

# Z Masters 2018

## Solving Sysplex Problems with zCP3000

Session A26

Gretchen Frye

[frye@us.ibm.com](mailto:frye@us.ibm.com)

IBM Washington Systems  
Center

z Systems Capacity

Planning Tools - Developer

© Copyright IBM Corporation 2018



# Agenda - Solving Sysplex Questions with zCP3000

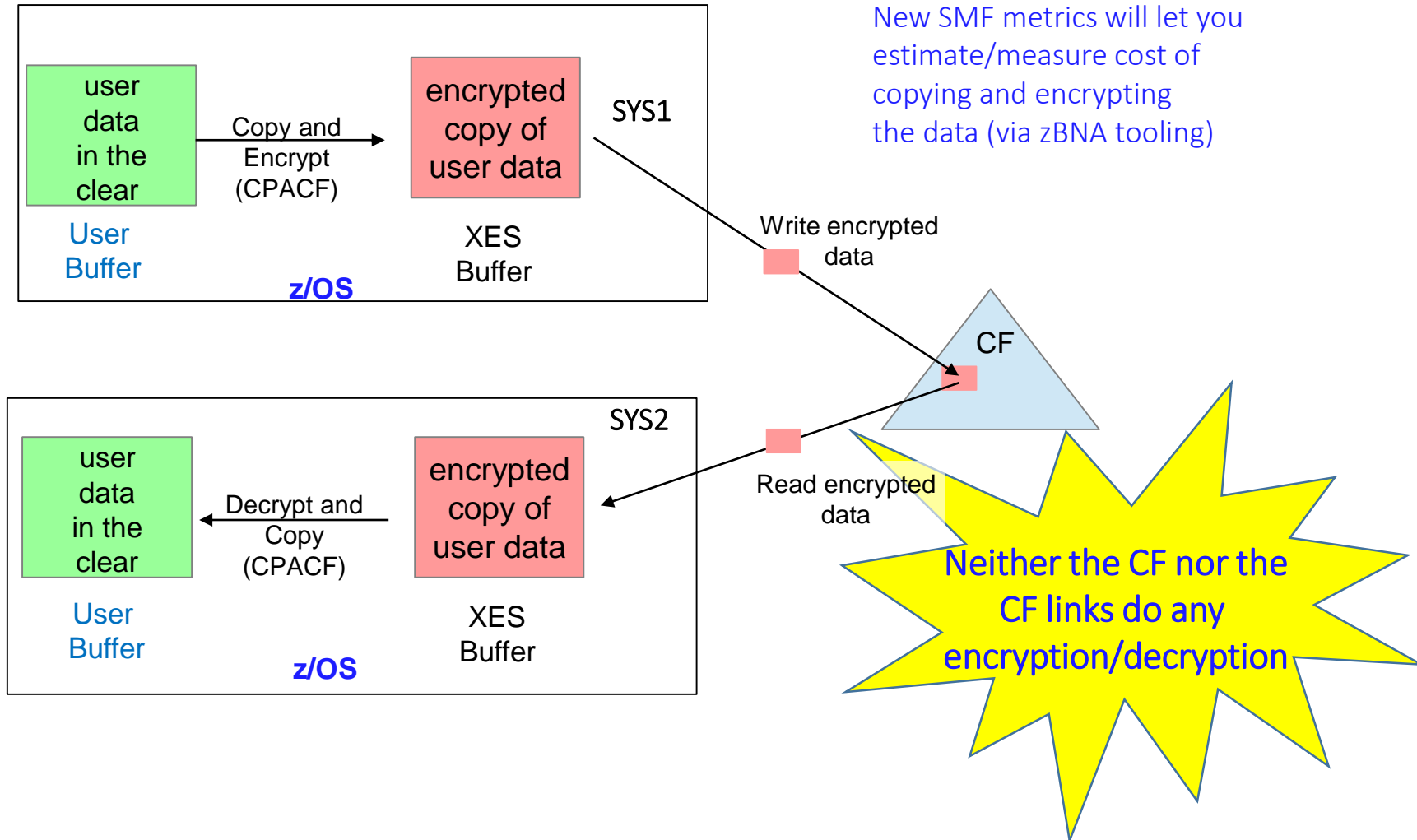
- **New Technology**
- Getting Started
- Understand problem areas and key resources
- Model new hardware or links or Thin Interrupt
- Coupling Link Considerations

Reference slides include links, graph recommendations, and references.

# New Technology Support

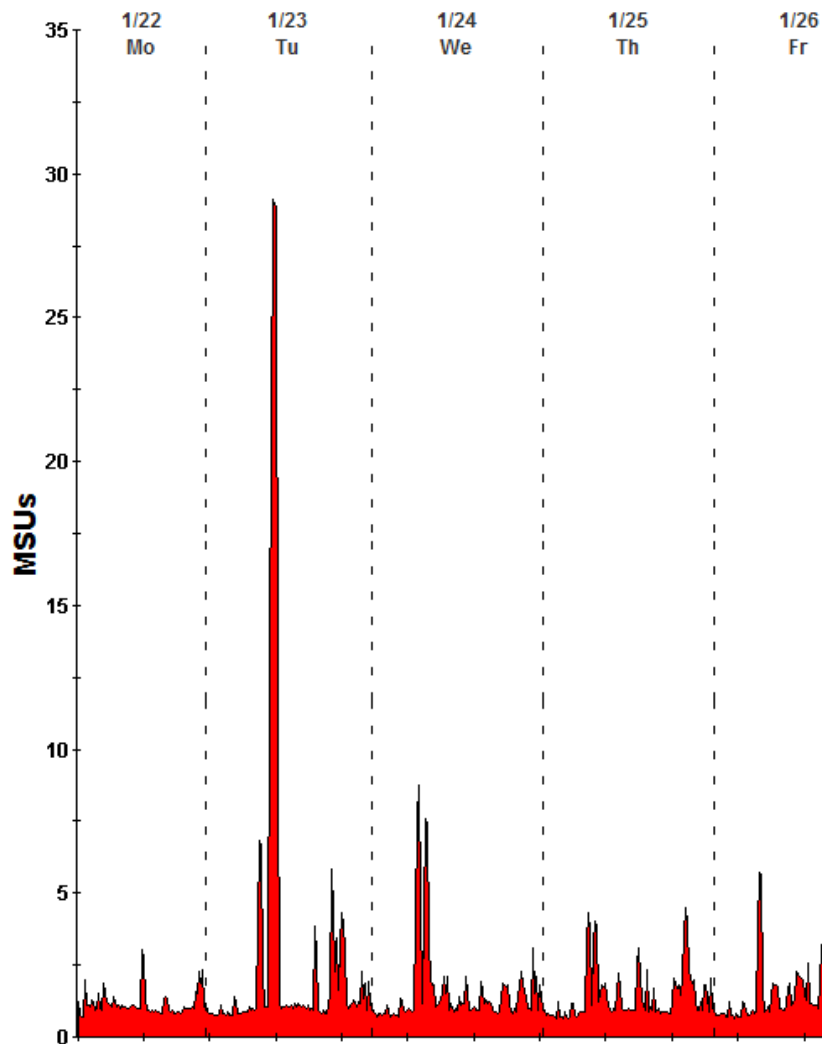
- Support for the latest hardware
- Integrated Coupling Adapter (ICA)
- Coupling Express Long Range (CE LR)
- Coupling Facility (CF) Processor Scalability  
Improved exploitation of nway
- CF Encryption
  - zCP3000 - CEC1064 CF Encryption Estimation
  - CEC1065 CF Encryption w/ alts
  - zBNA support to estimate impact from encryption

# CF Encryption



# zCP3000 CF Encryption Report

Additional CPU for CF Encryption for CPC \_\_\_\_\_



CPC window  
->Analysis  
->CEC1064

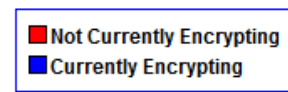
This graph represents the additional CPU utilization that will be required on a 2964-728 with 28 GCPs to encrypt and decrypt all data going to and from any attached Coupling Facility. It is based on new fields in the RMF 74 subtype 4 records which record the length of the data which was passed to the coupling facility. Be aware that for data which is currently encrypting that MSU consumption is already taking place. For data which is not currently encrypting, that additional MSU consumption will be consumed when encryption is activated.

The model contains data from 6 coupling facilities and 84 structures.

The top 5 structures and their required utilizations is illustrated in the table below:

Coupling Facility	Structure	Type	Encrypted Now	Average	Maximum
CF03N3I1	IXC_LIST_01	LIST	No	0	3
CF03N3I1	IXC_LIST_03	LIST	No	0	21
CF04N3I1	IXC_LIST_04	LIST	No	0	1
CF04N3I1	IXC_LIST_05	LIST	No	0	1
CF04N3I1	IXC_LIST_06	LIST	No	0	9

None of these structures are currently encrypted.



# CF Encryption Cost Estimation

(for both zBNA and zCP3000)

Requires new SMF 74-4 fields.

z/OS support to generate new fields

- Will be included in z/OS 2.3 base
- Is rolled down to V2.2 (APAR OA51879)

# Coupling Link Relative Speed

Internal Coupling Links			
Link type	Sub-chan	Latency (mics)	Speed (Mbs/sec)
IC-zEC12	7	1	9400
<b>IC-z14, z196</b>	<b>7</b>	<b>1</b>	<b>8900</b>
IC-z13	7	1	8500
IC-z10 EC	7	1	7500
IC-z13s	7	1	7300
IC-zBC12	7	1	7100
IC-z114	7	1	6500
IC-z9 EC	7	1	5000
IC-z9 BC	7	1	4000
IC-z10 BC	7	1	3200

External Coupling Links			
Link type	Sub-chan	Latency (mics)	Speed (Mbs/sec)
<b>ICA (CS5) @ 70m</b>	<b>8</b>	<b>2</b>	<b>6000</b>
IFB3	7	3	5000
IFB3 - zBC12, z13s	7	3	4000
<b>ICA (CS5) @ 150m</b>	<b>8</b>	<b>2</b>	<b>3700</b>
IFB3 – z114	7	3	2500
ICB4	7	4	1500
IFB 12X	7	8	1000
<b>CE LR</b>	<b>8</b>	<b>13</b>	<b>800</b>
IFB 12X – z9	7	8	600
IFB 1X	7/32	10	400
ISC3	7	12	200

**z14 will be the last machine to support InfiniBand links.  
z13 was the first to support ICA and CE-LR**



# Coupling Thin Interrupt

the arrival of an unsolicited signal on a coupling link generates an interrupt.

(starting with zBC12 and zEC12-GA2)

- Both z/OS and the Coupling Facility can exploit this.
- CF and z/OS exploitation are independent of each other.
- z/OS support mainly benefits low weight partitions
- For Coupling Facilities, it benefits CFs sharing CPU resource
- It does not benefit CFs with dedicated engines.

## IBM recommends:

- Use dedicated engines for production CFs
- Otherwise enable Coupling Thin Interrupt for all CFs



# Agenda - Solving Sysplex Questions with zCP3000

- New Technology
- **Getting Started**
- Understand problem areas and key resources
- Model new hardware or links or Thin Interrupt
- Coupling Link Considerations

[Reference slides](#) include links, graph recommendations, and references.

# Getting Started

- **Plan the Study**
- Current performance concerns?
- Which sysplexes/CFs matter, and which don't?
- Should the study include overview information?

**Always pull down the latest version of CP3KEXTR and zCP3000.**

## You may also need

- Partition names and lpar weights for CFs
- Current IOCP decks for all machines.

# Collecting Model Input Data

Capture the **\*right\* period of time,** (representative of what you want to do)

- Collect 1 week of data.
- Assume 24x7 unless proven otherwise
- All members of “production” sysplexes
- **If you are looking at link consolidation, include all members, all sysplexes, including dev/test.**
- CPUMF (SMF 113) helps get the workload characterization right.
- All partitions that belong together as a production group

# Too Much Data!

## 2018 Testcase:

73 EDFs @ 3.8MB average

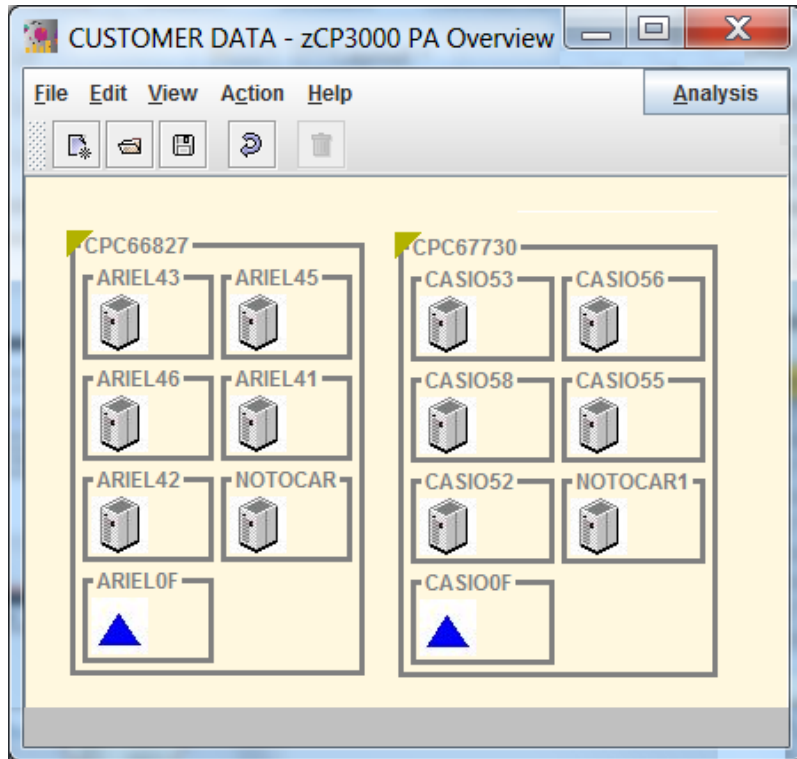
273 MB of input data



- Collect one week, not two
- Shut down everything else.
- File->Trim option to delete I/O (BCU, BCUT, ACT, PATH) from EDF\*
- After load, delete uninteresting shifts (weekend, night), then save 3PA
- After load, delete uninteresting intervals, then save 3PA
- Ask [CPSTOOLS@US.IBM.COM](mailto:CPSTOOLS@US.IBM.COM) for help

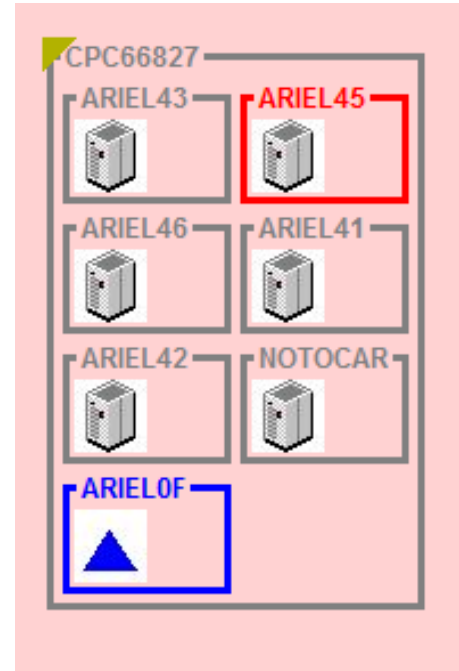
# zCP3000 “modes”

## PA – Performance Analysis



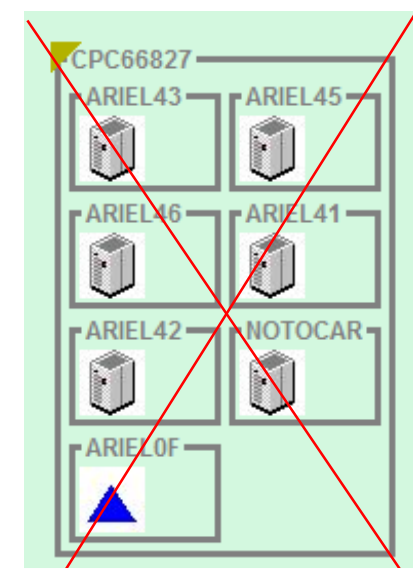
**PA** – detail on the current, alt CPUs, Healthchecks, sysplex configuration

## QM – Quick Migration



**QM** - change the configuration: new CPU type, move LPARs, new link type, thin interrupt, data center distance.

## CP – Capacity Planning



**CP** – workload growth; not really for sysplex modelling.

# Correct the configuration when necessary

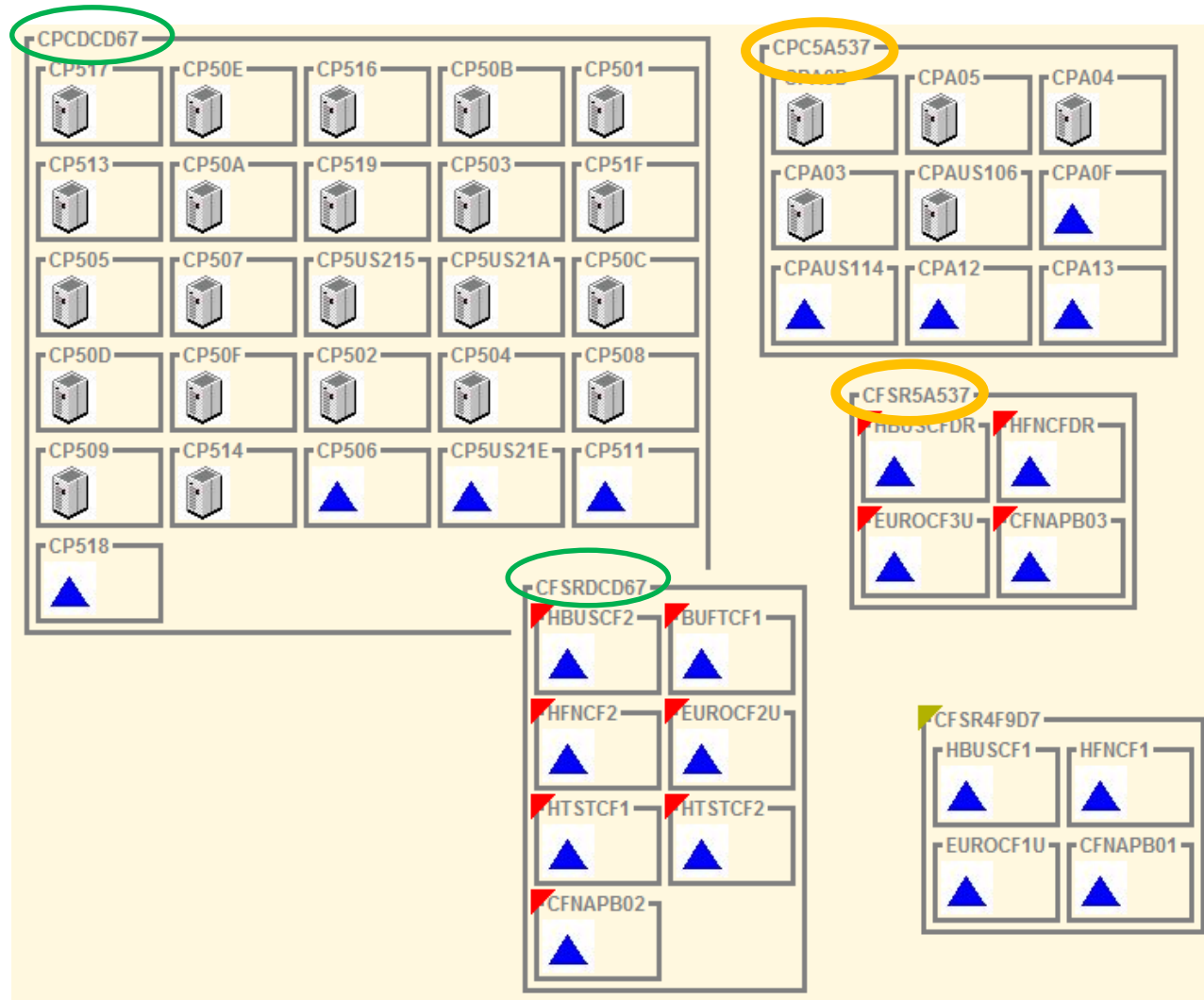
## Standalone CF problems

- If a standalone CF has the same serial number as a CPC, these CF partitions ended up on the wrong CPC.
- **Internal coupling links on CFSR machines will be red triangled**, if a CF is in the wrong place. However, there may be no red triangles, if there are no IC links.
- Weight and engine type will be correct for that partition on the CPC, but not on the CFSR, so *be careful to move the CF to the right LP*.

## Link definition problems

- **No longer an issue since z/OS 2.1 SMF 74-4 Channel Path Information**
- **Invalid IC link? The CF is in the wrong place.**

# Correct the Machine layout when necessary



CPCDCD67  
CFSRD67  
CPC5A537  
CFSR5A537  
CFSR4F9D7

Notice the very similar serial numbers.

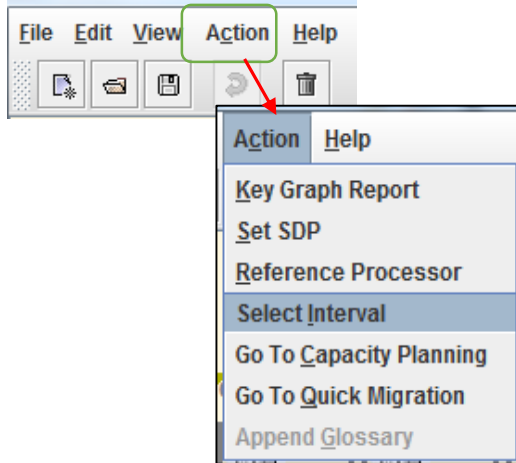
There are really only 3 machines in this model.

The red triangles are because of IC links on that "extra" machine.

