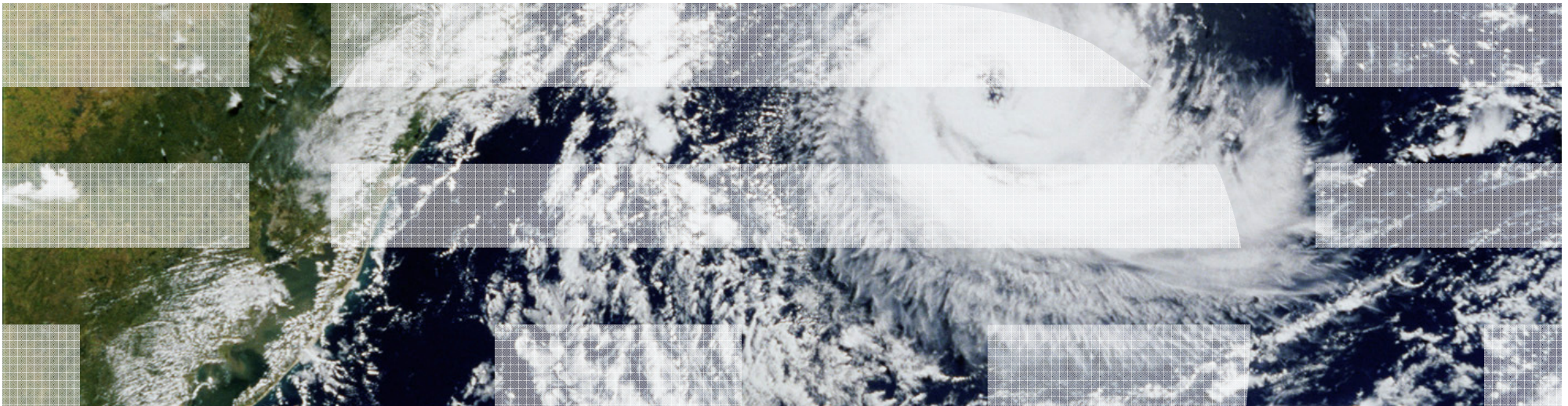


z/OS Capacity Provisioning: Overview and Update for z/OS V1.12

SHARE in Boston – 04 Aug 2010

Session Number 7780



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Agenda



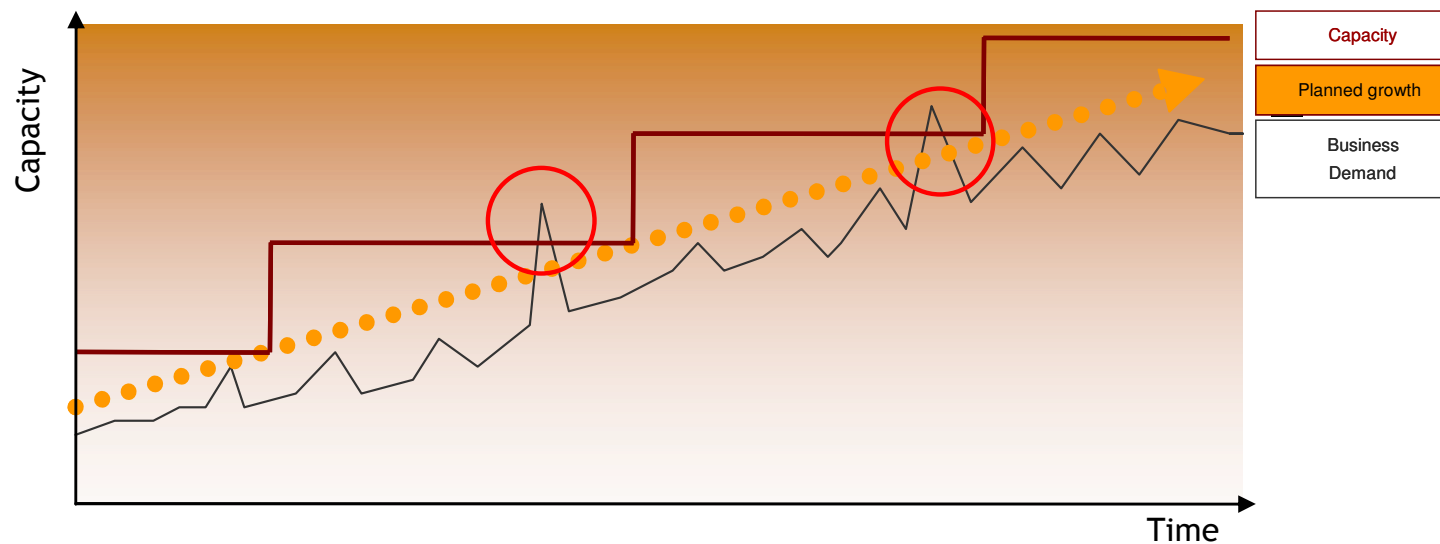
- *Capacity Provisioning Overview*
- *Capacity Provisioning to simplify management of temporary capacity*
 - *Processing Modes*
 - *CPM Configuration*
 - *Reports, Logs, Audit Trails*
 - *Updates and future enhancements*
 - *Documentation*
- *Implementation Steps*



IBM z/OS Capacity Provisioning Basics



- **Contained in z/OS base component free of charge**
 - Requires z/OS RMF element, or equivalent
 - Runs on z/OS Release 9 and above
- **Based on System z On/Off Capacity on Demand Feature**
(zEnterprise 196 or System z10)



Capacity Provisioning Capabilities Overview



- The Capacity Provisioning Manager (CPM) can control temporary processing on IBM z196 or z10
 - Number of zAAPs or zIIPs
 - General purpose capacity
 - Considers different capacity levels (i.e. effective processor speeds) for subcapacity processors (general purpose capacity)
 - Can advise on logical processors
 - Can control one or more IBM zEnterprise or System z10 servers
 - Including multiple Sysplexes
 - Provides command interface to z196 static power save mode

CPM differentiates between different types of provisioning requests:

- Manual requests from the z/OS console through Capacity Provisioning Manager commands
- Via user defined policy at specified schedules
- Via user defined policy by observing workload performance on z/OS

