services Conducting Cyber Warfare

Bureau 121



https://en.wikipedia.org/wiki/Bureau_121

Reconnaissance General Bureau (RGB)



https://en.wikipedia.org/wiki/Reconnaissance_General_Bureau

North Korean Trained and Supported Proxies Conducting Cyber Warfare

Lazarus Group



https://en.wikipedia.org/wiki/Lazarus_Group

Partial List Only

Your Cyber Warfare Threat

Iranian Intelligence Services Conducting Cyber Warfare

Iranian Cyber Army



https://en.wikipedia.org/wiki/Iranian_Cyber_Army

Revolutionary Guard Corps



https://en.wikipedia.org/wiki/Islamic_Revolutionary_Guard_Corps#Basij

Basij



<https://en.wikipedia.org/wiki/Basij>

**Passive Defense
Organization (NPDO)**



<https://www.iranwatch.org/iranian-entities/passive-defense-organization>

Iranian Trained and Supported Proxies Conducting Cyber Warfare

Rocket Kitten

https://en.wikipedia.org/wiki/Rocket_Kitten

Iranian Cyber Brigades



<https://www.interregional.com/en/hacker-brigades>

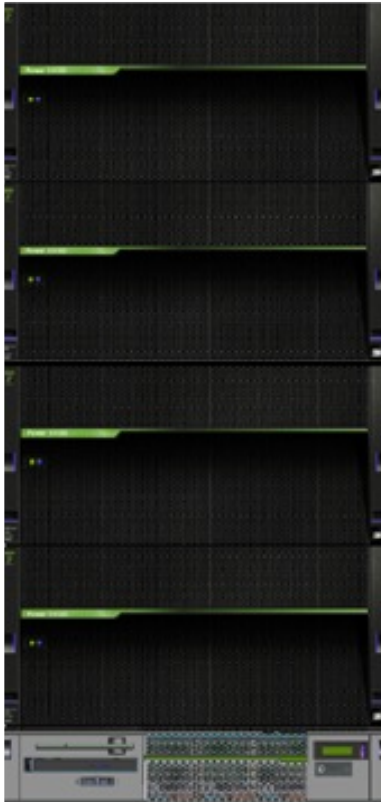
Partial List



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IBM Power Security



- ✓ Enhanced end-to-end security, co-optimized with PowerVM
- ✓ Built-in security features at all layers in the stack (i.e., processor, memory, systems, firmware, OS, and hypervisor).
- ✓ Transparent encryption of all the memory
- ✓ Transparent encryption/compression for fast VM mobility
- ✓ Cybersecurity (Transparent memory encryption, 4x crypto engines, ready for quantum-safe cryptography)
- ✓ 100X fewer security vulnerabilities than VMware

Protect data from
core to cloud

- Transparent memory encryption
- Support for Quantum safe cryptography and Fully Homomorphic Encryption
- 2.5X faster AES crypto performance per core vs. Power E980⁴
- Advanced protection for ROP attacks



IBM PowerSC

Compliance and Drift Analysis

- HIPAA, PCI, CIS, and more

Security

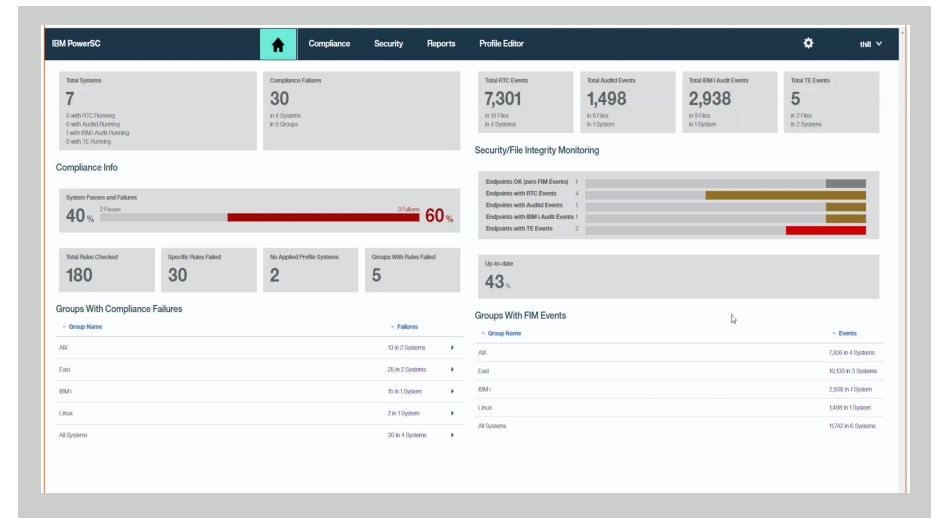
- File Integrity Monitoring (FIM)
- Allow/Block listing
- Endpoint Detection & Response

