



IBM Passport Advantage Software

Sub-capacity (Virtualization) License Counting Rules

IBM Power Systems (System p and System i) PowerVM Virtualization Environment

NOTE: Please use these rules in conjunction with the [Sub-capacity licensing attachment](#)

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Sub-capacity Licensing Requirements Summary

- Customers must:
 - ▶ Agree to the terms of the Sub-capacity Attachment, and follow Virtualization Capacity License Counting rules for their Eligible Virtualization Environment(s)
 - ▶ Use Eligible Sub-capacity Products
 - ▶ Use Eligible Virtualization Technologies
 - ▶ Use Eligible Processor Technologies
 - ▶ Use the IBM License Metric Tool (ILMT) and maintain report documentation
 - Certain ILMT use exceptions may apply

PLEASE NOTE:

- *The above is only a summary. For details about sub-capacity licensing requirements, see the Sub-capacity Attachment and other information referred to above, at [Passport Advantage Sub-capacity licensing information](#)*
- *Customers are responsible for the installation of the IBM License Metric Tool and for the server it runs on.*



Definitions

- **Dedicated partition (LPAR):**
 - Processors are always allocated in whole increments (no micro-partitioning)
 - Resources are only moved between partitions “explicitly” (e.g. by an operator or a scheduled job)

- **Entitled Capacity (EC)**
 - The actual processor core capacity available to a partition. May be changed via DLPAR operation after startup. It is a unit of measure for shared processing capacity. One EC accomplishes approximately the same work as one dedicated processor core. Formerly referred to as PrU.

- **Virtual Processor (VP)**
 - Defines the maximum number of physical processor cores that the system can access simultaneously to provide the processing capacity of a shared processors partition
 - The processing capacity of a partition is evenly distributed across the virtual processors

- **Online VP**
 - The actual VPs available to a partition. May be changed via DLPAR operation after startup.

- **Shared pool:**
 - Pool of processor cores shared by capped and uncapped partitions
 - System automatically moves processor core resources between partitions as needed
 - Processor cores are allocated in increments of 0.01 processor core



Definitions

▪ **Shared processors Partition (Also known as Micro-partition LPAR)**

- A logical partition that utilizes processor resources from the shared processing pool using Micro-Partitioning technology are referred to as shared processor partitions.
- The processing unit assigned to a shared processors partition is known as processor entitlement, or entitled capacity. A shared processors partition can be defined as “capped” or “uncapped”
- The POWER Hypervisor automatically moves processor core resources among partitions based on each partition’s entitled capacity, “capped or uncapped” attributes, and its load

▪ **Capped partition:**

- This type of shared processor partition can never be allocated processing capacity that is more than its Entitled Capacity

▪ **Uncapped partition:**

- This type of shared processor partition can be allocated processing capacity that can exceed its Entitled Capacity. It can access the unused processor cores in the shared pool, when available, up to the Online VP value (VP).

