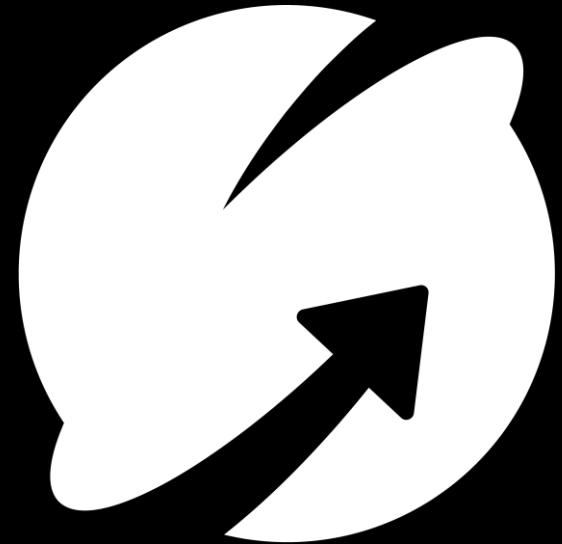


What if you quickly had to recover an IMS database, could you?

Ron Bisceglia  
Distinguished Engineer, IMS Tools  
[rbisceglia@rocketsoftware.com](mailto:rbisceglia@rocketsoftware.com)



# Agenda

The reality of being able to recover

IBM IMS Recovery Solution Pack

Establishing a good backup policy

Insuring recovery readiness

Validate, Learn, Practice

Demo

# Are you prepared to recover your data?

## Key challenges all businesses face today

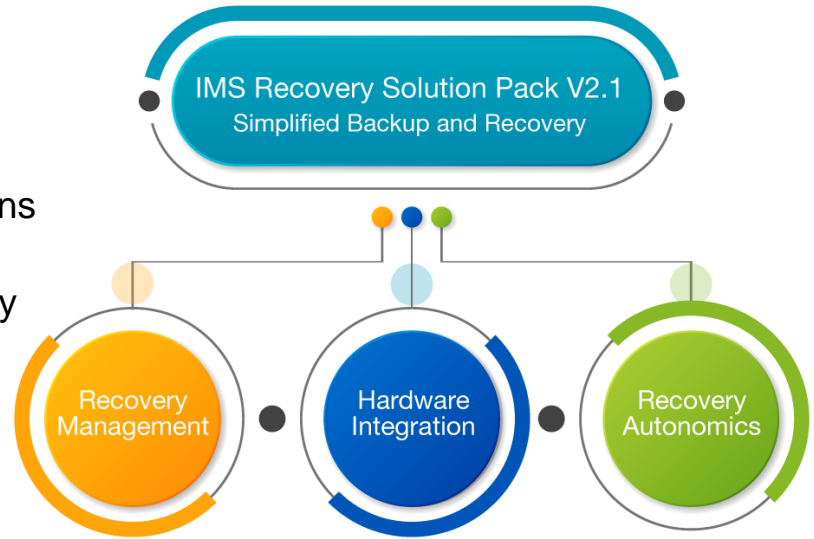
- Being able to recover from missing, unavailable or corrupted data
- Aligning backups with application needs
- Knowing recovery time objectives and SLAs
- Business resiliency is not just disaster recovery
- Protecting against cyber threats

**How well would your business manage?**



# What's is the IBM IMS Recovery Solution Pack?

- IMS Recovery Expert
- IMS Database Recovery Facility
- IMS Database Recovery Facility Extended Functions
- IMS High Performance Change Accumulation Utility
- IMS High Performance Image Copy
- IMS Index Builder
- Data Sensors
- [IMS Tools SETUP](#) and [IBM Tools Base](#)



