

# DEVELOPING ADVANCED THIN CLIENT APPLICATIONS WITH BI BEANS

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## INTRODUCTION

With the introduction of Oracle OLAP as part of the Oracle 9i/10g database and Oracle 9i/10g Business Intelligence Beans (BI Beans) as an Add-in to Oracle 9i/10g JDeveloper (JDeveloper) the landscape for development of Business Intelligence applications is changing. This all has a major effect on how fast feature-rich applications can be developed. This presentation introduces the developer to this new environment and presents an example of how to extend the “canned” java application generated by JDeveloper.

## OVERVIEW OF THE ORACLE OLAP AND BI BEANS ARCHITECTURE

### **ORACLE OLAP – WHAT IS IT?**

Businesses need to analyze their businesses in ways that decision makers at all levels can quickly respond to changes in the business climate. While a standard transactional query might ask, “How many bolts were sold last month?” An analytical query might ask, “How do sales in the Midwest for the last 3 months compare with the forecast? Now how does that compare to a year ago?”

Analytical queries require an online analytical processing (OLAP) solution. Oracle 9i provides comprehensive support for OLAP:

- The Oracle relational database management system (RDBMS) remains the most efficient and secure way to store your data. By developing a data warehouse, you can provide data in a form suitable for business analysis.
- OLAP Services provides a Java OLAP API and an analytical engine. OLAP Services provides the means to build analytical applications that support complex statistical, mathematical, and financial calculations along with predictive analytical functions such as forecasting, modeling, consolidations, allocations, and scenario management. Because the OLAP API is all Java, OLAP Services supports deployment of analytical applications to large, geographically distributed user communities on the Internet.
- The Oracle BI Beans complements OLAP Services by providing pre-built Oracle JDeveloper or other Java development environments to build analytical applications, which can be deployed as either Java or HTML (“thin”) clients.

### **OLAP OPTION**

The Oracle OLAP Option provides the query performance and calculation capability of a multidimensional database. In addition, it provides a Java OLAP API that is appropriate for the development of internet-ready analytical applications.

Unlike other marriages of OLAP and RDBMS technology, Oracle9i OLAP Services is not a thinly disguised multidimensional database using bridges to move data from the relational data store to a multidimensional data store. Instead, it is truly an OLAP enabled relational database.

As a result, Oracle9i provides the performance and calculations of a multidimensional database along with the scalability, accessibility, security, manageability, and high availability of the Oracle9i database.

In its broadest definition, OLAP Services consists of the following components: the Oracle Java OLAP API, one or more OLAP services that run as child processes of a database instance, a metadata repository in each database instance, and tools within Oracle Enterprise Manager for creating OLAP metadata and managing OLAP services.