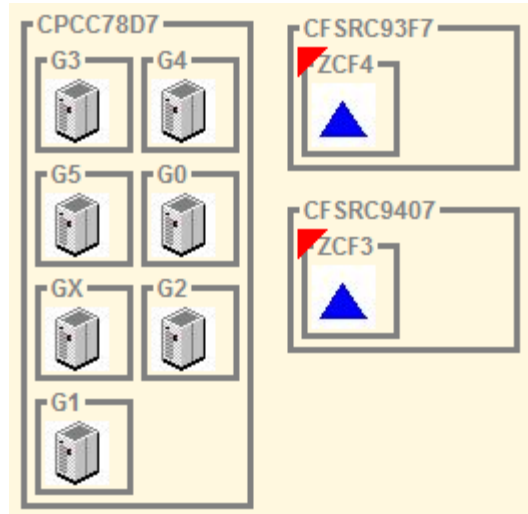


# Do Some Preliminary Stuff

## 1) Select a Study Interval



## 2) Fix CF red triangles



## Open the CF to see what the problem is:

Partition	SYSID:	Reqs/sec	SubChann...	CF Links:	Link Type:	Km	Path Utiliza...
CPCC78D...	CSG3	41.4	28	4	[IFB-1x]	0.0	0.0%
CPCC78D...	CSG4	29.6	28	4	[IFB-1x]	0.0	0.0%
CPCC78D...	CSG5	25.6	28	4	[IFB-1x]	-1.0	0.0%
CPCC78D...	CSGT	8.0	28	4	[IFB-1x]	0.0	0.0%
CPCC78D...	SY2	386.7	28	4	[IFB-1x]	0.0	0.0%
CPCC78D...	VIPA	376.0	28	4	[IFB-1x]	0.0	0.0%

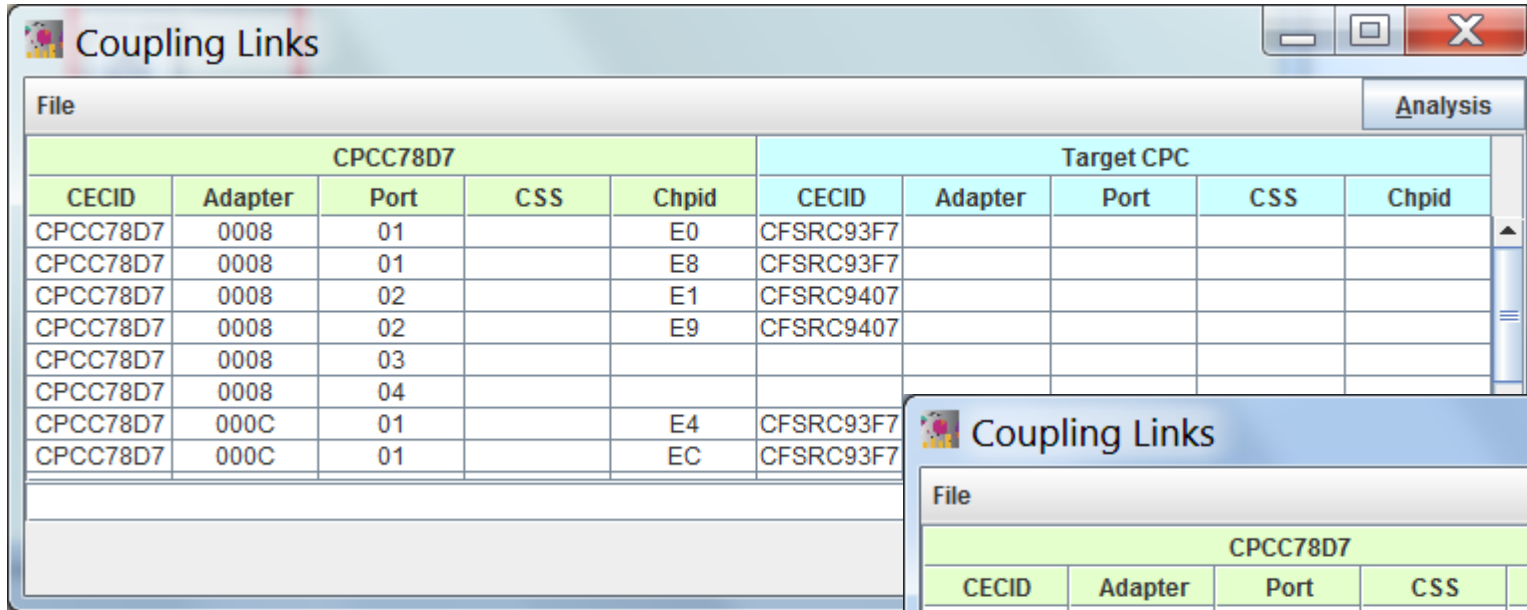
CF Study Interval 2/2/18 09:00

Correct the machine layout

Set Distance

Fix Link Definitions

# Understand the physical links...

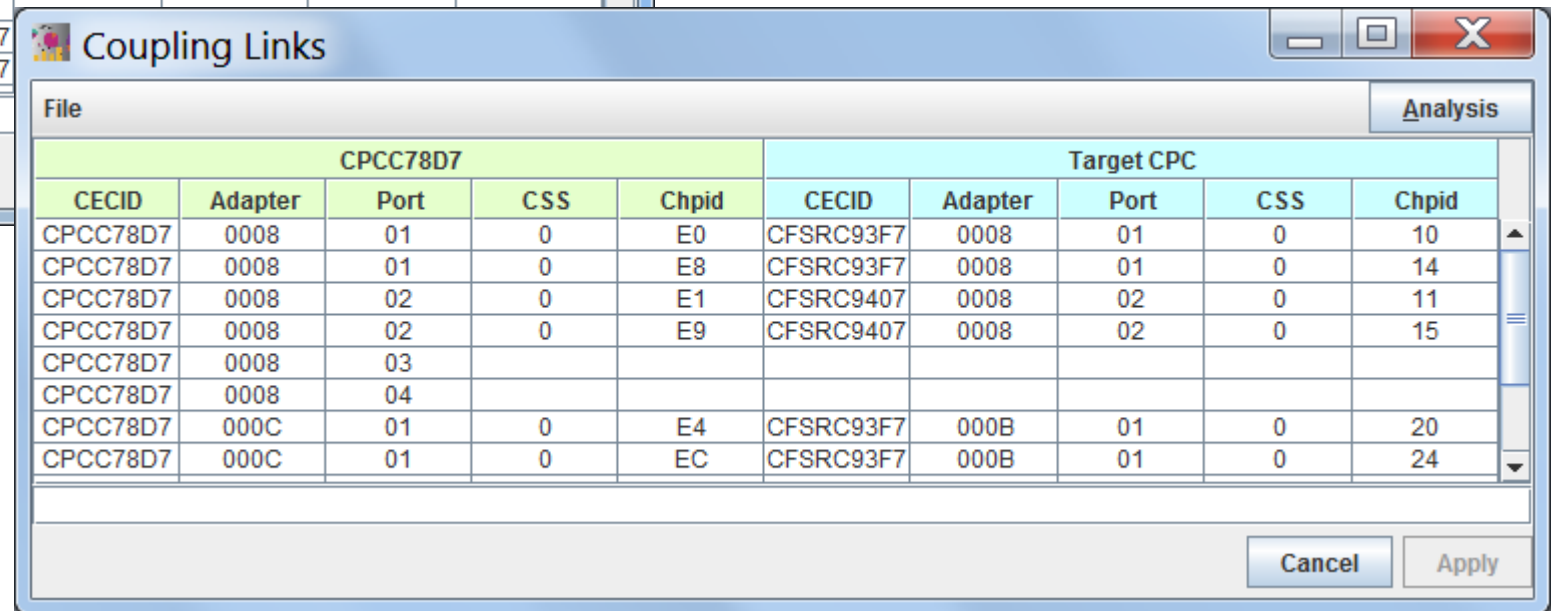


CPCC78D7					Target CPC				
CECID	Adapter	Port	CSS	Chpid	CECID	Adapter	Port	CSS	Chpid
CPCC78D7	0008	01		E0	CFSRC93F7				
CPCC78D7	0008	01		E8	CFSRC93F7				
CPCC78D7	0008	02		E1	CFSRC9407				
CPCC78D7	0008	02		E9	CFSRC9407				
CPCC78D7	0008	03							
CPCC78D7	0008	04							
CPCC78D7	000C	01		E4	CFSRC93F7				
CPCC78D7	000C	01		EC	CFSRC93F7				

See all of those blank columns?

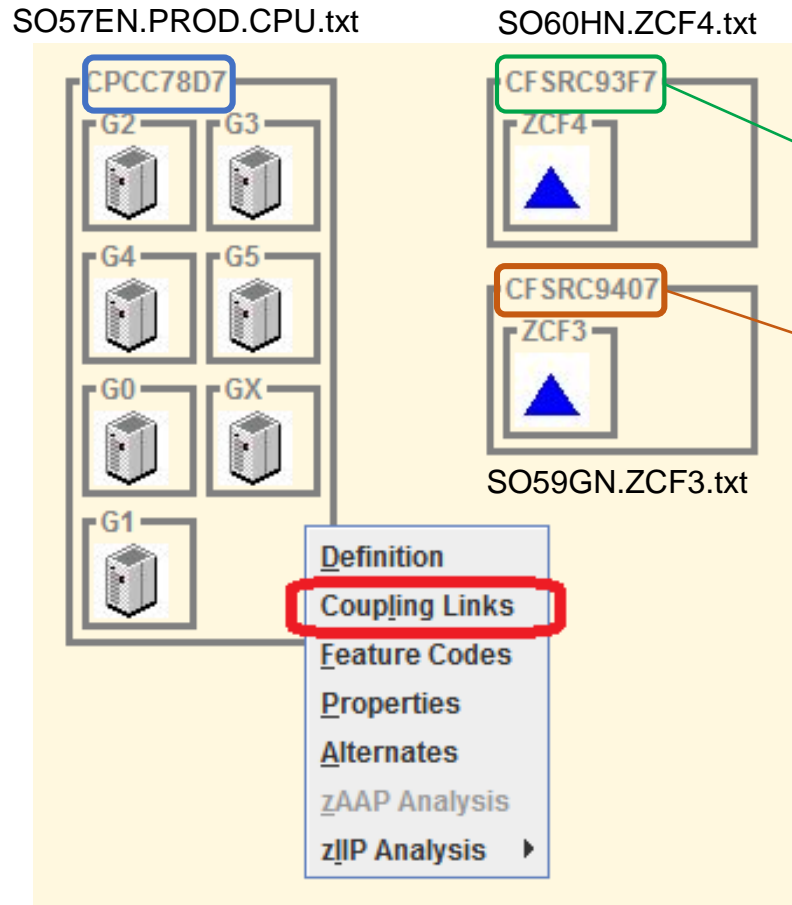
Load IOCP decks

What blank columns?



CPCC78D7					Target CPC				
CECID	Adapter	Port	CSS	Chpid	CECID	Adapter	Port	CSS	Chpid
CPCC78D7	0008	01	0	E0	CFSRC93F7	0008	01	0	10
CPCC78D7	0008	01	0	E8	CFSRC93F7	0008	01	0	14
CPCC78D7	0008	02	0	E1	CFSRC9407	0008	02	0	11
CPCC78D7	0008	02	0	E9	CFSRC9407	0008	02	0	15
CPCC78D7	0008	03							
CPCC78D7	0008	04							
CPCC78D7	000C	01	0	E4	CFSRC93F7	000B	01	0	20
CPCC78D7	000C	01	0	EC	CFSRC93F7	000B	01	0	24

# Importing IOCP Information



- Know which IOCP goes with which machine.
- Right click within the CPCC78D7 border.
- Select Coupling Links.

CPCC78D7					Target CPC				
CECID	Adapter	Port	CSS	Chpid	CECID	Adapter	Port	CSS	Chpid
CPCC78D7	0008	01		E0	CFSRC93F7				
CPCC78D7	0008	01		E8	CFSRC93F7				
CPCC78D7	0008	02		E1	CFSRC9407				
CPCC78D7	0008	02		E9	CFSRC9407				
CPCC78D7	0008	03							
CPCC78D7	0008	04							
CPCC78D7	000C	01		E4	CFSRC93F7				
CPCC78D7	000C	01		EC	CFSRC93F7				

# Importing IOCP Information

The screenshot illustrates the process of importing IOCP information into the Coupling Links table. The 'Coupling Links' window shows a table with columns for CPCC78D7 (CECID, Adapter, Port, CSS, Chpid) and Target CPC (CECID, Adapter, Port, CSS, Chpid). The 'Load IOCP for CPCC78D7' button is highlighted with a red box. The 'Select the IOCP for CPCC78D7' dialog box is open, showing a file selection process. The 'Open' and 'Cancel' buttons in the dialog box are highlighted with blue boxes, and blue arrows point from these buttons to the 'CSS' and 'Chpid' columns in the 'Coupling Links' table, indicating that the selected IOCP information is being imported into these columns.

CPCC78D7					Target CPC				
CECID	Adapter	Port	CSS	Chpid	CECID	Adapter	Port	CSS	Chpid
CPCC78D7	0008	01	0	E0	CFSRC93F7			0	10
CPCC78D7	0008	01	0	E8	CFSRC93F7			0	14
CPCC78D7	0008	02	0	E1	CFSRC9407			0	11
CPCC78D7	0008	02	0	E9	CFSRC9407			0	15
CPCC78D7	0008	03							
CPCC78D7	0008	04							
CPCC78D7	000C	01	0	E4	CFSRC93F7			0	20
CPCC78D7	000C	01	0	EC	CFSRC93F7			0	24
CPCC78D7	000C	02	0	E5	CFSRC9407			0	21
CPCC78D7	000C	02	0	ED	CFSRC9407			0	25
CPCC78D7	000C	03							

# Importing IOCP information

The screenshot illustrates the process of importing IOCP information into the system. It shows several windows and tables:

- Open Dialog:** Shows the file selection process. The file `SO59GN.ZCF3.txt` is selected from the `IOCP` directory.
- Coupling Links Table:** A table with columns for File, Port, CSS, Chpid, CECID, and Adapter. A red box highlights the `Import Other IOCPs` button.
- Selection Dialog:** A dialog box for matching the selected file to a target CPC. The text reads: "Match LSYSTEM=SO59G in SO59GN.ZCF3.txt to the CPC it belongs to." The dropdown menu shows `CFSRC9407`.
- Target CPC Table:** A detailed table showing the mapping of source data to target CPC information. A blue box highlights the `Port` column for the `CFSRC9407` entries.

File	Port	CSS	Chpid	CECID	Adapter	Target CPC
CPCC78D7	0008	01	0	E0	CFSRC93F7	
CPCC78D7	0008	01	0	E8	CFSRC93F7	
CPCC78D7	0008	02	0	E1	CFSRC9407	
CPCC78D7	0008	02	0	E9	CFSRC9407	
CPCC78D7	0008	03				
CPCC78D7	0008	04				
CPCC78D7	000C	01	0	E4	CFSRC93F7	
CPCC78D7	000C	01	0	EC	CFSRC93F7	
CPCC78D7	000C	02	0	E5	CFSRC9407	
CPCC78D7	000C	02	0	ED	CFSRC9407	
CPCC78D7	000C	03				

hpid	CECID	Adapter	Port	CSS	Chpid
E0	CFSRC93F7			0	10
E8	CFSRC93F7			0	14
E1	CFSRC9407	0008	02	0	11
E9	CFSRC9407	0008	02	0	15



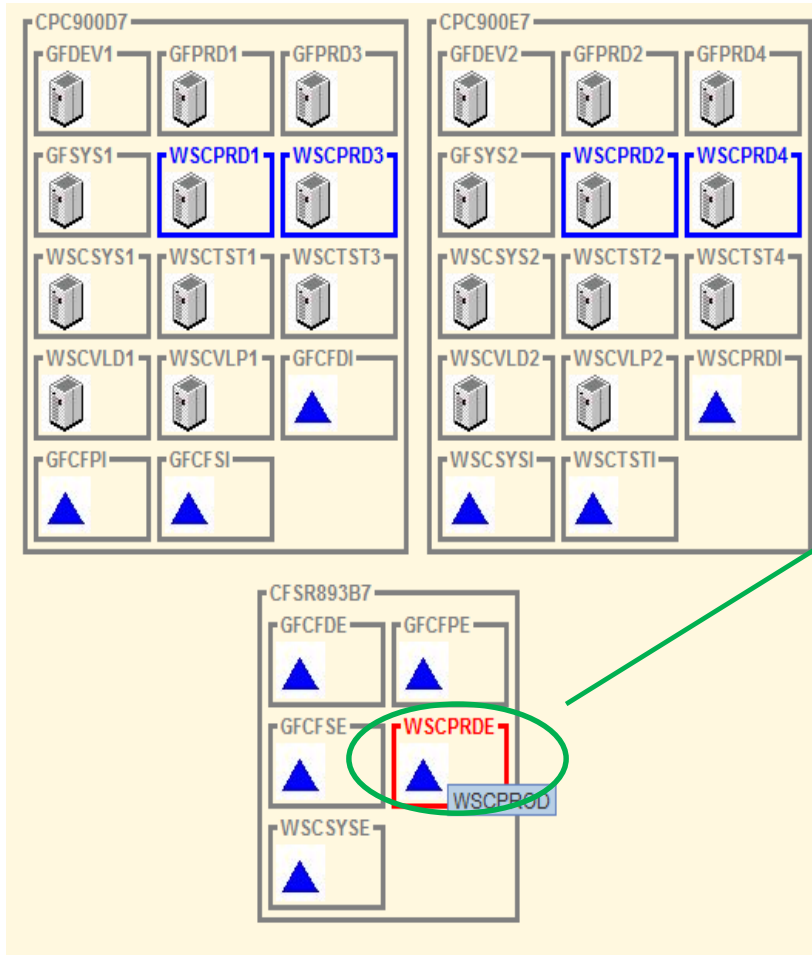
# Agenda - Solving Sysplex Questions with zCP3000

- New Technology
- Getting Started
- **Understand problem areas, key resources and intervals**
- Model a new hardware or links or Thin Interrupt
- Coupling Link Considerations

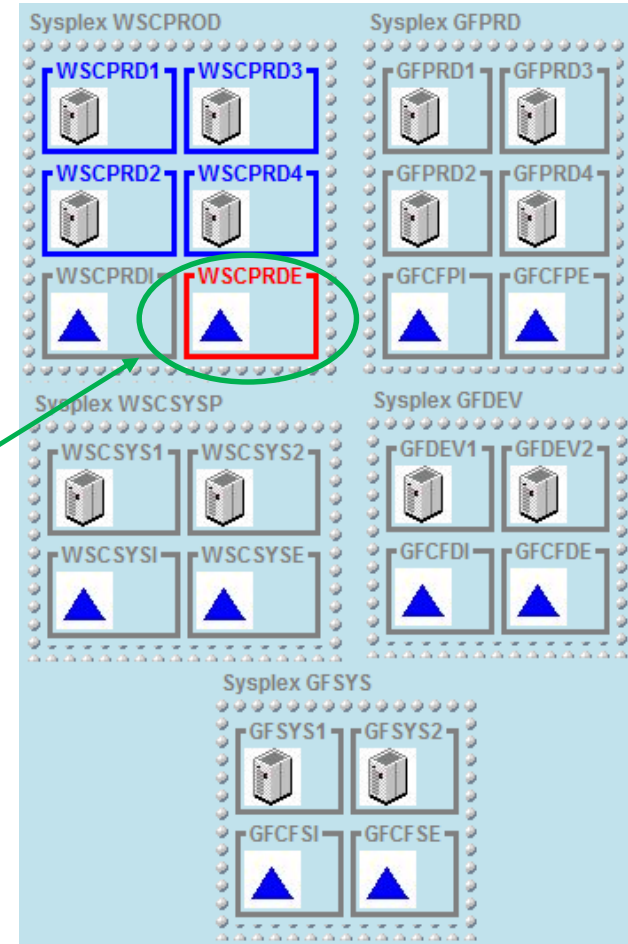
Reference slides include links, graph recommendations, and references.

# Understand the Collected Model Data

View->Physical



View->Sysplex Logical



Select WSCPRDE to highlight the other members of the WSCPROD sysplex.



