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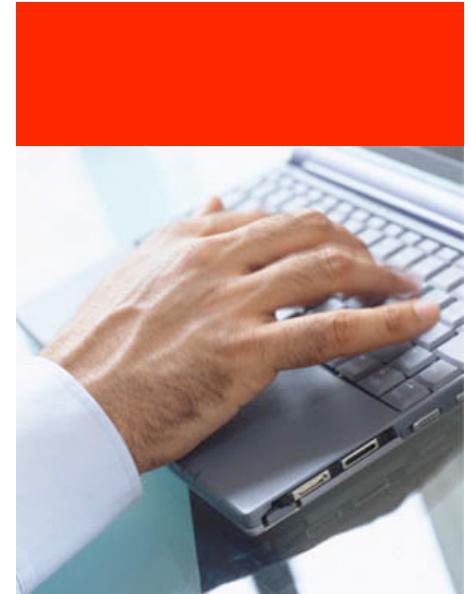
Oracle Database Backup-and-Recovery Best Practices and New Features

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Database High Availability

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VLDB Expert
Turkcell Communication Services

Agenda

- What Keeps You Awake at Night?
- Oracle Data Protection Planning & Solutions
- Oracle Backup & Recovery Solutions
 - Physical Data Protection
 - Recovery Manager
 - Oracle Secure Backup
 - Logical Data Protection
 - Flashback Technologies
 - Recovery Analysis
 - Data Recovery Advisor
 - Putting It All Together: Customer Example
- Turkcell Backup & Recovery Case Study
- Q&A



What Keeps You Awake at Night?

Data Protection Concerns...



- Meeting recovery SLAs?
- Reducing exposure to data loss?
- Meeting backup windows?
- Dealing with long-term backup storage?
- Management complexity?
- Budget?

...Where do I begin?

Assess Recovery Requirements

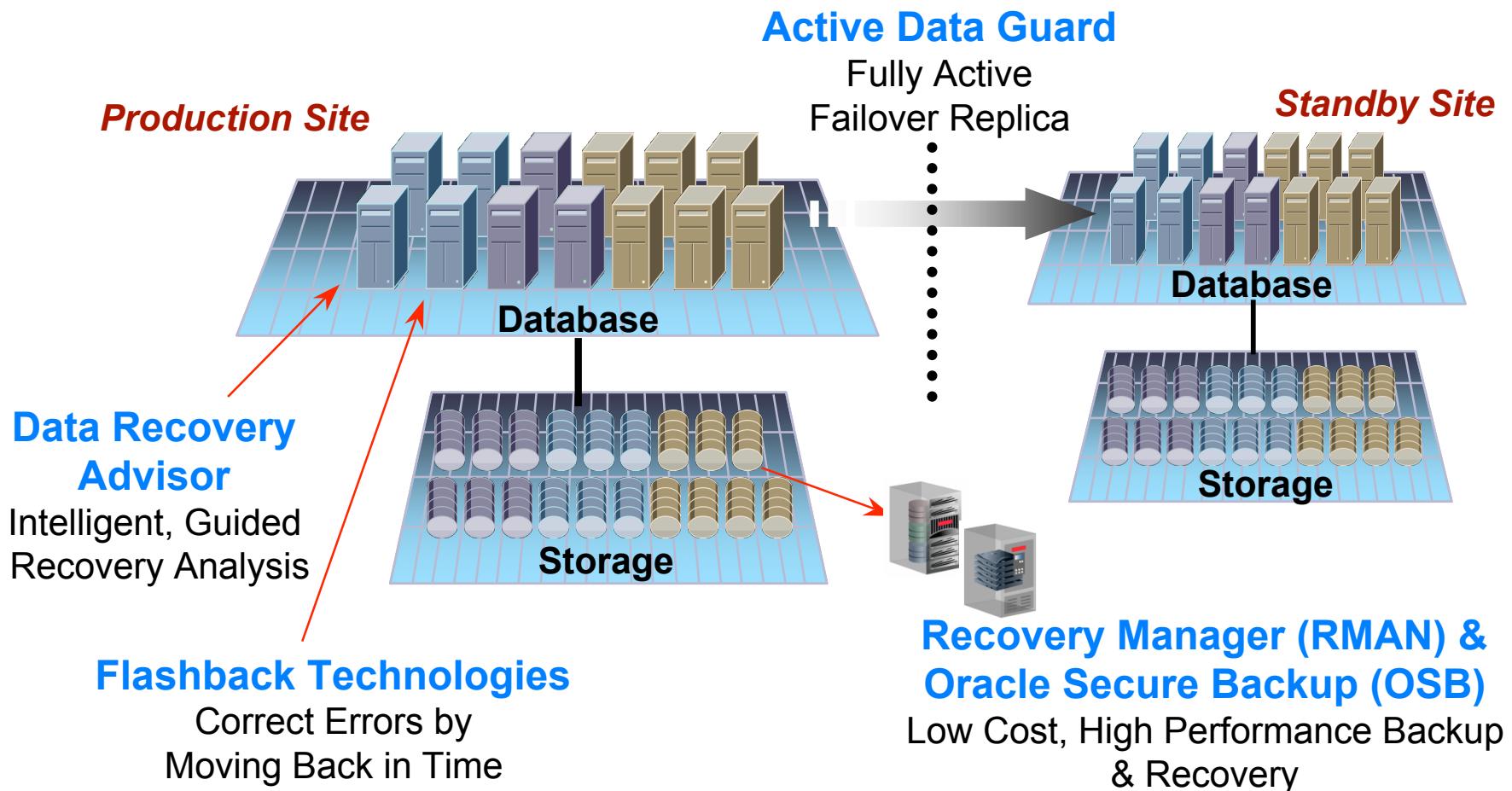
First Step in Data Protection Planning



- **Identify** and prioritize critical data
- **Design** recovery requirements around data criticality
 - Assess tolerance for data loss - *Recovery Point Objective (RPO)*
 - How frequently should backups be taken?
 - Point-in-time recovery required?
 - Assess tolerance for downtime - *Recovery Time Objective (RTO)*
 - Downtime: Problem identification + recovery planning + systems recovery
 - Tiered RTO per level of granularity, e.g. database, tablespace, table, row
 - Determine backup retention policy
 - Onsite, offsite, long-term
- **Assess** data protection requirements
 - Physical: Disasters, outages, failures, corruptions
 - Logical: Human errors, application errors

Oracle Maximum Availability Architecture

Robust & Integrated Data Protection



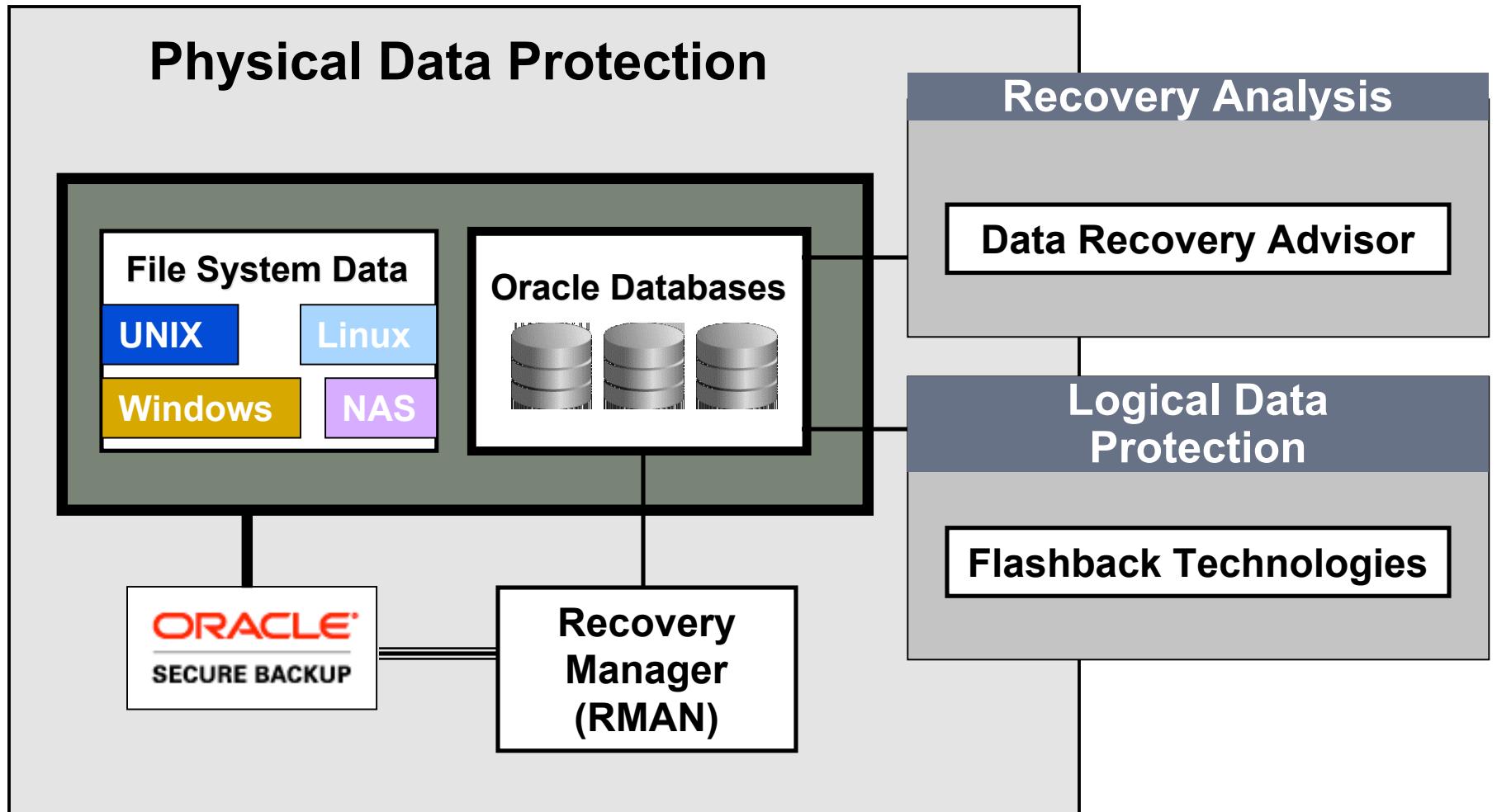
Oracle Data Protection Solutions

Backup & Recovery	Recovery Time Objective (RTO)
Physical Data Protection <ul style="list-style-type: none">• Recovery Manager (RMAN)• Oracle Secure Backup (OSB)	Hours/Days
Logical Data Protection <ul style="list-style-type: none">• Flashback Technologies	Minutes/Hours
Recovery Analysis <ul style="list-style-type: none">• Data Recovery Advisor	Minimizes time for problem identification & recovery planning

