
ORACLE®

Oracle Database 10g : The Self-Managing Database

Richard Sarwal
Vice President
Oracle Corporation

ORACLE

Agenda

- Key Manageability Challenges
- Oracle's Management Approach
- Manageability Revolution - Oracle Database 10g
- What Does It Mean to You?
- Q&A

Why is Manageability Important?

Managing IT is Managing the Business

For Customers

- Increase in Size & Complexity
- High Administration Cost
- Unacceptable Failure Cost

For ISV Partners

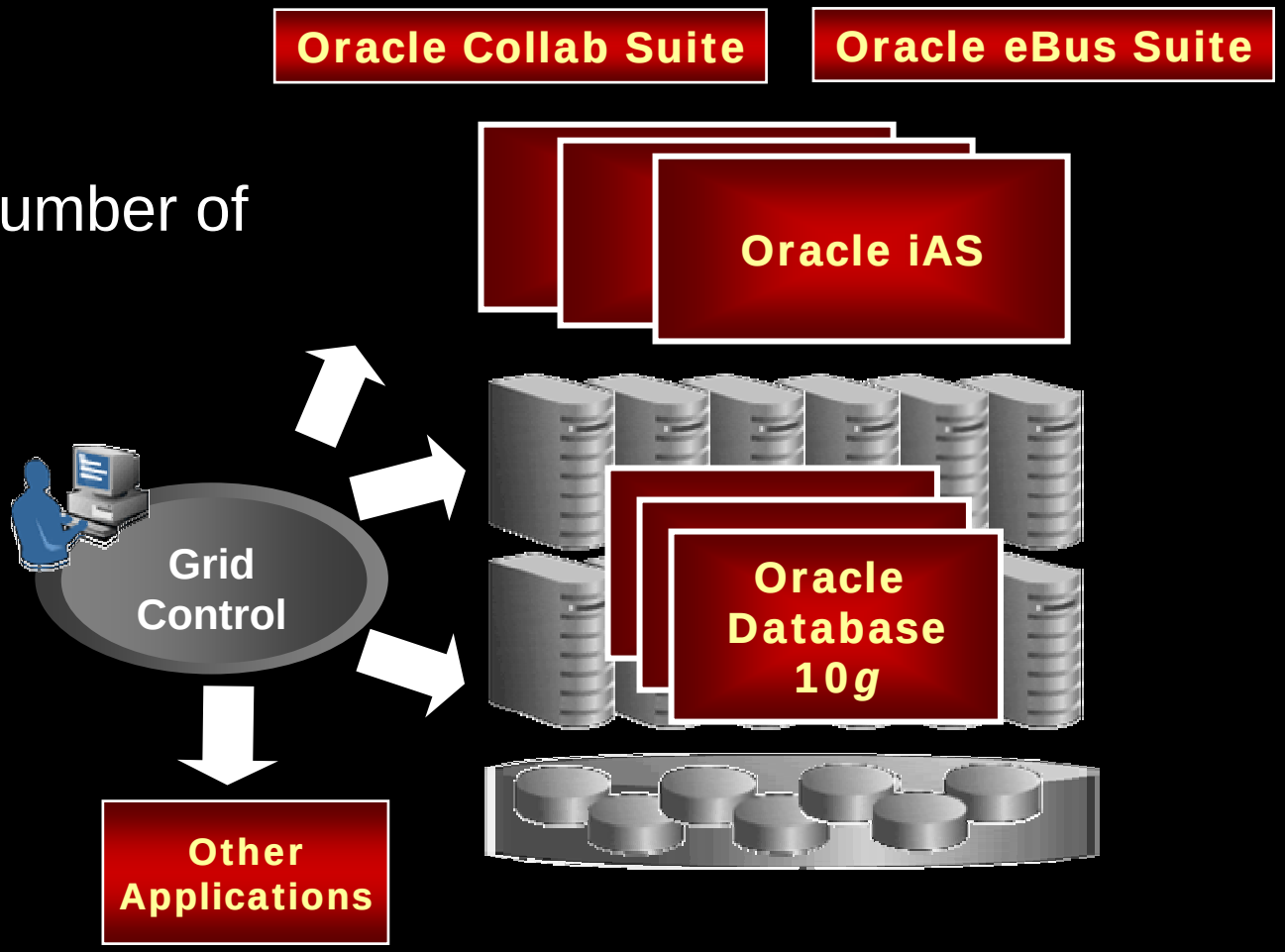
- Increase in Deployment Complexity
- Increase in Development Cost
- High Support Cost

…….and it is getting harder!

Oracle's Management Approach

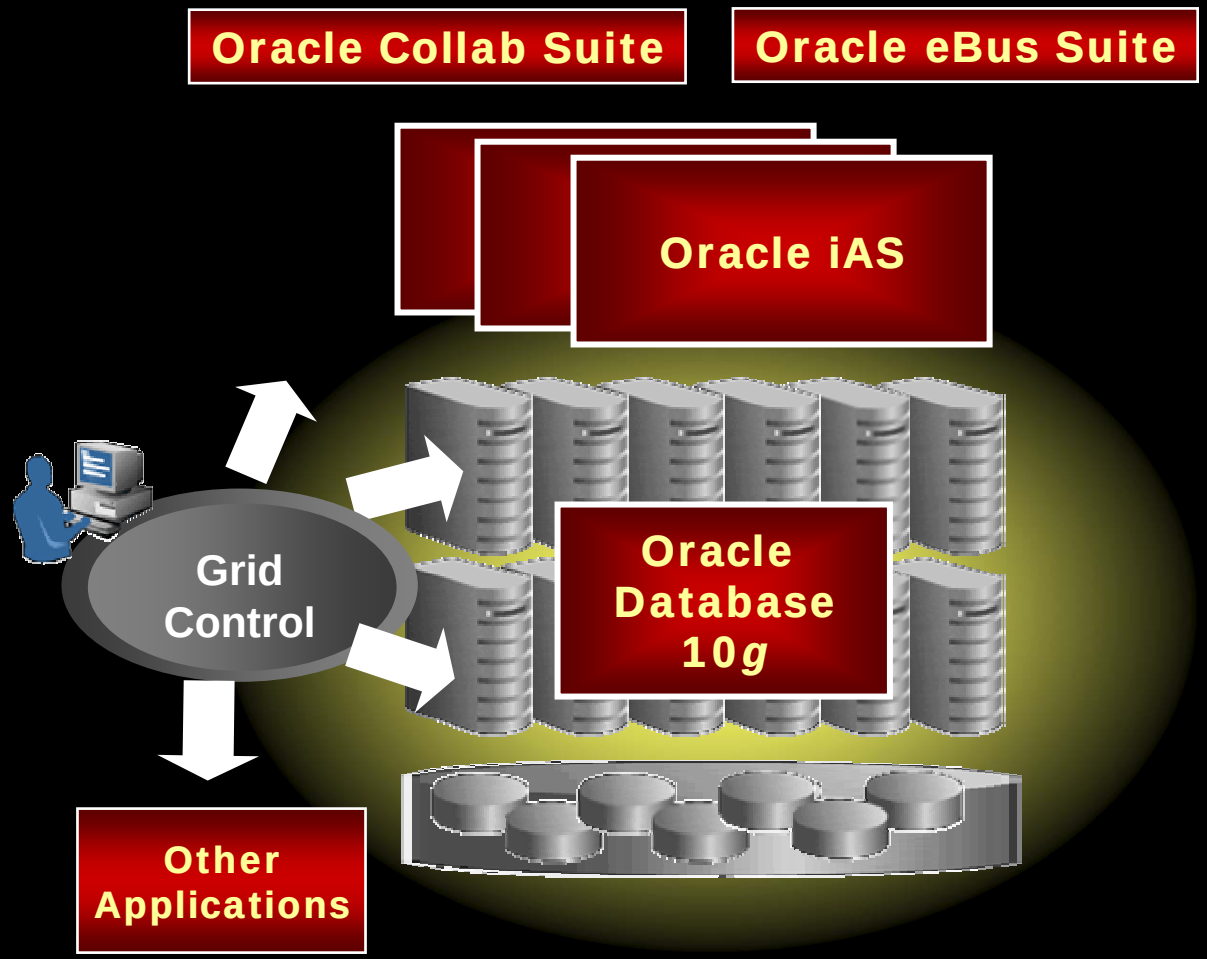
Complete Manageability Solution

- Manage entire infrastructure
- Manage large number of systems



Make Single Database Easy to Manage

- Make RAC Easy to Manage
- Enable the Grid
- For Application ISV Partners
- For End Users
- For All Types of Workload

