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Session z119

CF Analysis and Sysplex Aggregation Qualification

Gretchen Frye
Advisory Software Engineer

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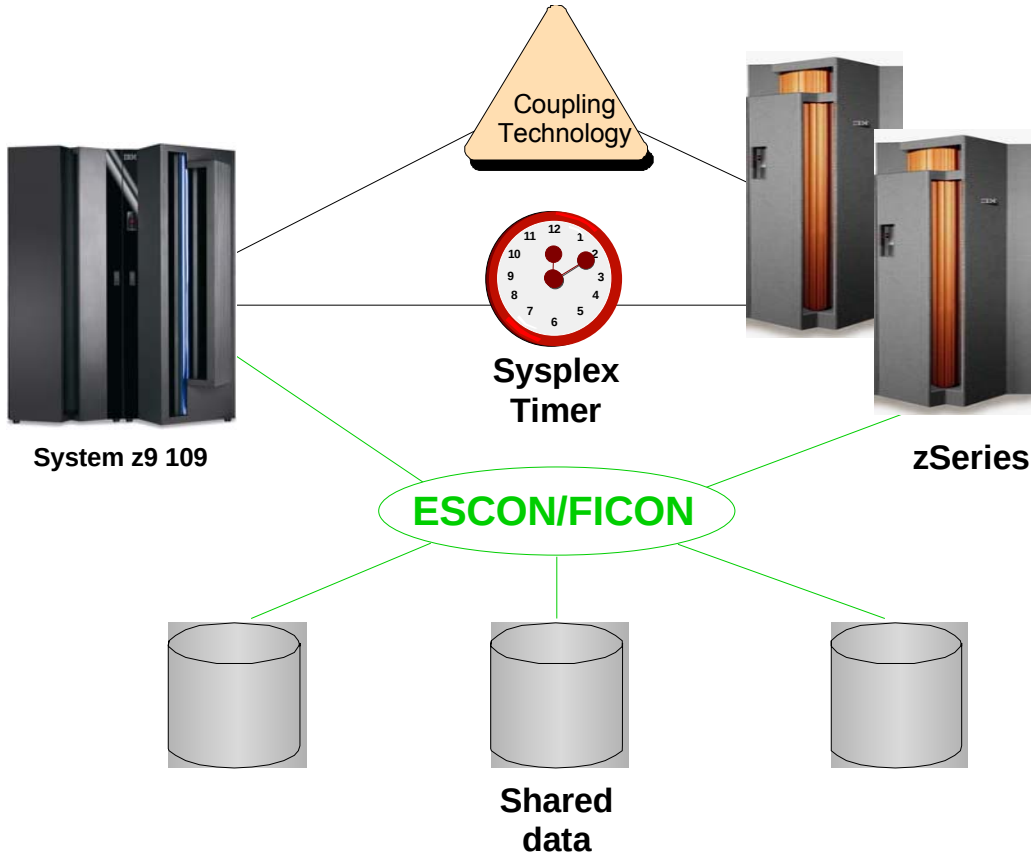
Agenda

- Sysplex Aggregation
  - What it is
  - Qualifying Requirements
    - ✓ Hardware
    - ✓ Software
    - ✓ Operational
  - Examples
  - Tool support
- CF Analysis using zCP3000

Parallel Sysplex – What is it ?

- Hardware
  - Timer
  - I/O Connectivity
  - Coupling Facility
- Software
  - XCF/XES
  - WLM
- µ-code (Microcode)
  - CFCC
  - Processor µ-code



Sysplex Aggregation

- Software pricing benefits
- This session: Technical Qualifications, *NOT* pricing
- For pricing : sysplex, subcapacity, etc.

Session Z116 “z/OS Pricing”

Amy Tobenkin

Thursday @ 3:30pm

What is a Parallel Sysplex?

- Up to 32 z/OS logically functioning as one
- Transparent supporting infrastructure
- Hardware and software components

Parallel Sysplex Benefits

- Continuous availability
- Flexible growth
- High-performance shared data across systems
- **Potential software pricing benefit**

Sysplex Aggregation Pricing

- software licenses priced as a single entity

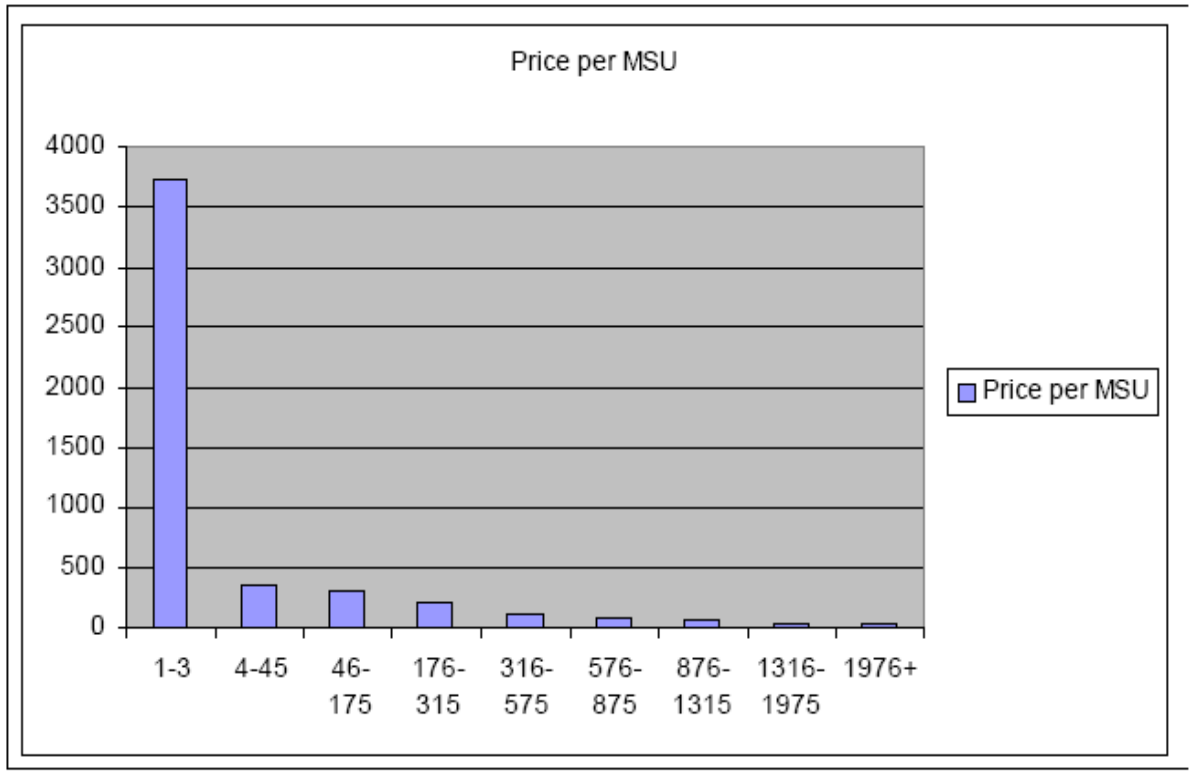


Figure 2-1 Effect of decreasing unit price as capacity increases

Sysplex Aggregation Pricing

- Non-aggregated price:

  82 + 174 = 256

- Aggregated price:

  188

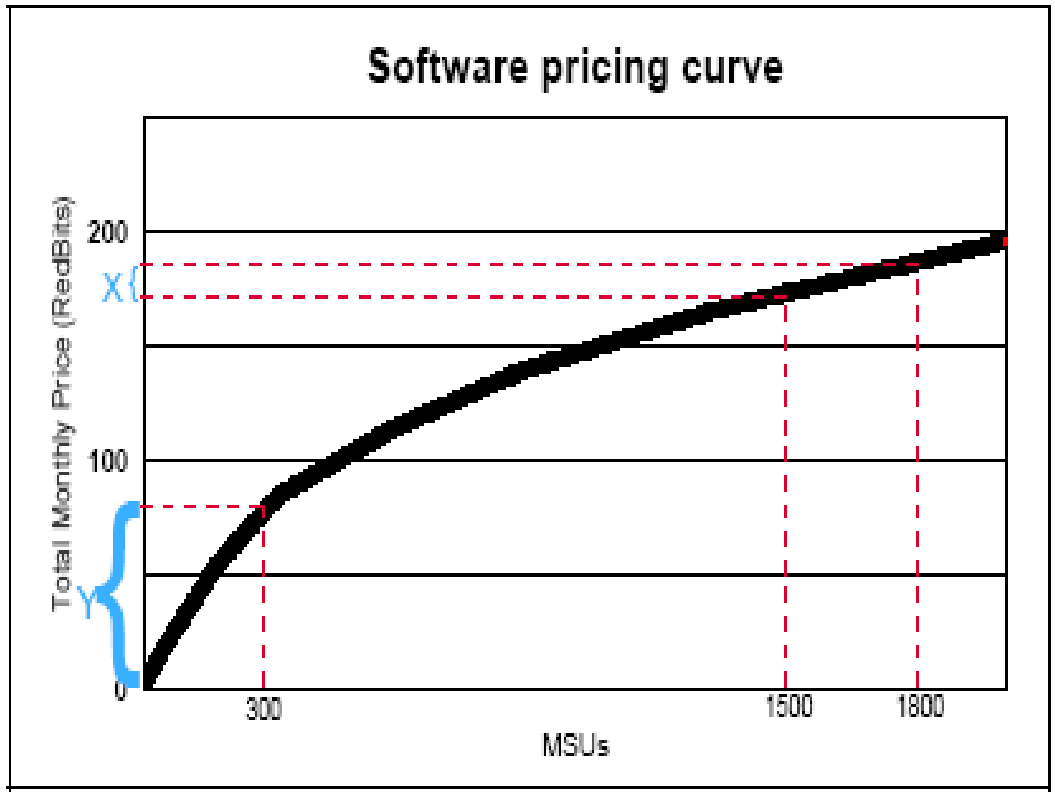


Figure 2-2 Pricing curve

** (not real prices)

Sysplex Aggregation

…of software charges across ***actively coupled*** machines

Criteria:

- Hardware – z9, zSeries, 9672, OEM
- Software – z/OS, OS/390, and Systems Enablement Function
- Operation - 50% of the total z/OS used on that machine
- Validation - System Verification package

Aggregation Criteria - Software

Systems Enablement Function

- Application Data Sharing including:
  - IMS/TM: with IMS DB or DB2
  - CICS: with IMS DB or DB2 or VSAM RLS
  - TSO and DB2 data sharing
  - An eligible **Independent Software Vendors Data Base**
- GRS Star Implementation
- JES2 Checkpoint in the coupling facility
- RACF database caching
- SmartBatch multisystem processing
- Automated tape sharing and switching

Aggregation Criteria - Software

Systems Enablement Function (continued)

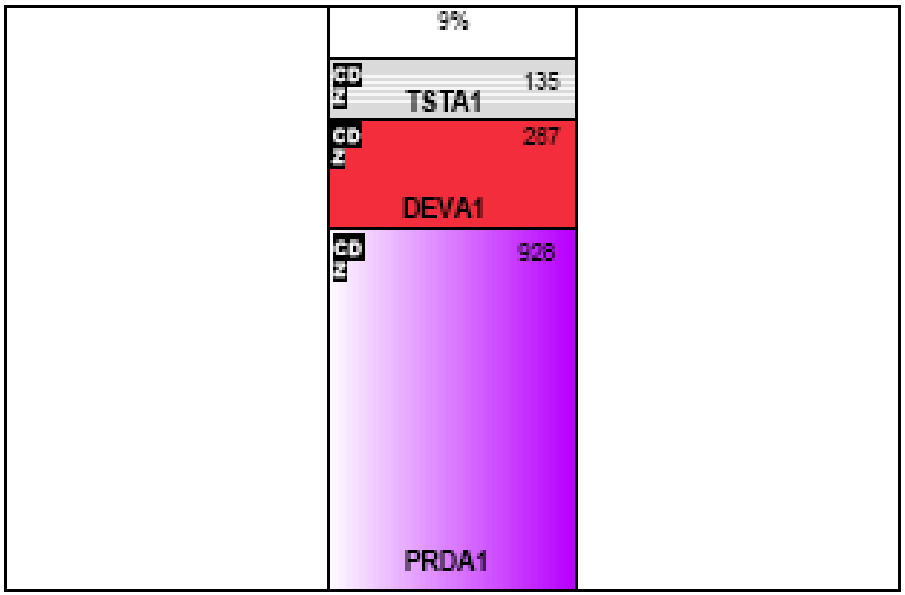
- VTAM Generic Resources
- VTAM MULTINODE Persistent Sessions
- System logger SYSLOG (OPERLOG)
- System logger LOGREC
- System logger Resource Recovery Services
- WebSphere MQ shared message queues
- HSM common recall queues
- Enhanced catalog sharing

Aggregation Criteria - Operation

Terminology

- **Parallel Sysplex -** z/OS images with a shared sysplex CDS, common time source, common Coupling Facility.
- **PrimaryPlex -** utilization from a sysplex's LPARs is more than half of all MVS-based utilization on that CPC.
- **PricingPlex** - the group of *CPCs* with the same PrimaryPlex.

Aggregation Criteria - Operation Sample Configuration 1

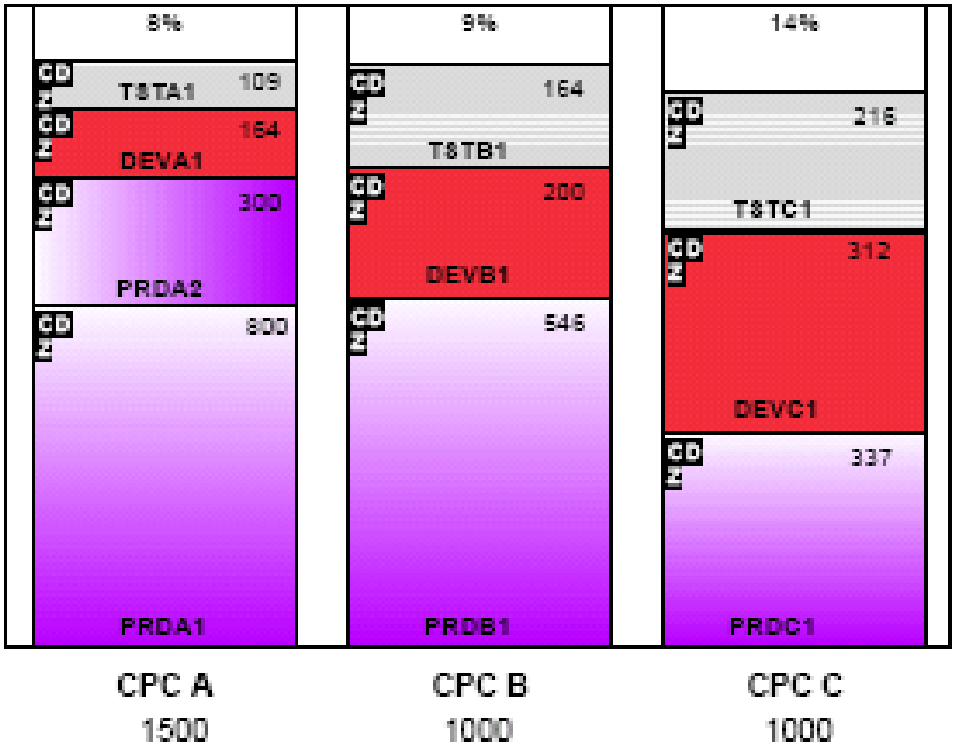


Sysplex

- Test
- Dev
- Prod

CPC	LPAR	Sysplex	Avg MSU	% MVS MSUs
A	TSTA1	Test	135	11%
A	DEVA1	Dev	287	21%
A	PRDA1	Prod	928	68%

Aggregation Criteria - Operation Sample Configuration 2



CPC	LPAR	Sysplex	Avg MSU	% MVS MSUs
A	TSTA1	Test	109	8%
A	DEVA1	Dev	164	12%
A	PRDA1	Prod	800	58%
A	PRDA2	Prod	300	22%
B	TSTB1	Test	164	18%
B	DEVB1	Dev	200	22%
B	PRDB1	Prod	546	60%
C	TSTC1	Test	216	25%
C	DEVC1	Dev	312	36%
C	PRDC1	Prod	337	39%

Aggregation Criteria - Operation Sample Configuration 2

CPC	LPAR	Sysplex	Avg MSU	% MVS MSUs
A	TSTA1	Test	109	8%
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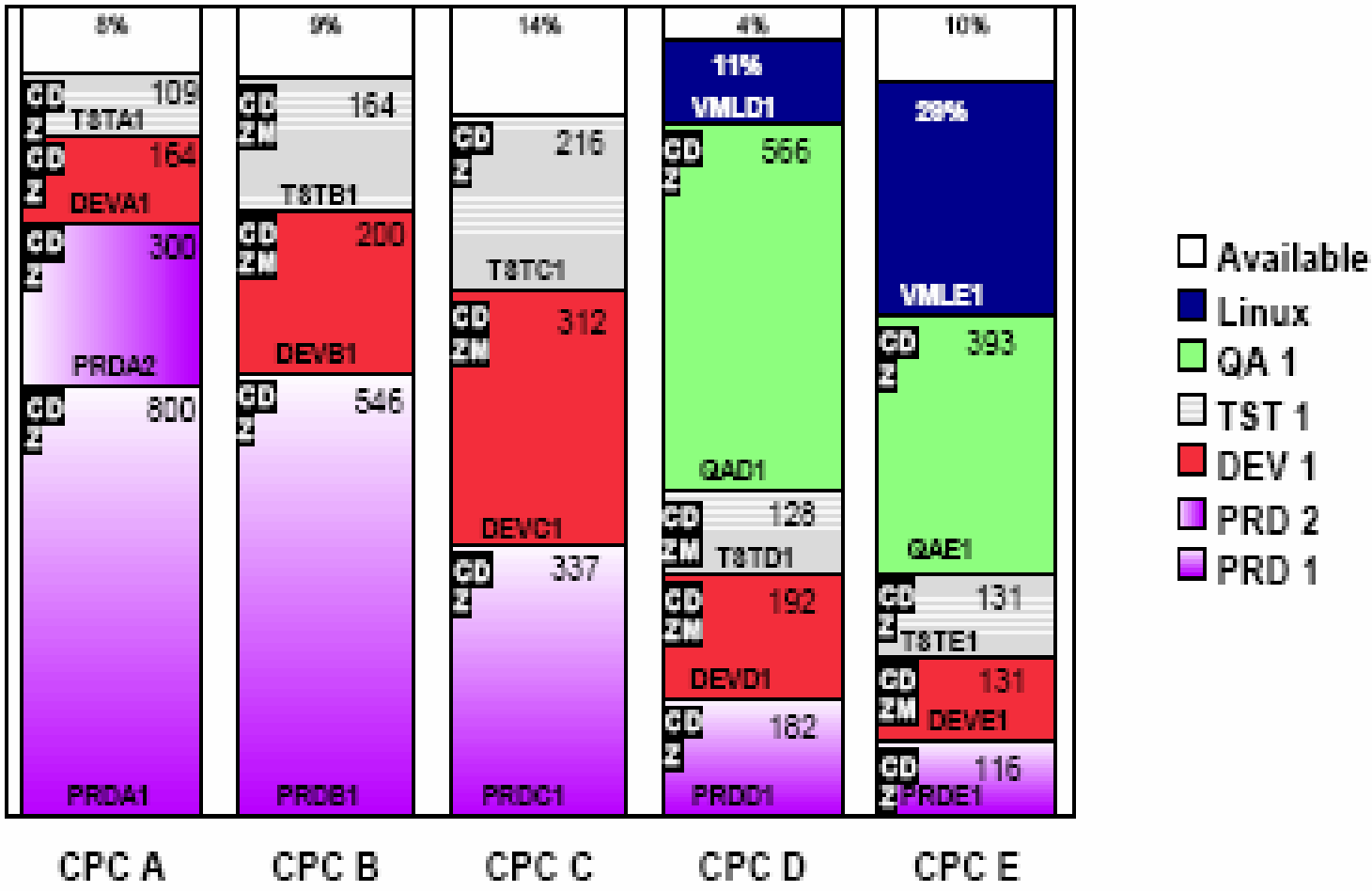
C	TSTC1	Test	216	25%
C	DEVC1	Dev	312	36%
C	PRDC1	Prod	337	39%

