Oracle Big Data Science

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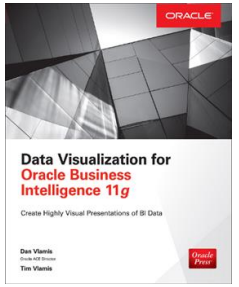
Vlamis Software Solutions

- Vlamis Software founded in 1992 in Kansas City, Missouri
- Developed 200+ Oracle BI and analytics systems
- Specializes in Oracle-based:
  - Enterprise Business Intelligence & Analytics
  - Analytic Warehousing
  - Data Mining and Predictive Analytics
  - Data Visualization
- Multiple Oracle ACEs, consultants average 15+ years
- www.vlamis.com (blog, papers, newsletters, services)
- Co-authors of book “Data Visualization for OBI 11g”
- Co-author of book “Oracle Essbase & Oracle OLAP”
- Oracle University Partner
- Oracle Gold Partner



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ORACLE APPROVED EDUCATION CENTER

ORACLE Gold Partner
Specialized
Oracle Business Intelligence
Foundation Suite 11g

CELEBRATING EXCELLENCE
vlamis 25 YEARS
SOFTWARE SOLUTIONS

Vlamis Software Solutions

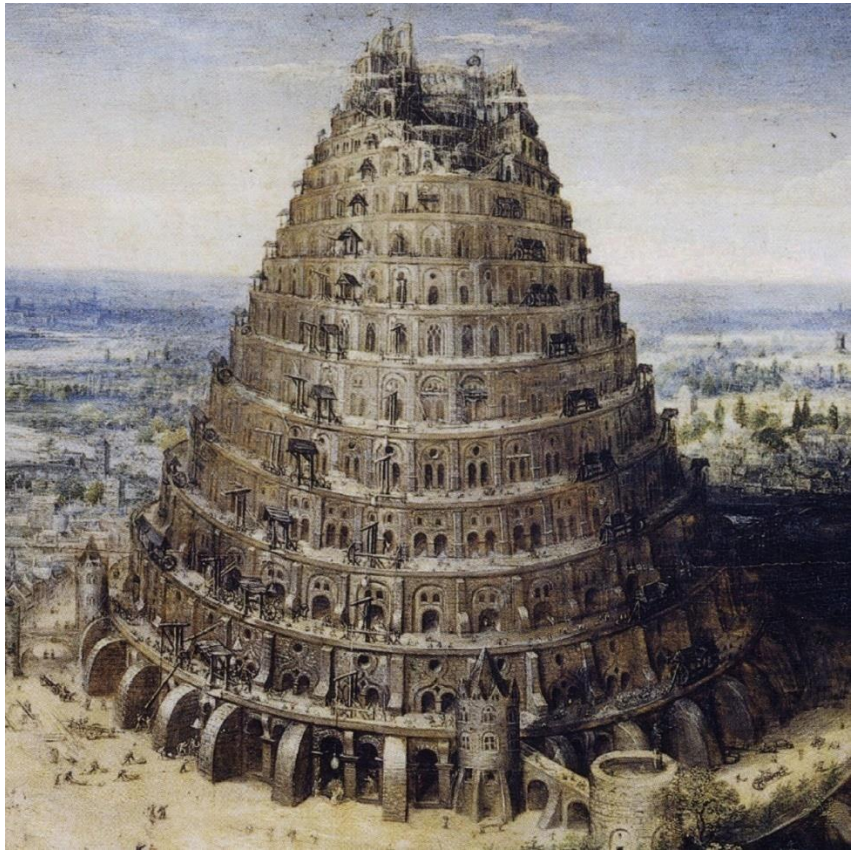
- **Tim Vlamis – Vice President & Analytics Strategist**
  - 30+ years in business modeling and valuation, forecasting, and scenario analyses
  - Oracle ACE
  - Instructor for Oracle University's Data Mining Techniques and Oracle R Enterprise Essentials Courses
  - Professional Certified Marketer (PCM) from AMA
  - MBA Kellogg School of Management (Northwestern University)
  - BA Economics Yale University
- **Dan Vlamis – President**
  - Founded Vlamis Software Solutions in 1992
  - 30+ years in business intelligence, dimensional modeling
  - Oracle ACE Director
  - Developer for IRI (expert in Oracle OLAP and related)
  - BIWA Board Member since 2008
  - BA Computer Science Brown University

Presentation Agenda

- Oracle's Big Data Strategy (our interpretation)
- Oracle Portfolio of Big Data Science Products
  - Big Data Discovery
  - Big Data SQL
  - Oracle R Advanced Analytics for Hadoop (ORAAH)
  - Big Data Spatial and Graph
- Predictive Analytics in Hadoop
- Predictive Analytics in Oracle Database (Oracle Advanced Analytics)
  - Oracle Data Mining
  - Oracle R Enterprise
- Strategies for Enterprise Scale Data Science

Oracle's Big Data Science Strategy

Many Languages

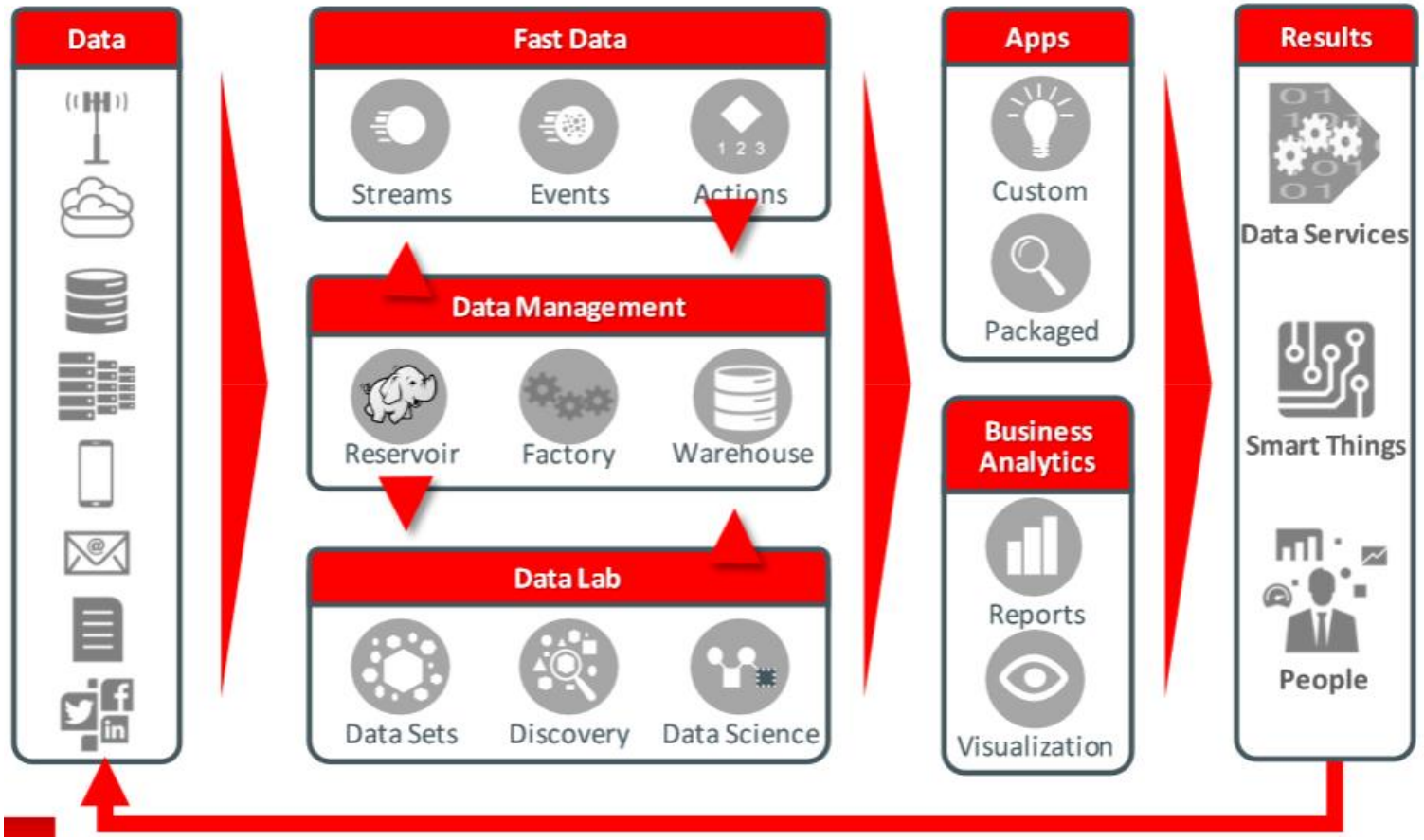


Oracle has competing “Service Branches”

