ClearTechnologies™

IBM

Virtualizing SAP HANA Deployments

Why Infrastructure Matters

March

24

2023

Trusted Advisor

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/

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)

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***

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

Partial List Only

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

Sandworm
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)

Chinese Trained and Supported Proxies Conducting Cyber Warfare

Double Dragon
https://en.wikipedia.org/wiki/Double_Dragon_(hacking_group)

Hafnium
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

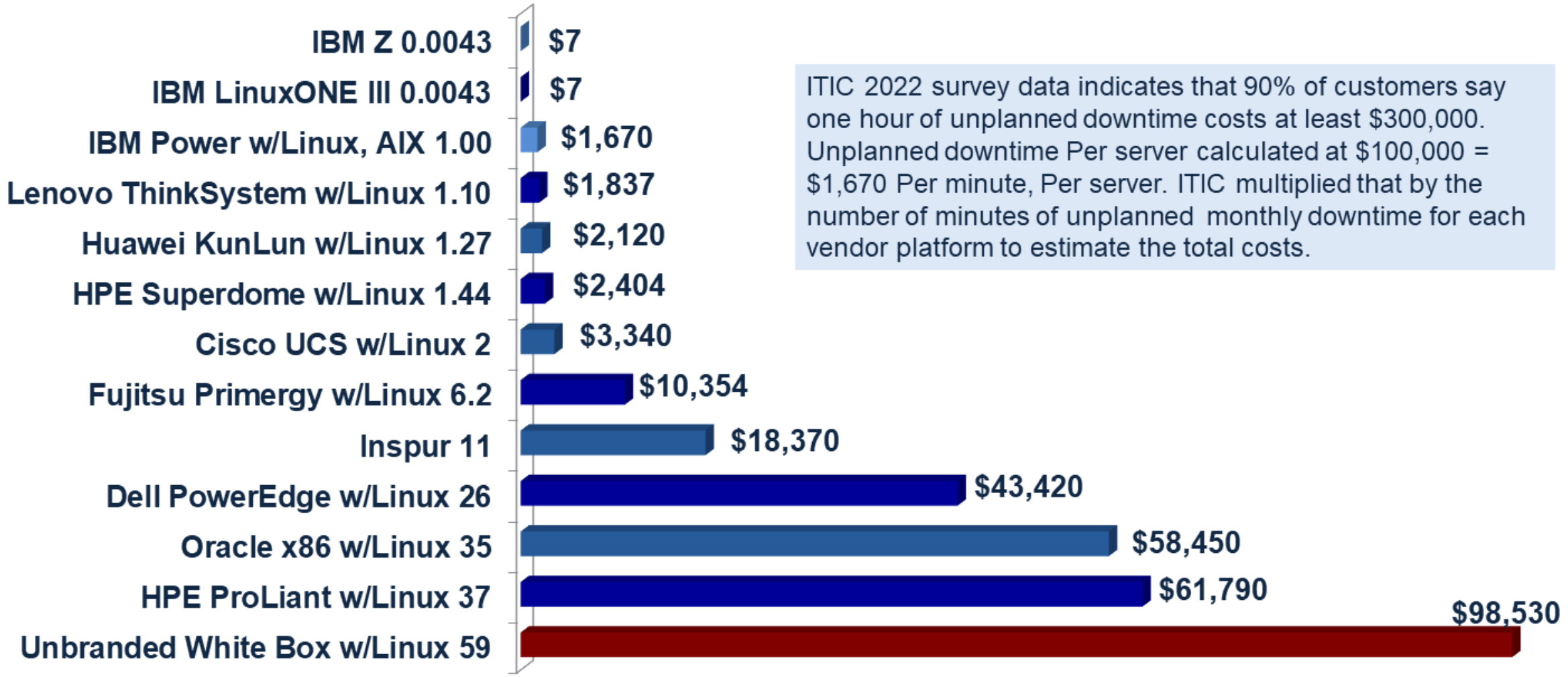
Rocket Kitten
https://en.wikipedia.org/wiki/Rocket_Kitten

