

z/OS Capacity Provisioning



Management Concepts & Basic Mechanisms
+ z/OS V2R3 updates

Agenda

- *Capacity Provisioning's Field of Activity*
- *Infrastructure and Processing Modes*
- *Configuration & Management Actions*
- *Reports, Logs & Audit Trails*
- *Documentation*

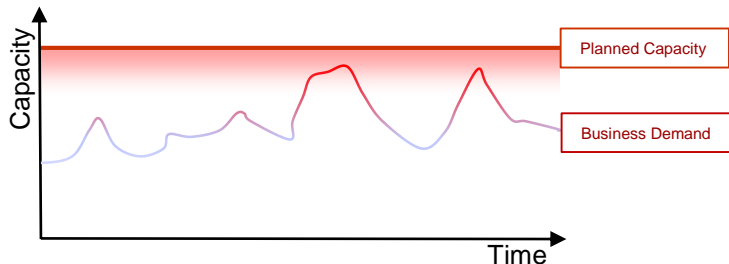


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Rationale – Changing the approach to Capacity Planning

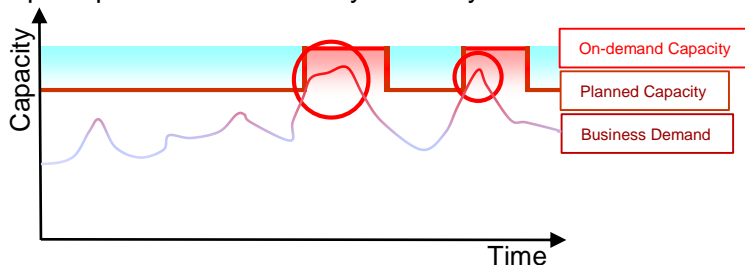
▪ **Static - setting maximum limit**

- Planning is guided by *potential* consumption peaks
- Certain probability of Billing Periods with surplus capacity that remains unused



▪ **Elastic - setting base capacity limit**

- Planned capacity is based on *expected* consumption
- Unexpected consumption peaks are covered dynamically



Rationale - Manual capacity upgrades

- | | | |
|----|---|----------|
| 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, change capacity | 5 min |

... meanwhile, so much workload may have queued up that a small amount of additional capacity would be insufficient to decrease the queued workload

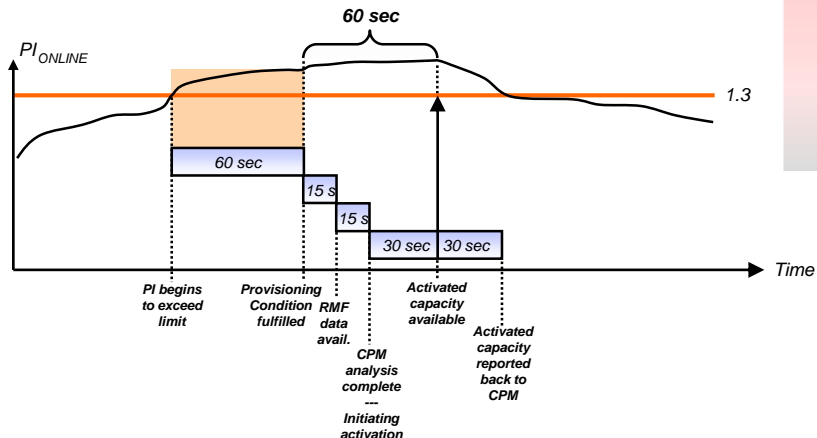
→ Much more capacity has to be added



CPM can react faster and reduce cost

Rationale - CPM activation reaction time – typical delays

1. Policy ProvisioningCondition fulfilled – full duration (e.g. PI above 1.3 for at least **1 minute**) **60 sec**
2. RMF MinTime (e.g. **30 seconds**) reporting delay - Ø 50% **+15 sec**
3. CPM Analyzer.CycleTime evaluation delay – Ø 50% (adjustable to e.g. **30 seconds**) **+15 sec**
4. OOCoD activation lag (**60 seconds** on z13 by BCpii/HW) - Ø 50% **+30 sec**



=> Aggregated
detection
+ activation
delays of
60 seconds



Rationale - Capacity Provisioning Basics

- Capacity Provisioning is a **z/OS base** component
 - **Free** of charge
- CPM is mostly zAAP* eligible Java workload
(*zIIP when run on z13 systems)
- Uses BCPii for communication with Hardware (SE/HMC)
- Uses z/OS base element CIM for internal communication (with z/OSMF) and with performance monitoring
- For **on-demand** management, requires a **monitoring component** on each observed z/OS system (such as z/OS RMF or equivalent)
- Exploits System z **On/Off Capacity on Demand** feature
 - On/Off Capacity on Demand record must be active
 - Activates CPC-shared processors
- Exploits **Defined Capacity** and **Group Capacity**
- A single **Capacity Provisioning Manager** instance can control capacity on **any number of CPCs or z/OS systems**
 - Management not limited to Capacity Provisioning Manager's local CPC or local sysplex



Rationale - Main Components of Capacity Provisioning

■ The Capacity Provisioning Manager (CPM)

- The server program that monitors defined systems and CPCs
- Is customized with the Capacity Provisioning Domain Configurations and Policies
- Takes management actions as appropriate

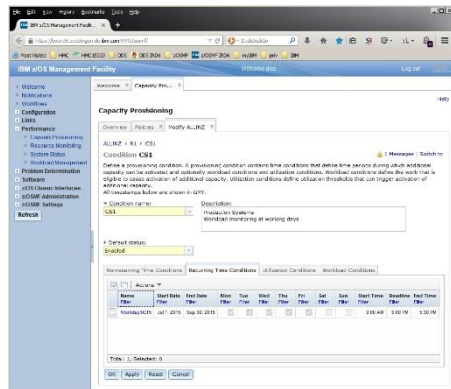
```
CP01042I Activity report generated at 11/17/2015 07:51:47

Number of activities between 11/15/2015 and 11/17/2015 was 6
Activation for CPC PC2 at 11/16/2015 15:02:01
Activation of model 729, 2 CAAPS and 2 ZIIPS
Inducing policy element is policy PROD4Q15, rule RPHQ3,
provisioning condition NORM2, time condition HISHIFT2
Inducing utilization condition HICP1

Activation for LPAR LPAR1 on CPC CPC1 at 11/15/2015 07:33:10
Activation of 25 MSU
Capacity after activation: 175 MSU
Capacity before activation: 150 MSU
Inducing policy element is policy PROD4Q15, rule MIDMONTH,
provisioning condition WEEKEND, time condition SATSUNDAY
Inducing system is PRO01 in sysplex PRO01PLEX
Inducing workload is WLM service definition PRO0DEF,
policy PRODPOL, service class period CICSHIGH.1
```

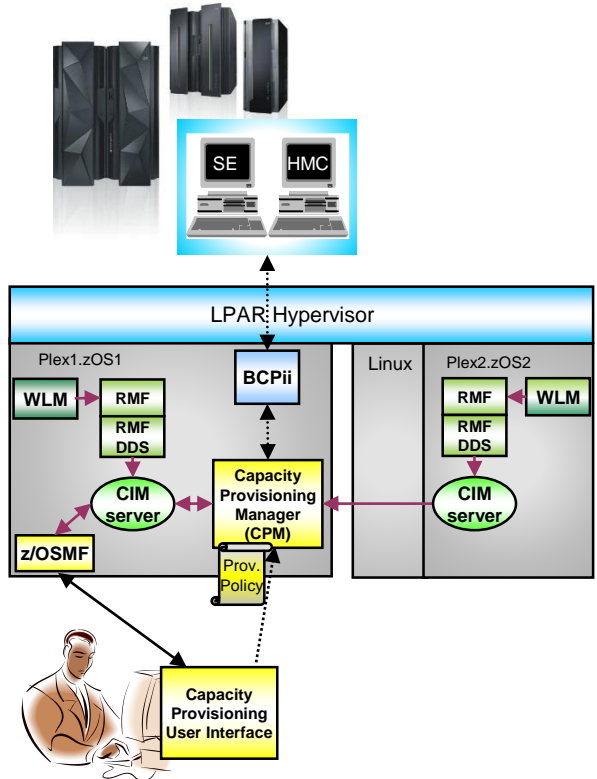
■ The z/OSMF Capacity Provisioning task

- The browser-based user interface for administering Capacity Provisioning Domain Configurations and Policies
- Interacts with CPM
- Is not required for regular operation of CPM



Rationale - 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
 - 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
- Capacity Provisioning User Interface is front end to administer Capacity Provisioning policies
 - z/OSMF Capacity Provisioning task



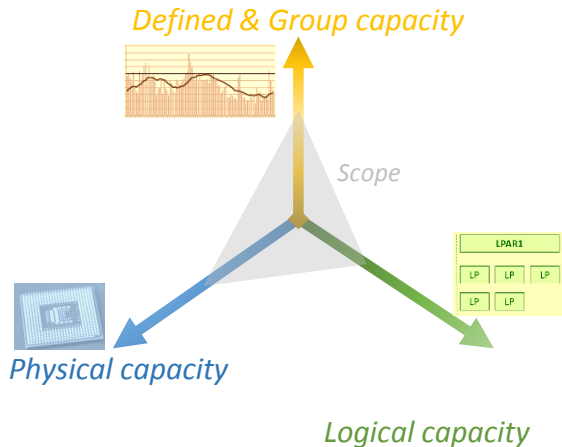
Rationale - Capacity Provisioning Management in a Nutshell

▪ Policy-based navigation in an n-dimensional resource space

- Currently supported processor centric dimensions:

- **Physical capacity**
CEC wide On/Off CoD
- **Logical capacity**
System oriented
- **Defined & Group capacity**
Soft-capping limits

- The CPM policy specifies navigation limits/scope for each dimension



▪ Provisioning triggers

- Manual
- Time schedules
- Workload performance
- Resource utilization



Processing Modes – a gradual approach to CP

CPM can operate in one of four modes that allow for different degrees of automation

▪ **Manual mode**

- Server capacities can be controlled via CPM commands
- Interactive mode without active CP policy

▪ **Analysis mode**

- CPM processes policy and informs the operator when a capacity change becomes due according to policy criteria
- Operator decides whether to ignore or to follow CPM advises to change capacity manually (via HMC/SE or the CPM commands)

▪ **Confirmation mode**

- CPM processes policy, OOCOD record and Defined Capacity levels are examined.
- Every capacity change action needs to be authorized (confirmed) by the operator

▪ **Autonomic mode**

- Similar to the confirmation mode, except that no operator intervention is required

Minimum requirements

- *HMC connectivity*
- *Valid On/Off CoD record or Defined Capacity*
- *Domain Configuration with managed CPCs*
- *Policy*
- *Domain Configuration with observed systems*
- *CIM & Monitoring product on each observed system*



Various reports are available with information about workload, processor consumption, provisioning status, and the rationale for provisioning recommendations

Processing Modes – required infrastructure – MANUAL mode

CPM runtime system

```
F CPOSERV,APPL=R D
CP01008I Domain report
Active processing mode is MANUAL

...
F CPOSERV,APPL=R C
CP01010I Configuration report
CPC PRODCPC2 with record * is enabled
CPC is matched with serial 000012345678
Hardware is of type 2827 with model H66
Current model is 704 with 664 MSU
Permanent model is 703 with 511 MSU
Active record ID is 01234567
Hardware has 4 spare processors
Active resources GP/zAAP/zIIP 153(1/0)/0/0
IFL/ICF/SAP 0/0/0

...
F CPOSERV,APPL=A R CPC=PRODCPC2 MODEL=705
CP01023I Temporary upgrade for CPC PRODCPC2
to model 705 successfully initiated

...
```

External Trigger

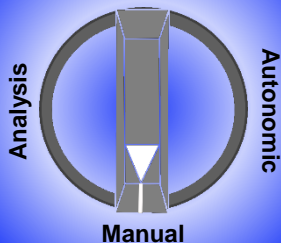
Operator, Automation,
Home-grown Detector

Java runtime environment

CPM

sample started task CPOSERV

Confirmation



BCPii / CEA

Runtime DS/HFS

sample JCL CPOMKDSN
& /usr/lpp/cpo/samples

Security Definitions

sample JCL CPOSEC1

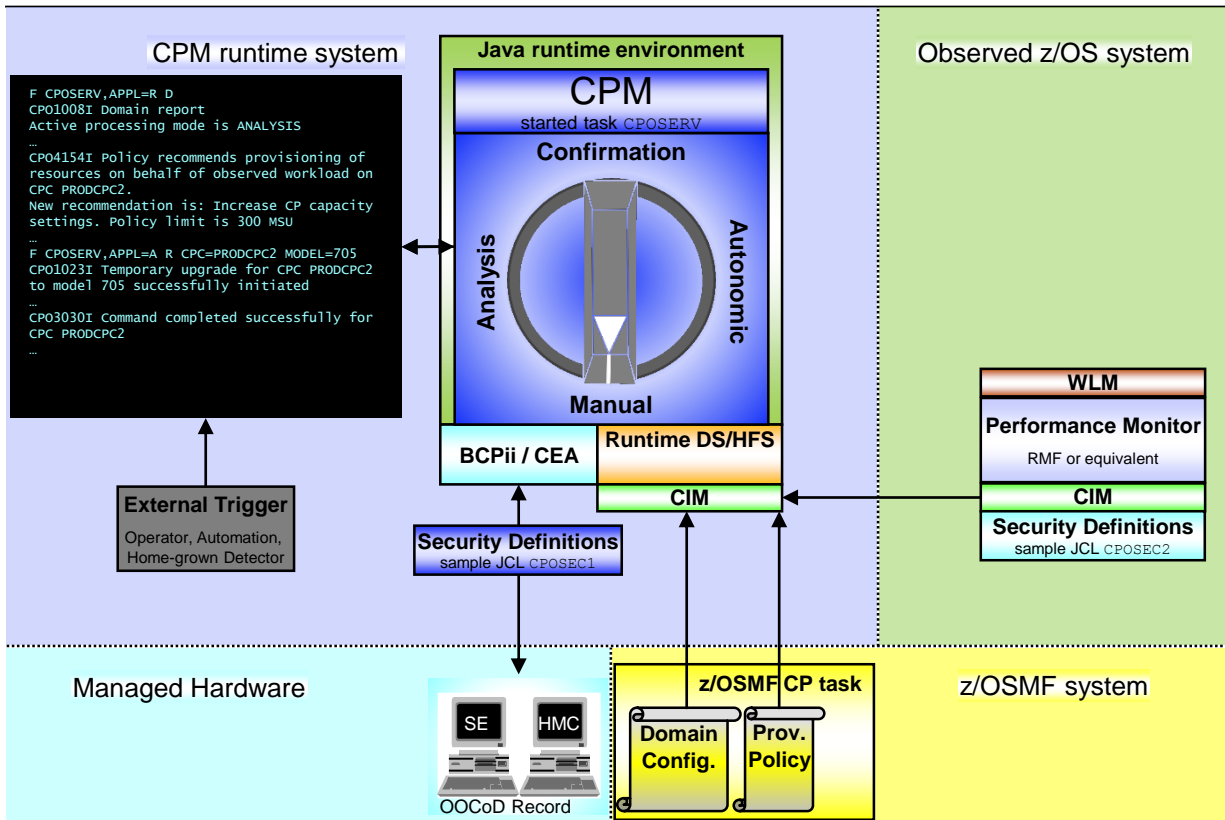
Domain
Config.

