AIX and PowerVC

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Thanks to:
Jennifer Monk Lin, Senior Offering Manager, AIX & PowerSC
Flemming Guldager Danielsen – Komplex-IT
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Topics

- AIX Roadmap and Service Extension Review
- AIX Standard Edition Features
- AIX Enterprise Edition Changes
- PowerVC + PowerVC Manager
- Demo of PowerVC
# AIX and Power Systems Value

<table>
<thead>
<tr>
<th>Performance</th>
<th>Reduced Downtime</th>
<th>Investment Protection</th>
<th>Security</th>
</tr>
</thead>
<tbody>
<tr>
<td>- POWER8 with AIX gives 2X performance over POWER7</td>
<td>- &quot;IBM’s AIX v 7.1 running on Power Systems, averaged approximately eight minutes of per server/annum downtime and recorded the least amount overall downtime due to Tier 1, Tier 2 and Tier3 outages for the best reliability among survey respondents.&quot; [ITIC 2014-2015 Global Server Hardware, Server OS Reliability Report]</td>
<td>- Binary Compatibility Guarantee</td>
<td>- Zero PowerVM Vulnerabilities to date</td>
</tr>
<tr>
<td>- Reduced HW/SW Maintenance Costs</td>
<td></td>
<td>- Extended Software Maintenance Contract Options</td>
<td>- Rich set of security features (Trusted AIX, AIX Security Expert, RBAC, JFS2, Auditing Subsystem, etc)</td>
</tr>
<tr>
<td>- Reduced floor space and energy costs through consolidation</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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AIX Release Life Cycle View

IBM Strategy and Roadmap Whitepaper


AIX 5.3 Service Extension on POWER8
• Generally Available Offering as of 3/11/16
• Extend Service Contracts to June 2017 on migrations to POWER8
• Contact local TSS Rep for Pricing
• Executive Approval only needed for cases outside of offering parameters

AIX 6.1 End of Service
• Service Extension Offering expected in 2Q2016

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All statements regarding IBM’s future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.
Dynamic Flash Cache

Dynamically enable server side caching of storage data to enhance workload performance

- Server caches SAN data in server attached storage (SSD, SAS attached drawer, FC connected flash, etc.) - Provides storage vendor agnostic I/O caching solution integrated into AIX
- Data integrity remains as cache is read-only. Writes go straight through to the SAN
- Cache is transparent to workloads and requires no application code changes
- Supports virtualization features such as Live Partition Mobility (Requires VIOS 2.2.4)
- For workloads that use RAM as an I/O cache, smaller RAM caches may be possible with a flash based cache

Introduced in: AIX 7.1 TL4 SP2, AIX 7.2 TL0 SP0

- Improve transactional workload performance (more transactions, lower response times)
- Improve SAN infrastructure performance via SAN off-load

https://ibm.biz/AIX72_Flash_Cache
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Dedicated: Dedicated flash LUN

Virtualized: Flash LUN managed by VIOS

- LPM Capable
- Requires VIOS 2.2.4
Benefits of using http download access

- Communication occurs over a single http port, easy firewall management
- Secure transactions use digest authentication methods (TLS v1.0/1.1/1.2)
- Actions are driven from the client's end (the install target), no host access required

How does it work?

- The HTTP service is an embedded http service option in NIM.
- The service is dynamic, binds to a well-known port, and exists only when resources are being remotely served.
- IPv4 and IPv6 environments are supported

What is supported?

- NIM scripting customization
- Filesetinstall, bundle install

Limitations

- No support for network boot
- No support for NIM BOS installation
- No support for Thin Server provisioning

For more Information - http://ibm.co/2bbojrJ
Goal: Reduce the need to patch unnecessary packages

- All the new split-out packages are installed by default.
- User may remove the individual (split-out) packages if no other packages require them.
- Once removed, those packages will not be installed/updated during future TL or SP updates.
- If customers have installp packages dependent on any of the three filesets, they will need to update the pre-req for AIX 7.2.
- Full details: [http://ibm.biz/aix72_bos_net_packaging](http://ibm.biz/aix72_bos_net_packaging)
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Dynamic System Optimizer for POWER8

Automatically and dynamically tune software in real time via continuous runtime analytics

