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Oracle Database 11g – New Features For DBA

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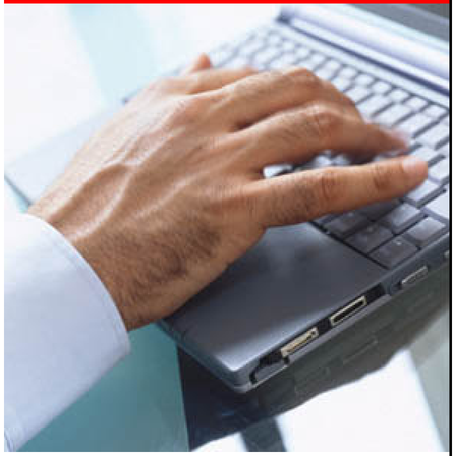
Agenda

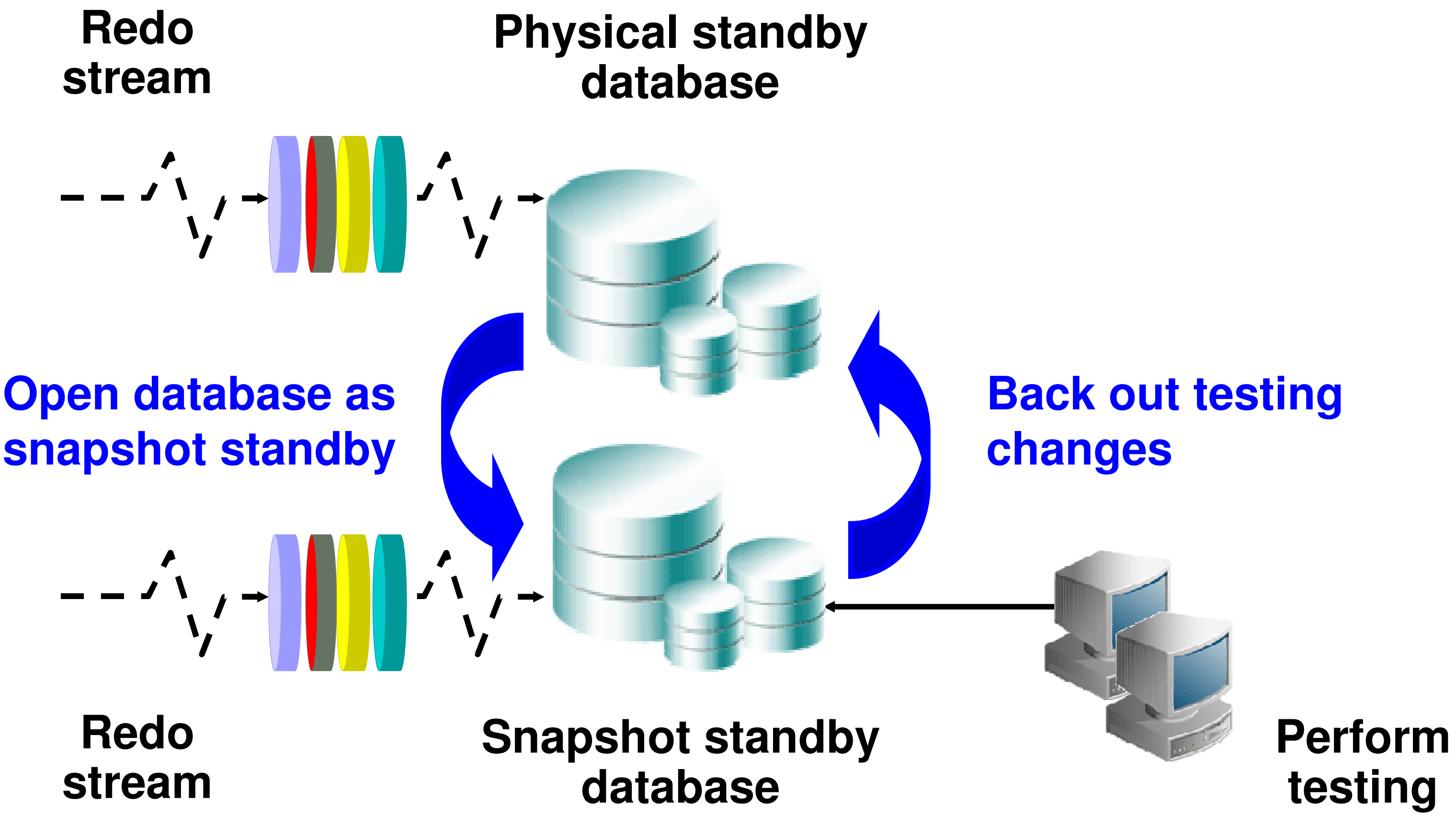


- Hot Patching
- Snapshot Standby Database
- Active Data Guard
- Real Application Testing
- SQL Plan Management
- Automatic Memory Management
- Statistics Preferences
- ASM Performance
- Partitioning
- Table Compression
- Oracle Total Recall