Oracle's Big Data Strategy

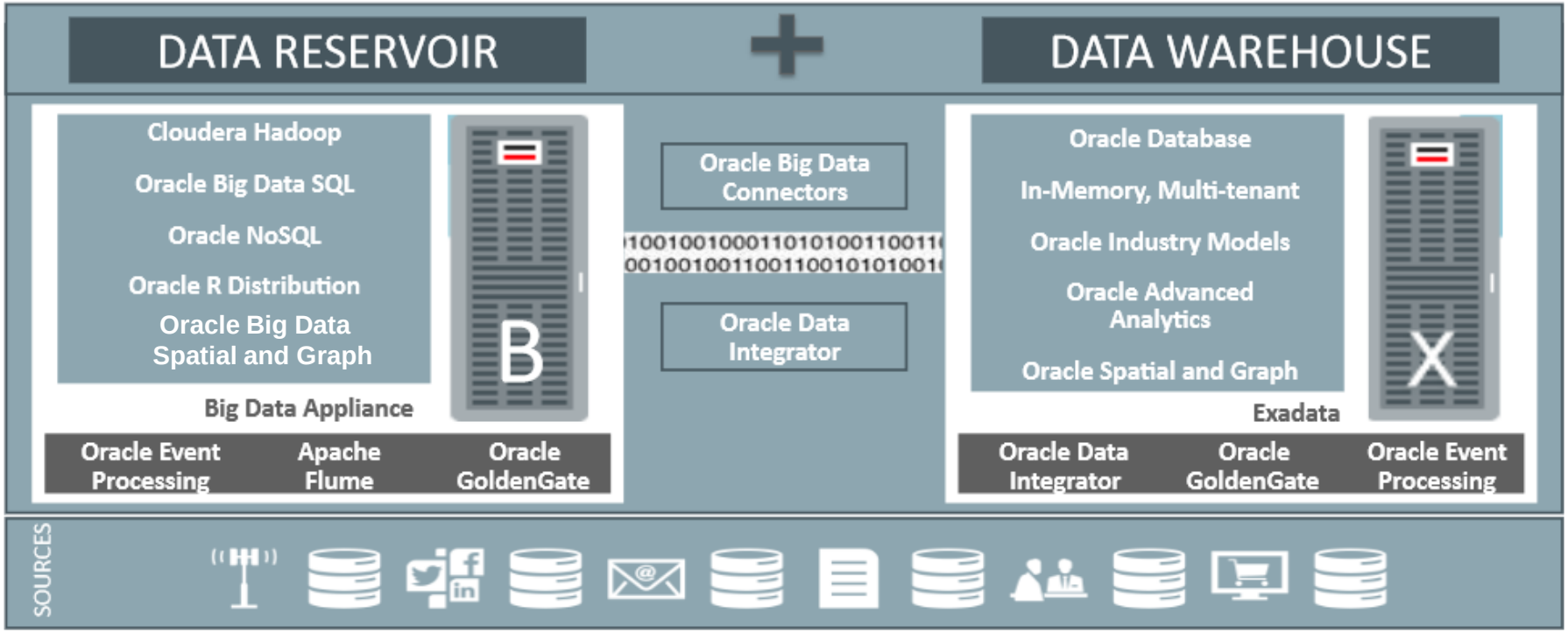
	Per User	PerProcessor
Big Data Connectors		$2,000
Big Data Spatial and Graph		$2,000
GoldenGate for Big Data	$400	$2,000
ODI Advanced Big Data Option	$150	$5,000
Big Data Discovery	$20,000	$50,000
NoSQL Database EE	$200	$10,000
Big Data SQL (BDA only)		$4,000

Big Data Information Flows



Oracle Big Data Management System

The Big Picture – Oracle Big Data Management System



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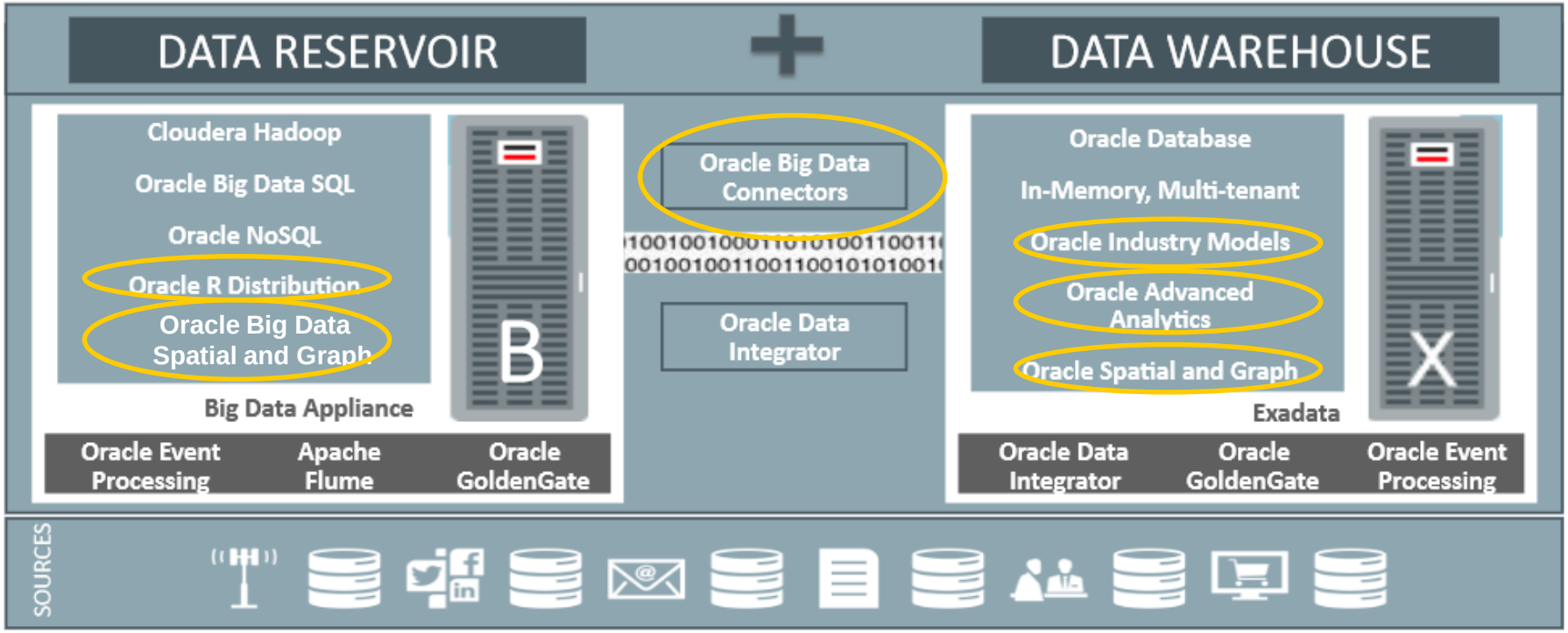

