



Introduction to partitioning



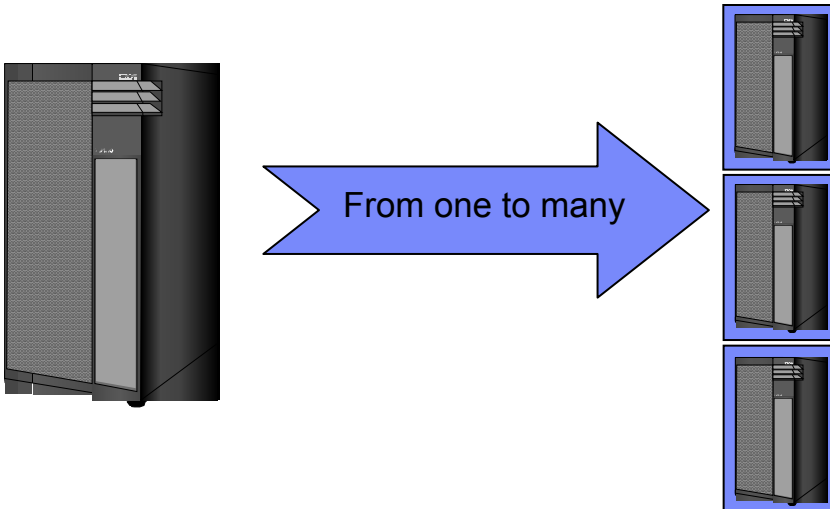
Unit objectives

After completing this unit, you should be able to:

- Describe the following terms:
 - Partition, logical partition (LPAR), resource
- Describe the benefits of partitioning
- Describe the following partition concepts:
 - Dynamic logical partitioning
 - Micro-partitioning
 - Virtual I/O
 - Live Partition Mobility (LPM)
 - Capacity on demand (CoD)
- Describe the functions of the Hardware Management Console (HMC)
- Describe the functions performed by the POWER Hypervisor
- Describe the overall process for configuring partitions
- List references for IBM POWER5, POWER6, and POWER7 processor-based system partitioning

What is a partition?

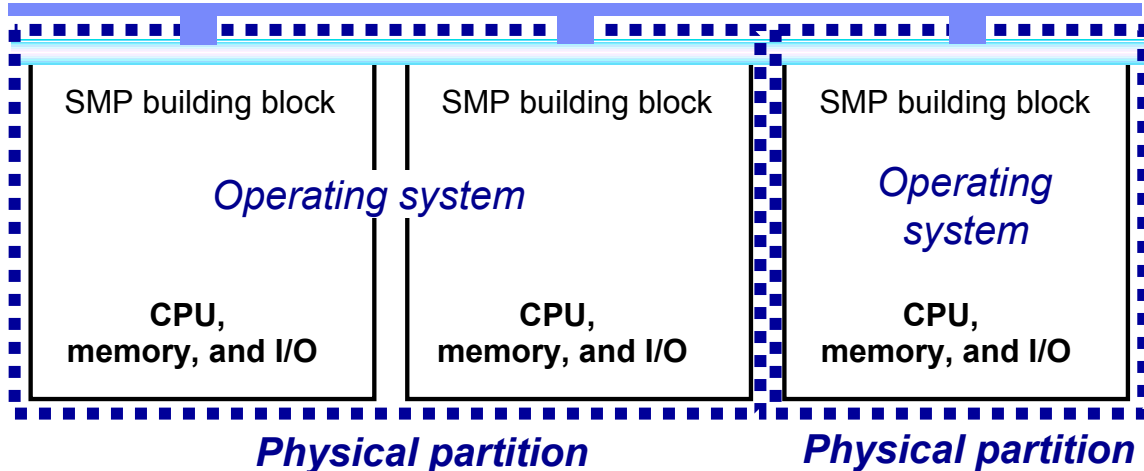
- Partition:
 - The allocation of one system's resources to create logically separate systems
 - An independent operating environment



Physical partition

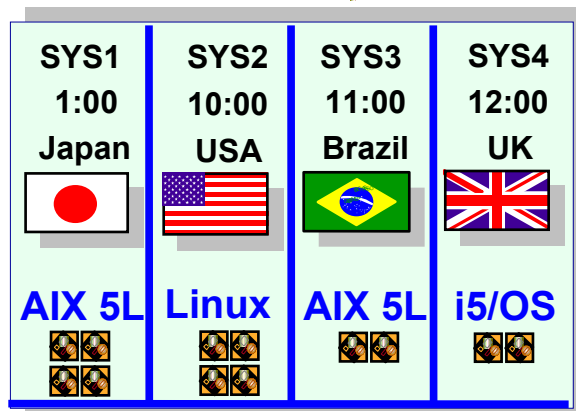
- Physical partition:
 - Resources are allocated in physical building blocks.
 - Blocks contain groups of processors, memory, and I/O slots.

Interconnect



Logical partition

- A *partition* is the allocation of system resources to create logically separate systems within the same physical footprint.
- A *logical partition* exists when the isolation is implemented with firmware.
 - Not based on physical system building block
 - Provides configuration flexibility

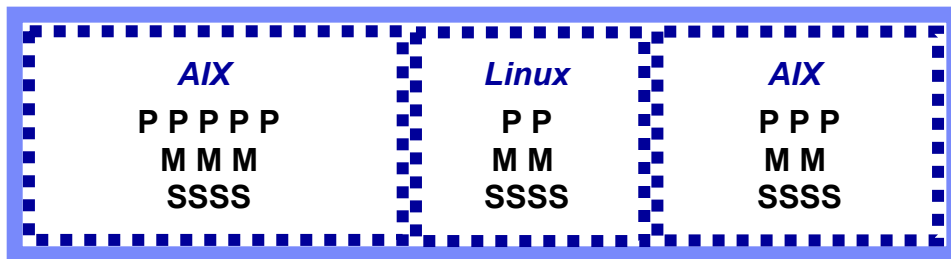


Partition characteristics

- Each partition has its own:
 - Operating system
 - Licensed Internal Code (LIC) and Open Firmware
 - Console
 - Resources
 - Other things expected in a stand-alone operating system environment, such as:
 - Problem logs
 - Data (libraries, objects, file systems)
 - Performance characteristics
 - Network identity
 - Date and time

