What if you had to quickly recover an IMS database, could you?

Jonathan Howells

Product Manager:
IMS Tools

Agenda

- The reality of being able to recover
- Establishing a good backup policy
- Performing recovery
- Ensuring recovery readiness
- Validate, learn, practice

Are you prepared to recover your data?

Key challenges all businesses face

- Being able to recover from missing, unavailable or corrupted data
- Aligning backups with application needs
- Knowing recovery time objectives and SLAs
- Protecting against cyber threats
- Business resiliency is not just disaster recovery

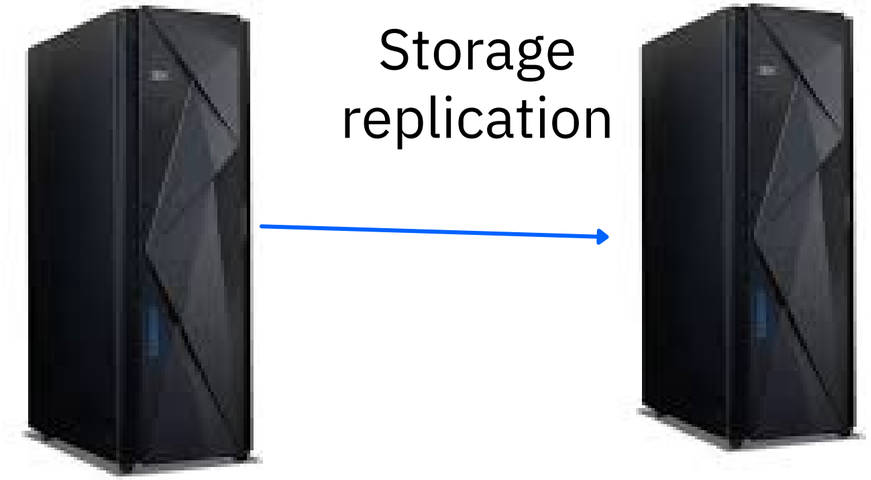
How well would your business manage?

Recovery Scenarios

Scenario Type	Typical Cause	Recovery Approach
Hardware failure	Disk crash, power loss	Image copy + log apply
Software failure	IMS/zOS abend	Restart / backout / log recovery
Application error	Bad program logic	PITR or transaction backout
Human error	Wrong command/job	Restore + selective recovery
Transaction failure	Abended unit of work	Dynamic/batch backout
Media corruption	Data set damage	Rebuild + restore
Maintenance issue	Failed reorg/load	Rollback or restart utility
Disaster recovery	Site failure	Full DR restore
PITR requirement	Business rollback	Controlled log-based recovery
DBRC/log issues	Metadata mismatch	RECON/log correction

DASD or disk replication for disaster recovery or high availability

Site A



Site B

Components of recovery

Be ready for recovery

- Perform image copies of database data sets
  - Take advantage of hardware features such as FlashCopy
- Perform image copies of index data sets (or not)
  - Take advantage of hardware features such as FlashCopy

Run change accumulations (or not)

Collect sensor data and compare to policies

Perform recovery

- Determine recovery point
  - Point in time or other
  - Synchronized with other databases, such as Db2
- Perform database recovery
  - Stop database
  - Run change accumulation (maybe)
  - Restore image copy of database data sets
    - Take advantage of hardware features such as FlashCopy
    - Merge change accumulation
  - Apply log updates since last change accumulation
  - Create or recover index data sets
  - Check pointers
  - Create image copy
  - Restart database

How can and should I recover index data sets?

Recover index data sets from image copies

- Consumes MSUs to create image copies (that you hope you will never use)
- Requires indexes to be defined to DBRC as recoverable
  - Increases IMS logging (consumes MSUs)
- Requires separate image copies for each index type: primary, secondary (including PSINDEXes)

Should I run change accumulations?

