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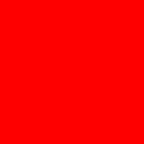


**ORACLE®**



## **Scalability and Performance made easy with Oracle Database 11g and Oracle Optimized Warehouses**

Hermann Baer  
Director, Product Management



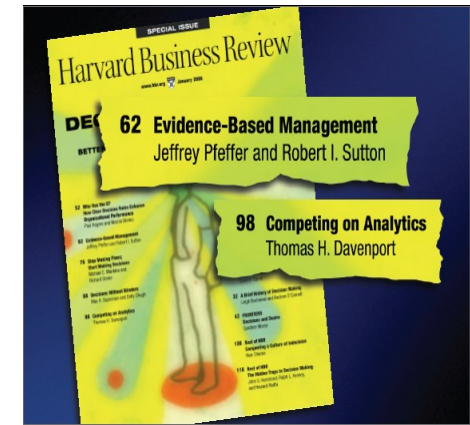
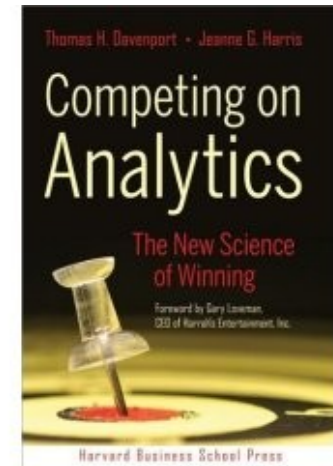
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# Agenda

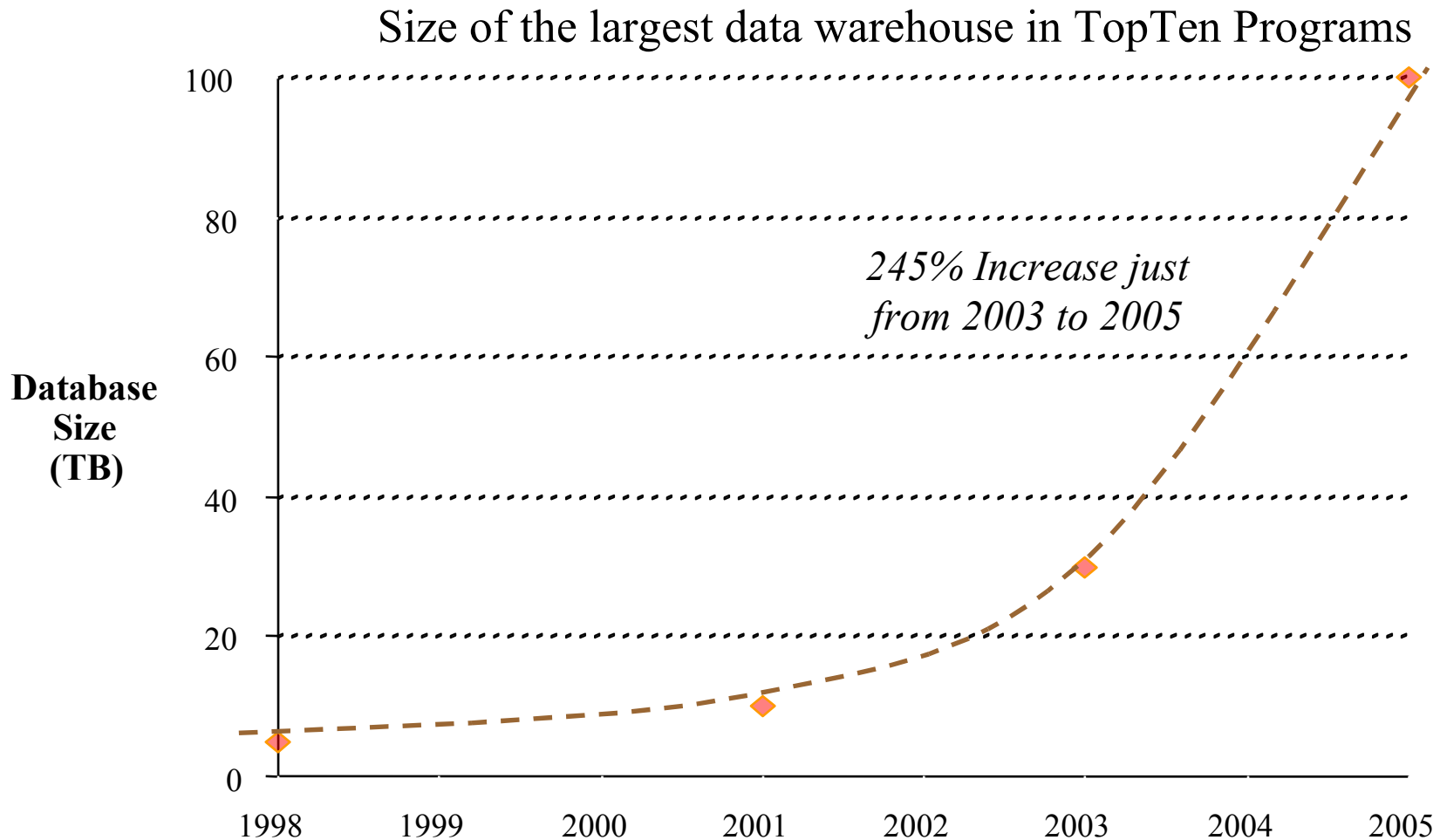
- Data warehouse market overview
- Oracle Data Warehouse strategy
- Oracle Optimized Warehouse Initiative

# Data Warehousing Business Drivers

- How did sales do this quarter and what is the year over year growth?
- How much revenue is driven by my current marketing campaign?
- How does this year's employee turnover compare to the last 5 years'?
- How has company profitability changed over the past 3 years?
- What are my most profitable products by region by year?

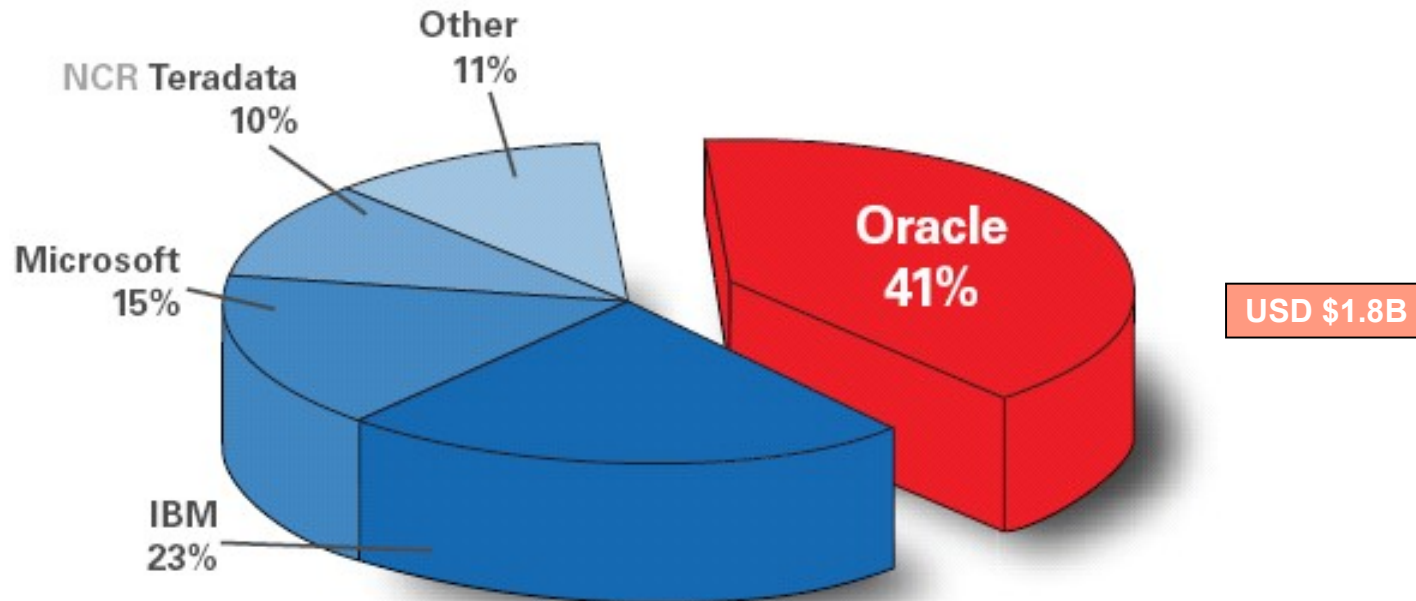


# Data Volumes Growing Exponentially



Source: 2005 TopTen Program, November 2005 © Winter Corporation, Waltham, MA, USA