Patch Management

- Trusted Network Connect (TNC)
- Detect & alert policy issues
- Policy enforcement

Multifactor Authentication

- Policy-based and Centrally administered
- Simplified logins (Tokens and SSO)



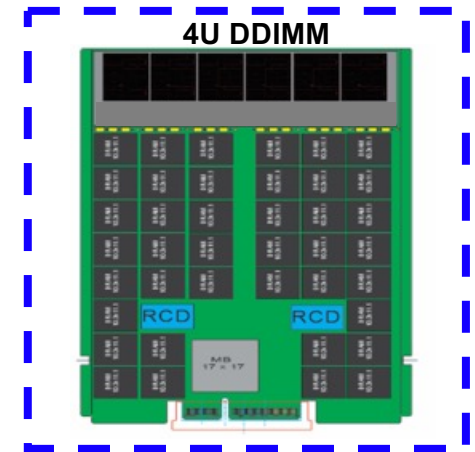
PowerSC is a user-friendly, web-based UI to manage Security & Compliance

IBM Power Memory Performance

With SAP HANA being an in-memory database, system memory is crucially important in keeping your SAP application running 24x7

4U Enterprise DDIMM has enhanced buffer, N+1 voltage regulation, and spare DRAM technology

Providing higher bandwidth and flexibility for future memory technologies
Full memory encryption for added security



- 2X better memory RAS than industry standard DIMMs¹
- 2.4X higher memory bandwidth than scalable x86 processors
- DDR4 running at up to 3200 Mbps data rate provides 409 GB/s peak memory bandwidth per socket
- Transparent memory encryption with no additional management setup and no performance impact
- Chipkill technology with advanced ECC protects from memory chip failure - plus spare
- Active Memory Mirroring (AMM) feature supported - Mirrors hypervisor memory to provide resiliency from uncorrectable memory errors

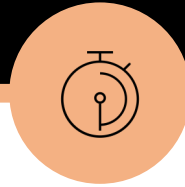


Why Act Now?



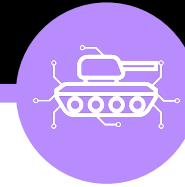
CYBER ATTACKS

Ransomware attacks
increased 95% in 2021



RANSOMWARE

"time to ransom"
dropping to a matter of
hours



CYBER WARFARE

Complete data wipe
(production & backups)
No ability to recover

INCREASING THREATS

Be Ready for ANYTHING

IBM CYBER SECURITY

Predict attacks

Cyber attack prevention

Respond to Cyber Attacks

Integrated
Simplified
Automated

On Prem

Public Cloud

IBM CYBER RESILIENCE

Business Recovery

Immutable Data

Accelerated Discovery

Protecting SAP HANA with the IBM Storage Portfolio

IBM recommends a comprehensive plan for protecting your SAP HANA databases



IBM Storage Protect



IBM Storage Protect Plus

Creates backups and stores them on flash, disk, tape, and object



IBM Storage Copy Data Management

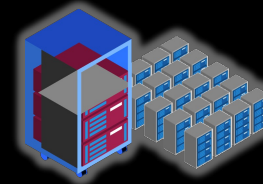
Creates and manage primary storage hardware snapshots