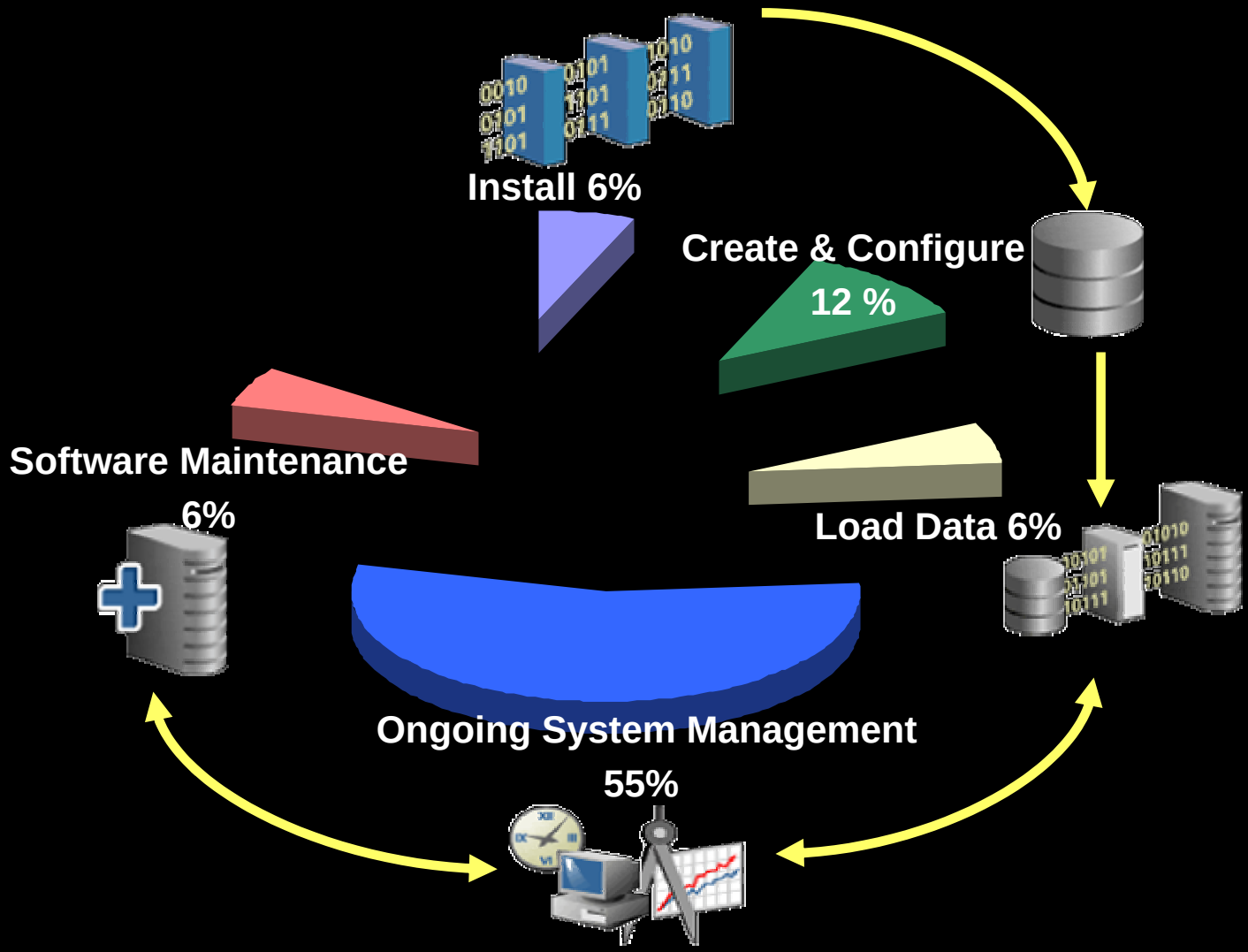


Manageability Revolution

Unprecedented Development Effort

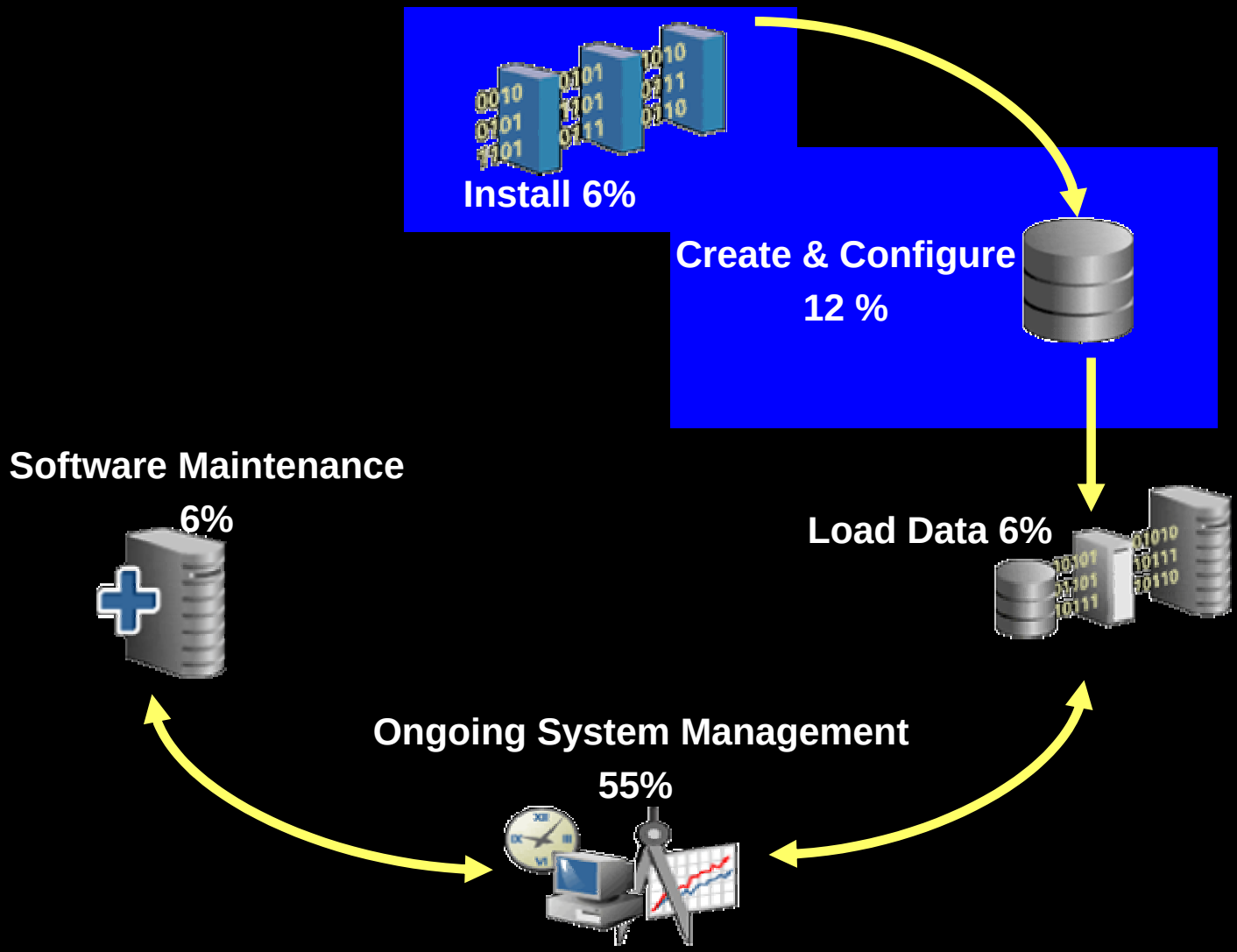
- Single, biggest effort
  - 50% of the architects in the organization
  - 200+ engineers
  - Gathered customers feedback
  - Active, focused development
  - Not just research!
- Wide-spread effort
  - Projects span entire technology stack
- Long term commitment

Where DBA's spend their time



Source: IOUG 2001 DBA Survey

Where DBA's spend their time



Source: IOUG 2001 DBA Survey

Software Installation

- Fast lightweight install
  - Major redesign of installation process
  - Single CD, 20 Minutes
  - CPU, memory, disk space consumption greatly reduced
  - Extremely lightweight client install (3 files) using Oracle Instant Client
- Automation of All Pre and Post Install Steps
  - Validate OS Configuration, patches, resource availability etc.
  - Configure all components (listeners, database, agent, OMS, OID etc.) for automatic startup and shutdown
- Enhanced silent install

Simplified Creation & Configuration

- Greatly reduced database creation time using pre-configured, ready-to-use database
- 90% reduction of initialization parameters: < 30 Basic parameters
- Automatically setup common tasks, e.g. backups
- Automatically configures LDAP server
- Automatic Shared Server Set-up
- Easy Connect Naming

Basic Parameters

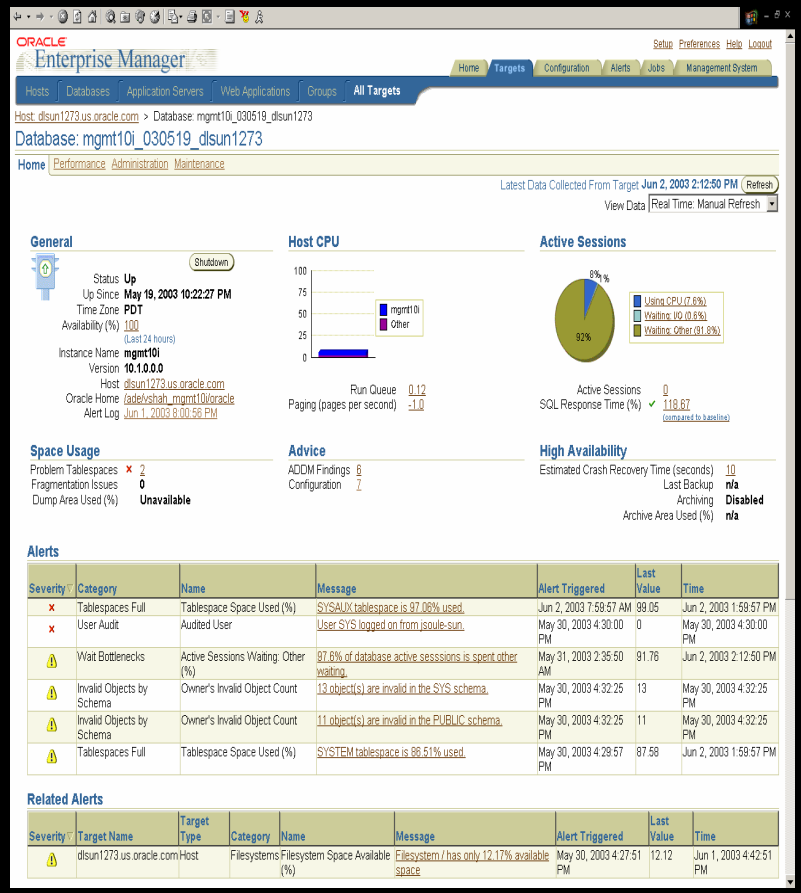
- compatible
- processes
- sessions
- undo_management
- pga_aggregate_target
- nls_language
- nls_territory
- db_domain
- shared_servers
- instance_number
- cluster_database
- db_block_size
- sga_target
- control_files
- db_name
- db_recovery_file_dest
- open_cursors
- remote_listener
- rollback_segments
- db_recovery_file_dest_size
- db_create_online_log_dest_n
- db_create_file_dest
- log_archive_dest_n
- log_archive_dest_state_n
- star_transformation_enabled
- undo_tablespace
- remote_login_passwordfile
- db_file_multi_block_read_count
- db_unique_name

Simplified Upgrade

- Pre upgrade checks (e.g. parameter settings)
- Post upgrade status checks
- Time estimator
- Re-startable
- Guide administrators in using best practices

Out-of-the-Box Database Control

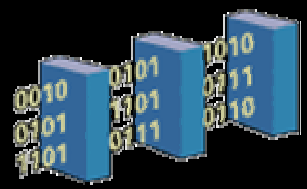
- No separate install
- Fully functional administration and monitoring after database creation
- Listener discovery, configuration & monitoring



Seamless Out-of-the-Box Experience

- Fast, lightweight Install
- Simplified Create & Configure
- Simplified Upgrade
- Out-of-the-box Database Control

Where DBA's spend their time



Install 6%

Create & Configure
12 %

Load Data 6%

Software Maintenance
6%

Ongoing System Management
55%

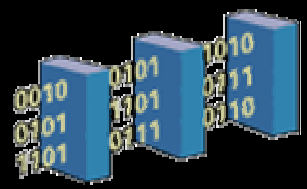
Source: IOUG 2001 DBA Survey

Efficient Data Load

Oracle Database 10*g*

- Data Pump
  - 60% faster than Export (single stream)
  - 15X-20X faster than Import (single stream)
  - Automatic Parallelism – multiple streams
  - Re-startable
  - Size estimation on export dumpfiles
- Cross Platform Transportable Tablespaces

Where DBA's spend their time



Install 6%

Create & Configure
12 %

Load Data 6%

Ongoing System Management
55%

Software Maintenance
6%

Source: IOUG 2001 DBA Survey

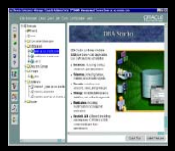
Ongoing System Management

55% of DBA's time is spent in ongoing management, monitoring and tuning

1. Performance Diagnosis & Troubleshooting
2. Space & Object Management
3. SQL & Application Tuning
4. System Resource Tuning
5. Backup and Recovery