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

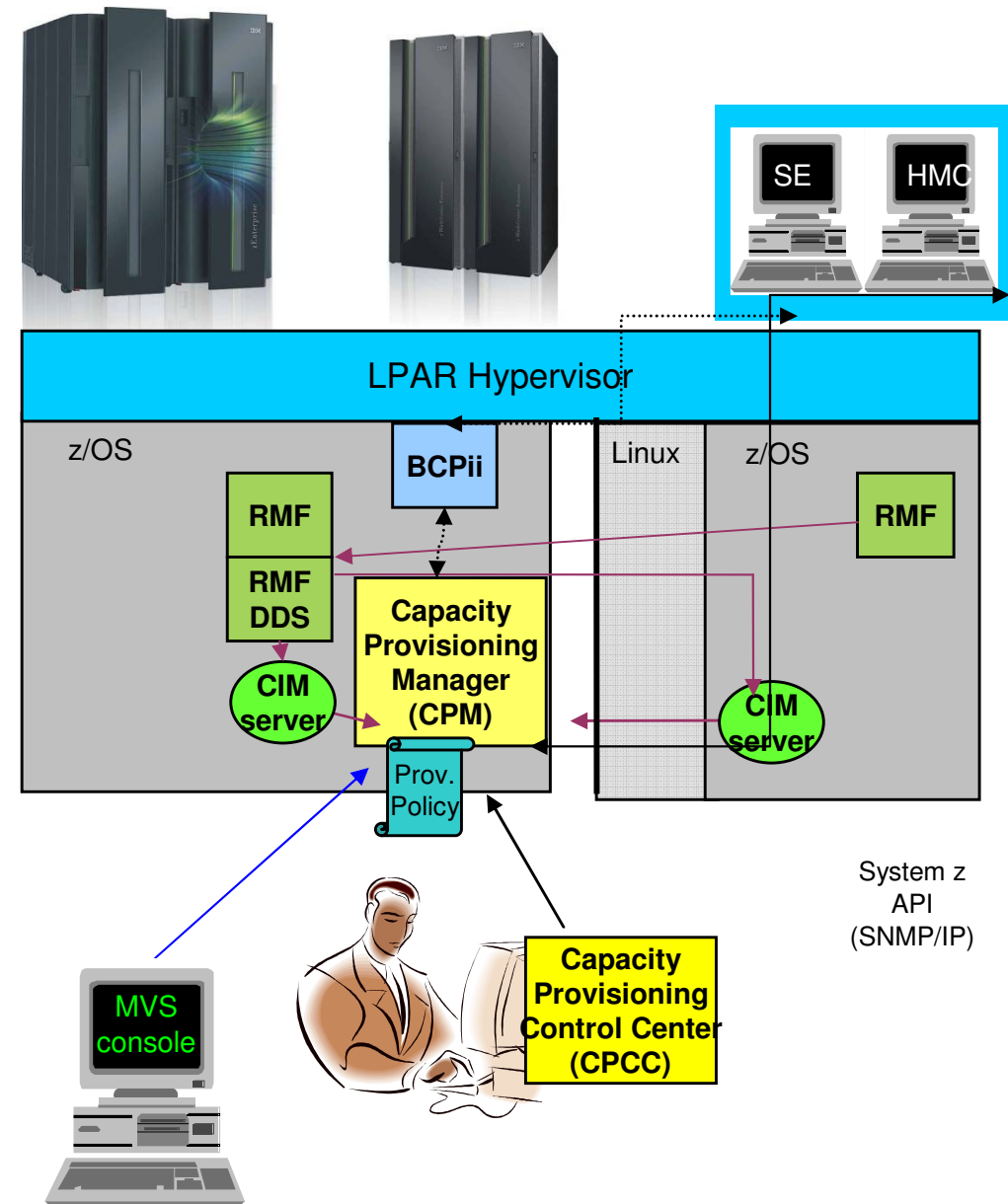
... meanwhile, so much workload may have queued up that one additional processor would be insufficient to decrease the queued workload

→ Two processors have to be added

CPM can react faster and reduce cost

Capacity Provisioning – Infrastructure in a Nutshell

- 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
 - 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 - recommended
 - System z API (SNMP via IP)
- Capacity Provisioning Control Center is front end to administer Capacity Provisioning policies



Overview on Observed Metrics

CPC Metrics

- Per processor type
 - Shared physical utilization
 - Total logical processors
 - Total weights
 - Physical processors

LPAR/System Metrics

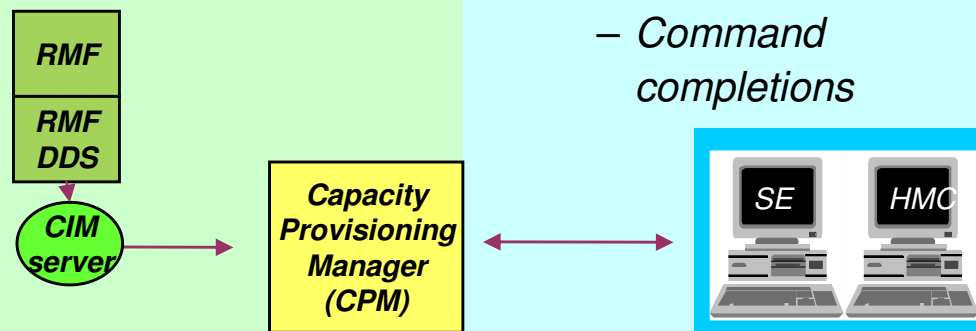
- *WLM Service definition, policy, service classes Shared/dedicated*
- *Initial capping*
- *Defined capacity*
- *Capping*
- *4h Rolling Average*
- *Dispatchable units (InR Queue)*
- *IRD weight & vary CPU mgmt*
- *Per processor type*
 - *Online CPs, zAAPs, zIIPs*
 - *Reserved processors*
 - *LPAR weight*
 - *MVS utilization*
 - *LPAR utilization*

Service Class Period Metrics

- *Local PI*
- *Sysplex PI*
- *%Capped*
- *Delays*
- *Per processor type*
 - *Processor delays*
 - *TCB, SRB*

Support Element

- *H/W model*
- *Spare processors*
- *Installed OOCoD records*
- *Current S/W model*
- *Current number of processors*
- *For OOCoD record*
 - *Activation limits, validity, current activation level*
- *Event subscriptions*
 - *Capacity accounting change*
 - *Command completions*



Main Components of Capacity Provisioning

▪ The Capacity Provisioning Manager (CPM)

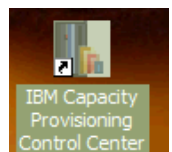
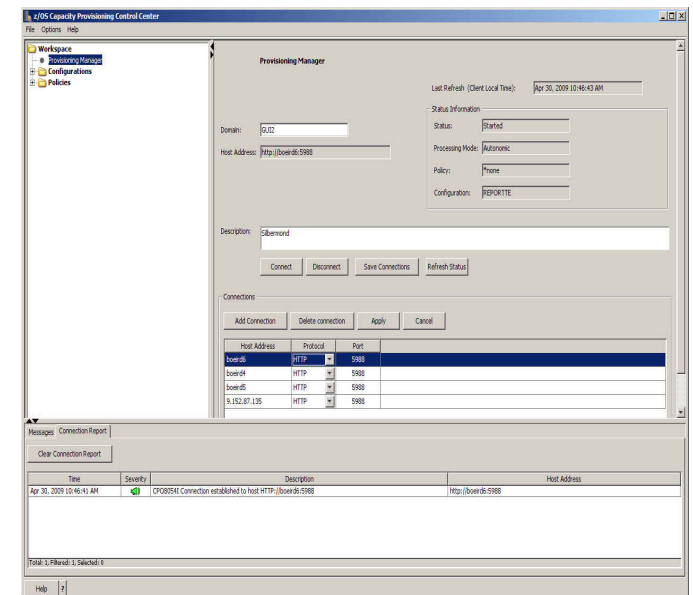
– is the server program that monitors the defined systems and CPCs and takes actions as appropriate and authorized by the policies.

