



Db2[®] z/OS[®] RECOVERY

How Best Practices Have Changed to Address New Threats

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Agenda

Do we really need to do recoveries anymore?

- The new and improved reasons we need to worry about our data
- What if you do need to do a recovery, is there time, is there data?
 - Recovery Readiness
 - Recovery Preparation

Why Do We Worry About Recovery ?

- **Regulations**
- **Customer Satisfaction**
- **Revenue**
- **The Business**
 - Self Imposed
 - Segment Imposed
 - Government Imposed

Certain Expectations Exist



Do We Even Do Recovers Anymore ?

Recovery Is a Real Challenge

- Exploding Data Volumes / Db2 Objects
- Staff Productivity and Expertise pressures
 - Recovery was a 'part time' job
 - Many hours go into DR preparation and testing
 - More data, more apps, ... More DBAs?
- Planned downtime pressures
 - Brief outages must be eliminated
 - Consistent, cross DBMS, backups
- Never a good time for an Unplanned outage



Who Are Our Villains As We Build Our Recovery Story ?

... A long time ago in a galaxy far far away ...

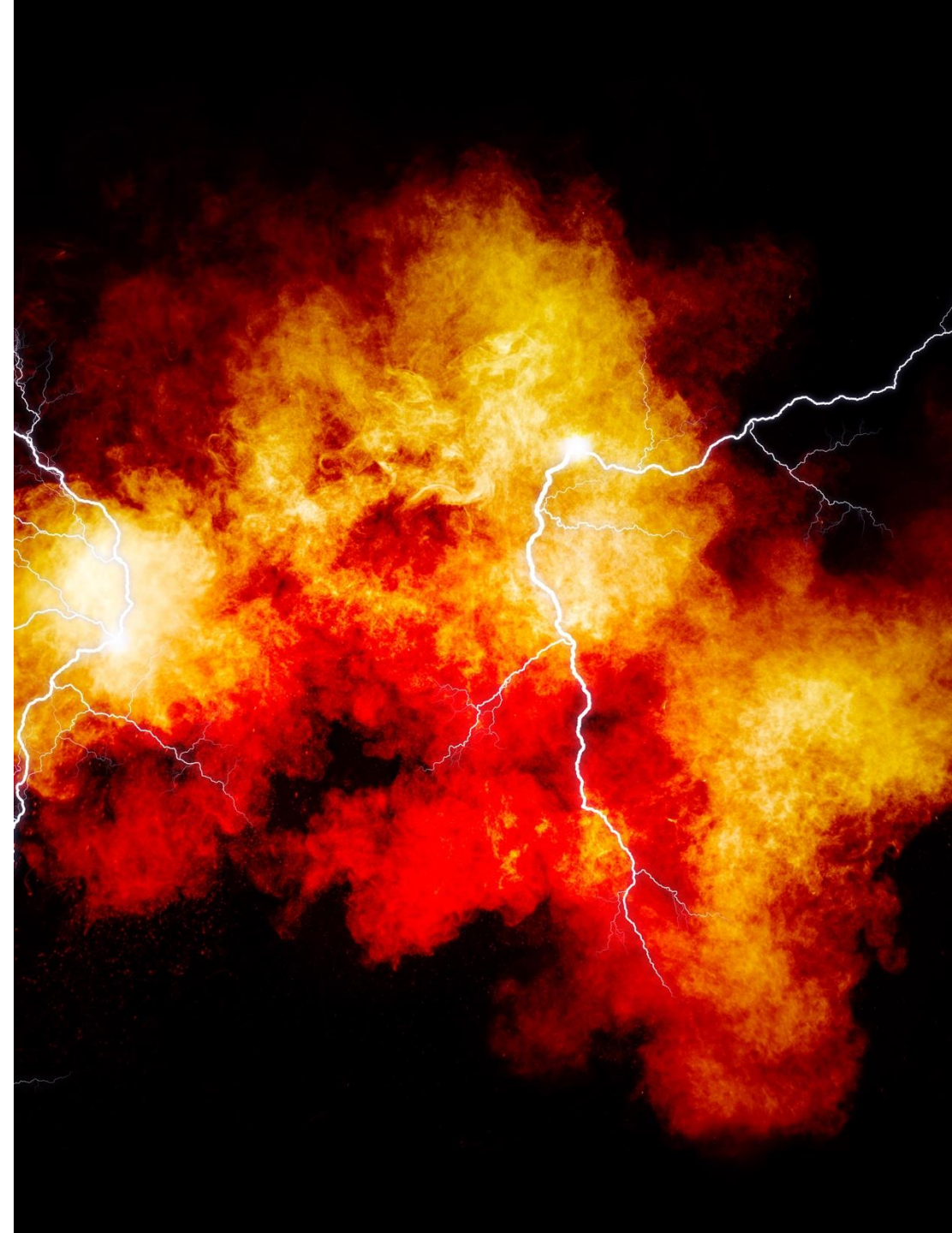
- Db2 itself
- z/OS Hardware Issues
- Self Inflicted
 - Application Issues
 - Hardware additions/maintenance
 - Oops was that production



Who Are Our Villains As We Build Our Recovery Story ?