Source: IOUG 2001 DBA Survey

Manageability Challenges - Today



Application & SQL Management

Optimizer Stats *Response time*

Throughput *Schema/Index*

Backup & Recovery Management

Tapes, MTTR

Disaster Recovery

System Resource Management

CPU Utilization

Memory Pools

Processes

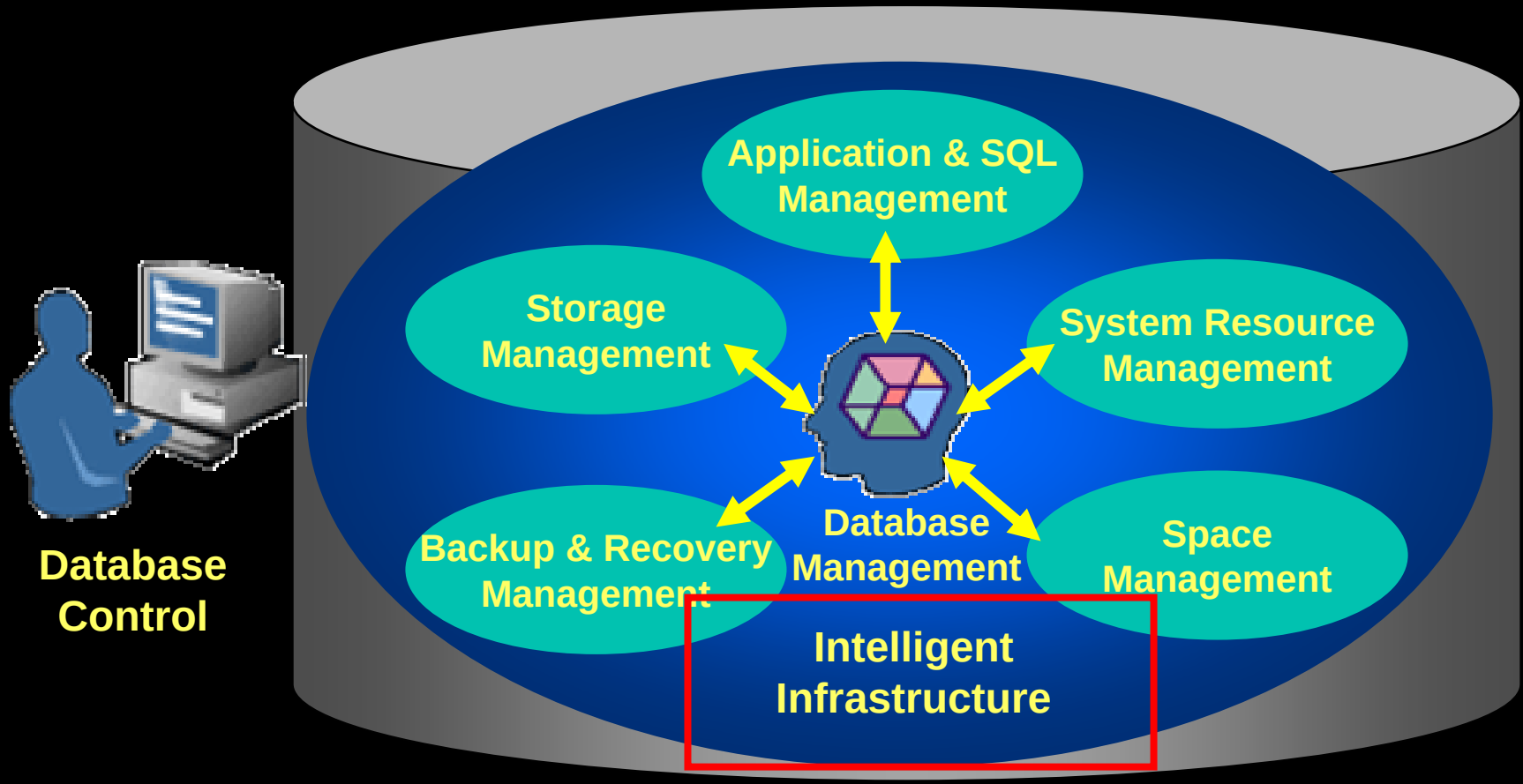
Internal Space Management

Table growth trend *Space fragmentation*

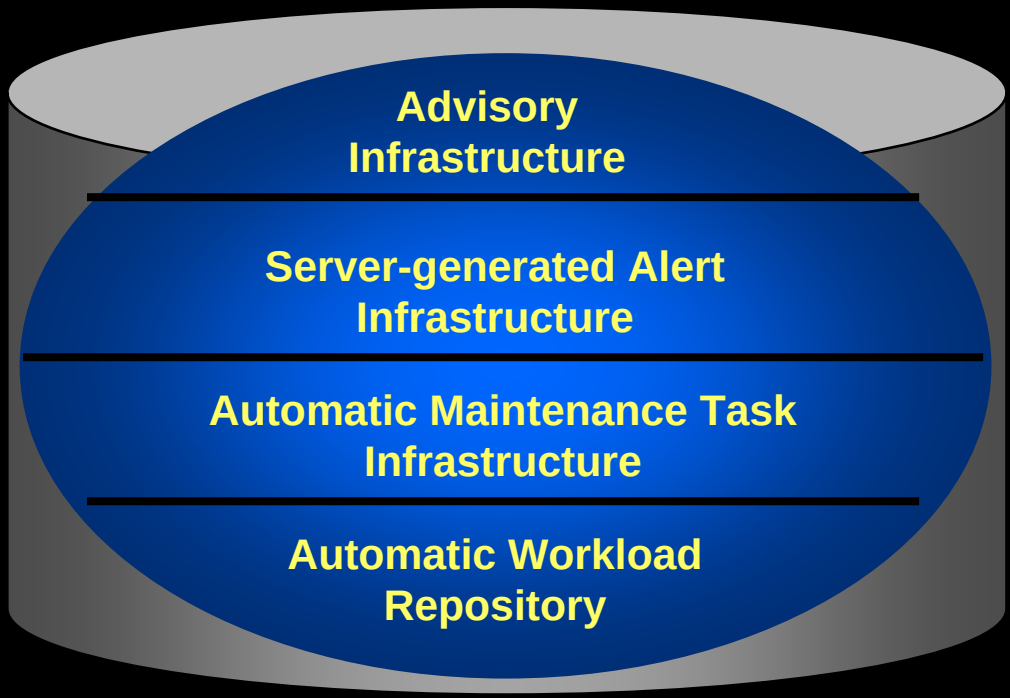
External Storage Management

Disk Configuration *Stripe Size* *Data Redistribution*

Oracle Database 10*g* – Self-Managing Database

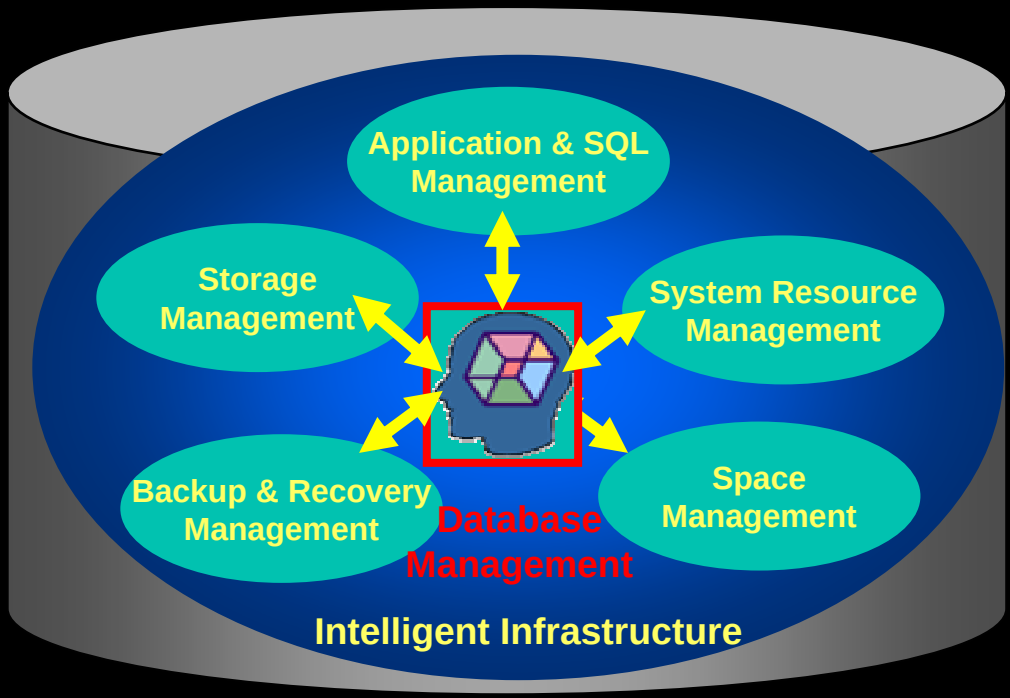


Intelligent Infrastructure



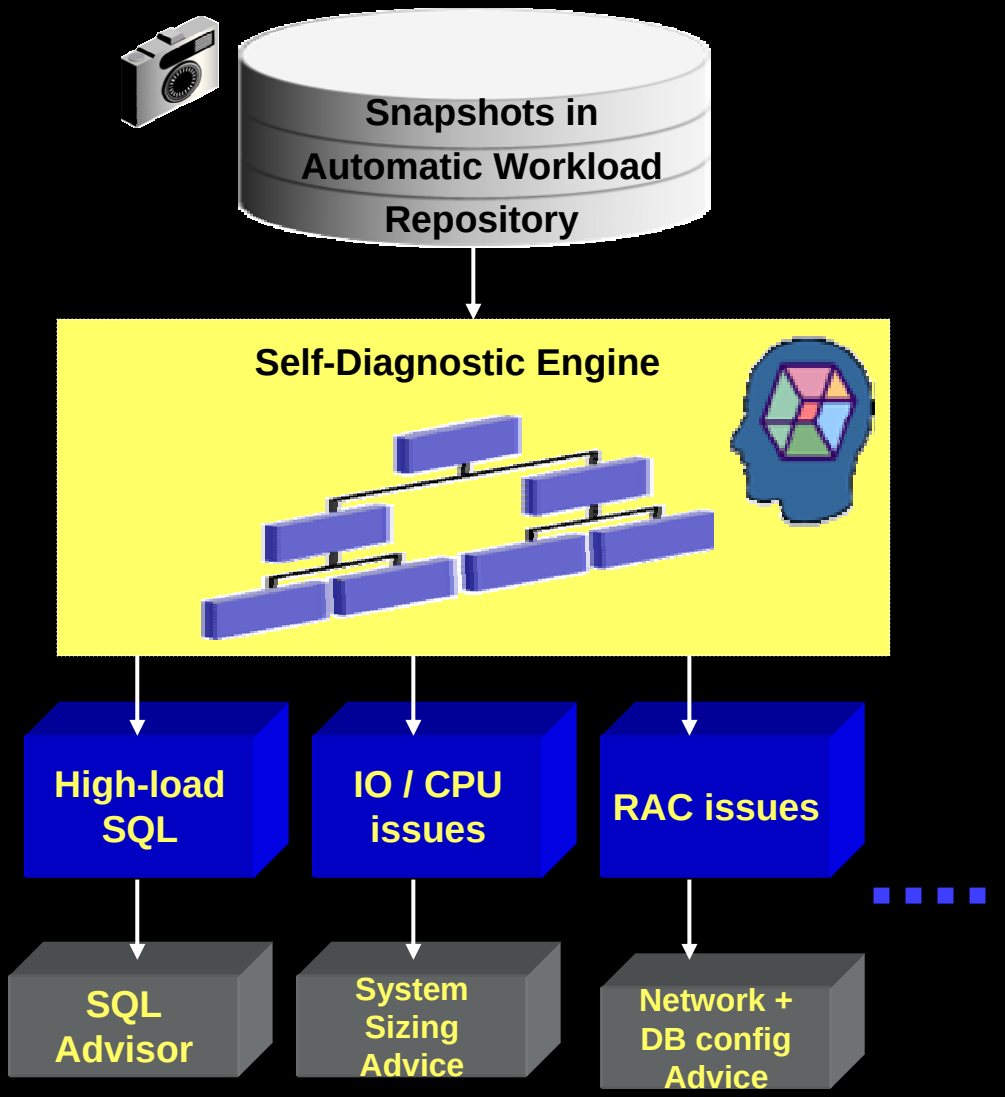
- **Automatic Workload Repository**
  - "Data Warehouse" of the Database
  - Code instrumentation
- **Automatic Maintenance Tasks**
  - Pre-packaged, resource controlled
- **Server-generated Alerts**
  - Push vs. Pull, Just-in-time, Out-of-the-box
- **Advisory Infrastructure**
  - Integrated, uniformity

Automatic Database Diagnostic Monitor (ADDM)



- Performance expert in a box
- Integrate all components together
- Automatically provides database-wide performance diagnostic, including RAC
- Provides impact and benefit analysis
- Provides Information vs. raw data
- Runs proactively
- Real-time results using the Time Model

ADDM's Architecture



- Instrument database code paths to produce Time & Wait Model
- Classification Tree is based on decades of Oracle performance tuning expertise
- Pinpoint root cause and non-problem areas
- Active Session History – snapshot of session activity every second
- Runs proactively & manually

Performance Diagnostic: Before and Now

Scenario: Hard parse problems

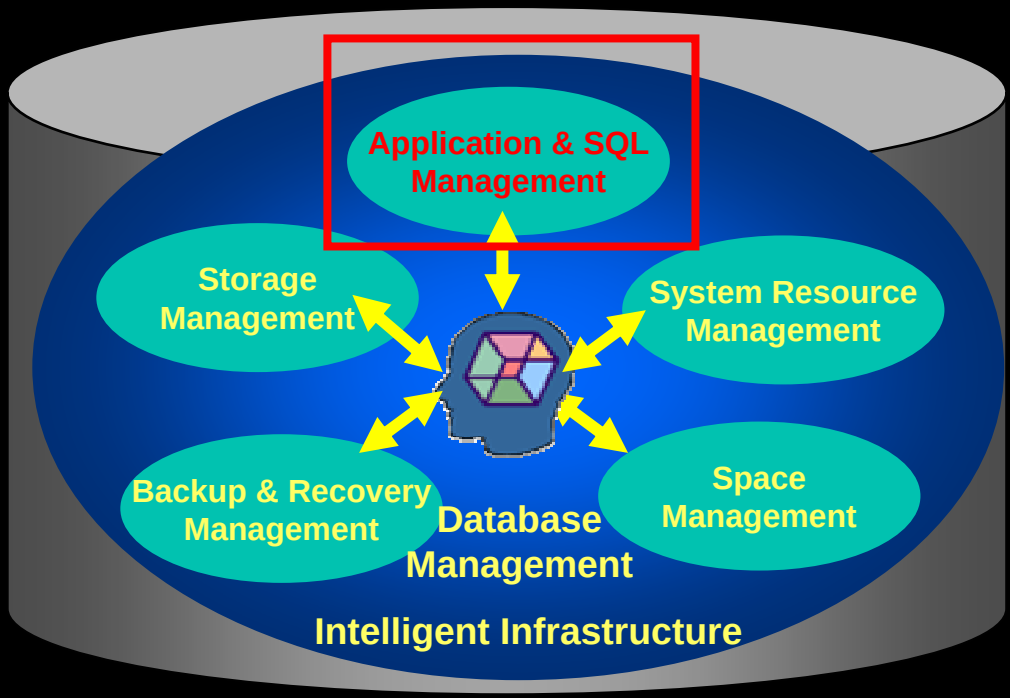
Before

1. Examine system utilization
2. Look at wait events
3. Observe latch contention
4. See wait on shared pool and library cache latch
5. Review v$sysstat (difficult)
6. See “parse time elapsed” > “parse time cpu” and #hard parses greater than normal
7. Identify SQL by..
   - Identifying sessions with many hard parses and trace them, or
   - Reviewing v$sql for many statements with same hash plan (difficult)
8. Examine objects accessed and review SQL
9. Identify “hard parse” issue by observing the SQL contains literals
10. Enable cursor sharing