Iranian Cyber Brigades

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

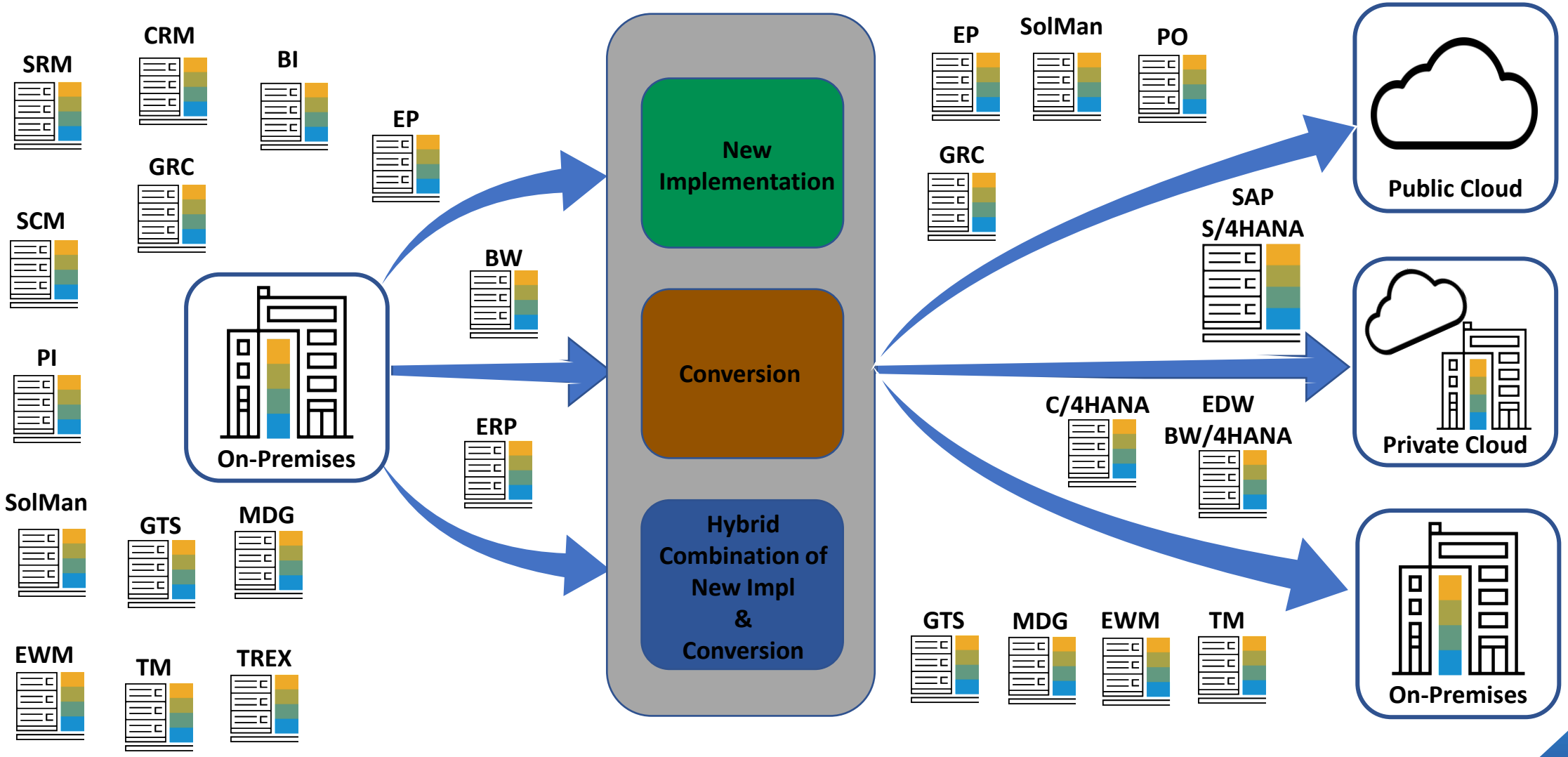
Partial List Only

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



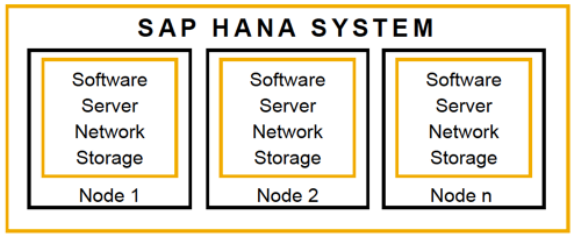
ITIC 2022 survey data indicates that 90% of customers say one hour of unplanned downtime costs at least $300,000. Unplanned downtime Per server calculated at $100,000 = $1,670 Per minute, Per server. ITIC multiplied that by the number of minutes of unplanned monthly downtime for each vendor platform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

