CPSM Workload Management in CICS with Explorer
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What’s the problem?

In the beginning …

… things were simple ….
What’s the problem?

But as things get more complex …

MVS1

CICSa  CICSb
CICSc  CICScd

…and then more complex still …

MVS1  MVS2  MVS3

CICSa  CICSb  CICSe  CICSf  CICSi  CICSj
CICSc  CICScd  CICSg  CICSh  CICSk  CICSl
What’s the problem?

…and then more complex …

<table>
<thead>
<tr>
<th>Plex1</th>
<th>MVS1</th>
<th>CICSa</th>
<th>CICSb</th>
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<td>CICSV</td>
<td>CICSW</td>
<td>CICSX</td>
</tr>
</tbody>
</table>
What’s the problem?

…it all becomes more complicated to manage.

– Definitions managed & maintained locally
– Applications are statically routed
– Which leads to…

Availability problems

Lower probability of meeting response time goals
What is the solution? - Workload Management …

- Network - TCP/IP load balancing & VTAM Generic Resource
- Sysplex - z/OS Workload Manager
- CICS sub-system - CICSPlex SM

Workload Management
TCP/IP balancing (balance web-services and CICS WEB clients)

- Sysplex Distributor - provides balancing of IP packets across multiple IP stacks.
- Virtual IP Addressing (VIPA) - provides non-disruptive rerouting around a failing network adapter.
- DNS approach - balances IP connections in a z/OS Sysplex IP domain. This is based on feedback from MVS™ WLM about the health of the registered applications. It is still supported for CICS use.
- Port Sharing - provides a simple way of spreading HTTP requests over a group of CICS router regions running in the same z/OS image.
VTAM Generic Resource - Balance terminal access

LOGON APPLID(TOR1)

LOGON APPLID(TOR2)
z/OS WLM overview

- Works with z/OS System Resource Manager (SRM)
- Dynamically allocates resources (Processor, Storage, IO Priority)
- Service Definition (Contains 1 or more Service Policies)
- Policy defined in terms of “Goals”, not resources
  - Service Policy: One per Sysplex, Can switch Policy when required
  - Service Class: Describes performance objectives for part of workload
- Report Class
z/OS WLM overview - Goals

- **Response time** – How quick to run work
  - Average Response Time,
    - E.g. Average transaction response should be 2 seconds
  - Percentile Response Time,
    - E.g. 95% of transactions should complete in 3 seconds
- **Velocity**
  - How fast work should run as a % of the time it’s ready,
    - High Value – When work is ready, run it quickly
    - Low Value – When work is ready, can wait to run
  - Used to get CICS active
- **Discretionary** – Work with no goals
z/OS WLM overview – classification rules

- How work get classified to Service Class
- Some Classification Rules available for CICS:
  - SI – SubSystem (Applid)
  - UI – Userid
  - TN – Transaction Name
  - LU – LUName
Setting Goal “Importance” of meeting a goal

- Relative value --- 1 (very important) to 5 (readily sacrificed)
- Attempt to satisfy '1' goals before '2's, etc ...
- Allows WLM to protect critical work and react to changing capacity

Measuring Goals via Performance Index

- Used to easily compare the different goal types
- A calculated value that reflects how well the work in a service class is meeting it's goal ...
  - $PI = 1$ --- exactly meeting the goal
  - $PI < 1$ --- beating the goal
  - $PI > 1$ --- missing the goal

$ Actual Goal \quad PI = Actual Goal$
z/OS WLM and CICS: 1

- When CICS starts, as job or Started Task: uses JES or STC classifications
- Once CICS is active,
  - CICS connects to z/WLM
  - CICS Sub-System related Service Classes are used
- At CICS startup, CICS will allocate a Pool of Performance blocks based on MAXTASKS (MXT)
  - Sampled at regular intervals, e.g. every 250ms
  - Communicates transaction state to z/OS WLM
  - Do NOT over allocate MXT
z/OS WLM and CICS: 2

● Task Attach (initial dispatch)
  ■ Associate Performance Block with incoming transaction
  ■ **Classify** transaction or obtain from MRO/IPIC datastream
  ■ **Initialise** Performance Block (Service Class token and Transaction state data)

● Task Execution - CICS Dispatcher informs z/OS WLM of transaction status
  ■ Active, Waiting, Ready, Idle
  ■ Lock, Conv, I/O, Timer, Misc, Other_product, ...