Run image copies on a regular interval
Run change accumulation between image copies

- Consumes MSUs to create change accumulations (that you hope you will never use)
  - High MSU consumption for sorting
- Avoids log contention during recovery when running multiple recovery jobs in parallel
- Required for data sharing environments if using IMS base utilities for recovery

Establishing a good backup policy and preparing for recovery

Developing a good backup policy

Component	Policy Example
Full Image Copy	Daily
Incremental Copy	Every 4 hours
Log Archive	Continuous
Log Retention	7 days
RECON Backup	Daily + after changes
DR Replication	Near real-time
Recovery Testing	Monthly

The benefits of fast replication

FlashCopy

- Optional licensed feature of IBM Enterprise storage subsystems (DS8Ks)
- Creates instant copy of a volume or data set at specific point-in-time
- Often referred to as Point-in-Time copy, instantaneous copy or time zero (t0) copy

Advantages

- Can copy huge volumes of data very quickly (seconds to a few minutes)
- Minimal disruption for the running applications
- Copy process is offloaded to the storage subsystem
- Lower host CPU and I/O costs

Usage examples

- Creating a System Level Backup (SLB) of IMS and Db2 production volumes
- Creating image copies
- Recovering database data sets

Improving efficiency of backups with IMS Recovery Solution Pack

Uses advanced copy technology (such as FlashCopy), when available

- High-speed database copy features
- Rapid backup of IMS database data sets or IMS systems

Image copy many databases in parallel

Choose the options that meet your needs

- Batch image copy
- Concurrent (fuzzy) image copy
- Incremental image copy

Improving performance of change accumulation with IMS Recovery Solution Pack

High-speed creation of change accumulation data sets
Run multiple change accumulation groups in parallel

- Read logs only once
  Stream the output to each group simultaneously

Aspect	Without RSP	With RSP
CA setup	Manual	Automated
Log handling	Many individual logs	Consolidated CA datasets
Recovery time	Longer	Shorter
Risk of errors	Higher	Lower
DBRC coordination	Manual	Integrated

Create system level backups

Can include a single IMS system or multiple IMS systems in a data sharing environment

Single backup of multiple IMS or IMS and Db2 subsystems at a consistent point in time

- Useful for coordinated disaster recovery

Create quiesce points

Requires CSL address spaces

Can include Db2 objects

Performing recovery

What type of recovery do you need?

Available in base IMS recovery utilities and IMS Recovery Solution Pack

vailable in IM
very Solution

Point in time recovery

- Specify timestamp to which you want to recover
- Use previous image copy (before timestamp)
- Apply last change accumulation
- Apply logs up until specified recovery timestamp but only for committed updates

Recovery with IMS & Db2 Recovery Expert

Build coordinated recovery job for the type of recovery you need

- Current time
- User timestamp (aka point in time)
- Quiet time range found in quiet time analysis

Reducing recovery time, MSUs, and human error with IMS Recovery Solution Pack

Simple user interface to specify recovery point in time
Automatically find required data and create recovery job

- Find the right image copies
- Find the right logs
- Delete and define recovery data sets using new or existing attributes

Improving recovery procedures

ISPF interface to create recovery job

Choose the type of recovery and let the system find the appropriate backup artifacts

Single job created for you
Recovery steps determined automatically based on backup assets and type of recovery needed

Ensuring recovery readiness

- Primary image copy has no valid secondary image copy
- HALDB is not initialized
- HALDB partition is disabled
- No area data set is defined
- Database recovery asset(s) are not catalogued
- No area data set is available
- LOG recovery asset(s) not catalogued
- One or more area data sets are unavailable
- CA recovery asset(s) not catalogued
- Backout is needed
- Recovery asset(s) not catalogued

Ensure DBRC and z/OS catalog are in sync

Cyber Resiliency has heightened the need to ensure a business can recover back to a time before a cyber event

- z/OS Catalog
  - Generation Data Groups (GDGs)
  - SMS retention period
  - JCL RETPD parameter

Verify recovery assets

Ensures that the necessary data sets exist and are usable in case a recovery is needed

