

Oracle® Fusion Middleware

User's Guide for Oracle MapViewer

12c Release 2 (12.2)

E60152-04

November 2016

Describes how to use Oracle MapViewer, a tool that renders maps showing different kinds of spatial data.

Copyright © 2001, 2016, Oracle and/or its affiliates. All rights reserved.

Primary Author: Chuck Murray

Contributors: Joao Paiva, L.J. Qian, Jayant Sharma, Honglei Zhu

This software and related documentation are provided under a license agreement containing restrictions on use and disclosure and are protected by intellectual property laws. Except as expressly permitted in your license agreement or allowed by law, you may not use, copy, reproduce, translate, broadcast, modify, license, transmit, distribute, exhibit, perform, publish, or display any part, in any form, or by any means. Reverse engineering, disassembly, or decompilation of this software, unless required by law for interoperability, is prohibited.

The information contained herein is subject to change without notice and is not warranted to be error-free. If you find any errors, please report them to us in writing.

If this is software or related documentation that is delivered to the U.S. Government or anyone licensing it on behalf of the U.S. Government, then the following notice is applicable:

U.S. GOVERNMENT END USERS: Oracle programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, delivered to U.S. Government end users are "commercial computer software" pursuant to the applicable Federal Acquisition Regulation and agency-specific supplemental regulations. As such, use, duplication, disclosure, modification, and adaptation of the programs, including any operating system, integrated software, any programs installed on the hardware, and/or documentation, shall be subject to license terms and license restrictions applicable to the programs. No other rights are granted to the U.S. Government.

This software or hardware is developed for general use in a variety of information management applications. It is not developed or intended for use in any inherently dangerous applications, including applications that may create a risk of personal injury. If you use this software or hardware in dangerous applications, then you shall be responsible to take all appropriate fail-safe, backup, redundancy, and other measures to ensure its safe use. Oracle Corporation and its affiliates disclaim any liability for any damages caused by use of this software or hardware in dangerous applications.

Oracle and Java are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Xeon are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Opteron, the AMD logo, and the AMD Opteron logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

This software or hardware and documentation may provide access to or information about content, products, and services from third parties. Oracle Corporation and its affiliates are not responsible for and expressly disclaim all warranties of any kind with respect to third-party content, products, and services unless otherwise set forth in an applicable agreement between you and Oracle. Oracle Corporation and its affiliates will not be responsible for any loss, costs, or damages incurred due to your access to or use of third-party content, products, or services, except as set forth in an applicable agreement between you and Oracle.

Contents

Preface	xix
Audience.....	xix
Documentation Accessibility	xix
Related Documentation.....	xix
Acknowledgments	xx
Conventions	xx
New and Changed Features.....	xxi
MapViewer Core	xxi
Oracle Maps HTML Javascript API (V2)	xxii

1 Introduction to MapViewer

1.1 Overview of MapViewer	1-1
1.1.1 Basic Flow of Action with MapViewer	1-2
1.1.2 MapViewer Architecture	1-3
1.2 Getting Started with MapViewer	1-4
1.3 Prerequisite Software for MapViewer	1-4
1.4 Installing and Deploying MapViewer in WebLogic Server 12c	1-4
1.4.1 Deploying MapViewer Using the Universal Installer.....	1-5
1.4.1.1 Installing WebLogic Server	1-5
1.4.1.2 Creating Required JRF Components Using the Repository Creation Utility	1-5
1.4.1.3 Installing MapViewer Using the Universal Installer.....	1-7
1.4.1.4 Configuring WebLogic Server	1-7
1.4.1.5 Starting WebLogic Server and Configuring MapViewer	1-9
1.4.2 Manually Deploying an Exploded MapViewer EAR Folder in WebLogic Server..	1-10
1.4.2.1 Prerequisites for Manually Deploying MapViewer	1-10
1.4.2.2 Unpacking the MapViewer EAR File into a Folder.....	1-10
1.4.2.3 Deploying MapViewer from an Exploded EAR File.....	1-11
1.4.3 Manually Deploying an Unexploded MapViewer EAR File in WebLogic Server..	1-12
1.4.3.1 Preparing to Install MapViewer From an Unexploded EAR File	1-12
1.4.3.2 Installing MapViewer from an Unexploded EAR File.....	1-15
1.4.4 After Deploying MapViewer	1-15
1.4.4.1 Verifying If the Deployment Was Successful.....	1-16
1.4.4.2 Running SQL Scripts.....	1-16