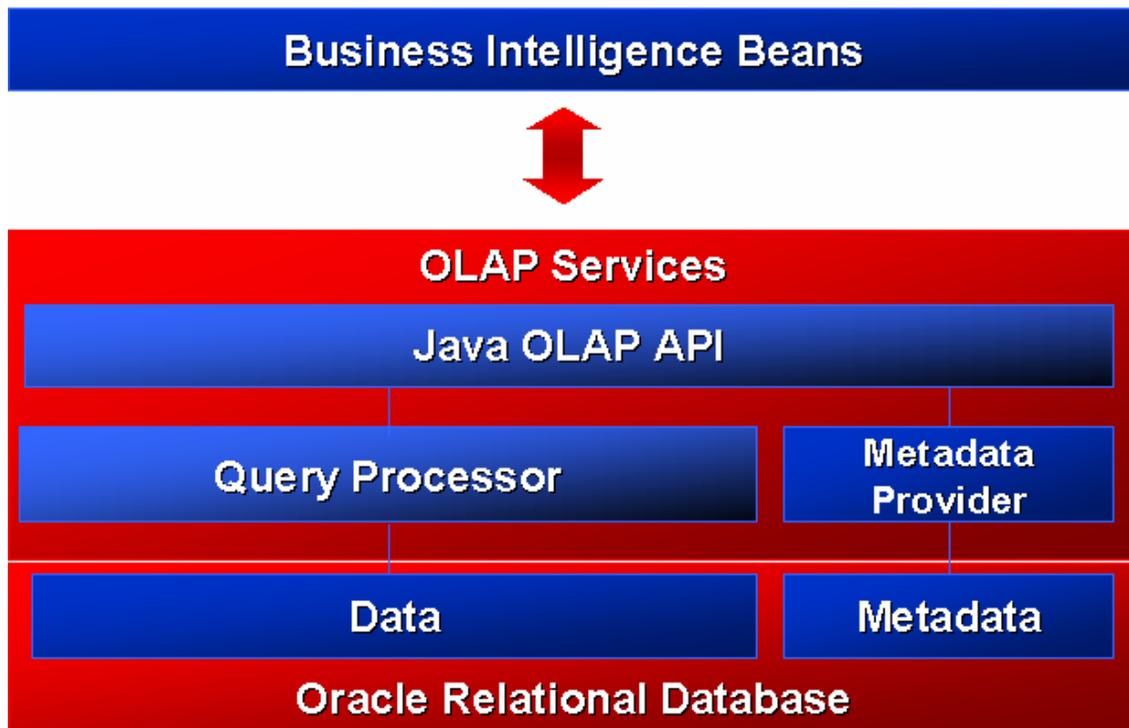


Figure 1. Oracle OLAP Services Architecture

## ANALYSIS FUNCTIONS

The enhancements to SQL to support analysis functions have greatly improved in the recent years. The goal of these enhancements is to make it easier to write highly performant business intelligence queries against the database. A list of the family of queries that have been added is presented below:

- Ranking family
- Window Aggregate
- Reporting Aggregate family LAG/LEAD
- Linear Regression family
- Inverse Percentile family
- Hypothetical Rank and Distribution family
- FIRST/LAST Aggregates family

## MATERIALIZED VIEWS

One of the techniques employed in data warehouses to improve performance is the creation of summaries, or aggregates. Materialized Views are a special kind of aggregate view which improves query execution times by pre-calculating expensive joins and aggregation operations prior to execution, and storing the results in a table in the database. For example, a table may be created which would contain the sum of sales by region and by product.

## COMMON WAREHOUSE METADATA

One of the most important advances is the establishment of a metadata standard. Metadata is used to represent a wide range of information, including information about the sources that are used to create the data warehouse, data transformations, security and business rules, etc. Metadata is what gives meaning to the data in the data warehousing environment. In order for tools to interoperate, they must understand each other's metadata, and they must be able to cooperate and use the metadata generated by each other.

Common Warehouse Metadata (CwM) defines a standard for metadata sharing. The objective of Common warehouse Metadata is to provide an open standard metamodel and application program interfaces (APIs) for data warehousing and decision support tools.

Common Warehouse Metadata enables end user customers to dramatically lower the initial and ongoing costs of building, operating and using data warehouses for decision support by providing an open object model and an open, network-oriented API.

## JAVA OLAP API

The Oracle OLAP API is a Java programming interface to OLAP Services. The analytical BI Beans are built using this API; you can extend (or even replace) the functionality provided by the BI Beans by using Java classes.

The Oracle Java OLAP API is designed from the 'ground up' for OLAP. It is a modern Java, object-oriented API. It provides a simple means of expressing complex multidimensional queries containing with high analytic content.

The Java OLAP API complements the new SQL analytical functions the relational database. Relatively simple analytical applications might choose to use SQL, while more sophisticated analytical applications will use the Java OLAP API. OLAP Services will make significant use of new SQL analytical functions in the relational database

Key features of the Java OLAP API include:

- A multidimensional object model. Other Java OLAP API APIs do not provide an object model - it's up to each application to implement one. This is not a trivial task.
- A complete set of OLAP calculation functions (for example, statistical, mathematical, financial, and time series functions).
- Support for asymmetric queries. For example, nested rankings.
- Calculated (virtual) dimension members that can be used just as stored dimension members.
- Incremental query construction. For example, select all products at the Item level, keep products where sales grew 50% or more as compared with last year, remove products with a margin of less than 25%.
- Multidimensional cursors allow an application to request a subset of data within the users query (for example, only those cells of data which can actually be displayed on the users monitor). This offers significant performance tuning opportunities to the application developer.

