Customer Experiences Using DB2 Recovery Expert for z/OS
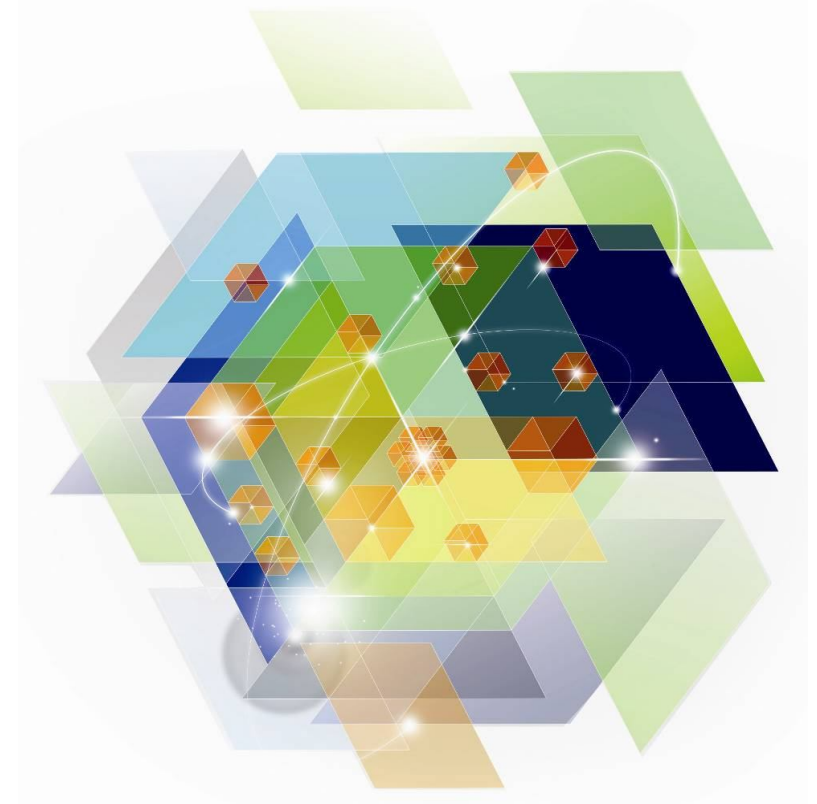
John Campbell, IBM DE, DB2 for z/OS

Anthony Ciabattoni, Product Specialist

May 23, 2012

Joining Us in Discussion Today

John and Anthony will share customer experiences with backup and recovery scenarios and how Recovery Expert can help develop an ongoing strategy

Customer Example – Meeting RTO

- **Worldwide financial company that serves millions of customers online and batch have a strict Recovery Time Objective (RTO):**
  - Minimize downtime to accommodate 24 x7 online users
  - Meet SLAs while reducing costs, especially CPU

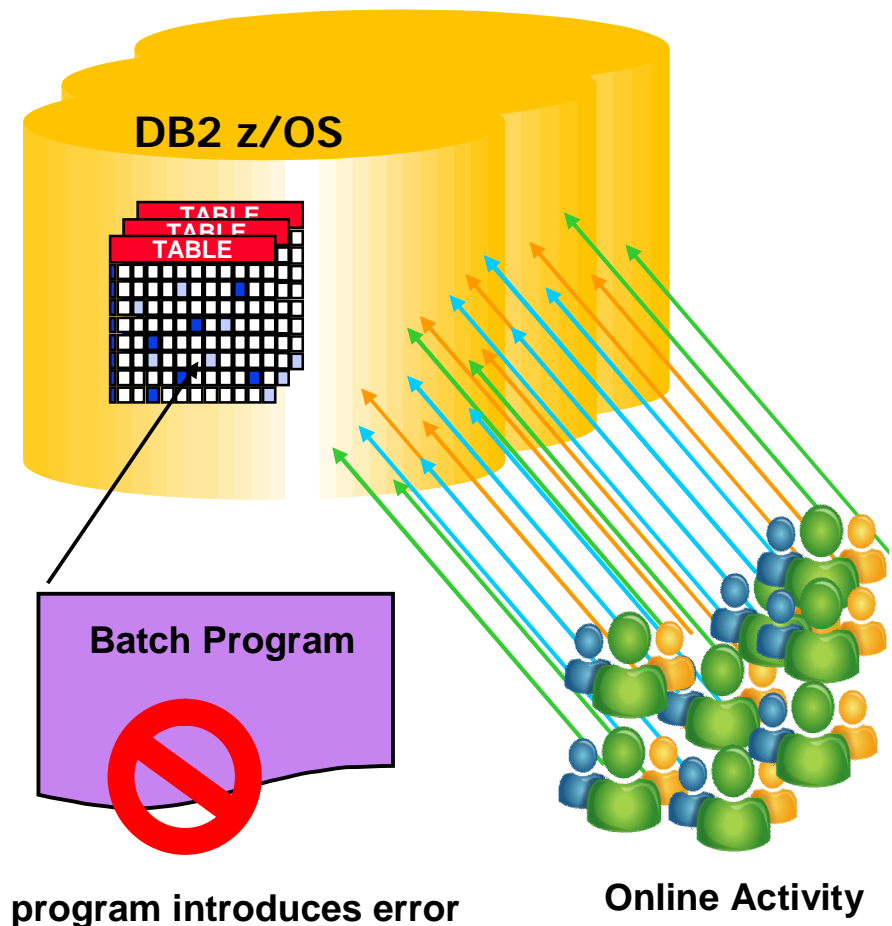| Business	Average cost per hour/downtime
Brokerages	$6.5 MM
Credit Card Authorizations	$2.6 MM
Financial Institutions	$1.495 MM
Airline Reservations	$89,500