- Lists or prints the recovery assets that are required to recover the specified databases
- Allocates all recovery assets to ensure that they exist
- Opens all recovery assets to ensure that they are valid

Often used at disaster recovery sites
Useful at production sites to ensure DBRC settings are in sync with SMS, HSM data set management

Monitor for potential recovery problems

Use automation or autonomics to watch for exceptions to recovery readiness

Automatically send notifications when a recoverability problem is detected, or a threshold is exceeded

Ensure you have image copies for as far back as you may need to recover

Ensure you have image copies and/or change accumulations to meet recovery time objectives

Ability to inspect the RECONs to find potential database recoverability problems

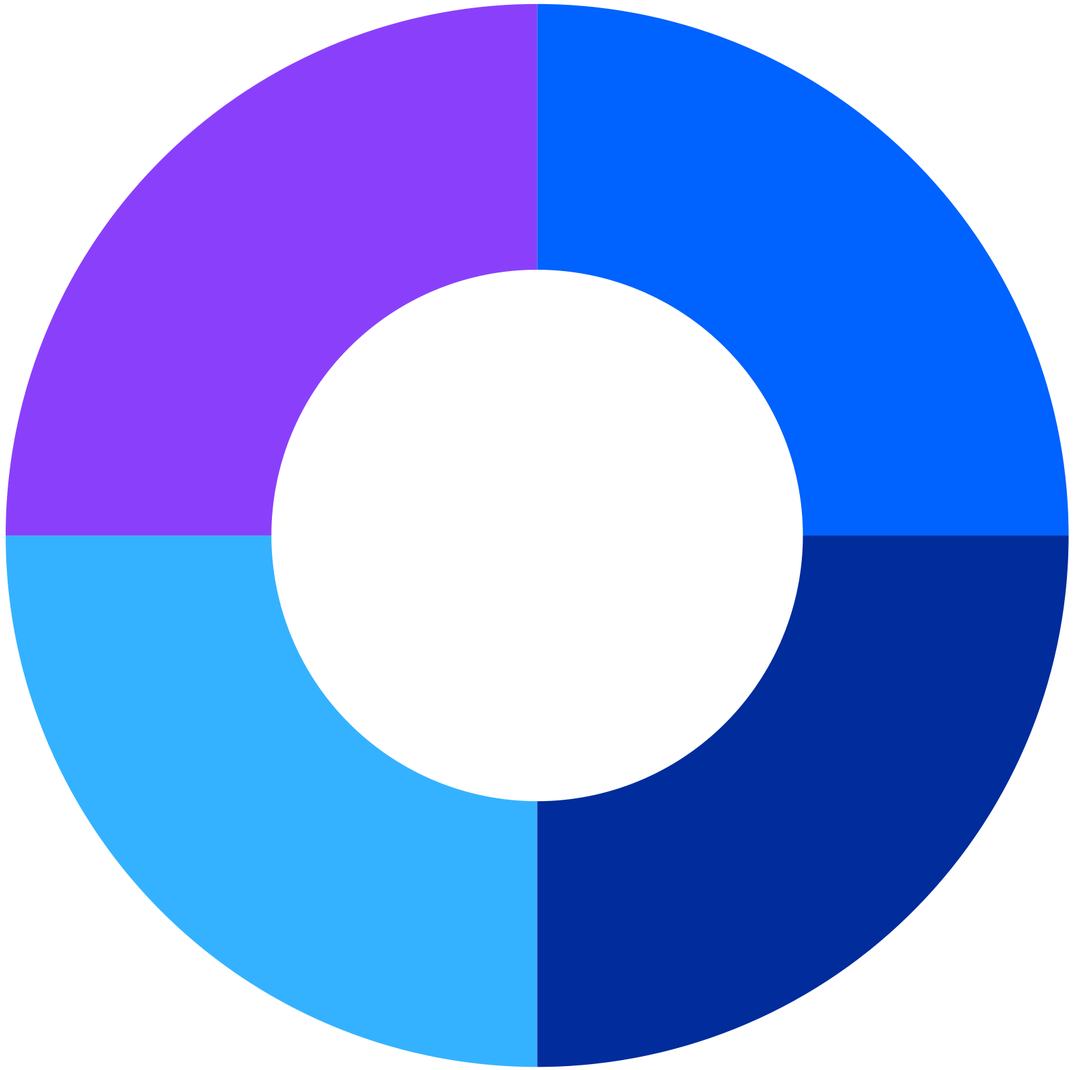
IMS recovery preparedness: Autonomics

Sensors
Gathering database statistics at regular intervals for your environment, including space utilization, fragmentation, **recovery readiness**, and optimization

Policies
IBM and user-defined policies and thresholds to determine when exceptions should be triggered

Exceptions
Sensors exceed policy thresholds

Automation
Notifications, recommendations and taking corrective actions based on exceptions



Monitor:

Collect data from a managed resource

Store sensor data for processing
Visualize sensor data in IMS Administration Foundation (web browser interface)

