Sub-Capacity for Linux on Z Middleware

Middleware programs running in the Linux operating system environment are licensed through Passport Advantage which has sub-capacity licensing rules which are different from the sub-capacity licensing rules of the traditional z/OS, z/TPF, and z/VSE z Systems operating system environments. The Passport Advantage website has extensive information about all aspects of Passport Advantage Virtualization Capacity (Sub-capacity) Licensing on all supported platforms.

This web page serves as an overview for z Systems customers who want to understand how to count the required number of engines for licensing Linux Middleware in a z Systems environment, including when Linux is running as a guest of z/VM.

Linux is able to run on two different kinds of z Systems server engines:

1. Integrated Facility for Linux engines, often called IFLs
2. General purpose processors, often called Central Processor engines or CPs

Since the most common z Systems environment is Linux on IFLs the following examples will show IFLs, but the licensing rules are exactly the same if Linux is running on CPs.

When a customer qualifies for sub-capacity licensing under Passport Advantage, the maximum license requirement rules for a software product are:

- Customer does not have to purchase more license entitlement for a product than the number of active engines on the machine (e.g. maximum DB2 UDB licenses on a 12-way machine is 12)
- Customer does not have to purchase more license entitlement for a product than the number of engines assigned to the shared pool where that product runs (e.g. maximum of 7 MQSeries licenses for a shared pool with 7 engines). Note: This limit does not affect the additional license entitlement that might be required for dedicated partitions.

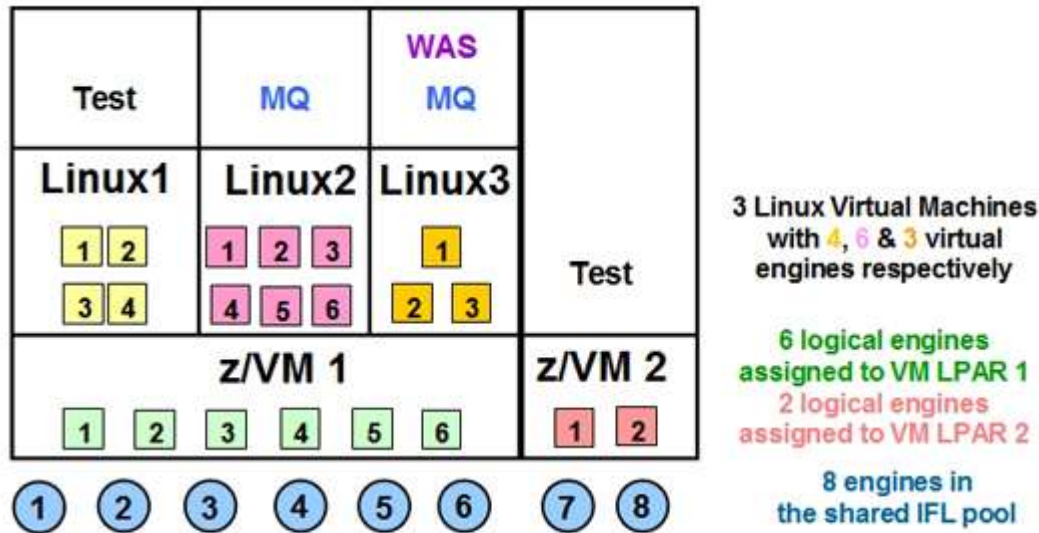**See the following pages for some Engine Counting Examples**

See the last page in the document for information on Passport Advantage Part Numbers for Linux on z

