ORACLE BUSINESS INTELLIGENCE FOUNDATION SUITE

Technical Overview

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TABLE OF CONTENTS

INTRODUCTION

ENABLING ENTERPRISE BUSINESS INTELLIGENCE

Many organizations today use a collection of Business Intelligence (BI) tools and applications to allow experts to gather information from a variety of sources, analyze it, and share it with managers and staff. However, ever-increasing business dynamics and increased competition means businesses now require a much higher level of value from their BI investments. BI must now help drive profitable growth, change, and many other operational and financial performance goals. Not only does BI need to deliver significant Return on Investment (ROI), but it also needs to be deployed in a manner that minimizes Total Cost of Ownership (TCO).

Enterprise Business Intelligence must give managers and staff much more than tools that access information. It must provide a broad set of capabilities, from self-service monitoring of performance and processes to driving action based on insights. Enterprise Business Intelligence requires not just a comprehensive BI tool set, but pervasive BI that provides insight to all employees within the context of their workflows. It needs to unify the many fragmented systems into a coherent enterprise view, while aligning forward-looking information to real time and historical data. It must be integrated ensuring accuracy and integrity of information across all delivery channels and resulting in lower cost of ownership. It must be open, meaning it will plug into the company's existing middleware architectures and data infrastructure. It needs to be fully secure to protect all enterprises information assets. It needs to support BI applications that scale from single-node departmental to multi-node enterprise-scale solutions regardless of user population or whether on-premise or on the cloud is the desired deployment model.

To achieve this vision the Oracle Business Intelligence (BI) Foundation Suite delivers the most complete, open, and integrated business intelligence tools and technologies on the market today. The Oracle BI Foundation Suite provides comprehensive and complete capabilities for business intelligence, including enterprise reporting, dashboards, ad hoc analysis, multi-dimensional OLAP, scorecards, and predictive analytics on an integrated platform. The Oracle BI Foundation Suite enables access to information through multiple channels such as web-based user interfaces, industry standard portals, mobile devices, and the Microsoft Office Suite of applications. A powerful enterprise information model unifies disparate data systems within an organization and provides a platform for BI tool integration. The Oracle BI Foundation Suite is completely open: (1) supporting both Oracle and non-Oracle data sources ranging from file-based data, to all popular relational database management systems, and to leading multi-dimensional sources; (2) supporting prevalent middleware solutions including application servers and security systems; and (3) providing open-APIs for integration with a range of enterprise systems. A strong and flexible security model ensures that information is accessed and delivered by those with the appropriate privileges. The Oracle BI Foundation Suite simplifies systems deployment and management through integrated systems management tools that offer single-click scale out capabilities that can support a range of deployments with proven capabilities for applications that reach tens of thousands of users accessing multi-terabytes of data. Finally, the Oracle BI Foundation suite offers best-in-class capabilities for managing the development lifecycle for BI applications with proven support for hundreds of geographically disperse developers.

In summary, traditional BI tools are not designed to enable the insight-driven enterprise. A fundamentally different infrastructure and business intelligence solution set is required to meet this need. The Oracle Business Intelligence Foundation with its complete, open and integrated modern

architecture and broad range of analytical capabilities is the only business intelligence solution designed to meet the needs of today's insight-driven organizations.

PRODUCT OVERVIEW

The Oracle BI Foundation Suite provides powerful capabilities that offer significant value for BI applications across the enterprise. The Oracle BI Foundation Suite consists of Oracle Business Intelligence Enterprise Edition 11g, Oracle BI Publisher, Oracle Essbase, Oracle Scorecard and Strategy Management, and Oracle Essbase Analytics Link (EAL). Following is an overview of the key components and features of the Foundation Suite.

Server Components

- *Common Enterprise Information Model:* The semantic model of OBIEE. It is accessed via an open API, making it available to any Oracle or non-Oracle delivery channel, thus providing a common version of the truth for all Business Intelligence users and applications.

- *Oracle BI Server:* A highly scalable, highly efficient query and analysis server that integrates data via sophisticated query federation capabilities from multiple relational, unstructured, OLAP, and pre-packaged application sources, whether Oracle or non-Oracle.

- *Oracle Essbase:* The industry-leading multi-dimensional online analytical processing (OLAP) server, providing a rich environment for effectively developing custom analytic and enterprise performance management applications.

- *Oracle Essbase Analytics Link:* Enables the delivery of effective management and financial analytic reporting to a broad user community by facilitating the real-time or on-demand transfer of financial information from Oracle Hyperion Financial Management to Oracle Essbase.
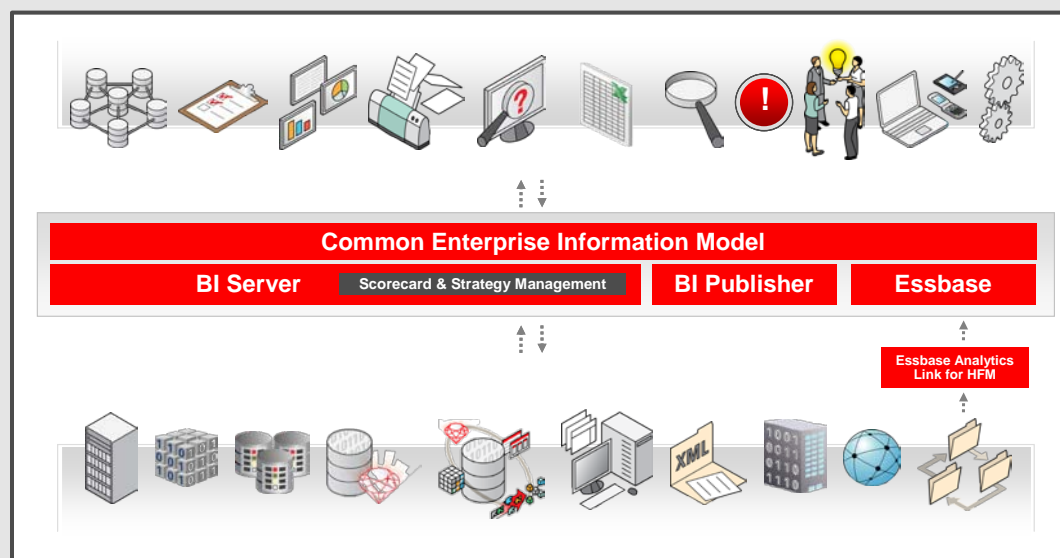

Figure 1 - Oracle BI Foundation Suite Overview Architecture

End-User Delivery Components

- *Enterprise Reporting:* Oracle Business Intelligence (BI) Publisher (formerly XML Publisher) is an enterprise reporting solution for authoring, managing, and delivering highly formatted documents, such as operational reports PDF forms, shipping labels, checks, sales and marketing letters, and much more. Built on open standards, reports can be designed using a feature-rich online layout editor or through familiar desktop products and viewed online or scheduled for delivery to a wide range of destinations. While Oracle BI Publisher is fully integrated with OBIEE 11g, it can also be deployed separately.

- *Ad hoc Query and Reporting:* A powerful ad-hoc query and analysis environment that works against a logical view of information from multiple data sources in a pure Web environment. This single interface is designed to seamlessly handle both relational and OLAP style analysis.

- *Interactive Dashboards:* Rich, interactive pure Web dashboards that display personalized information to help guide users in effective decision making.

- *Scorecard and Strategy Management:* Extends the Oracle BI Enterprise Edition (OBIEE) with capabilities that enable strategic goals to be communicated across the organization and monitoring progress over time. Oracle Scorecard and Strategy Management includes visualizations that graphically communicate strategy & strategic dynamics using Strategy maps, Cause and Effect diagrams, and Custom views. Scorecard metadata objects and visualizations are treated just like any other OBIEE 11g metadata object and can be easily embedded in dashboards, ad-hoc query and analysis views and can be monitored as alerts.

- *Actionable Intelligence:* Consists of an Action Framework that provides the ability to invoke a workflow, web services, web content, additional BI content, java method, and other custom procedures from any delivery channel and an alerting engine that captures and distributes notifications via multiple channels in response to pre-defined business events and/or data exceptions to speed exception based decision making.

- *Integrated Search:* Ability to search existing content based on full indexing of Dashboards, Analyses, Views, Prompts, KPIs, Scorecards, Publisher Reports, Agents, Actions, Catalog, and Folders. Ability to drill into BI with context; Index metadata & prompts. Search results can be secured via SSO integration.

- *BI on the go:* Consists of capabilities to provide Business Intelligence content when the user is not directly connected to the enterprise network. Includes Briefing Books — reports that capture a series of snapshots of an Oracle BI Dashboard or report allowing the information to be viewed offline in presentation style; rich integration with Microsoft Office allowing for interaction with BI content and access to pre-built analysis and mobile from Office products.

Systems Management Components

- *Oracle Enterprise Manager Integration:* Providing centralized, comprehensive web based management of small to enterprise level systems. This enables an Oracle BI system administrator to manage a multi server enterprise system from a single interface.

ORACLE BI PRODUCT STRATEGY

The Oracle BI Foundation Suite is designed to meet the requirements for a new class of enterprise business intelligence solutions. It consists of a broad set of capabilities including ad-hoc query and analysis, interactive dashboards, scorecards, reporting, proactive intelligence and alerts, mobile analytics, and more. The Oracle BI Foundation Suite is designed around the following principles:

- *Unified Enterprise View of Information:* Virtually every organization has information fragmented in multiple repositories and enterprise applications. The Oracle BI Foundation Suite enables organizations to define a single, consistent, and logical view of enterprise information across these heterogeneous systems such as data warehouses, multidimensional sources, and operational transaction systems. It provides the business with a unified, enterprise view of their information.

- *Unified Semantic View of Information:* The Oracle BI Foundation Suite allows an organization to model the complex information sources of their business as a simple, semantically unified, logical business model. It provides facilities to map complex physical data structures including tables, derived measures, and OLAP cubes into business terms - abstracting how a business user expresses calculations. It translates familiar, easy-to-understand business concepts into the technical details required to access the information. The Oracle BI Foundation Suite is unique in the market because it defines an enterprise semantic layer that spans across the unified enterprise view of information.

- *End User Self Service:* The Oracle BI Foundation Suite provides business users with the ability to access the information they need without for the need for assistance from professional analysts. Because end-users work with the unified, semantic view of the information, they are provided with self-service access to analyses across multiple sources via multiple delivery channels while maintaining a consistent definition of the information. Business users only need to understand a single, business-oriented view of their information.

- *Real-time Information Access:* With technologies like trickle feed ETL, Business Activity Monitoring, Business Event Management and federated data access directly from transaction processing systems, the Oracle BI Foundation Suite allows users to combine historical and real-time information to get an up-to-the-minute view of their business. In addition, Oracle BI can combine data from real-time systems with data in the Data Warehouse to give unparalleled insight into the business.

- *Insight-driven Action:* The proactive intelligence facilities of Oracle BI Delivers and the Guided Analytics facilities of the Interactive Dashboards are designed to help business users navigate information quickly and to effectively troubleshoot problems and take action proactively in response to business events.

- *Unified Platform:* The Oracle BI Foundation Suite is an integrated suite sharing a service-oriented architecture; integrated data access services; integrated analytic and calculation infrastructure; integrated metadata management services; a common semantic business model; an integrated security model and user preferences; and integrated administration tools which improve access to information and lower operational costs.

FOUNDATION SUITE SERVER TECHNOLOGY

The Oracle BI Foundation Suite features the industry's best-in-class server technologies for relational and multidimensional analysis. This section describes the rich capabilities of the Oracle BI Server and Oracle Essbase as well as the associated tools to develop and maintain applications and metadata.

ORACLE BI SERVER

Oracle BI Server is a highly scalable, highly efficient query, reporting and analysis server that provides services that enable the other components of the Business Intelligence Suite such as Analysis & Interactive Reporting, Dashboards, Data Mining and Analytic Applications.

The Oracle BI Server exposes its services through standard ODBC and JDBC-compliant interfaces. Clients of the Oracle BI Server see a logical schema view independent of the source physical database schemas. Oracle BI Server clients submit "Logical" SQL, which ultimately gets translated by the server to native, source-specific data source query languages like SQL and MDX. Intermediate processing to calculate complex business metrics and integrate multiple data sources occurs within the Oracle BI Server Execution Engine. The Oracle BI Server infrastructure includes facilities such as session and query management, cancellation, statistics logging, monitoring, and other server administration functions.

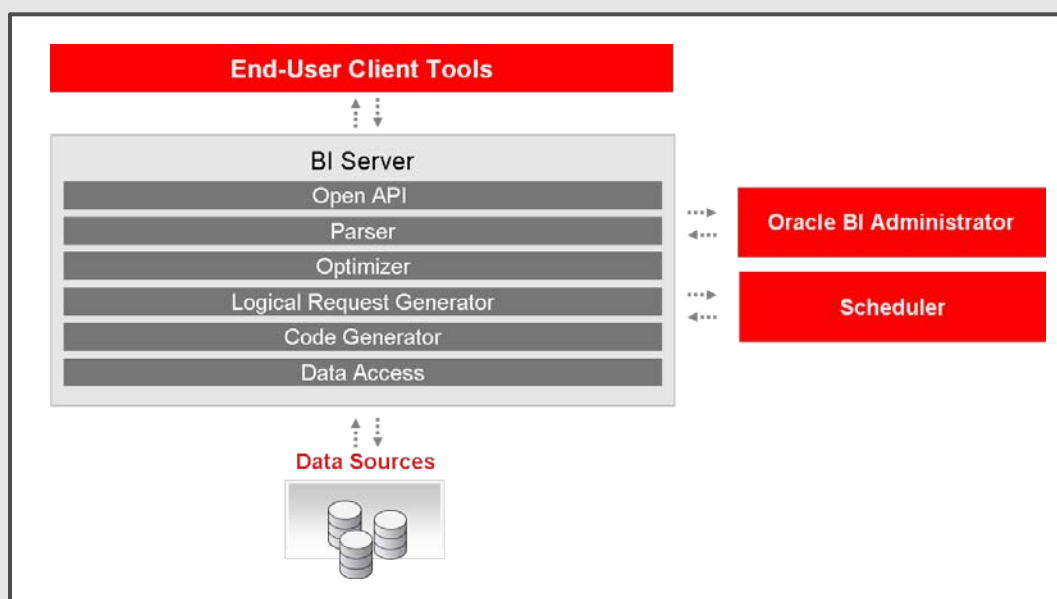Figure 2 - BI Server Functional Components

COMMON ENTERPRISE INFORMATION MODEL

The advanced semantic layer structure used in the Oracle BI Server is called the Common Enterprise Information Model. This model provides a single version of truth for all BI system users and applications. It takes advantage of all the features of the BI Server. This model is layered to provide flexibility and maintainability:

- *Physical Layer:* models each physical source's connection parameters and schema. In the case of a relational source, the schema would include tables, columns, joins, and security parameters. Metadata rich multi-dimensional sources like Oracle Essbase, Oracle OLAP Microsoft SQL Server Analysis Services or SAP BW, the full metadata models are imported including measures, dimensions and hierarchies. This is the only layer that is aware of the physical nature of the source, such as whether it is relational 3rd normal form, star, snowflake, multidimensional cubes or XML. If the source is a database, this layer is the only one that is aware of what brand and release the database is, and what functions it does or doesn't support.

- *Business Model and Mapping Layer:* models the way the business elements function: conformed dimensions and hierarchies, measures (including aggregation rules, complex business calculations, dimensionality and time series), data security rules, and human-readable attributes and dictionary definitions. The mappings from the semantic objects back to the physical objects define the federation and aggregate navigation across multiple sources. Because of this layering and mapping, the physical source can migrate to a different brand of database, or even add an aggregate, without impacting the business model, presentation layer or reports.

- *Presentation Layer:* organizes the semantic objects, or "logical columns," into "logical tables" that can be exposed to users by role. Presentation tables and columns are completely localizable allowing a single implementation to consistently support users across languages around the globe. These are normally the only objects in the semantic layer that are exposed via the ODBC and JDBC interfaces, whether the client is Oracle BI, a custom program or a 3rd party BI tool. This allows the administrator to provide subject organization to make objects easy for users of Oracle BI Foundation clients or other third party client tools to find, as well as to apply role-specific security.

THE ORACLE BI SERVER PROVIDES THE FOLLOWING KEY CAPABILITIES

Query Parsing and Compilation

At a simplified level, the internal layers of Oracle BI Server have two primary functions: (A) compile incoming query requests into executable code, and (B) execute the code. Query compilation is composed of the following five phases: (1) parsing, (2) logical request generation, (3) navigation, (4) rewrites, and (5) code generation. The final output of the query compiler is executable code. This code is passed to the execution engine that is then responsible for executing the code in parallel. The Oracle BI Server has ground breaking innovation in query parsing and compilation techniques; content aware data federation; parallel execution; connectivity adapters; custom memory management and latch contention.