▪ The Capacity Provisioning Control Center (CPCC)

– is the Graphical User Interface (GUI) component. It is the interface through which administrators work with provisioning policies and domain configurations.

– Optionally, you can use the CPCC to transfer provisioning policies and domain configurations files to the CPM, or to query the Capacity Provisioning Manager status.

– The CPCC is installed and used on a Windows™ workstation. It is not required for regular operation of CPM.



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- *Capacity Provisioning Overview*
- *Capacity Provisioning to simplify management of temporary capacity*
 - *Processing Modes*
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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 ignore that information or to perform the up-/downgrade manually (using the HMC/SE or the available CPM commands)

- **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

Agenda



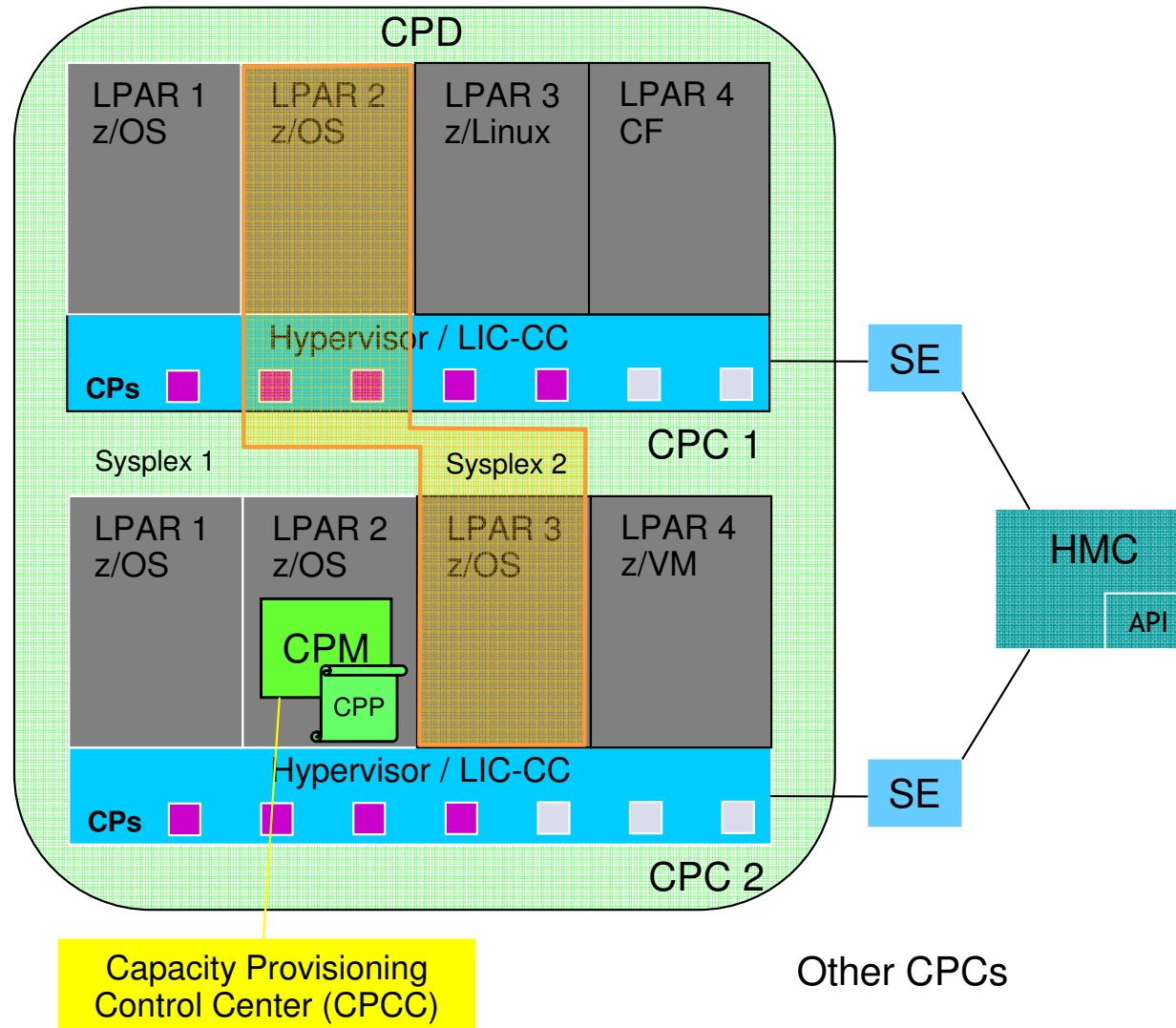
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CPM Policies and Processing Parameters

- 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
 - **Policy** contains the information as to
 - 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
 - **PARM** data set contains setup instructions such as UNIX environment variables, and various processing options that may be set by an installation.