Primary Plex - the sysplex with >50% MSUs used on that CPC

Primary Plex	CPC	License MSU	Pricing MSU
PROD	A	1500	2500
PROD	B	1000	
n/a	C	1000	1000

Aggregation Criteria - Operation
Sample Configuration 3



Aggregation Criteria - Operation
Sample Configuration 3 - Two Primary Plexes

CPC	LPAR	Sysplex	Avg MSU	% MVS MSUs
A	TSTA1	Test	109	8%
A	DEVA1	Dev	164	12%
A	PRDA1	Prod	800	58%
A	PRDA2	Prod	300	22%
B	TSTB1	Test	164	18%
B	DEVB1	Dev	200	22%
B	PRDB1	Prod	546	60%
C	TSTC1	Test	216	25%
C	DEVC1	Dev	312	36%
C	PRDC1	Prod	337	39%

CPC	LPAR	Sysplex	Avg MSU	% MVS MSUs
D	VMLD`	n/a	n/a	n/a
D	QAD1	QA	566	53%
D	TSTD1	Prod	128	12%
D	DEVD1	Prod	192	18%
D	PRDD1	Test	182	17%
E	VMLE1	n/a	n/a	n/a
E	QAE1	QA	393	51%
E	TSTE1	Test	131	17%
E	DEVE1	Dev	131	17%
E	PRDE1	Prod	116	15%

Aggregation Criteria - Operation
Sample Configuration 3 - Two Primary Plexes

Primary Plex	CPC	License MSU	Pricing MSU
PROD	A	1500	2500
PROD	B	1000	
n/a	C	1000	1000
QA	D	1250	2500
QA	E	1250	

Aggregation Criteria - Validation

System Verification Package

http://www-03.ibm.com/servers/eserver/zseries/swprice/sysplex/pdf/svp.pdf

1. Name of ***PrimaryPlex***
2. Common Systems Enablement Function used
3. CF Structure for that Systems Enablement Function
4. 5 consecutive business days
5. Prime Shift Hours (and optional 2 consecutive eliminated hours)
6. Type / Model / Serial Number of each Machine in the ***PricingPlex***

7. Sysplex Calculator Report (PlexCalc)
8. CF Activity Report (RMF)

Aggregation Criteria - Validation Tools

- PlexCalc
  - No charge tool

    http://www-03.ibm.com/servers/eserver/zseries/swprice/sysplex/sysplex_calc.html

  - SMF Type 70 records from

    ****Every MVS on every CPC****

  - Required with System Verification Package

Aggregation Criteria - Validation

PlexCalc Tool

```
============== SYSPLEX CALCULATOR ==============
Release Date 12/20/2005
Customer Name CUSTOMER NAME
Machine  Serial MSUs      LPARs
CPC1     11111  248       FK15D, FK15A(1), FK15B
CPC2     22222  492       FKI7A(1), FKI7C, FKI7B
CPC3     33333  402       FKI1B(1), FKI1A
CPC4     44444  410       FKI14A
CPC5     55555  350       FKI4D, FKI4A, FKI4B(1), FKI4C
CPC6     66666  392       FKI5A(1), FKI5B
CPC7     77777  330       FKI12A(1), FKI12B
CPC8     88888  410       FKI17A
CPC9     99999  187       FKI10A(1), FKI10B, FKI10C, FKI10I
```

LPAR name, not SYSID

SMF 70 input collected

(1) This LPAR has general CPs assigned yet SMF data for this LPAR was not provided in the input stream.

Aggregation Criteria - Validation

PlexCalc Tool

"Based on IBM's Parallel Sysplex Aggregation criteria, Sysplex Calculator has determined that .."

- the PrimaryPlex for CPC1 is FPKD
- the PrimaryPlex for CPC2 is FPKE
- the PrimaryPlex for CPC3 is FPKU
- the PrimaryPlex for CPC4 is FPKE
- the PrimaryPlex for CPC5 is FPKU
- the PrimaryPlex for CPC6 is FPKW
- the PrimaryPlex for CPC7 is FPKW
- the PrimaryPlex for CPC8 is FPKW
- the PrimaryPlex for CPC9 is FPKD

PricingPlex 1

PricingPlex 2

PricingPlex 3

PricingPlex 4

Aggregation Criteria - Validation

Tools

- zCP3000
  - No charge tool for IBM and entitled IBM Business Partners

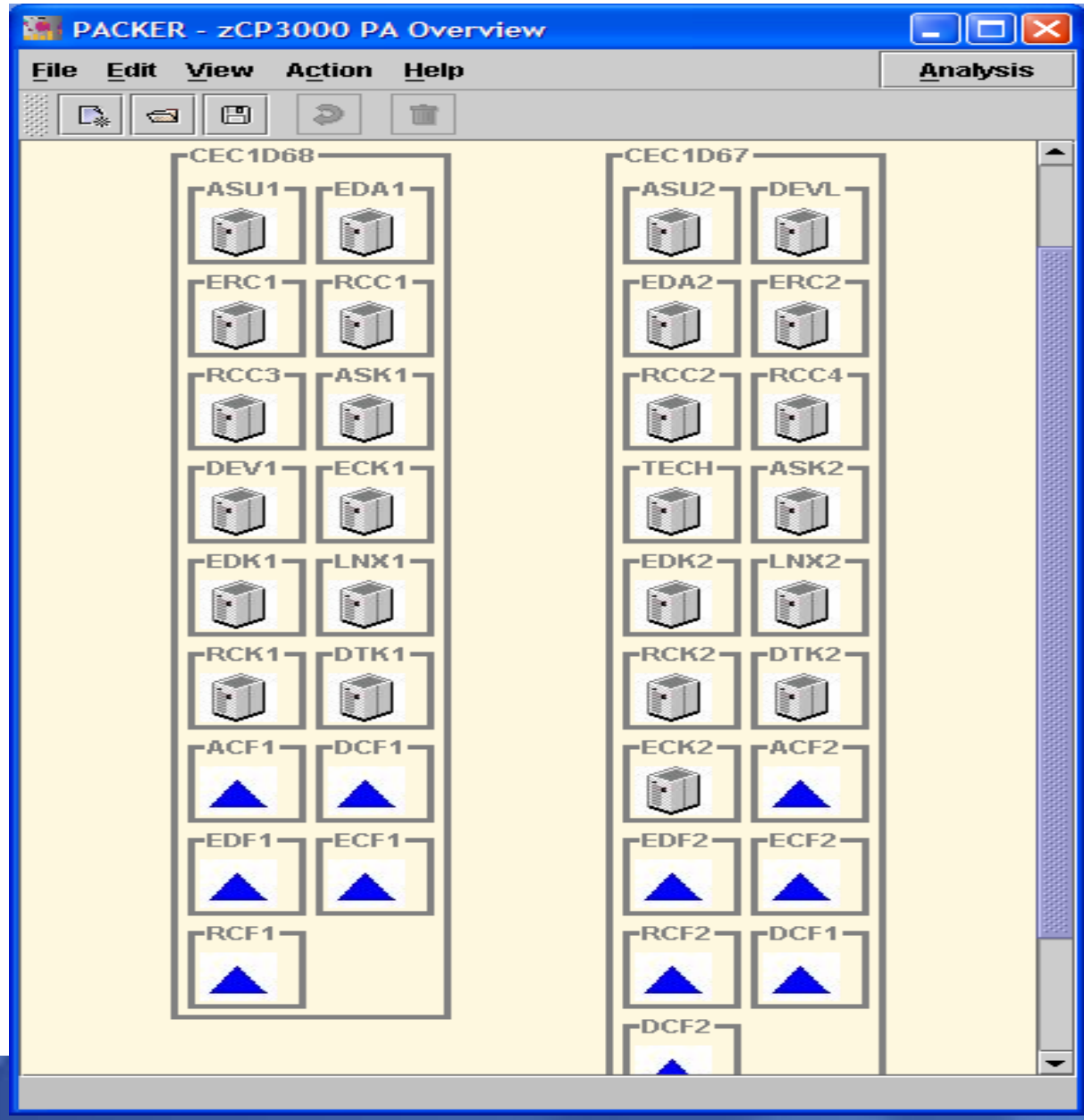
    IBM - http://w3.ibm.com/support/americas/wsc/cpsproducts.html