# Oracle #1 for Data Warehousing



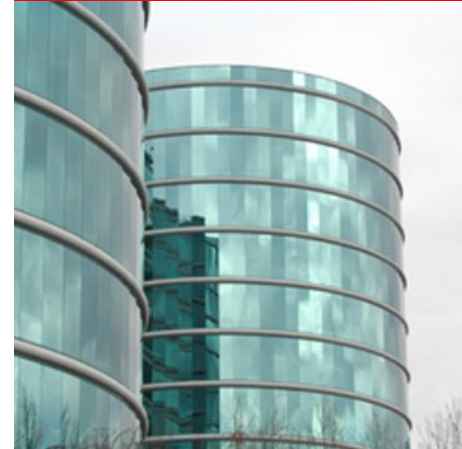
## Worldwide Data Warehouse Management Market Share, 2006

Total Market = USD \$4.4B, 12.4% growth YoY

Source: IDC, 2007 – Data Warehouse Platform Tools 2006 Vendor Shares

**Oracle**

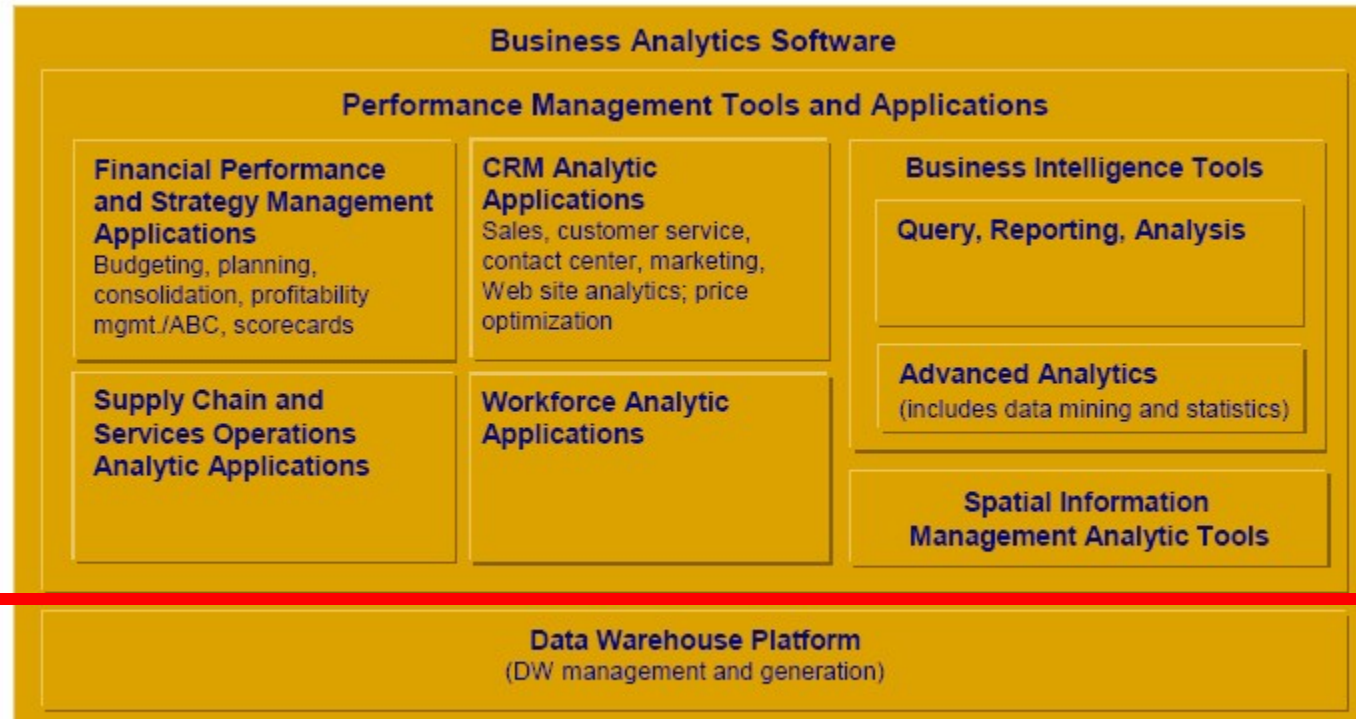
# **Data Warehouse Strategy**





# Why a Data Warehouse?

IDC's Business Analytics Taxonomy, 2007



Source: IDC, 2007

**Industry-Standard Best Practice:**  
**The Data Warehouse is the Foundation**  
**of Business Intelligence and Performance Management**

# Data Warehousing Strategy

- Best database for BI and data warehousing
  - No other database can compare on the breadth and sophistication of Oracle's database features
- Complete solution portfolio
  - Complete database platform including ELT and Analytics
  - Oracle BI and Performance Management solutions
  - Broadest array of third-party technologies and solutions
- On the right hardware infrastructure
  - Offer customers a choice of solutions tailored to meet needs



# Data Warehousing

## with Oracle Database 11g

- Embedded ELT and Data Quality
- Industry leading performance and scalability
- Comprehensive integrated analytics
- Reliable, easy to manage, low cost grids



# **Data Warehousing**

## **with Oracle Database 11g**

- **Embedded ELT and Data Quality**
- Industry leading performance and scalability
- Comprehensive integrated analytics
- Reliable, easy to manage, low cost grids

# Oracle Warehouse Builder

## Data integration

- Embedded into Oracle Database 11g installation
  - Feature of enterprise and standard editions
- Integrate data from disparate data sources
  - High performance data loading optimized for Oracle Database
  - Extreme scalability with support for RAC and Partitioning
  - Declarative, highly productive drag and drop design capabilities
- Optional ERP/CRM connectors
  - eBusiness Suite, Peoplesoft, Siebel
  - SAP

# Oracle Warehouse Builder

## Data quality

- Improve enterprise data quality
  - Name and Address cleansing
  - Fuzzy matching and merging
  - Data profiling and data auditing
  - Business rule support in profiling and ETL
- Provide data modeling capabilities for Oracle
  - Relational (tables, views, MVs, UDT, etc.)
  - Dimensional (slowly changing dimensions, OLAP support, etc.)
- Enterprise metadata management
  - End-to-end attribute level lineage and impact analysis
  - Extensible repository to hold any metadata

# Oracle Warehouse Builder

## Packaging

### Enterprise ETL Option

- Performance
- Productivity
- Reusability
- Metadata Management

### Data Quality Option

- Data Profiling
- Anomaly Detection
- Business Rules
- Audit

### ERP/CRM Connectors

- Oracle EBS
- PeopleSoft
- Siebel
- SAP

## Core Features

(No extra cost with database SE/SE1/EE)



# Data Warehousing

## with Oracle Database 11g

- Embedded ELT and Data Quality
- **Industry leading performance and scalability**
- Comprehensive integrated analytics
- Reliable, easy to manage, low cost grids



# New in Oracle Database 11g

- Advanced compression
- Online upgrades and patching
- Real Application Testing
- Active Data Guard
- Secure Files
- Total Recall
- Real Application Clusters Performance Management
- OLAP-based Materialized Views
- And more...