Source: Dataquest

Customer DB2 Application Environment

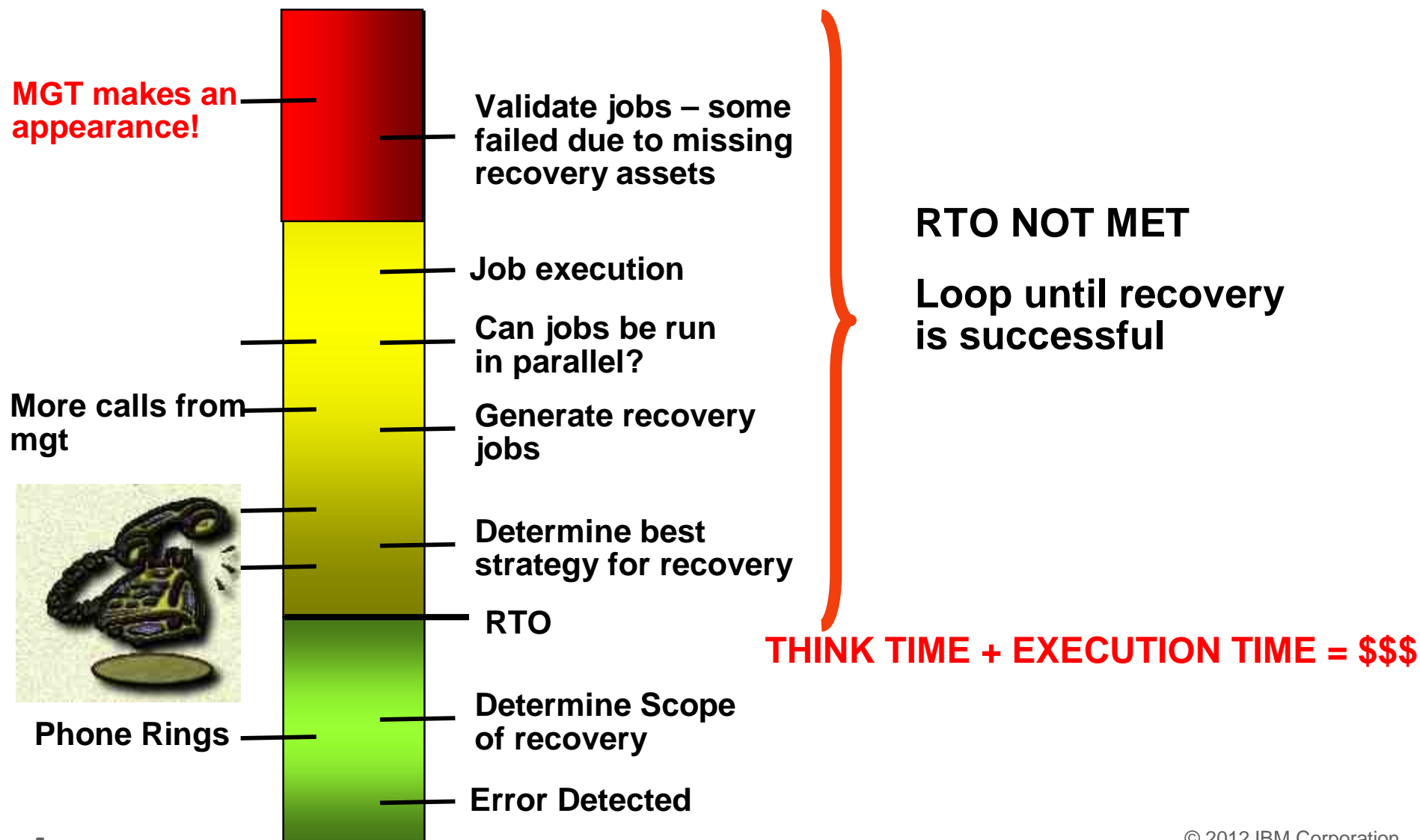- **Business Critical Batch Application**
  - SLA dependent
  - Time sensitive Recovery Time Objective (RTO)
  - Daily/Nightly image copies
    - SHRLEVEL(CHANGE)
  - No specified batch window
  - Application utilizes DB2 enforced RI

- **Application Outage**
  - Batch jobs/packages cause table(s) corruption
    - Incorrect input file used
    - Program logic/SQL changes
    - Table(s) corruption results in a recovery necessity

DB2 z/OS

TABLE
TABLE
TABLE

Batch Program

Batch program introduces error   **Online Activity**

Timeline to Recovery

MGT makes an appearance!

Validate jobs – some failed due to missing recovery assets

Job execution

Can jobs be run in parallel?

More calls from mgt

Generate recovery jobs

Determine best strategy for recovery

RTO

Phone Rings

Determine Scope of recovery

Error Detected

RTO NOT MET

Loop until recovery is successful

THINK TIME + EXECUTION TIME = $$$

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Recovery Advisor | Log Analysis | System Restore | Log Based Recovery | Specifications | Messages | Logs

Recovery Advisor

Objects | New Tab

- Welcome
- 1. Location
- 2. Objects
- 3. Point in Time
- 4. Recovery Plan

Select the objects that you want to recover.

Select the objects you wish to recover in the list of available objects, and click the Include button to add them to the list of objects to recover. The list at the bottom of the window will help you by showing detailed properties for the objects you click on.
In order to define a pattern matching multiple objects, select the node labeled Pattern under the type of object you wish to select, then click the Include button. A window will display where you can type the specific pattern values.
The objects you select, as well as objects related to them, will be recovered. For example, if you select a table space, the tables it contains will also be recovered. On the Recovery Plan page, you should carefully review the complete list of objects under Recovered Objects in the Recovery plans tree.