Things we have no control over

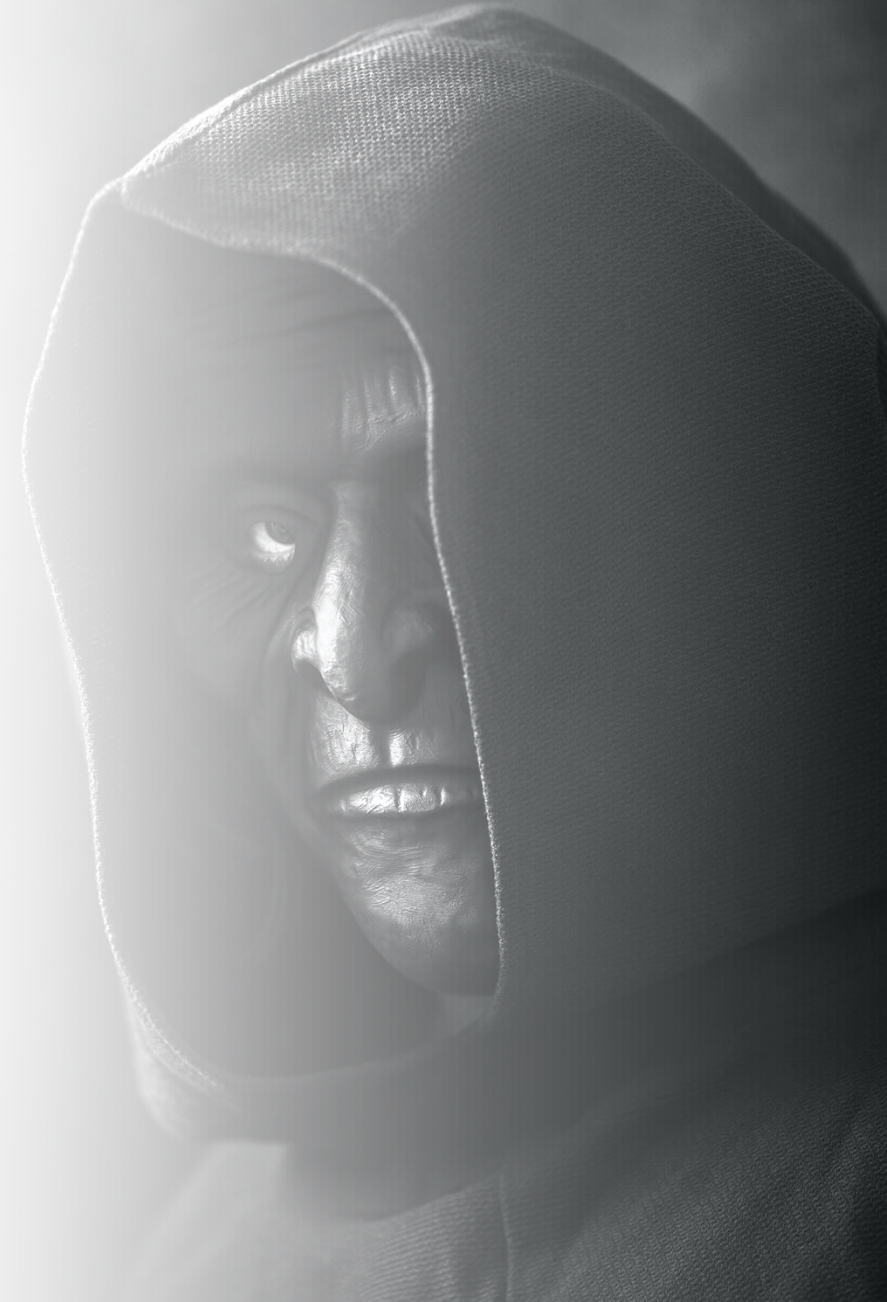
- Mother Nature
 - Hurricanes
 - Irene and Sandy
 - Floods
 - Power Outages
 - Fires