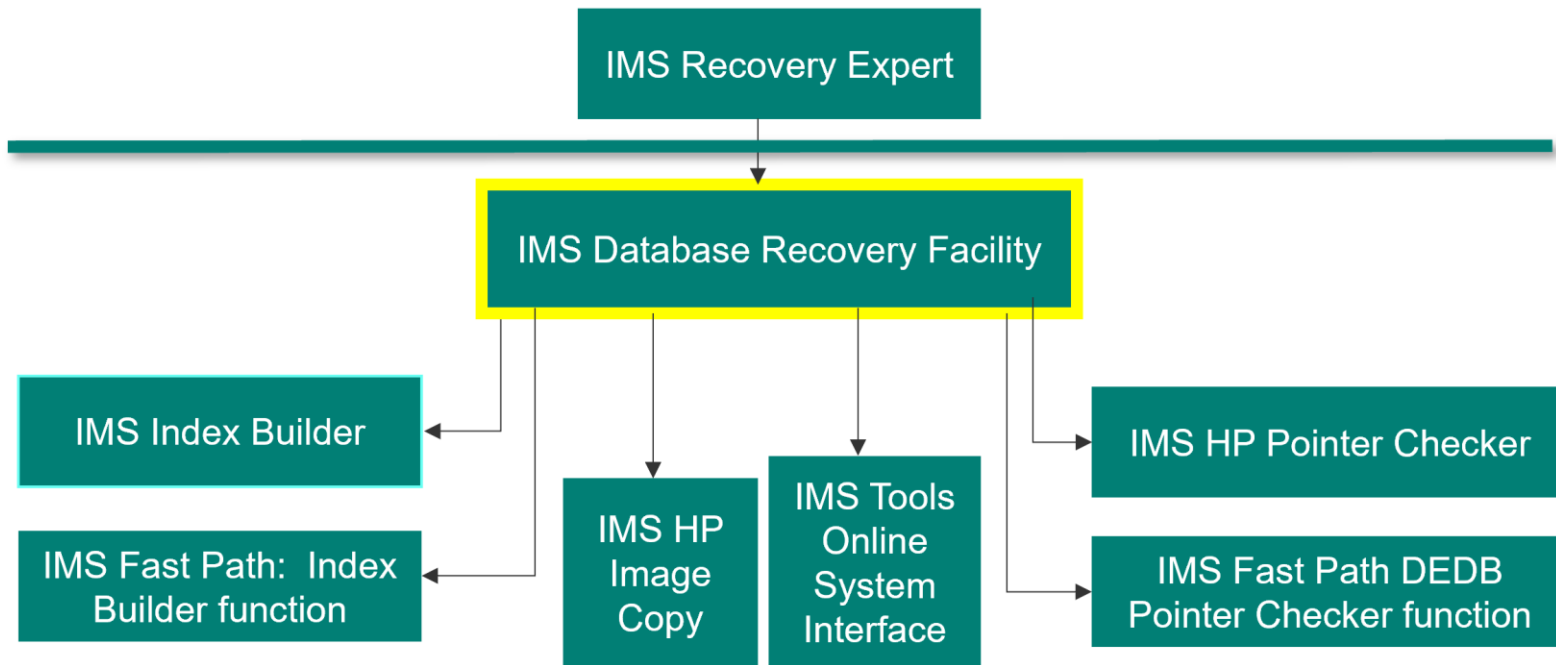
# What is IBM IMS Index Builder for z/OS?

- Streamlines index creation, reorganization, maintenance, and recovery
- Provides one step procedure for building all IMS index types including primary, secondary, and indirect list data sets(ILDS)
  - Creates multiple indexes in one job step
- Eliminates the need to image copy index databases for backup and recovery
- Allows for indexes to be defined as non-recoverable to DBRC
  - Eliminates logging
- Does not rebuild Fast Path Index databases
  - IMS Fast Path Secondary Index Rebuild function needed

