IBM Systems

DBSHIELD – Protecting The RACF Database

RACF User's Group (RUG) October 30, 2008

Ira Ringel

IBM Systems

Table of Contents

- Trademarks
- Session Objectives
- Overview
- Usage & Invocation
- Interactions & Dependencies
- Migration & Coexistence Considerations
- Installation
- Validation
- Session Summary
- Appendix

1

Trademarks

- See url http://www.ibm.com/legal/copytrade.shtml for a list of trademarks.

Session Objectives

- DBSHIELD will help prevent many scenarios of bad RACF database (DB) sharing, which lead to DB corruption.
  - DB corruption may go unnoticed, be an annoyance, or bring a shop to it knees. RACF L2 may have to spend many hours trying to straighten out a corrupted DB.
- Before a database is used, if a questionable scenario is detected, it will be identified to the operator, who will choose the appropriate action to avoid DB corruption.
- There are no migration issues per-se as this is a new function.
- DBSHIELD installs with the rest of RACF R10.
- DBSHIELD analysis and update occurs during initialization, and during the RVARY command.
- See Appendix "A" for a list of Publications and References
- See Appendix "B" for the new messages

Overview

- **Problem Statement / Need Addressed:**
  - Over the years, the largest cause of RACF Multiple System Outages (MSOs) has been DB corruption as the result of incorrect DB sharing.

  - Bad sharing occurs when there are system(s) in data sharing mode, and system(s) in non-data sharing mode using the same database.

  - It is also bad sharing when 2 different sysplexes both in data sharing mode using the same database, because a coupling facility may only span 1 sysplex.

Overview

- **Systems in a sysplex may use RACF sysplex communication.**
  - Note that RACF sysplex communication may only be specified at IPL via the ICHRDSNT
  - RACF sysplex communication (SPC) is a prerequisite for data sharing mode

- **RACF SPC creates the XCF group, IRRXCF00. Each system entering RACF SPC becomes a member of that group.**
  - The first member defines the Group DSNT (GDSNT)
  - Subsequent members request the GDSNT, which names the databases and the mode (non-data sharing mode, or data sharing mode) to be used

- **The mode passed in the GDSNT may differ from the mode specified by the initial ICHRDSNT.**
  - The last successful RVARY DATASHARE or RVARY NODATASHARE issued by an IRRXCF00 member will change the mode passed by the GDSNT
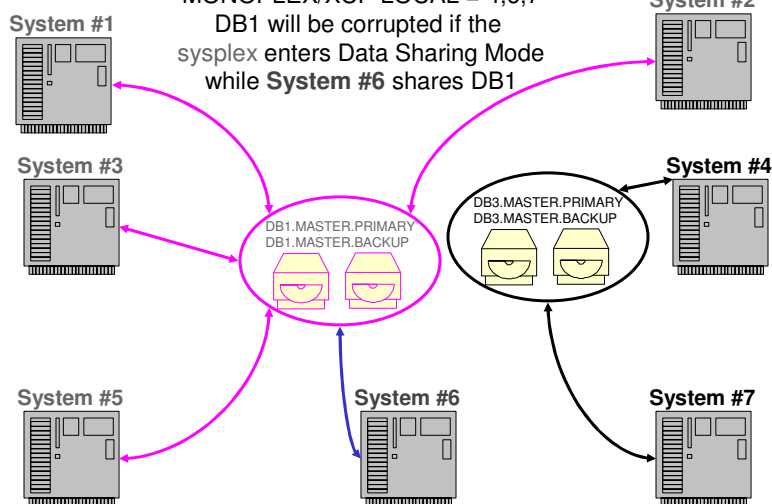
3

Overview

- **Data sharing mode utilizes the coupling facility (CF) which holds the most recently used blocks of the database.**
  - The CF remembers which members have read which block

- **In data sharing mode, when a system updates a block in the DB, under serialization**
  - The system will cross invalidate the block (other members the CF has given the block to, are told that the block is invalid)
  - Send the updated block to the CF and write it to the DB

- **Altering, and especially deleting, & adding profiles may affect many blocks of the database.**

- **In a bad DB sharing scenario, what happens is that when the non-data sharing mode system updates a block, the systems in data sharing mode are not told which blocks are now invalid.**
  - This ultimately leads to database corruption.