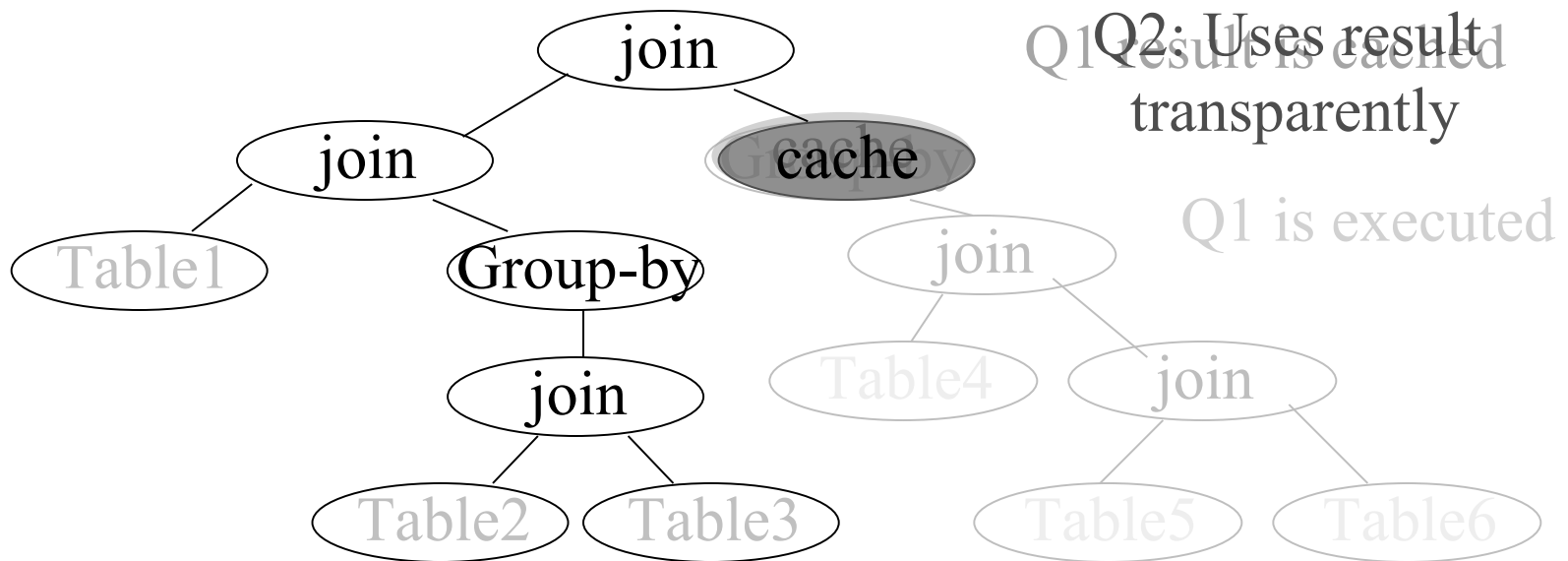
# New in Oracle Database 11g

## for business intelligence and data warehousing

- VLDB
  - Composite Range-Range
  - Composite List-Range
  - Composite List-List
  - Composite List-Hash
  - REF Partitioning
  - Virtual Column Partitioning
  - Compression enhancements
- Performance
  - Query Result Cache
- Data loading
  - Change data capture enhancements
  - Materialized view refresh enhancements
- Manageability
  - Partition Advisor
  - Interval Partitioning
  - SQL Plan Management
  - Automatic SQL Tuning with Self-Learning Capabilities
  - Enhanced Optimizer Statistics Maintenance
  - Multi-Column Optimizer Statistics
  - ASM Fast Resync, Fast VLDB Startup and other enhancements
- SQL
  - SQL Pivot and Unpivot
  - Continuous Query Notification
- OLAP
  - Continued database integration
    - Cube metadata in the Data Dictionary
    - Materialized view refresh and SQL rewrite
    - Fine-grained data security on cubes
  - Simplified application development
    - Fully declarative cube calculations
    - Cost-Based Aggregation
    - Simpler calculation definitions
- Data Mining
  - Simplified development and deployment of models
    - Supermodels: data preparation combined with mining model
    - Additional packaged predictive analytics
    - Integration in database dictionary
  - New algorithms: “General Linear Models”
    - Encapsulates several widely used analytic methods
    - Multivariate linear regression; logistic regression

# Database Result Cache

- Automatically caches results of queries
  - Cache is shared across statements and sessions on server
  - Significant speed up for read-only / read-mostly data
  - Full consistency and proper semantics
  - Cache refreshed when any underlying table updated

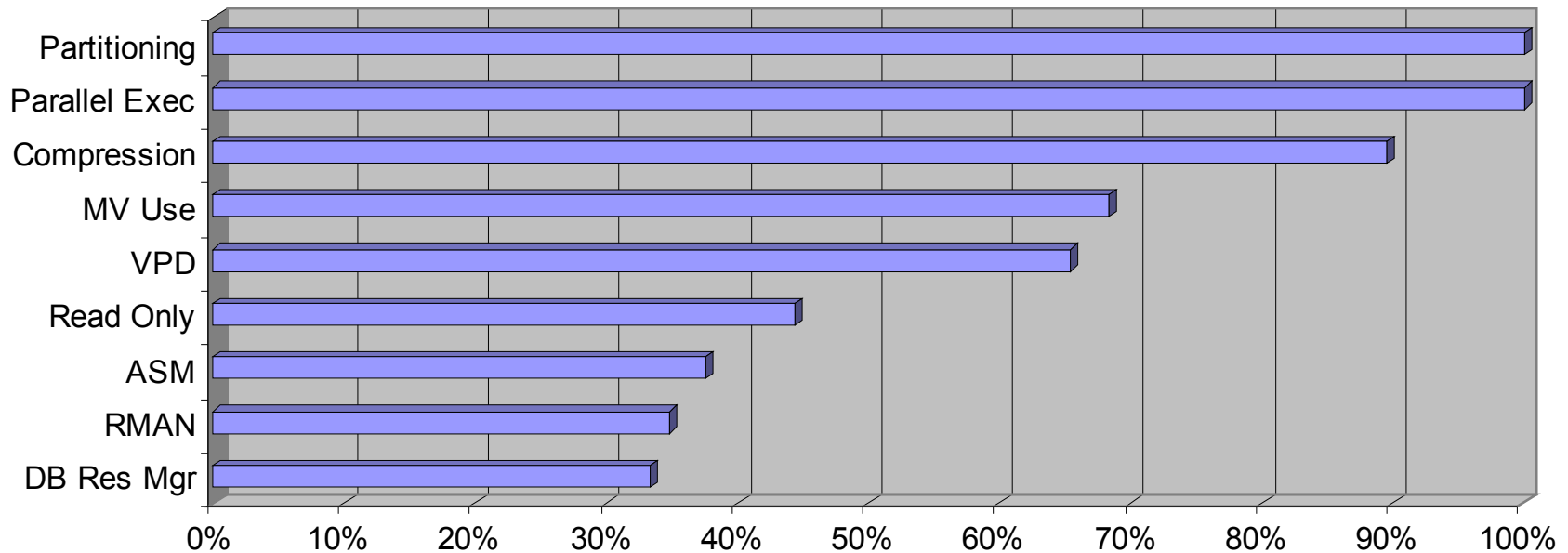


# Query Result Cache Opportunity

- Retail customer data (~50 GB)
  - Concurrent users submitting queries randomly
    - Executive dashboard with 12 heavy analytical queries
  - Cache results only at in-line view level
  - 12 queries run in random, different order – 4 queries cached
- Measure average, total response time for all users

# Users	No cache	Cache	Improvement
2	186 s	141 s	24%
4	267 s	201 s	25%
8	447 s	334 s	25%

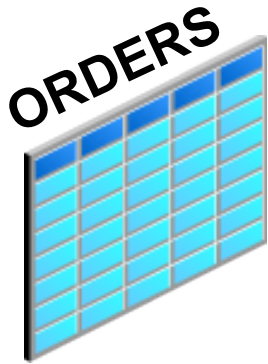
# Large-Scale Data Warehouse Features



Partitioning, parallelism, and compression are the foundation for large-scale data warehousing