- *Parsing:* In the first compilation phase, the multi-threaded parser accepts the full ANSI SQL compliant syntax (including sub-queries, derived tables, set operations, etc…) and generates a parse tree as its output. Subsequently, the logical request generation component is responsible for instantiating the inferred aggregation in the simplified SQL supported by the Oracle BI Server.

- *Logical Request Generation:* The navigation and rewrite phases do the bulk of the work in compiling a query. The output of these two major phases is an execution plan that is then fed into the code generation phase. The navigator is responsible for the "content-

aware" data federation capabilities, such as partitioning by source, partitioning by value range, and aggregate navigation; the input to the navigator is a logical request tree describing the precise semantics of the requested data while its output is the initial physical execution plan. The navigator exploits knowledge of content to eliminate the predominant majority of traditional multi-database joins. It also has built-in support for common business analytics such as time series comparisons, shares, and dimension-specific aggregation rules.

- *Rewrite/Optimizations:* Once the navigator generates the initial physical execution plan, the rewrite phase of the compiler is responsible for distributed relational query optimization and optimal native SQL or MDX generation. This phase covers (i) Multi-database join plan generation; (ii) Function shipping; (iii) Functional compensation analysis; and (iv) Optimized SQL or MDX generation. (Functional Compensation means the BI Server executes the query function when the physical source database does not support the function requested by the logical query, such as RANK() against a Microsoft Access database.) The Oracle BI Server's join engine is seamlessly invoked when necessary, as determined by the following: physical location of tables, SQL functionality supported by the source database(s), and analytical complexity of the original logical query. Join plans are constructed to maximize collective function shipping down to the source databases. Two types of internal join strategies are currently supported: (1) sort/merge and (2) parameterized nested loop joins (PNLJ). (PNLJ optimizes cross-database joins by fetching a small result set from database A and joining it to a large table in database B using a parameterized query, thus avoiding the slow operation of fetching the large result to the BI Server to join it there.) The BI Server further supports federated lookup tables allowing disparate systems to lookup values across one another and merge result on the fly. Optimal function shipping reduces loads on the source database and the network. The most important query processing elements to function ship include GROUP BY and aggregation; Filters; and Multi-pass SQL operations.

- *Equivalence Preserving:* aggregate and filter rewrites may push aggregates and filters through the tree (past operators such as joins, UNION ALLs, etc.) down to the database, thus reducing database load and network traffic. Both WHERE and HAVING filters may also be pushed to the database, depending on the GROUP BY clause.

Code Generation

Code generation is responsible for producing the native query processing language directives to communicate with heterogeneous, remote databases (i.e. physical SQL or MDX generation). It is also responsible for generating the code for any remaining query processing that has not been function shipped to remote databases. This includes the insertion of parallel execution directives for the Analytics execution engine.

Parallel Execution Engine

- The Oracle BI Server execution engine is a state-of-the-art; parallel SQL execution engine extended with analytical execution operators. It leverages the sophisticated technology and architectural concepts developed over more than 20 years in the database research community. Some of its key features:

- Function-Shipping: The Oracle BI Server ships directives for native SQL or MDX query strings; directives to execute one or more aggregation passes; and directives for various types of filters to the source database.

- Parallel Query Execution: The Oracle BI Server allows multiple queries to be submitted and executed in parallel, perhaps on different machines. Any cancellations would also be done in parallel.

- Sort Optimizations: If sorts required for the FULL OUTER JOIN cannot be pushed to the databases, the Oracle BI Server has facilities to allow sorts to be done in parallel. It ensures that no rows are lost between the two queries.

- Merge: The Oracle BI Server has sophisticated join facilities to merge two or more result sets from several parallel queries.

- Ranking and Filtering: The Oracle BI Server can rank and filter rows efficiently.

Information Reliability

Oracle BI Server defines and stores all the elements of analytic calculations as metadata in a central repository. This provides a centralized, consistent definition of measures for all users. Should the definition of a measure need to change, it needs only be changed within the central repository and all analyses and existing reports automatically use the new definition. This eases the maintenance burden and lowers cost of ownership.

Oracle BI Database Gateways

Oracle BI Server has an extensible and open connectivity layer with a set of adapters that are responsible for communicating with source data servers. An Oracle BI Gateway is a dynamically loaded library that can be configured to run within the Oracle BI Server process itself or in an external process. Individual adapters have been built to communicate with for the following systems:

- Relational Database System including Oracle Database, Oracle Exadata Database Machine, Oracle TimesTen In Memory Database, DB2, DB2, , Microsoft SQL Server, Teradata, Netezza, Informix, Sybase and other ODBC compliant data sources

- OLAP Sources including Oracle Essbase, Hyperion Financial Management, Oracle Database OLAP Services, Oracle RPAS, Microsoft Analysis Services Cubes, and SAP BW Infocubes.

- XML Data Sources including access to other types of data servers (e.g., other non-relational servers), Microsoft Excel spreadsheets, and Web Services.

Mission Critical Performance, Scalability, and Reliability

Oracle BI Server has a number of performance, scalability, and reliability optimizations to provide optimal performance and scalability whether users are constructing new analyses; changing the visualization of an existing analysis; or refreshing several analyses embedded on a single dashboard. The most important performance and scalability features are described below.

Highly Efficient Oracle BI Server Design

The Oracle BI Server offers several performance and scalability optimizations including custom heap memory management to avoid memory contention issues; hashing to avoid central locking; specialized synchronization mechanisms such as spin latches; parallel query and computation execution engines; and high-throughput connectivity adapters. When performance requirements exceed the capability of a single server, Oracle BI Servers can be clustered together with session replication and automatic fail-over. Oracle BI is architected to leverage the capabilities and scalability of modern 64-bit operating systems.

Highly Efficient Data Sourcing and Aggregation

Oracle BI Server minimizes data retrieval time by selecting the most efficient data sources to satisfy user queries. It is aware of and automatically selects "aggregate tables" in relational databases or cubes in multidimensional sources like Oracle Essbase or Oracle OLAP. Pre-aggregating and storing additive information is the standard practice for improving the query performance of relational databases. When users request information at a high "grain" of aggregation, the Oracle BI Server can use the pre-aggregated sources instead of requiring the database to add up the detail at report time. Oracle BI Server can select appropriate summary tables in lieu of the detail table based on where the requested columns are located in their respective hierarchies.

Oracle BI Server further builds its own summary aggregates through its data mart automation feature. This feature builds, refreshes and queries summary data stored in standard relational databases or in memory databases like Oracle TimesTen Database.

Aggregate navigation or transparent query rewrite across federated relational, in memory and multidimensional data sources ensure that the entire available data architecture is fully leveraged.

Exploiting Database Facilities

Oracle BI Server also optimizes performance and minimizes network traffic by exploiting the native capabilities of the available relational and multidimensional database platforms. When generating SQL (or other query languages such as MDX), the Oracle BI Server is aware of the functions and language constructs that the database supports and generates highly optimized target-specific queries. The Oracle BI Server "function-ships" this optimized SQL or MDX to the database conducting as much processing as possible in the database itself. Examples of such differences between databases include string processing, statistical and mathematical functions; logical if-then-else statements; expression maps in HAVING clause; and others. Conversely, if the database platform does not support a function or a SQL feature, the Oracle BI Server will itself compensate for the missing functionality using its own computation and data processing engine. By doing so, it exploits the advances in query optimization, indexing, data partitioning and other technologies in relational databases. Note that the Oracle BI Server can perform a superset of the data manipulation and calculation capabilities of SQL compatible database products. This ability to customize the query language to the platform and to compensate for missing functionality is unique to the Oracle BI Server.

Oracle BI natively (or via ODBC) supports virtually all major relational and multidimensional data sources but has unparalleled optimizations for the industry leading Oracle Database and Oracle Exadata Database machine. Oracle BI's Oracle Call Interface (OCI) integration, query gateway, extensive use of Oracle SQL grammar and integration with other defining features like Oracle Virtual Private Database, Oracle Spatial and Locator, Oracle OLAP Option and Oracle Data Mining make Oracle BI the industry's standard for Oracle Database. No 3rd party BI vendor has the capability or knowledge to integrate better with Oracle Database than Oracle BI.

Connection Pooling

The Oracle BI Server can be configured with one or multiple connection pools for each database. The administrator can specify a maximum number of database connections to keep open until they are unused for a specified period. As the query load increases, the number of open connections increases in the connection pool. When the maximum number is reached, the server will queue new connection requests. This prevents database servers from being overloaded. With more than one connection pool configured per database, specific users or groups of users can be assigned to specific connection pools. This allows an administrator to give certain groups higher priority.

Query Reuse and Caching

When multiple users access the Oracle BI Server, many queries will have similar content allowing the Oracle BI Server to intelligently re-use previous query results, a capability called "query caching". These are the caching methods available:

- *Web Server:* Oracle Analytics' Web Server caches queries and query results. When a user submits a query, the web server examines the logical SQL to see if it matches an existing cached query. If it does, then the Web Server uses the results without re-submitting logical SQL to the Oracle BI Server. As a user generates new data views, manipulates a pivot table, or returns to a recently viewed dashboard page, the Web Server uses cached results. The user can explicitly "refresh" the query if needed.

- *Oracle BI Server:* Query caching is a highly differentiating feature that also occurs inside the Oracle BI Server. The Oracle BI Server saves each component of a logical query, the text of the logical SQL component, the time and date of the query, the list of physical tables used in the SQL (or other query language), and the results of the query. The Oracle BI Server will analyze each new query it receives and determine whether it can answer it using cache. Oracle BI Server will refresh reports leveraging a mix of on the fly data source queries and cache, when available, to provide the fasted possible end user query experience.

- *Database Server:* The Oracle BI Server also allows queries that require extensive database processing to be pre-scheduled to run so that results are already available when users open their dashboards.

A frequently experienced benefit of caching is improved dimensional browsing performance. Since it has been estimated that 80% of user queries to a data warehouse are pure dimensional browses, this results in a significant reduction in database activity and improves the responsiveness of the system.

Scalability and Availability

The Oracle BI Server supports clustering for high availability and scalability. The clients themselves may be active-active clustered, as in the case of the Oracle BI Presentation Services, BI Publisher or Delivers.

The BI Server cache is cluster-aware in order to maximize the performance benefit of cache seeding. Also, on-line metadata changes can be made against the BI Server designated as the Master, and then automatically synchronized with the other BI Servers in the configuration to maintain information reliability. Oracle BI publishes benchmarks on industry leading hardware and operating systems demonstrating linear scalability for 10s of thousands of concurrent users.

Accessing Oracle BI Server Information

Oracle BI Server presents itself to other applications as ODBC or JDBC data source or also as web services. This means that virtually any ODBC or JDBC-capable report writer or web service enabled query tool can use the Oracle BI Server as if it were a relational database. When it does, the

query/reporting tool: (i) does not need connectivity to underlying data sources; (ii) is completely insulated from changes in source tables and database platforms; (iii) benefits from BI Server caching, aggregate awareness, and other performance accelerators; (iv) automatically takes advantage of the built-in security and connection pooling of the Oracle BI server, and (v) can use all the tables and columns of the Presentation Layer subject area of the Common Enterprise Information Model as if they were stored in a single simple database schema. This enables reporting tools to leverage all the derived measures contained in the logical data model the same as any other column. Users of these tools are insulated against returning erroneous results as a result of incorrect table joins or missing data – SQL traps sometimes known as chasm traps, fan traps, or missing data traps.

Multiple Layers of Security

Oracle BI Server enforces multiple layers of security across objects and data: Data access at row-level (implemented either in the repository or in the database), object permissions and query limits (governors). Oracle BI Server will leverage session or user level variable to dynamically apply security rules to each incoming query. This enables fully personalized environment and secured data access for each end user.

Physical Data Storage Independence

The Oracle BI Server and its Common Enterprise Information Model eliminates the need for business users to understand physical data storage and enables them to combine data from multiple enterprise information sources quickly and easily. Some of the key features of Oracle BI Server in this area are:

- *Combining Structured Data from Multiple Sources:* Oracle BI Server allows users to combine data from multiple applications or databases in a single calculation. For instance, to compare sales forecasts, quotas, and actual revenue to accurately predict revenue growth, a business user may need to combine data from three sources – the forecasting system, the sales system, and the general ledger. Within the Common Enterprise Information Model and Oracle BI the three sources appear as one logical source to the business user.

- *Combining Relational and OLAP Data Sources:* Oracle's Common Enterprise Information Model allows users to combine data from a relational system and an OLAP source in a single calculation. For example, a user can compare sales forecasts from an Oracle CRM System with budget data from an Oracle Essbase planning application. To clients of the Common Enterprise Information Model, the forecast and budget data appear to be from the same logical source.

- *Combining multiple Relational databases, in memory databases, or Relational and OLAP, for Aggregate Navigation:* Pre-building measure aggregations during the load window is the most important data warehousing practice for achieving good query performance on large datasets, usually producing three or more orders of magnitude improvement overall. The Oracle BI Server has sophisticated "aggregate navigation" features to take advantage of all available aggregates transparently - users see the performance improvement without being aware of the extra tables. The BI Server uniquely allows the aggregate tables to exist in a different database than the detail tables, or for the aggregates to use a multidimensional source such as Essbase for lower TCO.

- *Combining Relational and Spreadsheet Data Sources:* Oracle BI allows users to combine data from relational databases with non-relational data from Excel spreadsheets, for example, in a single calculation to compute a complex metric.

- *Combining Transactional Data with Data Warehouse Information:* Finally, the Common Enterprise Information Model allows users to combine data from a data warehouse with information from transaction processing systems in a single calculation to get the most up-to-date value of a metric.

Unlike the Common Enterprise Information Model, many business intelligence tools restrict users by allowing access to only information from a single data source for a specific calculation or analysis. In addition, some of these tools even restrict a user's access to a single data source during an entire session. The Common Enterprise Information Model uniquely enables pervasive access to information to answer a business question that may require data from one or more sources.

Complex Business Measures

Oracle BI's Common Enterprise Information Model allows users to define complex business measures — such as market share changes versus a year ago or sales percentage changes versus a year ago — in calculations. Some of the key features of Oracle BI business measures are:

- *Complex Business Measures:* are a challenge to compute in SQL or in most commonly used reporting products because they either: (i) involve "row to row" comparisons, something SQL was not designed to do, or (ii) involve queries that combine multiple levels of aggregation. The Oracle BI Server allows complex business measures to be calculated at query execution time without having to pre-calculate and store data.

- *Eliminates Time-based Reporting Tables:* The Oracle BI Server eliminates the need to create and store complex time-based reporting tables. For instance, most organizations have tables structured with N*M columns representing the last N periods of data for M measures plus N*M more showing the variance from last year and so on. Oracle BI Server makes these measures available by simply defining them in Common Enterprise Information Model metadata, thereby eliminating the need to build and physically maintain such tables.

- *Derived Measures:* Oracle BI Server simplifies the use of derived measures, i.e. measures that are computed on a query result set, such as ranks, Ntiles, standard deviations, running totals, moving averages, and moving medians. These derived measures are difficult to compute in SQL but are very useful — moving average and moving median are valuable functions for smoothing data and discerning trends. Oracle's Common Enterprise Information Model allows users to define new formulas using existing measures.

Integrated Segmentation Engine

Oracle BI Server includes a flexible segment and list designer engine that leverage the Common Enterprise Information Model to build highly targeted and sophisticated lists or segments, Oracle BI Server optimizes the complex SQL generation and dynamically persists relevant information. The result is an optimal query design for retrieving of lists, samplings and record counts of complex filtering operation made on extremely large datasets.

Oracle Business Intelligence Administration

The BI administration tool is used by administration-role users to create, manage and maintain the Common Enterprise Information Model described above. The administration tool has been designed with wizards, utilities, and interface design elements to help the administrator work efficiently with real-world, large-scale enterprise metadata.

- *Calculation Wizard:* helps administrators write formulas (e.g. percent share) and assures their correctness

- *Metadata Import Wizard:* connects to each type of data source and populates the physical catalog metadata for that source. In the case of multidimensional sources such as Essbase and Hyperion Financial Management, even business model semantics such as dimensions, hierarchies and aggregations are imported and populated.

- *Open BI Server XML Metadata API:* Oracle BI provides an XML based API for Common Enterprise Information Model metadata exchange. This API enables conversion of the entire OBIEE 11g repository to XML and back. This open API enables extraction, reuse and manipulation (add/update/delete) of OBIEE 11g metadata.