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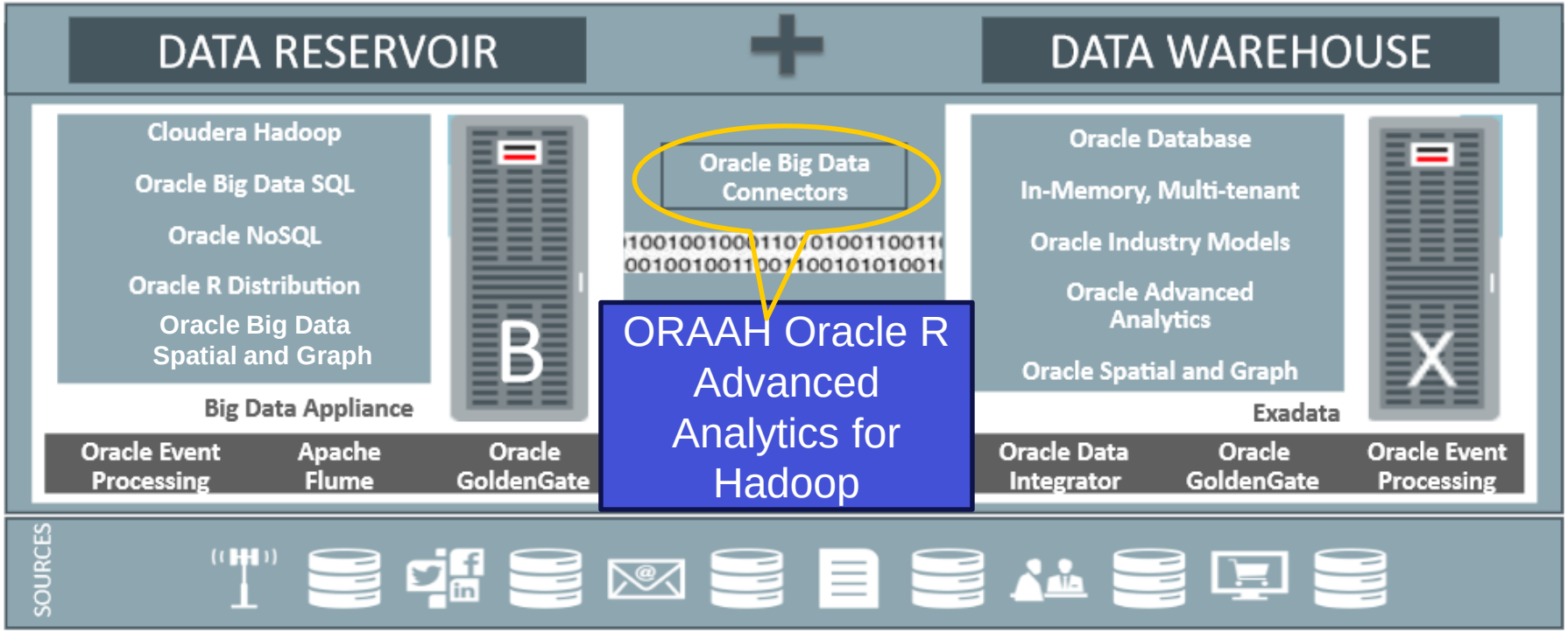