1.4.4.3	Creating MapViewer Array Types (If Necessary)	1-17
1.5	Upgrading MapViewer	1-17
1.5.1	Shutting Down the Old WebLogic Server.....	1-17
1.5.2	Deploying MapViewer in WebLogic Server 12c	1-18
1.5.3	Running the Upgrade Assistant Wizard	1-18
1.6	Administering MapViewer.....	1-19
1.6.1	Logging in to the MapViewer Administration Page	1-19
1.6.2	Configuring MapViewer.....	1-20
1.6.2.1	Specifying Logging Information	1-27
1.6.2.2	Specifying Map File Storage and Life Cycle Information.....	1-28
1.6.2.3	Restricting Administrative (Non-Map) Requests	1-29
1.6.2.4	Specifying a Web Proxy	1-30
1.6.2.5	Specifying Global Map Configuration Options	1-30
1.6.2.6	Customizing the Spatial Data Cache	1-32
1.6.2.7	Specifying the Security Configuration	1-32
1.6.2.8	Registering a Custom Image Renderer.....	1-33
1.6.2.9	Registering a Custom Spatial Provider	1-34
1.6.2.10	Registering Custom Nonspatial Data Providers.....	1-34
1.6.2.11	Customizing SRS Mapping	1-35
1.6.2.12	Customizing WMS GetCapabilities Responses.....	1-35
1.6.2.13	Customizing WMTS GetCapabilities Responses	1-36
1.6.2.14	Configuring the Map Tile Server for Oracle Maps.....	1-37
1.6.2.15	Defining Permanent Map Data Sources	1-38
1.6.2.16	Configuring and Securing the Map Data Server for the HTML5 API	1-40
1.6.3	Performing MapViewer Administrative Tasks	1-41
1.7	Oracle Real Application Clusters and MapViewer.....	1-42
1.7.1	Creating a Container Oracle RAC Data Source for the MapViewer Server.....	1-43
1.7.1.1	Create a Container Oracle RAC Data Source	1-43
1.7.1.2	Create a MapViewer Data Source Using a Container Data Source.....	1-47
1.7.2	Creating a MapViewer Data Source Using the Oracle RAC Service Name	1-48
1.7.3	Restarting MapViewer	1-48
1.8	High Availability and MapViewer.....	1-48
1.8.1	Deploying MapViewer on a Middle-Tier Cluster.....	1-49
1.9	Secure Map Rendering	1-49
1.9.1	How Secure Map Rendering Works	1-50
1.9.2	Getting the User Name from a Cookie	1-52
1.9.3	Authenticating Users: Options and Demo	1-52
1.9.4	Using Single Sign-On (SSO) with MapViewer	1-53
1.9.4.1	Install Oracle Access Manager.....	1-53
1.9.4.2	Configure MapViewer	1-53
1.9.4.3	Configure Oracle Access Manager.....	1-56
1.9.4.4	Configure MapViewer Oracle Access Manager Logout Parameters	1-56
1.9.4.5	Configure Oracle HTTP Server.....	1-56
1.10	MapViewer Demos and Tutorials	1-57