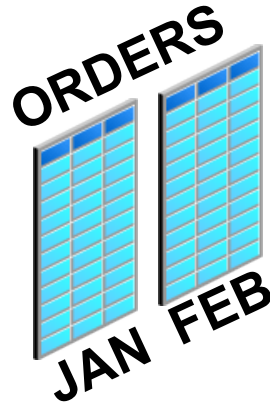
# Oracle Partitioning

## Transparent to applications



**Large Table**

**Difficult to Manage**

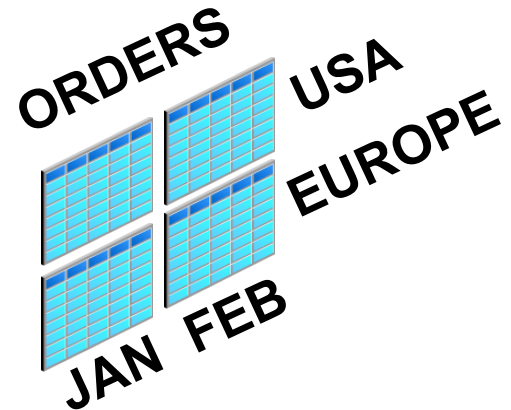


**Partition**

**Divide and Conquer**

**Easier to Manage**

**Improve Performance**



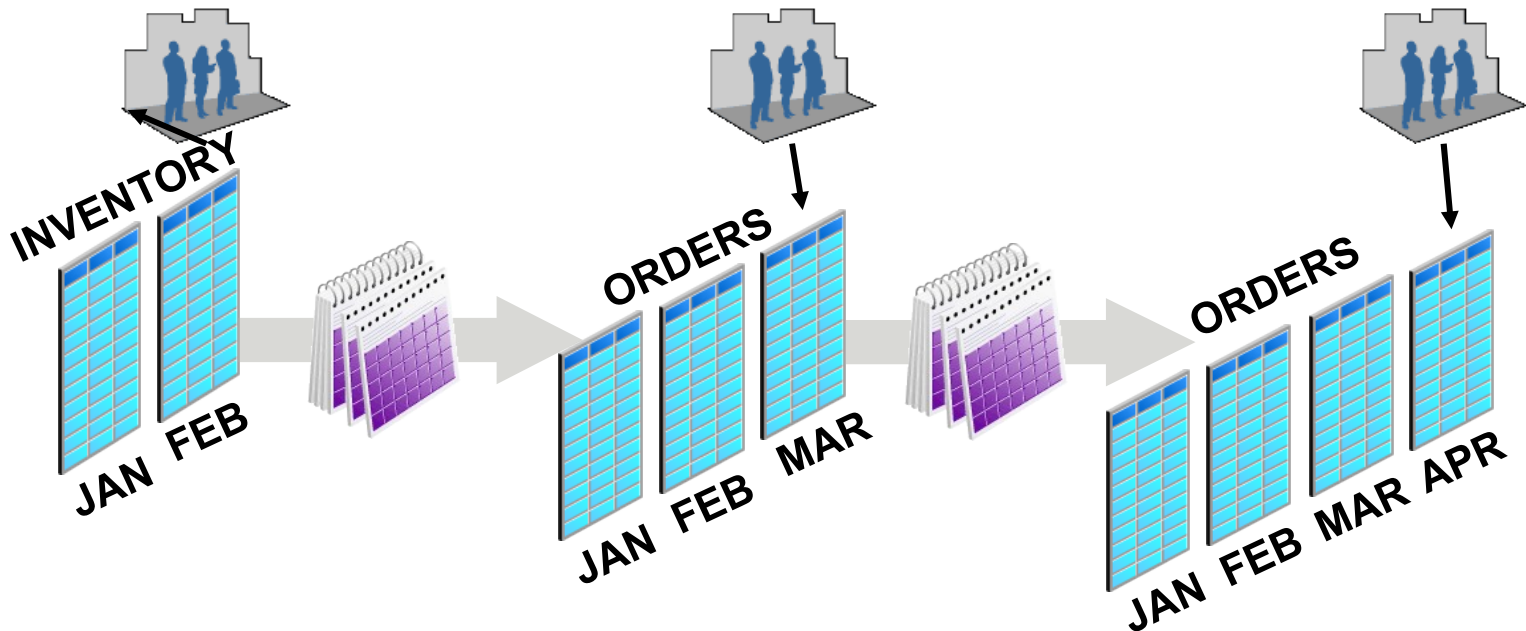
**Composite Partition**

**Better Performance**

**More flexibility to match  
business needs**

# Interval Partitioning

- Partitions are created automatically as data arrives



# Composite Partitioning

- Two-dimensional partitioning schemes
- Extensions in Oracle Database 11g

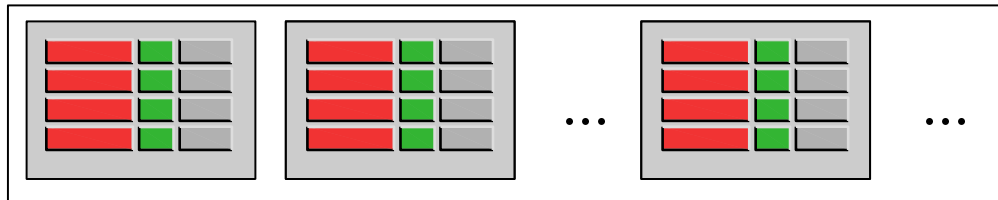
	Range	List	Hash
Range	11g	9i	8i
List	11g	11g	11g

- e.g. List-range:
  - Partition by country, then by week
  - Partition by line-of-business, then by week



# Before REF Partitioning

**Table ORDERS**



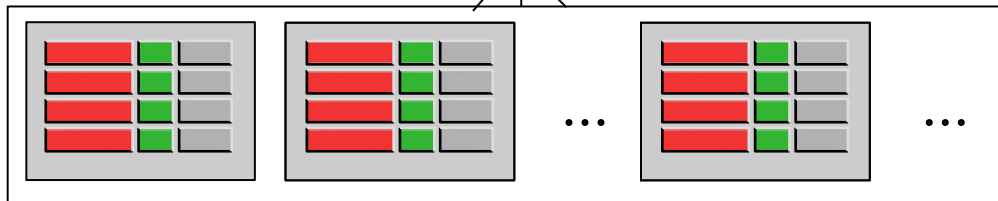
Jan 2007

Feb 2007

- RANGE(**order\_date**)
- Primary key **order\_id**

- Redundant storage of order\_date
- Redundant maintenance

**Table LINEITEMS**



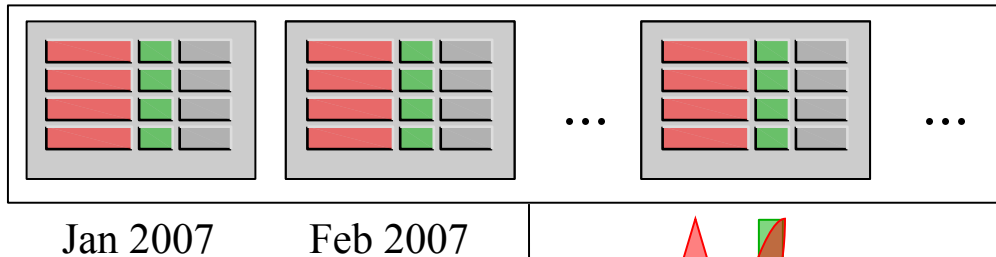
Jan 2007

Feb 2007

- RANGE(**order\_date**)
- Foreign key **order\_id**

# With REF Partitioning

Table ORDERS

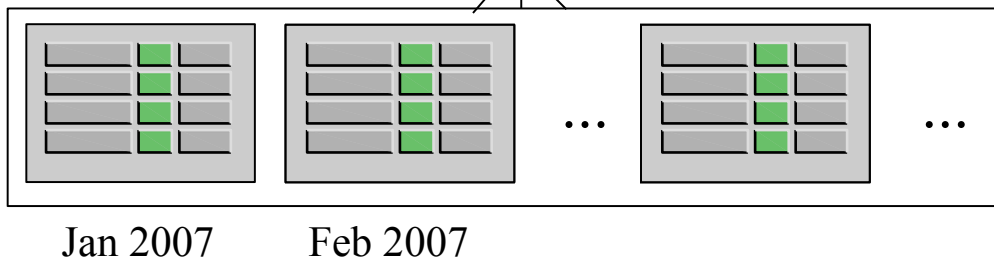


- RANGE(`order_date`)
- Primary key `order_id`

## PARTITION BY REFERENCE

- Partitioning key inherited through PK-FK relationship

Table LINEITEMS



- RANGE(`order_date`)
- Foreign key `order_id`

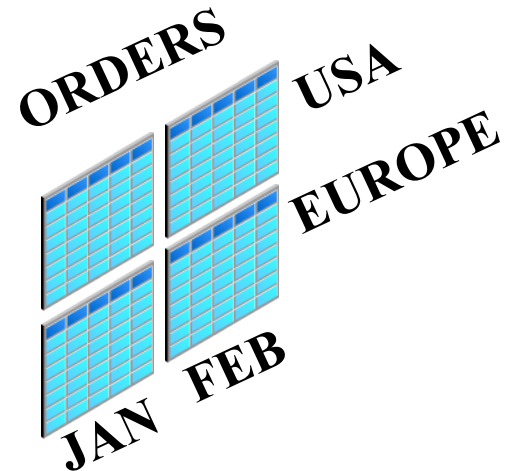
# Virtual Column Partitioning

## ORDERS

ORDER_ID	ORDER_DATE	CUSTOMER_ID...
9834- <b>US</b> -14	12-JAN-2007	65920
8300- <b>EU</b> -97	14-FEB-2007	39654
3886- <b>EU</b> -02	16-JAN-2007	4529
2566- <b>US</b> -94	19-JAN-2007	15327
3699- <b>US</b> -63	02-FEB-2007	18733

REGION	AS (SUBSTR (ORDER_ID, 6, 2))
US	
EU	
EU	
US	
US	

- REGION requires **no storage**
- Partition by ORDER\_DATE, REGION



# Oracle Partitioning

## What customers are saying



“... We are able to do a lot of partition elimination for customer queries.”

--Mike Ogden, Senior Technical Architect, AT&T.



“... You can't run very large databases effectively without partitioning.”

--Douglas Miller, Director of IT Operations, R L Polk.



“... Partitioning is part of the secret sauce that helps us scale our database environment.”

--Logan McLead, IT Straregy, Dell.

