

Setting Up a Sub-Capacity SAS[®] License in the z/OS Operating Environment

Release Information

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Introduction

Starting in SAS 9.1.3, customers can license SAS software to run in the z/OS operating environment for less than the full capacity of the machine by licensing a specific logical partition (LPAR), which is a subset of the machine's total resources. To accommodate this licensing model, SAS offers sub-capacity pricing for qualified customers. Contact your SAS Account Representative to determine whether you qualify for this pricing. Sub-capacity pricing is based on the maximum capacity of a logical partition.

In order for SAS to generate a correct setinit for sub-capacity pricing, qualified customers need to submit system-specific information. This document describes how to find that information, some considerations for defining a sub-capacity LPAR, and how to use the Hardware Management Console (HMC) to set the capacity definition for a logical partition.

Providing the Required LPAR Information for the Sub-Capacity License Setinit

In order to create the SAS setinit for the sub-capacity LPAR, you must provide the following information about your processor environment to your SAS representative:

- the z/OS command output which displays your CPU information
- the Resource management Facility (RMF) CPU report that shows the Millions of Service Units (MSU) that are assigned to the LPAR

By providing this information to SAS prior to using the setinit, SAS can ensure that the MSU value that is provided in the setinit is adequate for the LPAR on which SAS will run.

Display the CPU Information

Issue the z/OS command `D M=CPU` from the LPAR on which the SAS sub-capacity license will be installed to display pertinent system-specific information. The output that is returned should be similar to the following display:

```
D M=CPU
IEE174I 12.01.41 DISPLAY M 944
PROCESSOR STATUS
ID  CPU  CR              SERIAL
00  +    +              02345A2066
01  +    -              12345A2066

CPC ND = 002066.0A2.IBM.02.00000002345A
CPC SI = 2066.0A2.IBM.02.000000000002345A
CPC ID = 00
CPC NAME = P002345A
LP NAME = TST1          LP ID = 1
MIF ID = 1
```

Send a copy of this output to your SAS representative.

Run the Resource Management Facility CPU Report

Run the following job to display the LPAR capacity for the z/OS system on which the sub-capacity license will be installed.

```
//JOBNAME JOB
//SMF EXEC PGM=IFASMFDP
//SMFIN DD DSN=SYS1.MAN1,DISP=SHR <== SET TO YOUR SMF DATASET
//RMF DD DSN=&&RMFIN,UNIT=SYSDA,SPACE=(CYL,(4,2)),DISP=(,PASS)
//SYSPRINT DD SYSOUT=*
/* PICK RECORDS FOR ANY RMF INTERVAL. */
/* THIS EXAMPLE PICKS UP THE 8:00 INTERVAL. */
START(0759)
END(0801)
INDD(SMFIN,OPTIONS(DUMP))
OUTDD(RMF,TYPE(70))
//*
//RMF EXEC PGM=ERBRMFPP,COND=(0,LT)
//MFPINPUT DD DSN=&&RMFIN,DISP=SHR
REPORTS(CPU)
```

The SMFIN DD file must contain an SMF TYPE 70 record written during the time range that is specified in the START and END parameters. The SMF TYPE 70 records are written at the end of each RMF recording interval. This interval is defined by your organization, and there are usually several intervals recorded in a 1 hour period.

In the output, locate the MFR00001 output data set. It looks similar to the following display:

```
BROWSE - MFR00001      RMF      - Page 2      Line 1      Cols 1-132
COMMAND ==>

                                P A R T I T I O N   D A T A   R E P O R T

                                z/OS V1R11      SYSTEM ID T0A2      DATE 01/20/2010
                                RPT VERSION V1R11 RHF      TIME 14.15.00

MVS PARTITION NAME              TST1      NUMBER OF PHYSICAL PROCESSORS
IMAGE CAPACITY                  30      CP
NUMBER OF CONFIGURED PARTITIONS 4
WAIT COMPLETION                 NO
DISPATCH INTERVAL              DYNAMIC

----- PARTITION DATA ----- -- LOGICAL PARTITION PROCESSOR DATA --
NAME      S      MGT DEF      ACT DEF      WLM%      PROCESSOR-  ---DISPATCH TIME DATA---
          S      MGT DEF      ACT DEF      WLM%      NUM  TYPE      EFFECTIVE      TOTAL
TST1      A      10  0      2 NO      0.0      2  CP      00.01.57.443  00.01.58.361
CF02      A      10  0      0 NO      0.0      1  CP      00.00.04.991  00.00.05.326
DEV0      A      20  10     1 NO      0.0      2  CP      00.01.04.663  00.01.05.517
PROD      A      70  0      5 NO      0.0      2  CP      00.05.13.299  00.05.14.107
*PHYSICAL*
TOTAL      00.08.20.397  00.08.29.026
***** Bottom of Data *****
```

The display shown above shows where you will get the image capacity.