# CF Window Summary

(Main window-> double click a CF)

CF Information

Peer Information

Link Information  
Double click row for detail

Structure Information  
(sortable)  
Double click row for detail

GFCFPE: Coupling Facility PA Summary

View Action Analysis

CF Name: GFCFPE  
Sysplex Name: GFPRD  
CF Machine Type: 2828-H06/A00  
CF Level: 19  
Lpar Utilization: 1.2%  
Engines: (1) ICF  
Relative Share: Dedicated Engines

Peer Name: GFCFPI  
CF Machine Type: 2827-H20(504)  
CF Level: 19  
Storage Defined: 5,157 mb  
Dump Storage: 1 mb  
Storage Available: 1,191 mb

Partition	SYSID	Reqs/sec	SubChann...	CF Links	Link Type	Km	Link ...
CPC900D...	GFP1	652.6	28	4	[IFB3-12x, IFB-12x]	0.0	0.1%
CPC900E...	GFP2	857.1	28	4	[IFB3-12x, IFB-12x]	0.0	0.3%
CPC900D...	GFP3	1,456.1	28	4	[IFB3-12x, IFB-12x]	0.0	0.1%
CPC900E...	GFP4	1,728.4	28	4	[IFB3-12x, IFB-12x]	0.0	0.3%

CF Study Interval: 3/4/16 14:00 | Link Quick Fix | Set KM (all CFs)

Structure	Type	Size	Reqs/sec	Duplexed?
DNPGFR0_LOCK1	LOCK	259	3,283.1	<input type="checkbox"/>
DNPGF00_LOCK1	LOCK	259	289.2	<input type="checkbox"/>
DNPGFR0_GBP6	CACH	204	221.7	<input checked="" type="checkbox"/>
DNPGFR0_GBP1	CACH	644	193.2	<input checked="" type="checkbox"/>
ISGLOCK	LOCK	9	177.1	<input type="checkbox"/>
IXCPRD1	LIST	10	126.2	<input type="checkbox"/>
DNPGFR0_GBP32...	CACH	159	105.4	<input checked="" type="checkbox"/>
DNPGFR0_GBP5	CACH	323	96.1	<input checked="" type="checkbox"/>
DFHGFLS_CFPR...	LIST	1	39.4	<input checked="" type="checkbox"/>
DNPGFR0_GBP16...	CACH	477	31.2	<input checked="" type="checkbox"/>
DNPGFR0_GBP11	CACH	323	28.1	<input checked="" type="checkbox"/>
DNPGF00_GBP6	CACH	13	26.4	<input checked="" type="checkbox"/>
DNPGF00_SCA	LIST	64	25.7	<input type="checkbox"/>
DNPGFR0_SCA	LIST	64	12.6	<input type="checkbox"/>
DNPGFR0_GBP13	CACH	323	10.1	<input checked="" type="checkbox"/>
DNPGF00_GBP32...	CACH	19	6.2	<input checked="" type="checkbox"/>
DNPGF00_GBP3	CACH	10	5.4	<input checked="" type="checkbox"/>
DNPGF00_GBP4	CACH	10	4.7	<input checked="" type="checkbox"/>
<b>41 Structures</b>	<b>Totals</b>		<b>4,694.2</b>	<b>25 duplexed</b>

Cancel Apply

Graph CF1014 on the CF Window

# Coupling Link Detail

(CF window-> double click a link row)

**GFCFPE : GFP2 : Coupling Link Detail**

Analysis

Sysplex Name : GFPRD  
SYSID : GFP2  
CF Study Interval : 2016-03-04 14:00:00 00:15:00

CPC900E7 on 2827-504				
Sysplex Member GFP2				
Adapter	Port	Chpid	SYSIDs	LinkType
0008	02	8D	GFP2,GFP4	IFB-12x
0009	02	9D	GFP2,GFP4	IFB3-12x
000A	02	AD	GFP2,GFP4	IFB-12x
000B	02	BD	GFP2,GFP4	IFB3-12x

Link Configuration

Current

CF Machine Type: 2828-Z01  
Link Type: 3-12x, IFB-12x  
Subchan/chpid: 7  
Chpids: 4  
Subchannels: 28  
Distance(km): 0.0

CFSR893B7 on 2828-Z01		
Coupling Facility GFCFPE		
Adapter	Port	Chpid
0008	01	4D
0009	01	3D
000A	01	5D
000B	01	6D

Utilization		Current
CF		0.012
Sysid		0.153
Subchannel		0.003

Requests/sec		Current
Sync		683.26
Async		173.86
Total		857.12

Service Time (usec)		Current
Sync		4.91
Async		388.62
Average		82.74

Apply Cancel

Mixed linktypes

IFB3 – 5000  
Mb/sec  
12x – 1000  
Mb/sec

# Structure Detail

(CF window-> double click a structure)

For critical structures,

- Mostly synchronous?  
(except XCF requests)
- Activity by system
- Include 1-2 reports from 1-2 key structures in the deliverable.

**Analysis**

Sysplex Name GFP RD                      Structure Name DNPGR0\_LOCK1  
CF Name GFCFPE                              Structure Type LOCK  
Study Interval 2016-03-04 14:00:00 00:15:00 % of CF Utilization 52.6%

CF Link Type	GFP1	GFP2	GFP3	GFP4
	IFB-12x	IFB-12x	IFB-12x	IFB-12x

**Synchronous**

Requests per ...	GFP1	GFP2	GFP3	GFP4
Average	451.52	559.23	1553.9	1525.67
Maximum	1334.55	1634.64	2842.31	3004.69
Study Interval	300.78	484.77	1135.93	1361.61

Service Time (...)	GFP1	GFP2	GFP3	GFP4
Average	4.45	4.68	4.66	4.9
Maximum	4.77	5.02	4.87	5.1
Study Interval	4.43	4.73	4.58	4.81

**Asynchronous**

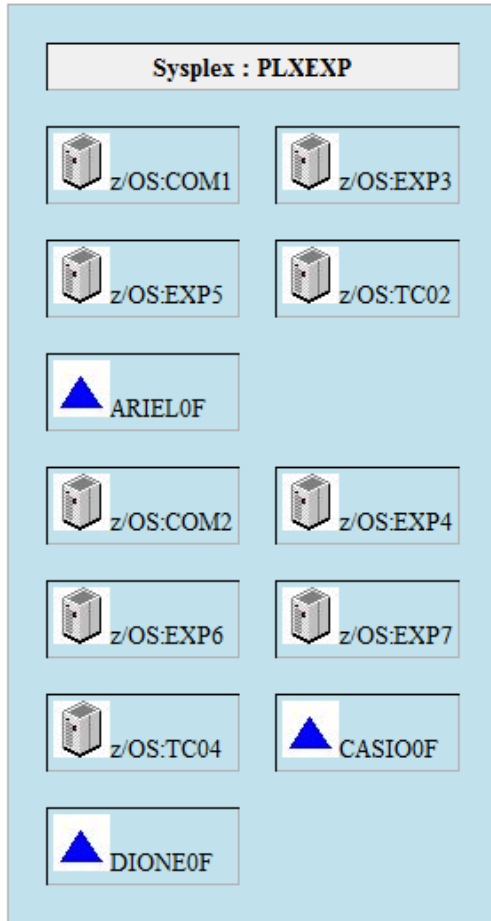
Requests per ...	GFP1	GFP2	GFP3	GFP4
Average	0.0	0.0	0.0	0.0
Maximum	0.0	0.0	0.0	0.0
Study Interval	0.0	0.0	0.0	0.0

Service Time (...)	GFP1	GFP2	GFP3	GFP4
Average	0.0	0.0	0.0	0.0
Maximum	0.0	0.0	0.0	0.0
Study Interval	0.0	0.0	0.0	0.0

Ok

# PLEX1007 Sysplex Overview

(Sysplex window->Analysis)



The PLXEXP sysplex for this configuration is comprised of 9 z/OS systems and 3 coupling facilities, residing on 3 different processors.

Processor	Partition Type	ID	(#) Link Type
CPC66827 2827-723	CF	ARIEL0F	(5) IFB3-1x (4) IC
	SYS	EXP3	(4) IFB-1x (5) IFB3-1x (4) IC
	SYS	COM1	(4) IFB-1x (5) IFB3-1x (4) IC
	SYS	TC02	(4) IFB-1x (5) IFB3-1x (4) IC
CFSRFE033 2098-E10	SYS	EXP5	(4) IFB-1x (5) IFB3-1x (4) IC
	CF	DIONE0F	(4) IFB-1x
CPC67730 2827-722	CF	CASIO0F	(5) IFB3-1x (4) IC
	SYS	EXP4	(4) IFB-1x (5) IFB3-1x (4) IC
	SYS	COM2	(4) IFB-1x (5) IFB3-1x (4) IC
			(4) IFB-1x (5) IFB3-1x

Graph PLEX1007 on the Logical Sysplex Window

# PLEX1012 CPC Coupling Links Summary

(Right Click CPC->Coupling Links->Analysis)

CPCC78D7					Target CPC				
CECID	Adapter	Port	CSS	Chpid	CECID	Adapter	Port	CSS	Chpid
CPCC78D7	0008	01	0	E0	CFSRC93F7	0008	01	0	10
CPCC78D7	0008	01	0	E8	CFSRC93F7	0008	01	0	14
CPCC78D7	0008	02	0	E1	CFSRC9407	0008	02	0	11
CPCC78D7	0008	02	0	E9	CFSRC9407	0008	02	0	15
CPCC78D7	0008	03							
CPCC78D7	0008	04							
CPCC78D7	000C	01	0	E4	CFSRC93F7	000B	01	0	20
CPCC78D7	000C	01	0	EC	CFSRC93F7	000B	01	0	24
CPCC78D7	000C	02	0	E5	CFSRC9407	000B	02	0	21
CPCC78D7	000C	02	0	ED					
CPCC78D7	000C	03							
CPCC78D7	000C	04							

Table 1. Coupling Link Summary for CPCC78D7

CPCC78D7				Target					
Adapter	Port	Chpid	Partitions	CPC	AID	Port	Chpid	Partition Names	
0008	01	E8	ZZPLEX2: VIPA GLF5 GLFT GLF4 GLF3 GLF2	CFSRC93F7	0008	01	14	ZZPLEX2: ZCF4	
0008	01	E0	ZZPLEX2: VIPA GLF5 GLFT GLF4 GLF3 GLF2	CFSRC93F7	0008	01	10	ZZPLEX2: ZCF4	
0008	02	E9	ZZPLEX2: VIPA GLF5 GLFT GLF4 GLF3 GLF2	CFSRC9407	0008	02	15	ZZPLEX2: ZCF3	
0008	02	E1	ZZPLEX2: VIPA GLF5 GLFT GLF4 GLF3 GLF2	CFSRC9407	0008	02	11	ZZPLEX2: ZCF3	
000C	01	EC	ZZPLEX2: VIPA GLF5 GLFT GLF4 GLF3 GLF2	CFSRC93F7	000B	01	24	ZZPLEX2: ZCF4	
000C	01	E4	ZZPLEX2: VIPA GLF5 GLFT GLF4 GLF3 GLF2	CFSRC93F7	000B	01	20	ZZPLEX2: ZCF4	
000C	02	E5	ZZPLEX2: VIPA GLF5 GLFT GLF4 GLF3 GLF2	CFSRC9407	000B	02	21	ZZPLEX2: ZCF3	
000C	02	ED	ZZPLEX2: VIPA GLF5 GLFT GLF4 GLF3 GLF2	CFSRC9407	000B	02	25	ZZPLEX2: ZCF3	

Table 3. Summary of Coupling Link Adapters on CPC CPCC78D7

# CF Health Check

(CF window->Analysis->CF1000)

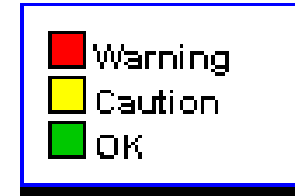
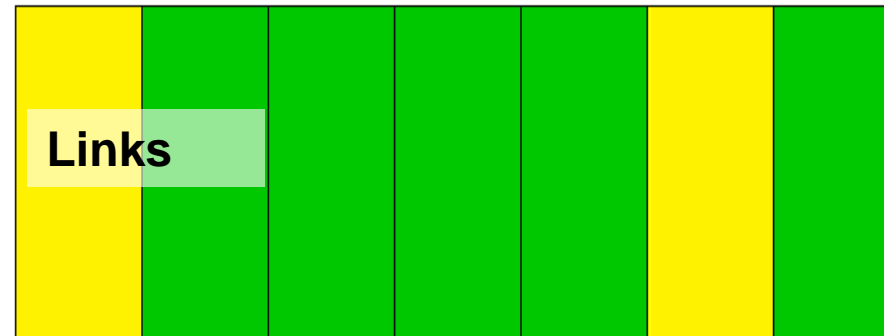
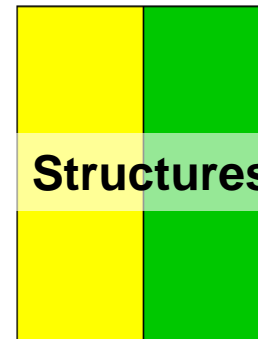
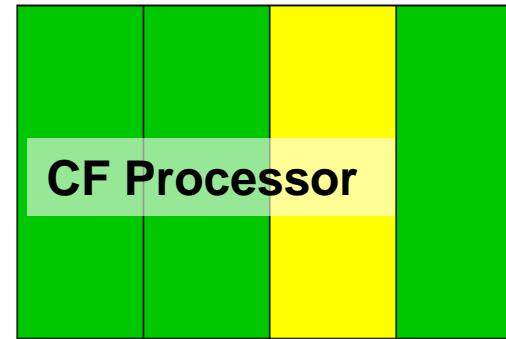
A single report giving insights on several key areas.

**WARNING (RED)** is a strong indication of a problem.

**CAUTION (YELLOW)** indicates a potential problem.

**OK (GREEN)** means that the analysis didn't find a problem.

Red or Yellow means that we think you should look further at this area. It does not mean there *is* a problem.



Graph CF1000 on the CF Window



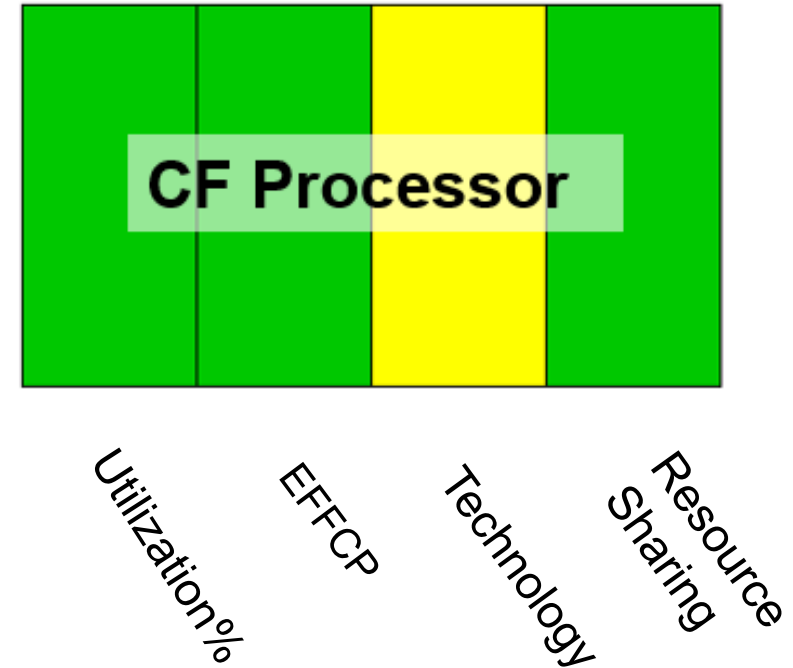
# CF Health Check – CF Processor

## Rules: if Thin Interrupt

1. Utilization : warn if cfutil>90%, and effcp>=entitled CPs
2. (EFFCP rule is n/a and will not appear)
3. Hardware should be current generation.
4. Are all resource sharers using Thin?

## Rules: if not Thin Interrupt

1. LPAR Utilization should be <50%
2. Effective Engines should be >= 1
3. Hardware should be current generation.
4. Sharing, with more than one PROD



Graph CF1000 on the CF Window

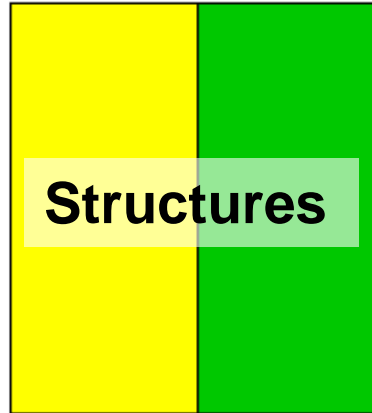


# CF Health Check - Structures

## Lock Contention

Lock Requests had to wait because the lock was already held.

Fix in the Application, if possible.



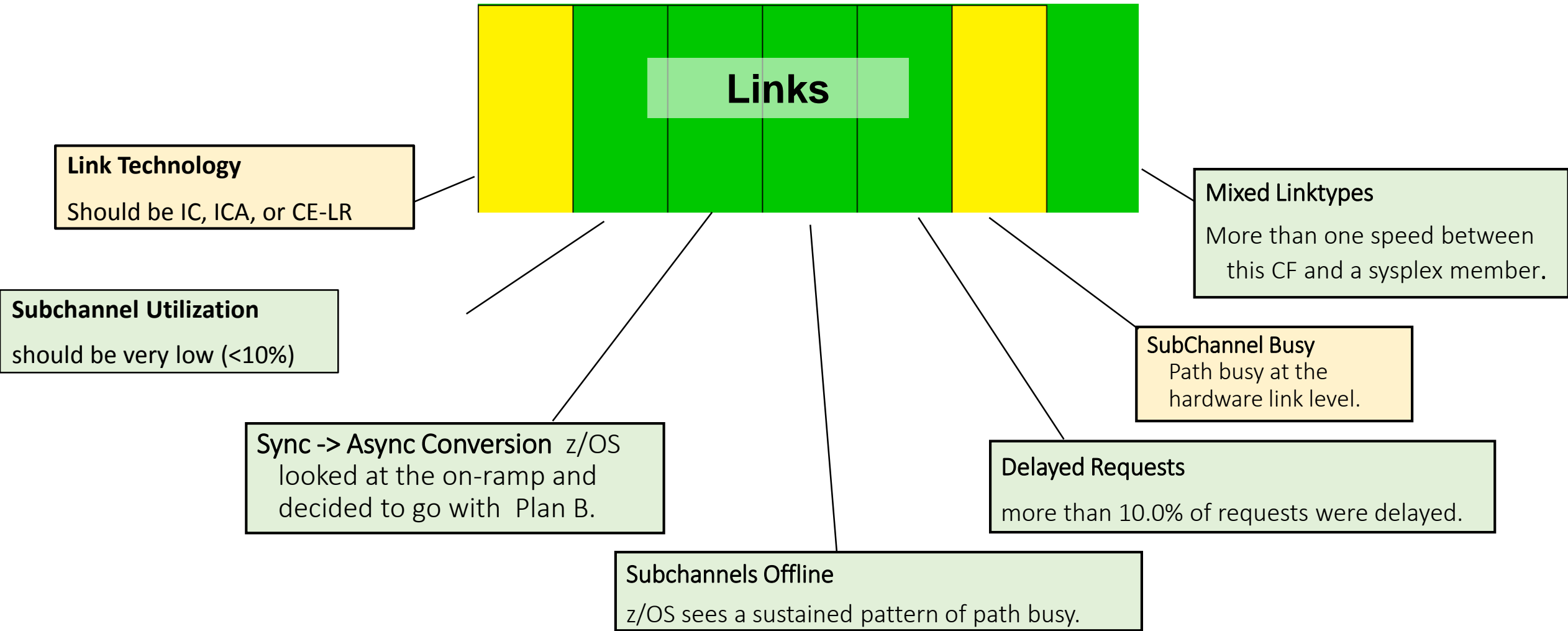
## False Lock Contention

2 locks hash to the same index.

Increase the Structure size.

Structures	Type	Average Req/sec	Lock Contention	False Lock Contention
DNPDBR0_LOCK1	LOCK	11,742.6	2.02%	0.70%
DNPDBO0_LOCK1	LOCK	59.7	0.04%	0.02%

# CF Health Check - Links



Graph CF1000 on the CF Window

# Service Time

**The metric that you should be looking at.**

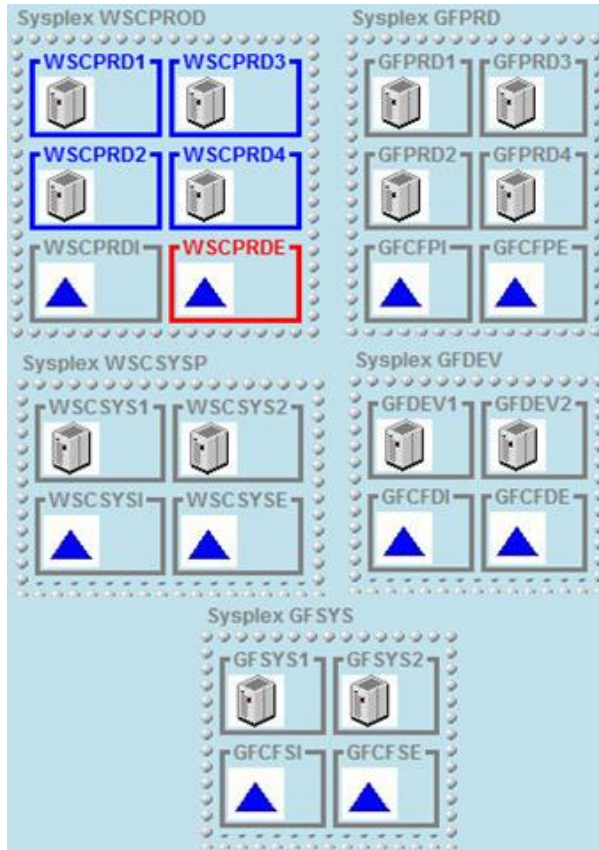
From: when z/OS issues a CF request,  
To: when the return is recognized by z/OS.

- It is comprised of:
- Host Hardware
  - Link Latency
  - Data Transfer\*
  - CF Busy time
  - **Does not include queue time.**

\* Actual Data Transfer size is unknown.

# Service Time

(Main window->View->Logical Sysplex)



The metric to look at,  
but where to start looking?