# Advanced Compression

## Compress Large Application Tables

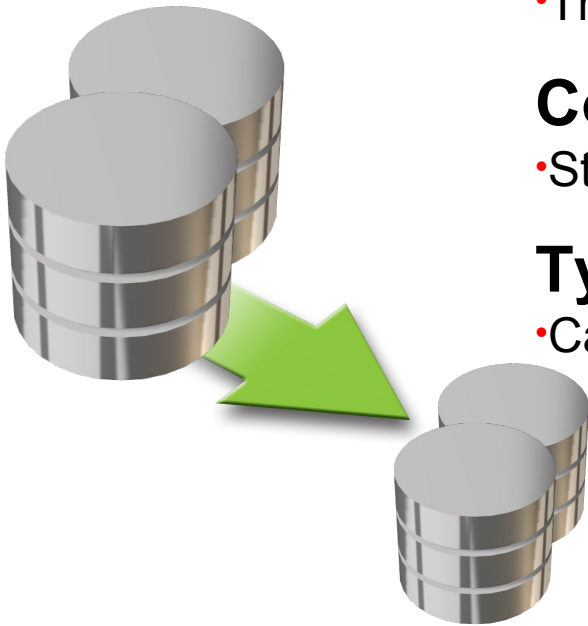
- Transaction processing, data warehousing

## Compress All Data Types

- Structured and unstructured data types

## Typical Compression of 2-4X

- Cascade storage savings throughout data center



Up To  
**4X**  
Compression

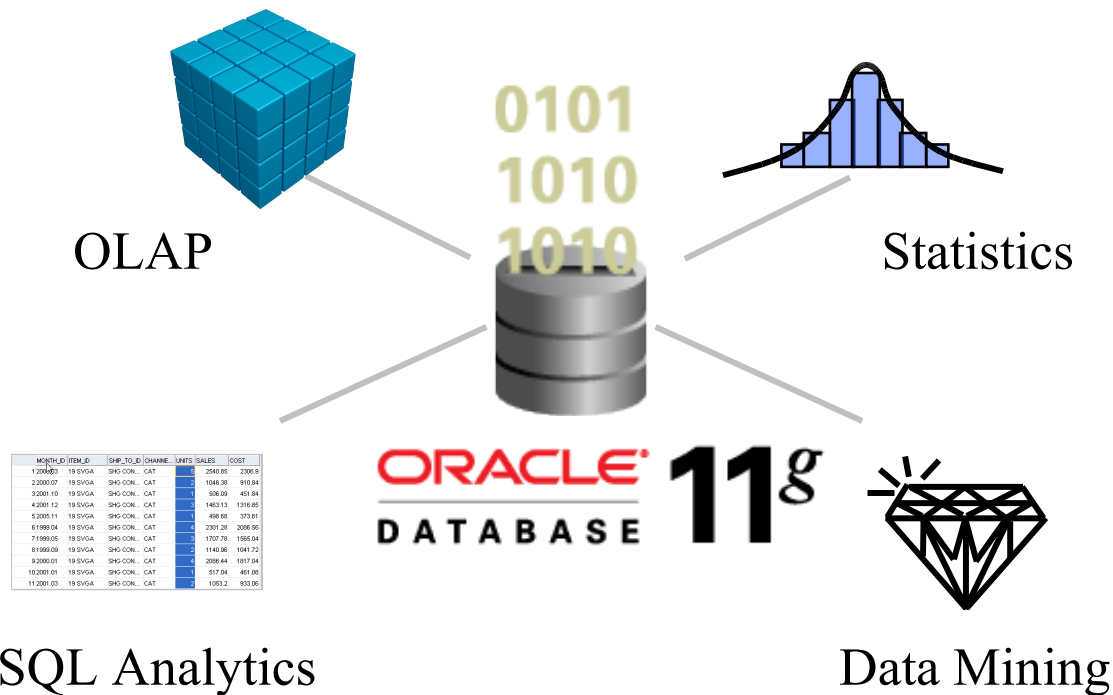


# Data Warehousing

## with Oracle Database 11g

- Embedded ELT and Data Quality
- Industry leading performance and scalability
- **Comprehensive integrated analytics**
- Reliable, easy to manage, low cost grids