- *Aggregate Persistence Wizard:* enables the administrator to use the Common Enterprise Information Model metadata to design and automate the deployment and loading of aggregate tables, and to automatically create their mappings in the metadata. This significantly lowers the TCO of the very important performance technique of pre-aggregation.

- *Global Change Utilities:* A rename wizard makes it easy to change the tech-oriented names of multiple physical data objects to more human-friendly names at once, substituting text, changing case, and adding prefixes or suffixes. Similarly, the administrator can set the aggregation rule for dozens of measures all at once, rather than one column at a time.

- *Dependency and Impact Analysis within the Common Enterprise Information Model:* A query utility allows the administrator to find metadata objects by type, while filtering on properties and relationships to other objects. For example, an administrator could find all logical columns that are dependent on specific physical table or column to determine which subject area columns will be affected if a certain physical column is deleted in the database.

- *Dictionary:* The administration tool provides facilities to export Common Enterprise Information Model metadata, such as formulas and human-readable object description fields, to create dictionary functionality for end users. Answers users will see dictionary information in roll-overs of catalog objects, with links to the HTML dictionary page associated with the object. Links on that page lead to definitions of other objects it is derived from.

- *Session Management:* The administration tool offers a way to view (and terminate) current user sessions; see the variables being used in each session; list the available cache entries by subject area, user, or physical table; and report on the recent history of cache usage. Usage logs written by the Oracle BI Server(s) can provide a basis for understanding usage patterns, response times, and load variations. This information is useful for diagnosing and tuning systems. Security rules enforced in the source databases can be used together with security rules enforced in Oracle BI.
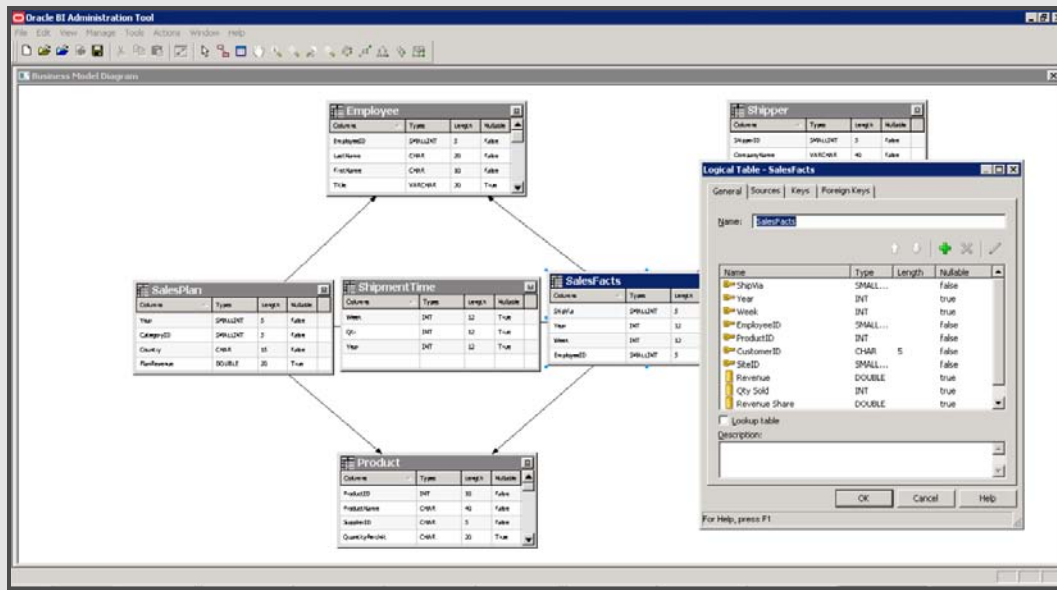
Figure 3 - BI Administration Tool

Multi-User Development Environment

Two distinctive features of the Common Enterprise Information Model are its enterprise scalability, and its support for portable BI applications. The Administrator environment provides the ability to develop and manage applications of this scale and portability.

- *Three-way Merge:* One reason why the Oracle BI Server is the only BI platform with a successful set of BI applications is its powerful three-way merge. This enables customers to update a configured application to the next release without losing their changes. The rule-based algorithm automatically resolves conflicts when possible, and presents the developer with a simple decision list to resolve the remainder.

- *Branching:* As in code development, organizations can use branches to manage parallel projects on different schedules. Project check-out ensures each branch or sub-branch is self-consistent and unit-testable. A streamlined form of three-way merge is used to check branches back in so they can be integration-tested with other projects and migrated to production.

- *Development Sandboxes:* Individual developers can check out smaller projects to do their development and unit testing on their own, private BI stack.

- *BI Server XML API:* The Common Enterprise Information Model has an XML schema and utilities to enable export, import and altering of individual objects.

- *Patch Creation and Application:* Developers can create XML patches to incrementally migrate content from one model to another.

- *Bug Fixing:* When a production bug must be fixed without impacting large projects under development for the future, the developer can either use an XML patch to apply a few

individual object changes, or check out a new branch from production to make bigger changes.

- *Migration:* Enterprise Manager migrates new repository versions from development to production, and enables a zero-downtime rolling restart. The XML API provides the ability to automate any parameter changes required.

ORACLE ESSBASE

Oracle Essbase is the market-leading multi-dimensional OLAP server that enables the development of advanced forward-looking analytic applications that enable speed-of-thought analytics. By leveraging its self-managed, rapid application development capabilities, business users can quickly model complex business scenarios. For example, line-of-business personnel can simply and rapidly develop and manage analytic applications that can forecast likely business performance levels and deliver "what-if" analyses for varying conditions. Oracle Essbase supports extremely fast query response times for vast numbers of users, large data sets, and complex business models.

Component Overview and Deployment Architecture

Essbase incorporates powerful architectural features to handle a wide range of analytic applications across large multiuser environments. The following illustration provides a high-level view of the information flow between the three tiers of the Essbase architecture. The client tier (on the left) includes Essbase Server clients, such as the Oracle BI Server, Oracle Hyperion Smart View for Office, and administration interfaces. The middle tier (in the center) includes services, such as Oracle Hyperion Provider Services, Oracle Essbase Administration Services, and Oracle Essbase Studio Services. The database tier (on the right) is made up of the Essbase Agent and Essbase Database. Communication between the client and middle tiers, and the middle and database tiers, is through HTTP. Communication between the client and database tiers is through TCP/IP or HTTP. Clients access is through an open API interface that includes support for the MDX language. Communication between data sources and the metadata catalog with the middle and database tiers is through ODBC and JDBC drivers.
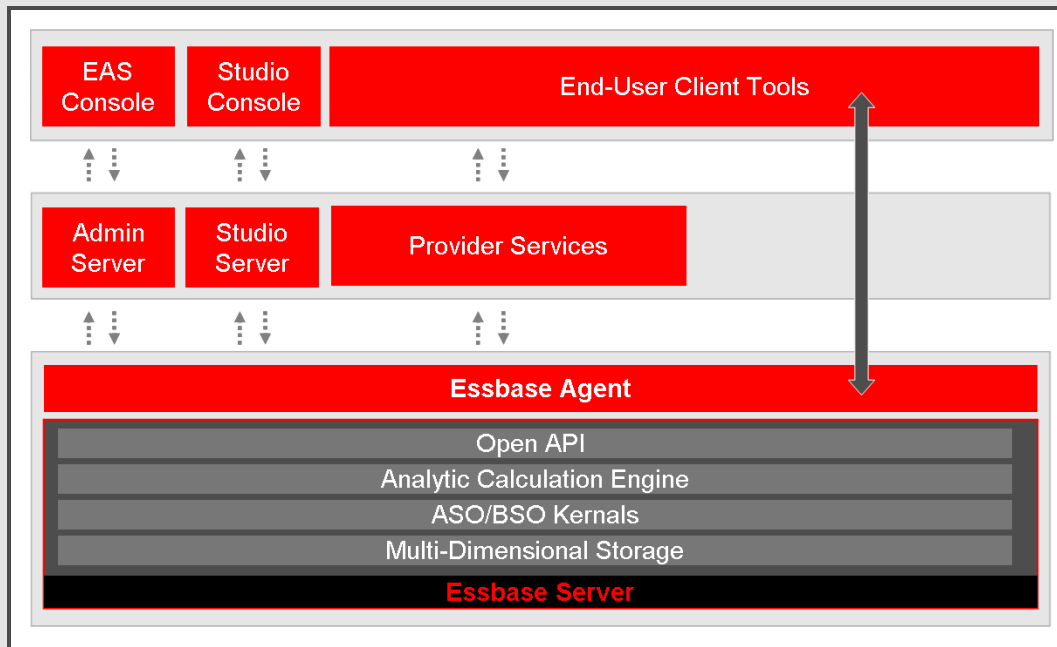
Figure 4 - Essbase Functional Architecture

All Essbase application components, including database outlines and calculation scripts, application control, and multidimensional database information, reside on a server. With Essbase, you can configure server disk storage to span multiple disk drives, enabling you to store large databases. Essbase requires a server to run a multi-threaded operating system so a server can efficiently manage simultaneous requests. A server also runs a server agent process that acts as a traffic coordinator for all user requests to applications managing communications and security. The Essbase Server leverages Oracle Process Management and Notification Server (OPMN) to manage starting and stopping agent processes. OPMN also enables Essbase high-availability services.

Optimized Multi-dimensional Storage

The Essbase server provides advanced multi-user read and write capabilities, including data update and multi-user recalculation. Business users with front-end tools can write data back to a server and recalculate the data on a server using calculation scripts—key functionality to support sophisticated modeling and planning applications.

The Essbase database is a multi-threaded OLAP database that takes advantage of symmetric multiprocessing hardware platforms. The server acts as a shared resource, handling all data storage, caching, calculations, and data security. The Essbase Server client needs only to retrieve and view data that resides on a server.

The Essbase database provides multiple storage options with unique and complementary capabilities:

- Block storage option (BSO) arranges dimensional members into dense and sparse dimensions and stores data in dense hyper cubes that are indexed by sparse dimension members. BSO is optimized for write-back and procedural calculation operations.

- Aggregate storage option (ASO) is designed to handle high-dimensionality sparse data sets and supports rapid aggregation of the data. ASO can calculate aggregate values dynamically or as needed administrators can materialize aggregate views for frequently accessed dimensional levels.

- In addition to ASO and BSO, Essbase also provides a hybrid storage model called XOLAP. With XOLAP metadata is stored in an ASO outline and the data itself resides in relational. The benefit of XOLAP is reduced data redundancy. The trade-offs include some feature limitations, including lack of write-back capabilities and performance is dependent on RDBMS abilities.

ASO databases complements BSO databases and enable dramatic increases in database dimensionality. Using aggregate storage, Essbase serves a wide range of analytic needs—financial analysis, planning, budgeting, sales analysis, marketing analysis, supply-chain analysis, and profitability analytics—all from a single analytic infrastructure. Essbase partitioning capabilities allow ASO databases to be combined with BSO databases to create a single application view allowing end-users to take advantage of the benefits of both storage models.

Essbase provides for several compression options that optimize the use of physical storage including, bitmap compression, run length encoding (REL), zlib compression, and Index Value pair compression.

Performance, Scalability and Availability

Essbase is a true enterprise-class multi-dimensional OLAP server offering unparalleled user and data scalability on a high performance infrastructure. Essbase applications have been successfully deployed in departmental BI solutions and have also demonstrated scalability to tens of thousands of users and billion cell databases. Essbase supports both 32- and 64-bit computing across both Windows and Unix operating environments. Essbase includes a number of features that support high availability and scalability.

Efficient Cache-Architecture

Essbase offers a number of memory caches to improve performance for query, load, and calculation operations. Essbase provides default size settings for each cache; however cache settings can be adjusted as necessary to optimize performance needs based upon available memory, database size, service level commitments, and batch windows.

High-Availability Options

Essbase provides both active-passive and active-active clustering capabilities. Active-passive Essbase clusters support failover with write-back to databases. Essbase failover clusters use the service failover functionality of the Oracle Process Manager and Notification (OPMN) server. A single Essbase installation is run in an active-passive deployment, and one host runs the Essbase agent and two servers. OPMN stops, starts, and monitors the agent process. Active-active Essbase clusters support high availability and load balancing. An active-active Essbase cluster supports read-only operations on the databases and requires the use of Provider Services.

Trickle-Feeds

Essbase offers a number of techniques to load incremental data into databases while minimizing maintenance windows. Database slices in ASO allow data to be trickle-fed into a database while online. With database slices, data can be stored in multiple slices. For example, a real-time slice can be loaded without impacting the historic slices, allowing users to remain active in the database and immediately see data as it is updated. In addition, by loading into a specific slice of data, incremental loads performance is optimized.

Flexible Business Model Development

Essbase offers many key advantages to help business users develop effective multidimensional applications. Business analysts can quickly develop forward-looking applications and quickly model complex business scenarios. For example, line-of-business personnel can simply and rapidly develop and manage analytic applications that can forecast likely business performance levels and deliver "what-if" analyses for varying conditions.

The basis of an Essbase analytic application is a business outline which defines the dimensions, dimension members, hierarchical relationships, member attributes, calculations, and business rules for an application.
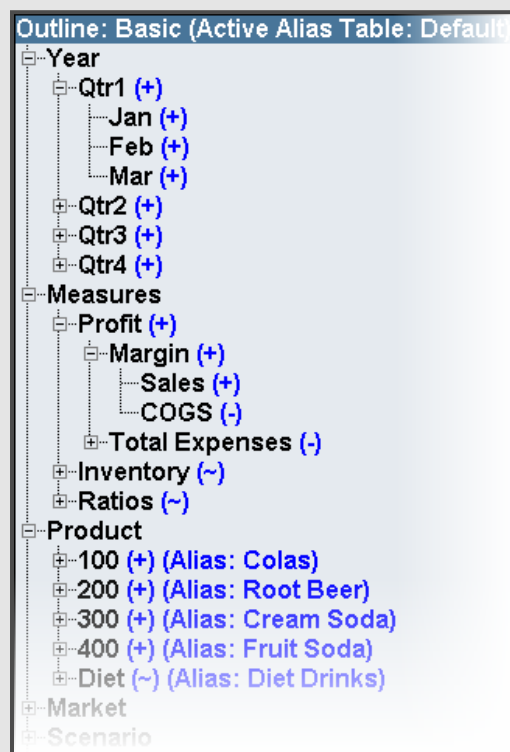

Figure 5 - Essbase Outline

Using out-of-the box tools that are delivered with Essbase, business users can:

- Use graphical interfaces to define and manage a business outline

- Quickly add dimensions, change calculations, and modify hierarchies to reflect new business developments. In addition, the business rules interface automatically defines and dynamically loads large amounts of data, including data from spreadsheets, flat files, and supported relational database tables directly into a database.

- Define key calculations without having to write a program.

- Define data security rules for individuals and groups and customize views and retrieval procedures for each user without writing a program.

Multi-Dimensional Calculation Engine

Essbase includes powerful calculation features for demanding analytic requirements.

Essbase ASO supports MDX member formulas. MDX is a specialized language for querying and manipulating data stored in the multi-dimensional OLAP servers. MDX is a feature-rich language supporting capabilities ranging from member selection to advanced multi-dimensional calculations.

Essbase BSO includes a rich library to define advanced and sophisticated procedural business logic and relationships. The Essbase calculation engine supports straightforward aggregations to complex cross-dimensional allocations and includes built-in financial and time series intelligence. The Essbase calculator delivers premium performance and breadth of functionality. The Essbase calculation language features:

- Conditional and Logical Operators

- Boolean Functions

- Relationship Functions

- Calculation Operators

- Mathematical Functions

- Member Set Functions

- Range and Financial Functions

- Allocation Functions

- Forecasting Functions

- Statistical Functions

- Date & Time Function

Essbase gives users the flexibility to build, customize, and extend the calculator through custom-defined macros and functions, as well as the ability to span calculations across databases. On multiprocessor systems, an administrator can configure a single calculation request to use multiple threads to accomplish the calculation, providing enhanced calculation speed.

Several methods are employed to calculate an Essbase database:

- *Outline Calculation:* The Essbase outline is metadata that describes the hierarchical relationships between dimensional members. Calculations can be determined by outline relationships. For example, assuming a member "Operating Income" with children "Gross Revenue" and "Operating Costs". The Essbase outline can specify a metadata

relationship where "Operating Income" is the result of subtracting "Operating Costs" from "Gross Revenue". Outline members may also be defined as formulas, for example a member "%Variance" may be defined using a calculation function with inputs of "Actual" and "Budget".

- *Member Formula:* A member in an Essbase outline may have an associated formula. The result of the formula may be stored or may be dynamic, i.e. executed upon end-user retrieval.