    BP - http://partners.boulder.ibm.com/src/atsmastr.nsf/WebIndex/PRS1762

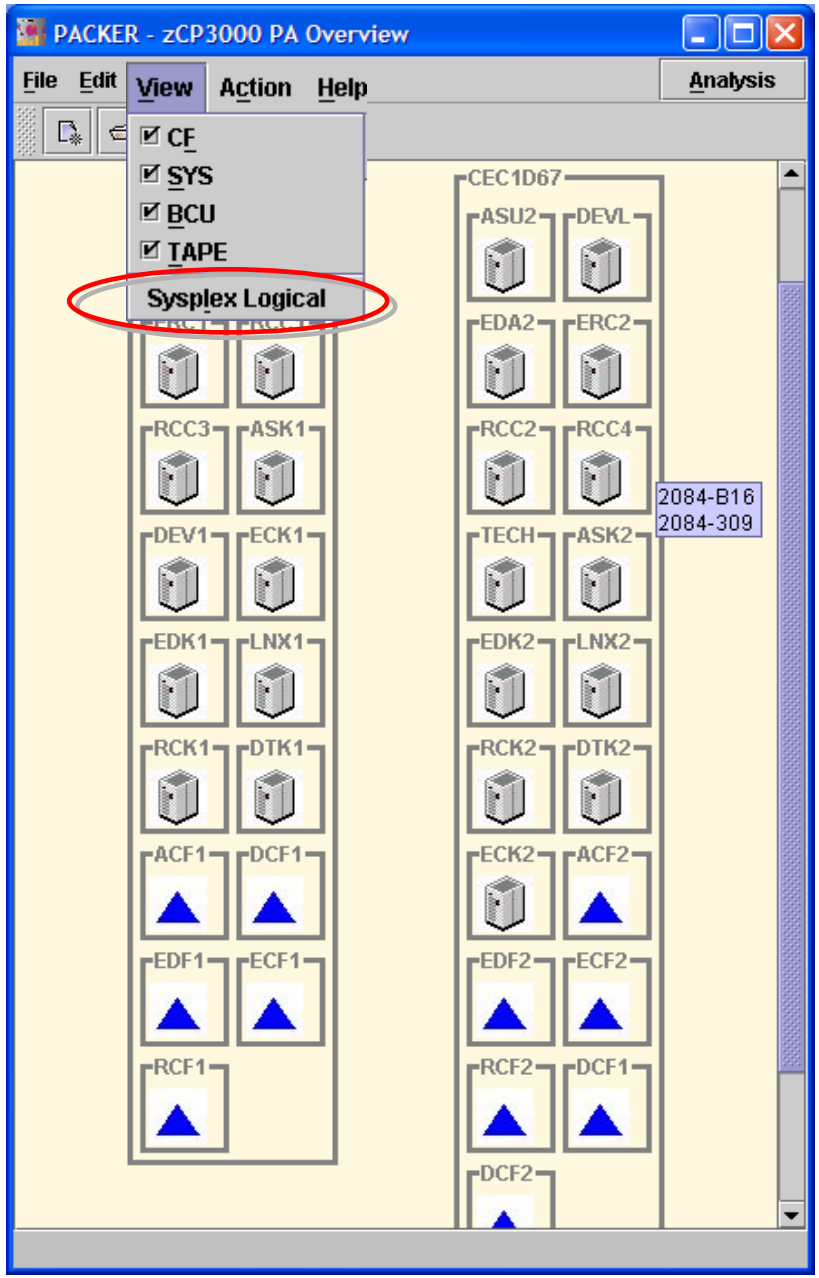
  - Extracted data (EDF) from every MVS on every CPC