Introduced in: AIX 7.2 TL0 SP2, AIX 7.1 TL4 SP2; Included in AIX 7.1 EE and AIX 7.2 SE

- Workload placement
  - Optimize placement in platform topology
  - Group threads in common affinity domain
- Multi-thread Memory affinity
  - Reduce reference to remote memory
  - Migrate hot pages to local memory domains
- Dynamic page sizes
  - Promote memory regions to 16M pages

24 Core Server Java Workload – SPEC Jbb2005

<table>
<thead>
<tr>
<th>DSO</th>
<th>Out of Box</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.9</td>
<td>0.95</td>
</tr>
<tr>
<td>1</td>
<td>1.05</td>
</tr>
<tr>
<td>1.1</td>
<td>1.15</td>
</tr>
</tbody>
</table>

AIX Dynamic System Optimizer

AIX Kernel
Data, Controls, and Policies

PowerVM
Data, Controls, and Policies

Power HW
Data, Controls, and Policies

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VNIC – SR-IOV Adapter Virtualization with LPM Support (AIX 7.1 and 7.2)

- **Improved performance**
  - Removes data copies and reduces LPAR to VIOS control traffic
  - Reduces VIOS CPU Utilization
  - Exploits adapter offload support for Intra-CEC communication
  - Multiple queue model

- **Deterministic Quality of Service**
  - One-to-one relationship between client partition virtual adapter and adapter VF
  - Extends VF QoS capability to client LPAR
  - Isolation, multi-tenancy

- **Works with LPM**

- **Client based redundancy model**
  - Etherchannel, Network Interface Backup (NIB)
  - Allows for higher Client side network performance via multiple links

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**AIX 7.2 – Other Notes and Changes**

- Supported on all POWER 7 and POWER 8 systems, firmware, and VIOS levels (removed POWER4, POWER5, and POWER6 Support)
- AIX 7.2 is binary compatible with prior AIX releases
- Java 7 64-bit is the default (Additional Java levels are included on the AIX 7.2 expansion pack.)
- Removed packages (only happens at release levels):
  - NIS+, NDAF, IBM Virtual Shared Disk (rsct.vsd), IBM Systems Director Components; pConsole, Selected old adapters, IP over FC driver, Fcparray head driver, graPhigs, Java5, Bos.Ined, Obsolete locales, Selected performance toolbox components & eclipse2.rte, including bos.perf.gtools and performance workbench GUI
- Removed Trusted Computing Base in lieu of AIX Trusted Execution
- CIFS moved to Expansion Pack, JFS removed as an install option
- EOL LPPs not supported in 7.2: Fast Connect, Performance Toolbox, PowerSC Trusted Surveyor not supported on AIX 7.2 as management server
- Openssh added to install menu
- Added HTTPD support in nim
- bos.net.tcp.client repackaging: bos.net.tcp, bos.net.ftp, bos.net.snmp
Open Source for AIX

IBM will port, keep current and provide timely security fixes - enabling clients to leverage open source skills.

**Open source package repository for AIX**
http://www.ibm.com/systems/power/software/aix/linux/toolbox/

- **yum** package management now available, with repository access from both ftp and https protocols. rpm is also updated to allow automatic dependency discovery. *New ability to automate installation and updates.*
- **cloud-init** and all dependencies now available in the repository, and support for licensed AIX users. *Easy virtual machine customization for the cloud.*

**Community projects**
IBM Facilitated contributions to open source projects

- **chef** automation for configuration, deployment, and management. Chef-client for AIX is now enhanced with new recipes in the AIX cookbook. [https://supermarket.chef.io/cookbooks/aix/](https://supermarket.chef.io/cookbooks/aix/)
- **github** community to create and collaborate on open source projects for AIX [http://github.org/aixoss](http://github.org/aixoss)
- **node.js** popular event driven Javascript, optimized for Power Systems on AIX [https://nodejs.org/en/download/](https://nodejs.org/en/download/)

New policies to maintain and **address security vulnerabilities**, and expanded commitment to keep **key packages updated**

80+ packages updated this year

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AIX Enterprise Edition Evolution