10 CFs

14 z/OS members

~= 350 structures

180 intervals

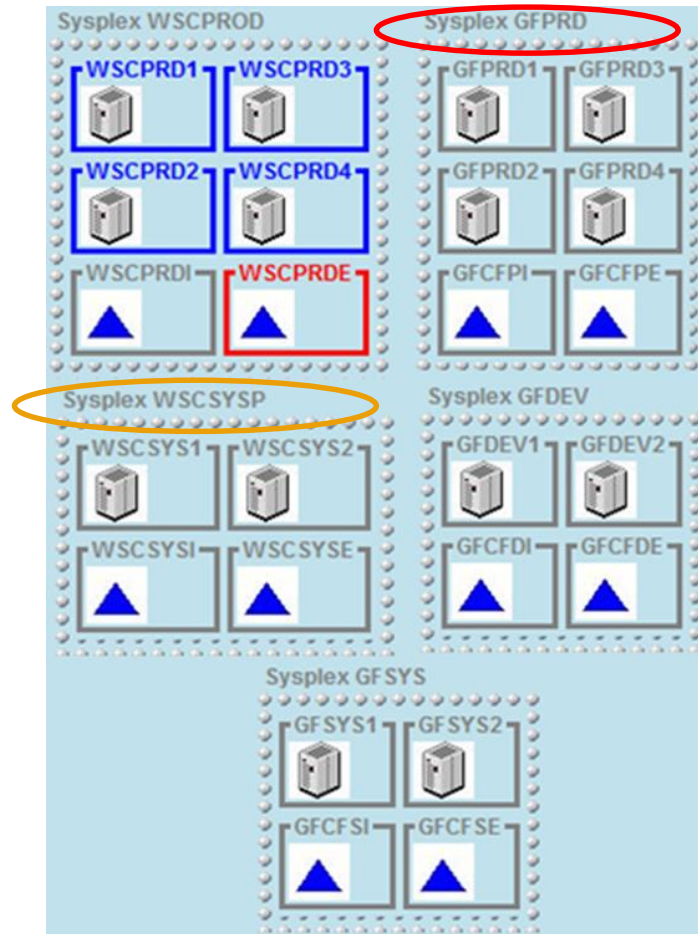
Locks, Cache, List ops

Sync and Async

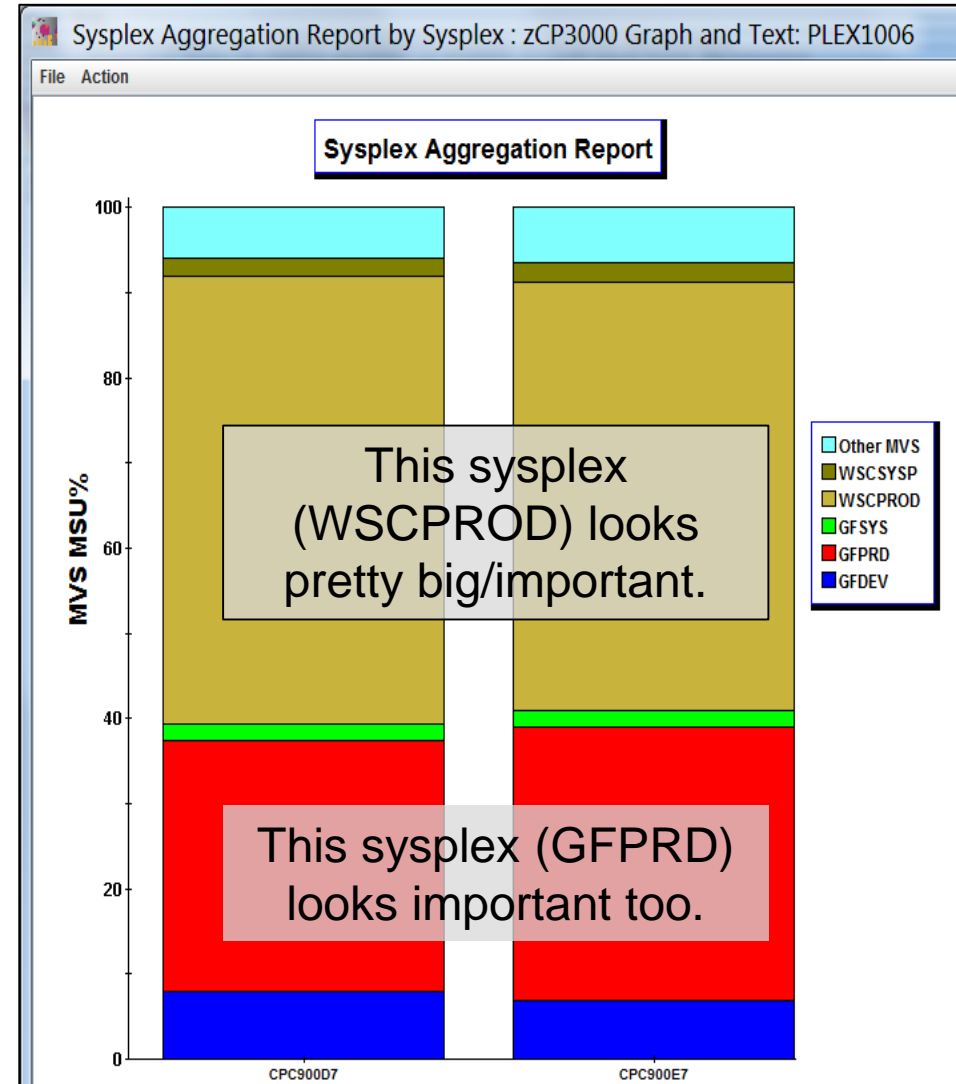
- **Difficult to scope.**
- **Difficult to characterize.**
- **Difficult to summarize.**

# Where to start?

(Main window->View->Logical Sysplex)



(Sysplex window->Analysis->PLEX1006)



# Focus on 1-2 key structures on key CFs

- Click on the column head to sort.
- Double click the row to see more about LOCK1
- Note: **mixed linktypes**

(Main window-> double click WSCPDRDE)

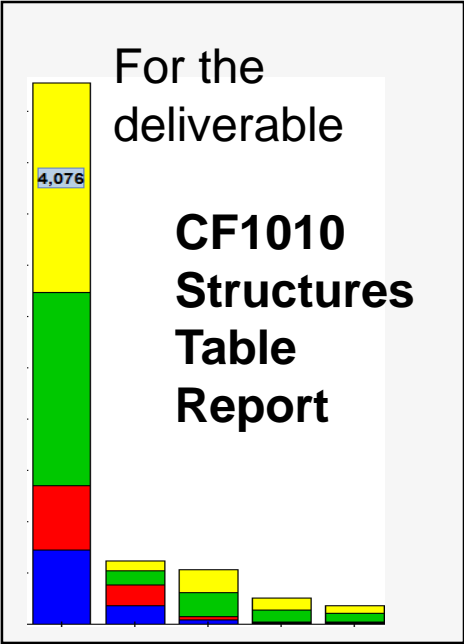
CF Name: WSCPDRDE  
 Sysplex Name: WSCPDRD  
 CF Machine Type: 2828-H06/A00  
 CF Level: 19  
 Lpar Utilization: 3.9%  
 Engines (1) ICF  
 Relative Share Dedicated Engines

Peer Name: WSCPDRDI  
 CF Machine Type: 2827-H20(504)  
 CF Level: 19  
 Storage Defined: 5,157 mb  
 Dump Storage: 1 mb  
 Storage Available: 1,282 mb

Partition	SYSID:	Reqs/sec	SubChan...	CF Links:	Link type	Km	Link Utili...
CPC900D...	PRD1	2,123.8	28	4	[IFB3-12x, IFB-12x]	0.0	0.6%
CPC900E...	PRD2	1,935.0	28	4	[IFB3-12x, IFB-12x]	0.0	0.5%
CPC900D...	PRD3	5,328.0	28	4	[IFB3-12x, IFB-12x]	0.0	0.6%
CPC900E...	PRD4	5,460.4	28	4	[IFB3-12x, IFB-12x]	0.0	0.5%

CF Study Interval 3/4/16 14:00 Link Quick Fix Set KM (all CFs)

Structure	Type	Size	Reqs/sec	Duplexed?
DNPDBR0_LOCK1	LOCK	259	10,554.0	<input type="checkbox"/>
IXCPDR1	LIST	15	1,240.7	<input type="checkbox"/>
DNPDBR0_GBP6	CACH	204	1,064.5	<input checked="" type="checkbox"/>
DNPDBR0_GBP1	CACH	645	514.5	<input checked="" type="checkbox"/>
DNPDBR0_GBP3...	CACH	160	358.1	<input checked="" type="checkbox"/>
DNPDBR0_GBP5	CACH	323	285.2	<input checked="" type="checkbox"/>
DNPDBR0_GBP11	CACH	323	186.3	<input checked="" type="checkbox"/>
DFHXQLS_TSQW...	LIST	60	115.8	<input type="checkbox"/>
DFHXQLS_DELIC...	LIST	4	100.0	<input type="checkbox"/>
39 Structures	Totals		14,847.3	23 duplexed





# Service Time by Structure

- z/OS wants to run all requests synchronously (except for XCF).
- Insufficient bandwidth or slow service will cause it to convert to async.
- Therefore, except for IXC requests and distances > 1km, all async requests should be viewed as a lack of resource.
- HUGE difference between **sync** and **async** service time (13 vs 182 mics).
- Service Time graphs available from the CF window, the Link window, and the Structure detail window.

Structure Detail Window – also report STR1000

(CF window-> double click DNPDBR0\_GBP15)

WSCP10D : DNPDBR0\_GBP15 : Structure ...

Analysis

Sysplex Name WSCP10D Structure Name DNPDBR0\_GBP15  
 CF Name WSCP10D Duplex Primary Structure Type CACH  
 Study Interval 2016-03-04 14:00:00 00:15:00 % of CF Utilization 33.2%

CF Link Type	PRD1	PRD2	PRD3	PRD4
IFB-12x	IFB-12x	IC	IFB-12x	IC

**Synchronous**

Requests per ...	PRD1	PRD2	PRD3	PRD4
Average	3009.53	2682.62	0.54	1.1
Maximum	8840.45	9996.79	11.16	13.24
Study Interval	1867.51	1690.67	0.14	0.25

Service Time (...)	PRD1	PRD2	PRD3	PRD4
Average	12.56	9.76	8.03	9.19
Maximum	18.56	17.44	35.24	39.82
Study Interval	13.59	10.36	6.26	5.74

**Asynchronous**

Requests per ...	PRD1	PRD2	PRD3	PRD4
Average	30.13	8.3	0.06	0.09
Maximum	165.65	61.36	2.62	3.98
Study Interval	48.57	14.41	0.0	0.01

Service Time (...)	PRD1	PRD2	PRD3	PRD4
Average	182.06	166.66	150.56	271.82
Maximum	453.03	463.43	1132.75	732.69
Study Interval	234.78	190.53	114.33	219.17

Ok



# Service Time for Important Structures

(WSCPDRDE window-> double click DNPDBR0\_LOCK1)

WSCPDRDE : DNPDBR0\_LOCK1 : Structure... Analysis

Sysplex Name WSCPDRD Structure Name DNPDBR0\_LOCK1  
CF Name WSCPDRDE Structure Type LOCK  
Study Interval 2016-03-04 14:00:00 00:15:00 % of CF Utilization 52.0%

CF Link Type	PRD1	PRD2	PRD3	PRD4
IFB-12x	IFB-12x	IFB-12x	IFB-12x	IFB-12x

**Synchronous**

Requests per ...	PRD1	PRD2	PRD3	PRD4
Average	2127.71	2630.23	3023.9	3960.76
Maximum	55845.62	57201.2	4893.62	6151.57
Study Interval	1450.68	1250.07	3777.25	4076.0

Service Time (...)	PRD1	PRD2	PRD3	PRD4
Average	4.88	4.9	4.89	4.92
Maximum	5.34	5.29	5.97	5.07
Study Interval	4.96	5.01	5.0	4.92

**Asynchronous**

Requests per ...	PRD1	PRD2	PRD3	PRD4
Average	0.0	0.0	0.0	0.0
Maximum	0.0	0.0	0.0	0.0
Study Interval	0.0	0.0	0.0	0.0

Service Time (...)	PRD1	PRD2	PRD3	PRD4
Average	0.32	0.0	0.0	0.0
Maximum	57.0	0.0	0.0	0.0
Study Interval	0.0	0.0	0.0	0.0

Ok

- Pick a busy structure.
- Double click to look at structure detail.
- Note which links are busiest.
- Are most requests running synchronously?
- Are they getting good service time?
- Maybe include STR1000 or STR1012 in the customer deliverable, to show that it's happy.

Graph Selection

STR1000	Structure Detail Summary
STR1012	Synchronous Service Time
STR1013	Asynchronous Service Time
STR1019	Weighted Average Service Time
STR1014	Lock Contention Over Time
STR1015	Lock Contention as a Percent Over Time
STR1016	Request Rate by SYSID
STR1017	Intensity for Synchronous Requests
STR1018	Intensity for Asynchronous Requests

Favorites Sel All Doc All Show OK

# Identify key coupling links

Which Sysplexes->CFs are important?

WSCPDI, WSCPDE on sysplex WSCPROD  
GFCFPI, GFCFPE on sysplex GFPRD

- Sort the links by request rate (CF window, click on the column header)
- Look at the CF Structures Report to see which links are busiest for the busiest (aka most important) structures.
- Look at anything shows up yellow in the Subchannels part of the CF Health Check.

10 CFs  
14 z/OS  
members  
~= 350  
structures  
180 intervals

# Can't one number tell me if the links are ok for this CF?

No, because ...

Different # of Subchannels and requests per z/OS system

Different link speeds

Variation in data transfer sizes.

Uneven distribution of requests from z/OS members.

(main or sysplex window-> double click WSCPRDE)

The screenshot shows the 'WSCPRDI: Coupling Facility PA Summary' window. It contains the following information:

- CF Name:** WSCPRDI
- Sysplex Name:** WSCPROD
- CF Machine Type:** 2827-H20(504)
- CF Level:** 19
- Lpar Utilization:** 9.4%
- Engines:** (1) ICF
- Relative Share:** Dedicated Engines
- Peer Name:** WSCPRDE
- CF Machine Type:** 2828-H06/A00
- CF Level:** 19
- Storage Defined:** 5,157 mb
- Dump Storage:** 1 mb
- Storage Available:** 1,818 mb

Partition	SYSID:	Reqs/sec	SubChann...	CF Links:	Link Type:	Km	Link Utiliza...
CPC900D...	PRD1	3,269.5	28	4	[IFB3-12x, I...	0.0	0.7%
CPC900E...	PRD2	3,084.1	14	2	[IC]	0.0	0.5%
CPC900D...	PRD3	3,568.3	28	4	[IFB3-12x, I...	0.0	0.7%
CPC900E...	PRD4	3,369.4	14	2	[IC]	0.0	0.3%

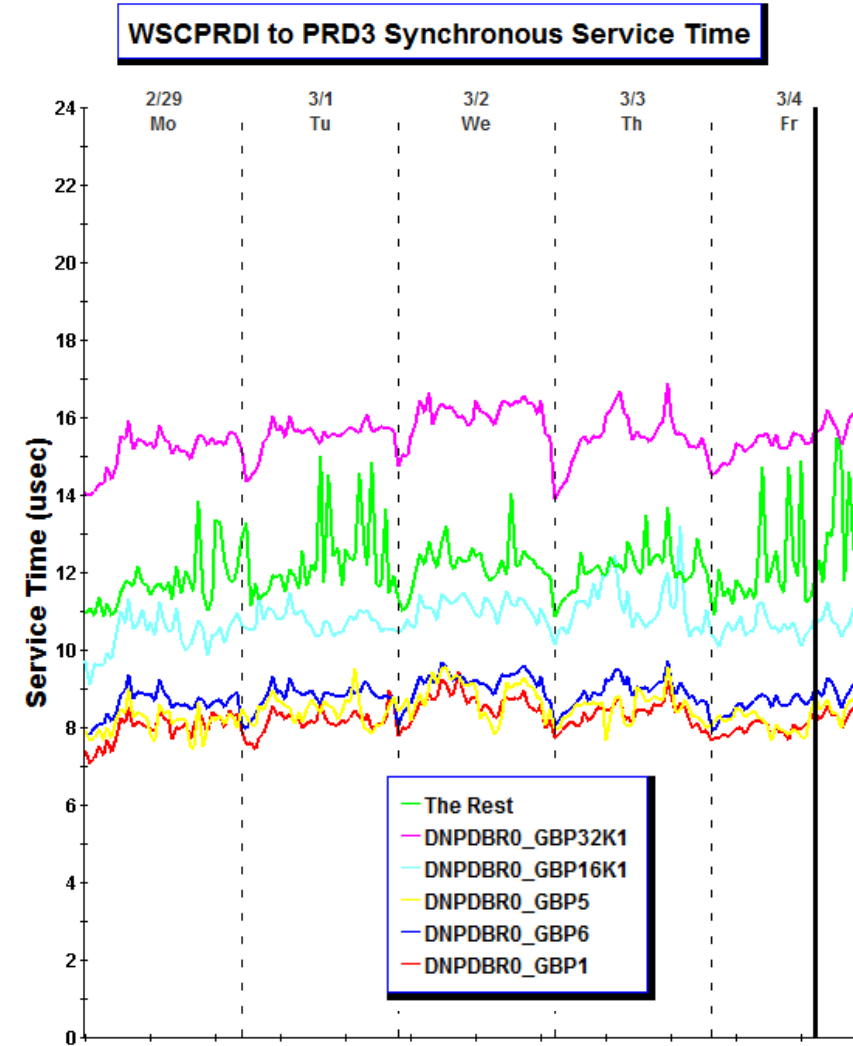
CF Study Interval: 3/4/16 14:00 | Link Quick Fix | Set KM (all CFs)

Structure	Type	Size	Reqs/sec	Duplexed?	
DNPDBR0_GBP15	CACH	81	3,621.6	<input checked="" type="checkbox"/>	
DNPDBR0_GBP1	CACH	644	2,212.7	<input checked="" type="checkbox"/>	
DNPDBR0_GBP6	CACH	203	1,826.3	<input checked="" type="checkbox"/>	
DNPDBR0_GBP5	CACH	323	1,718.1	<input checked="" type="checkbox"/>	
IXCPRD2	LIST	15	1,449.9	<input type="checkbox"/>	
DNPDBR0_GBP1...	CACH	476	906.3	<input checked="" type="checkbox"/>	
26 Structures			Totals	13,291.2	23 duplexed

# Service Time by Link

- If a key structure has bad service time on a specific link, look at the service time for all traffic on that set of links.
- (there are 4 “links” running between WSCPRDI to PRD3).
- Which means there are 4 chpids: 88, 98, A8, B8
- Those 4 chpids run through 4 different adapters on CPC900D7.
- ***It would be nice to look at the physical link as well.***

(CF window->PRD3 link->Analysis->CFL012)



# Sysplex Graph Recommendations

See graph index in reference slides.  
Use zCP3000 “favorites” function.

## Probably in every study

- zCP3000 main view : [Topology](#)
- per CPC (Coupling Links window): [Coupling Links Summary](#)
- Sysplex Logical window : [Sysplex Topology](#), [Coupling Summary](#)
- For each CF : [CF Summary](#), CF Health Check,  
[CF Migration Summary report](#)

**PA Mode**

**PA and QM Mode**

**QM only**

## Look for areas of interest

- [Thin Interrupt Effect](#)
- [CF Structures Table](#)
- [CF Link Topology](#)
- [Coupling Adapter Summary](#)

• [CF Link Summary](#), [Link Migration Comparison](#)

- Service Time for Synchronous Structures
- Request Rate by System over Time
- Request Rate by Request Type and System

## Drill down in areas of interest

- CF Logical Utilization over Time
- Advanced CF (shared ICF)
- Subchannel Busy
- Synchronous Service Time (Link)

- Lock Contention % of Requests
- Synchronous Intensity
- Delayed Requests
- Busiest Structures with Queue Time

# Agenda - Solving Sysplex Questions with zCP3000

- New Technology
- Getting Started
- Understand problem areas, key resources and intervals
- **Modeling new hardware or links or Thin Interrupt**
- Coupling Link Considerations

Reference slides include links, graph recommendations, and references.



# Modeling configuration changes

## You must be in QM Mode

- Resolve red triangles and fill in IOCP info before going to QM mode.
- Multiple changes (machine, linktype, dispatch), in any order.
- Configuration changes may then affect:
  - ICF utilization
    - w/ the speed of the CPC or alt
    - nway change
  - Service time when:
    - Linktype or distance changes
    - CF machine type changes [via drag and drop](#)
    - CF Dispatch mode changes (ie Thin Interrupt vs dedicated)
  - % ops executing synchronously
  - Channel path utilization
  - z/OS utilization changes will be very small

# Service Time vs Sysplex Overhead

## Sysplex Op service time depends on

- Type of Request
- Amount of data being carried\*
- How request will be executed (sync or async)
- Simplex or Duplex
- Path busy or anticipated path busy (queued request)
- Link latency
- Link speed
- Link distance
- CF speed and responsiveness
- z/OS speed

\* (not measured)

## Sysplex Overhead (on z/OS) is dependent on

How request will be executed (sync or async)  
Service Time, for synchronous requests

***Service time does not include queue time.  
-> see CF Health Check, Subchannels, Delayed Requests***

# Heuristic Sync->Async Conversion

- z/OS keeps a table of observed CF service times for each structure.
- Depending on the estimated efficiency tradeoff, it may convert any synchronous operation to asynchronous.
- Conversion is done \*before\* the request is ever launched.
- Requests converted this way are async from the start. They do not count as a “changed” request.
- With 10 mics added per km distance, anything over 2km will certainly be async.

## Approximate Threshold for Conversion

z/OS Host		Microseconds
z9-EC	2094-701	36.92
z9-BC	2096-Z01	44.65
z10-EC	2097-701	26.00
z10-BC	2098-Z01	31.27
z196	2817-701	26.00
z114	2818-Z01	26.45
zEC-12	2827-701	26.00
zBC-12	2828-Z01	26.00
z13	2964-701	26.00
z14	3906-701	26.00

Note: This is **COMPLETELY DIFFERENT** from subchannel busy sync->async conversions.

# Cookbook steps to model new hardware

Collect data for all sysplex members (and maybe dev/test).

Fully define the sysplex in it's current state in PA mode.