Domain Configuration



- 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

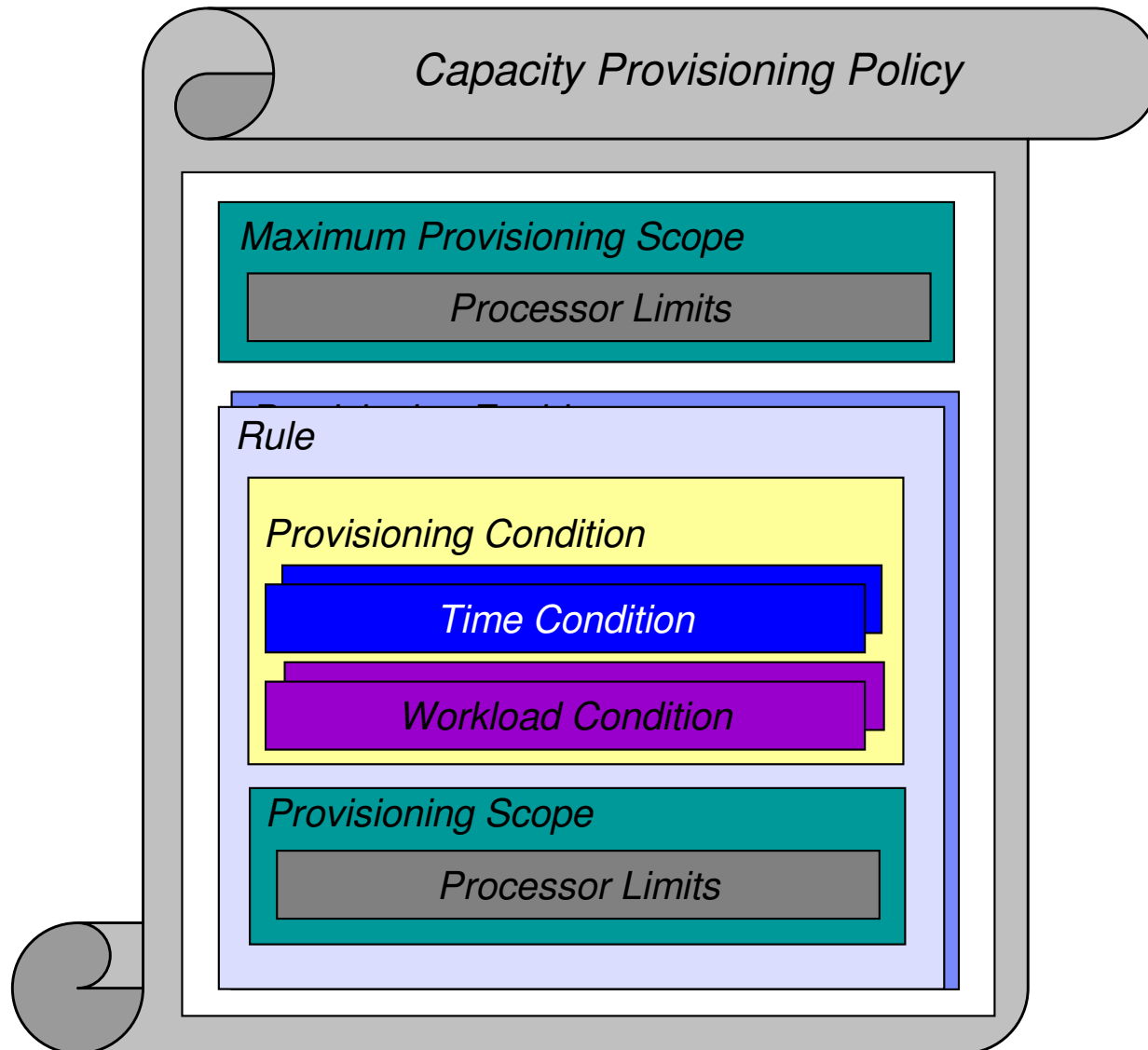
The Capacity Provisioning policy defines the circumstances under which additional capacity may be provisioned:

- 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

Policy Overview

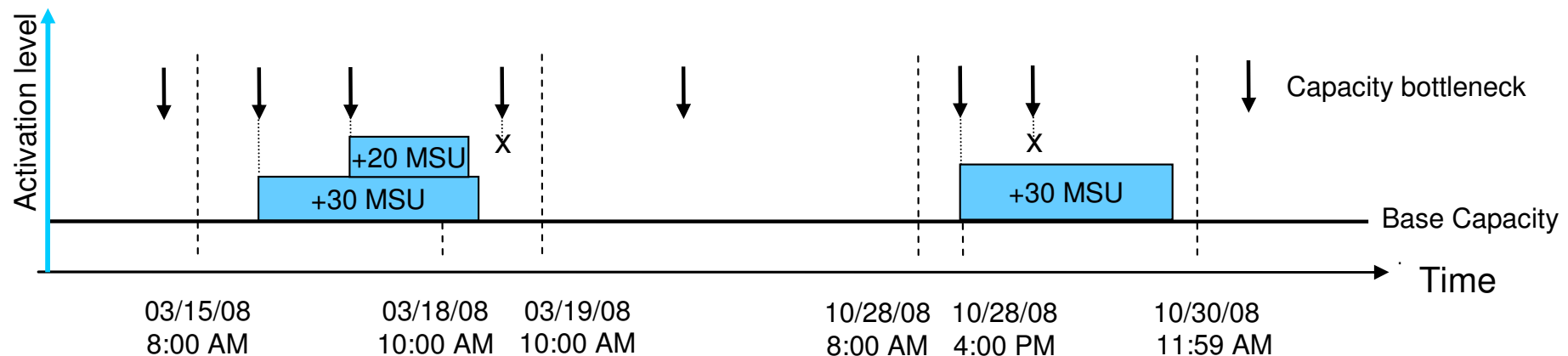


- The „Maximum Provisioning Scope“ defines the maximum additional capacity that may be activated, by all the contained rules
- „Provisioning Condition“ is simply a group of Time and Workload Conditions that can be referred to via its name
- “Provisioning Scope” defines the maximum capacity that may be activated based on the rule
 - Specified as number of zAAP/zIIP processors, or
 - MSU for general purpose capacity

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

Name	Start Time	Deadline	End Time
TC1	03/15/08 08:00 AM	03/18/08 10:00 AM	03/19/08 10:00 AM
TC2	10/28/08 08:00 AM	10/28/08 04:00 PM	10/30/08 11:59 AM



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
- Previously, CICS and IMS transaction service classes could be used to trigger provisioning actions
 - Service classes that the servers are managed to could always be used, though.

Restriction was eliminated with z/OS V1.12. Rollback to V1.10 and V1.11 via

OA29641

Workload Condition Properties

Policy: SAMPWLD1

Rule: EndOfOct_WEB

Condition: EndOfOct_WEB

Workload Condition: WEB_App

Description: Workload condition for WEB application

* Sysplex: *

* System: SYS1

Importance Filters: **Included Service Classes** Excluded Service Classes

Service Definition	Service Policy	Service Class	P...	Provisioning PI	Duration in min	Deprovisioning PI	Duration ...	PI-Scope
*	*	SCWEB	1	1.6	10	1.3	20	System

Workload Condition Parameters

- 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

Workload Condition Parameters cont.

- PI (Performance Index) criteria:
 - Activation threshold:
PI of service class periods must exceed the activation threshold for a specified duration before the work is considered to require help.
 - Deactivation threshold:
PI of service class periods must fall below the deactivation threshold for a specified duration the work is considered to no longer require help.

