# Mission-critical cloud and virtualization solutions based on the POWER architecture

**CLOUD COMPUTING 2020 presentation**

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IBM

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Ian Robinson manages the Power Systems virtualization, private cloud and automation portfolio of hardware and software at IBM. He previously served in a variety of technology leadership roles at notable Silicon Valley companies that include VMware, Brio Software and Zone Labs. Most recently, he was CMO of cross-platform virtualization pioneer Transitive Corporation, prior to its acquisition by IBM in 2009.

Ian's domain expertise spans virtualization/cloud, mobile/IoT, security, database/analytics, and software development (including Agile methodologies and DevOps). In addition to a Masters degree in Engineering and MBA from San Jose State University, he completed an MS in Information Systems at the University of San Francisco, where he also served as an adjunct professor.

# Why IBM Power Systems?

Compute for data-intense and mission critical apps

Industry leading reliability, performance and security

Database SAP ERP, CRM, SCM

Business and data management workloads

IBMi AIX Linux

Unix, Linux and IBM i operating environments

Deployed by banks, telcos, retailers, government, etc.

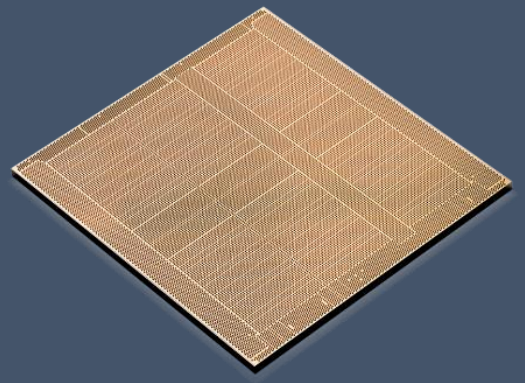
Used in 3 of the world's top 10 fastest supercomputers

# Proven reliability

IBM Power Systems ranked the most reliable for 10th straight year delivering 99.9996% uptime.*

# Built-in security

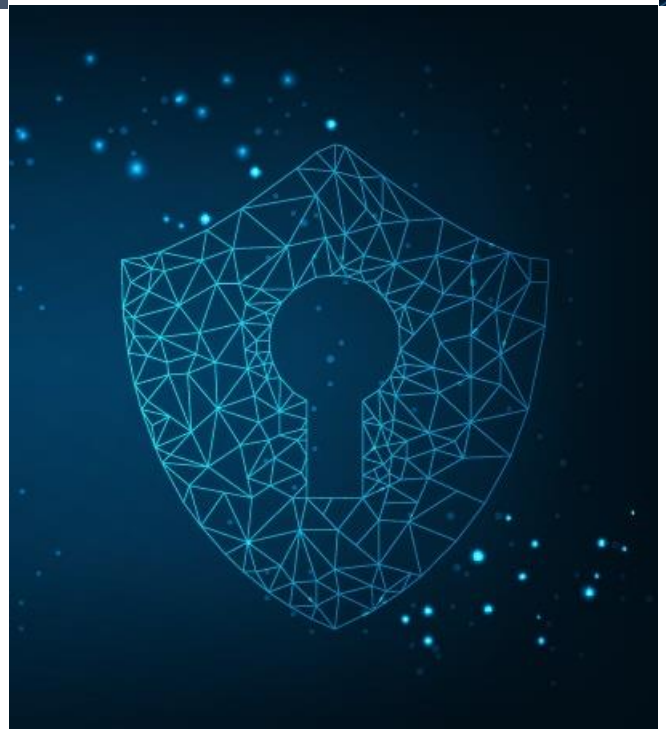
IBM Power Systems have security built in at all layers, from processor to the OS, designed to deliver end-to-end security.



* ITIC 2019 Global Server Hardware, Server OS Reliability Survey Mid-Year Update. The highest uptime of 99.9996% is calculated based on 2.0 minutes/server/annum unplanned downtime of any non-mainframe Linux platforms

# Affordably scales capacity and performance

IBM POWER9 processor drives the world's fastest supercomputers and is ready to accelerate your enterprise.



# Simple multicloud integration

IBM Power Systems enable the most data intensive and mission critical workloads in private and hybrid cloud environments.

# POWER9 processor

1st chip with PCIe4

~1TB/s Bandwidth into chip

4GHZ Peak Frequency

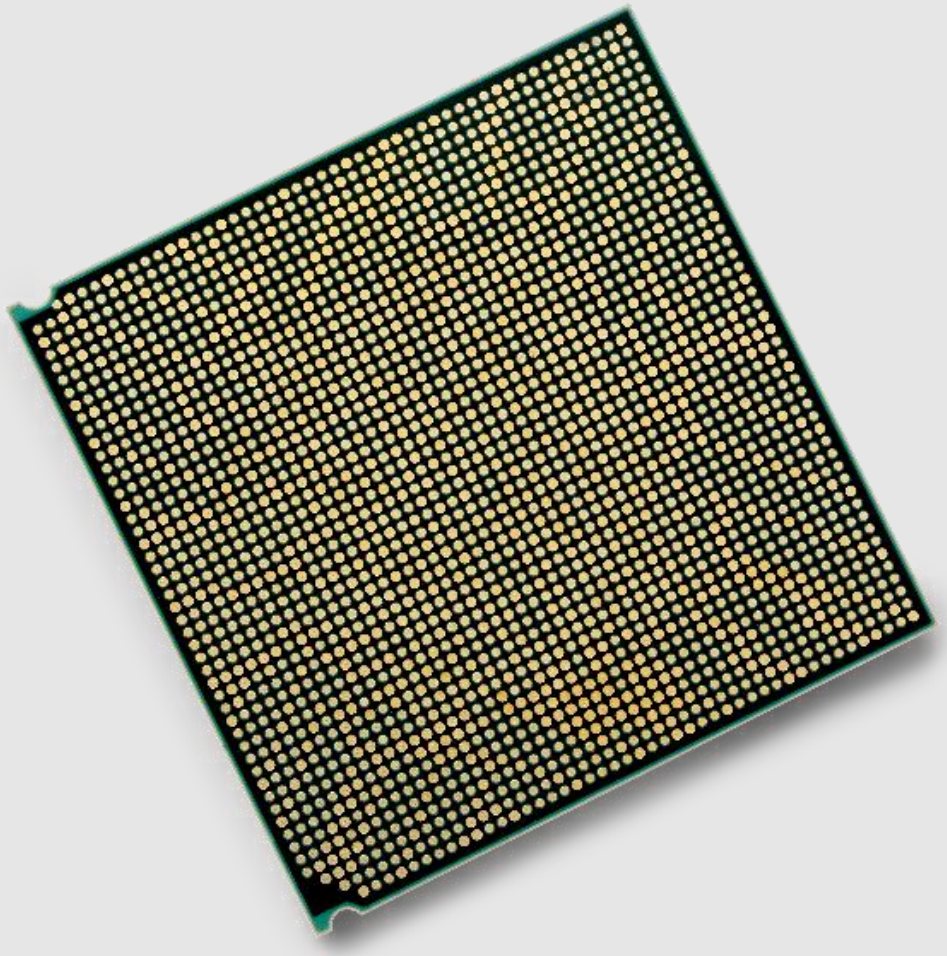
7 TB/s Bandwidth

8 Billion Transistors

>15 Miles of wire

>24B VIAs

17 Levels of metal



**Innovation that makes a difference for mission critical applications**

# PowerVM builds upon IBM's virtualization heritage

## A 50-year track record in virtualization and cloud innovation continues with PowerVM

| 1967 | 1973 | 1999 | 2004 | 2008 | 2010 | 2014 | 2018 | 2021 |
|---|---|---|---|---|---|---|---|---|
| IBM Research develops **hypervisor** that becomes VM on the mainframe | IBM announces systems with **physical partitioning** | IBM announces **LPAR** on POWER™ | IBM debuts POWER Hypervisor™ for System p™ and System i™ | IBM ships PowerVM Editions | PowerVM delivers enhanced storage virtualization | PowerVM enabled for OpenStack integration | PowerVM built into all POWER9 enterprise servers | PowerVM provides foundation for POWER10 generation |

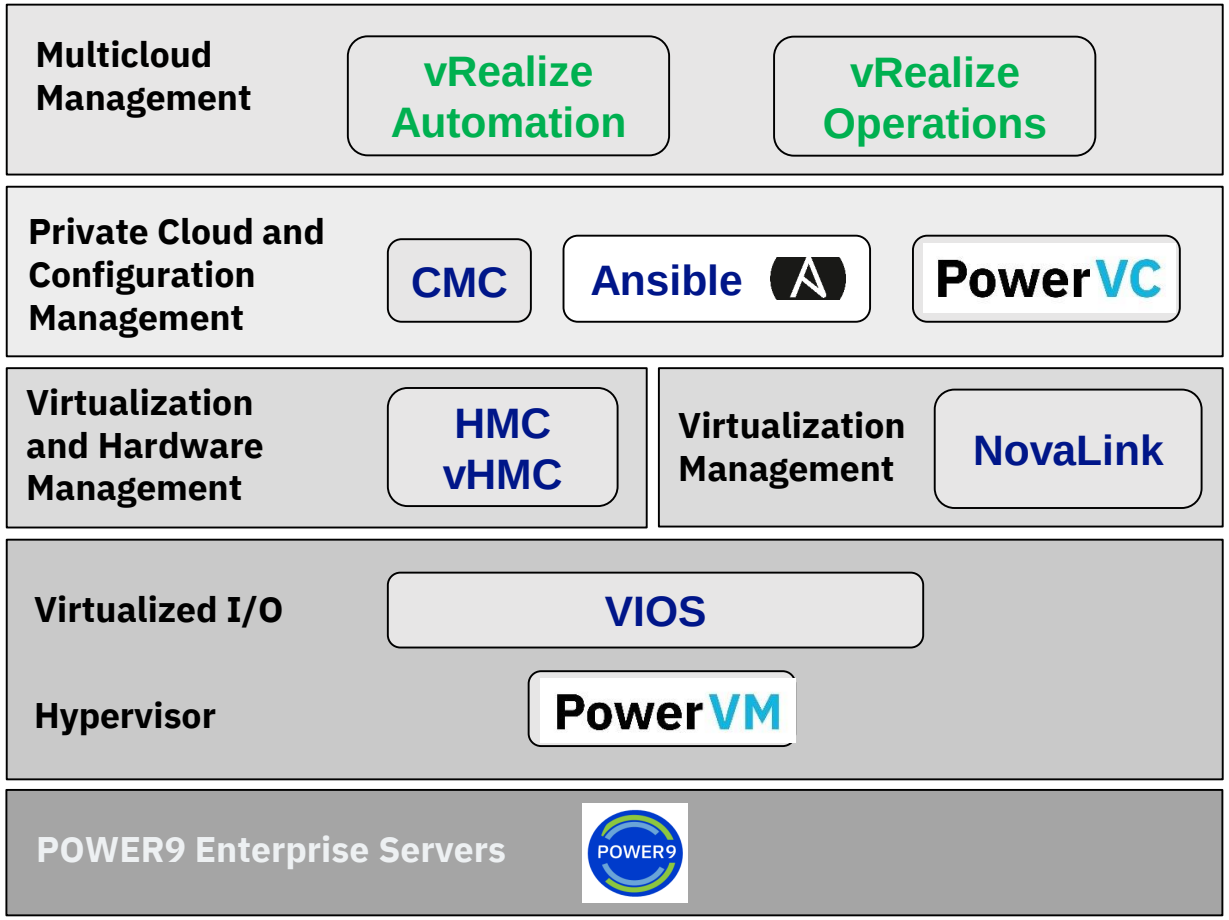
PowerVM


PowerVM

# Power Systems virtualization stack: Updated for a multicloud world

Throughout 2020, the entire POWER9 virtualization and private cloud stack has been refreshed to optimize support for multicloud architectures.

