

# **DataMontage™**

**Version 5.0**

## **Developer's Guide**

## DataMontage Version 5.0 Developer's Guide

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# 1 Getting Started

## 1.1 Overview

The DataMontage™ software system is a collection of Java and JavaScript software applications and libraries that enable you to create, display, and print information-dense arrays of timelines, XY graphs, and notes that share a common X or datetime axis. This document describes how to use the *DataMontage Software Developer's Kit to develop and deploy applications which embed DataMontage software*. This document presumes familiarity with the appearance and interactive behavior of these graphical displays as described by the *DataMontage Version 5.0 User's Guide*.

The DataMontage Software Developer's Kit comprises:

DataMontage/J Run-time Library	Java library that can be called from within client-side and server-side Java applications to create, modify, load, save, and display DataMontage graphical displays. In version 5.0, this library also includes functions for exporting DataMontage Java-based container objects into JSON objects that are read by DataMontage/JS. The DataMontage/J library is described in sections 6 through 12. The application programming interface (API) is described by Javadoc documentation that is included in the Developer's Kit.
DataMontage/JS Run-time Library	JavaScript library that can be called from within JavaScript programs running within Web browsers to display DataMontage graphical displays encoded as JSON objects using JavaScript and Scalable Vector Graphics (SVG). The DataMontage/JS library is described in section 13. The DataMontage JSON format mirrors a subset of the DataMontage Java classes. The names of the properties in DataMontage JSON files are the same as the XML tags used in DataMontage XML configuration files.
DataMontage Editor	Window desktop application that enables you to create, edit, and save DataMontage configuration files that specify the content and appearance of graphical displays interactively, without programming.
DataMontage Viewer	Windows desktop application that enables you to view DataMontage configuration files that have been created by the DataMontage Editor or by a DataMontage/J application that uses the DataMontage/J run-time system.
DataMontage Applet	Java applet that displays DataMontage/J objects within a Web browser.

DataMontage software uses two types of files:

DataMontage Configuration Files (.dm, .xml)	These files contain serialized DataMontage container objects. These files can be zipped (.dm files) or unzipped (.xml files). They are usually created by the DataMontage/J run-time system, but they can also be created by programs written in other languages that write XML files.
DataMontage JSON Files (.json)	These JSON-format files contain serialized DataMontage container objects that can be read and displayed by DataMontage/JS run-time library. They can be created by using the DataMontage/J run-time system to export a DataMontage container object into json format. They can also be created by programs written in other languages such as a JavaScript program running within a browser.

Figure 1 shows the relationships among the DataMontage software components and files.

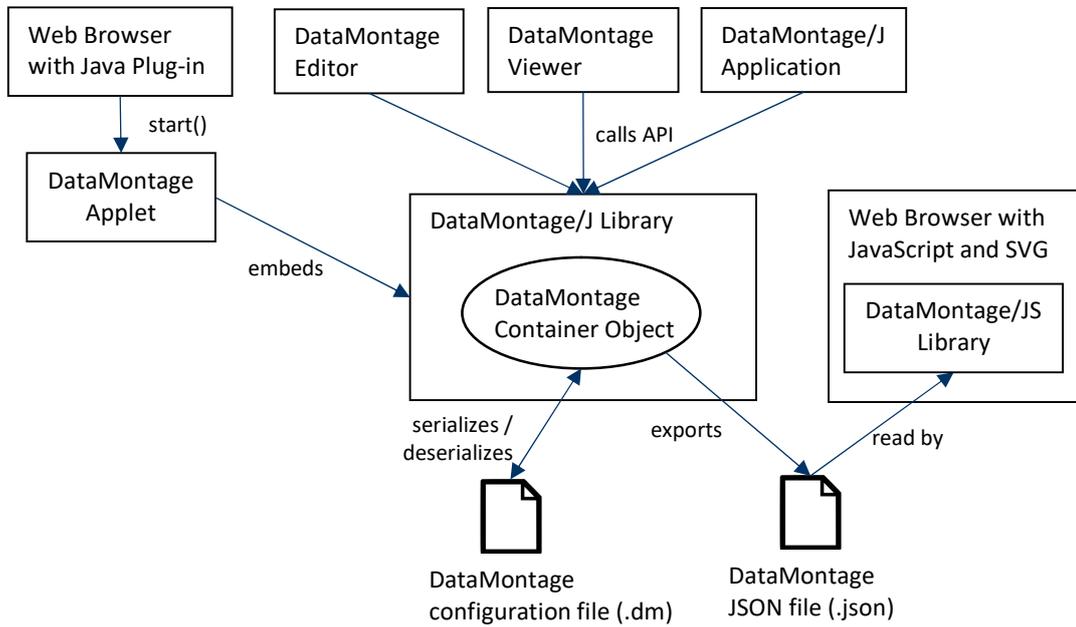


Figure 1 – DataMontage software components and files.

## 1.2 Configuration Requirements

RAM	4 GBytes
Free disk	20 Mbytes
Display monitor resolution	1024 x 768 pixels or higher
Display monitor colors	8 bit color or higher
Video memory	2 Mbytes
Java	The DataMontage Editor, DataMontage Viewer, and DataMontage/J run-time library require pre-installation of Java 7 or later. DataMontage/J was compiled using Java 7.
Operating System	The DataMontage Editor, DataMontage Viewer, and DataMontage/J run-time library are written in Java and run on Windows computers. The DataMontage software distribution provides Windows command files for launching the DataMontage Viewer and Editor desktop applications.
Web Browser	The DataMontage applet (deprecated) runs on Web browsers that support Java applets. The DataMontage/JS run-time library run on Web browsers that support JavaScript and Scalable Vector Graphics (SVG).

### 1.3 Installing DataMontage

Before installing a new version of DataMontage, uninstall any previous versions of DataMontage. If you need to run multiple versions of DataMontage on your computer, copy the entire previous installation folder to another location on your computer's file system before uninstalling a previous version.

To install a new version of the software, run the DataMontage installation program file (e.g., `DataMontage_5.0.exe`). By default, the installation program installs the files in the *installation folder* whose default location is `c:\Program Files\Stottler Henke\DataMontage 5.0`.

### 1.4 Uninstalling DataMontage

To uninstall DataMontage software, select *Add or Remove Programs* or the *Programs and Features* menu item from the Windows Control Panel. In the list of programs, select *DataMontage* and press the *Change/Remove* button. If DataMontage is not listed, run file *uninstall.exe* in the DataMontage installation folder.

### 1.5 Launching the DataMontage Editor

To invoke the DataMontage Editor, select *DataMontage/Editor* from the Windows *Start/All Programs* menu. This action runs Windows command file `runDataMontageEditor.bat` in the DataMontage installation directory. It invokes the Java run-time system and launches the DataMontage Editor application.

**Note:** If you are editing or displaying DataMontage graph containers that contain custom user interactions (section 9) that rely on certain Java classes and methods, edit the command file to include the appropriate Java libraries using the Java `-cp` switch. For example, if you use the SQL query operations feature to populate a graph container with data from a SQL database, edit the command file to include Java Database Connectivity (JDBC) driver library files needed to access the database. To run procedures that require large amounts of memory, use the Java `-Xms` and `-Xmx` switches to control memory allocation. If you use DataMontage in combination with different Java libraries, you may find it useful to create additional Windows command files with different settings.

### 1.6 Java

DataMontage 5.0 requires pre-installation of Java 7 or later. You can download the Java software distribution from <http://www.java.com/>.

### 1.7 Web Browsers

New in version 5.0, the DataMontage/JS library renders DataMontage displays within Web Browsers that support JavaScript and Scalable Vector Graphics (SVG).

### 1.8 Third Party Software

DataMontage 5.0 redistributes D3.js, a JavaScript library for manipulating documents based on data (<https://d3js.org/>). License: <https://github.com/d3/d3/blob/master/LICENSE>.

### 1.9 Distributing DataMontage Run-Time Software Files

If you have purchased DataMontage run-time licenses, you can distribute run-time software files and install them onto single-user desktop computers or onto server computers. These files include:

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- Java Software: DataMontage.jar
- JavaScript Software: files in folder /js.
- End user Documentation: DataMontage\_5.0\_users\_guide.pdf, DataMontage\_5.0\_overview.pdf

The DataMontage Developer's License allows you to use the following resources:

- *Software: DataMontageEditor.jar*
- *API documentation: files in folders java-doc and xml\_schema*

## 2 What's New

**Oracle has announced that support for Java applets will be deprecated in Java 9 and later. Oracle recommends that developers transition from Java applets to alternatives such as Java WebStart. See:**

- <http://www.oracle.com/technetwork/java/javase/migratingfromapplets-2872444.pdf>, and
- <https://docs.oracle.com/javase/tutorial/deployment/webstart/>.

DataMontage version 5.0 provides the following new capabilities for users and developers, compared to version 4.2:

Rendering containers within Web browsers using JavaScript.	Prior to version 5.0, DataMontage containers could be displayed within Web browsers using the DataMontage applet. The DataMontage/JS library, introduced in DataMontage 5.0, supports the rendering of DataMontage displays within Web browsers that support Scalable Vector Graphics (SVG). Currently, the SVG support renders timelines but not xy graphs.	Section 11.
Time zone properties	Prior to version 5.0, DataMontage used the Java Virtual Machine's (JVM) time zone when storing datetimes within DataMontage (.dm) files and when displaying DataMontage containers. DataMontage 5.0 provides a new, optional property named <code>SavedTimeZone</code> that specifies the time zone used to store datetimes within DataMontage (.dm) files. When creating a new <code>GraphContainerXDatetime</code> object, either programmatically or by using the DataMontage Editor, set the <code>SavedTimeZone</code> property before populating the container with datetimes.  DataMontage 5.0 also provides a new, optional property named <code>OutputDisplayTimeZone</code> that specifies the time zone used to display datetimes.	Javadoc: <code>pro</code> <code>OutputDispla</code> <code>SavedTimeZ</code> <code>GraphContai</code>
Separate overlapping data points in timelines	Prior to version 5.0, DataMontage enables the optional vertical separation of timeline intervals with overlapping times. DataMontage 5.0 enables the optional vertical separation of timeline data points with overlapping times.	Javadoc: <code>pro</code> <code>SeparateOve</code> <code>class Timelin</code>
Range ticks on x and x2 axes	Prior to version 5.0, DataMontage displayed custom tick labels that specify the values of values on the x and x2 axes. DataMontage 5.0 adds the ability to label <i>ranges of values</i> on the x and x2 axes.	Javadoc: <code>pro</code> <code>IsRangeTickL</code> <code>in class XAxis</code>
SQL Operations support for stored procedures	Prior to version 5.0, DataMontage SQL operations populated containers using SQL queries. DataMontage 5.0 adds the ability to populate containers using calls to stored database procedures, specified as <code>call procedure_name(arglist);</code>	
Additional XY Graph shape groups	DataMontage 5.0 supports four additional symbol groups that can be used within XY graphs: <code>VerticalBarFromBottom</code> , <code>VerticalBarAlignLeftFromBottom</code> , <code>VerticalBarAlignRightFromBottom</code> , and <code>VerticalBarAlignRight</code>	Javadoc: <code>pro</code> <code>BasicShapeG</code>

Additional features and bug fixes may be listed in the release notes, installation file *release\_notes.txt*.