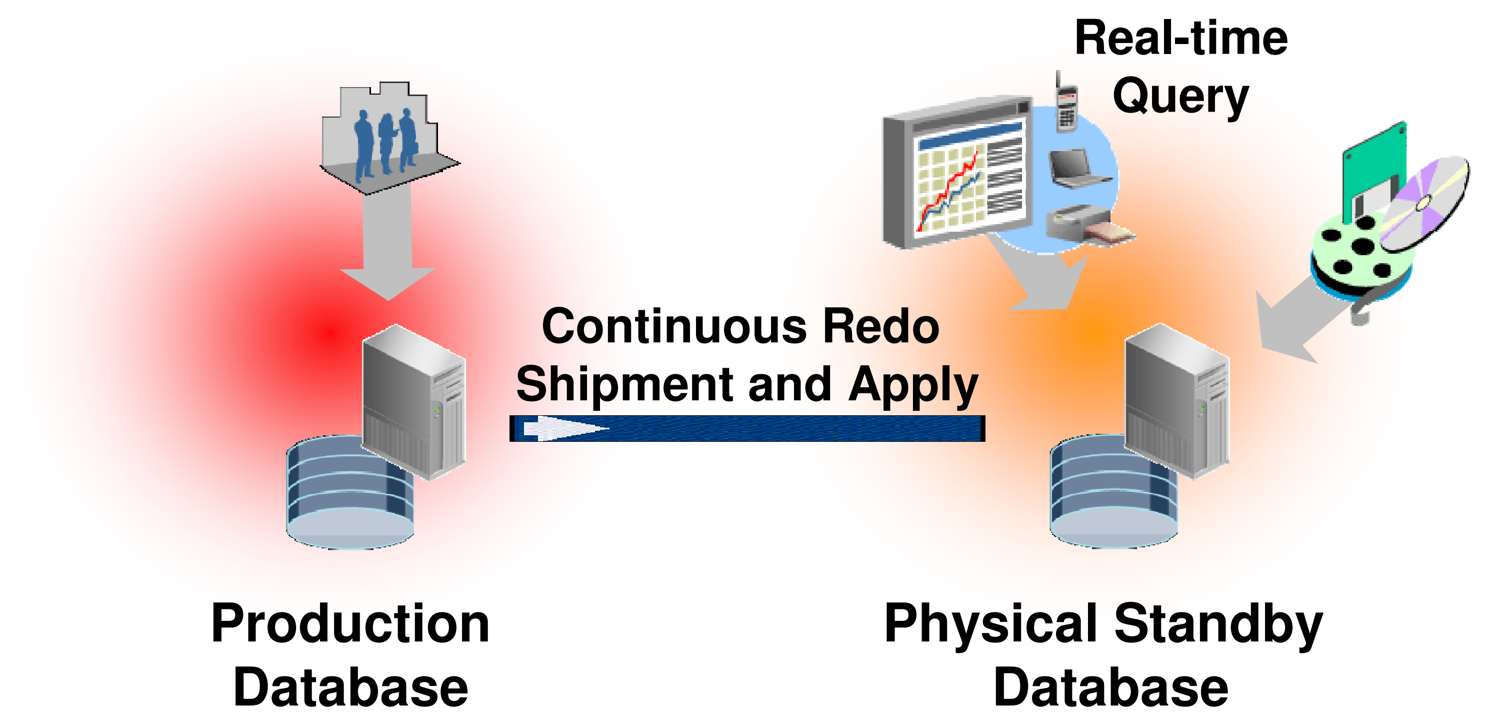
Hot Patching

- Conventional patch
  - Applied to on-disk image of Oracle executables
  - Downtime needed to relink Oracle executables
- Hot patch
  - Shipped as dynamic / shared library
  - Use OPatch to apply
  - Applied Oracle processes running in memory
    - Additional memory (one OS page) per Oracle process
  - No downtime needed to relink Oracle executables
  - Persistent across instance restarts
  - OPatch identifies conflicts between hot and conventional patches
  - Availability: Small and diagnostic patches on Linux x86 (32 and 64 bit), Solaris SPARC-64
  - Long-term goal: CPU
- Recommendation
  - Avoid “urgent” downtime by applying hot patch
  - At “pre-scheduled” downtime, replace hot patch with conventional patch to save memory

Snapshot Standby Database


Redo stream
Physical standby database
Open database as snapshot standby
Back out testing changes
Redo stream
Snapshot standby database
Perform testing

Active Data Guard



- Open physical standby for read-only queries
- Maintain ongoing recovery on the physical standby

Requires license for Active Data Guard

SQL Plan Management

- Capture, store, and use verified execution plans for frequently-used SQL statements.
- SQL Plan Baseline in SYSAUX tablespace
  - SQL text, outline, bind variables, compilation environment
  - Retention period: 53 weeks (default)
  - Space budget: 10% (default)
- Usage scenarios
  - Ongoing system, data, application, and database changes
    - Store well-tuned SQL execution plans in SQL Plan Baseline
  - Database upgrade
    - Source database: Capture well-tuned SQL execution plans in SQL Tuning Set
    - Upgraded database: Copy SQL Tuning Set to SQL Plan Baseline