SAP Big Picture



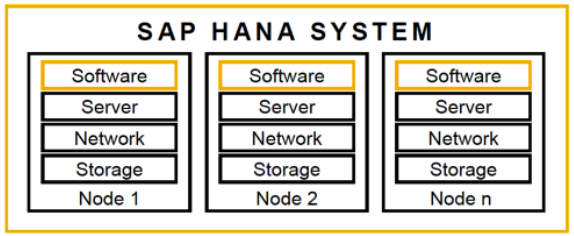
Two deployment options to choose from

Appliance



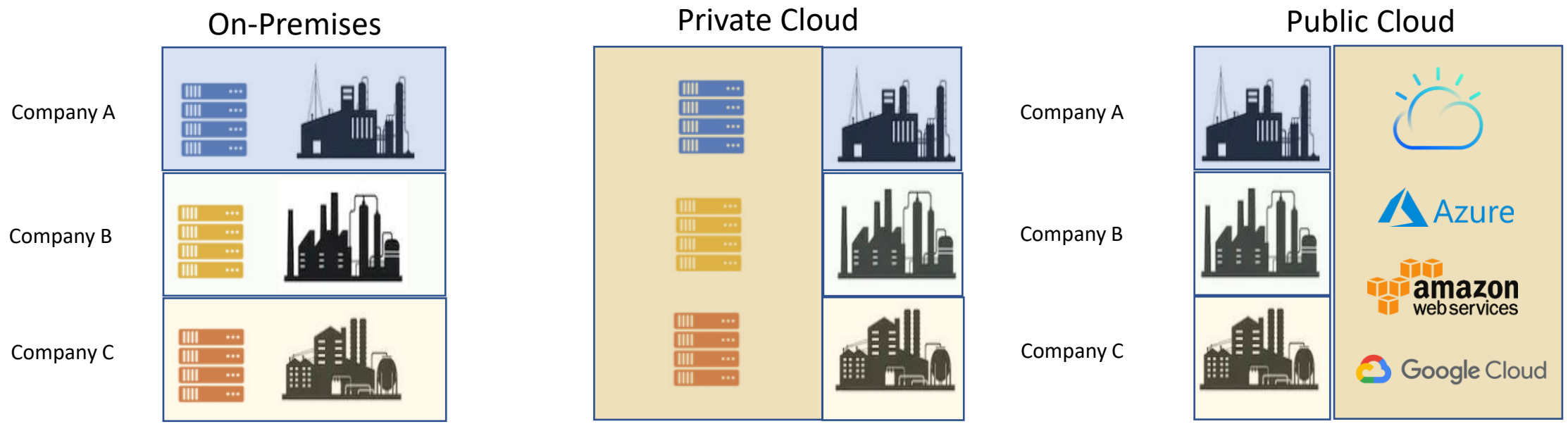
All-in one box certified partners
(1,100+ configurations – 64GB to 24TB)

Tailored Data Center Integration



Choice of components that meet SAP requirements from different vendors

Consistency Matter?



intel => Bare Metal vmware vSphere *

Bare Metal vmware vSphere *

* Bare Metal vmware vSphere

GCP KVM

Azure Mod-Hyper-V

AWS Nitro

POWER9 => PowerVM

PowerVM

PowerVM

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 **>=99.999%**

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

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 E980[4] • Advanced protection for ROP attacks

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):

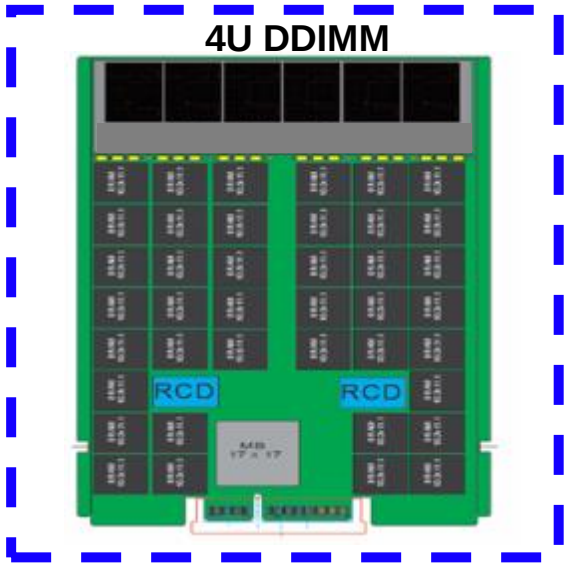
- Full x4 chipkill corrections, can survive 3 chipkills, leveraging memory ECC and spare DRAMs without memory bandwidth performance loss
- Dynamic row repair allows for fixing certain DRAM fails without taking the memory/system down
- Uses fewer signals than ISDIMMs which means lower chance for bus failure
- 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

IBM Power Memory Performance

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



New Differential DIMM Technology (DDIMM)
4U Enterprise DDIMM has enhanced buffer, N+1 voltage regulation, and spare DRAM technology

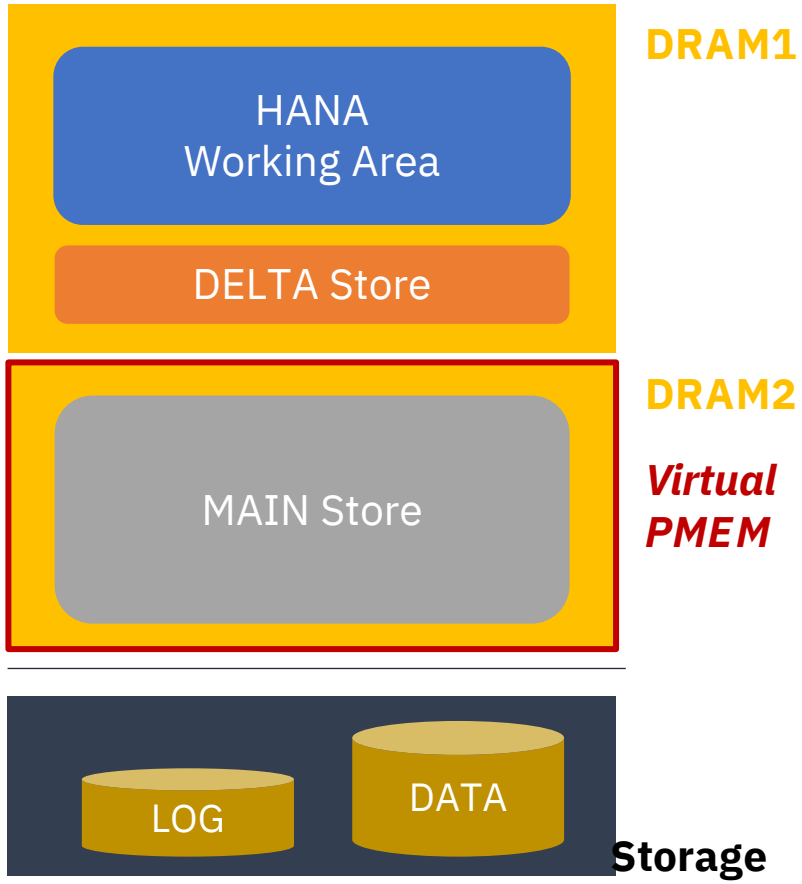
New Open Memory Interface (OMI)
Providing higher bandwidth and flexibility for future memory technologies
Full memory encryption for added security