- *Calculation Script Calculation:* A calculation script can be used to define procedure that leverages the rich Essbase calculation language for simple to complex operations that can be executed on a dynamic or batch basis. For example, a financial analyst may create a calculation script that projects a forecast to aggregated members using a regression model and then allocate that forecast to lower level members.

Essbase Application Administration

Essbase offers two interfaces for application construction and management. Essbase Studio is the primary interface for developing new Essbase applications and refreshing existing applications. Essbase Administration Services is the primary interface for managing and maintaining the Essbase application environment.

Features of Essbase Studio

Essbase Studio simplifies cube construction by delivering a single environment for performing tasks related to data modeling, cube designing, and analytic application construction. With a wizard-driven user interface, Essbase Studio supports modeling of the various data source types from which Essbase applications are typically built.

The two core components of Essbase Studio include the Studio console which is the graphical interface used to model and build Essbase applications and the Studio Catalog, a common metadata repository that captures all metadata related to Essbase applications built in the enterprise and allows the reuse of metadata at the lowest level of granularity. The catalog gives Essbase Studio knowledge of the common metadata that is shared across the various applications enterprise-wide.
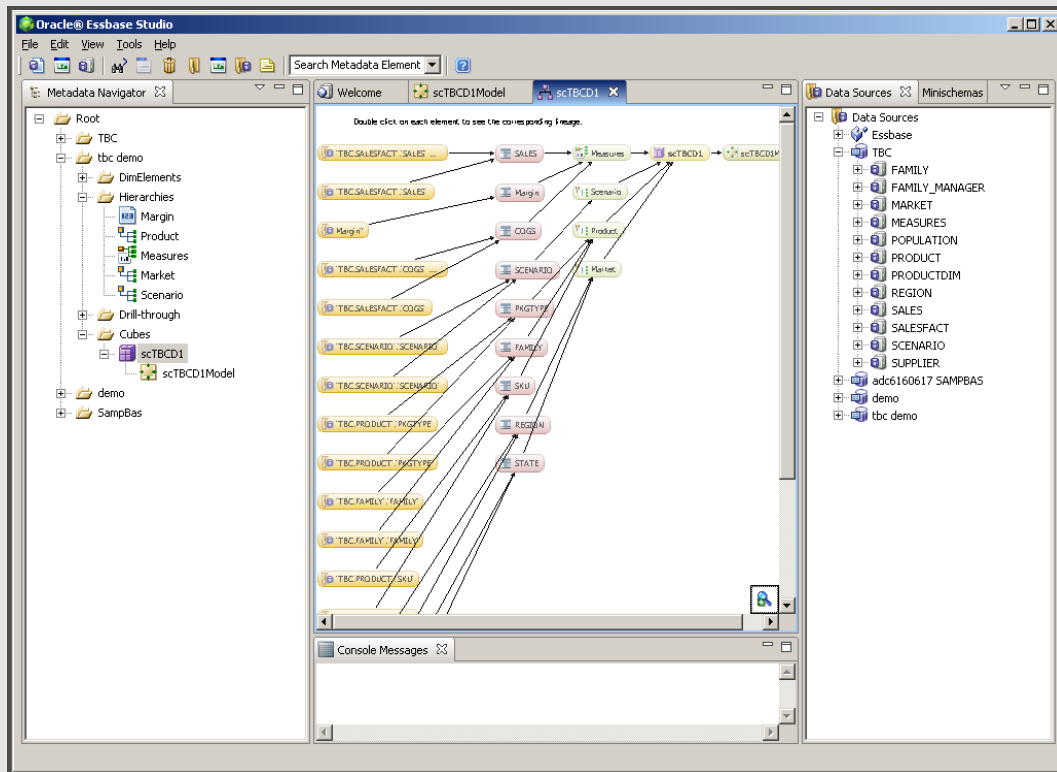
Figure 6 - Essbase Studio Console

The Essbase Studio Console interface consists of three main work areas:

- *Source Navigator:* The Source Navigator consists of two tabs: (1) The Data Sources tab is used to view, create, and manage data connections to physical sources for Essbase applications. (2) The Minischemas tab is a graphical representation of the tables and relationships from one or more data connections.

- *Work Area:* The Work Area, by default in the middle pane of the Essbase Studio Console, is used to display and work with metadata elements and graphical representations of source and metadata elements.

- *Metadata Navigator:* The Metadata Navigator, displayed by default in the left pane of the Essbase Studio Console, contains the metadata elements derived from the physical data sources when you create a data source connection. Metadata elements are used to create cube schemas and models that work with Essbase. Essbase models are used to create and deploy Essbase cubes.

Essbase Studio supports several drill-through options: relational databases, Oracle BI Server, URLs, custom SQL, and Java methods. Drill-through functionality is supported from data cells and member cells and is dynamically linked to cubes with matching metadata context.

Essbase Studio also supports lineage tracking through a rich graphical view of the metadata relationships, allowing users to follow application lineages to their metadata components and through to the data sources from which they were sourced.

Features of EAS

Essbase Administration Services (EAS) is the cross-platform administration tool for Essbase. EAS consists of a Java middle-tier server (Administration Server) and a client console (Administration Services Console) which can be launched either as a Java application or from a browser.

The Administration Services Console makes Essbase administration tasks easy to perform. The console provides wizards, editors, dynamic menus, and other tools to help you implement, monitor, and maintain Essbase.

The EAS console provides capabilities that include:

- Manage Outlines and formulas
- Load data and build dimensions
- Monitor Essbase applications
- Manage caches
- Create and execute calculation scripts
- Create and execute administrative scripts
- Create and execute MDX scripts
- Create and manage partitions

ORACLE BI SERVER AND ESSBASE INTEGRATION

The BI Server and Essbase provide powerful semantic integration, specifically:

- Essbase as a provider to the Common Enterprise Information model - Essbase's rich metadata model and powerful calculations can be integrated into the Common Enterprise model allowing for (1) Federation with other data sources and (2) End-user interaction using the MOLAP capabilities of BI Presentation Services. OBIEE 11g offers a complete understanding of Essbase semantics.

- The Oracle BI Administration experience is as simple as importing the Essbase outline semantics and drag-drop actions to create the Business Model and Presentation layers. Within minutes, OBIEE 11g users can access information from Essbase. In addition, as necessitated by changes in the Essbase outline, incremental update is available.

- Essbase as a consumer of the Common Enterprise Information model - Essbase Studio can leverage the Common Enterprise Information model to build Essbase applications. Essbase Studio can read the Oracle BI Server XML metadata schema to build business outlines and load data from Oracle BI Server supported sources. This provides a further ability to promote a single version of the truth within the enterprise.

ORACLE ESSBASE ANALYTICS LINK FOR ORACLE HFM

Oracle Essbase Analytics Link for Hyperion Financial Management enables the delivery of effective management and financial analytic reporting to a broad user community. It integrates and merges multiple operational data sources into a single data model, providing detailed information for analytical measurements (KPIs) and the application of advanced analytics. Merging financial and operational information in a single platform makes it easy to deliver a comprehensive management reporting environment.
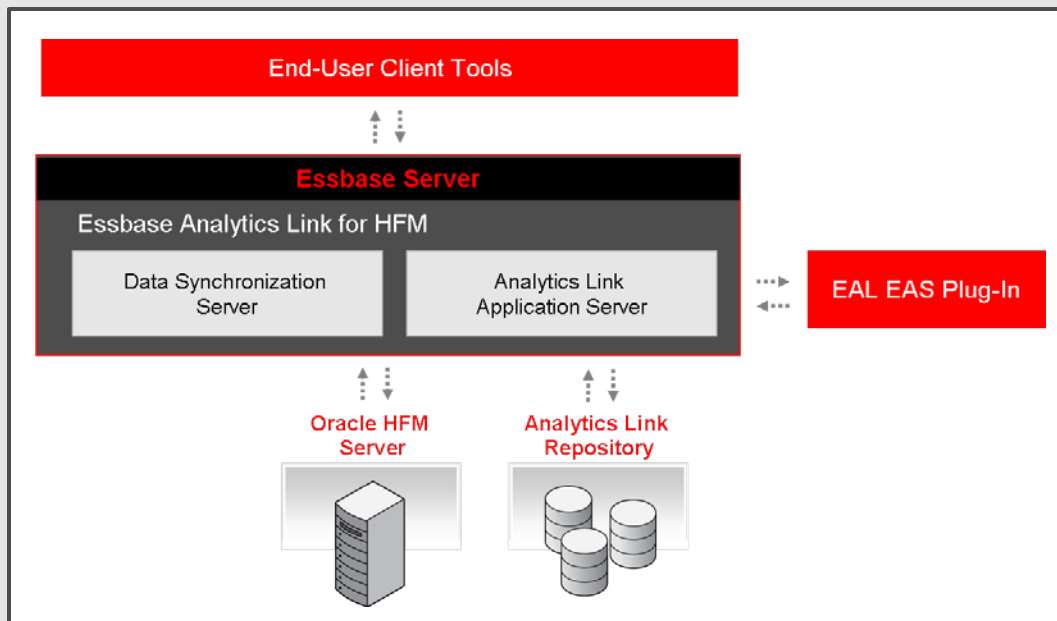
Figure 7 - Essbase Analytics Link Functional Architecture

Oracle Essbase Analytics Link for Hyperion Financial Management facilitates the seamless integration of Oracle Hyperion Financial Management with Oracle Essbase. It delivers real-time or on-demand financial information from Oracle Hyperion Financial Management to Oracle Essbase. The result is a single reporting solution that incorporates Oracle Hyperion Financial Management information within a market leading OLAP solution enabling users to customize the financial dimensionality, merge additional data sources and create advanced analytic KPIs and by doing so help provide more detailed analysis of the reported GAAP results.

Oracle EAL Architecture Overview

Oracle EAL consists of these software components:

- *Analytics Link Application Server:* Manages the metadata extraction from Financial Management, initializes the creation of the Analytics Link application, creates the Essbase outline, and provides Web services for Analytics Link Administration Services Console Plug-in.

- *Analytics Link Repository:* Stores the metadata that is extracted from Financial Management, which is used to create the Analytics Link application and the Essbase database and ensures consistency between Financial Management and Essbase.

- *Analytics Link Data Synchronization Server:* Creates the Analytics Link application (which is the replication of the Financial Management application), performs data aggregation on demand, synchronizes Data Synchronization Server data with Financial Management, and serves queries coming from Essbase.

- *Analytics Link Administration Services Console Plug-in:* Provides the user interface to manage Analytics Link Servers nodes and Analytics Link bridges. All administration activities are based on Web Services.

- *Analytics Link Financial Management Connector:* Enables Analytics Link Application Server to access Financial Management data.

Benefits of EAL

- Delivers continuous operations for Financial Management by eliminating previously required downtime.

- Reduces IT costs by eliminating high implementation costs and the deployment of additional servers.

- Improves efficiencies through improved performance and scalability of real-time data synchronization.

- Reduces risk by ensuring data integrity and reliability between source and target systems.

- Improves business insight through real-time Business Intelligence reporting based on current financial information.

- Reduces barriers to sharing data by offering standard Business Intelligence access to application-proprietary data.

FOUNDATION SUITE END-USER CAPABILITES

The Oracle BI Foundation Suite provides a fully integrated suite of complementary product components to deliver the complete range of analysis functionality and styles. Described below are the technical underpinnings of these capabilities as well as detailed information on specific end-user product capabilities supporting dashboarding, ad hoc analysis, search, enterprise reporting and strategy management and scorecarding.

ORACLE BI PRESENTATION SERVICES

Oracle BI Presentation Services generates the user interface such as dashboards and analyses which are used to visualize data from the Oracle BI Server. This server interacts with the Oracle BI server as an ODBC client and: (i) generates the dashboards, analysis and reporting user interface; (ii) responds to user selections, generates logical SQL for the Oracle BI Server, and caches logical SQL statements and their results; (iii) records the specifications the user makes about how data should be presented and interacts with the charting engine to create graphs; (iv) pivots and aggregates data after the Oracle BI Server generates the result set and (v) provides user and group security for all of the Dashboards and Dashboard objects (reports).

When a user session begins, Oracle BI Presentation Services submits the user's identity (either username/password or some other token) to the Oracle BI Server; authenticates the user; and then

requests the Oracle BI Server to provide the "databases", "tables", and "columns" that the user is entitled to use. These objects are displayed in the user interface as subject areas, folders, and columns. A Subject Area is a logical business-based grouping of pre-defined columns. The Oracle BI Server also provides metadata information to Presentation Services about column properties such as data types, aggregation rules, and whether or not the user can drill on the column – each of these elements also affect how data is displayed in the user interface. Naturally data security is enforced also.

Features of Oracle BI Presentation Services

Oracle BI Presentation Services provides a rich interactive user experience within a 100% pure Web environment based on HTML, DHTML, and JavaScript only — no client downloads, plug-ins, Active-X controls, or applets are used. This intuitive browser-based environment allows business users with very little training to define new analyses and create new queries. Some of the additional important features of Oracle BI Presentation Services include:

- *Logical SQL Generation:* Oracle BI Presentation Services allows users to visually define queries by presenting a graphical representation of the query as the user selects and manipulates columns and adds filters (constraints) to the query. The Oracle BI interface also allows users to enter logical SQL directly – the results can then be formatted and displayed within the Oracle BI interface. Once the user submits the query, Oracle BI Presentation Services sends logical SQL to the Oracle BI Server. As mentioned above, it is at this point that highly-complex requests to respective data sources for reports like those blending relational and multidimensional queries are generated. Years of research and testing have gone into optimizing these unique queries.

- *User Interface Personalization:* Oracle BI users can personalize the structure of their user interface including defining views, layout specification, properties of individual graphs, tables, and pivot tables. Oracle BI Presentation Services stores these personalization definitions in a metadata catalog called the Presentation Catalog as an XML Schema that includes metadata about the user interface and security information such as users, groups, and roles.

- *Web Catalog and security Administration:* Oracle BI Presentation Services provides a pure browser-based administration tool to administer all functions in the Web Catalog. Oracle BI Presentation Services complement Oracle BI Server security with extensive set of controls, configuring privileges to access functionality in the Oracle Business Intelligence user interface. Administrators can control which users access what dashboards; set user privileges; create and manage groups and roles; change group membership lists; re-name or delete catalog folders and saved analyses, and view and manage sessions.

- *Performance, Availability and Scalability:* Oracle BI Presentation Services can be clustered and also allows web servers to be clustered for scalability and availability. If web server processing capacity becomes a bottleneck to system performance, an administrator can configure and leverage multiple Oracle BI Presentation Services and HTTP servers (Please see the "Oracle BI Systems Management" section). A variety of load balancing facilities are supported to distribute user sessions and maintain session affinity with the HTTP server.

Described above are the core features of Oracle BI Server and Oracle BI Presentation Services. The next sections of this document will explore functional sub-components of these servers like dashboards, reporting and analysis capabilities in more detail.

HOMEPAGE

While Interactive Dashboards are ideal for the consumption of pre-created BI content, a unified BI Homepage provides a starting point for an open-ended approach to access saved content and create new BI content. From this launch page an intuitive, task-based interface leads the user to the appropriate builder interfaces. Helpful documents and links are presented for users ramping up on new skills.

Also shown are a listing of the most-recently accessed content and the most popular as well. Most popular content shines a light on what users are accessing most frequently and often indicates best-practices. A unified taskbar present at all times permits quick access to product capabilities as well as search and account settings.

UI-based integration is also supported by seamless product integration at the catalog level. All BI content resides in a common catalog enabling search, archiving, migration, unified dev-to-prod activities and the re-use of common objects across any number of personal and shared catalog items.

INTEGRATED BI SEARCH

Oracle BI Search is a powerful new searching capability that leverages Oracle's Secure Enterprise Search (SES) technology to allow end users to perform full text searches on items in the BI catalog. Dashboards, reports, scorecards, KPIs and actions are all fully searchable objects and can be retrieved by fields that include author, title, type, and popularity.

In Addition to searching metadata attributes, Users can also search for dimensional and report data.

A few simple examples of possible BI searches:

- Find all *reports* authored by *Jacques*

- Find *sales* related *KPIs* that are authored by *Susan*

- Find all dashboards that have *customer sales* data on them and specifically filtered on '*Acme Inc*'

- Find *Net Income* reports for *year 2010* and *Acme Inc*

BI ANALYSIS AND REPORTING

BI Analysis & Reporting provides end users with broad ad-hoc query, analysis and reporting capabilities. It is a pure Web-based environment that is designed for users who want to create new analyses from scratch or modify and change existing analyses that appear on dashboard pages. Users interact with a logical view of the information — completely sheltered from data structure complexity. Users can also easily create a range of interactive content types which can be saved, shared, modified, formatted, or embedded in the user's personalized dashboard or enterprise portal. Oracle BI Analysis & Reporting is designed to handle both relational and OLAP style (multidimensional) interactions in a single comprehensive, easy to use user interface.