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AIX 7.2 Enterprise Edition Evolution
AIX 7.2 Enterprise Edition V1.1 5765-CD1
AIX 7.2 Standard Edition
IBM Cloud Manager with OpenStack
PowerVC Standard Edition
PowerSC Standard Edition
IBM Tivoli Monitoring
IBM BigFix Lifecycle

AIX 7.2 Enterprise Edition V1.2 5765-CD1
AIX 7.2 Standard Edition
IBM Cloud PowerVC Manager
PowerVC Standard Edition
PowerSC Standard Edition
IBM Tivoli Monitoring
IBM BigFix Lifecycle

AIX 7.1 Enterprise Edition Evolution
AIX 7.1 Enterprise Edition V1.1 5765-CD3
AIX 7.1 Standard Edition
IBM Cloud Manager with OpenStack
PowerVC Standard Edition
PowerSC Standard Edition
IBM Dynamic System Optimizer
IBM Tivoli Monitoring
IBM BigFix Lifecycle

AIX 7.1 Enterprise Edition V1.2 5675-CD3
AIX 7.1 Standard Edition
IBM Cloud PowerVC Manager
PowerVC Standard Edition
PowerSC Standard Edition
AIX Dynamic System Optimizer
IBM Tivoli Monitoring
IBM BigFix Lifecycle

Clients with active SWMA Entitlement will see download entitlement for the latest offerings within the Enterprise Edition Bundle

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## AIX Release Summary

### AIX 7.1 TL4
- Cloud Init Activation Engine*
- New optimized cpfile() API
- syncd and LVM Sync Pacing
- ProbeVue Enhancements
- Large Page Performance Optimizations
- VNIC Client
  - 64/32-bit Shared Mutex
- libiconv Performance Improvements
- New LVM rootvg Failure Recovery Options for PowerHA
- Preferred Read LVM Mirror

### AIX 7.2
- CAPI Attached Flash
- Live Kernel Update (i-fixes)
- Storage Agnostic Flash Caching
- Granular TCP/IP Applications Packaging
- RDSv3 over RoCE
- HTTP Support for NIM Updates

### PowerSC 1.1.4
- NERC Compliance Profile
- PCI Profile Audit Enhancements
- TNC Update and i-fix Automation

* Provided on the AIX Linux toolbox site
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- New!! IBM Cloud PowerVC Manager
  - Simplified Cloud Management offering focused on Power Systems
  - Self-Service Portal, Automated Approvals, Metering Data, OpenStack Services, Image templates for Cloud Deployments

- New Storage Capabilities
  - Improved data deletion policies

- New HA Capabilities
  - Remote VM Restart with NovaLink configurations

- Dynamic Resource Optimizer(DRO) Improvements
  - Balances workloads using Mobility Capacity on Demand(COD) to move resources to workloads for PowerVM NovaLink environments
  - Basic scheduling for DRO services which allows DRO to activated based on a schedule

- Enhanced Security Isolation
  - New Security Projects integrated with role-based security controls

- Active Memory Expansion Support for VM Deployments

- Automates VM provisioning and best practices
- Improve resource utilization to reduce capital expense and power consumption
- Increase agility and execution to quickly respond to changing business requirements
- Increase IT productivity and responsiveness
- Manage scalability without adding complexity
What Can PowerVC do for you?

“A simple tool to quickly roll out LPARs/Virtual Machines on Power Systems”

- Easily clone, copy and relocate Power Systems virtual machines
  - Improve virtual machine consistency through replication
  - Policy-based placement of new and relocated virtual machines
  - Complete virtual machine management: Storage, Compute, Network

- Quick and easy installation to get you up and running quickly
  - One button verification of stack integration and operational environment
  - Simplify operations by not having to logon to HMC, VIOS, or storage to provision virtual machines

- Build a Private Cloud with PowerVC + Upward integration to cloud managers for private cloud management
  - Build on OpenStack APIs for automation and extensibility
  - Integration to IBM Cloud Orchestrator
Key PowerVC Capabilities

- Virtualization management for Power Systems – PowerVM and PowerKVM

- Key Capabilities
  - Advanced virtualization management for Power Systems
  - Virtual machine capture and deployment
  - Virtual machine relocation
  - Policy based VM placement
  - One-click system evacuation
  - Optimization and rebalancing
  - Quick setup and Time to Value

