



IBM Software Group

WebSphere® Adapters V6.0.2

IBM WebSphere® Adapter for JDBC V6.0.2



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Updated March 9, 2007

This presentation will focus on the details of the business object model of WebSphere Adapter for JDBC V6.0.2

Agenda

- **Business Object Model**
- Inbound and Outbound Operations
- Summary and References

This section provides an overview of the object model.

Business Object Structure

- Two types of business objects

- ▶ First type

- Includes Tables, View, Stored Procedures, and Synonyms/Nicknames
 - Analyzes the database to get all schemas first
 - Creates a list of Tables, Views, Stored Procedures, and Synonyms/Nicknames from the database as a tree structure
 - Each simple attribute (represents a single value) within the object corresponds to a column in that selected database objects.
 - represent a view that spans multiple database tables
 - Stored Procedures
 - Only support service type Outbound
 - Support all operations in Outbound
 - New Execute operation

The JDBC Enterprise Metadata Discovery (EMD) allows you to generate BOs from the objects in a database. Currently it generates business objects (BOs) from 2 types of objects. The first type of business object includes Tables, Views, Stored Procedures and Synonyms/Nicknames. And the second type of object is the User-specified select statement.

In first type of business object, JDBC EMD will allow you to discover the objects by generating a list of all the schemas in the database first. Within each schema there will be lists of Tables, Views, Stored Procedures and Synonyms/Nicknames that you are allowed to select and request JDBC EMD to generate the corresponding BOs for them. The JDBC EMD will analyze the metadata of the selected objects and generate attributes in the BO. Those attributes are generated based on the columns of those selected database objects. Each simple attribute within the object corresponds to a column in that table or view. Each business object can represent a view that spans multiple database tables. The WebSphere Adapter for JDBC can use this type of business object when processing outbound requests with the operations of retrieve and retrieveAll or processing inbound events with the operations of create, update, and delete.

If you have chosen to add Stored Procedures to the BOs, the Verb Application Specific Information (ASI) will be set as specified in the table. It would support all operations in Outbound service type only. A new Execute operation is available with Store Procedure and it deals with execution of the Store Procedure.

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Business Object Structure (Cont.)

▶ Second type

- User-specified select statement (QueryBO)
 - Specifies one select statement first
 - Specifies BO name, type, and dummy values of all parameters in the where clause
 - Executes to get list of columns, and their types
 - Generates one Query BO for that select statement
 - Only support service type Outbound
 - Supports only one operation RetrieveAll



In the second type, JDBC EMD allows you to specify one select statement first. You will then need to specify BO name, the types and dummy values of all parameters in the 'where' clause. The JDBC EMD will run this select statement, and analyze the metadata of the returned ResultSet to get the list of columns, and their types. After getting such information, JDBC EMD will generate one Query BO for this select statement.

Business Object Structure

- Each BO can be flat or hierarchical
 - ▶ Flat
 - All attributes are simple and represent one row in the table
 - ▶ Hierarchical
 - Attributes represent a child BO, an array of child BOs, or a combination
 - Each child BO can contain a child BO, an array of child BOs or a combination

Each business object can be of a flat or hierarchical structure. A flat structure is where all attributes are simple and represent one row in the table. A hierarchical structure is where attributes represent a child business object, an array of child business objects or a combination.

Business Object Structure

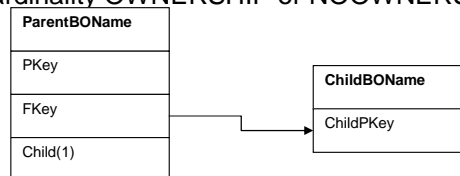
- Data descriptions generated from the database components using Enterprise Service Discovery are represented as XML schemas
- Business Object
 - ▶ Maps to a complex type definition
 - ▶ Attributes map to element type definition
 - ▶ Application Specific Information is contained in annotations at the complex type
 - ▶ Application Specific Information for each property is contained in annotations for the element types



Data descriptions generated from the database components using enterprise service discovery are represented as XML schemas. Looking at the structure of a business object, the business object maps to a complex type definition and attributes map to element type definitions. Application specific information is contained in annotations at the complex type, and application specific information for each property is contained in annotations for the element types.

