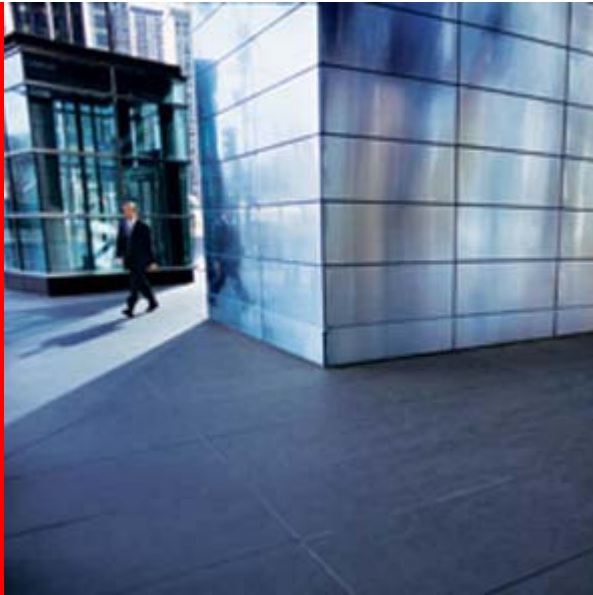





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WORLD**



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Continuous Data Protection (CDP) for the Oracle Database

Tammy Bednar
Group Product Manager – High Availability



The following is intended to outline our general product direction. It is intended for information purposes only, and may not be incorporated into any contract. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described for Oracle's products remain at the sole discretion of Oracle.

Agenda

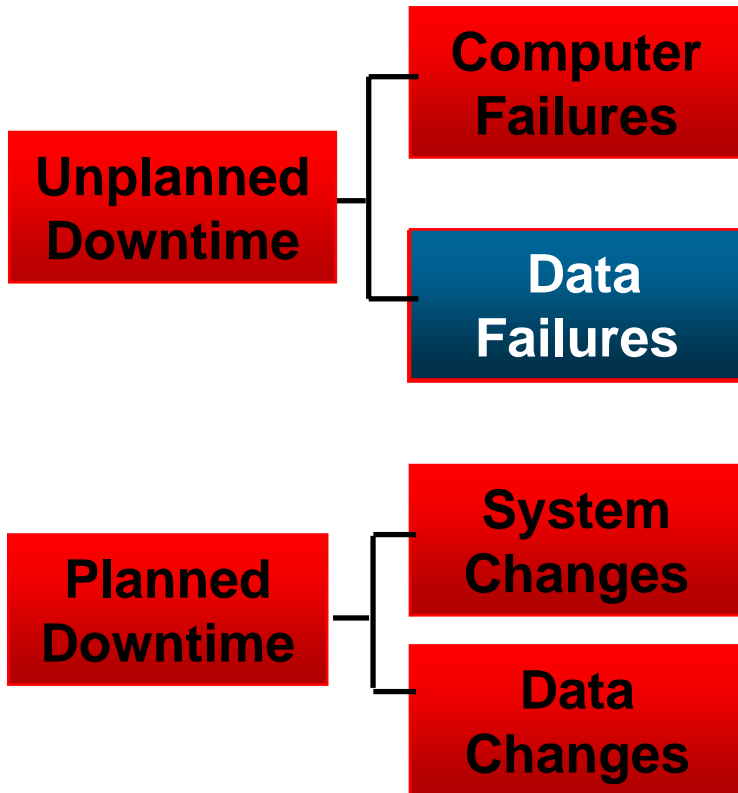
- What is CDP?
- The Oracle Components of CDP
- Summary
- Q & A



What is Continuous Data Protection (CDP)?

- *Continuously captures data modifications*
- *Enables recovery points from any point in the past*
- *Stores changes independent of the primary data*

CDP is High Availability and Data Repair



Continuous Data Protection

- Addresses both physical and logical errors
 - RTO is met with fast failover solutions to another host
 - RPO is unique to CDP by providing recovery to any point in time
- Savings are achieved
 - Reduced downtime
 - Higher availability
 - Zero data loss

Oracle Has Built-In CDP Capability

- Flashback Technology – recovery point granularity to an SCN
- Oracle Data Guard – real-time, continuous data protection to separate location from the primary data center
- RMAN and Flash Recovery Area – data changes are stored in a separate location from the primary storage

No need for Oracle customers to invest in 3rd party software to achieve CDP



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Flashback Technologies

Recover To Any Point In Time

Human Error Repair to Any Point in Time

- Estimated to be the biggest single cause of downtime
- Need to quickly determine what happened and fix it
 - Localized damage
 - Needs surgical detection and repair
 - Example – removed wrong person named ‘Smith’
 - Widespread damage
 - Requires drastic action to avoid long downtime
 - Example – batch job deletes this month’s orders
- Analysis and correction using traditional recovery is slow and complex
 - Restore database to point in time and extract data
- Oracle Database 10g is a breakthrough release for human error correction



How does Flashback Work?