### 3 Top-Level Classes (DataMontage/J)

Each DataMontage graphical display is configured by a top-level DataMontage container object and its sub-objects. Each container object contains zero or module objects, and each module objects contains zero or more timeline and/or XY graph objects. Each timeline can contain and display datapoints and/or intervals. Each XY graph can contain and display datapoints. The container object also contains zero or more note objects, one per time-stamped note.

The independent (X) axis values of DataMontage datapoints and XY data points can be double-precision floating point values or datetime values. The DataMontage/J library provides one set of classes for containers with double-precision X values and a second set of classes for containers with datetime X values:

- The DataMontage *GraphContainerXDouble* class stores container objects in which the X values are double precision or floating point. Names of classes that support double-precision data end with "XDouble".
- The DataMontage *GraphContainerXDateTime* class stores container objects in which the X values are datetimes. Names of the classes for datetime data end with "XDateTime".

The following table summarizes the highest-level classes.

GraphContainerXDateTime GraphContainerXDouble	Each graph container object contains module objects. Each GraphContainerXDateTime object contains GraphModuleXDateTime objects, and each GraphContainerXDouble object contains GraphModuleXDouble objects.
GraphModuleXDateTime GraphModuleXDouble	Each module object contains timeline and/or XY graph objects. Each GraphModuleXDateTime object contains TimeLineXDateTime and/or XYGraphXDateTime objects, and each GraphModuleXDouble object contains TimeLineXDouble and/or XYGraphXDouble objects.  The number of graphs per row is specified for each module. Graphs and timelines can be vertically stacked (number of graphs per row = 1) or arranged in rows and columns (number of graphs per row > 1). Different modules can contain different numbers of graphs per row. A module can contain a mixture of XY graphs and timelines if they are vertically stacked, but only XY graphs can be arranged in rows and columns.
XYGraphXDateTime XYGraphXDouble	Each object represents an XY (time series) graph displayed within a graph module. XYGraphXDateTime objects contain XYGraphDataPointXDateTime objects that represent data points with datetime X values. XYGraphXDouble objects contain XYGraphDataPointXDouble objects that represent data points with double-precision X values.
TimeLineXDateTime TimeLineXDouble	Each object represents a Gantt chart-style timeline that contains data point and time interval objects. Each TimeLineXDateTime object contains TimeLineDataPointXDateTime and/or TimeLineIntervalXDateTime objects that represent data points and timelines, respectively, bounded by datetime X values. Each TimeLineXDouble object contains TimeLineDataPointXDouble and/or TimeLineIntervalXDouble objects that are bounded by double-precision X values.

The DataMontage/JS library renders JSON objects which contain graph container, graph module, and timeline objects. The DataMontage/JS uses one JSON format for containers with double-precision X values and a second JSON format for containers with datetime X values. The DataMontage/JS library currently does not support XY graphs. The format of the DataMontage JSON objects is documented in DataMontage installation file `js/json_format.html`.

## 4 DataMontage Editor

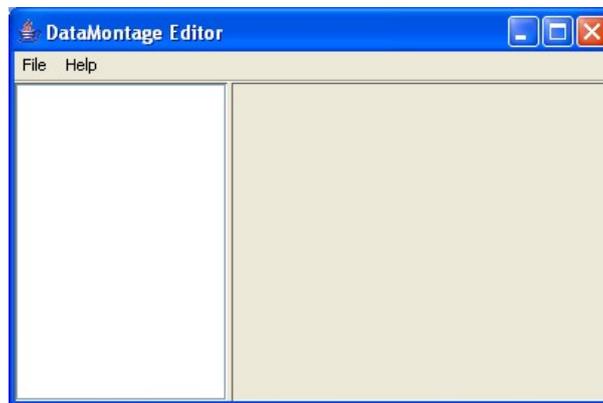
You can use the *DataMontage Editor* to:

- Create graphical displays for data review - You can specify the layout and appearance of the graphs and timelines and enter operational data to be displayed or printed for analysis and review. You can

save and distribute DataMontage configuration files to other users , so they can review them using the DataMontage Viewer or another application that uses the DataMontage API.

- Create graph mockups - You can specify the layout and appearance of graphs and timelines and enter sample data to create mockups that illustrate a particular way of presenting data. By enabling easy creation of mockups, the Editor enables rapid, iterative design.
- Create graph templates - You can specify the layout and appearance of graphs and timelines to create a template that is used as a starting point for a graph container. Using the DataMontage Viewer or the DataMontage/J library, you can populate the graph container by replacing the sample data in it, if any, with operational data retrieved from databases.

To invoke the DataMontage Editor, select DataMontage/Editor from the Windows Start menu. Figure 2 shows the DataMontage Editor when it is first invoked.



**Figure 2** – DataMontage Editor when first invoked.

Each DataMontage graph container contains modules, and each module contains timelines or graphs. The left-hand side Overview pane shows an icon for the graph container and an icon for each module, time series graph, and timeline. Icons are displayed in a hierarchy to show the order and grouping of the modules, graphs, and timelines that they represent. To open the graph container icon and view its modules, or to open a module icon and view its graphs or timelines, click on the plus (+) sign button next to the icon. To close a graph container or module icon, click on the minus (-) sign button. Figure 3 shows a graph container that contains five modules.

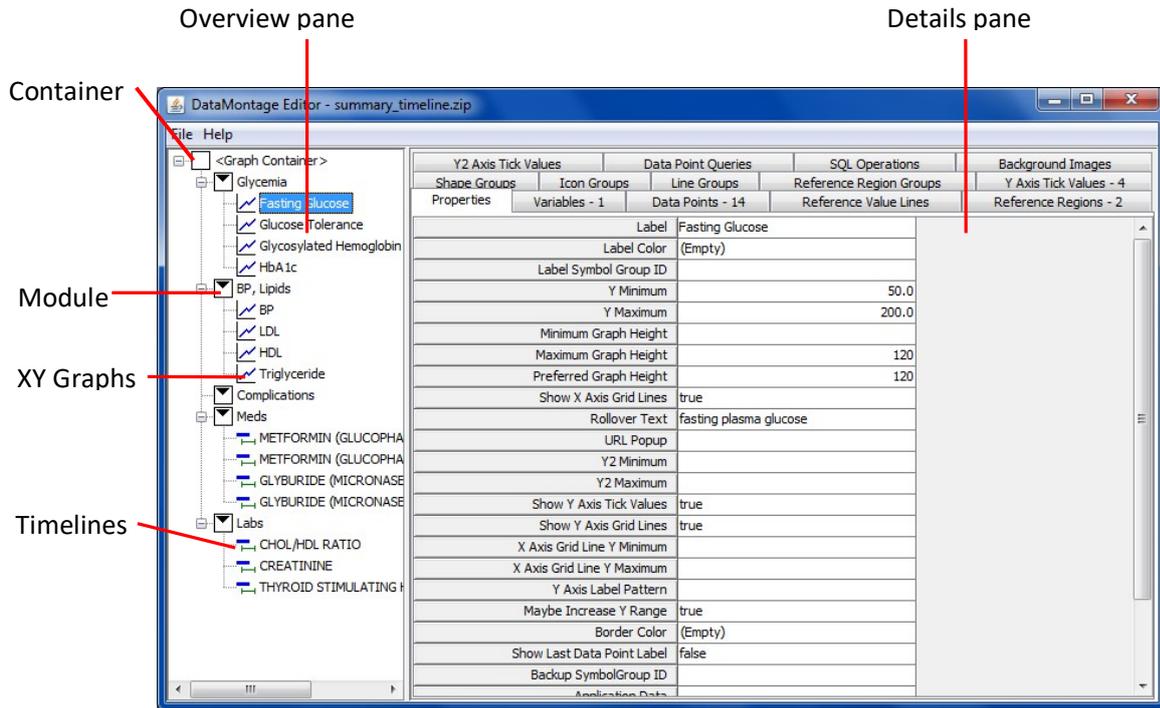


Figure 3– DataMontage Editor used to edit a DataMontage graph container

The right-hand side Details pane shows tabbed windows that let you view and edit the details of the graph object selected in the Overview pane.

#### 4.1 DataMontage Editor Sample Session

The following script describes how you can create a simple DataMontage display comprised of one module and one timeline with two shape groups and two data points.

1. Launch the DataMontage Editor by selecting *DataMontage/Editor* from the *Windows Start/All Programs* menu.
2. Create a new DataMontage graph container with date time X values by selecting *New/DateTime* from the top-level *File* menu.
3. Click on the node in the Overview Pane labeled *<Graph Container>*. A set of tabbed windows for editing the graph container should appear in the Details Pane on the right side of the window.
4. Click on the cell to the right of *Title* in the *Properties* tabbed window. Type "Sample Graph Container" and press the *return* key. The Editor updates the label of the graph container node in the Overview Pane with this title.
5. In the Details Pane, click on the tab labeled *Shape Groups*.
6. Click the right mouse button anywhere in the area below the column headers in the Details Pane. Select *Append Row* twice from the context menu. The Editor creates two new rows.
7. Click on the cell in row 1 under the column header *Group ID*. Enter "normal".
8. Click on the cell in row 2 under the column header *Group ID*. Enter "high".