This stack forms the foundation of multiple POWER-based public cloud initiatives, as well as the thousands of mission-critical enterprise deployments worldwide.



# How PowerVM delivers virtualization benefits

Deploying a virtualized workload with PowerVM is simple:

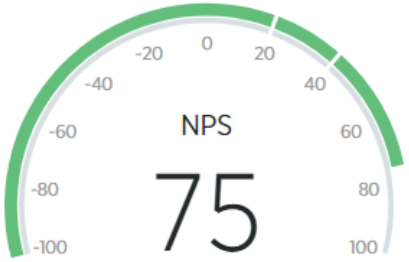
- Create a new PowerVM virtual machine (VM)
- Install the operating system (AIX, IBM i or Linux) in the VM
- Install the workload application(s) in the VM
- Configure the operating system and applications as required

The VM can now be easily stored, moved, copied, archived or modified !

PowerVM


Benefits of virtualizing workloads with PowerVM include:

- **Extreme consolidation** – many diverse workloads can be hosted on one server
- **Rapid provisioning** – deploying a ready-to-run workload is quick and easy
- **High scalability** – deploying multiple copies of a workload type is simplified
- **Easy recoverability** – restoring a workload after an outage is fast and reliable

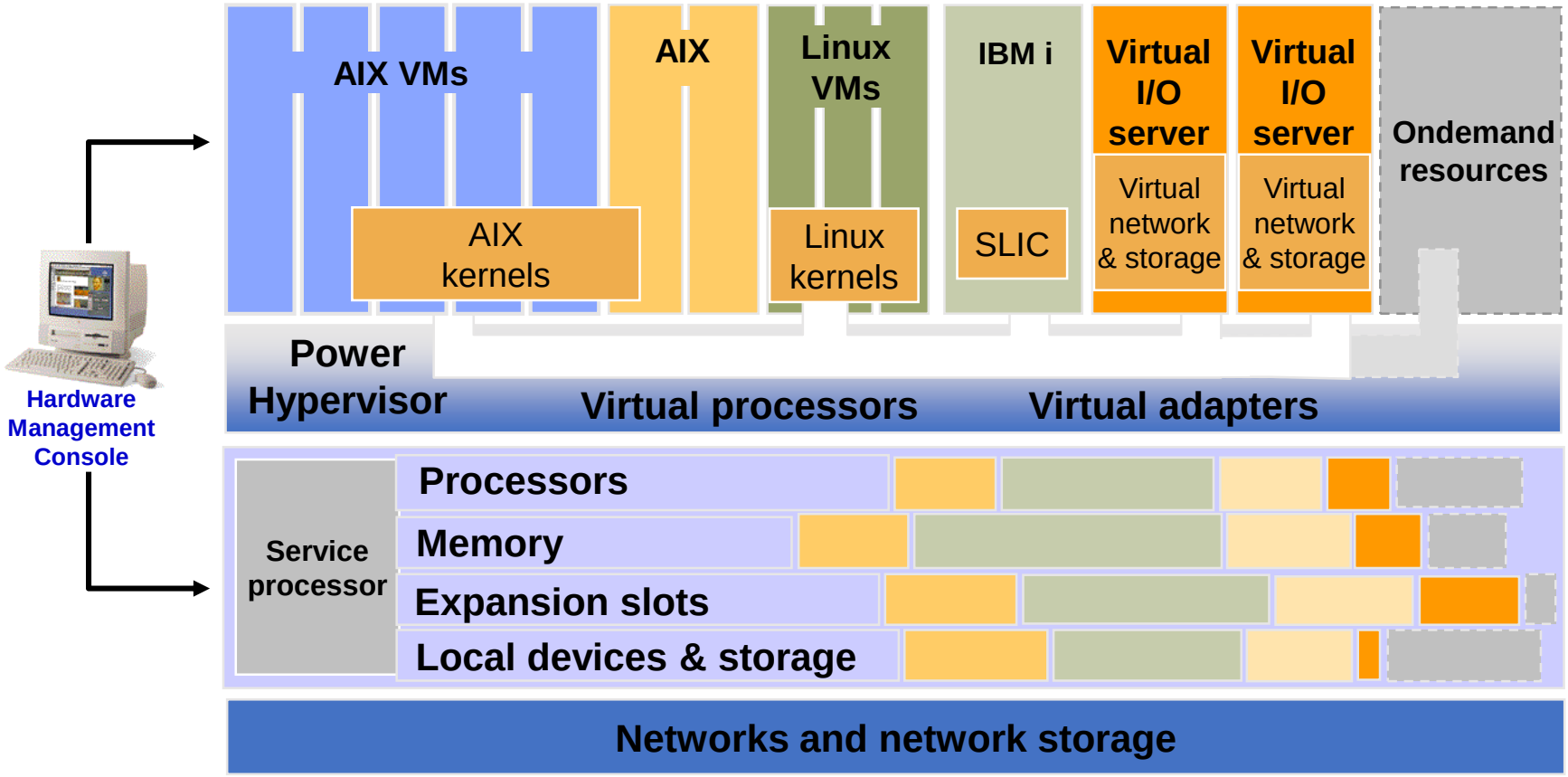


# PowerVM virtualization architecture

PowerVM

**PowerVM key design points**

- Designed for high **efficiency** to provide high overall performance
- Designed for high **scalability** – linear from 1/20 to 256 cores
- Designed for **isolation** to provide security and "no compromise" consolidation
- Designed for maximum resource **granularity** to reduce wasting resources

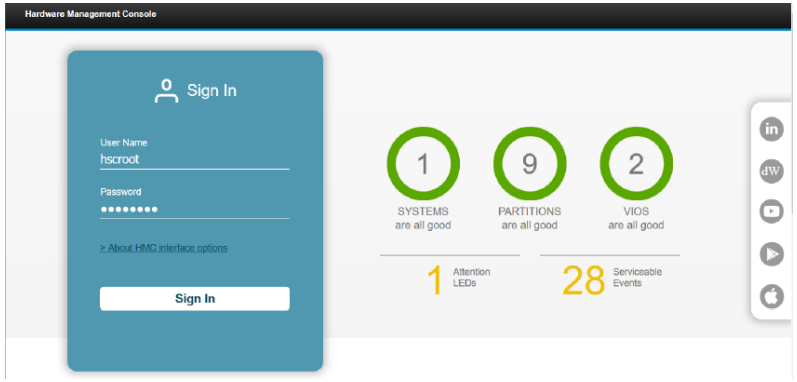


# Power Hardware Management Console (HMC)

Management appliance for Power servers

Available as hardware appliance or vHMC

Driven by Web-based enhanced UI, CLI or API



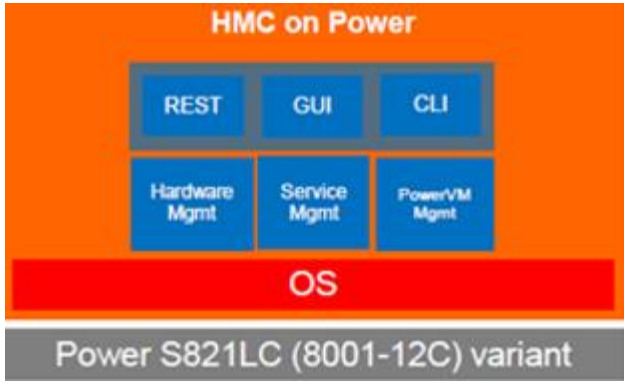




*Table 1. Dimensions*

| Width | Depth | Height | Weight |
|---|---|---|---|
| 437 mm (17.2 in.) | 705.3 mm (27.76 in.) | 43.0 mm (1.7 in.) | 14.5 kg (32 lb) |

*Table 2. Electrical* [1, 2]

| Electrical characteristics | Properties |
|---|---|
| Maximum measured power | 300 W |
| Maximum kVA | 0.330 |
| Maximum thermal output | 1024 BTU/hr |
| Input voltage | 100 - 127 V ac or 200 - 240 V ac |
| Frequency | 50 or 60 Hz |

1.Preliminary data is subject to change.

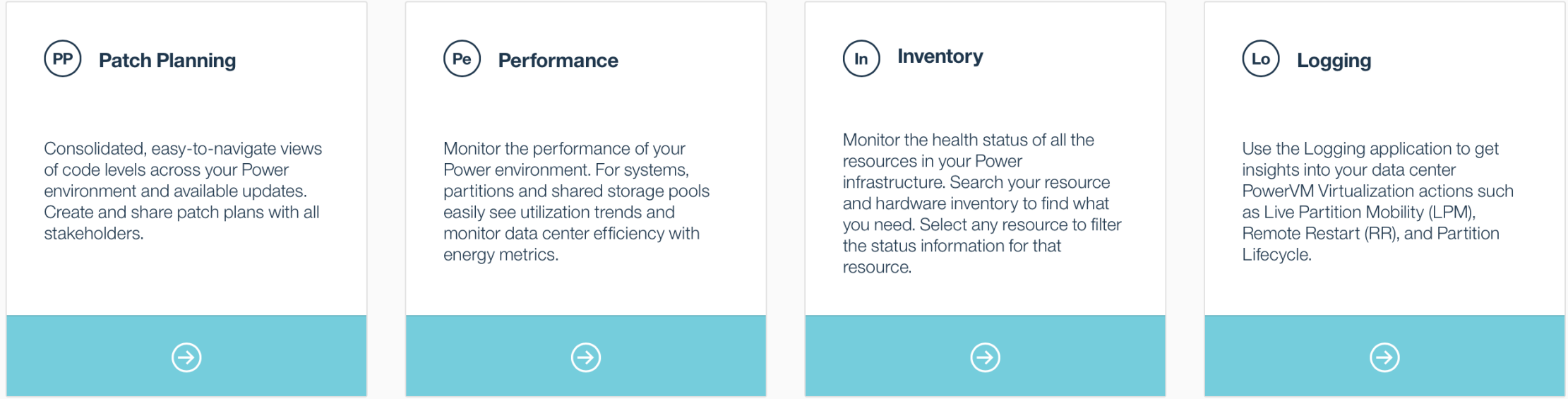
2.Power consumption and heat output vary depending on the number and type of optional features that are installed and the power-management optional features that are in use.

https://www.ibm.com/support/knowledgecenter/POWER8/p8had/p8had_hmc7063cr1.htm

http://www-01.ibm.com/common/ssi/ShowDoc.wss?docURL=/common/ssi/rep_sm/1/877/ENUS7063-_h01/index.html&lang=en&request_locale=en