- Each of the flashback features provide the ability to undo a human error without restoring a backup.
- But the implementation and the Oracle Database infrastructure differs based on the feature
- Flashback utilizes the following database architectures



- Undo

- Leverages Oracle's unique multi-version read consistency architecture



- Tablespace free space

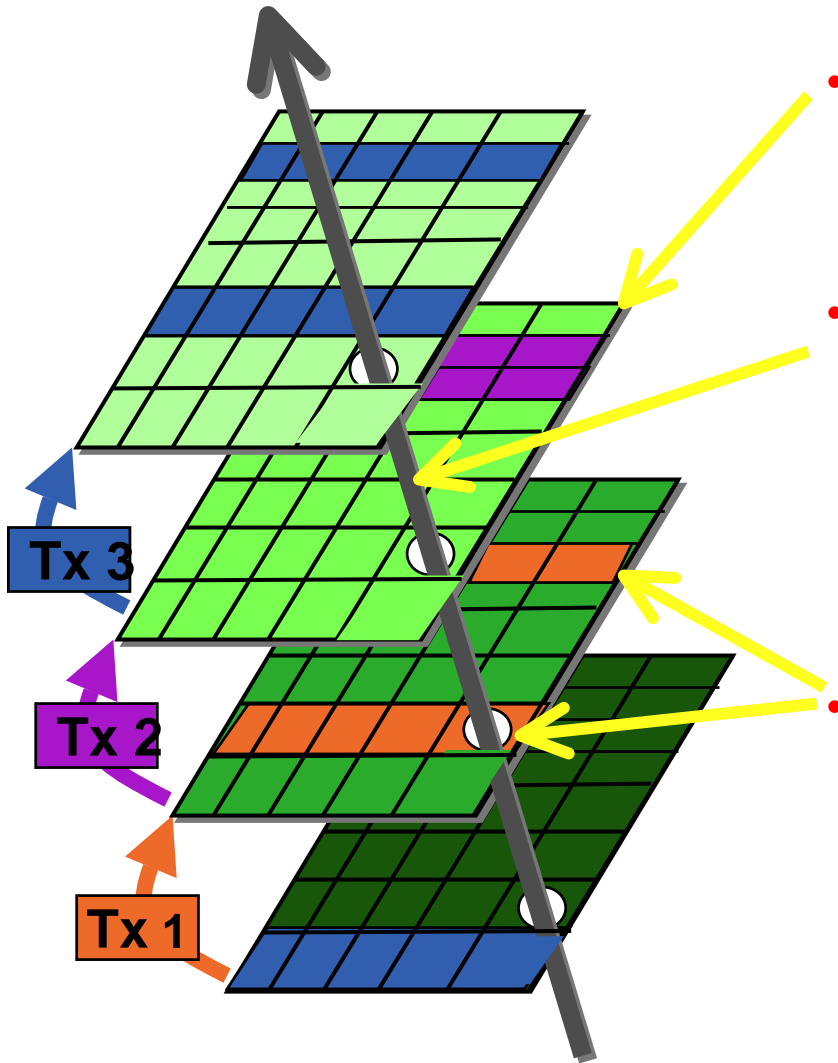
- Utilizes unused segments to safeguard data



- Flash Recovery Area

- Utilize disk for storage of recovery files

Flashback Time Navigation



Flashback Query

- Query all data at point in time

```
Select * from SALARY AS OF '2:00 P.M.' where ...
```