Oracle10*g*

1. Review ADDM recommendations
2. ADDM recommends use of cursor_sharing

Application and SQL Management



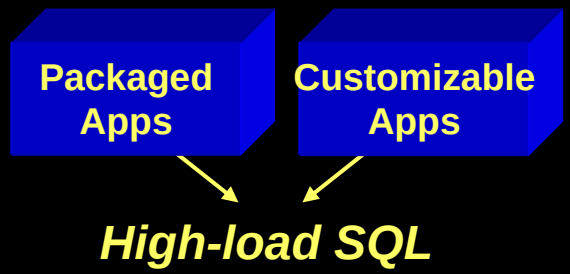
Key to efficient SQL execution: Oracle Cost-based Optimizer

- Proven Technology
  - Over 10 years of production usage
  - Adopted by all top-tier applications vendors
- Sophisticated functionality
  - Automatically-gathered object and system (CPU, IO, Caching) statistics
  - Comprehensive set of access paths, adaptive search strategy
  - Cost-based transformations
  - Automatic allocation of memory and parallelism
  - Versioned optimizer statistics

Remaining Challenges

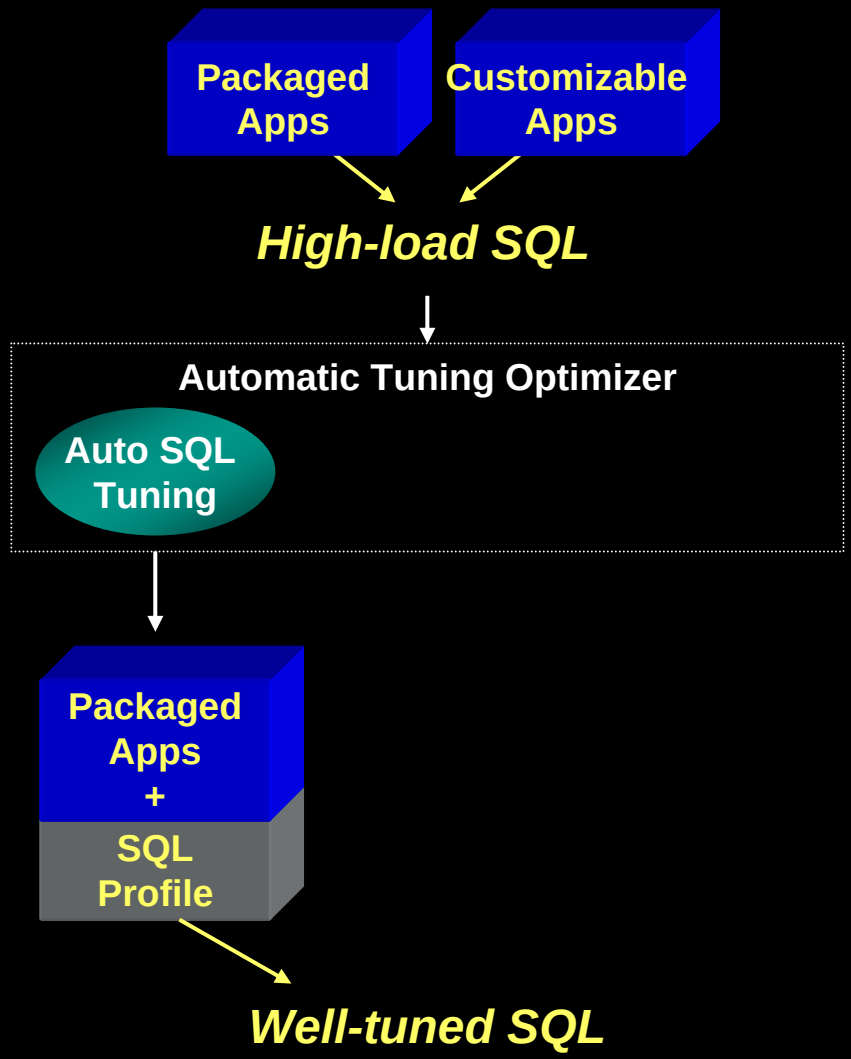
- How to quickly find optimal plans for complex queries?
  - Sub-optimal plans caused by correlations, complex predicate selectivity
- What is “bad” SQL?
- How to work-around ‘bad’ SQL in packaged applications?
- How to ‘globally’ optimize an entire application’s SQL statements?
  - Adding an index may help one statement, but what is the impact on the rest of the application

Automatic Tuning Optimizer



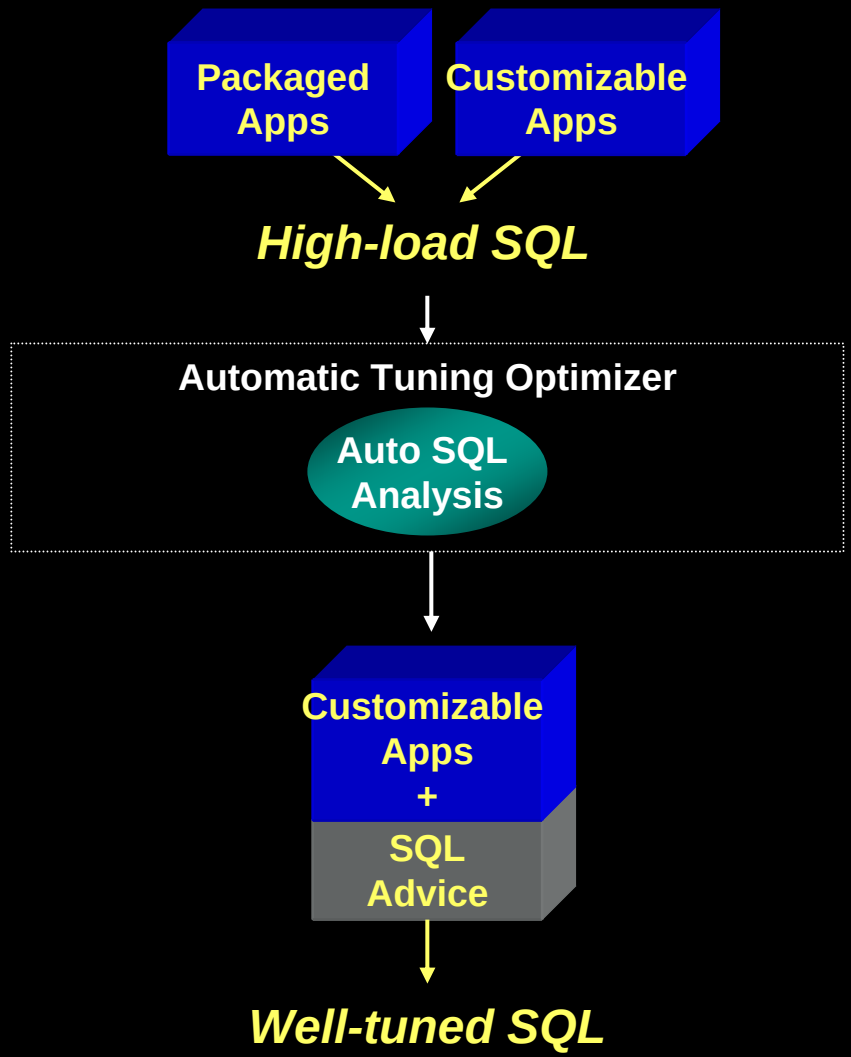
- Identify ‘bad’ SQL
  - Automatic workload capture
  - Automatic identification of high-load SQL
  - Top N highest resource-consuming SQL Statements

Automatic Tuning Optimizer



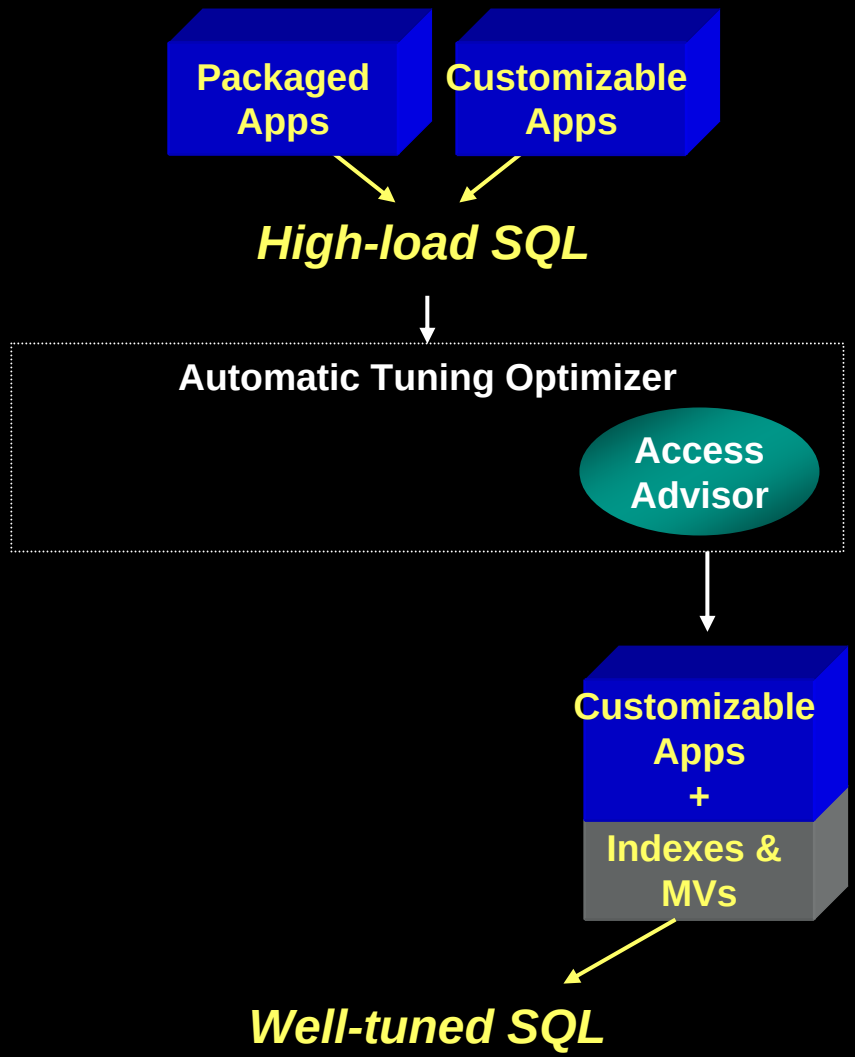
- Automatic SQL Tuning
  - Learn from past executions
  - Dynamic sampling, partial execution techniques
  - Profile the SQL statement to feedback to optimizer
  - No change to SQL text