- 2X better memory RAS than industry standard DIMMs[1]
- 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

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 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.

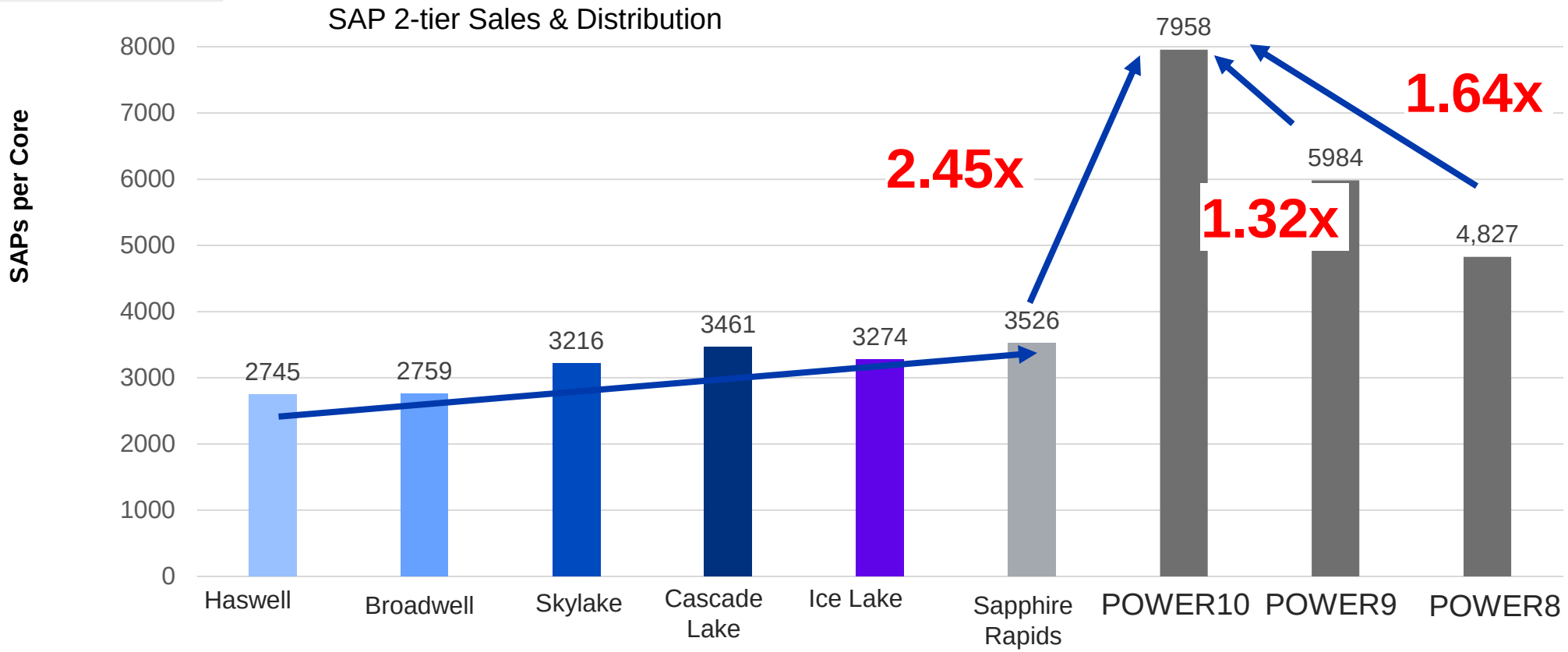
PMEM Advantages

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!