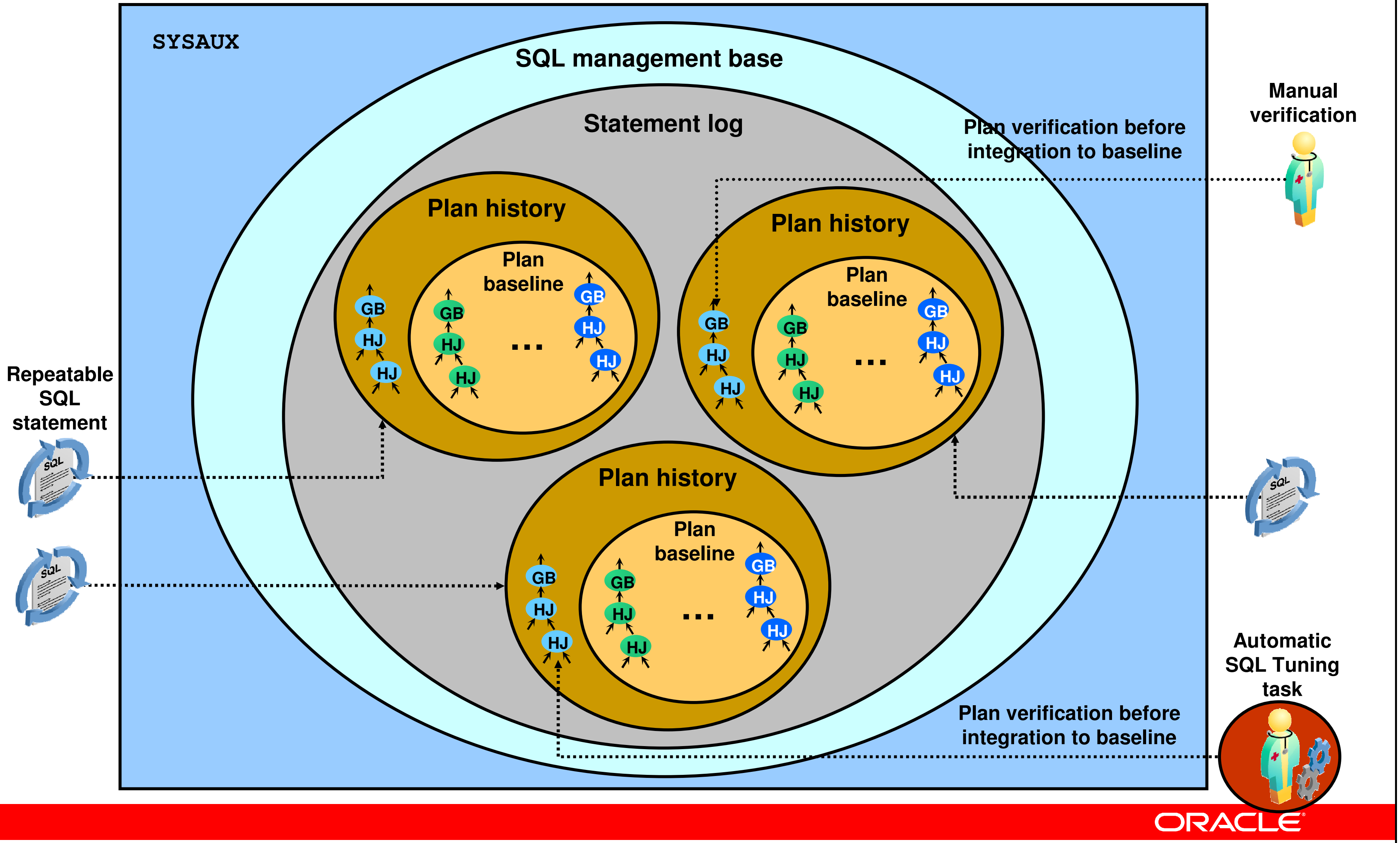
SQL Plan Management

Capture, store, and verify SQL plans

- 1. First execution plan for SQL added to SQL Plan Baseline
- 2. Maintain history of SQL execution plans
  - Automatic: `OPTIMIZER_CAPTURE_SQL_PLAN_BASELINES` = TRUE
  - Manual: Use `DBMS_SPM` to load plans from SQL Tuning Sets or shared pool
- 3. Verify and accept a plan into SQL Plan Baseline
  - Automatic: SQL tuning task `SYS_AUTO_SQL_TUNING_TASK`
  - Manual: SQL Tuning Advisor
  - Manual: Use `DBMS_SPM`
- 4. Mark one or more plans for a SQL as FIXED
  - Manual: Use EM or `DBMS_SPM`

SQL Plan Management

Baseline Architecture



SQL Plan Management

Use SQL plans

- 1. Cost Optimizer generates best-cost plan
- 2. If `OPTIMIZER_USE_SQL_PLAN_BASELINES` = FALSE
  - SQL executed with best-cost plan
- 3. If `OPTIMIZER_USE_SQL_PLAN_BASELINES` = TRUE
  - Best-cost plan compared with SQL Plan Baseline
  - If best-cost plan exists in SQL Plan Baseline
    - Status = ACCEPTED or FIXED
      - Use it to execute SQL
    - Status <> ACCEPTED and FIXED
      - Use FIXED / ACCEPTED plan from SQL Plan Baseline to execute SQL
  - If best-cost plan is not found in SQL Plan Baseline
    - Add best-cost plan to SQL Plan Baseline
    - Use FIXED / ACCEPTED plan from SQL Plan Baseline to execute SQL

Real Application Testing

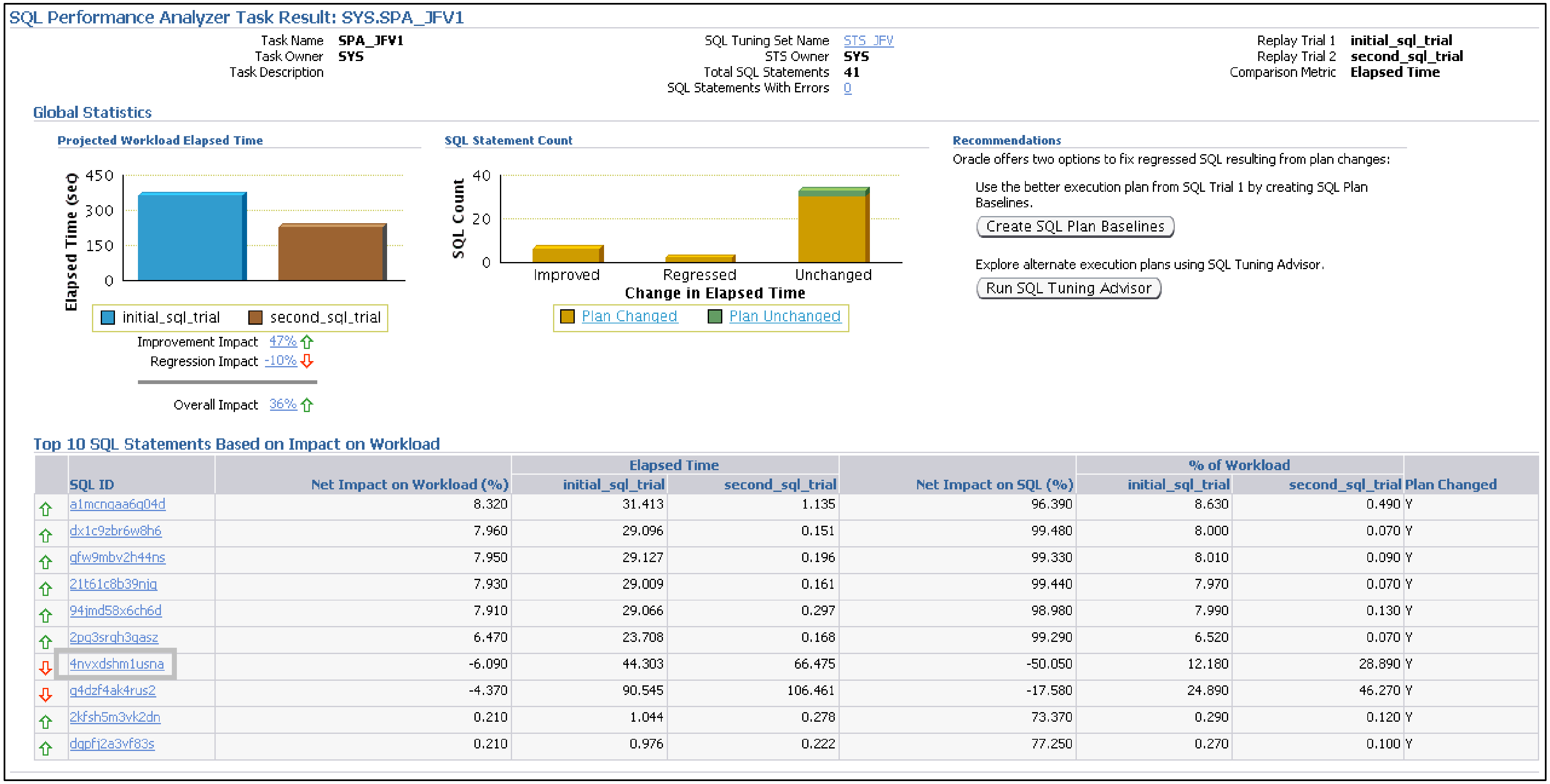
SQL Performance Analyzer

- Compare performance of a SQL statement, before and after change
  - Database upgrades, performance tuning, schema changes, statistics gathering, database parameter changes, OS and hardware changes
- SQL Workload not considered
- Compare SQL execution plan and execution statistics
- Use EM or `DBMS_SQLPA`
- Follow-up actions:
  - Tune regressed SQL using SQL Tuning Advisor
  - Store good execution plans in SQL Plan Baseline

Requires license for Real Application Testing

Real Application Testing

SQL Performance Analyzer



SQL Performance Analyzer Task Result: SYS.SPA_JFV1

Task Name	**SPA_JFV1**	SQL Tuning Set Name	STS_JFV	Replay Trial 1	**initial_sql_trial**
Task Owner	**SYS**	STS Owner	**SYS**	Replay Trial 2	**second_sql_trial**
Task Description		Total SQL Statements	**41**	Comparison Metric	**Elapsed Time**
		SQL Statements With Errors	0		

Global Statistics

Projected Workload Elapsed Time

Improvement Impact 47% ⇧
Regression Impact -10% ⇩

Overall Impact 36% ⇧

SQL Statement Count

Recommendations

Oracle offers two options to fix regressed SQL resulting from plan changes:

Use the better execution plan from SQL Trial 1 by creating SQL Plan Baselines.