Analyze, plan, and execute

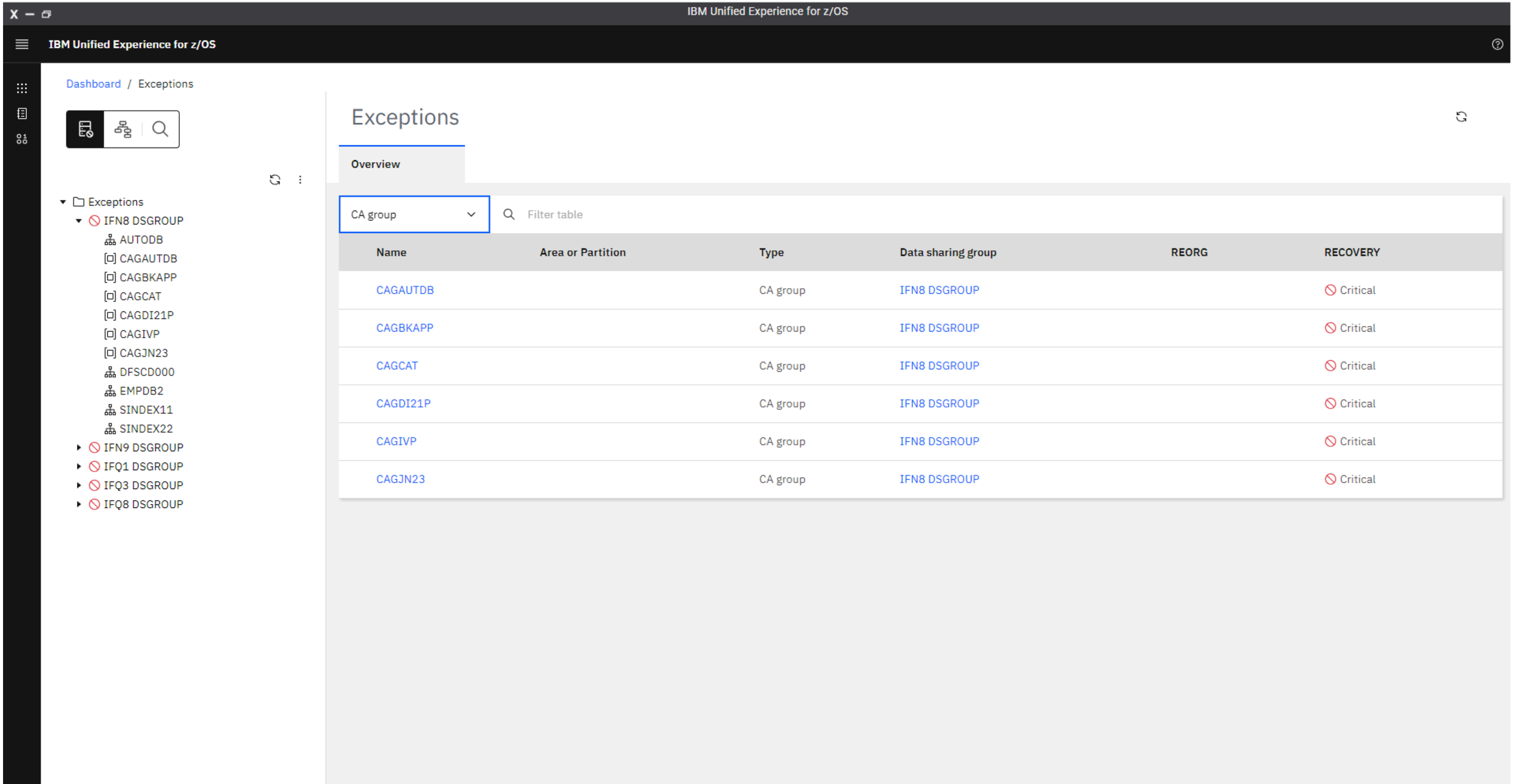
Passive autonomics

- Notifications (email, text, WTO) when sensor data