Hierarchical Business Object Single Cardinality Relationship

- Parent BO has an attribute that represents one child BO
 - ▶ At least two attributes represent the relationship stored in the parent BO
 - The type of one attribute in the parent BO is of the same type as the child BO
 - A simple attribute that contains the child BO's primary key as a foreign key in the parent BO
 - ▶ Parent BO has as many foreign key attributes as the child BO has primary key attributes
 - ▶ Each parent BO can have only one child BO of a given type
 - ▶ Parent BO can have cardinality OWNERSHIP or NOOWNERSHIP child BO (lookup tables)

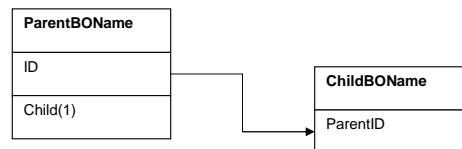


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The next several slides discuss hierarchical business object cardinality relationships. In case of a hierarchical business object with a single cardinality relationship, the parent business object has an attribute that represents one child business object. At least two attributes represent the relationship stored in the parent business object. In the parent business object, the type of one attribute is of the same type as the child business object. Also, a simple attribute in the parent business object contains the child business object's primary key as a foreign key. Since the foreign key for the child business object is stored in the parent business object, each parent business object can have only one child business object of a given type. Cardinality can be of the ownership or noownership kind. With ownership, typically each parent business object owns the data within the child business object that it contains. For example, customer business object contains one address business object. When a new customer is created, a new row is inserted into both Customer and Address tables; likewise for other operations. The address is unique to that customer. In case of nowownership, there are cases where multiple hierarchical business objects contain the same data, which none of them owns. For example, address business object contains a state business object that represents the state lookup table. When a new address is created, the state is basically retrieved from the lookup table and not created; likewise for other operations. The state business object is independent of the address business object.

Hierarchical Business Object Single Cardinality Relationship (Cont.)

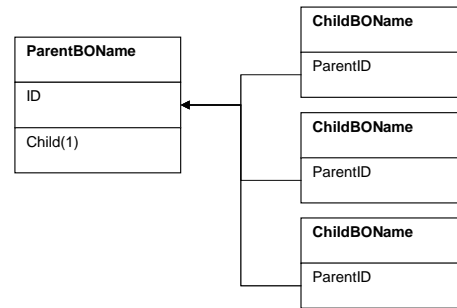
- Relationship is stored in the child BO
 - ▶ Child BO contains a foreign key whose value is identical to the value in the parent BO's primary key
 - ▶ Child BO does not exist independently of its parent BO and can be accessed only through the parent BO
 - ▶ Requires the parent BO and its primary key value to exist before the child BO and its foreign key value can be created



Another case of a hierarchical business object with a single cardinality relationship is where the relationship is stored in the child business object. In this case, the child business object contains a foreign key whose value is identical to the value of the parent business object's primary key. The child business object does not exist independently of its parent business object and can be accessed only through the parent business object. This type of relationship requires that the parent business object and its primary key value exist before the child business object and its foreign key value can be created.

Hierarchical Business Object Multiple-Cardinality Relationship (Cont.)

- An attribute in the parent BO represents an array of child BOs
 - ▶ Has only one attribute that represents the relationship (primary key)
 - ▶ Foreign key is stored in the child BO
 - ▶ Child BO has as many foreign keys as the parent has primary keys
 - ▶ Each parent BO can have 0 or more child BOs



In case of a hierarchical business object with a multiple cardinality relationship, an attribute in the parent business object represents an array of child business objects. The parent business object has only one attribute that represents the relationship, the primary key. The foreign key is stored in the child business object. The child business object has as many foreign keys as the parent has primary keys. Each parent business object can have zero or more child business objects.