9. *Double-click* on the cell in row 2 under the column header *Color*. Select a red color swatch and press *OK*. Because these two new shape groups were defined at the container level, they can be referenced by any data point in any XY graph or timeline in the container.
10. Click the right mouse button anywhere on the Overview Pane. Select *Insert/Module* from the context menu that appears. The Editor adds a module icon to the Overview Pane.
11. Click the right mouse button anywhere on the Overview Pane. Select *Insert/Timeline* from the context menu that appears. The Editor adds a timeline icon to the Overview Pane, and the timeline icon is selected.
12. Click on the cell to the right of *Label* in the *Properties* tabbed window. Type in "Sample Timeline" and press the *return* key. The Editor updates the label of the graph container node in the Overview Pane with this title.
13. Click on the *Data Points* tab in the Details Pane.
14. Click the right mouse button anywhere in the area below the column headers in the Details Pane. Select *Append Row* twice from the context menu. The Editor creates two new rows.
15. In the cell in row 1 under the *DateTime* column, enter "1/2/07 0200" to specify January 2, 2007 at 2:00AM. To widen a column, move your mouse to the right of the column until you see the cursor change shape to a two-headed arrow. Then, click and drag your mouse to the right to change the column width.
16. In the cell in row 1 under the *DateTime* column, enter "Jan 3, 2007" to specify January 3, 2007.
17. In the cell in row 1 under the *Symbol Group ID* column, double-click and select "normal" from the pull-down list.
18. In the cell in row 2 under the *Symbol Group ID* column, double-click and select "high" from the pull-down list.
19. Select *Preview* from the *File* menu to launch the DataMontage Viewer application and see a display of the graph container.
20. Click the right mouse button over the DataMontage Viewer display. Select *Show Graph Key/Container* from the context menu to display a graph key describing all graphical elements in the graph container.

## 4.2 DataMontage Editor Top-Level Menu

The File menu of the DataMontage Editor contains the following menu items:

<i>New</i>	Creates a new DataMontage graph container. When you create a new container, the Editor asks you whether X axis values will be date times or floating point values.
<i>Open</i>	Opens a DataMontage graph container stored in a configuration file. You can select either a configuration file (with .xml file extension) or a Zip file (with .zip file extension) that contains the XML configuration file. In the latter case, the Zip file and the configuration file must share the same name, with different file extensions.
<i>Save</i>	Saves the currently open DataMontage graph container to a DataMontage configuration file.
<i>Save As...</i>	Saves the currently open DataMontage graph container to a configuration file with a different name. If you specify a file name that ends with ".zip" or ".dm", DataMontage will save the XML file in compressed Zip format. If you specify a file name that ends with ".xml", DataMontage will save the file in uncompressed XML format.
<i>Preview</i>	Invokes the DataMontage Viewer application to display the current graph container.

<i>Preview SVG</i>	Generates temporary HTML and JSON files for previewing the currently open DataMontage container as a Scalable Vector Graphics (SVG) object within a Web page.
<i>&lt;Recent Files&gt;</i>	Opens a previously saved DataMontage configuration file.
<i>Exit</i>	Exits the Editor application.

### 4.3 Using the Overview Pane to Edit the Layout

You can interact with the Overview Pane to create, delete, or rearrange modules, XY graphs, and timelines. When you click the right mouse button over the Overview pane, the Editor displays a context menu that contains the following menu items:

<i>Undo</i>	Undoes the last editing operation performed in the Overview pane.
<i>Redo</i>	Redoes the last editing operation performed in the Overview pane.
<i>Cut</i>	Deletes the currently selected module, XY graph, or timeline and stores this object in the clipboard.
<i>Copy</i>	Copies the currently selected module, XY graph, or timeline and stores this object in the clipboard.
<i>Paste</i>	Inserts the module, time series graph, or timeline currently stored in the clipboard into the graph container.
<i>Delete</i>	Deletes the currently selected module, XY graph, or timeline.
<i>Move</i>	Moves the currently selected module, XY graph, or timeline Up or Down or to the Top or Bottom of the graph container.
<i>Insert</i>	Inserts a module, XY graph, or timeline into the graph container.
<i>Rename</i>	Prompts you to enter a new Label property for the currently selected module, XY graph, timeline, or graph container.

### 4.4 Using the Details Pane to Specify Appearance

The Details Pane displays tabbed windows, so you can view and edit the details of the module, XY graph, timeline, or container that is selected in the Overview pane. The Editor displays a different set of tabbed windows for each of the four types of graph objects.

#### 4.4.1 Details Pane – Common Tabbed Windows

Some of the tabbed windows enable you to specify properties of shape groups, icon groups, line groups, and reference interval and regions that control how data and reference data are displayed.

Shape Groups	Shape groups specify the appearance of symbols drawn within XY graphs and timelines to indicate data points. Graph symbols can also be drawn next to the labels of XY graph and timelines and at the beginning and/or end of timeline intervals to provide additional information about the interval. Within XY graphs, you can use different symbol groups to encode additional information about particular data points. For example, you can use a particular symbol shape or color to highlight data point values that
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are lower or higher than expected. A shape group can be specified for use within a graph, timeline, module, or container. For example, if a shape group is specified for a module, it can be used to display data points in any timeline or XY graph in that module. If a shape group is specified for a timeline, it can be used only within the timeline. Some shape groups are multivariate and display more than one value. For example, the BoxPlot shape group displays the median, upper and lower quartile, and range. The OpenCloseTicks shape group shows the opening, closing, low, and high value of a stock price.

- Icon Groups                      You can display data points by drawing icons instead of symbols. Each icon group object specifies a type of icon that is rendered by a Java class that implements a Java interface named IconSupplier. DataMontage provides two built-in implementations of the IconSupplier interface. The `com.stottlerhenke.datamontage.icon.TextIconMaker` Java class renders data points by drawing a single character or short text string. The `com.stottlerhenke.datamontage.icon.ImageIconLoader` Java class load icons represented as image files in GIF or JPEG format. An advantage of encoding icons in GIF format is that you can set the image's background to be transparent. An icon group can be specified for a graph, timeline, module, or container.
- Line Groups                      Line groups specify the color and thickness of reference lines and lines that connect data points within XY graphs that belong to the same variable. A line group can be specified for a graph, timeline, module, or container.
- Interval Groups                Each interval group object specifies the color, style, and height of horizontal bars used to display a set of timeline intervals.
- Reference Region Groups      Reference region groups specify the color used to fill a region within XY graphs to show a datetime/X value range and/or a Y value range. The region group also specifies the layer number. When two reference regions overlap, regions with larger layer number are drawn over regions with smaller layer numbers.
- Reference Interval Groups     Reference interval groups specify the color used to fill a region within timelines to show a datetime/X value range.

The following table shows the types of appearance groups that can be defined for each type of sub-object: containers, modules, graphs, and timelines.

<i>Type of Appearance Group</i>	<i>Container</i>	<i>Module</i>	<i>XY Graph</i>	<i>Timeline</i>
<i>Shape Groups</i>	●	●	●	●
<i>Icon Groups</i>	●	●	●	●
<i>Line Groups</i>	●	●	●	
<i>Reference Region Groups</i>	●	●	●	
<i>Interval Groups</i>	●	●		●
<i>Reference Interval Groups</i>	●	●		●

The DataMontage Editor also provides tabbed windows that enable you to specify SQL query operations (section 4) and data point queries (section 5) for all four types of graph sub-objects.

#### 4.4.2 Details Pane – Graph Containers

In addition to the common tabbed windows described in section 3.4.1, the DataMontage Editor displays the following tabbed windows in the Details pane when the graph container icon is selected:

Core Properties	This tabbed window displays and prompts for some single-valued property values of the container.
Formatting Properties	This tabbed window displays and prompts for single-valued property values that control the container's appearance.
Context Properties	This tabbed window displays and prompts for single-valued property values that configure the container's context menu.
Note Group	The note group object specifies the color, size, and font family used to display time-stamped notes.
Zoom Periods	A DataMontage graph container can contain zero or more zoom periods. Each zoom period specifies the graph container's X value range that is displayed when the zoom period is selected by the user using the DataMontage Viewer or Applet context menu.
X Axis Tick Values	You can specify one or more tick values and labels that override the default tick values and labels drawn on the X or X2 axes.
SQL Parameters	A graph container can contain zero or more SQL Query Operations that populate the graphical display with data retrieved from a SQL database. Each SQL Query Operation contains a SQL query with optional SQL parameters. Before defining a SQL Query Operation with one or more parameterized SQL queries, you should use this tabbed window to declare the parameters by entering their names, data types, and labels. The name is used each SQL Query Operation to refer to this parameter. More than one SQL Query Operation can refer to the same parameter. When the DataMontage Viewer populates a graph container with SQL data, it prompts the user for the value of each SQL parameter value, using the parameter label as a prompt. A software application can supply a value for each SQL parameter when it uses the DataMontage/J library to instruct the graph container to populate itself with SQL data.
Notes	<p>Each Note object represents a text note that is displayed in a list within the graph container. When the user clicks on a note display, DataMontage displays a vertical highlight line in all timelines and graphs to indicate the note's time stamp or X axis value.</p> <p>A Note object can be configured to store a JavaScript expression so that when a user clicks on a Note in the user interface, DataMontage evaluates the expression to perform an action such as highlighting or filtering parts of the DataMontage container. This feature enables users to select among pre-defined views of the data in the graph container. Reference: <i>Note</i> class; <i>NoteFolder</i> and <i>ScriptExpression</i> properties.</p>

Data Point Queries	Each data point query specifies criteria for selecting and highlighting data points and/or time intervals in graphs and timelines, based on the value of their applicationData property. Each query can be invoked by selecting its menu item from the context menu.
X2 Axis	An optional second X axis can be displayed at the top of the graph container. For example, the primary X axis could correspond to Greenwich Mean Time (GMT), and the second X axis could show the local time zone. The offset between the X and X2 axes can be configured to change at specified times or X values. Reference: XaxisTickValue class; several new properties. This tabbed window enables you to configure the X2 axis and its offsets from the X axis.