sample XML

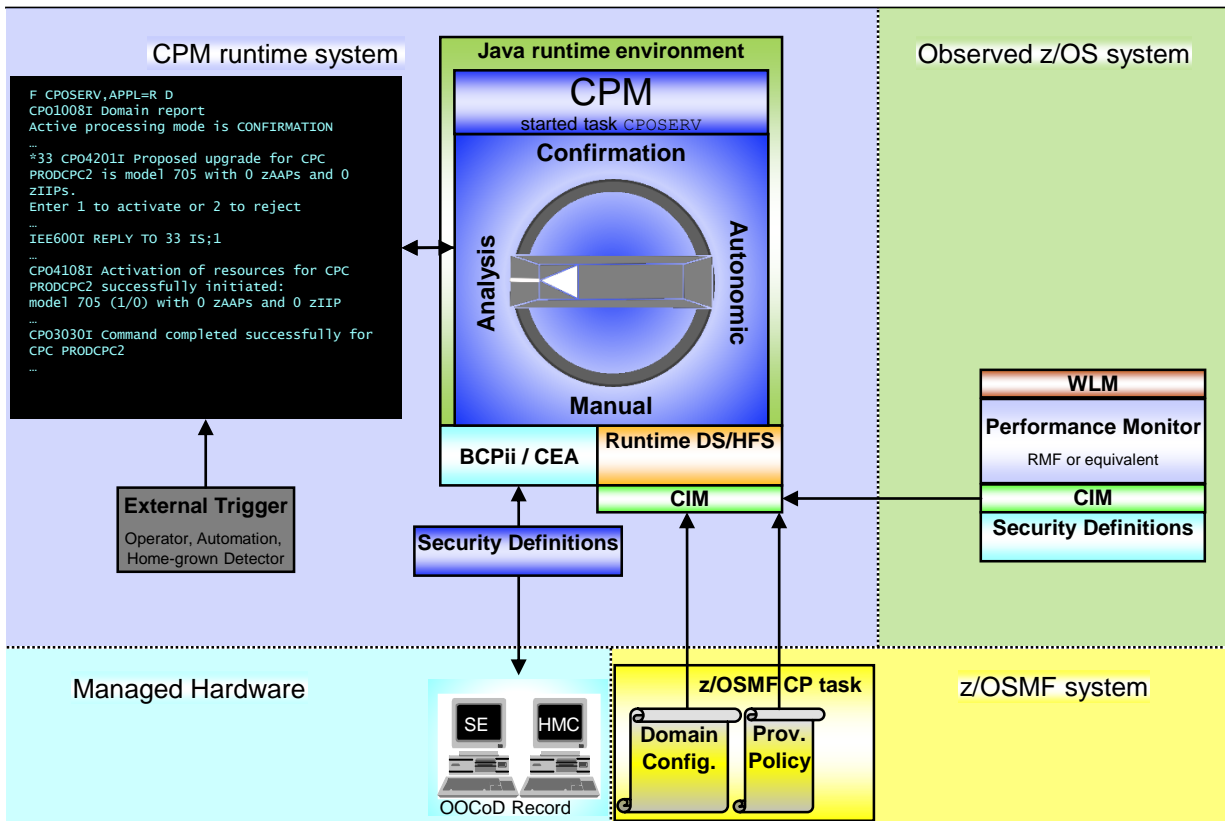
Managed Hardware



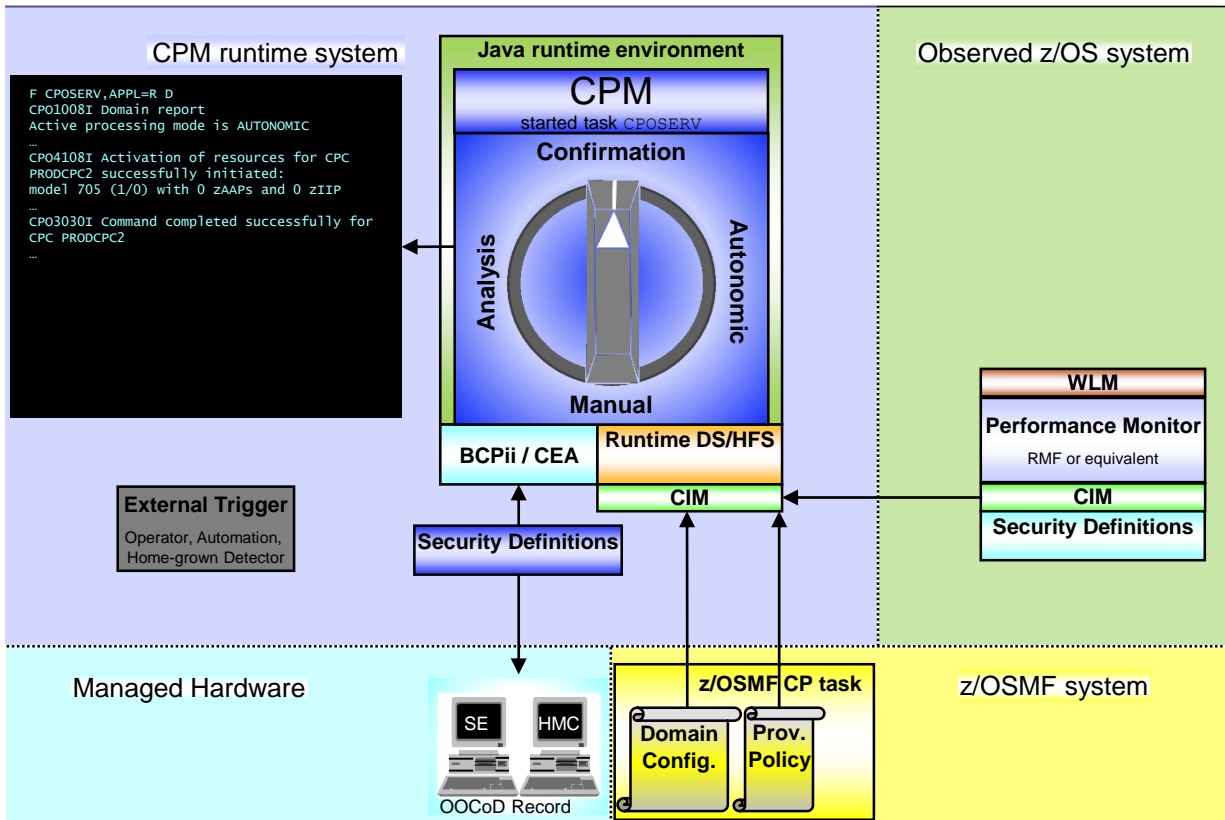
Processing Modes – required infrastructure – ANALYSIS mode



Processing Modes – interaction – CONFIRMATION mode



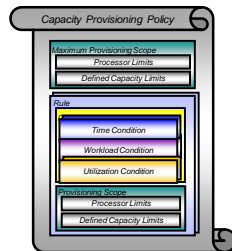
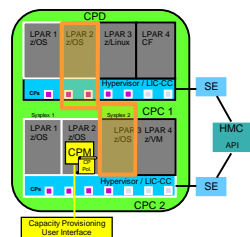
Processing Modes – interaction – AUTONOMIC mode



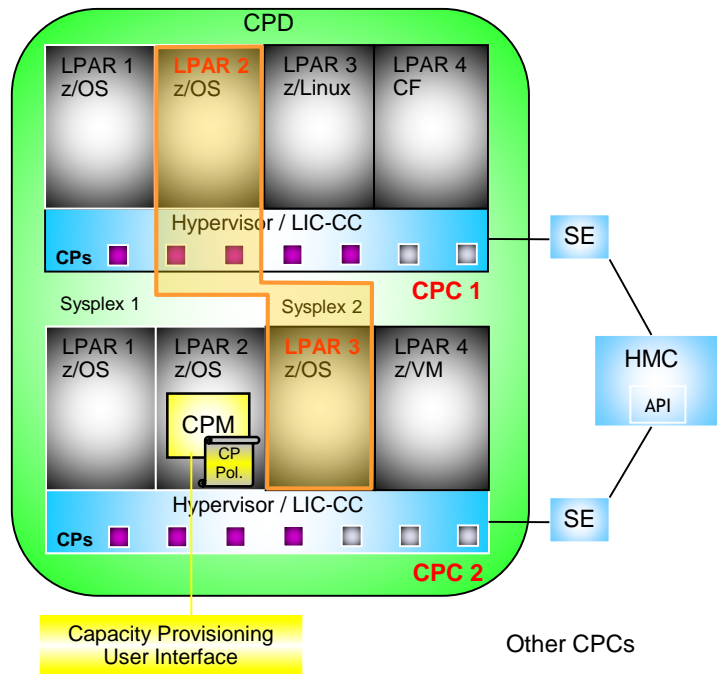
Configuration

3 configuration entities for Capacity Provisioning

- **Domain configuration**
Topology and connections of managed CPCs and z/OS systems
- **Policy**
 - Allowed activation scope
 - Permitted timeframes
 - Provisioning-eligible workload condition or consumption level
- **PARM**
Data set with setup instructions about environment variables and various processing options



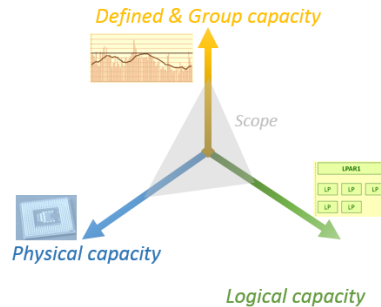
Domain Configuration



- Defines the **CPCs** and z/OS **systems** controlled by a CPM instance = a CP domain
- One or more CPCs, sysplexes and z/OS systems can be defined into a CP domain
- Sysplexes and CPCs do not have to be completely contained in a CP domain, but should not belong to more than one CP Domain
- One active CP policy per CP Domain
- Multiple sysplexes and hence multiple WLM service definitions may be involved at once

Policy - Aspects of policy driven management

- CPM can be run at different levels of automation
- Activation of additional resource capacity is restricted by type and scope
- Triggers for activations can vary between on-demand and planned type



Overall setting |

Policy definitions

Policy Approach

The CP policy defines circumstances under which additional capacity may be provisioned:

- Three “dimensions” of criteria considered:
 - **When** is provisioning allowed
 - **Which** work or processor load qualifies for provisioning
 - **How much** additional capacity may be activated
- Criteria are specified as “rules” in the policy:

```
If
{ in the specified time interval
  the specified work or processor “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

Capacity Provisioning Policy

Maximum Provisioning Scope

Processor Limits

Defined Capacity Limits

Rule

Provisioning Condition

Time Condition

Workload Condition

Utilization Condition

Provisioning Scope

Processor Limits

Defined Capacity Limits

- **Maximum Provisioning Scope** defines the maximum additional capacity that may be activated by all the contained rules
- **Provisioning Condition** is a combination of Time and Workload Conditions that can be referred to via its name
- **Provisioning Scope** defines the maximum additional capacity that may be activated based on the rule
 - Specified as number of zAAP / zIIP processors
 - MSU for general purpose capacity
 - MSU for Defined Capacity
 - MSU for Group Capacity

Policy: Provisioning Scope – Defined Capacity Limits

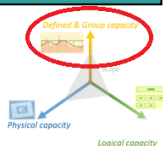
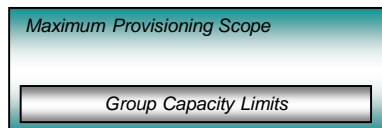
- Specified through the system's + sysplex name
 - CPM automatically maps the scope the correct LPAR
- Max number of **additional** MSU that may be activated
 - Required **delta** capacity will be activated by CPM
- Provisioning scope exists in two flavours:
 - Maximum provisioning scope defines an upper limit of resources that may be activated in total for all the contained rules at any point in time. Additionally, capacity increments can be defined. Increments are defined in MSU.
 - 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 up to 300 of additional MSU for workload 1 and up to 200 of additional MSU for workload 2, but at no point in time more than 400 of additional MSU.“



System	Sysplex	Max. MSU	Primary Inc. MSU	Secondary Inc. MSU
PRODSYS1	PLX1	150	45	35
PRODSYS3	PLX2	50	20	30

Policy: Provisioning Scope – Group Capacity Limits

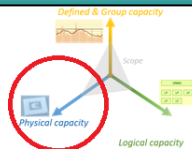
- Name of Group for which resource activation is allowed
- CPC within provisioning domain hosting the group
- Max number of **additional** MSU that may be activated
 - Required **delta** capacity will be activated by CPM
- Provisioning scope exists in two flavours:
 - Maximum provisioning scope defines an upper limit of resources that may be activated in total for all the contained rules at any point in time. Additionally, capacity increments can be defined. Increments are defined in MSU.
 - 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 up to 300 of additional MSU for workload 1 and up to 200 of additional MSU for workload 2, but at no point in time more than 400 of additional MSU.“



Group	CPC	Max. MSU	Primary Inc. MSU	Secondary Inc. MSU
PRODGRP1	CPC1	400	45	35
TESTGRP3	CPC2	50	20	30

Policy: Provisioning Scope – Processor Limits

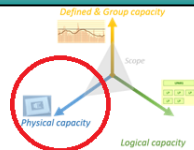
- CPC within provisioning domain for which activation of resources is allowed
- Max number of **additional** MSU / zAAPs / zIIPs that may be activated
 - Only required capacity will be activated by CPM
- Provisioning scope exists in two flavours:
 - **Maximum provisioning scope** defines an upper limit of resources that may be activated in total **for all the contained rules** at any point in time
 - For general purpose capacity, increments are defined in MSU (not models)
 - **Rule provisioning scope** 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	Primary Increment MSU	Secondary Increment MSU	Max zAAPs	Max zIIPs
CPC1	400	100	150	3	5
CPC2	800	120	80	0	0

Policy: Mapping Processor Limits to ITR ratios

- CPM maps policy MSU definitions to 'real' ITR ratios
 - At most, CPM activates the processor model that doesn't exceed the amount of allowed extra MSU as specified in *Max. MSU*
 - For each increment, CPM will activate the next model with **at least** the specified amount of additional *Primary Inc. MSU* or *Secondary Inc. MSU*



CPC	Max. MSU	Primary Inc. MSU	Secondary Inc. MSU
z13A	400	100	150

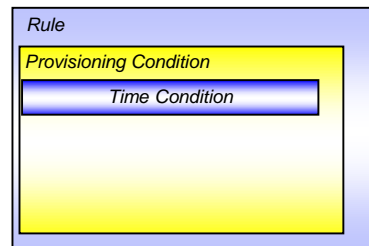
z13 (2904) ITR		
Model	MSU	
715	2244	} +114 MSU
716	2358	
717	2472	} +112 MSU
718	2584	
719	2695	} +111 MSU
720	2801	
		} +106 MSU

Summary of increments:

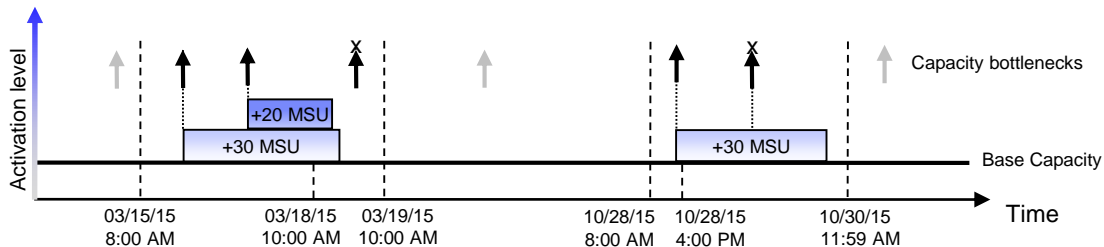
- Models 715-716: +340 MSU
- Models 717-718: +451 MSU
- Models 719-720: +106 MSU

Policy: Provisioning Conditions - Time

- Time condition defines when capacity may be activated. Non-recurring time conditions specify
 - Start Time: provisioning allowed
 - Deadline: provisioning no longer allowed
 - End Time: deactivation should begin



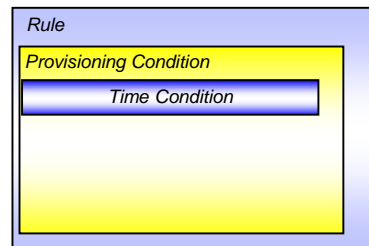
Name	Start Time	Deadline	End Time
TC1	03/15/15 08:00 AM	03/18/15 10:00 AM	03/19/15 10:00 AM
TC2	10/28/15 08:00 AM	10/28/15 04:00 PM	10/30/15 11:59 AM



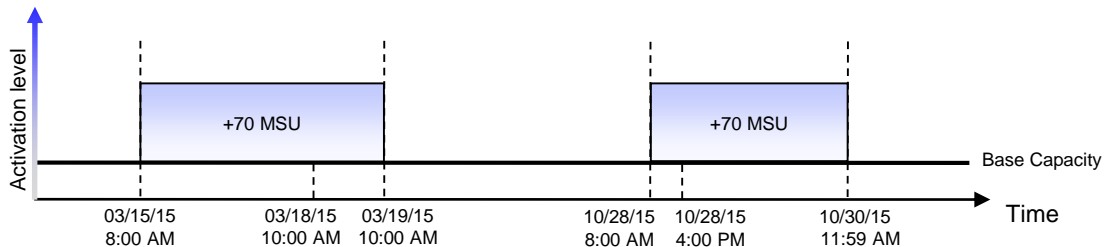
- With an additional workload or utilization condition, **conditional** activation will be performed:
 - Between Start Time and Deadline, capacity will be added gradually as needed (up to the rule scope)
 - De-activation of unneeded capacity before End Time staged, all at once at/after End Time

Policy: Provisioning Conditions - Time

- Time condition defines when capacity may be activated. Non-recurring time conditions specify
 - Start Time: provisioning allowed
 - Deadline: provisioning no longer allowed
 - End Time: deactivation should begin



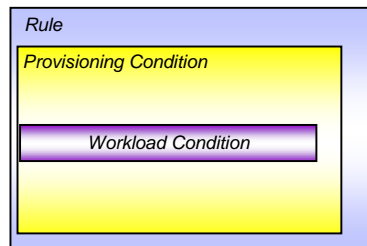
Name	Start Time	Deadline	End Time
TC1	03/15/15 08:00 AM	03/18/15 10:00 AM	03/19/15 10:00 AM
TC2	10/28/15 08:00 AM	10/28/15 04:00 PM	10/30/15 11:59 AM



- Without additional workload or utilization condition, **scheduled** activation will be performed:
 - Full capacity as specified in the rule scope
 - Unconditionally at start time, and de-activation at end time

Policy: Provisioning Conditions - Workload

- Identifies the work that may trigger the activation of additional capacity
- Whenever work does not achieve its WLM goal due to insufficient capacity and additional capacity would help
- Parameters:
 - Validity area
 - System/Sysplex that may run eligible work
 - Workload specification
 - Importance filter / Service Class list
 - WLM Performance Index criteria
 - Activation threshold:
Provisioning PI and duration
 - Deactivation threshold:
Deprovisioning PI and duration
- Can manage on behalf of **CICS-server** or **CICS-transaction** ServiceClasses & sorts out (non CPU-critical) MAXTASK situations

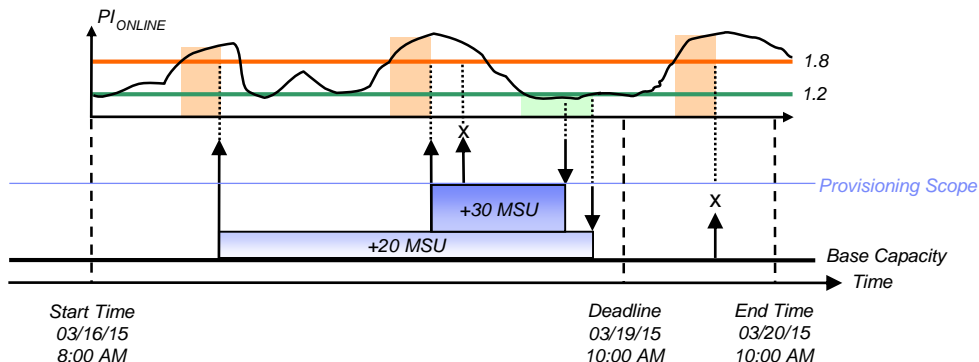


Policy: Sample Workload Condition

Sample definition:

Name: PT1
Systemplex: PLEX1
System: SYSA
Included Service Class Periods:
ONLINE in WLMSD with **PI** ≥ 1.8 for 10 min until **PI** ≤ 1.2 for 10 min
Excluded Service Class Periods:
BACKUP in WLMSD

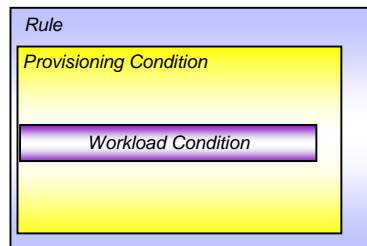
Monitor all "ONLINE" Service Class PIs except of SC "BACKUP":



Policy: Provisioning Conditions – Workload criterion PI

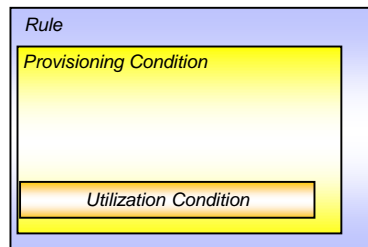
Properly tuned WLM Service Class goals are compelling for:

- WLM to make best use of available processor resources
- CPM to help out with extra capacity as soon as WLM cannot fulfil its goals
 - PI should be a timely indication of processor bottlenecks
 - PI must fall reliably when situation is not critical any more



Policy: Provisioning Conditions - Utilization

- Monitors the physical processor utilization of the whole CPC
- Whenever the utilization exceeds a give limit the CEC is eligible for processor activation
- Does not discriminate between causing system or workload
- Parameters:
 - Target CPC
 - Processor type
 - Differentiate between CP, zIIP (and zAAP)
 - Utilization limit criteria
 - Activation threshold:
Provisioning utilization % and duration
 - Deactivation threshold:
Deprovisioning utilization % and duration



Policy: (De)Provisioning – Additional criteria

- Control *aggressiveness* of on-demand provisioning
 - Capacity per step and quick succession

- Determine additional preconditions for provisioning
 - WLM PI not the only trigger for provisioning

- Decide how long activated capacity should be kept
 - Specify minimum duration of activation
or last possible time for de-provisioning



Policy: Provisioning – Additional criteria

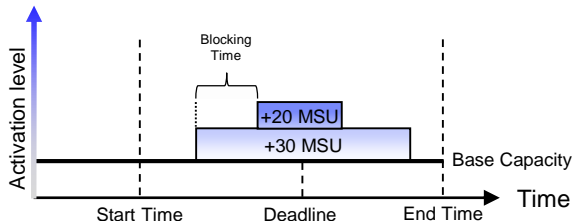
Control *aggressiveness*
of on-demand provisioning



- Policy scope's increments
 - Tell how many MSU to increment in each step
 - Are specified per resource



- PARM-key BlockingTime
 - Defines waiting period between each step
 - Allows measurements to adapt to capacity changes



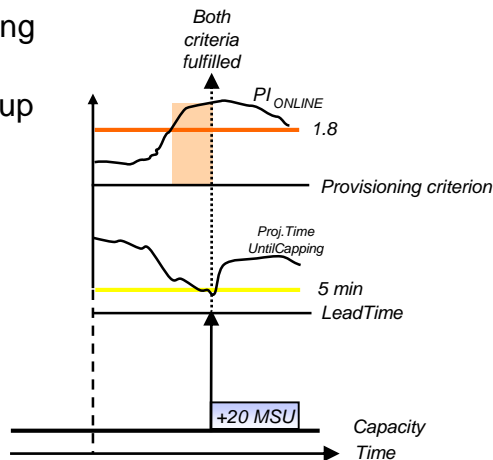
Policy: Provisioning – Additional criteria for Defined/Group capacity

Control how *foresighted* Defined or Group Capacity is activated

- PARM-key LeadTime

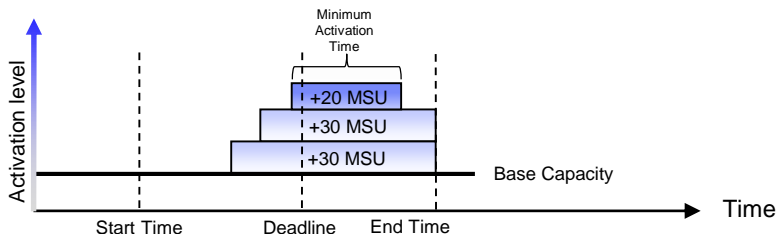
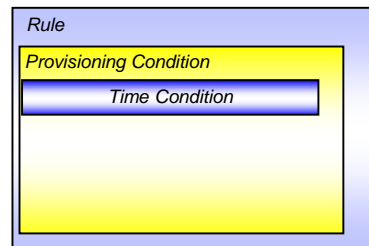
- Primary trigger for activation is a detected business need by suffering workload defined through the *Provisioning Criterion*
- **Additional and necessary criterion**
For DefinedCapacity increase - LPAR capping is imminent (will happen within x minutes)
- For GroupCapacity increase - Capacity Group **and** LPAR capping is imminent (will happen within x minutes)
- Default value is 5 minutes

RMF Data Portal for z/OS	
RMF Report [IRD6.MVS_IMAGE] : CPC (Central Processor Complex)	
Time Range: 03/25/2013 08:35:00 - 03/25/2013 08:36:00	
Partition Name: IRD6	CPU Type: 2827
Weight % of Max: ****	4h MSU Average: 5
WLM Capping %: 0.0	4h MSU Maximum: 7
Proj Time until Capping: 14400	Proj Time until Group Capping: 14400



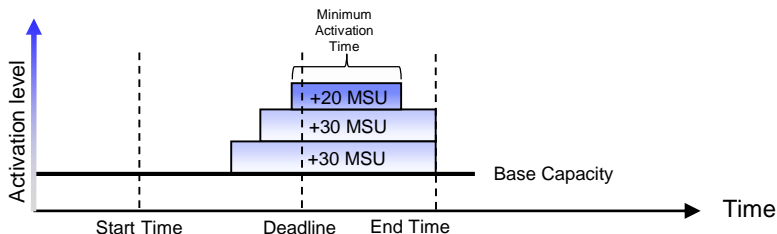
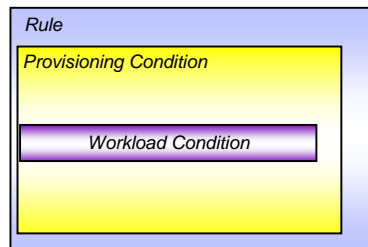
Policy: Deprovisioning – Additional criteria

- Activated capacity is normally deactivated as soon as de-provisioning criterion is fulfilled
 - **Before Deadline:** staged (de-)provisioning of additional capacity if necessary
 - **Before End Time:** staged de-provisioning of unneeded activated capacity
 - **At/After End Time:** deprovisioning of all activated capacity at once
- Deprovisioning can be delayed
 - PARM-key `MinimumActivationTime`
 - Allows to keep already 'payed' capacity for a longer period
- Deprovisioning can be enforced before a certain time
 - Suitable combination of Time-Condition's `Deadline` and `EndTime` and PARM-key `MinimumActivationTime`
 - Could be aligned to your billing period's end



Policy: Delaying or Blocking Deprovisioning

- Activated capacity is normally deactivated as soon as de-provisioning criterion is fulfilled
- Policy-driven deprovisioning can be delayed
 - Commands `MANAGE RESOURCE / SET BASE` allow to restart/change `MinimumActivationTime`
- Policy-driven deprovisioning can be blocked
 - Command `DISABLE CONFIGURATION CPC=xxx` temporarily takes server out of CPM's policy management



Additional CPM Processing and Directives

- Exceeding an activation threshold is a **necessary** condition for workload-based provisioning, but **not sufficient**
 - Underlying CPM processing examines many metrics and parameters to ensure
 - The observed performance bottleneck is caused by a capacity shortage of the respective type
 - That additional capacity could actually be consumed by the workload that incurred the capacity demand
- Deprovisioning also under control of additional parameters
 - `Minimum activation time` specifies for how long any added capacity must remain active *at a minimum*
- For many aspects of CPM processing additional directives may be specified in the `PARM` member
 - Refer to documentation for full list



Additional CPM Processing – Demand Detection explained

- Workload report displays
 - recognized demands by resource-type
 - reasoning of unrecognized demands with failed criteria