Automatic Tuning Optimizer



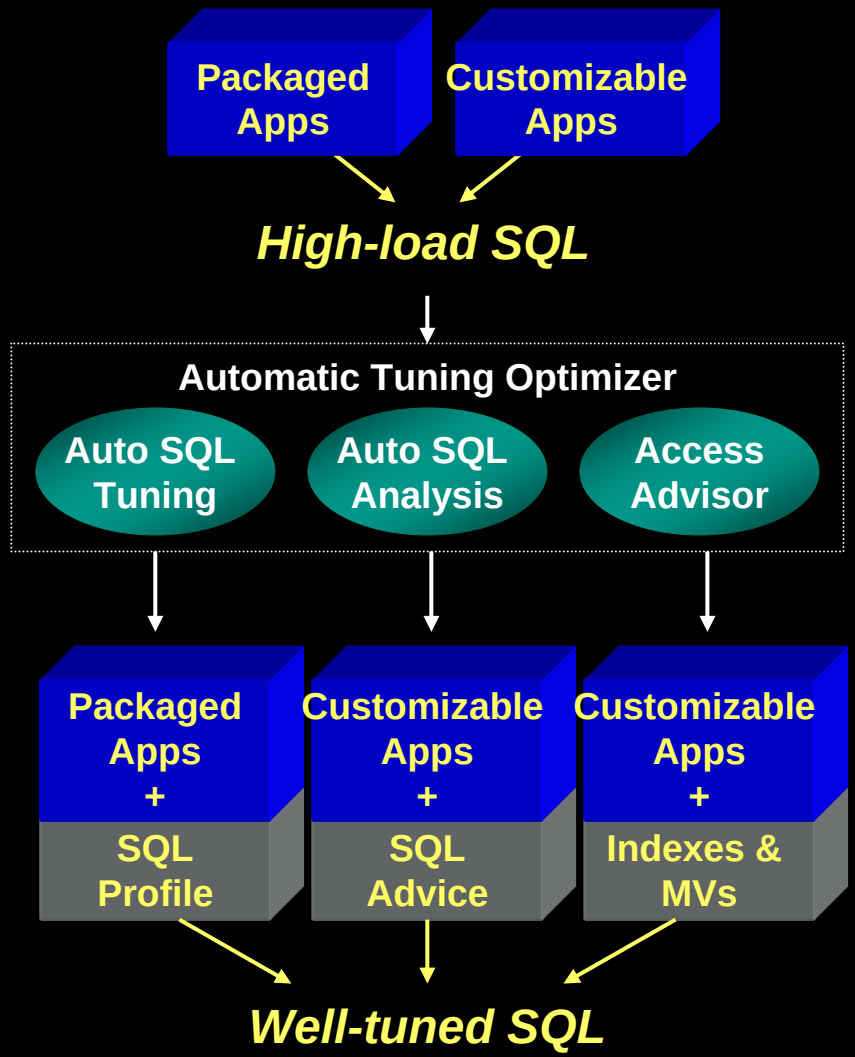
- Automatic SQL Analysis
  - Optimizer explains decision points
  - Advises on badly written SQL, stale statistics, bad schema

Automatic Tuning Optimizer



- SQL Access Advisor
  - Advise on access paths
  - Indexes, Materialized Views, Indexes on Materialized Views
  - Consider entire workload
  - Consider Impact on insert/update/delete

Automatic Tuning Optimizer



- Complete SQL Management
  - Automated workload capture, identification of high-load SQL
  - Automatic SQL Tuning
  - Automatic SQL Analysis
  - SQL Access Advisor

SQL Tuning: Before and Now

Scenario: Bad SQL in Packaged Applications

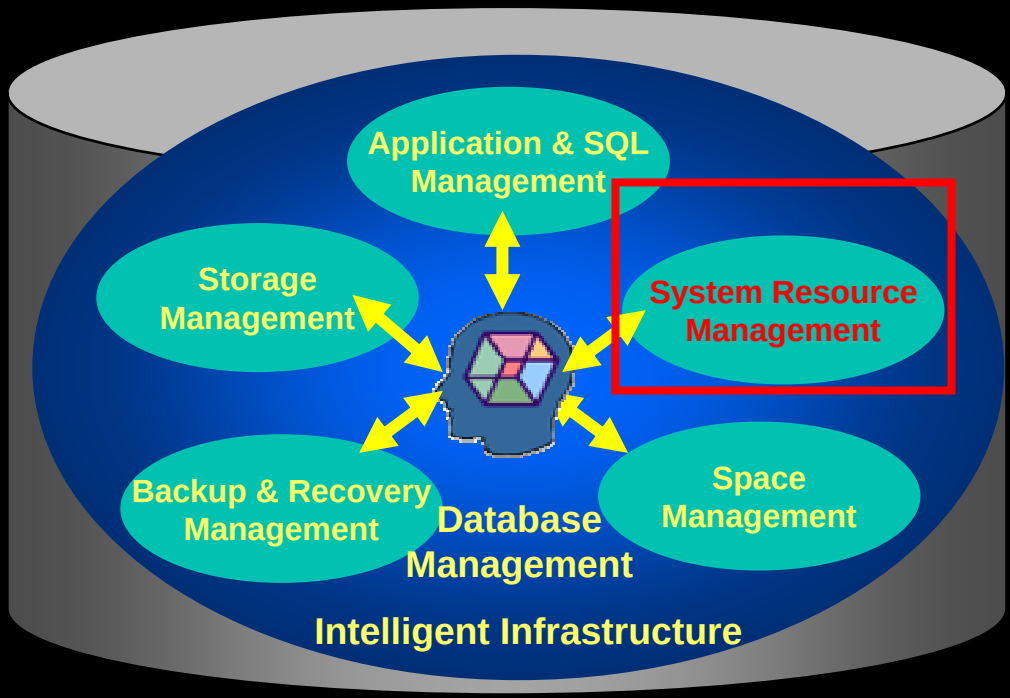
Before

1. Examine system utilization
2. Look at wait events
3. See wait on DB scattered read
4. Determine scope – system wide, module-dependent, user-dependent?
5. Identify SQL by (difficult)
   - Identifying sessions with high DB scattered read waits and trace them, or
   - Reviewing Top Sessions in OEM
6. Get explain plan
7. Examine objects accessed (size/cardinality)
8. Review SQL statistics and/or compare to object statistics (v$sql) (difficult)
9. Identify the problem
10. Contact packaged app vendor
11. Produce test case for vendor
12. Vendor produces patch/upgrade
13. Patch/upgrade installed in customer's next maintenance cycle

Oracle10*g*

1. Review ADDM recommendations
2. Follow link to run Automatic SQL tuning
3. Accept SQL Profile recommendations from SQL Tuning

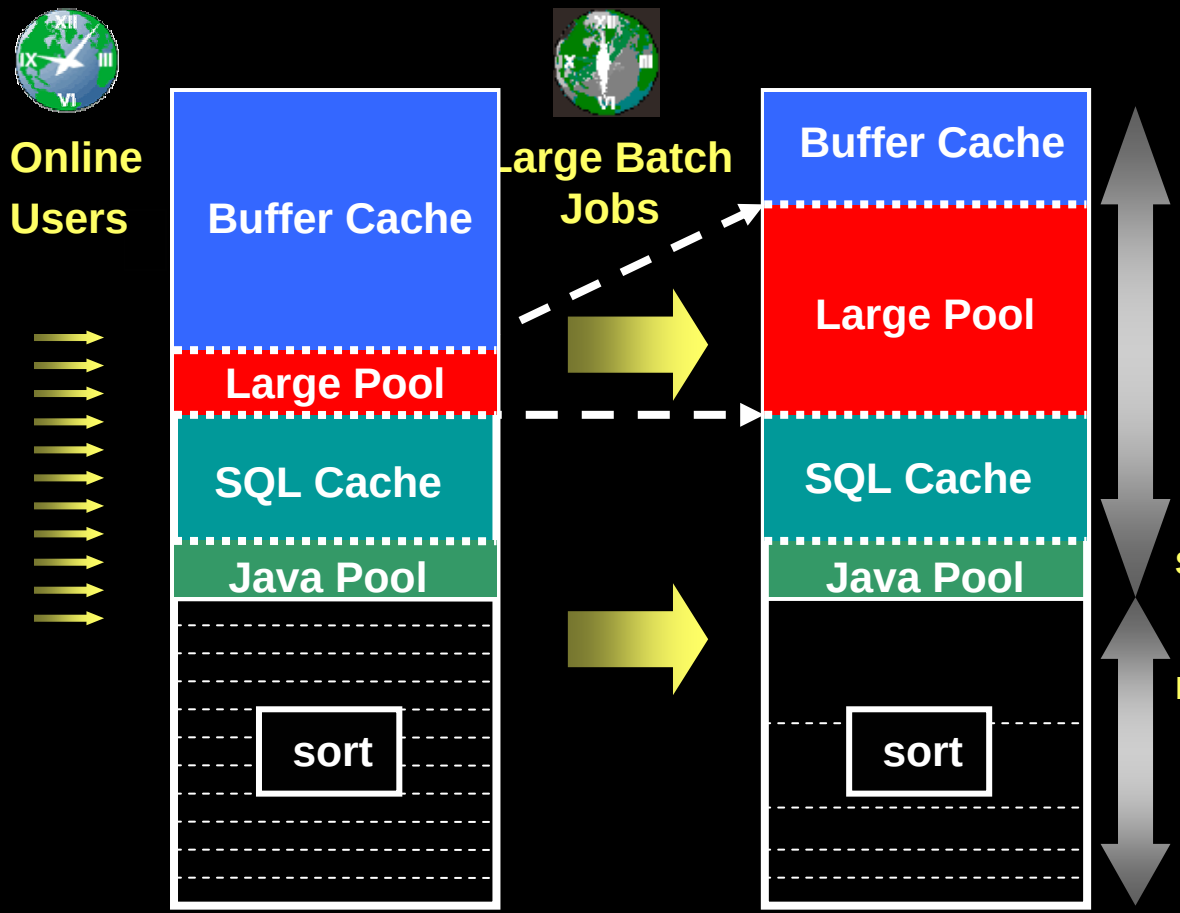
System Resource Management



Oracle 9i

- Resource Manager controls and prioritizes CPU usage
- Automatic SQL Memory Tuning

Automatic Shared Memory Tuning



- Automatically adapts to workload changes
- Maximizes memory utilization
- Single Parameter makes it easier to use
- Helps eliminate out of memory errors
- Can help improve performance

SGA Memory Management: Before and Now

Scenario: Out-of-memory Errors (ORA-4031)

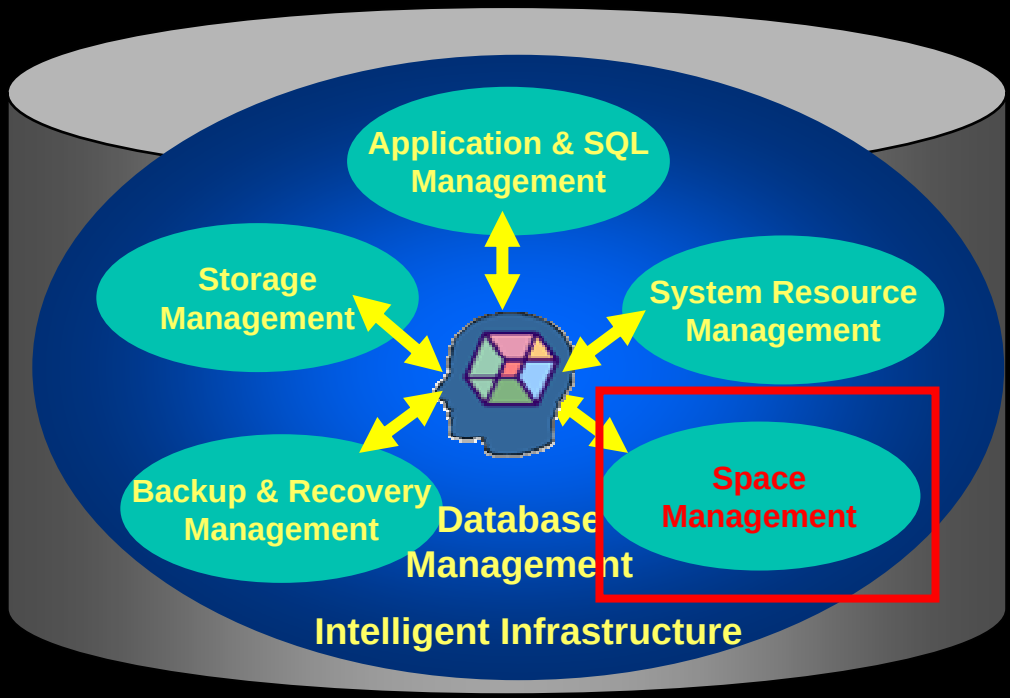
Before

1. Launch Buffer Pool Advisor
2. Examine output; check if Buffer Pool is over allocated
3. If so, reduce size of Buffer Pool
4. Launch Shared Pool Advisor
5. Examine output; check if Shared Pool is under allocated
6. If so, increase size of Shared Pool

