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Planning for and Using
System Managed CF Structure Duplexing

Riaz Ahmad
IBM Washington Systems Center
Gaithersburg, Maryland

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Topics

- What is CF Duplexing ?

- Hardware requirements

- Software requirements

- Migration

- Summary

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Overview of Duplexing

Hardware Requirements

Software Requirements

Migration

Summary

What is SM CF Duplexing?

- System allocates a secondary instance of a Coupling Facility structure
  - ► Replicates the structure contents in the secondary structure to establish duplexing

- System transparently replicates Coupling Facility operations
  - ► Update structure contents in both structure instances in a synchronized manner to maintain data consistency between the primary and secondary structure contents

- In the event of a failure affecting one of the instances
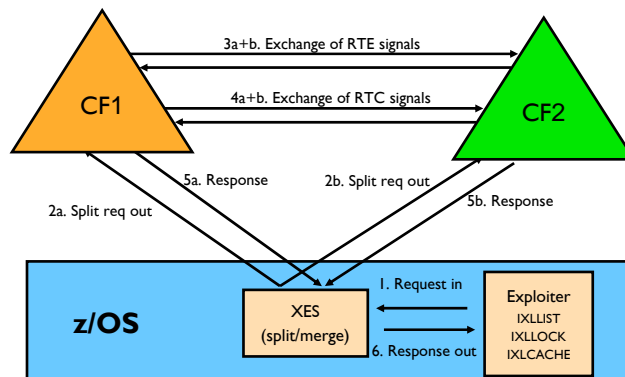 - ► System failovers to simplex mode using only the unaffected structure instance with no loss of data

Why Duplex?

- To provide near-continuous availability for CF structure data in case of hard failure through rapid and transparent duplexing failover between the primary and secondary structures
  - ► CF or structure failure
  - ► Loss of CF Connectivity

- To enable configuration simplification and overall cost reduction for Parallel Sysplex®
  - ► Enabling the use of non-standalone CFs (e.g. ICFs) for all resource sharing and data sharing environments

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Duplexing Candidates

▪Structures whose connectors:

- ►Do not support rebuild at all

- ►Support rebuild but
  - –Either cannot rebuild the structure contents when the structure and one or more connectors are simultaneously lost as the result of lack of failure-isolation
  - –Or reconstruction of the data in failure scenarios is time-consuming or error-prone

- ►Do not support User-Managed Duplexing

CF Duplexing Protocol Flow

Mainline Coupling Facility Requests

- All mainline CF requests are transparently processed appropriately as simplex or duplex

- z/OS internally handels
  - Request splitting and conversion
  - Protocols for driving duplexed requests to the CFs
  - Request response reconciliation

- CFCC internally handels:
  - CF-to-CF signalling to coordinate structure object updates

CFRM Policy

- Determines if and when a structure is to be duplexed

  - DUPLEX(DISABLED) - Never duplexed
  - DUPLEX(ALLOWED)   - Manual
  - DUPLEX(ENABLED)   - Automatic

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Stopping Structure Duplexing

- SETXCF operator command
  - ► SETXCF STOP,RB,DUPLEX,STRNAME=xxx,KEEP=OLD
  - ► SETXCF STOP,RB,DUPLEX,STRNAME=yyy,KEEP=NEW

- IXLREBLD

- Automatically:
  - ► When CFRM policy change disallows duplexing
  - ► When duplex command reconciliation detects failure
  - ► When failure affects one of the structure instances

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Remember !