- Fix red triangles, "extra" standalone CF machines, km distance
- For standalone CFs : model, engine type, and LPAR weight
- Import IOCP information, when available.
- Generate some reports, like the Health Checks for key SYS and CF

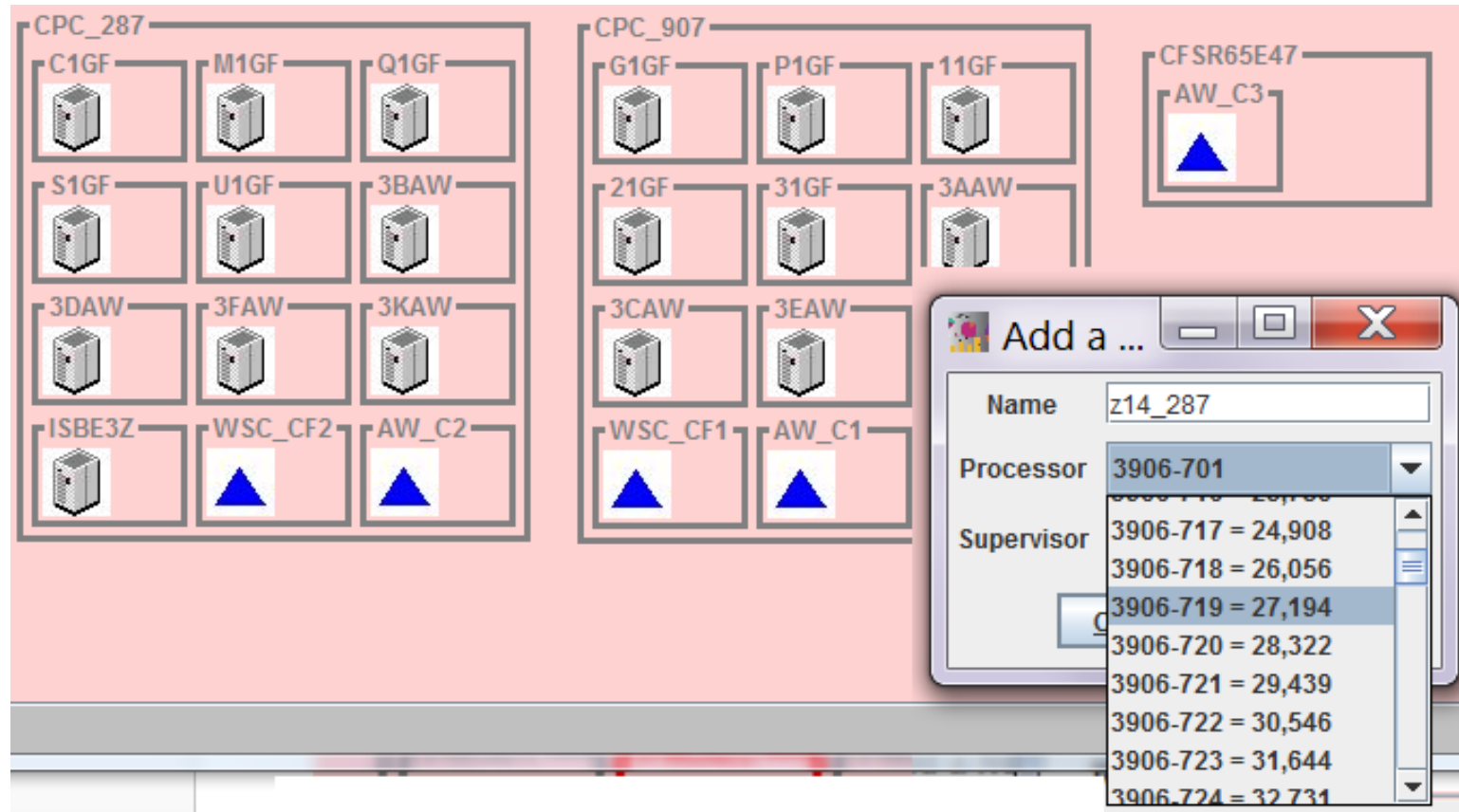
Save then go to QM mode.

- Add a new z14
- Move partitions to the new CPC → service time recal
- Define engines and lpars of the new z14 → service time recal
- Upgrade link types → service time recal
- Change dispatch mode → service time recal

***Look at the CF Migration Report →***

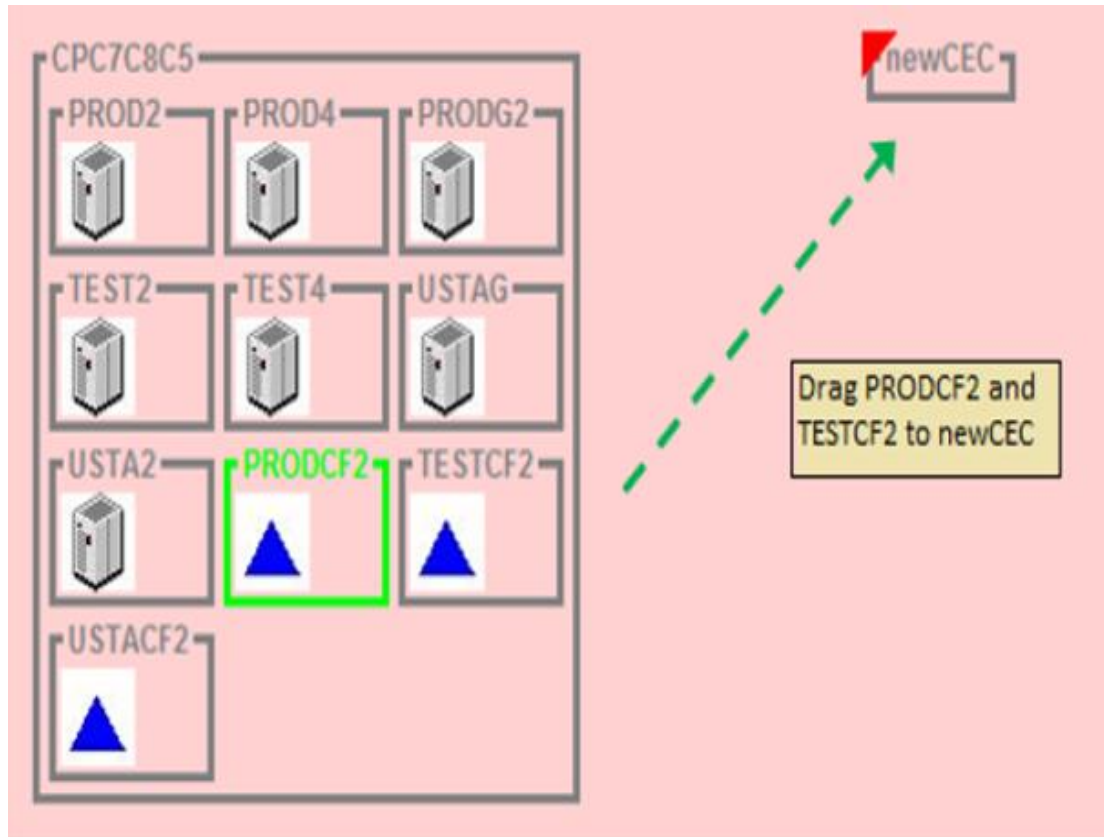
# Change the CF machine type

Step 1 – add the new machine



# Change the CF machine type

Step 2 – move some partitions there



The new CPC will still be marked in error because the definition needs to change to accommodate the partitions that just moved there.





# Change the CF machine type

## Step 3 – define real engines and partitions

The screenshot shows the 'Define CPC newCec' dialog box. At the top, the 'Supervisor' is set to 'LPAR' and the 'Zaap On Ziip' checkbox is unchecked. Below this is a table with columns: Interval, Processor, GCPs, zAAPs, zIIPs, ICFs, IFLs, PwrSav, and Change. The 'ICFs' column values are 1.0, 0.0, 0.0, 0.0, 0.0, and 0.0. A context menu is open over the first row, with 'All Field' selected. Below the first table is a second table with columns: Name, CtlPgm, Workload, Wkld Type, Type, No, Weight, Weight%, Cap, Abs Cap, MinCap, and MaxCap. The 'Weight' column values are 90 and 10. 'Cancel' and 'Apply' buttons are at the bottom right.

Interval	Processor	GCPs	zAAPs	zIIPs	ICFs	IFLs	PwrSav	Change
4/1/13 10:00	2827-H20	1.0	0.0	0.0	1.0	0.0	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4/1/13 11:00	2827-H20	1.0	0.0	0.0	0.0	Field to End	<input type="checkbox"/>	<input checked="" type="checkbox"/>
4/1/13 12:00	2827-H20	1.0	0.0	0.0	0.0	Row to End	<input type="checkbox"/>	<input type="checkbox"/>
4/1/13 13:00	2827-H20	1.0	0.0	0.0	0.0	All Field	<input type="checkbox"/>	<input type="checkbox"/>
4/1/13 14:00	2827-H20	1.0	0.0	0.0	0.0	All Row	<input type="checkbox"/>	<input type="checkbox"/>
4/1/13 15:00	2827-H20	1.0	0.0	0.0	0.0		<input type="checkbox"/>	<input type="checkbox"/>

Name	CtlPgm	Workload	Wkld Type	Type	No	Weight	Weight%	Cap	Abs Cap	MinCap	MaxCap
PRODCF2	CFCC	CFCC	Default	ICF	1.0	90	0.0%	<input type="checkbox"/>		1252.8	1392.0
TESTCF2	CFCC	CFCC	Default	ICF	1.0	10	0.0%	<input type="checkbox"/>		139.2	1392.0

# Change the Coupling Links

- Double click a link on the CF window.
- Click “Upgrade Link”
- Change the linktype
- Change #chpids
- Change Subchannels\*

“Before” is PA mode.

“Current” shows the changes so far in QM.

“Estimated” shows the effect of the new change.

WSCPRDI : PRD1 : Coupling Link Detail

Analysis

Sysplex Name: WSCPROD    Cecid:    Machine Type:     
SYSID: PRD1    new900D7    2964-504     
CF Name: WSCPRDI    new900E7    2964-701     
CF Study Interval: 2016-03-04 14:00:00 00:15:00

Link Configuration

	Configuration Befo...	Upgrade
Machine Type	2827-701	2964-701
Link Type	[IFB3-12x, IFB-12x]	IFB-12x
Subchannels per c...	7	7
Chpids	4	4
Subchannels	28	28
Distance(km)	0.0	0.0

Channel Paths

Sysplex Member					Link...	Coupling Facil			
SYS...	CECID	Ada...	Port	Chpid		CECID	Ada...	Port	Chpid
PRD...	new...	08	02	88	IFB...	new...	08	01	80
PRD...	new...	09	02	98	IFB...	new...	09	01	90
PRD...	new...	0A	02	A8	IFB...	new...	0A	01	A0
PRD...	new...	0B	02	B8	IFB3...	new...	0B	01	B0

Utilization	Before	Current	Estimated
CF	9.4%	9.4%	9.4%
Sysid	26.6%	33.8%	33.8%
Subchannel	0.7%	0.8%	0.8%

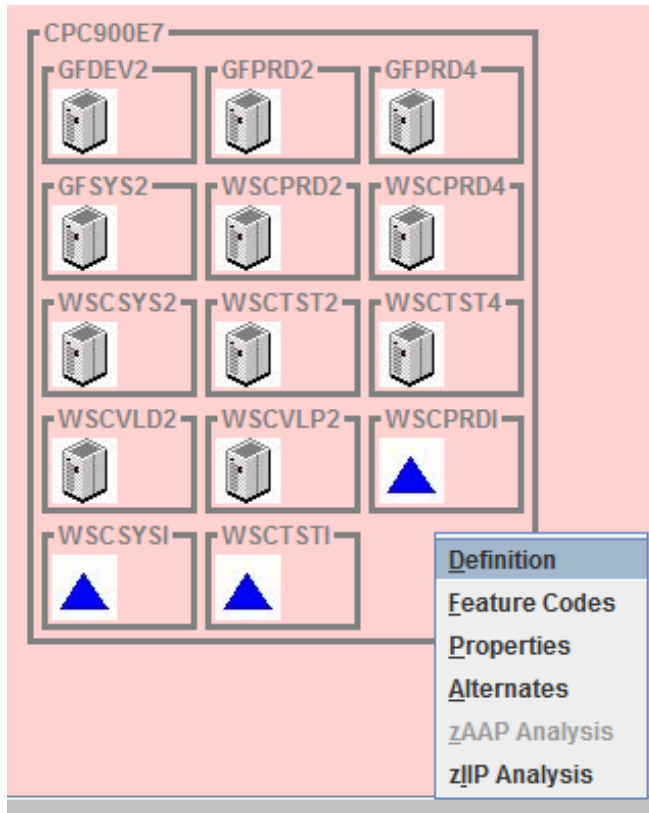
Requests/sec	Before	Current	Estimated
Sync	2873.99	2587.07	2587.07
Async	395.5	682.42	682.42
Total	3269.49	3269.49	3269.49

Service Time (usec)	Before	Current	Estimated
Sync	15.98	19.78	19.78
Async	213.35	93.53	93.53
Average	39.76	35.18	35.18

Apply    Cancel

# Change from Dedicated to Thin Interrupt

## Step 1 – change the LPAR definition

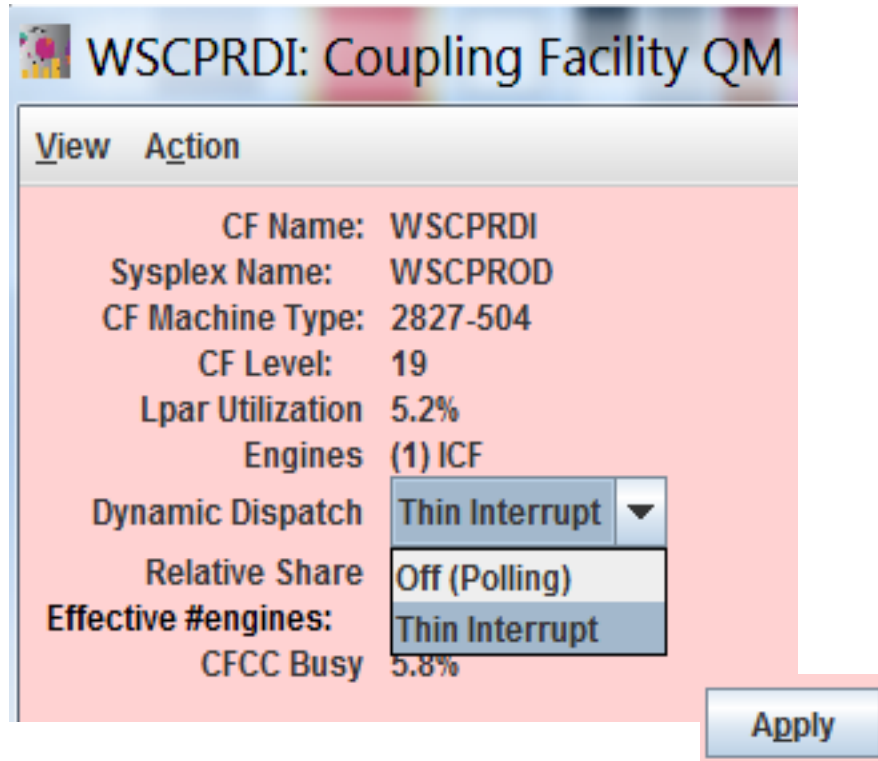


Name	CtlPgm	Workload	Wkld Type	Type	No	Weight	Weight%	Cap	A
GFDEV2	z/OS-2.1	High	CPU-MF	CP	2.0	94	10.6%	<input type="checkbox"/>	
				zIIP	1.0	60	7.2%	<input type="checkbox"/>	
GFPRD2	z/OS-2.1	Average	CPU-MF	CP	2.0	49	5.5%	<input type="checkbox"/>	
				zIIP	2.0	170	20.5%	<input type="checkbox"/>	
GFPRD4	z/OS-2.1	Average	CPU-MF	CP	2.0	163	18.4%	<input type="checkbox"/>	
				zIIP	2.0	170	20.5%	<input type="checkbox"/>	
GFSYS2	z/OS-2.1	Average	Default	CP	1.0	24	2.7%	<input type="checkbox"/>	
				zIIP	1.0	10	1.2%	<input type="checkbox"/>	
WSCP...	z/OS-2.1	High	CPU-MF	CP	2.1	147	16.6%	<input type="checkbox"/>	
				zIIP	2.0	170	20.5%	<input type="checkbox"/>	
WSCP...	z/OS-2.1	Average	CPU-MF	CP	2.1	296	33.4%	<input type="checkbox"/>	
				zIIP	1.0	170	20.5%	<input type="checkbox"/>	
WSCSYS2	z/OS-2.1	Average	CPU-MF	CP	1.0	42	4.7%	<input type="checkbox"/>	
				zIIP	1.0	20	2.4%	<input type="checkbox"/>	
WSCTST2	z/OS-2.1	Average	Default	CP	1.0	70	7.9%	<input type="checkbox"/>	
				zIIP	1.0	60	7.2%	<input type="checkbox"/>	
WSCTST4	z/OS-2.1	Average	Default	CP	1.0	47	0.0%	<input type="checkbox"/>	
WSCVLD2	z/VM-6.3	Average/...	Default	IFL	2.0	400	44.4%	<input type="checkbox"/>	
WSCVLP2	z/VM-6.3	Average/...	Default	IFL	2.0	500	55.6%	<input type="checkbox"/>	
WSCPRDI	CFCC	CFCC	Default	ICF	2.0	70	Ded	<input type="checkbox"/>	
WCSYSI	CFCC	CFCC	Default	ICF	1.0	10	Field to End	<input type="checkbox"/>	
WSCTSTI	CFCC	CFCC	Default	ICF	1.0	20	All Field	<input type="checkbox"/>	

Change weight from Ded to 70.  
Change LCPs from 1 to 2. → Why?

# Change from Dedicated to Thin Interrupt

Step 2 – change the dispatch mode for WSCPRDI



WSCPRDI: Coupling Facility QM

View Action

CF Name: WSCPRDI  
Sysplex Name: WSCPROD  
CF Machine Type: 2827-504  
CF Level: 19  
Lpar Utilization: 5.2%  
Engines: (1) ICF  
Dynamic Dispatch: Thin Interrupt  
Relative Share: Off (Polling)  
Effective #engines: Thin Interrupt  
CFCC Busy: 5.8%

Apply

LPAR definition must already be set to sharing.

Thin Interrupt service time is similar, slightly worse than for dedicated.

# Generate a before and after report

Last Step : generate a CF Migration Summary for each major CF.

The screenshot displays two windows from the IBM Z Systems interface. The main window, titled "DIONE0F: Coupling Facility QM Summary", shows system parameters for a Coupling Facility (CF) named DIONE0F. The parameters include Sysplex Name (PLXEXP), CF Machine Type (2964), CF Level (16), Lpar Utilization (7.8%), Engines (1), Dynamic Dispatch (Off), Relative Share (50.0%), Effective #engines (1.8), and CFCC Busy (8.4%). Below these parameters is a table with columns for Partition, SYSID, and Resource. The table lists three partitions: CPC66827... (COM1), CPC67730... (COM2), and CPC66827... (EXP3).

Overlaid on the main window is a "Graph Selection" dialog box. This dialog box contains a list of graph options:

CFID	Description
CF1014	Coupling Facility Summary
CFQ100	CF Migration Summary
CF1010	CF Structures Table
CF1026	Structure Execution Time
CF1027	Thin Interrupt Effect on Synchronous Execution (w/Alts)
CF1028	Thin Interrupt Effect on Synchronous Service Time (w/Alts)

At the bottom of the dialog box, there are buttons for "Favorites", "Sel All", "Doc All", "Show", and "OK". The "CF Migration Summary" option in the list is circled in red, and a green arrow points from the "Analysis" button in the main window to this option.