Explore alternate execution plans using SQL Tuning Advisor.

Top 10 SQL Statements Based on Impact on Workload

			Elapsed Time			% of Workload		
	SQL ID	Net Impact on Workload (%)	initial_sql_trial	second_sql_trial	Net Impact on SQL (%)	initial_sql_trial	second_sql_trial	Plan Changed
⇧	a1mcnqaa6q04d	8.320	31.413	1.135	96.390	8.630	0.490	Y
⇧	dx1c9zbr6w8h6	7.960	29.096	0.151	99.480	8.000	0.070	Y
⇧	gfw9mbv2h44ns	7.950	29.127	0.196	99.330	8.010	0.090	Y
⇧	21t61c8b39njq	7.930	29.009	0.161	99.440	7.970	0.070	Y
⇧	94jmd58x6ch6d	7.910	29.066	0.297	98.980	7.990	0.130	Y
⇧	2pq3srgh3qasz	6.470	23.708	0.168	99.290	6.520	0.070	Y
⇩	4nvxdshm1usna	-6.090	44.303	66.475	-50.050	12.180	28.890	Y
⇩	g4dzf4ak4rus2	-4.370	90.545	106.461	-17.580	24.890	46.270	Y
⇧	2kfsh5m3vk2dn	0.210	1.044	0.278	73.370	0.290	0.120	Y
⇧	dgpfj2a3vf83s	0.210	0.976	0.222	77.250	0.270	0.100	Y

Requires license for Real Application Testing

Real Application Testing

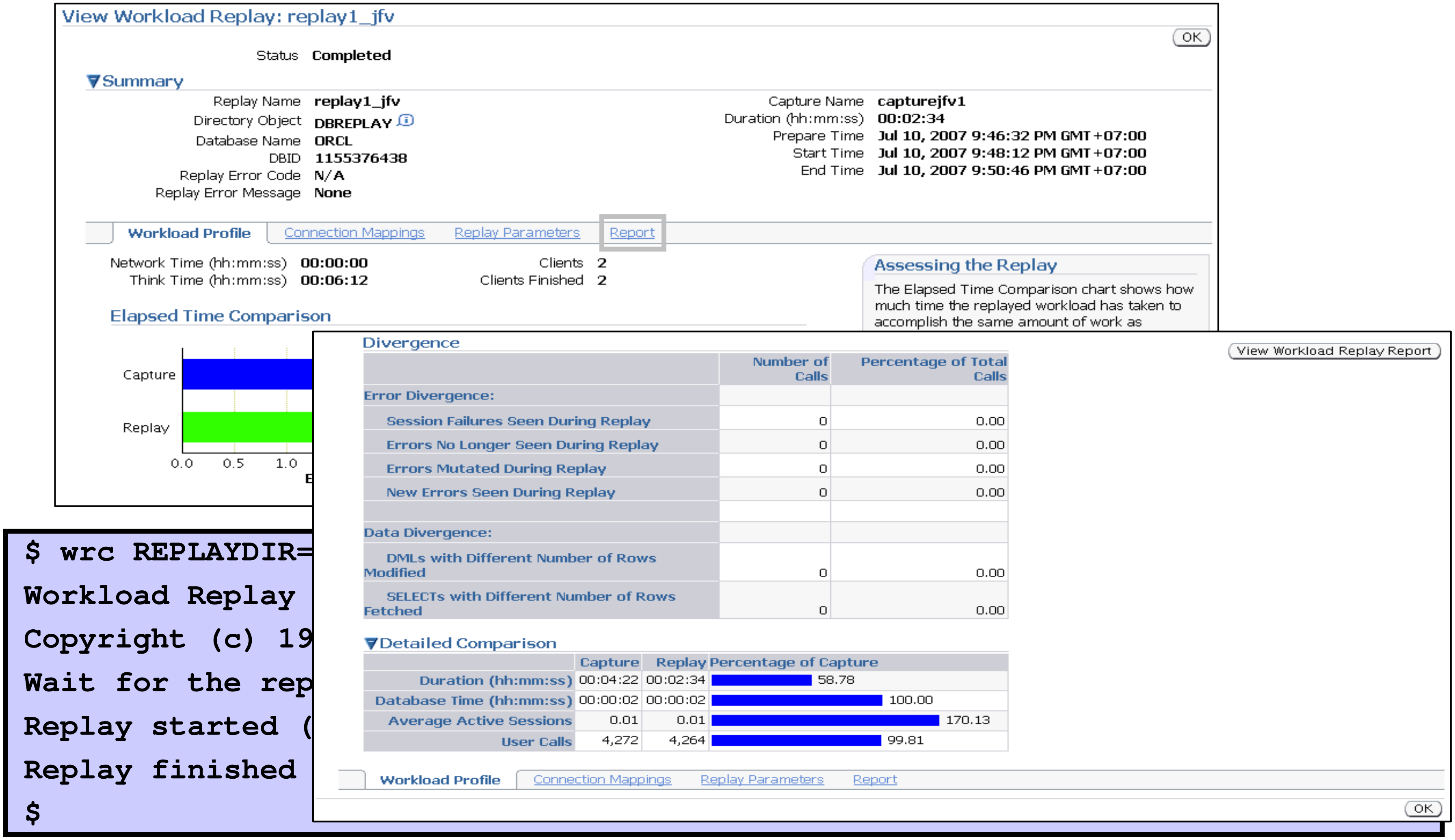
Database Replay

- Test production database workload in test before change
  - Database upgrades, performance tuning, schema changes, statistics gathering, database parameter changes, OS and hardware changes
- Use EM or `DBMS_WORKLOAD_CAPTURE / DBMS_WORKLOAD_REPLAY`
- Process:
  - Capture production workload (including concurrency)
  - Move captured workload files to test system
  - Make desired changes in test system
  - Configure test environment for replay
  - Replay production workload in test
  - Analyze and report on performance