Partition resources

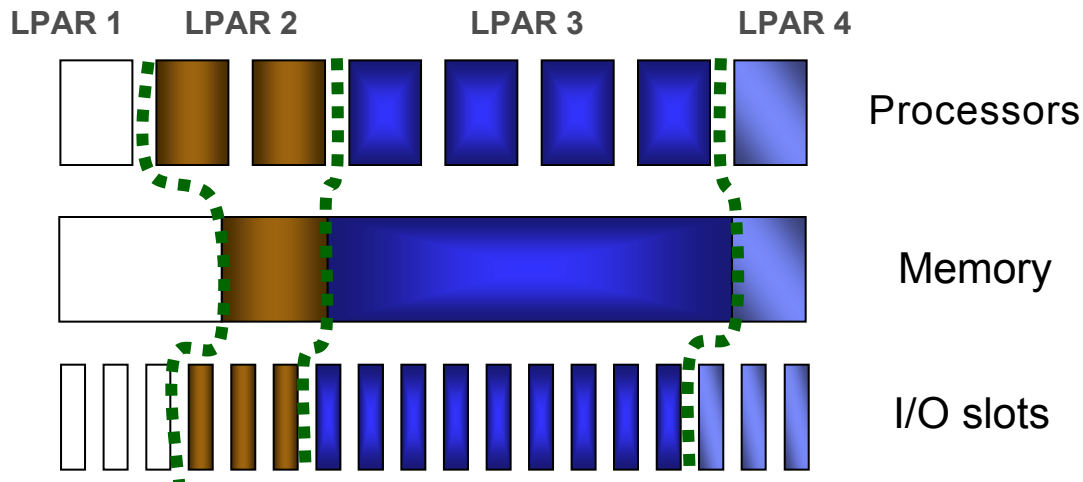
- Resources are allocated to partitions.
 - Memory allocated in units as small as the LMB size
 - Dedicated whole processors or shared processing units
 - Individual I/O slots
 - Including virtual devices
- Some resources can be shared.
 - Virtual devices
 - Host Ethernet adapter
- Some core system components are inherently shared.



S = I/O Slot
M = Memory
P = Processor

LPAR resource example

- Flexibility to allocate resources depending on need
- With DLPAR operations, resources can be moved, removed, or added without restarting the partition.



IBM POWER5+ LPAR-capable systems

IBM Power Systems

- IBM POWER5+ processor-based LPAR-capable systems:
 - IBM System p5 entry, mid-range, and high-end servers
 - Example models:
 - IBM System p5 505
 - IBM System p5 510
 - IBM System p5 520
 - IBM System p5 550
 - IBM System p5 560
 - IBM System p5 570
 - IBM System p5 575
 - IBM System p5 590
 - IBM System p5 595



Visit <http://www.ibm.com> for latest list of models.

IBM POWER6 LPAR-capable systems

IBM Power Systems

- IBM POWER6 processor-based LPAR-capable systems:
 - Entry, mid-range, and high-end servers
 - IBM Power Systems
 - Example models:
 - IBM Power Blade Express servers
 - IBM Power 520
 - IBM Power 550
 - IBM Power 560
 - IBM Power 570
 - IBM Power 575
 - IBM Power 595



Visit <http://www.ibm.com> for latest list of models.

IBM POWER7 LPAR-capable systems

IBM Power Systems

- IBM POWER7 processor-based LPAR-capable systems:
 - IBM Power Systems
 - Example models:
 - IBM BladeCenter PS700/701/702 Express
 - IBM Power 750
 - IBM Power 770
 - IBM Power 780
 - IBM Power 755



Visit <http://www.ibm.com> for latest list of models.

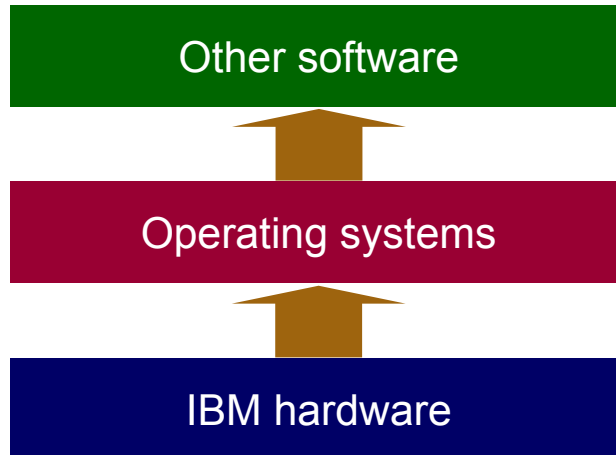
Benefits of using partitions

- Capacity management:
 - Flexibility to allocate resources
- Consolidation:
 - Consolidate hardware, floor space, software licenses, support contracts, and in-house support and operations
 - Efficient use of resources
- Application isolation on a single frame:
 - Separate workloads
 - Guaranteed resources
 - Data integrity
- Merge production and test environments:
 - Test on same hardware

The ability to have virtual Ethernet and virtual I/O devices is a benefit to using POWER5, POWER6, and POWER7 processor-based partitions.

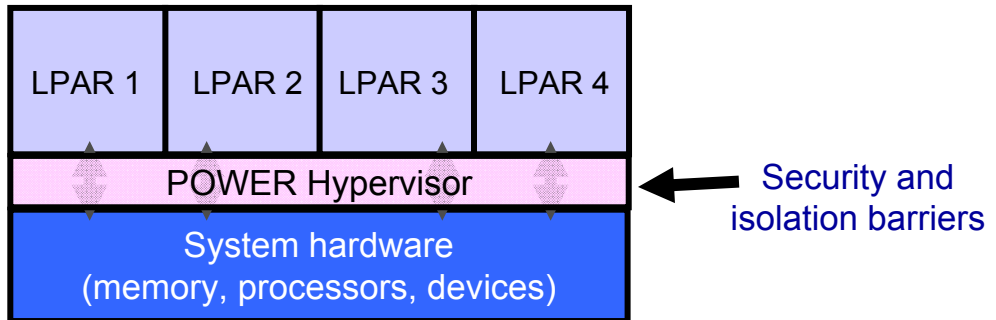
Software licensing

- Licensing is per operating system and is based on processing power.
 - Partial processor and shared processor pool features affect licensing.
- Third-party application provider licenses will vary.