- Duplexing is NOT a "no brainer" solution that can be turned on for all structures without any planning

- Through the CFRM policy, the installation has full control over whether to duplex any particular structure
  - ► Test/stage duplex implementation
  - ► Exploitation availability
  - ► Performance cost/benefit analysis for a given structure, given actual workload characteristics

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Overview of Duplexing

▪▪▷ Hardware Requirements

Software Requirements

Migration

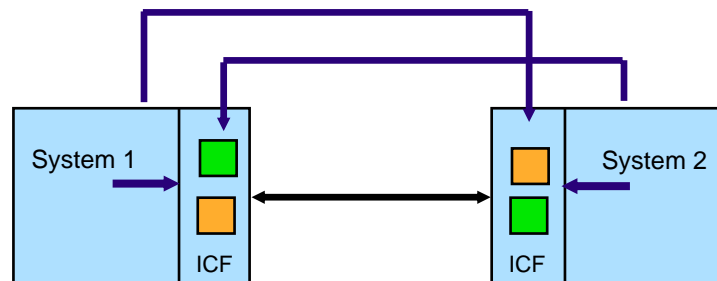Summary

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Hardware Requirements

- IBM $e$server zSeries™ or G5/G6 Servers

- Two or more Coupling Facilities
  - ► IBM $e$server zSeries z990 or z890
    - CFCC Level 12 Driver 52
  - ► IBM $e$server zSeries z800 or z900
    - CFCC Level 12 Driver 3G
  - ► IBM 9672 G5/G6
    - CFCC Level 11 Driver 26
  - ► Latest microcode maintenance level

  - ► Standalone CF must be R06, z900-100, z800-0CF, z890, z990

- CF-to-CF links

CF-to-CF Links and Capacity

Bidirectional communication required for duplexed command execution
- ► Provided via standard Coupling Facility links of any type
  - ► Peer-mode links – zSeries
- ► CF support for sender channels
  - – Requires APAR OW45976 for HCD

- ▪ For availability and capacity:
  - ► Configure redundant CF-to-CF links

- ▪ Loss of CF-to-CF connectivity during signal exchanges can cause structure to fall out of duplexing

- ▪ It may be necessary to provide additional CPU, link
  - ► Duplex operations consume more resources than simplex operations
  - ► May be offset by existing excess capacity
  - ► Depends on which structures are duplexed

Hardware Configuration

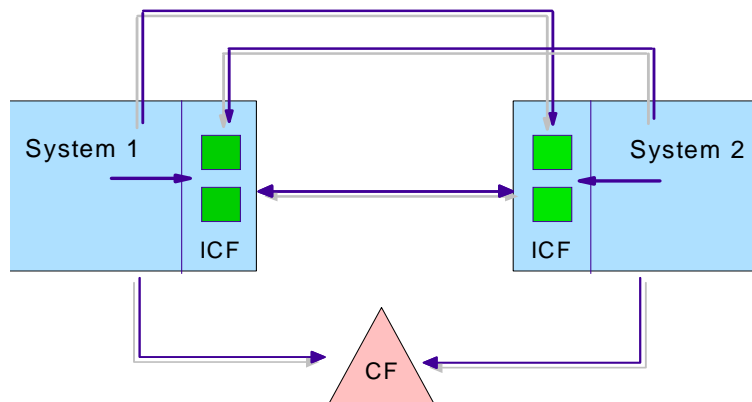Provides complete failure-isolation from all structure connectors

Hardware Configuration

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Software Requirements

- Operating System
  - ► z/OS 1.2 or higher
  - ► APAR OW41617

- CFRM Couple Data Set
  - ► New format
  - ► APAR OW41617 enables format utility to process SMDUPLEX keyword

- CFRM Policy Updates

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Software Requirements ....

- Exploiting subsystems

  - ► May require installation of new software levels or PTFs to enable duplexing support

  - ► Document their migration procedures

  - ► All exploiter instances must be at a duplexing capable level before relevant structure is duplexed

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Exploiters

- ► CICS®   Shared TS, CF data tables, named counter
- ► Comm Server   GR, MNPS (VTAM®)
- ► DB2®   SCA
- ► DFSMS   RLS lock (VSAM), Common Recall Queue
- ► IMS™   CQS, EMH, VSO structures
- ► IRLM   Lock (DB2 and IMS)
- ► JES2   Checkpoint
- ► MQSeries®   Shared queues
- ► WLM   Shared enclaves, LPAR clusters (IRD)
- ► BatchPipes®
- ► System Logger

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CFRM Policy Updates

▪ Update structure statements

- ► DUPLEX (ALLOWED|ENABLED)