SAP SD Benchmarks

Power Systems continuously improves per core performance

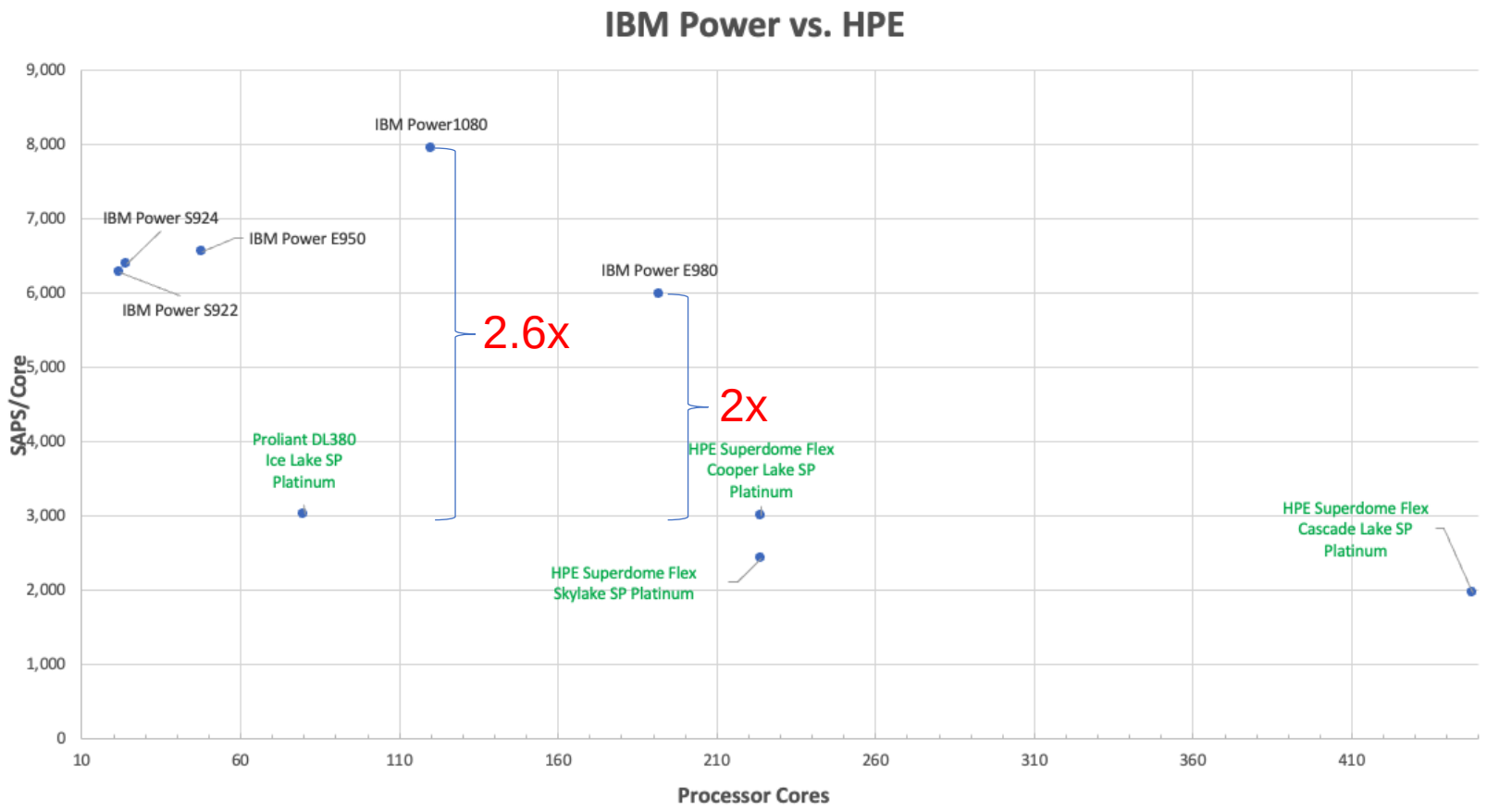


Source: https://www.sap.com/dmc/exp/2018-benchmark-directory/#/sd

- **World record 8-socket performance**
- **More performance per core**
  - **4X vs 16-socket Intel[1]**
  - **2.7X vs 8-socket Intel[2]**

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.

IBM Power vs HPE



Power10 with 120c are **2.6x** better than HPE Superdome Flex 280 with Cooper Lake using 224c

Power10 with 120c are 4x better than HPE Superdome Flex with Cascade Lake using 448c

Power10 E1080 - 8 sockets
120c
995,050 SAPS

HPE 280 – 8 sockets
224c
670,830 SAPS

HPE 280 – 16 sockets
448c
877,050 SAPS

IBM Power HANA Support

BW on HANA and BW/4HANA (OLAP Workloads):

ScaleUp: 40 TB

(Up to 20TB for L class sizing; up to 40TB is allowed for M & S class sizing)

ScaleOut: 16 x 32 TB = 512 TB

Suite on HANA and S/4HANA (OLTP & Mixed Workloads):

ScaleUp: 32 TB

ScaleOut (S/4HANA only): Min. 2 x 6 TB up to 4 x 32 TB = 128 TB

Models L/S1022, L/S1024, and E1050 supported with production HANA since November 8, 2022

- E1050:
  - Up to 96 cores, 16 TB
  - Up to 8 production LPARs
- L/S1022, L/S1024:
  - Up to 48 cores – 8 TB
  - Up to 4 production LPARs

