Sub-capacity (Virtualization) License Counting Rules

IBM System z™ Virtualization Environment

NOTE: Please use these rules in conjunction with the **Passport Advantage License Agreement**

December 1, 2017

Index of Items

December 1, 2017

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
    - • Tivoli Asset Discovery for Distributed (TADd) or IBM BigFix Inventory, may be used in lieu of IBM License Metric Tool.

PLEASE   NOTE:

▪*The above is only a summary. For details about sub-capacity licensing requirements, see the Sub-Capacity Licensing Terms 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.*

December 1, 2017

System z Definitions

- **Logical Partition (LPAR):**
  - ▸ IBM System z servers can be partitioned into separate logical computing systems. System resources (memory, processors, I/O devices) can be divided or shared among many such independent logical partitions (LPARs) under the control of the LPAR hypervisor, which comes standard on all System z servers. Each LPAR supports an independent operating system (OS) loaded by a separate initial program load (IPL).

- **Virtual Machine (VM):**
  - ▸ z/VM is an operating system implementation of IBM virtualization technology providing the capability to run full-function operating systems such as Linux on System z and z/OS as "guests" of z/VM. These guests are called virtual machines and perform as if they were completely independent machine environments as far as the guest operating system is concerned.
  - ▸ zKVM is an open source virtualization option for running Linux-centric workloads that uses common Linux-based tools and interfaces.

System z Definitions continued

- **Processor types:**
  - ▸ System z servers have several types of processors (also called engines), two of which are pertinent for distributed software licensing purposes:
    - *Central Processor (CP), also known as a General Purpose processor, which can execute any kind of workload*
    - *Integrated Facility for Linux (IFL) processor which is limited to executing only Linux for System z workloads with or without the z/VM hypervisor*

- **Dedicated Partition:**
  - ▸ Resources are only moved between partitions "explicitly" (e.g. by an operator or a scheduled job)
  - ▸ Engines are always allocated in whole increments

- **Shared Pool:**
  - ▸ Pool of IFL or CP engines shared by partitions
  - ▸ System automatically dispatches processing resources between partitions as needed
  - ▸ Engines are always allocated in whole increments

LPARs with Shared Pool

Server with 5 IFLs
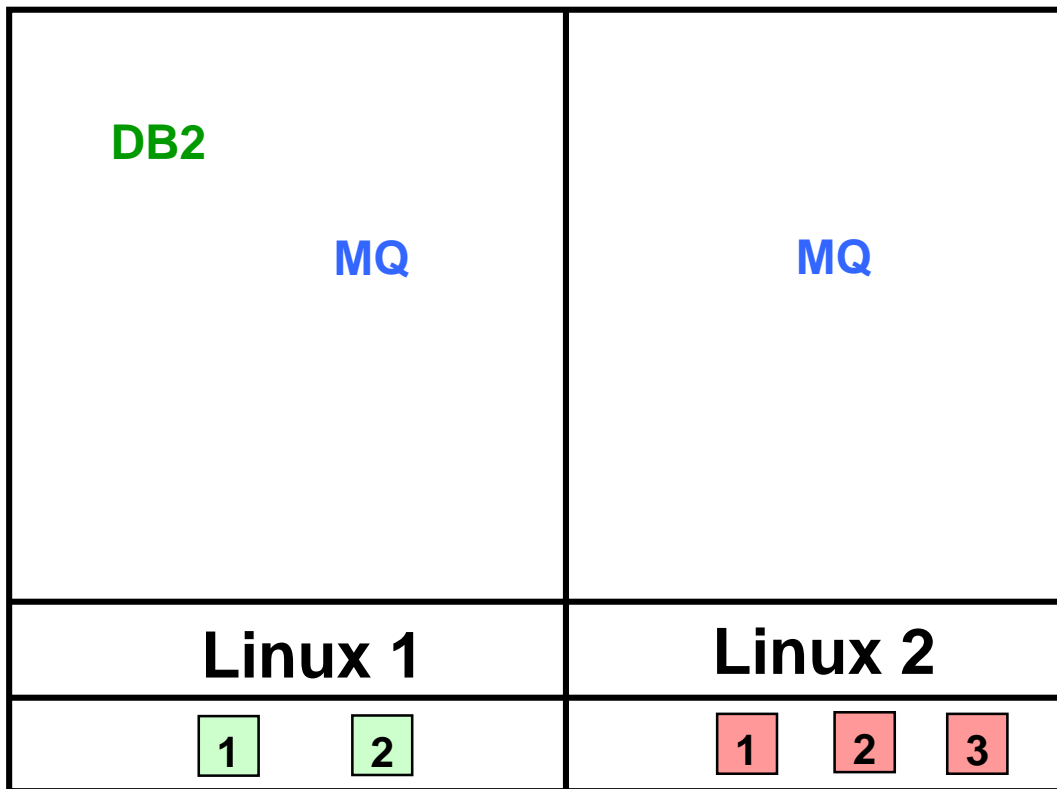
Cores to be licensed

1 IFL or CP engine = 1 processor core

DB2	MQ	Partition
2	2	Linux 1
	3	Linux 2
2	5	Total IFLs for Partition
5	5	Capacity Limit
2	**5**	**Total IFLs**

License Rule: The lower of the sum of each partition for a product, or the engine capacity of the shared pool