● Task Detach - Report or Notify the z/OS WLM of end of transaction
  ■ **Report** – signals transaction completion (Response Time)
  ■ **Notify** – signals partial transaction completion (AOR, FOR)
Work distributed to the CICS System ‘best’ able to perform the work within the Sysplex
Based on z/OS WLM goals

z/OS WLM controls which Requesting/Routing (TOR) CICS Regions receive the work to be routed under CICSPlex SM criteria
- Regions in bigger/more powerful LPARs may be favoured
- CICSPlex SM will favour local routing
z/OS WLM: Deciding how the work reaches CICS

- z/OS WLM controls which Routing (TOR) CICS Regions receive work
- can also affect which AOR is chosen when using CICSPlex SM
- Once in CICS: routed via CPSM criteria
  - May favour regions in bigger/more powerful LPARs
  - favours local routing
    - Can give impression of “Unbalanced” Workload
    - Reality: work goes to System(s) best able to deal with the work
    - uneven distribution may be an accurate reflection of the capabilities of the environment
## z/OS WLM View in CICS Explorer

(split in 2 pictures)

### CNX0211I Context: HEROPLEX. Resource: MVSWLM. 6 records collected at May 10, 2014 3:34:17 PM

<table>
<thead>
<tr>
<th>Region</th>
<th>Goal Management</th>
<th>Workload Name</th>
<th>Service Class</th>
<th>Report Class</th>
<th>Goal Type</th>
<th>Goal Mode</th>
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<tbody>
<tr>
<td>CICSF</td>
<td>TRANSACTION</td>
<td>CICSWORK</td>
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<td>CICSSTC</td>
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</table>

### Region Velocity Goal Value Goal Importance WLM Server CEC Machine CEC Model CPU Critical Storage Critical

<table>
<thead>
<tr>
<th>Region</th>
<th>Velocity Goal Value</th>
<th>Goal Importance</th>
<th>WLM Server</th>
<th>CEC Machine</th>
<th>CEC Model</th>
<th>CPU Critical</th>
<th>Storage Critical</th>
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<tr>
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<td>2097</td>
<td>720</td>
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<td>N/A</td>
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<td>NO</td>
</tr>
</tbody>
</table>
zWLM & CICSplex SM Workload Management

- Uses z/OS WLM ‘Average Transaction Response Times’ to influence the ‘LOAD’
What can CICS do

- Dynamic Routing
  - Transactions associated with a terminal
    - Physically ‘entered’ at a terminal
    - Or via Via an EXEC CICS START TERMID command
  - Dynamic Program Link (DPL)
    - EXEC CICS LINK PROGRAM command
- Distributed Routing
  - Non-Terminal initiated STARTs
    i.e. EXEC CICS START with no TERMID
  - CICS BTS
  - Inbound WebServices, if modified to make them routable
- Done via user replaceable programs, CICS …
  - … calls the appropriate program to decide where to route to
  - … passes the program the DFHDYPDS commarea
When is the Routing Program called?

**dynamic**
- **Program**
  - If defined: DYNAMIC(YES)
  - If not defined: Program not defined and the program is not autoinstalled
- **Transaction**
  - If defined: DYNAMIC(YES)
  - If not defined: SIT - DTRTRAN={CRTX|name}

**distributed**
- **Transaction Starts (Non-Terminal Initiated)**
  - TRANSACTION defined ROUTABLE(YES)
- **CICS BTS**
  - PROCESS or ACTIVITY started by RUN ASYNCHRONOUS
  - TRANSACTION associated with PROCESS or ACTIVITY has DYNAMIC(YES) and REMOTESYSTEM is blank
- **Inbound WebServices**
  - Target program defined DYNAMIC(YES)
  - A program in the PIPELINE changes contents of
    - Container DFHWS-USERID
    - Container DFHWS-TRANID & referenced TRANID defined DYNAMIC(YES)
So what part does CICSPlex SM play?

It supplies the program **EYU9XLOP** to act as both…

- … the Dynamic Routing Program
  - SIT - DTRPGM
  - SPI - SET SYSTEM DTRPROGRAM

- … the Distributed Routing Program
  - In SIT - DSRTPGM
  - SPI - SET SYSTEM DSRTPROGRAM

Once called…

- CICSPlex SM Workload Management facilities create a list of suitable, candidate, target CICS Regions, based on:
  - the transaction
  - the terminal id, luname, user id, or process type.