- Based on OpenStack
  - Leverage open community

- Capabilities beyond OpenStack
  - Simplified user interface
  - Platform EGO scheduler
  - Reliability and serviceability
Installing PowerVC

1. Configure the yum repository for the PowerVC install. For Red Hat Enterprise Linux 7, some of the prerequisites for installing PowerVC are moved from the Red Hat Enterprise Linux OS media to an Optional Software channel that is accessed using the RHN connection.
   a. Configure the yum repository by selecting and adding the new channel for Optional Software.
   b. Verify that yum is seeing the new optional repository file. `yum repolist`
2. Open a web browser and navigate to the Entitled Software Support Website.
   a. Sign in with your IBM® ID.
   b. Select Software downloads then select the Power (AIX) brand.
   c. Select the customer number you want to work with and click Continue.
   d. Under 5692-A6P, select the edition of PowerVC that you purchased, and click Continue.
   e. Choose to download either the PPC64, PPC64LE or the x86_64 tar file.
3. Extract the tar file that matches your environment to the location you want to run the installation script from:
   - For PPC64, extract `/powervc-install-ppc-rhel-1.3.1.0.tgz`, where `/powervc-install-ppc-rhel-1.3.1.0.tgz` is the directory where the iso image was mounted.
   - For PPC64LE, extract `/powervc-install-ppcle-1.3.1.0.tgz`, where `/powervc-install-ppcle-1.3.1.0.tgz` is the directory where the tar file was downloaded to.
   - For x86_64, extract `/powervc-install-x86-rhel-1.3.1.0.tgz`, where `/powervc-install-x86-rhel-1.3.1.0.tgz` is the directory where the iso image was mounted.
4. Change the directory to: `/powervc-1.3.1.0/`, where `/powervc-1.3.1.0/` is the directory you extracted the tar file to in step 3.
5. Start the installation by using one of the following methods:
   Note: You must perform these steps as root.
   a. Run `./install` to start the installation, and then select the edition from the list of options presented. For the list of available options, run `./install -h`.
   b. Select the edition to install. 1 - IBM PowerVC Standard 2 - IBM Cloud PowerVC Manager 9 - Exit
   c. Select the offering from the list of options presented. Select the offering type to install. 1 - Standard managing PowerVM 2 - Standard managing PowerKVM 9 - Exit

   Enter the appropriate value on your keyboard.
   - PowerVC prompts you with a list of files that would be modified during installation.
   - Confirm and choose to continue with the procedure.
   - To have PowerVC configure the firewall for you, run the following command: `./install -c firewall`
   - Alternatively, you can perform silent installation by running the following command: `./install -s standard`

   After you accept the license agreement, IBM Power® Virtualization Center is installed on the management server.
   An installation log file can be found in the following location: `/opt/ibm/powervc/log`
6. After the installation is complete, it is recommended that you visit Fix Central to download and install any fix packs that are available.
Ensuring the PowerVC Environment is Operational and Healthy

Verify the both the management server and managed systems...

Management Server Checks...
- Operating System pre-requisites
- Network configuration
- PowerVC processes
- MariaDB configuration
- File system space
- Communication with all resources

Server Checks...
- Required VIOS levels and mode
- Host network configuration
- Valid machine types and models
- Maximum number of hosts

Storage Checks...
- Valid machine types and models
- LUN Visibility test
- Required SVC firmware level

- Runs interactively from the Home page of the console
- Runs from the command line when the management server is not started
- Produces and saves the last report - viewable at any time
- Proactive identifies root cause of environmental problems that would result in failures
PowerVC Demo
Virtual Machine Management

Providing the fundamental visibility and management for Power virtual machines…

- Start and stop the virtual machine
- Delete the virtual machine
- Capture VM as Image
- Resize including DLPAR
- Migrate using placement policy

Virtual Machine Health…
- Virtual Machine State
- Virtual Machine Status
- Red/Green/Yellow Indicators

Virtual Machine Properties…
- Processor, memory, disk
- Related host information
- Network configuration
- Disk volumes (separate tab)