# What is IMS Database Recovery Facility?

- An IMS Tools product which provides fast and efficient recoveries of your IMS databases.
- Simplifies database recoveries
  - Automatically stops and starts databases being recovered
  - Combines all operations into one step/job by invoking other tools
    - Index Builder/ IMS Fast Path Secondary Index Rebuild
    - High Performance Image Copy
    - High Performance Pointer Checker/ IMS Fast Path DEDB Pointer Checker
  - Processes input data in parallel when recovering multiple database data sets
    - Single pass of the change accumulation and log data sets
  - Doesn't require change accumulation prior to recovery

# IMS Recovery Solution Pack Integration



# IMS Database Recovery Facility Recovery Types

## Recovery Types Supported:

- **Recovery to Current Time (FULL)**
  - No RCVTIME or RCVTYPE keyword specified
  - Uses last IC registered in DBRC and applies Last CA+Logs after the last image copy timestamp
- **Timestamp Recovery (TSR)**
  - Keyword: **RCVTIME(timestamp,TSR)**
  - Uses previous IC (before timestamp) and applies Last CA+Logs up until the specified recovery timestamp
- **Point-in-Time Recovery (PITR)**
  - Keyword: **RCVTIME(timestamp,PITR)**
  - Uses previous IC (before timestamp/) and applies Last CA+Logs
  - Minimum of 2 archived logs per IMS Subsystem must be available after the specified recovery timestamp
- **Last Image Copy Recovery (LASTIC)**
  - Keyword: **RCVTYPE(LASTIC)**
  - Uses discovered timestamp of last IC taken when database was not allocated for update
  - Recovery is either a full recovery or TSR Recovery
  - No logs are used
- **Last Point-in-Time-CA Recovery (LASTPITCA)**
  - Keyword: **RCVTYPE(LASTPITCA)**
  - Recovery is always a PITR recovery
  - No logs are used



# What does IMS Database Recovery Facility do?

- Recovers only committed data to a specified time
- Can automatically recover to the last image copy (no timestamp is required): LASTIC
- Can automatically recover to the last point-in-time change accum (PITCA): LASTPITCA
- Can perform a PITR or TSR recovery (timestamp supplied by user)
- Can perform a FULL recovery (uses current time; no timestamp supplied)
- Creates copies of PROD data without affecting Database Availability
  - By using image copy, change accumulation, and log data sets as input, you can create copies of database data sets to any point in time via point-in-time recovery (PITR) without having to access production copies
  - Generates output data set names using a prefix or suffix, date, time, high-level qualifier, and/or literal for Test environments
- Provides automatic delete/define capabilities for database data sets
- Output data sets can be created automatically using existing attributes, or new attributes provided by keywords, or user-provided IDCAMS definitions via a PDS

# Establishing a Good Backup Policy

# Developing a Good Backup Policy

## Backup Methods / Tools

- Image Copies
  - Copy of individual data sets
  - Full, Incremental
  - Index Copies—not widely exploited
- Change Accumulation
  - Accumulate logs needed for recovery
  - Can reduce recovery time
- System Level Backup
  - Copy of entire IMS System
- Backups should be taken in alignment with application processes

## Backup Media / Technology

- Disk
  - Can be migrated to tape over time
- Tape
  - Real tape, virtual tape
- Fast Replication
  - FlashCopy, EMC Timefinder, etc
- Remote Site Mirroring
  - True purpose is disaster recovery

# What is IBM IMS High Performance Image Copy?

- Uses advanced copy technology and provides high-speed database copy features for rapid backup of IMS database datasets.
- Supports all IMS Database Types
  - Standard Full Function, HALDB, Fast Path DEDB
- Supports several processing options for creating image copies
  - Batch Image Copy
  - Concurrent (Fuzzy) Image Copy
  - Incremental Image Copy
  - Advanced Image Copy Services
    - Exploits advantages of point-in-time copy functions(Concurrent Copy, FlashCopy, and SnapShot) of DFSMSDss Advanced Copy Services to produce image copies

