Capacity Provisioning
Update for z/OS V1.13 and V1.12

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Wednesday, February 6, 2013
Session 13099

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Agenda

- Capacity Provisioning Overview and Updates
- IBM z/OS Management Facility Capacity Provisioning Task

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Today's challenges to manage capacity

- Unexpected events and workload spikes can afford higher processing capacity
- Manual capacity management can be time-consuming and error prone
- Capacity provisioning decisions must be made without sound data
Manual capacity upgrades
How it could look like

1. Workload increases 0 min
2. Operator realizes bottleneck 5-10 min
3. Operator informs system programmers and manager 2 min
4. Discussion 10 min
5. Logon to HMC, activate record 5 min

... meanwhile, so much workload may have queued up that one additional processor would be insufficient to decrease the queued workload

→ Two processors have to be added

CPM can react faster and reduce cost
Capacity Provisioning Capabilities Overview

- The Capacity Provisioning Manager (CPM) can control temporary processor resources on IBM zEC12, z196 or z10
  - General purpose capacity
    • In terms of model capacity and MSUs
  - Number of zAAPs or zIIPs
  - Can advise on logical processors
  - Can control one or more IBM zEnterprise or System z10 servers
    • Including multiple Sysplexes
  - Helps to control static power save mode of IBM zEnterprise systems

CPM allows for different types of provisioning requests:
- Manually at the z/OS console through Capacity Provisioning Manager commands
- Via a user defined policy at specified schedules
- Via a user defined policy by observing workload performance on z/OS
**Capacity Provisioning – Infrastructure**

- **z/OS WLM** manages workloads to goals and business importance
  - WLM indicators available through monitoring component
    - E.g. z/OS Resource Measurement Facility (RMF)
    - One RMF gatherer per z/OS system
    - One RMF Distributed Data Server (DDS) per Sysplex

- Capacity Provisioning Manager (CPM) retrieves critical metrics through CIM

- CPM communicates to support elements or HMC, via BCPii

- Graphical front end to administer Capacity Provisioning policies and Domain Configurations
  - Capacity Provisioning Control Center (CPCC) for Windows
  - Web based z/OSMF Task (V1R13)
Main Components of Capacity Provisioning

- **The Capacity Provisioning Manager (CPM)**
  - The server program that monitors the defined systems and CPCs and takes actions as appropriate and authorized by the policies.

- **The Graphical front ends**
  - Capacity Provisioning Control Center (CPCC) or z/OSMF Capacity Provisioning Task (V1R13)
  - The interface through which administrators work with provisioning policies and domain configurations.
  - Can be used to transfer provisioning policies and domain configurations files to the CPM, or to query the Capacity Provisioning Manager status.
  - Not required for regular operation of CPM.
Processing Modes

Capacity Provisioning Manager can operate in one of four modes that allow for different degrees of automation

- **Manual mode**
  - Server capacities can be controlled via CPM commands
  - Command driven mode where no CPM policy is active

- **Analysis mode**
  - CPM processes capacity provisioning policy and informs the operator when a provisioning / deprovisioning action would be due according to criteria specified in the policy.
  - It is up to the operator either to perform the up-/downgrade manually (using the HMC/SE or the available CPM commands) or to ignore that information.

- **Confirmation mode**
  - CPM processes the policy and interrogates the On/Off CoD record to be used for capacity provisioning.
  - Every provisioning action needs to be authorized (confirmed) by the operator.

- **Autonomic mode**
  - Similar to the confirmation mode, except that no human (operator) intervention is required.

Various reports are available with information about workload and provisioning status, and the rationale for provisioning recommendations.
CPM Policies and Processing Parameters

- CPM server uses three types of input:
  - **Domain configuration** defines the topology and connections, such as the CPCs and z/OS systems that are to be managed by the server
    - Contains the ID of the On/OffCoD record to use
  - **Policy** contains the information as to
    - Workload based activation
      - which work is provisioning eligible, under which conditions and during which timeframes,
      - how much capacity may be activated when the work suffers due to insufficient processing capacity
    - Schedule based activations
      - **PARM** data set contains setup instructions such as UNIX environment variables, and various processing options that may be set by an installation.
Domain configuration defines the CPCs and z/OS systems that are controlled by an instance of the CPM.