Example 1
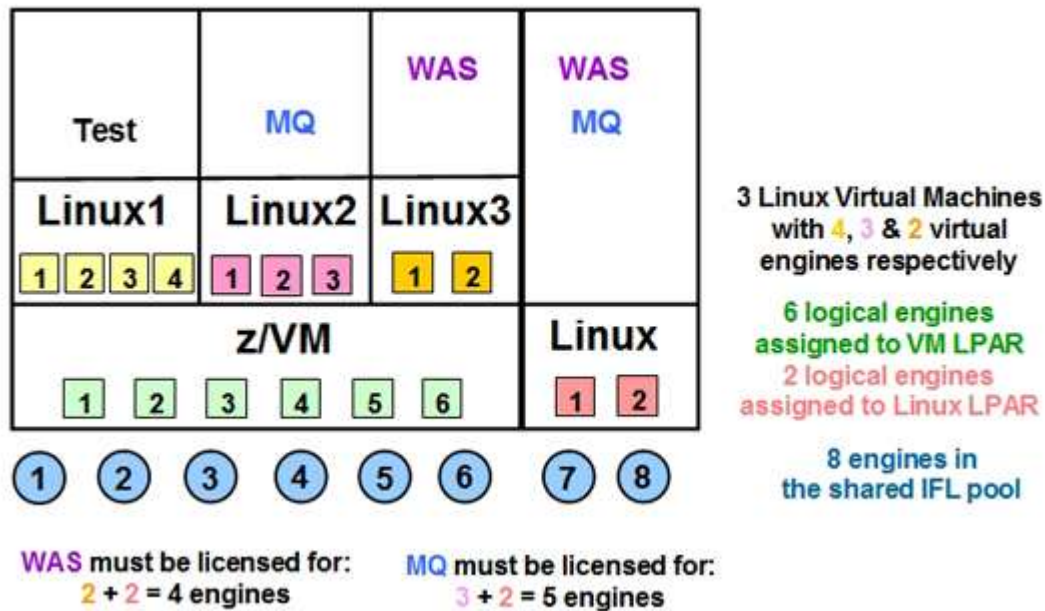
- In this example we have a z Systems machine with a shared pool of 8 IFL engines in a 2 LPAR configuration. One LPAR running z/VM with Linux guests has a shared pool of 6 logical engines assigned, the other LPAR running Linux without z/VM has 2 logical engines.
- The three Linux virtual machines each have a different number of virtual engines assigned (4, 3 and 2 respectively).
- WebSphere Application Server is running in guest Linux3 with 2 virtual engines and in the Linux LPAR with 2 logical engines for a total required license entitlement of 4 engines.
- MQSeries is running in guest Linux2 with 3 virtual engines and in the Linux LPAR with 2 logical engines for a total required license entitlement of 5 engines.
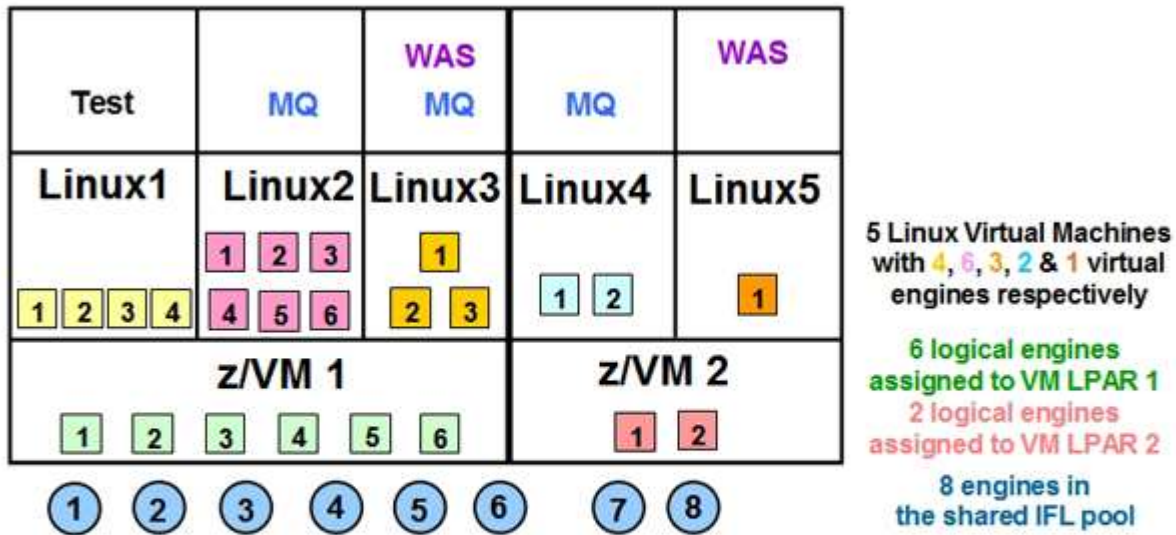
Example 2