# CFQ100 CF Migration Summary Report

Before and after comparison of:

- CF configuration summary, CF link utilizations
- Configuration summary for all CFs and z/OS members of the sysplex

Sysplex PLXEXP Configuration After Migration							
	CECID	Model	Partition	SCP Level	Logical Engines	Relative Weight	Engine Type
	DIONE0F	newZ13	DIONE0F	16	1	Dedicated Engines	ICF
	COM1	CPC66827	ARIEL43	ZV011300	2	1.6%	GCP

- Key Structures

Structures	Type	Duplexed?	Reqs/sec	Configuration Before Migration			Configuration After Migration		
				%Sync	Service Time		%Sync	Service Time	
					Sync	Async		Sync	Async
DB2DS0E_LOCK1	LOCK	No	27,508.9	96.1%	15.8	47.5	100.0%	14.2	-
CQSTMSGQ	LIST	No	13,318.3	88.7%	21.4	57.0	88.7%	24.6	44.8
ISGLOCK	LOCK	No	9,700.3	99.9%	15.3	56.1	100.0%	14.2	-
IXCLST01	LIST	No	5,071.4	0.0%	-	61.7	0.0%	-	56.5
DB2DS0S_LOCK1	LOCK	No	2,285.5	98.1%	15.1	44.3	100.0%	14.3	-

Graph CFQ100 on the CF Window (QM only)



# CFQL001 CF Link Migration Comparison

Service Time (usec)	Before	Current	Estimated
Sync	20.3	15.1	8.49
Async	100.64	82.5	79.24
Average	78.73	75.76	59.77

## CFQL001 Report

### CF Link Window

	Duplex	Structure Type	Requests/sec	%Synchronous		Service Time (usec)			
				Before	After	Synchronous		Asynchronous	
						Before	After	Before	After
IXCLST01		LIST	592.5	0.0%	0.0%	0.0	0.0	100.5	79.2
ISTGENERIC		LIST	143.0	98.6%	100.0%	22.0	9.2	156.9	29.4
ISGLOCK		LOCK	78.1	100.0%	100.0%	17.1	7.2	0.0	27.5
IRRXCF00_P001		CACH	3.7	96.7%	100.0%	23.9	9.8	122.4	30.1
OPERLOG		LIST	0.2	95.0%	100.0%	29.1	9.2	68.2	29.4
Total/Weighted Average			817.6	27.3%	27.5%	20.3	8.5	100.6	79.2

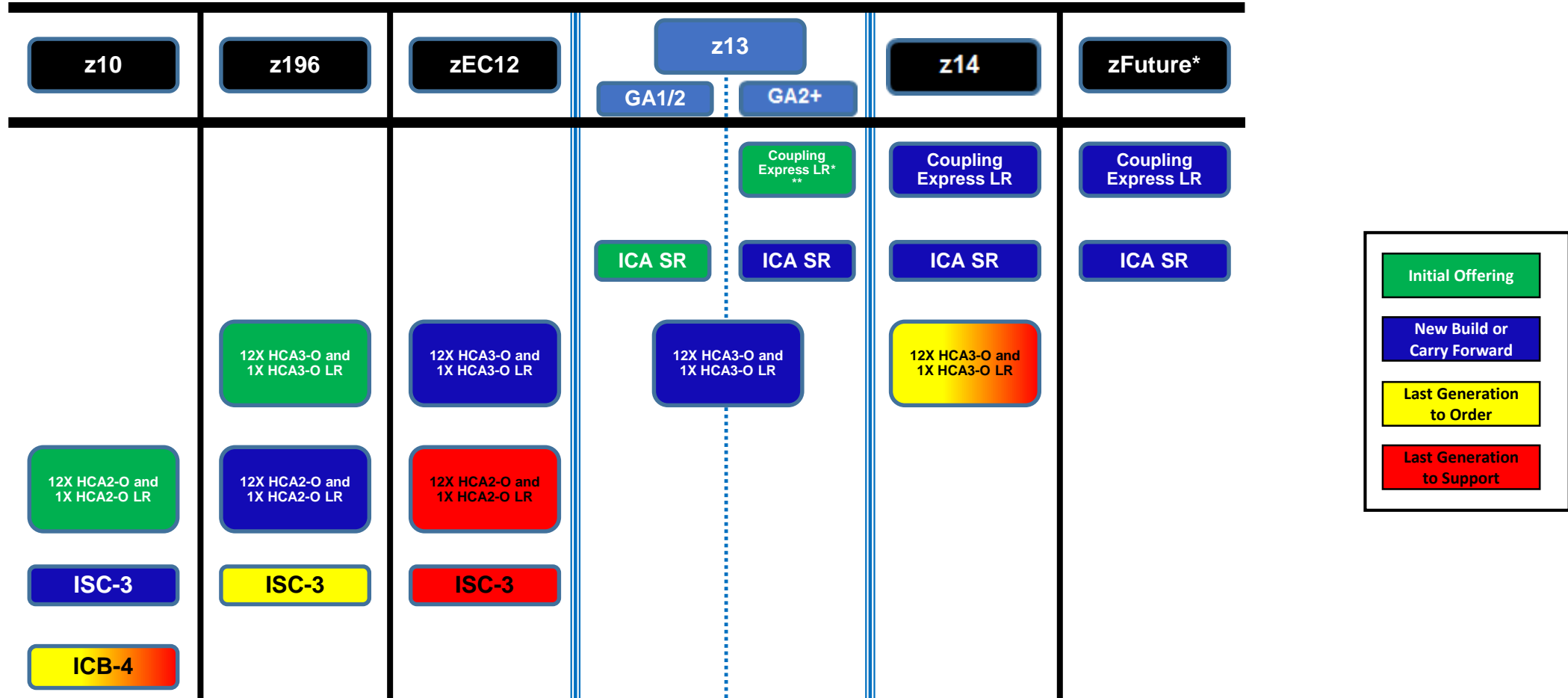
- The Total/Weighted Average will agree w/ the Request Activity Summary on the Link Window.
- All structures have better sync service time, and better yet, more requests will run synchronously.
- I.e., currently 3.3% of IRRXCF00\_P001 requests run asynchronously w/ a service time of 122.4 microseconds. After the z13 and IFB3 migration, those 3.3% will run synchronously w/ a service time of 9.8 mics.

# Agenda - Solving Sysplex Questions with zCP3000

- New Technology
- Getting Started
- Understand problem areas and key resources
- Model a new hardware or links or Thin Interrupt
- **Coupling Link Considerations**

Reference slides include links, graph recommendations, and references.

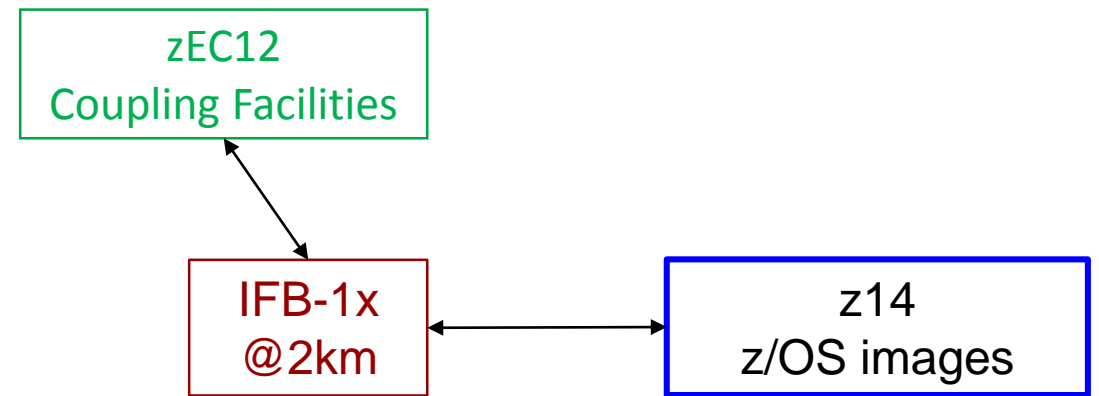
# Coupling Link Roadmap – High End (HE) Systems



# InfiniBand Link Migration problem#1

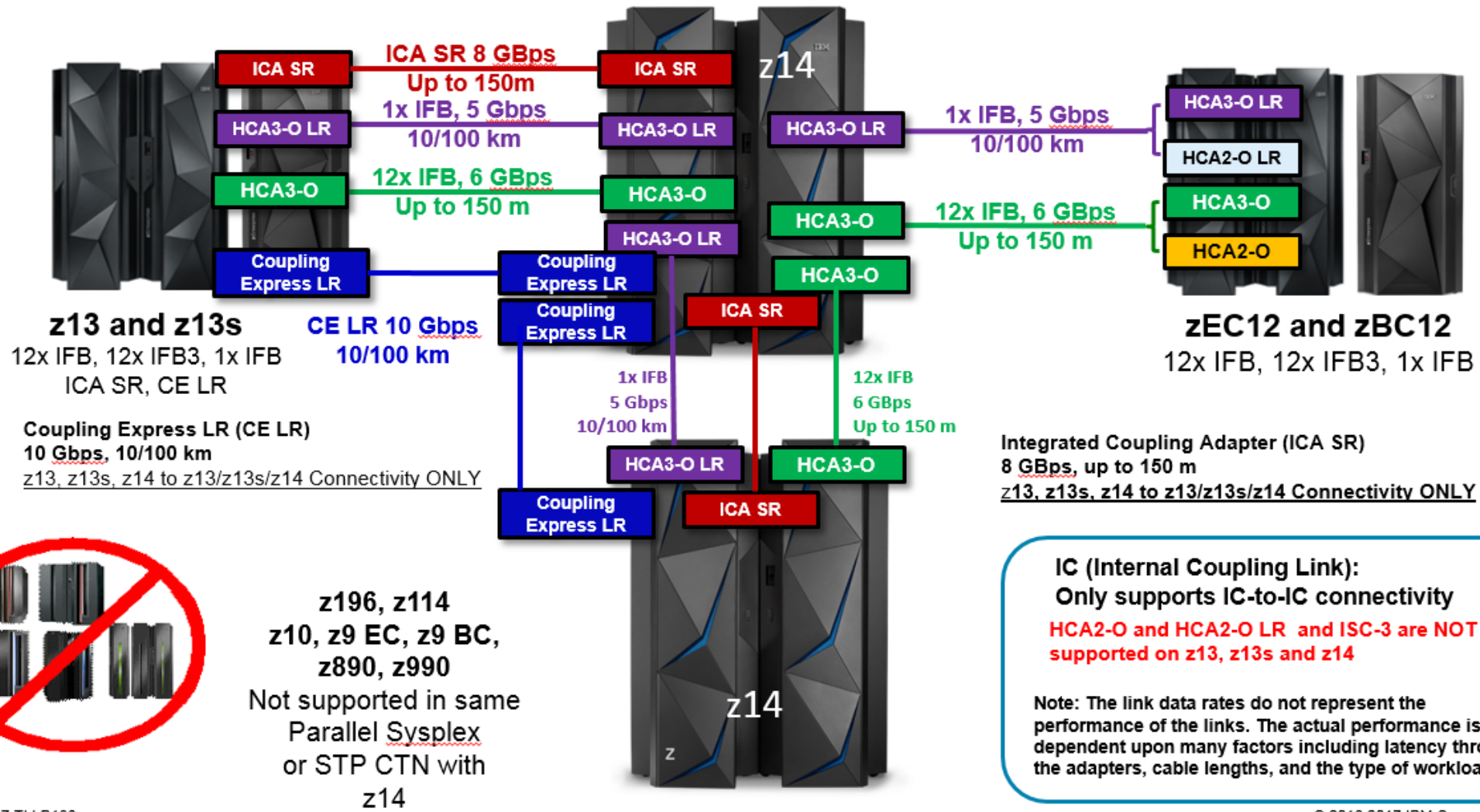
*Fast migration to ICA SR short-distance coupling link technology.  
Really fast migration to CE LR long-distance coupling.*

- ICA links : z13 and up
- CE-LR links : z13 and up
- IFB3 : z196,z114 through z14
- IFB-12x : z9-EC through z14
- IFB-1x : z10-EC through z14
  
- ISC-3 : Jurassic period through zEC12
- zEC12/zBC12 WFM Dec 31, 2017



Standalone CF will have to upgrade before z14 PROD can.

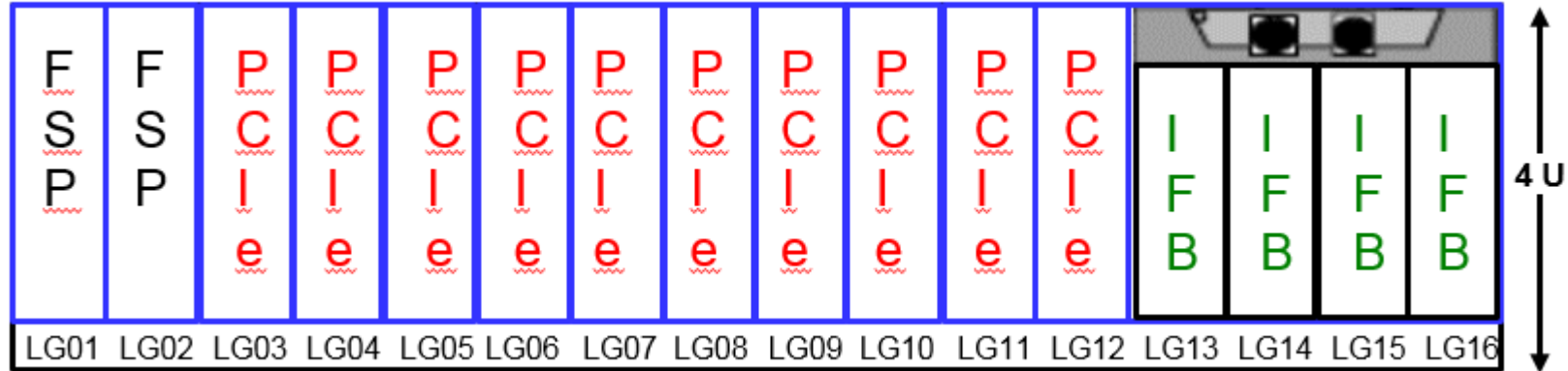
# z14 Coupling Connectivity



IBM Z TLLB186

© 2016,2017 IBM Corporation

# z14 CPC Drawer I/O Fanout



PCIe Fanout Slots (Ten), slots LG03 – LG12 support:

- Up to 10 one-port PCIe 16 GBps I/O fanouts to support up to 10 domains in 32-slot PCIe I/O drawers

- Up to 10 ICA (short range) or CE-LR (long range) two-port coupling fanouts

IFB Fanout Slots (Four), LG13 – LG16, can support:

- Up to four HCA3-O 12x InfiniBand coupling fanouts, 8 12x 6 GBps links – Two per fanout

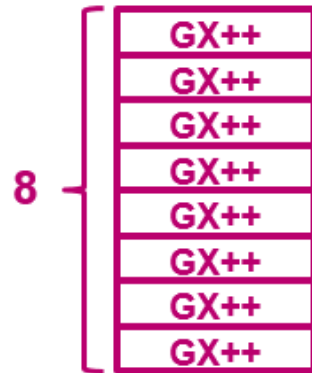
- Up to four HCA3-O LR 1x InfiniBand coupling fanouts 16 1x 5 Gbps links – Four per fanout

\* z14 is the LAST IBM Z server to support InfiniBand features (SoD)

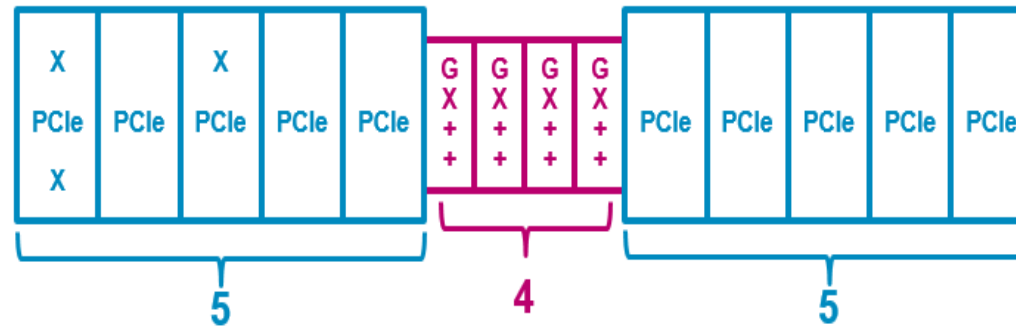


# InfiniBand Link Migration problem#2

zEC12 / z196 Book



z13/z14 Drawer



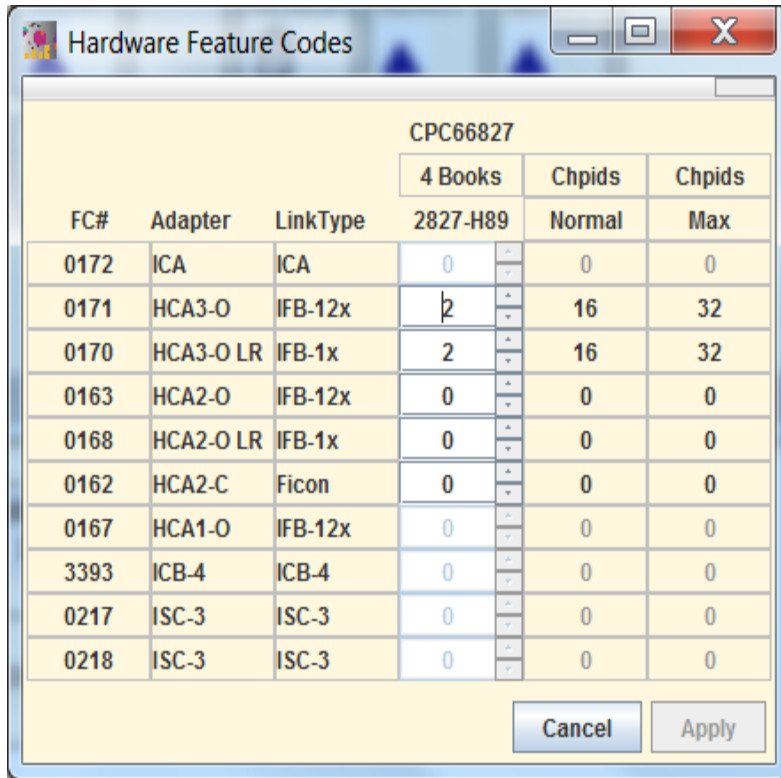
InfiniBand uses **GX++** fanouts

ICA-SR and CE-LR use PCIe fanouts

Migrating the same number of IFB coupling links to z13/z14 from z196/zEC12 may require additional CPC drawers

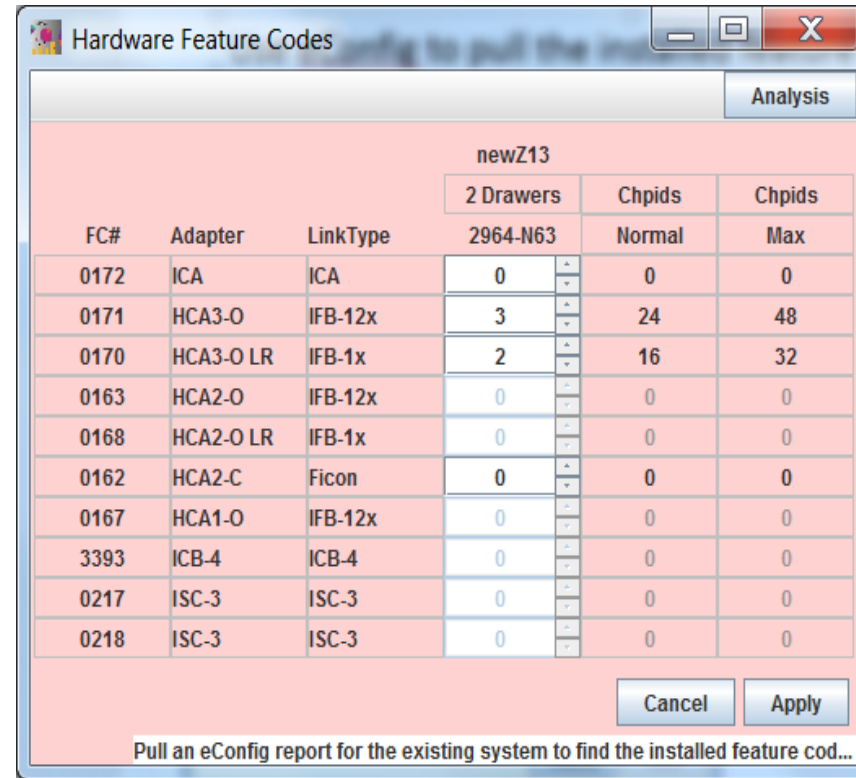
# InfiniBand Link Migration

Use eConfig to determine the current installed adapters.  
Define a new z13, then configure adapters.  
zCP3000 will tell you how many books on the new machine.



Hardware Feature Codes window for CPC66827. The table shows the current configuration of adapters and link types, with columns for FC#, Adapter, LinkType, 2827-H89, Chpids Normal, and Chpids Max.

FC#	Adapter	LinkType	CPC66827		
			4 Books 2827-H89	Chpids Normal	Chpids Max
0172	ICA	ICA	0	0	0
0171	HCA3-O	IFB-12x	2	16	32
0170	HCA3-O LR	IFB-1x	2	16	32
0163	HCA2-O	IFB-12x	0	0	0
0168	HCA2-O LR	IFB-1x	0	0	0
0162	HCA2-C	Ficon	0	0	0
0167	HCA1-O	IFB-12x	0	0	0
3393	ICB-4	ICB-4	0	0	0
0217	ISC-3	ISC-3	0	0	0
0218	ISC-3	ISC-3	0	0	0



Hardware Feature Codes window for newZ13. The table shows the configuration of adapters and link types for the new system, with columns for FC#, Adapter, LinkType, 2964-N63, Chpids Normal, and Chpids Max. The window includes an Analysis button and Cancel/Apply buttons.

FC#	Adapter	LinkType	newZ13		
			2 Drawers 2964-N63	Chpids Normal	Chpids Max
0172	ICA	ICA	0	0	0
0171	HCA3-O	IFB-12x	3	24	48
0170	HCA3-O LR	IFB-1x	2	16	32
0163	HCA2-O	IFB-12x	0	0	0
0168	HCA2-O LR	IFB-1x	0	0	0
0162	HCA2-C	Ficon	0	0	0
0167	HCA1-O	IFB-12x	0	0	0
3393	ICB-4	ICB-4	0	0	0
0217	ISC-3	ISC-3	0	0	0
0218	ISC-3	ISC-3	0	0	0

# Adding drawers just for the Gx++ fanouts?

- Migrate 12x and IFB3 to (faster) ICA type links.
- Migrate 1x to (faster) CE Long Range links.
- ICA and CE-LR are z13 and above only.
- Eliminate FICON Express8 (also uses GX++)
- Consolidate chpids on to fewer IFB/ICA links

→ Max 4 chpids per port for IFB3, ICA, CE-LR

# InfiniBand Link Migration problem #3

IFB-12x and 1x allowed up to 8 chpids per link.  
IFB3 protocol allowed max 4 chpids per link.

ICA and CE-LR allow max 4 chpids per link.

**IFB links\* with >4 chpids need to be reconfigured.**

How do you know if you have this problem?