▪ **Micro-partitioning:**

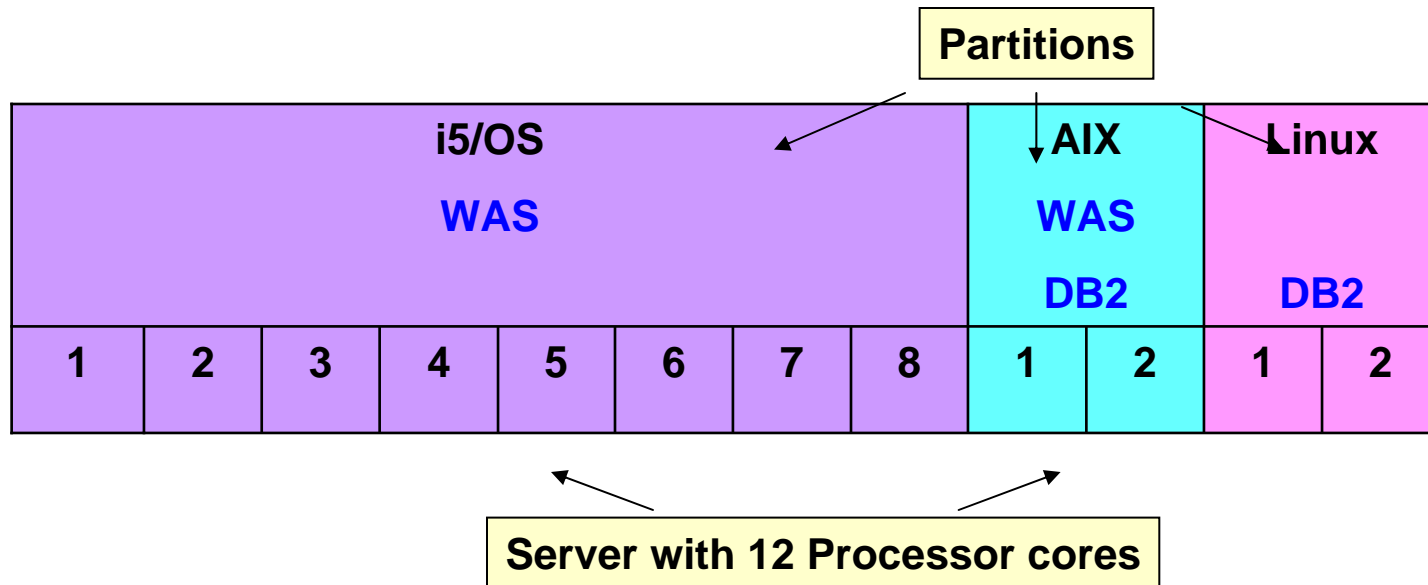
- The ability to divide a physical processor’s computing power into fractions of a processing unit and share them among multiple logical partitions.
- To obtain the number of license entitlements the customer should acquire, add up the total number of cores per server then round up to the next whole number of processor cores (aggregate and round up, by server)
- Processor units are allocated in increments of 0.01 processor core

▪ **Multiple Shared Pools**

- A POWER6 capability that allows the physical shared processor pool to be subdivided into multiple virtual pools. LPARs that are part of a shared pool are limited by the number of processor resources in that pool. There is only one level of pool nesting, the virtual shared pools are always a child to the physical shared processor pool. POWER5 systems only have the physical shared processor pool.

License Counting – Dedicated LPAR

- License entitlements required are based on processor core capacity available to the software in the partition
- For the example below:
 - WebSphere Application Server (WAS): PVUs for 10 cores need to be licensed
 - DB2 Enterprise Server Edition (DB2): PVUs for 4 cores need to be licensed



License Counting – Dynamic LPAR

- System i and System p provide the capability to dynamically move processor core resources between partitions
- Customer must acquire PVUs for the highest* number of processor core capacity available to the IBM software

Example:

Customer's basic configuration:

i5/OS WAS								AIX WAS DB2		Linux DB2	
1	2	3	4	5	6	7	8	1	2	1	2

Changed during batch peak:

i5/OS WAS									AIX WAS DB2	Linux DB2	
1	2	3	4	5	6	7	8	9	1	1	2

Changed for simulation work:

i5/OS WAS						AIX WAS DB2				Linux DB2	
1	2	3	4	5	6	1	2	3	4	1	2

- License PVUs for: 10 WAS cores (consistent throughout) + 6 DB2 cores (from simulation peak)

* greater of a) what the partition starts with or b) the result of a DLPAR operation

License Counting – Single Shared Pool with Capped and Uncapped Partitions

Server with 12 processor cores

D Capped AIX DB2	E Uncapped i5/OS WAS
VP = 6 EC = 4.00	VP = 7 EC = 5.00

A i5/OS	B AIX	C Linux	Shared Pool (9 processor cores)								
1	1	1	1	2	3	4	5	6	7	8	9

DB2 cores to license:

- 4 from EC for capped partition D

WAS cores to license:

- 7 from VP for uncapped partition E

License Rules:

- For Capped Partitions: The highest* level of Entitled Capacity (EC);
 - EC was formerly referred to as Processing Unit (PrU).
- For Uncapped Partitions: The highest* number of Online VP (Virtual Processors)
- Shared Pool: the lower of the sum of each partition for a product or the processor capacity of the shared pool

* The greater of what the partition starts with or the result of a DLPAR operation

License Counting – Single Shared Pool with Capped and Uncapped Partitions

Server with 12 processor cores

DB2 cores to license:

1 from dedicated partition B
 4 from EC for capped partitions E and F
 3 from VP for uncapped partition H
8 total

D	E	F	G	H
Capped	Capped	Capped	Uncapped	Uncapped
i5/OS	AIX	Linux	i5/OS	AIX
	DB2	WAS	WAS	WAS
		DB2		DB2
VP = 1	VP = 4	VP = 4	VP = 7	VP = 3
EC = 1.00	EC = 2.00	EC = 2.00	EC = 3.00	EC = 1.00

A	B	C	Shared Pool (9 processor cores)								
i5/OS	AIX	Linux									
	DB2										
1	1	1	1	2	3	4	5	6	7	8	9

WAS cores to license:

2 from EC for capped partition F
 10 from VP for uncapped partitions G and H

12 total reduced to 9*

* maximum cores available in shared pool

License Rules:

- For Capped Partitions: The highest* level of Entitled Capacity (EC);
 - EC was formerly referred to as Processing Unit (PrU).
- For Uncapped Partitions: The highest* number of Online VP (Virtual Processors)
- Shared Pool: the lower of the sum of each partition for a product or the processor capacity of the shared pool

* The greater of what the partition starts with or the result of a DLPAR operation

License Counting - Micro-Partitioning (Fractional cores) with Single Shared Pool, Capped & Uncapped Partitions

Server with 12 processor cores

DB2 cores to license:
 1.0 from dedicated partition B
 2.9 from EC for capped partitions E and F
 3.0 from VP for uncapped partition H
 6.9 rounded up to 7.0
7.0 total cores to license

D	E	F	G	H
Capped	Capped	Capped	Uncapped	Uncapped
i5/OS	AIX	Linux	i5/OS	AIX
		WAS	WAS	WAS
	DB2	DB2		DB2
VP = 3	VP = 4	VP = 4	VP = 7	VP = 3
EC = 2.10	EC = 1.60	EC = 1.30	EC = 3.00	EC = 1.00

A	B	C	Shared Pool (9 processor cores)								
i5/OS	AIX DB2	Linux									
1	1	1	1	2	3	4	5	6	7	8	9

WAS cores to license:
 1.3 from EC for capped partition F
 10 for uncapped partitions G and H
 11.3 total, rounded up to 12
Reduced to 9, maximum cores available in shared pool

- License Rules:
- For Capped Partitions: The highest* level of Entitled Capacity (EC)
 - EC was formerly referred to as PrU (Processing Units).
 - For Uncapped Partitions: The highest* number of Online VP (Virtual Processor Cores)
 - Shared Pool Capping Rule: the lower of the sum of each partition for a product or the processor core capacity of the shared pool
 - Aggregate fractional processor cores, apply shared pool capping rules, and round up at the server level to the next whole processor core.
- * The greater of what the partition starts with or the result of a DLPAR operation

License Counting – POWER6 Multiple Shared Pool with Capped and Uncapped Partitions

Server with 12 processor cores

DB2 cores to license:

- 1.0 from dedicated partition B
 - 1.7 from EC for capped partition E
 - 3.0 from VP for uncapped partition H
- = 5.7 rounded up to 6**

	D Capped i5/OS	E Capped AIX DB2	F Capped Linux WAS	G Uncapped i5/OS WAS	H Uncapped AIX WAS DB2						
	VP = 2 EC= 1.80	VP = 4 EC= 1.7	VP = 4 EC = 2.00	VP = 7 EC = 2.00	VP = 3 EC = 1.00						
A i5/OS	B AIX DB2	C Linux	Virtual Shared pool #1 7 processor cores			Virtual Shared pool #2 5 processor cores					
Physical Shared Pool (9 processor cores)											
1	1	1	1	2	3	4	5	6	7	8	9

WebSphere cores to license:

- 2 from EC for capped partition F
 - 7 from VP for uncapped partition G
 - 3 from VP for uncapped partition H
- = 12 but reduced to 5** (the size of the virtual shared pool #2)

License Rules:

- For Capped Partitions: The highest* level of Entitled Capacity (EC)
 - EC was formerly referred to as PrU (Processing Units).
- For Uncapped Partitions: The highest* number of Online VP (Virtual Processor Cores)
- Shared Pool Capping Rule: the lower of the sum of each partition for a product or the processor core capacity of the shared pool
- Aggregate fractional processor cores, apply shared pool capping rules, and round up at the server level to the next whole processor core.