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- Business Object Model
- **Inbound and Outbound Operations**
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This section provides details of inbound and outbound operations

Application Specific Information

- **Business Object ASI**
 - ▶ **TableName**
 - Database table associated with the business object
 - ▶ **StatusColumnName**
 - Name of the database column used to perform logical delete operations. If defined, the adapter performs a logical delete operation. If not defined, the adapter performs a physical delete operation.
 - ▶ **StatusValue**
 - Signifies whether a business object is inactive or delete
 - ▶ **SPName**
 - The name of stored procedure
 - ▶ **ResultSet**
 - Indicates if the stored procedure will return ResultSet or not
 - ▶ **MaxNumberOfRS**
 - Represents the number of result sets that the stored procedure returns
 - ▶ **ReturnValue**
 - Name of corresponding attribute in the Stored Function business object
 - ▶ **SelectStatement**
 - The SELECT statement

Application-specific information in business object definitions provides the adapter with application-dependent instructions on how to process business objects. The adapter parses the application-specific information from the attributes or verb of a business object or from the business object itself to generate queries for create, update, retrieve, and delete operations. The adapter stores some of the business-object's application-specific information in cache and uses this information to build queries for all the verbs.

Application Specific Information (Cont)

- Verb ASI
 - ▶ Associate Stored Procedures at the verb level
 - ▶ Each Stored Procedure definition consists of:
 - StoredProcedureType
 - Determines when the stored procedure is called
 - A total of 15 Verbs ASIs to configure
 - For example: BeforeCreateSP, AfterCreateSP, CreateSP, . . .
 - StoredProcedureName
 - Name of the Stored Procedure associated with the appropriate StoredProcedureType
 - ResultSet
 - Determines whether a resultset is returned
 - Parameters
 - Can be a combination of input only (IP), output only (OP), and input and output (IO)
 - ReturnValue
 - Implies that it is a function call and not a procedure call. The parameter will be set to "RS" or a BO attribute's name if the stored procedure has a return value.

In the case of verb application specific information, associated stored procedures are specified. Each stored procedure definition consists of the storedproceduretype, storedprocedurename, resultset, and parameters. Oracle stored procedures can return ResultSets as OUTPUT parameters only, whereas other databases return them as return values. This feature for Oracle is handled by defining an output parameter as a ResultSet (OP=RS).

Application Specific Information (Cont)

- Attribute ASI for attributes
 - ▶ ColumnName
 - ▶ PrimaryKey
 - ▶ ForeignKey
 - ▶ UniqueIdentifier (UID)
 - ▶ OrderBy
 - ▶ FixedChar
 - ▶ ByteArray
 - ▶ KeepRelationship
 - ▶ Ownership
 - ▶ BLOB
 - ▶ CLOB
 - ▶ DataType
 - ▶ SPPParameterType
 - ▶ ChildBOType
 - ▶ ChildBOTypeName

The application-specific information for attributes differs depending on whether the attribute is a simple attribute or an attribute that represents a child or an array of child business objects. The application-specific information for an attribute that represents a child also differs depending on whether the parent-child relationship is stored in the child or in the parent

Business Object Content

- Relate to the amount and purpose of information conveyed by the business object
- After Image
 - ▶ Presence of a top-level verb indicates After Image
 - ▶ State of business object after all changes have been made
- Delta
 - ▶ Absence of a top-level verb indicates Delta
 - ▶ Operation must be ApplyChanges and no verb specified
 - Adapter will inspect ChangeSummary information to identify the operation for each business object
 - ApplyChanges is an outbound operation

The business object content relates to the amount and purpose of information conveyed by the business object. There are two categories of business object content, after image and delta. After image content represents the state of the business object after all changes have been made. This type of content is indicated by the presence of a top-level verb in the business graph of the business object. Delta content represents the changes that have happened to the business object content. This type of content is indicated by the absence of a top-level verb. The outbound operation, applyChanges, only supports the delta content.