# What is High Performance Change Accumulation?

- An IMS tool that performs high-speed creation of change accumulation datasets
- Improves the performance of change accumulation operations by running multiple change accumulation groups in parallel and streaming the output to each group simultaneously
  - Supports Batch and Concurrent Image Copies
  - Supports Point-in-Time Change Accumulations
  - Processes multiple CAGRPs in parallel reading logs only once
  - Significantly faster than basic Change Accumulation Utility

# What is IBM IMS Recovery Expert?

- An IMS Tool that assists in avoiding accidental data loss or corruption by providing the fastest, and least costly method of backup and recovery
- Backup Process
  - Back up an entire IMS system nearly instantaneously with a significantly reduced likelihood of application downtime
  - Allow high-speed creation of image copy data sets for multiple database data sets simultaneously
  - Support efforts to reduce storage costs by utilizing one backup for multiple purposes
  - Reduce use of CPU, I/O, and tape resources in backup processes
  - Automatically perform backup validation to achieve more successful recoveries
- ISPF interface to simplify running recovery (demo)



# IBM IMS Recovery Expert – System Level Backup (SLB)

- Provides the ability to backup an entire IMS system (full or data only) using storage-based fast-replication technologies
  - IBM FlashCopy, EMC TimeFinder, HDS ShadowImage, IBM DFSMSdss
- Almost instantaneous backup of multiple volumes with little to no impact to the active IMS subsystems
- Normal SLB can include a single IMS system or multiple IMS systems in a data sharing environment
- Combined SLB allows for a single backup of multiple IMS or IMS and DB2 subsystems to a consistent point in time
  - Useful for coordinated DR

# IBM IMS Recovery Expert: Create Quiesce Points

- Create Quiesce Point function
  - Allows you to create recovery points for one or more databases
  - Can include Db2 objects
  - ‘Deallocates’ one or more Databases using type-2 UPDATE command across IMS Data-Sharing Systems
    - Requires CSL address spaces
    - Optionally Switches Logs across IMS systems
    - Puts databases back into state before quiesce issued



Insuring recovery readiness

# Do you monitor for potential recovery problems?

- Do you use automation/autonomics to watch for recurring database monitoring tasks?
- Do we have change accumulations to insure recovery time objectives>
- Able to inspect the RECONS to find potential database recoverability problems?
- Do we have image copies for as far back as we may need to recover to?
- Can you automatically send notifications when a problem is detected, or a threshold exceeded?



# IMS Database Recovery Facility: Extended Functions

- Health Checker (HCHECK) function

- Examines the RECONS to identify issues which could potentially jeopardize IMS database recovery
- Checks over 20 different conditions

- Primary IC has no valid Secondary Image Copy
- HALDB is not initialized
- HALDB Partition is disabled
- No Area Data Set is defined
- DB Recovery asset(s) 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

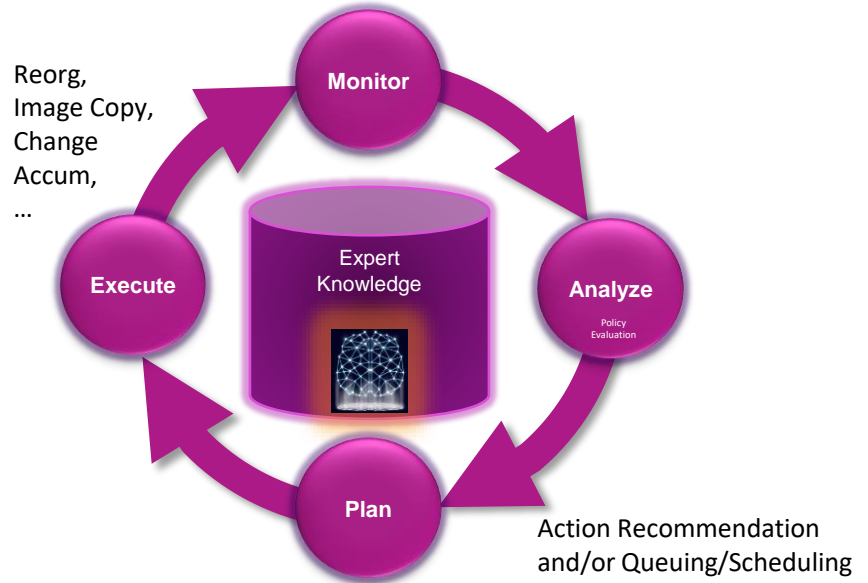
- No Image Copy Taken
- CA Group has no valid CA run
- Image Copy is Needed
- Minimum CA records not available
- Image Copy is Recommended
- No corresponding SECLOG for PRILOG
- No Batch Image Copy taken
- No corresponding SECSLDS for PRISLDS
- No Online Image Copy taken
- DB has EEQE, so recovery may be needed
- HALDB has Prohibit Authorization status
- DB is not part of a Change Accumulation group