IBM Storage Sentinel

Creates immutable snapshots and scans them for Ransomware

SAP HANA



Object / Cloud



Tape



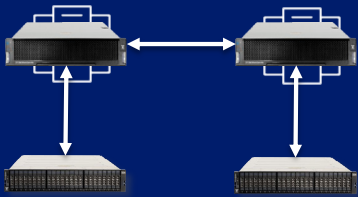
Disk/Flash

Increasing Security w/ Rapid Recovery



Built with
IBM Spectrum Virtualize

Enhanced High-availability Zero RPO/RTO



HyperSwap Zero RPO/RTO



Enterprise Disaster Recovery >Zero RTO



Multi-Platform Support

100% data
availability guarantee

2-site and 3-Site Options
Can be combined with HyperSwap

Pure HPE IBM
Dell/EMC NetApp 500+ others...

Protection from failures
and disasters

Encrypted – Immutable – Rapid Recovery

1

Make Immutable Copies of Data

Safeguarded Copy

CSM/CDM/Internal Scheduler to automate creation and restore of data copies

2

Test Copies of Data

Isolated infrastructure to test data copies

Ensure copies are not corrupted/infected using application tools Test infrastructure can be logically or physically isolated

Blueprint for testing and recovery process

3

Automate Process

Automation of taking copies and testing

Automation of test & restore process



FlashSystem Cyber Vault is as simple as 1, 2, 3, 4

1

Immutable Copies of Data

Created with IBM Safeguarded Copy
Can not be changed once created

2

Proactive Monitoring

Early warning signs of attack with
IBM Storage Insights
Recommend integration with SIEM
such as IBM QRadar

Cyber Vault



Blueprint
Automation

Rapid Recovery

Restore production from validated data
copies on primary storage
Recovery from point-in-time copy