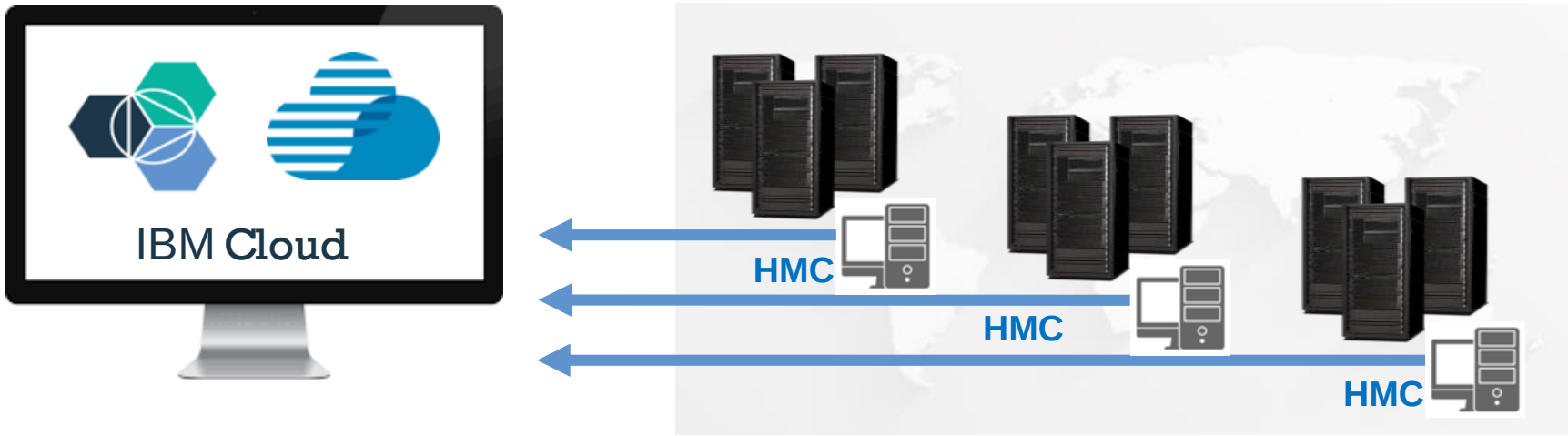
# IBM Cloud Management Console (CMC)

- The IBM Cloud Management Console (CMC) is a SaaS-based manager that provides a consolidated view of Power-based deployments, spanning multiple regions and datacenters.
- CMC provides a comprehensive inventory of systems and virtualized resources, consolidated performance data to optimize utilization and performance across multiple Power-based data centers, and aggregated logging information for additional insights.
- Delivered as a SaaS offering from the IBM Cloud, CMC offers convenient pay-as-you-go multi-cloud management. A one-year CMC entitlement is included with E950 and E980 servers.



# CMC connects HMCs to the Cloud

*Cloud-based microservices that can be accessed securely, anytime, anywhere for the entire enterprise*




- *As data centers scale out and up, the need increases for a complete view of the Power infrastructure*

## Inventory Aggregation

- View all Power Systems, HMCs, VMs, etc. across the entire enterprise
- See basic health & state

## Performance Monitoring

- Aggregated performance across Power enterprise
- Energy monitoring
- OS metrics

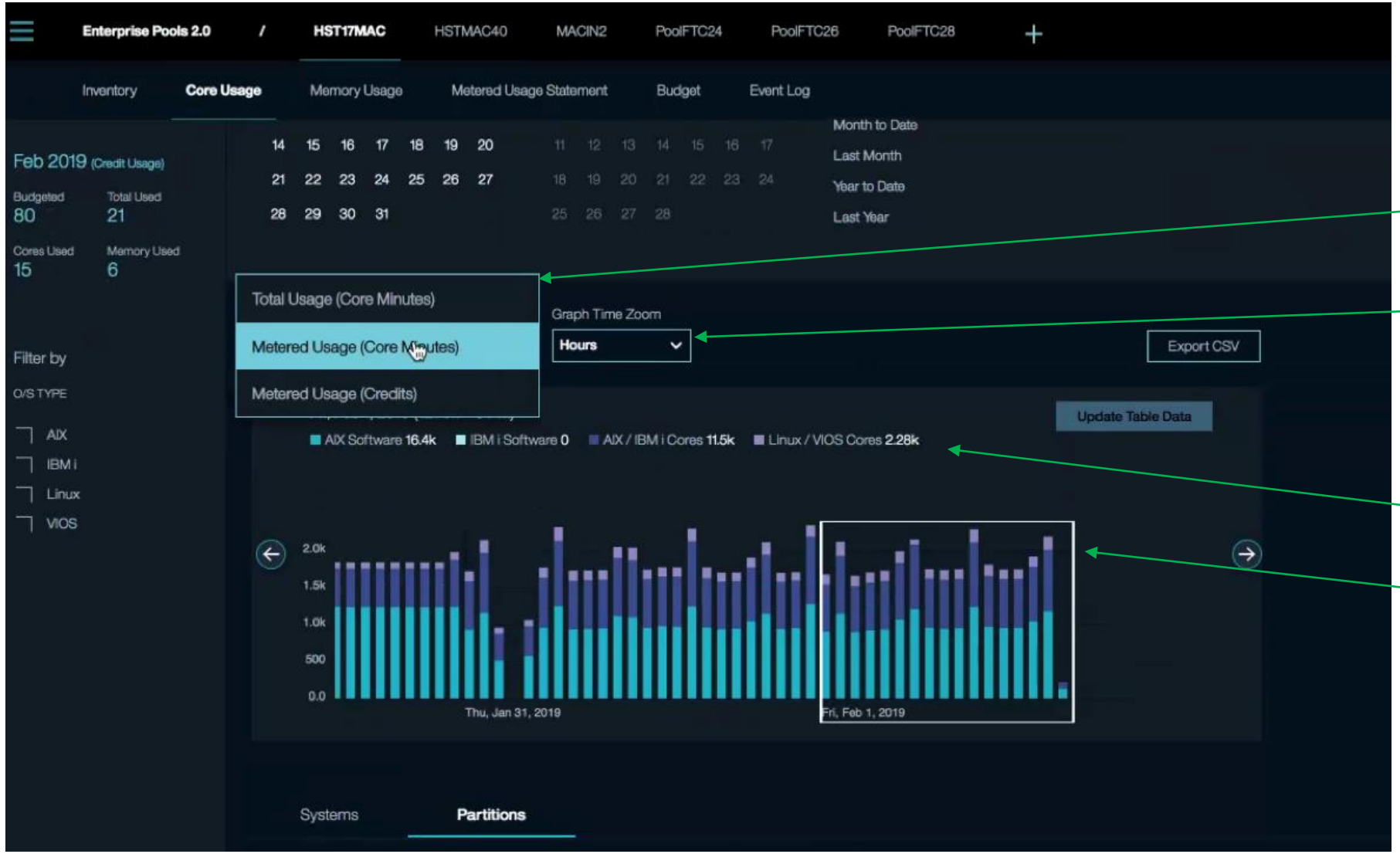
## Log Trends

- Log aggregation
- Telemetry

## Patch Planning

- Patch compliance reports for firmware, HMC, NovaLink, VIOS, and OS
- Scheduled maintenance plan management

# CMC hosts the UI for Power Enterprise Pools 2.0

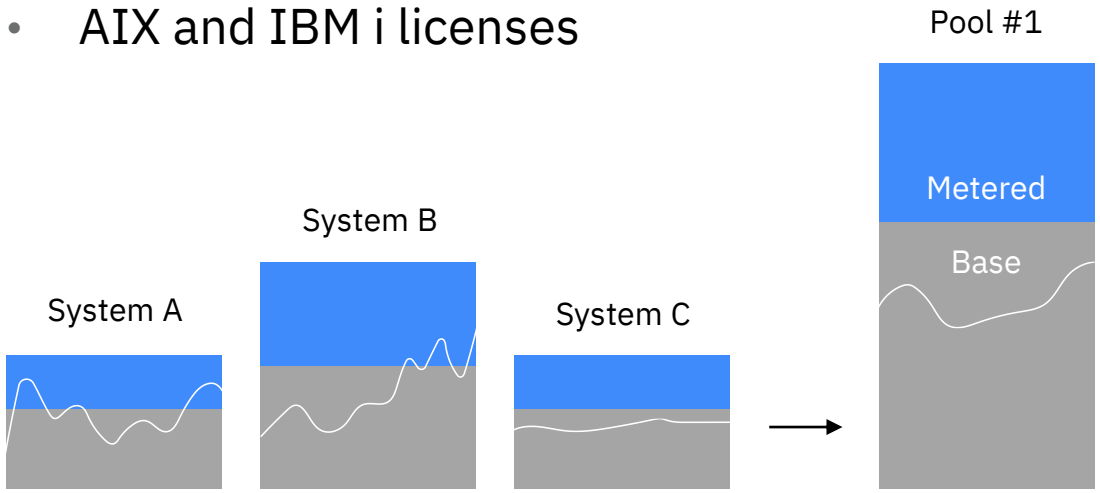



- Analyze Total or Metered Usage
- Change the Time Frame for analysis (Minute, Hour, Day, Week, Month)
- Usage by resource type
- Trending Analysis with ability to adjust time scale

# POWER Private Cloud Solution Enterprise Pools 2.0

Handle demand spikes across collections of POWER servers with Base and Metered Capacity, which includes:

- Processor activations
- Memory activations
- AIX and IBM i licenses




**Optimize costs with dynamic, pay for use pricing.**
**All processor & memory resources are fully activated.**

## How it all works

Purchase servers with **Base** capacity.

Variable demand addressed by buying Capacity Credits for **Metered** capacity.

**IBM Cloud Management Console with HMC** automatically monitors and debits against Capacity Credits for actual resource usage by the minute.

## Which servers?*

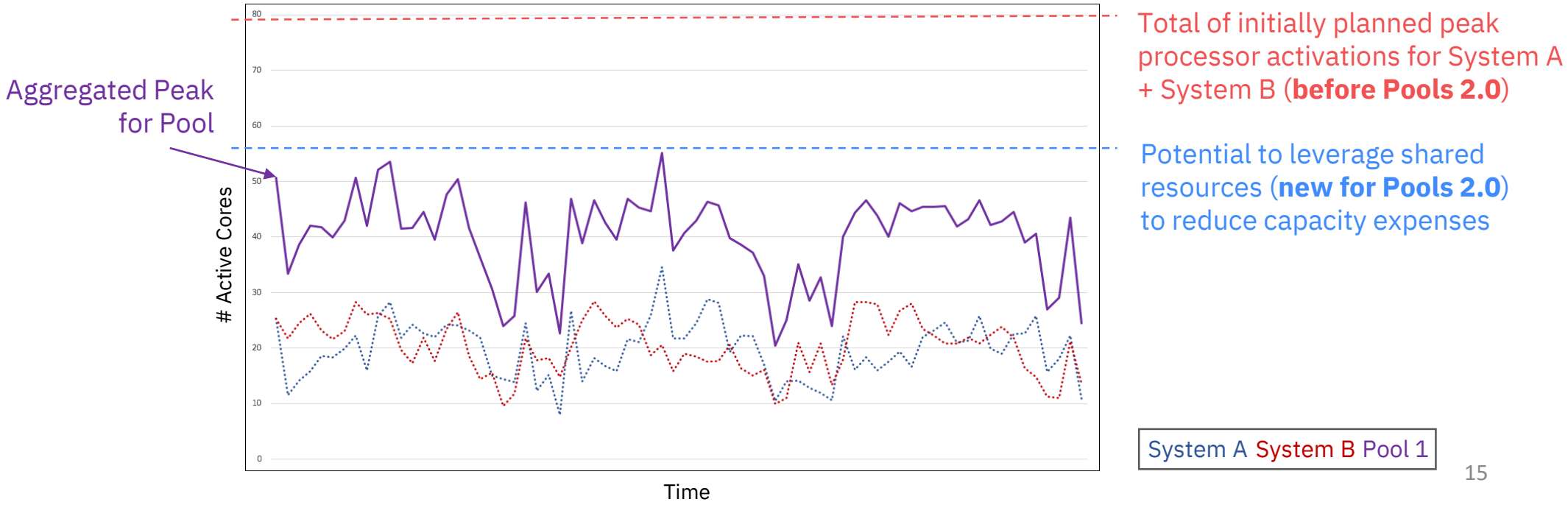
Deploy across a pool of POWER E980 or POWER E950 systems.