Disaster Recovery	Recovery Time Objective (RTO)
Physical Data Protection <ul style="list-style-type: none">• Active Data Guard	Seconds/Minutes

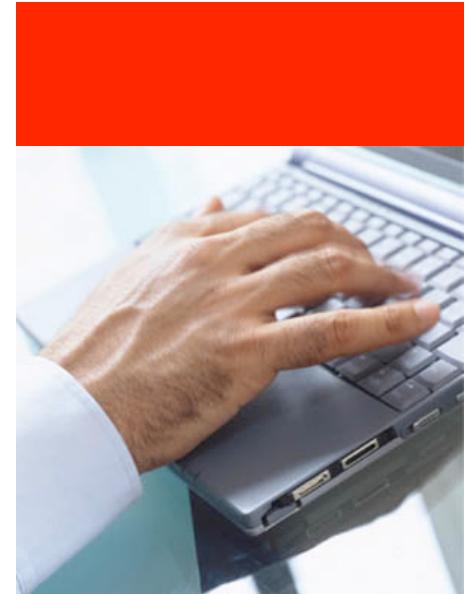
Oracle Backup & Recovery Solutions

“Backup and Recovery on Steroids”



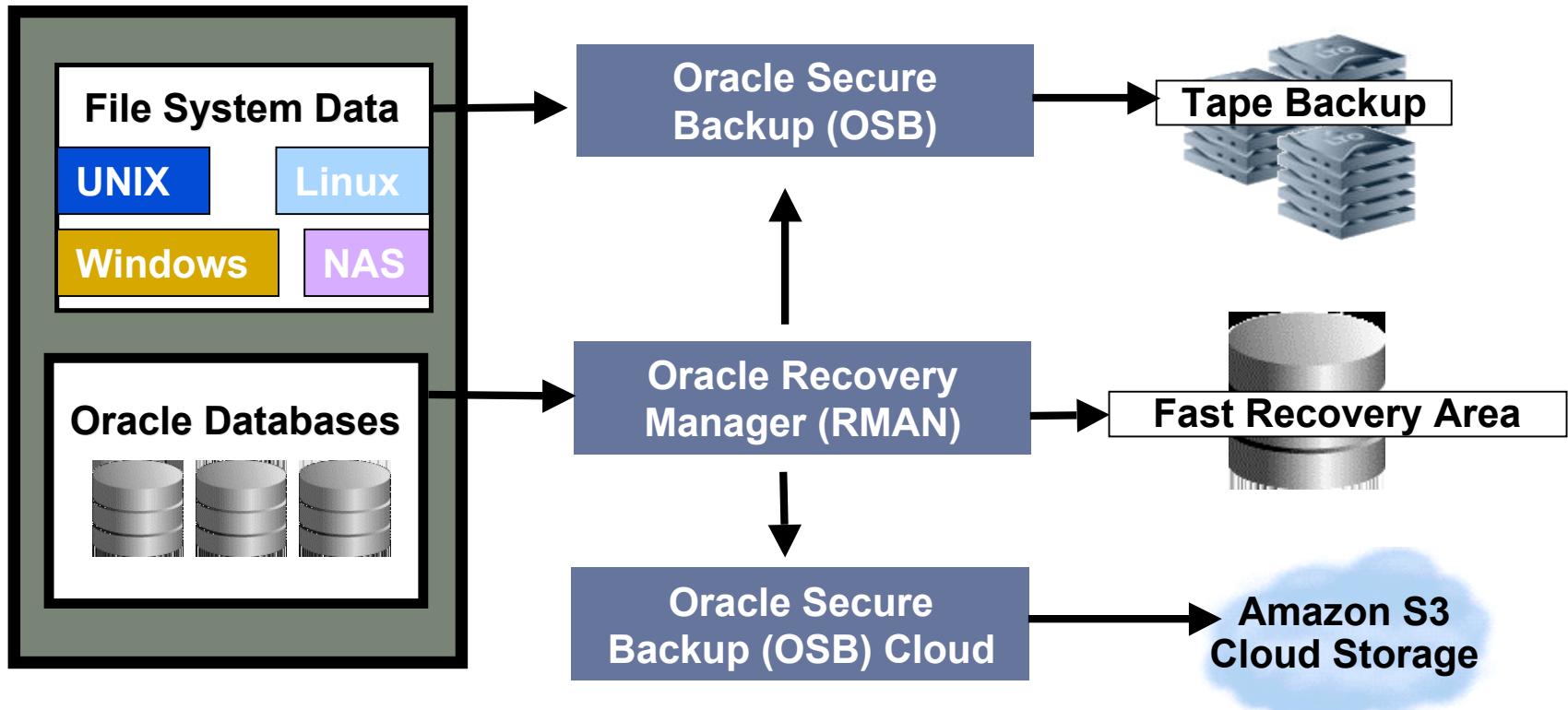
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Backup & Recovery Foundation

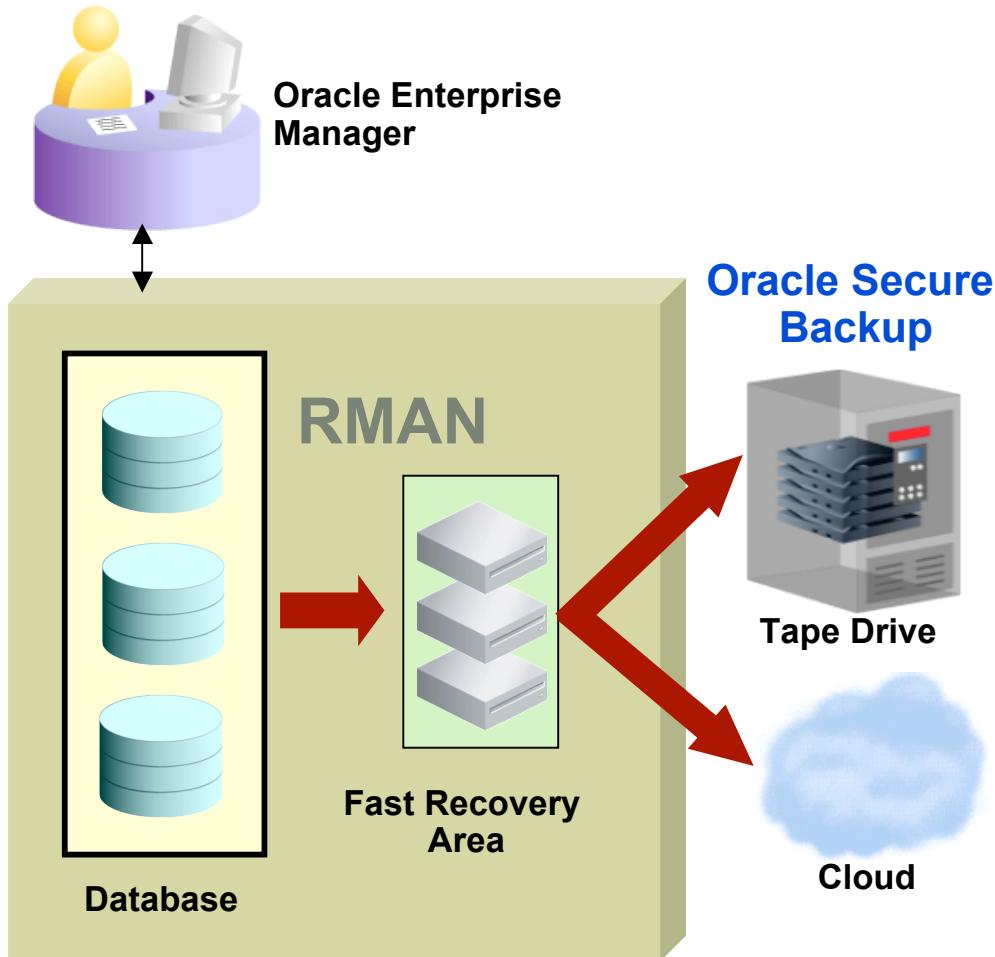
Complete Oracle Solution from Disk to Tape



- Oracle backup and recovery for your entire IT environment
- Multiple media options available to meet the most stringent SLAs
 - Local disk, remote Cloud storage, physical and virtual tape