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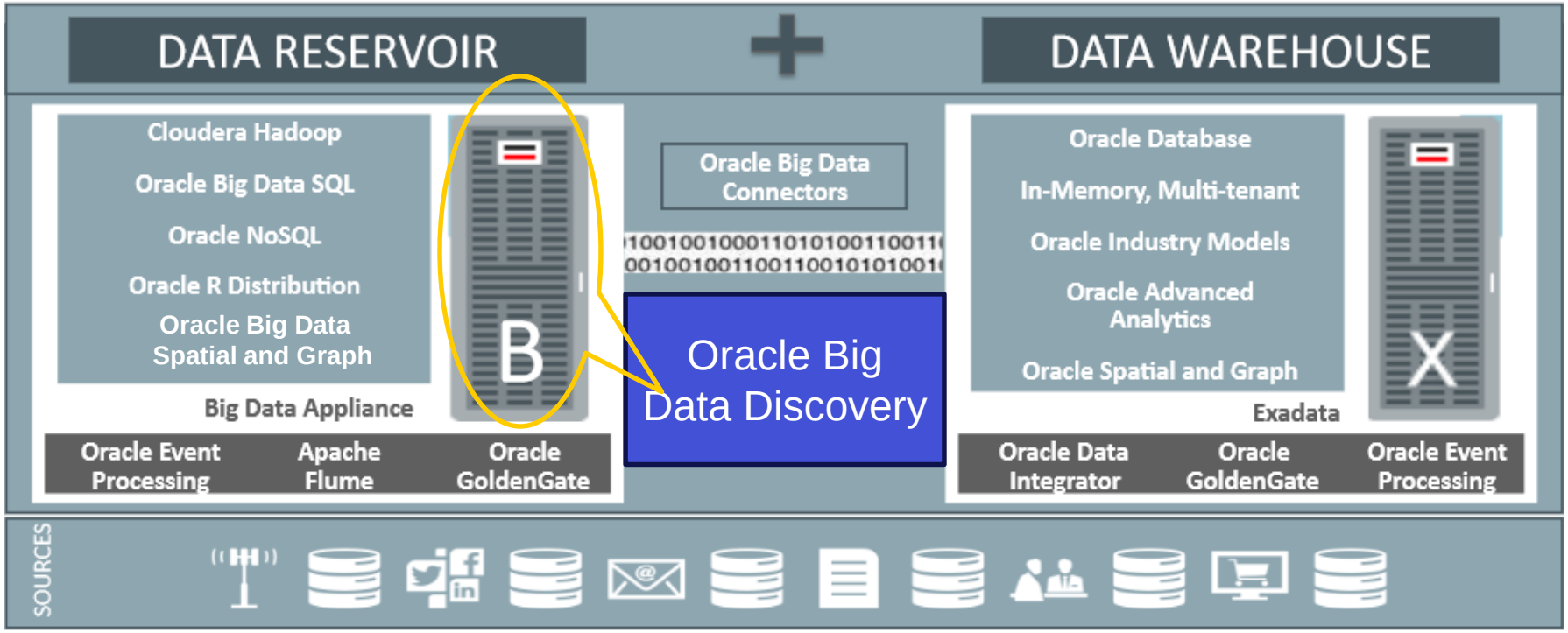
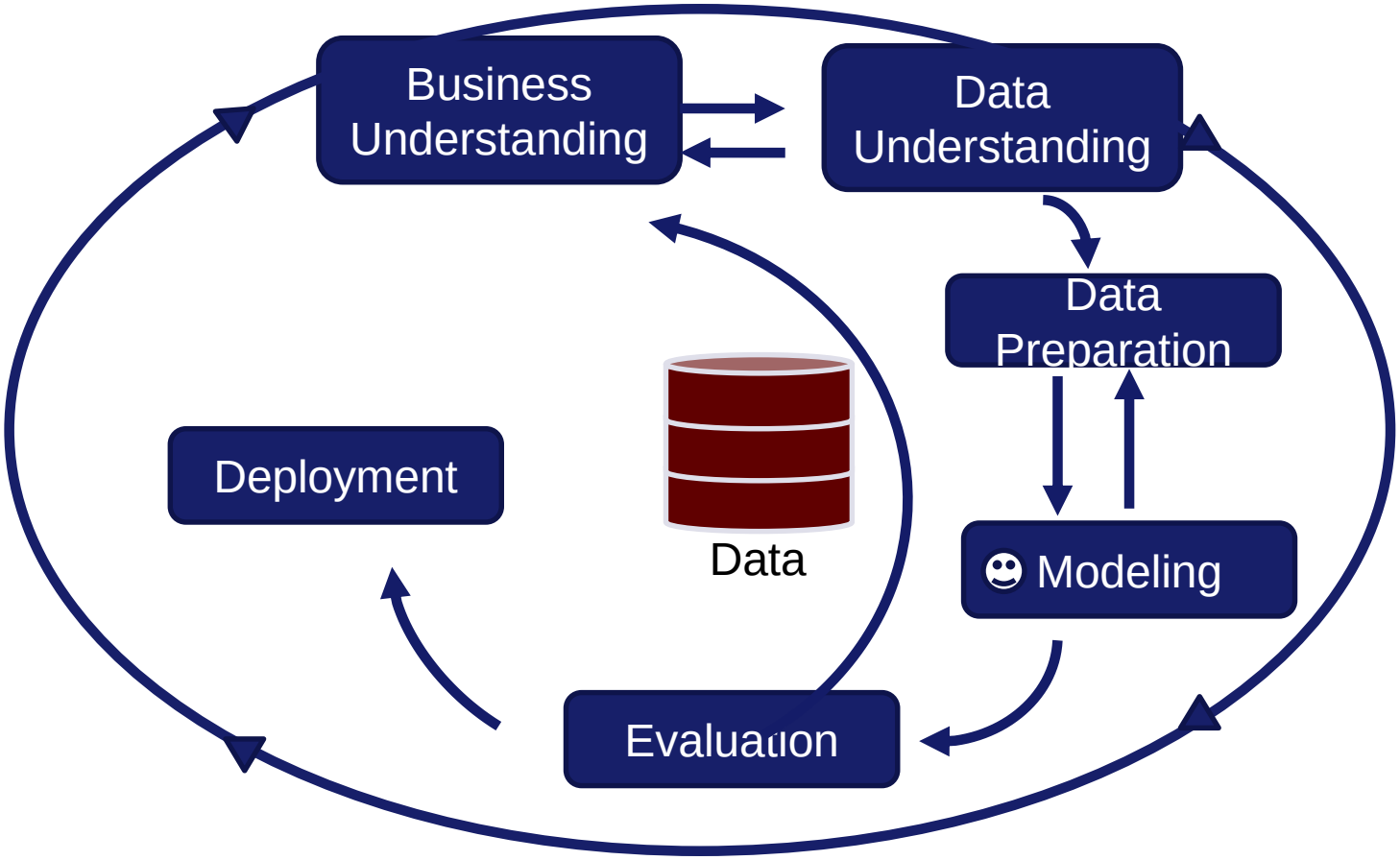
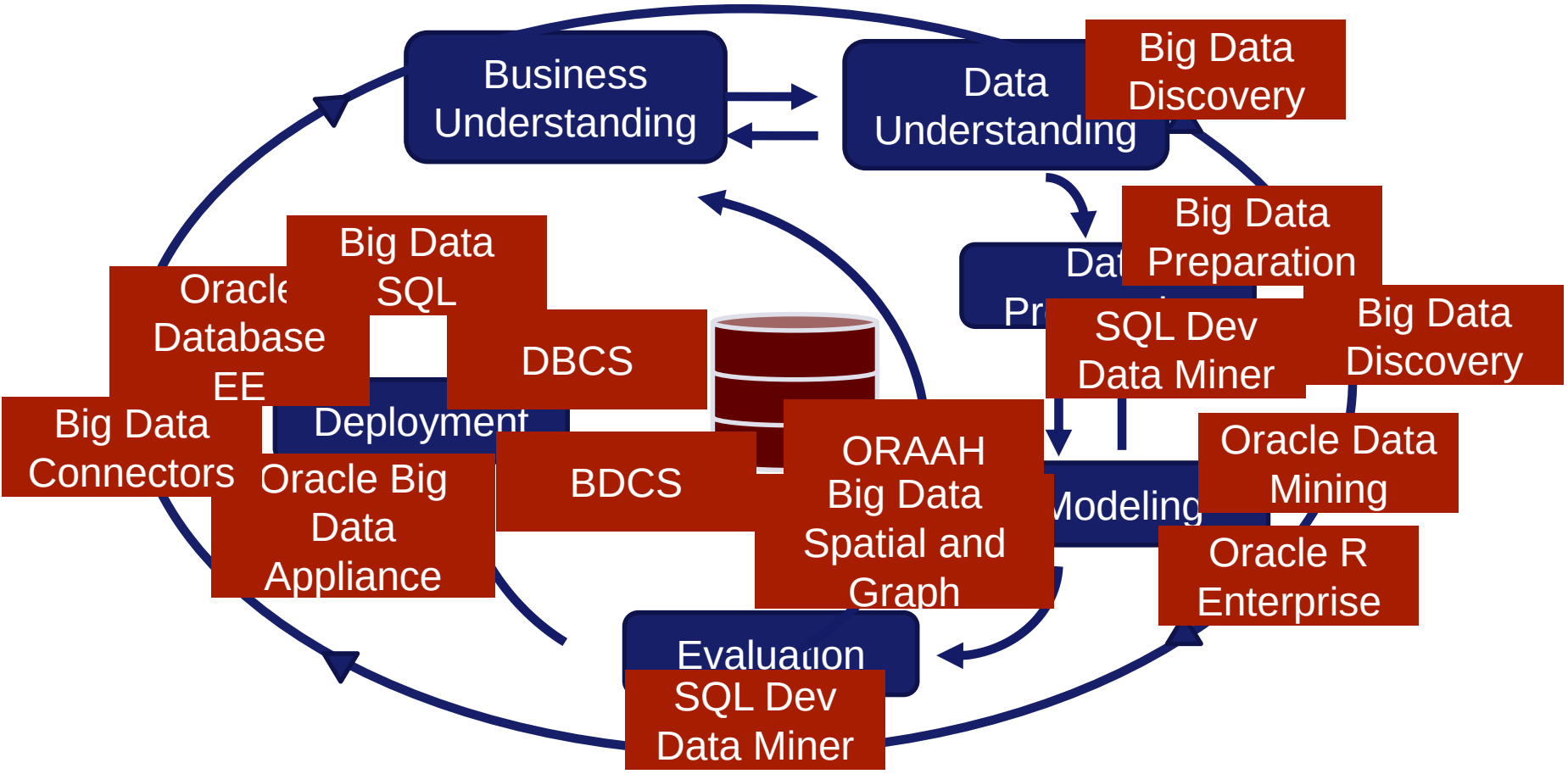