Note: CICSPlex SM does not do the routing, CICS does

The list of candidate Target Regions is based upon the Workload to which the Requesting/Routing Region belongs.
The CICSPlex SM Workload Management model

Workload Balancing
The process which decides which of the Target Regions is considered to be the most suitable, the ‘best’, candidate to route to, assuming:
● Work ‘could’ be sent to any of the Target Regions
● Work does not have an ‘affinity’ with a specific Region

Workload Separation
How CICSPlex SM Workload Management allocates specific work
● to specific set(s) of Target Regions
● for specific reasons
Workload Balancing

What Workload Balancing is NOT!
- NOT a means of EVENLY distributing work
- NOT a way to CONSISTENTLY distribute work

“Balancing” is a misnomer
… so what is it?
Workload Balancing is...

Providing CICS with the ‘best’ Target Region, at the moment the request was made, from all of the possible candidates.

ITS NOT EVENLY DISTRIBUTING WORK
How does it know which the ‘best’ is?
What is a CICSPlex SM Workload?

At its most basic
- One or more Requesting/Routing Regions
- One or more Target Regions
- One Workload Specification
- Workload balancing

Workload Specification resource (WLMSPEC)
- Defines a Workload
- The Workload must be “associated” with
  - Routing Region(s) (Dynamic & Distributed)
  - Target Region(s) (Distributed only)
- Specifies default target scope
- Specifies algorithm type (QUEUE or GOAL)
New WLM Specification in CICS Explorer

- Algorithm type (QUEUE or GOAL)
  - Used when you select best target region in target scope to which transaction is routed
  - Default routing algorithm applied to every routed dynamic transaction in workload
  - Except transaction group specifies own routing algorithm

- Primary search criterion
  - Which criterion (USERID or LUNAME) is checked first
Load and MVS effects

‘Queue Algorithm’
- LOAD = Current Tasks / Maxtasks
- Also defined to CICSPlex SM (via EYUPARMS)
  - WLMLOADCOUNT – for “Current Tasks” count
    - ALLQUEUED - All queue tasks waiting for MAXTASK or TRANCLASS
    - MXTQUEUED - Exclude tasks waiting for TRANCLASS
  - WLMLOADTHRS – 1-100%,
    Threshold as a % value of LOAD before CICSPlex SM will route off the local CEC (all other things … Health, Link, Affinities … being equal)

‘GOAL’ Algorithm
- ‘QUEUE’ + MVS WLM average transaction response time goals
- Average response-time goals
- Percentile response-time goals (since CICS 4.1)
  - Percentage of transactions to be completed in the target response time
WLM routing change for IPIC connections and Link

- WLM LINK weighting factor changed for IPIC connections
  - IPIC became faster → weighting moved above LU6.2 and Indirect
  - New LINK weighting order
    1. Local
    2. MRO/IRC (same LPAR)
    3. MRO/XCF (same Sysplex)
    4. IPIC
    5. LU6.2
    6. Indirect

- Specify routing algorithm on TRANGRP
  - New ALGTYPE attribute
  - Before: specified on WLMSPEC → algorithm applies to entire workload
  - Now: Allows different transaction to have different behaviors

5 Routing algorithms
1. QUEUE
2. GOAL
3. INHERIT
4. LNQUEUE (Exclude LINK weighting)
   Route transaction to target region with best combination of:
   - Health (MaxTask, Short-on-storage, Dumping, Stalled)
   - Task queue depth (or load)
   - Abend probability, when calculated
   - RTA event impact, when defined

5. LNGOAL (Exclude LINK weighting)
   Route transaction to target region that:
   - Is the most likely to allow transaction to meet its response time goal
Example Transaction Level Routing via different routing algorithms

**AOR** Workload defines default algorithm: QUEUE
Standard CICSPlex SM routing algorithm

**AOR** High priority work: GOAL
To exploit z/OS workload management goals

**AOR** Low priority work: Link Neutral Queue.
Speed not priority, efficiency of system load more important.

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### Diagram:

- **QOR** samples transactions based on priorities and routing rules.
- **CMAS** controls the flow of transactions between different queues.
- **CICSplex** represents the system architecture for managing transaction routing.
- **AOR** algorithms dictate the operational routing of transactions within the system.
This will become your default rule

Event
- analysis (RTADEF) or status definition (STATDEF) that might affect transactions using the default transaction group for this workload specification.
- If a real-time analysis event is generated by this definition, WLM uses the information to select the best routing for those transactions.
- If this field is blank, no analysis or status definition is associated with the default transaction group.
What are affinities?