Oracle Recovery Manager (RMAN)

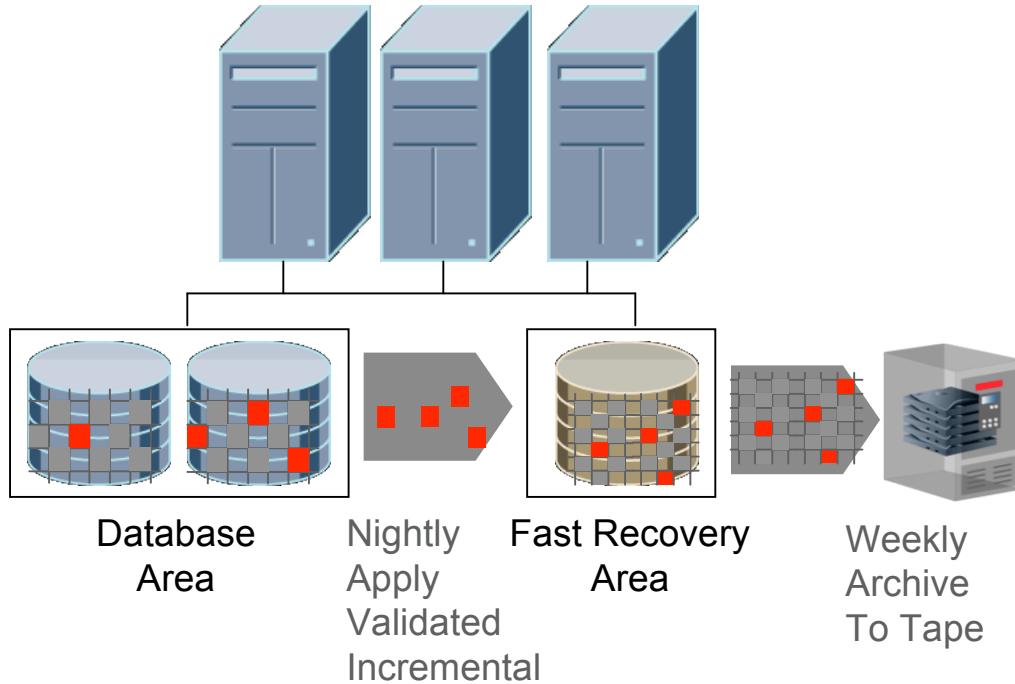
Oracle-integrated Backup & Recovery Engine



- Intrinsic knowledge of database file formats and recovery procedures
 - Block validation
 - Online block-level recovery
 - Tablespace/data file recovery
 - Online, multi-streamed backup
 - Unused block compression
 - Native encryption
- Integrated disk, tape & cloud backup leveraging the Fast Recovery Area and Oracle Secure Backup

Oracle Fast Recovery Area

Automatic Disk-to-Disk (D2D) Backup & Recovery



Integrated backup-storage tiering

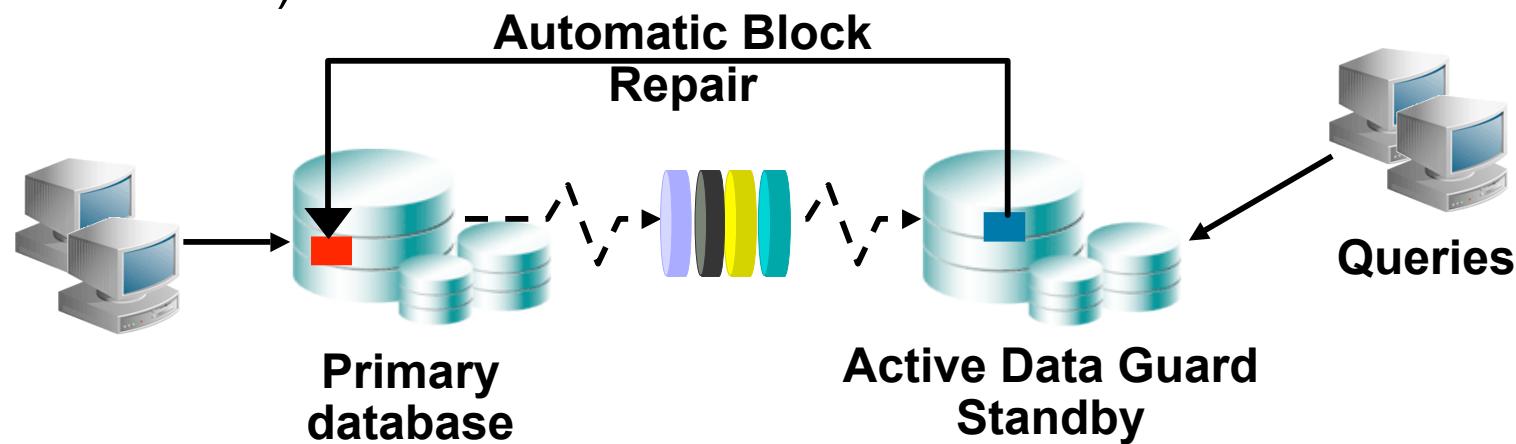
- Fast Recovery Area – Integrated D2D backup and recovery
 - Favorable disk economics – low-cost disks used for recovery area
 - Oracle makes it even better with ‘restore-free recovery’:
 - `switch datafile 4 to copy;`
 - `recover datafile 4;`
- Fast incremental backups
 - Backs up only changed blocks
 - Changed blocks are tracked using a very efficient algorithm, e.g. 20X faster
- Nightly incremental backup rolls forward recovery area backup
 - No need to do full backups
 - `recover copy of database with tag 'ORCL' ;`

RMAN New Features

Oracle Database 11g Release 2

- Automatic Block Repair

- Allows corrupt blocks on the primary database to be automatically repaired from physical standby database, as they are detected.
- In-line and transparent. User sees brief wait from query on corrupt block while it is being repaired.
- Can also be performed on-demand via RECOVER command
- Requires Active Data Guard (real-time query on physical standby database).



RMAN New Features

Oracle Database 11g Release 2

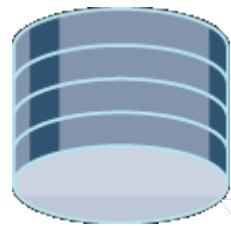
- Backup compression: popular way to save on storage costs
- Multiple RMAN backup compression levels
 - Choose compression levels & backup throughput
 - **[BASIC] | HIGH | MEDIUM | LOW**
 - HIGH – reduces backup size by 40%+ depending on data type
 - LOW – least impact on backup throughput
 - MEDIUM – best balance between compression and throughput
 - HIGH | MEDIUM | LOW require Advanced Compression Option

RMAN New Features

Oracle Database 11g Release 2

- In previous releases, DUPLICATE required RMAN client connections to source and clone databases.
- With enhanced DUPLICATE, connection to source database not needed for environments where network connection is not available.

Source Database

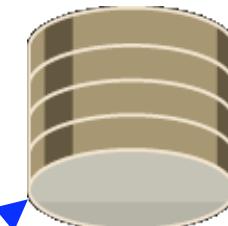


Firewall
Restriction

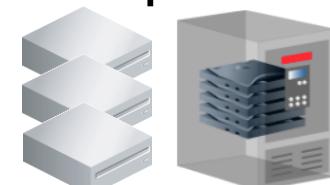
SQL Net
Connections

RMAN
Client

Clone Database



Restore
Processes



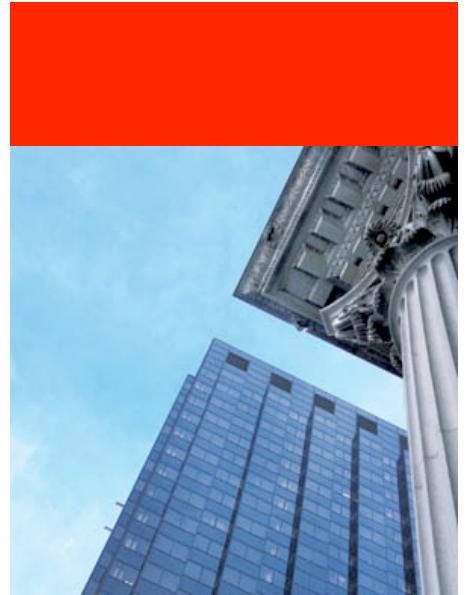
Disk/Tape Backup

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Additional RMAN New Features

Feature	Benefit
Backup Fast Recovery Area to disk	<ul style="list-style-type: none">Protect Fast Recovery Area with on-disk backup of its RMAN backups, archived logs, and controlfiles.
Extended tablespace point-in-time recovery (TSPITR) capabilities	<ul style="list-style-type: none">Recover a dropped tablespace.Perform multiple tablespace point-in-time recoveries, without requiring recovery catalog
Resumable DUPLICATE	<ul style="list-style-type: none">DUPLICATE can resume processing from most points of failure, reducing overall time.
CONVERT DATABASE can skip unneeded datafiles	<ul style="list-style-type: none">Reduces overall conversion time by only processing the required UNDO-containing data files.
SET NEWNAME FOR TABLESPACE DATABASE	<ul style="list-style-type: none">Simplifies renaming of datafiles for RESTORE, DUPLICATE, and TSPITR operations.