- Model E1080 supported with HANA production since February 24, 2022
- - Up to 240 cores - 40 TB OLAP & 32 TB OLTP
- - Up to 16 productions LPARs

Power v Intel - Comparison

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

What's the 'V' Difference

x86

SAP Support for VMware is very restrictive

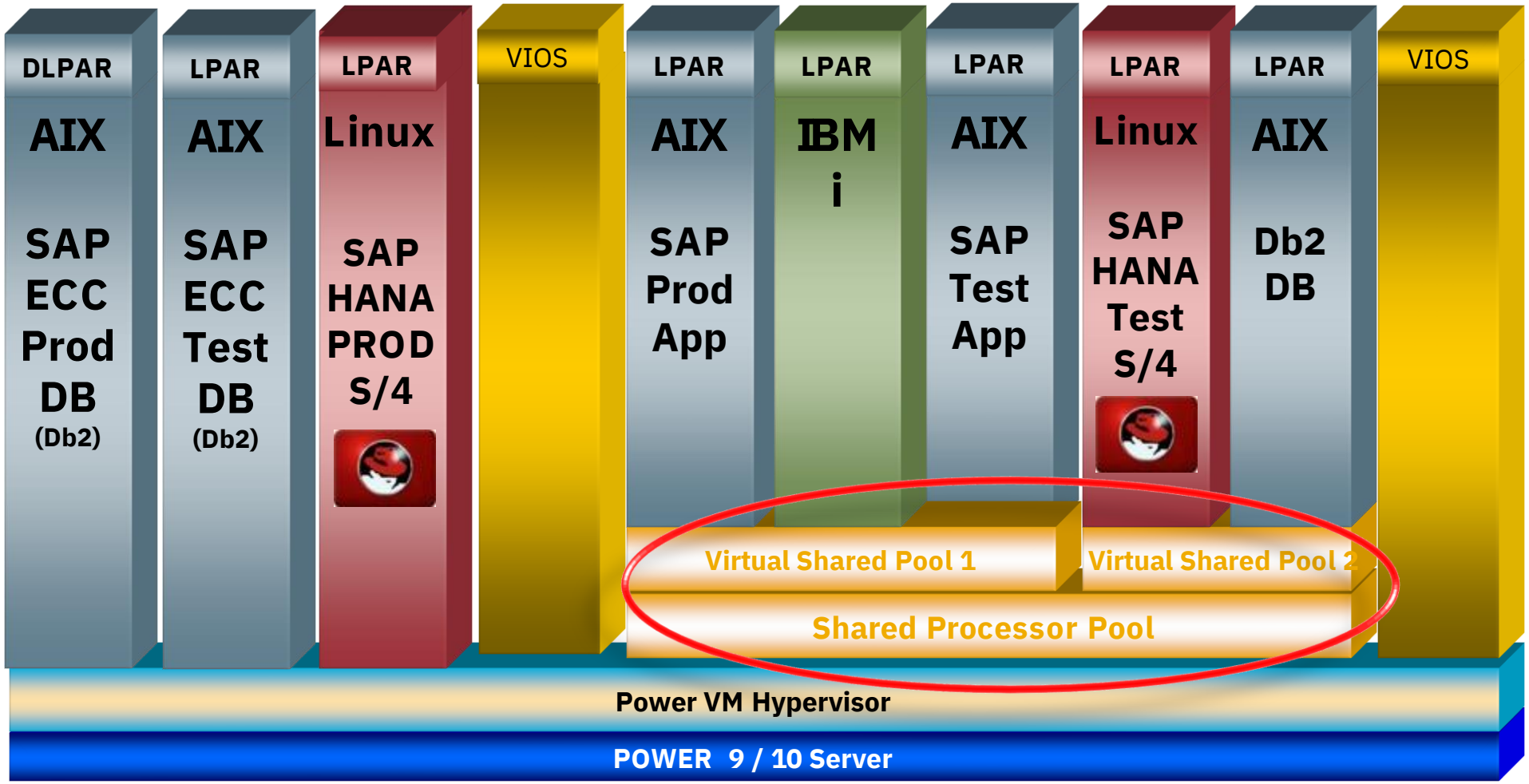
- Production HANA VM CPU Sizing Options:
  - Minimum ½ Socket (½ socket HANA VMs can only share the other ½ socket with other HANA VM's)
  - Next size up is 1 Full Socket
  - Then 2 Socket
    - *CPU granularity beyond one socket on x86 is in full socket increments!*
  - CPU's MUST be set to Dedicated 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