# IMS Database Recovery Facility: Extended Functions

- Verify Recovery Assets (VERIFY) function
  - Ensures that the necessary data sets exist and that they 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
- Used often in disaster site recoveries
- Also useful at production sites to make sure DBRC settings are in sync with SMS, HSM data set management

# What is Autonomics

- [Autonomic Computing](#) concept arose in early 2000s in the IT industry
  - It envisioned to develop computer systems capable of self-management or self-healing
- In the Autonomic Computing architecture, the system management cycle consists of the following four steps:
  - **Monitor**
    - mechanisms that collect data from a managed resource
  - **Analyze**
    - mechanisms that correlate and model complex situations
  - **Plan**
    - mechanisms that construct the actions needed to achieve goals and objectives
  - **Execute**
    - mechanisms that control the execution of a plan with considerations for dynamic updates



- Another important component:
  - **Knowledge** (or *Know-how*)
    - Data used by the autonomic four functions, which includes historical logs, symptoms and policies

# Autonomics is enabled by IBM IMS Tools Base

- A no-charge product that contains various components that are required for some IMS Tools.
- Includes the following components
  - **IMS Tools Knowledge Base**
  - **Distributed Access Infrastructure**
  - **Policy Services**
  - **Autonomics Director**
  - IMS Tools Common Services
  - IMS™ Tools Hardware Data Compression Extended
  - IMS Batch Terminal Simulator extensions
  - IMS Admin Foundation

# IMS Recovery Solution Pack – Recovery Sensor

- Recovery Sensor is a batch job which can be scheduled by Autonomics Director or any job scheduler
  - Can also be run by an individual user on demand
- Obtains information from the RECONs regarding potential database recoverability problems, indications of potentially long running recovery jobs, etc.
- Control card driven input to select specific databases to be monitored and the specific information to be obtained
- Stores Sensor Data in the ITKB so that it can be processed by Autonomics Director and Policy Services

# Monitoring for Potential Recovery Problems

Autonomics -> Automates recurring database monitoring tasks, including on-demand scheduling of database sensor and evaluation of user policies.

- Looks at information in the RECONS regarding potential database recoverability problems, indications of potentially long running recovery jobs, etc. For example:
  - The number of hours since the data base, area, or partition was last image copied
  - The number of hours since a CA was performed for a particular CA group
  - Recovery needed flag for DB, AREA, or HALDB Partition
  - Image Copy needed flag for DB, AREA, or HALDB Partition
  - Image Copy Recommended flag
  - Backout needed flag
  - Database is not in a CA group flag
  - Minimum versions of an image copy that are available
  - EEQE count for DB, AREA or HALDB Partition
- Notifications (email, text, WTO) are made when a condition is detected or exceeds a user controlled threshold