- CF1000 CF Healthcheck Links rule about mixed speed (some IFB3, some IFB-12x)
- PLEX1012 Sysplex Coupling Links Summary lists the chpids per adapter/port

# PLEX1012 Sysplex Coupling Links Summary

These 5 chpids will run at 12x not IFB3 speed



Sysplex Member					LinkType	Coupling Facility				
CECID	Adapter	Port	Chpids	Sys/CF		CECID	Adapter	Port	Chpids	Sys/CF
CPC900D7	0008	01	80	[GFP1, SYS1, GFP3, PRD3, PRD1, GFD1]	HCA3-O	CFSR893B7	0008	02	40	[WSCSYSE]
			82	[GFP1, GFP3, PRD3, PRD1, GFD1]	HCA3-O				42	[WSCPRDE]
			84	[GFD1]	HCA3-O				44	[GFCFDE]
			85	[GFP1, GFP3, GFD1]	HCA3-O				45	[GFCFPE]
CPC900D7	0008	02	88	[PRD3, GFCFDI, GFCFPI, PRD1, GFCFSI]	HCA3-O	CPC900E7	0008	01	80	[WSCPRDI]
			89	[SYS1, PRD3, GFCFDI, GFCFPI, PRD1, GFCFSI]	HCA3-O				81	[WSCSYSI]
CPC900D7	0009	01	90	[GFP1, SYS1, GFP3, PRD3, PRD1, GFS1, GFD1]	HCA3-O	CFSR893B7	0009	02	50	[GFCFSE]
			92	[GFP1, GFP3, PRD3, PRD1, GFS1, GFD1]	HCA3-O				52	[WSCSYSE]
			94	[GFD1]	HCA3-O				54	[WSCPRDE]
			95	[GFP1, GFP3, GFD1]	HCA3-O				55	[GFCFDE]
CPC900D7	0009	02	96	[GFP1, GFP3, GFS1, GFD1]	HCA3-O	CPC900E7	0009	01	56	[GFCFPE]
			98	[PRD3, GFCFDI, GFCFPI, PRD1, GFCFSI]	HCA3-O				90	[WSCPRDI]
CPC900D7	000A	01	A2	[GFP1, GFP3, PRD3, PRD1, GFS1, GFD1]	HCA3-O	CFSR893B7	000A	02	32	[WSCPRDE]
			A4	[GFD1]	HCA3-O				34	[GFCFDE]
			A5	[GFP1, GFP3, GFD1]	HCA3-O				35	[GFCFPE]
			A6	[GFP1, GFP3, GFS1, GFD1]	HCA3-O				36	[GFCFSE]
CPC900D7	000A	02	A8	[PRD3, GFCFDI, GFCFPI, PRD1]	HCA3-O	CPC900E7	000A	01	A0	[WSCPRDI]
			AA	[SYS1, PRD3, GFCFDI, GFCFPI, PRD1]	HCA3-O				A2	[WSCSYSI]
CPC900D7	000B	01	B2	[GFP1, GFP3, PRD3, PRD1, GFD1]	HCA3-O	CFSR893B7	000B	02	B2	[WSCPRDE]
			B4	[GFD1]	HCA3-O				B4	[GFCFDE]
			B5	[GFP1, GFP3, GFD1]	HCA3-O				B5	[GFCFPE]
CPC900D7	000B	02	B8	[PRD3, GFCFDI, GFCFPI, PRD1]	HCA3-O	CPC900E7	000B	01	B0	[WSCPRDI]

Import from IOCP

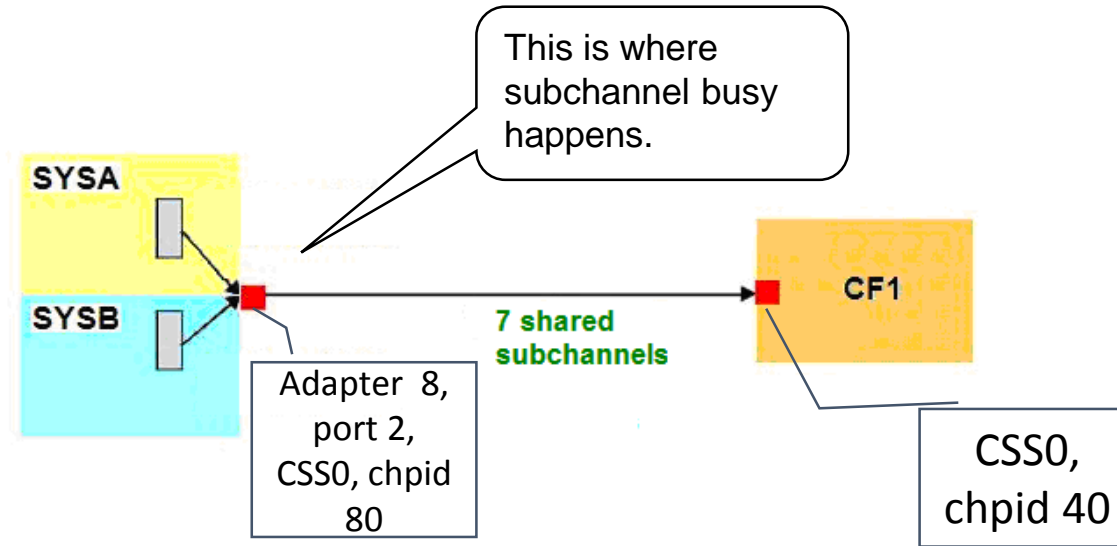
You can't migrate these 5 chpids directly from InfiniBand to ICA-SR type links.

# Shared links vs shared channel paths

(a primer)



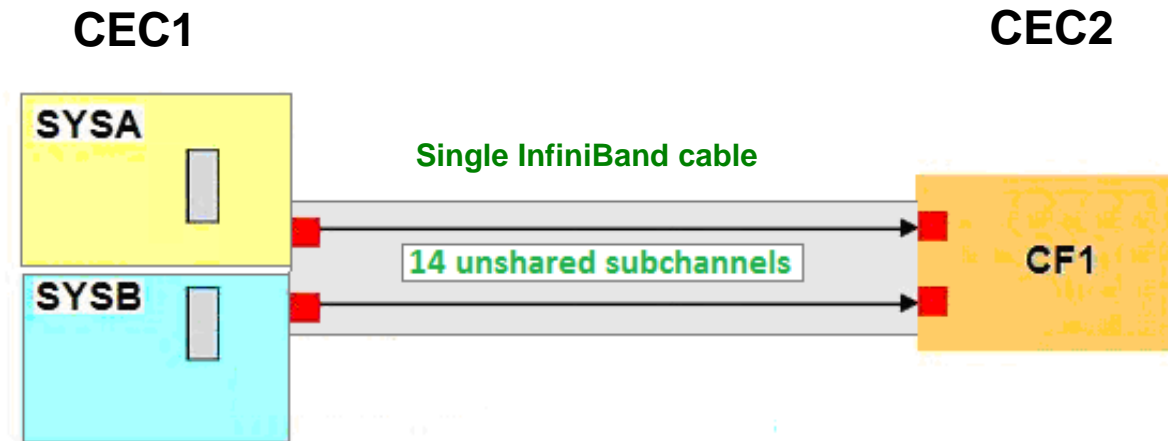
# Shared Channel Paths



## IOCP Definition of a shared cf link:

```
CHPID PATH=(CSS(0),80),SHARED,  
PARTITION=((WSCSYSA,WCSYSB),(=)),  
CPATH=(CSS(0),40),CSYSTEM=EXTRNCF1,  
AID=08,PORT=1,TYPE=CIB
```

# Multiple CHPIDs on a single InfiniBand Link



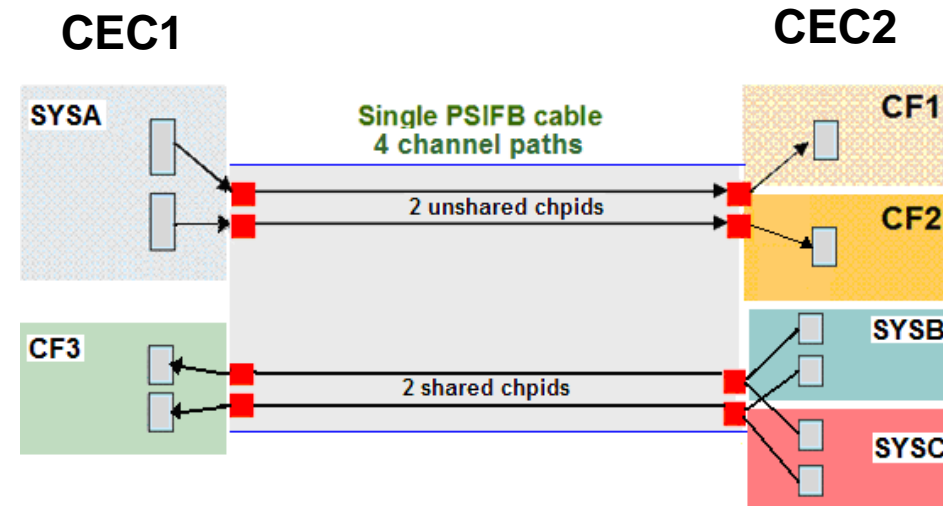
This InfiniBand link carries 2 unshared chpids.

- **No subchannel busy** because the chpids are unshared.
- This physical link can carry 2 more chpids.\*
- Generally, the same adapter type on both ends.\*\*

# Shared Chpids vs Shared Links

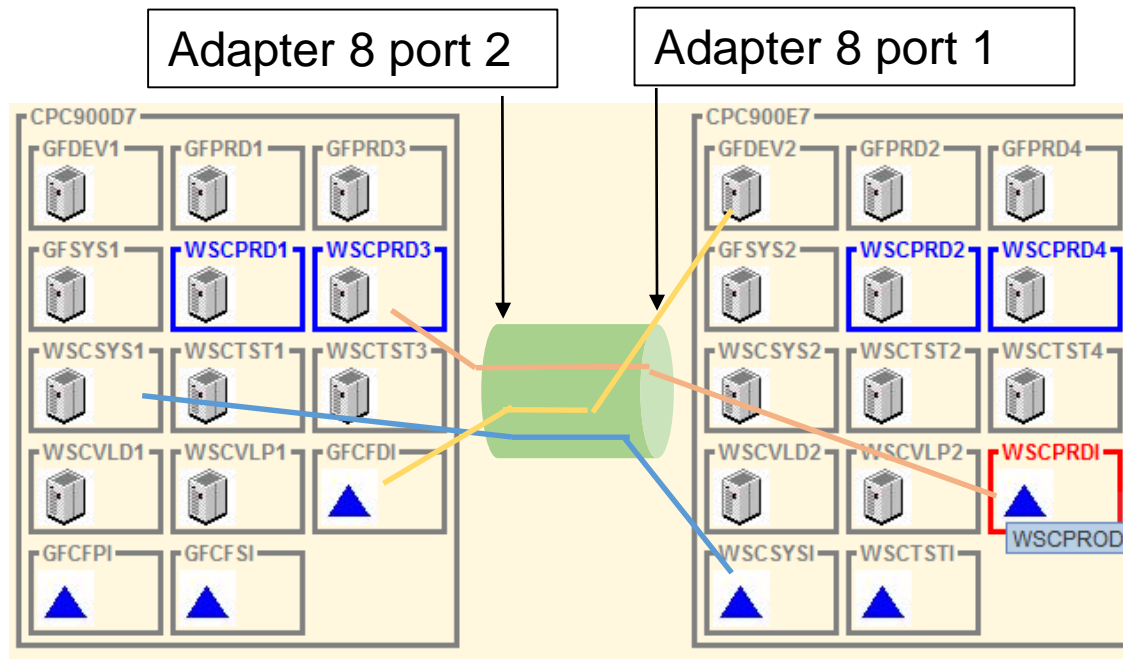
This InfiniBand link carries 4 chpids.

There is also a 2<sup>nd</sup> port (physical link) not shown.



- InfiniBand will let you configure more than 4 chpids per port, but you should not. ICA allows max 4.
- SYSA has one chpid each to CF1 and CF2; it is not sharing these chpids with any other z/OS system on CEC1. The CF1 partition sees 1 chpid, and the CF2 partition sees 1 chpid.
- SYSB and SYSC each have 2 chpids to CF3, but they are shared. CF3 sees 2 chpids.

# Shared Physical Links

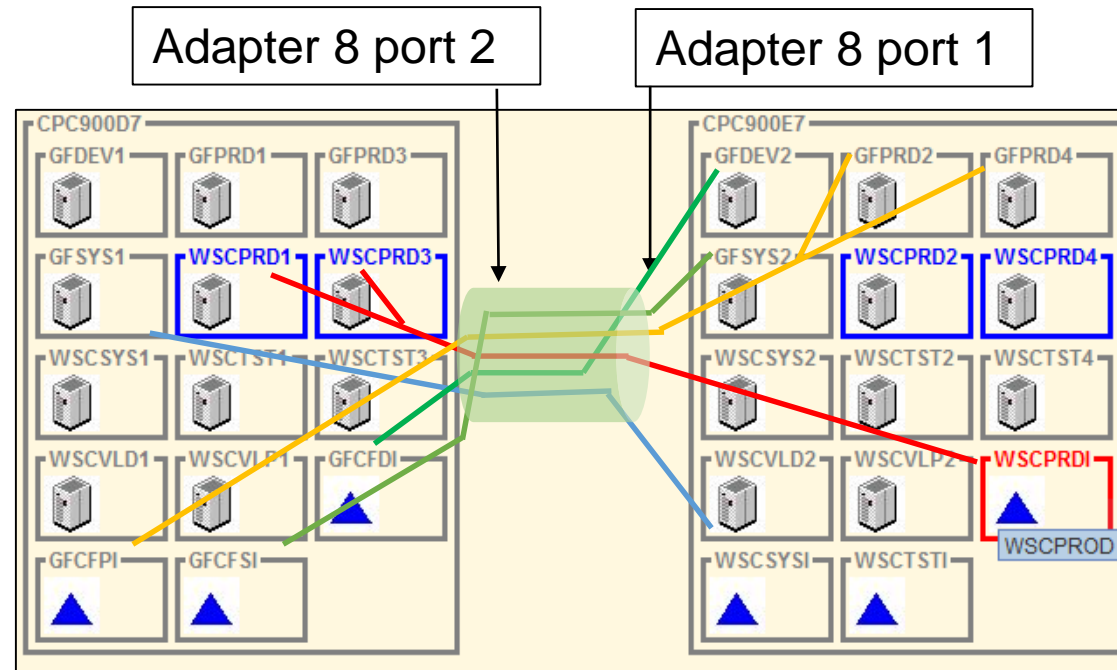


A simplified view.

- all of the chpids running through an adapter/port.
- multiple sysplexes
- z/OS partitions can share chpids
- SYSes and CFs on either end, or both.

# Shared Physical Links

This link is carrying 5  
chpids, so all 5 will run  
in 12x mode not IFB3.



Chpid 88 on 900D7 adapter 8 port 2, connecting to chpid 80 on 900E7 adapter 8 port 1.

Chpid 89 on 900D7 adapter 8 port 2, connecting to chpid 81 on 900E7 adapter 8 port 1.

Chpid 8D on 900D7 adapter 8 port 2, connecting to chpid 85 on 900E7 adapter 8 port 1.

Chpid 8E on 900D7 adapter 8 port 2, connecting to chpid 86 on 900E7 adapter 8 port 1.

Chpid 8F on 900D7 adapter 8 port 2, connecting to chpid 87 on 900E7 adapter 8 port 1.

# Shared Links, Shared Chpids

WSCPDI : PRD1 : Coupling Link Detail

Sysplex Name: WSCP  
 SYSID: PRD1  
 CF Name: WSCPDI  
 CF Study Interval: 2016-03-04 14:00:00 00:15:00

Cecid: CPC900D7  
 Machine Type: 2827-504  
 CPC900E7  
 2827-701

Link Configuration

Link Type: [IFB3-12x, IFB-12x]  
 Subchannels per chpid: 7  
 Chpids: 4  
 Subchannels: 28  
 Distance(km): 0.0

Channel Paths

Sysplex Member					LinkType	Coupling Facility			
SYSIDs	CECID	Ada...	Port	Chpid		CECID	Adapt...	Port	Chpid
PRD1,PRD3	CPC900D7	08	02	88	IFB-12x	CPC900E7	08	01	80
PRD1,PRD3	CPC900D7	09	02	98	IFB-12x	CPC900E7	09	01	90
PRD1,PRD3	CPC900D7	0A	02	A8	IFB-12x	CPC900E7	0A	01	A0
PRD1,PRD3	CPC900D7	0B	02	B8	IFB3-12x	CPC900E7	0B	01	B0

Utilization		Current
CF		9.4%
Sysid		26.6%
Subchannel		0.7%

Requests/sec		Current
Sync		2873.99
Async		395.5
Total		3269.49

Service Time (usec)		Current
Sync		15.88
Async		213.35
Average		39.76

Why are 3 of these chpids in 12x mode?

Chpid 88 runs on that link we just saw, which carries 5 chpids.

Noted in CF1000 CF Health Check PLEX1012 Links Summary



# CF1000 CF Healthcheck for WSCPRDI

Links Rule 6 notices that there are different speed links.

## Links Rule 6 - Mixed Link Speeds - Caution

For some WSCPROD sysplex members, link speeds between WSCPRDI and that sysplex member operated at different speeds. This may be as intended, however it can make transaction speeds less consistent.

SYSID	links	chpids	Mbs/sec	LinkType
PRD1	1	[B8]	5,000	IFB3 protocol, adapter type HCA3-O
	3	[88, A8, 98]	1,000	IFB-12x linktype, adapter type HCA3-O
PRD2	2	n/a	9,400	IC IC
PRD3	1	[B8]	5,000	IFB3 protocol, adapter type HCA3-O
	3	[88, A8, 98]	1,000	IFB-12x linktype, adapter type HCA3-O
PRD4	2	n/a	9,400	IC IC

# PLEX1012 Coupling Links Summary

Shows you why chpid 88 is running in IFB-12x, not IFB3, link speed.

Sysplex Member					LinkType	Coupling Facility				
CECID	Adapter	Port	Chpids	Sys/CF		CECID	Adapter	Port	Chpids	Sys/CF
CPC900D7	0008	01	80	[GFP1, SYS1, GFP3, PRD3, PRD1, GFD1]	HCA3-O	CFSR893B7	0008	02	40	[WSCSYSE]
			82	[GFP1, GFP3, PRD3, PRD1, GFD1]	HCA3-O				42	[WSCP RDE]
			84	[GFD1]	HCA3-O				44	[GFCFDE]
			85	[GFP1, GFP3, GFD1]	HCA3-O				45	[GFCFPE]
CPC900D7	0008	02	88	[PRD3, GFCFDI, GFCFPI, PRD1, GFCFSI]	HCA3-O	CPC900E7	0008	01	80	[WSCP RDI]
			89	[SYS1, PRD3, GFCFDI, GFCFPI, PRD1, GFCFSI]	HCA3-O				81	[WSCSYSI]

Sysplex Member					LinkType	Coupling Facility				
CECID	Adapter	Port	Chpids	Sys/CF		CECID	Adapter	Port	Chpids	Sys/CF
CPC900E7	0008	01	85	[GFP2, GFP4, GFD2, GFS2]	null	CPC900D7	0008	02	8D	[GFCFSI]
			86	[GFD2]	null				8E	[GFCFDI]
			87	[GFP2, GFP4, GFD2]	null				8F	[GFCFPI]

(because there are 5 chpids configured on CPC900D7/8/2 link to CPC900E7/8/1)

# CFL005 CF Link Topology Report

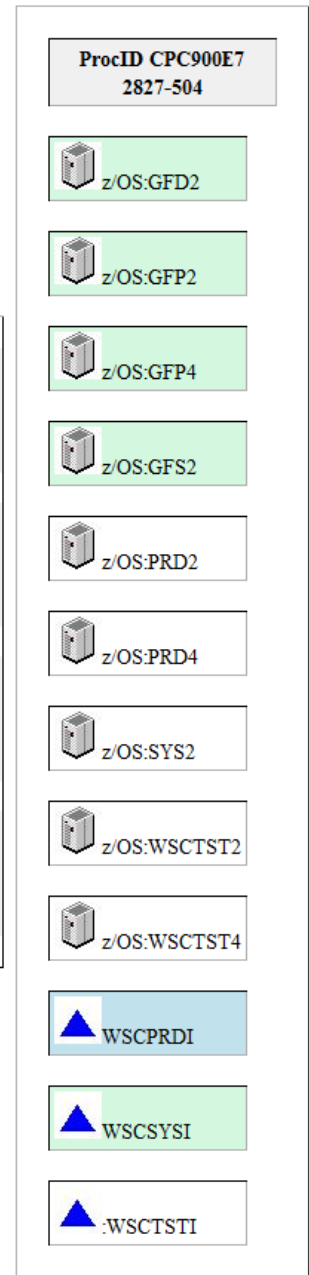
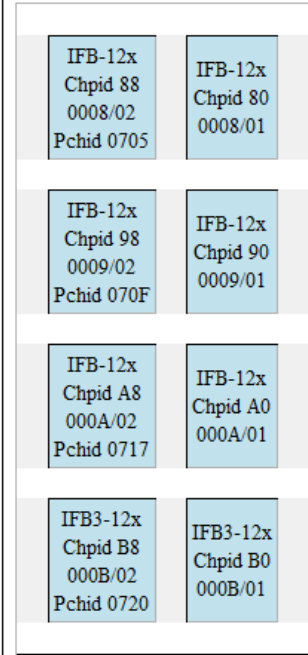
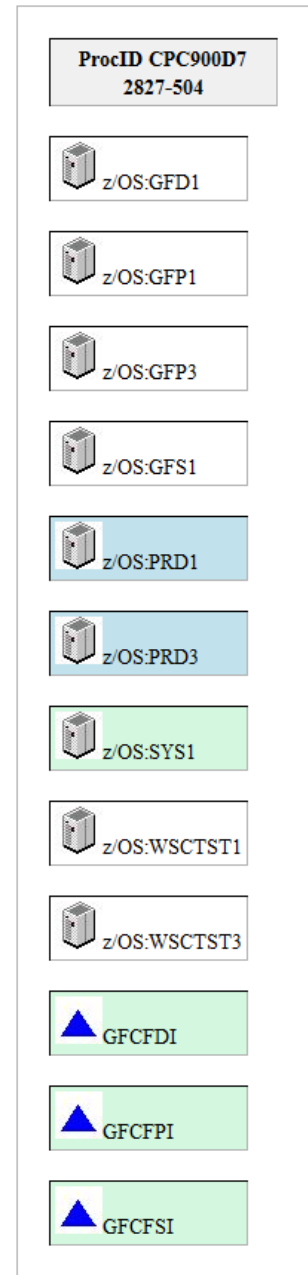
Looking at the link from CF WSCPRDI To z/OS PRD1

CHPID Sharing

PRD1 and PRD3 CPC900D7 share 4 chpids to the WSCPRDI coupling facility on CPC900E7, running over 4 different physical links.