#### 4.4.3 Details Pane – Modules

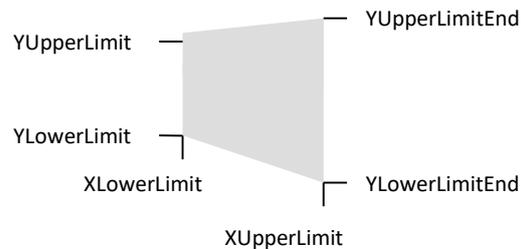
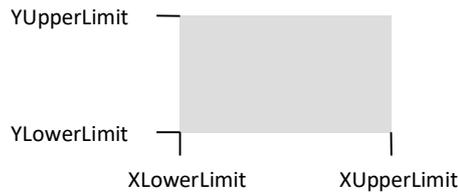
The DataMontage Editor displays tabbed windows in the Details pane for each type of appearance group. Additional tabbed windows enable you to edit Module property values, SQL query operations, and data point queries. The X Axis Tick Values tabbed window enables you to specify X axis tick values for the module that may be different than those for the graph container.

#### 4.4.4 Details Pane – XY Graphs

The Editor displays the following tabbed windows in the Details pane when an XY graph icon is selected:

Variables	Each variable groups zero or more data points in an XY graph that represent different measurements over time of the same thing. Each graph can contain data points for one or more variables.
Data Points	Each data point describes a quantitative measurement that is associated with a variable. The data point's X value specifies when the measurement was made, and the Y value specifies the measured value. Optionally, each data point can be associated with a symbol group that describes its appearance. Some multivariate shape groups display more than one value, stored in other properties of the data point object. A variable can be associated with a line group that describes the appearance of the line that connects the variable's data points.
Reference Value Lines	Each reference line can specify a constant Y value that spans the length of the graph. A reference line can also be a line segment that is specified by values at a start time and at an end-time. A discontinuous or piecewise continuous line can be created by adjoining multiple reference value line segments. If the Y axis is drawn using a logarithmic scale, either each reference value line must be constant, or its changing value must be specified using the Function property that contains an arithmetic JavaScript expression.
Reference Regions	Each reference region uses color to show an X/datetime or Y value range. Each region can be bounded by constant upper and/or lower Y axis values. If no upper bound is specified, the region spans all parts of the graph above the lower bound. If no lower bound is specified, the region spans all areas below the upper bound. Each region can also be bounded by optional

lower and upper limits on its X axis range. Optionally, Y axis bounds can be specified at the region's X axis upper limit to specify a trapezoidal shape. Multiple reference regions can share the same reference region group, and therefore the same color, so you can create regions with complex shapes by creating adjacent regions that belong to the same reference region group. If the Y axis is drawn using a logarithmic scale, either the *YUpperLimit* and *YLowerLimit* of each reference region must be constant, or its changing value must be specified using the *UpperBoundFunction* and *LowerBoundFunction* properties.



- Y Axis Tick Values      Each object specifies the value and label of a (left hand) Y axis tick mark.
- Y2 Axis Tick Values    Each object specifies the value and label of a (right hand) Y2 axis tick mark.
- Background Images      XY graphs can display one or more background images which are drawn behind data points. For example, an image could display geographic boundaries to serve as the background of a bubble plot in which each data point's XY coordinates indicate a geographic location.

#### 4.4.5 Details Pane – Timelines

The Editor displays the following tabbed windows in the Details pane when a timeline icon is selected:

- Data Points            Each timeline data point describes an event or observation at a point in time. Observations displayed within time lines are usually qualitative, but quantitative values can be displayed as text labels that appear next to each data point's symbol in the timeline. For example, heart rate measurements can be displayed as text labels above each data point (e.g., "135/80").
- Intervals                Each timeline interval describes an event or condition that spans an interval bounded by start and/or end date times or by lower and/or upper X axis values.
- Reference Intervals    Each reference interval is displayed as a colored background region that spans the interval's range, delimited by start and/or end times or by X axis

lower and/or upper bounds. Each reference interval belongs to a reference interval group that specifies the reference interval's color.

#### 4.4.6 Details Pane – Editing Tables

In most of the tabbed windows, the Details pane enables you to view and edit data in tables. Each table row displays an object, and each column displays values for a property. To enter or change the value of an object's property, double-click the left mouse button over the table cell. Depending upon which property you select, you will be able to enter a new value by typing into the table cell itself, selecting a value from a pull-down list, or entering a value using a popup dialog.

A context menu provides editing operations that help you edit values in table cells. To select this menu, click the right mouse button over the Details pane. When the Properties tabbed window is displayed, the context menu contains the following items:

<i>Undo</i>	Undoes the last editing operation
<i>Redo</i>	Redoes the last editing operation
<i>Cut Cells</i>	Deletes the values in the currently selected table cells and copies these values to the clipboard.
<i>Copy Cells</i>	Copies the values in the currently selected table cells to the clipboard.
<i>Paste</i>	Pastes the values stored in the clipboard to the table.
<i>Clear</i>	Clears the values of the currently selected table cells.

Other tabbed windows display rows and columns of data that you can edit. The context menu for these windows contains items that enable you to edit tabular data:

<i>Undo</i>	Undoes the last editing operation.
<i>Redo</i>	Redoes the last editing operation.
<i>Cut</i>	Deletes the values in the currently selected cell and copies them to the clipboard.
<i>Copy</i>	Copies the values in the currently selected table cell to the clipboard.
<i>Paste</i>	Pastes the values stored in the clipboard to the currently selected table cell.
<i>Paste as New Rows</i>	Pastes the values stored in the clipboard to the currently selected table cell.
<i>Clear</i>	Clears the values of the currently selected table cell.
<i>Delete Rows</i>	Deletes the currently selected rows.
<i>Append Row</i>	Adds a new row to the bottom of the table.
<i>Insert Row</i>	Inserts a new row before the currently selected row.
<i>Sort</i>	Sorts the rows so that values in the selected column are in ascending or descending order. You can also sort in ascending order by clicking on the column header while pressing the control key. You can sort in descending order by clicking on the column header while pressing the control and shift keys.
<i>Move</i>	Moves the currently selected row Up or Down or to the Top or Bottom of the table.

#### 4.4.7 Details Pane – Entering Dates

Some of the DataMontage properties store date or date time values. You can enter a date using the following formats:

- YYYY-MM-DD – 4 digit year, a number between 1 and 12 to specify the month, and the day of the month, separated by dash (-) characters.
- MM/DD/YY or MM.DD.YYYY – In locales such as the United States, you can enter the month number, day of month, and two or four digit year, separated by slash (/) characters or periods (.).
- DD/MM/YY or DD.MM.YYYY – In locales such as Europe, you can enter the day of month, month number, and a two or four digit year, separated by slash (/) characters or periods (.).
- Mon DD, YYYY or Month DD, YYYY - In locales such as the United States, you can enter the month name or three letter abbreviation, day of month, comma, and four digit year.
- DD Month YYYY - In locales such as Europe, you can enter the day of the month, month name, and four digit year. In the UK, you can enter a three letter month abbreviation.

To enter a date time, enter a date, followed by a time, separated by a single space or letter T. You can enter the time portion of the date time using the following formats.

- 24 hour time - "1:45" specifies 45 minutes past 1:00 AM, and "13:45:50" specifies 45 minutes 50 seconds past 1:00 PM. You can also enter 24 hour times with 2 digit hours without colons such as "0145" or "134550".
- 12 hour time – e.g., "1:45am" specifies 45 minutes past 1:00 AM, and "1:45:50 pm" specifies 45 minutes 50 seconds past 1:00 PM.

Use a space character or 'T' character to separate the date and time portions of a date time value. For example, in the United States, you can enter either "3/4/07 13:45:50" or "2007-03-04T1:45 pm" to specify 1:45 PM on March 4, 2007.

After you enter a date or date time, DataMontage redisplay the value in its standard format. It displays dates as a four digit year, two digit month of the year, and two digit day of the month, separated by dashes (e.g., 2007-01-05). It displays times as the hour of the day (between 0 and 23), followed by minutes (between 0 and 59) and seconds (between 0 and 59), separate by colons. The Editor truncates the hours, minutes, or seconds portion of a date time if those values equal 0 *and* the graph container's Precision property is set to Days. The Editor truncates the seconds portion of the date time if it equals 0 and the Precision property is set to Minutes or Days.

#### 4.4.8 Embedding SQL Query Builders within the Editor

To create a custom SQL Query Builder, a Java software developer can create a Java class that implements the *SQLQueryBuilder* Java interface defined in Java package *com.stottlerhenke.com.datamontage.editor*. This interface is described in the DataMontage on-line Javadoc documentation. To use your SQL Query Builder, edit the Windows command that launches the DataMontage Editor (e.g., in command file *runDataMontageEditor.bat*) to include:

```
-qcQueryBuilderClassname
```

where *QueryBuilderClassname* is a placeholder for the full name of the Java class that implements the custom SQL query builder. Optionally, you can also supply a comma-separated list of String constructor arguments when creating an instance of the query builder Java class by including the following command-line switch and argument:

`-qaQueryBuilderArgumentList`

## 5 SQL Query Operations (DataMontage/J)

A DataMontage container can optionally specify SQL query operations that populate the graph container with data retrieved from a relational database. Using the *SQL Operations* tabbed window, you can enter SQL query operations for each module, XY graph, timeline, and graph container. Each SQL query operation specifies the:

- Operation Type – determines how the SQL data is used to populate the graph container by creating data points, intervals, graphs, timelines, and/or modules.
- SQL Query – specifies a SQL query or a call to a stored procedure that determines which data should be retrieved from a relational database. You can type this SQL query into the text editor dialog displayed by the Editor. DataMontage's custom SQL query builder feature enables you to create a custom SQL Query Builder and configure the DataMontage Editor to invoke it. Using a custom SQL query builder, you can specify SQL queries more easily for your particular database. Section 3.5 describes how to use custom SQL query builders.
- SQL Parameters – specifies the names of zero or more parameters whose values are bound to placeholders in a parameterized SQL query statement or call to a stored procedure. There should be one SQL parameter for each placeholder in the SQL query or stored procedure call. Parameter names for each SQL operation are selected from the list of SQL parameters specified in the graph container's SQL Parameters tabbed window. The SQL Operations feature recognizes a pre-defined SQL parameter named “\_storage\_area” (GraphContainer.SQL\_OPERATIONS\_VARIABLE\_STORAGE\_AREA). If a GraphContainer declares this variable, DataMontage sets the database connection's default storage area, using the JDBC method `setCatalog`, to the value of this parameter. This feature enables you to create GraphContainer objects with SQL Operations that can be applied to multiple storage areas that contain similar tables and columns.