Available objects

Include | Exclude | Filter

- BOB
- CAMPBELL
- CUST#1
  - ACCOUNT
  - DEPART
  - DEPART_NUM
  - EMPLOYEE_ACCT
  - EMPLOYEE_NUM
  - GLWTACT
  - GLWTDNG
  - GLWTDPT
  - GLWTEMP
  - GLWTENG
  - GLWTEPA
  - GLWTJBS
  - GLWTLCN
  - GLWTLNG
  - GLWTLNM
  - GLWTPGW

Selected objects

Remove | Remove All

- Table CUST#1.DEPART

Properties

Name	Value
Remarks	DePartmenTs within an organisation.
Table space	GLWSDPT
OBID	3
DBID	275
Created timestamp	2012-04-26-12.50.26.478013
Database	CUST#1
Table type	T

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◀ Back | Next ▶ | Save | Close | Help

Select Point in Time

Select from

○ Object definition levels ◉ Recovery history events ○ Quiet times

Events

Timestamp	Start RBA	Database	Space	Space Type	Type	Secondary Ty|	Share Leve
2012-04-26-12.50.26.403602	000022F2E5DD	CUST#1	GLWSDPT	T	C	L	
2012-04-26-12.50.34.261400	0000232E6E00	CUST#1	GLWSDPT	T	S		
2012-04-26-12.50.34.455348	00002332F538	CUST#1	GLWSDPT	T	F	S	R
2012-04-26-14.22.09.455161	000047EB4CA6	CUST#1	GLWSDPT	T	F		C
2012-04-26-14.24.41.555318	000047FCD068	CUST#1	GLWSDPT	T	Q	W	
2012-04-26-14.25.02.070120	0000480BDC99	CUST#1	GLWSDPT	T	Q	W	
2012-04-26-14.29.57.245292	0000480CF9ED	CUST#1	GLWSDPT	T	F		C
2012-04-26-14.30.39.917248	0000481E2C71	CUST#1	GLWSDPT	T	Q	W	
2012-04-26-14.31.56.335989	0000481FBAB1	CUST#1	GLWSDPT	T	F		C

☑ Show events that are not points of consistency   Filter... Refresh

OK Cancel Help

Recovery Plan Generation Options

| Restricted Objects | RECOVER | COPY | **Parallel Jobs** | DDL Options | Rebuild Index |

Specify the options for parallel jobs.

Number of parallel jobs for data recovery [3] ▲▼

Specify the maximum number of concurrent jobs [3] ▲▼

OK Cancel Help

Recovery Advisor | Log Analysis | System Restore | Log Based Recovery | Specifications | Messages | Logs

Recovery Advisor

Recovery Plan | New Tab

Welcome
1. Location
2. Objects
3. Point in Time
4. Recovery Plan

Generate and execute a plan to recover the selected objects.

Click Generate to generate one or more recovery plans for the selected objects. The Generate DDL only checkbox can be used to generate only the DDL for the selected objects. After generating, you can select a plan to review its details.
If it has been some time since you generated the recovery plans, you can click Validate to check whether the external resources required by the plans (such as image copy data sets) are still available.
Finally, select the plan you wish to use for recovery, and click Run to run it. To instead view or edit the JCL generated to run the plan, click View JCL.

─ Recovery plans ─

Generate...   ☐ Generate DDL only

Plans		Properties	
⊞ 🗀 Plan 1: Using RECOVER with BACKOUT (cost = 6.01)		**Name**	**Value**
⊞ 🗀 Plan 2: Using DSN1COPY and RECOVER LOGONLY (cost = 6.24)		Estimated number of disk page copies	19111
⊞ 🗀 Plan 3: Using Restore from System Level Backup and RECOVER LOGONLY (cost = 7.63)		Estimated number of cpu milliseconds	5753
⊞ 🗀 Plan 4: Using RECOVER (cost = 8.74)		Estimated number of tape page copies	0
⊞ 🗀 Plan 5: Using undo SQL (cost = 55.88)		Log point	C001108BB732
⊟ 🗀 Plan 6: Using RECOVER to IC and redo SQL (cost = 57.53)		Estimated number of tape drive allocations	0
⊟ 🗀 Serial Job Group		Estimated number of disk allocations	20
⊞ 🗐 Job 1		Plan name	Using RECOVER to IC and redo SQL
☐ 🗀 Parallel Job Group		Estimated relative cost of the recovery plan	57.53
⊞ 🗐 Job 1			
⊞ 🗐 Job 2			
⊞ 🗐 Job 3			
⊞ 🗐 Job 2			
⊞ 🗀 Plan 7: Using DSN1COPY of IC and redo SQL (cost = 57.62)			
⊟ 🗀 Recovered Objects			
⊞ 🗋 Database CUST#1			
⊞ 🗐 Table space CUST#1.GLWSDPT			
⊞ 🗐 Table space CUST#1.GLWSEMP			
⊞ 🗐 Table space CUST#1.GLWSEPA			
⊞ 🗐 Table space CUST#1.GLWSPJA			
⊞ 🗐 Table space CUST#1.GLWSPRJ			
⊞ 🗐 Table space CUST#1.XGLW0000			

IBM DB2 Recovery Expert for z/OS

Preferences Help About

Recovery Advisor | Log Analysis | System Restore | Log Based Recovery | Specifications | Messages | Logs

Recovery Advisor

Recovery Plan | New Tab

- Welcome
- 1. Location
- 2. Objects
- 3. Point in Time
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Finally, select the plan you wish to use for recovery, and click Run to run it. To instead view or edit the JCL generated to run the plan, click View JCL.