```
MODIFY CPOSERV,APPL=REPORT WORKLOAD TYPE=DETAILED

CPO1005I workload report generated at 12/18/2015 18:04:19
workload is analyzed for 1 system(s)
workload for system PROD1 of sysplex PRODPLEX on CPC CPC1
CICSHI.1 PL/PD/DL/DD/S 1.8 5 1.2 15 System
  PI from 12/18/2015 17:02 is 2.76
  Last limit crossing was 12/18/2015 17:47
  Demand for additional physical zIIPs not recognized
  System zIIP-utilization too low
  Demand for additional physical zAAPs not recognized
  System zAAP-utilization too low
  Demand for additional defined capacity recognized
  Demand for additional physical CPS not recognized
  Demand for capacity level increase not recognized
  Demand for additional logical CPS not recognized
  CPC-wide CP-utilization too low
End of report
```

Overview on Observed Metrics

CPC Metrics

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

LPAR/System Metrics

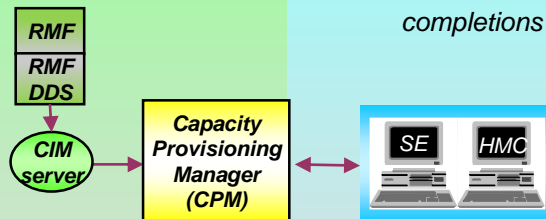
- WLM Service definition, policy, Service classes Shared/dedicated
- Initial capping
- Defined capacity
- Capping & Time-to-cap
- 4h Rolling Average
- Dispatchable units (InR Queue)
- IRD weight & Vary CPU mgmt.
- Per Processor type
 - Online CPs, zAAPs, zIIPs
 - Reserved processors
 - LPAR weight
 -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

Service Class Metrics

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

Support Element

- H/W model
- Spare processors
- Installed OoCoD records incl. Validity, Activation limits, Current activation level
- Current S/W model
- Current number of processors
- Power save (z196 and later)
- Event subscriptions
 - Capacity and accounting change
 - Command completions

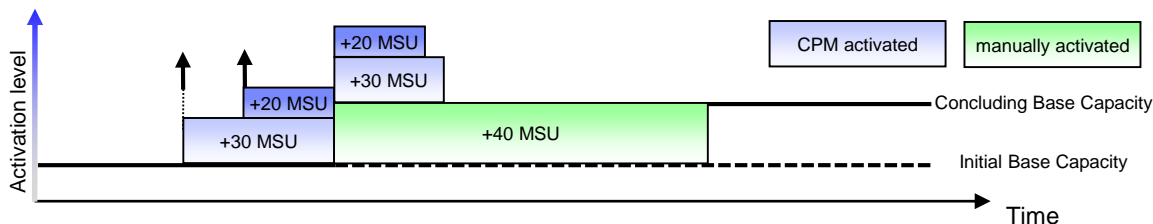


Avoiding false positives – adjustable parameters to consider

- In your CPM Policy
 - Specify a high Policy's ProvisioningLimit
(=limit that the ServiceClasses' PerformanceIndex must exceed for triggering an activation)
 - Specify a prolonged Policy's ProvisioningDuration
(=duration during which the PI must exceed the ProvisioningLimit)
- In the CPM Control Parameters
 - By default, CPM will only activate OOCoD capacity if other measurements exceed certain threshold
 - System's MVS busy must exceed 95%
Adjustable with parameter `Analyzer.Threshold.MvsUtilCp`
 - CPC wide physical utilization must exceed 95%
Adjustable with parameter `Analyzer.Threshold.TotalSharedPhysicalUtilCp`
 - Amount of delay samples per monitoring interval must exceed 5
Adjustable with parameter `Analyzer.Threshold.ScpcpDelaySamples`
 - ...and many more

Concurrency with manual operations

- While CP is managing resources, the operator might change capacity **concurrently**
- CP distinguishes between resources it activated itself and those not under CP-control
- CP will **not de-activate** the **amount** of capacity that has not been activated by itself



- Command `MANAGE RESOURCE` allows to transfer management of *manually* activated temporary capacity (OOCoD) to CP
- Command `SET BASE` allows to hand over or to take away management of *manually* activated Defined/Group Capacity to or from CP

- History of actual workload and system activity available with CPM reports
 - Especially REPORT WORKLOAD, REPORT UTILIZATION, REPORT ACTIVITY
 - Available at the z/OS console, and in the z/OSMF Capacity Provisioning task
 - 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

Reports – Current capacity reporting

- Configuration report displays
 - data related to all CPCs listed in your Domain Configuration
 - data related to all observed systems listed in your Domain Configuration
 - information whether system is currently observed
 - information of current WLM service definition
 - **information about Defined Capacity or Group Capacity that applies to the system's LPAR**