2 MapViewer Concepts

2.1	Overview of MapViewer	2-1
-----	-----------------------------	-----

2.2	Styles	2-2
2.2.1	Scaling the Size of a Style (Scalable Styles)	2-3
2.2.2	Specifying a Label Style for a Bucket	2-5
2.2.3	Orienting Text Labels and Markers	2-7
2.2.3.1	Controlling Text Style Orientation.....	2-7
2.2.3.2	Controlling Marker Orientation	2-8
2.2.4	Making a Text Style Sticky	2-8
2.2.5	Getting a Sample Image of Any Style	2-9
2.2.6	Allowing a Text Style to Overlap or Be Overlapped	2-10
2.3	Themes.....	2-11
2.3.1	Predefined Themes	2-12
2.3.1.1	Styling Rules in Predefined Spatial Geometry Themes	2-12
2.3.1.2	How MapViewer Formulates a SQL Query for a Styling Rule	2-14
2.3.1.3	Styling Rules with Binding Parameters.....	2-15
2.3.1.4	Applying Multiple Rendering Styles in a Single Styling Rule.....	2-16
2.3.1.5	Using Multiple Rendering Styles with Scale Ranges	2-17
2.3.1.6	Caching of Predefined Themes.....	2-17
2.3.1.7	Feature Labels and Internationalization	2-18
2.3.1.8	Primary and Secondary Labels for Linear Features	2-21
2.3.2	JDBC Themes.....	2-22
2.3.2.1	Defining a Point JDBC Theme Based on Two Columns	2-23
2.3.2.2	Storing Complex JDBC Themes in the Database	2-24
2.3.3	Image Themes	2-25
2.3.3.1	Creating Predefined Image Themes	2-26
2.3.4	GeoRaster Themes	2-27
2.3.4.1	Creating Predefined GeoRaster Themes	2-30
2.3.4.2	Using Bitmap Masks with GeoRaster Themes.....	2-34
2.3.4.3	Reprojection of GeoRaster Themes	2-35
2.3.4.4	Virtual Mosaic Themes	2-35
2.3.5	Network Themes.....	2-37
2.3.5.1	Creating Predefined Network Themes.....	2-39
2.3.5.2	Using MapViewer for Network Analysis	2-40
2.3.6	Topology Themes	2-41
2.3.6.1	Creating Predefined Topology Themes	2-43
2.3.7	WFS Themes	2-44
2.3.7.1	Creating Predefined WFS Themes	2-47
2.3.8	WMPS Themes	2-48
2.3.8.1	How the tile_resizing_option Attribute Works	2-51
2.3.8.2	snap_to_tile_scale and tile_resizing_option Attribute Usage Guidelines.....	2-53
2.3.8.3	Creating Predefined WMPS Themes	2-54
2.3.9	Custom Geometry Themes.....	2-55
2.3.10	Annotation Text Themes	2-60
2.3.11	LRS (Linear Referencing System) Themes	2-64
2.3.12	Thematic Mapping	2-67
2.3.12.1	Thematic Mapping Using External Attribute Data	2-73
2.3.13	Attributes Affecting Theme Appearance	2-76
2.4	Maps.....	2-77

2.4.1	Map Size and Scale	2-78
2.4.2	Map Legend	2-80
2.5	Data Sources	2-83
2.5.1	Catalog Data Sources	2-84
2.5.1.1	Export the Necessary Metadata from an Oracle Database	2-84
2.5.1.2	Export the Necessary Spatial Tables	2-85
2.5.1.3	Edit the MapViewer Configuration File to Add the Catalog Data Source.....	2-86
2.5.1.4	Restart the MapViewer Server.....	2-86
2.6	How a Map Is Generated	2-86
2.7	Cross-Schema Map Requests	2-87
2.8	Workspace Manager Support in MapViewer	2-90
2.9	MapViewer Metadata Views.....	2-93
2.9.1	xxx_SDO_STYLES Views.....	2-94
2.9.2	xxx_SDO_THEMES Views	2-95
2.9.3	xxx_SDO_MAPS Views	2-96
2.9.4	xxx_SDO_CACHED_MAPS Views.....	2-96
2.10	Oracle Maps	2-97
2.10.1	Overview of Oracle Maps.....	2-97
2.10.2	Architecture for Oracle Maps Applications	2-97