RMAN Best Practices



RMAN Best Practices

- Fast Recovery Area (FRA) guidelines
 - Place FRA on separate storage & store backups, in addition to copy of control file, redo logs, and archived logs, to protect all needed recovery-related files from production outages.
 - When estimating FRA size, if you want to keep:
 - Control file backups and archived logs
 - Estimate archived logs generated between successive backups on the busiest days and multiply total size by 2 to account for activity spikes.
 - Archived logs and Flashback logs
 - Multiply the archived log size between backups by 4, assuming Flashback retention = time between archived log backups.
 - Incremental backups
 - Add in their estimated sizes
 - On-disk image copy backup
 - Add in size of the database minus the size of temp files

RMAN Performance Factors

Balancing Backup and Restore Requirements

Consideration	Performance Effect
Incremental Backup Strategy	<ul style="list-style-type: none">Incremental backup strategy improves backup performance, with trade-off in recovery performanceEnable block change tracking for fast incremental backupsCumulative vs. differential incremental backups‘Incremental forever’ requires an initial full then incrementals thereafter<ul style="list-style-type: none">Fast recovery: Current image copy of database readily available
Multiplexing	<ul style="list-style-type: none">Backup ‘x’ files in parallel per channel, improving backup performanceRMAN multiplexing level = <code>min(FILESPERSET, MAXOPENFILES)</code>Exception: Set <code>MAXOPENFILES = 1</code> for SAME or ASM datafilesSet # of RMAN channels = # of tape drives, so that <i>media management multiplexing is not used for RMAN backups</i><ul style="list-style-type: none">Setting # of RMAN channels > # of tape drives will impact restore, due to interleaved backup pieces on single tape
Hardware/Network/Storage	<ul style="list-style-type: none">Assess host resources, production disk I/O, HBA/network, tape drive throughputMinimum performant component of these will be performance bottleneck

Data Warehouse B&R Best Practices

- Exploit partitioning and read-only tablespaces
 - Older partitions can be moved to read-only tablespaces
 - Backup read-only tablespaces once, then periodically, depending on tape retention policy
- Divide full backup workload across multiple days
- Leverage database & backup compression
- Save time with tablespace level backups
 - Backup index tablespaces less frequently than data tablespaces
 - Backup scarcely used tablespaces less frequently
 - Reduce restore time for most critical tablespaces, by grouping them together in separate backups
- Take incremental backup when NOLOGGING operations finish to ensure recoverability

Test, Test, Test Recovery...



Recovery Scenario	Oracle Technologies
Media Failure	RMAN – restore all files to new storage location
Block Corruption	RMAN Validate, Block Media Recovery, Trial Recovery, LogMiner
User/Logical Error	Flashback Technologies, RMAN TSPITR, LogMiner
Disaster	Data Guard; RMAN -- restore all files to new host/storage

- **Data Recovery Advisor – built-in database failure diagnosis, analysis, & repair tool**

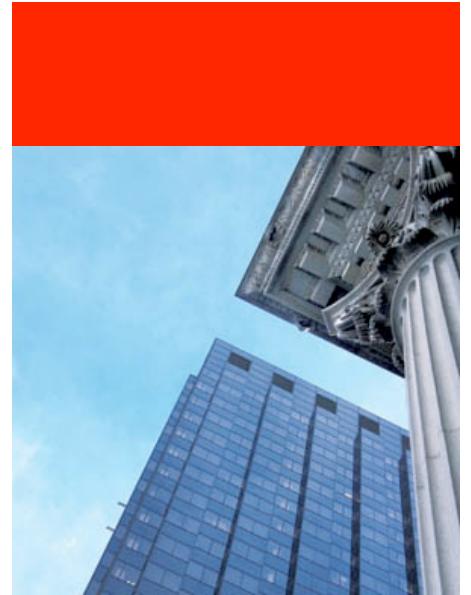
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DATABASE 11g

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Additional Resources

- RMAN Step-by-Step Performance Tuning (NEW)
 - http://www.oracle.com/technology/deploy/availability/pdf/rman_tuning_mm_bp.pdf
- Very Large Database Backup & Recovery Best Practices
 - http://www.oracle.com/technology/deploy/availability/pdf/vldb_br.pdf
- Best Practices using Recovery Manager with Oracle Data Guard and Oracle Streams
 - <http://www.oracle.com/technology/deploy/availability/pdf/oracle-openworld-2008/298772.pdf>

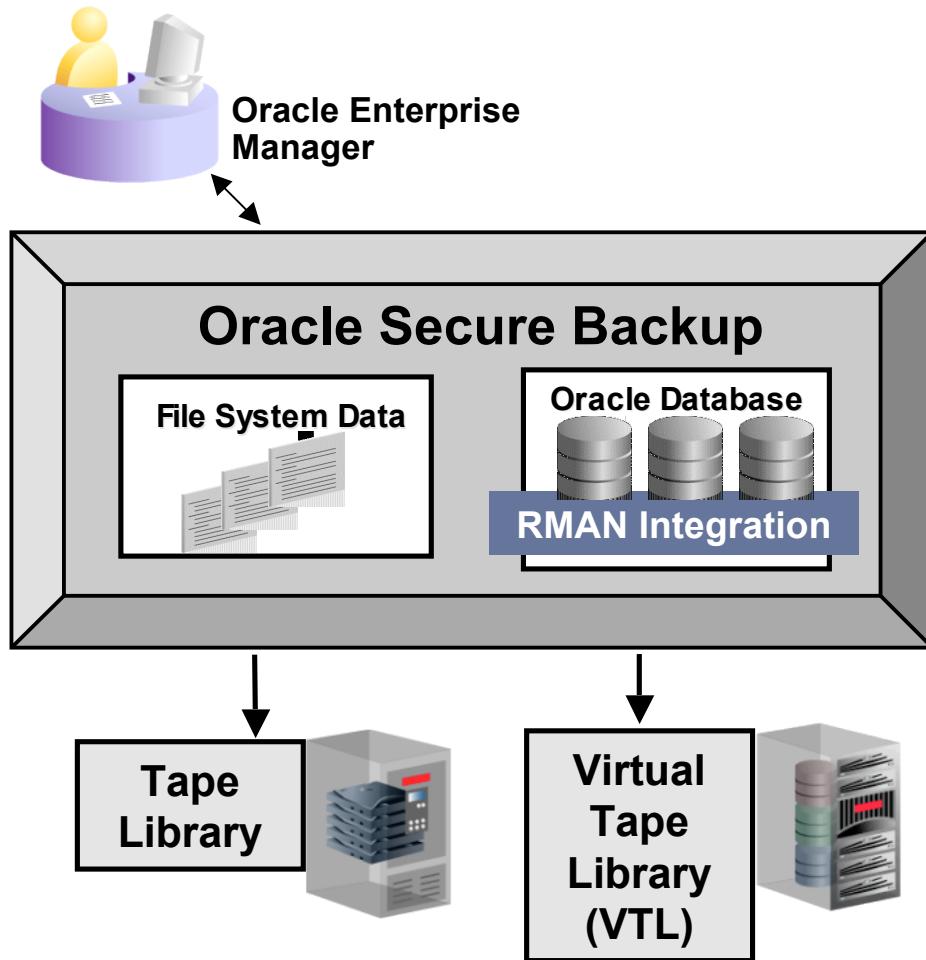
Oracle Secure Backup



Oracle Secure Backup (OSB)

Enterprise Tape Backup Management

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SECURE BACKUP



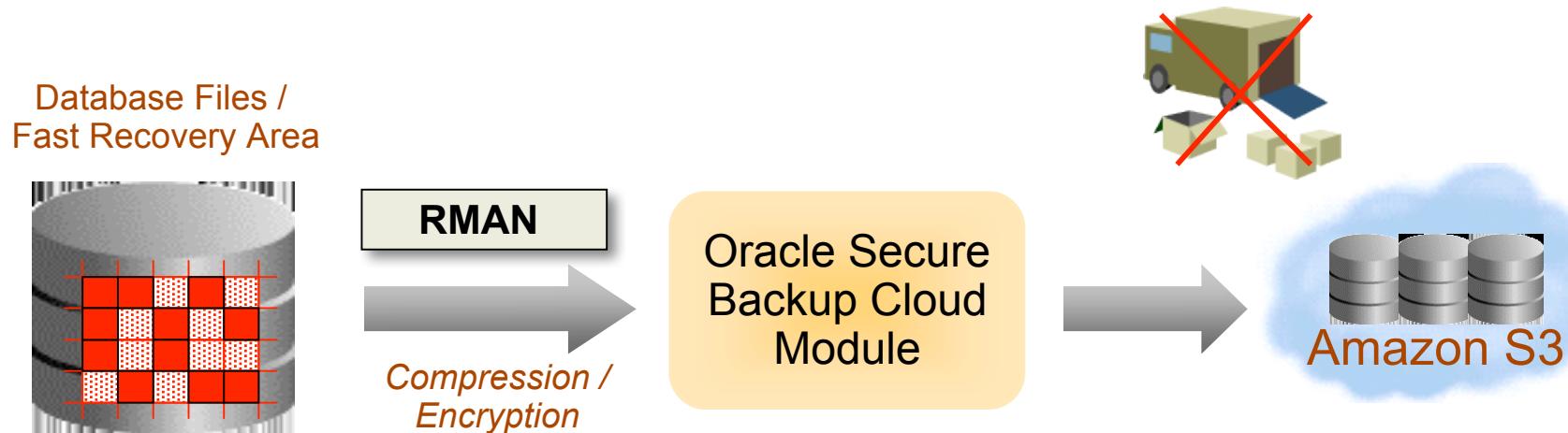
Protects Entire IT Environment

- Oracle Database 11g Release 2 to Oracle9i
- **25 – 40% faster tape backup**
- Heterogeneous file systems (UNIX/Linux / Windows) and NAS devices
- **Built-in Oracle Integration**
- Centralized management in distributed environments
- **Over 75% less expensive than comparable products**