```
MODIFY CPOSERV,APPL=REPORT CONFIGURATION
```

```
CP01010I Configuration report generated at 12/18/2015 18:15:00
```

```
...
```

```
System TESTSYS1 in sysplex TESTPLX1 is enabled (default enabled)
```

```
Primary host address: testsys1.yourdomain.com
```

```
Alternate host address: 9.123.456.789
```

```
Protocol: HTTP, port: 5988
```

```
The system at primary host address is observed
```

```
  This system is available since 02/05/2015 16:46:32
```

```
  This system is running on the CPC CPC2
```

```
  WLM service definition: SAMPLESD, active policy: SAMPLEP
```

```
LPAR LPAR1 in capacity group TESTGRP3 with 270 MSU
```

```
The system at alternate host address is not observed
```

```
End of report
```

Reports – Current OOCoD management status

- Record report displays
 - Currently active capacity on a CPC
 - Share of capacity that is managed by CPM
 - Additional capacity allowed by the On/Off CoD record

```
MODIFY CPOSERV,APPL=REPORT RECORD CPC=G14

CP04430I Record report generated at 12/10/2015 16:04:34
Record Id:          A0123456 (On/Off CoD)
CPC name:          G14
Management state:  provisioned, deprovisioning blocked
                  until 13/10/2015 02:12:51
Expiration date:   12/31/2015 23:59:59
Active resources:  145 MSU, 0 ZAAPS, 0 ZIIPS
                  0 IFLs, 0 ICFs, 0 SAPs
Managed resources: 1 CPS, 0 CLIs, 0 ZAAPS, 0 ZIIPS
Activation time:   01/02/2015 06:45:00
Activation limits: 3 ZAAPS, 3 ZIIPS
                  3 IFLs, 3 ICFs, 3 SAPs
Residual capacity: 150 MSU days, 4 ZAAP days, 5 ZIIP days
                  1 IFL days, 1 ICF days, 1 SAP days

Allowed models:
  Model CP  CLI  MSU  MSU  MSU  MSU  Activation
                   original absolute relative managed  type
505   0   0    0   240  -145  --    MAN
506   1   0   39   279  -106  --    MAN
605   0   1   52   292  -93   --    MAN
507   2   0   77   317  -68   --    MAN
606   1   1   99   339  -46   0     MAN
705   0   2  123   363  -22   --    MAN
607   2   1  145   385   0    46    PM
706   1   2  182   422   37   --    --
707   2   2  239   479   94   --    --
```

Reports – Current Defined Capacity management status

- Defined Capacity report displays
 - data of a Capacity Group a system's LPAR belongs to
 - can also be issued by specifying the LPAR and CPC
 - the current CPM management state
 - potential of additional capacity as defined by policy
 - CPM-managed share of current capacity
 - current capacity
 - current ProjectedTimeUntilLPARCapping & 4HRA measurements

```
MODIFY CPOSERV,APPL=REPORT DEFINEDCAPACITY SYS=TESTSYS3 PLEX=PLX3
```

```
CP01095I Defined capacity report generated at 12/18/2015 18:15:55
```

```
Defined capacity for LPAR TESTLP3 on CPC TESTCPC3
```

```
Management state:          increased
Policy limit:              175 additional MSU
Management base:          40 MSU
Managed capacity:         160 additional MSU
Current capacity:         200 MSU
Remaining time until capping: 500 seconds
4 hour rolling average:    193 MSU
```

Reports – Current Group Capacity management status

- Group Capacity report displays
 - data of a Capacity Group a system's LPAR belongs to
 - can also be issued by directly specifying the group and CPC
 - the current CPM management state
 - potential of additional capacity as defined by policy
 - CPM-managed share of current capacity
 - current capacity

```
MODIFY CPOSERV,APPL=REPORT GROUPCAPACITY SYS=TESTSYS1 PLEX=TESTPLX1
```

```
CP01096I Group capacity report generated at 12/18/2015 18:15:30
```

```
Group capacity for system TESTSYS1 in sysplex TESTPLX1
```

```
Group name: TESTGRP3
```

```
CPC name: CPC2
```

```
Management state: increased, decrease blocked  
                   until 12/18/2015 18:25:00
```

```
Policy limit: 50 additional MSU
```

```
Management base: 250 MSU
```

```
Managed capacity: 20 additional MSU
```

```
Current capacity: 270 MSU
```

```
End of report
```

Reports – Alternate Demand Detection & Management History

- Further reports
 - Current bottleneck detection based on *Utilization Conditions*

```
CP01022I CPC utilization report generated at 11/17/2015 08:21:22
Utilization is observed for 1 CPC(s)
CPC CPC1: utilization from 11/17/2015 08:20
CP 92.6%, ZAAP -%, ZIIP -%
Utilization condition UC1
PU/PD/DU/DD/PT 91.7% 2 33.3% 15 CP
Last CPC utilization threshold crossing was at 11/17/2015 8:17
Demand for additional physical CPs recognized
Demand for capacity level increase recognized
End of report
```

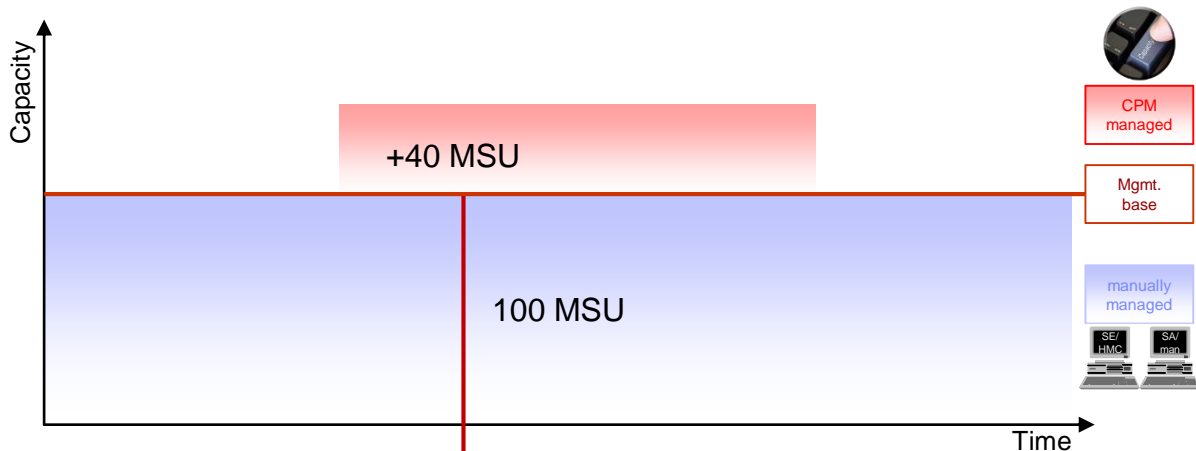
- Management history