3 MapViewer Servers

3.1	MapViewer Map Server	3-1
3.1.1	Map Request Examples.....	3-2
3.1.1.1	Simple Map Request	3-3
3.1.1.2	Map Request with Dynamically Defined Theme.....	3-3
3.1.1.3	Map Request with Base Map, Center, and Additional Predefined Theme.....	3-3
3.1.1.4	Map Request with Center, Base Map, Dynamically Defined Theme, and Other Features	3-4
3.1.1.5	Map Request for Point Features with Attribute Value and Dynamically Defined Variable Marker Style	3-5
3.1.1.6	Map Request with an Image Theme	3-7
3.1.1.7	Map Request for Image of Map Legend Only	3-7
3.1.1.8	Map Request with SRID Different from Data SRID	3-8
3.1.1.9	Map Request Using a Pie Chart Theme.....	3-9
3.1.1.10	Map Request Using Ratio Scale and Mixed Theme Scale Modes.....	3-11
3.1.1.11	Map Request Using Predefined Theme (Binding Parameter and Custom Type).....	3-12
3.1.1.12	Map Request Using Advanced Styles and Rendering Rules	3-13
3.1.1.13	Map Request Using Stacked Styles	3-14
3.1.1.14	WFS Map Requests.....	3-15
3.1.1.15	Java Program Using MapViewer	3-18
3.1.1.16	PL/SQL Program Using MapViewer	3-20
3.1.2	Map Request DTD	3-21
3.1.2.1	map_request Element	3-26
3.1.2.2	bounding_themes Element	3-31
3.1.2.3	box Element	3-34
3.1.2.4	center Element	3-35

3.1.2.5	geoFeature Element.....	3-35
3.1.2.6	jdbc_georaster_query Element	3-38
3.1.2.7	jdbc_image_query Element	3-38
3.1.2.8	jdbc_network_query Element.....	3-40
3.1.2.9	jdbc_query Element.....	3-40
3.1.2.10	jdbc_topology_query Element.....	3-42
3.1.2.11	legend Element	3-42
3.1.2.12	map_tile_theme Element	3-45
3.1.2.13	north_arrow Element	3-46
3.1.2.14	operation Element	3-46
3.1.2.15	operations Element.....	3-47
3.1.2.16	parameter Element	3-47
3.1.2.17	scale_bar Element	3-48
3.1.2.18	style Element	3-49
3.1.2.19	styles Element	3-50
3.1.2.20	theme Element	3-50
3.1.2.21	themes Element.....	3-53
3.1.2.22	theme_modifiers Element	3-54
3.1.3	Information Request DTD	3-54
3.1.4	Map Response DTD.....	3-55
3.1.5	MapViewer Exception DTD	3-56
3.1.6	Geometry DTD (OGC)	3-56
3.2	MapViewer Map Data Server.....	3-59
3.2.1	Domains and Map Data Server URL Patterns.....	3-60
3.2.2	Map Data Server Request Parameters	3-60
3.2.2.1	Getting Data from a Predefined Geometry Theme	3-60
3.2.2.2	Getting Data from a JDBC Theme.....	3-61
3.2.2.3	Getting Annotation Text from a JDBC Theme	3-62
3.2.2.4	Getting Topology Data	3-63
3.2.3	Interpreting Data Returned from the Map Data Server.....	3-68
3.2.4	Map Data Server Error Handling	3-69
3.3	Map Tile Server	3-69
3.3.1	Map Tile Server Concepts.....	3-71
3.3.1.1	Map Tile Layers and Map Tile Sources	3-71
3.3.1.2	Storage of Map Image Tiles.....	3-71
3.3.1.3	Coordinate System for Map Tiles.....	3-73
3.3.1.4	Tile Mesh Codes.....	3-74
3.3.1.5	Map Tile Requests	3-74
3.3.1.6	Tiling Rules.....	3-75
3.3.1.7	Tile Background Color and Out-of-Bounds Color.....	3-75
3.3.2	Map Tile Server Configuration	3-76
3.3.2.1	Global Map Tile Server Configuration	3-76
3.3.2.2	Map Tile Layer Configuration	3-76
3.3.2.3	Map Tile Storage Schemes: Internal Mesh Code or XYZ.....	3-84
3.3.2.4	Creating a Map Tile Layer Using an External Web Map Source.....	3-85
3.3.3	Map Cache Auto-Update.....	3-86