Send a copy of this output to your SAS representative.

Defining a Sub-Capacity LPAR

The SAS sub-capacity license for a z/OS operating environment is based on the image capacity in MSUs that is reported by z/OS for the LPAR in which SAS is licensed. This value can be set to less than the full machine capacity in several ways (see below). Unless the image capacity value is adjusted, the reported image capacity for the LPAR is determined by the MSU capacity of all the central processors (CPs) that are potentially available to the LPAR. This number of CPs that are potentially available is the lesser of either of the following:

- the sum of all active and reserved processors defined to the image at activation time
- the total number of general CPs in the CEC

Note: When setting the image capacity, only general-purpose CPs count. Specialty processors such as zIIPs and zAAPs are not included in the capacity calculation.

There are three ways in which an LPAR image capacity, as reported by z/OS, can be less than the full capacity of the machine:

1. **Restrict the number of CPs.** Define the LPAR with fewer CPs than actually exist on the machine. These CPs can be either dedicated or shared. In this case, the LPAR capacity is the maximum MSU capacity that this number of processors could achieve. This is calculated by IBM as the total capacity of the assigned and reserved processors.
2. **Set a hard cap.** Limit the capacity of the LPAR in which SAS will be licensed by setting the LPAR weight and turning on capping. This method is known as hard capping. The LPAR capacity is calculated as follows:
$$((\text{LPAR-weight}) / (\text{Sum-of-all-LPAR-weights}) * (\text{MSU-of-shared CPs})) + (\text{MSU-of-dedicated-CPs})$$

Note: Because the LPAR MSU cap is affected by the LPAR-weight of other LPARS, the MSU cap can be changed without changing the definition of the LPAR on which SAS is running. Customers must exercise care to ensure that the changes do not increase the MSU value beyond the amount that SAS is licensed to use.

Consider this example:

- There are four active LPARS. Three have a weight of 50. The LPAR on which SAS is running has a weight of 30 and is capped.
 - The machine that is being used is a z/10 Model 706, and there are no dedicated processors. The rated MSU capacity of this machine is 571 MSU.
 - The image capacity is calculated as follows:
$$((30 / 180) * 571) + 0 = 95.2 \text{ MSU}$$
 - To use a sub-capacity SAS license in this LPAR, the setinit must specify an MSU value of 96 or larger. Fractional MSU specification is not allowed.
3. **Set a soft cap.** The LPAR has a defined capacity that is managed by the z/OS Workload Manager (WLM). In this approach, which is known as soft capping, the HMC is used to establish a defined capacity for the LPAR. z/OS WLM then manages the capacity of the LPAR to this value by dynamically manipulating the hardware capping controls. WLM manages to a soft cap that is based on the rolling 4-hour average MSU usage by the LPAR. In this case, the defined MSU value is specified in the machine's hardware console definition for the LPAR, and the image capacity of the LPAR is equal to the defined capacity. The SAS setinit MSU value must specify a value that is at least as large as the defined capacity. Unlike the hard cap scenario, this value is not dependent on the weights that are assigned to the different LPARS.

The following summarizes how LPAR capacity is determined:

1. If capping is not in use, then:
LPAR Capacity = MSU of the number of CPs defined for the LPAE (whether dedicated or shared)

2. If the LPAR uses hard capping, then:

$$\text{LPAR Capacity} = (\text{LPAR-weight}) / (\text{Sum-of-all-LPAR-weights}) * (\text{MSU-of-shared-CPs}) + (\text{MSU-of-dedicated-CPs})$$

3. If the LPAR used soft capping, then:

LPAR capacity = the number of MSU specified for the Defined Capacity setting

Note: If the LPAR capacity that is defined in the soft cap exceeds the maximum possible MSU rating for that number of CPs, the reported LPAR capacity is the smaller value.