- In this example we have a z Systems machine with a shared pool of 8 engines in a 2 LPAR configuration. LPAR 1 is running z/VM with Linux guests and it has a shared pool of 6 logical engines assigned; LPAR 2 is running a test z/VM and it has 2 logical engines.
- The three Linux virtual machines each have a different number of virtual engines assigned (4, 6 and 3 respectively).
- WebSphere Application Server is running in guest Linux3 with 3 virtual engines so it has a required license entitlement of 3 engines.
- MQSeries is running in guest Linux2 with 6 virtual engines and in guest Linux3 with 3 virtual engines. At first you might think that totals 9 engines, but remember we don't charge for more than the actual number of logical or real engines available for that program to run upon, so we must cap the number of engine entitlements required at 6 which is the number of logical engines shared by all of the z/VM guests in LPAR 1.
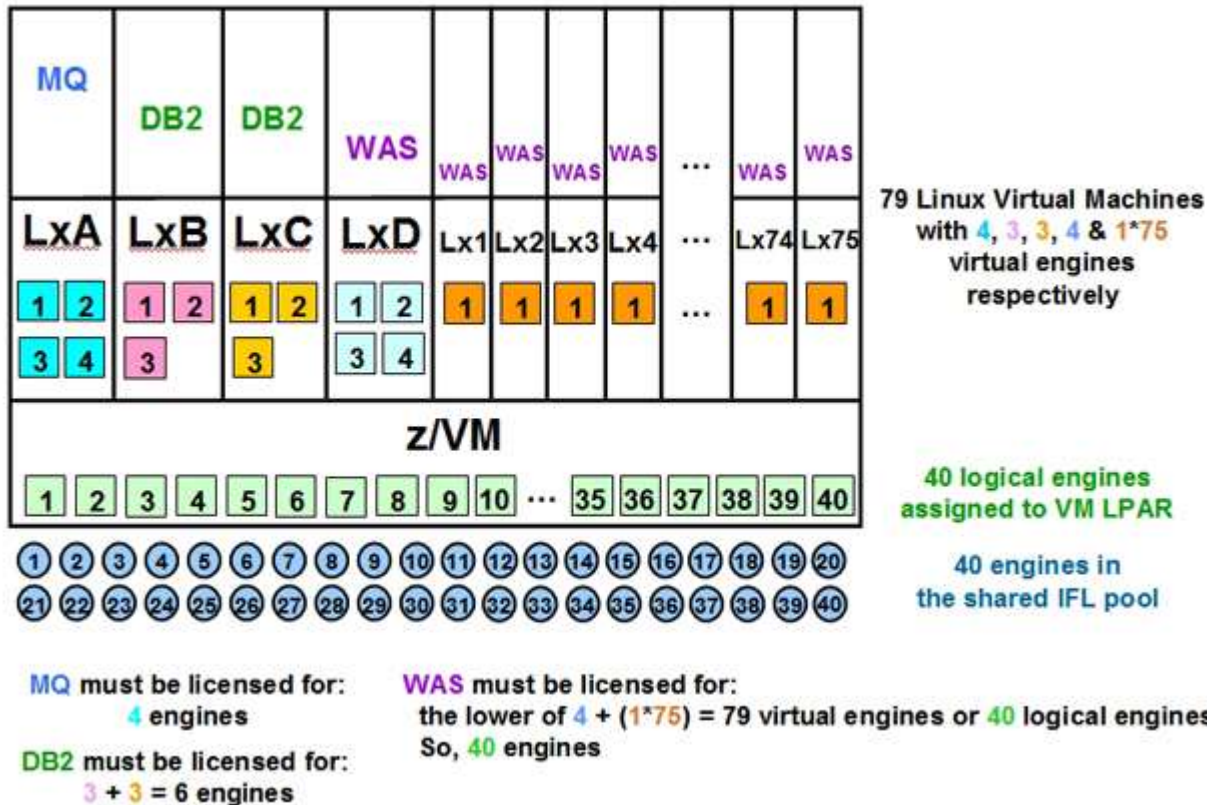
Example 3