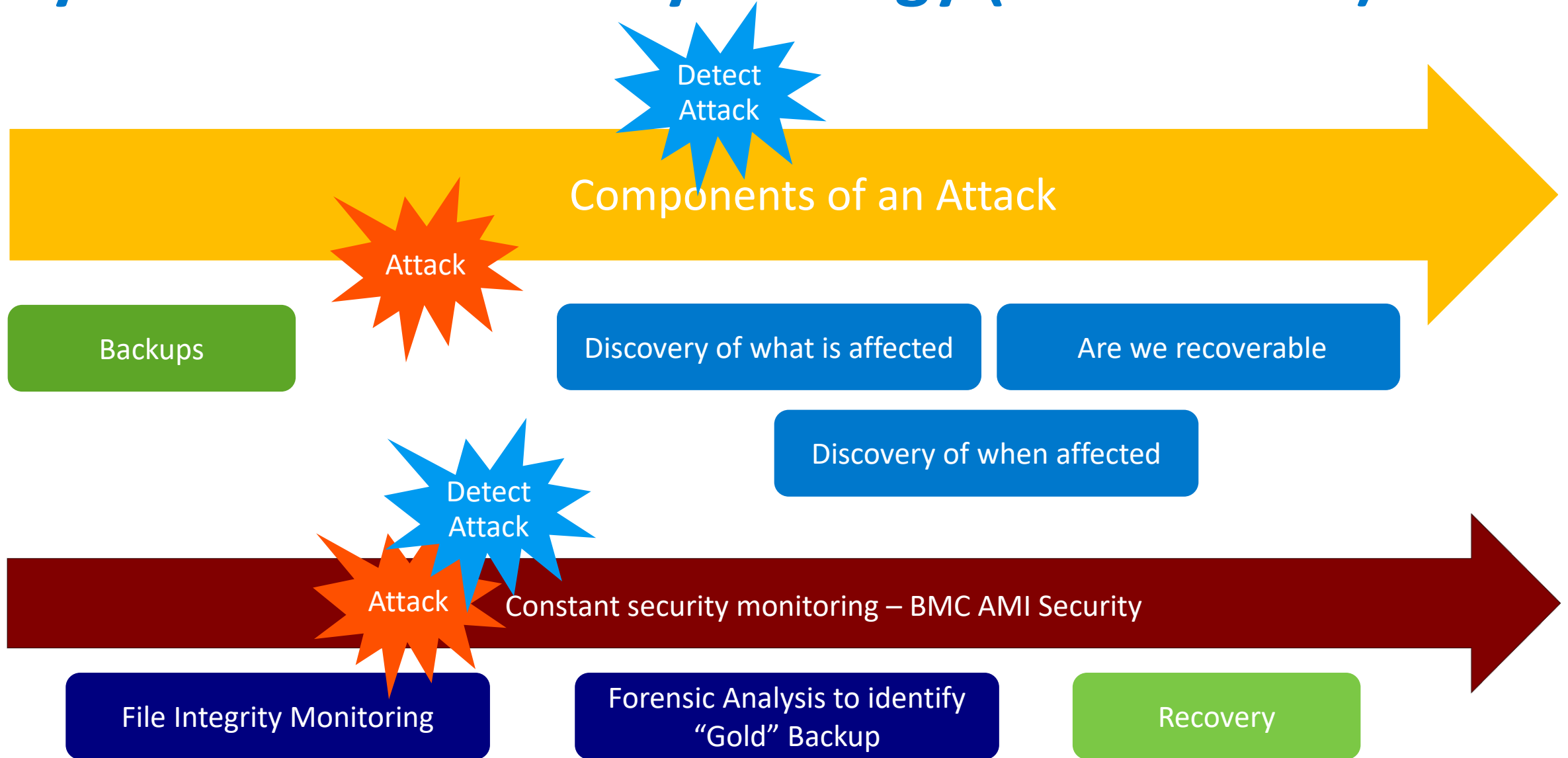
The Most Recent Villain Lurking in the Shadows

Cyber attacks/Ransomware

- How is the business going to handle protecting our data
 - Ransomware account for over 25% of security attacks
 - Average cost of a data breach is the highest it has ever been
 - Every Mainframe is under attack
 - The power of the MF makes things worse
 - 98K files / 50 GB encrypted in 4 minutes off platform
 - Don't build a fence – you need to protect against infections
 - Discover early



Cyber Attack Recovery Strategy (Db2 centric)



With Any Story There Needs to be Heroes

What if you need to do a recovery

- Are we ready for any type of recovery?
- Are we prepared for recovery?
- Is there enough time?
- Is there enough data, recovery resources?



DB2 Recovery Readiness – Recover Ready

- Prepare for the Worst
- Are we Ready to fight the Villains?
 - Check your Resources
 - Check your Equipment