2 logical IFLs assigned to LPAR 1
3 logical IFLs assigned to LPAR 2

5 IFLs in the shared pool

DB2

MQ   MQ

Linux 1   Linux 2

1 2   1 2 3

1 2 3 4 5

LPARs with Shared Pool – Multiple Engine types

Server with 3 IFLs & 3 CP engines
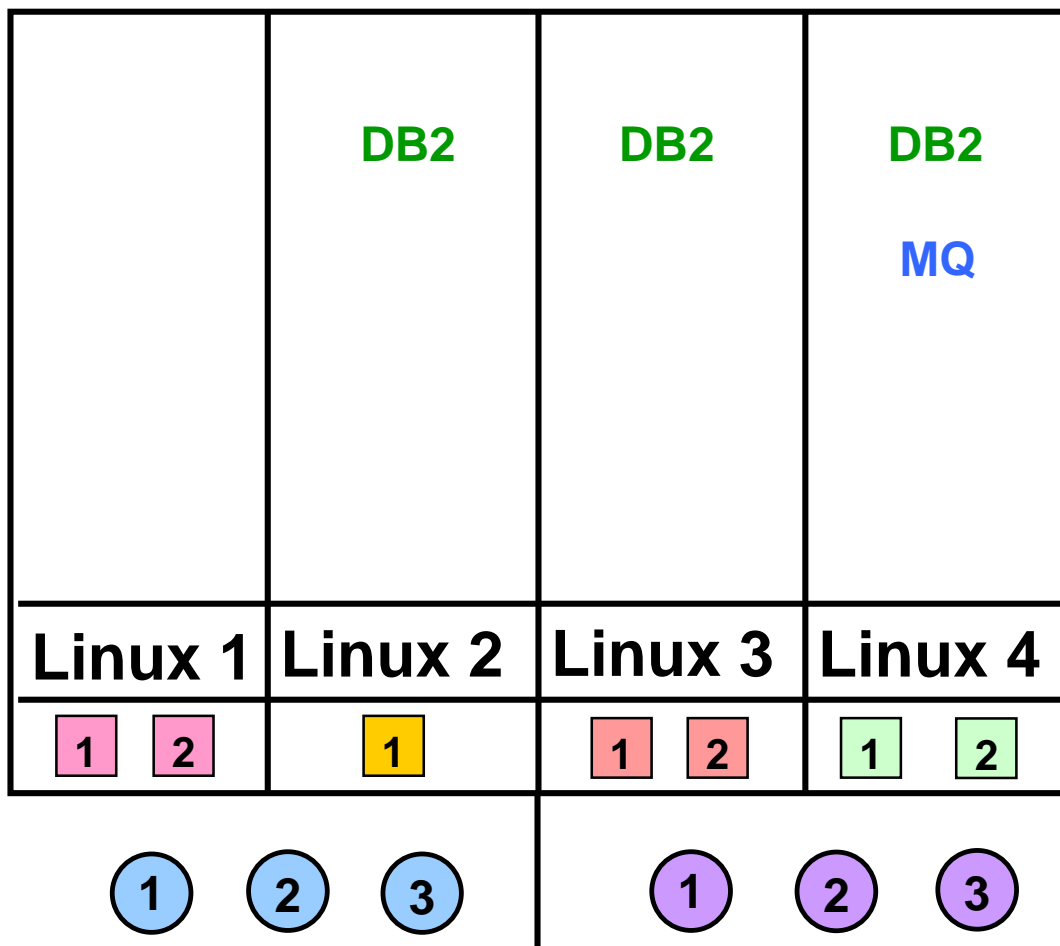
Cores to be licensed

1 IFL or CP engine = 1 processor core

DB2 (IFL)	DB2 (CP)	MQ (CP)	Partition
1			Linux 2 LPAR
	2		Linux 3 LPAR
	2	2	Linux 4 LPAR
1	4	2	Tot IFL/CP for Partition
3	3	3	Capacity Limit
4 (1 IFL + 3CP)		2	Total IFL / CP engines

License Rule: The lower of the sum of each partition for a product, or the engine capacity of the shared pool

1 logical IFL assigned to LPAR 2
2 logical CPs assigned to LPAR 3
2 logical CPs assigned to LPAR 4

3 IFLs in a shared pool &
3 CPs in a shared pool

| DB2 | DB2 | DB2 |
| | | MQ |

Linux 1	Linux 2	Linux 3	Linux 4
1 2	1	1 2	1 2

(1) (2) (3)   (1) (2) (3)

December 1, 2017

z/VM/zKVM with Linux Guests - IFLs

Server with 8 IFLs

Cores to be licensed

1 IFL or CP engine = 1 processor core

WAS	MQ	Partition
	3	Linux 2 VM
2		Linux 3 VM
2	3	Total IFLs for Partitions
6	6	Capacity Limit
2	3	Total IFLs for z/VM LPAR
2	2	Linux LPAR
4	**5**	**Total IFLs**

Test

MQ

WAS

MQ

WAS

Linux1 | **Linux2** | **Linux3**

`1` `2` `3` `4`   `1` `2` `3`   `1` `2`
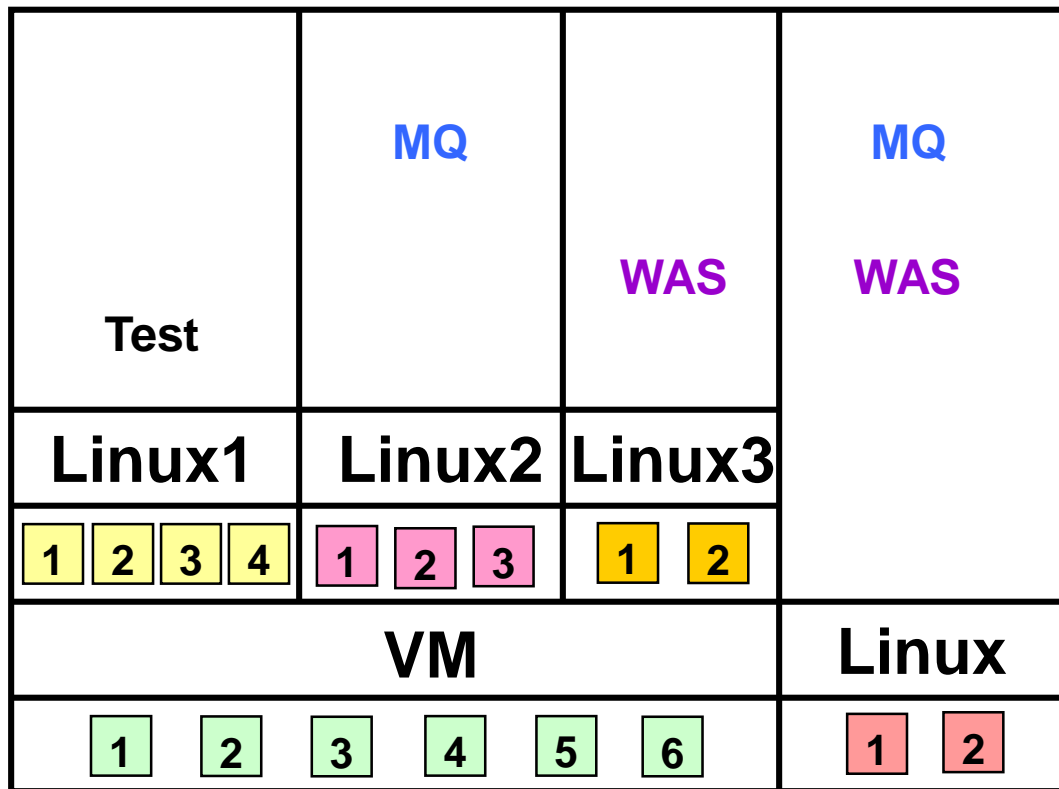
VM | **Linux**