exceeds policy values

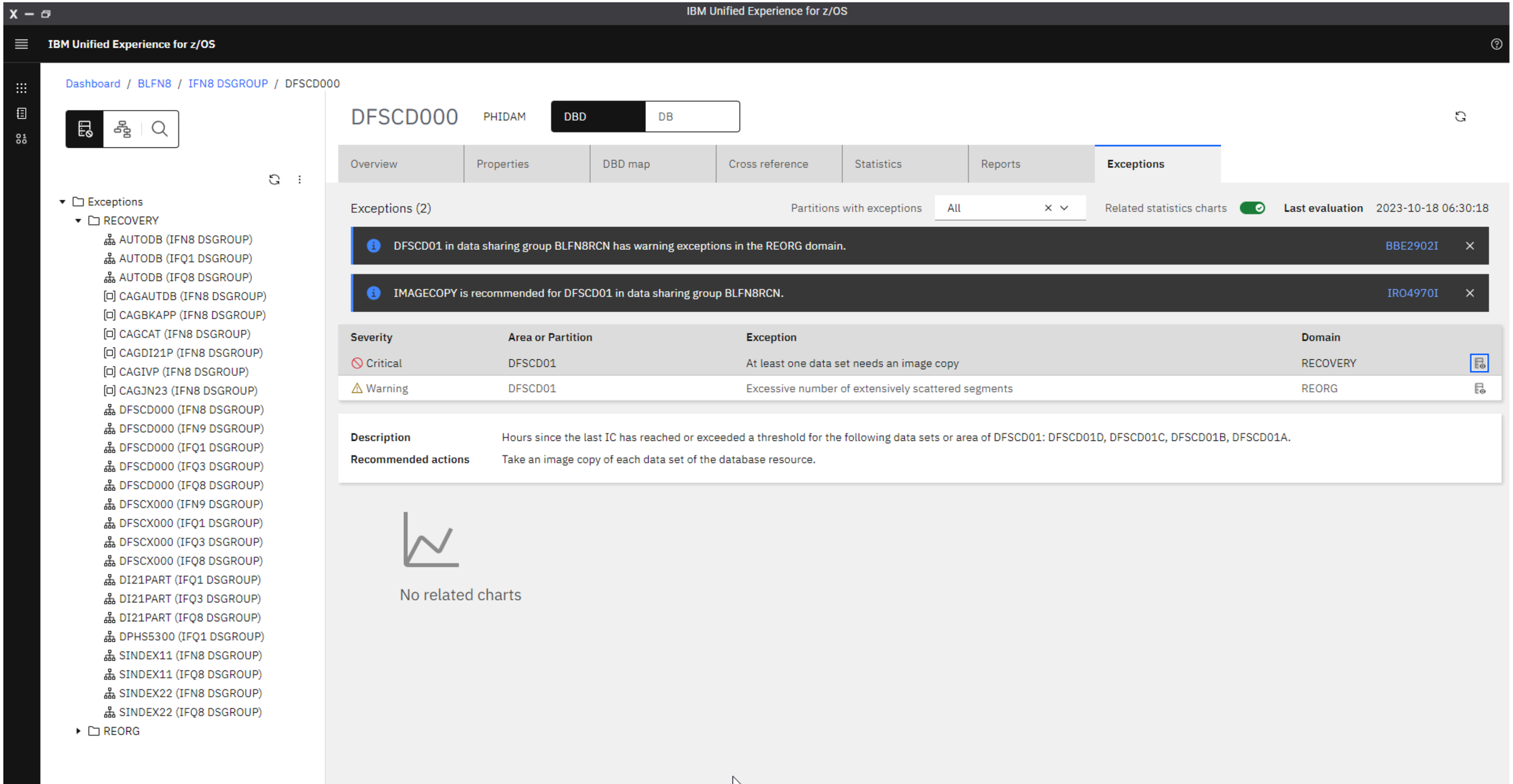
Active autonomics

- Scheduling a task automatically: reorg, image copy, etc.