Flashback Versions Query

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

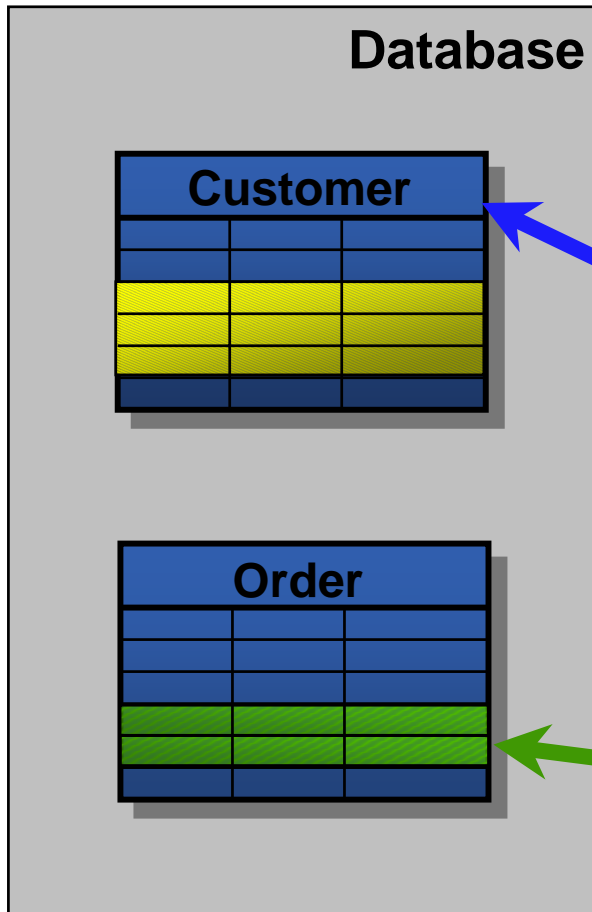
```
Select * from SALARY VERSIONS BETWEEN  
'2:00 PM' and '3:00 PM' where ...
```

Flashback Transaction Query

- See all changes made by a transaction

```
Select * from FLASHBACK_TRANSACTION_QUERY  
where xid = '000200030000002D';
```

Flashback Error Correction



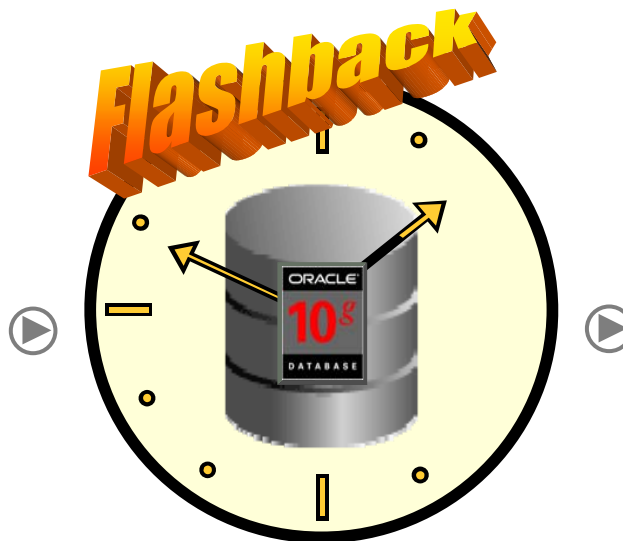
- Recovery at all levels
- Database Level
 - Flashback Database restores the whole database to time
 - Uses Flashback Logs
- Table Level
 - Flashback Table restores rows in a set of tables to time
 - Uses UNDO in database
 - Flashback Drop restores a dropped table or a index
 - Recycle bin for DROPs
- Row Level
 - Flashback Query restores rows to time

Flashback Query



Human Error

- Delete rows from the employees table and discover the incorrect rows were removed. Your HR application needs the data for your business workflows. What do you do?



Flashback

```
select * from Emp AS  
OF 3:00 pm where  
Ename='Smith' ;
```

OR

```
Insert into EMP select  
* from Emp AS OF  
3:00 pm where  
Ename='Smith' ;
```

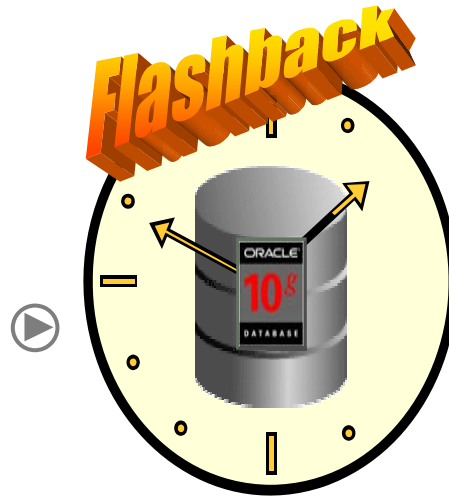
Data Repair in seconds to desired SCN

Flashback Versions Query and Flashback Transaction Query



Human Error

- An Application Developer is working in a test environment and updates tables for a test. He inadvertently makes incorrect updates and will cause them to lose several hours of testing and cannot afford to fall behind.