Within one Global Resource Serialization complex

SYSPLEX = 1,2,3,5

MONOPLEX/XCF-LOCAL = 4,6,7

DB1 will be corrupted if the sysplex enters Data Sharing Mode while **System #6** shares DB1

System #1
System #2
System #3
System #4
System #5
System #6
System #7

DB1.MASTER.PRIMARY
DB1.MASTER.BACKUP

DB3.MASTER.PRIMARY
DB3.MASTER.BACKUP

4

Overview

- **Problem Statement / Need Addressed:**
  - Sometimes installations have incorrect database sharing configurations.
  - Most often it's a finger-check. With a new release you get a sample ICHRDSNT (data set names table), the client updates the database names OK, but forgets to set either the sysplex communication bit, or the data sharing mode bit. When IPLed, the system comes up in non-data sharing mode. If other systems are already using the DB in data sharing mode, this leads to corruption.

Overview

- **Solution:**
  - DBSHIELD during IPL, or RVARY DATASHARE or RVARY ACTIVE, will analyze the primary database (and if defined, or being ACTIVATEd, a separate analysis of the backup database).
  - A forensic analysis of GXFACILI IRRPLEX_*sysplex-name* profiles is carried out. The APPLDATA field contains an indication of either DATA SHARING MODE or NON-DATA SHARING MODE.
    - The forensic evidence of how the database has last been used, is looked at in conjunction with the mode (or requested mode) of the system.
  - If a mix of modes is detected. Or if entering a data sharing mode environment and an IRRPLEX_*sysplex-name* profile for another sysplex exists, then either the cmd will fail outright (RVARY DATASHARE) or a WTOR will be presented asking for guidance.

5

IBM

Overview

Benefit:

– This support will catch many kinds of incorrect database sharing.

IBM

Overview

- Using DBSHIELD you can:
  1. Avoid incorrect RACF database sharing

- Value:
  1. Avoid unwanted down time due to a corrupted RACF database
  2. Avoid recovery scenarios
  3. Avoid lengthy calls with L2

IBM

Usage & Invocation

- The support is invoked by:
  - IPL
  - RVARY ACTIVE
  - RVARY DATASHARE
  - RVARY NODATASHARE – no analysis, but APPLDATA of 'NON-DATA SHARING MODE' written to this sysplex's GXFACILI IRRPLEX_*sysplex-name* profile

- New/Changed External Output
  - New WTOs with explanations of the situation if encountered
  - New WTORs to accompany the WTOs
  - See Appendix "B"

IBM

Migration & Coexistence Considerations

- No migration considerations
- z/OS R10 systems may share RACF databases with lower level systems.
- **An environment in which some systems have the new support, and some do not, does <u>not</u> make the risk of corruption greater than that currently being experienced within an environment which had no systems with the new support.**
- RVARY DATASHARE and RVARY NODATASHARE if done from a down level system, will not update the GXFACILI IRRPLEX_*sysplex-name* profile's APPLDATA.
  - ❖ **These commands should be done from an uplevel system to keep the APPLDATA current.**

IBM

Installation

- Prerequisites for installation
  - Planning considerations
    - You may pre-define whatever GXFACILI IRRPLEX_*sysplex-name* profile(s) are appropriate, setting its APPLDATA to either DATA SHARING MODE or NON-DATA SHARING MODE.
    - This will make the first R10 IPL analysis meaningful
    - Pre-definition of these profiles is not required

IBM

Validation

- None. Please do **NOT** attempt to configure your systems to cause database corruption.

8

Session Summary

- **If you share your database correctly, then this support is be transparent.**
- If analysis detects a corruption scenario, with either the primary or the backup database during IPL or RVARY ACTIVE the operator will be prompted
  - if primary = backup, and you CONTINUE on the primary, you will likely see the same message for the backup
- If analysis detects a corruption scenario, with either the primary or the backup database during RVARY DATASHARE, the command will not proceed.

- Any Questions?

Appendix A

- z/OS Security Server RACF Messages and Codes SA22-7686-11
SA22-7681-10.   Has updates for the new initialization messages:
  ICH584I, ICH585I, ICH586A, ICH587A, ICH588A, ICH589A, ICH590A, ICH591A, ICH596I, ICH597I, ICH599I, ICH600A

  Has updates for the new RVARY messages:
  ICH15031I, ICH15032I, ICH15033A, ICH15034A, ICH15037I, ICH15038I, ICH15040A, ICH15041I, ICH15042A

- z/OS Security Server RACF Systems Programmer's Guide
  Has updates in the Operating Considerations chapter, sysplex considerations, sharing a database, guarding against data corruption resulting from incorrect database sharing