POWER Hypervisor functions

- The POWER Hypervisor is firmware that provides:
 - Virtual memory management:
 - Controls page table and I/O access
 - Manages real memory addresses versus offset memory addresses
 - Virtual console support
 - Security and isolation between partitions:
 - Partitions allowed access only to resources allocated to them (enforced by the POWER Hypervisor)
 - Shared processor pool management



Hardware Management Console

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- The HMC provides:
 - Virtual console windows
 - LPAR configuration and operation management
 - Capacity on demand (CoD) management
 - Service tools
 - Access to LPM function
- PC-based console:
 - Running custom Linux and Java applications
 - Remotely accessible
 - Connects to service processor over private or open network



Desktop

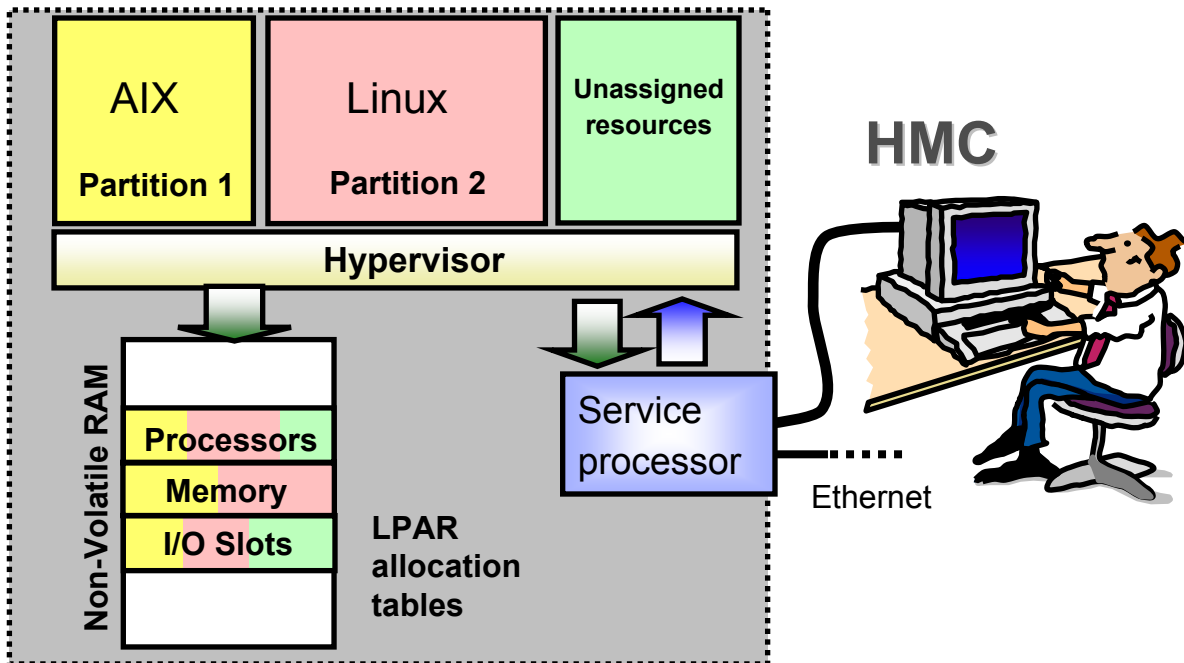


Rack-mount

The big picture

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Managed system



Advanced partition features

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- Dynamic resource allocation
- Advanced processor concepts
- Virtual I/O
- Integrated Virtual Ethernet
- Active Memory Sharing
- Live Partition Mobility
- Capacity on demand

Dynamic partitioning

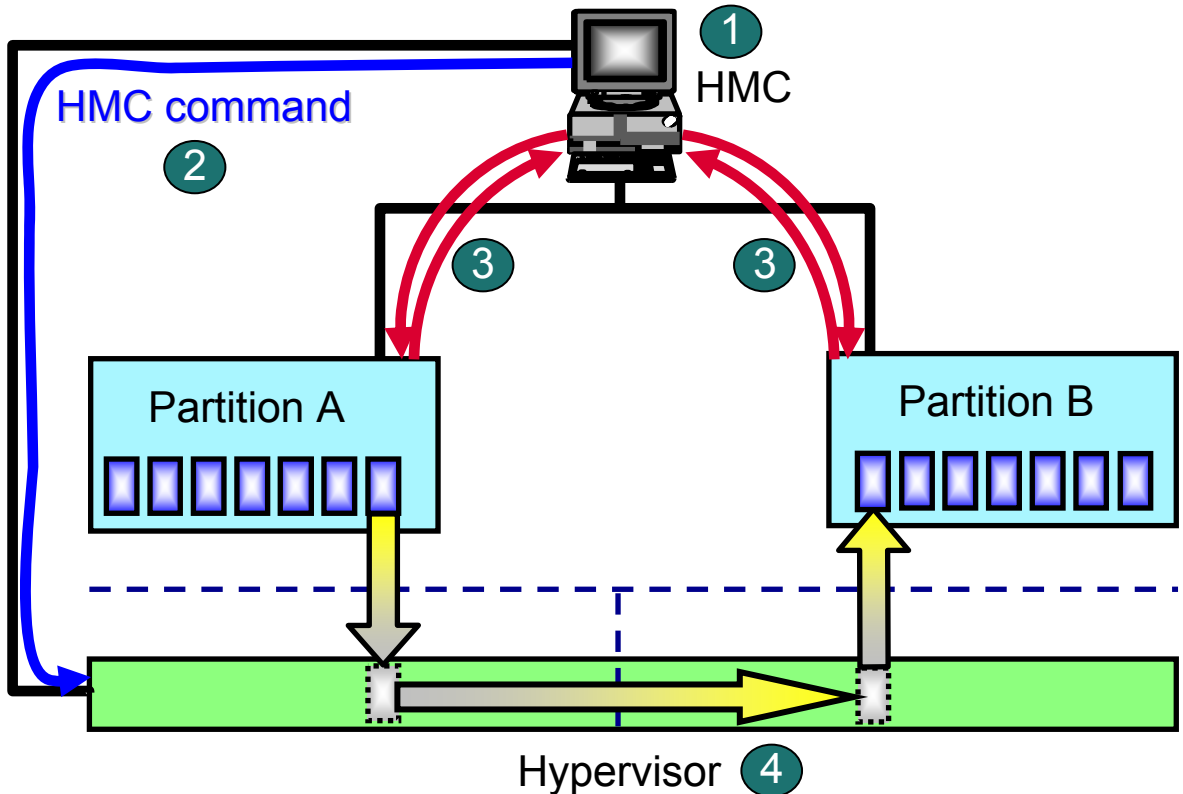
- DLPAR is the ability to add, remove, or move resources between partitions without restarting the partitions.
- Resources include:
 - Processors, memory, and I/O slots
 - Add and remove virtual devices
- Security and isolation between LPARs are not compromised.
 - A partition sees its own resources plus other *available* virtual resources.
 - Resources are reset when moved.
- Applications might or might not be DLPAR-aware.