Flashback

Choose SCN: Transaction Details

Transaction ID 04000C00A7020000
User HR
Commit SCN 1408165
Commit Time Sep 18, 2006 12:00:00 AM

Operation	Table Owner	Table Name	Undo SQL
DELETE	HR	DEPARTMENTS	insert into "HR"."DEPARTMENTS"("DEPARTMENT_ID","DEPARTMENT_NAME","MANAGER_ID","LOCATION_ID") values ('10','DEPARTMENT',null,null)
DELETE	HR	EMPLOYEES	insert into "HR"."EMPLOYEES"("EMPLOYEE_ID","FIRST_NAME","LAST_NAME","EMAIL","PHONE_NUMBER","HIRE_DATE","JOB_ID") values ('113','Luis','Popp','LPOPP','515.124.4567','TO_DATE('07-DEC-99','DD-MON-RR)','FI_ACCOUNT','6900',NULL,'108','100');
DELETE	HR	EMPLOYEES	insert into "HR"."EMPLOYEES"("EMPLOYEE_ID","FIRST_NAME","LAST_NAME","EMAIL","PHONE_NUMBER","HIRE_DATE","JOB_ID") values ('112','Jose Manuel','Uman','JMURMAN','515.124.4469','TO_DATE('07-MAR-98','DD-MON-RR)','FI_ACCOUNT','7800',NULL,'108','100');
DELETE	HR	EMPLOYEES	insert into "HR"."EMPLOYEES"("EMPLOYEE_ID","FIRST_NAME","LAST_NAME","EMAIL","PHONE_NUMBER","HIRE_DATE","JOB_ID") values ('111','Ismael','Sciara','ISCIARRA','515.124.4369','TO_DATE('30-SEP-97','DD-MON-RR)','FI_ACCOUNT','7700',NULL,'108','100');
DELETE	HR	EMPLOYEES	insert into "HR"."EMPLOYEES"("EMPLOYEE_ID","FIRST_NAME","LAST_NAME","EMAIL","PHONE_NUMBER","HIRE_DATE","JOB_ID") values ('110','John','Chen','JCHEN','515.124.4269','TO_DATE('28-SEP-97','DD-MON-RR)','FI_ACCOUNT','9200',NULL,'108','100');
DELETE	HR	EMPLOYEES	insert into "HR"."EMPLOYEES"("EMPLOYEE_ID","FIRST_NAME","LAST_NAME","EMAIL","PHONE_NUMBER","HIRE_DATE","JOB_ID") values ('109','Daniel','Faviet','DFAVIET','515.124.4169','TO_DATE('16-AUG-94','DD-MON-RR)','FI_ACCOUNT','9000',NULL,'108','100');

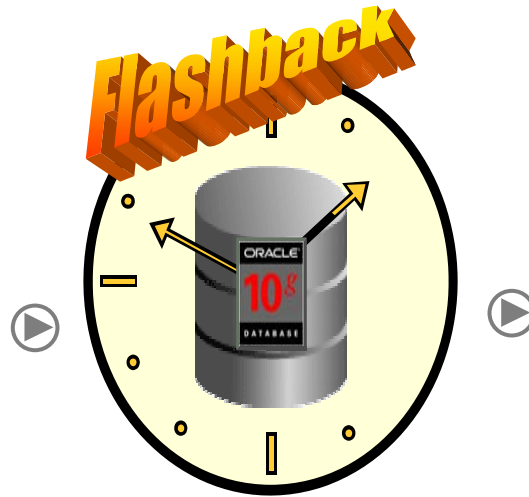
Data Repair in minutes

Flashback Database

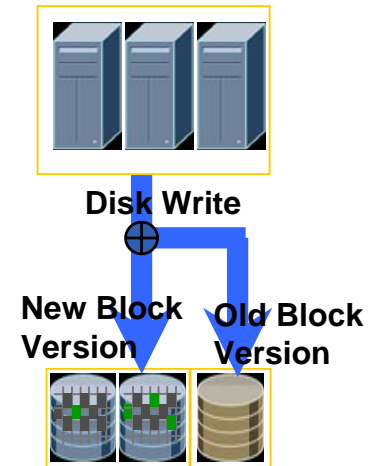


Human Error

- In order to update PL/SQL applications, users must be logged off of the system. The new PL/SQL procedures have been tested in the QA environment, but the upgrade does not go as smoothly as planned.