`1` `2` `3` `4` `5` `6`   `1` `2`

① ② ③ ④ ⑤ ⑥ ⑦ ⑧

License Rule: The lower of the sum of each partition for a product, or the engine capacity of the shared pool

3 Linux Virtual Machines with 9 virtual engines

6 logical IFLs assigned to z/VM LPAR
2 logical IFLs assigned to Linux LPAR

8 IFLs in the shared IFL pool

z/VM/zKVM with Linux Guests - CPs

Server with 8 CPs

Cores to be licensed

1 IFL or CP engine = 1 processor core

WAS	MQ	Partition
	3	Linux 2 VM
2		Linux 3 VM
2	3	Total CPs for Partitions
6	6	Capacity Limit
2	3	Total CPs for z/VM LPAR
2	2	Linux LPAR
4	**5**	**Total CPs**

Test

MQ

MQ

WAS

WAS

Linux1	Linux2	Linux3
1 2 3 4	1 2 3	1 2

VM

Linux

1 2 3 4 5 6

1 2

1 2 3 4 5 6 7 8

License Rule: The lower of the sum of each partition for a product, or the engine capacity of the shared pool

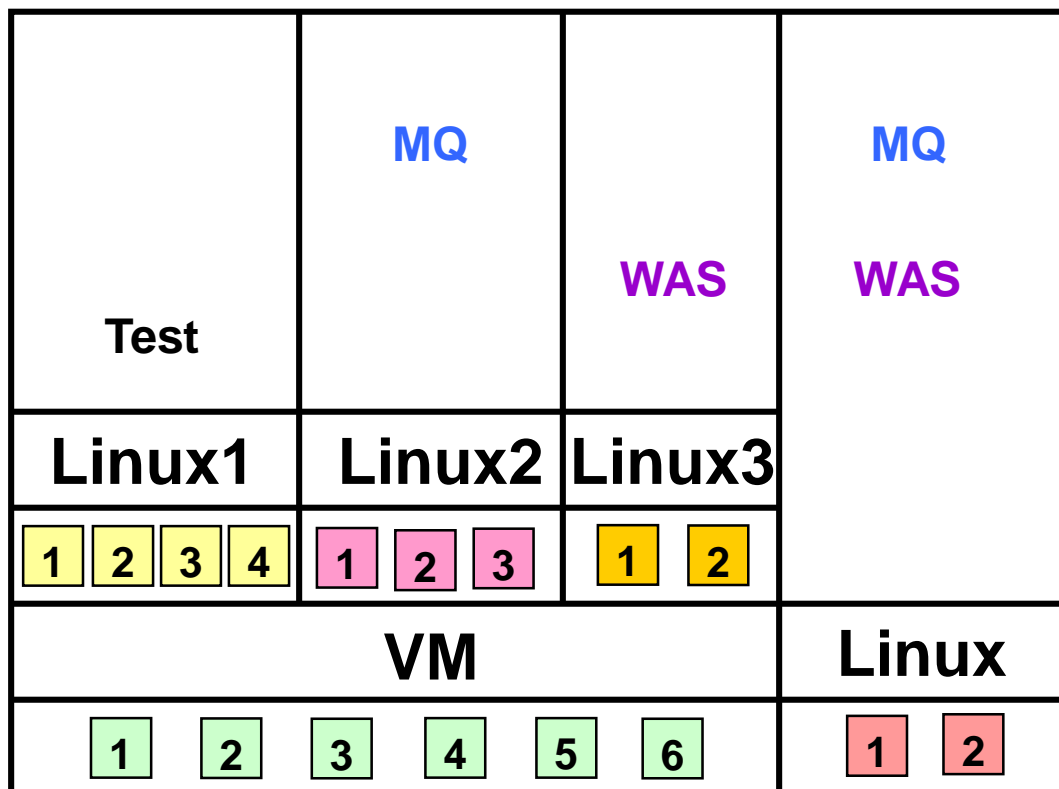**3 Linux Virtual Machines with 9 virtual engines**

6 logical CPs assigned to z/VM LPAR
2 logical CPs assigned to Linux LPAR

8 CPs in the shared pool

z/VM/zKVM with Linux Guests – Capping at z/VM/zKVM LPAR

Server with 8 IFLs

Cores to be licensed

1 IFL or CP engine = 1 processor core

WAS	MQ	Partition
	6	Linux 2
3	3	Linux 3
3	9	Total IFLs for Partitions
6	6	Capacity Limit
3	**6**	**Total IFLs**