3.3.3.1	Add the <dirty_tile_auto_update> element to the mapViewerConfig.xml configuration file	3-86
3.3.3.2	Add the <auto_update> element to tile layer definition	3-87
3.3.3.3	Create the dirty MBR table, base tables' log table, and triggers	3-88
3.3.3.4	Start the MapViewer server and test the map cache auto-update feature.....	3-92
3.3.4	UTFGrid for Map Tiles: Including Text Information About Features	3-93
3.3.4.1	Enabling the UTFGrid Option for a Tile Layer	3-93
3.3.4.2	Encoding a Key and Decoding a Grid Cell's Value.....	3-94
3.3.4.3	Building a UTFGrid Test Case	3-94
3.3.5	External Map Source Adapter.....	3-100

4 MapViewer JavaBean-Based API

4.1	Usage Model for the MapViewer JavaBean-Based API	4-1
4.2	Preparing to Use the MapViewer JavaBean-Based API	4-3
4.3	Using the MapViewer Bean.....	4-3
4.3.1	Creating the MapViewer Bean.....	4-3
4.3.2	Setting Up Parameters of the Current Map Request	4-4
4.3.3	Adding Themes or Features to the Current Map Request.....	4-6
4.3.4	Adding Dynamically Defined Styles to a Map Request	4-8
4.3.5	Manipulating Themes in the Current Map Request.....	4-10
4.3.6	Sending a Request to the MapViewer Service	4-12
4.3.7	Extracting Information from the Current Map Response.....	4-13
4.3.8	Obtaining Information About Data Sources.....	4-13
4.3.9	Querying Nonspatial Attributes in the Current Map Window	4-13
4.3.10	Using Optimal Methods for Thick Clients.....	4-15

5 MapViewer XML Requests: Administrative and Other

5.1	Managing Data Sources	5-1
5.1.1	Adding a Data Source (Administrative).....	5-2
5.1.2	Removing a Data Source (Administrative).....	5-4
5.1.3	Redefining a Data Source	5-4
5.1.4	Listing All Data Sources (Administrative or General-Purpose)	5-5
5.1.5	Checking the Existence of a Data Source (General-Purpose)	5-6
5.2	Managing Tile Layers.....	5-7
5.2.1	Getting Client Side Configuration.....	5-7
5.2.2	Getting Cache Status	5-8
5.2.3	Clearing, Prefetching, or Refreshing Cache	5-9
5.2.4	Exporting Tile Cache	5-10
5.2.5	Stopping, Resuming, or Removing an Existing Cache Administrative Task	5-11
5.2.6	Getting the Status of an Administrative Request.....	5-12
5.2.7	Creating or Redefining a Cache Instance	5-13
5.2.8	Removing a Cache Instance	5-14
5.2.9	Restarting the Tile Layer Cache Server	5-14
5.2.10	Taking a Tile Layer Offline or Bringing It Online.....	5-15
5.3	Listing All Maps (General-Purpose)	5-15
5.4	Listing Themes (General-Purpose).....	5-16
5.5	Listing Styles (General-Purpose)	5-17

5.6	Listing Styles Used by a Predefined Theme (General-Purpose)	5-18
5.7	Getting Style Definitions (General-Purpose)	5-19
5.8	Managing In-Memory Caches.....	5-19
5.8.1	Clearing Metadata Cache for a Data Source (Administrative)	5-20
5.8.2	Clearing Spatial Data Cache for a Theme (Administrative).....	5-20
5.9	Editing the MapViewer Configuration File (Administrative).....	5-21
5.10	Restarting the MapViewer Server (Administrative).....	5-22