- One or more CPCs, sysplexes, and z/OS systems can be defined into a domain.
- Sysplexes and CPCs do not have to be completely contained in a domain but must not belong to more than one Capacity Provisioning domain.
- One active Capacity Provisioning policy per domain.
- Multiple Sysplexes and hence multiple WLM service definitions may be involved.
Policy Approach

The Capacity Provisioning policy defines the circumstances under which additional capacity may be provisioned:

- Three “dimensions” of criteria considered:
  - When is provisioning allowed
  - Which work qualifies for provisioning
  - How much additional capacity may be activated

- These criteria are specified as “rules” in the policy:

  ```
  If {
    - in the specified time interval
    - the specified work “suffers”
  }
  Then up to {
    - the defined additional capacity may be activated
  }
  ```

- The specified rules and conditions are named and may be activated or deactivated selectively by operator commands
Rules: Provisioning Conditions – Time

- Time condition defines when temporary capacity may be activated:
  - Start Time: provisioning of additional capacity allowed
  - Deadline: provisioning of additional capacity no longer allowed
  - End Time: deactivation of additional capacity should begin

<table>
<thead>
<tr>
<th>Name</th>
<th>Start Time</th>
<th>Deadline</th>
<th>End Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC1</td>
<td>03/15/11 08:00 AM</td>
<td>03/18/11 10:00 AM</td>
<td>03/19/11 10:00 AM</td>
</tr>
<tr>
<td>TC2</td>
<td>10/28/11 08:00 AM</td>
<td>10/28/11 04:00 PM</td>
<td>10/30/11 11:59 AM</td>
</tr>
</tbody>
</table>

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Rules: Recurring time conditions

- Recurring time conditions allow to define recurring time windows without resorting to ENABLE and DISABLE commands.
- Starting with z/OS 1.13 CPM supports (weekly) recurring time conditions:
  - Defined by start date, end date and day of week.
  - Available for z/OS V1.11, V1.12 through APAR OA35284.
Rules: Provisioning Conditions – Workload

- Identifies the work that may trigger the activation of additional capacity,
  - when that work does not achieve its goal due to insufficient capacity and
    additional capacity would help.
  - expressed as one or more WLM service class periods

- Starting with z/OS V1.12, Capacity Provisioning supports CICS and IMS
  work which is managed to WLM transaction goals. The support is available
  for z/OS V1.10 and V1.11 with APAR OA29641.

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Rules: Provisioning Conditions – Workload

- **Parameters:**
  - Sysplex/Systems: The z/OS systems that may run eligible work
  - Workload specification:
    - Importance Filter:
      Eligible service class periods, identified by WLM importance
    - Included Service Classes: Eligible service class periods
      Extends the set of Service Class periods with qualified work (extends the default set of default eligible service classes) and may specify different PI criteria
    - Excluded Service Classes: Identifies service class periods, that should not be considered
PI (Performance Index) criteria:

- **Provisioning PI + Duration:**
  PI of service class periods must exceed the provisioning PI for the specified duration before the work is considered to require help.

- **Deprovisioning PI + Duration:**
  PI of service class periods must fall below the deprovisioning PI for the specified duration the work is considered to no longer require help.