CRISP-DM Phases

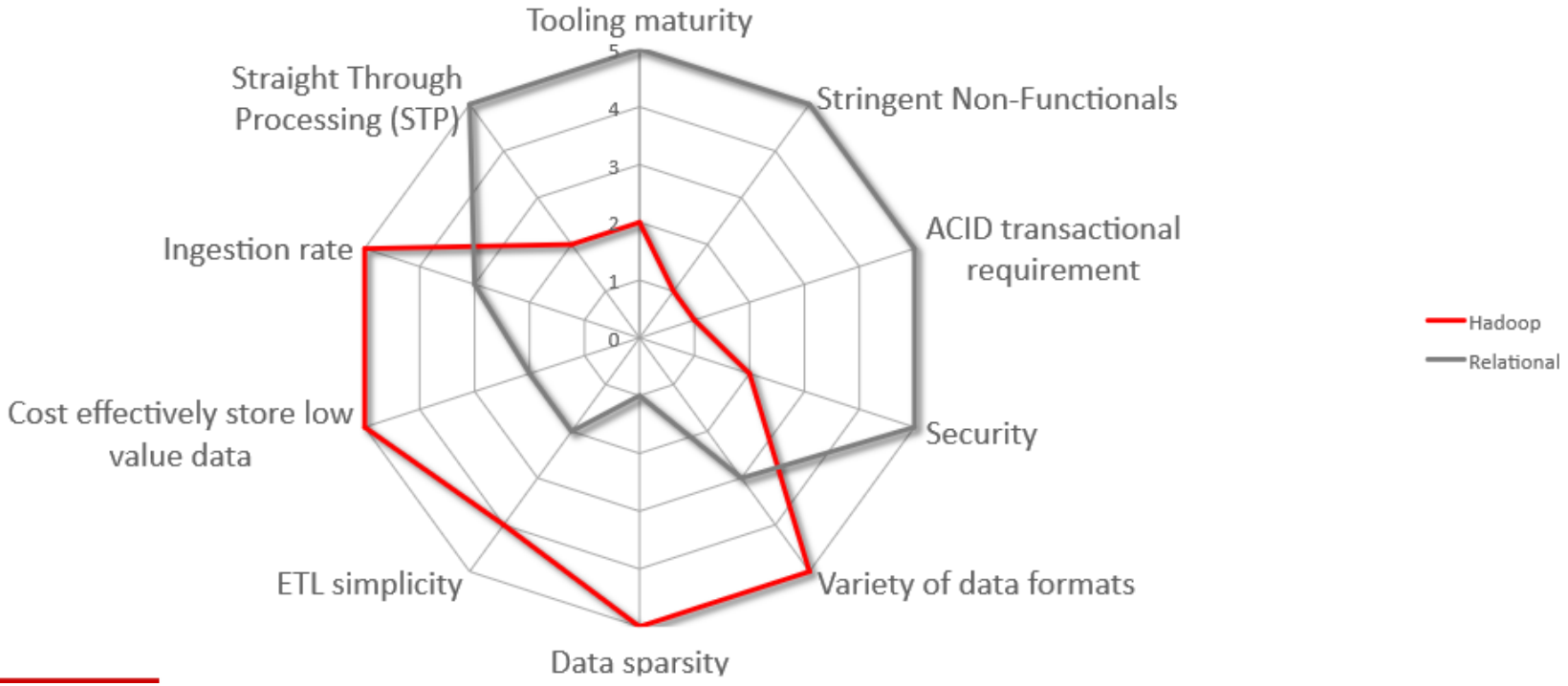


CRISP-DM Phases



Conventional database or Big Data technologies

Typical technical decision criteria



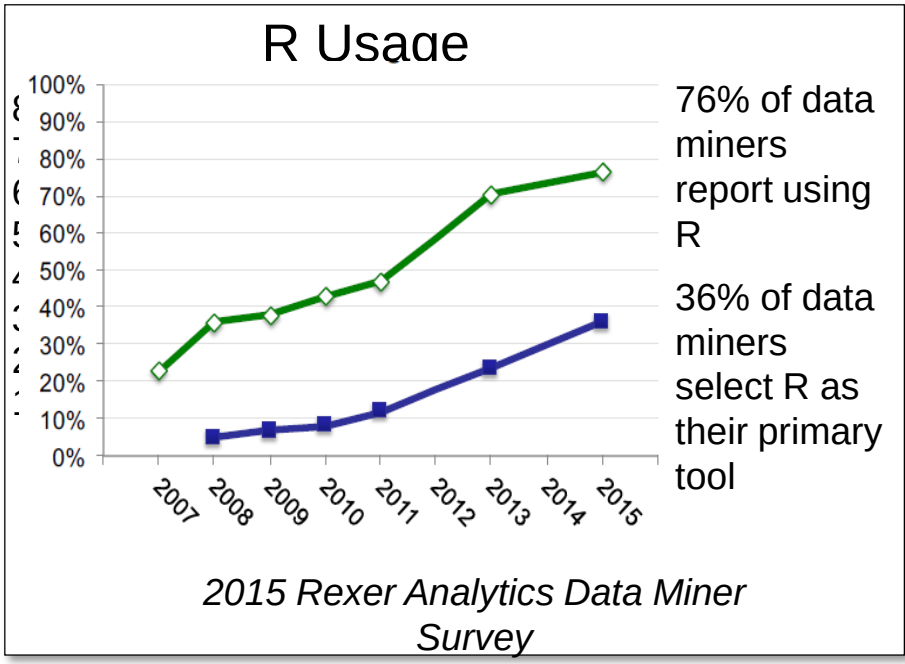
Big Data Science is Young

Oracle Big Data Discovery

- Visual “front-end” for Hadoop and “Data Lab”
- Catalog data sets
- Visualize attributes by data type and sort by relevance
- Discover patterns, outliers, and correlations
- Enrich and transform data (munging)
- Explore with interactive visualizations
- Build galleries and tell Big Data Stories

What is R?

- An **Open Source** scripting language and environment for statistical computing and graphics http://www.R-project.org/
- Popular alternative to **SAS, SPSS** & other proprietary statistical environments
- 2 million+ users worldwide and growing
- Thousands of R packages available
- Taught extensively in higher education



Oracle's R Technologies

- Oracle R Distribution
- ROracle

- Oracle R Advanced Analytics for Hadoop (ORAAH)
- Oracle R Connector for Hadoop (ORCH)

- Oracle R Enterprise (part of Oracle Advanced Analytics)

Oracle R Advanced Analytics for Hadoop

- Part of the Big Data Connectors package
  - ORAAH and Oracle Loader for Hadoop
  - Oracle SQL Connector for Hadoop
  - Oracle Xquery for Hadoop
  - Oracle Data Integrator Enterprise Edition (restricted)
- Execution of R scripts in Hadoop
- R interface to Hive tables through transparency layer
- R interface for Oracle database tables through transparency layer
- Set of pre-packaged algorithms
- ORCH (Oracle R Connector for Hadoop)

ORAAH Algorithms

- Linear regression
- Generalized linear models (GLM)
- Neural Net
- Low rank matrix factorization
- Non-negative matrix factorization
- Principle components analysis (PCA)

ORAAH MR Hadoop & Spark Functions

Current release 2.5.1

Function	Description
orch.cor	Generates a correlation matrix with a Pearson's correlation coefficients.
orch.cov	Generates a covariance matrix.
orch.getXlevels	Creates a list of factor levels that can be used in the xlev argument of a model.matrix call. It is equivalent to the .getXlevels function in the stats package.
orch.glm	Fits and uses generalized linear models on data stored in HDFS. Can fit the algorithm using the new Spark-based computation for a much faster computation and scoring as well.
orch.kmeans	Perform k-means clustering on a data matrix that is stored as a file in HDFS.
orch.lm	Fits a linear model using tall-and-skinny QR (TSQR) factorization and parallel distribution. The function computes the same statistical parameters as the Oracle R Enterprise ore.lm function.
orch.lmf	Fits a low rank matrix factorization model using either the jellyfish algorithm or the Mahout alternating least squares with weighted regularization (ALS-WR) algorithm.
spark.connect	Connects to an Apache Spark server through YARN or Standalone mode and creates a Context for use with the Spark-based algorithms in ORAAH

ORAAH MR Hadoop & Spark Functions

Current release 2.5.1

Function	Description
orch	o model complex, erns in the data. r faster computation.
orch	ization model using ets than the .
orch	is function is used for
orch	
orch	s predicted ratings
orch	
orch	

New ORAAH release 2.6.0 adds Apache Spark MLlib machine learning algorithms from R

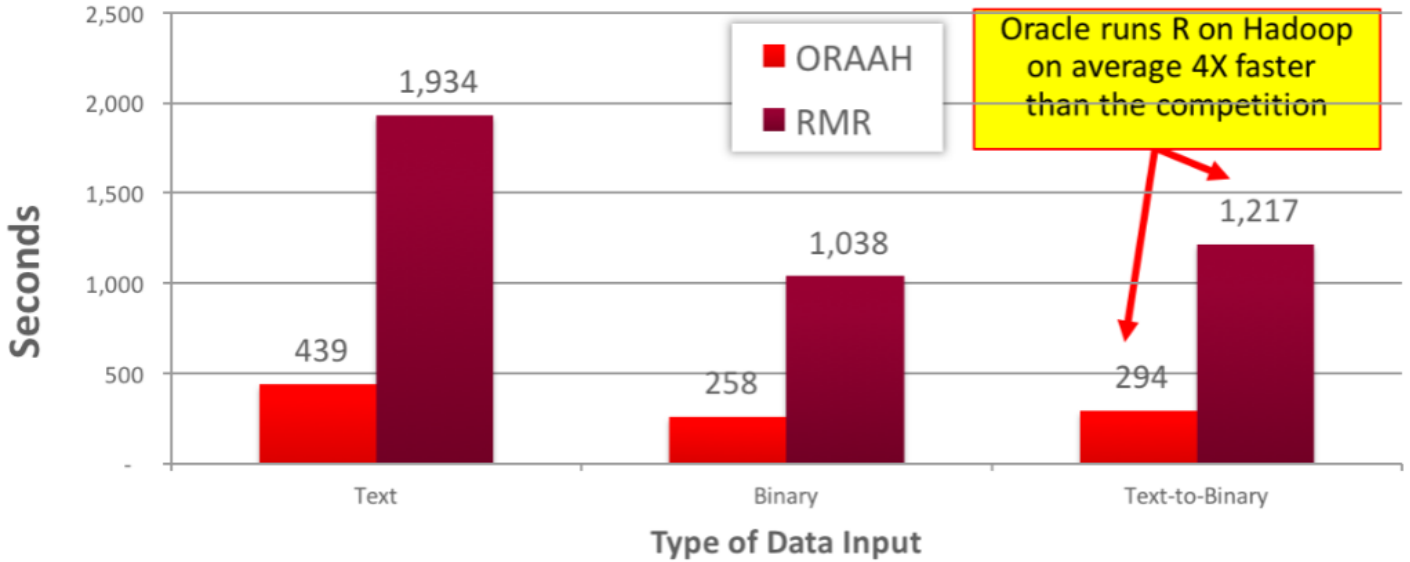
(plus more)