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Oracle Secure Backup Cloud Module

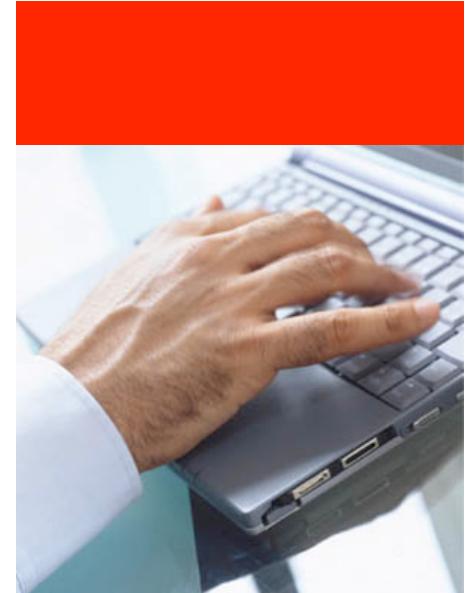
Offsite Database Backups in the Cloud



- Oracle Secure Backup Cloud module: Backup databases to Amazon Cloud
 - Complements local disk and/or tape backup
 - Eliminates IT management overhead of a disaster recovery site
 - Backed by Amazon S3 uptime SLAs
- \$3,500 per RMAN channel
- More information: <http://www.oracle.com/technology/tech/cloud/index.html>

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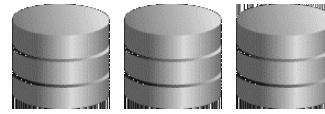


Logical Data Protection

Fast 'Rewind' of Logical Errors

Physical Data Protection

File System Data
UNIX
Linux
Windows
NAS

Oracle Databases


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SECURE BACKUP

Recovery Manager (RMAN)

Recovery Analysis

Data Recovery Advisor

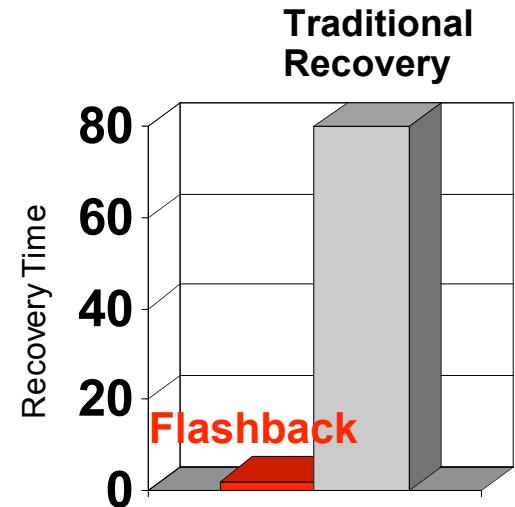
Logical Data Protection

Flashback Technologies

Flashback Technologies

Error Detection & Correction

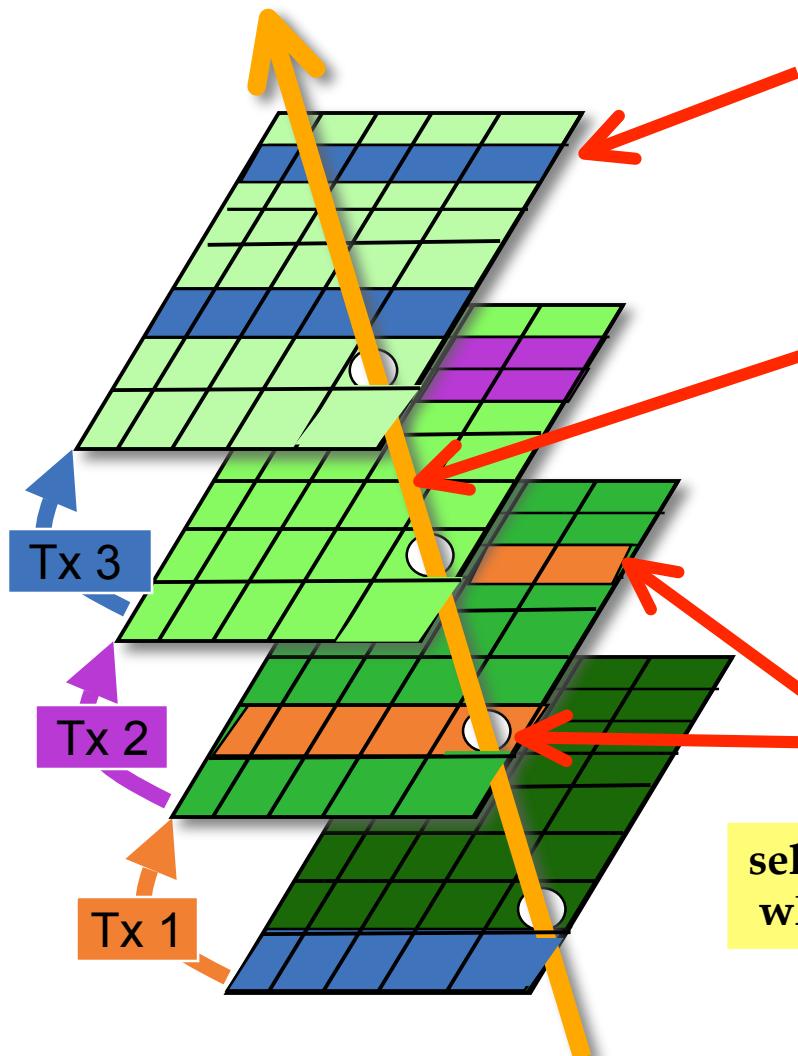
- Flashback revolutionizes error recovery
 - View 'good' data as of a past point-in-time
 - Simply rewind data changes
 - Time to correct error equals time to make error



Correction Time = Error Time + ~~f(DB_SIZE)~~

- Low impact
- Excellent tool for configuring QA, Dev and Training databases
- Flashback is easy – simple commands, no complex procedure

Error Investigation with Flashback



- **Flashback Query**

- Query all data at point in time

```
select * from Salary AS OF '12:00 P.M.' where ...
```

- **Flashback Version Query**

- See all versions of a row between times
- See transactions that changed the row

```
select * from Salary VERSIONS BETWEEN '12:00 PM' and '2:00 PM' where ...
```

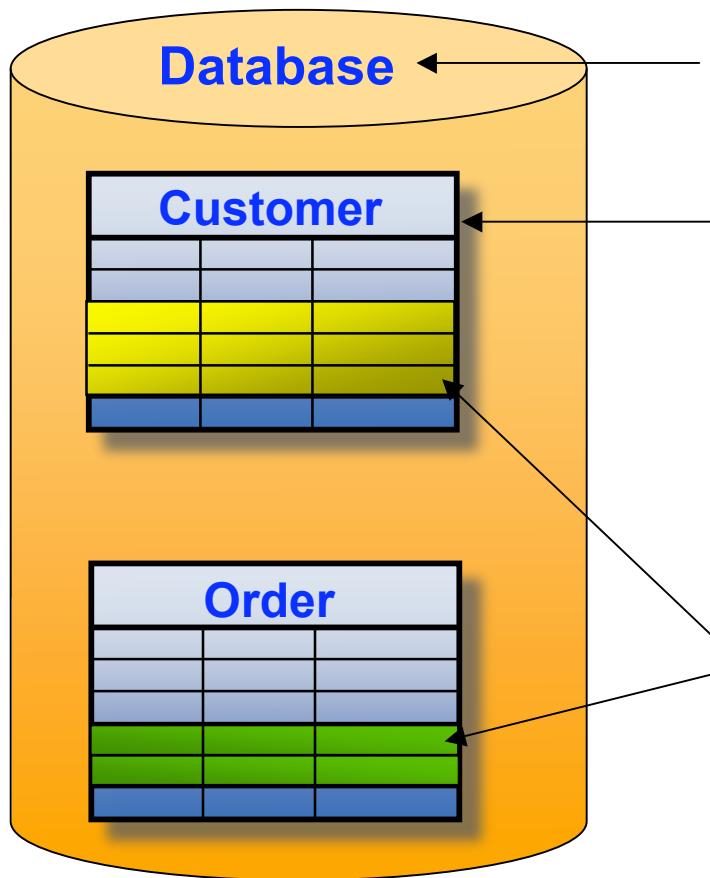
- **Flashback Transaction Query**

- See all changes made by a transaction

```
select * from FLASHBACK_TRANSACTION_QUERY  
where xid = HEXTORAW('000200030000002D');
```

