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

CLOUD COMPUTING 2020 presentation

Ian Robinson
Virtualization/Cloud Offering Manager
IBM Power Systems
idrobinson@us.ibm.com

October 2020
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

Business and data management workloads

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

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

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.

* 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.
POWER9 processor

- 7 TB/s Bandwidth
- 1 TB/s Bandwidth into chip
- 4 GHz Peak Frequency
- 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 IBM Research develops hypervisor that becomes VM on the mainframe
1973 IBM announces systems with physical partitioning
1999 IBM debuts POWER Hypervisor™ for System p™ and System i™
2004 IBM ships PowerVM Editions
2008 PowerVM delivers enhanced storage virtualization
2010 PowerVM enabled for OpenStack integration
2014 PowerVM built into all POWER9 enterprise servers
2018 PowerVM provides foundation for POWER10 generation
2021

PowerVM
Power is virtualization without limits

PowerVM
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.
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!

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 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

<table>
<thead>
<tr>
<th></th>
<th>Width</th>
<th>Depth</th>
<th>Height</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Width</td>
<td>437 mm (17.2 in.)</td>
<td>705.3 mm (27.76 in.)</td>
<td>43.0 mm (1.7 in.)</td>
<td>14.5 kg (32 lb)</td>
</tr>
</tbody>
</table>

Table 2. Electrical

<table>
<thead>
<tr>
<th>Electrical characteristics</th>
<th>Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum measured power</td>
<td>300 W</td>
</tr>
<tr>
<td>Maximum kVA</td>
<td>0.330</td>
</tr>
<tr>
<td>Maximum thermal output</td>
<td>1024 BTU/hr</td>
</tr>
<tr>
<td>Input voltage</td>
<td>100 - 127 V ac or 200 - 240 V ac</td>
</tr>
<tr>
<td>Frequency</td>
<td>50 or 60 Hz</td>
</tr>
</tbody>
</table>

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

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.

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

* As of 2Q20

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

Aggregated Peak for Pool

Total of initially planned peak processor activations for System A + System B (before Pools 2.0)

Potential to leverage shared resources (new for Pools 2.0) to reduce capacity expenses

IBM Cloud Management Console with HMC

POWER Private Cloud Solution
Enterprise Pools 2.0
PowerVC for virtualization management and private cloud

**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 API provides open standards-based integration with cloud ecosystem partners
PowerVC 2.0: Latest release

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

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.

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

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)

Endpoints

IBM Power Systems
IBM Z Systems
x86 Systems
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

Pay as you go for what you use
Self-service experience, from anywhere
Rapid access to resources – compute, storage, GPUs, network bandwidth

Cloud is a capability and not a place

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

Automate, simplify management & Dev/Ops
Deploy & scale apps rapidly – run anywhere
Continuous software, infrastructure innovation

*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?

Enterprise transformation required for cloud adoption

**Public Cloud**
- Backup & archive
- Front office/desktop
- ERP
- Big data & analytics
- Disaster recovery

**Private Cloud**
- Workloads needing low latency to back ends
- Existing database workloads
- Applications with sensitive data
- Risk & compliance services
- Web applications/e-commerce
- Digital experience solutions
- Customer service
- Enterprise social solutions
- Third-party applications
- Mobile applications
- Non-core business processes
- Development and test workloads

**Maintain & Evolve**
- Applications with complex processes and transactions
- Highly customized applications
- Not yet virtualized applications
- Data sovereignty/residency
- Regulation-intensive applications
- Information-intensive applications
- Batch processing

---

* IBM Institute for Business Value study, "Tailoring Hybrid Cloud" August 2016
Digital transformation by Power Systems clients includes…

Simplifying Infrastructure Management & Automation
- run AIX apps on AIX systems managed elsewhere
- run AI / Machine Learning apps as a service and pay as you go
- provision apps with ease and simplicity
- simplify operations of their IT infrastructure

Delivering a Cloud Experience and Increasing Agility
- create a self-service cloud experience within the data center
- manage multiple clouds in a unified manner
- deploy multi-arch apps in a repeatable, continuous DevOps model
- apply internal charge metrics for server usage

Providing an Innovation Fabric for the Business
- use as much open source software as possible
- build new apps using the latest software approaches
- leverage AI technology to create next-gen innovation
- modernize existing apps to microservices & new software technologies

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:

Cloud Services - Container Based

Data Function

ERP, CRM, Relational DB, ML/AI Apps

New Cloud Native Apps:

Cloud native container services
Build once, deploy anywhere

PRIVATE (IaaS)
PUBLIC (IaaS)
PRIVATE (PaaS)
PUBLIC (PaaS)
HYBRID MULTICLOUD

Customer Resource Management
Relational Database
ML/AI Applications

ERP, CRM, Relational DB, ML/AI Apps

PRIVATE (IaaS)
PUBLIC (IaaS)
PRIVATE (PaaS)
PUBLIC (PaaS)

Red Hat OpenShift

PRIVATE (PaaS)
PUBLIC (PaaS)
HYBRID MULTICLOUD
Modernization and Cloud journey for Power Systems

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

  - Manage Hardware and Ops
    - HMC
  - Traditional IT Infrastructure
  - Manage Cloud Infrastructure
    - PowerVC Cloud

  - 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

IBM Value

Business Logic/Tech Platforms

---

Business Logic/Tech Platforms

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize

Business Logic/Tech Platforms

---

Managed Service

Business Partner IP

Business Partner

SAP

Power IaaS

Operating System

Server/Virtualization

Storage

Network

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

Other IBM Cloud Resources

- x86 Compute
- VMware Cloud Storage
- Developer Services

IBM Managed Services

- SAP
- Business Partner IP
- Business Partner

IBM Value

Partner Value

- LP
- AR
- PowerVM
- IBM Storwize
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

<table>
<thead>
<tr>
<th>World-class public cloud</th>
<th>Hybrid multicloud platform</th>
</tr>
</thead>
<tbody>
<tr>
<td>IaaS &amp; advanced services on IBM’s public cloud</td>
<td>Consistent stack and management for multicloud</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expertise</th>
<th>Advise on cloud</th>
<th>Build for cloud</th>
<th>Move to cloud</th>
<th>Manage on cloud</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Advanced Services</th>
<th>AI</th>
<th>Hyper Protect</th>
<th>IoT</th>
<th>Blockchain</th>
<th>Analytics</th>
<th>ML</th>
<th>Quantum</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Capabilities</th>
<th>Application</th>
<th>Data</th>
<th>Integration</th>
<th>Automation</th>
<th>Management</th>
<th>Security</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Foundation</th>
<th>Common Services</th>
<th>RHEL</th>
<th>RH OpenShift</th>
<th>Multi-cluster Management</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Business Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Build with the latest tech tech on any cloud</td>
</tr>
<tr>
<td>Improve visibility &amp; control across hybrid, multicloud</td>
</tr>
<tr>
<td>Ensure app &amp; data portability with no lock in</td>
</tr>
<tr>
<td>Optimize on the best fit cloud model and vendor</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Business Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovate faster with greater agility</td>
</tr>
<tr>
<td>Create more insights from data</td>
</tr>
<tr>
<td>Improve ROI and competitive edge</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructure</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Cloud</td>
</tr>
<tr>
<td>IBM Power Systems</td>
</tr>
</tbody>
</table>
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

IBM containerized software
Packaged with Open Source components, pre-integrated with the common operational services and secure by design

Operational services
Logging, monitoring, metering, security, identity access management, image registry

Container platform
Kubernetes-based and portable

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
### Cloud Pak for Multicloud Management
- Multi Cloud Manager
- Cloud Application Management
- Cloud Event Manager
- Cloud Automation Manager

### Cloud Pak for Application
- Open liberty
- WAS liberty
- Spring
- Kabanero Enterprise
- JBoss
- istio
- jenkins
- node.js
- Transformation advisor

### Cloud Pak for Data
- Cloudant
- Cognos
- MariaDB
- MongoDB
- Redis
- etcd
- *PostgreSQL
- *NetApp Persistent Storage
- *Wand Taxonomies and Ontologies
- *Knows for Banking
- *Lightbend Reactive Microservices
- *Prolifics Prospecting Accelerator

### Cloud Pak for Integration
- App Connect Enterprise
- Event Streams
- RabbitMQ
- Watson Voice gateway
- Integration explorer
- Watson Voice gateway

### Cloud Pak for Automation
- Business Automation Workflow
- Operational Decision Management
- Business Automation Insight
- Business Automation Content Analyzer
- File Connect Manager
- Robotic Process Automation

### Cloud Pak for Security
- Federated Search
- Case Management
- Universal Data Insights
- Security orchestration and Automation
- Development Framework

---

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

**Power VC**
- Linux
- AIX

**Power VM**
- KVM

**Bare-metal**
- IBM Power Systems
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**

**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

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