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## Highlights

- Deliver services with superb economics by consolidating virtualised workloads
  - Deliver services built for the cloud faster by automating deployment of virtual machines (VMs) and storage
  - Optimise utilisation of server and storage resources to control cost and boost return on investment (ROI)
  - Scale out or scale up your virtualised deployments without paying underlying performance penalties
  - Eliminate scheduled downtime by deploying live mobility between servers
  - Deliver higher quality services by improving virtual resource management.
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# IBM PowerVM

*Virtualisation without limits*

IBM® PowerVM provides the industrial-strength virtualisation solution for IBM Power Systems servers that run IBM AIX, IBM i and Linux workloads. Based on more than a decade of evolution and innovation, PowerVM represents the state of the art (SOTA) in enterprise virtualisation and is broadly deployed in production environments worldwide by most Power Systems owners.

The Power Systems family of scale-out and scale-up servers includes proven<sup>1</sup> workload consolidation platforms that help clients control costs while improving overall performance, availability and energy efficiency. With these servers and PowerVM virtualisation solutions, an organisation can consolidate large numbers of applications and servers, fully virtualise its system resources and provide a more flexible, dynamic IT infrastructure. In other words, Power Systems with PowerVM deliver the benefits of virtualisation without limits.

PowerVM also offers a secure and resilient virtualisation environment, built on the advanced reliability, availability and serviceability (RAS) features, extreme scalability and leadership performance<sup>2</sup> of the Power Systems platform, based on the outstanding Power processors.

## Employing virtualisation

You can employ virtualisation in many ways to achieve improvements in efficiency and flexibility:

- Consolidation of multiple workloads in a cloud, including those on underutilised servers and systems with varied and dynamic resource requirements
- Rapid deployment and scaling of workloads to meet changing business demands
- Aggregation of system resources such as compute, network and storage into shared pools for dynamic reallocation between multiple workloads



- Application development and testing in secure, independent domains
- Live mobility of active workloads between servers to support platform upgrades, systems balancing, or to avoid planned maintenance downtime.

### **Processor virtualisation**

The Power Systems family gives you the freedom to either use the scale-up or scale-out processing model to run the broadest selection of enterprise applications without the costs and complexity often associated with managing multiple physical servers. PowerVM can help eliminate underutilised servers because it is designed to pool resources and optimise their use across multiple application environments and operating systems (OS). Through advanced VM capabilities, a single VM can act as a completely separate AIX, IBM i, or Linux operating environment, using dedicated or shared system resources. With shared resources, PowerVM can automatically adjust pooled processor, memory or storage resources across multiple OS, borrowing capacity from idle VMs to handle high resource demands from other workloads.

With PowerVM on Power Systems, you have the power and flexibility to address multiple system requirements in a single machine. PowerVM Micro-Partitioning supports multiple VMs per processor core and depending upon the Power Systems model, can run up to 1000 VMs on a single server – each with its own processor, memory and input/output (I/O) resources. Processor resources can be assigned at a granularity of 1/100th of core. Consolidating systems with PowerVM can help cut operational costs, improve availability, ease management and improve service levels, while allowing businesses to quickly deploy applications.

Multiple Shared processor pools allows for the automatic non-disruptive balancing of processing power between VMs assigned to shared pools, resulting in increased throughput. It also provides the ability to cap the processor core resources used by a group of VMs to potentially reduce processor-based software licensing costs.

Shared Dedicated Capacity allows for the ‘donation’ of spare central processing unit (CPU) cycles from dedicated processor VMs to a shared processor pool. Since a dedicated VM maintains absolute priority for CPU cycles, enabling this feature can increase system utilisation without compromising the computing power for critical workloads.

Because its core technology is built into the system firmware, PowerVM offers a highly-secure virtualisation platform that has received the Common Criteria Evaluation and Validation Scheme (CCEVS) EAL4+ certification<sup>3</sup> for its security capabilities.

### **Memory virtualisation**

PowerVM features IBM Active Memory Sharing (AMS), a technology that allows you to intelligently and dynamically reallocate memory from one VM to another for increased utilisation, flexibility and performance. AMS enables the sharing of a pool of physical memory among VMs on a server, helping to increase memory utilisation and drive down system costs. AMS has a capability to optimise memory by removing duplicate memory pages further minimising memory usage.

### **I/O virtualisation**

The Virtual I/O Server (VIOS) is a special purpose VM that can be used to virtualise I/O resources for AIX, IBM i and Linux VMs. VIOS owns the resources that are shared by VMs. A physical adapter assigned to the VIOS can be shared by many VMs which reduces cost by eliminating the need for dedicated I/O adapters. Shared storage pools allow storage subsystems to be combined into a common pool of virtualised storage that can be shared by the VIOS on multiple Power Systems servers. VIOS SSP Flash Caching enables to transparently accelerate AIX, IBM I and Linux workloads.

N\_Port ID Virtualisation (NPIV) support provides direct access to Fibre Channel (FC) Adapters from multiple VMs, simplifying the deployment and management of FC storage area network (SAN) environments.