- **All above are based on available UNDO**

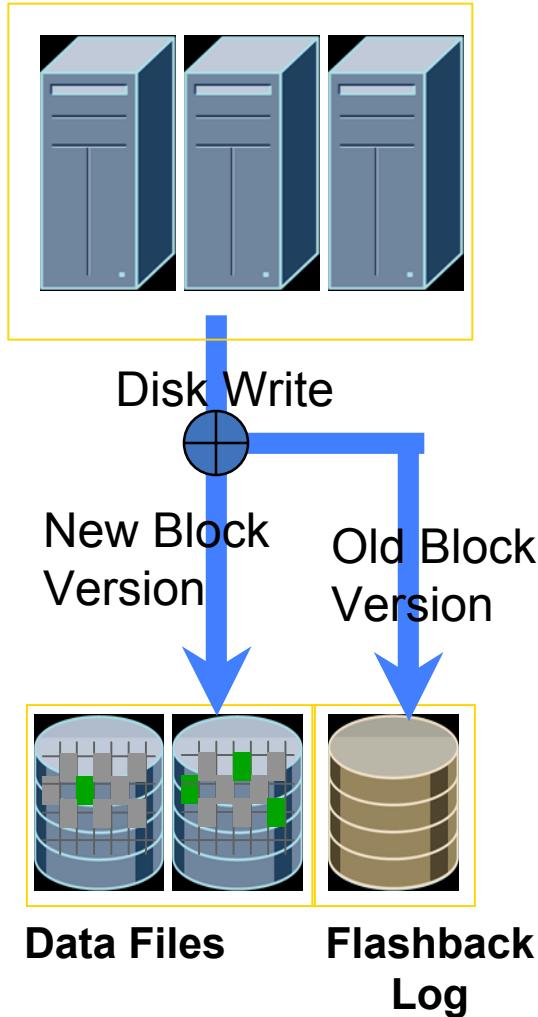
Error Correction with Flashback



- **Flashback Database** – restore database to any point in time
- **Flashback Table** – restore contents of tables to any point in time (undo-based)
- **Flashback Drop** – restore accidentally dropped tables (based on free space in tablespace)
- **Flashback Transaction** – back out transaction and all subsequent conflicting transactions (redo-based)

Flashback Database

Continuous Data Protection (CDP)



- Fast point-in-time recovery strategy
- Eliminate the need to restore a whole database backup
- Continuous data protection for database
 - Optimized, before-change block logging
 - Restores just changed blocks
 - Replay log to restore DB to desired time
- It's fast - recover in minutes, not hours
- It's easy - single command restore

Flashback Database to '2:05 PM'

“Rewind” button for the Database

Flashback Technologies New Features

Oracle Database 11g Release 2

- **Increased Availability**
 - Enable Flashback Database while database is open
 - Test Flashback without having to take downtime
- **Better Manageability**
 - Monitor Flashback Database progress with `v$session_longops`
 - Progress percentage can be found with `(SOFAR / TOTALWORK)`
- **Minimize System Impact**
 - Optimized Flashback logging for batch/insert intensive loads
 - Potentially reduce Flashback logging impact to ~2%
- **Extended Dependency Tracking**
 - Flashback Transaction supports foreign key dependency tracking

Best Practices – Undo-based Flashback

Flashback Query, Flashback Table

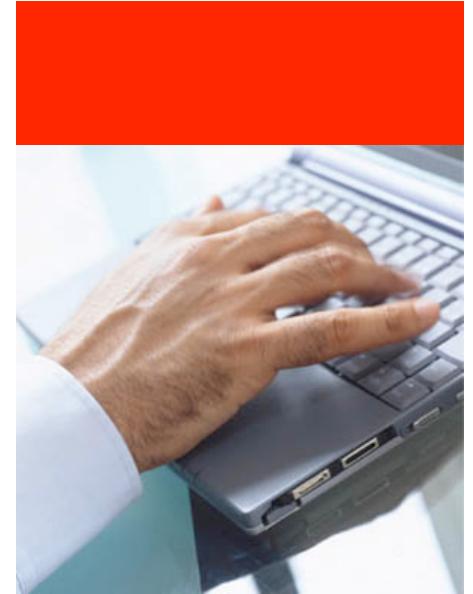
- Use Undo Advisor (available through Enterprise Manager) to get recommendations on available undo retention for various sizes.
- Use fixed size undo
 - Undo retention automatically tuned for best possible retention based on tablespace size and current system load.
- Be aware of DDL restrictions – not possible to query in the past if table structure is modified (e.g. drop/modify column, move table, etc.)
- Further details:
http://download.oracle.com/docs/cd/B19306_01/appdev.102/b14251/adfns_flashback.htm#sthref1496

Best Practices – Flashback Database

- Tune FRA storage
 - Use ASM, configure enough disk spindles, etc.
- Use physical standby database to test Flashback logging
- Use `V$FLASHBACK_DATABASE_LOG` to size log space, after running workload > duration of Flashback retention period.
- Create Guaranteed Restore Point (GRP) without enabling Flashback logging
 - Saves disk space for workloads where same blocks are repeatedly updated
 - Drop GRP to immediately reclaim space
- Further details:
[Metalink Note 565535.1 Flashback Database Best Practices & Performance](#)

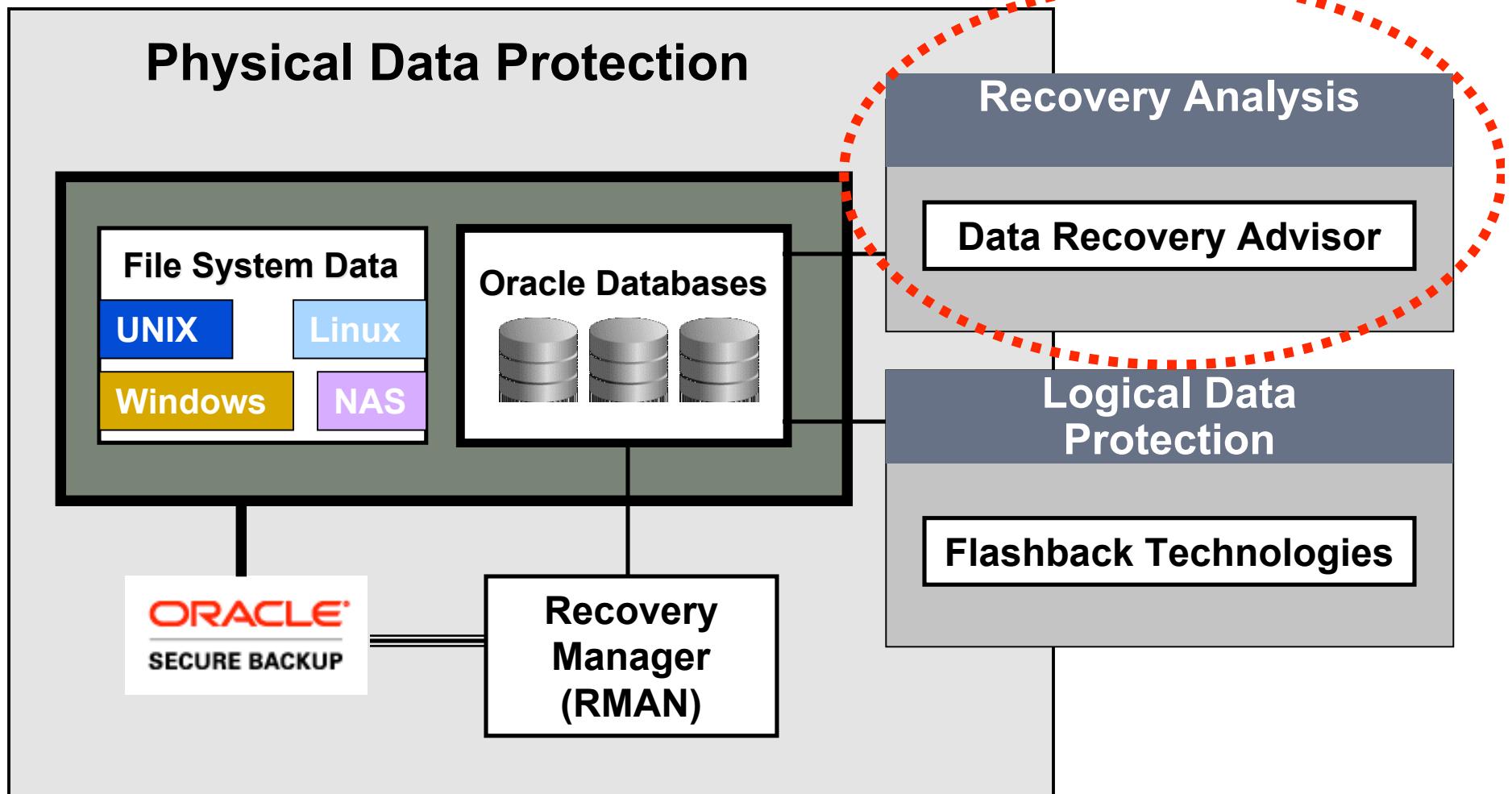
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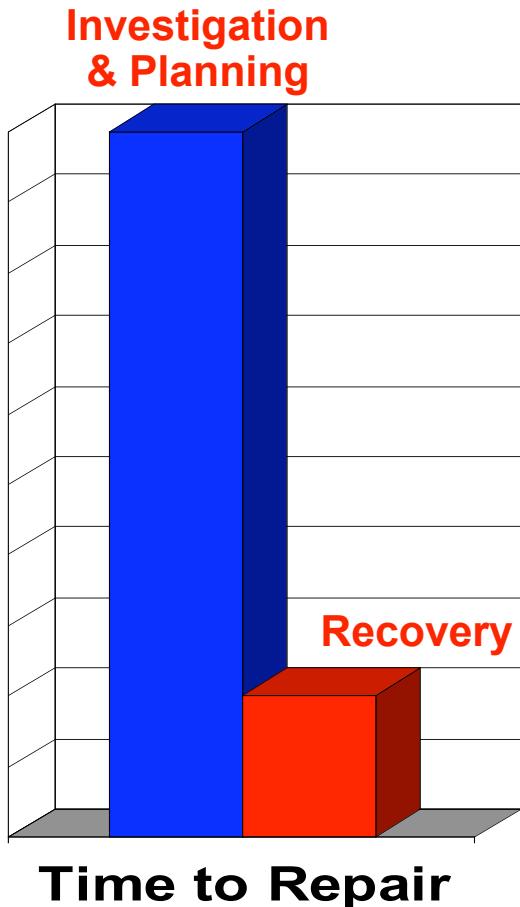
Recovery Analysis