```
CP01042I Activity report generated at 11/17/2015 07:51:47
Number of activities between 11/15/2015 and 11/17/2015 was 1
Activation for LPAR LPAR1 on CPC CPC1 at 11/16/2015 07:33:10
Activation of 25 MSU
Capacity after activation: 75 MSU
Capacity before activation: 50 MSU
Inducing policy element is policy SAMPPOL, rule ENDOFMONTH,
provisioning condition WEEKEND, time condition SatSunDay
Inducing system is PRODL in sysplex PRODPLEX
Inducing workload is WLM service definition PRODDEF,
policy PRODPOL, service class period CICSHIGH.1
```

New with V2R3 - Flexible concurrency of CPM and manual capacity management

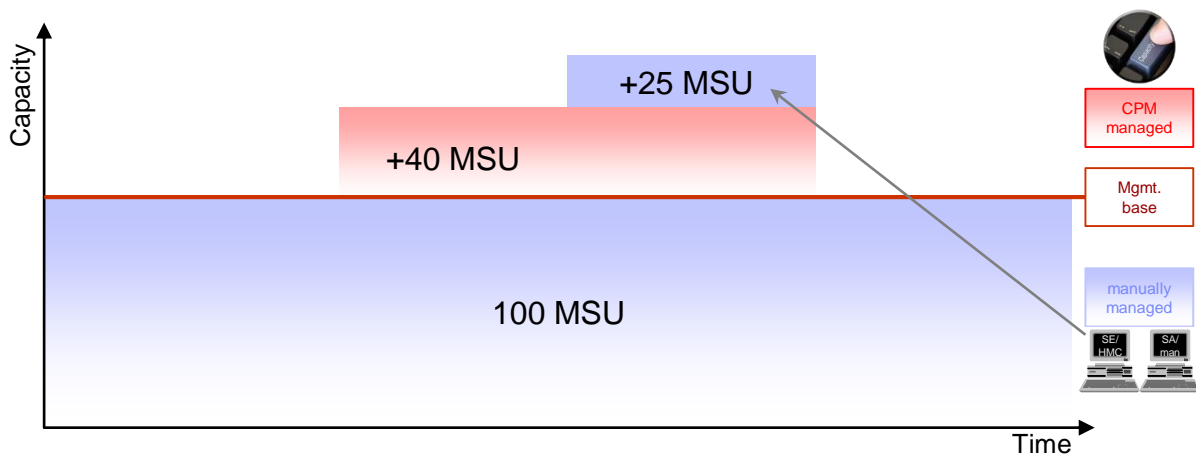


CPM managed Capacity vs. 'manually' managed Capacity



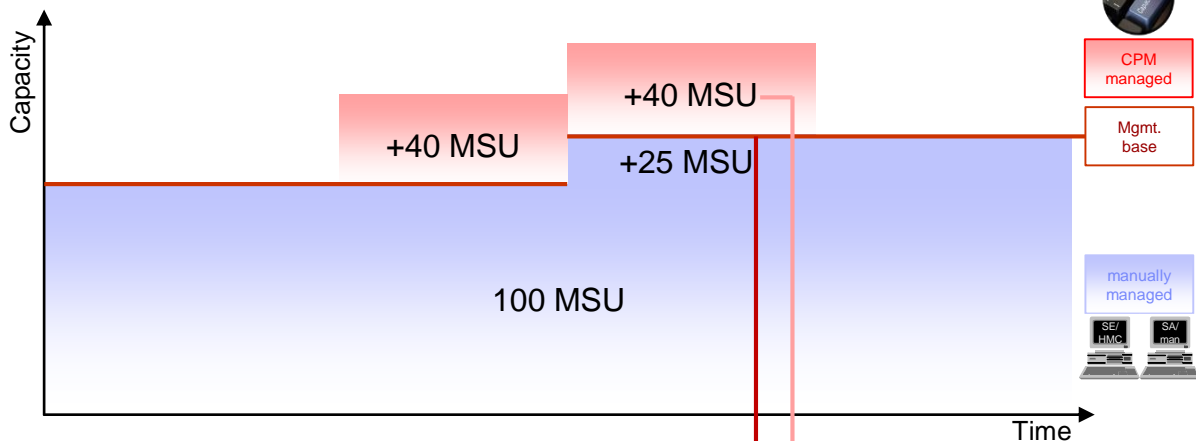
```
CPO1095I Defined capacity report generated at 06/18/2016 18:15:30
Defined capacity for LPAR PROD1 on CPC Z13A
...
Management state:          increased, decrease blocked until
                           06/18/2016 18:35:05
Policy limit:              75 additional MSU
Management base:          100 MSU
Managed capacity:         40 additional MSU
Current capacity:         140 MSU
```

CPM managed Capacity vs. 'manually' managed Capacity



```
CPO1095I Defined capacity report generated at 06/18/2016 18:15:30
Defined capacity for LPAR PROD1 on CPC Z13A
...
Management state:          increased, decrease blocked until
                           06/18/2016 18:35:05
Policy limit:              75 additional MSU
Management base:          100 MSU
Managed capacity:         40 additional MSU
Current capacity:         140 MSU
```


CPM managed Capacity vs. 'manually' managed Capacity

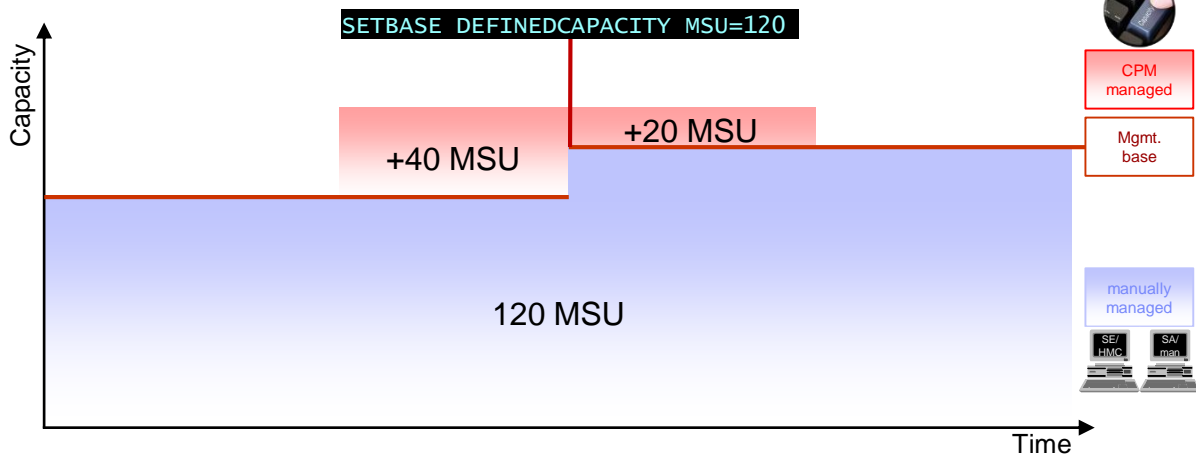


```
CPO1095I Defined capacity report generated at 06/18/2016 18:21:50
Defined capacity for LPAR PROD1 on CPC Z13A
...
Management state:          blocked until
                           06/18/2016 18:36:11
Policy limit:              75 additional MSU
Management base:          125 MSU
Managed capacity:         40 additional MSU
Current capacity:          165 MSU
```

Hand-over Solution - SET BASE for Defined and Group Capacity

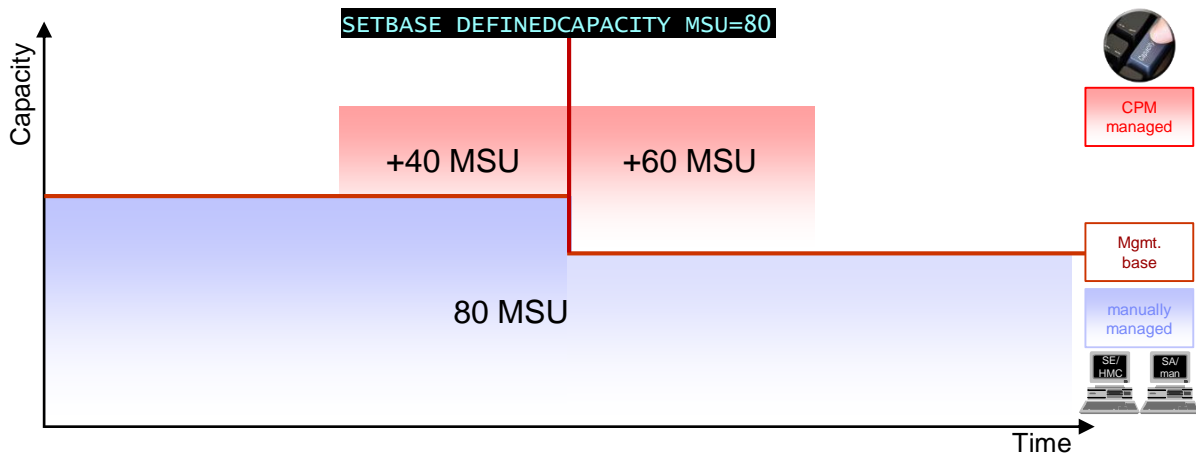


Raising the Management base with SET BASE



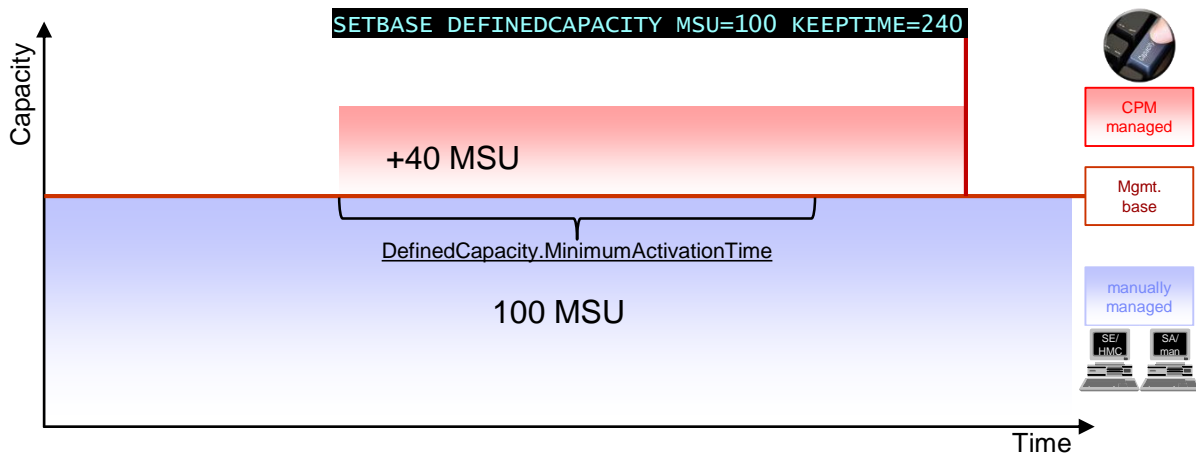
```
CPO1095I Defined capacity report generated at 06/18/2016 18:21:12
Defined capacity for LPAR PROD1 on CPC Z13A
...
Management state:      blocked until
                       06/18/2016 18:23:43
Policy limit:          75 additional MSU
Management base:      120 MSU
Managed capacity:     20 additional MSU
Current capacity:      140 MSU
```

Lowering the Management base with SET BASE