The *Remove Data before SQL Operations* property, specified in the Properties tabbed window, controls whether any data in the container, module, timeline, or XY graph should be removed before executing SQL query operations. Usually, this property should be set to true. For example, you can create a graph container that is used as a template that is populated with data queried from a database. Set the Remove Data before SQL Operations property to true to ensure that any example data in the template is removed before the template is populated.

The *Database Connection URL* property, specified in the graph container's Properties tabbed window, specifies a Java Database Connectivity (JDBC) Uniform Resource Locator (URL) that identifies the location of the database to be accessed. For example, to access an Oracle database, you could specify a URL of the form:

`jdbc:oracle-thin:@host_name:ip_port_number:db_name`

where *host\_name*, *ip\_port\_number*, and *db\_name* are placeholders for the name of the database's host computer, the database server's Internet Protocol port number, and the name of the Oracle database.

When executing SQL operations, DataMontage first executes container-level SQL operations. Then, it executes SQL operations for the first module and SQL operations for each timeline or graph within the module. Then, it executes SQL operations for the second module and SQL operations for each timeline or graph within the second module, and so on.

### 5.1 SQL Query Operations – Graph Containers

A graph container can contain seven types of SQL query operations.

The **Add Modules with Graphs** operation creates zero or more modules, and each module contains one or more graphs each containing one or more data points. The SQL query must return a result set that contains six required columns with non-null values and up to three optional columns with null values allowed. Rows in this table must be grouped so that rows with the same module header are adjacent and rows with the same module header and XY graph label are adjacent. DataMontage creates a module for each distinct value of the module header column, and it creates an XY graph for each combination of module header and XY graph label.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	No	Module header
2	Yes	No	XY graph label
3	Yes	No	Variable name
4	Yes	No	X axis value
5	Yes	No	Y axis value
6	No	Yes	Symbol group ID
7	No	Yes	Data point label
8	No	Yes	Data point rollover text
9	No	Yes	Data point application data
10	No	Yes	Size of data point (overrides size specified by symbol group)

The **Add Modules with Timelines with Data Points** operation creates zero or more modules, and each module contains one or more timelines each containing one or more data points. The SQL query must return a result set that contains four required columns with non-null values and up to three optional columns with null values allowed. Rows in this table must be grouped so that rows with the same module header are adjacent and rows with the same module header and timeline label are adjacent. DataMontage creates a module for each distinct value of the module header column, and it creates a timeline for each combination of module header and timeline label.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	No	Module header
2	Yes	No	Timeline label
3	Yes	No	X axis value
4	Yes	No	Symbol group ID
5	No	Yes	Data point label
6	No	Yes	Data point rollover text

7	No	Yes	Data point application data
---	----	-----	-----------------------------

The **Add Modules with Timelines with Intervals** operation creates zero or more modules, and each module contains one or more timelines each containing one or more time intervals. The SQL query must return a result set that contains five required columns with non-null values and up to three optional columns with null values allowed. Rows in this table must be grouped so that rows with the same module header are adjacent and rows with the same module header and timeline label are adjacent. DataMontage creates a module for each distinct value of the module header column, and it creates a timeline for each combination of module header and timeline label.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	No	Module header
2	Yes	No	Timeline label
3	Yes	No	Start X axis value of the interval
4	Yes	No	End X axis value of the interval
5	Yes	No	Interval group ID of the interval
6	No	Yes	Interval label
7	No	Yes	Interval rollover text
8	No	Yes	Interval application data

The **Add Modules with Timelines with Data Points and Intervals** operation creates zero or more modules, and each module contains one or more timelines each containing one or more data points and/or time intervals. The SQL query must return a result set that contains six required columns and up to three optional columns with null values allowed. Rows in this table must be grouped so that rows with the same module header are adjacent and rows with the same module header and timeline label are adjacent. DataMontage creates a module for each distinct value of the module header column, and it creates a timeline for each combination of module header and timeline label.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	No	Module header
2	Yes	No	Timeline label
3	Yes	Yes	X axis value of the datapoint, if not null. If null, this row specifies a time interval.
4	Yes	Yes	Start X axis value of the interval, if not null
5	Yes	Yes	End X axis value of the interval, if not null
6	Yes	No	Symbol group or interval group ID
7	No	Yes	Data point or time interval label
8	No	Yes	Data point or time interval rollover text
9	No	Yes	Data point or time interval label application data

If the container contains any modules before SQL operations are executed, the first module is used as a template when creating new modules, and the first graph or timeline in that module is used as a template for

creating new graphs and timelines. Thus, new modules, graphs, or timelines created by the SQL operations will contain the same properties and sub-objects specified for the template module, graph, or timeline. For example, you could specify symbol groups in a module or graph template that would be copied and able to be referenced by data points in modules and graphs created by SQL operations.

The **Add Notes** operation creates zero or more time-stamped notes. The SQL query must return a result set that contains one required column with non-null values and up to seven optional columns with null values allowed.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	No	Note text
2	Yes	Yes	X axis value of the note, if not null. If null, this row specifies a time interval.
3	No	Yes	Javascript expression that is evaluated when the user clicks on the note.
4	No	Yes	Name of the note folder in which the note is placed
5	No	Yes	Symbol group ID specifies the symbol drawn next to the note. Symbols can be used to indicate the type of note.
6	No	Yes	Data point or time interval rollover text
7	No	Yes	Application data stored in the note
7	No	Yes	ID of the note which can be used to identify the note using container-level method <i>getNoteForID</i> .

The **Add Title** operation sets the title of the graph container. The SQL query must return a result set that contains one required column containing the title.

The **Add Narrative** operation sets the narrative of the graph container. The SQL query must return a result set that contains one required column containing the narrative.

## 5.2 SQL Query Operations - Modules

A module can contain four types of SQL query operations. The **Add Graphs** operation creates zero or more graphs each containing one or more data points. The SQL query must return a result set that contains six required columns with non-null values and up to three optional columns with null values allowed. Rows in this table must be grouped so that rows with the same XY graph label are adjacent. DataMontage creates a new graph for each distinct value of XY graph label.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	No	XY graph label
2	Yes	No	Variable name
3	Yes	No	X axis value
4	Yes	No	Y axis value
5	No	Yes	Symbol group ID

6	No	Yes	Data point label
7	No	Yes	Data point rollover text
8	No	Yes	Data point application data
9	No	Yes	Size of data point (overrides size specified by symbol group)

The **Add Timelines with Data Points** operation creates zero or more timelines each containing one or more data points. The SQL query must return a result set that contains three required columns with non-null values and up to three optional columns with null values allowed. Rows in this table must be grouped so that rows for the same timeline label are adjacent. DataMontage creates a timeline for each distinct value of timeline label.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	No	Timeline label
2	Yes	No	X axis value
3	Yes	No	Symbol group ID
4	No	Yes	Data point label
5	No	Yes	Data point rollover text
6	No	Yes	Data point application data

The **Add Timelines with Intervals** operation creates one or more timelines each containing one or more time intervals. The SQL query must return a result set that contains four required columns and up to three optional columns with null values allowed. Rows in this table must be grouped so that rows for the same timeline label are adjacent. DataMontage creates a timeline for each distinct value of timeline label.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	No	Timeline label
2	Yes	Yes	Start X axis value of the interval
3	Yes	Yes	End X axis value of the interval
4	Yes	No	Interval group ID of the interval
5	No	Yes	Interval label
6	No	Yes	Interval rollover text
7	No	Yes	Interval application data

The **Add Timelines with Data Points and Intervals** operation creates zero or more timelines each containing one or more data points and/or time intervals. The SQL query must return a result set that contains five required columns and up to three optional columns with null values allowed. Rows in this table must be grouped so that rows for the same timeline label are adjacent. DataMontage creates a timeline for each distinct value of timeline label.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	No	Timeline label

2	Yes	Yes	X axis value of the datapoint, if not null. If null, this row specifies a time interval.
3	Yes	Yes	Start X axis value of the interval, if not null
4	Yes	Yes	End X axis value of the interval, if not null
5	Yes	No	Symbol group or interval group ID
6	No	Yes	Data point or time interval label
7	No	Yes	Data point or time interval rollover text
8	No	Yes	Data point or time interval label application data

The **Add Rollover Text** operation sets the rollover text of the module. The SQL query must return a result set that contains one required column containing the rollover text.

If the modules contains any timelines or graphs before SQL operations are executed, the first graph or timeline is used as a template when creating new graphs or timelines. Thus, new graphs, or timelines created by the SQL operations will contain the same properties and sub-objects specified for the template graph, or timeline.

### 5.3 SQL Query Operations - XY Graphs

A module can contain one type of SQL query operations. The **Add Data Points** operation adds zero or more data points to the XY graph. The SQL query must return a result set that contains six required columns with non-null values and up to three optional columns with null values allowed.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	No	Variable name
2	Yes	No	X axis value
3	Yes	No	Y axis value
4	No	Yes	Symbol group ID
5	No	Yes	Data point label
6	No	Yes	Data point rollover text
7	No	Yes	Data point application data
8	No	Yes	Size of data point (overrides size specified by symbol group)

### 5.4 SQL Query Operations - Timelines

A timeline can contain three types of SQL query operations. The **Add Data Points** operation adds zero or more data points to the timeline. The SQL query must return a result set that contains two required columns with non-null values and up to three optional columns with null values allowed.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	No	X axis value
2	Yes	No	Symbol group ID
3	No	Yes	Data point label

4	No	Yes	Data point rollover text
5	No	yes	Data point application data

The **Add Time Intervals** operation adds one or more time intervals to the timeline. The SQL query must return a result set that contains three required columns and up to three optional columns with null values allowed.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	Yes	Start X axis value of the interval
2	Yes	Yes	End X axis value of the interval
3	Yes	No	Interval group ID of the interval
4	No	Yes	Interval label
5	No	Yes	Interval rollover text
6	No	Yes	Interval application data

The **Add Data Points and Intervals** operation adds one or more data points and/or time intervals to the timeline. The SQL query must return a result set that contains four required columns and up to three optional columns with null values allowed.