Intelligent, Guided Recovery



Data Recovery Advisor

The Motivation



- Oracle provides robust tools for data repair:
 - ✓ RMAN – physical media loss or corruptions
 - ✓ Flashback – logical errors
 - ✓ Data Guard – physical problems
- However, problem diagnosis and choosing the right solution can be error prone and time consuming
 - Errors more likely during emergencies

Data Recovery Advisor (DRA)

- Oracle Database tool that automatically diagnoses data failures, presents repair options, and executes repairs at the user's request
- Determines failures based on symptoms
 - E.g. an “open failed” because datafiles f045.dbf and f003.dbf are missing
 - Failure Information recorded in diagnostic Automatic Diagnostic Repository (ADR)
 - Flags problems before user discovers them, via automated health monitoring
- Intelligently determines recovery strategies
 - Aggregates failures for efficient recovery
 - Presents only feasible recovery options
 - Indicates any data loss for each option
- Can automatically perform selected recovery steps
- Accessed via RMAN or EM

Reduces downtime by eliminating confusion

Data Recovery Advisor Wizard

The screenshot shows the Oracle Enterprise Manager 10g Grid Control interface. The top navigation bar includes links for Home, Targets (which is selected), Deployments, Alerts, Compliance, Jobs, and Reports. The main menu bar below the navigation bar includes Hosts, Databases, Middleware, Web Applications, Services, Systems, Groups, and All Targets. The current page is 'Targets' under 'All Targets'.

The main content area displays the 'Information' section, which lists two items: 'Database Failures - 1' and 'Current Status - MOUNTED'. Below this is the 'Perform Recovery' section.

Oracle Advised Recovery (highlighted with a red box):

The Data Recovery Advisor has detected failures. Click on "Advise and Recover" to have Oracle analyze and produce recovery advice.

Advise and Recover

Failures Detected Critical: 0 High: 1 Low: 0
Failure Description One or more non-system datafiles are missing

User Directed Recovery

Recovery Scope Whole Database Recover

Operation Type Recover to the current time or a previous point-in-time
Datafiles will be restored from the latest usable backup as required.
 Restore all datafiles
Specify Time, SCN or log sequence. The backup taken at or prior to that time will be used. No recovery will be performed in this operation.
 Recover from previously restored datafiles

► Decrypt Backups

Host Credentials

To perform recovery, supply operating system login credentials to access the target database

Overview

- Recover database failures as advised by Oracle
- Restore and/or recover the entire database or selected objects
- Restore files to a new location
- Recover tablespaces to a point-in-time based on a timestamp, system change number (SCN), or log sequence number
- Recover datafile data blocks that are marked as corrupted, or based on datafile block IDs or tablespace block addresses
- Flashback database or tables to a specific system change number (SCN) or timestamp

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Data Recovery Advisor – View Failures

ORACLE Enterprise Manager 10g Grid Control

Home Targets Deployments Alerts Compliance Jobs Reports

Hosts | Databases | Middleware | Web Applications | Services | Systems | Groups | All Targets

Database Instance: NewYork.us.oracle.com >

View and Manage Failures

Last Refresh March 20, 2009 12:18:44 PM EDT

Select dropdown values and optionally enter failure description and impact strings to filter the data that is displayed in your results set.

Failure Description	Impact	Priority	Status	Time Detected
	CRITICAL or HIGH	OPEN	All	Go

Select failures and ... [Advise](#) [Close](#) [Set Priority High](#) [Set Priority Low](#)

[Select All](#) | [Select None](#) | [Expand All](#) | [Collapse All](#)

Select Failure Description	Impact	Priority	Status	Time Detected
<input type="checkbox"/> ▾ Data Failures				
<input checked="" type="checkbox"/> ▾ One or more non-system datafiles are missing	See impact for individual child failures	HIGH	OPEN	2009-03-20 12:15:27.0
<input checked="" type="checkbox"/> Datafile 5: '/private3/oracleddg/oradata/NewYork/example01.dbf' in EXAMPLE might be missing	Some objects in tablespace EXAMPLE might be unavailable	HIGH	OPEN	2009-03-20 12:15:27.0

TIP All CRITICAL failures must be selected before "Advise". All CRITICAL failures must be unselected before "Set Priority High" or "Set Priority Low".

Related Links

[Checkers](#)

[Home](#) | [Targets](#) | [Deployments](#) | [Alerts](#) | [Compliance](#) | [Jobs](#) | [Reports](#) | [Setup](#) | [Preferences](#) | [Help](#) | [Logout](#)

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Data Recovery Advisor – Manual Repair

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Manual Actions

The following user actions may provide a faster recovery path for certain simple failures. Click "Re-assess Failures" if user actions are performed. Otherwise, click "Continue with Advise" to use the recovery advice generated for the failures selected.

Manual Action Details

If file /private3/oracledg/oradata/NewYork/example01.dbf was unintentionally renamed or moved, restore it

Cancel Re-assess Failures Continue with Advise

Home | Targets | Deployments | Alerts | Compliance | Jobs | Reports | Setup | Preferences | Help | Logout

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Data Recovery Advisor – Recovery Advice