Questions that need to be answered daily

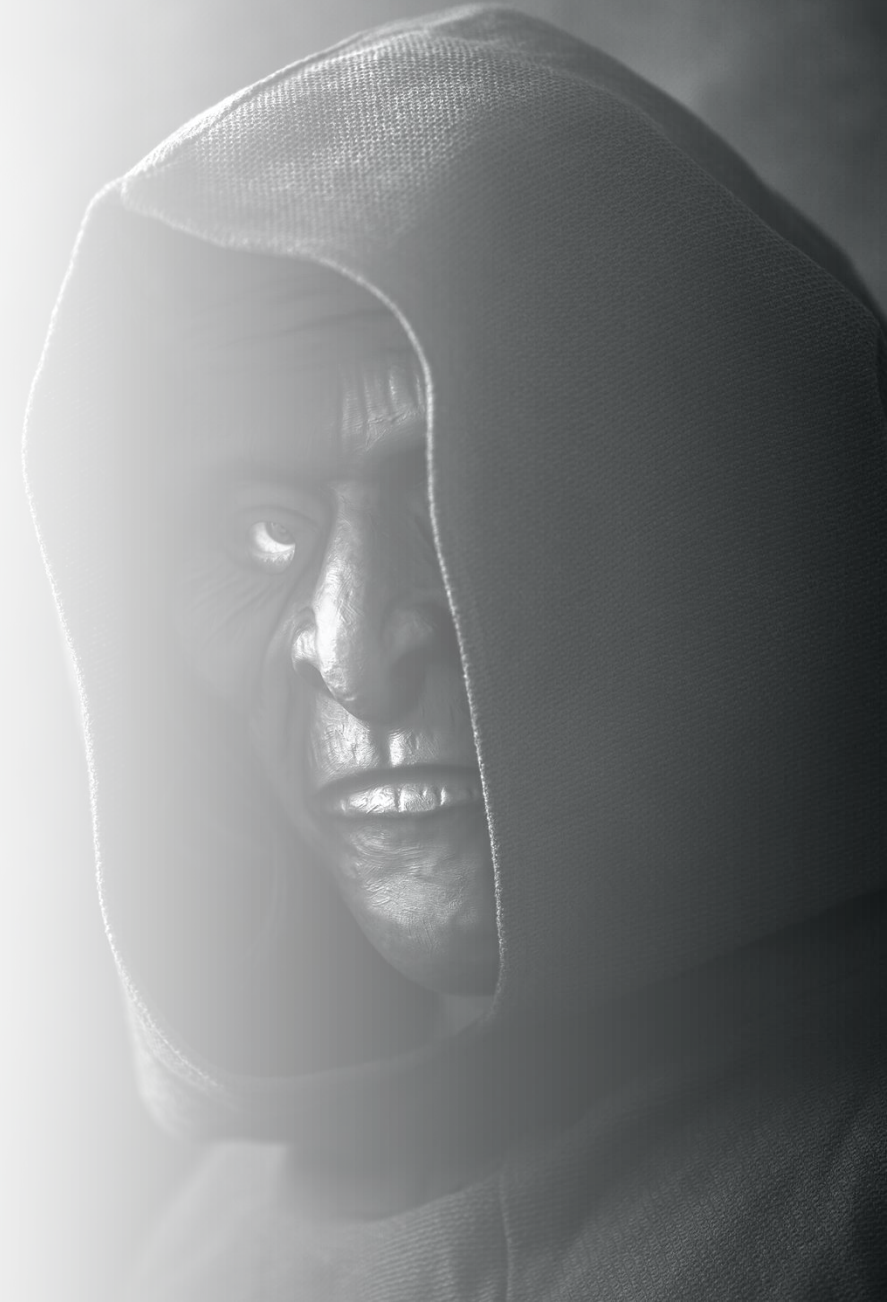
- Backup strategy meet our needs?
- How much log do we have to apply ?
- Do we have enough log available locally to recover from last image copy?
- What happens if PLAN A fails ... do we have a Plan B
- Which Application objects should be recovered first?

Wow How Db2 Backups Have Changed ...

Why have they changed – because of the bad guys

- Day 1 – Recovery
- Day 2 – Data Unload
- Day 3 – Data Migration
- Today – another target of Ransomware
 - Data and backups are exposed
 - Requirement to protect our backups – Cyber Resilient Backups
 - Many solutions from Hardware and Software Vendors
 - Copy Separation – Safeguarded Copy/Air Gap/Special Hardware/Vaults
 - Still have the same issues
 - Data Loss
 - Data Latency

Does our Backup and Db2 Log Strategy meet our Recovery Requirements?



Backups Ready for Any Type of Recovery?

Application Database Backups

- Verify that our objects are recoverable to our needs
- Verify the DB2 Resources are still out there
- Manually build queries to check
 - What to check for ...
 - The MINIMUM number of image copies that need to exist
 - The MAXIMUM number of days since the last image copy
 - The MAXIMUM number of logs since the last image copy
 - Third Party Software provides VERIFY function with copies
 - Automate Warnings or taking needed image

Are we taking Image Copies Frequent enough?