License Rule: The lower of the sum of each partition for a product, or the engine capacity of the shared pool
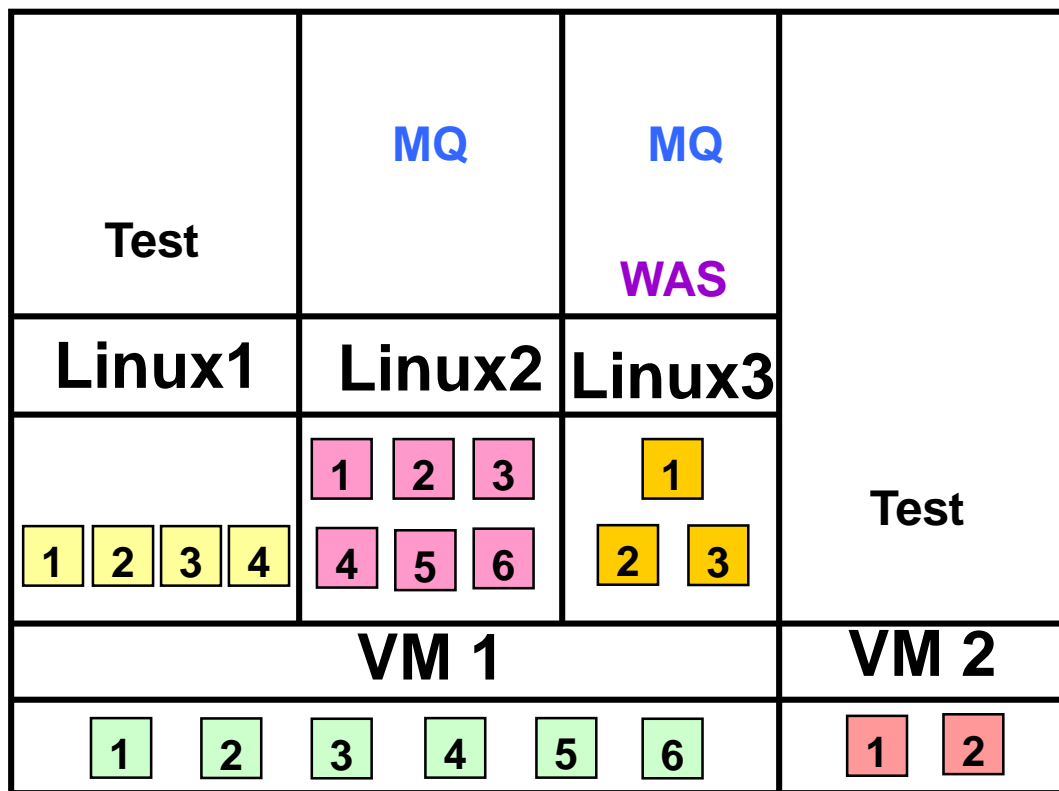
3 Linux Virtual Machines with 13 virtual engines

6 logical IFLs assigned to z/VM1 LPAR
2 logical IFLs assigned to z/VM2 LPAR

8 IFLs in the shared pool

December 1, 2017

z/VM/zKVM with Linux Guests – Capping at Server

Server with 4 IFLs

Cores to be licensed

1 IFL or CP engine = 1 processor core
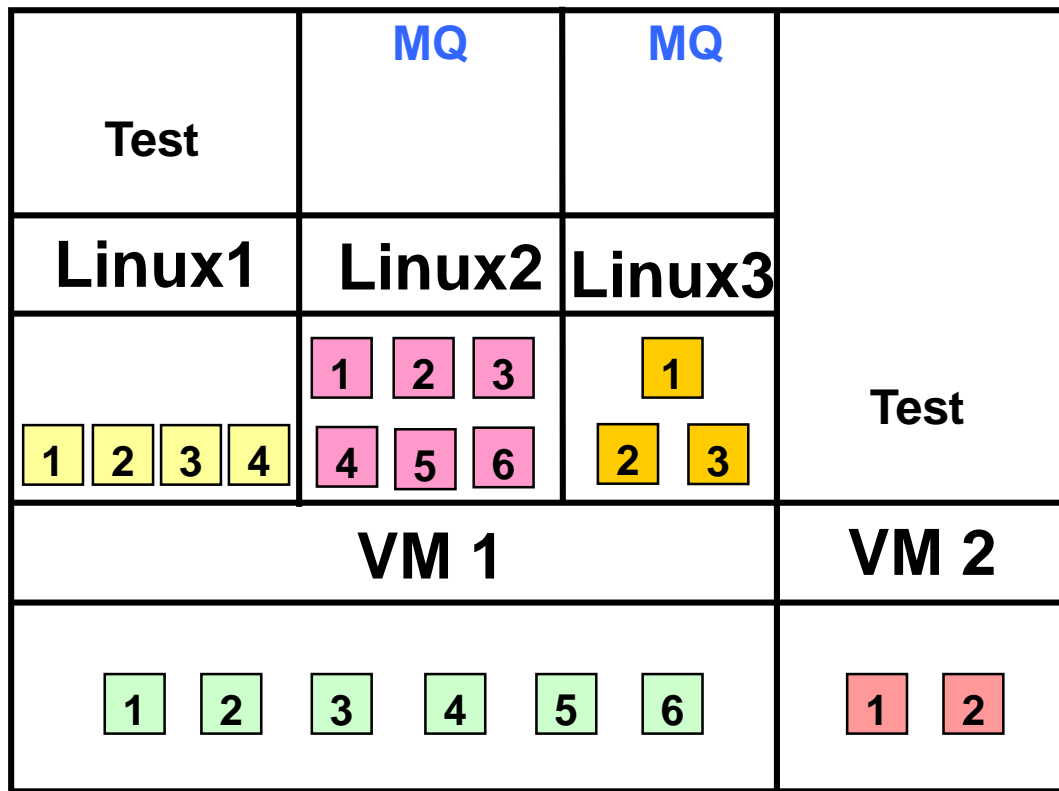
MQ	Partition
6	Linux 2
3	Linux 3
9	Total IFLs for Partitions
6	Capacity Limit Pool
6	Total IFLs for z/VM 1 LPAR
4	Capacity Limit Server
4	**Total IFLs**

License Rule: The lower of the sum of each partition for a product, or the engine capacity of the shared pool. The licenses will not exceed the number of activated engines in the server.