Flashback



Flashback Database
to '2:05 PM'

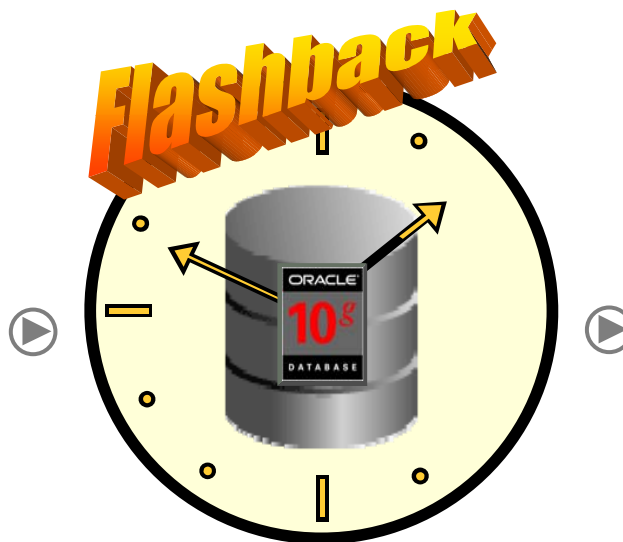
Data Repair in minutes

Flashback Table



Human Error

- Several tables are involved in updates but result in logical corruption. What can you do?



Flashback

Flashback TABLE
EMPLOYES,
DEPARTMENTS,
JOBS TO 4:00 PM;;

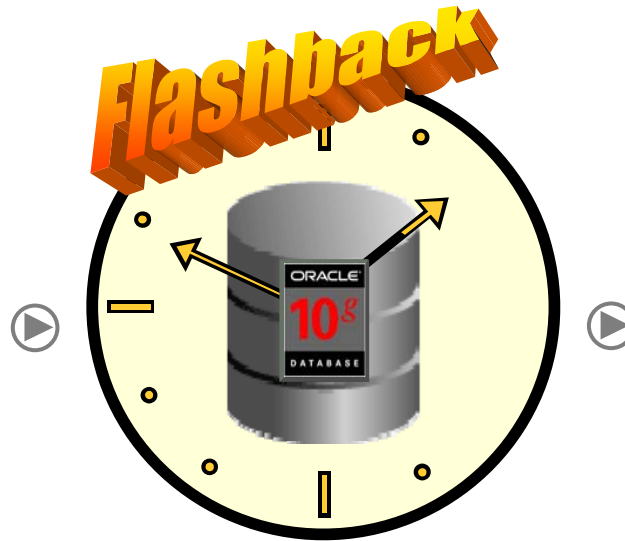
Data Repair in seconds to desired SCN

Flashback Drop



Human Error

- It's 2:00 am and you have put in several hours at the office. Last task of the day is to run maintenance operations and delete un-need tables. Oops – deleted the production table.



Flashback

USERS		
Dept		
Emp		

**Flashback Table
EMP to before drop;**

Data Repair in seconds to desired SCN

Revolution in Recovery

- Flashback Revolutionizes Recovery
 - Operates on just the changed data
 - Time to correct error equals time to make error
 - Minutes instead of hours

Correction Time = Error Time + ~~DB_SIZE~~

- Flashback is Easy
 - Single command instead of complex procedure
 - Easy-to-use framework to quickly analyze and repair corruptions that occur as a result of human errors
 - Fixes localized as well as widespread damage