- Log Processing to use these image copies

Incremental Copies

- Affect Recovery Time



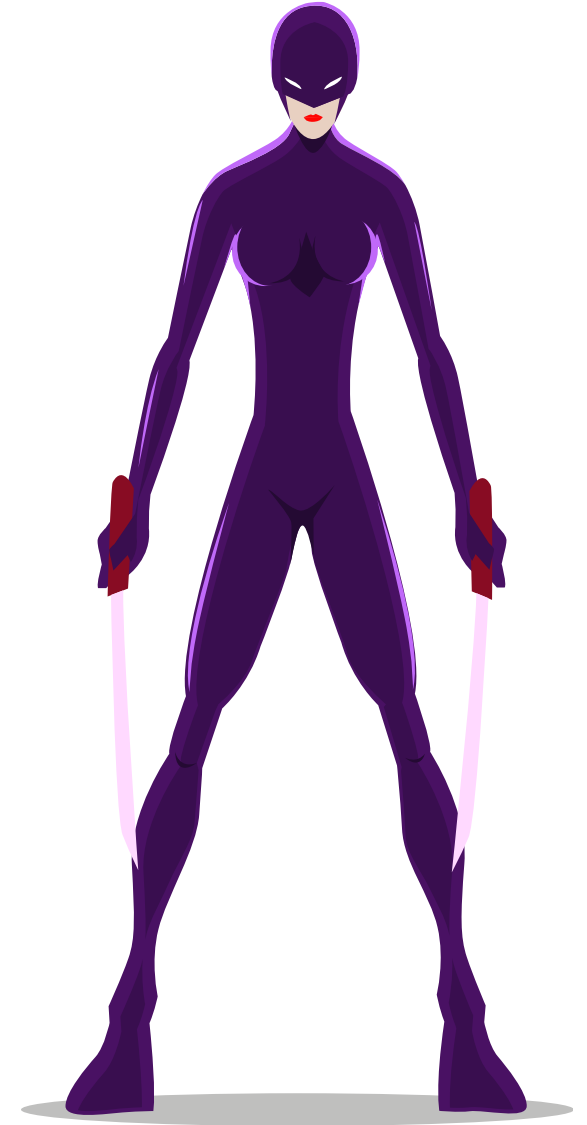
Checking Our Db2 Logging Environment

- **System Programmers and DBAs working together!!!**
- **Active Log Pairs**
 - More the better
- **Since DB2 V10 – Add Active Logs on the fly**
- **Recovery Readiness**
 - Write Archive Logs to DASD allow HSM to migrate
 - Attempting to avoid tape contention when needed for recovery
 - Quicker recovery on DASD
- **Recovery Readiness Question**
 - How long do we need to keep the logs around.
 - When addressing Logging - *#1 Priority - Recovery*



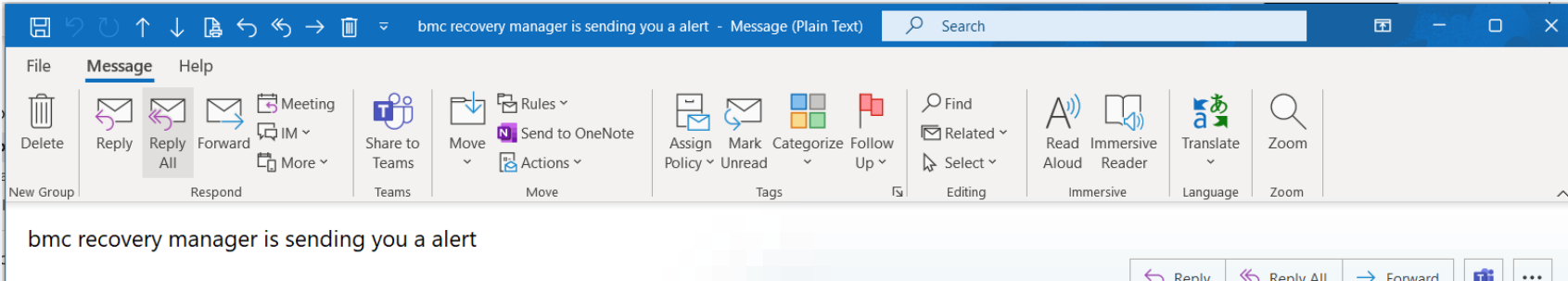
Verifying Recovery is to be Recovery Ready

- **Build a daily Recovery Health check to support all the recovery scenarios**
 - Local / Remote Recovery
 - Subsystem or Application Level Recover
 - Validate our Application Recoveries
 - Many types of Recovery Points
 - TOCOPY, TIMESTAMP, QUIESCE, LOGPOINT
 - Can we support each with our Readiness
 - Products on the market
 - Recovery Expert, Recovery Analyzer, Recovery Manager ... probably more
- **Consider Recovery Time and Recovery Point**