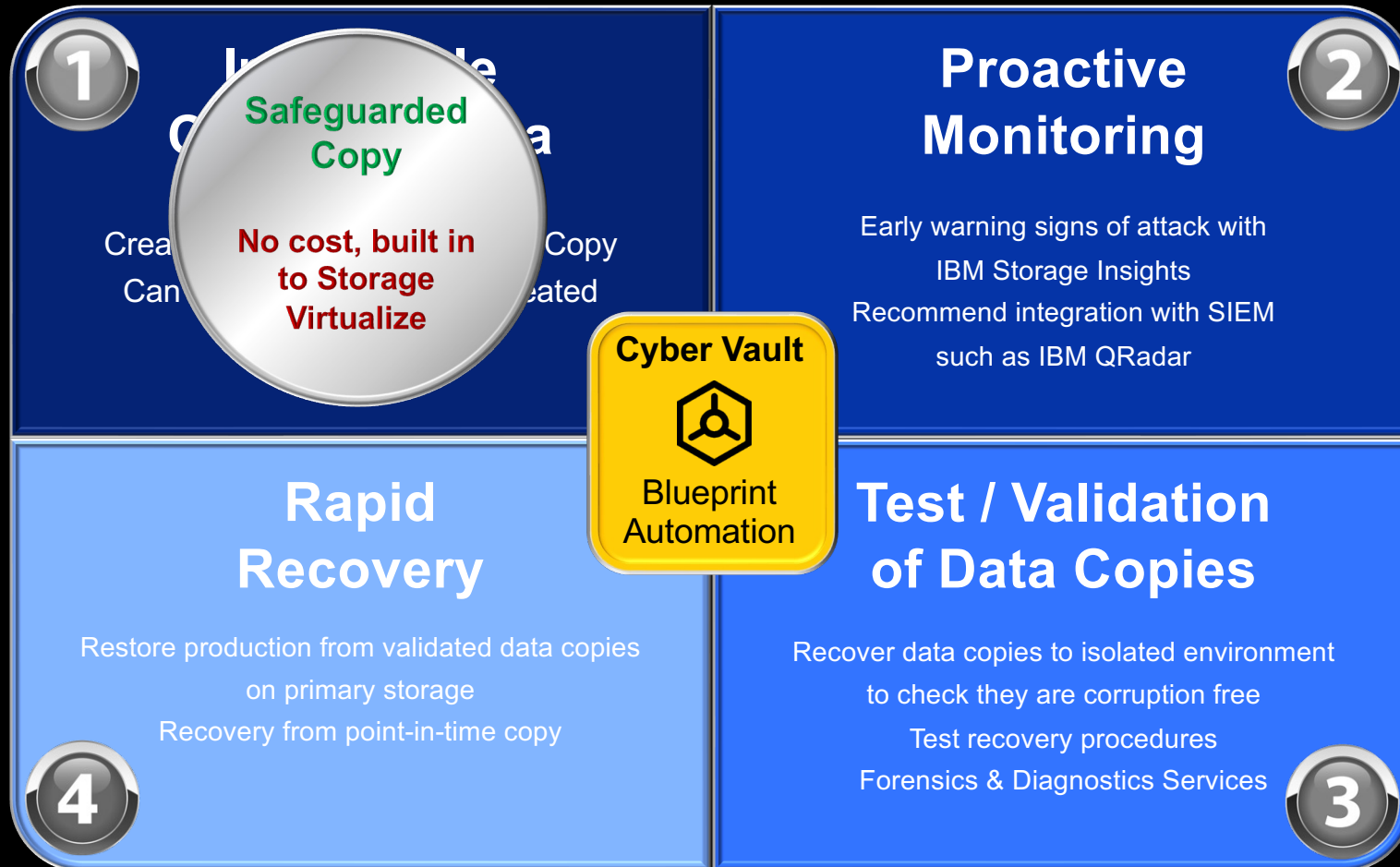
4

Test / Validation of Data Copies

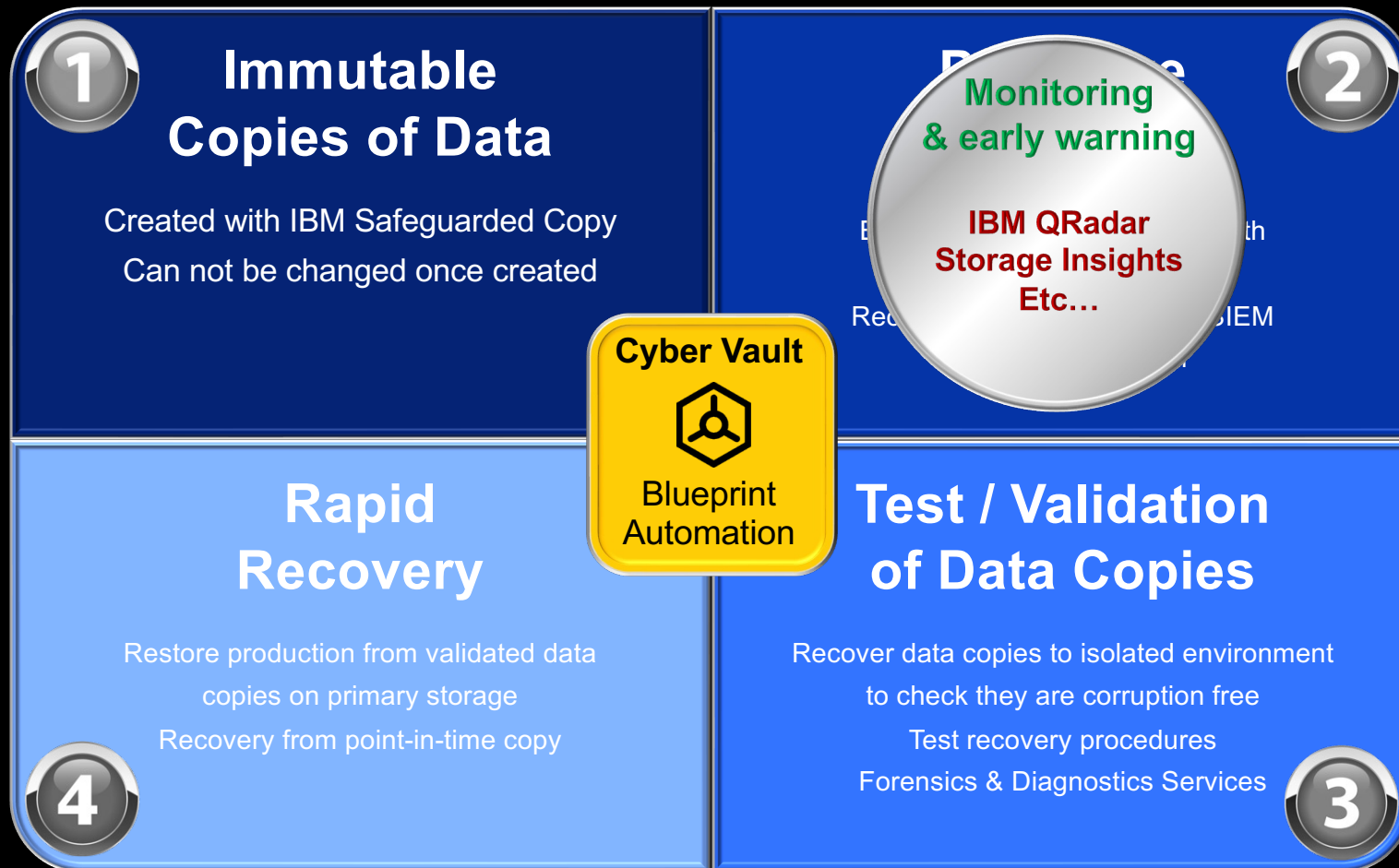
Recover data copies to isolated environment
to check they are corruption free
Test recovery procedures
Forensics & Diagnostics Services