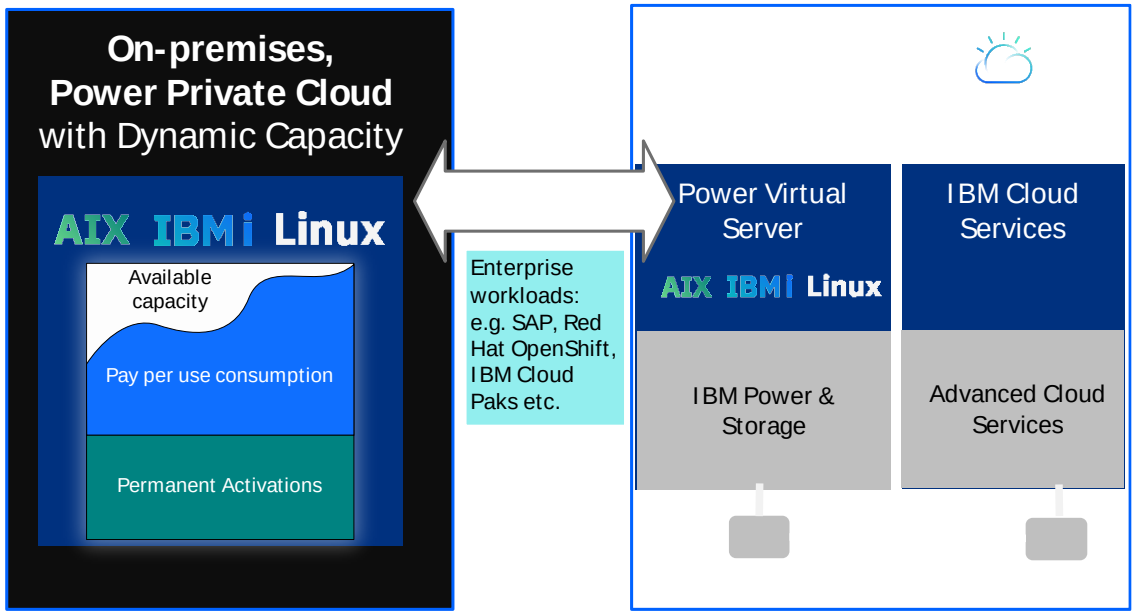
- Production HANA VM CPU Sizing Options:
  - Minimum 4 Virtual Processors
  - Can increase Entitlement in increments of .01
  - There are no restrictions on socket boundaries
  - CPU's can be shared across all other VM's on the system – over commitment is supported
  - Dynamic add/remove of CPU is supported 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

Secret Sauce - PowerVM



Frictionless Hybrid Cloud

Consistent experience for elastic computing across the IT environment



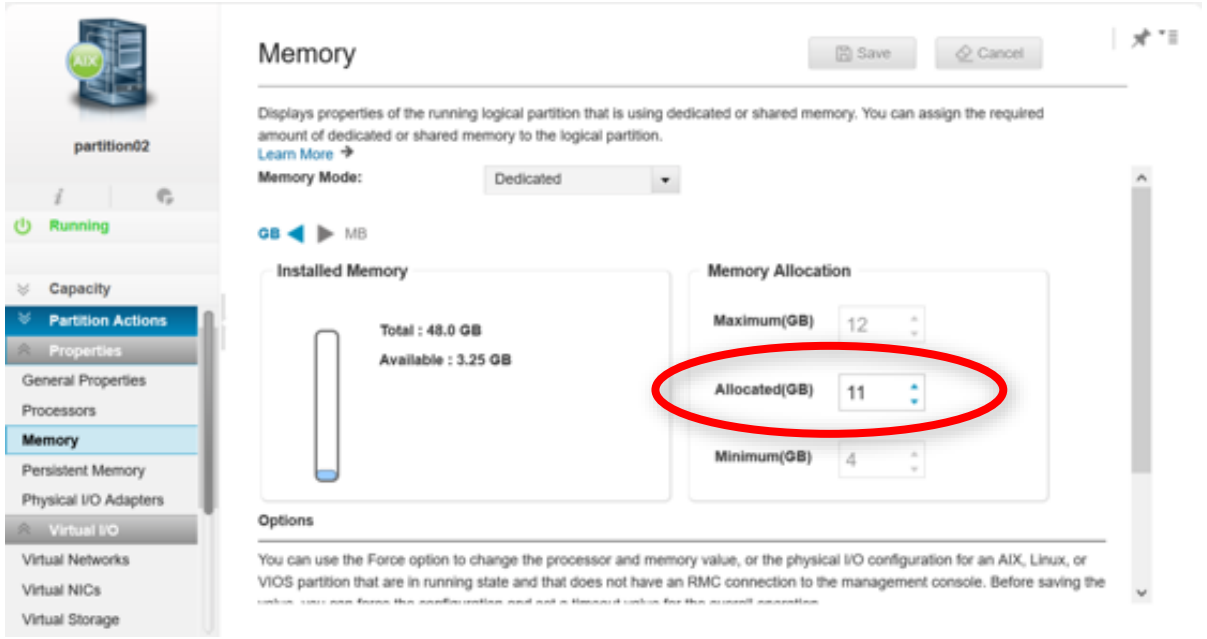
- Consistent and compatible IT architecture – no additional middleware or application refactoring required
- Extend workloads across on-premises and Power Virtual Server
- Consistent management and automation services across hybrid & heterogeneous architectures

Infrastructure Granularity

Looks like …
Smells like …
Hybrid Cloud!