Requires license for Real Application Testing

Real Application Testing

Database Replay



View Workload Replay: replay1_jfv

Status Completed

▼Summary

Replay Name	replay1_jfv
Directory Object	DBREPLAY
Database Name	ORCL
DBID	1155376438
Replay Error Code	N/A
Replay Error Message	None

Capture Name	capturejfv1
Duration (hh:mm:ss)	00:02:34
Prepare Time	Jul 10, 2007 9:46:32 PM GMT+07:00
Start Time	Jul 10, 2007 9:48:12 PM GMT+07:00
End Time	Jul 10, 2007 9:50:46 PM GMT+07:00

Network Time (hh:mm:ss)	00:00:00
Think Time (hh:mm:ss)	00:06:12
Clients	2
Clients Finished	2

Elapsed Time Comparison

Assessing the Replay

The Elapsed Time Comparison chart shows how much time the replayed workload has taken to accomplish the same amount of work as

```
$ wrc REPLAYDIR=
Workload Replay
Copyright (c) 19
Wait for the rep
Replay started (
Replay finished
$
```

Divergence

	Number of Calls	Percentage of Total Calls
Error Divergence:		
Session Failures Seen During Replay	0	0.00
Errors No Longer Seen During Replay	0	0.00
Errors Mutated During Replay	0	0.00
New Errors Seen During Replay	0	0.00
Data Divergence:		
DMLs with Different Number of Rows Modified	0	0.00
SELECTs with Different Number of Rows Fetched	0	0.00

▼Detailed Comparison

	Capture	Replay	Percentage of Capture
Duration (hh:mm:ss)	00:04:22	00:02:34	58.78
Database Time (hh:mm:ss)	00:00:02	00:00:02	100.00
Average Active Sessions	0.01	0.01	170.13
User Calls	4,272	4,264	99.81

Requires license for Real Application Testing

Real Application Testing

- Some SQL Performance Analyzer and Database Replay functionality is available in earlier releases.
- Check Metalink Note 560977.1 for required patches
- SQL Performance Analyzer
  - Source database (upgrade from): Oracle 9.x, 10.1.x, 10.2.x
  - Destination database (upgrade to): 10.2.0.2+, 11.1.0.6+
  - Useful for SQL performance testing during upgrade to Oracle 10.2, 11g
- Database Replay
  - Capture workload from Oracle 9.2.0.8 and 10.2.0.2+
  - Replay workload in Oracle 11.1.0.6+
  - Useful for SQL workload testing during upgrade to Oracle 11g

Requires license for Real Application Testing

Automatic Memory Management

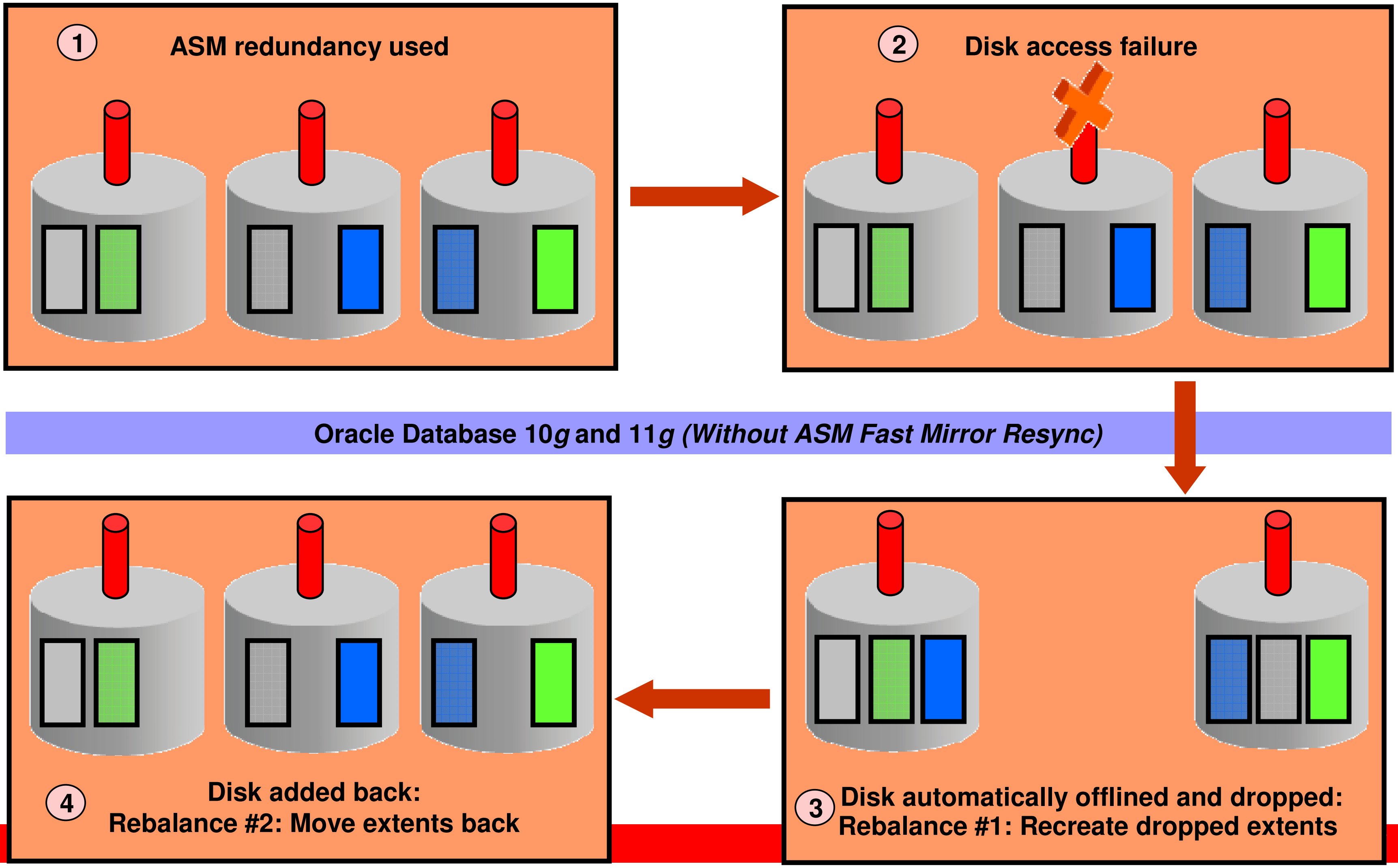
- Overall memory usage controlled by `MEMORY_TARGET`
  - Manually resize up to `MEMORY_MAX_TARGET`
  - Automatic sizing of SGA and PGA for Oracle instance
- When `MEMORY_TARGET` is defined:
  - Automatically sizes auto-tunable SGA components and PGA
    - Default policy: 60% SGA (`SGA_TARGET`) and 40% PGA (`PGA_AGGREGATE_TARGET`)
  - Memory components resized depending on workload and usage
  - SGA and PGA parameters, if defined, become lower limits
- When `MEMORY_TARGET` is not defined:
  - SGA and PGA behave as in Oracle 10g