Column #	Required?	Nulls allowed?	Description of contents
1	Yes	Yes	X axis value of the data point, if not null.
2	Yes	Yes	Start X axis value of the interval, if not null
3	Yes	Yes	End X axis value of the interval, if not null
4	Yes	No	Symbol group or interval group ID
5	No	Yes	Data point or time interval label
6	No	Yes	Data point or time interval rollover text
7	No	Yes	Data point or time interval label application data

## 6 Highlighting using Data Point Queries (DataMontage/J)

DataMontage graph containers, modules, XY graphs, and timelines can be configured to contain DatapointQuery objects that specify how to select and highlight data points and/or time intervals based on the value of each comparison object stored in its applicationData property. Each query can be invoked by selecting a context menu item. The data point query's selectionMethod property specifies the name of the Boolean Java method that returns true if the comparison object's data point or time interval should be highlighted. The selection method can specify a required constraint on each comparison object, or it can specify a required relationship between each comparison object and a reference object. DataMontage provides three ways of specifying the source of the reference object. The reference object can be:

- The value of the applicationData property of the data point or time interval currently selected by the user. The applicationData object must be an instance of the Java class named by the query's *referenceClass* property.
- The value of the query's *referenceValue* property,

- The value of a text string entered by the user into a text edit GUI control whose label is specified by the query's *referenceValuePrompt* property.

The selection method can be a static method of the class specified by the query's *staticSelectionMethodClass* property. Static selection methods can accept either one argument (the comparison object) or two arguments (the reference object and the comparison object). If the selection method is not static, the method must be defined for the Java class of the reference object.

Property	Source of reference object			
	No reference object	<i>applicationData</i> of user-selected data point or time interval	Value of <i>referenceValue</i> property	Text string entered by user
menuLabel	required	required	required	required
comparisonClass	required	required	required	required
selectionMethod	required	required	required	required
staticSelectionMethodClass	required	optional	optional	optional
highlightMethod	optional	optional	optional	optional
color	optional	optional	optional	optional
referenceClass		required		
referenceValue			required	
referenceValuePrompt				required

The following table above shows whether a data point query property is required (req), optional (opt), or not accepted, depending upon the source of the query's reference object. Note that only one of the properties *referenceClass*, *referenceValue*, or *referenceValuePrompt* should be specified. If none of the properties are specified, no reference object is used by the query.

The example *DatapointQuery* specified below is invoked when the user selects the context menu item labelled "Compare strings". Because the *referenceClass* property is set, the reference object is the *applicationData* property of the currently selected data point or time interval. The *referenceClass* property specifies that the menu item is enabled only if the reference object is an instance of the *java.lang.String* class. The *comparisonClass* property specifies that comparison objects must be instances of class *java.lang.Object*. Each comparison object is compared to the reference object by invoking the "equals" method of the reference object. This method accepts a single argument, the comparison object which, according to the *comparisonClass* property, must be an instance of class *java.lang.Object*.

If the *staticSelectionMethodClass* property had been set, DataMontage would compare the comparison object with the reference object by invoking a static method named "equals" defined for the class specified by the *staticSelectionMethodClass* property. This method would accept two arguments, the reference object (1<sup>st</sup> argument) and the comparison object (2<sup>nd</sup> argument). The *color* property specifies the highlighting color in #RRGGBB hexadecimal format. In this example, selecting data points and time intervals are highlighted in green (red = #00, green = #FF, blue = #00). The *highlightMethod* property specifies how data points are highlighted. A value of "Circle", the default, specifies that an unfilled circle is drawn around the data point. A value of "Flash" specifies that the data point symbol flashes.

Property	Value
menuLabel	Compare strings
comparisonClass	java.lang.Object
selectionMethod	equals
staticSelectionMethodClass	
color	#00FF00
highlightMethod	Flash
referenceClass	java.lang.String
referenceValue	
referenceValuePrompt	

## 7 Graph Subsets (DataMontage/J)

DataMontage graph containers and modules can be optionally configured to specify one or more graph subset manager classes. The *graphSubsetsManagerClasses* property, defined for containers and modules, stores a comma-separated list of fully-qualified graph subset manager class names. Each container-level graph subset manager specifies one or more container graph subsets, and each module-level graph subset manager specifies one or more module graph subsets.

To create a graph subset manager, create a Java class that implements the DataMontage API Java interface named *GraphSubsetsManager* in the *com.stottlerhenke.datamontage.interaction* package. This interface specifies methods that return the list of graph subset IDs, return a graph subset label, and determine whether a graph or module belongs to a particular graph subset, identified by its ID. The DataMontage API documentation specifies this interface in detail in Javadoc format. File *GraphSubsetsManagerApplicationData.txt* in the *code\_samples* folder contains an example implementation of a graph subset manager class. This class is included in file *DataMontage.jar* and supports selection of subsets based on the String values stored in the *applicationData* property of each graph or timeline.

## 8 Custom User Interactions (DataMontage/J)

You can customize the user interactions of a DataMontage graph container by creating a Java class that implements the *UserInteractions* Java interface in the *com.stottlerhenke.datamontage.interaction* package.

The *DefaultUserInteractions* class provides a default implementation of *UserInteractions* interface. You may find it convenient to implement custom user interactions by creating a class that extends *DefaultUserInteractions* class in order to inherit some methods and override others. The *UserInteractionsDemo* class provides a simple example implementation of the *UserInteractions* class. The Developer's Kit includes source code for both of these classes.

To instruct DataMontage to use a particular class to control user interactions when displaying a graph container, call the *GraphContainer.setUserInteractionsClass* method or use the DataMontage Editor to set the value of the *UserInteractionsClass* property.

You may find it helpful to create a Java application development project, so you can step through the methods in this class when testing and debugging it. The DataMontage Developer's Kit includes source code for the Viewer application that you can use to create this project.

## 8.1 Rollover Text

The UserInteractions Java interface specifies a number of methods named `getRolloverText` that enable customization of the information displayed in the tool tip window. These methods accept as arguments:

- one or more DataMontage graphical objects that lie under the mouse cursor, such as an `XYGraph` and `XYGraphDataPoint`.
- a `java.awt.Point` object that specifies the location of the mouse cursor within an `XYGraph` or `Timeline`, if the mouse cursor lies within one of these types of objects.

As the user's mouse moves over the graphical display, DataMontage calls the `getRolloverText` method with the most specific signature. For example, if the mouse cursor is over an `XYGraph` but not over any sub-object within the graph (e.g., a data point, reference value line, or reference region), DataMontage calls the method:

```
java.lang.String getRolloverText(XYGraph graph, java.awt.Point point)
```

If the mouse cursor is over an `XYGraphDataPoint` within an `XYGraph`, DataMontage calls the method:

```
java.lang.String getRolloverText(XYGraph graph, java.awt.Point point,  
XYGraphDataPoint dp)
```

By default, the string “\n” embedded within rollover text is interpreted as a newline character. However, if the rollover text begins with `<html>` and ends with `</html>`, HTML tags are honored and “\n” is not interpreted as a newline character.

## 8.2 Custom Context Menus

DataMontage displays a context menu when the user presses the right mouse button. The UserInteractions interface also enables developers to add custom menu choices to the Montage context menu by providing a number of methods named `getCustomMenu`. Different method signatures correspond to the different types of graphical objects. When the right mouse button is pressed, DataMontage calls every `getCustomMenu` method with a signature that matches the objects that lie under the mouse cursor. For example, if the user presses the right click button when the mouse cursor is over a `GraphModule`, DataMontage calls method:

```
java.util.Vector getCustomMenu(GraphModule module)
```

If the mouse cursor is also over a `Graph` object, DataMontage also calls method:

```
java.util.Vector getCustomMenu(Graph graph)
```

Your implementation of each `getCustomMenu` method should return a `Vector` of `JMenu` objects that specify the label and action of each menu choice. DataMontage combines all of the `JMenu` objects returned by each `getCustomMenu` method and adds a custom menu choice to the popup menu for each `JMenu` object. You can get the selected DataMontage sub-object (e.g., data point or interval) by calling the `GraphContainer.getSelectedObject` method. You can call the `GraphModule.getGraphContainer` and the `Graph.getGraphModule` methods to get a handle to the graph container.

### 8.3 Mouse Actions

You can also specify actions to be carried out when the user presses and releases the left mouse button over an xy graph or timeline by overriding the default implementation of the following methods: `leftMouseReleased`, `leftMouseDoubleClicked`, and `mouseMoved`. Consult the JavaDoc for the details of these methods.

The `UserInteractions` Java interface includes methods that support dragging and dropping of symbols and time intervals within timelines. The `DefaultUserInteractions` Java class implements these methods, so users can relocate or resize data points and intervals via drag and drop while pressing the Shift key. However, this behavior is disabled. To enable these behaviors, define a subclass that overrides the `DefaultUserInteractions.isDraggingEnabled` method.

You can call a graph's `getObjectAt` method to determine whether the mouse button was released over a sub-object, such as a data point or interval, and apply an operation to the sub-object.

### 8.4 Drag and Drop within Timelines

The `UserInteractions` Java interface includes methods that support dragging and dropping of symbols and time intervals within timelines:

```
mouseDragDrop, mouseDragged, isMouseDragging.
```

The default implementation of these methods by the `DefaultUserInteractions` Java class enables users to change the timing and duration of data points and time intervals within timelines via drag and drop while pressing the shift key.

### 8.5 Initializing Containers

The `UserInteractions` Java interface defines a Java method that initializes the container. This method is called after DataMontage completes its own initialization of the container. The signature of this method is:

```
public void initialize(GraphContainer container)
```

Within your `UserInteractions` methods, you might find it convenient to query information stored in the `applicationData` property of the container, module, graphs, or data points and/or intervals, to determine the object's identity and other information.

## 9 Embedded JavaScript Expressions (DataMontage/J)

Some DataMontage properties store Javascript expressions that are evaluated by the Javascript engine embedded within the Java run-time system. These Javascript expressions:

- Initialize graph containers (see section 9.2),
- Define actions executed when users select custom context menu items (see section 9.4),
- Define actions executed when users select Note objects (see section 9.5),
- Specify values of reference value lines in `XYGraphReferenceValueLineXDouble` objects (see property `Function`), and

- Specify the upper and lower bounds of XYGraphReferenceValueLineXDouble objects (see properties UpperBoundFunction and LowerBoundFunction).

Oracle technical note, *The Nashorn Java API*, describes how to access Java from the JavaScript engine embedded within the Java 8 run-time system. See:

<https://docs.oracle.com/javase/8/docs/technotes/guides/scripting/nashorn/api.html>.

## 9.1 Loading Javascript Files During Initialization

When a DataMontage container initializes, it can load Javascript files specified in the *GraphContainer* property named *JavaScriptFileNames* into the Javascript engine. DataMontage property values containing Javascript expressions can refer to the Javascript functions defined within these files. If a Javascript file is identified by a relative URL, rather than a full URL, the location of the DataMontage container file is used as the base URL.