* The greater of what the partition starts with or the result of a DLPAR operation



ILMT Licensing Counting Rules – for Single Server Environments

License Rules for Partitions, Shared Pools, and Micro-partitioning for each product:

- for a Dedicated LPAR, the highest* number of cores allocated to the LPAR
- for a Capped Partition, the highest* amount of Entitled Capacity (EC)
- for a Uncapped Partitions, the highest* amount of VP (Virtual Processor Cores)
- for a Shared Processor Pool, the lower of the sum of each partition for a product or the processor core capacity of the shared pool
- Aggregate fractional processor cores, apply shared pool capping rules, and round up at the server level to the next whole processor core
 - (lower of the sum of the virtual cores or the server capacity)

* The greater of what the partition starts with or the result of a DLPAR operation

- The licensing rules in the preceding pages reflect how ILMT will operate to calculate PVUs
- If ILMT does not yet support a Eligible Virtualization Environment, or you qualify for an exception to use ILMT, you will need to follow the Manual Calculation of Virtualization Capacity.
- The Manual Calculation of Virtualization Capacity rules can be found in the following pages
- To find out if a Eligible Virtualization Technology is supported by ILMT visit
[Passport Advantage Sub-capacity licensing information](#)

Manual Calculation of Virtualization Capacity

- Eligibility Criteria: Customers must use the IBM License Metric Tool, with the following exceptions
 - ▶ ILMT does not support the Eligible Virtualization Environment
 - ▶ Customer has fewer than 1000 employees and contractors - [Tool recommended](#)
 - ▶ Customer server Full Capacity licensing for a PVU product is less than 1000 PVUs (on servers with an Eligible Virtualization Environment) - [Tool recommended](#)
- Requirements: For the above exceptions, customers must manually manage, track and prepare Audit Reports
 - ▶ An Audit Report must be prepared at least once per quarter and identify the following detail: Each Eligible Sub-Capacity Product deployed in each Eligible Virtualization Environment
 - ▶ An Eligible Virtualization Environment can be a Single Server or a Group of Servers (Server Cluster)
 - ▶ In addition to the above detail, the report should provide a summary total of the required number of PVUs by and for each Eligible Sub-Capacity Product
 - ▶ Audit Reports must be prepared as frequently as is required to maintain a history of increases to Virtualization Capacity and Full Capacity
 - ▶ Each Audit Report must be **signed and date stamped**, at least once per quarter

The above is only a summary. For detailed terms please see the [Sub-capacity licensing attachment](#)

Manual Calculation of Virtualization Capacity – Rules

For Single Server Environments:

License Rules for a partition, shared pools and micro-partitioning for each product:

- ▶ for a Dedicated LPAR, the highest* number of cores allocated to the LPAR
- ▶ for a Capped Partition, the highest* amount of Entitled Capacity (EC)
- ▶ for a Uncapped Partition, the highest* amount of Online VP (Virtual Processor Cores)

**The greater of what the partition starts with or the result of a DLPAR operation (in whole cores)*

The PVU licensing requirement is based on the maximum number of virtual processor cores in the partitions available to a product (lower of the sum of the virtual cores or the server capacity)

If you want to use sub-capacity licensing for any other PowerVM technology, including shared processor pool, you must use the ILMT tool

Manual Calculation of Virtualization Capacity - Worksheet Example

Worksheet has 3 tabs;
use the following tabs

- Instructions & Information
- Single Server

[Web Link: Worksheet for Manual Calculation of Virtualization Capacity](#)