* As of 2Q20

# POWER Private Cloud Solution Enterprise Pools 2.0

Handle demand spikes across collections of POWER servers with Base and Metered Capacity.

IBM Cloud Management Console with HMC



# PowerVC for virtualization management and private cloud

PowerVC

**PowerVC API provides open standards-based integration with cloud ecosystem partners**





## PowerVC

**Key Features:**

1. Deploy VMs in minutes
2. Full lifecycle management of VMs
3. Automated VM recovery
4. Single-click host evacuation
5. Automated cloud optimization
6. Multi-tenancy and resource isolation
7. Software-defined networking
8. OpenStack API enablement
9. Open integration with multi-cloud managers

## PowerVC for Private Cloud

**Key Features:**

1. ***EVERYTHING in PowerVC Standard Edition***
2. Self-service, single-click deployment for cloud users and developers
3. Policies, metering and quota management to govern how the private cloud operates
4. Import/export VMs to/from clouds

# PowerVC 2.0: Latest release

PowerVC

Refreshed Carbon user experience (from an extensive IBM Design Thinking project during 2019-2020)

Context-sensitive logs display

Scales up to manage **10,000** VMs and **20,000** Volumes

Migration of volumes with retype support

Multi-factor authentication (MFA)

Persistent Memory support

SLES certification for PowerVC Manager

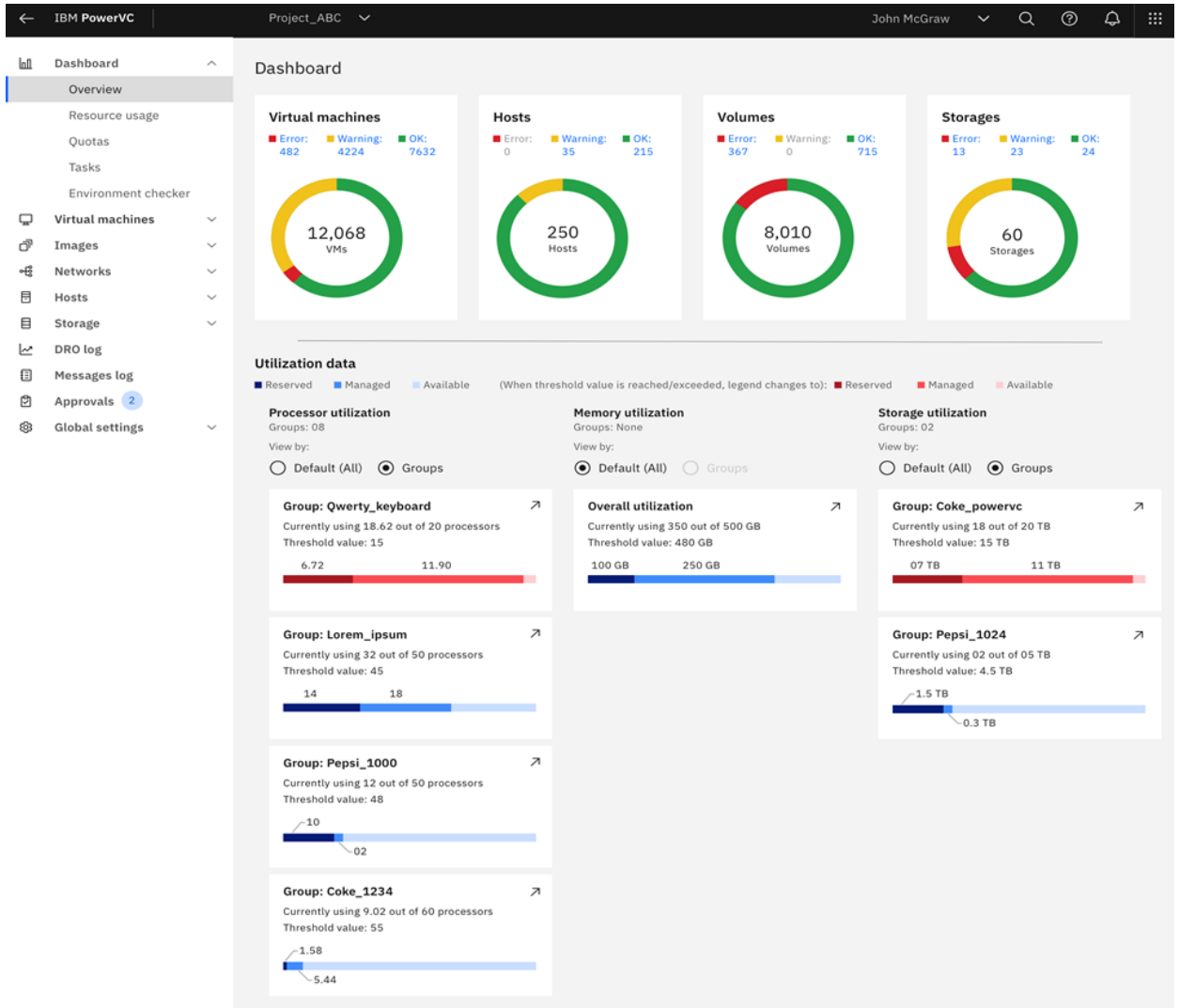
RHEL 8 support with full Python 3 compatibility.

Consistency groups, snapshot and restore

Volume clone for backup

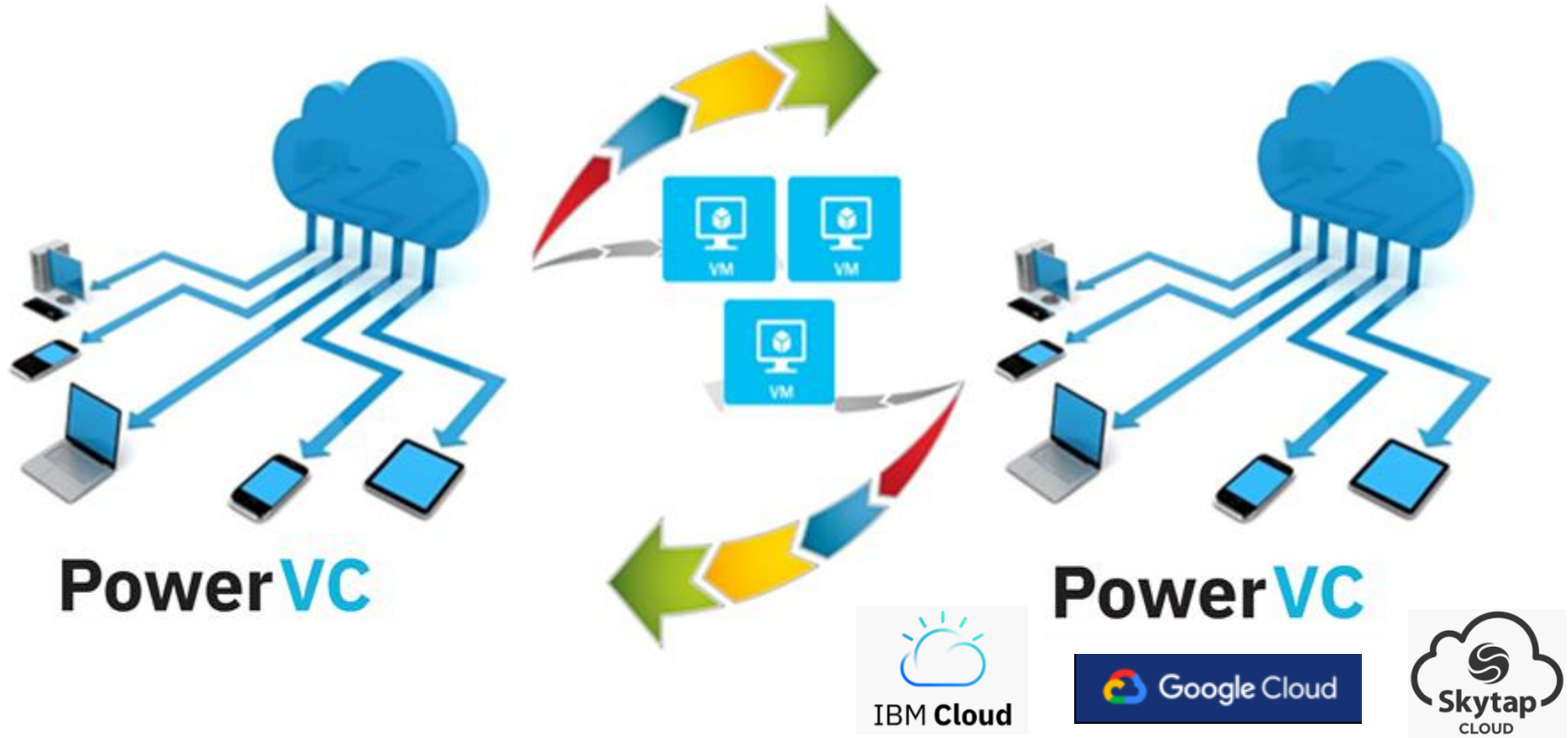
VM clone to simplify redundant workload  deployment

Global Mirror for IBM Storwize for enabling DR



# PowerVC enables VM import/export for cloud mobility

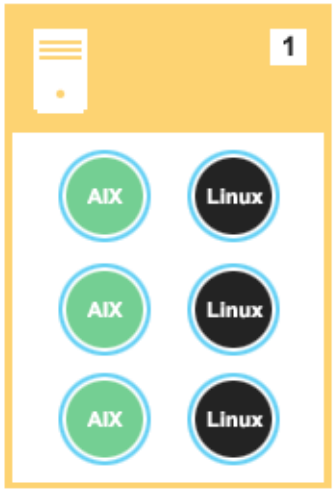
PowerVC

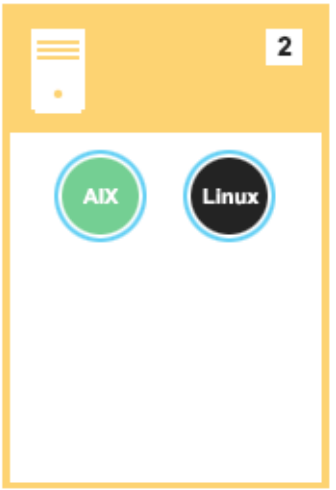


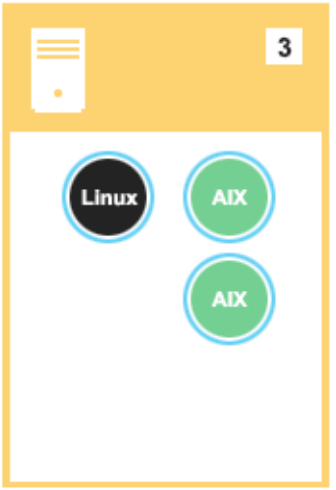

Move any VM between clouds or data centers as needed, for seamless hybrid cloud agility

# PowerVC Dynamic Resource Optimizer (DRO)

- **Example:** When a server exceeds its predefined utilization threshold, VMs from that server are migrated to less-burdened servers in the host group.
- In this case, three hosts are in a host group that has DRO enabled.
- When Host #1 becomes overburdened, the VMs are automatically migrated via LPM to other hosts in the host group.