- A dependency to return to the same Target Region caused by a program leaving a requirement to return there, e.g. for local data
- Affinity Relationships
  - USERID
  - Luname
  - Global
  - Locked
  - BAPPL
- Must be set if Affinities processing required
- Each affinity relationship supports different lifetimes

Affinity lasts for specified Lifetime, specified on WLMSPEC (default) or Tran Group
- DELIMIT - Mode END (e.g. for a Menu transaction)
- PCONV - Until end of psuedo-conv using EXEC
- CICS RETURN TRANSID
- ACTIVITY/PROCES - Until CICS BTS Activity or Process is no longer active
- SIGNON - Duration of a user Signon -> Signoff
- LOGON - Duration of a VTAM logon -> Logoff
- SYSTEM - Duration of the region (Avoid these!)
- PERMANENT - Duration of the Workload (Avoid these!)
Affinities

Means transactions must run in the same target region for the lifetime of the affinity

- **Relationship (BAPPL)** - transactions associated with same BTS process
  - >> SYSTEM, PERMANENT, ACTIVITY, PROCESS

- **GLOBAL** - transactions started from any terminal by any START command
  - >> SYSTEM, PERMANENT

- **LOCKED** - transactions in group associated with dynamically-linked programs within same unit of work
  - >> UOW

- **LUNAME** - transactions in group that are associated with same terminal
  - >> SYSTEM, PERMANENT,

- **USERID** - transactions initiated from terminal by a START command & executed on behalf of the same user ID
  - >> SYSTEM, PERMANENT

“Automatically create affinities” creates affinity using Relationship & Lifetime fields, if not selected - affinity not automatically created, but it can be created by a customized version of the dynamic routing program EYU9WRAM.
Locked Affinity (CICS 4.2)

- Resolves problems with multiple DPLs in a single UOW (UOW affinity problem)
- New CICS affinity relationship: LOCKED
- New CICS affinity lifetime: UOW
- Changes to:
  - Views: WLMSPEC, TRANGRP, WLMAWORK, WLMATGRP, WLMATAFF, WLM AWTOR
  - User Replaceable Modules: DFHDYPS, EYURWCOM, EYURWTRA
Abend probability per WLM Group or Tran Group

- Used to help avoid an AOR if Transaction Abends
- Specified on WLMSPEC and TRANGRP definitions
- If handled, routing program doesn’t know about it
- Critical: Acceptable level of abend probability (Abend Health)
  - 0 - Abend Compensation OFF
  - 2-99% - chance of abend
  - Region considered unhealthy if exceeded
- Threshold: Abend load threshold (Abend Load)
  - 0 – Required if Abend Health is 0
  - 1-98% chance of abend
  - Double Target Load when reached
Health

Combination of …

● Target Region Health
  ■ CICS States: SOS, Dumping, Maxtasks
    (CICSPlex SM notified by CICS)
  ■ CPSM States:
    ✦ Stalled (CICSPlex SM Stall detection process)
    ✦ MAS is Non-Responsive (active MAS has lost contact with its managing CMAS)

● Target Region “Quiesced” from Workload
● RTA Event associated with WLMSPEC/TRANGRP
● Abend Compensation
Add Routers, Select Targets

Routing: systems (CSYSDEF) AND system groups (CSYSGRP)

Parenthesis mean: part of workload already

Target: systems (CSYSDEF) OR system groups (CSYSGRP)

Text: take routers from existing workloads
TODO: Change Screenshot
Workload Balancing – Routers and Targets

CICSplex

- Requesting/Routing Scope
  - TOR1
  - TOR2

- Workload Specification association
  - WLMSPEC1
  - Target Scope: AOR1, AOR2, AOR3

- Multiple Workloads within CICSplex

- Routing region can only be associated with 1 Workload

- Requesting/Routing Scope
  - TOR3
  - TOR2

- Workload Specification association
  - WLMSPEC2
  - Target Scope: AOR4, AOR5, AOR6

- Routing and Target at same time

- Target for multiple workloads
Queue mode

<table>
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<tr>
<th>Link</th>
<th>MRO/XM</th>
<th>Load</th>
<th>Pabnd(ABCD)</th>
<th>SOS</th>
<th>Dump</th>
<th>Stall</th>
<th>RTA Severity</th>
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<td>0.0</td>
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</tbody>
</table>