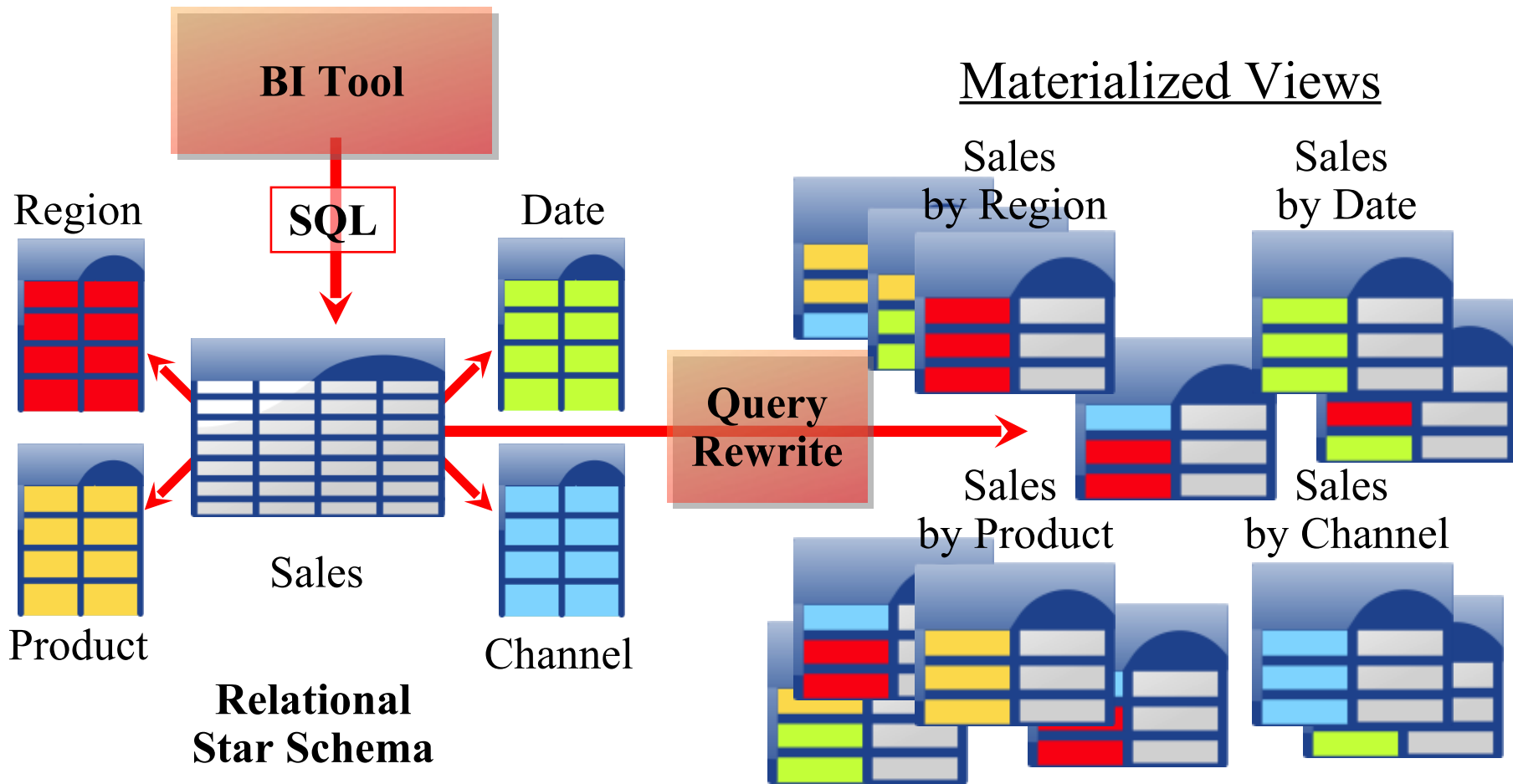
# Integrated Analytics



- Bring the analytics to the data
- Leverage core database infrastructure

# Business Intelligence Analysis

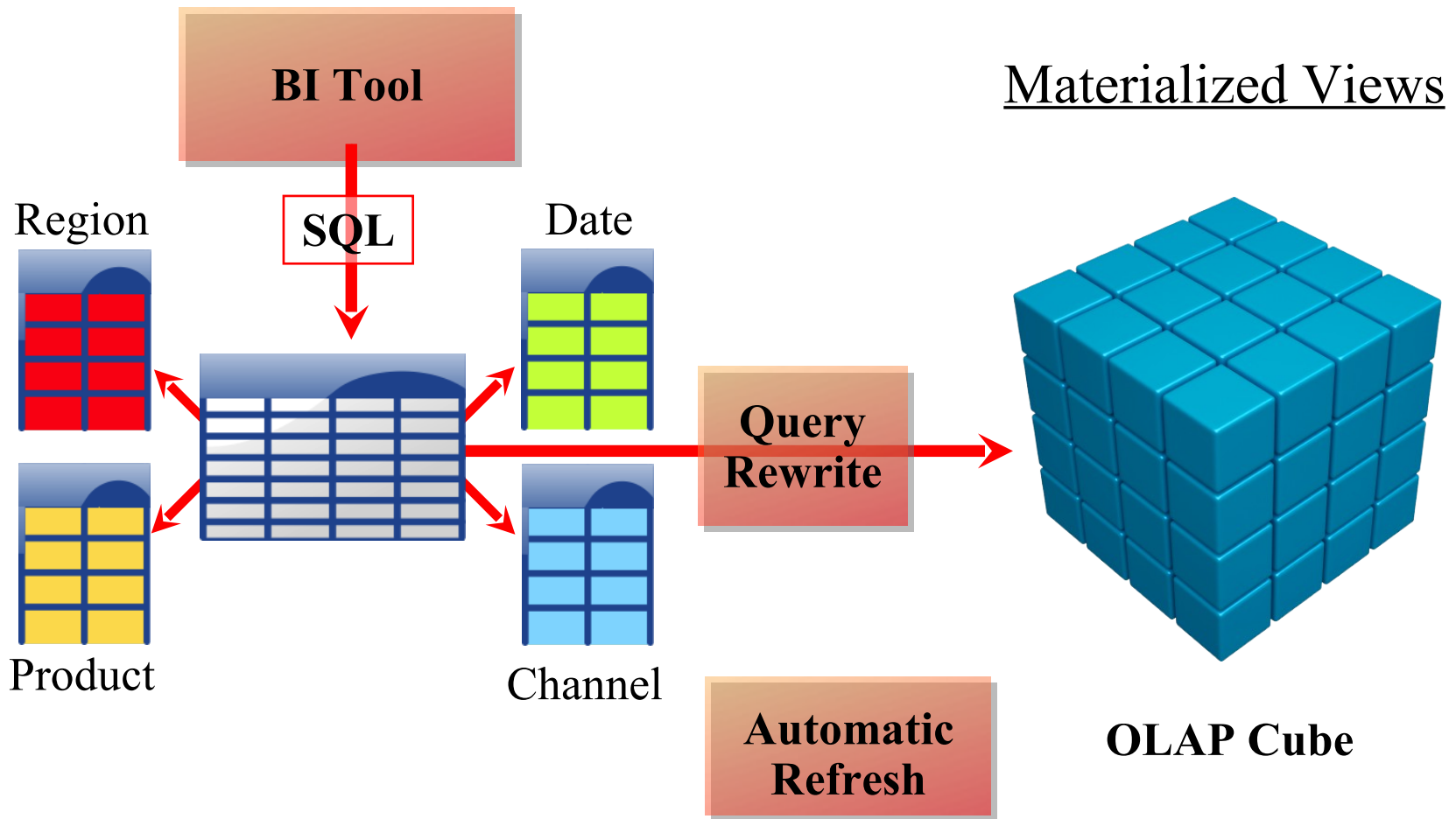
## Typical Architecture Today





# New in Oracle Database 11g

## Cube-Organized Materialized Views





# Data Warehousing

## with Oracle Database 11g

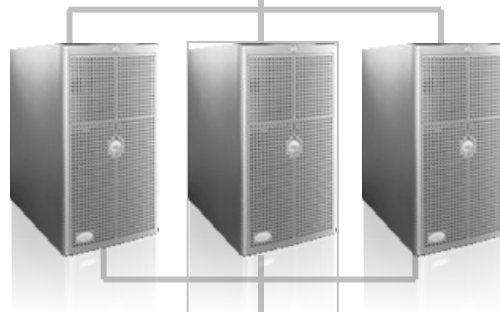
- Embedded ELT and Data Quality
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# Data Warehousing Grid