What Kind of Health Check We Talking ...

```
===== Object Set Health Check - [REDACTED] =====  
Command ==> _____  
  
Select one or more options with / or S and press Enter.  
  
s Check for unrecoverable events  
s Verify required archive logs for recovery  
s Verify image copies taken within 3__ hours (max 960) or __ days (max 40)  
s Check if data changes made to objects since the specified recovery point  
s Verify that objects are encrypted  
_ Check for objects in exception status (not RW)  
[ ] Check for entries in SYSCOPY/BMCXCOPY older than the timestamp  
  
Recovery point . . . 2022 - 05 - 11 - 08 . 02 . 30 (YYYY-MM-DD-HH.MM.SS)  
Copy type . . . . LP (LP, LB, RP, RB, FC)  
Rebuild indexes . . N (Y or N)
```



To

We removed extra line breaks from this message.

```

** BMC AMI Recovery Manager for Db2 V12.01.00 - OBJECTSET
** BMC AMI Recovery for Db2 V12.01.00
XXXXX.
----- PAYROLL UNRECOVERABLE EVENTS SINCE 2022-05-08
XXXXX.
----- PAYROLL ARCHIVE LOGS REQUIRED FOR RECOVERY PO
XXXXX.
----- PAYROLL OBJECTS WITH NO IMAGE COPIES WITHIN 4
XXXXX.
----- MKTCWR.PAYROLL OBJECTS WITH CHANGED DATA SINCE 2022-
0 C XXXXX. of 164 Objects (0 percent)
----- MKTCWR.PAYROLL OBJECTS THAT ARE NOT ENCRYPTED
0 0 XXXXX. RYPTED OUT OF 85 TABLESPACES
----- MKTCWR.PAYROLL OBJECTS WITH EXCEPTION STATUS (NOT RW

```

bmc AMI Command Center for Db2 Workspace Apps

Signed In as MKTCWR

Reiber-DBA*

DB2 Navigator File Locator Job Browser Performance Schema Management **Recovery Management** Scratchpad Product Tools

Recovery Report Card

- Payroll App Recovery Dashboard

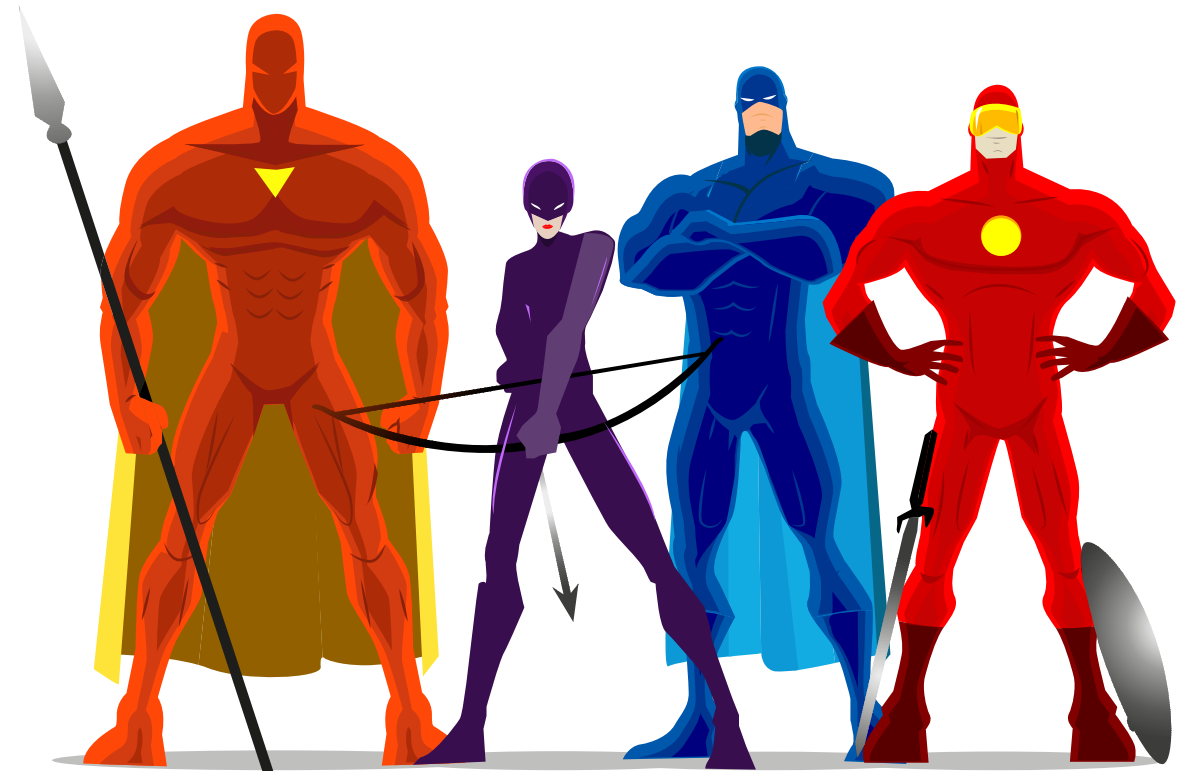
DB2 Subsystem: DJJ
Generated: 2022-05-11 09:45:18