ORAAH is Fast

Oracle R Advanced Analytics for Hadoop – **vs. Rhadoop (RMR)**

Best platform available to run Hadoop-R jobs vs. Revolution Analytics' RHadoop

Performance on a 6-node BDA X3-2, 16 cores and 47 GB of Total RAM assigned
Covariance computation on 100 GB HDFS/200 columns input dataset



https://blogs.oracle.com/R/entry/oraah_enabling_high_performance_r

ORACLE

Oracle Advanced Analytics

- Licensed option to Oracle Database Enterprise Edition
- Two primary components
  - Oracle Data Mining
  - Oracle R Enterprise
- Includes an extensive set of APIs, algorithms, and capabilities

Oracle's Advanced Analytics

In-Database Data Mining Algorithms*—SQL & R & GUI Access

Classification

- Decision Tree
- Logistic Regression (GLM)
- Naïve Bayes
- Support Vector Machine (SVM)
- Random Forest

Regression

- Multiple Regression (GLM)
- Support Vector Machine (SVM)
- Linear Model
- Generalized Linear Model
- Multi-Layer Neural Networks
- Stepwise Linear Regression

Clustering

- Hierarchical k-Means
- Orthogonal Partitioning Clustering
- Expectation-Maximization

Attribute Importance

- Minimum Description Length
- Unsupervised pair-wise KL div.

Anomaly Detection

- 1 Class Support Vector Machine

Time Series

- Single & Double Exp. Smoothing

Predictive Queries

- Clustering
- Regression
- Anomaly Detection
- Feature Extraction

Feature Extraction & Creation

- Nonnegative Matrix Factorization
- Principal Component Analysis
- Singular Value Decomposition

Market Basket Analysis

- Apriori – Association Rules

Open Source R Algorithms

- Ability to run any R package via Embedded R mode

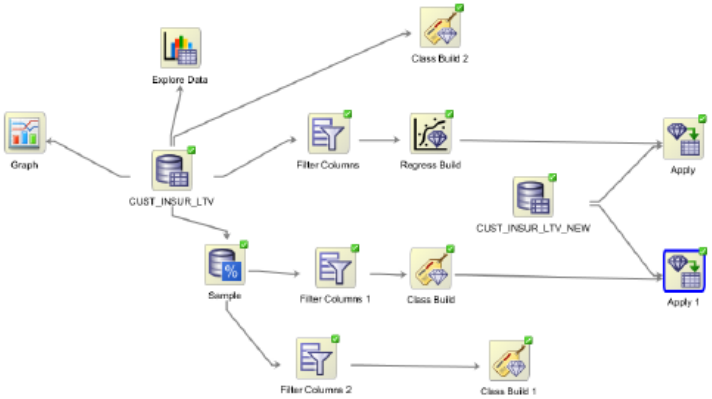
* supports partitioned models, text mining