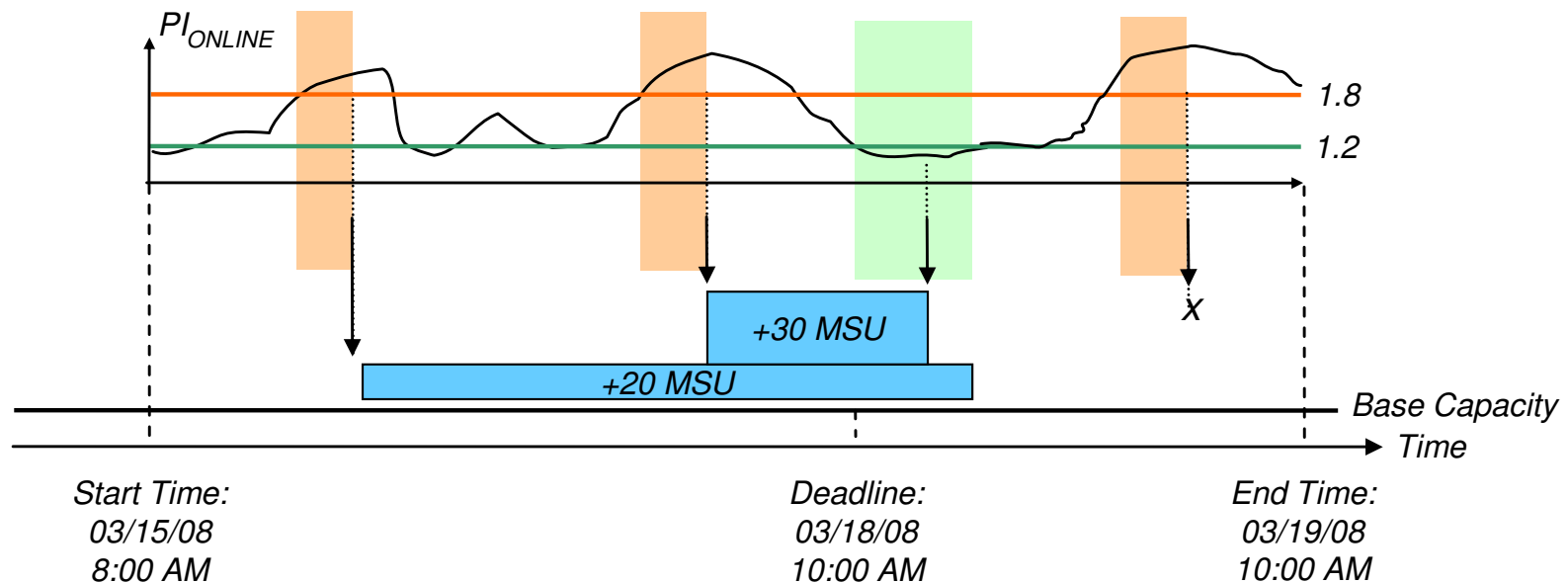
- If no workload condition is specified a scheduled activation and deactivation will be performed:
 - Full capacity as specified in the rule scope
 - Unconditionally at the start and end times of the time condition

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:



Rule: Provisioning 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
- Provisioning scope exists in two flavors:
 - Maximum provisioning scope defines an upper limit of resources that may be activated **in total** for all the contained rules at any point in time
 - Provisioning 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.“

CPC	Max MSU	Max zAAPs	Max zIIPs
<i>CPC1</i>	<i>400</i>	<i>3</i>	<i>5</i>
<i>CPC2</i>	<i>800</i>	<i>0</i>	<i>0</i>

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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
 - Current capacity information also available via STSI instruction, and related MVS programming interfaces

Agenda



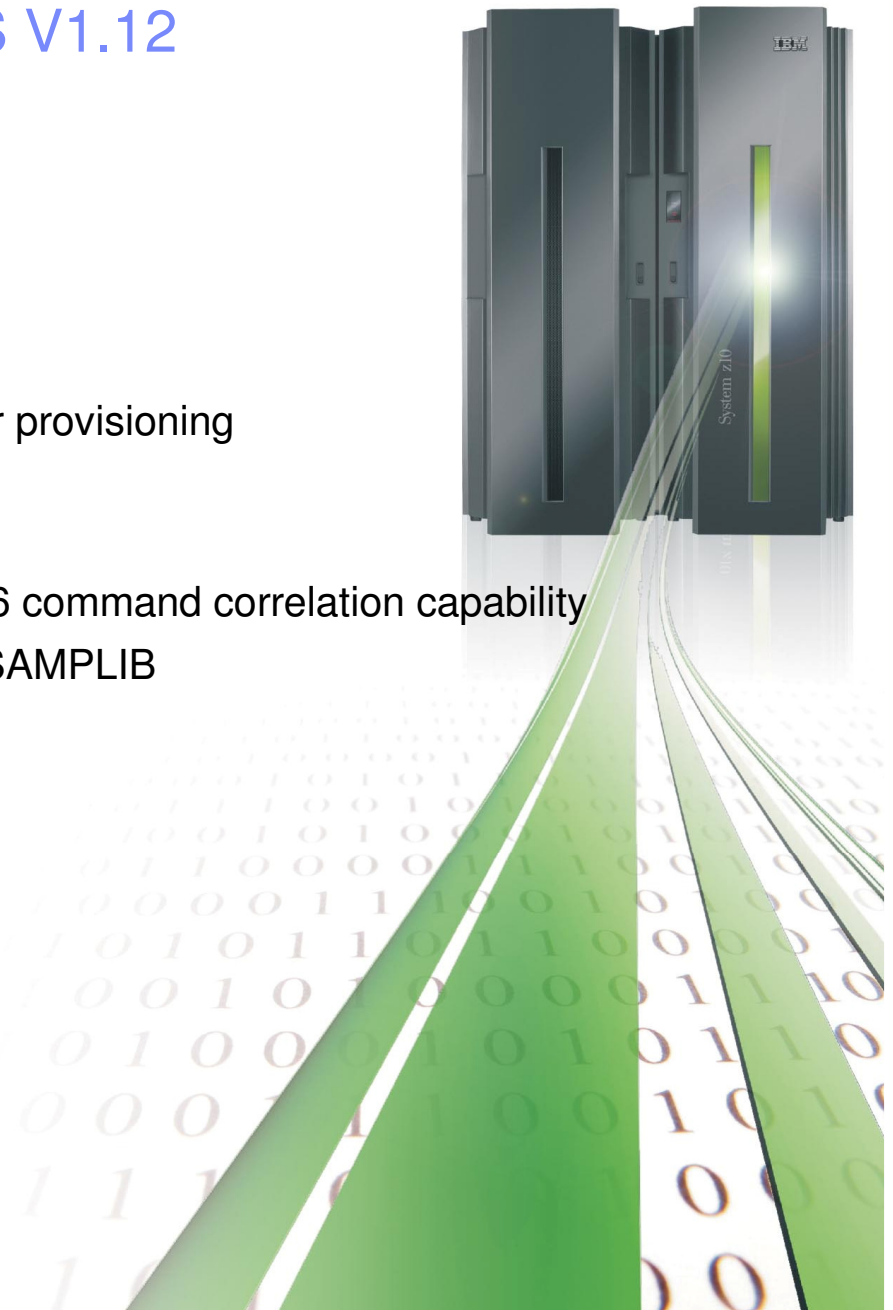
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Capacity Provisioning Enhancements in z/OS V1.12

- Capacity Provisioning management enhancements
 - Also CICS and IMS *transaction* service class may trigger provisioning actions
 - Installation can specify to use “rolling PI” management for provisioning durations
 - Better management if PIs fluctuate
 - More reliable hardware control by exploiting z10 and z196 command correlation capability
 - Simplified setup via sample security definitions in SYS1.SAMPLIB
 - Commands to control z196 static power save mode

- Control Center Enhancements
 - New install process
 - Multiple releases can be installed in parallel
 - Support for Windows Vista [™]
 - Additional reports available in UI
 - Domain, Configuration and active policy





Support of zEnterprise 196 – Static Power Save Mode



- Commands to disable or enable static power save mode:

Syntax

►► `DISABLE POWERSAVE CPC=name`
 `D PS`

►► `ENABLE POWERSAVE CPC=name`
 `E PS`

– Commands not available on z/OS V1.9

- 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 00CoD 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.