If no workload condition is specified a scheduled activation and deactivation will be performed:
- Full capacity as specified in the rule scope
- Unconditionally at the start and end times of the time condition
Sample Workload Condition

Sample definition:

**Name:** PT1  
**Sysplex:** PLEX1  
**System:** SYSA  
**Included Service Class Periods:**  
ONLINE in WLMSD with $PI \geq 1.8$ for 10 min until $PI \leq 1.2$ for 10 min  
**Excluded Service Class Periods:**  
BACKUP in WLMSD

Monitor Service Class PI's:

- Start Time: 03/15/11 8:00 AM  
- Deadline: 03/18/11 10:00 AM  
- End Time: 03/19/11 10:00 AM  

- Base Capacity  
- +20 MSU  
- +30 MSU  

$PI_{ONLINE}$  

$1.8$  

$1.2$  

$X$
Rules: Processor Scope Processor Limits

- CPC within provisioning domain for which activation of resources is allowed
- Max number of additional MSU/zAAPs/zIIPs that may be activated
  - Only the required delta capacity will be activated by the CPM
- Processor scope exists in two flavours:
  - Maximum processor scope defines an upper limit of resources that may be activated in total for all the contained rules at any point in time
  - Processor scope on the “rule“ level defines an upper limit of resources that may be activated for the single rule at any point in time
  - Allows for definitions like „I authorize 300 MSU for workload 1 and 200 MSU for workload 2, but at no point in time more than 400 MSU.“

<table>
<thead>
<tr>
<th>CPC</th>
<th>Max MSU</th>
<th>Max zAAPs</th>
<th>Max zIIPs</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPC1</td>
<td>400</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>CPC2</td>
<td>800</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Primary and secondary capacity quantum

- Provisioning increments allow for faster or more aggressive provisioning
- Starting with z/OS 1.13 CPM supports primary and secondary activation quantum
  - Primary quantum added for first activation on a given CPC
  - Secondary added on subsequent activations
  - Defined on “Maximum Processor Scope” panels
    - Only general purpose capacity supports primary and secondary quantum
- Available for z/OS V1.11, V1.12 through APAR OA35284
Additional CPM Processing and Directives

• For workload-based provisioning it is a necessary condition that the performance index exceeds the specified provisioning PI
  • However, that is not at a sufficient condition
  • The underlying CPM processing examines many metrics and parameter to ensure that:
    • The observed performance bottleneck is actually caused by a capacity bottleneck
    • That additional capacity could actually be consumed by the workload incurring the capacity demand

• Deprovisioning is under control of additional parameters
  • The “minimum activation time” specifies for how long any added capacity must remain active at a minimum.
    • It is specified in the PARM member

• For many aspects of the CPM processing additional directives may be specified in the PARM member
  • Refer to documentation for full list
Reports, Logs, Audit Trails

- History of actual workload and system activity available with CPM reports
  - Especially REPORT ACTIVITY, REPORT WORKLOAD
  - Reports can be directed to files and archived
- History of capacity changes available via CPM logging
  - Metrics, decisions and other data can be logged to file system
  - Binary format
- Other information available:
  - RMF Mon III data sets
  - Model and capacity changes recorded outside CPM
    - SMF22
    - RMF 70.1, 72
    - Current capacity information also available via STSI instruction, and related MVS programming interfaces
zEnterprise Static Power Save Mode
(requires APAR OA30433)

- Commands to enable or disable static power save mode:
  
  Syntax

  ```
  DISABLE POWERSAVE CPC=name
  ```

  ```
  ENABLE POWERSAVE CPC=name
  ```

- Existing reports are extended to report on power-save capability, and whether power-save mode can currently be enabled

  ```
  CPC R35 with record * is enabled (default enabled)
  CPC is matched with serial 000020089F25 since 07/23/2010 13:32:13
  Hardware is of type 2817 with model M49
  Current model is 722 with 2119 MSU, 1 zAAPs, and 1 zIIPs
  No usable OOCoD record available
  Power save mode is enabled
  ```

- If power-save mode cannot be re-enabled in current period: “Power save mode is disabled and not allowed”
- For CPCs supporting static power save mode the Provisioning Manager will not consider adding capacity based on the active policy while in power save mode
  - Already activated temporary capacity may be deactivated
  - ACTIVATE RESOURCE and DEACTIVATE RESOURCE commands are not affected by power save mode.
Capacity Provisioning Summary