WAS must be licensed for
3 + 1 = 4 engines

MQ must be licensed for the sum of (a) + (b):
(a) is the lower of: 6 + 3 = 9 virtual engines or 6 logical engines
(b) is the lower of: 2 virtual engines or 2 logical engines
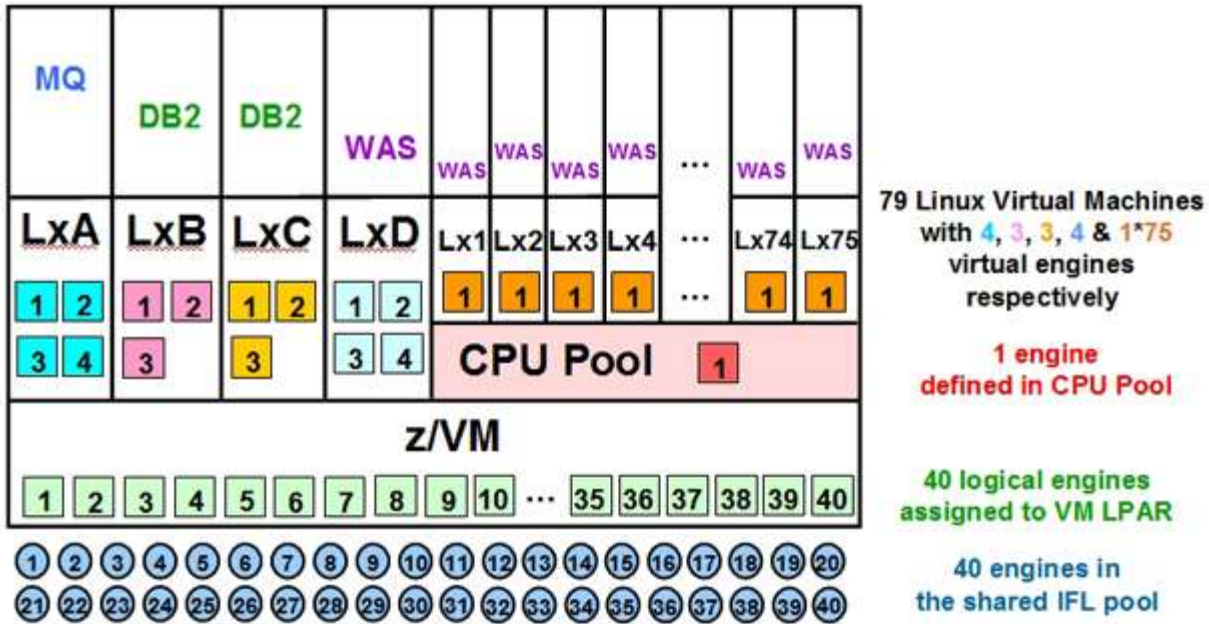So, 6 + 2 = 8 engines

- In this example we have a z Systems machine with a shared pool of 8 real engines in a 2 LPAR configuration. LPAR 1 is running z/VM with three Linux guests and it has a shared pool of 6 logical engines assigned; LPAR 2 is running z/VM with two Linux guests and it has a shared pool of 2 logical engines assigned.
- The five Linux virtual machines each have a different number of virtual engines assigned (4, 6, 3, 2 and 1 respectively).
- WebSphere Application Server is running in guest Linux3 with 3 virtual engines in a shared pool of 6 logical engines, and in guest Linux 5 with 1 virtual engine in a shared pool of 2 logical engines, so it has a total required license entitlement of 4 engines.
- MQSeries is running in guest Linux2 with 6 virtual engines and in guest Linux3 with 3 virtual engines. At first you might think that totals 9 engines, but remember we don't charge for more than the actual number of logical or real engines available for that program to run upon, so we must cap the number of engine entitlements required at 6 which is the number of logical engines shared by all of the z/VM guests in LPAR z/VM 1. Then we also have guest Linux 4 with 2 virtual engines in LPAR z/VM 2 with 2 logical engines, so the overall total is 6 MQ engines in z/VM 1 and 2 MQ engines in z/VM 2 for a total of 8 logical engines on this machine with 8 IFLs.

Example 4a

MQ must be licensed for:
   4 engines

DB2 must be licensed for:
   3 + 3 = 6 engines

WAS must be licensed for:
   the lower of 4 + (1*75) = 79 virtual engines or 40 logical engines
   So, 40 engines