Statistics Preferences

- Define for table, schema, or database
- Preference `PUBLISH`
  - Gather statistics but do not publish in data dictionary
  - Test statistics in current session by setting `OPTIMIZER_USE_PENDING_STATISTICS` = TRUE
  - Publish in data dictionary using `DBMS_STATS`
- Preference `INCREMENTAL`
  - Incrementally gather global statistics for changed partitions
- Preference `STALE_PERCENT`
  - % of changes on a table for statistics to be considered stale

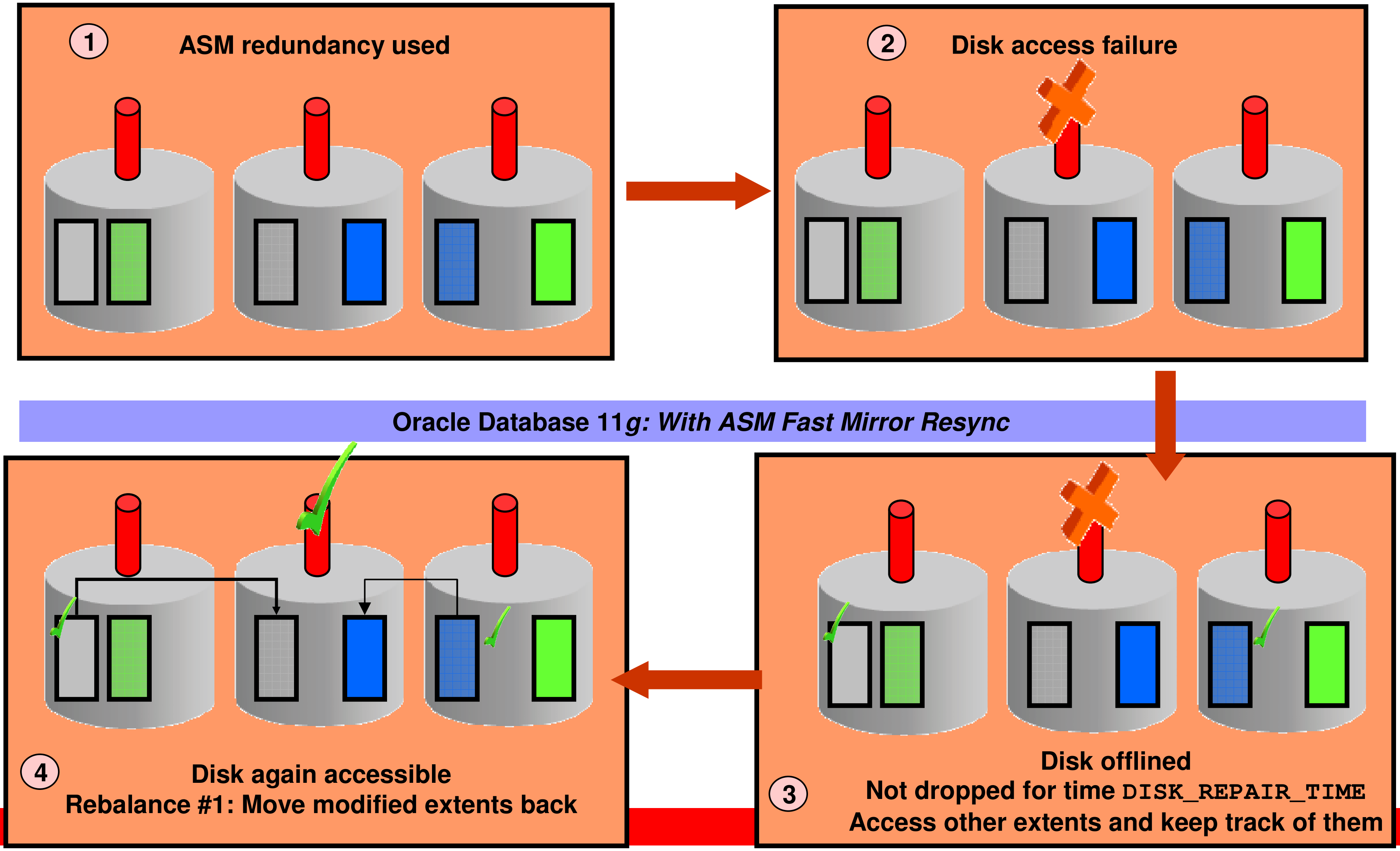
ASM Performance

ASM Fast Mirror Resync


1
ASM redundancy used
2
Disk access failure
Oracle Database 10*g* and 11*g* *(Without ASM Fast Mirror Resync)*
3
Disk automatically offlined and dropped:
Rebalance #1: Recreate dropped extents
4
Disk added back:
Rebalance #2: Move extents back

ASM Performance

ASM Fast Mirror Resync



1 ASM redundancy used

2 Disk access failure

Oracle Database 11*g: With ASM Fast Mirror Resync*

3 Disk offlined
Not dropped for time `DISK_REPAIR_TIME`
Access other extents and keep track of them

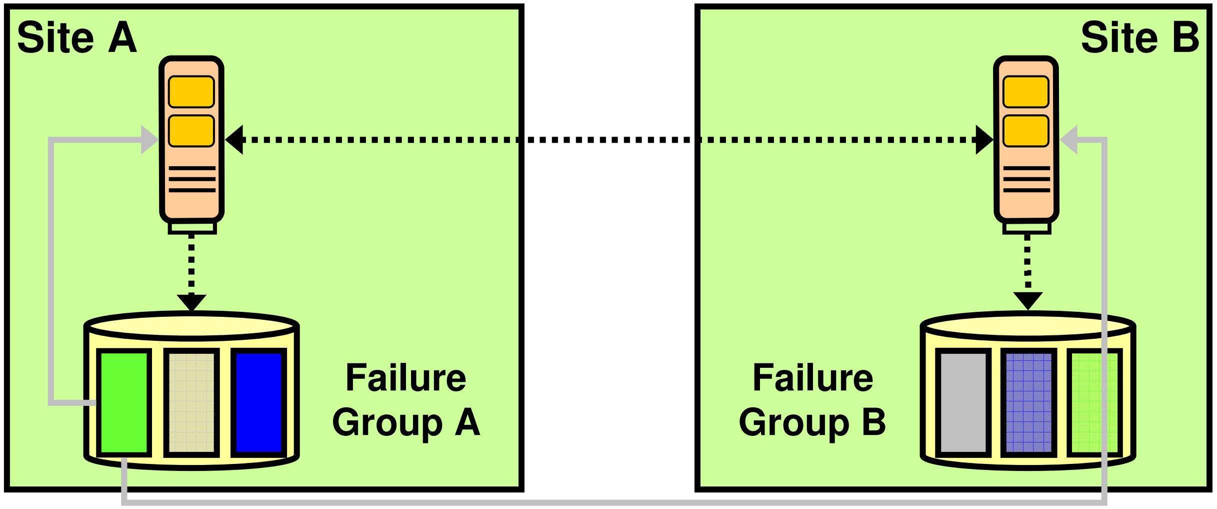
4 Disk again accessible
Rebalance #1: Move modified extents back