Sample CPCC Report in z/OS V1.12

z/OS Capacity Provisioning Control Center - Domain GUI2

File Options Help

Workspace

- Provisioning Manager
 - Status
 - Active Configuration
 - Active Policy
 - Domain
- Configurations
- Policies

Active Configuration

Configuration: CKDM1

Status:

Last Refresh At:

Time Zone:

CPCs

Name	Record ID	Active MSU	Active zAAPs	Active zIIPs	Enabled	Default Enabled
DAN2	*	N/A	N/A	N/A	<input type="checkbox"/>	<input type="checkbox"/>
ECL2	CR7LYKLY	174	0	3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
H42	*	N/A	N/A	N/A	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

General

CPC: ECL2 Serial: 000510070882

Type/Model: 2097/E40

Correlation Status: Matched Correlation Status Since:

Error Status: No Error

Configuration

Current:		Permanent:	
Model:	725	Model:	722
MSU:	1805	MSU:	1631
zAAPs:	4		
zIIPs:	7		
Spares:	2		

On/Off CoD Status

Record ID: CR7LYKLY

MSU: 174

Capacity Level: 0

	Active	Limit	Remaining
CPs:	3		N/A
zAAPs:	0	4	N/A
zIIPs:	3	4	N/A

Sample AutoReplies provided in z/OS V1.12

- IBM-Supplied SYS1.PARMLIB(AUTOR00) specifies default auto-replies for messages CPO4205I and CPO4206I
 - These are issued when CPM-initiated capacity changes were not detected within the specified timeframe
 - Default reply says to continue managing from current capacity setting

```
BROWSE      SYS1.PARMLIB(AUTOR00)                               Line 00000342 Col
Command ==> _____ Scroll =
/*****/
/* CP04205I CPC name: Enter '1' to keep waiting for pending      */
/*           activation or '2' to accept current capacity setting */
/*                                                                 */
/* Rule: 3                                                         */
/*                                                                 */
   Msgid(CP04205I)   Delay(60S) Reply(2)
/*****/
/* CP04206I CPC name: Enter '1' to keep waiting for pending      */
/*           deactivation or '2' to accept current capacity setting */
/*                                                                 */
/* Rule: 3                                                         */
/*                                                                 */
   Msgid(CP04206I)   Delay(60S) Reply(2)
```

Security setup samples for multiple components

- Security setup especially for the CIM component can be difficult because the description needs to allow for many permutations of possible configuration options.
- For most installations those different options are unneeded complexity:
 - A “fast-path” configuration best on recommended options can accelerate the setup
- With z/OS V1.12 the CIM and Capacity Provisioning components provide consistent samples in SYS1.SAMPLIB
 - CFZSEC for CIM (to be run first)
 - CPOSEC1,2 for Capacity Provisioning
 - Also z/OSMF security definitions are compatible
- Samples provide customizable job streams with RACF definitions
- It is required to
 - Review samples for compatibility with your environment
 - Complete with information for which no meaningful default exists

New Function Overview

<i>z/OS (CPM) release</i> <i>Function</i>	<i>z/OS V1.12</i>	<i>z/OS V1.11</i>	<i>z/OS V1.10</i>	<i>z/OS V1.9</i>
<i>z196 Static Power Save Mode</i>	OA30433	OA30433	OA30433	OA30433 Toleration-only
<i>Samples for security definitions (CIM, CPM, z/OSMF)</i>	+ (OA32854)			
<i>Control Center reporting enhancements, Windows Vista™ support</i>	+			
<i>CICS/IMS transaction classes support</i>	+	OA29641	OA29641	
<i>RMF provider can locate DDS dynamically</i>	+	OA31118	OA31118	
<i>z/OS BCPii Support and Logical Processor Mgmt</i>	+	+	OA25426 OA24945	

+: Support integrated into release base

Control Center Interoperability

z/OS (CPM) release \ CPCC	z/OS V1.12	z/OS V1.11	z/OS V1.10	z/OS V1.9
CPCC V1.12	+	-	-	
CPCC V1.11	☺	+	+	☺
CPCC V1.10	☺	+	+	☺
CPCC V1.9		☺	☺	+

+: Fully interoperable

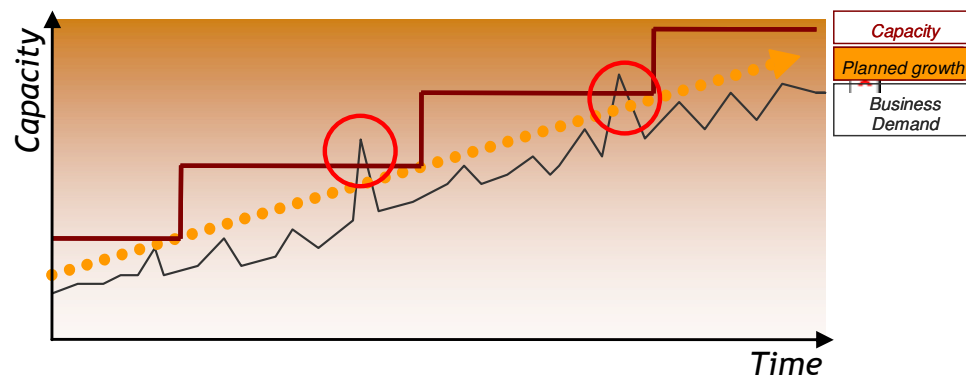
☺ : Compatible. Limited to common functionality

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 Monitoring Facility (RMF) or equivalent
- Uses open standards protocol
 - [Common Information Model \(CIM\)](#)

- Mostly zAAP eligible

- **Hardware Pre-requisites**

- IBM zEnterprise 196, or System z10 EC or BC
- Based on System z On/Off Capacity on Demand

Documentation

- *z/OS MVS Capacity Provisioning User's Guide*, SC33-8299, at <http://publibz.boulder.ibm.com/epubs/pdf/iea2u130.pdf>
- *IBM DEMOzone Demonstration of Capacity Provisioning*
http://www.demos.ibm.com/servers/Demo/IBM_Demo_IBM_z_OS_Capacity_Provisioning-Jan09.html
- *Website under the WLM homepage*
<http://www.ibm.com/servers/eserver/zseries/zos/wlm/cp>
- *ITSO Redbook:*
System z10 Enterprise Class Capacity on Demand, SG24-7504
<http://www.redbooks.ibm.com/abstracts/sg247504.html?Open>



- *Capacity on Demand advancements on the IBM System z10, IBM J. RES. & DEV. VOL. 53 NO. 1 PAPER 15 2009*
<http://www.research.ibm.com/journal/abstracts/rd/531/axnix.html>

Thank you!