3 Linux Virtual Machines with 13 virtual engines

6 logical IFLs assigned to z/VM1 LPAR
**2 logical IFLs assigned to z/VM2 LPAR**

4 IFLs in the shared pool

Test

Linux1   **Linux2**   **Linux3**

MQ   **MQ**

Test

Linux1: 1 2 3 4

Linux2: 1 2 3 / 4 5 6

Linux3: 1 / 2 3

VM 1   **VM 2**

VM 1: 1 2 3 4 5 6
VM 2: 1 2

① ② ③ ④
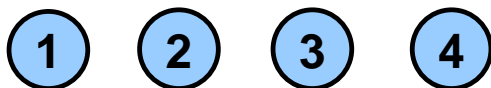
z/VM/zKVM with Linux Guests – CPU Pooling
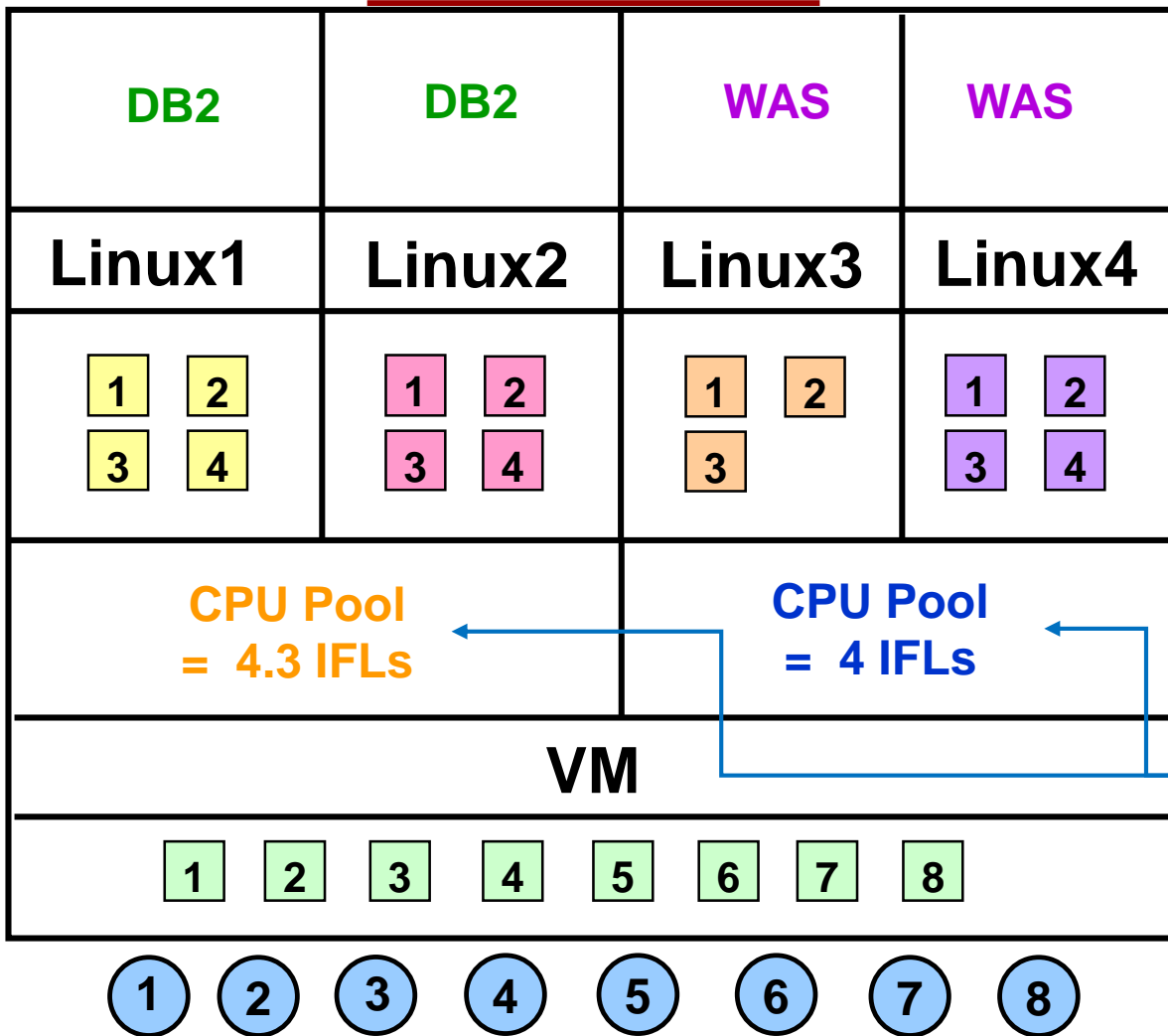
Cores to be licensed

1 IFL or CP engine = 1 processor core

DB2	WAS	Partition
4		Linux 1
4		Linux 2
	3	Linux 3
	4	Linux 4
8	7	Partition Capacity
4.3	4	CPU Pool Capacity
5	4	**Total Capacity**

Server with 8 IFLs

DB2	DB2	WAS	WAS
Linux1	Linux2	Linux3	Linux4
1 2 3 4	1 2 3 4	1 2 3	1 2 3 4

CPU Pool = 4.3 IFLs

CPU Pool = 4 IFLs

VM

1 2 3 4 5 6 7 8

1 2 3 4 5 6 7 8

- CPU Pool Capping Rule: the lower of the sum of each partition for a product or the processor core capacity of the CPU pool
- Aggregate fractional processor cores, apply CPU pool capping rules, and round up at the server level to the next whole processor core.