ASM Performance

ASM Preferred Mirror Read

W/O Preferred Read:

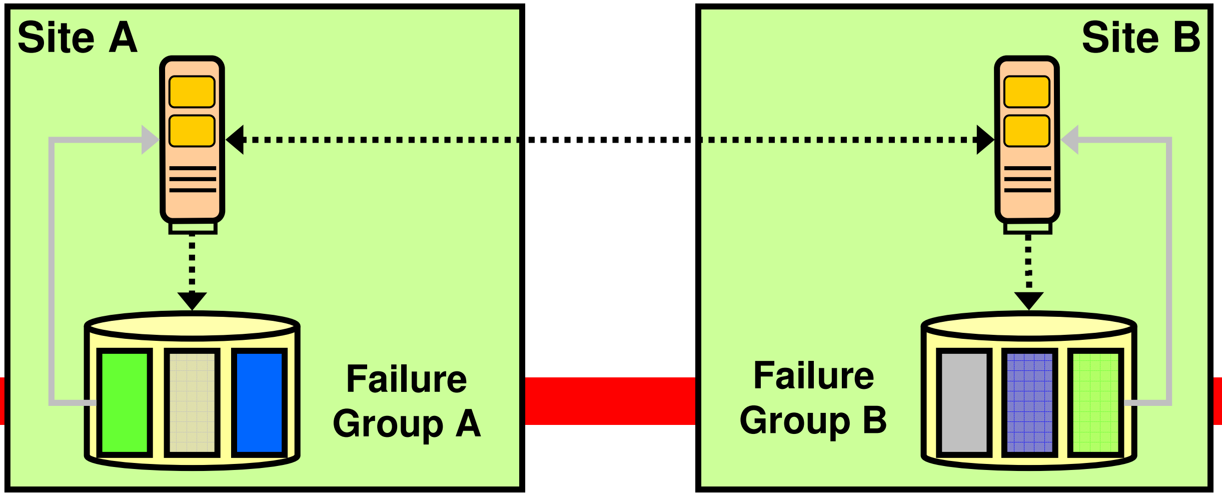
Read primary extent



```
ASM_PREFERRED_READ_FAILURE_GROUPS =
DG_A.FG_A                          DG_A.FG_B
```

With Preferred Read:

Read local extent



Partitioning

Interval Partitioning

- Extension of range partitioning
- Automatic creation of range partitions based on interval
- Useful for Information Lifecycle Management (ILM)

```
-- Automatic creation of monthly range partitions beyond 1-1-2004
CREATE TABLE SH.SALES_INTERVAL
(order_no NUMBER, time_id DATE, amount NUMBER)
PARTITION BY RANGE (time_id)
INTERVAL (NUMTOYMINTERVAL(1,'month')) STORE IN (tbs1,tbs2,tbs3,tbs4)
(
 PARTITION P1 values less than (TO_DATE('1-1-2002','dd-mm-yyyy')),
 PARTITION P2 values less than (TO_DATE('1-1-2003','dd-mm-yyyy')),
 PARTITION P3 values less than (TO_DATE('1-1-2004','dd-mm-yyyy')));

-- Insert a row that causes partition for May 2005 to be created
INSERT INTO SH.SALES_INTERVAL VALUES (100, ’10-MAY-2005’, 20000);
```

Requires license for Partitioning

Partitioning

Virtual Column-based Partitioning

- Virtual column using functions or expressions
- Virtual column not stored physically
- Partition data as per business requirements

```
CREATE TABLE employees
( employee_id  number(6) not null,
  first_name varchar2(30),
  last_name  varchar2(40) not null,
  …
  total_compensation as (salary *( 1+commission_pct))
)
PARTITION BY RANGE (total_compensation)
( PARTITION p1 VALUES LESS THAN (50000),
  PARTITION p2 VALUES LESS THAN (100000),
  PARTITION p3 VALUES LESS THAN (150000),
  PARTITION p4 VALUES LESS THAN (MAXVALUE)
);
```

Requires license for Partitioning

Partitioning

Reference Partitioning

- Partition child table using same method as parent table
- Partition-key column not needed in child table
- Partition maintenance operations on parent cascade to child table

```
-- Create range-partitioned parent table.
CREATE TABLE orders
( order_id     NUMBER(12),  order_date   DATE,
  customer_id  NUMBER(6),   order_status NUMBER(2),
  order_total  NUMBER(8,2)
  CONSTRAINT   orders_pk PRIMARY KEY(order_id))
PARTITION BY RANGE(order_date)
( PARTITION Q105 VALUES LESS THAN (TO_DATE('1-1-2005','DD-MM-YYYY')),
  PARTITION Q205 VALUES LESS THAN (TO_DATE('1-2-2005','DD-MM-YYYY')));

-- Create reference-partitioned child table (no ORDER_DATE column).
CREATE TABLE order_item
( order_id     NUMBER(12) NOT NULL, line_item_id NUMBER(3) NOT NULL,
  product_id   NUMBER(6) NOT NULL,  unit_price   NUMBER(8,2),
  quantity     NUMBER(8),
  CONSTRAINT   order_items_fk FOREIGN KEY(order_id) REFERENCES orders(order_id)
) PARTITION BY REFERENCE(order_items_fk);
```

Requires license for Partitioning

Partitioning

System Partitioning

- Application-controlled partitioning
- No partitioning keys
- Row placement using partition-extended syntax
- No unique local indexes, split operation, and CTAS

```
-- Create system partitioned table
CREATE TABLE systab (c1 integer, c2 integer)
PARTITION BY SYSTEM
(
  PARTITION p1 TABLESPACE tbs_1,
  PARTITION p2 TABLESPACE tbs_2,
  PARTITION p3 TABLESPACE tbs_3,
  PARTITION p4 TABLESPACE tbs_4
);
-- Insert row with partition-extended syntax
INSERT INTO systab PARTITION (p1) VALUES (4,5);
```