Recovery plans

[Generate...] ☐ Generate DDL only

Plans

- Plan 5: Using RECOVER to IC and redo SQL (cost = 58.23)
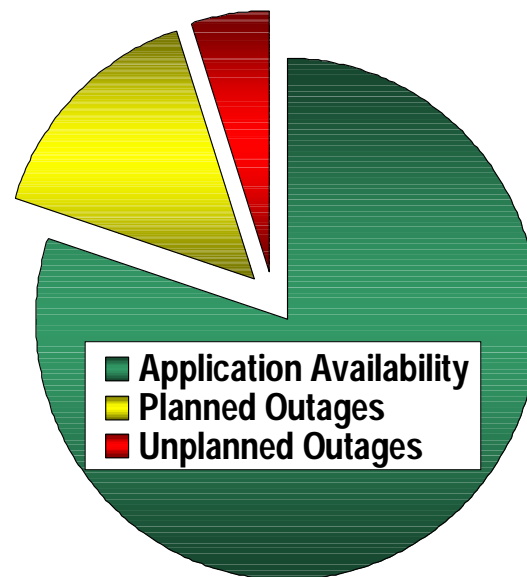 - Serial Job Group
    - Job 1
      - Check Status
      - SQL
      - -START DATABASE
      - Check Status
    - Parallel Job Group
      - Job 1
        - RECOVER
        - REBUILD INDEX
      - Job 2
      - Job 3
    - Job 2
      - REBUILD INDEX
      - CHECK DATA
      - CHECK DATA
      - Log analysis
      - SQL
      - Check Status
      - -START DATABASE
      - Check Status

Properties

Name	Value
Plan name	Using RECOVER to IC and redo SQL
Estimated number of tape drive allocations	0
Estimated relative cost of the recovery plan	58.23
Log point	000110A1A65F
Estimated number of cpu milliseconds	5823
Estimated number of disk allocations	23
Estimated number of tape page copies	0
Estimated number of disk page copies	19813

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How Does Recovery Affect Availability

Got Unplanned Outages???

Application Availability
Planned Outages
Unplanned Outages

WHAT'S THE COST TO <u>YOUR</u> COMPANY WHEN APPLICATIONS ARE DOWN?

Customer Example

- Very large global insurance company

- DBA staff manages multi-database environment, with each DB2 containing various application environments

Customer Application Environment

- THOUSANDS and THOUSANDS of OBJECTS

- Heavy users of DB2-enforced RI

- 100,000+ DB2 packages

- Lots of triggers and stored procedures

- JDBC/OBDC accesses

- 50,000-60,000 tables

- 15TB-20TB environment

- Multiple non-production DB2 environments

- Iterative/fluid development methodology
  - Concurrent projects w/ lots of changes
  - Many schema changes throughout the week
    - Often need to back out implemented schema changes
    - Can range from one to multiple back out changes per week

Backing Out Complex Schema Changes

Without Recovery Expert

DBA selects method of loading data:

- unload/load method
- DSN1COPY method

If unload/load, DBA needs to unload data:

- Unload from current base table
- Unload from an image copy

Drop Table

Recreate table minus the implemented changes

Load data into table

- LOAD utility
- DSN1COPY

If DSN1COPY, DBA needs to rebuild indexes

Execute RUNSTATS on table/indexes

Recreate views
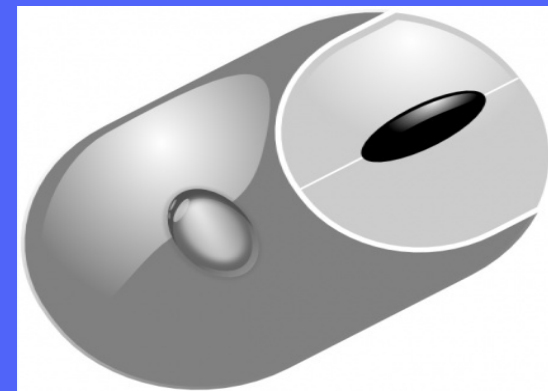
Grant appropriate authorities on table