## ORACLE BUSINESS INTELLIGENCE BEANS

To meet the needs of the marketplace, Oracle has developed BI Beans. These components enable the rapid development of OLAP applications. The combination of the Java OLAP API and Common Warehouse Metadata provide APIs that make the BI capabilities of those servers accessible to Java programmers. The role of BI Beans is to complete the engine-API-tools offering by providing the following:

- Graphical views of OLAP data including a pivot table and rich business charts
- User interfaces for easily formulating OLAP queries, calculations, sorting criteria and other analytic functions, both at application design-time and at run-time
- Support for visual programming using Java integrated development environments (IDE)
- Support for building Internet computing-compliant n-tier OLAP applications
- Interoperability with third-party components through support for open standards, notably Beans, CORBA/IIOP and InfoBus

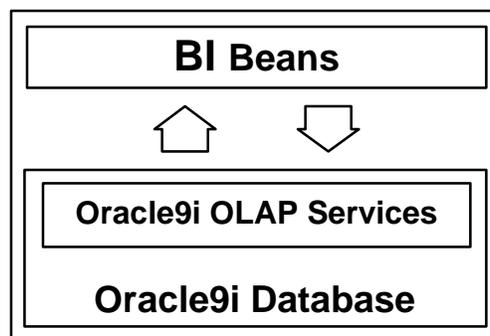


Figure 2. BI Beans and Oracle OLAP Interaction

The Oracle Java Tools will provide a tools infrastructure (IDE, repository, n-tier development, modeling, etc.) that will enable developers to build applications that take advantage of Internet computing. The BI Beans leverage the services provided by Java and

fit naturally into the Java environment. People who become proficient in developing applications using Java will be able to construct robust BI applications without having to learn separate tools or infrastructure-related concepts.

*Key Features of BI Beans:*

- Support visual development
- Transform any Java IDE into a powerful OLAP development tool
- Standard pages without programming
- Optimized for Oracle environments
- Open, standards-based
- Beans: properties, methods, and events
- Property Editors and Customizers
- BI functionality can be built into any Java based application including Relational based applications

Oracle’s JDeveloper has been enhanced with design-time running of objects, wizards for creation of “BI Pages” and a rich set of customizers and property editors to allow for very rapid BI application development.

### **ROBUST SET OF ANALYTICAL COMPONENTS**

The first release of the BI Beans focuses on the most common BI components used in analytical applications today. In particular, the following JavaBean components that comprise the application fall into three general categories: 1) presentation beans, 2) analysis beans and 3) persistence services. Below is a diagram describing the relationships between the components.