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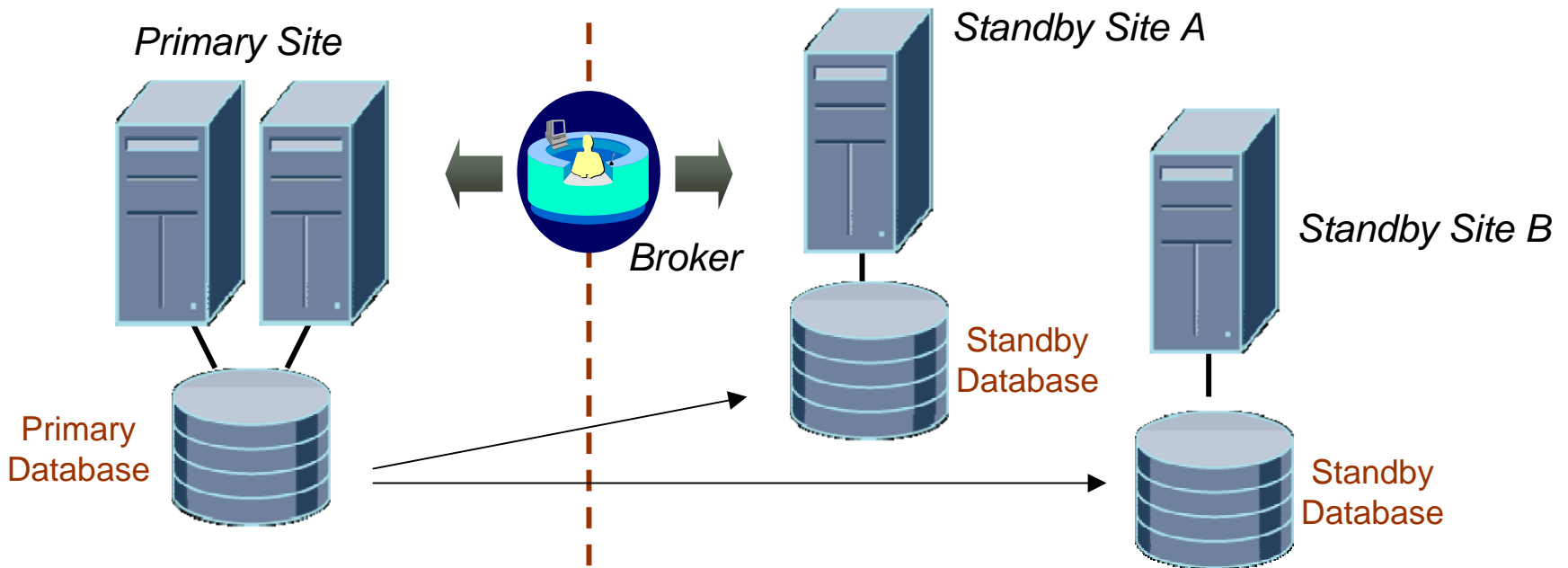
Data Guard

More than just for disaster recovery

Oracle Data Guard

- Oracle's disaster recovery solution for Oracle data
- Automates the creation and maintenance of one or more synchronized copies (standby) of the production (or primary) database
- If the primary database becomes unavailable (disasters, maintenance), a standby database can be activated and assume the primary role
- Feature of Oracle Database Enterprise Edition (EE)

Data Guard Configuration



- Managed as a single configuration
- Primary and standby databases can be Real Application Clusters or single-instance Oracle
- Up to nine standby databases supported in a single configuration

Data Guard – Beyond DR

1. *High Data Availability*

- ✓ *Integrated high availability through Fast-Start Failover*

Automatic Data Repair in seconds to desired SCN



Data Guard Utility Meter

Data Guard – Beyond DR

2. *Comprehensive Data Protection*

- ✓ ***Protection from data corruptions***
 - Faulty systems component could physically corrupt data files / redo log files / control file, affecting primary database operations
- ✓ ***Protection from operational errors***
 - The only available online redo log was corrupted



Data Guard Utility Meter

Data Guard – Beyond DR

3. *Efficient Systems Utilization*

- ✓ *Administrator utilization*
 - *Rolling database upgrades*
 - *Migrate data centers, SANs, platforms*
 - *Use physical standbys for backups*
 - *Cloning / testing of production workload*
- ✓ *End-user utilization*
 - *Use logical standbys for apps, reporting, read-access*



Data Guard Utility Meter



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RMAN & Flash Recovery Area

Store Changes Independent of the Primary

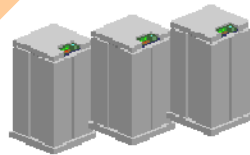
Recovery Manager: Oracle's Backup & Recovery Utility



Enterprise
Manager
& 3rd Party Tools



Network

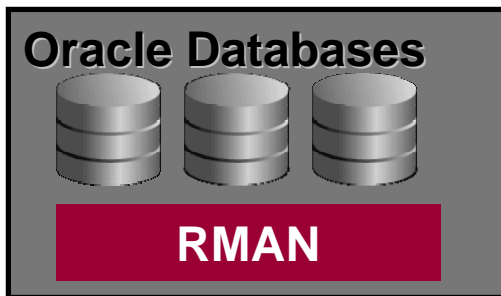


Installed and ready to use!