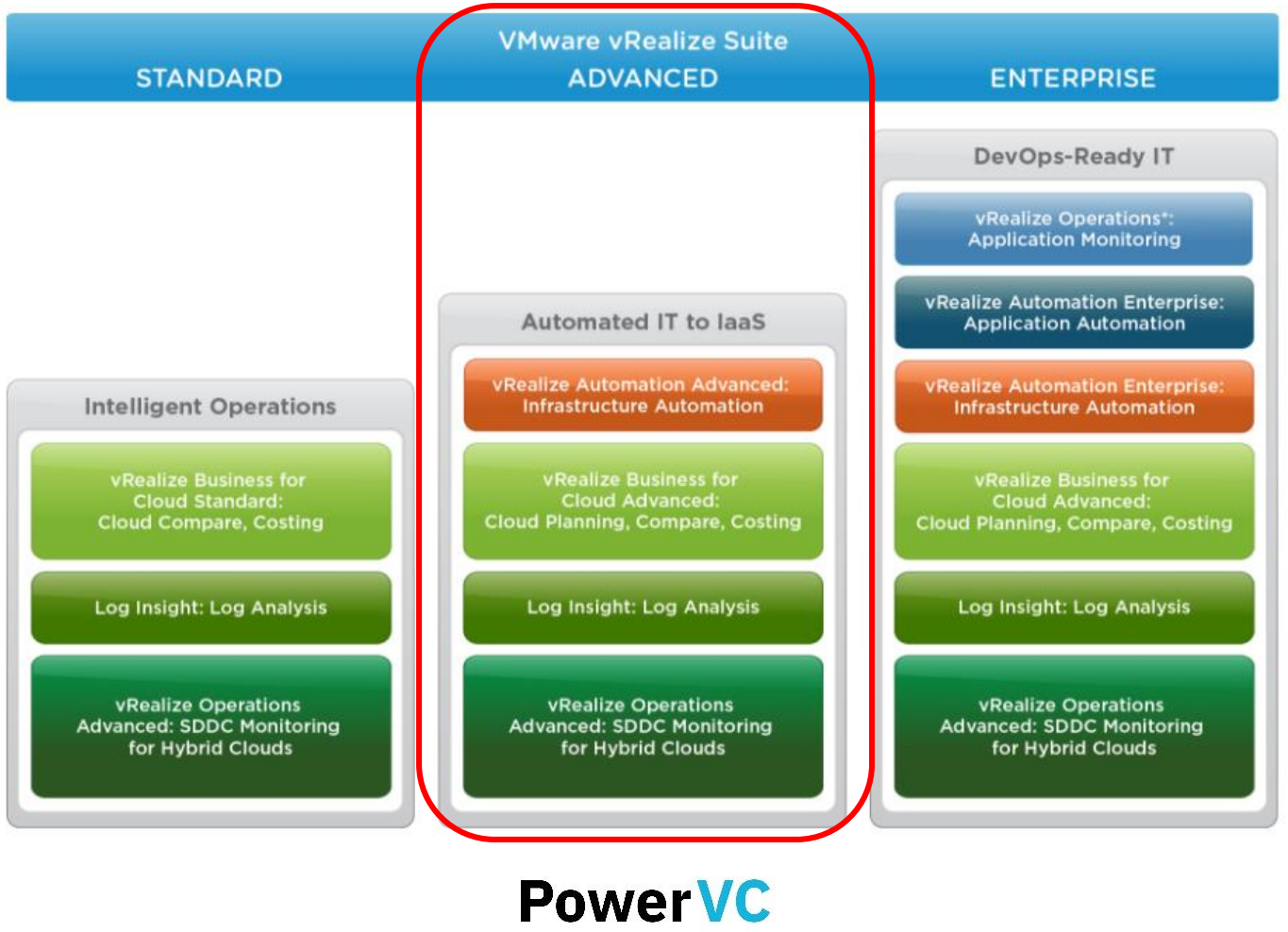




https://www.ibm.com/support/knowledgecenter/en/SSXK2N_1.3.0/com.ibm.powervc.standard.help.doc/powervc_dro_hmc.html

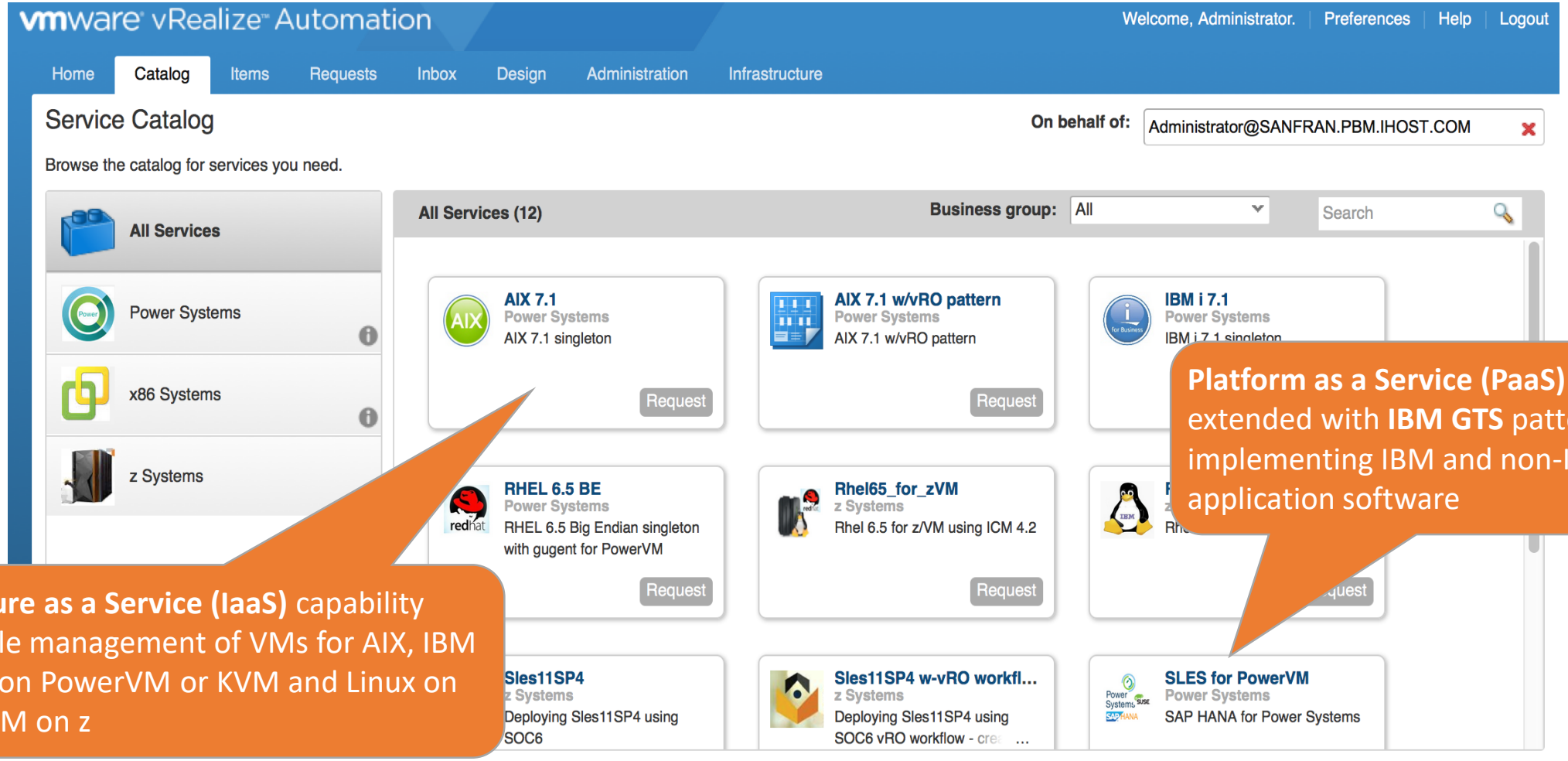
# VMware vRealize Suite and Power Systems

- VMware vRealize Suite is a multi-cloud manager that is sold in three Editions: Standard, Advanced and Enterprise
- Most Power customers with large x86 server deployments have vRealize Advanced Edition. which includes Automation and Operations
- vRealize Automation can manage PowerVM workloads, with integration provided by PowerVC northbound APIs
- The result is a consistent virtualization and cloud management experience across x86 and Power infrastructure



# vRealize Automation: Manages Power, x86 and Z virtualization

vRealize Automation provides an integrated multicloud management experience

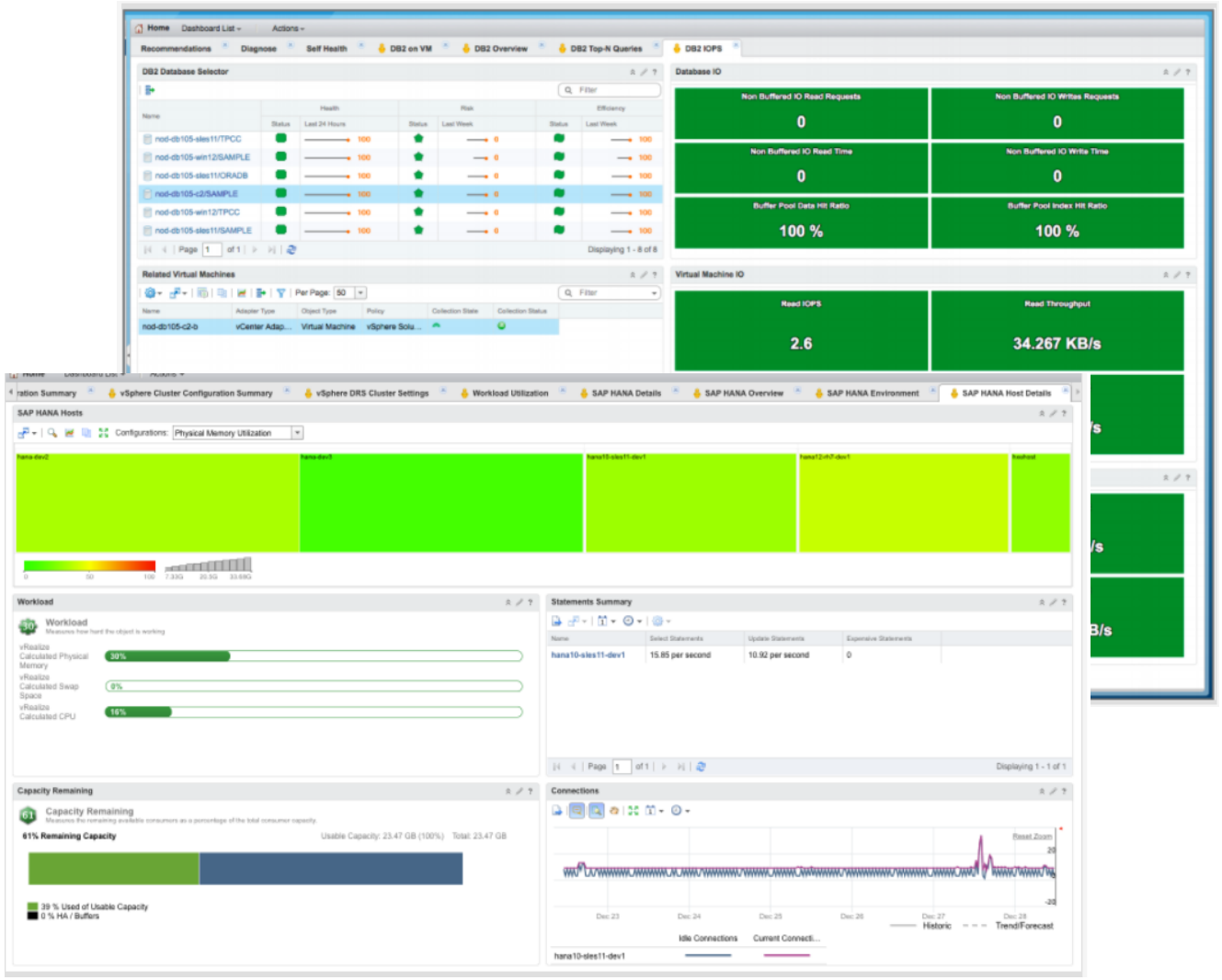



**Infrastructure as a Service (IaaS)** capability with lifecycle management of VMs for AIX, IBM i and Linux on PowerVM or KVM and Linux on z/VM or KVM on z

**Platform as a Service (PaaS)** capability extended with **IBM GTS** patterns for implementing IBM and non-IBM application software

# VMware vRealize Operations for IBM Power

**VMware vRealize Operations for Power** delivers efficient capacity management, proactive planning and intelligent remediation, helping customers optimize, plan and scale multicloud deployments.