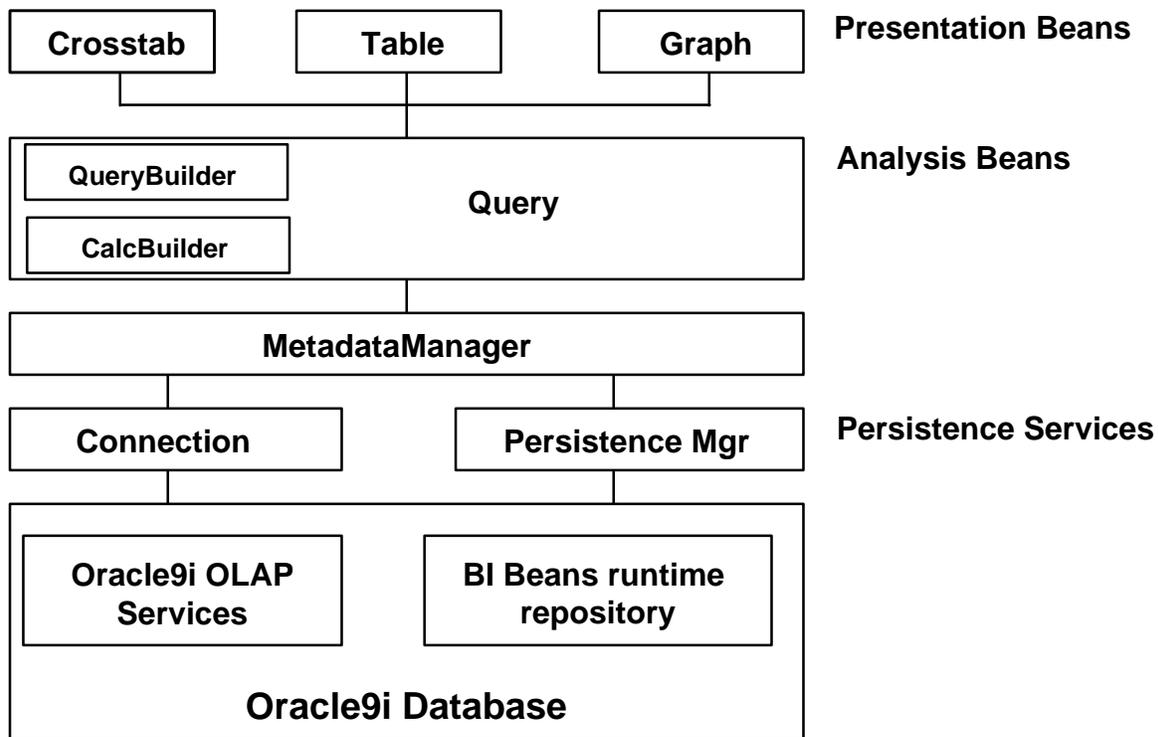


Figure 3. BI Beans Architecture

### **PRESENTATION BEANS**

*GRAPH, TABLE AND CROSSTAB*

The Presentation Beans display the results of queries using graphs, tables and crosstabs. Depending on the nature and requirements of the application, these data presentations may be Java or HTML based. For example, high-end analytical users who spend a large

percentage of their work week analyzing past business performance or developing forecasts of future performance need a highly interactive environment. The Java versions of the Presentation Beans enable a rich, interactive experience. For example:

- rotating the dimensions in a presentation is accomplished using drag and drop
- formatting is achieved through direct manipulation. A formatting toolbar is offered to enhance the interaction.
- data entry with clipboard support is provided.
- frozen row and column headers aid the navigation through large reports.

The HTML versions of the presentation beans can display the custom formats that have been defined and saved by the Java client. They also have the added benefit of not requiring Java to be downloaded to the client. However, the interactive definition of formatted documents is more difficult and end users are subject to the limitations of HTML.

## **ANALYSIS BEANS**

The Presentation Beans are solely responsible for rendering the data in different formats. The business logic is provided by the Analysis Beans. This separation of the business logic from the presentation is extremely important because it enables multiple clients (e.g. Java, HTML, WAP, etc.) to access the same application code.

The following components comprise the Analysis Beans:

## QUERY

Behind any report or chart is a query. The query specifies exactly what the user is viewing in the presentation: the measures (e.g. Sales, Costs), dimensions (e.g. Product, Geography and Time), selections for each dimension (e.g. last 6 months) and the layout of the dimensions (e.g. Product in the rows, Time in the Columns, paging on Geography).

Much of the business logic for a business intelligence application is contained in the Query. One typically thinks that drilling down on the Northeast Region in a crosstab as an operation that takes place on the Crosstab bean. In reality, this is not the case; the operation is affecting the query that the underlying Crosstab is displaying. As mentioned earlier, the Crosstab is simply a rendering engine that is displaying query results. User interactions such as paging and pivoting are also methods on the query.

The Query bean uses the Java OLAP API to query and manipulate data. The Java OLAP API, in turn, generates highly tuned SQL to resolve the request.

## QUERYBUILDER

The QueryBuilder provides a simple user interface to define the query. It is a very powerful tool that enables users to specify the following query properties:

- the measures and dimensions
- the dimension selections (e.g. Top 5 Products sold in each City)
- the layout of the dimensions on the report

A key strength of the QueryBuilder is that the end user does not need to understand a query language to define the query. Powerful queries are made simple by presenting the query definition in business terms - which end users modify to meet their needs.