<u>**Using BI Analysis and Reporting**</u>

An intuitive interface and the fact that business users work entirely within understandable models of information completely expressed in business terminology allows Oracle BI Analysis & Reporting to be learned quickly.

The BI Analysis & Reporting user begins by choosing a subject area — such as "Marketing", "Sales", or "Inventory." The user then sees within that Subject Area folders containing "semantic business objects" that define the business terms against which the user can define calculations or analysis. For instance, if a user chooses "Sales" as a topic, he or she may find items such as "Gross Revenue", "Net Revenue", "Net Revenue % Change vs. Last Year", or "Net Revenue Rank". A specific business term can be dragged and dropped to be included in an analysis. Selecting objects named "Region", "Revenue", and "Current Month" creates a calculation that could be stated as "Show me the revenue for each region during the current month."

As the user selects business terms or columns, BI Analysis & Reporting builds a query. This query is referred to as "logical SQL", since it expresses the logical content of the request. This logical query will be sent to the Oracle BI Server, which will interpret the logical query and create subsequent physical queries to the underlying data sources where the data is stored.

<u>**Features of BI Analysis and Reporting**</u>

- *Data Storage Independence:* BI Analysis & Reporting eliminates the need for users to understand physical data storage — which physical table stores revenue for the current month, for instance. Measures can be selected with a single click even if the information is stored in two separate physical databases. Oracle BI Analysis & Reporting also eliminates the need for users to understand how business rules are constructed, for example, how revenue is calculated.

- *Sharing Analysis Online:* After saving analyses, users can easily add these complex layouts to Interactive Dashboards using a drag and drop dashboard editor to share these publicly. Dashboards can be tweaked and modified without limit.

- *Saved Analysis:* Measures, descriptive attributes, filters, sorting patterns, sub-totals, graphs, and pivot table views can be added, deleted, or changed at any time. After a user makes all the changes, the new analysis can be saved and shared with a group of users.

- *Powerful Ad-Hoc Analysis:* Since the analytic process is often iterative — select measures, add filters, examine results, add new columns, change filters, delete columns, and so on — Oracle BI Analysis & Reporting does not impose a prescribed order in which calculations are defined such as measures first, then attributes, and then filters. The Ad-Hoc Analysis interface provides a controlled and intuitive way for end user to define custom additional calculations and aggregations, at report level. This allows a flexible organic growth of the overall business value and feeds semantic layer with agile enhancements.

- *Personalization:* Oracle BI Analysis & Reporting automatically filters and personalizes information by user based on the user's identity or role.
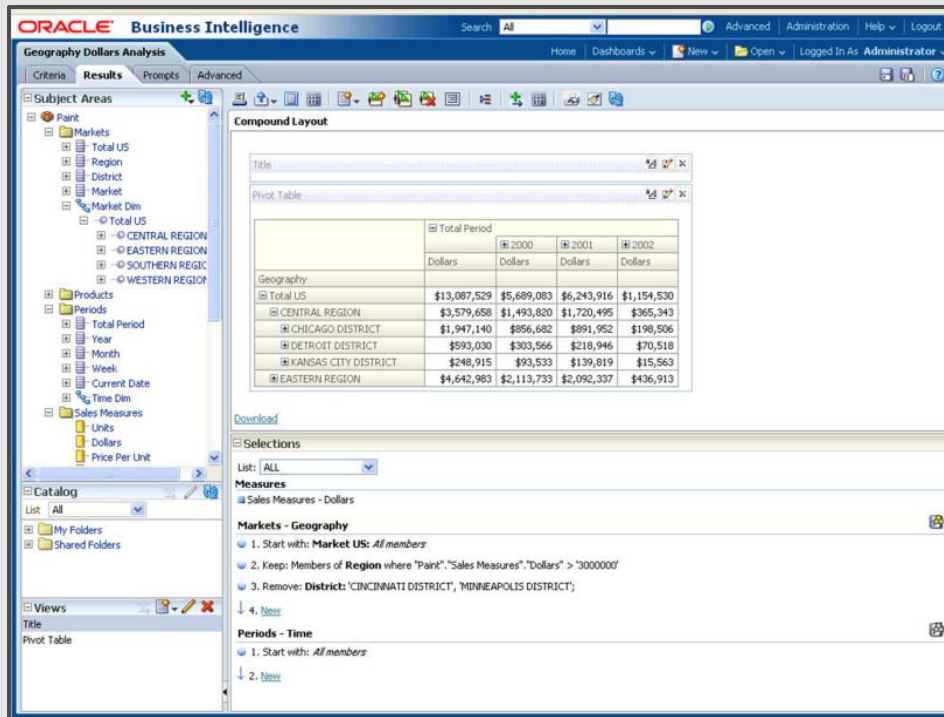
Figure 8 - BI Analysis and Reporting

Blended Relational and Multidimensional Analysis

BI Analysis & Reporting uniquely provides a seamless user interface for reporting & analysis against both relational and multidimensional/OLAP data sources. In many cases a complete view of the enterprise can only be obtained by looking across historic information stored in a relational datastore to insight around predictive or planning analyses stored multidimensionally in OLAP cubes. A classic example might be historic sales data blended with financial planning projections.

As mentioned above, the BI Server generates optimized, native queries for each data source and uses the concept of function shipping to squeeze the most performance out of each relational or multidimensional source. Queries are optimized for Essbase as well as a range of additional multidimensional sources

As end-users start to build a new query against that simplified logical business model, OLAP-style constructs like a presentation of hierarchal columns and intelligent navigation of data in ragged or skip-level hierarchies are utilized. Within the pivot table, end-users are can slice and dice data directly by sorting or dragging and dropping columns to generate an infinite number of pivoted or prompted layouts. The ability to either manually or dynamically add/keep/remove members within a selection, or generate unique custom groups or calculated items are also available.

Users can create and save any of these new objects in the catalog for their own reuse or securely share those extensions with their workgroups without IT intervention. These OLAP-style interactions are the end-user metaphors expected for use with multidimensional data and are optimally-suited for this analysis. Based on the BI Server's ability to generate the all-important logical business model, however, these styles of multidimensional interaction can also be used in analyses against non-OLAP source systems.

BI Visualizations

Clear and descriptive data visualization is essential for the interpretation of business data as well to identify trends or outliers in real-time and guide exploratory data analysis. Oracle BI simplifies the creation of these visualizations and provides powerful visualization facilities supporting these goals.

- *Charts and Graphs:* BI Analysis & Reporting allows dozens of out-of-the box graph views to be added to analysis and customized. Graph views are provided by integration with the Oracle Fusion Middleware Data Visualization Tools. ADF Data Visualization components are a set of rich, interactive JSF components that provide animation, interactivity and graphical and tabular capabilities for visualizing and analyzing data.

- *Interactive Pivot Table:* Drag and drop slicing and dicing. Please see above.

- *Geospatial Views:* BI Map Views can be inserted into any analysis and are presented as multiple BI data layers mapped to and displayed on top of spatial data. Map Views are generated by Oracle MapViewer – a Java application and map rendering feature of Oracle Application Server. Geospatial data resides in an Oracle Database with the Spatial or Locator option. A significant amount of base global geographic data is provided out-of-the-box based on a partnership with NAVTEQ, the leading global provider of digital map, traffic and location data that enables navigation and location-based platforms around the world.

- *Other Views:* Numerous additional widgets for interacting with analysis (e.g., view or column selectors) as well as other text-based views like ticker, narrative or filter views are also easily added to reports.

- *Scorecarding Views:* Please see the "Oracle Scorecard and Strategy Management" application below.

- *Dynamic formatting and interaction:* Both at the analysis level and at the larger, more complex Dashboard level, tools facilitating data analysis like conditional formatting, master-detail behaviors (where interaction with one view drives context to others) and auto-wiring of individual analyses to Dashboard-level prompts and widgets can be configured.
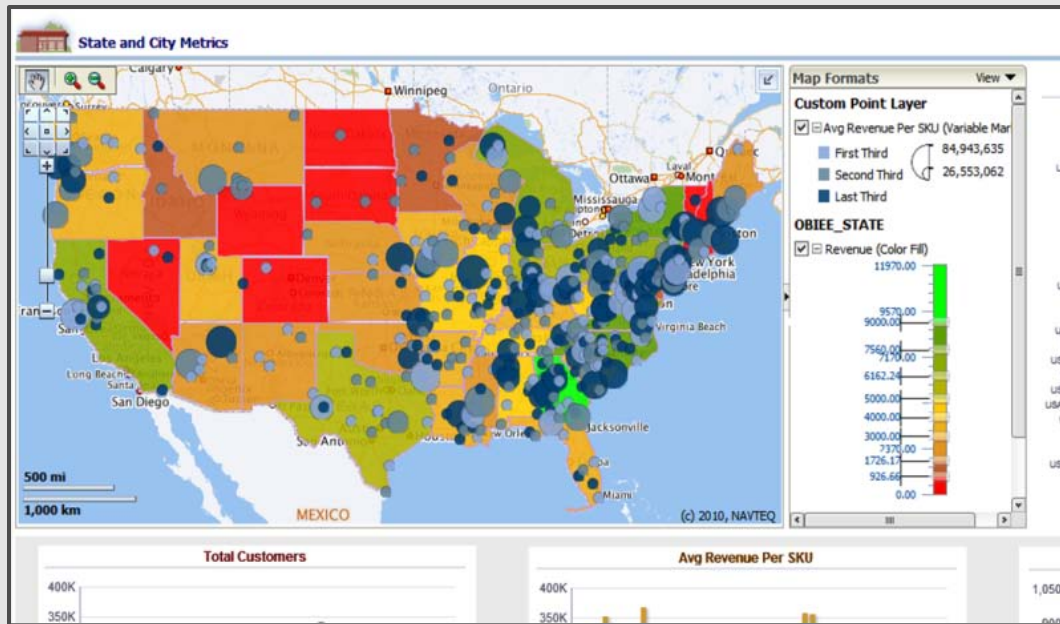
Figure 9 - BI Geospatial View

INTERACTIVE DASHBOARDS

Interactive Dashboards makes it easy for business users to access pre-created, consumer-based Business Intelligence information. BI Interactive Dashboards run within a pure Web architecture and provides users with a rich, interactive experience where information is filtered and personalized to a user's identity or role. This helps to make business information intuitive and easy to understand and guide users in their decision making. Much of the content on the Dashboards is created from within BI Analysis & Reporting. Users interact with dashboard objects like live reports, prompts, graphs, tables, pivot tables, geospatial views, sliders, graphics, tickers, and external content. Through the dashboard editor, users have the ability to quickly and easily drag and drop information from various sources to assemble personalized and shared dashboards.

Features of BI Interactive Dashboard

Some of the important features of Interactive Dashboard are:

- *Power of Analytics:* BI Interactive Dashboard provides a powerful interactive analytic environment for business users precluding the need for them to navigate to query and analysis mode to perform complex calculations.

- *Sharing Information Online:* BI Interactive Dashboards can be published as online work centers enabling groups of users to share information with each other.

- *Personalization:* BI Interactive Dashboards can be personalized to automatically display data based on the user's identity or role.

- *Data Filtering:* BI Interactive Dashboards can show analyses pre-filtered by data and data threshold values set by the user. Data-level security is always maintained as well.

- *Sharing Information Offline:* BI Interactive Dashboards can be saved and distributed for offline use as Briefing Books or Reports. Dashboard content and data can be downloaded to Excel or PowerPoint, or more direct data formats.

- *Saved Customizations:* Users can modify analyses, layouts, filters, etc. on BI Interactive Dashboards and save these modified dashboards for their personal or shared use. Snapshots of Dashboards can also be saved or shared as a handy URL link.

- *Custom Styles:* BI Interactive Dashboards utilize cascading style sheet standards. Corporate standards can be adopted and styles can also be driven by personal preference or user group membership.
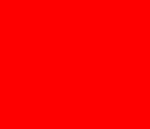
Using BI Interactive Dashboards

Business users build BI Interactive Dashboards without any involvement from an IT specialist and or programming. They create dashboard pages and select and organize content using a web-based dashboard editor. To add content to a page, a user simply drags and drops the analysis from a web catalog in the left panel. The web catalog lists all saved content – prompts, analyses, and dashboard pages.

Figure 10 - BI Interactive Dashboard

Users interact with dashboard content by selecting prompted values and filtering data; drilling on graphs or tables to access detail and related content; changing the sort order or sort direction of columns; maintaining context and moving to a different analysis by automatically passing constraints; or selecting columns to display. On the dashboard, users can also contextually invoke the Action Framework using Actions (see below).

BI Interactive Dashboards are flexible information containers which can embed a corporate "portal", web page or image on the Internet/intranet, a Word document, or Excel workbook, for example.

Interactive Dashboards are unique, however, in that content added will be auto-wired together to pass interactive dashboard state/parameters, exhibit master-detail behaviors and automatically pass context to business workflows leveraging the Action Framework. Table, Pivot Tables, Charts, Graphs and Geospatial Views all participate in this eventing framework. This capability allows sophisticated interactions on Dashboards to be defined without programming. For example:

- Any content listening for events from a slider widget can be immediately updated.

- Clicking on a state in a geospatial view can update tabular and graphical content contextually.

- Clicking on a cell in a pivot table could dynamically pass row-level parameters to a web-service waiting for those arguments to kick-off a related business process.

ORACLE SCORECARD AND STRATEGY MANAGEMENT

Oracle Scorecard and Strategy Management extends the Oracle BI suite with capabilities intended at communicating strategic goals across the organization and monitoring their progress over time. The Scorecard & Strategy Management will provide capabilities to establish specific goals, define how to measure their success, and communicate that information down the entire organization.

Armed with this insight, employees can understand *their* impact on achieving success and align their actions accordingly. As they use Scorecards to measure the outcome of their actions, they can quickly make adjustments as needed to successfully achieve the goals.

Oracle Scorecard and Strategy Management enables organizations to:

- Provide a framework that organizes strategic thinking and performance measurement.

- Clarify and build consensus on strategic direction.

- Communicate strategy and measures of success.

- Align behavior and increase focus on priority initiatives.

- Support strategic planning through metric relationship analysis and organizational learning.

Oracle Scorecard and Strategy Management provides the necessary tools to:

- Define organization's strategic goals.

- Establish strategy.

- Establish key performance indicators.

- Monitor scorecards.

- Override assessments if necessary.

- Communicate status to key individuals within organization.

The Oracle Scorecard and Strategy Management provides support for commonly available frameworks including Balanced Scorecard, Six sigma, Baldridge or Total Quality Management, or it can be used as a purely operational measurement reporting tool.
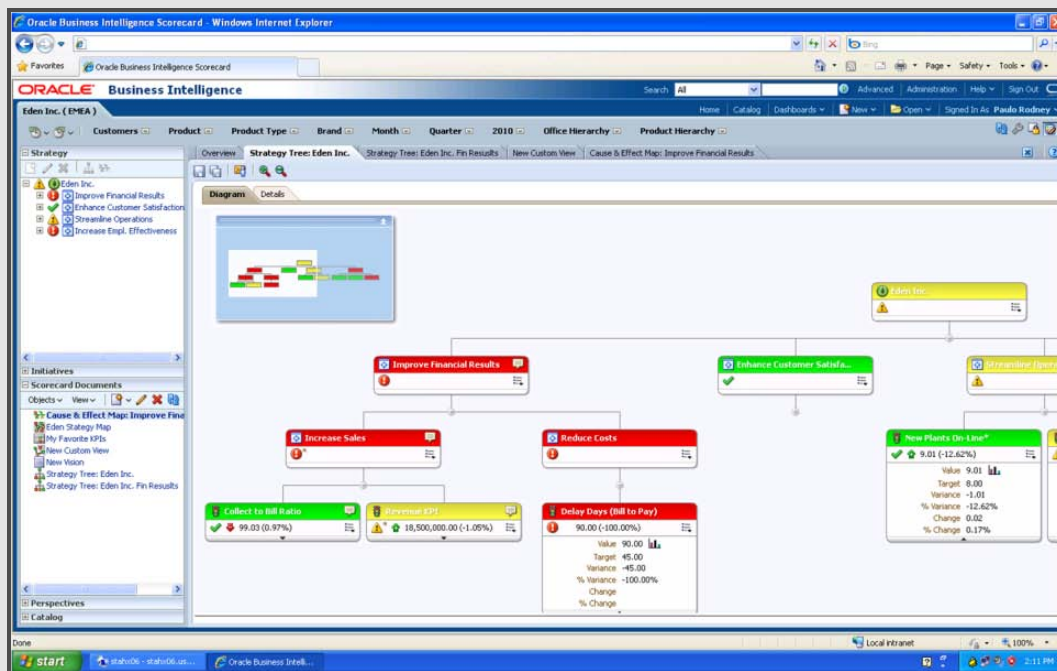

Figure 11- Oracle Scorecard and Strategy Management

Features of Oracle Scorecard and Strategy Management

- *KPI Builder and Actions:* The new KPI Builder allows customers to build Key Performance Indicators to be used within scorecards and dashboards. OBIEE 11g KPIs leverage the BI Server's semantic layer to provide multidimensional and hierarchical KPIs that will allow business users to monitor performance from the highest levels of the organization down to the lowest operational details. KPIs created by business users can also trigger contextual actions defined within the OBIEE 11g action framework. KPIs will have the ability to trigger actions such as:
    - Email alerts
    - ERP workflows and BPEL processes
    - Invoke Web Service
    - Execute Java methods
- *Annotations, Attachments and Collaboration:* While viewing KPIs, Initiatives or Objectives business users can initiate discussion threads and attach related documents to collaborate with other users. These discussions will then be associated with those items and are contextually available from any of the visualizations.