DLPAR allows you to react to changing resource needs.

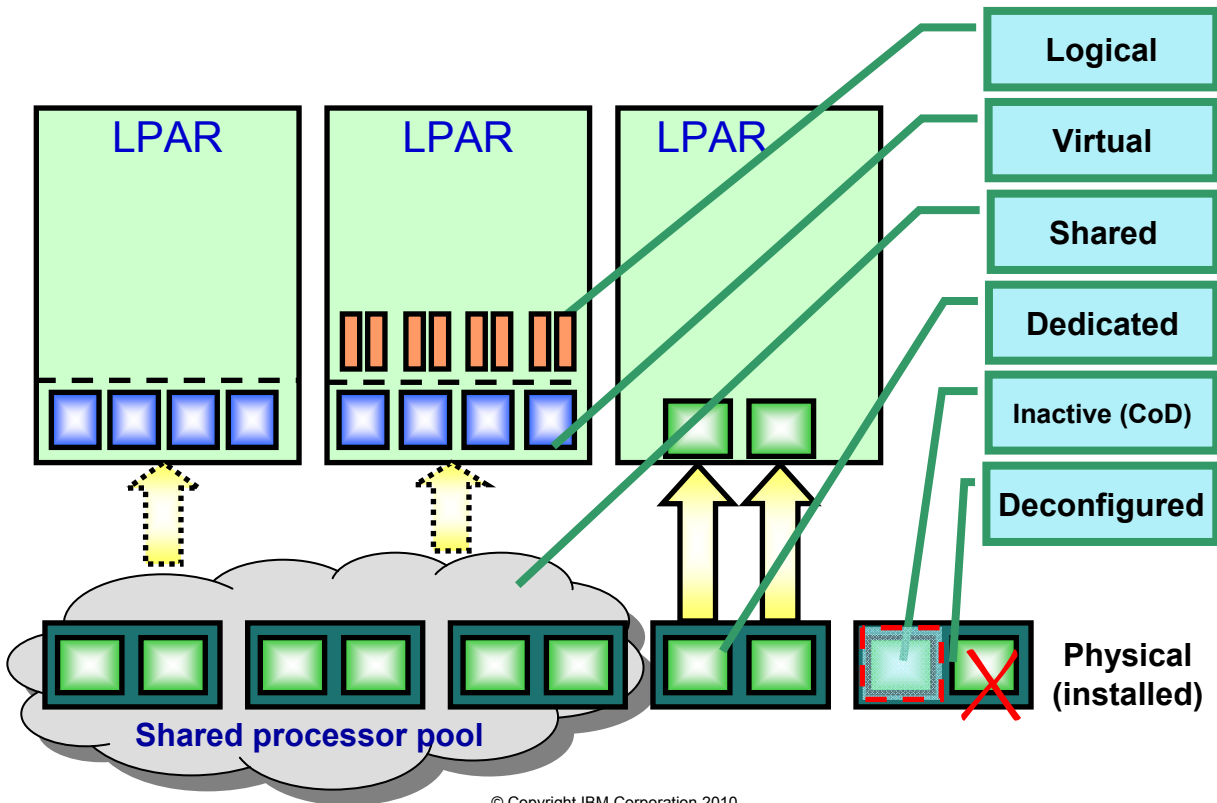
How DLPAR works

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Processor concepts

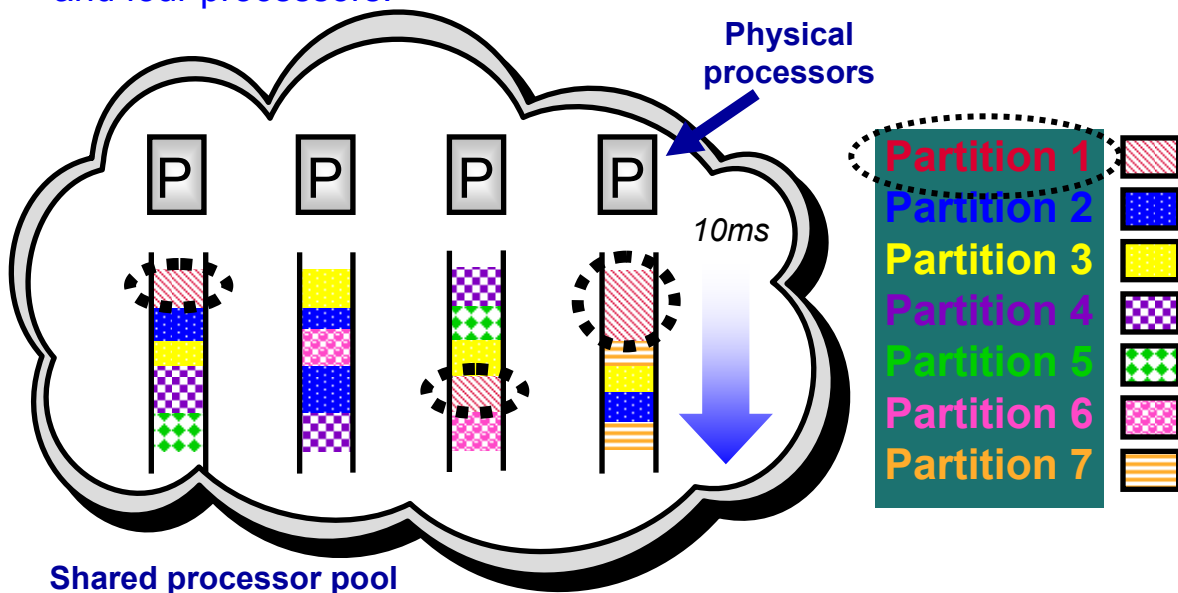
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Micro-partitioning: Shared processor pool