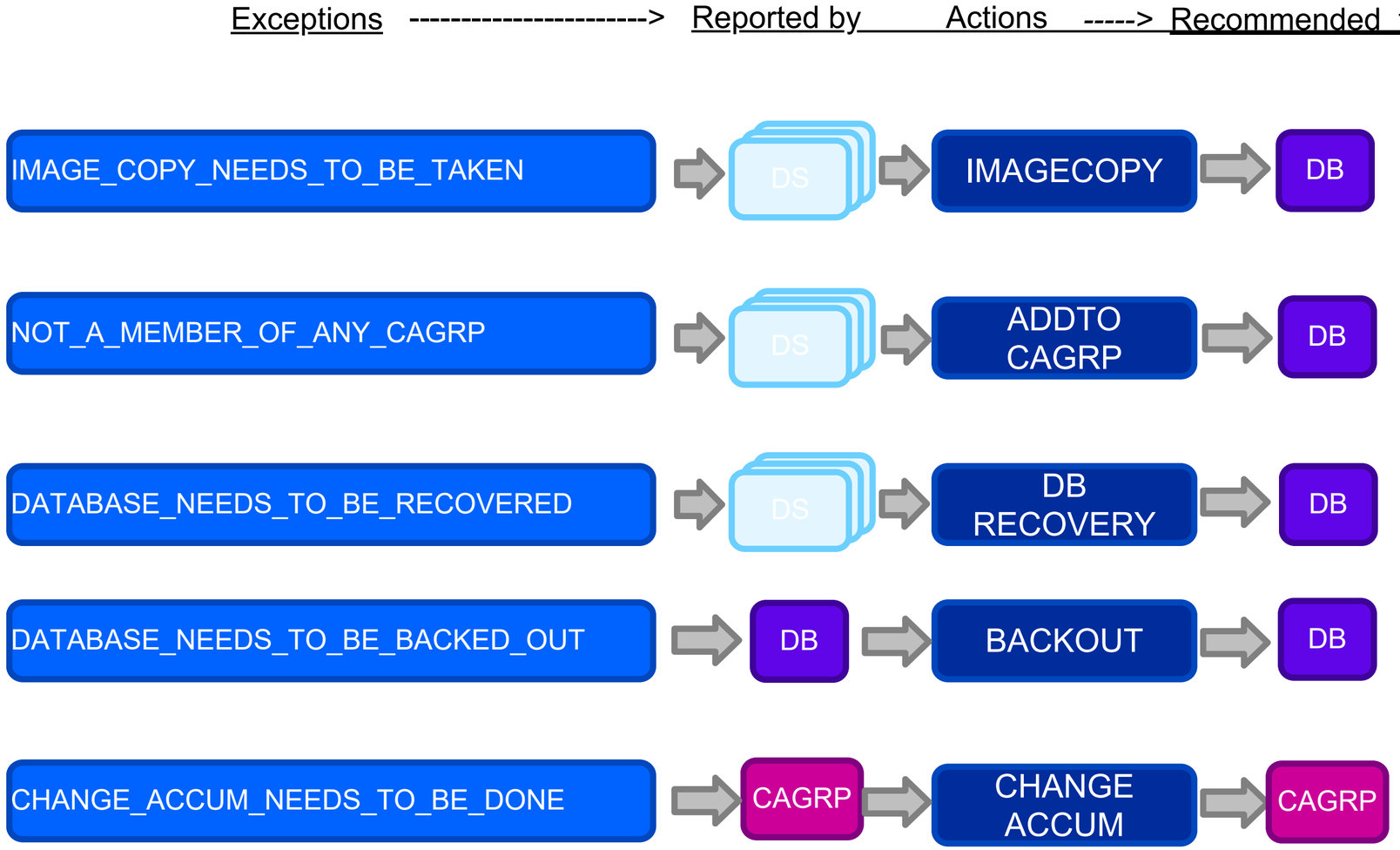
Recovery exceptions



Recovery exceptions



Actions in Recovery Domain



Keyword for Process Action	Description
IMAGECOPY	Take an image copy of each data set of the database resource.
ADDTOCAGRP	Add all data sets of the database resource to a DBRC CAGRP.
DBRECOVERY	Perform recover process for the database resource.
BACKOUT	Perform backout process for the database updates.
CHANGEACCUM	Create a new change accumulation for the change accumulation group.

Validate, learn, practice

Redirect recovery for recovery simulation scenarios

- Recover business critical applications to a different set of objects
- Use these objects to perform recovery simulation without affecting any production data
- Backups and logs from the production system are read
  - Providing production volume recovery simulations
  - Use the simulated recovery to
- Prove your recoverability
- Understand accurate time to recover
- Practice!

Progress rate displayed during recovery
APAR PH59163, PTF UI95821

Customer scenario: Converting logically related databases to HALDB

The situation

- Weather event approachin
- Two logically related datab space
  - Databases required for emergency aid processing
- Need to convert to HALDB
  - Important to first test the conversion with copies of real production databases
  - Both databases needed to reflect same point in time
- Multiple steps required and DBA having issues
  - Overwhelmed with multiple tasks

Initial request

- Practice and test conversion to HALDB for two logically related databases
  -
  -
- Minimize steps to reduce human error
  -
  -
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Final solution