Recreate RI

Run CHECK utility to validate data integrity

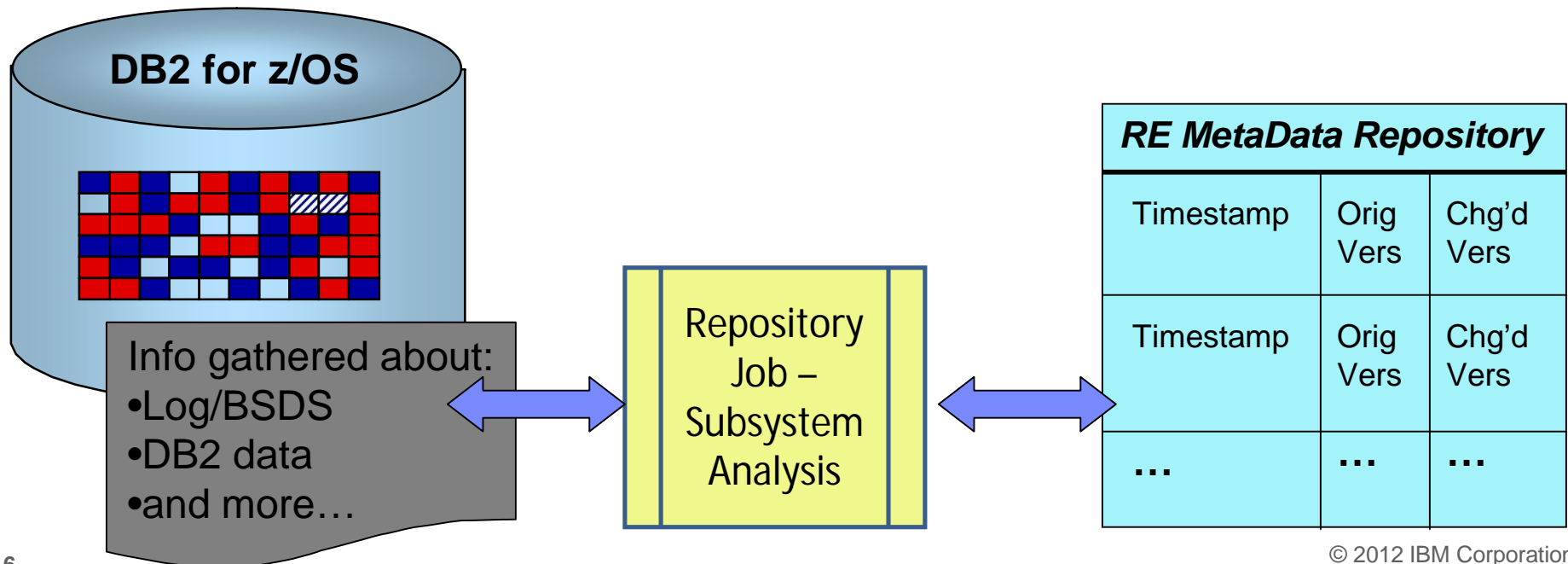Recreate any associated triggers

Bind packages that were invalidated

With Recovery Expert

Point and click!

Recovery Expert Meta Data Repository

- **Backup and Recovery Assets Needed:**
  - System Level Backup/Image Copy
  - Archive Logs
  - Up-to-date Recovery Expert Meta Data Repository

DB2 for z/OS

Info gathered about:
- Log/BSDS
- DB2 data
- and more…

Repository Job – Subsystem Analysis

RE MetaData Repository		
Timestamp	Orig Vers	Chg'd Vers
Timestamp	Orig Vers	Chg'd Vers
…	…	…

Select Point in Time

Select from
(•) Object definition levels   ( ) Recovery history events   ( ) Quiet times

Levels

Type	Qualifier	Name	Level Create Timestamp	Level End Timestamp
Table	CUST#2	GLWTEMP	2012-04-26-12.52.17.767917	2012-04-26-16.18.37.522166
Table	CUST#2	GLWTEMP	2012-04-26-16.18.37.522167	2012-04-26-16.19.29.462317
Table	CUST#2	GLWTEMP	2012-04-26-16.19.29.462318	2012-04-26-16.20.05.577254
Table	CUST#2	GLWTEMP	2012-04-26-16.20.05.577255	2012-04-26-16.35.42.401890
Table	CUST#2	GLWTEMP	2012-04-26-16.35.42.401891	2012-04-26-16.36.16.246984
Table	CUST#2	GLWTEMP	2012-04-26-16.36.16.246985	

Filter...   Refresh

OK Cancel Help

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Recovery Plan Generation Options ⊠

| JCL Parameters | Restricted Objects | RECOVER | COPY | Parallel Jobs | **DDL Options** | Rebuild Index |

Specify the parameters to use for DDL generation.

☑ Grants   ☑ Roles   ☑ Binds

☑ Storage Gorups   ☑ Table Spaces   ○ Packages   ⊙ Packages and Plans

☑ Databases   ☑ Tables   ○ Replace   ⊙ Add

☑ Indexes   ☑ Views   DBRM Library 1 `TSAXC.PA1A.DBRMLIB`

☑ Aliases   ☑ DataTypes   DBRM Library 2

☑ Functions   ☑ Stored Procedures   DBRM Library 3

☑ Synonyms   ☑ Triggers   DBRM Library 4

☑ Sequences

OK   Cancel   Help

Recovery Advisor | Log Analysis | System Restore | Log Based Recovery | Specifications | Messages | Logs

Recovery Advisor

Recovery Plan | New Tab

- Welcome
- 1. Location
- 2. Objects
- 3. Point in Time
- 4. Recovery Plan

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If it has been some time since you generated the recovery plans, you can click Validate to check whether the external resources required by the plans (such as image copy data sets) are still available.

Finally, select the plan you wish to use for recovery, and click Run to run it. To instead view or edit the JCL generated to run the plan, click View JCL.

— Recovery plans —

Generate...   ☐ Generate DDL only

Plans

- ⊟ 📂 Plan 1: Using RECOVER with BACKOUT (cost = 7.16)
  - ⊟ 📂 Serial Job Group
    - ⊞ Job 1
    - ⊞ 📂 Parallel Job Group
    - ⊞ Job 2
- ⊞ 📂 Plan 2: Using DSN1COPY (cost = 7.16)
- ⊞ 📂 Plan 3: Using undo SQL (cost = 60.79)
- ⊞ 📂 Plan 4: Using DSN1COPY and RECOVER LOGONLY (cost = 68.57)
- ⊞ 📂 Plan 5: Using RECOVER (cost = 73.43)
- ⊞ 📂 Plan 6: Using RECOVER to IC and redo SQL (cost = 460.7)
- ⊞ 📂 Plan 7: Using DSN1COPY of IC and redo SQL (cost = 461.1)
- ⊟ 📂 Recovered Objects
  - Storage group SYSDEFLT
  - Database CUST#2
  - Table space CUST#2.GLWSDPT
  - Table space CUST#2.GLWSEMP
  - Table space CUST#2.GLWSEPA
  - Table space CUST#2.GLWSPJA
  - Table space CUST#2.GLWSPRJ
  - Table space CUST#2.XGLW0000
  - Table partition CUST#2.GLWSDPT.0
  - Table partition CUST#2.GLWSEMP.1

Properties

Name	Value
Estimated relative cost of the recovery plan	7.16
Estimated number of tape page copies	0
Estimated number of tape drive allocations	0
Estimated number of disk allocations	23
Estimated number of disk page copies	20983
Log point	000048455470
Plan name	Using RECOVER with BACKOUT
Estimated number of cpu milliseconds	716

Validate | Run | View JCL...