Not a substitute for PlexCalc

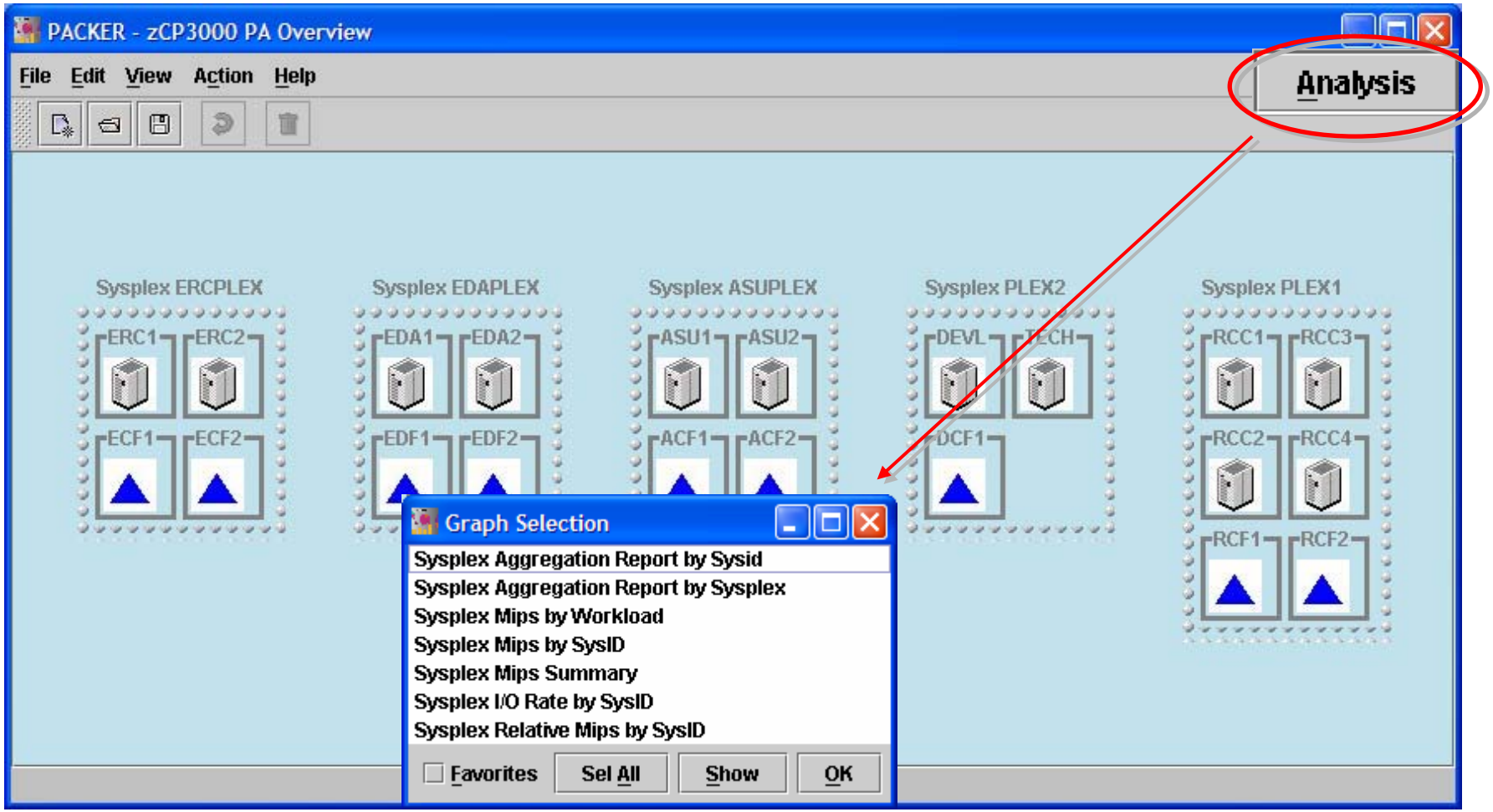
Sample Configuration 4 - Five SysPlexes



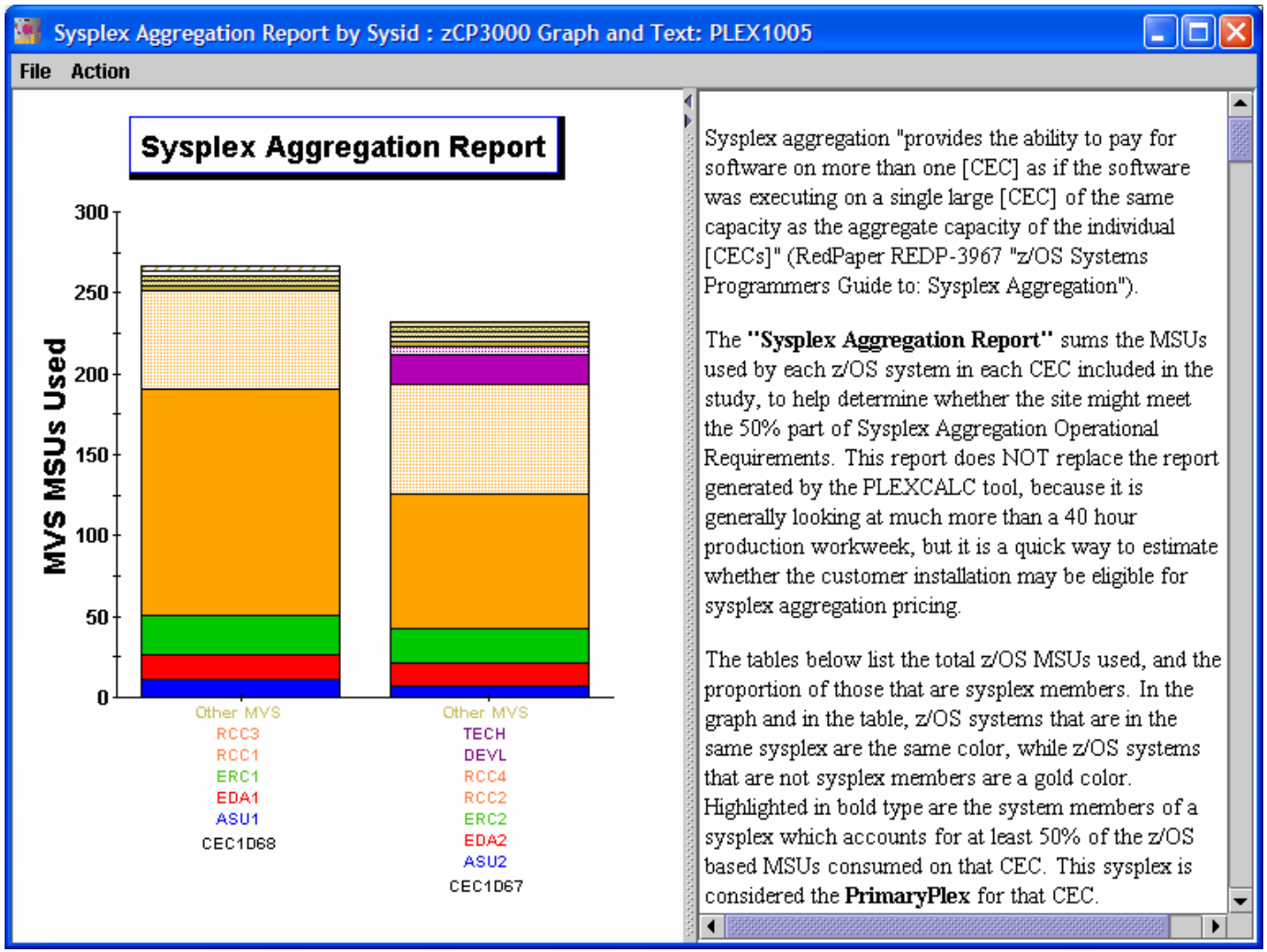
Sample Configuration 4 - Five SysPlexes



Sample Configuration 4 - Five SysPlexes



Sample Configuration 4 - Five SysPlexes



Sample Configuration 4 - Five SysPlexes

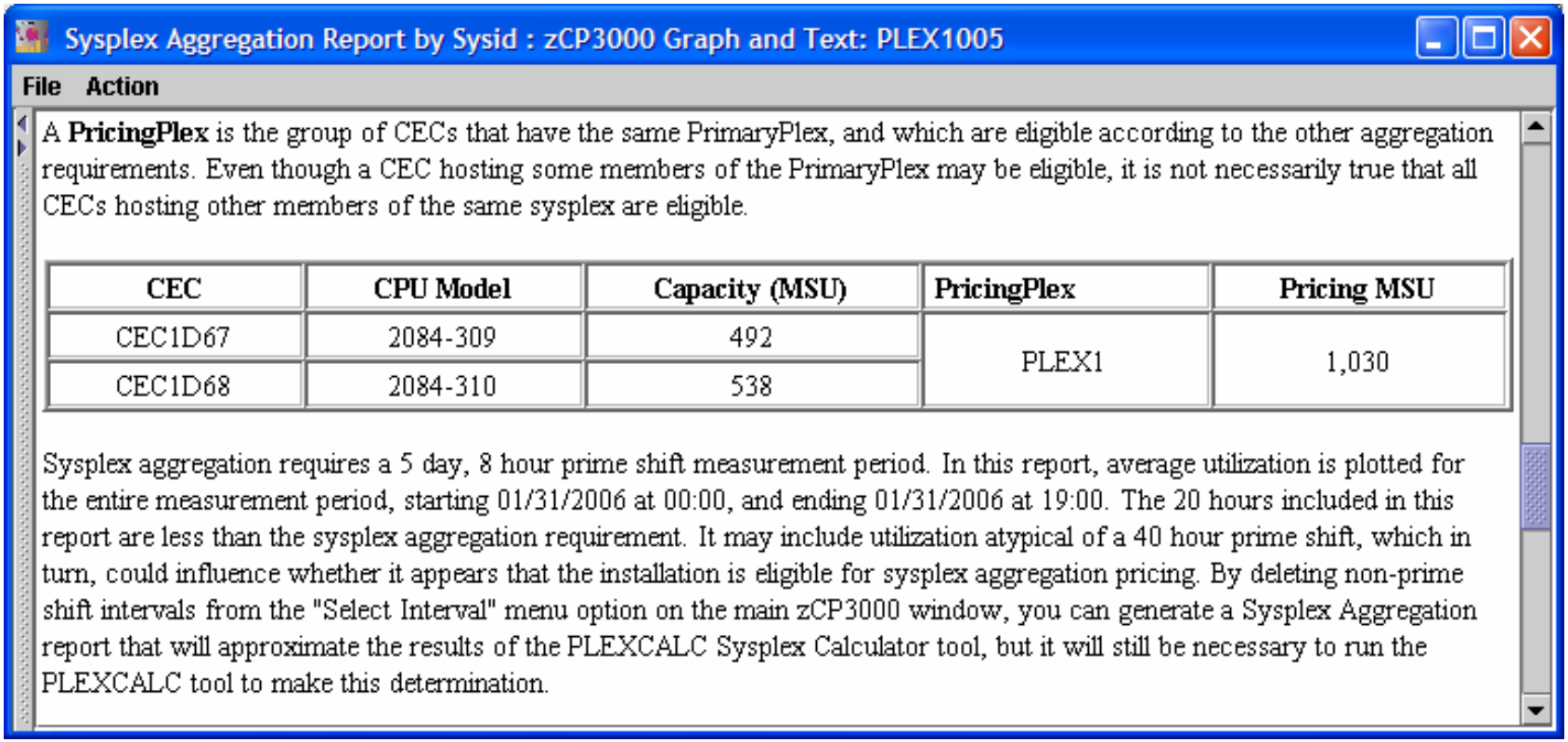
Sysplex Aggregation Report by Sysid : zCP3000 Graph and Text: PLEX1005

File Action

The tables below list the total z/OS MSUs used, and the proportion of those that are sysplex members. In the graph and in the table, z/OS systems that are in the same sysplex are the same color, while z/OS systems that are not sysplex members are a gold color. Highlighted in bold type are the system members of a sysplex which accounts for at least 50% of the z/OS based MSUs consumed on that CEC. This sysplex is considered the **PrimaryPlex** for that CEC.

CEC	SYSID	SCP	Sysplex	Avg MSU used	% of MVS-based MSUs
CEC1D67	ASU2	z/OS	ASUPLEX	6.88	3.0%
CEC1D67	EDA2	z/OS	EDAPLEX	13.90	6.0%
CEC1D67	ERC2	z/OS	ERCPLEX	21.50	9.3%
CEC1D67	**RCC2**	**z/OS**	**PLEX1**	**83.59**	**36.0%**
CEC1D67	**RCC4**	**z/OS**	**PLEX1**	**67.75**	**29.2%**
CEC1D67	DEVL	z/OS	PLEX2	17.86	7.7%
CEC1D67	TECH	z/OS	PLEX2	5.13	2.2%
CEC1D67	ASK2	z/OS		3.22	1.4%
CEC1D67	EDK2	z/OS		2.86	1.2%
CEC1D67	RCK2	z/OS		3.68	1.6%
CEC1D67	DTK2	z/OS		2.89	1.2%
CEC1D67	ECK2	z/OS		2.89	1.2%
CEC1D67	Total	MVS		232.14	100.0%

Sample Configuration 4 - Five SysPlexes



Sysplex Aggregation Report by Sysid : zCP3000 Graph and Text: PLEX1005

File Action

A **PricingPlex** is the group of CECs that have the same PrimaryPlex, and which are eligible according to the other aggregation requirements. Even though a CEC hosting some members of the PrimaryPlex may be eligible, it is not necessarily true that all CECs hosting other members of the same sysplex are eligible.

CEC	CPU Model	Capacity (MSU)	PricingPlex	Pricing MSU
CEC1D67	2084-309	492	PLEX1	1,030
CEC1D68	2084-310	538		

Sysplex aggregation requires a 5 day, 8 hour prime shift measurement period. In this report, average utilization is plotted for the entire measurement period, starting 01/31/2006 at 00:00, and ending 01/31/2006 at 19:00. The 20 hours included in this report are less than the sysplex aggregation requirement. It may include utilization atypical of a 40 hour prime shift, which in turn, could influence whether it appears that the installation is eligible for sysplex aggregation pricing. By deleting non-prime shift intervals from the "Select Interval" menu option on the main zCP3000 window, you can generate a Sysplex Aggregation report that will approximate the results of the PLEXCALC Sysplex Calculator tool, but it will still be necessary to run the PLEXCALC tool to make this determination.

But what about…

- zCP3000 vs PlexCalc
- zIIPs and zAAPs
- MVS guests under VM
- LPARS with different GMT offsets

Aggregation Criteria - Validation

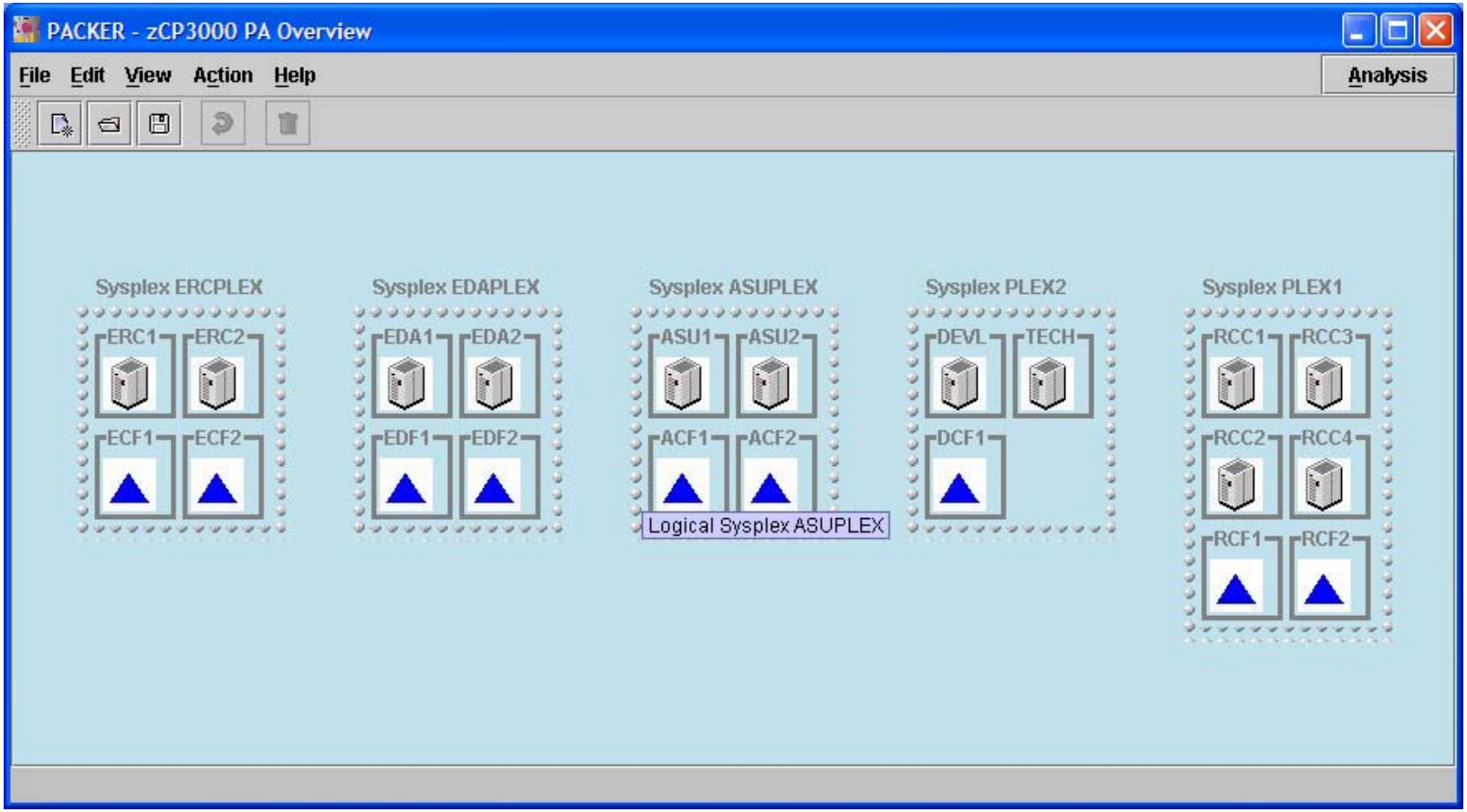
When is revalidation required?