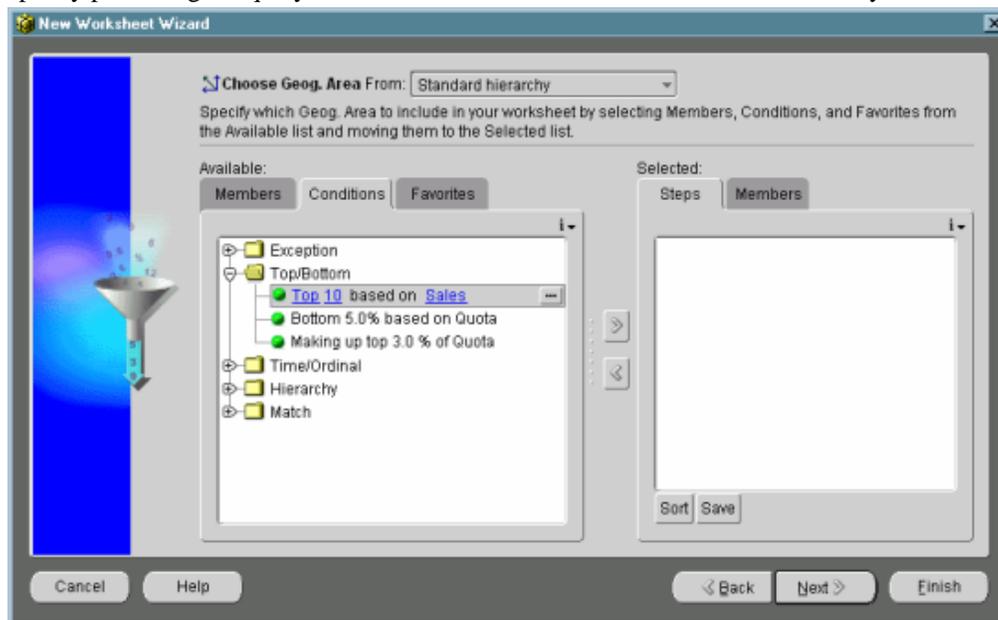


Figure 4 - QueryBuilder

## CALCBUILDER

The Calculation Builder allows users to create derived calculations (custom measures) through templates. Calculation Builder has full support for the advanced analytic functions of Oracle9i OLAP, including functions for time-series analysis, and many other calculations.

## BI BEANS CATALOG

The BI Beans Catalog is used to save, retrieve, and manage all developer-defined and user-defined analytical objects, such as reports, graphs, favorite queries, and custom measures. Object definitions are stored in the Catalog as XML. The BI Beans Catalog is designed

to support large distributed user communities who share analytical objects in collaborative environments. Developers take advantage of the Catalog at design time and hook application logic to the Catalog, so users can access Catalog functionality from the application at runtime.

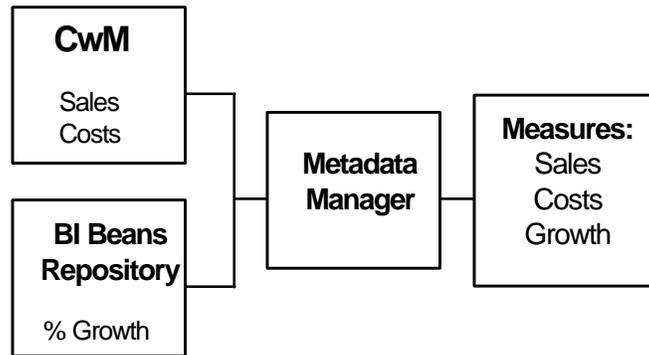


Figure 5 BI Catalog Architecture

End users need to access common pieces of information (e.g. Sales and Costs); this information is stored in the CwM or ECM. Users also need access to personal calculations (e.g. % Growth) whose definitions are stored in the beans repository. These personal calculations may not be meant for general use, so they have not been defined into the common schema.

When creating a new query or calculation, users need integrated view of both personal and common metadata. The BI Catalog provides that integrated view of information.

#### USER INTERFACE COMPONENTS

BI Beans also provides Java-based and HTML versions of user-interface components to support the opening and saving of objects to the Catalog. The BI Explorer (pictured right) provides Catalog browsing functionality similar to Windows Explorer. You can also create folders and set security privileges.