- **Capacity Provisioning allows for faster reaction to workload fluctuations**
  - Replacing manual analysis with policy based monitoring of workloads
  - Customer defined criteria and objectives
  - Supports general purpose, zAAP, and zIIP capacity
  - Can be used to control z196 static power save mode

- **Can be configured to different levels of automation**
  - z/OS system commands for capacity changes
    - Eliminates need to access HMC
  - Scheduled capacity changes
  - Provide capacity recommendations to staff
  - Optionally, full automation, eliminating human intervention

- **z/OS base component**
  - z/OS Release 9 and above
  - Utilizes z/OS Resource Measurement Facility (RMF) or equivalent
  - Uses open standards protocol
    - Common Information Model (CIM)
  - Mostly zAAP eligible

- **Hardware Pre-requisites**
  - IBM zEC12, z196 or z10
  - Based on System z On/Off Capacity on Demand
Agenda

- Capacity Provisioning Overview and Updates
- IBM z/OS Management Facility Capacity Provisioning Task

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With z/OSMF R13 APAR PM74519 the Capacity Provisioning Task can be used as a replacement of the Capacity Provisioning Control Center.

- View the domain status, active configuration and active policy
- Full editing capability for Policies and Domain Configurations
- Import/Export functionality
- Install and Activate functionality
- Copy/Paste support
  - Whole policies or domain configurations
  - Single elements
- No installation on local workstation required
- Multi User support
Provision Manager Reports in z/OSMF

Complete your sessions evaluation online at SHARE.org/SanFranciscoEval
Policy Editing in z/OSMF
Policy Editing Guided by Messages

Capacity Provisioning

Policy ATSHARE
A provisioning policy contains a set of provisioning rules, which define the time periods in which additional capacity is required. The maximum processor scope restricts the systems on which Capacity Provisioning applies for these systems.

Policy name: ATSHARE
Description: Capacity Provisioning Demo Policy

Messages

Processor limit "CPC88"

ATSHARE → Rule1 → CPC88

Processor Limit CPC88
Define a processor limit for a CPC. A processor limit is activated for the CPC through all the contained systems.

- CPC: CPC88
- Max. MSU: 700
- Max. zAAP processors: 1
- Max. zIIP processors: 1

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Navigation between Edit Elements
Import and Installation

Import Policy from Domain

Select a connection, then a domain and then the policy you want to import.

The field "Connection" shows all connections that are defined in the Provisioning Manager tab.

* Connection: boeird6:5968 (HTTP)
* Domain: FCTR5
* Policy: ROLLPI2

Import
- Import with new name
- Policy name: POLY2
- Replace existing policy with same name

OK  Cancel  Help

Install Policy

Select a connection and then a domain you want to install the policy to.

Verify that the policy to be installed is correct.

Policy: ATSHARE
Description: Capacity Provisioning Demo Policy for San Francisco Share
Last modified: Jan 18, 2013 11:32:53 AM
Modified by: bossuda

The field "Connection" shows all connections that are defined in the Provisioning Manager tab.

* Connection: boeird6:5968 (HTTP)
* Domain: FCTR5

(Activate policy immediately after successful installation)

OK  Cancel  Help

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Documentation

- \textit{z/OS MVS Capacity Provisioning User’s Guide, SC33–8299}
  \url{http://publibz.boulder.ibm.com/epubs/pdf/iea2u141.pdf}

- Website under the Capacity Provisioning homepage
  \url{http://www-03.ibm.com/systems/z/os/zos/features/cpm/}

- IBM \textit{z/OS Management Facility Website}
  \url{http://www-03.ibm.com/systems/z/os/zos/zosmf/}

- \textit{zEnterprise System Capacity on Demand User's Guide, SC28-2605}
  \url{http://www-01.ibm.com/support/docview.wss?uid=isg296907662ee3456d1852577690056367e}