Customer must notify IBM when they add an additional mainframe into an existing qualified Parallel Sysplex.

- Server upgrade
- Server Consolidation
- Server Consolidation with CPC upgrade
- Non-sysplex work grows significantly
- Workload on PrimaryPlex offloaded to zAAP

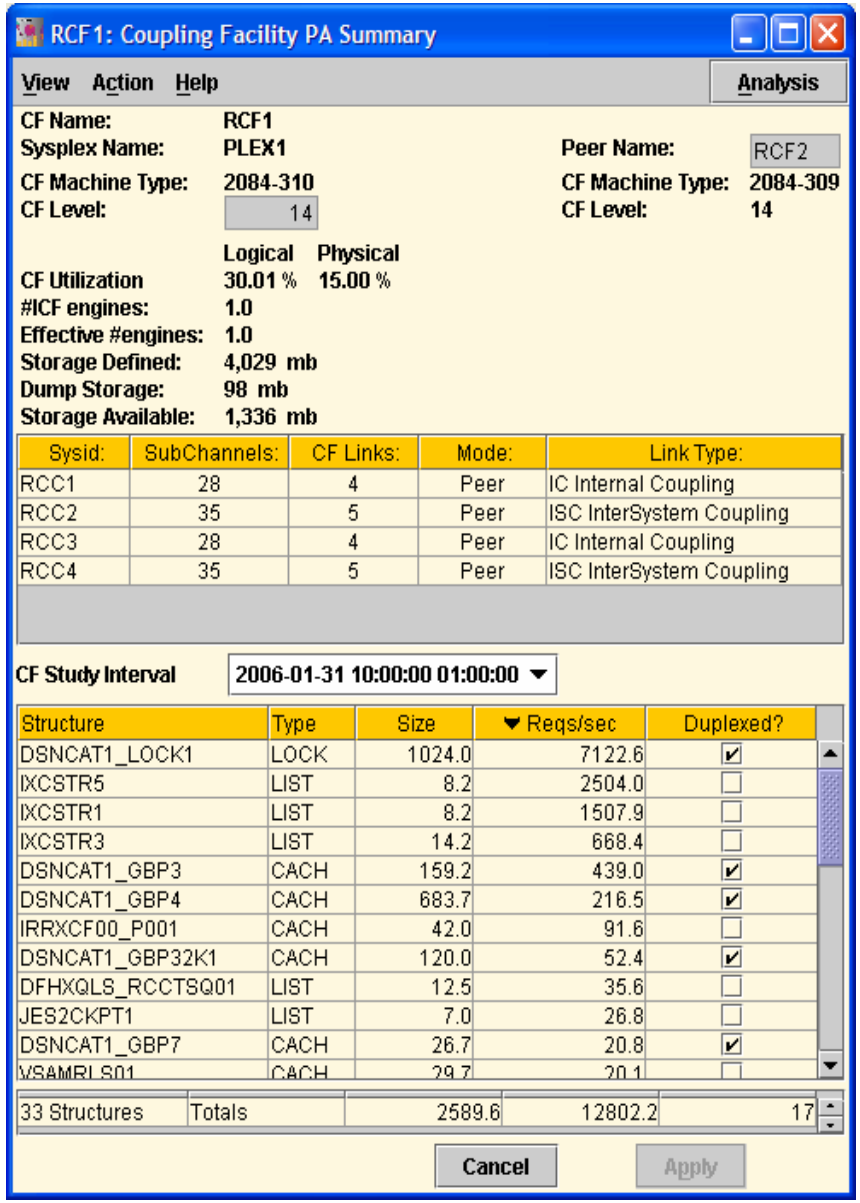
CF Analysis with zCP3000

zCP3000 CF Analysis



zCP3000 CF Analysis

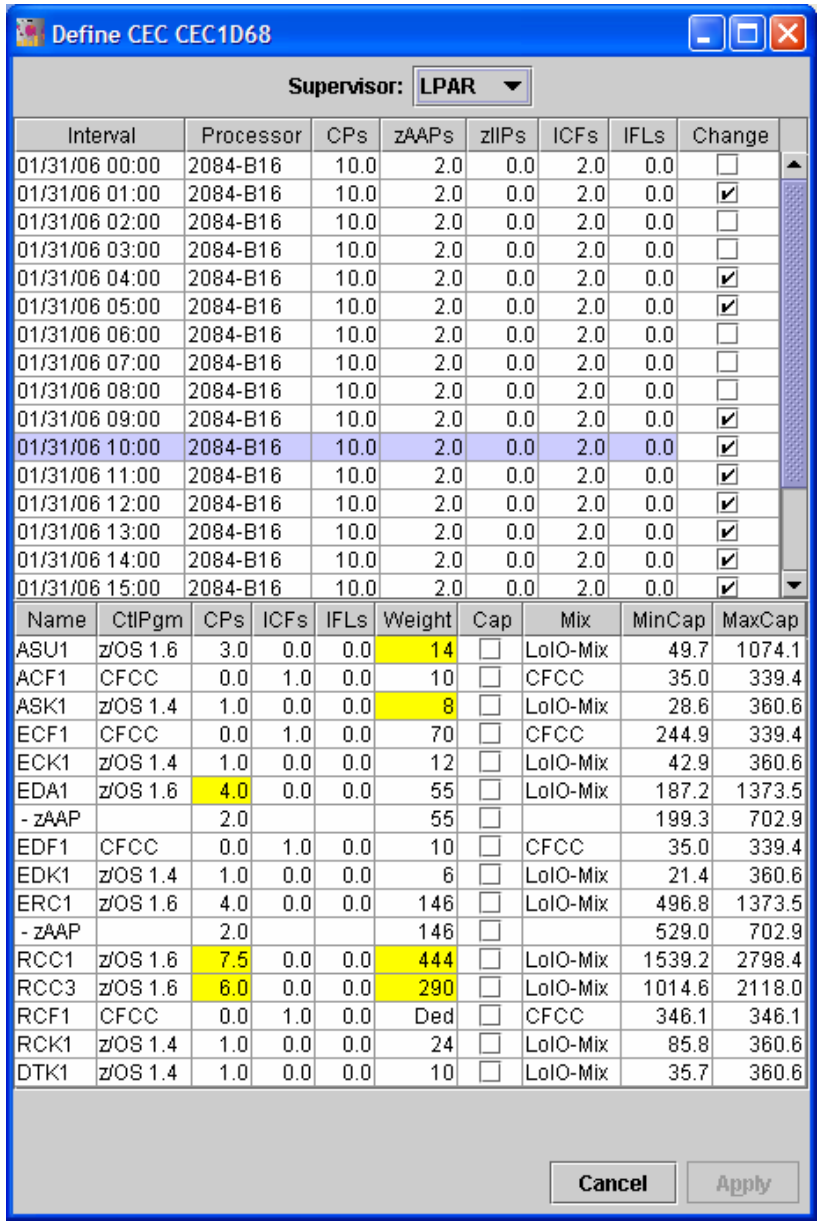
- Duplexed Structures
- Physically separate CF peers
- Logical ≠ Physical Utilization
- Effective = Real Engines
- Peer mode CF links
- Highest request rate is a synchronous, duplexed lock structure



zCP3000
CF Analysis

CEC Definition

- CEC has 2 real ICF engines
- RCF1 partition has 1 real, dedicated engine.