धन्यवाद

Hindi

多謝

Traditional Chinese

ขอบคุณ

Thai

Спасибо

Russian

Gracias

Spanish

Thank You

English

Obrigado

Brazilian Portuguese

شكراً

Arabic

多谢

Simplified Chinese

Danke

German

Bedankt

Dutch

Grazie

Italian

Merci

French

நன்றி

Tamil

ありがとうございました

Japanese

감사합니다

Korean



Backup



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Suggested Implementation Sequence (1)

1. Verify pre-requisite software (Monitoring component, Java) and recommended service
 - See subsequent charts

2. Set up z/OS RMF, including Distributed Data Server
 - In most installations this will already be done

3. Set up z/OS CIM
 - Follow [z/OS Common Information Model User's Guide](#)
 - Include „Appendix F. Connecting the RMF CIM providers to the RMF Distributed Data Server (DDS)”
 - No need to include “Cluster / Couple Dataset / JES2-JES3Jobs Provider Setup”

Suggested Implementation Sequence (2)

4. Set up z/OS Capacity Provisioning

- Follow [z/OS MVS Capacity Provisioning User's Guide](#), chapter 3
 - On z/OS R10 and above decide whether to use BCPii (recommended), or SNMP

If BCPii is chosen,

-Verify PSP bucket and required microcode level-set up Common Event Adapter in full function mode, and the HWIBCPii address space.

For both BCPii and SNMP some definitions are required at Support Element/HMC.

5. Verify Capacity Provisioning function

- Some CPM “PARM” settings simplify testing
 - Accelerate via reduced time duration
 - Provisioning suggestions in relatively uncinstrained environment
- Enable logging
- Enable tracing, if problems are encountered

Capacity Provisioning Service Data



- Capacity Provisioning is z/OS BCP FMID
 - z/OS V1.12: HPV7770
 - z/OS V1.11: HPV7760
 - z/OS V1.10: HPV7750
 - z/OS V1.9: HPV7740
- Component ID (COMPID): 5752SCCAP
- Required service (all components, not just Capacity Provisioning) is identified via functional PSP bucket
 - Use “**CAPPROV/K**” keyword to search
- Capacity Provisioning APARs that include a new level of the Capacity Provisioning Control Center (CPCC) specify a **++HOLD REASON(DOWNLD)** action

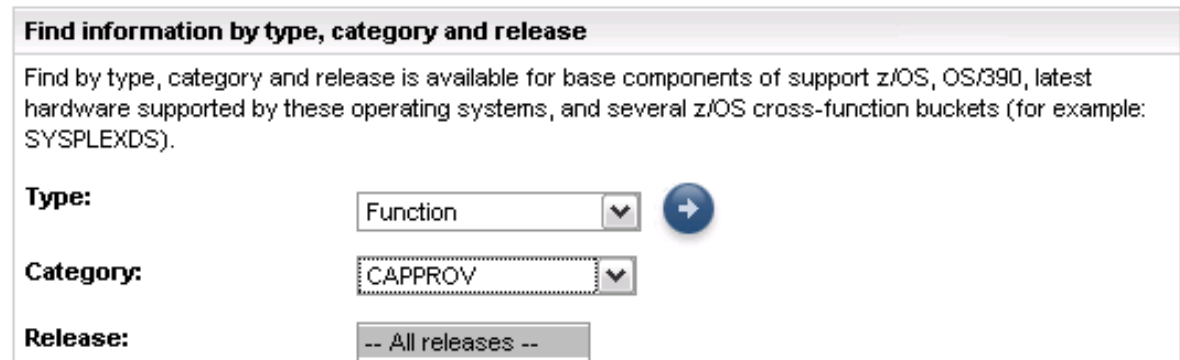
How to obtain a Functional PSP Bucket

- Go to http://techsupport.services.ibm.com/390/psp_main.html

Preventive Service Planning buckets


for mainframe operating environments

- Select Type=Function
- Select Category=CAPPROV



Find information by type, category and release

Find by type, category and release is available for base components of support z/OS, OS/390, latest hardware supported by these operating systems, and several z/OS cross-function buckets (for example: SYSPLEXDS).

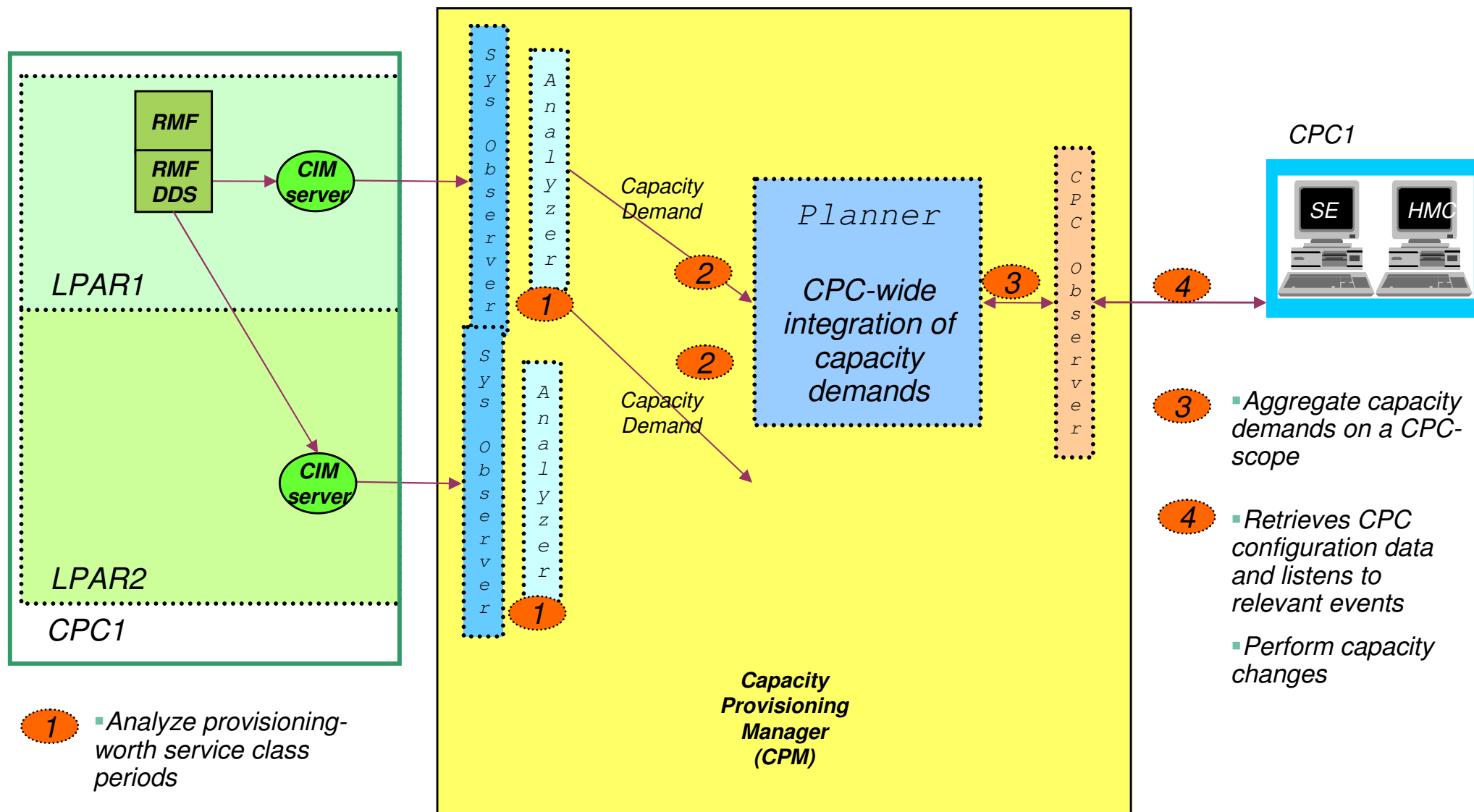
Type: 