Appendix B Initialization Messages

- **ICH584I ICHEINTY *TYPE* ERROR AGAINST PROFILE *PROFILE* IN CLASS *CLASS* ON THE DATABASE WITH MASTER DATA SET *DSNAME* ON VOLUME *VOLSER*. HEX RC=*RC*, AND REASON=*REASON***

- **ICH585I RACDEF DEFINE ERROR AGAINST PROFILE *PROFILE* IN CLASS *CLASS* ON THE DATABASE WITH MASTER DATA SET *DSNAME* ON VOLUME *VOLSER*. HEX RC=*RC* AND REASON=*REASON***

Appendix B Initialization Messages

- **ICH586A IF ANY SYSTEM IS USING THE DATABASE WITH MASTER DATA SET *DSNAME* ON VOLUME *VOLSER* IN DATA SHARING MODE, AND ANY OTHER SYSTEM CONCURRENTLY USES IT IN NON-DATA SHARING MODE, DATABASE CORRUPTION WILL RESULT. PROFILE *PROFILE-NAME* IN CLASS *CLASS* INDICATES THAT THIS DATABASE WAS LAST USED IN DATA SHARING MODE, BUT IT IS NOW TO BE USED IN NON-DATA SHARING MODE. IF THE DATABASE IS NOT BEING USED BY ANOTHER SYSTEM IN DATA SHARING MODE, SPECIFY 'CONTINUE'. OTHERWISE SPECIFY 'FAILSOFT' AND THE SYSTEM WILL ENTER FAILSOFT MODE**

  Issued when IPLing into non-data sharing mode, and any GXFACILI IRRPLEX_*sysplex-name* profile indicates data sharing mode.

Appendix B Initialization Messages

- **ICH587A THE RACF DATABASE WAS CHOSEN TO BE PROTECTED FROM CORRUPTION. NOW ENTERING FAILSOFT MODE.**

- **ICH588A CONTINUED USE OF DATABASE *DSNAME* ON VOLUME *VOLSER* CAN RESULT IN DATABASE CORRUPTION AND SYSTEM OUTAGE. IF ANY SYSTEM IS USING THE DATABASE IN DATA SHARING MODE, AND ANY OTHER SYSTEM CONCURRENTLY USES IT IN NON-DATA SHARING MODE, DATABASE CORRUPTION WILL RESULT. YOU ARE INITIALIZING INTO DATA SHARING MODE. PROFILE *IRRPLEX_SYSPLEX-NAME*, IN CLASS *CLASS* INDICATES NON-DATA SHARING MODE. IF THE DATABASE IS NOT BEING USED BY SYSTEMS OUTSIDE OF THIS SYSPLEX AND IS NOT BEING USED BY SYSTEMS IN THIS SYSPLEX IN NON-DATA SHARING MODE, THEN SPECIFY 'CONTINUE'. OTHERWISE SPECIFY 'NODATASHARE' AND THE SYSTEM WILL INITIALIZE IN NON-DATA SHARING MODE.**

Issued when IPLing into data sharing mode, it is the 1st system to enter RACF sysplex communication, at least one IRRPLEX_ profile is found and no IRRPLEX_ profile indicates data sharing mode

© 2008 IBM Corporation

Appendix B Initialization Messages

- **ICH589A CONTINUED USE OF DATABASE *DSNAME* ON VOLUME *VOLSER* CAN RESULT IN DATABASE CORRUPTION AND SYSTEM OUTAGE. IF ANY SYSTEM IS USING THE DATABASE IN DATA SHARING MODE, AND ANY OTHER SYSTEM CONCURRENTLY USES IT IN NON-DATA SHARING MODE, DATABASE CORRUPTION WILL RESULT. YOU ARE INITIALIZING INTO DATA SHARING MODE. PROFILE *IRRPLEX_SYSPLEX-NAME*, IN CLASS *CLASS* INDICATES NON-DATA SHARING MODE. IF THE DATABASE IS NOT BEING USED BY SYSTEMS OUTSIDE OF THIS SYSPLEX AND IS NOT BEING USED BY SYSTEMS IN THIS SYSPLEX IN NON-DATA SHARING MODE, THEN SPECIFY 'CONTINUE'. OTHERWISE SPECIFY 'FAILSOFT' AND THE SYSTEM WILL ENTER FAILSOFT MODE.**