- Integral feature of the database that sends data to disk and tape
- **Smart**
 - Sophisticated backup and recovery strategies
- **Fast**
 - Optimized backup to disk for fastest recovery
 - Block level incremental backup
- **Reliable**
 - Block contents are validated during backup
- **Easy**
 - Simple management with Enterprise Manager
- **Supports over 20 Media Managers**
 - Veritas, Legato, Tivoli, HP, Oracle Secure Backup, etc.
- **FREE**

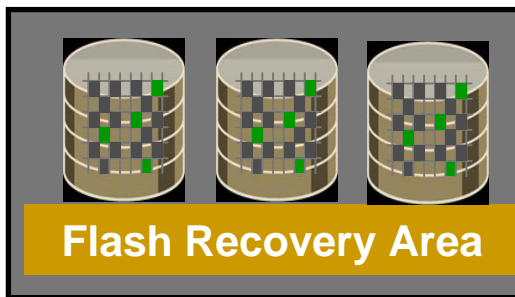
RMAN & Flash Recovery Area

High
Performant
Disk



RMAN Backups,
Archive logs,
Control file &
online log copies,
Flashback logs

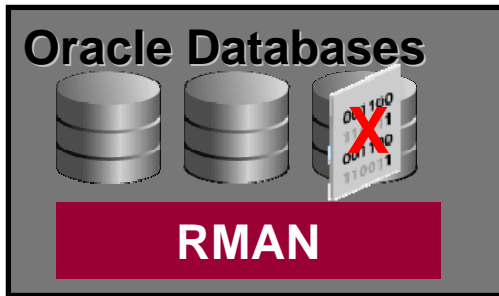
Low-cost,
ATA disk



- Flash Recovery Area is a single location to maintain files needed for physical errors
 - Locally can be used for fast recovery
 - On the standby site it can be used to protect the data remotely and offload backups
 - Set it and forget it
- RMAN provides intelligent and advanced recovery capabilities
 - Optimized incremental, updated Incremental backup, recovery file manageability
- Files needed to recover a database are located on on different storage from the production database to meet any recovery needs

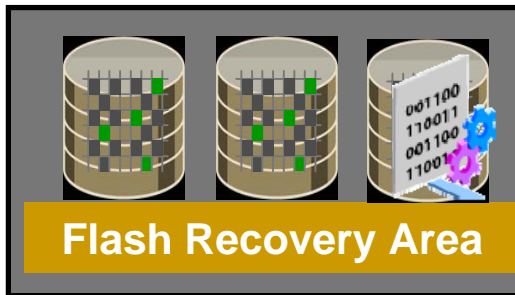
RMAN & Flash Recovery Area

High
Performant
Disk



RMAN Backups,
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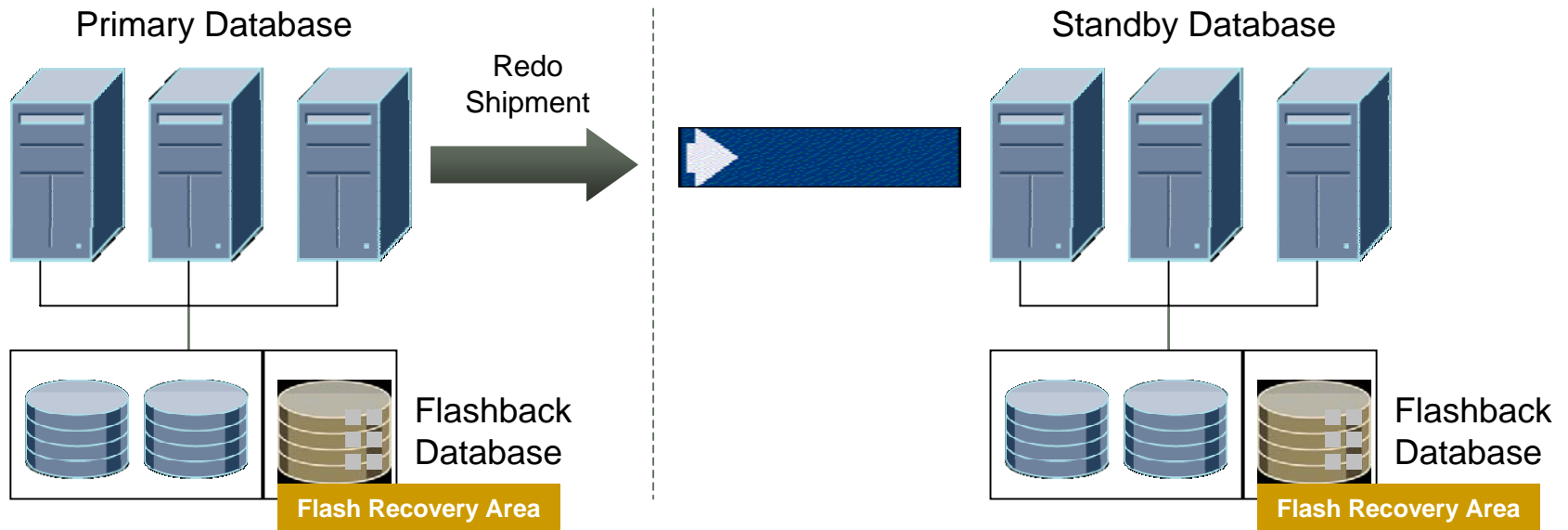
Low-cost,
ATA disk