Requires license for Partitioning

Partitioning

Composite Partitioning Enhancements

- Range top level
  - Range-Hash *(available since Oracle 8i)*
  - Range-List *(available since Oracle 9.2)*
  - Range-Range
- List top level
  - List-List
  - List-Hash
  - List-Range
- Interval top level
  - Interval-Range
  - Interval-List
  - Interval-Hash

Requires license for Partitioning

Advanced Compression

Table Compression

- Oracle 9*i* onwards: Table compression for direct loads
- Oracle 11g supports compression:
  - For direct loads and conventional DML
  - On table, partition, and tablespace
- No performance degradation for disk writes
  - Compress database block upon reaching PCTFREE
- Improved query performance due to less block reads
- Application transparent
- Benefits OLTP and Data Warehouse

```
-- Enable compression on new table.
CREATE TABLE t1 COMPRESS FOR ALL OPERATIONS;

-- Enable compression on existing table.
ALTER TABLE t2 COMPRESS FOR DIRECT_LOAD OPERATIONS;
```

Requires license for Advanced Compression

Total Recall

Flashback Data Archive

- Store historical data without setting `DB_FLASHBACK_RETENTION_TARGET`
- Access historical data using version queries
- No possibility of modifying historical data

```
-- 1. Create Flashback Data Archive.
-- RETENTION clause enabled automatic purging.
CREATE FLASHBACK ARCHIVE fda1 TABLESPACE tbs1 QUOTA 10G RETENTION 5 YEAR;

-- 2. Enable history tracking for a table.
ALTER TABLE inventory FLASHBACK ARCHIVE fla1;

-- 3. Make changes to rows in table over a period of time.

-- 4. Access historical data beyond UNDO_RETENTION.
SELECT product_number, product_name, count FROM inventory
AS OF TIMESTAMP TO_TIMESTAMP('2007-01-01 00:00:00', 'YYYY-MM-DD HH24:MI:SS');

-- 5. Disable history tracking for table.
ALTER TABLE stock_data NO FLASHBACK ARCHIVE;
```

Requires license for Total Recall

For More Information

- Oracle Database 11g
  - http://www.oracle.com/technology/products/database/oracle11g/index.html
- Oracle 11g Education (http://education.oracle.com)
  - Oracle 11g: New features for Administrators
  - Oracle 11g: Administration Workshop I and II
  - Oracle 11g: Performance Tuning
- Oracle Database 11g Documentation
  - http://www.oracle.com/pls/db111/homepage
- Metalink Notes
  - Note.454442.1: 11g Install Understanding about Oracle Base, Oracle Home and Oracle Inventory locations
  - Note.454631.1: 11g DBCA New features / Enhancements
  - Note.444709.1: COMPATIBLE Initialization Parameter and Upgrade/Downgrade to 11g
  - Note.454635.1: 11g DEFAULT Profile Changes
  - Note.443746.1: Automatic Memory Management(AMM) on 11g
  - Note 560977.1: RAT Availability in pre-11g releases

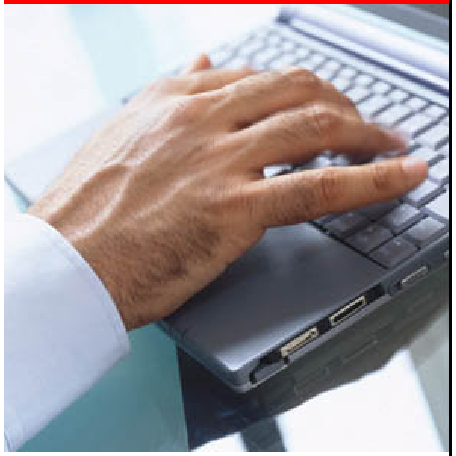
For More Information

http://search.oracle.com

Oracle Database 11g 🔍

or

http://www.oracle.com/



Oracle Advanced Customer Services

Oracle Advanced Customer Services

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- Oracle DB Implementation Guidance / Best Practices (Assisted Services)
- Enhanced Levels of Support – Increased personalization and proactivity (Priority Service, SSC)
- Best Practice Advice and Guidance for implementing all Oracle product families (Hyperion, PSFT, Siebel, etc.)

For further information, please contact ACS Field Support Rep:

George McCormick, george.mccormick@oracle.com, 917-674-9336

Solution Support Center

ORACLE
ADVANCED CUSTOMER SERVICES

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VIRTUAL CENTER OF EXCELLENCE

- Unparalleled technical expertise
- Support, Account Management, Product Development at your finger tips
- Dedicated toll-free number to Oracle Support

HIGHEST SYSTEMS AVAILABILITY

- System & performance assessments
- Personalized management of service requests
- Problem avoidance through quarterly reviews

PROVEN BEST PRACTICES

- ITIL v3 methodologies
- Unique tools, methods, & processes
- Oracle Solutions Lifecycle

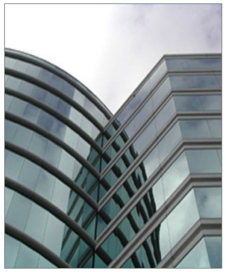
▶

VALUE

- **Achieve operational excellence**
- **Reduce costs and avoid unplanned downtime**
- **Minimize change-related risks**

Assisted Services

Assisted Services is a flexible set of Advanced Customer Services, designed to help optimize system availability and performance, enhance database and system administration practices, and improve backup and recovery processes.



ASSESSMENTS

- Performance & critical milestone assessments
- Technical requirements to meet business objectives
- Backup & recovery process review

EXPERTISE

- Implementation & upgrade planning
- Knowledge transfers & best practices for implementing business requirements
- Critical advice for software updates

PROBLEM MANAGEMENT & SYSTEM MAINTENANCE

- ACS Support Manager
- Named Engineers, on-site as required
- Database & sys administration assistance

VALUE

- **Optimize reliability, availability & performance**
- **Improve database & system administration processes**
- **Improve backup & recovery processes**

Assisted Services

DB / Core Tech

- Staff Augmentation
  - Project Related
    - Upgrades, Installs, etc..
    - Implementation of new technologies / enhancements (e.g. RAC, DataGuard, Streams, etc..)
  - Operational Support
  - Knowledge Transfer

- Proactive Assessments
  - Configuration
  - Performance
  - Patch
  - Patch Strategy
  - Stand by Assistance

ORACLE®