- In this example we have a z Systems machine with a shared pool of 40 real engines in a 1 LPAR configuration. The LPAR is running z/VM with 79 Linux guests and it has a shared pool of 40 logical engines defined.
- Four of the Linux virtual machines, LxA, LxB, LxC, and LxD, have 4, 3, 3, and 4 virtual engines defined respectively. There are also 75 small "test" virtual machines named Lx1 through Lx75, each with 1 virtual engine defined. Although these 75 test machines may run very little workload, they still must be included in the engine count which determines the licensing requirement.
- MQSeries is running in guest LxA with 4 virtual engines in a shared pool of 40 logical engines, so it has a total required license entitlement of 4 engines, which on this z Systems server means 480 Processor Value Units.
- DB2 is running in guest LxB with 3 virtual engines and in guest LxC with 3 virtual engines, in a shared pool of 40 logical engines, so it has a total required license entitlement of 6 engines, which on this z Systems server means 720 Processor Value Units.
- WebSphere Application Server is running in guest LxD with 4 virtual engines and also in all 75 of the guests named Lx1 through Lx75 each with 1 virtual engine. At first you might think that totals 79 engines, but remember we don't charge for more than the actual number of logical or real engines available for that program to run upon, so we must cap the number of engine entitlements required at 40 which is the number of logical engines shared by all of the z/VM guests in the LPAR. On this z Systems server this requires 4800 Processor Value Units.
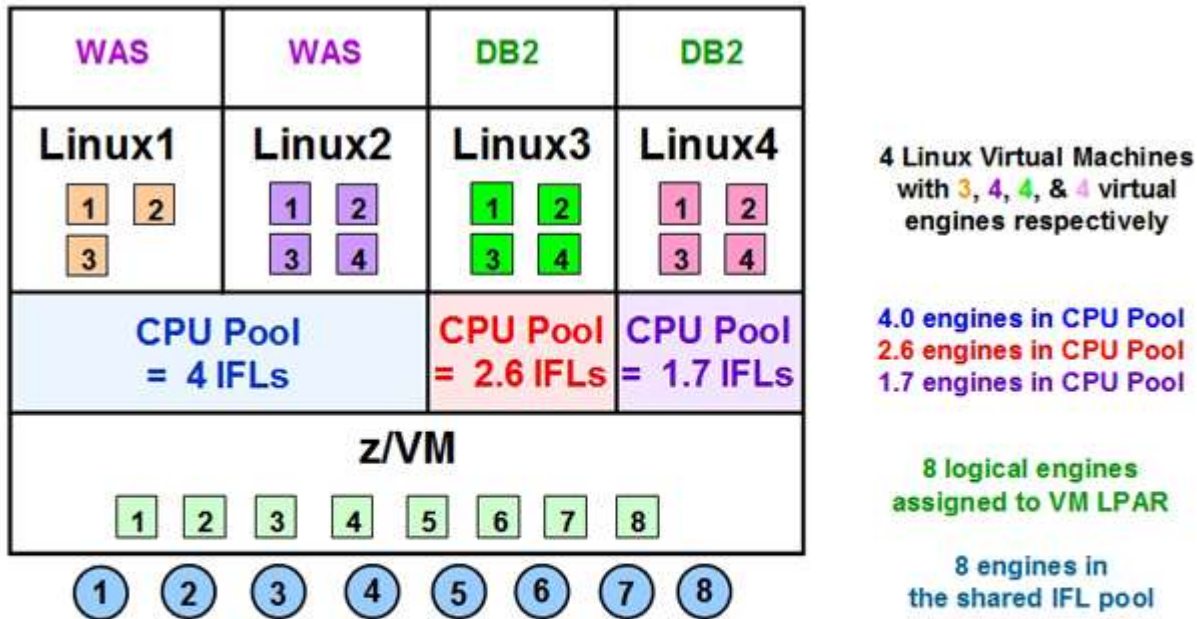
Example 4b

MQ must be licensed for:
   4 engines

DB2 must be licensed for:
   3 + 3 = 6 engines

WAS must be licensed for the sum of (a) + (b):
   (a) is 4 virtual engines
   (b) is the lower of 75 virtual engines or 1 pool engine
   So, 4 + 1 = 5 engines