- **Full stack dashboard**
  - HMC data provider
  - PowerVC data provider
- **AIX OS agent (7.1 and 7.2)**
- **Linux OS agent (RHEL and SUSE)**
- **SAP HANA management pack**
- **DB2 management pack**
- **Oracle management pack**

# Ansible automates repetitive IT management tasks

- Rolling out system software updates
- Ensuring that all servers stay configured properly and meet compliance requirements
- Validate correct security baseline is in place
- Provisioning software stacks within SLAs

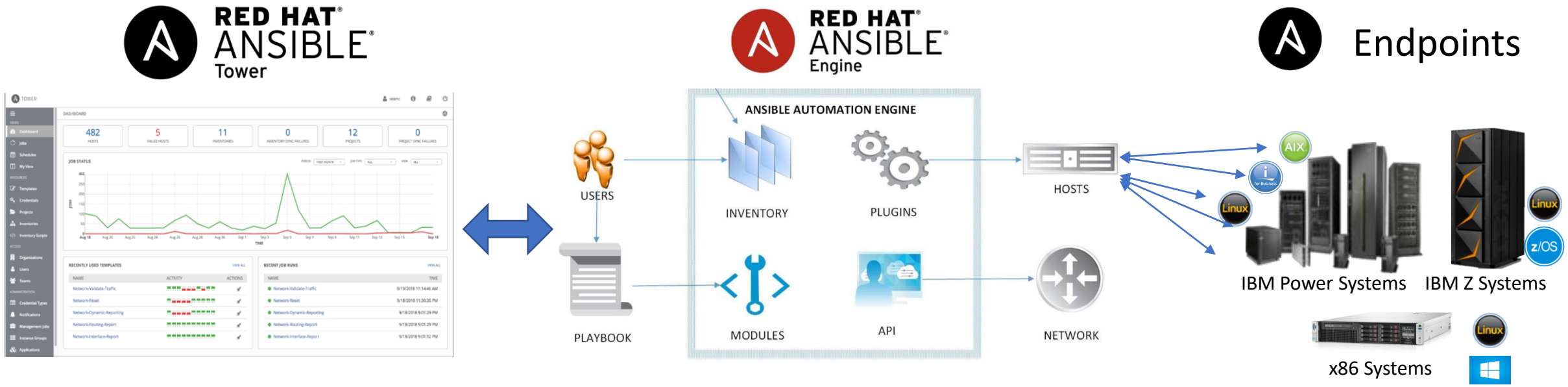
Automate deployment and management

Red Hat Ansible Automation Platform

Increases productivity of AIX, IBM i and IBM Power Systems admins

Extends consistent management across multiple platforms

# Red Hat Ansible Automation Platform for Power Systems




## 1 Red Hat Ansible Tower

- Enterprise-wide graphical control of Ansible estate

**Supported on x86 Linux**

## 2 Red Hat Ansible Engine

- Enterprise-wide control – i.e., runs playbooks

**Supported on x86 Linux**

## 3 Red Hat Ansible Endpoints

- Enterprise-wide automation; modules are executed here

**commercial support available from Red Hat**

community support only (at present)

# Ansible and Power Systems Cloud solutions

1. Ansible can automate anything—even cloud provisioning operations

2. From a POWER perspective, can automate both private cloud and public cloud infrastructure

3. **Private Cloud:** Ansible complements IBM PowerVC to automate VM provisioning—see an example

4. **Public Cloud:** Ansible complements IBM Power Virtual Server on IBM Cloud—see an example

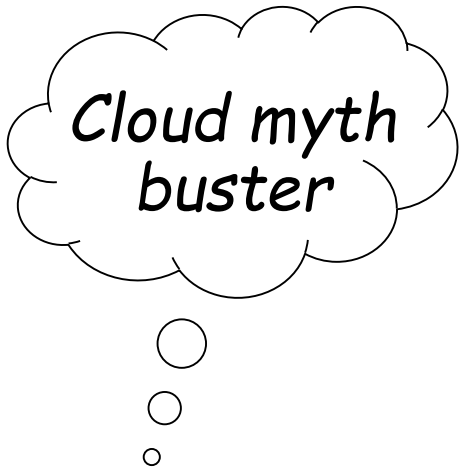
# Cloud has reset expectations for IT

**94%** of organizations
are using a mix of public & private clouds
and are embracing a multicloud strategy*

Pay as you go for what you use

Self-service experience, from anywhere

Rapid access to resources – compute, storage, GPUs, network bandwidth




Automate, simplify management & Dev/Ops

Deploy & scale apps rapidly – run anywhere

Continuous software, infrastructure innovation

Cloud is a capability and not a place

*IDC Cloud Forecast 2018-2020

# IT teams are defining how Power fits in multicloud plans

# Cloud placement considerations for Power workloads

Resilience – stateless or transactional?

Security – are the crown jewels locked down?

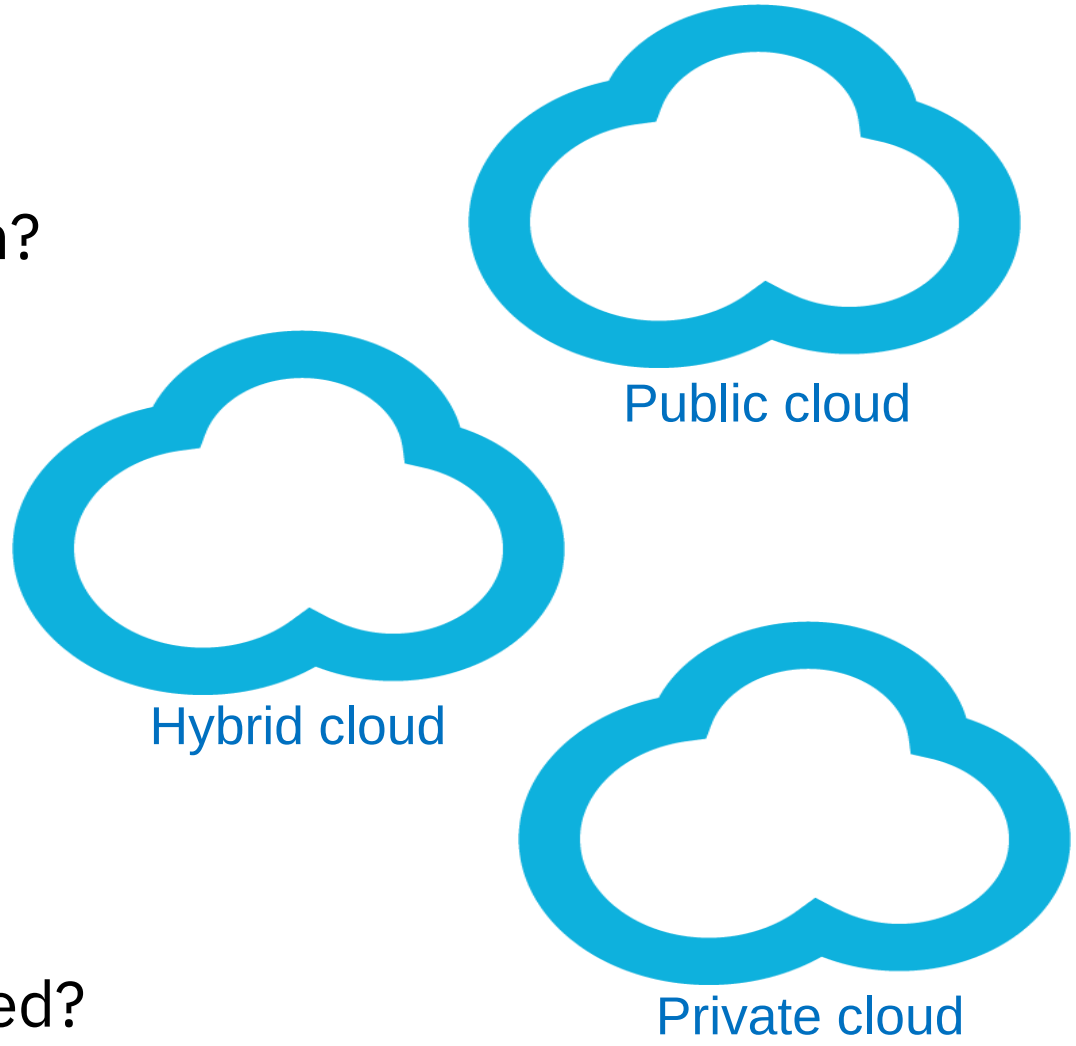
Performance – is it there when you need it?

Latency – is a dropped connection fatal?