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```
# restore and recover datafile
restore datafile 5;
recover datafile 5;
```

At the bottom of the page, there are links for Home, Targets, Deployments, Alerts, Compliance, Jobs, Reports, Setup, Preferences, Help, and Logout. Copyright information at the bottom states: 'Copyright © 1996, 2009, Oracle and/or its affiliates. All rights reserved. Oracle is a registered trademark of Oracle Corporation and/or its affiliates. Other names may be trademarks of their respective owners. About Oracle Enterprise Manager'.

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Data Recovery Advisor – Summary

The screenshot shows the Oracle Enterprise Manager 10g Grid Control interface. The top navigation bar includes links for Home, Targets (which is the active tab), Deployments, Alerts, Compliance, Jobs, and Reports. The sub-navigation bar below shows Hosts, Databases, Middleware, Web Applications, Services, Systems, Groups, and All Targets. The main content area displays the Data Recovery Advisor summary for a database instance at NewYork.us.oracle.com. The 'Review' section indicates a repair that includes complete media recovery with no data loss. A checked checkbox for 'Open Database after Recovery' is present, with a note that the database is currently not open and should be opened after a successful recovery. The 'Failures That Will Be Resolved' section lists a failure where one or more non-system datafiles are missing, specifically Datafile 5: '/private3/oracledg/oradata/NewYork/example01.dbf', with an impact note about objects in the EXAMPLE tablespace being unavailable. The 'RMAN Script' section contains the following RMAN command:

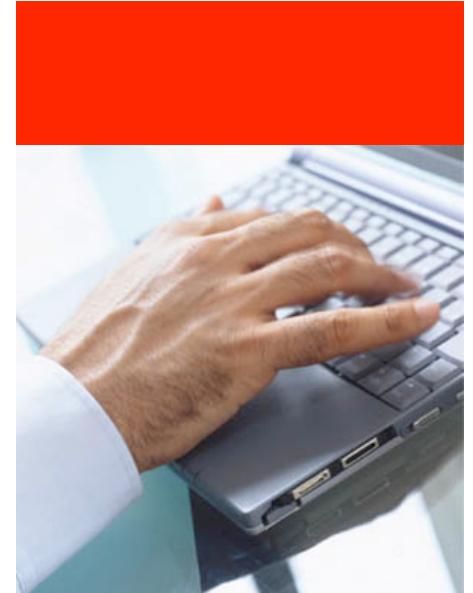
```
# restore and recover datafile
restore datafile 5;
recover datafile 5;
```

At the bottom, there are links for Home, Targets, Deployments, Alerts, Compliance, Jobs, Reports, Setup, Preferences, Help, and Logout, along with 'Cancel' and 'Submit Recovery Job' buttons.

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Agenda

- What Keeps You Awake at Night?
- Oracle Data Protection Planning & Solutions
- **Oracle Backup & Recovery Solutions**
 - Physical Data Protection
 - Recovery Manager
 - Oracle Secure Backup
 - Logical Data Protection
 - Flashback Technologies
 - Recovery Analysis
 - Data Recovery Advisor
 - **Putting It All Together – Customer Example**
- Turkcell Backup & Recovery Case Study
- Q&A



Putting It All Together..

Customer Example

Requirement	Service Level Agreement	Oracle Solution
RPO	Any point in time within recovery window	➤ Archived Log Mode
RTO		➤ RMAN, OSB, DRA
•Tier 3	<ul style="list-style-type: none"><1 hour for tablespace/datafile recovery<3 hours for full database recovery	
•Tier 2	<ul style="list-style-type: none"><30 min for row/table recovery (within last 3 hrs)<1 hour for database recovery from logical errors (within last 2 hrs)	➤ Flashback Table
•Tier 1	<ul style="list-style-type: none"><15 min for any database outage	➤ Flashback Database
Disaster Recovery	Failover to standby database at secondary site Backups sent offsite	➤ Data Guard
Retention Policy	Onsite backups - 3 day recovery window Offsite backups - 1 year tape retention	➤ Data Guard ➤ OSB
Backup Redundancy	Two backup copies on tape	➤ Fast Recovery Area, OSB ➤ OSB

Recovery SLAs

Customer Example

- Oracle Solution - RMAN + OSB + Data Guard + DRA
 - One-time image copy backup to Fast Recovery Area (FRA)
 - Daily differential incremental backup to FRA
 - Image copy rolled forward daily until “`sysdate - 4`”
 - FRA sized for one image copy backup + 4 incrementals + 4 days of archived logs
 - Daily backup of FRA to tape via OSB (retained for 1 month)
 - Daily vaulting of tape backups to offsite location (retained for 1 year)
 - Real-time, synchronized physical standby database in Maximum Performance mode for disaster recovery
 - Leverage DRA for real-time detection and analysis of failures

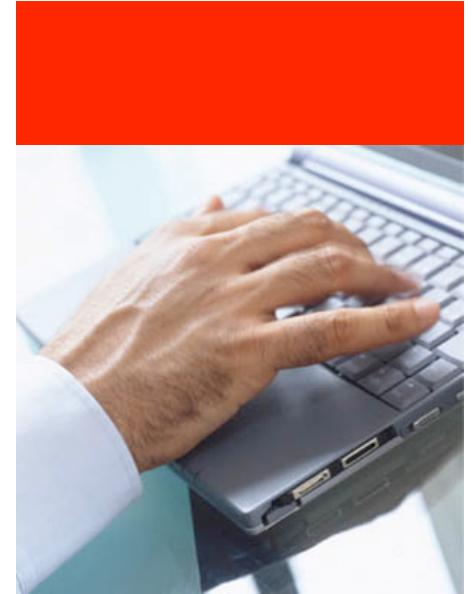
Recovery SLAs

Customer Example

- Oracle Solution – Flashback Technologies
 - Size UNDO tablespace for 3 hour retention period
 - Set Flashback Database target retention time to 2 hours
 - Provision Flashback log space in FRA, based on 2 hour workload

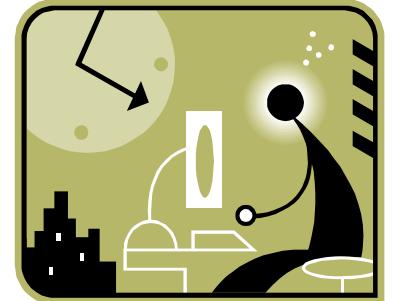
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Remember?

Data Protection Concerns...

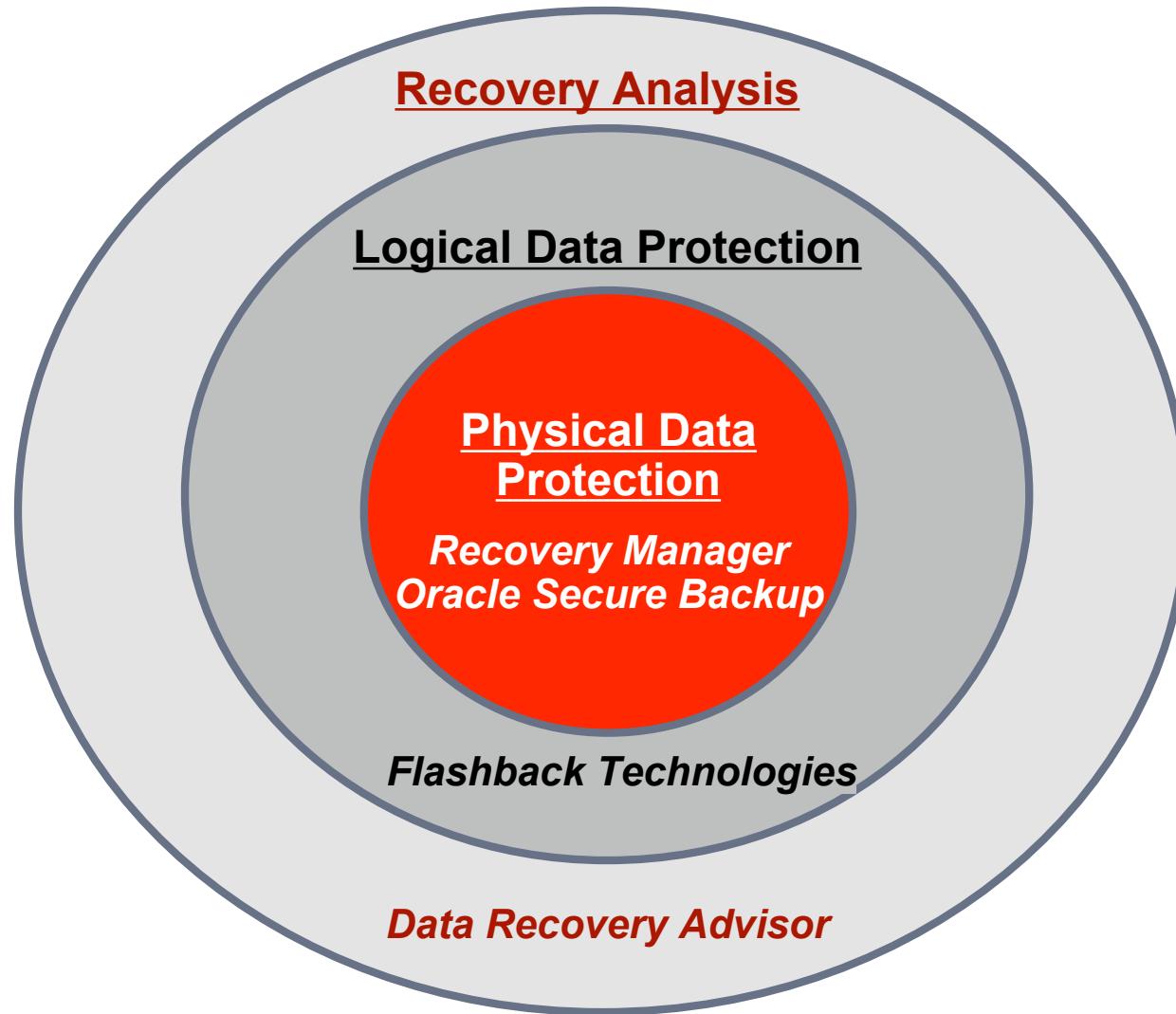


- Meeting recovery SLAs?
- Reducing exposure to data loss?
- Meeting backup windows?
- Dealing with long-term backup storage?
- Management complexity?
- Budget?

Solution...

Oracle Backup & Recovery Solutions

Complete & Targeted Recovery



OTN Resources

- Recovery Manager:

http://www.oracle.com/technology/deploy/availability/htdocs/RMAN_Overview.htm

- Oracle Secure Backup

<http://www.oracle.com/technology/products/secure-backup/index.html>

- Flashback Technologies

http://www.oracle.com/technology/deploy/availability/htdocs/Flashback_Overview.htm

- Oracle Cloud Computing Center

<http://www.oracle.com/technology/tech/cloud/index.html>

- Oracle Maximum Availability Architecture

<http://www.oracle.com/technology/deploy/availability/htdocs/maa.htm>

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HA Sessions, Labs, & Demos by Oracle Development

Sunday, 11 October – Hilton Hotel Imperial Ballroom B

3:45p Online Application Upgrade

Monday, 12 October – Marriott Hotel Golden Gate B1

11:30a Introducing Oracle GoldenGate Products

Monday, 12 October – Moscone South

1:00p Oracle's HA Vision: What's New in 11.2, Room **103**

4:00p Database 11g: Performance Innovations, Room **103**

2:30p Oracle Streams: What's New in 11.2, Room **301**

5:30p Comparing Data Protection Solutions, Room **102**

Tuesday, 13 October – Moscone South

11:30a Oracle Streams: Replication Made Easy, Room **308**

11:30a Backup & Recovery on the Database Machine, Room **307**

11:30a Next-Generation Database Grid Overview, Room **103**

1:00p Oracle Data Guard: What's New in 11.2, Room **104**

2:30p GoldenGate and Streams - The Future, Room **270**

2:30p Backup & Recovery Best Practices, Room **104**

2:30p Single-Instance RAC, Room **300**

4:00p Enterprise Manager HA Best Practices, Room **303**

Tuesday, 13 October – Marriott Hotel Golden Gate B1

11:30a GoldenGate Zero-Downtime Application Upgrades

1:00p GoldenGate Deep Dive: Architecture for Real-Time

Wednesday, 14 October – Moscone South

10:15a Announcing OSB 10.3, Room **300**

11:45a Active Data Guard, Room **103**

5:00p Exadata Storage & Database Machine, Room **104**

Thursday, 15 October – Moscone South

9:00a Empowering Availability for Apps, Room **300**

12:00p Exadata Technical Deep Dive, Room **307**

1:30p Zero-Downtime DB Maintenance, Room **103**

Demos Moscone West DEMOGrounds

Mon & Tue 10:30a - 6:30p; Wed 9:15a - 5:15p

Maximum Availability Architecture (MAA), **W-045**

Oracle Streams: Replication & Advanced Queuing, **W-043**

Oracle Active Data Guard, **W-048**

Oracle Secure Backup, **W-044**

Oracle Recovery Manager & Flashback, **W-046**

Oracle GoldenGate, **3709**

Hands-on Labs Marriott Hotel Golden Gate B2

Monday 11:30a-2:00p Oracle Active Data Guard, Parts I & II

Thursday 9:00a-11:30a Oracle Active Data Guard, Parts I & II

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