Definition	Summary	Detail
Unrecoverable Events Events: 71 Objects processed: 164	Archive Logs Missing Archive Logs: 0 Missing Copies: 42	Image Copies Missing Copies: 82 Objects processed: 164
Changed Objects Changed: 0 Objects processed: 164	Object Encryption Unencrypted: 85 Objects processed: 85	Exception Status In Exception Status: 64 Objects processed: 164
SYSCOPY/BMCXCOPY Check Objects with old SYSCOPY or BMCXCOPY Rows: 106 Objects processed: 164		

What Equipment Do We Have to Fight the Villains

Recovery Readiness and Preparation - Equipment

- RECOVER/REBUILD Utility
- COPY Utility
- CHECK
- Log Tool
- Unload / Load
- Reorg
- Report Recovery
- DSN1LOGP
- DSN1PRNT
- DSN1COPY



Tools to help Before, During and After
Heroes need to know how to operate

DB2 Recovery Preparation

Do we have a way to generate all the different Recovery Scenarios?

Application SLA

- Are our recoveries fast enough
- How do we make them meet the need of the business
 - What gets recovered first?

Db2 Databases - What spaces are logically/physically connected

- Application RI/DB2 RI
- What if the DBA on call doesn't know

JCL canned ready to go... want to go to the manual?

- What if a recovery is our only option
- Types of Recover... Application/System

Can we even do a recovery?

Preparation has more questions that need answers!!!

Application Recovery – Decisions, Decisions

Determine what objects need to be recovered.

- By Plan, Volume, Database
- What objects are included in the above

Where do I need to recover to?

- Image Copy (which one)
- Quiesce Point
- Timestamp
- Current

Build the process ...

- One recovery job or multiple
- Log being used in recovery?
- Recover Indexes or Rebuild
- Recover Backout an option?
- Do all spaces actually need to be recovered

Run the jobs

- Sit and wait ... hopefully no abends.

SITUATION:

- Recovery Required because multiple issues
- Submit multiple Recover Jobs
- All waiting on same tapes for archives and IC

BUSINESS IMPACT:

- Three Days to finally recover
- Estimated cost of downtime: **\$10 million**

SOLUTION: Tool to automate building Recover JCL

- Prepare for such issues

The DB2 Log is Your Friend ...

Log Tool / Log %

- Can everyone build and run the Log Tool ?
 - Easy to Simulate
- Transaction Level Recovery !!
- What if you lose updates to your DB2 Objects
- Verify Data on Databases
 - Review the log activity
- Find Recovery Points
 - Daily or Application Process

Log Tool is just another hero in the story

SITUATION:

- DBA accidentally dropped production database of customer loyalty information
- Loyalty app unavailable – completely offline
- Members unable to check balances or claim benefits

BUSINESS IMPACT:

- After working with BMC Support for 28 hours, **all data was recovered**
- Estimated cost of downtime: **\$14 million**