Issued when IPLing into data sharing mode, it is <u>NOT</u> the 1st system to enter RACF sysplex communication, at least one IRRPLEX_ profile is found and no IRRPLEX_ profile indicates data sharing mode

© 2008 IBM Corporation

11

Appendix B Initialization Messages

- **ICH590A IF SYSTEMS FROM MULTIPLE SYSPLEXES USE THE DATABASE WITH MASTER DATASET *DSNAME* ON VOLUME *VOLSER* IN DATA SHARING MODE, DATABASE CORRUPTION WILL RESULT. YOU ARE INITIALIZING INTO DATA SHARING MODE AND PROFILE *IRRPLEX_SYSPLEX-NAME*, IN CLASS *CLASS* INDICATES DATA SHARING MODE. IF YOU KNOW THAT THE DATABASE IS NOT BEING USED BY ANOTHER SYSPLEX THEN SPECIFY CONTINUE. IF THE DATABASE IS INDEED BEING USED IN DATA SHARING MODE BY ANOTHER SYSPLEX SPECIFY 'FAILSOFT' AND THE SYSTEM WILL ENTER FAILSOFT MODE. IF THE DATABASE IS BEING USED BY ANOTHER SYSPLEX, BUT IN NON-DATA SHARING MODE SPECIFY 'NODATASHARE' AND THIS SYSTEM WILL INITIALIZE IN NON-DATA SHARING MODE.**

Issued when IPLing into data sharing mode, it is the 1st system to enter RACF sysplex communication, profiles for sysplexes besides our own are found, and at least one of them indicates data sharing mode.

Appendix B Initialization Messages

- **ICH591A IF SYSTEMS FROM MULTIPLE SYSPLEXES USE THE DATABASE WITH MASTER DATASET *DSNAME* ON VOLUME *VOLSER* IN DATA SHARING MODE, DATABASE CORRUPTION WILL RESULT. YOU ARE INITIALIZING INTO DATA SHARING MODE AND PROFILE *IRRPLEX_SYSPLEX-NAME*, IN CLASS *CLASS* INDICATES DATA SHARING MODE. IF YOU KNOW THAT THE DATABASE IS NOT BEING USED BY ANOTHER SYSPLEX THEN SPECIFY 'CONTINUE'. OTHERWISE SPECIFY 'FAILSOFT' AND THE SYSTEM WILL ENTER FAILSOFT MODE.**

Issued when IPLing into data sharing mode, it is <u>NOT</u> the 1st system to enter RACF sysplex communication, profiles for sysplexes besides our own are found, and at least one of them indicates data sharing mode

- **ICH596I IN CLASS GXFACILI, AN IRRPLEX PROFILE WAS ENCOUNTERED ON THE DATABASE WITH MASTER DATA SET *DSNAME* ON VOLUME *VOLSER*, BUT THE SYSPLEX NAME PORTION OF THE PROFILE NAME WAS GREATER THAN 8 CHARACTERS. DATABASE SHARING CHECKS HAVE IGNORED PROFILE *IRRPLEX_SYSPLEX-NAME*.**

Appendix B Initialization Messages

- ICH597I IN CLASS GXFACILI, A PROFILE *IRRPLEX_SYSPLEX-NAME* WAS ENCOUNTERED ON THE DATABASE WITH MASTER DATA SET *DSNAME* ON VOLUME *VOLSER*. ITS APPLDATA IS NOT A RECOGNIZED VALUE.

- ICH599I THE RESPONSE WAS UNRECOGNIZED. RESPECIFY RESPONSE.

- ICH600A VALID RESPONSES ARE 'CONTINUE' OR 'NODATASHARE'
 --or-- VALID RESPONSES ARE 'CONTINUE' OR 'FAILSOFT'
 --or-- VALID RESPONSES ARE 'CONTINUE', 'FAILSOFT' OR 'NODATASHARE'.