Category:

Release:

- Alternatively, search for APARs containing CAPPROV/K

Workload Analysis and Planning

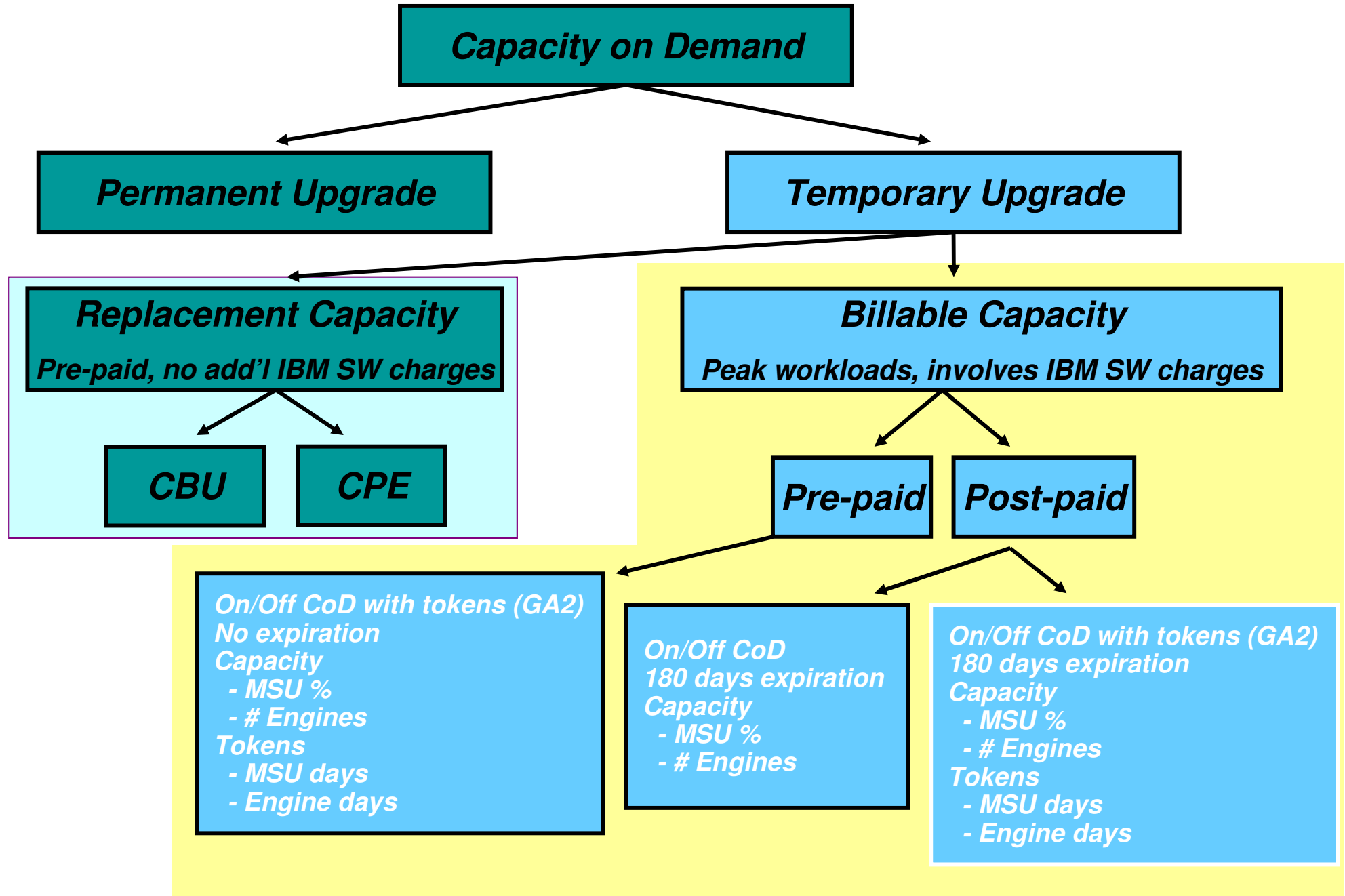


1 Analyze provisioning-worth service class periods

2 Inform planner component of capacity demands. E.g.
`Pescp[Identifier[SVPLEX7/R76/basepol/BASEPOL/CPMPCU/1]]`
 registers Capacity Demand with Provisioning Types
`[SpeedStep]` and State `CapacityDemandState.ACTIVE`

- 3** Aggregate capacity demands on a CPC-wide scope
- 4** Retrieves CPC configuration data and listens to relevant events
- Perform capacity changes

z10 – Basics of CoD



z10 On/Off CoD Overview

- *Temporary CP capacity up to 100% of purchased capacity*
- *Number of temporary zIIPs or zAAPs \leq total number of permanent + temporary CPs*
- *Number of temporary IFLs up to the total of purchased IFLs*
- *Number of temporary ICFs plus permanent ICFs \leq 16*

- *Number of real activations = unlimited, with unlimited duration*

- *Post paid Offering*
 - *record expires after 180 days*
 - *Optional: set spending limits on the offering*
- *Pre-paid Offering*
 - *No expiration date*

- *Tokens to control pre-paid offering or to set spending limits on post-paid offering*
 - *'telephone card'*
 - *Tokens are reduced based on highest usage within a 24 hour period*
 - *'MSU day' tokens for CPs and 'processor day' tokens for specialty engines*

What's z/OS CIM



The Common Information Model (CIM)

A system independent data model that describes resources in an IT enterprise

The CIMXML over HTTP communications protocol

A network protocol that defines how to access data objects in the Common Information Model

The CIM Server Infrastructure

An http-like server program that implements the mapping of the resources described in the Common Information Model and the system specific resources

The z/OS CIM Server

An Implementation of the CIM/WBEM Standard