- Oracle datafile is unusable
- RMAN switch to copy
- Utilizes the image copies in the Flash Recovery Area for repair

Data Repair in minutes

Integrated Oracle CDP Solution

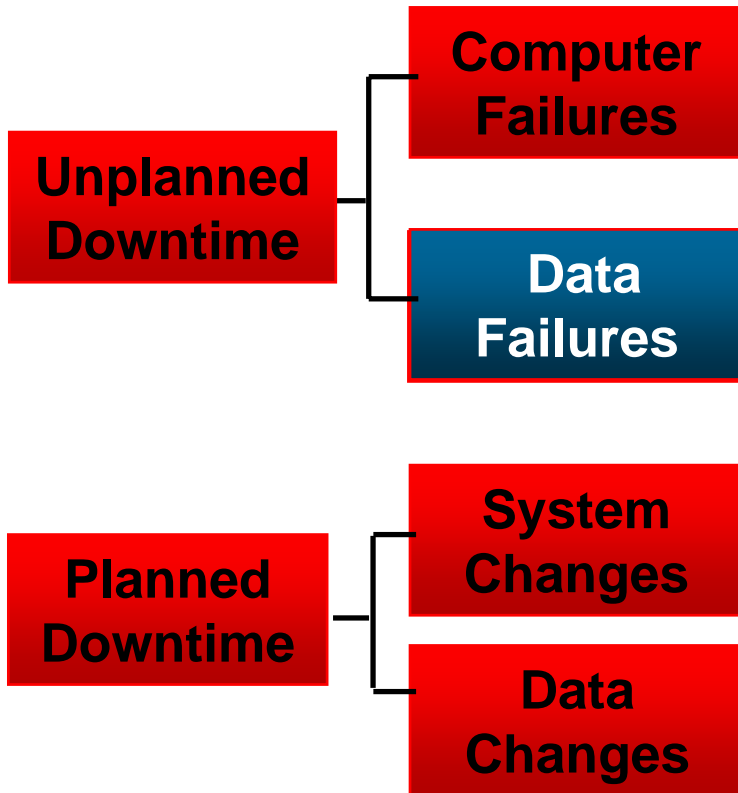


- Data is replicated independently of another host with Data Guard
- Flashback Database rewinds the standby to any point in time to recover from logical errors
- Flash Recovery Area stores changes independently of the primary and can be used to recover from physical errors

What do others say about Oracle's CDP?

- “Oracle has incorporated CDP-like functionality, called Flashback, into Oracle 10g .. that enables fast rewind of databases to earlier points in time.”
 - *Storage Magazine, Nov 2005*
- Application-based CDP is specific to a particular app, such as Oracle Corp.'s 10g. It's responsible for performing all of the continuous protection and journaling necessary to roll back to any point in time. Queries, rows, columns, tables, transactions or the entire database can be rewound to any point in time without disrupting the running application. Neither block- nor file-based CDP usually has that level of visibility. The value of application-based CDP is extensive application-awareness.
 - *Storage Magazine, March 2006*
 - *Only Database product included in this article!*

CDP is High Availability and Data Repair



Continuous Data Protection

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 - RPO is unique to CDP by providing recovery to any point in time
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 - Higher availability
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For More Information

<http://search.oracle.com>

High Availability Database 

or

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



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