This is the WTOR for ICH586A, ICH588A, ICH589A, ICH590A, ICH591A

Appendix B RVARY Messages

- **ICH15031I ICHEINTY** *TYPE* **ERROR AGAINST PROFILE** *PROFILE-NAME* **IN CLASS** *CLASS-NAME* **ON THE DATABASE WITH MASTER DATA SET** *DSNAME*. **HEX RC=***RC*, **AND REASON=***REASON*

- **ICH15032I RACDEF DEFINE ERROR AGAINST PROFILE** *PROFILE-NAME* **IN CLASS** *CLASS-NAME* **ON THE DATABASE WITH MASTER DATA SET** *DSNAME*. **HEX RC=***RC*, **REASON=***REASON*

Appendix B RVARY Messages

- **ICH15033A IF ANY SYSTEM IS USING THE DATABASE WITH MASTER DATASET** *DSNAME* **IN DATA SHARING MODE, AND ANY OTHER SYSTEM CONCURRENTLY USES IT IN NON-DATA SHARING MODE, DATABASE CORRUPTION WILL RESULT. PROFILE** *PROFILE-NAME* **IN CLASS** *CLASS-NAME* **INDICATES THAT THIS DATABASE WAS LAST USED IN DATA SHARING MODE, BUT IT IS NOW TO BE USED IN NON-DATA SHARING MODE. IF THE DATABASE IS NOT BEING USED BY ANOTHER SYSTEM IN DATA SHARING MODE, SPECIFY 'CONTINUE'. OTHERWISE SPECIFY 'CANCEL'.**

Issued when RVARY ACTIVEing into a non-data sharing mode
   environment, and <u>any</u> GXFACILI IRRPLEX_*sysplex-name* profile
   indicates data sharing mode.

Appendix B RVARY Messages

- **ICH15034A IF SYSTEMS FROM MULTIPLE SYSPLEXES USE THE DATABASE WITH MASTER DATASET** *DSNAME* **IN DATA SHARING MODE DATABASE CORRUPTION WILL RESULT. YOU ARE RVARYING INTO A DATA SHARING MODE ENVIRONMENT. OTHER IRRPLEX_ PROFILES EXIST, SUCH AS IRRPLEX_** *SYSPLEX-NAME* **IN CLASS** *CLASS-NAME*. **IF THE DATABASE IS NOT BEING USED BY ANOTHER SYSPLEX, THEN SPECIFY 'CONTINUE'. OTHERWISE SPECIFY 'CANCEL'.**

Issued when RVARY ACTIVEing into a data sharing mode environment,
or doing an RVARY DATASHARE, and <u>any</u> GXFACILI IRRPLEX_*sysplex-name* profile, besides the one for this sysplex, is found.
Note: RVARY DATASHARE trims the last sentence, and no WTOR is
   issued, the command does not complete.

Appendix B RVARY Messages

- **ICH15037I IN CLASS GXFACILI, AN IRRPLEX PROFILE WAS ENCOUNTERED ON THE DATABASE WITH MASTER DATA SET** *DSNAME***, BUT THE SYSPLEX NAME PORTION OF THE PROFILE NAME WAS GREATER THAN 8 CHARACTERS. DATABASE SHARING CHECKS HAVE IGNORED PROFILE IRRPLEX_***SYSPLEX-NAME***.**

- **ICH15038I IN CLASS GXFACILI, A PROFILE IRRPLEX_***SYSPLEX-NAME* **WAS ENCOUNTERED ON THE DATABASE WITH MASTER DATA SET DSNAME. ITS APPLDATA IS NOT A RECOGNIZED VALUE.**

- **ICH15040I THE RESPONSE WAS UNRECOGNIZED. RESPECIFY RESPONSE.**

Appendix B RVARY Messages

- **ICH15041A VALID RESPONSES ARE 'CONTINUE' OR 'CANCEL'**
  This is the WTOR for ICH15033A, ICH15034A, and ICH15042A

- **ICH15042A IF ANY SYSTEM IS USING THE DATABASE WITH MASTER DATA SET** *DSNAME* **IN DATA SHARING MODE, AND ANY OTHER SYSTEM CONCURRENTLY USES IT IN NON-DATA SHARING MODE, DATABASE CORRUPTION WILL RESULT. YOU ARE RVARYING INTO A DATA SHARING MODE ENVIRONMENT. PROFILE** *PROFILE-NAME* **IN CLASS** *CLASS-NAME* **INDICATES THAT THIS DATABASE WAS LAST USED IN NON-DATA SHARING MODE, BUT IT IS NOW TO BE USED IN DATA SHARING MODE. IF THE DATABASE IS BEING USED BY ANOTHER SYSTEM NOT ENABLED FOR RACF SYSPLEX COMMUNICATION SPECIFY 'CANCEL'. OTHERWISE SPECIFY 'CONTINUE'.**

  Issued when RVARY ACTIVEing into a data sharing mode environment, and the GXFACILI IRRPLEX_*sysplex-name* profile for this sysplex, is found, and it indicates non-data sharing mode.