

to be used in constructing a query diagram; and Database Contents, which allows the contents of an active database schema to be browsed. The contents of the query design category may be presented in palette form. The database contents category may be presented in tree form where column names underneath each table and view may display the name of the column and its type, separated by a double colon (for example, "employee_name::varchar"). The database contents tree can be used to browse the active schema.

[0050] Each open world may contain zero or more open editor windows. Each of the four types of editors may display a unique icon, followed by text describing the type of editor and the editor's contents. The format of the text may be in an abbreviated format or an extended format as follows:

[0051] EditorType: Contents

[0052] or

[0053] EditorType: WorldName[.ExtendedContents],

[0054] where EditorType is the type of editor ("Scene", "Data Element", "Query", or "World"), WorldName is the name of the world containing the contents, and Contents is the short name for the object being edited (for example, "DataElement1"), and ExtendedContents is the long name for the object being edited that includes the tokenized names of all parent objects, separated by periods (for example, "Scene1.ScatterChart1.DataElement1").

[0055] More than one editor window may be opened for a given part of a world. For example, the same scene may be edited in one editor at 100% magnification to see the entire scene, while another editor may be zoomed in to a smaller portion of the scene. A change to the scene in either editor may be reflected in both windows.

[0056] The scene editor window is used for graphically editing and debugging the contents of a top-level scene. The editor has two modes: a design mode and a runtime mode. In design mode view, objects are added from the graphics palette and displayed without the execution of any queries. Objects that are bound to data sources through one or more property values are represented by placeholder objects. In addition, no object events are generated, so any actions associated with objects are not executed. Scenes may be edited at any zoom level, which may be set from the navigation toolbar.

[0057] The design mode view provides two optional docking toolbars: a Selector Bar and a Parameter Bar. Scenes may be represented differently at different zoom levels, where each representation or drawing defines a LOD. The selector bar provides control over which LOD is currently being edited. The parameter bar displays a button for each parameter in the scene. If a scene has no parameters, the bar is not displayed unless it has been manually turned on from the View menu. The parameters displayed in the palette may be used in the Object Inspector for setting the value of an object's properties. The parameter bar may be updated automatically when parameters are created, deleted, or edited.

[0058] When the runtime mode is selected, the scene contents are compiled into byte code and then displayed, as discussed below. Any associated queries are executed, object events are generated, and associated actions are performed.

The runtime mode supports full navigation capability, so wormholes or jump links to other scenes are accessible. If a jump is made to another scene, the design view is also switched to the new scene. The runtime mode may be viewed simultaneously during edit operations in the design view by opening a second window. Multiple runtime views displaying the same scene operate independently and may not be slaved together. Each view has its own copy of global parameters which may be reflected in the world scenes tree for the active runtime view.

[0059] The data element editor window is used for graphically editing the representation of a data point resulting from a query. The data element editor window is shown in the design mode in **FIG. 12**. Both the selector bar and the data sources bar are visible.

[0060] Similar to the scene editor window, the data element editor has two modes: design mode and a runtime mode. In the design mode view, objects are added from the graphics palette and displayed without the execution of any queries. Objects that are bound to data sources through one or more property values are represented by placeholder objects. In addition, no object events are generated, so any actions associated with objects are not executed. Data elements may be edited at any zoom level, which may be set from the navigation toolbar.

[0061] The data elements may be represented differently at different zoom levels, where each representation or drawing defines an LOD. In addition, different objects in the data element may be associated with different axes. For example, a stock chart with volume-of-trading bars may have two Y axes. The data element for each trade day may have a high/low/close bar associated with the price axis and a volume bar associated with the volume axis. The selector bar provides control over which LOD and set of axes may be edited. The parameter bar displays a button for each parameter in the scene. The parameters displayed in the palette may be used in the Object Inspector for setting the value of an object's properties. The parameter bar is updated automatically when parameters are created, deleted, or edited.

[0062] The data sources bar displays a strip of buttons for each data source within scope of the data element. Each button corresponds to a column name that may be used in the Object Inspector. For a simple layout, a single data source is displayed. For nested layouts, a row may be displayed for each query. A query is considered in scope if the associated data element object exists as an ancestor to the data element in the world scene tree. The data sources bar may be updated automatically when data source columns are created, deleted, or edited.

[0063] The query editor offers three views of a query: the data sheet which displays the results of a correctly formed query; the query diagram view which provides a block diagram of the query structure; and the SQL view, which displays the actual SQL text. The user may switch between views by clicking on one of the corresponding mode buttons at the bottom of the window to the left of the scrollbar.

[0064] The data sheet view is a read-only view which shows the tabular results of the query. If the query is parameterized, the datasheet may only be available when a default value is available for each parameter contained in the query. The data sheet may be viewed simultaneously during