The target host can be selected by the user or selected based on the placement policy.
One Click System Evacuation

*Provides easy, graceful way to prepare for maintenance*

- Automatically relocate all virtual machines to other machines
  - Use the PowerVC scheduler to determine the target host or manually select the destination host
  - Clears the system of virtual machines without excessive administrator work
- Alternatively, fence off the physical host to prevent new virtual machines from being deployed or moved to that host
  - Option to allow administrators greater control of relocation operation
Host Groups allow the PowerVC administrator to create a logical boundary around a group of physical servers:

- Each server can only be in one host group.
- Deployment, mobility, and remote restart are only allowed within the group.
- Each group has its own placement policy.
- Hosts are placed in the default group when added.

Host Groups introduced in PowerVC v1.2.3:
PowerVC Advanced Placement

Scheduler support VM placement based on CPU & Memory capacity and CPU Utilization

The PowerVC scheduler takes the capacity of servers into account to determine which host to deploy or relocate VMs to. Hosts with the greatest free CPU or memory allocation becomes the target of the next VM.

The scheduler can also take host CPU utilization into account when scheduling VMs.

Free CPU / Memory Capacity

Host CPU Utilization
Affinity and Anti-affinity provide control over which VMs can be placed on the same host
- VMs with Affinity must be deployed to the same host
- VMs with Anti-Affinity must not be placed on the same physical host

VM with no affinity requirements – can go anywhere within the host group
VMs with affinity – must be placed on the same host
VMs with anti-affinity – cannot be placed on the same host

Host 1  Host 2  Host 3

Introduced in PowerVC v1.2.3
## PowerVC Placement Policies

<table>
<thead>
<tr>
<th>Policy</th>
<th>Description</th>
<th>Initial Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packing</td>
<td>Pack workload on fewest physical servers</td>
<td>✅</td>
</tr>
<tr>
<td></td>
<td>Maximizes usable capacity, reduces fragmentation, reduce energy consumption</td>
<td></td>
</tr>
<tr>
<td>Striping</td>
<td>Spread workload across as many physical servers as possible</td>
<td>✅</td>
</tr>
<tr>
<td></td>
<td>Reduce impact of host failures, higher application performance</td>
<td></td>
</tr>
<tr>
<td>CPU Balance</td>
<td>Place VMs on the hosts with the least allocated CPU</td>
<td>✅</td>
</tr>
<tr>
<td></td>
<td>Higher application performance</td>
<td></td>
</tr>
<tr>
<td>Memory Balance</td>
<td>Place VMs on the hosts with the most available memory</td>
<td>✅</td>
</tr>
<tr>
<td></td>
<td>Improve application performance</td>
<td></td>
</tr>
<tr>
<td>Affinity</td>
<td>Affinity specifies that VMs should be placed on the same host or few hosts</td>
<td>✅</td>
</tr>
<tr>
<td></td>
<td>Useful for collocating VMs on the same host(s)</td>
<td></td>
</tr>
<tr>
<td>Anti-Affinity</td>
<td>Do not place VMs on same host</td>
<td>✅</td>
</tr>
<tr>
<td></td>
<td>Useful for ensuring VMs are not collocated</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Availability cluster support (e.g. PowerHA)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Higher application performance</td>
<td></td>
</tr>
</tbody>
</table>
PowerVC v1.3 Dynamic Resource Optimizer (Q4 2015)

*Policy-based automation to balance workloads*

**PowerVC v1.3 Dynamic Resource Optimizer** allows for automated rebalancing of workloads between servers:
- Server workload can be automatically balanced two ways:
  - Relocating Virtual Machines between servers
  - Moving processor capacity between servers using Enterprise Capacity on Demand
- Works with AIX, IBM i or Linux VMs
PowerVC Multi-disk capture and deployment

**Capture**

Enter the name for the new image and select volumes to be captured.

The virtual machine shell_01 is comprised of 2 boot volumes and 3 data volumes.

Capture the following volumes:

- Boot set only
- Boot set and all data volumes
- Boot set and selected data volumes

All boot set volumes are required for capture and are not displayed below.