- *New Visualizations:* Oracle Scorecard and Strategy Management delivers new visualizations focused on communicating strategy and causal relationships between, KPIs, corporate objectives and initiatives. These views will be available within scorecards or can be embedded within dashboards. Examples of these views include:
    - KPI watch lists
    - Strategy trees
    - Strategy Maps
    - Cause and Effect Maps
    - Custom Views

Suite-wide Integration

Oracle Scorecard and strategy management was designed from the ground up to leverage all the key features of the OBIEE Suite. This is demonstrated via features such as:

- KPI Analyses allow users to drill from high level corporate objectives, to KPIs and into a KPI detailed data (via Answers) in order to explore data and ultimately identify the root cause of business exceptions.

- KPI Agents leverage the power of the *ORACLE BI DELIVERS* notification engine in order to reach out to key stakeholders of the strategy.

- KPI & Scorecard *Actions* leverage the ORACLE BI ACTION FRAMEWORK engine in order to associate recommended actions to business exceptions.

- Seamless Dashboard integration allows users to view strategic information alongside their favorite operational metrics.

ORACLE BI PUBLISHER

Oracle BI Publisher offers a highly scalable, enterprise class reporting server that generates and delivers reports from multiple data sources, in wide range document formats, via numerous delivery channels. Oracle BI Publisher reduces the high costs associated with the development, customization and maintenance of business documents while increasing the efficiency of reports management. It enables organizations to reduce costs and phase out archaic point solutions used to generate specialized documents.

BI Publisher is built on a report architecture that separates data logic, layout and formatting, and translations. Power users or IT staff can create shared data models that combine and structure data from multiple disparate sources. End users leverage those data models and can easily create pixel perfect report layouts directly in their web browser using the BI Publisher Layout Editor or use familiar desktop tools such as Microsoft Word, Microsoft Excel, Adobe Acrobat

Reports can be scheduled to generate multiple output documents and deliver to a wide range of destinations. Further, bursting enables the generation of tens of thousands of documents delivered according to delivery key preferences from a single report job.

BI Publisher is pure Java application that can be deployed on J2EE servers running 32bit or 64bit JDKs. It provides sophisticated data and document caching for fast performance. BI Publisher servers can be clustered for scalability or to meet failover requirements. All administration – creating

data source connections, configuring security, defining delivery destinations, etc. happens directly through a web browser. No administrative client tools to install.

When installed with Oracle Business Intelligence Enterprise Edition BI Publisher shares a common catalog and security model, and can leverage the metadata, calculation, caching, and intelligent request generation services of the BI Server.

Highly Formatted and Interactive Output

End users demand more from their reports today. With BI Publisher, users can view a report in interactive mode for lightweight analysis and generate pixel perfect reports in a wide range of output formats such as PDF, Microsoft Office formats, Flash and machine readable files such as EFT, EDI, XML, etc…
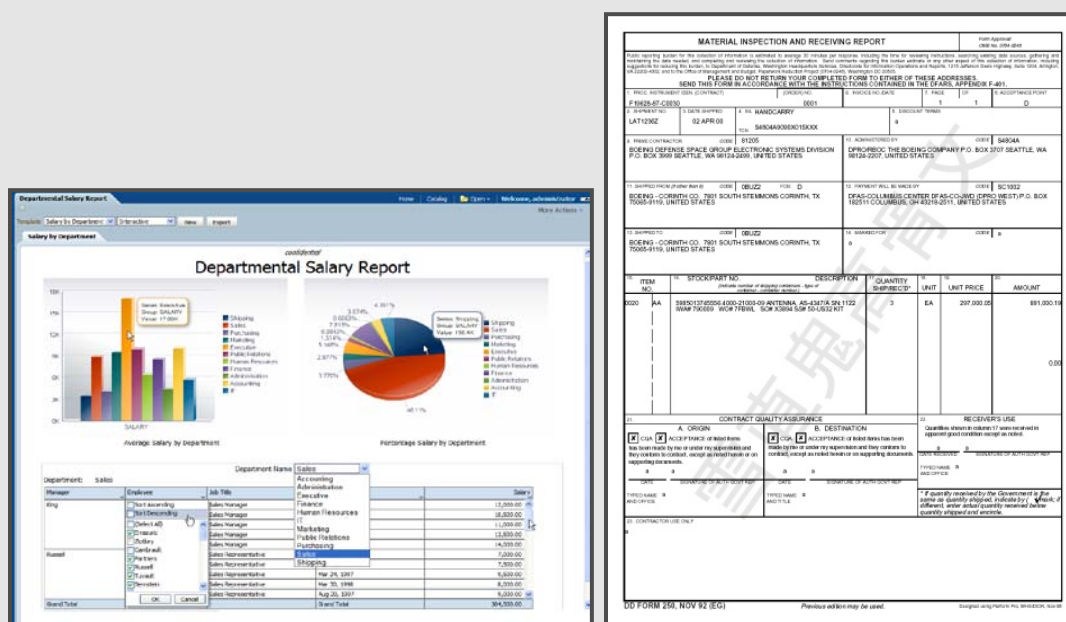

Figure 12 - Oracle BI Publisher Example Output

Data from Anywhere

The BI Publisher data engine enables power users and IT staff to create shared data models that can be used by a large number of end users to create reports. This leverages the expertise of technical teams and enables end users to get the reports with the layout and formats they want so everyone wins.

Using the BI Publisher Data Model Editor, users can combine and structure data from multiple, disparate data sources so that it is optimized for document generation. Whether your data is in an Oracle Database or other relational database that provides a JDBC connection; an ERP, HR, or CRM application; a spreadsheet; the Oracle BI Server; an Essbase cube or other MDX source; LDAP server; or available from a Web service or other process, the BI Publisher data engine can retrieve and structure the data you need. The BI Publisher data engine also efficiently caches data in

the middle tier to minimize load on your source systems and speed up subsequent document generation.

End User Reporting with Choice

The right tool can make all the difference in ease of creation and getting the desired output. Users can choose which layout tool meets their needs.

End users can easily create report layouts using the BI Publisher Layout Editor directly in a Web browser or with familiar desktop tools such as Microsoft Word, Microsoft Excel, or Adobe Acrobat. Developers may choose to use Adobe Flex Builder or any XML IDE.
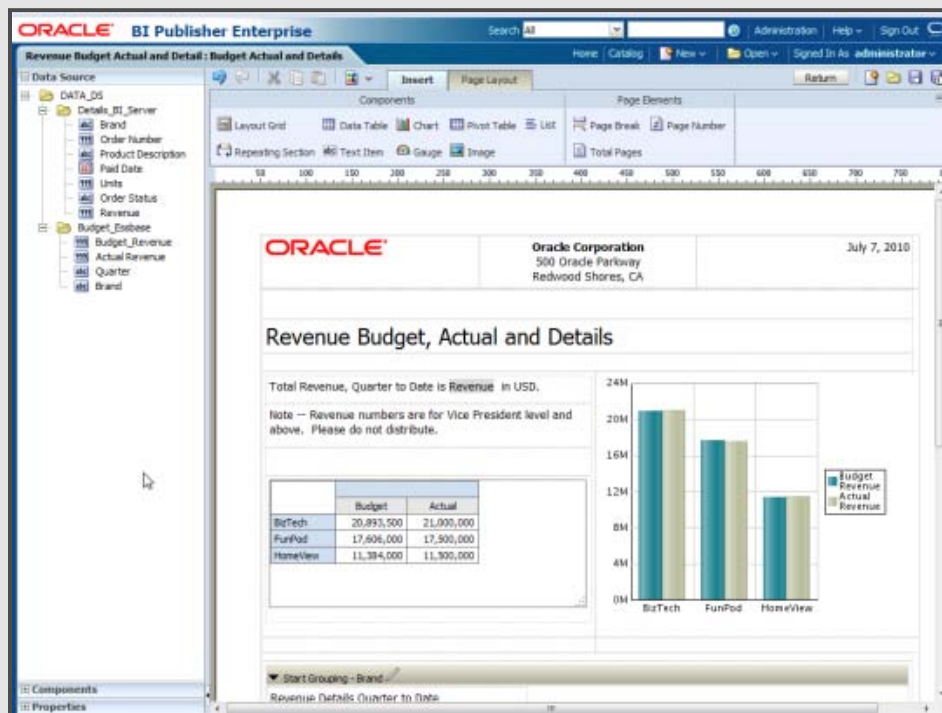
Figure 13 - Oracle BI Publisher Web Layout Editor

Deliver to Anywhere

Interact and view reports online or schedule and deliver multiple documents independently to multiple destinations like printers, e-mail, fax, WebDAV, or FTP/SFTP. A single report can be burst with personalized content to multiple output formats and destinations on a scheduled basis. The Delivery Manager's open architecture allows for easy implementation of custom delivery channels.

Manage scheduled jobs and report output from your browser. You can suspend, resume or delete scheduled jobs. When scheduling a job you may choose to save the output and data for each execution so you have an archive of the scheduled jobs. For jobs already completed you can then resend generated output and even republish snapshots of data with different layouts if needed.

Communicate Globally

BI Publisher supports over 150 languages and 200 territories. Layouts are converted to industry-standard files for easy in-house or professional translation. Each translation is separate, so modifications made to the layout, report or data model need not impact translations. BI Publisher includes automatic internationalization of dates and numbers, advanced bidirectional support, and font handling.

Unsurpassed Performance

BI Publisher is based on the W3C XSL-FO standard and is blazing fast. It can handle very large data inputs and generate output in less time, using very low levels of CPU time and memory on data sources. PDF documents have font subsetting and optimal compression so they minimize network consumption when being delivered.

Open Standards. Easy Integration.

BI Publisher is built on open standards -- Java, J2EE, XML, XSL-T, FO, RTF, PDF, IPP – allowing adoption alongside existing information technology investments and business intelligence tools… Data is handled as XML, and layout templates are internally converted to XSL-FO. BI Publisher can generate a wide range of industry standard output formats and deliver to printer, email, fax, and file destinations. In addition to its own security model, BI Publisher supports Oracle Fusion Middleware Security and LDAP as well as Oracle E-Business Suite, Oracle Database, and Oracle BI Server security.

Extensive web services are provided for SOA integration as well as a rich set of Java APIs for embedding in custom applications.

Pre-Delivered Content

BI Publisher is already the tool of choice for report delivery in many popular pre-packaged application suites, like the Oracle E-Business Suite, PeopleSoft, Siebel, JD Edwards and over 25 other Oracle products and applications. BI Publisher makes it easy to customize and extend the reporting content delivered in these products.

ACTIONABLE INTELLIGENCE

This section describes BI Foundation capabilities around actionable intelligence. Actionable intelligence extends BI beyond traditional reporting and analysis capabilities to proactive functionality that can aid users in the path of business discovery, functionality to automatically detect conditions identified by BI and alert users base upon these conditions and the ability to initiate processes outside of BI directly from BI content.

ORACLE BI DELIVERS

Oracle BI Delivers is a solution that through the creation of Agents provides the ability to proactively monitor business information; identify patterns to determine whether specific problems are occurring; filter the data based on data and time-based rules; alert users via multiple channels such as email, dashboards, and mobile devices including text messages and mobile phones; and allow

users to take action in response to the alerts they have received. Agents can be chained together. By passing contextual information from one Agent to another, it is possible to execute a multi-step, multi-person, and multi-application analytical workflow. As well, Oracle BI Delivers dynamically determines recipients and personalized content to reach the right users at the right time with the right information.

Using Oracle BI Delivers

Oracle BI Delivers provides a Web-based self-service Agent creation and subscription interface where users choose delivery options by creating individual delivery profiles. For example, a user might define an "out of office" delivery profile. Within a profile, delivery options can be varied according to the urgency of the alert. Alerts can be sent to individuals or groups. Users can save analyses, schedule them to run automatically, set data thresholds, and specify who is to be alerted when thresholds are exceeded. Oracle BI Delivers allows business executives to manage their organization by exception – receiving notifications and alerts from the BI infrastructure that is monitoring their organization and can quickly take action.

Figure 14- Oracle BI Delivers

Features of Oracle BI Delivers

Some of the features of Oracle BI Delivers are:

- *Create and Subscribe to Proactive Alerts:* Oracle BI Delivers presents an intuitive mechanism to allow business users to create, publish, and subscribe to proactive alerts and conditions. Users can select and schedule published requests to be executed and then

delivered to them via a multitude of devices. Users can define alert conditions on data driven thresholds on specific analytic measures and on time driven conditions.

- *Intelligent Agents:* Oracle BI Delivers provides the ability for any user (not just administrators) to define their own processes, called Agents. Agents "watch" for user-defined conditions and or thresholds upon which they notify the user. Oracle BI Delivers can take action based on a pre-defined decision tree. For example: "If supplies of Product A drop below 10,000 units send an e-mail to me, the warehouse, and the supplier."

- *Composite/Complex Conditions:* Oracle BI Delivers allows users to create Agents that watch for very complex conditions combining data-driven and time-based conditions on real-time and historical data. Like other catalog objects like Custom Groups or Calculations, a condition can be saved as an object for re-use, collaboration and sharing.

- *Multiple Delivery Channels and Profiles:* Users can personalize how they wish to be notified (e-mail, pager, iPhone, phone call) at various times of day and week. Delivery profiles can be matched to individual alerts to which a user subscribes.

Guided Analytics with BI Interactive Dashboards

Guided Analytics is a feature of BI Interactive Dashboards that enables the content and layout of BI Interactive Dashboards to change dynamically based on changes in the information being analyzed. Business events tracked by the same kinds of conditions referenced in Oracle BI Delivers drive the presentation of Guided Navigation links. This fact also allows business-based notifications to be coordinated between presentation on Dashboards, in e-mail or on mobile devices based on the urgency of that information with the rule being the data should be seen where it is most actionable and hidden where it is less useful or extraneous noise.

Sections in a dashboard page can be set up and only appear when there is pertinent/urgent information in the data. For example, a dashboard for a sales manager might contain a section that only appears when sales volumes for major products have declined in the current quarter, or if customer complaints have become a problem.

Individual links in a dashboard can work the same way. For example, when sales volumes for major products decline, a link could appear with a message notifying the user of the decline. Clicking on the link would bring up an analysis (or a whole dashboard) focusing on these products.

Through Guided Analytics, organizations can capture best practices in the use of information by one user or one division and guide other users or divisions on how to use the system in the same way. For example, it is possible to capture how an organization's best sales manager uses information to be more effective, and this information can be used to encourage every other sales manager in the organization to use information intelligently in the same way.

BI ACTION FRAMEWORK

Oracle BI Action Framework makes the business intelligence analysis actionable by delivering the ability to take action from within Oracle BI by invoking a business process or navigating to related content. Using the Action Framework, Oracle BI can be configured to interact with business process technologies such as the Oracle SOA Suite, transactional systems such as PeopleSoft and Siebel CRM, and other external systems via standards-based integration points such as web services. BI users are guided to take the appropriate actions from Dashboards, Analyses, charts, maps, and

Scorecard elements such as KPIs and Objectives. Actions can also be taken automatically by using Agents. Actions pass the context from BI to the target functionality. They are secure and re-usable across different BI components. Actions can be created to:

- Navigate to BI Content
- Navigate to a Web Page
- Navigate to E-Business Suite
- Navigate to Siebel CRM
- Navigate to EPM
- Invoke a Web Service
- Invoke a Java Method
- Invoke a Browser Script
- Invoke an HTTP Request

Figure 15 - Action Framework

BI ON-THE-GO

While BI insight is often consumed through classic browser-based UI's, more and more users are demanding they take BI content with them and receive updates away from the office location. At the same time the ability to capture and modify content within office productivity suites remains highly desirable.