- In this updated example we have the same z Systems machine with a shared pool of 40 real engines in a 1 LPAR configuration. The LPAR is running z/VM with the same 79 Linux guests and it still has a shared pool of 40 logical engines defined. But now there is also a CPU Pool with 1 engine defined to which the 75 small test virtual machines have been assigned.
- MQSeries hasn't changed, it is still running in guest LxA with 4 virtual engines in a shared pool of 40 logical engines, so it has a total required license entitlement of 4 engines, which on this z Systems server means 480 Processor Value Units.
- DB2 hasn't changed, it is still running in guest LxB with 3 virtual engines and in guest LxC with 3 virtual engines, in a shared pool of 40 logical engines, so it has a total required license entitlement of 6 engines, which on this z Systems server means 720 Processor Value Units.
- WebSphere Application Server is still running in guests Lx1 through Lx 75 each with 1 virtual engine. Although that totals 75 virtual engines the CPU Pooling support in z/VM allows the systems programmer to limit the amount of processing power given to the set of guests assigned to the CPU Pool, so in this case the execution of those 75 virtual engines is limited to the 1 engine defined for that shared pool. Then we also have guest LxD with 4 virtual engines, so overall that is a total of 5 logical engines for WAS on this machine with 40 IFLs. On this z Systems server this requires 600 Processor Value Units.

Example 5

WAS must be licensed for:
the lower of 3 + 4 = 7 virtual engines or 4 pool engines
So, 4 engines

DB2 must be licensed for the sum of (a) + (b):
(a) is the lower of 4 virtual engines or 2.6 pool engines
(b) is the lower of 4 virtual engines or 1.7 pool engines
So, 2.6 + 1.7 = 4.3 engines, rounded up to 5 engines

- In this example we have a z Systems machine with a shared pool of 8 real engines in a 1 LPAR configuration. The LPAR is running z/VM with four Linux guests and it has a shared pool of 8 logical engines assigned. There are also 3 CPU Pools defined, with 4 engines for the two WebSphere Application Server guests, 2.6 engines for one DB2 guest, and 1.7 engines for the second DB2 guest.
- z/VM CPU Pooling allows pools to be set up with fractional engines to facilitate finer granularity in the controlling and sharing of engine resources between guests. ILMT sub-capacity measurement allows for CPU Pool definitions with fractional engines, but all PVU licensing must be in full engine increments, so if necessary any fractional engine requirements will be rounded up at the end to the next whole engine.
- WebSphere Application Server is running in guest Linux1 with 3 virtual engines and in guest Linux2 with 4 virtual engines, and these two guests are assigned to a CPU Pool with a limit of 4 engines. So WebSphere Application Server has a total required license entitlement of 4 engines, which on this z Systems server means 480 Processor Value Units.
- DB2 is running in guest Linux3 with 4 virtual engines assigned to a CPU Pool with a limit of 2.6 engines. DB2 is also running in guest Linux4 with 4 virtual engines assigned to a CPU Pool with a limit of 1.7 engines. In both cases the CPU Pool is smaller than the number of virtual engines, so for Linux3 the required engine entitlement is 2.6 and for Linux4 the required engine entitlement is 1.7 for a total of 4.3 engines, which we round up for licensing purposes to 5 engines. On this z Systems server this requires 600 Processor Value Units.

Passport Advantage Part Numbers for Linux on z

Passport Advantage software is licensed and delivered using Part Numbers:

- Part Numbers for the materials which deliver the code (for example a DVD)
- Part Numbers for charging for the license entitlement

Most Passport Advantage Middleware programs which run in the Linux for z Systems environment are licensed with Processor Value Units (PVU). A PVU is a unit of measure used to differentiate licensing of software on different processor technologies (defined by Processor Vendor, Brand, Type and Model Number). Each software program has a unique price per PVU. See the [Processor Value Unit [PVU] licensing for Distributed Software](#) website for more information about PVUs, including a table defining the PVU requirements for the different processor types.

Many Passport Advantage Middleware programs have Part Numbers labeled with "Linux for z Systems"

- These Part Numbers are used to track Passport Advantage software originally sold for Linux projects which are intended to be deployed on z Systems or LinuxONE hardware, or are intended to be deployed on any supported platform with the intent to connect to, send data to, or receive data from z Systems or LinuxONE hardware.
- The purchase of a "Linux for z Systems" Part Number does not limit a customer's use of the license. If you later decide to redeploy on another supported platform you do not need to purchase a different license, though the new machine configuration and PVU rating may require additional entitlement.
- Similarly, a customer may redeploy a previously-purchased non-z license entitlement from distributed hardware onto z Systems without needing to purchase a different license so long as that program is supported on z Systems. Again, the z Systems configuration and PVU rating may require additional entitlement.
- A program license is applicable for all platforms it is possible to run it upon unless when the program is first announced, it explicitly states that it is only for one platform, both in its description and the announcement materials. There are very few programs available in Passport Advantage which are truly single platform in their applicability.