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◄ Back | Next ► | Save | Close | Help

Recovery Expert Benefits

DBA Resource Savings

– *Substantial DBA resources saved*
- *500+ hours annually reduced to 50-60 hours annually*
- *Saved resources can be allocated to other projects*
- *Availability = $$$*

Immaculate Execution

– *Guaranteed Recovery of critical data and objects*

– *Error-prone and manual process replaced by Recovery Expert generating accurate/precise plans/Jobs/JCL*

DB2 10 Customer Experiences

- DB2 10 provides more Online Schema options

  - Defer Alter for various object types with no recovery possible

- With Recovery Expert

  - *Ability to reverse conversion*
  - *Recover up to QUIESCE point prior to REORG materializing*

COMING ATTRACTIONS

Recovery Expert V2.2	**APAR PM63101**
Recovery Expert V3.1	**Coming Soon !**

Customer Example

- **Large health care provider with multiple subsidiaries for government and private customers**

- **Process over 400M claims with over 12M enrollment transactions**

- **Cover over 5M customers**

- **Large z196 environment with multiple LPARS of test, production, maintenance, QA**

- **Use IBM Storage of DS8100**

Customer Application Architecture

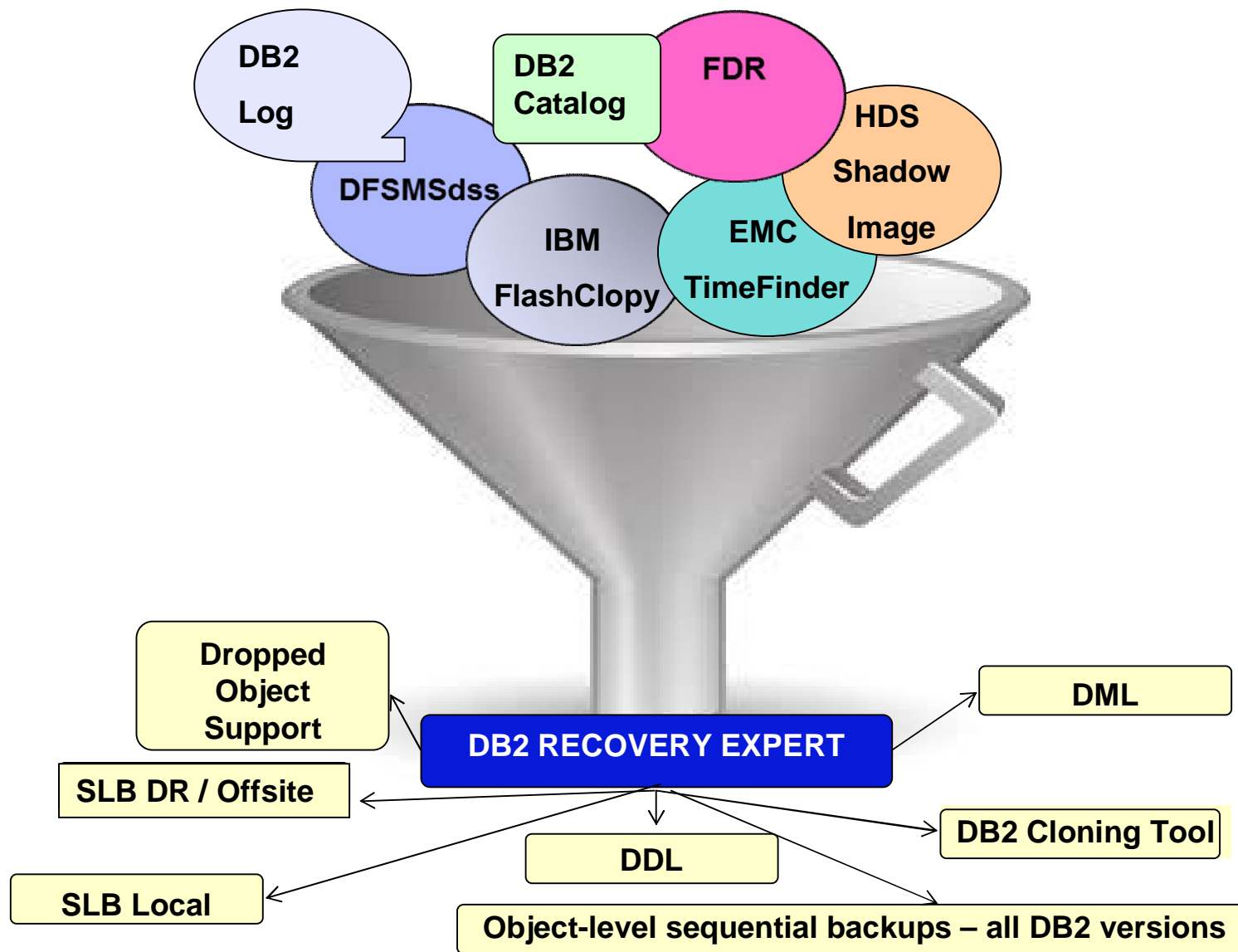- Application System availability 20 x 6

- Mix of online and batch applications
  - Mix of COBOL and JAVA
  - Mix of web-based and ISPF – with ISPF being phased out