```
CPO1095I Defined capacity report generated at 06/18/2016 18:21:12
Defined capacity for LPAR PROD1 on CPC Z13A
...
Management state:      blocked until
                       06/18/2016 18:23:43
Policy limit:         75 additional MSU
Management base:     80 MSU
Managed capacity:   60 additional MSU
Current capacity:    140 MSU
```

Prolong the activation duration with SET BASE KEEPTIME



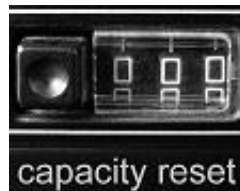
```
CPO1095I Defined capacity report generated at 06/18/2016 18:21:12
Defined capacity for LPAR PROD1 on CPC Z13A
...
Management state:          increased, decrease blocked until
                           06/18/2016 22:20:43
Policy limit:              75 additional MSU
Management base:          100 MSU
Managed capacity:         40 additional MSU
Current capacity:         140 MSU
```

Benefits - Use SET BASE to immediately



take over Defined Capacity management from CPM

reset CPM Defined Capacity management



hand over Defined Capacity for management to CPM

prolong CPM-managed Defined Capacity activation

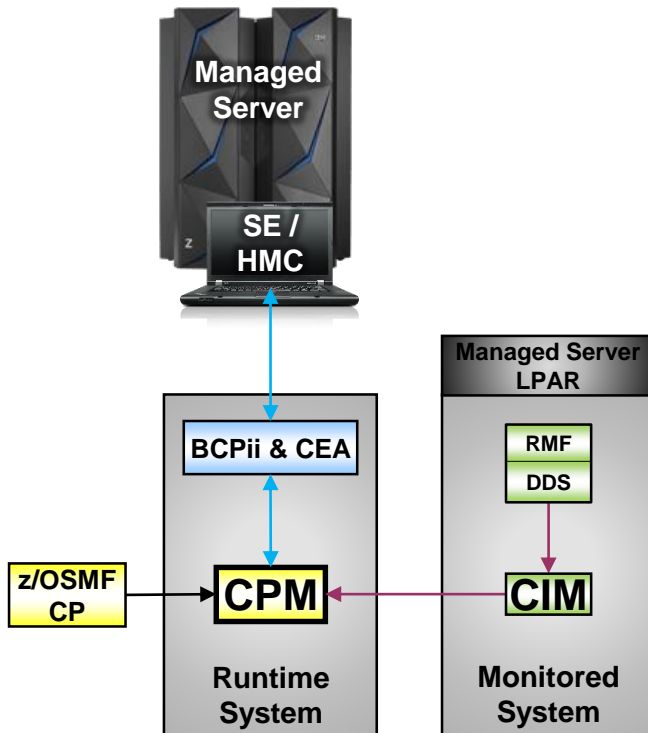


**Influence already initiated
CPM Defined Capacity management**

New with V2R3 - Enhance CPM's Management Domain availability



Capacity Provisioning Manager infrastructure



CPM reporting availability incidents – up to z/OS V2R2

```
CPO2001I Provisioning Manager starting at 07/31/2017  
07:22 for Domain IRD with policy * and mode *
```

```
CPO2016I Provisioning Manager successfully  
initialized. Policy is PROD3Q17, Configuration is  
PRODCFG1,  
and Processing Mode is AUTONOMIC
```

```
CPO3850E Unable to connect to CIM server at  
http://prodsys1.yourdomain.com:5989
```

```
CPO3019I Information for CPC Z13A available
```

```
CPO3027I Defined capacity information for CPC Z13A is  
available
```

```
CPO4103I A change of the manually activated resources
```

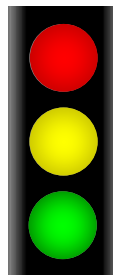
**Incident message not up to date or
displaced by subsequent messages**

Availability information in Configuration Report

```
CP01010I Configuration report generated at 07/31/2017
07:53:12
...
System PRODSYS1 in sysplex PRODPLEX is enabled
  (default enabled)
Primary host address: prodsys1.yourdomain.com
Alternate host address: 123.456.789.000
Protocol: HTTP, port: 5989
The system at primary host address is observed
  This system is unavailable since 07/31/2017 07:22:00
  This system is not yet initialized
  This system is not identified
The system at alternate host address is observed
  This system is unavailable since 07/31/2017 07:22:18
  This system is not yet initialized
  This system is not identified
...
End of report
```

Causal analysis of availability incidents is missing

CPM Health Report - Availability status at a glance



Error

CPO3850E Unable to connect to CIM server

Warning

CPO2135W Waiting for CPC information

OK

Health Report – on system console

```
/MODIFY CPOSERV,APPL=REPORT HEALTH TYPE=DETAILED
```

```
CPO1094I Health status report generated at  
07/31/2017 07:58:02  
overall health: 67%
```

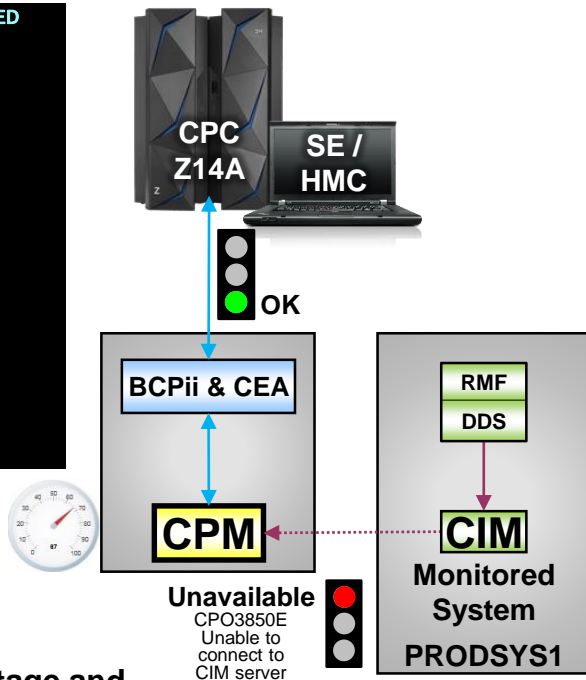
```
CPC Z14A health: OK
```

```
System PRODSYS1 Sysplex PRODPLEX health:  
Unavailable
```

```
CPO3850E Unable to connect to CIM server at  
http://prodsys1.yourdomain.com:5989  
CPO3802W The system at address  
prodsys1.yourdomain.com is unavailable
```

```
System PRODSYS3 Sysplex PRODPLEX health: OK
```

```
End of report
```



Integrates overall health status percentage and individual availability status with causal analysis for each domain configuration element

Health Report – on z/OSMF CP

- Workflows
 - Cloud Provisioning
 - Configuration
 - Consoles
 - Links
 - Performance
 - Capacity Provisioning**
 - Resource Monitoring
 - System Status
 - Workload Management
 - Problem Determination
 - Software
 - z/OS Classic Interfaces
 - z/OSMF Administration
 - z/OSMF Settings
- Refresh

Capacity Provisioning

Overview **Provisioning Manager** x

Provisioning Manager > Health

Active Configuration Health for Domain IRD

This page shows information about the active domain configuration and the health of its CPCs and z/OS systems.

Active configuration: PRODCFG1 Overall health: 67%



Report

CPCs **Systems**

Actions

No filter applied

System	Filter	S	F
<input type="radio"/>	PRODSYS1	F	
<input type="radio"/>	PRODSYS3	F	

IBM Knowledge Center

English

IBM Knowledge Center Full View

z/OSMF messages > CPO1001-CPO9999 > CPO messages > CPO3850E

CPO3850E Unable to connect to CIM server at address

Explanation

Unable to connect to the CIM server at the specified address. Possible reasons may be that the system is not running, the CIM server is not started, or a network problem.

User response

Ensure that the system and the CIM server are running and/or correct network problems.

Parent topic: [CPO messages](#)

Configure CPM to alert of overall health status changes

CPM Parameter `Health.ChangeMessage=YES`

```
CPO2133I The Provisioning Manager  
health changed from 50% to 67%
```

**Message CPO2133I can be monitored by
automation product for further steps**

Benefits - Health Alerting and REPORT HEALTH



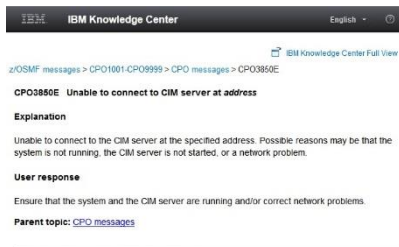
Be notified quickly
about availability problems

CPO2133I The Provisioning Manager
health changed from 50% to 67%

Correlate
reported problems
to managed servers
or monitored systems



Error
CPO3057E
Unable to
connect to
CPC Z14A



IBM Knowledge Center English

z/OSMF messages > CPO1001-CPO9999 > CPO messages > CPO3850E

CPO3850E Unable to connect to CIM server at address

Explanation

Unable to connect to the CIM server at the specified address. Possible reasons may be that the system is not running, the CIM server is not started, or a network problem.

User response

Ensure that the system and the CIM server are running and/or correct network problems.

Parent topic: [CPO messages](#)

Obtain further
problem related
CPO message
information

**Increase CPM reliability
with higher availability of
the management domain**

Documentation

- For more information contact: IBMCPM@de.ibm.com
- Website <http://www.ibm.com/systems/z/os/zos/features/cpm>
- z/OS MVS Capacity Provisioning User's Guide, SC34-2661-30, at <http://publibz.boulder.ibm.com/epubs/pdf/iea3u120.pdf>
- IBM DEMOzone Demonstration of Capacity Provisioning
<http://www14.software.ibm.com/webapp/download/demo.jsp?id=IBM+z%2FOS+Capacity+Provisioning+Jan09>
- 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>