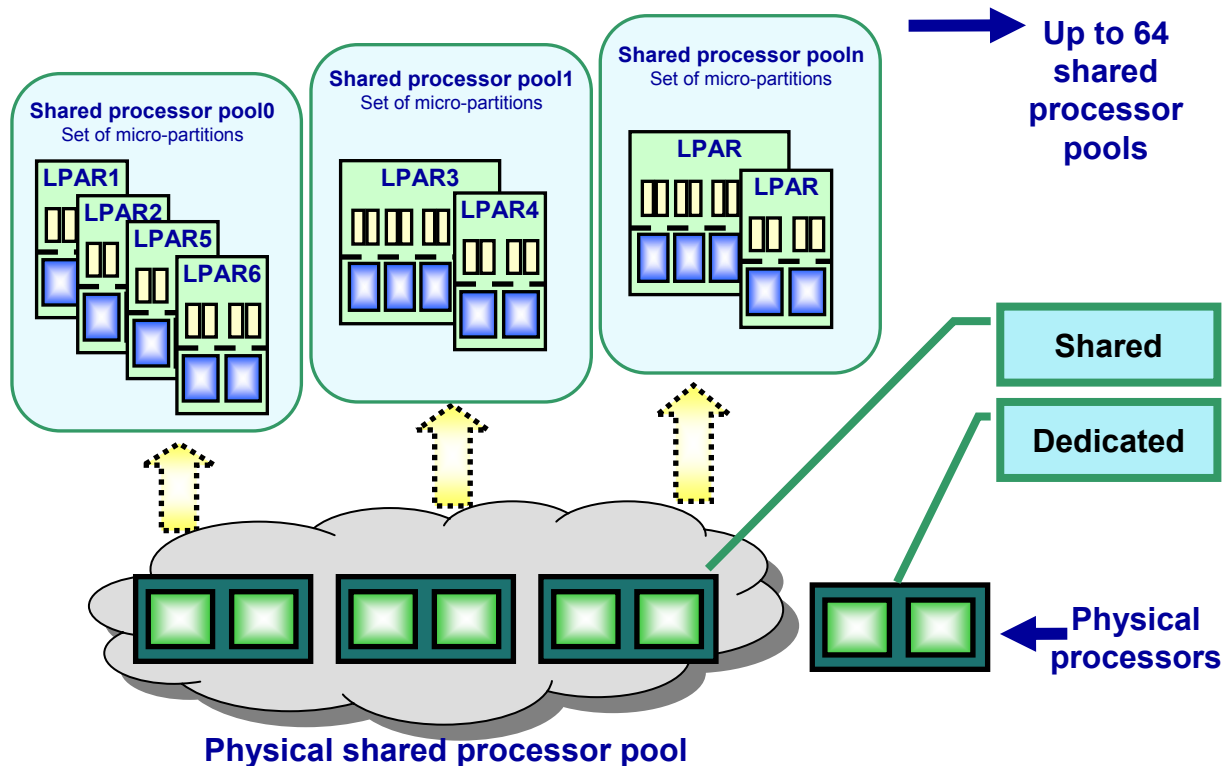
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- Time sliced sub-processor allocations are dispatched according to demand and entitled capacity.
 - This example shows one 10 ms time slice, seven running partitions, and four processors.