Oracle10*g*

(This space is intentionally left blank – No manual steps needed with Automatic Shared Memory Tuning)

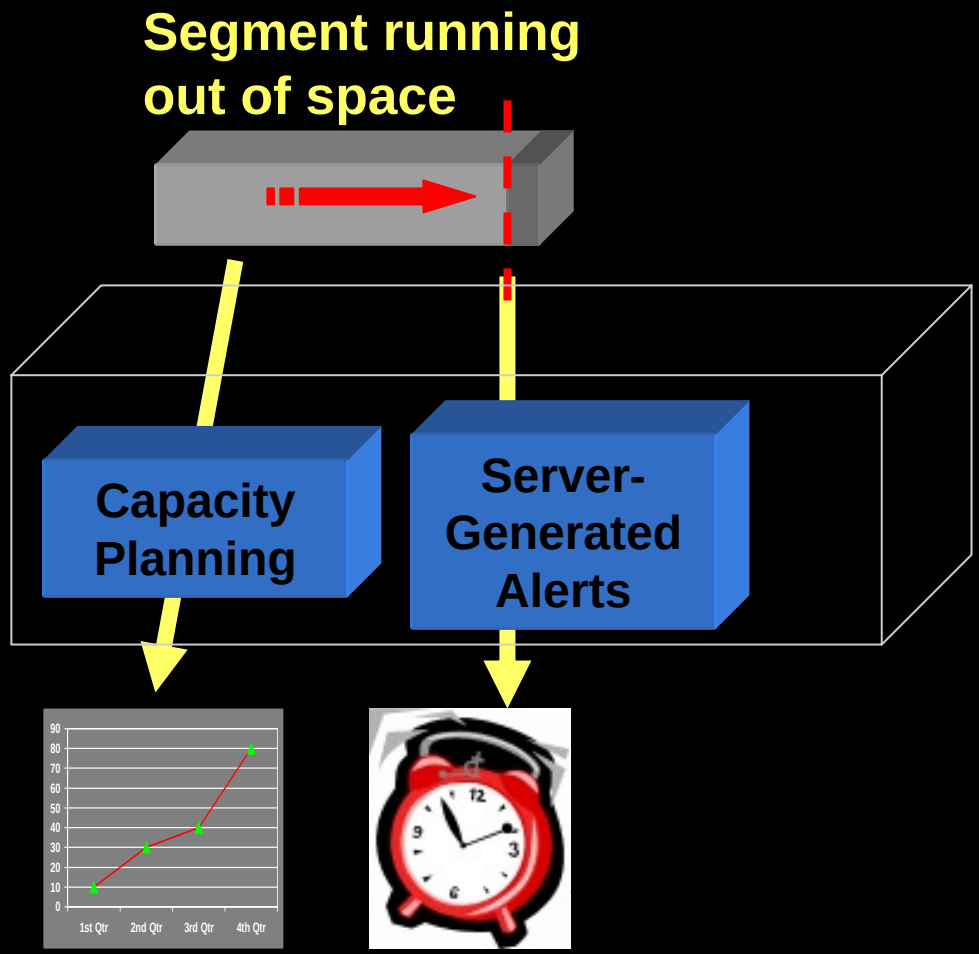
Automatic Space Management



Oracle9i

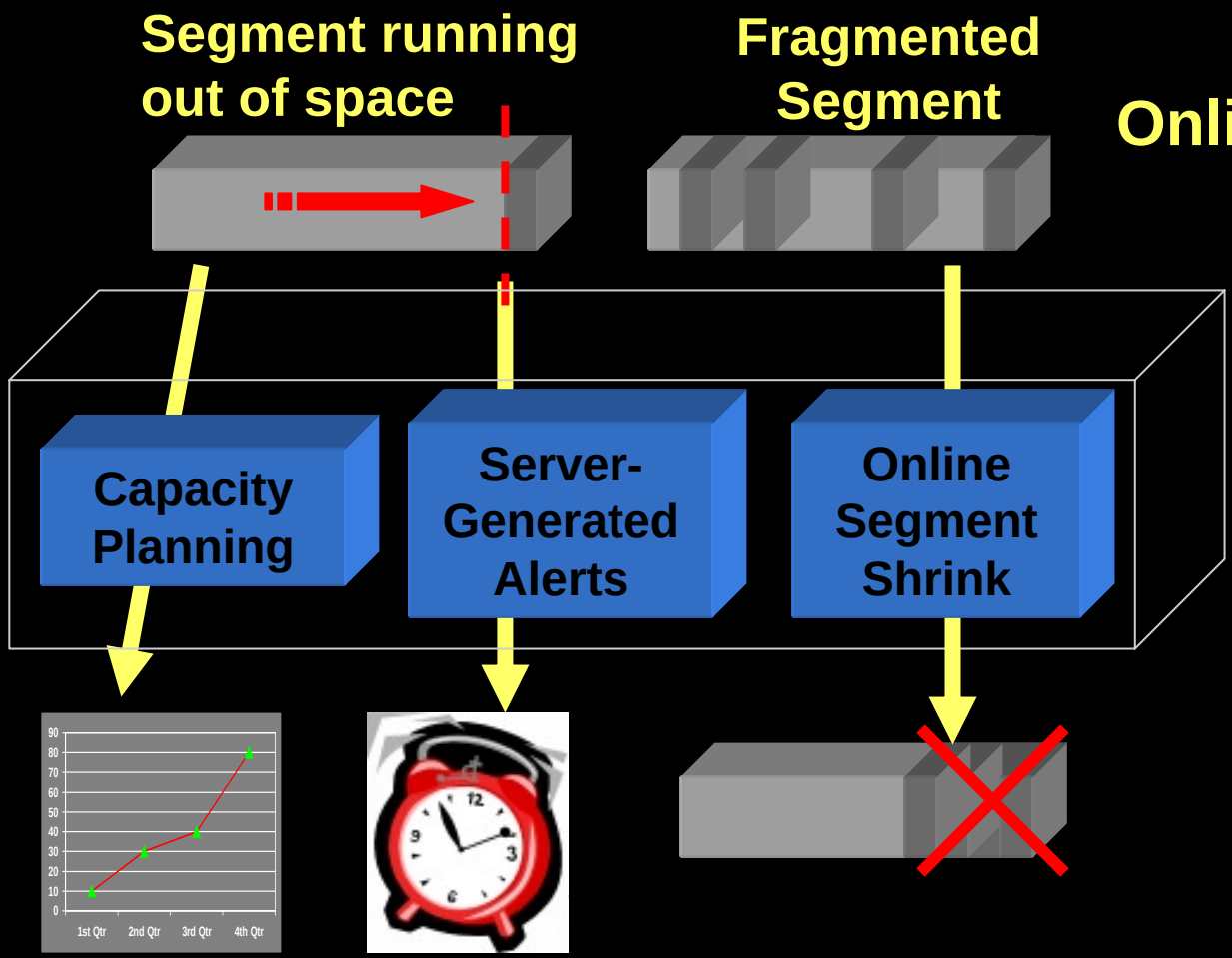
- Eliminates external space fragmentations
  - Locally Managed Tablespace
- Eliminates space allocation contention
  - Automatic Segment Space Management

Proactive Space Management



- Automatically monitor, capture space usage at space allocation time - efficient
- Advise and predict space growth trend, fragmentation
- “Just-in-Time” Alerts on space pressure

Proactive Space Management



Online Segment Shrink

- Reclaim space from internal fragmentation
- Improve performance
- In-place shrinking of tables
- Wait on DML operations

Space Management : Before and Now

Scenario: Reclaim Wasted Space

Before

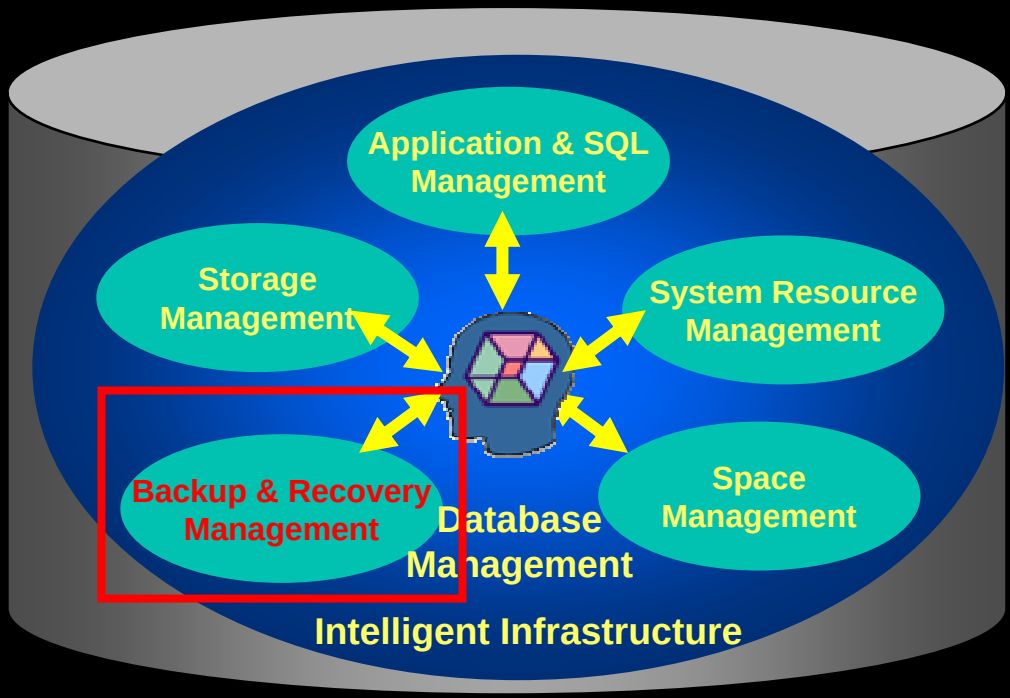
- Check to see which objects in the tablespace have pockets of wasted space due to deletion:
  1. Create a script that looks at DBA_TABLES view to compare the total space allocated for each object (BLOCKS * DB_BLOCK_SIZE) in a tablespace to the estimated space used by the object (AVG_ROW_LEN * NUM_ROWS)

     (assumes objects have been analyzed)
  2. Review script output and identify target objects for reorganization
3. Identify/Create “scratch” tablespace
4. For each object to be reorganized, use the Enterprise Manager Reorg wizard to recreate each object along with its dependencies

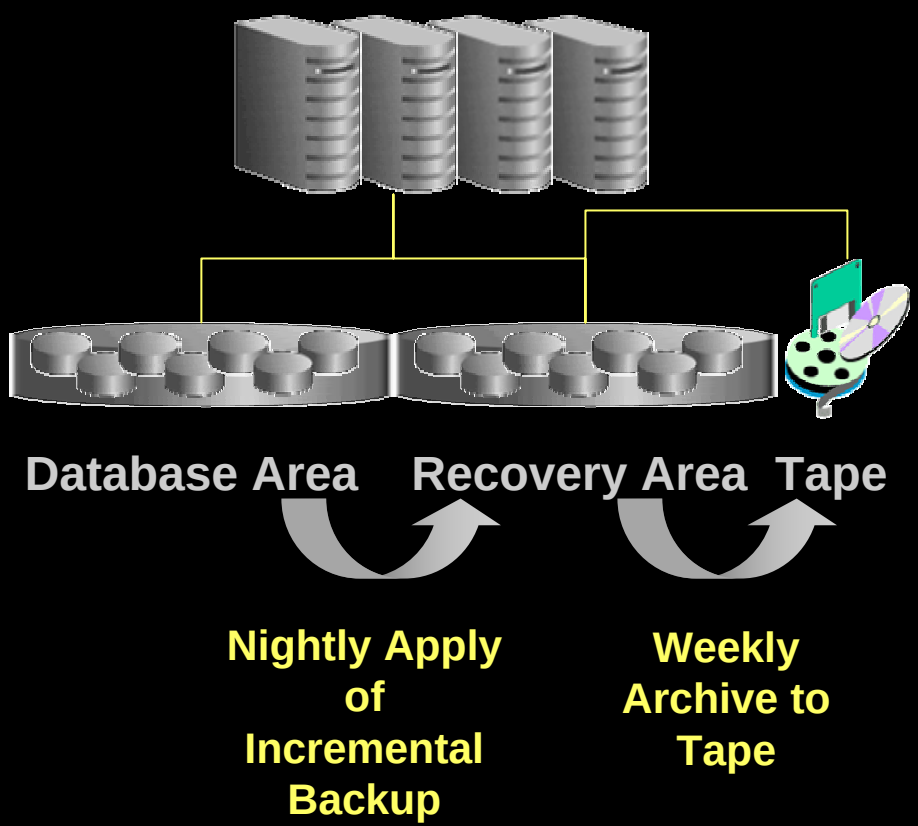
Oracle10*G*

1. Launch Segment Advisor to advise on which object(s) to shrink
2. Accept the recommendations to shrink the objects online and in-place