Feature	Benefits
<b>PowerVM hypervisor</b>	<ul style="list-style-type: none"> <li>• Supports multiple operating environments on a single system</li> </ul>
<b>Micro-partitioning</b>	<ul style="list-style-type: none"> <li>• Enables up to 20 VMs per processor core*</li> </ul>
<b>Dynamic logical partitioning</b>	<ul style="list-style-type: none"> <li>• Processor, memory and I/O resources can be dynamically moved between VMs</li> </ul>
<b>Shared processor pools</b>	<ul style="list-style-type: none"> <li>• Processor resources for a group of VMs can be capped, reducing software license costs</li> <li>• VMs can use shared (capped or uncapped) processor resources</li> <li>• Processor resources can automatically move between VMs based on workload demands</li> </ul>
<b>Shared storage pools (SSP)</b>	<ul style="list-style-type: none"> <li>• Storage resources for Power Systems servers and VIOS can be centralised in pools to optimise resource utilisation</li> </ul>
<b>VIOS SSP Flash Caching</b>	<ul style="list-style-type: none"> <li>• SSP Flash caching technology transparently accelerates AIX, Linux and IBM i workloads.</li> <li>• It supports concurrent data access to shared SSP devices across the landscape, enabling data-sharing environments to leverage flash acceleration as well.</li> <li>• SSP Flash Cache Acceleration is LPM compatible.</li> </ul>
<b>Integrated virtualisation manager</b>	<ul style="list-style-type: none"> <li>• Simplifies VM creation and management for entry Power Systems servers</li> </ul>
<b>LPM</b> <i>(Enterprise edition feature)</i>	<ul style="list-style-type: none"> <li>• Live AIX, Linux and IBM i VMs can be moved between servers, eliminating planned downtime</li> </ul>
<b>Active Memory Sharing (AMS)</b> <i>(Enterprise edition feature)</i>	<ul style="list-style-type: none"> <li>• Intelligently flows memory from one VM to another for increased memory utilisation</li> </ul>
<b>Active Memory Deduplication</b> <i>(Enterprise edition feature)</i>	<ul style="list-style-type: none"> <li>• Reduces memory consumption for AMS configurations by detecting and eliminating duplicate memory pages</li> </ul>
<b>NPIV</b>	<ul style="list-style-type: none"> <li>• Simplifies the management and improves performance of FC SAN environments</li> </ul>
<b>SR-IOV†</b>	<ul style="list-style-type: none"> <li>• Hardware based I/O virtualisation enhanced performance and enhanced quality of service controls</li> </ul>
<b>System planning tool</b>	<ul style="list-style-type: none"> <li>• Simplifies the planning for and installation of Power Systems servers with PowerVM</li> </ul>
<b>VIOS performance advisor</b>	<ul style="list-style-type: none"> <li>• Checks performance and health of the VIO Server then makes recommendations for performance improvement.</li> </ul>
<b>IBM PowerVP Monitor*</b> <i>(Enterprise edition feature)</i>	<ul style="list-style-type: none"> <li>• Provides performance intelligence to proactively address performance issues mapping virtual workloads to physical hardware</li> <li>• Simple performance colour coded health view of virtualised server</li> </ul>
<b>Little Endian Linux Guest Support‡</b>	<ul style="list-style-type: none"> <li>• Enables flexibility to run little endian Linux distributions such as SUSE Linux Enterprise Server (SLES) 12, Ubuntu 16.04 and Red Hat Enterprise Linux (RHEL) 7 on systems with AIX, IBM i and older Linux versions concurrently</li> </ul>
<b>Virtual NIC Adapter</b>	<ul style="list-style-type: none"> <li>• Enables improved performance and LPM when used with SR-IOV adapters.</li> </ul>
<b>NovaLink§</b>	<ul style="list-style-type: none"> <li>• Allows direct OpenStack connection to PowerVM Host</li> <li>• Improves cloud scalability and simplifies management</li> </ul>
<b>System and partition templates</b>	<ul style="list-style-type: none"> <li>• Enables repeatable error free deployment of VMs</li> </ul>

Single Root I/O Virtualisation (SR-IOV) support provides optimised I/O virtualisation within the hardware of the I/O network adapter. This I/O virtualisation option provides direct access to the network adapters from the VM or VIOS server which provides improved performance and enhanced quality of service (QoS) control. Live Partition Mobility (LPM) is enabled for VMs using SR-IOV adapters when they are combined with virtual NIC adapters.

## Live partition mobility

LPM supports the movement of a running AIX or Linux or IBM i VM from one Power Systems server to another without application downtime, helping avoid application interruption for planned system maintenance, provisioning and workload management. LPM can be used to simplify migration of operating environments to new servers temporarily or permanently.

## Systems management

PowerVM virtualisation features are managed through the Hardware Management Console (HMC) or by the Integrated Virtualisation Manager (IVM) on entry-level Power Systems. The advanced virtualisation and cloud management solution for PowerVM is IBM PowerVC which allows managing pools of cloud resources and simplifies managing the VM lifecycle. PowerVM has been enabled to support direct OpenStack management with the PowerVM NovaLink architecture.

## For more information

To learn more about IBM PowerVM, please contact your IBM representative or IBM Business Partner (BP), or visit the following website:

[ibm.com/systems/power/software/virtualization/index.html](http://ibm.com/systems/power/software/virtualization/index.html)

\* Available on systems with 7.7 firmware and above and all POWER8 systems

† Available on select Power Systems

‡ Available on systems POWER8 systems with firmware 8.30 or higher

§ Available on POWER8 systems with firmware 8.40 or higher

<sup>1</sup> PowerVM Case Studies: [ibm.com/systems/power/success/index.html](http://ibm.com/systems/power/success/index.html)

<sup>2</sup> Power Systems benchmark results: [ibm.com/systems/power/hardware/benchmarks/index.html](http://ibm.com/systems/power/hardware/benchmarks/index.html)

<sup>3</sup> Common Criteria Evaluation and Validation Scheme (CCEVS) EAL4 Augmented with ALC\_FLR.2 certification:  
<http://www.commoncriteriaportal.org/files/epfiles/ISCB-5-RPT-C043-CR-v1b.pdf>  
[http://www.commoncriteriaportal.org/files/epfiles/IBM-LPAR-Security-Target-v0%2033\\_FINAL.pdf](http://www.commoncriteriaportal.org/files/epfiles/IBM-LPAR-Security-Target-v0%2033_FINAL.pdf)



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