BI BRIEFING BOOKS

Briefing Books defined with Oracle BI Interactive Dashboards are report decks which can be assembled online then captured and delivered for offline consumption. Once generated, a Briefing Book becomes a multi-page pdf document with built-in outline-level navigation controls as well as navigation within pages. Any pdf reader can be used to consume this versatile format.

Users have the option to either create a snapshot in time of data when content is added or make Briefing Books "updateable" so they can be refreshed with up-to-date information. Briefing Books can also be used to archive the information locally or on a file server.

A Briefing Book can be requested in an ad hoc fashion or it can be scheduled and automatically sent to recipients via email using Oracle BI Delivers. Content can be personalized based on object and data-level security for each recipient. Within Oracle BI, travel profiles can also be defined to target specific mobile devices or accounts while on-the-road; although in many cases these distinctions are becoming less important as mobile devices become a de-facto platform for consuming e-mail and common attachments.

ORACLE BI MOBILE

The modern enterprise demands that analysis, updates and business insight be available at all times. Mobile devices play a key role and the Oracle BI Foundation Suite provides access to all BI Dashboard content via mobile devices and optimizes content for mobile consumption on those devices. Oracle's approach exploits not only the rock-solid Oracle BI foundation but also the proven value of existing BI application content as leveraged on mobile devices. This strategy provides an augmented but familiar user experience which can be immediately employed by users with little to no training.

Innovative Oracle BI features like the Action Framework, integrated Scorecard views, Geospatial views, Guided Navigation and complex Dashboard interactively can all be accessed via Oracle BI Mobile native device applications. Naturally, classic functionality like alerting and notification becomes even more powerful with the ability to further investigate and invoke a business action where the insight occurs. Many of these features relate directly to the "Actionable Intelligence" discussed in the previous section. Depending on the device, familiar BI content is enhanced with appropriate behaviors like gestural, pinch or swipe interactions and orientation recognition.

Figure 16 - Oracle BI Mobile on the Apple iPad

Oracle BI Mobile content is designed in the familiar and intuitive browser-based Oracle BI builder applications. Content can then be dynamically optimized for the target devices. This might mean collapsing a multi-column Dashboard into a single column or segmenting it out into smaller pieces for widget-style consumption. Importantly, Oracle BI Mobile applications feature integrated security and can leverage SSL, SSO and other middleware infrastructure investments.

BI OFFICE INTEGRATION

The Oracle BI Foundation Suite provides a full-range of Office integration capabilities. Office integration enables information from the Oracle BI Server, Analysis & Reporting, Interactive Dashboards, and BI Publisher to be available from the Microsoft Office environment, embedding up-to-the-minute corporate data in Microsoft Word, Excel, and PowerPoint documents. Users can share these Office documents with others over the web for collaborative decision-making.

Business users can waste a lot of time trying to cut and paste corporate data into their Microsoft Office documents. They need to determine (i) how to access data from many different systems; (ii) what security privileges they need to access this information; (iii) how to keep data in Microsoft Office current to avoid issues with data accuracy; and (iv) how to protect data so that it does not get into the hands of unauthorized users.

BI Office Plug-In

The BI Office Plug-in allows business users to add business intelligence information into Microsoft Office documents saving time; eliminating data accuracy problems; providing self-service access to information; and securely sharing information with co-workers with appropriate context.

There are several important features of the BI Office Plug-in.

- *Simplified Data Embedding:* The BI Office Plug-In makes embedding corporate data within Microsoft Office documents easy and efficient. A business user lays out a document template into which they would like to embed corporate data using Microsoft Word or Microsoft Excel. The user can easily change the layout; change the output format, and the locale (language, time zone) all within Microsoft Office. Once the user has defined the layout, they simply define a data source – either a database schema itself or a measure or dashboard within the Oracle BI Server – from which they would like to embed data into Microsoft Office. Facilities such as the Parameters Toolbar preserve analytic parameters within Microsoft Office.

- *100% Standard Microsoft Office Documents:* Unlike other Business Intelligence tools, the BI Office Plug-In generates a 100% standard Microsoft Office document. This allows users to format, to re-organize the document, to use macros, to perform cell-based calculations within Microsoft Office and to integrate data from non-analytic sources into the same document. Users can also modify data filters, saved selections, rules and formulas as needed while retaining all existing formatting and calculations in Microsoft Office.

- *Simplifies Security:* The BI Office Plug-In preserves the user's security information when accessing corporate data from Microsoft Office documents. This eliminates the need to maintain a separate username/password for the user - the same username/password that the user uses to access BI Interactive Dashboards can also be used to secure access to Microsoft Office, lowering security administration costs and simplifying maintenance.

- *Eliminates data inaccuracy:* The BI Office Plug-In eliminates data accuracy problems by allowing the user to choose to automatically refresh a single data item or all data in the Office document when the user connects to the network.

- *View Data in Context:* The BI Office Plug-In provides document recipients with greater context about the data they are accessing. By clicking on the data they are interested in, they can easily view the underlying report right from within Office.

- *Distribution:* The BI Office Plug-In allows users to share documents for collaborative decision making in a variety of ways: (i) place them online in an embedded dashboard; (ii) share them through online folders; (iii) share them through a Corporate Portal (Oracle Portal or others); and (iv) share them as e-mail attachments.
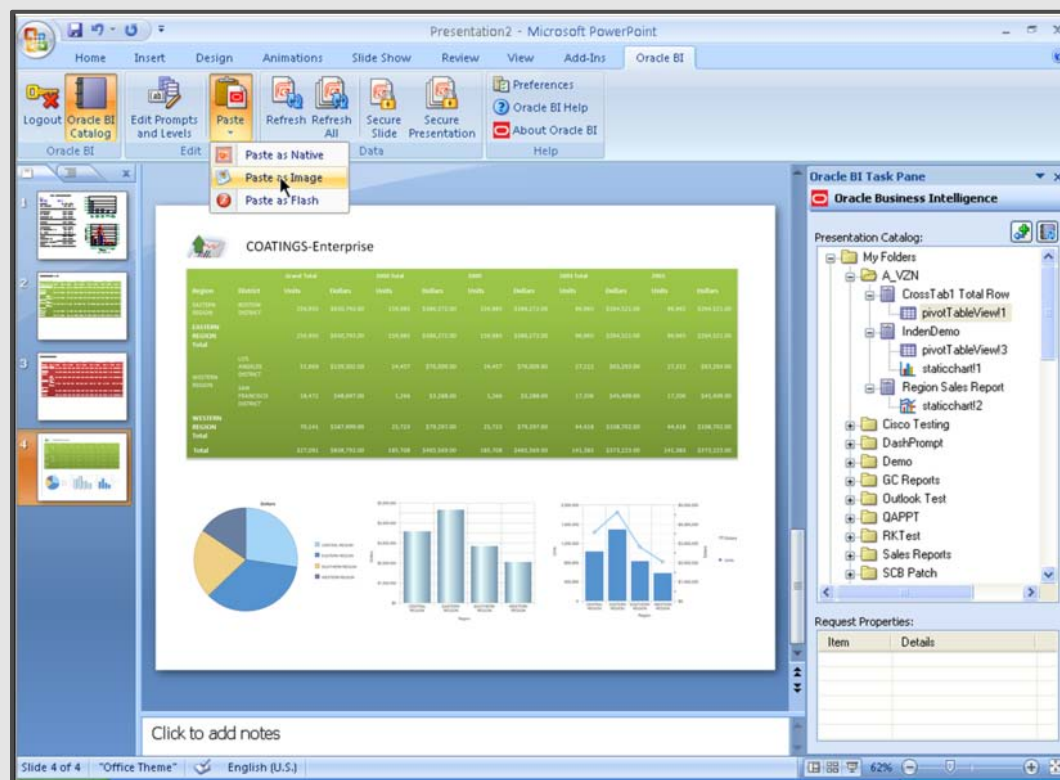

Figure 17 - Oracle BI Office Plug-in

The BI Office Plug-In integrates with the familiar Microsoft Office environment to provide business users with an easy and efficient way to embed accurate, updateable data into their documents, spreadsheets, and presentations. Resulting Office documents can be shared securely with others for collaborative decision-making. The BI Office Plug-In simplifies security, is easy to install via the auto-update mechanism of Microsoft Office, and eliminates data inaccuracy with the live update feature.

Oracle Smart View for Office

Oracle Smart View for Office extends the capabilities of the BI Office Plug-in. Smart View provides direct access to Oracle Essbase, the Oracle Hyperion Enterprise Performance Management (EPM)

Applications, and also to the Common Enterprise Information Model via the Oracle BI Server. Smart View provides the ability to integrate EPM & BI data directly from the data source into Microsoft Word, Microsoft PowerPoint, and Microsoft Outlook and the capability to synchronize information between Microsoft Word, Excel and PowerPoint.

Smart View is the tool of choice for power users when interacting with Essbase applications. For Essbase users, Smart View offers powerful free-form analysis, powerful pivot capabilities, zoom in-out, member selections, keep/remove members, full-access to Essbase metadata, write-back capabilities, and direct access to Essbase calculation scripts.
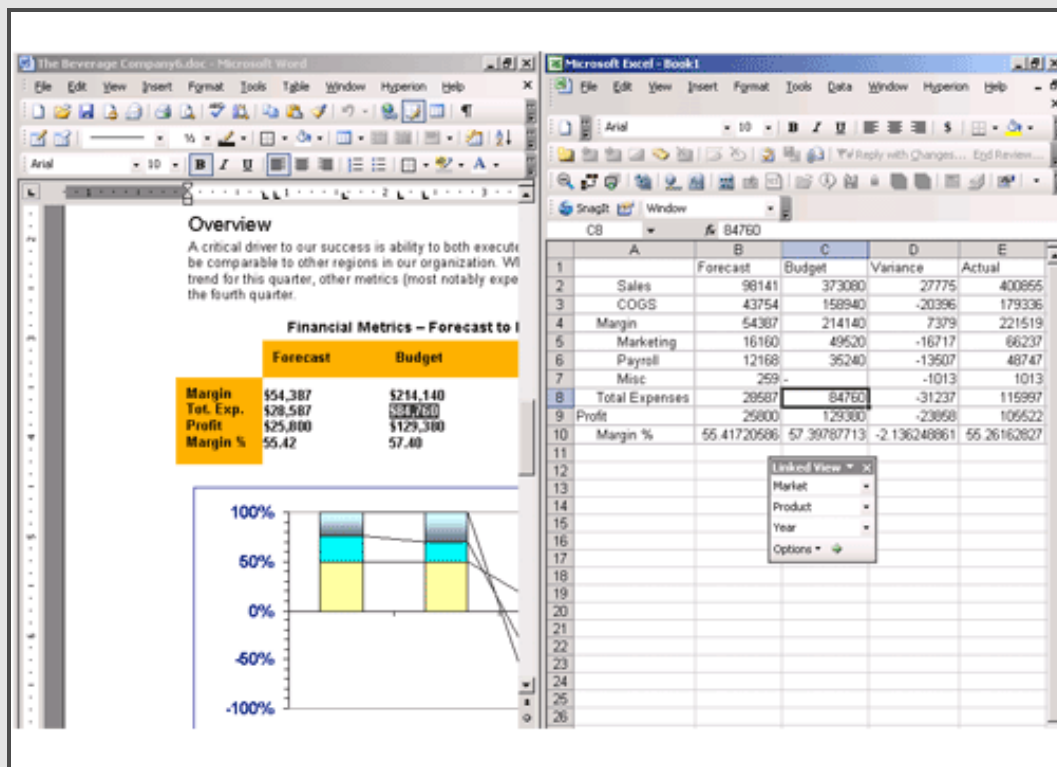

Figure 18 - Oracle Smart View for Office

CUSTOM DEVELOPMENT AND INTEGRATION

The Oracle BI Foundation Suite offers broad capabilities for building custom applications and integrations that leverage the extensive features within the Suite. Interfaces are open and conform to industry standards. The following section describes capabilities for custom development and integration.

APPLICATION DEVELOPMENT FRAMEWORK VIEWS

The Oracle Application Development Framework (ADF) is an end-to-end Java EE framework that simplifies application development by providing out of the box infrastructure services and a visual

and declarative development experience. Oracle BI provides BI view components for easy integration into ADF-based applications. The Applications are typically constructed using Oracle JDeveloper. ADF Views also provide the constituent building blocks for Oracle Fusion Applications.

Surfaced via Oracle BI are View Components which expose: complete reports, individual report views, complete Dashboards, individual Dashboard Pages and Scorecard views. A Programmatic View Object against the Oracle BI Server also exposes Logical SQL View Objects which can be incorporated into ADF applications. An additional ADF View that describes a wizard-based report creation tool is also available and serves a primary role in the Oracle BI accessibility strategy.

To reference the BI Views, the user can create a connection to BI Presentation Services in JDeveloper. This makes objects within the web catalog available via a resource palette to drag and drop into an ADF page. ADF-based integration supports personalization and context passing.

COLLABORATION, WEBCENTER AND PORTALS

Fact-based Insight is even more valuable when the insights can be shared and discussed with colleagues. Oracle BI 11g is fully integrated with Oracle WebCenter. WebCenter is an industry leading portal for social collaboration and information sharing which supports easy consumption and interaction with Oracle BI content. Users can also leverage WebCenter social collaboration features with BI Content. WebCenter Web 2.0 Collaboration features include: Search, tagging, tag clouds; Linking & document association; Discussion forums; Chat, presence, & real-time collaboration; Workspaces and Community lists.
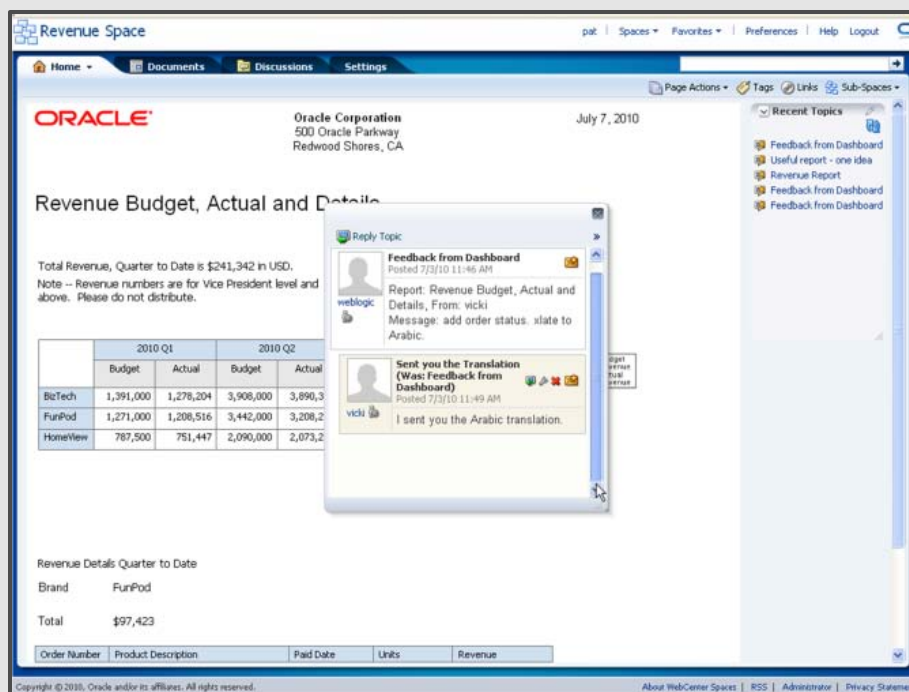

Figure 20 - Threaded discussion of Oracle BI content in WebCenter

Oracle BI also can be integrated into your choice of non-Oracle portals via industry standards. Whole dashboards, individual dashboard pages, or individual reports, charts or analysis can be delivered through corporate portals and with context passing and interaction.

WEB SERVICES

Oracle BI Presentation Services offers a programming interface using the Simple Object Access Protocol (SOAP). Oracle BI supports a number of web services for easy integration with custom applications and portals. These Web Services allow Session, HTMLView (GUI), XML View (Data) and Catalog operations. The SOAP API can be used to build Oracle BI custom user interfaces or to embed Oracle BI functionality within existing applications. This API can be used to start and manage web sessions; retrieve results from Oracle BI Presentation Services in XML format; embed Oracle BI Presentation Services results in third-party dynamic Web pages, Oracle WebCenter and Portal Frameworks; merge report parameters and logical SQL to create analyses and return results; and navigate and manage the Web Catalog.