4 Linux Virtual Machines with 15 virtual engines

CPU Pools

8 logical IFLs assigned to z/VM LPAR

8 IFLs in the shared pool

LPAR Group Capping on System z

Cores to be licensed

1 IFL or CP engine = 1 processor core

License Rule: The lower of the sum of each partition for a product, or the engine capacity of the shared pool. The licenses will not exceed the number of activated engines in the server.
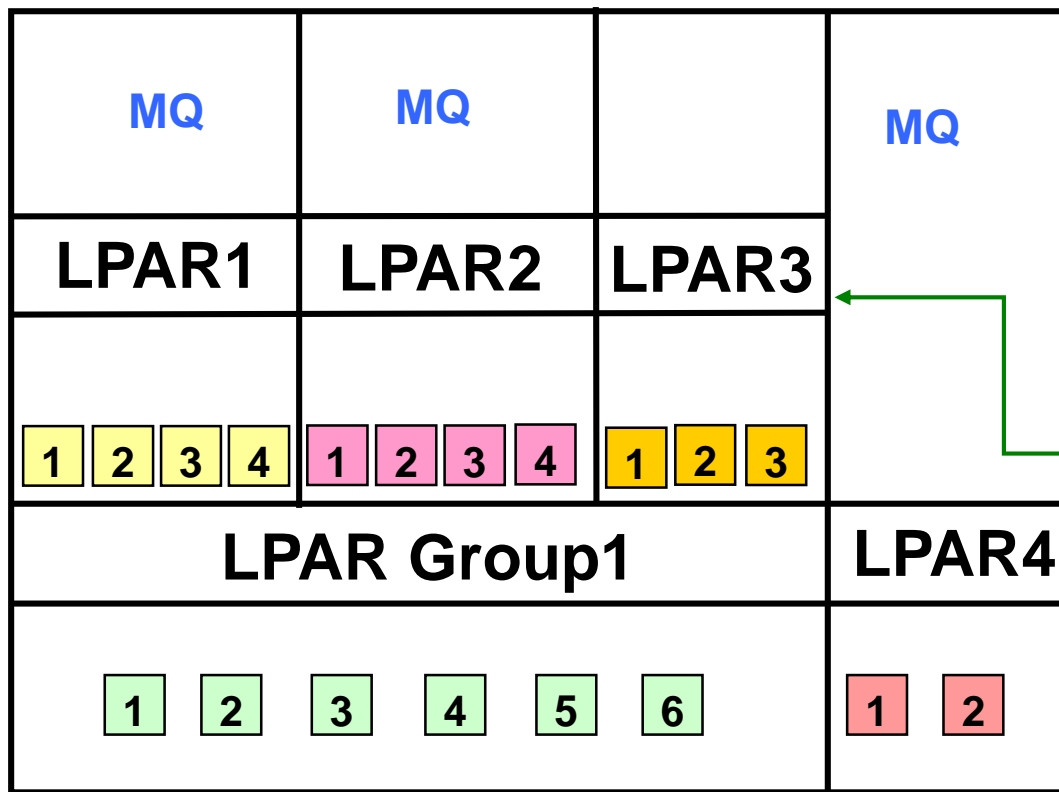
MQ	Partition
4	LPAR1
4	LPAR2
8	Total IFLs LPAR Group1
6	Capacity Limit Pool
2	Total IFLs for LPAR4
10	Capacity Limit Server
8	**Total IFLs**

MQ	MQ	MQ
LPAR1	LPAR2	LPAR3

| 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 | 1 | 2 | 3 |

LPARs in LPAR Group assigned logical IFLs

LPAR Group1   **LPAR4**

| 1 | 2 | 3 | 4 | 5 | 6 | | 1 | 2 |

6 logical IFLs assigned to LPAR Group1
2 logical IFLs assigned to LPAR

(1) (2) (3) (4) (5) (6) (7) (8) (9) (10)

10 IFLs in the shared pool

December 1, 2017

LPARs with mixed engine types (CP & IFL)

Server with 6 IFLs and 4 CPs
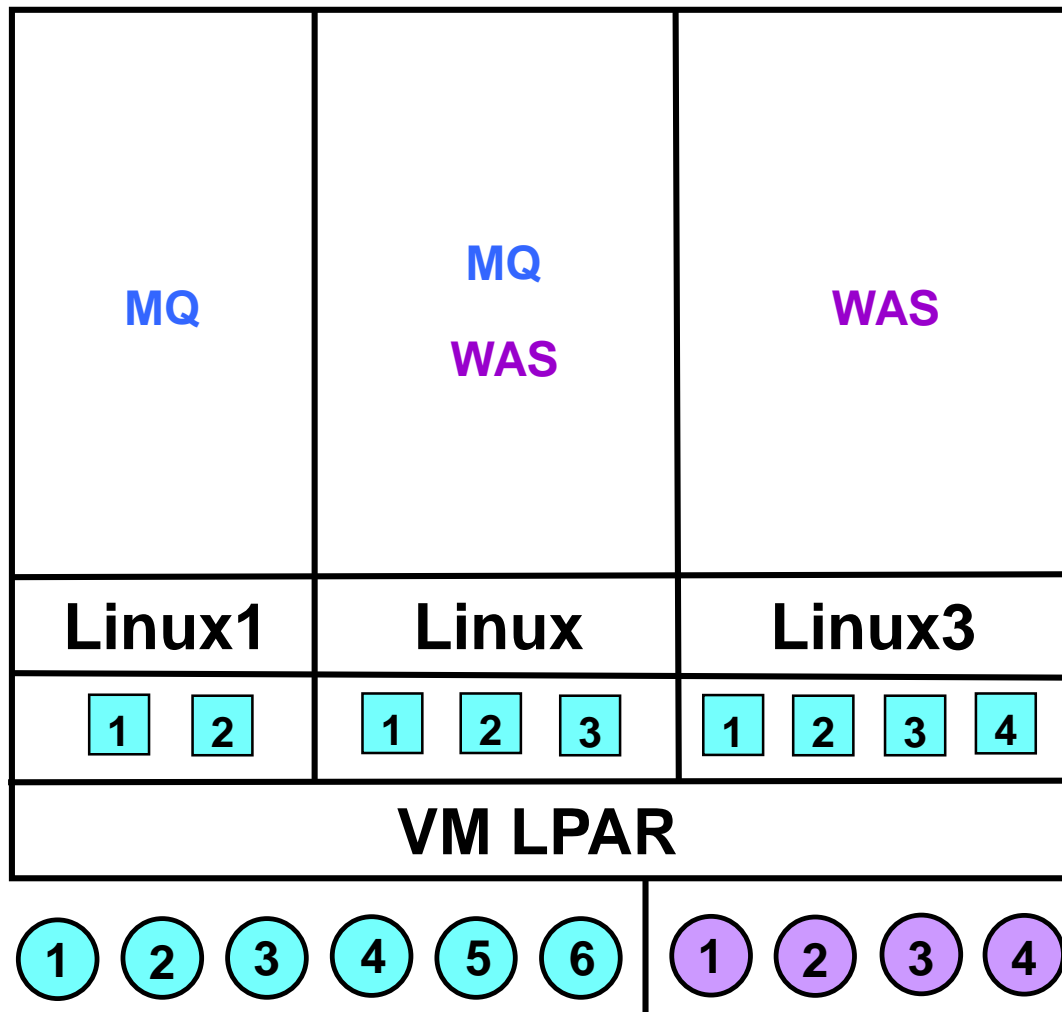
Cores to be licensed