All regions maxtask 100; abend load=2.0; Abend health=6.0

weight = (link*load*Abnd*100) + Health

$\begin{align*}
(1.0*0.55*2.0*100) + 0 &= 110 \\
(1.0*0.7*1.0*100) + 1000 &= 1070 \\
(1.0*6*2000.0*100) + 0 &= 140000 \\
(1.3*0.8*1.0*100) + 0 &= 104
\end{align*}$

VALUES ARE FOR ILLUSTRATIVE PURPOSES ONLY
CPSM Optimized Workload Management

- improves efficiency of workload distribution since V4.1
- addresses issue of "Batching" in heavy workloads spread across multiple LPARs
- Exploitation of z/OS coupling facility
  - “Near real time” Sysplex-wide focus on target region status
  - No impact to “non-optimized” WLM
- Enabled by configuring a Region Status Server
  - Uses CF Data Table for Region Status information: SOS, MaxTask, System or transaction dump in progress, Current Tasks?
  - Shared by all routing regions (in the Sysplex)

http://mainframezone.com/article/cics-sysplex-optimized-workload-routing
Workload Separation

TORs

Payroll AORs

Sales AORs
Transaction Level Control of Routing Decisions - Granularity

- Pre-CICS TS Version 4
  - Routing Algorithm could only be applied at the Workload (WLMSPEC) level.
  - Workload Separation differentiated where work went but not type of algorithm to be used.

- CICS TS Version 4 can apply Algorithm at Workload Separation level (WLMDEF & TRANGRP) as well as the Workload to
  - Use different routing algorithms for different types of application
  - For example to handle high & low priority work differently
  - Dynamically replace a 'live' workload by activating at Transaction Group level
  - Change behaviour of existing Workload Separation
  - Override the default WLM Specification behaviour without restarting Workload
  - By default Transaction Group will INHERIT the Algorithm of the Workload
Add Rules (WLMDEF) & group them (WLMGROUP)

Show Workload groups if containing > 1 rules, else show rule only

Show or Hide Names

Shows only rule description, toggle button to show names
Add new Rule, select existing Trangroup
Create New Trangroup

1. Browse for Trans in Target Scope
2. Select them to be added to Trangroup (Shift/Strg for multi-select)
In the WUI you would need to add every single transaction!
Sample WLMSPEC in CICS Explorer 5.2
Sample WLMSPEC: separation based on UserID

- **Rules:**
  - Default rule
  - General WLM Group
  - FILEA WLM Def
  - FILEA WLM Def - User=ARNOLD
  - FILEA WLM Def - User=LEICHER

- **Targets:**
  - **Targets:**
  - Terminal LU name: .*
  - User ID: *
  - BTS process type: *
  - Algorithm: INHERIT
  - Primary criterion: USERID
  - Status: ACTIVE
  - Event: RTAHELTH

- **Targets:**
  - **Targets:**
  - Terminal LU name: .*
  - User ID: ARNOLD
  - BTS process type: *

- **Targets:**
  - **Targets:**
  - Terminal LU name: .*
  - User ID: LEICHER
  - BTS process type: *
WLMSPEC after Installation

WLMSPEC becomes active after restarting Routing Region.

To refresh Rules, reinstall them after change.

Discard Rules via Right-Click.
More Views for Workload Management
## Router Views

![Router Views Table](image)

<table>
<thead>
<tr>
<th>Workload</th>
<th>Workload Owner</th>
<th>Routing Region</th>
<th>Contact Status</th>
<th>Optimization Status</th>
<th>CMAS Owner</th>
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<tbody>
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<td>WLMSPC01</td>
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<td>CICST</td>
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<td>CMAS01</td>
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</tbody>
</table>

![Router Status Table](image)

<table>
<thead>
<tr>
<th>Workload</th>
<th>Workload Owner</th>
<th>Routing Region</th>
<th>Contact Status</th>
<th>Optimization Status</th>
<th>Abend Compensation Status</th>
<th>FMID Sequence</th>
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<tbody>
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<table>
<thead>
<tr>
<th>Workload</th>
<th>MVS System Name</th>
<th>Release</th>
<th>Reporting CMAS</th>
<th>Start Time</th>
<th>TOR Owner</th>
<th>UOW Completes</th>
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<tr>
<td>WLMSPC01</td>
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<td>CMAS01</td>
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<td>CMAS01</td>
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</table>
## Workload Targets View (split)

### Workload Details

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<thead>
<tr>
<th>Workload</th>
<th>Target Reg...</th>
<th>Workload Owner</th>
<th>Status</th>
<th>Contact S...</th>
<th>Optimizat...</th>
<th>CF UpdateCount</th>
<th>Cpsmver</th>
<th>Routing Load</th>
<th>Routing Weight</th>
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### Health Status