3

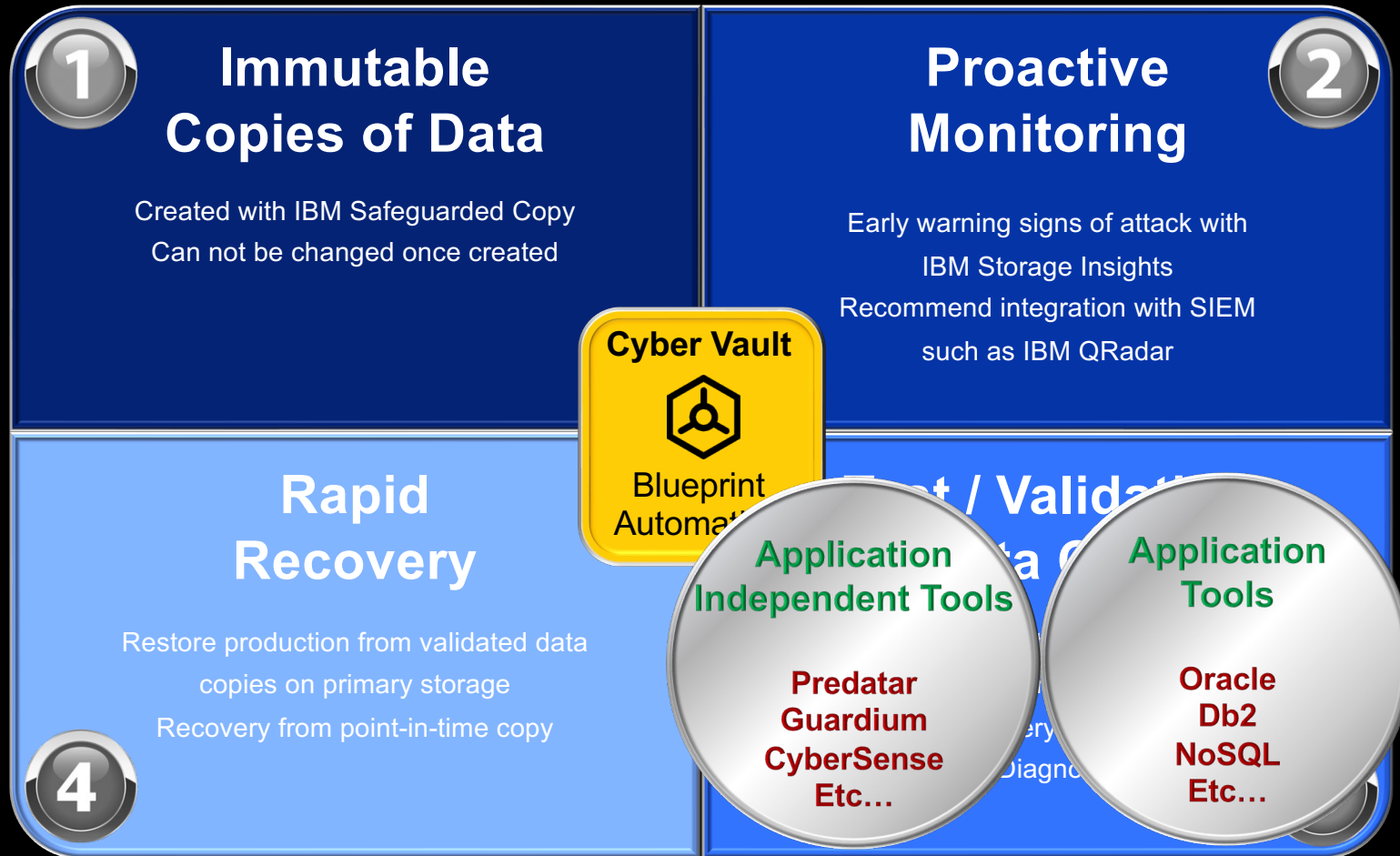
The Safeguarded component of Cyber Vault