By far the simplest and least confusing way to specify a sub-capacity value for an LPAR is to use the soft capping method to set a defined capacity. The other approaches are subject to many variations including the total number of processors on the machine (CPs and all specialty processors). Individual CP capacity declines as the total number of online processors that are on the machine increases. Also, changing the weight for any LPAR can affect the image capacity of the LPAR in which SAS is using. So, you could inadvertently cause the image capacity of an LPAR that is using hard capping to increase, and, thereby, cause the setinit check to fail.

Using the Hardware Management Console to Define LPAR Capacity

The HMC can be used to set the sub-capacity definition of an LPAR as follows:

1. Log on to the HMC and select the central processor complex (CPC) in which the LPAR capacity changes are to be made.
2. Navigate to the Operational Customization group and invoke the Change LPAR Control function.
3. Set a soft cap or hard cap MSU based on your current system configuration (as explained below).

Set a Soft Cap

To set a defined MSU capacity using the soft capping method:

1. Enter the desired MSU settings for the LPAR on the **CPs** tab.

The screenshot shows the 'Change Logical Partition Controls - P002FB22' window. The 'CPs' tab is active, displaying a table of logical partitions with the following data:

Logical Partition	Active	Defined Capacity	WLM	Current Weight	Initial Weight	Min Weight	Max Weight	Current Capping	Initial Capping	Number of Dedicated Processors	Number of Not dedicated Processors
CF02	Yes	0	<input checked="" type="checkbox"/>	10	10			No	<input type="checkbox"/>	0	1
DEVD	Yes	10	<input type="checkbox"/>	20	20			No	<input type="checkbox"/>	0	2
PROD	Yes	0	<input type="checkbox"/>	70	70			No	<input type="checkbox"/>	0	2
TST1	Yes	0	<input type="checkbox"/>	10	10			No	<input type="checkbox"/>	0	2

Below the table, the 'Processor running time' section is visible, with the following settings:

- Attention: It is recommended that you select "Dynamically determined by the system". Selecting "Determined by the user" risks suboptimal use of processor resources.
- Dynamically determined by the system
- Determined by the user
- Running time: 1 to 100 milliseconds
- Do not end the timeslice if a partition enters a wait state

Buttons at the bottom include 'Save to Profiles', 'Change Running System', 'Save and Change', 'Reset', 'Cancel', and 'Help'.

2. To make the change effective immediately, click **Change Running System**.
3. To make the change permanent for all subsequent image activations, click **Save to Profiles**.

Set a Hard Cap

To set the processor weight capping:

1. Enter the appropriate weighting value relative to all other LPARs on the CPs tab.

HMCT: Change LPAR Controls - Windows Internet Explorer provided by SAS

Change Logical Partition Controls - P002FB22

Last reset profile attempted: 2096S07RESET
Input/output configuration data set (IOCDS): a0 IODF89

CPs

Logical Partitions with Central Processors

Logical Partition	Active	Defined Capacity	WLM	Current Weight	Initial Weight	Min Weight	Max Weight	Current Capping	Initial Capping	Number of Dedicated Processors	Number of Not dedicated Processors
CF02	Yes	0	<input checked="" type="checkbox"/>	10	10			No	<input type="checkbox"/>	0	1
DEVD	Yes	0	<input checked="" type="checkbox"/>	20	20			No	<input checked="" type="checkbox"/>	0	2
PROD	Yes	0	<input type="checkbox"/>	70	70			No	<input type="checkbox"/>	0	2
TST1	Yes	0	<input type="checkbox"/>	10	10			No	<input type="checkbox"/>	0	2

Processor running time

Attention: It is recommended that you select "Dynamically determined by the system". Selecting "Determined by the user" risks suboptimal use of processor resources.

Dynamically determined by the system

Determined by the user

Running time: 1 to 100 milliseconds

Do not end the timeslice if a partition enters a wait state

Save to Profiles **Change Running System** Save and Change Reset Cancel Help

2. Select the **Initial Capping** box to hard cap the LPAR.
3. To make the change effective immediately, click **Change Running System**.
4. To make the change permanent for all subsequent image activations, click **Save to Profiles**.



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