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<th>Target Reg...</th>
<th>Events</th>
<th>Health Dump</th>
<th>Health MAS Non-responsive</th>
<th>Health MAXTASKS</th>
<th>Health Short On Storage</th>
<th>Health Stall</th>
<th>MAXTASKS</th>
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<tbody>
<tr>
<td>CICS1</td>
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<td>NO</td>
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<td>CICS3</td>
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<td>CICS4</td>
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<td>CICSF</td>
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### Resource Settings

<table>
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<tr>
<th>Target Reg...</th>
<th>RS Server Pool ID</th>
<th>RS Server Read Interval</th>
<th>RS Server Update Freq</th>
<th>Task Count</th>
<th>Task Load</th>
<th>Task Load Queue Mode</th>
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<tr>
<td>CICS1</td>
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<td>5</td>
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<td>CICS4</td>
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### Additional Info in Workload Target Status View

**Workload Target Status**


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<thead>
<tr>
<th>Target Region</th>
<th>Route Abends</th>
<th>Route Completes</th>
<th>Route Errors</th>
<th>Route Initiates</th>
<th>Route Notifies</th>
<th>Route Selections</th>
<th>Route Terminates</th>
<th>Routing Load</th>
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<tbody>
<tr>
<td>CICSF</td>
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</tbody>
</table>
# Workload Transaction views

## Workload Transactions

<table>
<thead>
<tr>
<th>Workload</th>
<th>Workload Owner</th>
<th>Transaction ID</th>
<th>Pseudoconversational</th>
<th>Transaction Group</th>
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<tbody>
<tr>
<td>WLMSPC01</td>
<td>CM01</td>
<td>AADD</td>
<td>N_A</td>
<td>TRGFILEA</td>
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<td>WLMSPC01</td>
<td>CM01</td>
<td>ABCD</td>
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<td>END</td>
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<td>N_A</td>
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## Workload Transaction Groups

<table>
<thead>
<tr>
<th>Workload</th>
<th>Workload Owner</th>
<th>Transaction Group</th>
<th>Status</th>
<th>Automatic Affinity Creation</th>
<th>Filter</th>
<th>Affinity</th>
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<tbody>
<tr>
<td>WLMSPC01</td>
<td>CM01</td>
<td>TRGFILEA</td>
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<table>
<thead>
<tr>
<th>Affinity Lifetime</th>
<th>Event Name</th>
<th>Abend Crit</th>
<th>Algorithm Type</th>
<th>Abend Threshold</th>
<th>Transaction Count</th>
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<tbody>
<tr>
<td>DELIMIT</td>
<td>RTAHELTH</td>
<td>5</td>
<td>INHERIT</td>
<td>2</td>
<td>6</td>
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</tbody>
</table>
TODO: new Online Rule View
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The “Batching” problem pre CICS V4

Routers (QOR) get load based on local CMAS data. AORs & Remote CMASs use 15 second heartbeat to keep in step. Routers & Targets managed by different CMASs - especially if high traffic and utilise the DSRTPGM exit (e.g. non terminal triggered transactions initiated by MQ triggers) - unaware of “maxtask” situations in interval.
With workload optimization

Local CMAS data spaces replaced by RS Servers utilizing Sysplex-wide Coupling Facility tables.
Use of RS servers feeding to Coupling Facility pool means:

- Same data available to all Routers in the Workload
- Control of updates to, and reads from, the Servers can be tailored (UPDATERS, READRS, TOPRSUPD, BOTRSUPD) at both CICSplex and individual CICS Region level. (frequent enough to be accurate, not so frequent it overloads the CF)
- Each region recorded in record in the data table
- A region status record is approximately 40 bytes long.
- For example, if PLEX1=100 regions then required structure is:
  Poolname = DFHRSTAT, Table name = PLEX1, 100 regions x 40 bytes = 4000 bytes total

For an accurate estimate of storage requirements, use the IBM CFSizer tool available at http://www.ibm.com/systems/support/z/cfsizer/.
**Target regions** maintain task count using CICS transaction manager
- all tasks in region (not just routed)
- (tailorable) periodic broadcast of load value broadcast with basic health status to Coupling facility
Routing regions (regardless of CMAS managing them) all access the same status data for potential targets. Data refreshed between 2 seconds to 1 millisecond, default 200 ms. The more frequent Refresh = more accurate load measure but heavier Coupling Facility usage.