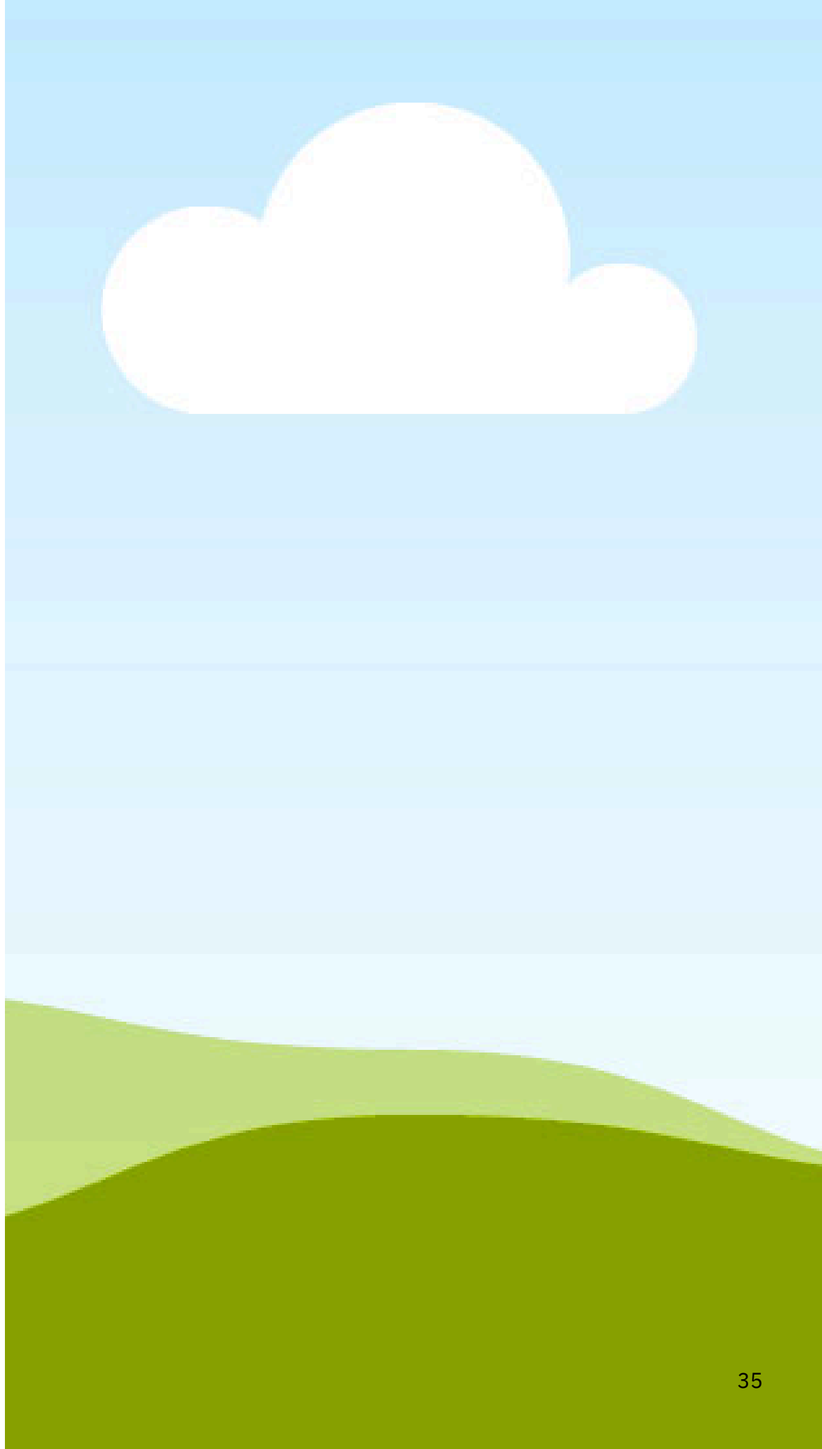
Use “Recover to copy” function

Specify both databases in one job

Recover to an alternate set of data sets

Use Point in Time Recovery option

Summary and resources for more information



Salesforce powers the entire indirect sales channel

Summary

Reduce costs for creating backups and improve recoverability

Reduce time needed to analyze and decide on the fastest, least costly recovery action

Improve recovery times and quicker return to normal service

Practice recovery for skills currency and to understand real recovery times

Automatically monitor the state of databases with proactive notification of ones that may need some action

A simple, easy-to-use ISPF interface

References

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IMS Tools Product Documentation
www.ibm.com/support/docview.wss?uid=swg27020942

IMS Fundamentals videos:
https://mediacenter.ibm.com/playlist/dedicated/122579632/1_b56rpdpt/1_jy8lv5f5

IMS Community (including IMS internship)
https://community.ibm.com/community/user/ibmz-and-linuxone/groups/public?CommunityKey=eba3ada3-db89-4dca-9154-328195f5e560

IMS new functions
https://www.ibm.com/docs/en/ims/15.5.0?topic=enhancements-ims-enhancement-ptfs

IMS Tools new functions
www.ibm.com/support/docview.wss?uid=swg22015506

IMS Tools support for IMS V15
https://www.ibm.com/support/pages/node/7151031

IMS Tools support for Managed ACBs
www.ibm.com/support/docview.wss?uid=ibm10731745

IMS Tools Videos on IBM MediaCenter
ibm.biz/ims-tools-mediacenter

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