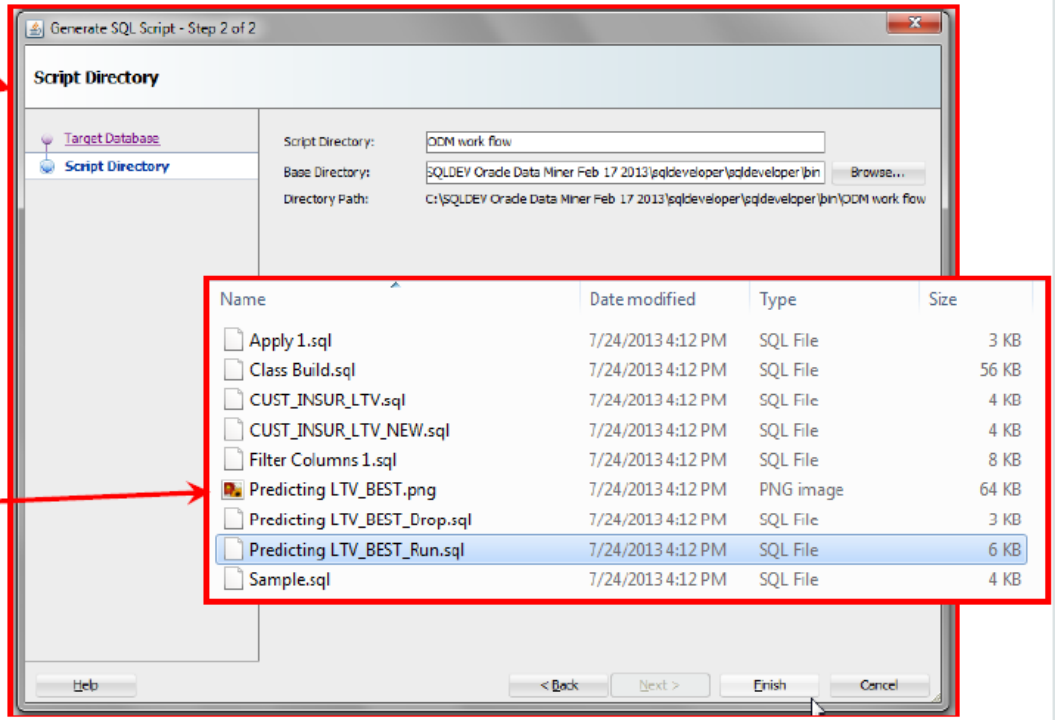
ORACLE

Data Miner GUI for Analytic Workflows

SQL Developer/Oracle Data Miner 4.0
New Features

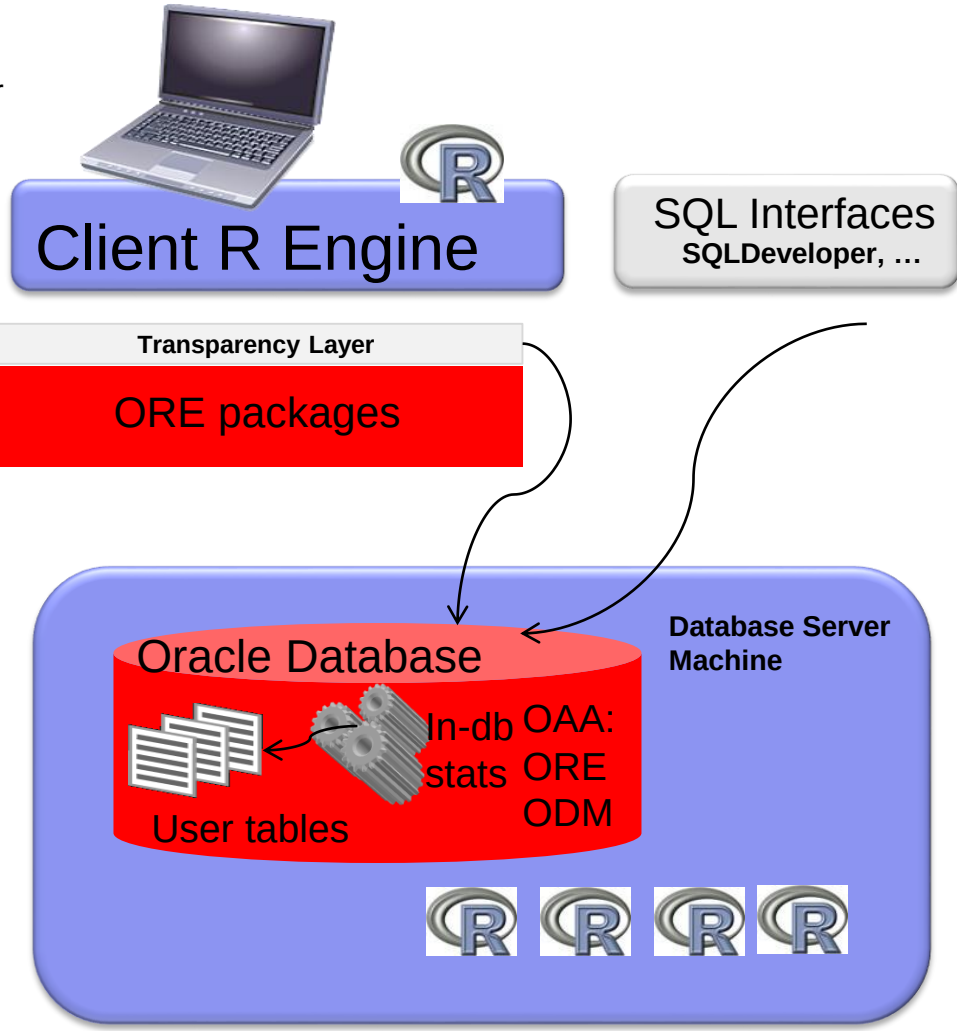
- **SQL Script Generation**
  - Deploy entire methodology as a SQL script
  - Immediate deployment of data analyst's methodologies



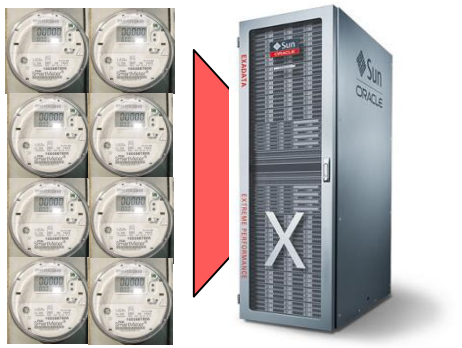


Oracle R Enterprise

- A comprehensive, database-centric environment for end-to-end analytical processes in R, with immediate deployment to production environments
- Operationalize entire R scripts in production applications – eliminate porting R code
- Seamlessly leverage Oracle Database as an HPC environment for R scripts, providing data parallelism and resource management
- Avoid reinventing code to integrate R results into existing applications
- Transparently analyze and manipulate data in Oracle Database through R using versatile and customizable R functions
- Eliminate memory constraint of client R engine
- Score R models in Oracle Database
- Execute R scripts through Oracle Database server machine for scalability and performance
- **Get maximum value from your Oracle Database and Exadata**
- Enable integration and management through SQL
- Integrate R into the IT software stack, e.g. OBIEE

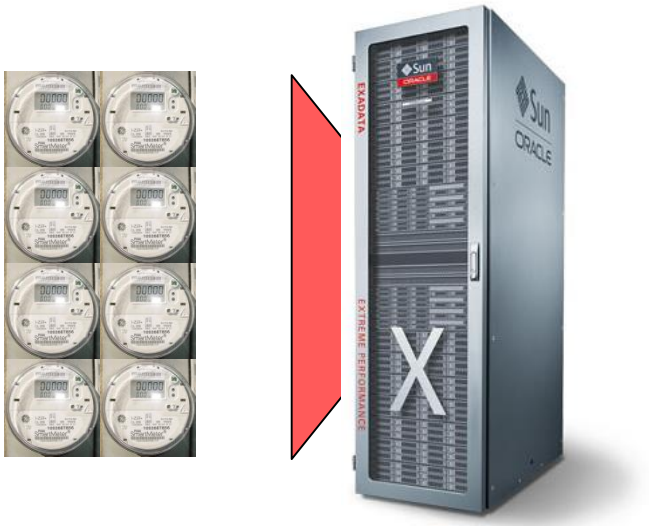


Sensor Data Analysis



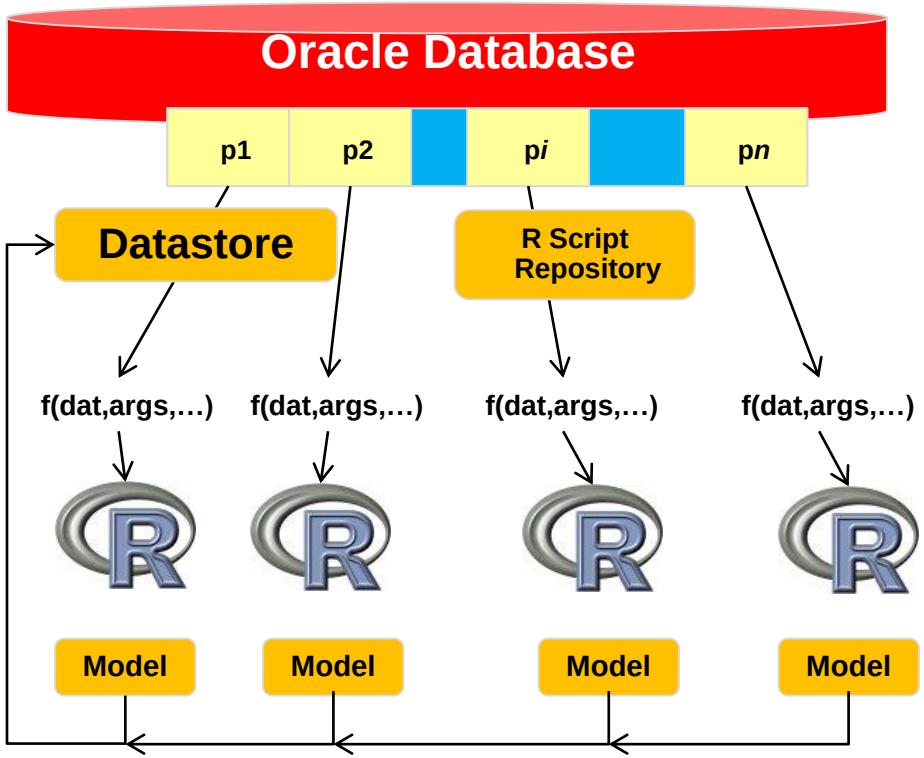
- 200K households, each with a utility "smart meter"
- 1 reading/meter/hour
- 200K x 8760 hours/year ➔ 1.752B readings per year
- 3 years worth of data ➔ 5.256B readings
- Each customer has 26,280 readings
- Build one model per customer to understand/predict customer
  monthly usage
- If each model takes 10 seconds to build, 556 hours (23+ days)
  …with 128 DOP ➔ 4.4 hours

Smart Meter Scenario

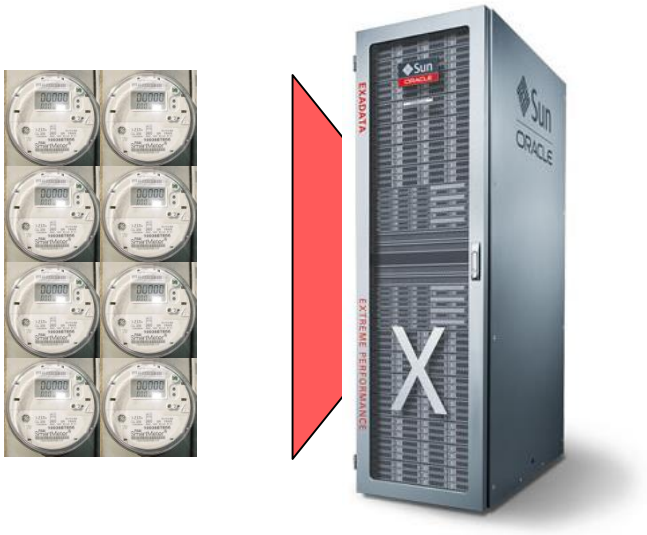



```
f(dat,args,…) {
    R Script
    build
    model

}
```