The early detection and monitoring components of Cyber Vault



The test and validation components of Cyber Vault



The real purpose behind Cyber Vault

1

Immutable Copies of Data

Created with IBM Safeguarded Copy
Can not be changed once created

2

Proactive Monitoring

Early warning signs of attack with
IBM Storage Insights
Recommend integration with SIEM
such as IBM QRadar

Cyber Vault



Blueprint
Automation

The Pay Off...

Recovering from the
primary array in just
minutes or hours
rather than days
or weeks

4

Test / Validation of Data Copies

Recover data copies to isolated environment
to check they are corruption free
Test recovery procedures
Forensics & Diagnostics Services

3

Sign up for our no-cost Cyber Resilience Assessment today

The Cyber Resiliency Assessment Template (CRAT) provides a way to evaluate the current data resilience of the organization, identifies strengths and weaknesses and provides recommendations to **build an effective cyber resilience plan.**

[IBM Cyber Resiliency Assessment](#)

Storage Cyber Resiliency & Disaster Recovery Assessment Report

IBM Security & Resilience

January 5, 2021



Overview

IBM is pleased to present a report based on our findings from the IBM Storage Cyber Resiliency & Disaster Recovery Assessment workshop that took place with the [Customer] team on December 9th, 2019. It is understood that an effective cybersecurity resiliency program must be grounded in effective systems and processes that provide valuable insight into information and events that occur within an environment and provide the confidence for an orchestrated storage resiliency process in order to not disrupt [Customer]'s business continuity objectives. By evaluating the current cybersecurity and resiliency environment, the organization now has specific recommendations designed to help increase the value of the solution and services in its environment and meet RTO and RPO requirements.

Additionally, [Customer] will be able to help deliver faster return on investment and higher operational productivity by leveraging time-tested practices and updates to product features and resiliency functions. It will be able to help decrease errors and inconsistencies through the implementation of the incremental recommendations we have provided in this document.

Executive summary

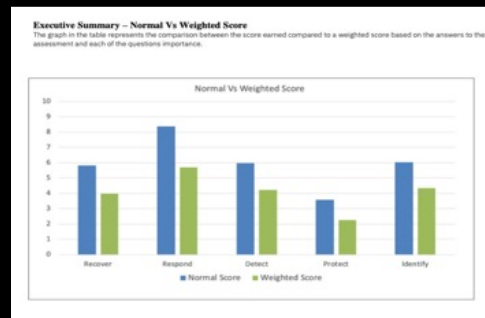
Based on the information gathered during our initial review within IBM during 4Q 2019 as well as the assessment workshop in Boston Harbor on December 9th, [Customer] has realized great value from its investment in cyber resilience and a generally open posture with other customers that IBM has worked with. However, there are several areas where [Customer] has exposure to risk resulting in unrecoverable data loss or corruption and where more value can be realized.