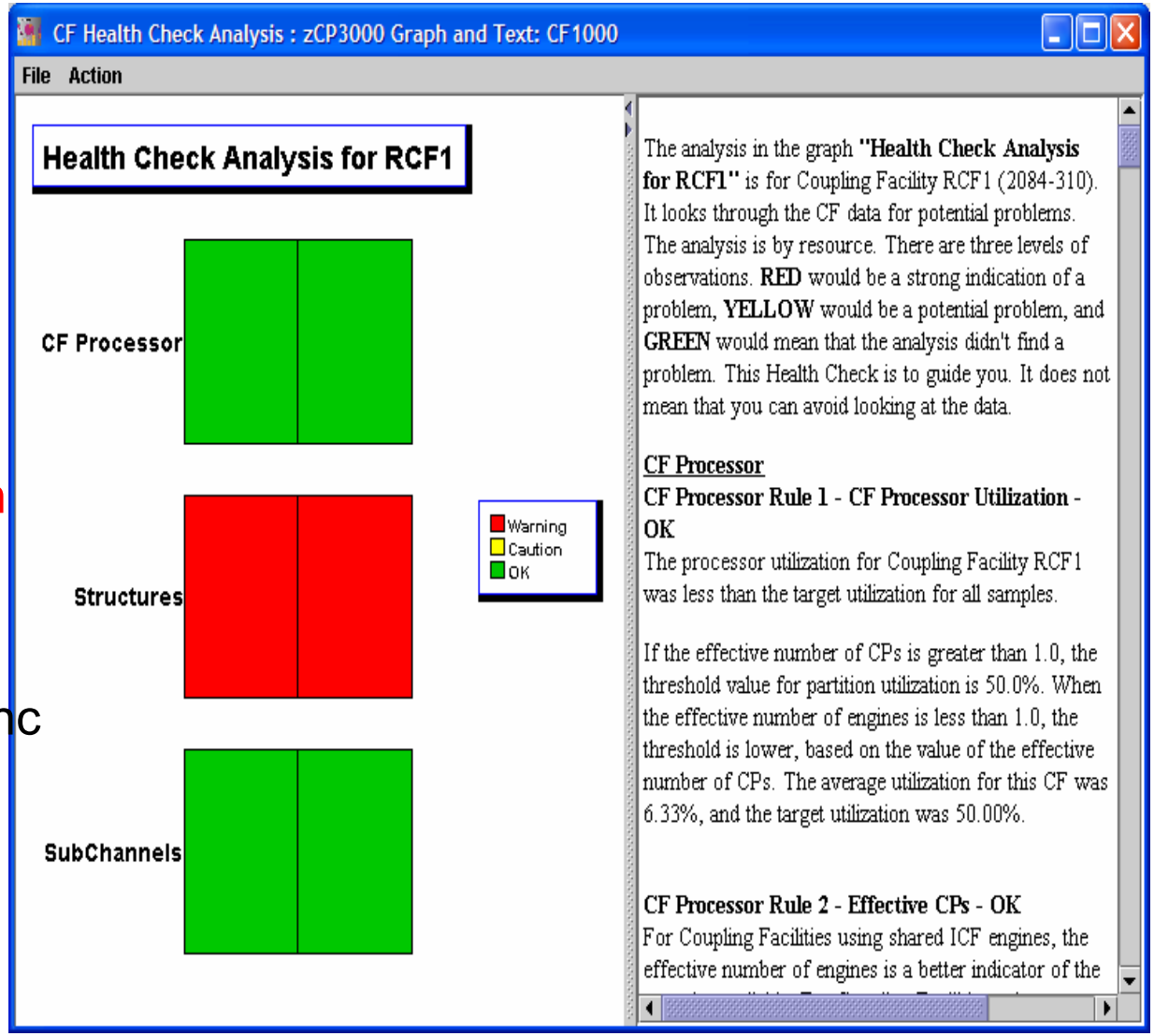


Interval	Processor	CPs	zAAPs	zIIPs	ICFs	IFLs	Change
01/31/06 00:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☐
01/31/06 01:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☑
01/31/06 02:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☐
01/31/06 03:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☐
01/31/06 04:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☑
01/31/06 05:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☑
01/31/06 06:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☐
01/31/06 07:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☐
01/31/06 08:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☐
01/31/06 09:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☑
01/31/06 10:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☑
01/31/06 11:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☑
01/31/06 12:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☑
01/31/06 13:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☑
01/31/06 14:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☑
01/31/06 15:00	2084-B16	10.0	2.0	0.0	2.0	0.0	☑

Name	CtlPgm	CPs	ICFs	IFLs	Weight	Cap	Mix	MinCap	MaxCap
ASU1	z/OS 1.6	3.0	0.0	0.0	14	☐	LoIO-Mix	49.7	1074.1
ACF1	CFCC	0.0	1.0	0.0	10	☐	CFCC	35.0	339.4
ASK1	z/OS 1.4	1.0	0.0	0.0	8	☐	LoIO-Mix	28.6	360.6
ECF1	CFCC	0.0	1.0	0.0	70	☐	CFCC	244.9	339.4
ECK1	z/OS 1.4	1.0	0.0	0.0	12	☐	LoIO-Mix	42.9	360.6
EDA1	z/OS 1.6	4.0	0.0	0.0	55	☐	LoIO-Mix	187.2	1373.5
- zAAP		2.0			55	☐		199.3	702.9
EDF1	CFCC	0.0	1.0	0.0	10	☐	CFCC	35.0	339.4
EDK1	z/OS 1.4	1.0	0.0	0.0	6	☐	LoIO-Mix	21.4	360.6
ERC1	z/OS 1.6	4.0	0.0	0.0	146	☐	LoIO-Mix	496.8	1373.5
- zAAP		2.0			146	☐		529.0	702.9
RCC1	z/OS 1.6	7.5	0.0	0.0	444	☐	LoIO-Mix	1539.2	2798.4
RCC3	z/OS 1.6	6.0	0.0	0.0	290	☐	LoIO-Mix	1014.6	2118.0
RCF1	CFCC	0.0	1.0	0.0	Ded	☐	CFCC	346.1	346.1
RCK1	z/OS 1.4	1.0	0.0	0.0	24	☐	LoIO-Mix	85.8	360.6
DTK1	z/OS 1.4	1.0	0.0	0.0	10	☐	LoIO-Mix	35.7	360.6

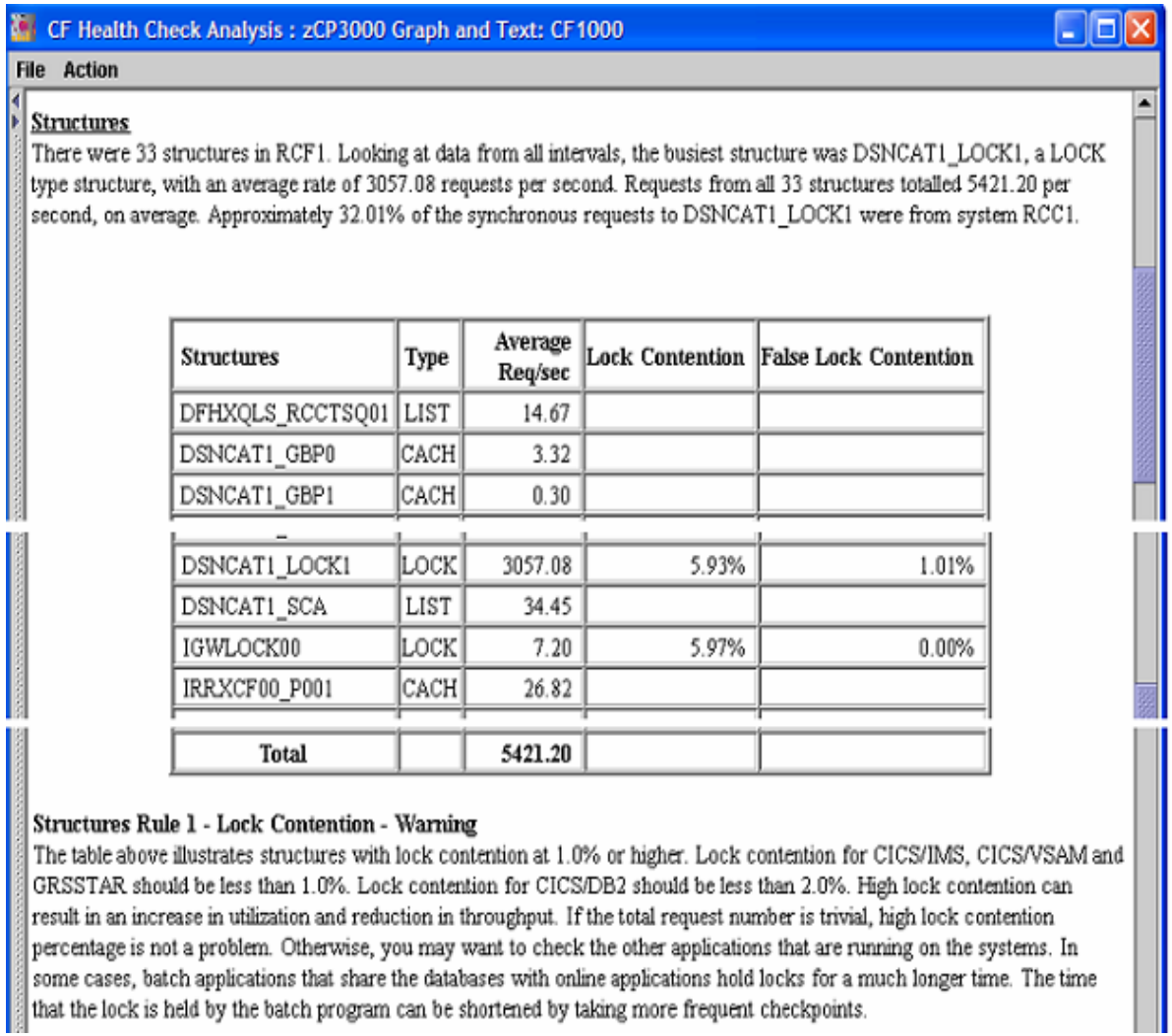
zCP3000 CF Analysis

- CF Utilization ok
- Effective Engines ok
- **Lock Contention**
- **False Lock Contention**
- Subchannel Link Utilization ok
- Subchannel Sync->Async



zCP3000 CF Analysis

- Highest Lock contention rate > 1.0%
- IGWLOCK00 Lock Contention with low request rate
- Increase structure size to reduce false lock contention.