- Near Real-Time Processing Claims

- Batch claims process 5 times daily

- Interactive claims process within minutes

- Process approximately over 800,000 medical claims per day

- Process approximately 500,000 pharmacy claims per day

Backup and Recovery Strategy

- **Prior (to RE) DB2 Backup strategy**
  - DB2 Archive Logs multiple times daily
  - 1200 to 1300 traditional DB2 image copies daily
  - Subset of critical tables image copied multiple times/day
  - Growth of critical tables is increasing image copy elapsed time

- **Customer has a CPU charge back model**
  - Get charged for each and every CPU second that is consumed
  - Able and licensed to use the fast replication technology

- **Desired (with RE) strategy**
  - Use Fast Replication for DB2 System Level Backup (SLB)
  - Archive DB2 logs multiple times/day

DB2 RECOVERY EXPERT – In's and Out's

DB2 Log

DB2 Catalog

FDR

HDS Shadow Image

DFSMSdss

IBM FlashClopy

EMC TimeFinder

DB2 RECOVERY EXPERT

Dropped Object Support

DML

SLB DR / Offsite

DB2 Cloning Tool

DDL

SLB Local

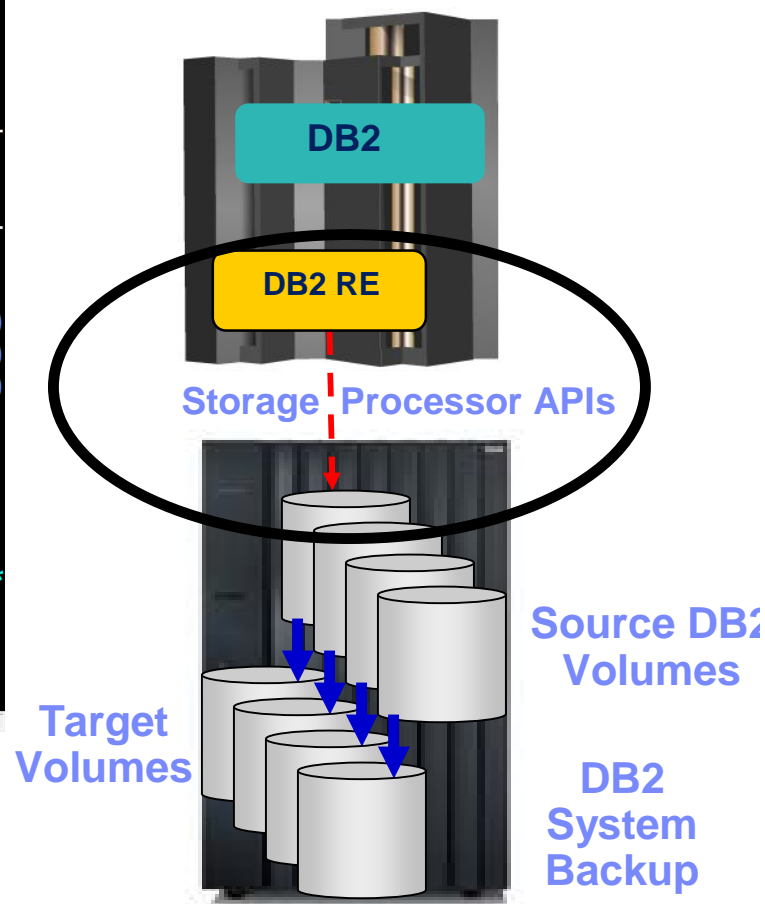Object-level sequential backups – all DB2 versions