[Customer] has many IT service providers of which IBM is a significant partner. Of the many environments considered and reviewed for this assessment, we have taken an enterprise-view. Performance in the environment is satisfactory, though [Customer] recognizes that the organization is one cyber breach away from severely impacting business continuity. [Customer] senior management must understand that risk is the new normal. Being a digital enterprise in 2020 means significant risk and Cyber-Resiliency (protection, data vaulting and recovery) is now an absolute part of the cost of doing business.

Additionally, IBM feels that [Customer] would benefit from the use of Spectrum Insights to measure different performance and capacity areas in order to drive them toward strong outcomes.

Cyber resiliency should be viewed as a dynamic and ever-evolving practice that requires continuous improvement and focus. With the continued expansion of the threat landscape and pace of technology change, it is imperative that organizations constantly take inventory of how they are doing and where they need to be evolving.

Please review the Recommendation Section for our roadmap, which, if followed, will improve functionality and increase the value realized from implementing resiliency and disaster recovery best practices and solutions. Establishing a mature cyber security and resiliency plan will enable a more proactive approach in detecting, identifying, and protecting their environments, as well as their ability to respond and recover quickly.

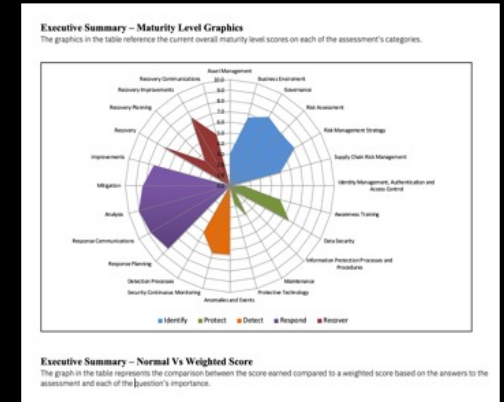



Value summary dashboard

Executive Summary – Summary View
The numbers in the table reference the current overall maturity level on each of the assessment's categories.

	Your score	Maturity Level
Total score	5.96	Practicing

	Your score	Maturity Level
Identify	6.54	Practicing
Asset Management	3	Developing
Business Environment	6.7	Practicing
Governance	7.5	Practicing
Risk Assessment	6.9	Defined
Risk Management Strategy	7.1	Defined
Supply Chain Risk Management	5	Developing
Protect	5.58	Developing
Identity Management, Authentication and Access Control	1.4	Initial
Awareness Training	6.0	Developing
Data Security	6.5	Practicing
Information Protection Processes and Procedures	0.7	Initial
Maintenance	3.3	Developing
Protective Technology	1.7	Initial
Detect	6.68	Practicing
Anomalies and Events	6.4	Practicing
Security Continuous Monitoring	6.5	Practicing
Detection Processes	6.6	Practicing
Respond	6.39	Mature
Response Planning	6.3	Mature
Response Communications	6.8	Mature
Mitigation	6.0	Mature
Analysis	6.3	Mature
Improvements	7.5	Practicing
Recover	5.21	Practicing
Recovery	7.5	Practicing
Recovery Planning	3.3	Developing
Recovery Improvements	7.5	Practicing
Recovery Communications	5.0	Developing



Assessments

SAP HANA Readiness Assessment

Cyber Security Assessment

Storage & Capacity Planning Assessment



SAP HANA on IBM Power Resources

SAP HANA on IBM Power brochure



IBM Power & SAP IDC Report



ITIC 2022 Reliability Survey



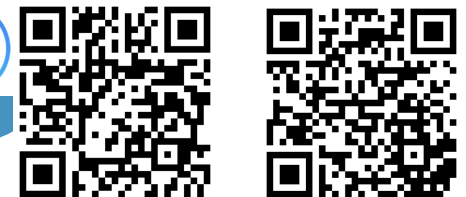
Power10 E1080



Power10 E1050



Power10 L1022 / L1024



Thank you

Q&A



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