VIRTUALIZATION ENVIRONMENT - SINGLE SERVER		
- This worksheet is for one standalone server for one Software Product		
- Per the Instructions on the first tab, you may choose to leverage this approach or develop / leverage your own processes and reporting format so long as you capture all of the information below		
- Enter data in input fields below (shaded area)		* Mandatory
Date of this Audit Report *	March 31, 2009	
Product Name *	IBM WEBSHERE APPLICATION SERVER NETWORK DEPLOYMENT	
Program Identification Number (57xx-xxx)	5724-H88	
P/N Description	IBM WEBSHERE APPLICATION SERVER NETWORK DEPLOYMENT PROCESSOR VALUE UNIT (PVU)	
Part Number	D55WJLL	
Server ID / Location	Server ID # F6015; Bldg 1, Room 1, Somers, NY	
Server Vendor / Brand	IBM System x	
Server Model	xxxxx	
Virtualization Technology used *	VMware ESX 3.5	
Processor Technology (Vendor, Brand, Type, Model#) * (A)	Intel Xeon Quad Core Model 35XX	
PVUs per core * (A)	70	
Total Activated Cores on Server * (C)	8	
Full Capacity PVUs for Server * (C)	560	
	DO NOT	DELETE ROW
VM, Partition ID * (whatever identifier used for any subdivision of a server such as LPAR #, IP address, hostname, etc.)	Cores (B) per Partition or VM *	User Comments
A	4	
B	4	
C	2	
D	2	
Sum of Virtual Cores *	12	
PVUs per core *	70	
Virtualization Capacity PVUs by Product for Server *	840	
PVU Licenses required by Product for Server * (C)	560	
* Mandatory Field		
[A] PVU's required for each physical processor core are listed on the PVU table (see link below, including vendor/brand designations)		
[B] For purposes of 'Manual Calculation' of Virtual Capacity, 1 virtual core (or CPU) is equivalent to 1 physical core. Enter values in whole cores.		
[C] Lower of Full Capacity or Virtualization Capacity		

▶ ▶ \ Instructions + Information \ **Single Server** \ Group of Servers "Cluster" /

Key Web Links

- PVU

- [PVU table and other information](#)

- Sub-capacity

- [Passport Advantage Sub-capacity licensing Information](#)

- [Virtualization Capacity License Counting Rules](#)

- [Sub-capacity licensing attachment](#)

Partition Settings

▪ **Processor Capacity setting:**

- ▶ Determines the amount of ECs assigned to the partition. Customers specify the minimum, desired, and maximum values
 - Minimum: Amount of EC required to start up the partition
 - Desired: The desired amount of EC for the partition to start with
 - Maximum: Used as an upper limit for future Dynamic LPAR (DLPAR) operations that customers execute to increase entitled capacity.

▪ **Virtual Processor setting:**

- ▶ Determines the amount of VPs assigned to the partition. Customers specify the minimum, desired, and maximum values.
 - Minimum: Amount of VPs required to start up the partition.
 - Desired: The desired amount of VPs for the partition to start with
 - Maximum: Used as an upper limit for future dynamic LPAR (DLPAR) operations that customers execute to increase the number of virtual processors.

Capped & Uncapped Partition License Counting Rationale

■ Capped partition:

- ▶ This type of shared processor partition can never be allocated processing capacity that is more than its Entitled Capacity.
- ▶ Entitled Capacity: The actual processor core capacity available to a partition. May be changed via DLPAR operation after startup.
- ▶ Virtual Processor (VP): Defines the number of physical processor cores that the system can access to provide the processing capacity of a shared processors partition.
- ▶ License the highest* amount of Entitled Capacity.
 - *A partition may start up with a certain Entitled Capacity but through a DLPAR operation, this Entitled Capacity may be increased or decreased. Hence, the license must cover the greater of the Entitled Capacity the partition starts with or the result of a DLPAR operation*

■ Uncapped partition:

- ▶ This type of shared processor partition can be allocated processing capacity that can exceed its Entitled Capacity.
- ▶ The Entitled Capacity defines the basic or 'start up' processor capacity
- ▶ The VP defines the number of physical processor cores that the partition can access to grab idle processor capacity available. It can access the unused processor cores in the shared pool, when available, up to the Online VP value (VP).
- ▶ Online VPs: The actual VPs available to a partition. May be changed via DLPAR operation after startup.
- ▶ License VP equal to the highest* amount of Online VPs.
 - *A partition may start up with a certain Online VP but through a DLPAR operation, this Online VP may be increased or decreased. Hence, the license must cover the greater of the Online VPs a partition starts with or the result of a DLPAR operation.*

* greater of a) what the partition starts with or b) the result of a DLPAR operation