Automatic Backup & Recovery

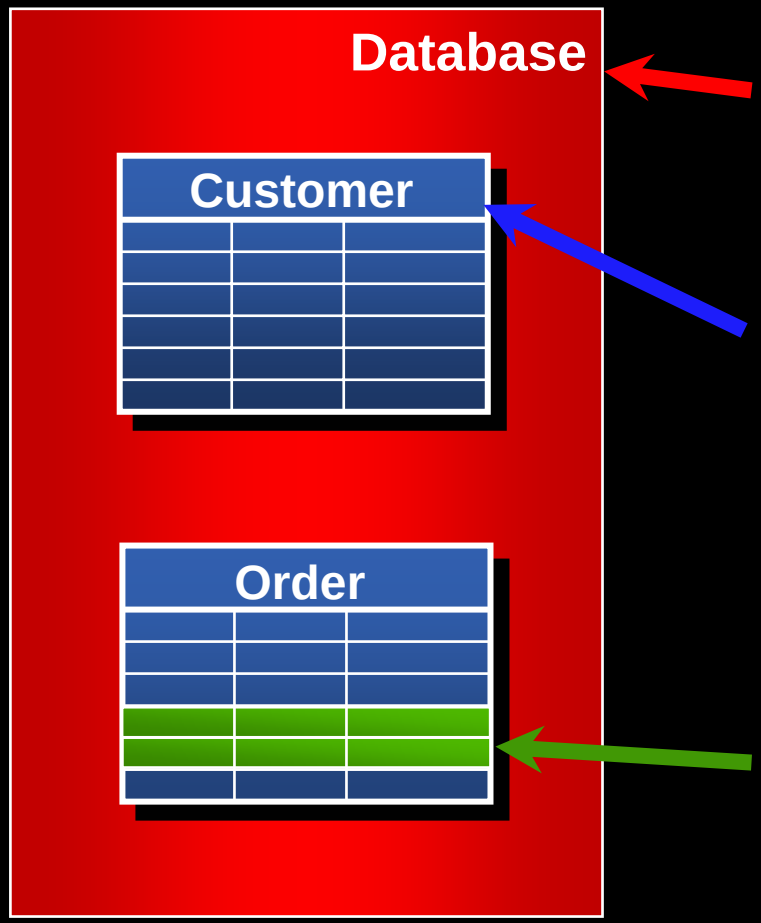


Automatic Backup and Recovery



- Fully automatic disk based backup and recovery
  - Set and Forget
- Nightly incremental backup rolls forward recovery area backup
  - Changed blocks are tracked in production DB
  - Full scan is never needed
  - Dramatically faster (20x)
- Use low cost ATA disk array for recovery area

Single-Command Recovery



- Easy recovery from human errors 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 Rows restores rows to time
    - Uses Flashback Query

Database Recovery: Before and Now

Scenario: Recovering mistakenly dropped a Table

Before

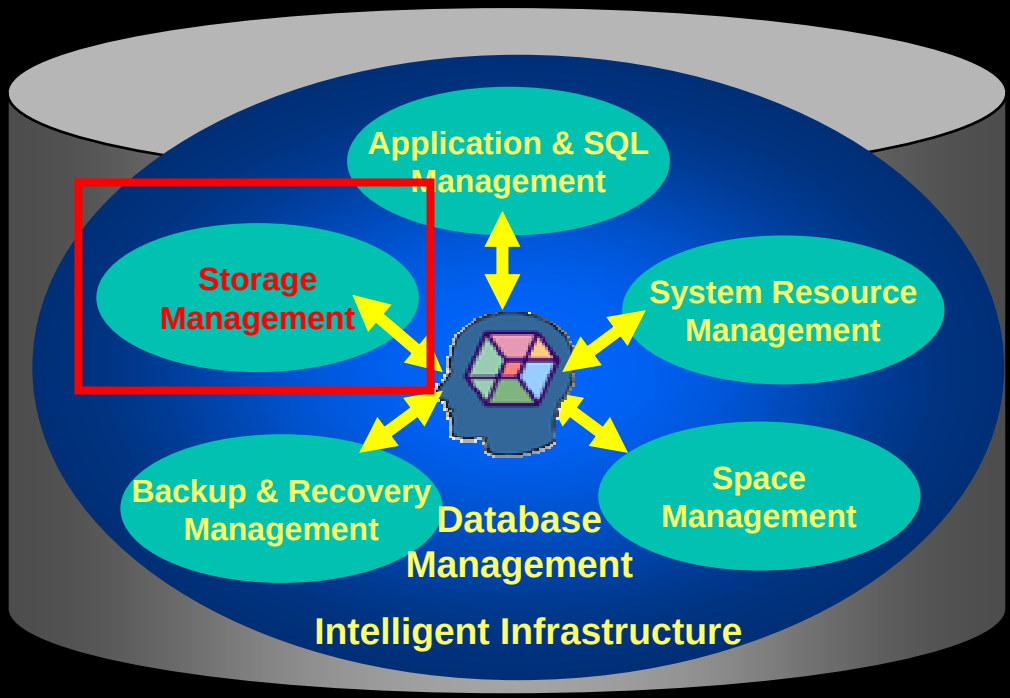
(Tablespace Point-in-time Recovery)

1. Prepare an auxiliary instance by first creating an Oracle password file
2. Create parameter file for auxiliary instance
3. Start auxiliary instance in NOMOUNT mode using SQL*Plus
4. Using RMAN interface to perform TSPITR
5. Using RMAN, connect to target database and bring tablespace in question online
6. Shutdown the auxiliary instance
7. Delete auxiliary instance data files, control files, and redo log files

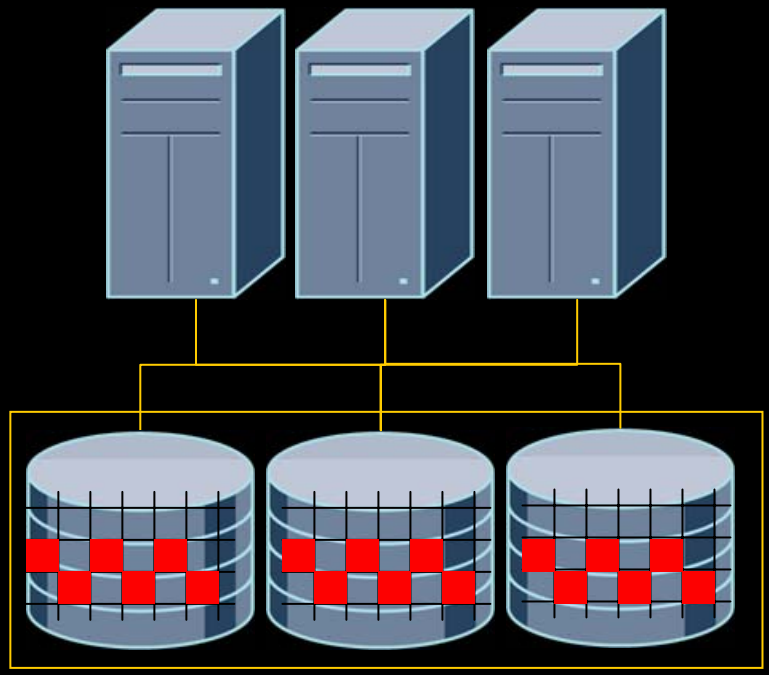
Oracle10*g*

1. Single Command Recovery: FLASHBACK TABLE <table_name> TO BEFORE DROP ;

Automatic Storage Management



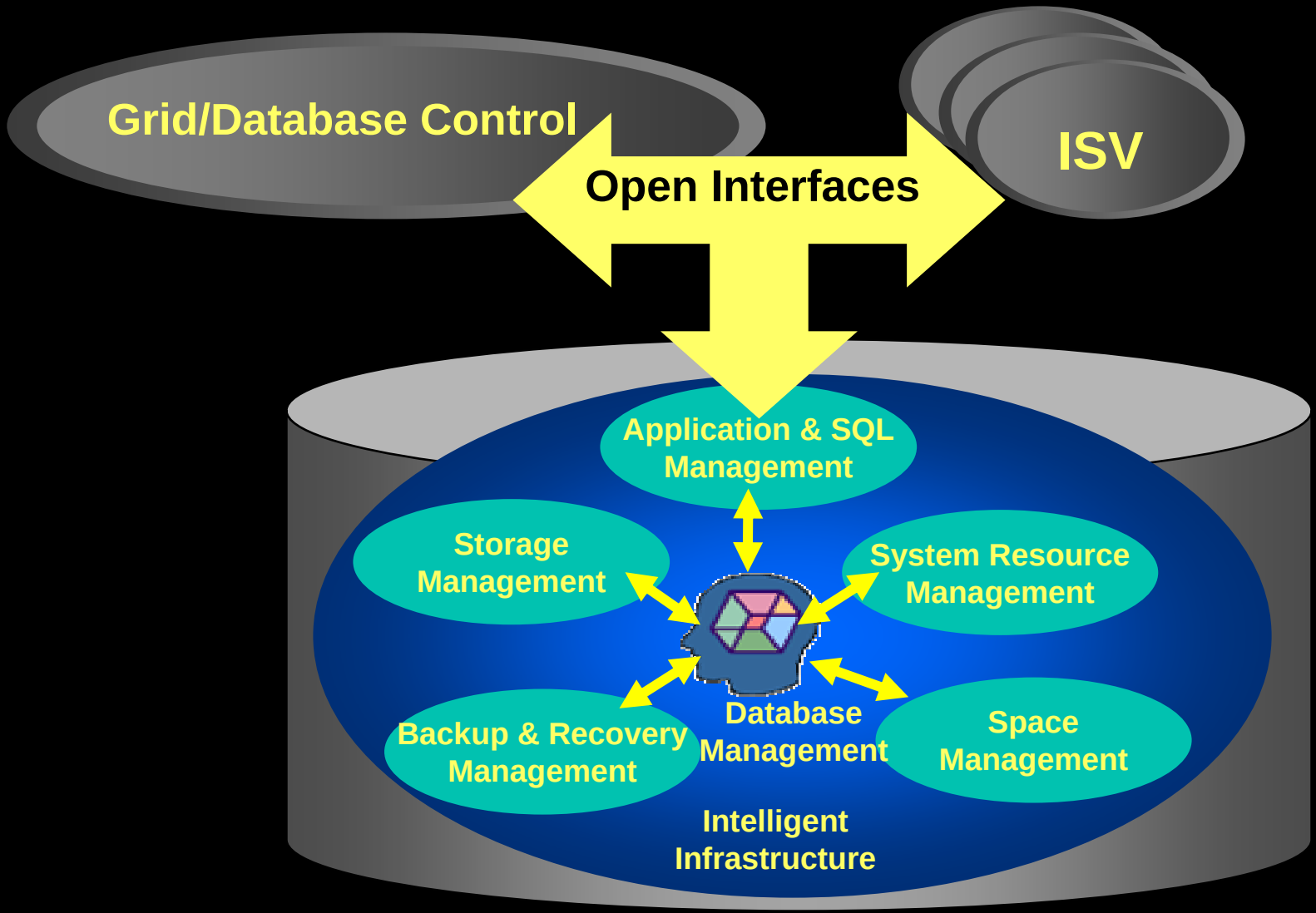
Automatic Storage Management - Benefits



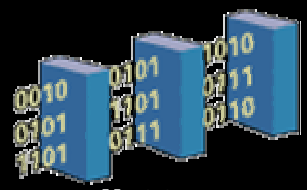
Automatic Storage Management

- **Automates daily storage administration**
  - Automatic I/O tuning
  - Eliminates disk fragmentation
  - Automatically selects allocation policy per Oracle file type
- **Automates storage re-configuration**
  - Automatic data copy on disk add/drop, no reconfiguring volume and re-striping
  - Online migration to new storage hardware