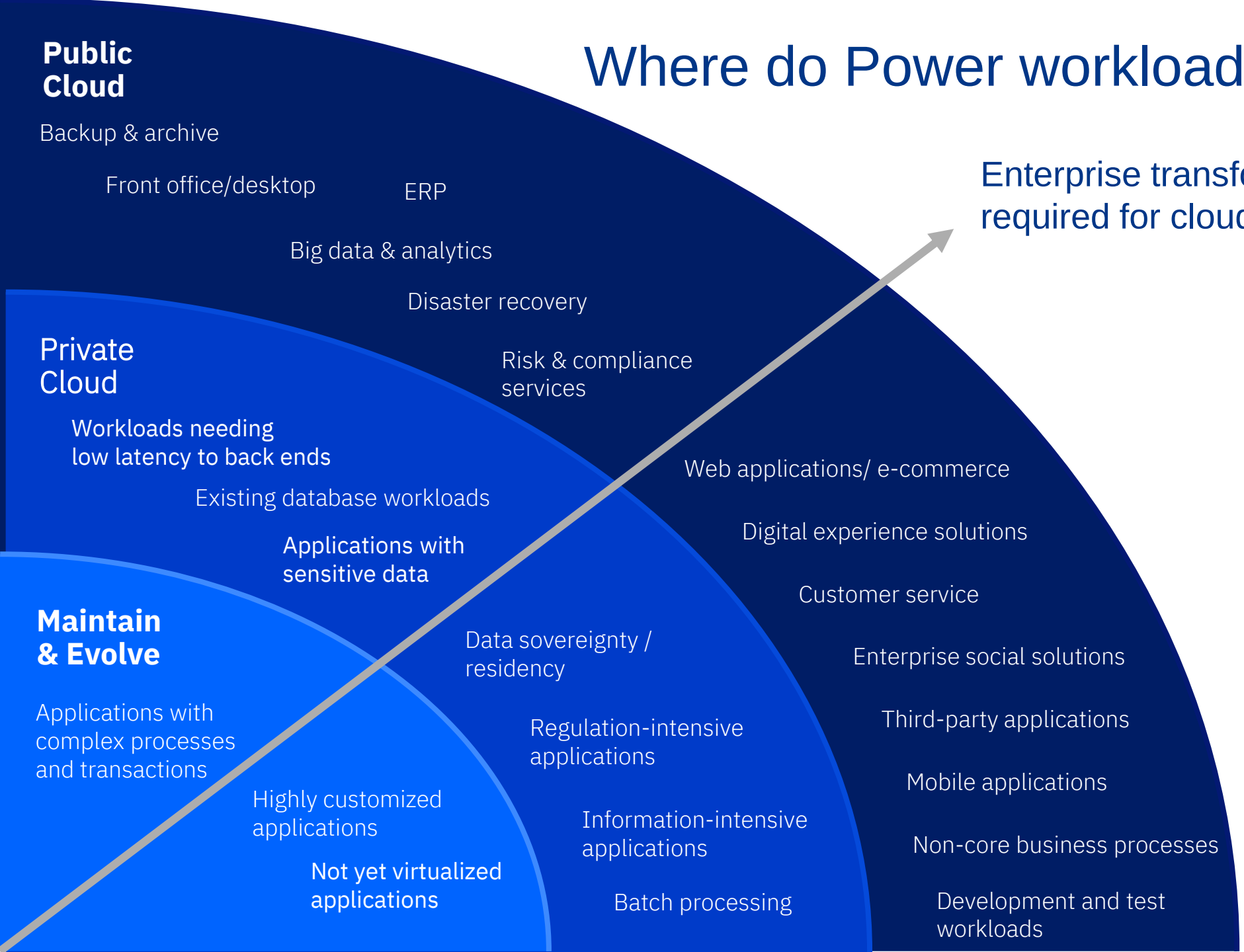
Predictability – is activity spiky or stable?

Compliance – local/regional/global?

Data sources – publicly-available or protected?



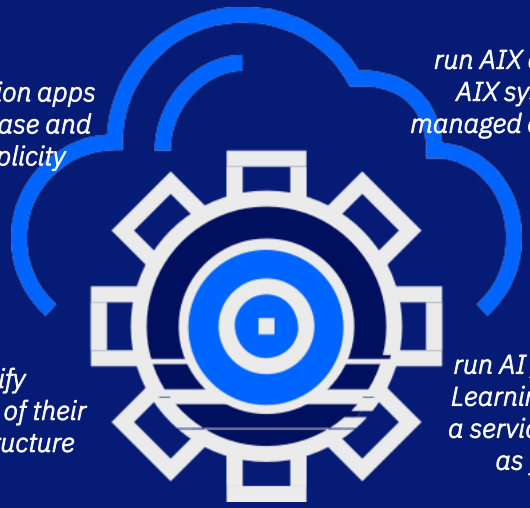
# Where do Power workloads belong?



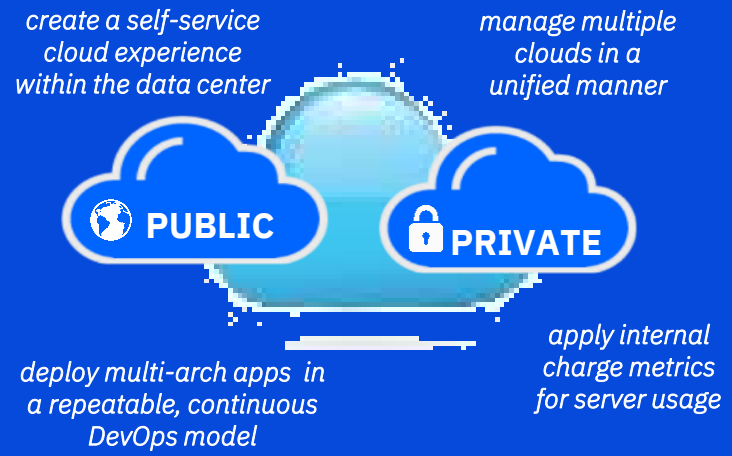

* IBM Institute for Business Value study, "Tailoring Hybrid Cloud" August 2016

# Digital transformation by Power Systems clients includes…

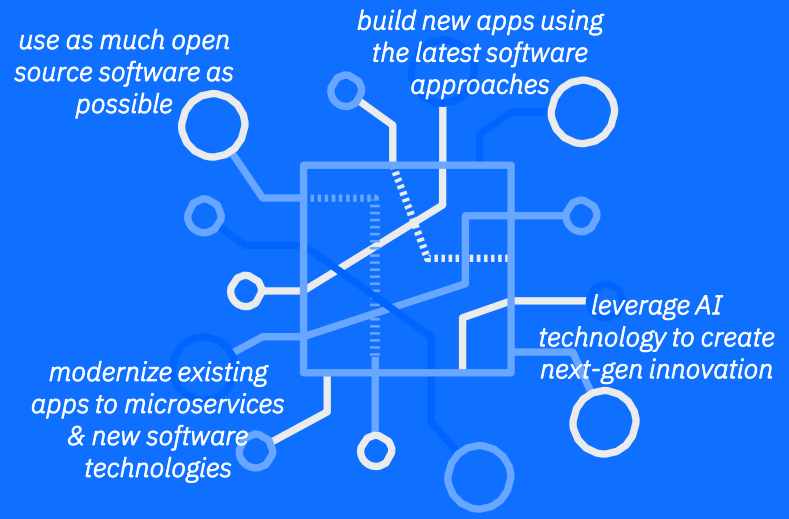
## Simplifying Infrastructure Management & Automation




## Delivering a Cloud Experience and Increasing Agility




## Providing an Innovation Fabric for the Business




**On Premises** (Private Cloud)**, Off Premises** (Public Cloud) **or Both** (Hybrid Cloud)

**…IBM Power Systems have you covered!**

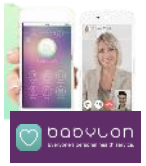
# Cloud is changing how applications are built and delivered

***A majority of the 25,000+ Power clients are in early stages of moving to cloud and modernizing their AIX and IBM i apps***

## Monolithic apps (VMs or bare metal)

- Enterprise Resource Planning
- Customer Resource Management
- Relational Database
- ML / AI Applications

## Cloud Enabled Applications




ERP, CRM, Relational DB, ML/AI Apps

Data

Function

Red Hat OpenShift

***Cloud Services - Container Based***

PRIVATE (PaaS)

PUBLIC (PaaS)

PRIVATE (IaaS)

PUBLIC (IaaS)

## New Cloud Native Apps

Red Hat OpenShift

***Cloud native container services***
***Build once, deploy anywhere***

PRIVATE (PaaS)

PUBLIC (PaaS)

HYBRID MULTICLOUD

# Modernization and Cloud journey for Power Systems

- **Seamless management** of IT infrastructure, multiple clouds and applications


IaaS

Manage Cloud Infrastructure
PowerVC Cloud


+

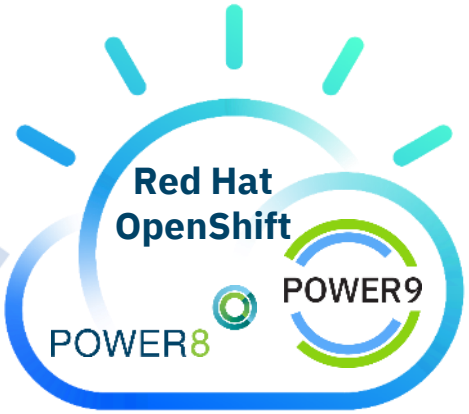
Manage Hardware and Ops
HMC

Traditional IT Infrastructure

PaaS

+

Create and Manage Cloud Native Apps
Red Hat OpenShift
+ Cloud Automation Mgr.




- ✓ Build solutions on existing Power virtualization stack
- ✓ Use PowerVC to manage Power Cloud infrastructure
- ✓ Modernize existing, build new apps on POWER and x86
- ✓ Securely connect to business critical data and apps
- ✓ Provide cloud automation and single self-service portal for AIX and IBM i VMs plus Linux containerized apps

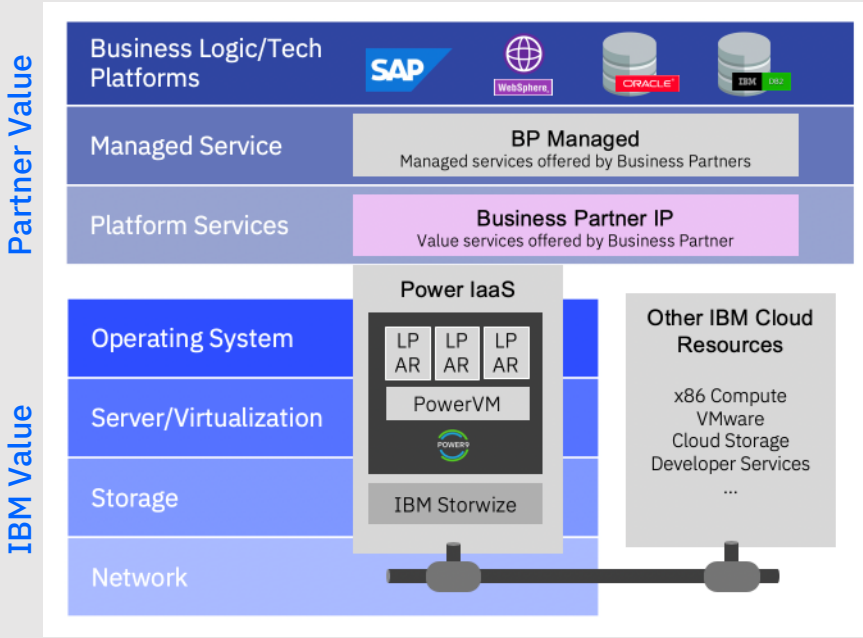
# IBM Power Systems Virtual Server on IBM Cloud

- Self-provision and purchase monthly subscription Power IaaS instances from IBM Cloud.
- Self-service VM management of pool of compute, memory, storage, network infrastructure.
- Secure access to PowerVM based VMs through client owned IBM Cloud resources.
- IBM manages IaaS resources and supports hardware/software up to OS deployment
- Client self-manages the Operating System and all software above the OS
- Client can bring their own OS images and add to available OS images.