**Fusion Middleware**



**Real Application Clusters**



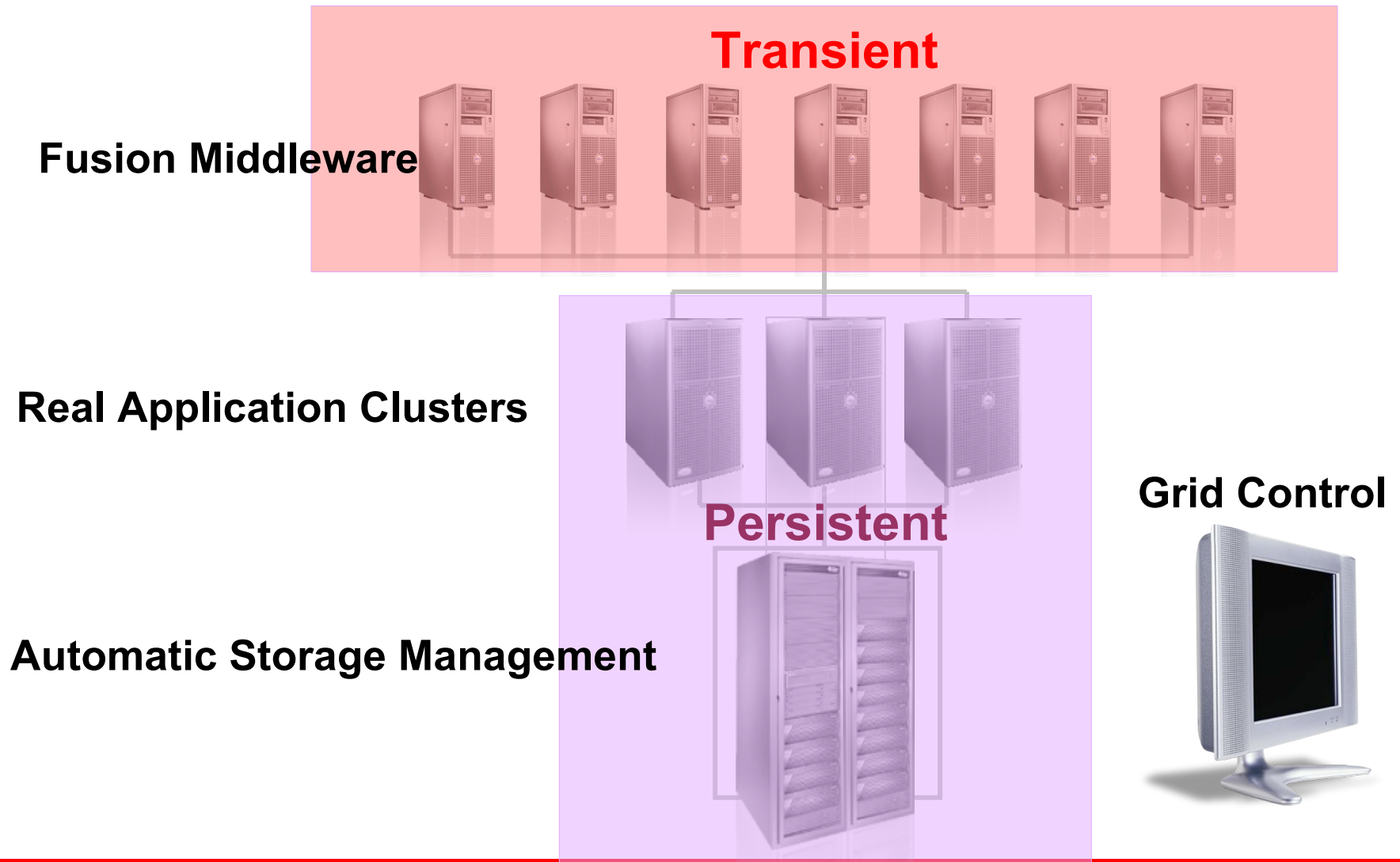
**Automatic Storage Management**



**Grid Control**



# Data Warehousing Grid



**Oracle**

# Optimized Warehouse Initiative

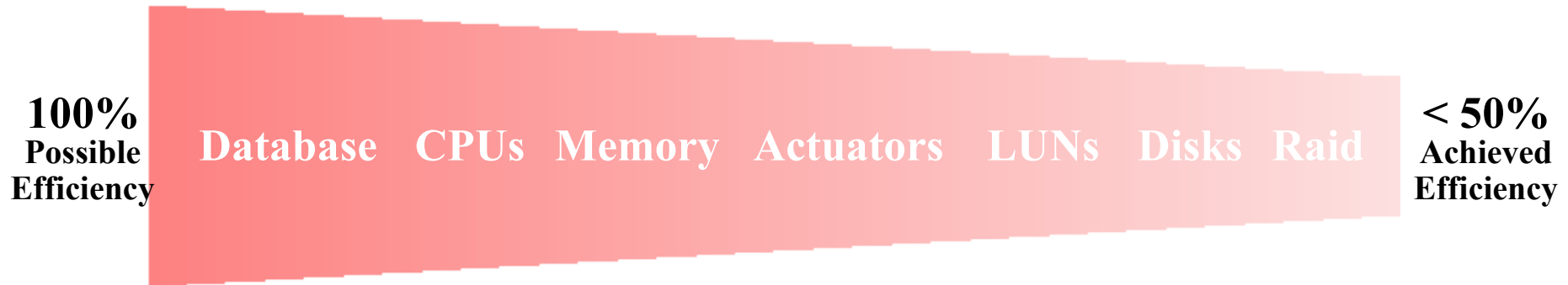


# Why Optimized Warehouses?

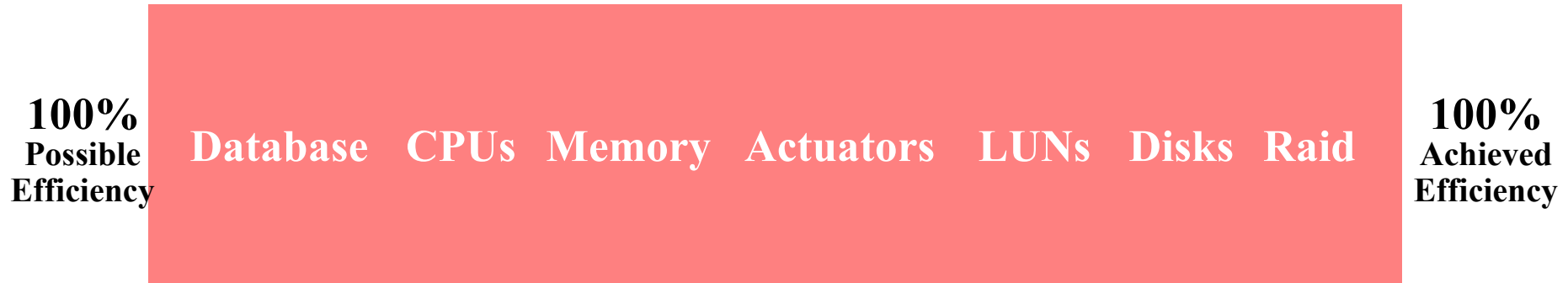
- Today our customers can buy any combination of hardware components to build a data warehouse.
- Some percentage of customers inevitably end up with poorly configured data warehouses
- The solution: Oracle Optimized Warehouse Initiative
  - Phase I: **Optimized Warehouse Reference Configurations**
    - Best practices and reference configurations
  - Phase II: **Oracle Optimized Warehouse**
    - Pre-packaged, pre-configured, pre-installed, calibrated & validated systems

# Balanced Configurations Drive Optimized Performance

## An Unbalanced Configuration



## A Balanced Configuration



# Goals for Oracle Data Warehouse Solutions



- Provide superior system performance
- Provide a superior customer experience
- Offer flexibility and choice of solutions