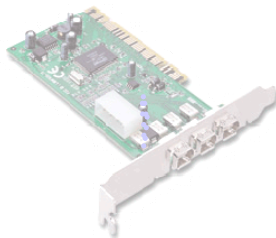
Multiple shared processor pools

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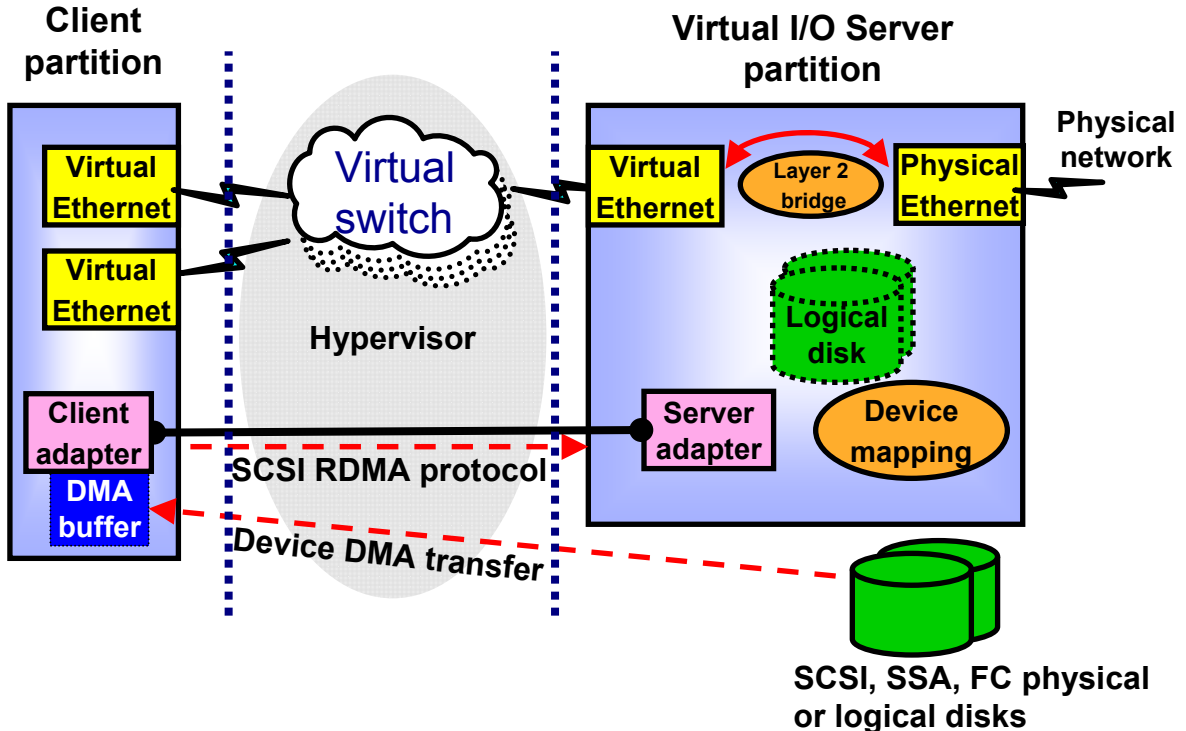
Virtual I/O

- Each partition has virtual I/O slots.
 - Configurable for each partition
- Virtual slots can have a virtual adapter instance.
 - Ethernet, SCSI, or Fibre Channel
- Virtual I/O slots can be dynamically added or removed just like physical I/O slots.
 - Cannot be dynamically moved to another partition



Virtual I/O example

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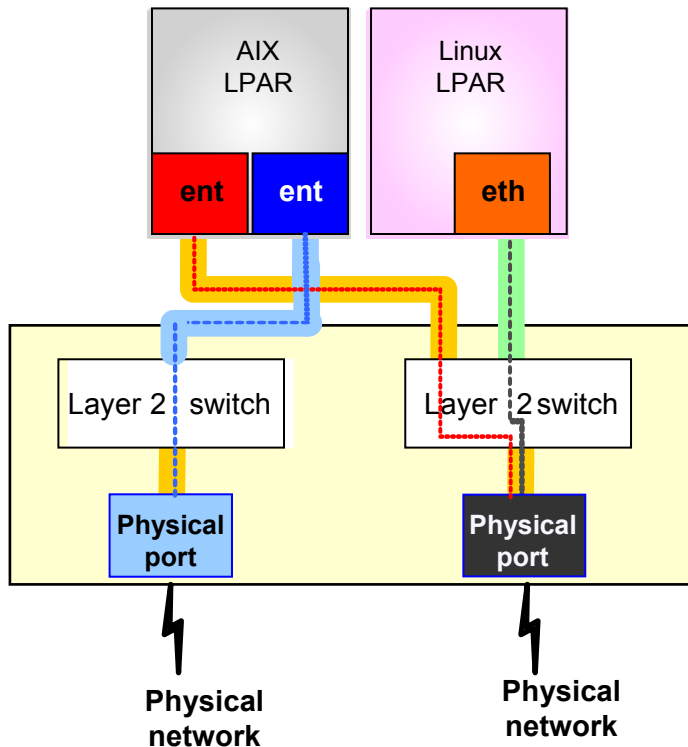
Integrated Virtual Ethernet

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- Also referred to as host Ethernet adapter:
 - Included in all POWER6 and POWER7 system configurations (except high-end)
 - Provides network connectivity for LPARs without a Virtual I/O Server:
 - Integrated high-speed Ethernet ports with hardware-assisted virtualization capabilities
 - Offers virtualization support for Ethernet connections
 - Three types are available:
 - Two port 1 Gbps^a (default)
 - Four port 1 Gbps^a
 - Two port 10 Gbps^b
 - Connected to the GX+ bus:
 - An LHEA must be created on the logical partition.
- a = RJ45 b = fiber