# RECON Group Summary Dashboard

RECON Group Summary

RECON Group Type or Database Type

Overall Health Statistics

■ Critical  
● Severe  
▲ Warning  
◆ Normal

Number of Exceptions

Number of Reports

Resource	Type	Overall	Critical	Severe	Warning	Recommendations	Reports
<b>CGROUP1</b>	CAGRP	■	1	0	0	1	0
CLASSRDB   DSCLSDV0	HDAM	■	2	0	1	0	12
COURSEDB   DSCRSDV0	HDAM	■	1	1	1	0	12
COURSEDB   DSCRSDV1	HDAM	■	1	1	1	0	12
FACILTDB   DSFACH00	HIDAM	■	2	0	0	0	12
FACILTIX   DSFACXV0	INDEX	◆	0	0	0	0	6
FACILTSX   DSFDAXV0	INDEX	◆	0	0	0	0	6
FACILTSX   DSFDAXV1	INDEX	◆	0	0	0	0	6
ORDHDAM   ESDDSDATA	HDAM	■	1	0	2	0	12
<b>SCHOOLDB   DSSCHHV0</b>	HIDAM	■	1	0	0	0	12
SCHOOLIX   DSSCHX10	INDEX	◆	0	0	0	0	6
SHRINDX1   DSNAMXV0	INDEX	◆	0	0	0	0	6
SHRINDX1   DSNAMXV1	INDEX	◆	0	0	0	0	6

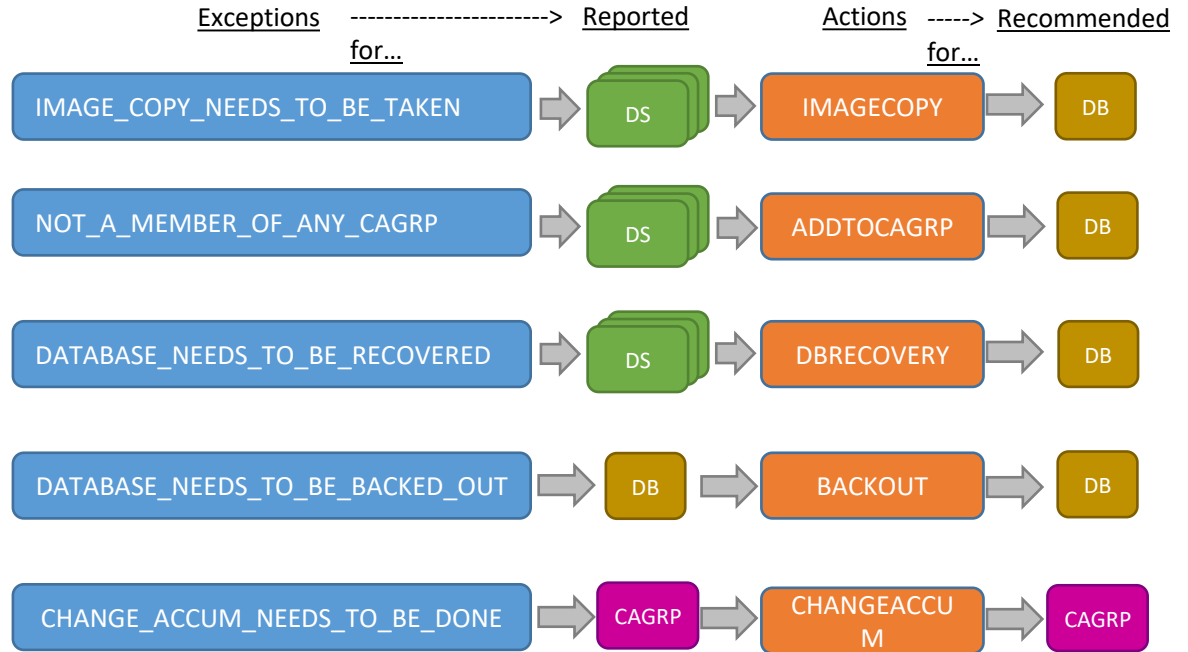
RECON Group

Member of RECON Group

Double click a member, to open the DBD Dashboard for the member.