CF Health Check Analysis : zCP3000 Graph and Text: CF1000

File Action

Structures

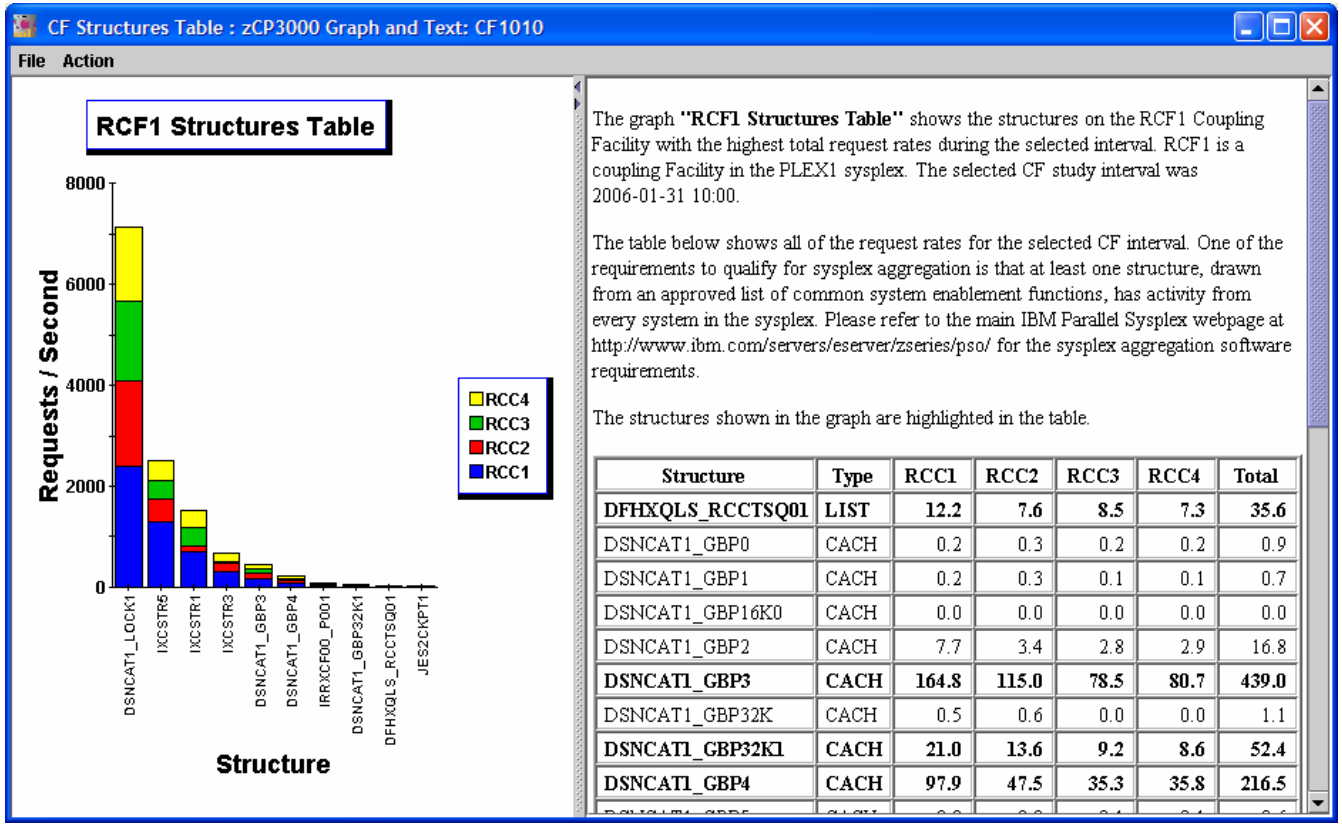
There were 33 structures in RCF1. Looking at data from all intervals, the busiest structure was DSNCAT1_LOCK1, a LOCK type structure, with an average rate of 3057.08 requests per second. Requests from all 33 structures totalled 5421.20 per second, on average. Approximately 32.01% of the synchronous requests to DSNCAT1_LOCK1 were from system RCC1.

Structures	Type	Average Req/sec	Lock Contention	False Lock Contention
DFHXQLS_RCCTSQ01	LIST	14.67		
DSNCAT1_GBP0	CACH	3.32		
DSNCAT1_GBP1	CACH	0.30		
DSNCAT1_LOCK1	LOCK	3057.08	5.93%	1.01%
DSNCAT1_SCA	LIST	34.45		
IGWLOCK00	LOCK	7.20	5.97%	0.00%
IRRXCF00_P001	CACH	26.82		
Total		**5421.20**		

Structures Rule 1 - Lock Contention - Warning

The table above illustrates structures with lock contention at 1.0% or higher. Lock contention for CICS/IMS, CICS/VSAM and GRSSTAR should be less than 1.0%. Lock contention for CICS/DB2 should be less than 2.0%. High lock contention can result in an increase in utilization and reduction in throughput. If the total request number is trivial, high lock contention percentage is not a problem. Otherwise, you may want to check the other applications that are running on the systems. In some cases, batch applications that share the databases with online applications hold locks for a much longer time. The time that the lock is held by the batch program can be shortened by taking more frequent checkpoints.

zCP3000 CF Analysis



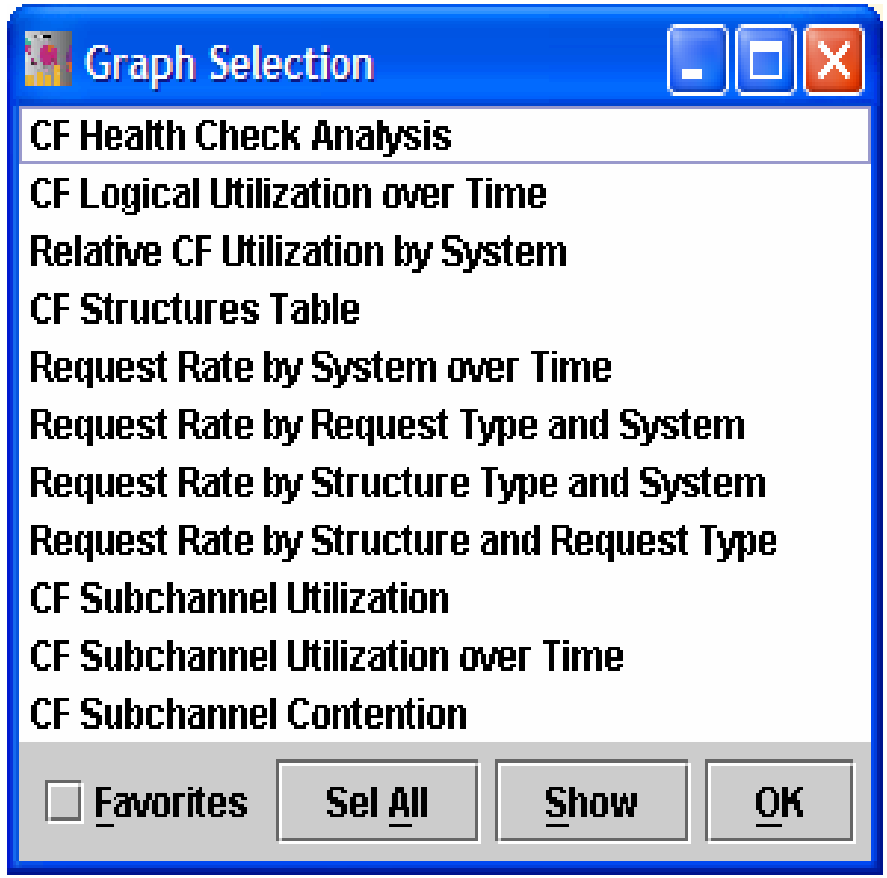
The graph **"RCF1 Structures Table"** shows the structures on the RCF1 Coupling Facility with the highest total request rates during the selected interval. RCF1 is a coupling Facility in the PLEX1 sysplex. The selected CF study interval was 2006-01-31 10:00.

The table below shows all of the request rates for the selected CF interval. One of the requirements to qualify for sysplex aggregation is that at least one structure, drawn from an approved list of common system enablement functions, has activity from every system in the sysplex. Please refer to the main IBM Parallel Sysplex webpage at http://www.ibm.com/servers/eserver/zseries/pso/ for the sysplex aggregation software requirements.

The structures shown in the graph are highlighted in the table.

Structure	Type	RCC1	RCC2	RCC3	RCC4	Total
DFHXQLS_RCCTSQ01	**LIST**	**12.2**	**7.6**	**8.5**	**7.3**	**35.6**
DSNCAT1_GBP0	CACH	0.2	0.3	0.2	0.2	0.9
DSNCAT1_GBP1	CACH	0.2	0.3	0.1	0.1	0.7
DSNCAT1_GBP16K0	CACH	0.0	0.0	0.0	0.0	0.0
DSNCAT1_GBP2	CACH	7.7	3.4	2.8	2.9	16.8
DSNCAT1_GBP3	**CACH**	**164.8**	**115.0**	**78.5**	**80.7**	**439.0**
DSNCAT1_GBP32K	CACH	0.5	0.6	0.0	0.0	1.1
DSNCAT1_GBP32K1	**CACH**	**21.0**	**13.6**	**9.2**	**8.6**	**52.4**
DSNCAT1_GBP4	**CACH**	**97.9**	**47.5**	**35.3**	**35.8**	**216.5**

zCP3000 CF Analysis



Reference

IBM Parallel Sysplex
- http://www-03.ibm.com/systems/z/pso/index.html

IBM Parallel Sysplex Aggregation
- http://www-03.ibm.com/servers/eserver/zseries/swprice/sysplex/

z/OS System Programmer's Guide to Sysplex Aggregation
- http://www.redbooks.ibm.com /redpapers/abstracts/redp3967.html

Tools from IBM Capacity Planning Support

- **IBM** http://w3-03.ibm.com/support/americas/wsc/cpsproducts.html
- **IBM BP** http://partners.boulder.ibm.com/src/atsmastr.nsf/WebIndex/PRS1762