Open Interfaces for ISV Partners



Where DBA's spend their time



Install 6%

Create & Configure
12 %

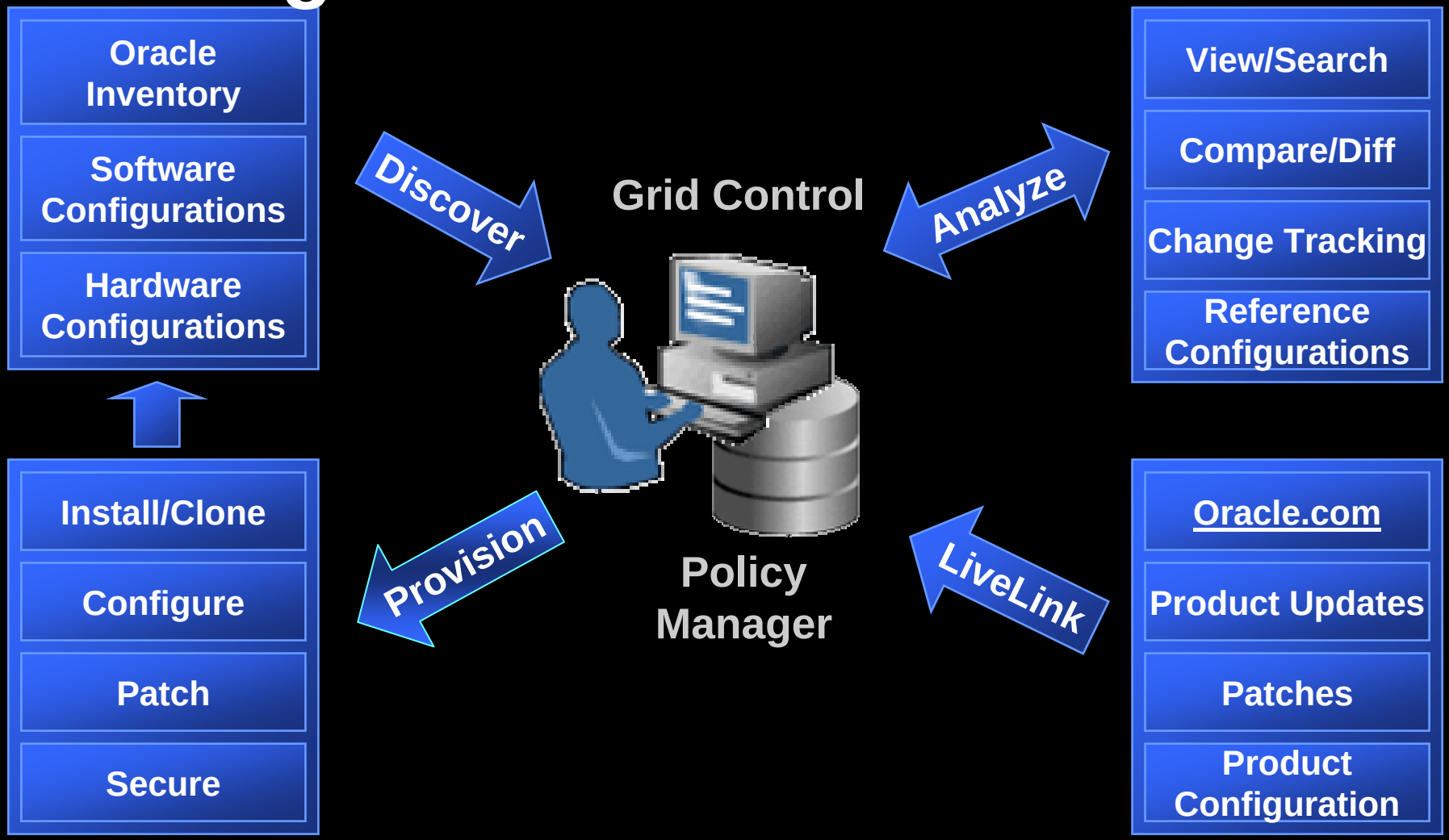
Load Data 6%

Ongoing System Management
55%

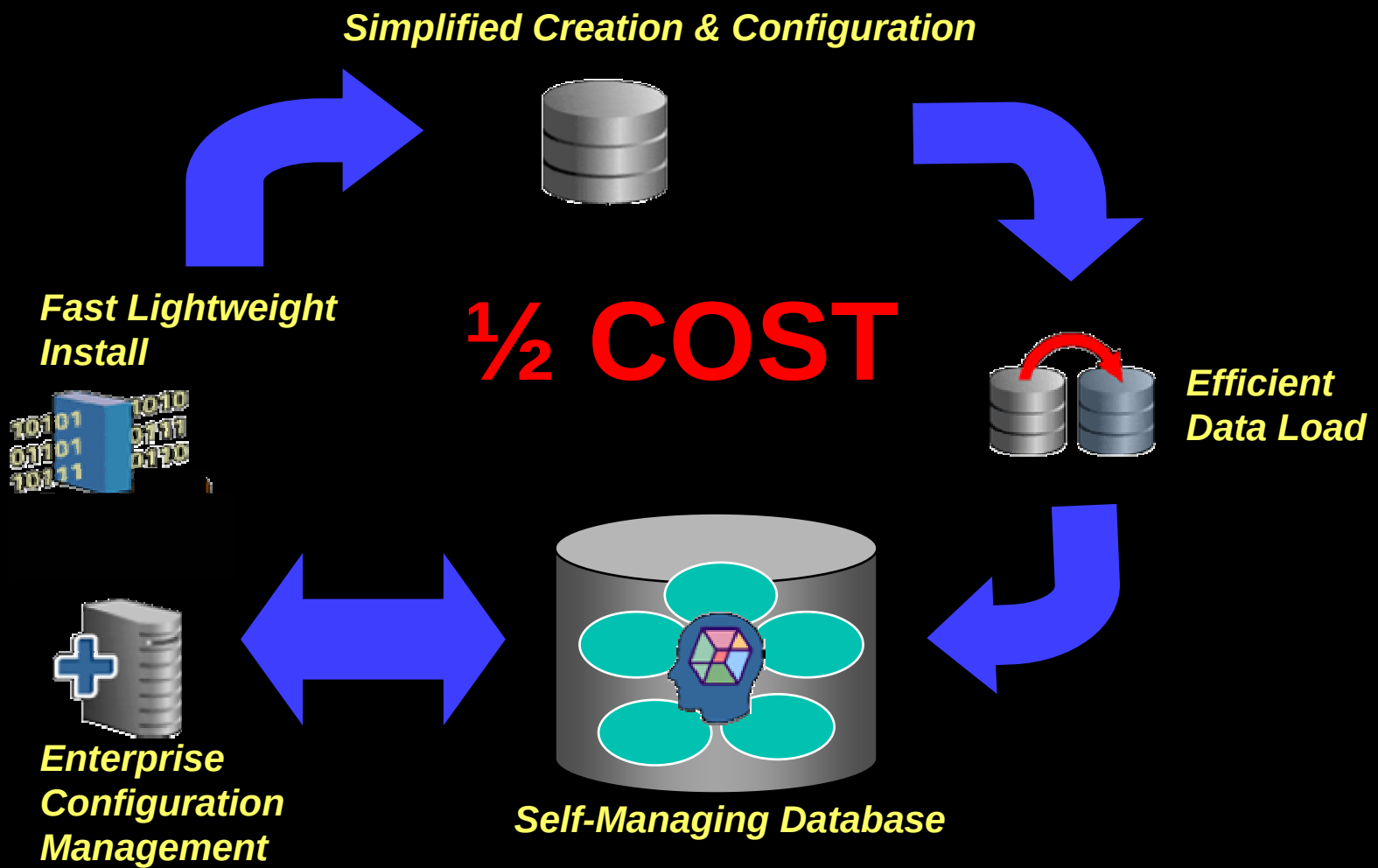
Software Maintenance
6%

Source: IOUG 2001 DBA Survey

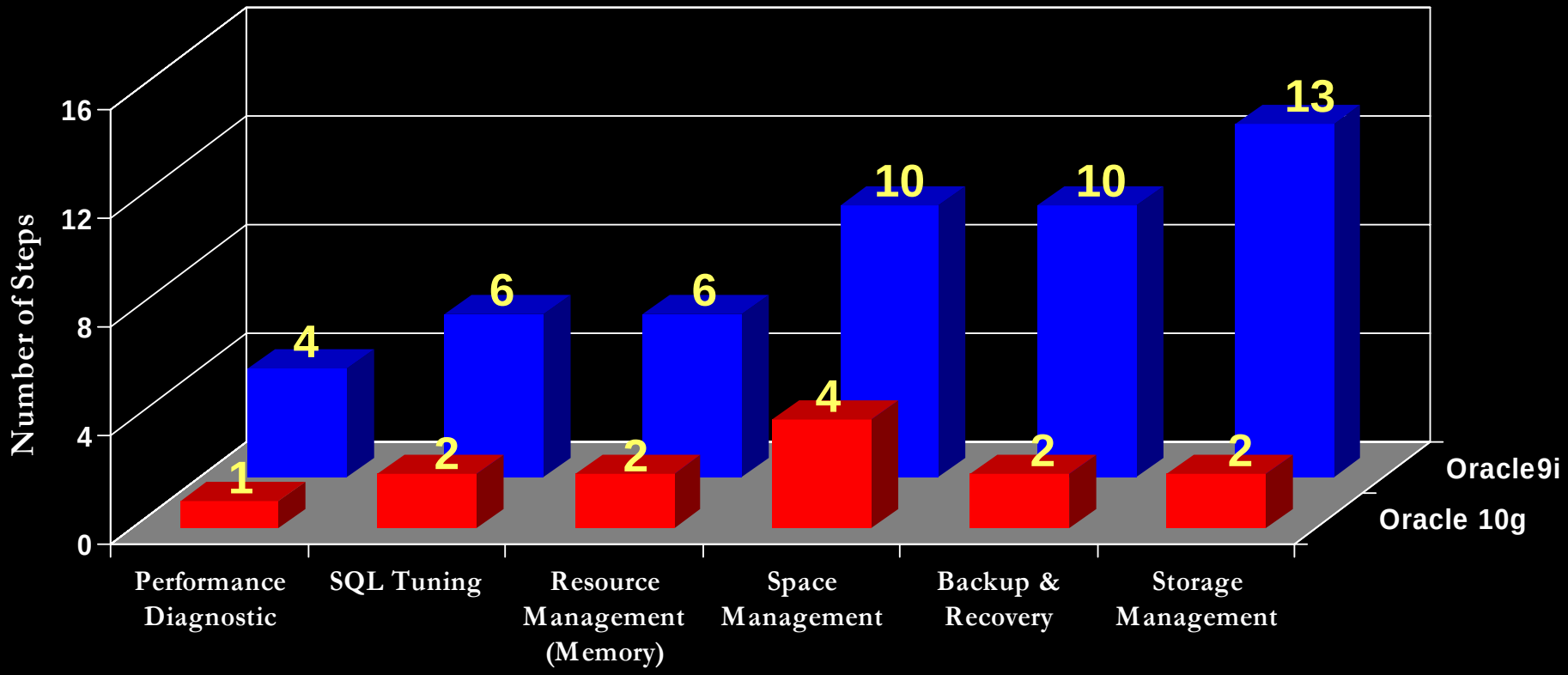
Enterprise Configuration Management



Oracle Database 10*g*



Oracle 10*g* : Twice as Manageable as Oracle9i



Result Summary

Oracle 10*g* required **44%** less time and **47%** fewer steps than Oracle9*i*.

ORACLE

What Does It Mean to You?

DBA of the Future Does MORE

- **MORE** sleep at nights!
- **MORE** weekends off!
- **MORE** databases
- **MORE** applications: OLTP, DW, OCS, iAS
- **MORE** users, larger databases
- **MORE** mission-critical applications
- **MORE** proactive and strategic
- **MORE** important and valuable!

LESS Cost for Businesses

For customers

- Less Administration Cost
- Less Capital Expenditure
- Less Failures

For Application ISV Partners

- Less Deployment Cost
- Less Development Cost
- Less Support Cost


QUESTIONS
ANSWERS


ORACLE®