SAMPLE APPLICATION (SAMPLEAPP)

The Oracle Sample Application for Business Intelligence Suite Enterprise Edition Plus (EE) is a comprehensive set of configuration examples for Oracle Business Intelligence Suite. This simple and easy to install content illustrates a broad range of Oracle Business Intelligence Suite capabilities including interactive dashboards, semantic layer modeling and several OBIEE source integration capabilities. The latest version of SampleApp can be downloaded any time from the Oracle Technology Network.

Essbase API

Essbase API—the developers' interface to Essbase—enables the creation of custom applications that take advantage of the MOLAP capabilities of the Essbase Server.

Oracle Essbase provides a powerful MOLAP solution that satisfies the complex calculation requirements of end-user analysts across the enterprise in various departments, including finance, accounting, and marketing. Essbase client tools provide access to centralized data through a variety of interfaces, including:

- Web-based interfaces
- Spreadsheet interfaces.
- Application and data management facilities.
- Custom programs you can develop using the Essbase Application Programming Interface (API).

The Essbase API provides a range of powerful and sophisticated features, including:

- Transparent client-server access
- Data manipulation, consolidation and reporting
- Encapsulated server login procedure
- Remote file management

- Application and database administration

- User and group administration

- Transparent, built-in security

- Customized memory and message handling

- Multiple platform support

- Function library that allows direct creation, manipulation, and maintenance of database outlines from a C or Visual Basic program

The API is an interface between the custom client program and Essbase and manages the transfer of data between client and server. Custom applications make calls to functions within the API using C or Java programs, and data is returned from the Essbase servers that the applications connect to. The API interface also includes the capability to interact with the MDX language, the de facto industry standard for querying MOLAP servers.

SYSTEMS MANAGEMENT

BI SYSTEMS MANAGEMENT

Oracle BI 11g introduces a comprehensive set of operational system management functionality based on open standards to lower the Total Cost of Ownership (TCO) of a BI system. This includes the areas of install, upgrade, patching, security and system lifecycle.

A key aspect of the Oracle BI systems management functionality is Oracle Enterprise Manager, providing centralized, comprehensive web based management of small to enterprise level systems. This enables an Oracle BI system administrator to manage a multi server enterprise system from a single place.
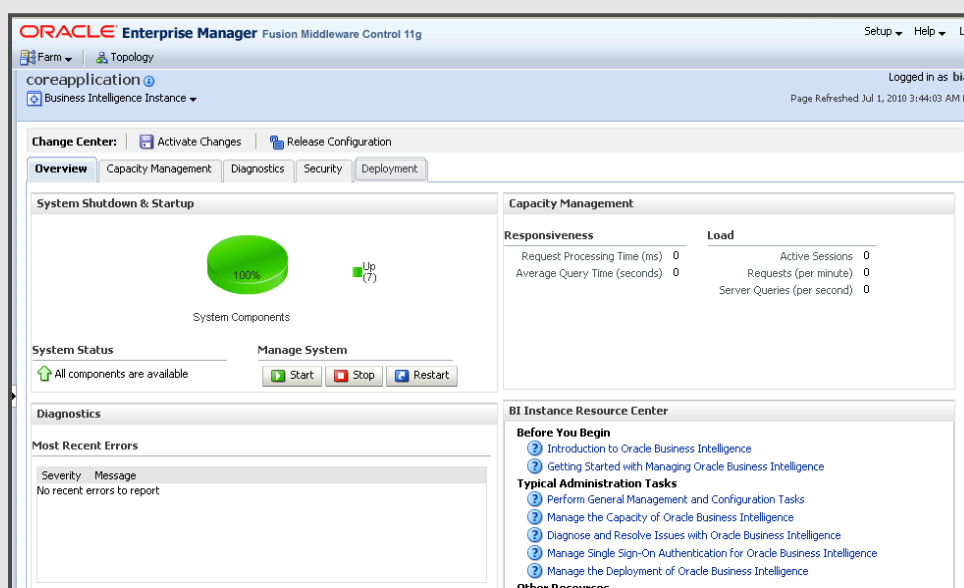

Figure 21 – Oracle BI System Management

The Enterprise Manager integrated Oracle BI screens have been designed for ease of use and low TCO by focusing on the common system lifecycle and administration tasks. There are tabs available for specific administration tasks in addition to a section that provides overall system status and control in addition to key metrics and diagnostic information.
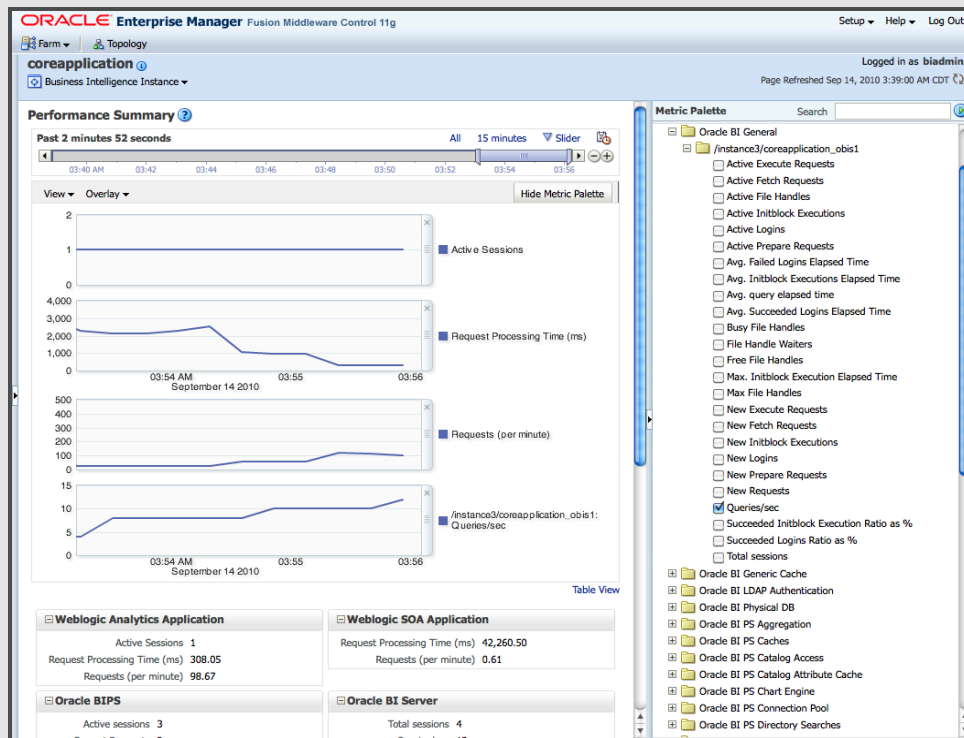

Figure 22 - Oracle BI System Monitoring

In order to make it easy to ensure the Oracle BI system is always available and provides the required enterprise class scalability, Oracle BI 11g introduces an advisory section that provides task based guidance for system optimization.

A key differentiator in Oracle BI 11g is the ability to perform a 'single click' scale out. A system administrator decides how to distribute the Oracle BI components such as the Oracle BI Server or Oracle BI Presentation Services across a set of clustered machines and Oracle Enterprise Manger automatically takes care of the provisioning and configuration.
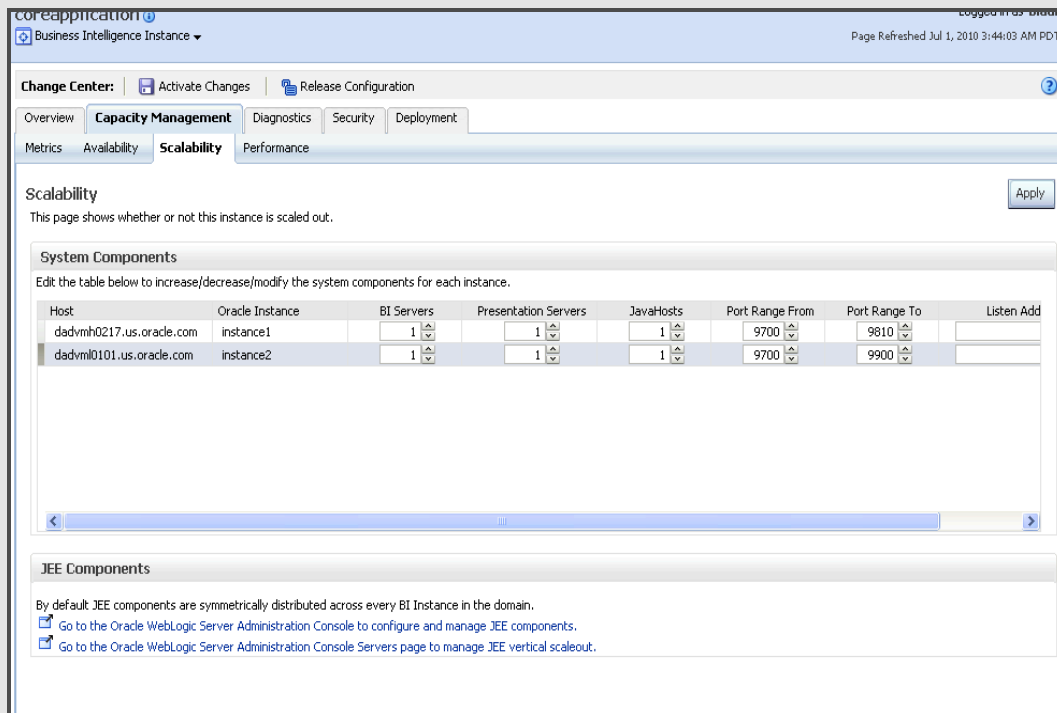
Figure 23 - Single Click System Scale Out

In addition, all this functionality is scriptable since under the covers Oracle BI systems management is built on Java MBeans.

In summary, Oracle Enterprise Manager provides an unrivalled, integrated system management experience for Oracle BI 11g and lowers the total cost of ownership through an intuitive, task based web interface.

SUMMARY

INTEGRATED FOUNDATION

The core components of the Oracle BI Foundation Suite: Oracle BI Enterprise Edition 11g, Oracle BI Publisher, Oracle Essbase, Oracle Scorecard and Strategy Management, and Oracle Essbase Analytics Link individually deliver significant benefit to customers. While other BI solutions may provide standalone capabilities in the functional areas covered by the BI Foundation components, the fundamentally unique proposition of the Foundation Suite is that each of the core components are integrated, significantly enhancing the value of the Business Intelligence investment.

The integrated foundation allows: (1) information and calculations from Essbase applications to be fully accessible through all delivery channels; (2) integration of Essbase information with other enterprise data sources; (3) creation of Essbase applications using common metadata; (4) creation of highly-formatted enterprise reports from common metadata; (5) integration of enterprise reporting with other BI content; (6) definition of KPIs that leverage data from Essbase and other enterprise

sources; (7) re-use of KPIs across Business Intelligence and Scorecard applications, (8) rich financial analytics information stored in Essbase sourced from operational financial applications and other sources.

Integration offers customers superior visibility into business operations and alignment across the business. The integrated Oracle BI Foundation Suite provides for the fastest time to value of any Business intelligence solution in the market.

ORACLE BI FOUNDATION SUITE KEY DIFFERENTIATORS

The sections above provide a detailed technical overview of the Oracle BI Foundation Suite. Let's briefly summarize some of the key technical differentiators between Oracle BI Foundation Suite and other Business Intelligence tools:

- *Integrated Platform:* Unlike competitor offerings, which are typically a collection of tools, The Oracle BI Foundation Suite is a truly integrated platform that leverages integrated metadata, integrated security, integrated content delivery infrastructure, and integrated systems management

- *Unified Enterprise View of Information:* The Oracle BI Foundation Suite and its Common Enterprise Information Model enables organizations to "federate", or combine enterprise data from multiple databases, enterprise applications, OLAP sources, and unstructured data sources in a single unified Enterprise View of Information. Since most organizations have multiple data warehouses, marts, and custom analytic applications, as well as new applications not yet loaded into any marts, this is a key requirement for end-to-end fact-based management of business processes and enterprise performance. Competitive products require separate metadata models for distinct data sources.

- *Unified Semantic View of Information:* The Common Enterprise Information Model allows an organization to model the complex information sources of their business in a simple, understandable, semantically unified, logical business model. This model-centric view (as compared to report-centric view of information) allows organizations to share the same definition for analytic measures/information across disparate users who may be calculating this information from disparate data marts and warehouses. The model-centric view enables true end-user self-service where users are insulated from the complexities of underlying data structures and are not required to re-build business semantics for each and every report. The result is greater consistency and accuracy of information.

- *Pervasive Business Insight:* The Oracle BI Foundation Suite is the only suite that provides business users with access to the information they need, when they need it, on multiple devices via multiple delivery channels, while maintaining consistency in the definition of the calculations, in a true self-service delivery model.

- *Real Time Insight:* The Oracle BI Foundation Suite allows business users to combine historical data and real-time information to get an up-to-the-minute view of their business – not just "what happened" but "what is happening?"

- *Insight Driven Actions:* The Oracle BI Foundation Suite provides true pro-active intelligence with Guided Analytics facilities and the Action Framework to help business

users navigate quickly to troubleshoot problems and invoke business processes to take action. Other tools are primarily focused on reporting what happened.

- *Business Process Optimization:* Integration between the Oracle BI Foundation Suite and Oracle BPEL Process Manager is designed to help integrate Business Insight into business workflows to drive Business Process Optimization – a feature Oracle refers to as "sense and respond."

- *Automated Performance Optimization:* Aggregate Persistence allows the administrator can use Common Enterprise Information Model metadata to quickly and easily create, load and maintain aggregate views, reducing the TCO of the most important data warehouse performance technique.

- *Best-in-class ROLAP:* The Oracle BI Foundation Suite provides users the best ROLAP experience in the market by providing flexible exploration of all data sources, broad schema support, multi-pass calculation capabilities, automated query tuning, and a task-oriented user interface.

- *Best in class MOLAP:* The Oracle BI Foundation Suite offers market leading MOLAP capabilities, with Oracle Essbase as the foundation for "what-if", custom planning and prediction capabilities; the industry's first fully unified ROLAP and MOLAP user interface; and the ability to seamlessly navigate across relational, OLAP, and unstructured data sources.

- *Best-in-class Reporting and Publishing:* The Oracle BI Foundation Suite offers a unified architecture for web-based interactive and document-centric production reporting; a powerful self-service user interface for report design and publishing; seamless integration with Microsoft Office; and support for relational, OLAP, and unstructured sources.

- *Best-in-class Scorecard and Strategy Management:* The Oracle BI Foundation Suite offers the industry's only integrated Scorecard and Strategy Management component that enables alignment with corporate objectives with KPIs as core metadata objects, advanced visualizations, and a flexible design that does not dictate a specific methodology.

- *Extensible Financial Analytics Platform:* The Oracle BI Foundation Suite provides capabilities to integrate and merge multiple operational financial data sources into a single data model, providing detailed information for analytical measurements (KPIs) and the application of advanced analytics.

- *Best-in-class Systems Management:* Unified operational systems management capabilities are provided across the entire Oracle BI Foundation Suite that offer clustering and availability with single-click scale out; comprehensive security and identity administration; and the ability to work in heterogeneous operational environments.

- *Best-in-class Multi-User Development:* The Oracle BI Foundation Suite offers the industry's most advanced capabilities for multi-user development environments supporting portable BI applications, lifecycle management processes, patching, bug-fixing, branching, and merging.

- *Fastest Time to Value:* Finally, with its unified infrastructure and its support for Pre-Packaged BI and EPM Applications, the Oracle BI Foundation Suite provides the fastest time-to-value for Business Intelligence investments in the market today.

CONCLUSION

The Oracle BI Foundation Suite is designed to help today's organizations drive profitable growth, change, and many other operational and financial performance goals. The Oracle BI Foundation Suite helps customers achieve this higher level of value by providing more than a comprehensive set of tools, but an integrated suite to make BI pervasive, providing insight to all employees within their normal work environment, applications and business processes.

The Oracle BI Foundation Suite delivers a comprehensive set of capabilities that span ad-hoc query and analysis, OLAP analysis, interactive dashboards, scorecards, reporting, proactive intelligence and alerts, mobile analytics, and more. The core components of the Foundation Suite, the Oracle BI Enterprise Edition 11g, Oracle Essbase, Oracle BI Publisher, Oracle Scorecard and Strategy Management, and Oracle Essbase Analytics Link are fully integrated to enable true closed-loop, insight driven business processes.

The Oracle BI Foundation Suite speeds time to value by integrating into the company's existing architecture, unifying the many fragmented systems into a coherent enterprise view while leaving data in place, and giving customers a "buy and tailor" option rather than just a "build" approach. It increases speed-to-insight by uniquely enabling comparisons of real time, historical and forward looking information while leaving data in place in its several sources.

The Oracle BI Foundation Suite thus provides the highest value, lowest TCO of any BI solution available today.