- ► Preference List must contain at least two duplex capable Coupling Facilities
    – Allocation algorithm changed
    – Most preferred CF may not be

- ► SIZE/INITSIZE

```
STRUCTURE NAME(DSNZPLEX_LOCK1)
        SIZE(150000)
        INITSIZE(132000)
        PREFLIST(CF1,CF2,CF103)
        REBUILDPERCENT(1)
        DUPLEX(ALLOWED)
```

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Migrate to Duplexing

- Determine which structures are to be duplexed

- Upgrade capacity as needed to support duplex structures
  - Coupling Facility storage
  - Coupling Facility CPs
  - Links

- Get Coupling Facility to appropriate CFLEVEL

- Configure CF-to-CF links

- Configure System-to-CF links to avoid path-busy

Migrate to CF Duplexing ....

- Migrate systems to level of z/OS that supports duplexing
  - Check the CFDUPLEXING PSP Bucket

- Migrate exploiter software to level supporting system-managed CF Duplexing

- Migrate CFRM CDS to level supporting SMDUPLEX

- Define and activate CFRM policy with DUPLEX parameter for desired structures

- Document operational procedures for failure scenarios

- Monitor and Tune

Migration caveats

- CFRM CDS must be formatted with SMDUPLEX record
- Only duplexing-capable z/OS systems can use a CFRM CDS formatted with SMDUPLEX
- Downlevel systems cannot join such a sysplex and use CFRM once the CDS with SMDUPLEX is in use
- Fallback to CDS without SMDUPLEX
  - ► Sysplex-wide IPL
- You can turn duplexing on/off via policy change
  - ► Does NOT require sysplex-wide IPL
- New connections that do not support duplexing will be unable to connect as long as the structure remains duplexed.
- Avoid starting duplexing for a structure until all connectors have been migrated to a software level that supports duplexing

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Operational caveats

- System Managed duplexing is built upon system managed rebuild processing and user managed duplexing

- While duplexed, a structure is considered to be indefinitely in a rebuild phase
  - The Duplex Established phase of a duplexing rebuild process

- Therefore, display commands and messages issued for duplexed structures will use rebuild terminology
  - Rebuild
  - Duplexing Rebuild
  - Old Structure
  - New Structure

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Operational caveats

- Policy change remains pending until physical instance(s) of structure allocated under old CFRM policy are deallocated

- Policy changed while structure duplexed, need to stop duplexing, start rebuild, then start duplexing to resolve pending changes

- Policy changed for simplex structure that is then duplexed, the new instance is allocated under the pending policy.
  - Need to stop duplexing (keep the new one), then start duplexing to resolve pending changes

- System managed CF structure duplexing is not started for a structure that has a pending policy change

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Benefits of CF Duplexing

- Near-continuous availability for CF structure data

- Enable use of an all-ICF solution

- Moving structures during planned reconfiguration for exploiters that don't support structure rebuild

Cost of CF Duplexing

- Potential configuration/setup cost
  - CF storage resources for duplexed structure instances
  - CF-to-CF links
  - System-to-CF links
  - System and CF processor resources

- Coupling efficiency cost
  - Duplexed command service time "deltas" resulting from the duplexing protocols
  - z/OS (XES) pathlength deltas resulting from splitting/merging duplexed commands
  - Impact varies with request rate and read/write ratio of workload

Cost of CF Duplexing

- Some of the additional resource requirements may be satisfied by excess capacity already in place for high availability and failover capability

- Recovery for failures in a simplex environment requires excess capacity so workload can continue to run on surviving systems, surviving CFs, etc.

- Recovery for failures in a duplexed environment may actually consume less resource because the structures operate in simplex mode until failed component is restored

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Additional Information

- System Manged CF Structure Duplexing (GM13-0103)
- z/OS Planning for Installation (GA22-7504)
- z/OS MVS™ Setting Up a Sysplex (SA22-7625)

- **ibm.com**/servers/eserver/zseries/pso
- **ibm.com**/servers/eserver/zseries/zos/bkserv