1 IFL or CP engine = 1 processor core

WAS	MQ	Partition
	2	Guest Linux 1
3	3	Guest Linux 2
4	.	Guest Linux 3
7	5	Total IFLs for Partitions
6	6	IFL pool Capacity Limit
6	**5**	**Total IFLs**

License Rule: The lower of the sum of each partition for a product, or the engine capacity of the shared pool

3 Linux Guest Machines. All of them using **IFL engines only (or CP engines only).**
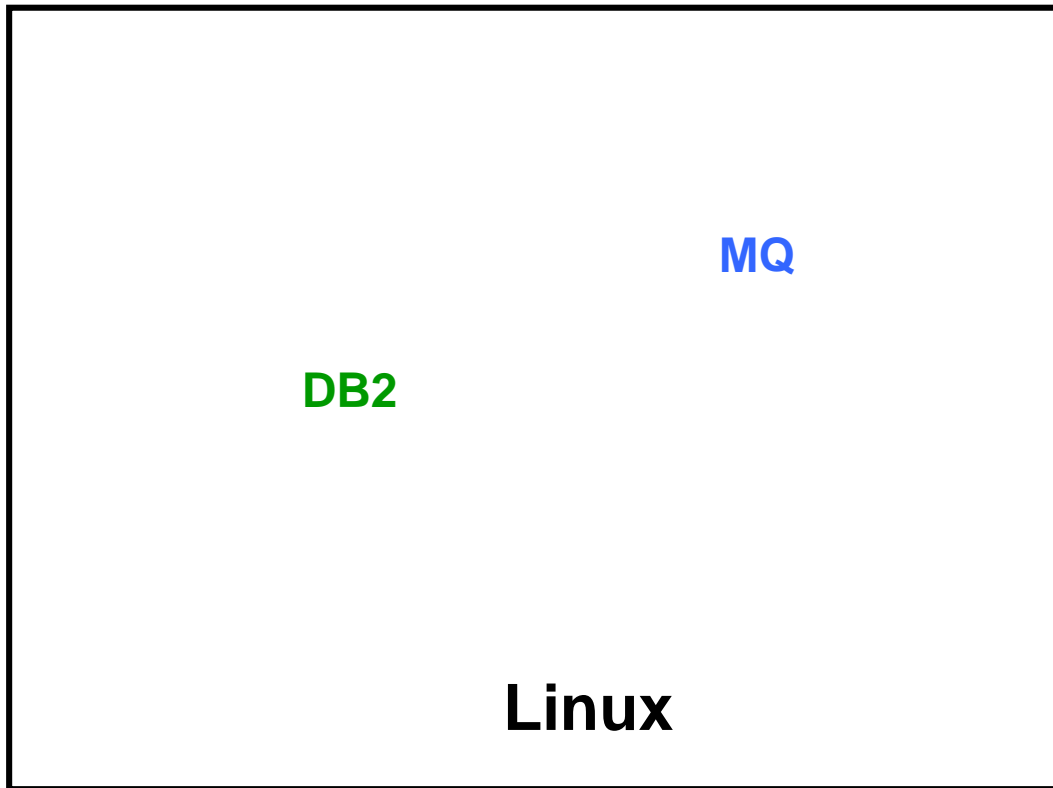
Mixed engine type linux guests on single LPAR are not supported !

All 6 logical IFLs all and 4 logicalCP assigned to VM LPAR

6 IFLs in a shared pool & 4 CPs in a shared pool

MQ	MQ WAS	WAS
Linux1	Linux	Linux3
1 2	1 2 3	1 2 3 4

VM LPAR

1 2 3 4 5 6   1 2 3 4

Machine in Basic Mode – No Partitioning

Server with 5 CPs

MQ

DB2

Linux

DB2 must be licensed for the **5 CP Engines**

MQ must be licensed for the **5 CP Engines**

(1) (2) (3) (4) (5)