#### THICK OR THIN BEANS?

The application developer has the choice of constructing applications using either a Rich (thick) Java Front-End or an HTML based Thin Client. The current 9i Beans development environment includes the capability to create a full featured Rich client that allows for complete interaction with the OLAP data stored in the Oracle database. The 9i Beans can currently create a thin client that does not have all the features available to the thick client. Such features as allowing the user access to the Querybuilder, CalcBuilder and presentation formatting is not available. The soon to be release 10g Beans adds many new features, mainly focused on thin client development, which include:

1. An HTML based Query Builder
2. An HTML based Calc Builder
3. Formatting Toolbar
4. Basic Stop Light Reporting on the HTML Toolbar
5. Formatted Export to Excel (Thin and Thick)
6. Many new wizards that allow for creation of Java, UIX (thin), and JSP(thin) applications frameworks

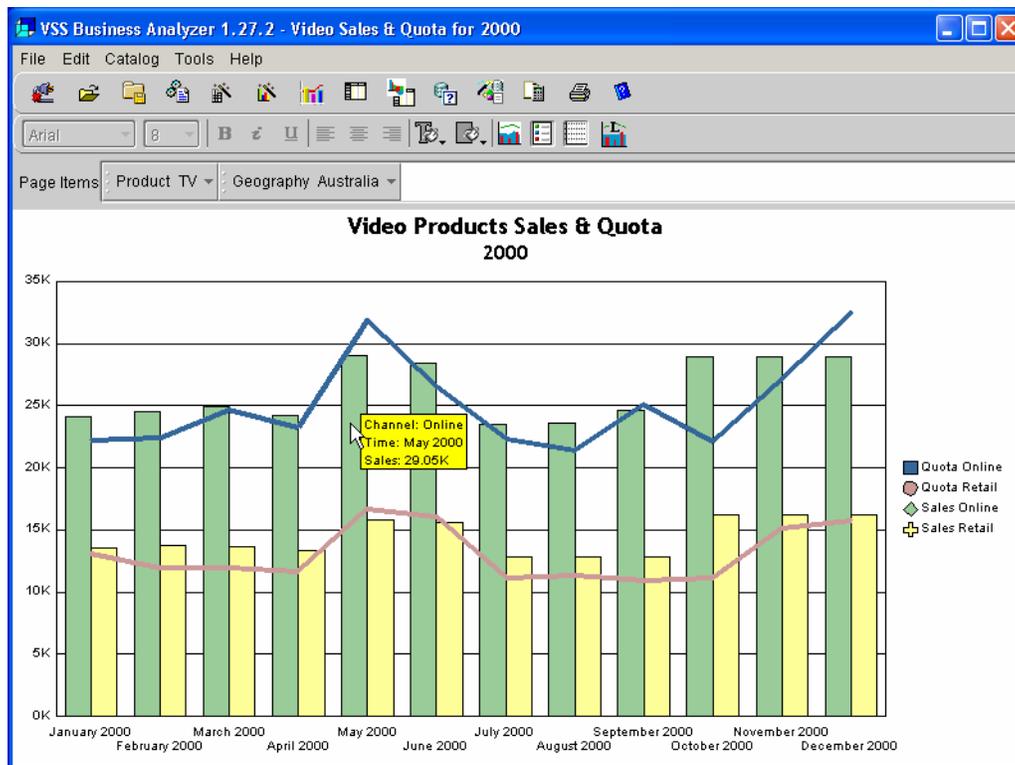
While the new HTML based functionality does not have the traditional windows “Drag and Drop” functionality the developer is still capable of creating an application that provides a full set of features to the end user who wants to have the ability to create or modify existing reports via a browser interface.