Link Sharing

Other z/OS systems and coupling facilities are using other chpids which also run over these same 4 physical links.



# CF Link Migration

- **Start planning the move to ICA and CE-LR now.**
- **Moving from IFB to ICA links?** both ends must be z13 and above.
- **Migrating IFB links to z13?** z13 cannot carry as many IFB per book.
- Ask for current IOCP decks for all machines, including standalone CF machines.
- Replace chpids one for one.

- **CF Health Check – Subchannel Busy?** Configure more chpids and share less. Or reduce chpids per CF-SYS connection, but share with fewer partitions.
- One power source per adapter (not port), so minimum two adapters per CPC.
- Maximum 4 chpids per port → **CF Health Check – Subchannel Mixed Linktypes**

# Support in zCP3000

- Channel Path data is already in CP3KEXTR and zCP3000.
- Look for problems flagged in the CF Healthchecks.
- Use the physical link based reports, like topology.
- Modeler will need to supply some configuration information.

Performance data is currently reported for CF-SYS. It is **\*NOT\*** reported per channel path. There is no way to tell you, for example, how much traffic is going over chpid 88.

# Solving Sysplex Questions with zCP3000

## Reference Slides

- Recommended Graphs and Graph Index
- Connectivity Reference : Max Supported Coupling Links
- What is Coupling Thin Interrupt, anyway?
- Dispatch Modes, Effective CPs
- Urls, Contacts, and how to stay informed.



# Sysplex Graph Recommendations

## Probably in every study

- zCP3000 main view : [Topology](#)
- per CPC (Coupling Links window): [Coupling Links Summary](#)
- Sysplex Logical window : [Sysplex Topology](#), [Coupling Summary](#)
- For each CF : [CF Summary](#), CF Health Check,  
[CF Migration Summary report](#)

**PA Mode**

**PA and QM Mode**

**QM only**

## Look for areas of interest

- [Thin Interrupt Effect](#)
- [CF Structures Table](#)
- [CF Link Topology](#)
- [Coupling Adapter Summary](#)

• [CF Link Summary](#), [Link Migration Comparison](#)

- Service Time for Synchronous Structures
- Request Rate by System over Time
- Request Rate by Request Type and System

## Drill down in areas of interest

- CF Logical Utilization over Time
- Advanced CF (shared ICF)
- Subchannel Busy
- Synchronous Service Time (Link)

- Lock Contention % of Requests
- Synchronous Intensity
- Delayed Requests
- Busiest Structures with Queue Time

# Index to recommended Graphs

## zCP3000 main view

- [INV1012 Topology](#)

## zCP3000 sysplex view

- [PLEX1007 Sysplex Overview](#)
- [PLEX1008 Sysplex Coupling Summary](#)
- [PLEX1005 Sysplex Aggregation](#)

## CPC Coupling Links Window

- [PLEX1012 Coupling Links Summary](#)

## CF Window

- [CF1014 CF Summary](#)
- [CF1000 Health Check Analysis](#)
- [CFQ100 CF Migration Summary report](#)
- [CF1027 Thin Interrupt Effect](#)
- [CF1010 Structures Table](#)
- [CF1001 Logical Utilization over Time](#)
- [CF1020 Advanced CF Utilization](#)
- [CF1017 Subchannel Busy](#)
- [CF1015 Delayed Requests](#)
- [CF1012 Service Time for Synchronous Structures](#)
- [CF1009 Request Rate by System over Time](#)
- [CF1004 Request Rate by Request Type and System](#)
- [CF1016 Busiest Structures with Queue Time](#)

## PA Mode

## PA and QM Mode

## QM only

## Structure Window

- [STR1015 Lock Contention %](#)
- [STR1017 Synchronous Intensity](#)

## CF Link Window

- [CFL005 CF Link Topology](#)
- [CFL001 CF Link Summary](#)
- [CFQL001 Link Migration Comparison](#)
- [CFL012 Synchronous Service Time](#)

# CF Connectivity Reference

	Max Supported Coupling Links								
	z14	z13s	z13	zEC12	zBC12	z196	z114	z10	z9
IC		32	32	32	32	32	32	32	32
CE LR	64	32	32	n/a	n/a	n/a	n/a	n/a	n/a
ICA SR	64	32	40	n/a	n/a	n/a	n/a	n/a	n/a
HCA3-O LR (1x)	64	32	64	64	32	48	32	n/a	n/a
HCA3-O (12x)	32	16	32	32	16	32	16	n/a	n/a
HCA2-O LR (1x)	n/a	n/a	n/a	32	12	32	12	32	n/a
HCA2-O (12x)	n/a	n/a	n/a	32	16	32	16	32	n/a
HCA1-O (12x)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	16
ISC-3	n/a	n/a	n/a	48	32	48	48	48	48
<b>Max chpids</b>	<b>512</b>	<b>256</b>	<b>256</b>	<b>128</b>	<b>128</b>	<b>128</b>	<b>128</b>	<b>64</b>	<b>64</b>

Link = Port (2 ports per adapter, except 4 port IFB-1X on HCA3-O LR)

# Coupling Thin Interrupt

**Starting with zBC12 and zEC12-GA2 the arrival of an unsolicited signal on a Coupling Facility link will generate an interrupt.**

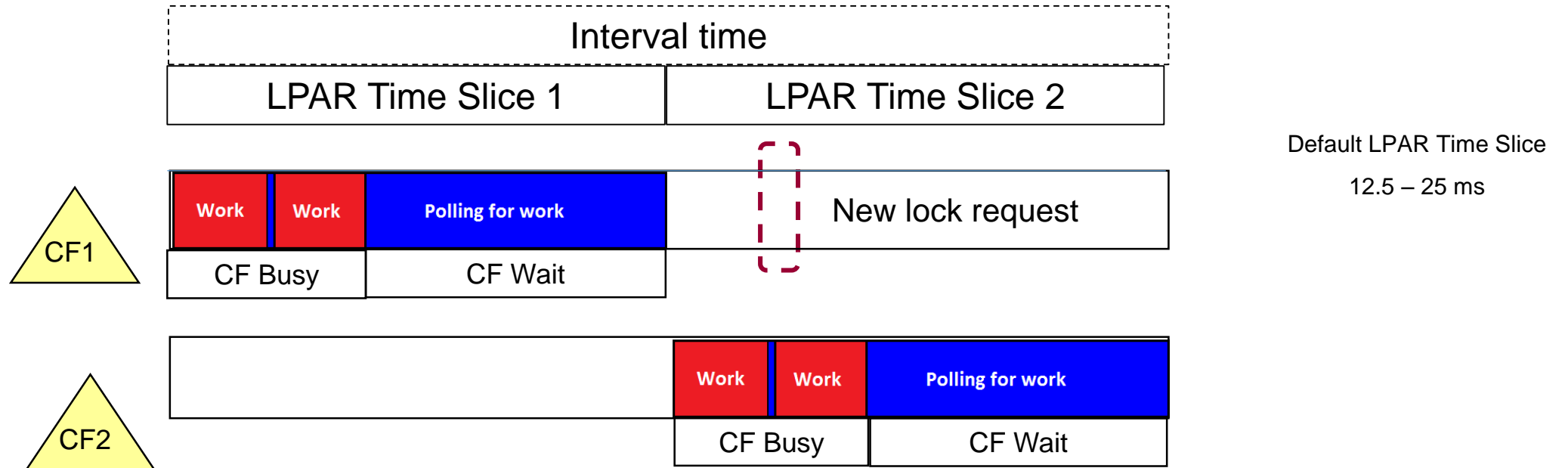
- Both z/OS and the Coupling Facility can exploit this.
- CF and z/OS exploitation are independent of each other.
- z/OS support mainly benefits low weight partitions
- For Coupling Facilities, it benefits CFs sharing CPU resource
- It does not benefit CFs with dedicated engines.

## **IBM recommends:**

- Use dedicated engines for production CFs
- Otherwise enable Coupling Thin Interrupt for all CFs

# CF Dispatch mode - Polling

“Regular” Sharing - Both CF1 and CF2 have DYNDISP=OFF



Default LPAR Time Slice  
12.5 – 25 ms

$$EFFCP = \frac{(\text{CF Busy} + \text{CF wait})}{\text{Interval time}}$$

EFFCP = ~ 0.5 engines  
CF (LPAR) Utilization = 17.5%  
CFCC Busy = 35%

**Big difference in scale** : microsec (sysplexOp) vs millisec(LPAR slice)

# Effective CPs vs Entitled CPs

$$\text{Effective CPs} = \frac{(\text{CF Busy} + \text{CF wait})}{\text{Interval time}}$$

EFFCP = ~ 0.5 engines  
CF (LPAR) Utilization = 17.5%  
CFCC Busy = 35%

**Entitled engines = relative weight / # of shareable engines of that type.**

- The engine equivalent of what the partition is entitled to.
- Not the same thing as capping.
- Partition can receive more or less than entitlement.

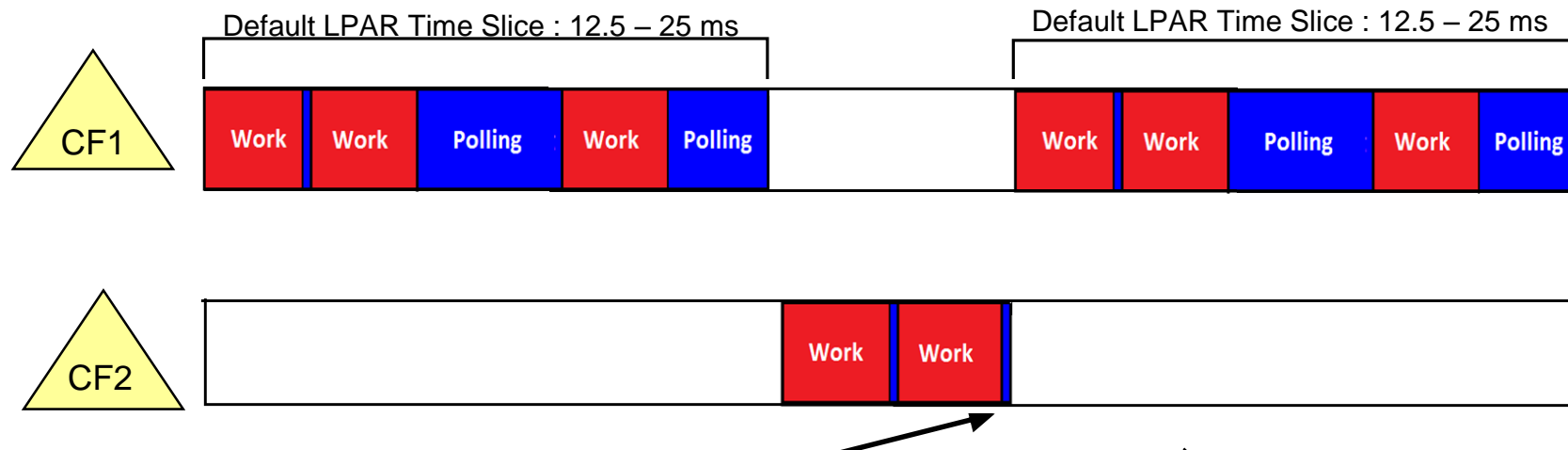
It's what LP mgmt is trying to deliver, if the partition wants it.  
And the partition is configured to be able to use it.

Don't ignore this zCP3000 msg:  
"Weight indicates more capacity than can be provided with the LCPs defined for ICF pool".



# CF Dispatch mode - Dynamic CF Dispatch

CF1 has DYNDISP=OFF & CF2 has DYNDISP=ON



**For CF1:**

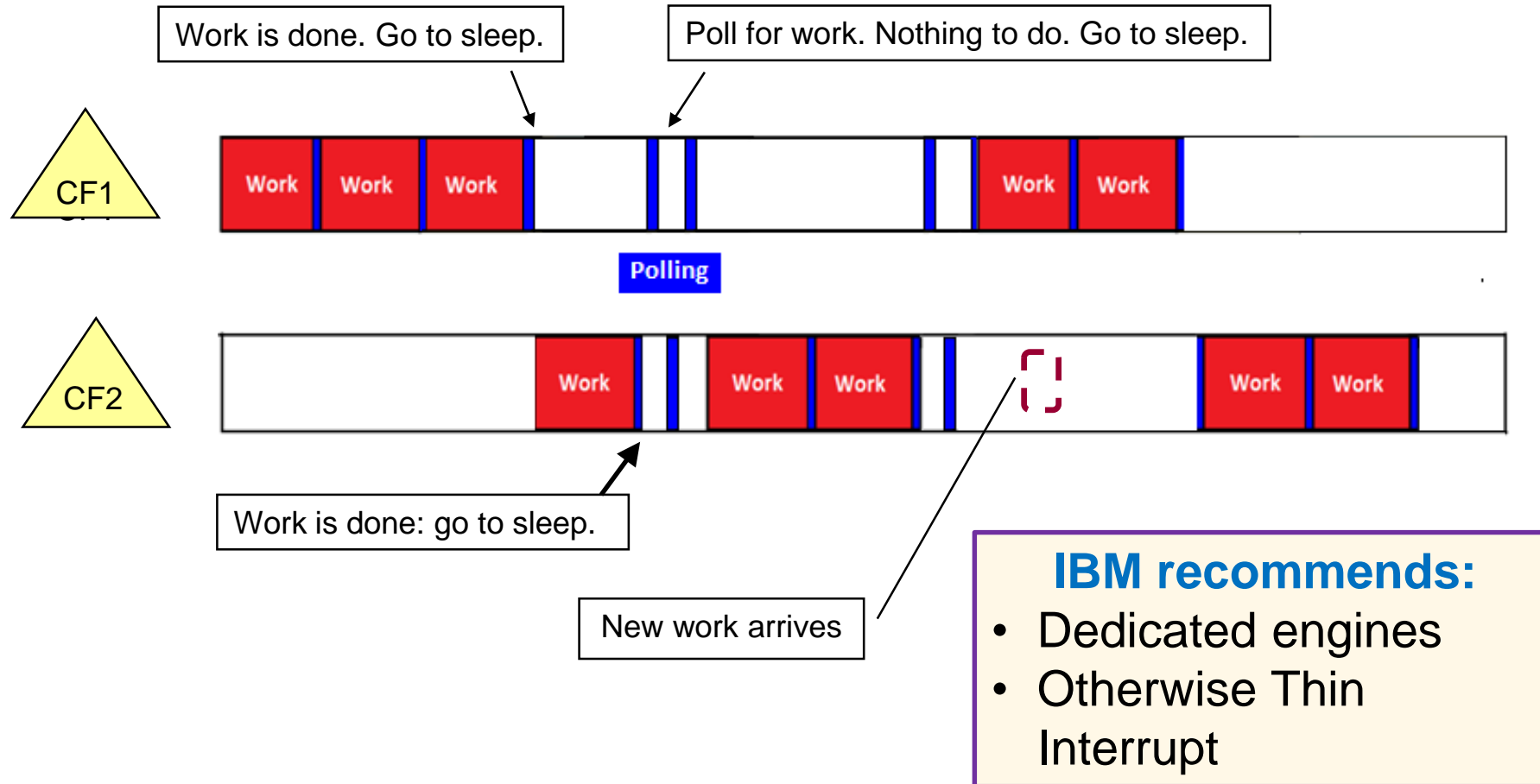
EFFCP = ~ 0.85 engines  
CF (LPAR) Utilization = 45%  
CFCC Busy = 56%

CF2 goes back to sleep.

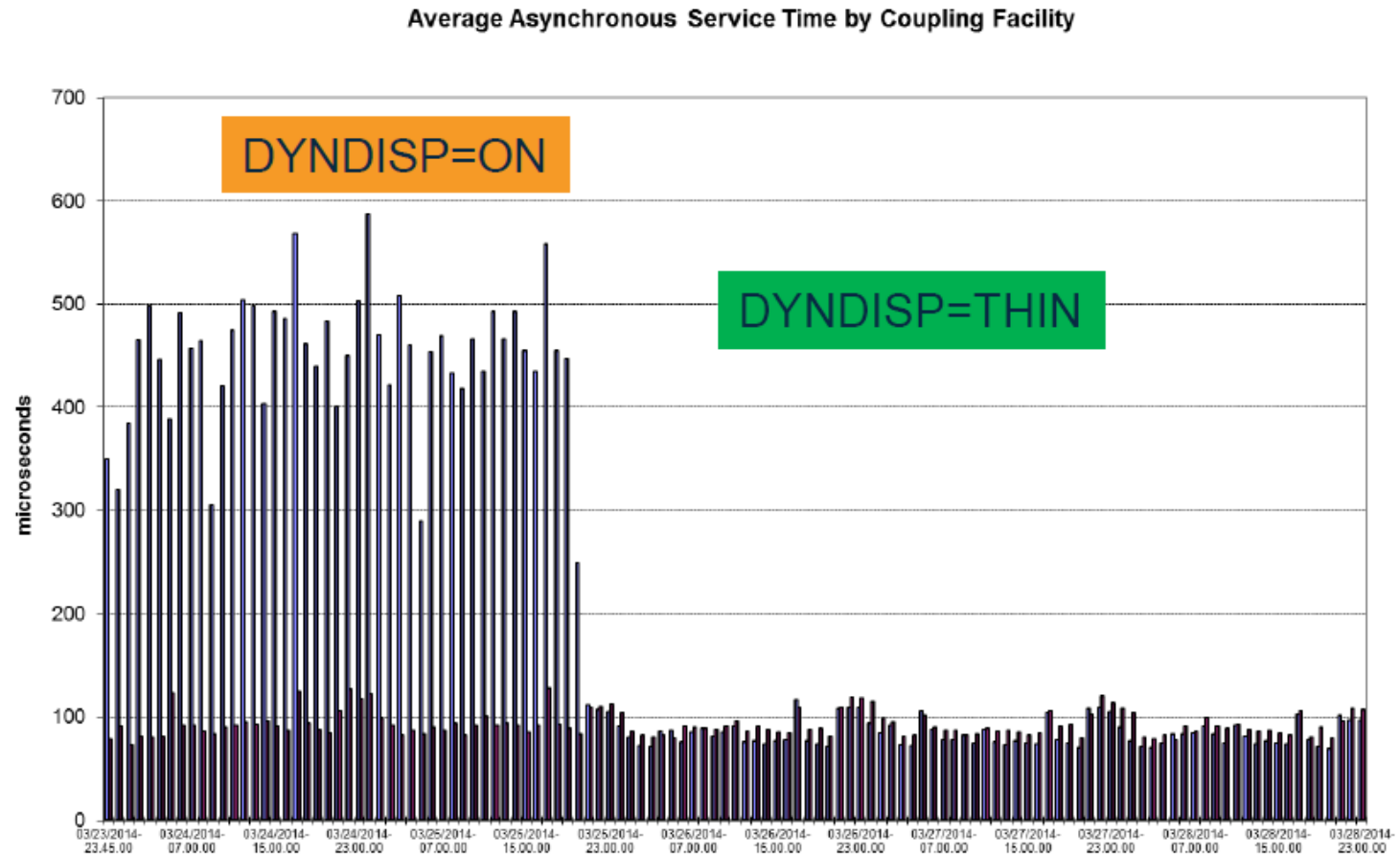
What happens to this Lock request ?

# CF Dispatch mode - Thin Interrupt

Both CF1 and CF2 have DYNDISP=THININTERRUPT



# Impact of Thin Interrupt



\* Frank Kyne, Share Session 15602: The Skinny on Coupling Thin Interrupts

# How to stay informed

## zCP3000 Google Group (private)

<https://groups.google.com/forum/#!forum/zcp3000>

Release announcements, comments, urgent problems, ideas, whatever.

## IBMers

Program WebPage	Download	User's Guide	Online Education	Change Notification
<a href="#">zCP3000 v06/16</a>	<a href="#">Download</a> 06/24/2016	01/31/2013	<a href="#">zCP3000 Library</a> <a href="#">Demos and Labs</a>	<a href="#">Subscribe</a> <a href="#">Unsubscribe</a>

**ALWAYS** pull down the latest version of CP3KEXTR and zCP3000 when starting a new study.

# Useful links

**zCP3000 Download & Doc**  
**zCP3000 Demos and Labs**

**IBM W3**  
[PRS1772](#)  
[PRS5318](#)

**PartnerWorld**  
[PRS1865](#)  
[PRS5319](#)

**Barbara Weiler's white paper on Coupling Thin Interrupts**

<https://www-03.ibm.com/support/techdocs/atmastr.nsf/WebIndex/WP102400>

**Frank Kyne: The Skinny on Coupling Thin Interrupts**

<https://share.confex.com/share/123/webprogram/Session15602.html>

**Other CPSTools Education & Downloads available at:**

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

**BPs** - [https://www-304.ibm.com/partnerworld/wps/servlet/ContentHandler/tech\\_PRS1762](https://www-304.ibm.com/partnerworld/wps/servlet/ContentHandler/tech_PRS1762)

Contact: [cpstools@us.ibm.com](mailto:cpstools@us.ibm.com)