## Power IaaS Details:

| | |
|---|---|
| Systems: | S922 or E980 |
| Compute: | 0.25-153 cores (15 for S922, 153 for E980), *Dedicated or Shared option for Cores* |
| Memory: | 8-64 GB per core |
| Storage Type: | Type: Tier 3 (SSD) or Tier 1 (NVMe) |
| Storage Quantity | 10 GB minimum, 10 GB increments |
| Network: | Public and/or Private IP |
| OS: | AIX / IBM i / Linux |

*Multi-tenant, self managed,*
*Power Infrastructure-as-a-Service in IBM Cloud*
*with consumption-based OPEX pricing*




### Pricing Methodology:

- Consumption based pricing:
  - Hourly pricing, monthly billing
- Pricing Calculator:
  - Power Virtual Server Price Estimator

# IBM Power Systems for Google Cloud

## Overview

Power infrastructure as a service

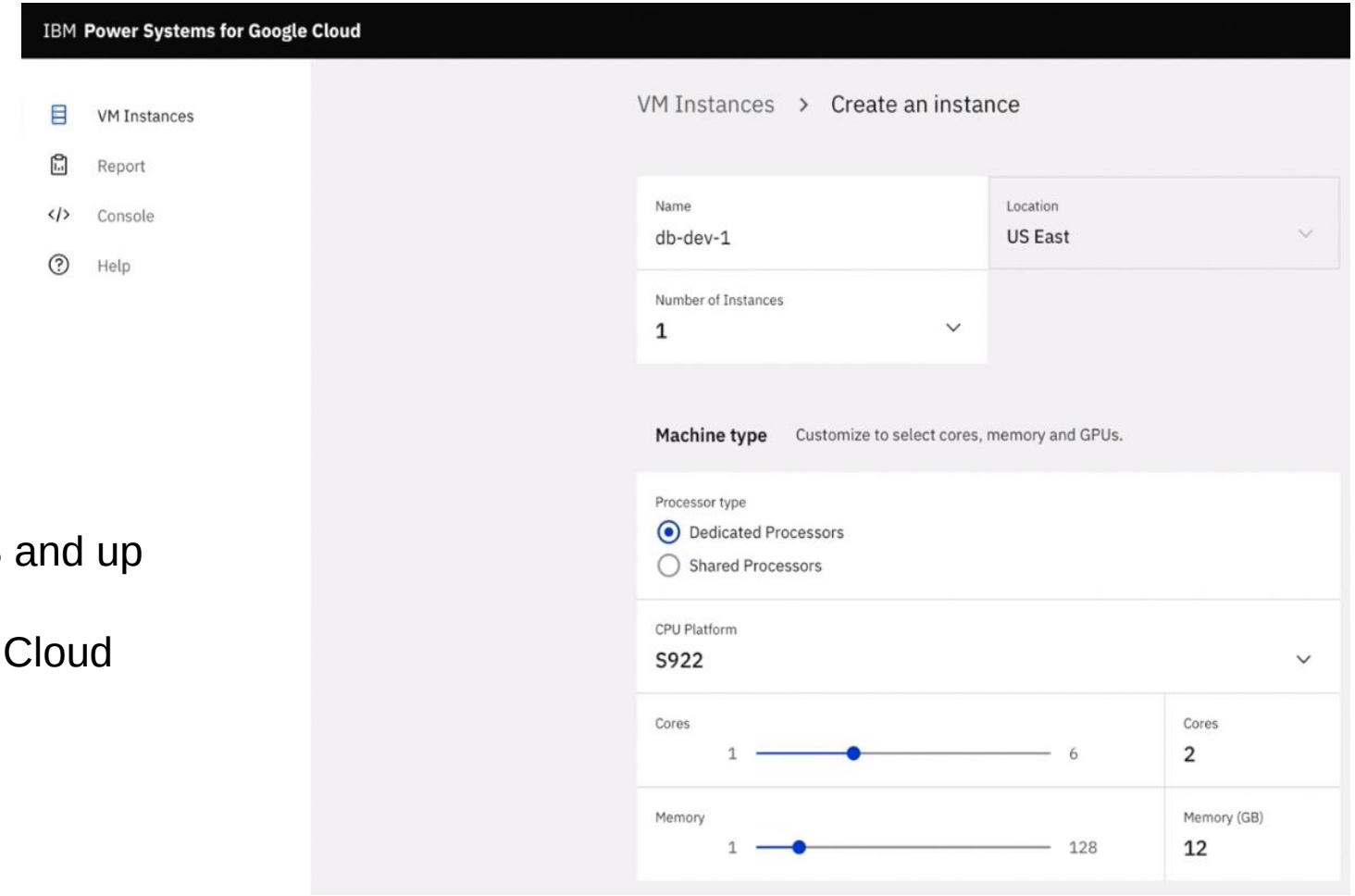
Capacity via monthly subscription

Complete Google Cloud user experience

Private, low-latency access to resources

IBM runs infrastructure, clients manage OS and up

One consolidated monthly bill from Google Cloud



# IBM and Red Hat: Hybrid Cloud Architecture
# **Open Platform** for innovation and growth

**Business Requirements**

Build with the latest tech on any cloud

Improve visibility & control across hybrid, multicloud

Ensure app & data portability with no lock in

Optimize on the best fit cloud model and vendor

| **World-class public cloud**<br>IaaS & advanced services on IBM's public cloud | **Hybrid multicloud platform**<br>Consistent stack and management for multicloud |
|---|---|

| | |
|---|---|
| **Expertise** | Advise on cloud \| Build for cloud \| Move to cloud \| Manage on cloud |
| **Advanced Services** | AI \| Hyper Protect \| IoT \| Blockchain \| Analytics \| ML \| Quantum |
| **Capabilities** | Application \| Data \| Integration \| Automation \| Management \| Security |
| **Foundation** | Common Services \| RHEL \| RH OpenShift \| Multi-cluster Management |

**Infrastructure**

IBM Cloud | AWS | Azure | Google | Edge | Private Cloud | IBM Power Systems, IBM LinuxOne/z Sys., IBM Storage

**Business Outcomes**

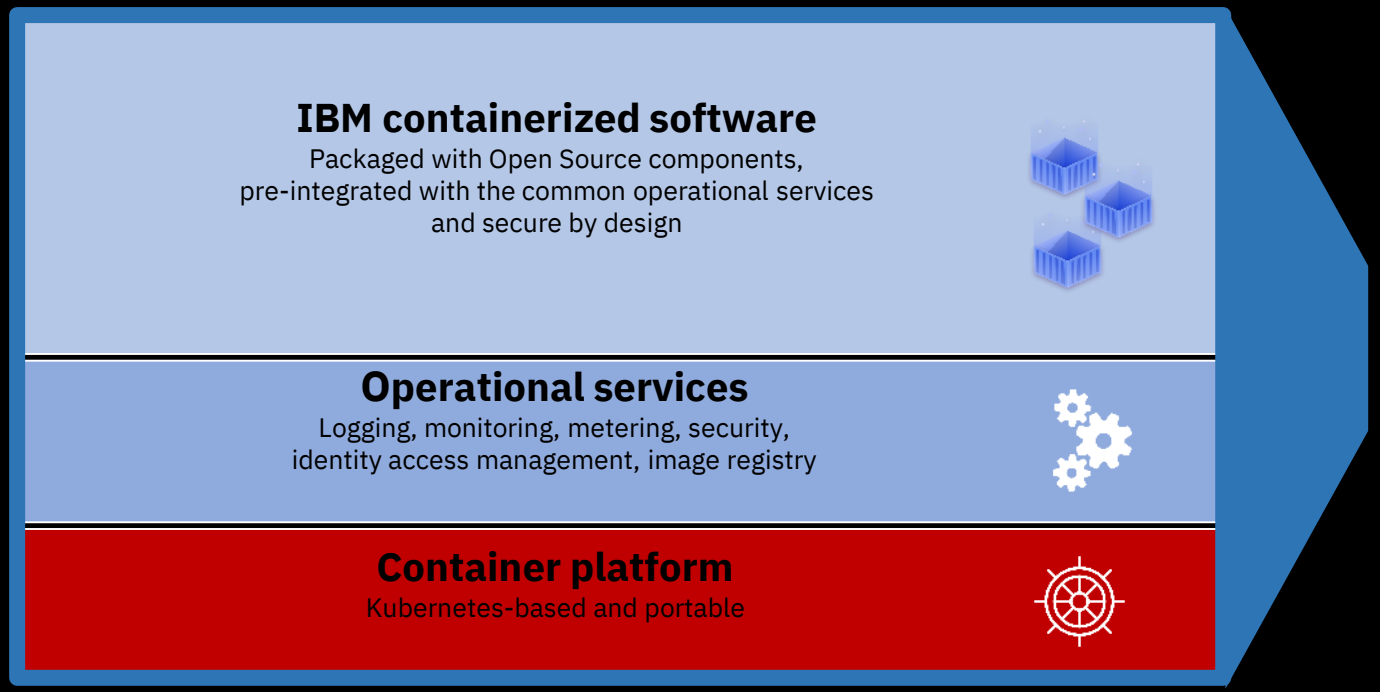
Innovate faster with greater agility

Create more insights from data

Improve ROI and competitive edge

# IBM Cloud Paks – Middleware Anywhere

*Enterprise-ready, containerized software solutions that give you an open, faster, more secure way to move core business applications to any cloud*




**Complete yet simple**
*Application, data and AI services, fully modular and easy to consume*

**IBM certified**
*Full software stack support and ongoing security, compliance and version compatibility*

**Run anywhere**
*On-premises, on private and public clouds and in pre-integrated systems*

Pre-integrated Systems · IBM Cloud · RED HAT OPENSHIFT · aws · Azure · openstack · Google Cloud · POWER9

# Cloud Paks and Red Hat OpenShift on Power Systems

## Cloud Pak for Multicloud Management

- Multi Cloud Manager
- Cloud Application Management
- Cloud Event Manager
- Cloud Automation Manager

Red Hat OpenShift

## Cloud Pak for Application

- Open liberty
- Swift
- WAS liberty
- Spring
- Kabanero Enterprise
- JBoss
- istio
- jenkins
- node.js
- Transformation advisor

*UrbanCode Deploy
*Developer Team Orch
*Dev Team Governance

+ Add-on *

RHOAR - OpenShift Application Runtimes

Red Hat OpenShift

## Cloud Pak for Data

- Cloudant
- DB2
- Cognos
- Streams
- MariaDB*
- Redis*
- MongoDB
- etcd

* PostgreSQL
* NetApp Persistent Storage
* Wand Taxonomies and Ontologies
* Knowis for Banking
* Lightbend Reactive Microservices
* Prolifics Prospecting Accelerator

+ Add-on * (including Watson AI, ...)

Red Hat OpenShift

## Cloud Pak for Integration

- App Connect Enterprise
- API Connect
- Event Streams
- MQ
- RabbitMQ
- Aspera
- Integration explorer
- Watson Voice gateway *
- Datapower

+ Add-on *

Red Hat OpenShift

## Cloud Pak for Automation

- Business Automation Workflow
- Operational Decision Management
- Business Automation Insight
- Business Automation Content Analyzer
- File Connect Manager
- Robotic Process Automation *

+ Add-on *

Red Hat OpenShift

## Cloud Pak for Security

- Federated Search
- Case Management
- Universal Data Insights
- Security orchestration and Automation
- Development Framework

Red Hat OpenShift

**Runs on choice of IBM Power Systems Infrastructure-as-a-Service (IaaS)**

PowerVC
PowerVM

Linux AIX i for Business

RED HAT ENTERPRISE VIRTUALIZATION
KVM
Linux

**Bare-metal**

# POWER9 Servers: Optimized for a hybrid cloud world

## Optimal solutions for private, public, hybrid and multi-clouds

- Built-in **PowerVM,** so every workload is virtualized with accelerated secure mobility
- Consistent multicloud management with **VMware vRealize Suite** integration
- Enterprise-wide IT automation with **Ansible**
- **PowerVC for Private Cloud** for virtualized resource optimization and a comprehensive private cloud portal
- Create new Power cloud-native container-based solutions alongside AIX and IBM i workloads with **IBM Cloud Paks**

**Read the white paper:**
https://www.ibm.com/downloads/cas/G4DO3DJE

### Additional POWER9 Cloud benefits

- Easy transfer of VMs between clouds
- Enterprise Pools for live resource reallocation
- Cloud-ready images for most Power software


- Broader term license and SaaS pricing options
- Mobility activation for legacy servers speeds migration
- Services: Power to Cloud Rewards Program

# Thank You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