# Actions in Recovery Domain

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



Validate, Learn, Practice

# How can you demonstrate recoverability in a timely manner?

## Recovery needs practice

- Determining recovery steps can be complex
- Need to understand related objects that may need to be recovered

## Redirected 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 and accurate time to recover.

# IMS Database Recovery Facility Alternate Output

## Alternate Outputs Supported:

### **OUTPUT(PRO): Production (original) DBDSs registered in DBRC**

- Recovers to original database data sets registered
- Original databases are affected

### **OUTPUT(DUP): Duplicate Data Set Copy**

- Recovers to non-original (different data set names)
- Original databases are unaffected

### **OUTPUT(BOTH): Performs both PRO and DUP functions at the same time**

- Recovers to both non-original and original
- Production databases are affected

### **OUTPUT(ICR): Incremental Image Copy**

- Creates new Image Copy from prior IC, archived logs, and/or CA
- Production databases are unaffected

### **OUTPUT(ICRCA): Similar to ICR, but creates a BATCH Incremental IC**

- Creates new Image Copy from prior IC, archived logs, and/or CA
- Clean Recovery Point or batch window must exist
- Original databases are unaffected

# Use the IMS Tools to test your recovery plans

- Use the Database Copy Generation capabilities to recover business critical applications to a different set of objects
- Backups and logs from the production system are read providing production volume recovery simulations
- Use these objects to perform recovery simulation without affecting any production data
- Use the simulated recovery to prove your recoverability and get an accurate knowledge of the time to recover.



**It's easy to test in order to validate, learn and practice**

Demo

# Summary

Reduced costs for creating backups and improve recoverability

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

Improved recovery times and quicker return to normal service

The capability to practice recovery and see 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



# Additional IMS and IMS Tools Links

## **IMS Tools website**

[www.ibm.com/it-infrastructure/z/ims/tools](http://www.ibm.com/it-infrastructure/z/ims/tools)

## **IBM Z Software Newsletter, Operations and Management**

<http://ibm.biz/zITSMNewsletterSubscribe>

## **IMS Tools Product Documentation**

[www.ibm.com/support/docview.wss?uid=swg27020942](http://www.ibm.com/support/docview.wss?uid=swg27020942)

## **IMS listserv**

<http://imslistserv.bmc.com>

## **IMS Tools new functions**

[www.ibm.com/support/docview.wss?uid=swg22015506](http://www.ibm.com/support/docview.wss?uid=swg22015506)

## **IMS Tools support for IMS V15**

[www.ibm.com/support/docview.wss?uid=swg22009341](http://www.ibm.com/support/docview.wss?uid=swg22009341)

## **IMS Tools support for Managed ACBs**

[www.ibm.com/support/docview.wss?uid=ibm10731745](http://www.ibm.com/support/docview.wss?uid=ibm10731745)

## **IMS Tools support for Data Set Encryption**

[www.ibm.com/support/pages/ibm-ims-tools-and-data-set-encryption-support](http://www.ibm.com/support/pages/ibm-ims-tools-and-data-set-encryption-support)

## **IMS Fundamentals videos:**

[https://mediacenter.ibm.com/playlist/dedicated/122579632/1\\_b56rpdpt/1\\_jy8lv5f5](https://mediacenter.ibm.com/playlist/dedicated/122579632/1_b56rpdpt/1_jy8lv5f5)

## **IMS Tools Videos on IBM MediaCenter**

[ibm.biz/ims-tools-mediacenter](http://ibm.biz/ims-tools-mediacenter)

## **IMS new functions**

[www.ibm.com/docs/en/ims/15.3.0?topic=enhancements-ims-enhancement-ptfs](http://www.ibm.com/docs/en/ims/15.3.0?topic=enhancements-ims-enhancement-ptfs)