- ITSO Redbook:
  \textit{System z10 Enterprise Class Capacity on Demand, SG24-7504}
  \url{http://www.redbooks.ibm.com/abstracts/sg247504.html?Open}

- Capacity on Demand advancements on the \textit{IBM System z10, IBM J. RES. & DEV. VOL. 53 NO. 1 PAPER 15 2009}
  \url{http://www.research.ibm.com/journal/abstracts/rd/531/axnix.html}
WLM, RMF, CPM Sessions

- **12792**: Remote RMF Report Access – Hands-on Lab  
  Juergen Baumann  
  Monday 02/04, 3:00-4:00 PM, Union Square 23-24, Fourth Floor

- **13088**: Workload Management Update for z/OS V1.13 and V1.12  
  Brad D. Snyder  
  Tuesday 02/05, 4:30-5:30 PM, Yosemite C, Ballroom Level

- **13099**: Capacity Provisioning Update for z/OS V1.13 and V1.12  
  Juergen Baumann,  
  Wednesday 02/06, 6:00-7:00 PM, Yosemite C, Ballroom Level

- **13089**: RMF: The Latest and Greatest  
  Brad D. Snyder  
  Thursday 02/07, 8:00-9:00 AM, Yosemite C, Ballroom Level

- **13090**: z/OS Workload Manager: What Are You Thinking  
  Brad D. Snyder  
  Thursday 02/07, 4:30-5:30 PM, Yosemite B, Ballroom Level
<table>
<thead>
<tr>
<th>ID</th>
<th>Day</th>
<th>Time</th>
<th>Title</th>
<th>Presenters</th>
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<tbody>
<tr>
<td>13059</td>
<td>2/5</td>
<td>9:30 – 10:30</td>
<td>z/OSMF What is it? And why would I want it?</td>
<td>Anuja Deedwaniya</td>
<td>Franciscan B, Ballroom Level</td>
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<tr>
<td>13052</td>
<td>2/5</td>
<td>12:15 – 1:15</td>
<td>Engaging Users and Reducing Complexity: z/OSMF Project Usability Discussion</td>
<td>Toshiba Burns-Johnson</td>
<td>Franciscan B, Ballroom Level</td>
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<td>13061</td>
<td>2/6</td>
<td>1:30 – 2:30</td>
<td>z/OSMF Advanced Functionality</td>
<td>Anuja Deedwaniya</td>
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<td>13048</td>
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<td>z/OSMF Roundtable</td>
<td>Anuja Deedwaniya</td>
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<td>13099</td>
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<td>6:00 – 7:00</td>
<td>Capacity Provisioning Update for z/OS 1.13 and 1.12</td>
<td>Juergen Baumann</td>
<td>Yosemite C, Ballroom Level</td>
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<td>13082</td>
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<td>8:00 – 9:00</td>
<td>New z/OSMF Software Management Capabilities</td>
<td>Greg Daynes</td>
<td>Franciscan B, Ballroom Level</td>
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<td>13089</td>
<td>2/7</td>
<td>8:00 – 9:00</td>
<td>RMF: The Latest and Greatest</td>
<td>Brad Snyder</td>
<td>Yosemite C, Ballroom Level</td>
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<td>13100</td>
<td>2/7</td>
<td>9:30 – 10:30</td>
<td>Manage your Workloads and Performance with z/OSMF</td>
<td>Juergen Baumann</td>
<td>Yosemite C, Ballroom Level</td>
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<td>z/OSMF User Experience</td>
<td>Doug Henry (US Bank) Mary Anne Matyaz (U.S. Customs) Anuja Deedwaniya(IBM)</td>
<td>Imperial A, Ballroom Level</td>
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<td>Marna Walle Greg Daynes</td>
<td>Union Square 23-24, Fourth Floor</td>
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<td>8:00 – 9:00</td>
<td>z/OSMF Software Management Hands-on Lab</td>
<td>Greg Daynes</td>
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Closing Slide –
Capacity Provisioning
Update for z/OS V1.13 and V1.12

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