When DataMontage initializes the Javascript engine, it tries to load Javascript file *nashorn:mozilla\_compat.js* which provides compatibility with the Mozilla Rhino Javascript engine used through Java 7, even when DataMontage is being executed by Java 8. In particular, you can call Mozilla (Rhino) Javascript functions *importPackage* and *importClass*.

- <http://www.oracle.com/technetwork/articles/java/jf14-nashorn-2126515.html>
- [http://docs.oracle.com/javase/8/docs/technotes/guides/scripting/prog\\_guide/javascript.html](http://docs.oracle.com/javase/8/docs/technotes/guides/scripting/prog_guide/javascript.html)
- <https://wiki.openjdk.java.net/display/Nashorn/Rhino+Migration+Guide>

## 9.2 Using Javascript to Initialize a Graph Container

The container-level InitializationExpression property contains an optional Javascript expression that is evaluated when the DataMontage graph container is initialized. This expression can call Javascript functions defined within Javascript files specified by the GraphContainer.JavascriptFileNames property.

## 9.3 Calling Java Methods from within Javascript

Javascript expressions in DataMontage properties and in Javascript files loaded into DataMontage are evaluated by the Javascript engine embedded within the Java run-time system. Thus, these Javascript expressions can also call Java methods such as those included in the DataMontage API. The *GraphContainer* property *ImportedJavaClasses* is a comma-separated list of fully-qualified Java classes (i.e., including the package name) They are imported when the container initializes, so they can be referenced without their package name. The *GraphContainer* property *ImportedJavaPackages* is a comma-separated list of Java packages that are imported, so all Java classes in these packages can be referenced without their package name. These JavaScript expressions can refer to a variable named *\_container* which is bound to the DataMontage container object.

## 9.4 Custom Javascript Context Menu Items

In addition to the method for defining custom menu items described in section 8.2, DataMontage provides an alternate method of defining context menu items using Javascript. This method is easier to use, but it is a somewhat less flexible. The Java method:

```
public void addJavascriptContextMenuItem(  
    String menuItemLabel, String menuAction, String enableMenuItemTest)
```

adds an item to the context menu. The first argument, `menuItemLabel`, specifies the label of the menu item. Periods (.) can be embedded within the menu item label to specify different parts of a cascading (hierarchical) menu. For example, if the context menu contains two items with labels "Set Graphs Per Row.2" and "Set Graphs Per Row.4", the top-level menu item is labelled "Set Graphs Per Row". When this item is selected, a submenu with items labeled "2" and "4" is displayed. The third argument, `enableMenuItemTest`, is a text string that is evaluated as a Javascript expression to determine whether the menu item should be enabled.

When the user selects a menu item, the second argument, `menuAction` is evaluated as a Javascript expression. An example DataMontage container that uses this feature is provided in folder `\examples\javascript\javascript_menu_items_notes.dm`. Reference: class `GraphContainer`, methods: `addJavascriptContextMenuItem`, `clearJavascriptContextMenuItems`.

## 9.5 Time-Stamped Notes with Javascript Expressions

A Note object can be configured to store a JavaScript expression so that when a user clicks on a Note in the user interface, DataMontage evaluates the expression to perform an action such as highlighting or filtering parts of the DataMontage container. This feature enables users to select among pre-defined views of the data in the graph container. See Javadoc: `Note` class; `ScriptExpression` property.

# 10 Developing and Deploying Applications (DataMontage/J)

## 10.1 Using the DataMontage/J Library

The DataMontage/J library is contained within a file named `DataMontage.jar` which is included in the DataMontage Software Developer's Kit distribution. When developing a Java application using an integrated development environment (IDE) such as JBuilder or Eclipse, configure your project to include this jar file. If you do not use an IDE, place this jar file in the class path.

Your Java applet or application uses the DataMontage/J library to create, populate, display, save, and print DataMontage graph container objects as follows:

1. Create an empty DataMontage graph container object by calling a constructor method for the `GraphContainerXDateTime` or `GraphContainerXDouble` class.
2. Alternatively, you can call the `loadXML` or `loadZippedXML` static methods of the `GraphContainerXDateTime` or `GraphContainerXDouble` classes to create a graph container from a DataMontage configuration file. This file might serve as a template that contains only appearance specifications, as described in section 10.2. Or, the file could contain all data and appearance attributes, ready for display. See `GraphContainer` methods `instantiateFromFile` and `instantiateFromURL`.
3. Call the `initialize` method of the DataMontage graph container (`GraphContainerXDateTime` or `GraphContainerXDouble`) object,
4. DataMontage graph container classes descend from the Java Swing `JPanel` class. DataMontage container objects may be embedded contained within a `Java.awt.Container` object. Display the DataMontage container object by calling the `setVisible` and/or `show` methods of the `Java.awt.Container` object. Either of these method calls will indirectly generate a call to the `repaint` method of the DataMontage container object.
5. In general, if your application modifies the content or organization of an embedded DataMontage container, it should call `recalculateLayout()` before calling `repaint()`. This ensures that DataMontage

recalculates the position and dimensions of the subwindows within a DataMontage graph container. For example, changes to the lengths of Y axis labels may change the widths of the graphs or timelines. However, if your program adds, deletes, or modifies data points in an XY graph that has specified (vs. calculated) lower and upper X and Y limits, your program can redisplay the graph container by calling its *repaint* method without calling the *recalculate* method. Bypassing the call to the *recalculateLayout* method enables you to add data in real time and redisplay the container more quickly.

6. Your program can call the *GraphContainerXDateTime.cleanup* or *GraphContainerXDouble.cleanup* method after the graph container is no longer used to release resources (such as listeners) that were created to support the container. Data Montage provides additional signatures for the *cleanup* method, so you can release resources associated with individual timelines and graphs that have been deleted from a *GraphContainer*.
7. The application programming interface (API) provided by these rendering classes is described in on-line documentation in Javadoc format that is included with the DataMontage Developer's Kit.

When deploying your Java application, place file *DataMontage.jar* in the class path or invoke your Java application using the `-cp` switch (e.g., `java -cp <directories and/or zip and jar files>`.) When developing or deploying a Java applet that uses the DataMontage library, set the `CODEBASE` and `ARCHIVE` attributes in the `APPLET` tag so that it can find file *DataMontage.jar*.

If your DataMontage container object invokes Java classes that implement customizations, use the `-cp` switch to specify the folder or JAR file(s) that contain those Java classes. When using the SQL Operations feature, include any JDBC library files in the class path that are needed to access SQL databases.

## 10.2 DataMontage/J Graph Templates

You may find it useful to create *graph templates* as serialized DataMontage graph container objects as follows:

1. Create an XML configuration file that specifies a DataMontage container object and its sub-objects. You may find it useful to use the DataMontage Editor.
2. Use the DataMontage Viewer application to view the DataMontage display. Edit the configuration file until you are satisfied with the graph's appearance.

Your DataMontage applet or application can use this template as follows:

1. Deserialize the XML configuration file to create a DataMontage graph container object,
2. Call Java methods provided by the DataMontage API to add or change data and appearance attributes as required by your applet or application, and
3. Display the DataMontage graph container within your applet or application or serialize it so that it can be loaded and displayed by another Java program (e.g., within a Java applet.)

## 10.3 Writing XML Configuration Files

You can create DataMontage XML configuration files from a DataMontage *GraphContainer* object by using the *saveXML* and *saveZippedXML* methods. You can also write DataMontage XML configuration files directly without creating in-memory container objects. This option enables you to create DataMontage XML files using a program written in any language, such as C++, PERL, Microsoft Visual Basic, or SAS. Configuration files use the eXtensible Meta Language (XML) meta-file format. The syntax of these files is specified by XML Schema Definition (XSD) files which are included with the DataMontage Developer's Kit. In general, each XML complex type corresponds to a DataMontage class, and each XML element corresponds to a property of a DataMontage class. You can compress the XML file using the ZIP file format to reduce the sizes of these files. If the name of

the XML file is *foo.xml*, the name of the zip file that contains the XML file should be *foo.zip* or *foo.dm*. These zipped files can be read by the *loadZippedXML* method defined by the *GraphContainerXDatetime* and *GraphContainerXDouble* classes.

#### 10.4 Printing and Exporting to Image Files

Files *DataMontagePrint.txt*, *DataMontagePrintDecorator.txt*, and *DMPrintToPDFUsingGhostScript.txt* in the `\code_samples` folder provide Java source code examples that print DataMontage graphs. These classes are also included in the *DataMontage.jar* library file in Java package `com.stottlerhenke.datamontage`. *GraphContainer* methods *createJPEG* and *createImageIO* creates image files in GIF, JPEG, PNG, or BMP formats from a graph container. Command files *DataMontagePrintJpeg.bat* and *DataMontagePrint.bat* in the top-level installation folder provide examples of invoking these methods. You can use the DataMontage Viewer application to print DataMontage containers and export containers to image files in GIF, JPEG, PNG, or BMP format.

#### 10.5 Embedding DataMontage/J within Server-Side Software

Your Java (web) server application can create DataMontage graph container objects and serialize them into XML configuration files so that they can be displayed by another program, such as the DataMontage applet, that embeds the DataMontage/J library.

- Create an empty DataMontage graph container object by calling a constructor method for the *GraphContainerXDateTime* or *GraphContainerXDouble* class. Or, you can read a DataMontage configuration file that serves as a template or starting point for your container.
- Call Java methods provided by the DataMontage API to specify the content and appearance of the DataMontage container object by creating DataMontage sub-objects and setting property values.
- Call the container-level *saveXML* method to serialize the DataMontage graph container object to an XML configuration file.
- Call the *GraphContainerXDateTime.cleanup* or *GraphContainerXDouble.cleanup* method after the graph container is no longer used to release resources such as listener objects that were created to support the container.

As an alternative, the Web server application can generate DataMontage configuration files using file I/O, without using the DataMontage/J API. This is useful if the Web server application is written in a language other than Java.

A Web server application can also export the DataMontage graph container object into an image file using formats such as GIF, JPEG, PNG, or Adobe Acrobat (PDF) for display by a client-side application or Web browser.