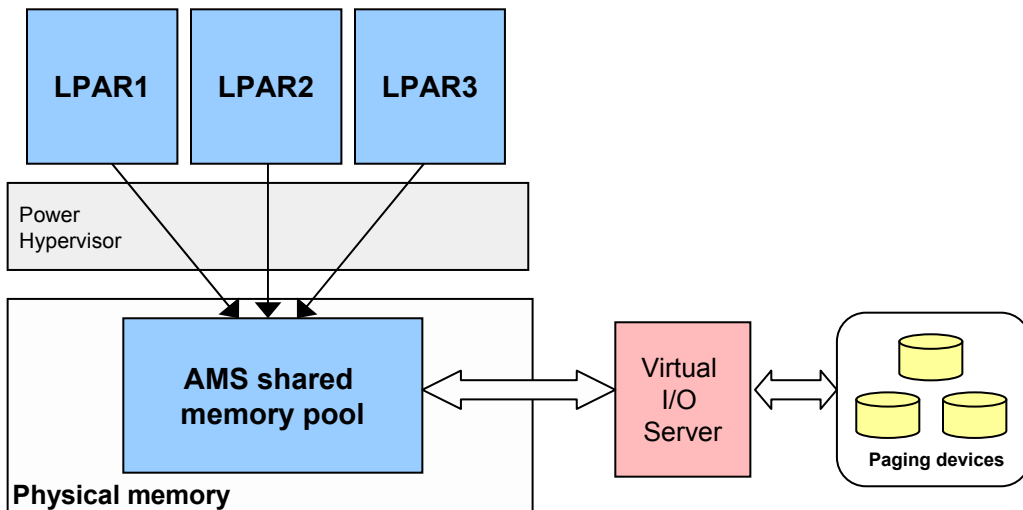


IVE example



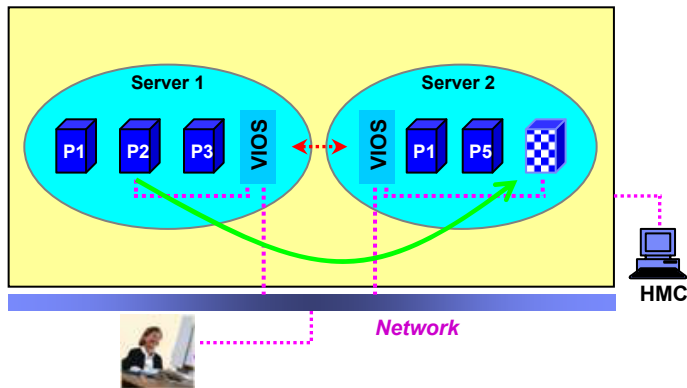
Active Memory Sharing

- Active Memory Sharing (AMS) allows multiple LPARs to share a common pool of physical memory.
 - AMS intelligently assigns memory from one partition to another based on memory page demands.
 - Optimizes memory utilization and provides flexible memory usage



Live Partition Mobility

- Migration or movement of an LPAR from one physical server to another
- Useful for:
 - Reducing the impact of planned outages and increasing application availability
 - Workload balancing and consolidation
 - Relocation of workload to enable workload
 - Provision of new technology with no disruption to service (migration to newer systems)
- Requirements:
 - POWER6 or POWER7 systems
 - LPAR must only have virtual adapters



Capacity on demand

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- Capacity upgrade on demand (CUoD)
 - Permanent activation of processors or memory
- Trial CoD
 - No charge 30-day activation of processors or memory resources
- On/Off CoD
 - Ability to activate processor or memory resources temporarily
- Utility CoD
 - Additional processor capacity on a temporary basis within the shared processor pool
- Capacity BackUp:
 - Processors and memory temporarily added to backup server
 - Prepaid for up to 90 days



PowerVM editions

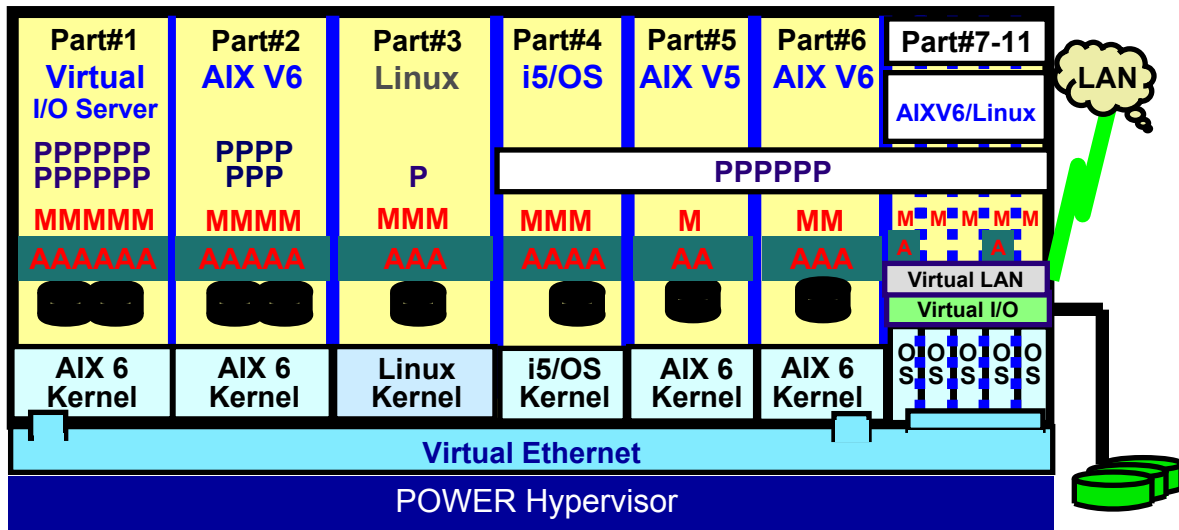
- PowerVM editions hardware features include the following components:

PowerVM editions	Express	Standard	Enterprise
Maximum LPARs	3 / Server	10 / Core	10 / Core
Management	VMControl, IVM	VMControl, IVM, HMC	VMControl, IVM, HMC
Virtual I/O Server	✓	✓	✓
PowerVM Lx86	✓	✓	✓
Shared dedicated capacity	✓	✓	✓
Multiple shared processor pools		✓	✓
Active Memory Sharing			✓
Live Partition Mobility			✓

- PowerVM Standard Edition is standard on the IBM System p5 590 and p5 595

Partitioning concepts summary

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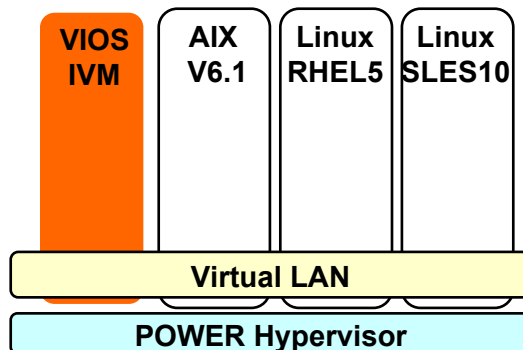