<table>
<thead>
<tr>
<th>Name</th>
<th>Size (GB)</th>
<th>State</th>
<th>Health</th>
<th>Storage Template</th>
<th>Storage Provider</th>
</tr>
</thead>
<tbody>
<tr>
<td>data_01</td>
<td>25</td>
<td>In Use</td>
<td>OK</td>
<td>S1VC_242_generic</td>
<td>S1VC_242</td>
</tr>
<tr>
<td>data_02</td>
<td>16</td>
<td>In Use</td>
<td>OK</td>
<td>S1VC_242_generic</td>
<td>S1VC_242</td>
</tr>
<tr>
<td>data_03</td>
<td>25</td>
<td>In Use</td>
<td>OK</td>
<td>S1VC_242_generic</td>
<td>S1VC_242</td>
</tr>
</tbody>
</table>

**Multi-disk capture and deployment** allows capture and deployment of boot and data volumes

- Works with AIX, IBM i or Linux VMs
- Boot and data volumes can be captured separately and combined and deployed together
- Disk volumes do not have to be on the same device
- Mirrored boot volumes are captured and deployed
- Up to 64 volumes supported

**Deploy**

Introduced in PowerVC v1.2.3
PowerVC Remote VM Restart enables restarting VMs from a failed host on another server
- Works with AIX, IBM i or Linux VMs
- Requires a human decision to perform restart using PowerVC
- Host Group policy controls VM placement
- Supports both PowerVM and PowerKVM
- Requires POWER8 with firmware 8.20

Improved recovery from unexpected system failures
Availability tools coverage

- PowerHA provides complete coverage and lowest recovery times
- PowerVC Remote VM Restart provides additional coverage for server hardware issues

![Diagram showing coverage and recovery times for PowerHA and PowerVC Remote VM Restart]
Customizable Deploy Templates provides standardized choices for self service users

PowerVC admin has control via policies & approvals for VM capture, deploy, VM expiration extension
**PowerVM NovaLink: Power Systems Platform Management Evolution**

**Goal:** Simplify PowerVM virtualization, accelerate cloud enablement, and improve scale

<table>
<thead>
<tr>
<th>Key Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved management scalability – support more virtual machines</td>
</tr>
<tr>
<td>Aligns PowerVM with the OpenStack community scale model – simplifying future OpenStack exploitation</td>
</tr>
<tr>
<td>Simplifies management configuration – HMC not needed for virtual machine deployment and configuration</td>
</tr>
<tr>
<td>Enables flexibility to use any OpenStack based manager to manage PowerVM</td>
</tr>
<tr>
<td>Uniform management for PowerVM and PowerKVM based systems</td>
</tr>
</tbody>
</table>

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### PowerVC Offering Structure

**PowerVC Standard Edition**  
*Simplified lightweight advanced virtualized management for scale up or scale out Power systems*

**IBM Cloud PowerVC Manager**  
*Simplified Lightweight Private Cloud for Power Systems*

- Cloud PowerVC Manager is included in AIX EE v1.2
- ICMO Customers with current SWMA are entitled to Cloud PowerVC Manager
- Sold standalone as well

**Price metric – Managed Core**

<table>
<thead>
<tr>
<th>Features- PowerVC</th>
<th>Standard</th>
<th>Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMC Support</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>PowerVM, PowerKVM</td>
<td>✓</td>
<td>PowerVM</td>
</tr>
<tr>
<td>P6,P7/7+POWER8</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Managed VM Type</td>
<td>AIX, IBM i, Linux</td>
<td>✓</td>
</tr>
<tr>
<td>Managed From OS</td>
<td>RHEL (Power &amp; X86)</td>
<td>✓</td>
</tr>
<tr>
<td>Highly available VIOS configs</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>One-click Evacuation</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Remote VM Restart</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Host Groups</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Affinity Rules</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Dynamic Resource Optimizer</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Self-service portal</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Access to OpenStack directly</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Policy based approvals</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Deploy Templates</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Metering</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Try PowerVC in our Hosted Trial Environment *for Free*

- Clients can try PowerVC using an IBM hosted environment.
- To sign up go to the Service Management wiki for at the links below

http://tinyurl.com/powervctrial

- This is popular so sign up now!!
- This is an easy way to tryout PowerVC without having to setup your environment
Tak for opmærksomhed og tid