### DESIGN AND IMPLEMENTATION CONSIDERATIONS

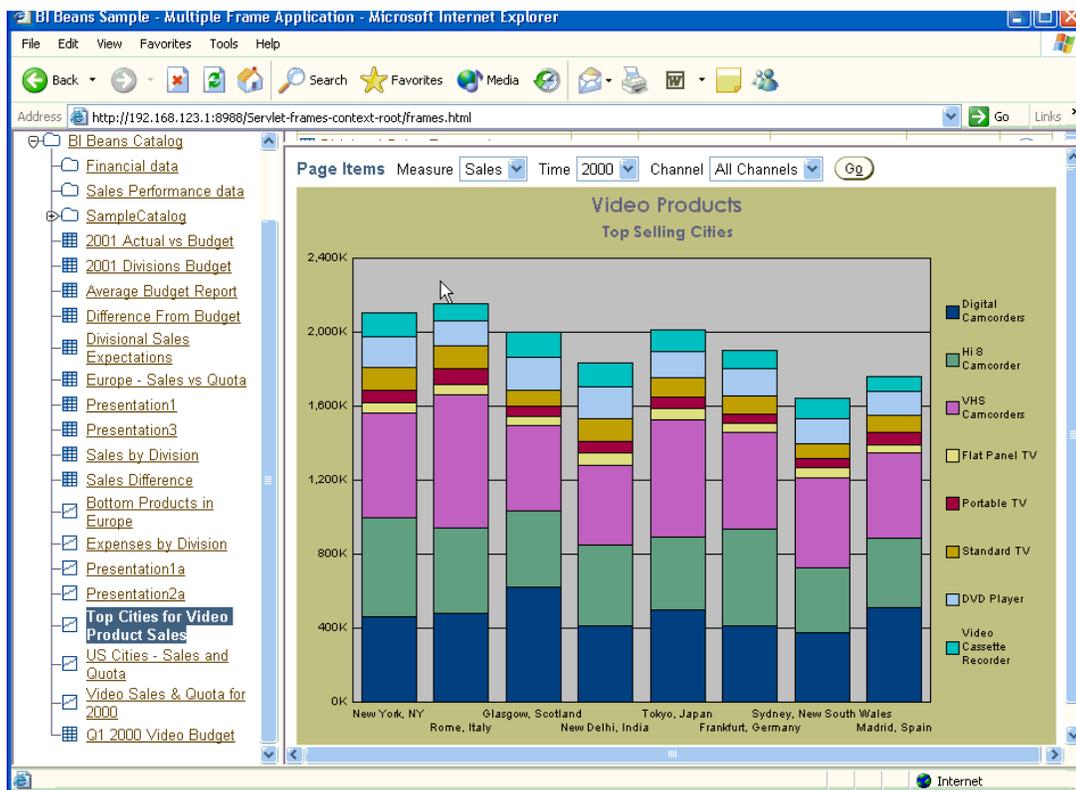
There are several issues that need to be considered when building BI Beans applications. Since BI Beans is now based upon Java there are enhanced functionality and flexible deployment options along with some limitations. There are some things that cannot be done in the thin client that can be done in the thick client. Most of these limitations pertain to usability and how the end-user wants the application to operate. .

Deployment options are now more flexible and have a much bigger impact on how the application is designed. The choice of fat or thin java/html client needs to be made and with this choice comes limitations on how the application looks and operates. If the desire is to have a simple high speed reporting system then thin client (html) deployment is the best choice. If download speed and workstation foot-print is not an issue and a more sophisticated front-end is necessary then a java client based application may be the best. A java client application will more closely resemble the windows client look and feel provided by OEO and Express Analyzer.

Figures 6 and 7 show examples of applications that were developed using JDeveloper and BI Beans and deployed either as a Java Client or a Thin (HTML) client. During the presentation the development process and applications possible with JDeveloper and BI beans will be demonstrated.



**Figure 6. Thick BI Application (VSSBA)**



**Figure 7. Thin BI Application**

## GOING BEYOND THE WIZARDS

While the wizards provided with BI Beans allow for creation of a working application they still only provide basic applications. The new thin client application wizards provide a more complete thin client application than the thick(java) client application wizard does. But even these applications can be improved. Using the generated applications as a basic framework is an excellent way to start. It is fairly simple to add features to these applications to enhance their functionality. The demonstration during the presentation will show how to add additional buttons and functionality, like a catalog browser and drill to detail functionality, to the generated JSP application.

## CONCLUSION

The ultimate goal of using Oracle JDeveloper and BI Beans is to enable the developer to provide an application to the end users that will allow them to gain a better understanding of their business performance in a productive way. This means that it is often important to deliver analytic content within the context of existing applications. The JDeveloper environment can not only develop traditional relational database applications but also provide for the development of comprehensive BI applications as well. This allows the development teams to leverage their valuable skills and provide more comprehensive mission critical solutions to meet the needs of all the users.

The result is quite simple – better business decisions due to more informed decision-makers.