⬅ **5 CPs in the server**

LPARs with Dedicated IFLs

Server with 5 IFLs
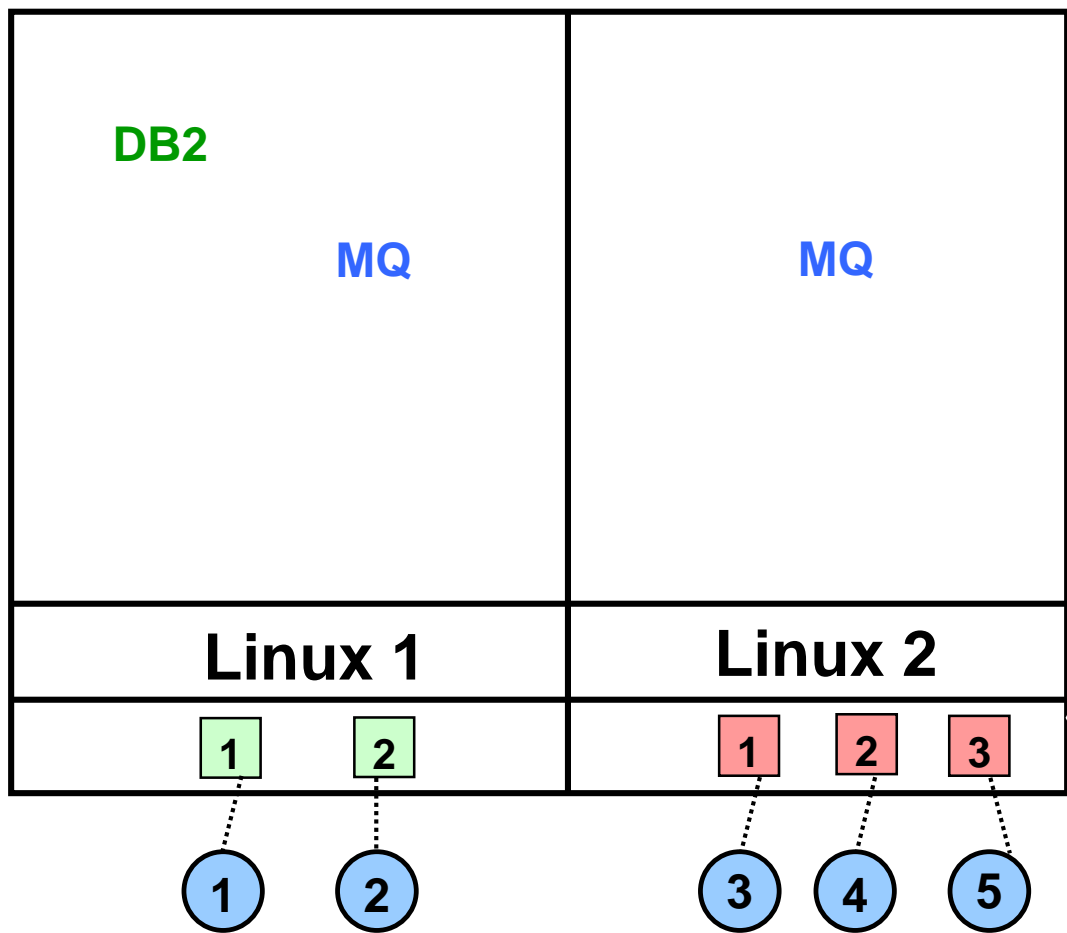
DB2

MQ

MQ

Linux 1

Linux 2

| 1 | 2 |

| 1 | 2 | 3 |

(1) (2)   (3) (4) (5)

Cores to be licensed

1 IFL or CP engine = 1 processor core

DB2	MQ	Partition
2	**2**	Linux 1
	3	Linux 2
2	5	Total IFLs for Partition
5	5	Capacity Limit
2	**5**	**Total IFLs**

License Rule: The sum of each partition for a product, or the physical capacity of the server

2 logical IFLs assigned to LPAR 1
3 logical IFLs assigned to LPAR 2

5 IFLs in the server

ILMT Licensing Counting Rules for Single Server EnvironmentS

- The lower of the sum of each partition for a product, or the engine capacity of the shared pool that the partition obtains its resources from. Note: This limit does not affect the additional licenses that might be required for dedicated partitions
  - Example: Maximum of 7 IFLs to be licensed for a shared pool with 7 IFLs.
  - For z/VM guests: The lower of the sum of the virtual engines available to each guest for a product, or the engine capacity of the z/VM LPAR that the guest obtains its resources from.
    - Example: Maximum of 5 IFLs to be licensed for a z/VM LPAR with 5 IFLs.

- The maximum licenses required for a program on a server, will not exceed the number of activated engines of the given type (IFL or CP engine) in the server, that are available to the program.
  - Example: Server with 4 IFLs and 3 CP engines. IFL capacity is available to DB2. CP capacity is not available to DB2. Maximum 4 IFL engines need to be licensed for DB2.

December 1, 2017

- 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

- <u>Eligibility Criteria</u>: 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

- <u>Requirements:</u> 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 **<u>signed and date stamped</u>**, at least once per quarter

*The above is only a summary. For detailed terms please see the <u>**Sub-capacity licensing attachment**</u>*

Manual Calculation of Virtualization Capacity – Rules

For Single Server Environments:

License Rules for LPARs and z/VM guests for each product:

▸ for a Dedicated LPAR, the highest* number of logical engines or IFLs allocated to the LPAR for a product

▸ for a z/VM guest, the highest* number of virtual engines available to each guest for a product

*The greater of what the partition starts with or the result of an increase in capacity (in whole cores)

The PVU licensing requirement is based on the maximum number of virtual engines (cores) in the partitions available to a product.

The lower of the sum of the virtual engines or server capacity (number of activated engines of the given type { IFL or CP engine } in the server)

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

December 1, 2017

Manual Calculation of Virtualization Capacity - Worksheet Example

Worksheet has 2 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 the mandatory information below
- Enter data in input fields below (shaded area)   * Mandatory

Date of this Audit Report *	March 31, 2009
Product Name *	IBM WEBSPHERE APPLICATION SERVER NETWORK DEPLOYMENT
Program Identification Number (57xx-xxx)	5724-H88
P/N Description	IBM WEBSPHERE 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)

http://www-01.ibm.com/software/lotus/passportadvantage/pvu_licensing_for_customers.html

(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**	

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](#)

December 1, 2017