#### 10.6 Using DataMontage/J with Java WebStart

The **DataMontage Viewer** application (`com.stottlerhenke.datamontage.test.Viewer`) works with Java WebStart. Specifically, the first (and only) command line argument can specify a DataMontage container file either by filename (as in earlier releases) or by URL string. URL strings must begin with either "http:" or "https:". To run the Viewer using Java WebStart, use the version of the DataMontage signed jar file that specifies all-permissions (e.g., *DataMontage\_all\_permissions.jar*).

A sample Java Network Launch Protocol (JNLP) file is located in the distribution folder at:

```
\examples\javaws\dm_viewer.jnlp
```

An application named **DataMontage WebViewer** accepts a single command line argument that specifies the URL of a DataMontage configuration file to be displayed. WebViewer requires only sandbox permissions. To run WebViewer using Java WebStart, use the version of the DataMontage signed jar file that specifies sandbox permissions (e.g., DataMontage\_sandbox.jar).

The Web server should be configured so that all files with the .jnlp file extension are set to the application/x-java-jnlp-file MIME type.

A sample Java Network Launch Protocol (JNLP) file is located in the distribution folder at:

```
\examples\javaws\dm_webviewer.jnlp
```

## 10.7 Using the DataMontage Applet Class

Using this approach, a Web application server generates HTML files that are downloaded and displayed by the user's Web browser. Each HTML file contains an applet tag that refers to a DataMontage configuration file generated by the server. The DataMontage applet (or subclass) deserializes this file into a DataMontage graph container object and displays it within a Web browser.

The DataMontage/J library provides two built-in applet classes that provide wrappers around the top-level DataMontage graph container classes. The *GraphContainerXDateTimeApplet* class enables the display of data with datetime X values, and the *GraphContainerXDoubleApplet* class enables the display of data with double-precision X values. These classes load a configuration file, identified as a URL by an parameter named *URLConfiguration*. This URL can be a full URL, or it can be relative to the path specified by the CODEBASE applet parameter. The *URLConfiguration* applet parameter can also identify a Zip archive file (with .zip or .dm file extension) that contains the configuration file. For example, a Zip file named *foo.dm* or *foo.zip* should contain a DataMontage XML configuration file named *foo.xml*.

The following code shows an example `<applet>` tag that can be embedded within a Web page to create a *GraphContainerXDateTimeApplet* object. This example also shows the JAR files that must be specified by the ARCHIVE attribute.

```
<applet
  CODEBASE = "."
  CODE     = "com.stottlerhenke.datamontage.applet.GraphContainerXDateTimeApplet.class"
  ARCHIVE  = "DataMontage.jar"
  NAME     = "DataMontage Applet"
  WIDTH   = 600    HEIGHT = 550
  HSPACE  = 0      VSPACE = 0
  MAYSCRIPT = true>
<param NAME = "URLConfiguration" VALUE = "cardiac_view.dm">
</applet>
```

Thus, you can create DataMontage displays and view them in a browser by creating an HTML file that includes an appropriate applet tag that references a DataMontage class, jar files, and a configuration file that specifies the content and format of the DataMontage graphical display.

The optional *defaultBaseURL* applet parameter resets the *defaultBaseURL* property of the DataMontage GraphContainer. The *URLPopup* or *URLNavigate* properties associated with DataMontage sub-objects specify

the URLs of web pages that are displayed in a popup window or navigated towards and displayed in the browser window. If DataMontage is embedded within a Java applet, the HTML page that contains the applet must define several JavaScript functions. The DataMontage Developer's Kit contains this JavaScript code in file DataMontageJavaScript.txt.

The HTML5 specification does not support the `<applet>` tag ([http://www.w3schools.com/tags/tag\\_applet.asp](http://www.w3schools.com/tags/tag_applet.asp)). Instead, it recommends use of the `<embed>` or `<object>` tags ([http://www.w3schools.com/tags/tag\\_embed.asp](http://www.w3schools.com/tags/tag_embed.asp), [http://www.w3schools.com/tags/tag\\_object.asp](http://www.w3schools.com/tags/tag_object.asp)).

An advantage of the `<object>` tag is that if the Java plug-in is not installed in the user's browser, use of the `<object>` tag will enable the browser to help the user download the appropriate Java plug-in. However, not all browsers support the `<object>` tag for Java applets.

The following code shows an example `<object>` tag that includes an `<embed>` tag to operate within browsers that do not support the `<object>` tag for Java applets. Using this tag, the `<object>` tag will be used if supported by the browser. If the `<object>` tag is not supported by the browser, the `<embed>` tag will be used.

```
<object classid="clsid:8AD9C840-044E-11D1-B3E9-00805F499D93"
  name="DataMontage GraphContainerXDateTimeApplet"
  width="800" height="675" hspace="0" vspace="0" align="middle">
  <param name="code"
    value="com.stottlerhenke.datamontage.applet.GraphContainerXDateTimeApplet.class">
  <param name="codebase" value="../../">
  <param name="archive" value="DataMontage.jar">
  <param name="type" value="application/x-java-applet;version=1.7.0">
  <param name="scriptable" value="true">
  <param name="mayscript" value="true">
  <param name="URLConfiguration" value="summary_timeline.dm">
  <comment>
    <embed code="com.stottlerhenke.datamontage.applet.GraphContainerXDateTimeApplet.class"
      name="DataMontage GraphContainerXDateTimeApplet"
      java_codebase="../../"
      archive="DataMontage.jar"
      width="800" height="675" hspace="0" vspace="0"
      scriptable="true" mayscript="true"
      URLConfiguration="summary_timeline.dm"
      type="application/x-java-applet;version=1.7.0">
    </embed>No Java Support.</noembed>
  </comment>
</object>
```

## 11 JavaScript Rendering Support (DataMontage/JS)

Beginning with version 5.0, the DataMontage/JS library displays DataMontage containers within Web browsers that support JavaScript and Scalable Vector Graphics (SVG). Currently, this feature only displays DataMontage timelines and does not display XY graphs.

The DataMontage/JS library translates a JSON file which encodes a DataMontage container object into an SVG element within an HTML page which can then be displayed by the browser. The DataMontage/JS library also provides methods for customizing user interactions such as adding user defined context menu items, similar to the custom user interactions enabled by the DataMontage/J library.

JavaScript class `dmDefaultUserInteractions`, defined in file `js/dm-user-interactions.js`, defines user interaction methods. For example, method `getTimelineCustomMenus` returns a list of context menu items when the user right-clicks over a timeline.

To add custom context menu items, create a `.js` file that defines a subclass of `dmDefaultUserInteractions` and override the relevant methods that return context menu items. See the example in `code_examples/javascript_customization`.

DataMontage JSON objects can be created in several ways:

- Selecting the File/Export to JSON menu item in the DataMontage Viewer exports the currently open DataMontage container to a DataMontage JSON file.
- The `JsonConverter` class in Java package `com.stottlerhenke.datamontage.export.json` define methods that write a DataMontage container object as a JSON file.
- The main method of the `DataMontageToJson` class in package `com.stottlerhenke.datamontage` generates a DataMontage JSON file from a DataMontage XML configuration file. Batch file `generatedDMJson.bat` in the DataMontage installation folder illustrates the invocation of this method.
- Standard JavaScript functions can create and modify DataMontage JSON objects.
- DataMontage JSON files can be rendered within SVG-enabled Web browsers in two ways:
  - Selecting the File / Preview SVG menu item in the DataMontage Editor generates a DataMontage JSON file from the currently open DataMontage container object. It also generates an HTML file that contains an SVG element and a script element that invokes the JavaScript method `svgId` to associate the SVG tag with the JSON file. The DataMontage Editor then launches the user's default Web browser to show the DataMontage container as an SVG object, embedded within the HTML page.
  - Creating an HTML file that invokes DataMontage/JS method `DM.container().svgId` associates a DataMontage JSON file with an SVG tag within an HTML file. When the SVG tag is associated with the JSON file, an SVG object is generated from the JSON file and then displayed within the Web browser (see example below).

The following example shows HTML statements needed to embed a JavaScript DataMontage Object within a Web page:

```
<!DOCTYPE html>
<meta charset="utf-8">
<link rel="stylesheet" type="text/css" href="dm/dm.css">
<link rel="stylesheet" type="text/css" href="dm/d3-context-menu.css">
<script src="dm/d3.js"></script>
<script src="dm/GeneralUtil.js"></script>
<script src="dm/d3-context-menu.js"></script>
<script src="dm/dm-user-interactions.js"></script>
<script src="dm/dm.js"></script>

<svg id="svg1" width="500" height="600"></svg>

<script>
  window.onload = function () {
    DM.container()
      .svgId("#svg1")
      .json("svgExampleIntervals.json");
  }
</script>
</html>
```

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The <link> elements specify style sheets and the first five <script> elements specify the JavaScript files that comprise the DataMontage/JS Library. In this example, the DataMontage/JS files reside in a folder named "dm". You can specify the URL of a different folder on your Web server that contains these files.

The <svg> element specifies the location, width, and height of the SVG object in the Web page in pixels or in percent. The id attribute uniquely identifies the <svg> element within the Web page.

The last <script> element calls JavaScript function DM.container().svgId to indicate the svg tag where the DM container will be displayed. The call to DM.container().json() associates a JSON file with an <svg> element and displays the content of the DM JSON file.

The following HTML excerpt shows how to associate optional custom interactions with a JavaScript DataMontage container.

```
<svg id="svg1" width="500" height="600"></svg>

<script src="./example-user-interactions.js"></script>

<script>
  window.onload = function () {
    DM.container()
      .setUserInteractions(new ExampleUserInteractions())
      .svgId("#svg1")
      .json("svgExampleIntervals.json");
  }
</script>
```

The first <script> element specifies the JavaScript file that defines the custom user interactions. The second <script> element instantiates a ExampleUserInteractions object defined in file example-user-interactions.js and associates this object with the DataMontage container. The second <script> element also calls function svgId to associate the DataMontage container with the <svg> element and calls function json to associate the container with a JSON file.

DataMontage 5.0 does not implement all the features provided by the Java version of DataMontage Java API. The JavaScript version implements most of the DataMontage timeline features, but it does not support hierarchical timelines, XY graphs, time-stamped notes, built-in context menu items, data point queries, graph subsets. File js/json\_format.html in the DataMontage installation folder documents the DataMontage JSON properties and indicates whether each property is supported by the DataMontage/JS library.