LPAR	LPAR Details	Memory in GB	vCPUs	Entitlement	Guaranteed cores
1	HANA OLAP L	1,200	10.0	75%	7.5
2	HANA OLAP S	1,200	5.0	75%	3.75
3	HANA OLAP S	1,200	5.0	50%	2.5
4	HANA OLAP M	1,440	8.0	60%	4.8
5	HANA OLTP1 High Priority	960	4.0	75%	3
6	HANA OLTP2 Low Priority	960	4.0	50%	2
7	App-Server 1	320	8.0	50%	4
8	App-Server 2	320	8.0	50%	4
9	App-Server 3	320	8.0	50%	4
10	App-Server 4	320	8.0	50%	4
11	test1	128	2.0	30%	0.6
12	test2	512	2.0	30%	0.6
13	test3	256	4.0	30%	1.2
14	test4	128	4.0	30%	1.2
15	demo	256	5.0	30%	1.5
	Total Resources Required	9264.0	80.0		43.15

Memory Flexibility



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

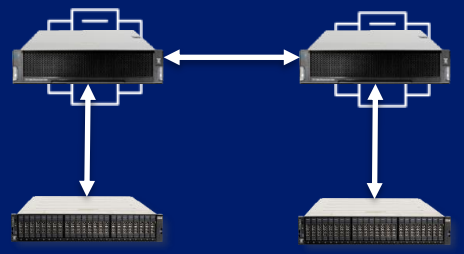
IBM "*Dynamic LPAR*" (DLPAR) operation to add memory to or remove memory from a running LPAR on POWER9

- 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.

Increasing Security, Performance & Resiliency

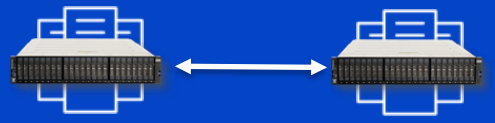
Enhanced High-availability
Zero RPO/RTO



Multi-Platform Support

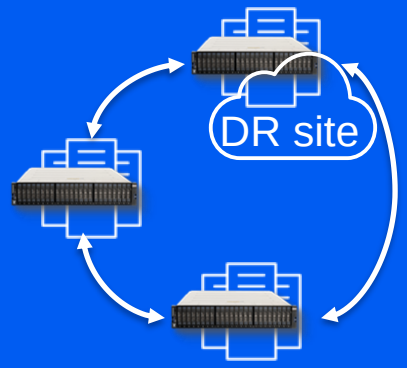
Pure HPE IBM
Dell/EMC NetApp 500+ others…

HyperSwap
Zero RPO/RTO



100% data availability guarantee

Enterprise Disaster Recovery
>Zero RTO



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

IBM Spectrum Virtualize

Cyber Vault

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

IBM Storage Sentinel

Automated Cyber Resilience and Recovery

Protect	Isolated & Immutable Snapshots
Detect	Automated Ransomware Scanning Engine
Recover	Safe Recover Point Identification
	Rapid Data Recovery

June 2022 — Epic

2H 2022 — SAP HANA

2023+ — vmware, ORACLE, Microsoft SQL Server

Cyber Resilience Assessment Tool (CRAT)

- **Workshop includes:**
- Two-hour virtual consulting workshop with IBM Storage, Security, & Resiliency POV
- Assessment probes over 100 different controls across 23 key categories from a Cyber Resilience standpoint
- Delivered using technology / vendor neutral framework
- *Audience* – IT Director / Storage Management teams + member of the Client Security Team

- **Client Outcomes:**
- Identification of blind-spots and recommended areas for improvement
- Discovery of the utilization of various existing solutions, integrations and overlaps that can be fine-tuned
- Customized Cyber Resilience strategy fitting the client's vision & mission

Deliverables:

- Detailed assessment report – ***Sample Report***
- Management presentation
- Prioritized list of recommended improvements & considerations

SAP HANA Technical Assessment (SHAT)

- **Workshop includes:**
- Eight-hour virtual consulting workshop with Clear SAP POV
- Assess Business Scenario Report
- Details extracted from the system
- Assessment probes Functional & Technical areas across 23 key categories from a Cyber Resilience standpoint
- Evaluating SAP and 3rd party tools
- Review functions & customizations

- **Client Outcomes:**
- Reduction of test scope
- Know where custom code can be retired and made more efficient
- See the impact to the business process
- Governance – clarify of role conflicts

Deliverables:

- Detailed assessment report – ***Sample Report***
- Management presentation
- Combined findings & enhanced business case

About Clear Technologies

- On-premises, Private Cloud and Public Cloud hosting & infrastructure reseller
- SAP Infrastructure Practice
- Managed services
- Hardware, Software & Services focused

- Cloud based storage reporting and analytics
- Heterogenous storage dashboard
- SaaS

Partnership & Trusted Advisor

We are a single point of contact, committed to consistently delivering the solution and services that are the best fit for your business.

- 30-year Value-Added Reseller
- Long history with Systems & Storage
- Strategic focus on SAP, and other innovative solutions
- Extraordinary Net Promotor Score
- Cognitive Leadership Program
- 3 IBM Champions

certified WBENC WOMEN'S BUSINESS ENTERPRISE