HMC

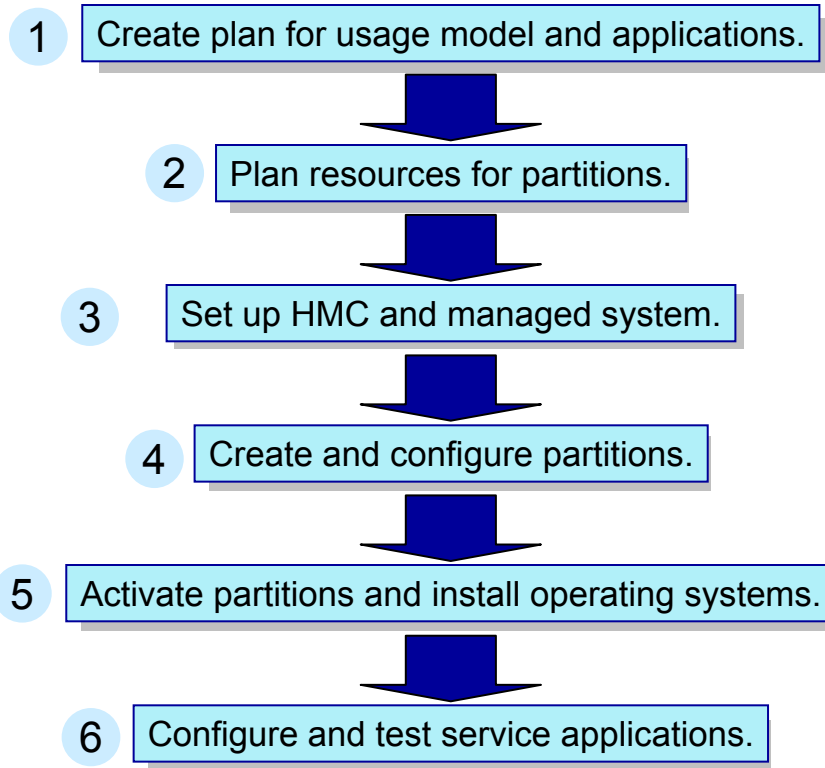
Integrated Virtualization Manager

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- Provides support for LPARs without a physical HMC:
 - **Manages a single server**
 - IVM software runs in the Virtual I/O Server partition.
 - **Provides a subset of HMC functionality**
 - Hypervisor has been modified to enable VIOS to manage the partitioned system without an HMC.
 - **Implicit rule of configuration and setup**
 - It requires that the server not be partitioned.
 - First operating system installed must be the VIOS.
 - **Virtual I/O server partition owns all physical I/O**
 - Client partitions can access virtual optical, virtual disk, virtual Ethernet, IVE, and console.



LPAR configuration process



LPAR references

- Documentation:
 - <http://www.ibm.com/support/publications/us/library/>
 - Software and hardware information centers available
 - <http://publib.boulder.ibm.com/eserver/>
- LPAR and PowerVM information:
 - <http://www-03.ibm.com/systems/power/software/virtualization/index.html>
- IBM Redbooks:
 - <http://www.redbooks.ibm.com/>
- Technical support Web sites:
 - <http://www.ibm.com/servers/eserver/support/unixservers/>
 - <http://www14.software.ibm.com/webapp/set2/sas/f/vios/home.html>
 - <http://www14.software.ibm.com/webapp/set2/sas/f/power5cm/power7.html>
- Linux Web site:
 - <http://www.ibm.com/systems/p/linux/>

Web links might change over time.

AN11 course content



- System p hardware overview
- HMC
- System Planning Tool
- HMC maintenance
- System power management
- Configuring LPARs
- Dynamic resource allocation

AN30 course content

IBM Power Systems



- Advanced processor concepts
- Virtual I/O
- Virtual network configurations
- VSCSI configurations
- IVE
- Service management

Checkpoint (1 of 2)

1. True or False: A partition is an independent operating environment.
2. What is it that makes *logical partitioning* different from *physical partitioning*?
 - a. Resource assignments are flexible.
 - b. Resources can be moved between partitions without a restart.
 - c. Partitioning is not dependent on physical system building blocks.
3. Which of the following are true for dynamic partition operations?
 - a. All AIX 6 partitions on POWER6 and POWER7 processor-based systems are capable of dynamic resource allocations.
 - b. Virtual I/O devices can be dynamically added or removed but not moved between partitions.
 - c. Partitions do not need to be restarted to add, remove, or move resources.
4. List the types of resources that are configured in partitions.

Checkpoint solutions (1 of 2)

1. **True** or False: A partition is an independent operating environment.
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4. List the types of resources that are configured in partitions.
Processors, memory, I/O slots (including the HEA)

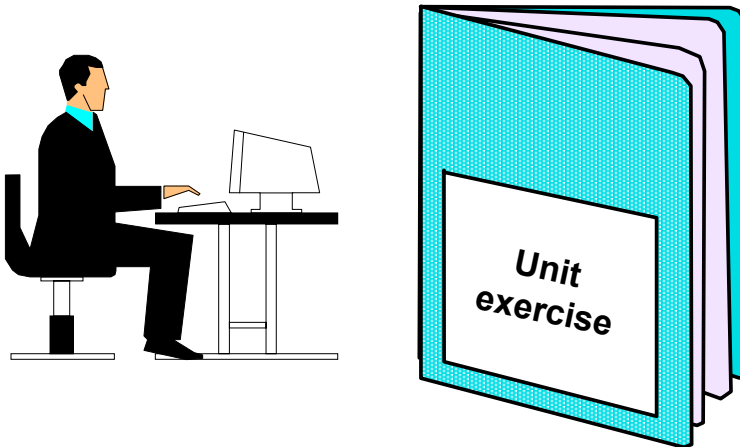
Checkpoint (2 of 2)

5. What system option provides the ability to order additional resources that can be activated when you need them?
6. Which of the following are benefits of using partitions?
 - a. Better management of resources across operating environments
 - b. Isolate applications that were all running on one system
 - c. Better high availability solution
 - d. Manage operational costs by consolidating resources
7. What is the system component that performs the resource allocation to partitions?
8. What is the system component needed to configure partitions, configure CoD, and provide access to virtual consoles?
9. What is the term used for the concept of allocating sub-processors to partitions?

Checkpoint solutions (2 of 2)

5. What system option provides the ability to order additional resources that can be activated when you need them? **Capacity on demand (CoD)**
6. Which of the following are benefits of using partitions?
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7. What is the system component that performs the resource allocation to partitions? **POWER Hypervisor**
8. What is the system component needed to configure partitions, configure CoD, and provide access to virtual consoles? **HMC or IVM**
9. What is the term used for the concept of allocating sub-processors to partitions? **Micro-partitioning**

Exercise



Unit summary

Having completed this unit, you should be able to:

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- Describe the benefits of partitioning
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