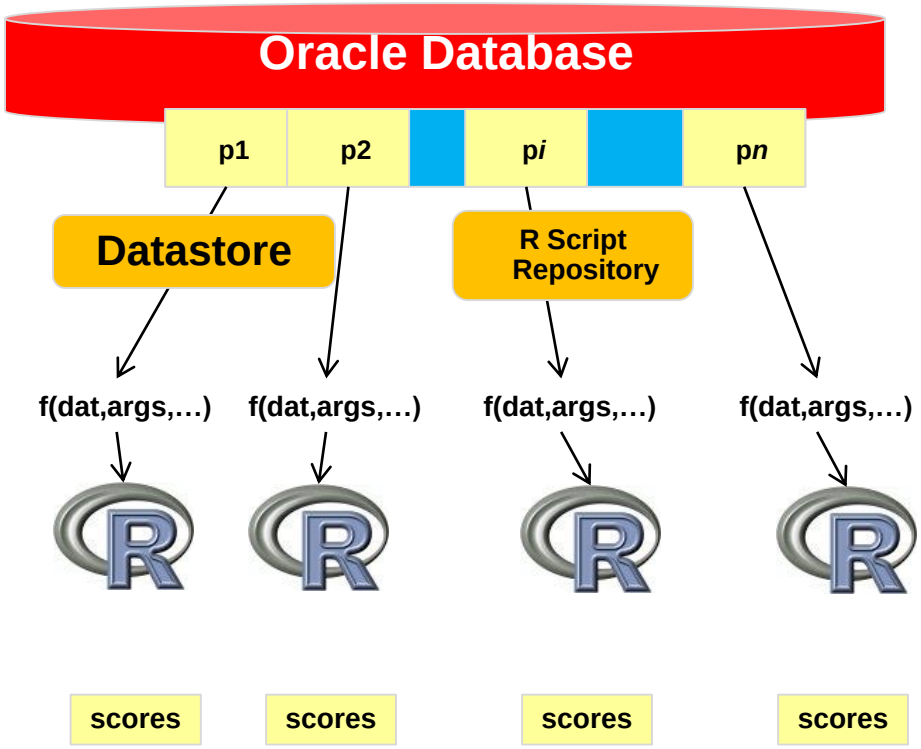


Smart Meter scenario



```
f(dat,args,…) {
    R Script
    score
    data

}
```



Oracle Big Data Connectors

- Oracle SQL Connector for HDFS
  - (previously called Oracle Direct Connector for HDFS)
  - Enables an Oracle external table to access data stored in HDFS or HIVE
  - Data can remain in source or be loaded into Oracle Database
- Oracle Loader for Hadoop
  - High-performance loader for HDFS data into Oracle Database
  - Transforms data in DB format and can sort by Pkey or user defined columns
- Oracle Xquery for Hadoop
  - Runs transformations expressed in XQuery by translating into MapReduce
- Oracle Data Integrator (limited license)
  - ETL tool w/ GUI for data movement to and from ODM, 3rd party, and Hadoop
- ORAAH (Oracle Advanced Analytics for Hadoop)

Big Data Connectors Certification Matrix

Overview | Features & Benefits | Resources | **Certifications**

Oracle Big Data Connectors Certification Matrix

	Oracle SQL Connector for HDFS	Oracle Loader for Hadoop	Oracle Data Integrator Enterprise Edition *	Oracle XQuery for Hadoop	Oracle R Advanced Analytics for Hadoop	Certified by	Support
CDH 4.x (Cloudera)	●	●	●	●	●	Oracle	Oracle
CDH 5.x (Cloudera)	●	●	●	●	●	Oracle	Oracle
Apache Hadoop 2.x	●	●	●	●	●	Oracle	Oracle
HDP 1.3 (Hortonworks)	●	●	●	●	●	Hortonworks	Oracle supports connectors, Customer contacts Hortonworks directly for Hadoop specific issues
HDP 2.1 (Hortonworks)	●	●	●	●	●	Hortonworks	Oracle supports connectors, Customer contacts Hortonworks directly for Hadoop specific issues

Big Data Spatial and Graph

- Property Graph Capability
- 35 high-performance analytic functions
  - Network theory analytics: centrality, connectedness, betweenness, etc.
- Text search integration through Lucene/SOLR
- Java APIs include
  - TinkerPop/Gremlin
  - Blueprints
  - Hadoop
  - NoSQL
  - HBase

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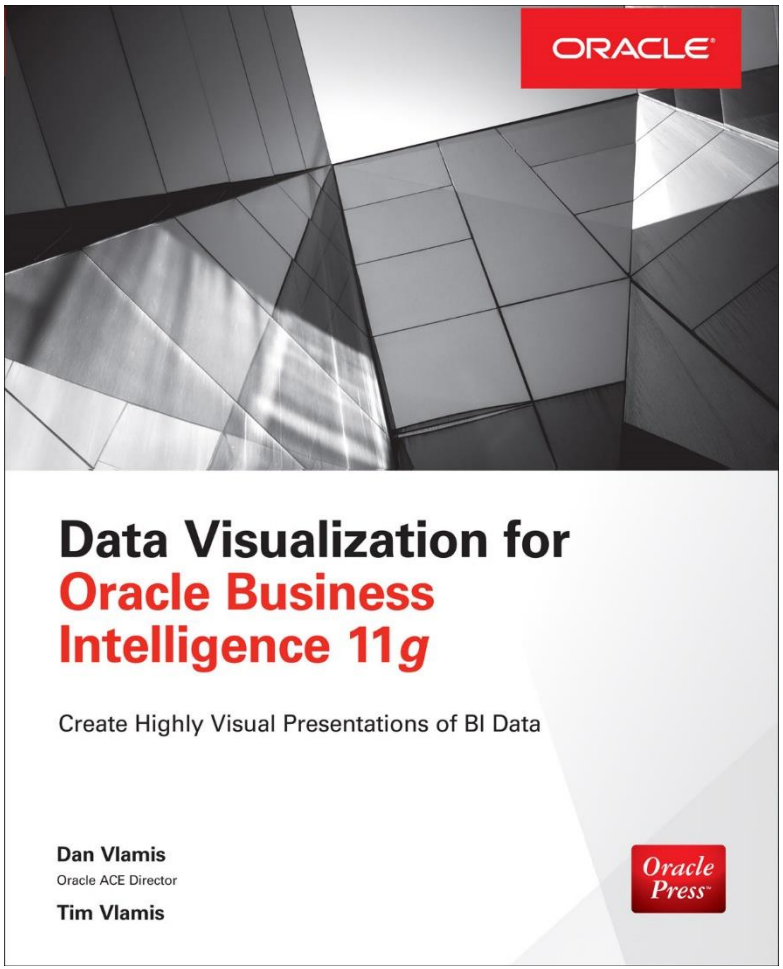
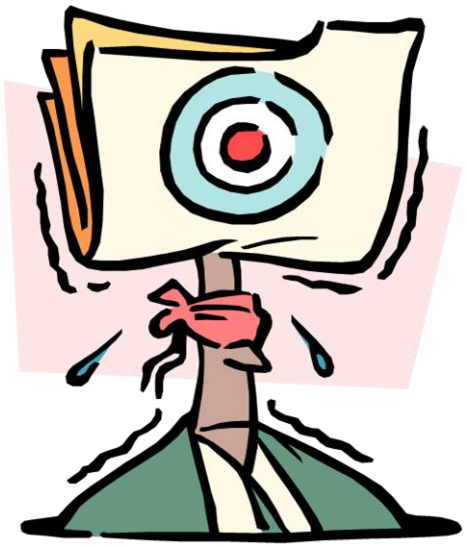
FOR THE ORACLE COMMUNITY

Drawing for Free Book

- Add business card to basket or fill out card



Questions?



Thank You!

Thank You for Attending Session **546**

Presenter Information

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