IBM DB2 RE System Level Backup Solution

```
S1 - montpellier - montpellier - BlueZone Mainframe Display
File  Edit  Session  Options  Transfer  View  Script  Help

Connections: montpellier          Attention  PA1  PA2  PA3  Reset  PF01 PF02 PF03 PF04 PF05 PF06 PF07 PF08 PF12  System Request

RCVYXPRT  V2R2 ---------- Update Backup Profile --------- 2012/04/12  21:40:05
Option  ===>                                             Scroll ===> PAGE


    Commands: ? - Show all commands
Line Commands: I - Insert  D - Delete  X - Exclude  U - Undo from exclude


--------------------------------------------------------------------------
Creator: SUDBRE    Name: DB31 PARTIAL BACKUP          SSID: DB31
Share Option: U  (Upd,View,No)   Description: PARTIAL BACKUP USING flashcopy
-------------------------------- Backup Options --------------------------
Backup Method    ==> L  (B/S/F/D/L)      Current Generation==> 01
Backup Scope     ==> D  (Full/Data)      Setup Needed      ==> Y
Backup Generations==> 01 (01 - 99)       Issue Log Suspend ==> Y  (Yes/No)
Offload Options  ==> N  (Yes/No/Update)  Validate DB2 Vols ==> Y  (Yes/No)
                                         Enable Obj Restore==> Y  (Yes/No)
----------------- Volume Mappings ----------------         Row 1 of 2
      Source   Dev    Src   Target
Cmd   Volumes  Type   Unit  Volumes   Message Area
_     DB3CA1   3390-3 39C0  DB3PB2
_     DB3US1   3390-3 39C1  DB3PBK
*********************** Bottom of Data ***********************************

S1    Ready (1)       10.3.20.52            TN3270      16:40:59 4/12/2012    NUM    00:02:27    12, 024
```
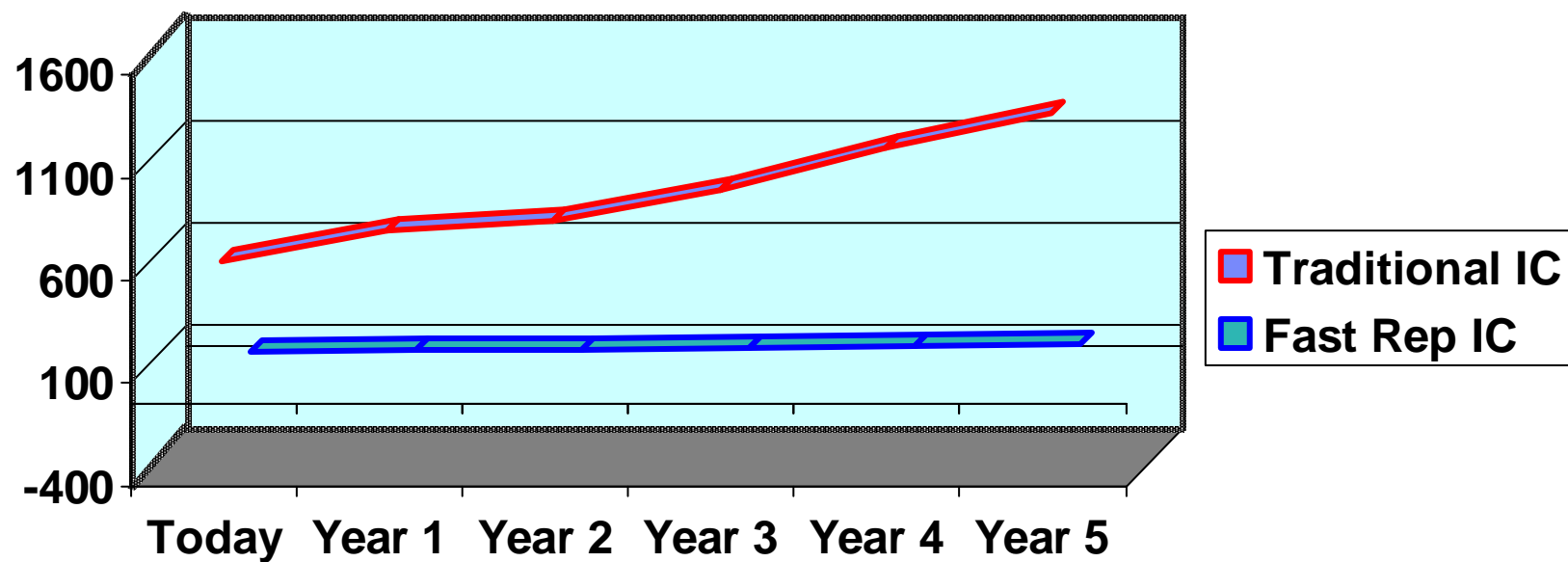
DB2

DB2 RE

Storage Processor APIs

Target Volumes

Source DB2 Volumes

DB2 System Backup

RE SLB replaces traditional ICs
One SLB = One Job

Lab testing: 13 TB in .5 Seconds
executed on storage processor!

CPU Savings with Recovery Expert

Backup and Recovery Summary

- **Complexity of recovery**

  - Recovery requires lots of time, effort and resources to plan/create/maintain

  - Unexpected stressful situations with executive scrutiny

- **Why Recovery Expert**

  - Reduces application service down time with faster and guaranteed recovery

  - Ability to easily back out unwanted schema changes or errors
    - Improves availability and application time to market
    - Industry-leading capability in DB2 10
  - Only storage-aware database product in industry
    - Multi-vendor support
    - Operational simplicity and efficiency
    - Ensures assets exist prior to backup/recovery
    - Integration with IBM DB2 Cloning Tool for z/OS for additional value
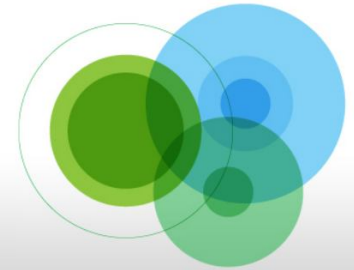
For more information…

- **Join John, Anthony and Denise at IOD**
  - DB2 Recovery Expert session with more information

- **Take advantage of a Recovery Planning Workshop (RPW)**
  - Information to help you understand the best practices for data recovery, planned and unplanned, in local and in disaster recovery environments

- **Use the Recovery Readiness Reporter (RRR)**
  - RRR is a reporting tool that will report on potential recovery deficiencies and assess current backup resource usage
  - It will expose those DB2 or IMS resources that may be missing backups - causing recoveries to fail
  - The recovery resources are analyzed for a given DB2 subsystem or IMS Control region

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InformationOnDemand 2012
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Mandalay Bay | Las Vegas, Nevada

DB2 for z/OS

DB2 Recovery Planning Management Workshop

Planning for the loss of data or system availability is probably not high on your daily list of action items. But, knowing that if disaster strikes, you can ensure the full and complete recoverability of your key data assets with the least amount of impact, is top on your priority list.

DB2 for z/OS is the database of choice for many of the top Fortune 500 companies. It is becoming more and more important to protect data and in the case of a disaster, be able to restart and recover as fast as possible. You need to understand the traditional DB2-based solution which consists of safe keeping and restoring image copies and logs. You also need to know general functions, applicable not only to DB2 data, but to the whole system, are hardware related, such as tape vaulting or disk volumes mirroring.

Learn the latest DB2 for z/OS enhancements that can also provide critical Point-In-Time recoveries. The disaster recovery solution consists of the combination of coherent options that best fit in with your needs, your current environment, and most importantly - your investment.

For more information, contact cjanace@us.ibm.com

Thank You

If you'd like to contact one our speakers:

John Campbell
campbelj@uk.ibm.com

Anthony Ciabattoni
Aciabattoni@rs.com