SOLUTION: Log Tool / Drop Recovery Tool

- Unique feature - Drop Recovery

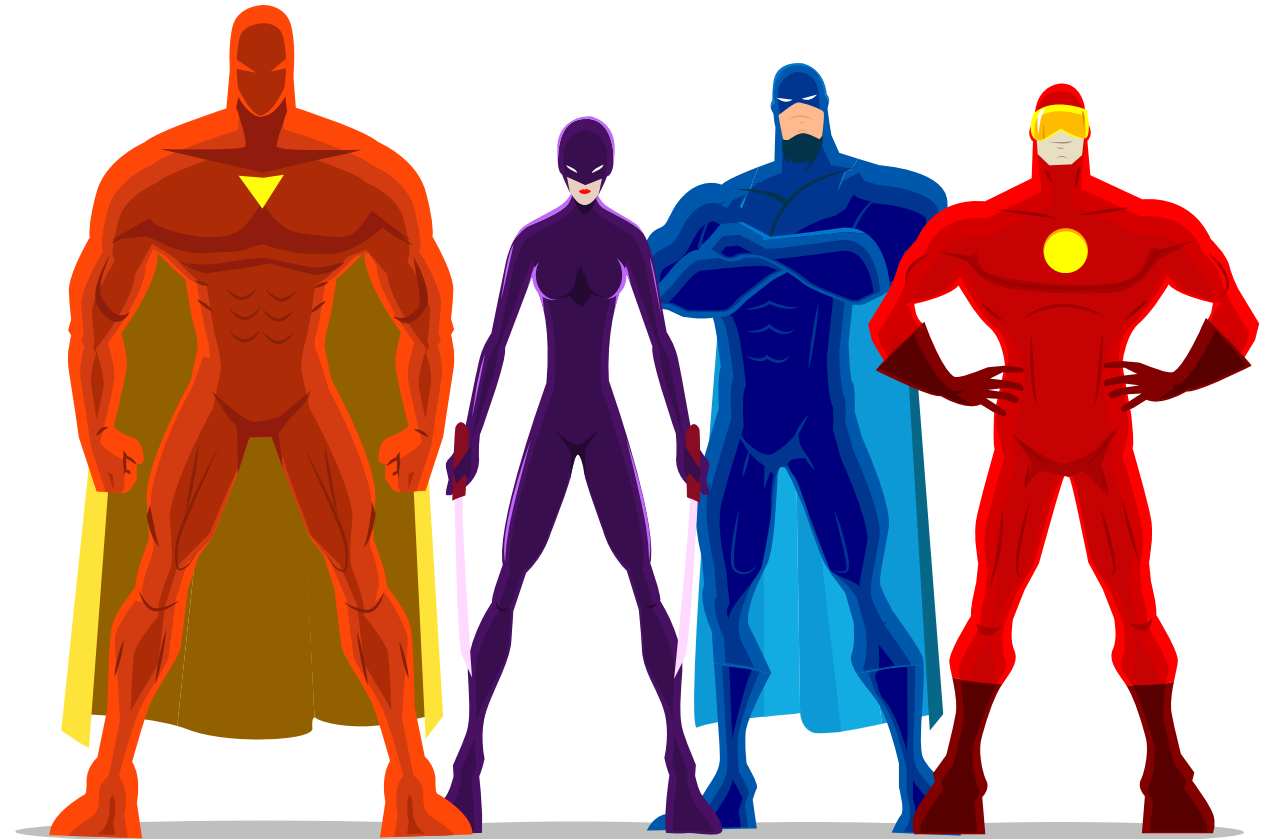
Other Facilities to Assist with Recoveries

- **Recovery Tools**

- OUTCOPY ONLY
 - Build an Image Copy on demand
- Redirected Recovery - INDEP OUTSPACE
- DROPRECOVERY

- **Infamous Drops**

- DROP RECOVERY
 - FULL Support
 - CREATE
 - RECOVERY
 - BIND, etc.



Ready, Prepare, Now... Let's Practice Recovery!!!

Who practices recovery?

- “We never do Recovery!!!”

Why Practice Recovery

- Recovery Time – Application Recovery SLAs
- Software Functionality
- Backup Strategy Confirmation
- Other Recovery Options

What should I practice

- Recovery Utility
- Log Tool
- Building Recovery/Log JCL jobs



How Do We Practice Recovery...

- **Great Question**
 - Simulation
 - Actual Recovery Execution
 - Estimation
- **Simulation - Recoveries**
 - Disaster Recovery
 - Local Subsystem Recovery
 - Local Application Recovery
- **Estimation**
 - Disaster Recovery
 - Find problem objects
 - Application Recovery
- **Collect the Data for use...**

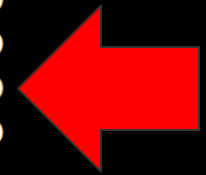


Local System Recovery - Simulation

```
===== Local System Recovery =====
Command ==> _____

Generates JCL to recover active DB2 subsystems at the local site.

Group owner . . . . . _____
Group name prefix . . . . . SIMREC_____
Recover start range . . 2014 - 04 - 30 13 . 08 . 56 (YYYY-MM-DD HH.MM.SS)
Recover end range . . . 2014 - 04 - 30 14 . 08 . 56 (YYYY-MM-DD HH.MM.SS)
  gen one job to convert timestamp to rba . 1 1. Yes 2. No
Job card data set . . . . . .RECMGR.JCL(JOBCARD)_____
System Resource recovery JCL output
  data set name . . . . . .RECMGR.JCL.SIM(SSYSRES)_____
Application data set RECOVER JCL output
  data set name . . . . . .RECMGR.JCL.SIM(SAPPRES)_____
Exclude Data Sharing Members. . . . . _____ Data Sharing only
Bypass Data Sharing Members in Status . . . 2 Quiesced 2 Deact ( 1 or 2 )
Update history file with HISTONLY option. . 2 1. Yes 2. No
Exclude unchanged from recovery . . . . . 2 1. Yes 2. No
Generate Objectset syntax . . . . . 1 1. Yes 2. No
Simulate recovery . . . . . 1 1. Yes 2. No
Include Clones. . . . . 2 1. Yes 2. No
  data set name . . . . . _____
*ARMUFS4 -ISFPCU4
```



Summary

No one should be a recovery expert

However ...

- Recovery Readiness
- Recovery Preparation
- Practice, Practice, Practice
- Be a hero

Recovery Equipment

- Exercise that equipment
 - It gets rusty
- Need to be able to act quickly
- Trust the Resources are Available
- Meet the need of the business