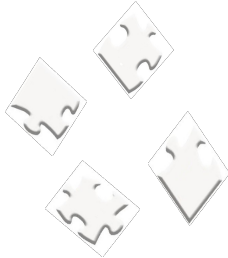


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# Full Range of DW Options

## Custom Solutions



**Flexibility for the most demanding data warehouse**

## Reference Configurations



**Documented best-practice configurations for data warehousing**

## Optimized Warehouse



**Scalable systems pre-installed and pre-configured: create-table ready**

Pre-configured, Pre-installed, Validated

Flexibility

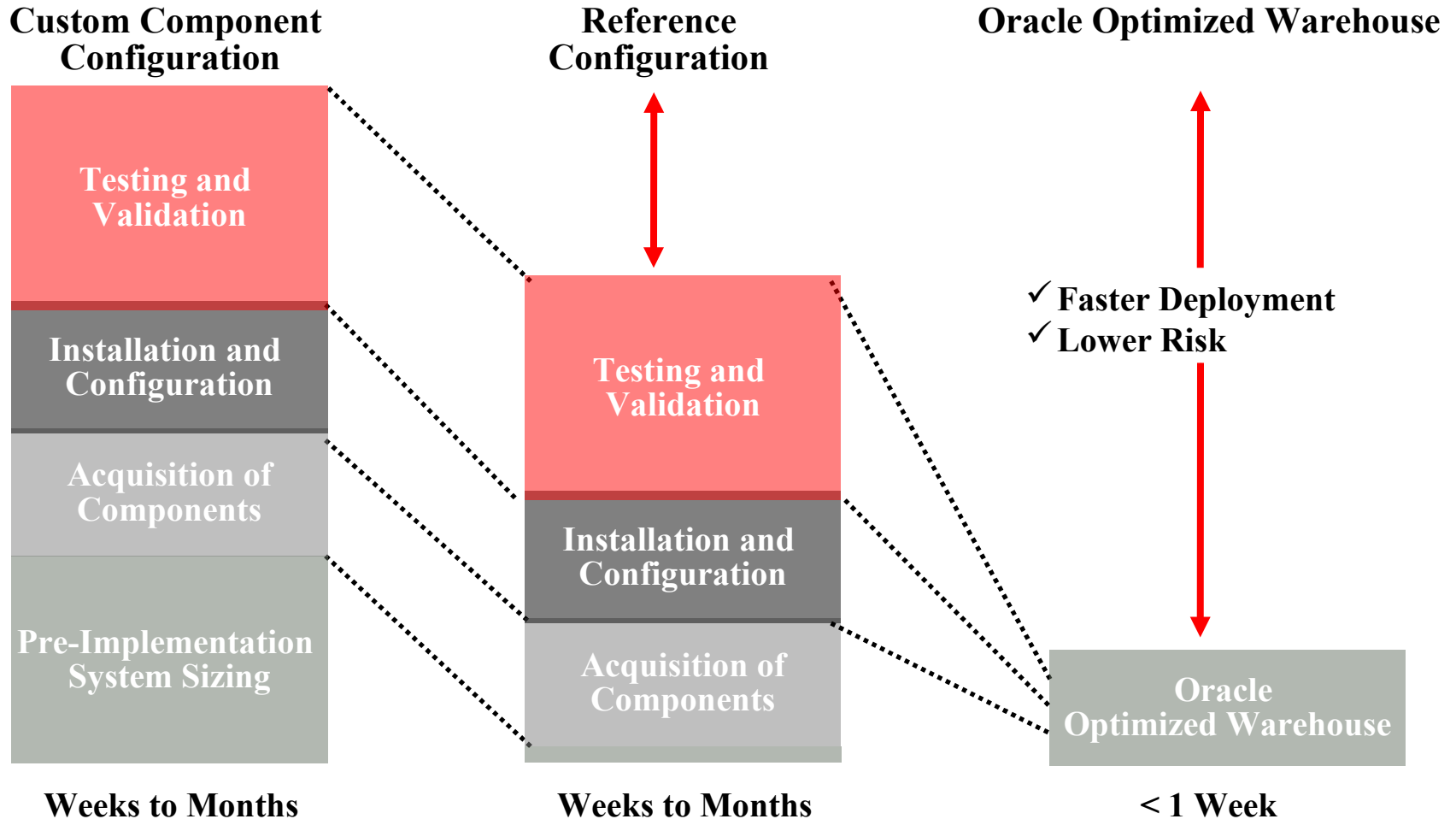


# Definition: Oracle Optimized Warehouse



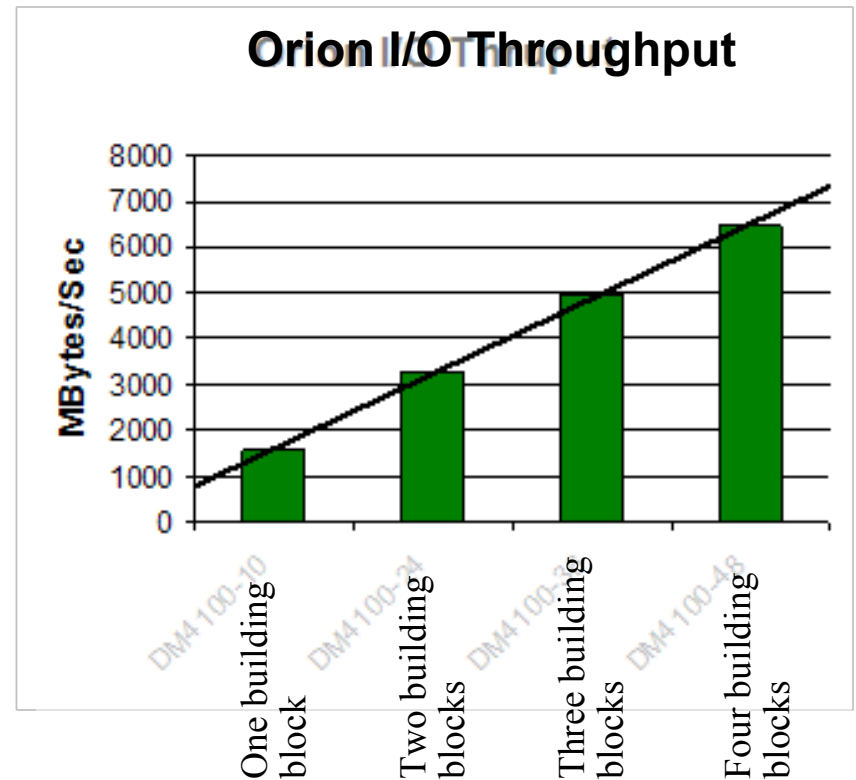
- Database, servers, storage
- *Pre-installed, pre-configured*
  - Oracle Database Enterprise Edition
  - Oracle Real Application Clusters
  - Oracle Partitioning
- *Validated* performance
- Sold as a single product
- Supported as a single product

# Reduce Risk & Accelerate Deployment



# Calibration Testing

- Goal: Balanced hardware configurations
  - Verify raw platform performance
  - Generate data warehouse IO workload
    - Using Oracle's ORION utility
  - Linear scalability



# Validation Testing

- Installation Verification:
  - ASM, Database, RAC
- Functional Testing:
  - Basic DBA operations
- Destructive Testing:
  - Test proper recovery from failures of nodes, HBA's, controllers, or disks
- Performance Testing:
  - Large-scale databases
  - Multi-user performance test
  - Single-node to multi-node scalability

Microsoft Excel - OIA\_verification\_test\_plan\_for\_panta.xls

Script Name	Test Description	Elapse time(sec)	Result (pass/Fail)	Comments
	<b>Tablespace creation</b>			
cr_tbs_data.sql	Create tablespace ts_data	180	PASS	What should
build_out_tbs.sh	Add datafiles to tablespace ts_data	126	PASS	SET Timing is
build_out_temp.sh	Add datafiles to tablespace ts_temp	8	PASS	
	<b>Create user</b>			
cr_user.sh	Create test user and allocate default tablespace as ts_data	21	PASS	
	<b>Data Generation</b>			
make_data.sh	Generate data for the twelve tables	4513	PASS	
make_sales.sh	Extra data generation steps for two large tables	2287	PASS	
	<b>Data Loading test</b>			
cr_ext_tables.sql	Create the external tables for the load	100	PASS	How much ds
	Validate external tables are accessible on all nodes	300	PASS	Where is the
cr_tables_and_load.sql	Create, load, and analyze the twelve tables	8456		Speed of con
additional_load_sr.sql	Complete incremental load of the two largest tables	3194		ROW COUNT
	<b>Multi-user tests</b>			
run_test.sh	Single node test => keep adding users until the average response is greater than 300 seconds			
	1 user	78	PASS	Average resp
	2 users	93	PASS	Identify log file
	4 users	143	PASS	
	8 users	198	PASS	
	16 users	240	PASS	
	32 users	298	PASS	
	64 users	321	FAIL	
	Rerun the single node test on two nodes => should be able to do twice as many users	296		Keeping addi
	Rerun the single node test on three nodes => should be able to do three times as many users	299		
	<b>Backup and Recovery</b>			
	Complete a full online backup of the database (6 pass runs)			

# Oracle Optimized Warehouses

## Superior Customer Experience



# Oracle Optimized Warehouses

## Superior System Performance





# Optimized Warehouse Roadmap

- **Phase One: Bundling, Validation, and Optimization**
  - Deliver pre-packaged, pre-installed, and pre-configured
  - Validation and Calibration of balanced configurations
  - Built from off-the-shelf components
- **Phase Two: 2<sup>nd</sup> generation Optimized Warehouse**
  - Enhance Optimized Warehouse with significantly differentiated functionality
  - Integrated management tools
  - In-depth product-development efforts
- **Phase Three: Optimized Solution Warehouse**
  - Include built-in Analytics and Business Intelligence
  - Industry specific Business Intelligence schemas & applications
  - Enables business-level 'solution selling'

# The Oracle Difference

## Optimized Data Warehouse

- Reduced risk
  - Proven high availability & performance
  - Enterprise ready security
  - Single support call
- Reduced time to decisions
  - Ease of deployment
  - Proven support for mixed workloads
  - Open platform support for BI Tools, Applications & Analytics
- Flexibility
  - Scale through modular building blocks
  - Choice of platform and operating system
  - Leverage your current IT infrastructure

# Oracle Optimized Warehouse

## Benefits

### Optimized Warehouse Reference Configurations

- Consistent messages for the customer from Oracle and the hardware partner
  - Reference Configurations are joint recommendations
- Find a complete and well-balanced system quickly
  - Customers need a quick sizing starting point
- Mitigate deployment risk
  - Provide and reuse best practices
- Shorten the sales cycle

# Oracle Optimized Warehouse Benefits

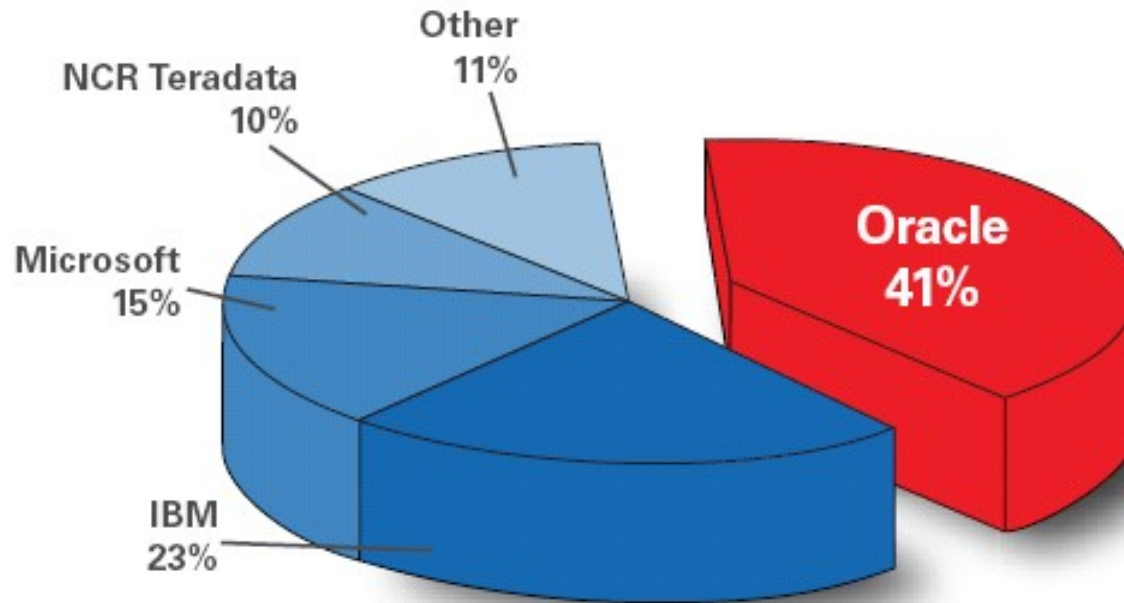
## Oracle Optimized Warehouse

- “Best of all worlds”
- Strengths of “Traditional” Appliances
  - High performance
  - Easy to buy
  - Simple to maintain
- Strengths of Oracle
  - Best-of-breed software
  - Widespread implementation expertise
  - Strong fit into existing IT infrastructure
  - Full-stack solutions

# Why Oracle Database 11g for Data Warehousing?

- Complete, integrated ETL and data-quality capabilities
- Consolidated platform optimized for grid computing
  - Eliminates the costs and inefficiencies of multiple data stores
  - Available in wide choice of configurations
- Unmatched analytic capabilities
  - Embedded OLAP, data-mining and statistics all accessible via SQL
- Next-generation BI with integrated OLTP and DSS
  - Build on world's most popular database
- Foundation of Oracle Business Intelligence solutions

# #1 for Data Warehousing



**Worldwide Data Warehouse Management  
Market Share, 2006**

# For More Information

<http://search.oracle.com>

oracle data warehousing



**or**

[www.oracle.com/bi](http://www.oracle.com/bi)



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