Operations

- Operations
 - ▶ A business object is passed to the adapter as a request that is processed according to the operation specified in the business object
- Inbound operations
 - ▶ After Image support only
 - Create
 - Update
 - Delete



Operations specified in the business object indicate what type of processing is requested. Business objects are passed to the adapter and processed according to the operation specified. In the case of inbound operations, after-image only support is available for the create, update, and delete operations.

Operations

- Outbound operations

- ▶ After Image

- Create
 - Update
 - Delete
 - Supports physical and logical deletes

- ▶ Delta support

- ApplyChanges (no top level verb exists)
 - Adapter will inspect ChangeSummary information to identify the operation for each business object



In case of outbound operations, after image support is available for create, update, and delete; delta support is available for applyChanges.

Operations

- Outbound operations

- ▶ Other supported operations

- Retrieve
 - RetrieveAll
 - Allows an array of business objects to be retrieved from the database
 - ResultSetLimit property determines number of records to return
 - Execute
 - Available with Stored Procedure only
 - Handles stored procedures different
 - Generates the required Stored Procedure BO corresponding to the SP definition in the database

Other supported outbound operations include retrieve and retrieveAll. In the case of retrieve, when given a hierarchical business object, the retrieve operation first makes a copy of the top level business object without any children. It will then recursively retrieve the child business objects starting with the parent of the incoming business object. In the case of retrieveAll, this operation enables the adapter to retrieve an array of business objects from the database. The ResultSetLimit property determines the number of records to return. This value can be set during the enterprise service discovery process, by specifying the value for MaxRecords on the Configure Objects panel for outbound ServiceType. Lastly, the new operation Execute is used with Stored Procedures (SP) only. It will generate the required SP corresponding to the SP definition in the databases.

Verbs

- Verbs
 - ▶ Reflect the state of the business object
 - ▶ Are definable in the Business Graph for After-Image business objects only
 - ▶ Are used to communicate the type of After-Image event
 - ▶ Verbs supported for After-Image
 - Create
 - Update
 - Delete
 - UpdatewithDelete

Verbs reflect the state of the business object and are definable in the Business Graph for after-image business objects only. The verb is used to communicate the type of after-image event. The four verbs supported for an after-image event are create, update, delete, and UpdatewithDelete.

Agenda

- Business Object Model
- Inbound and Outbound Operations
- **Summary and References**



This section summarizes and provides references for the WebSphere Adapter for JDBC V6.0.2.

Summary

- Provided different types of Business Objects
 - ▶ Tables, View, Stored Procedures and Synonyms/Nicknames
 - ▶ QueryBOs
- Looked at how each business Object is mapped
- Identified Business Object relationships
 - ▶ Flat
 - ▶ Hierarchical Single and Multiple Cardinality Relationships
- Surveyed application Specific Information for Business Object, Verb, and Attributes
- Specified Inbound and Outbound Operations

To summarize this presentation, the WebSphere Adapter for JDBC provides different types of business objects. They are including tables, view, stored procedures, synonyms/nicknames, and queryBOs. You have learned how each business object is mapped and been able to identified different business objects relationships. Application Specific Information is also examined for Business Object, Verb, and Attributes. Lastly, inbound and outbound operations are specified in the business object and they indicate what type of processing is requested.

Reference Information

- WebSphere Adapter for JDBC User Guide
- Java Connector Architecture
 - ▶ <http://java.sun.com/j2ee/connector/index.jsp>
- Enterprise MetaData Discovery
 - ▶ <http://www.ibm.com/developerworks/java/library/j-emd/>
- WebSphere Adapter Information Center
 - ▶ <http://www-306.ibm.com/software/integration/wbiadapters/library/infocenter/>
- WebSphere Process Integration Information Center
 - ▶ <http://publib.boulder.ibm.com/infocenter/dmndhelp/v6rxmx/index.jsp>



Additional reference information can be found at these URLs.

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