6 Oracle Maps

6.1	Feature of Interest (FOI) Server	6-1
6.1.1	Theme-Based FOI Layers.....	6-1
6.1.1.1	Predefined Theme-Based FOI Layers	6-2
6.1.1.2	Templated Predefined Themes.....	6-3
6.1.1.3	Dynamic JDBC Query Theme-Based FOI Layers	6-3
6.1.2	User-Defined FOI Requests.....	6-4
6.2	Oracle Maps JavaScript API	6-4
6.2.1	JavaScript API V1.....	6-5
6.2.2	JavaScript API V2.....	6-6
6.2.3	V1 and V2 APIs: Similarities and Differences	6-7
6.3	Developing Oracle Maps Applications.....	6-9
6.3.1	Using the V1 API	6-9
6.3.1.1	Creating One or More Map Tile Layers	6-9
6.3.1.2	Defining FOI Metadata	6-9
6.3.1.3	Creating the Client Application with the V1 API.....	6-10
6.3.2	Using the V2 API	6-11
6.3.2.1	Creating the Client Application with the V2 API.....	6-12
6.4	Using Google Maps and Bing Maps.....	6-14
6.4.1	Defining Google Maps and Bing Maps Tile Layers on the Client Side	6-14
6.4.2	Defining the Built-In Map Tile Layers on the Server Side.....	6-15
6.5	Transforming Data to a Spherical Mercator Coordinate System.....	6-15
6.5.1	Creating a Transformation Rule to Skip Datum Conversion.....	6-16
6.6	Dynamically Displaying an External Tile Layer	6-17

7 Oracle Map Builder Tool

7.1	Running Oracle Map Builder	7-1
7.1.1	Java Libraries for Theme Creation with GDAL and Teradata	7-2
7.2	Oracle Map Builder User Interface.....	7-2
7.3	Map Builder Web Version	7-4

8 Oracle MapViewer Editor

8.1	MapViewer Editor Concepts and Usage	8-1
8.1.1	About the MapViewer Editor	8-1
8.1.2	MapViewer Editor Main Window	8-2
8.1.3	Editing Sessions	8-3
8.1.3.1	Editing Mode.....	8-3
8.1.3.2	Security and Multiuser Editing Considerations	8-4

8.1.4	Getting Started: A Typical Workflow	8-4
8.1.4.1	Installing the USER_SDO_EDIT_SESSIONS View.....	8-4
8.1.4.2	Making a MapViewer Data Source Editable	8-5
8.1.4.3	Allowing Map Data Server Data Streaming.....	8-5
8.1.4.4	Launching the MapViewer Editor and Logging In.....	8-5
8.1.4.5	Selecting a Data Source and Creating a New Session.....	8-6
8.1.4.6	Adding Data Layers to a Session.....	8-7
8.1.4.7	Changing Data Layer Properties.....	8-8
8.1.4.8	Navigating the Map and Enabling Editing Mode	8-9
8.1.4.9	Selecting a Feature for Editing.....	8-9
8.1.4.10	Saving and Merging Session Edits.....	8-10
8.1.5	Known Issues	8-12
8.2	MapViewer Editor Reference.....	8-12
8.2.1	Session and Layer Preferences.....	8-12
8.2.1.1	<session-name> Properties	8-12
8.2.1.2	Control Layer Properties	8-13
8.2.1.3	Data Layer Properties	8-14
8.2.2	Edit Session Area	8-15
8.2.2.1	Session and Data Layer Operations Toolbar	8-15
8.2.2.2	Data Layers.....	8-16
8.2.2.3	Rendering Properties	8-16
8.2.2.4	Labeling Properties	8-17
8.2.3	Map Canvas Area	8-17
8.2.3.1	Navigation Panel	8-17
8.2.3.2	Map Scale Bar	8-18
8.2.4	Tools Area	8-18
8.2.4.1	Feature Tools	8-18
8.2.4.2	Drawing Tools.....	8-19
8.2.4.3	Vertex Tools.....	8-19
8.2.4.4	Grouping Tools	8-20
8.2.4.5	Geometry Tools.....	8-22
8.2.4.6	Transformation Tools	8-23

A XML Format for Styles, Themes, Base Maps, and Map Tile Layers

A.1	Color Styles	A-2
A.2	Marker Styles	A-2
A.2.1	Vector Marker Styles	A-3
A.2.2	Image Marker Styles.....	A-4
A.2.3	TrueType Font-Based Marker Styles.....	A-4
A.2.4	Using Marker Styles on Lines	A-5
A.3	Line Styles	A-6
A.4	Area Styles	A-7
A.5	Text Styles	A-8
A.6	Advanced Styles.....	A-9
A.6.1	Bucket Styles.....	A-9
A.6.1.1	Collection-Based Buckets with Discrete Values.....	A-9
A.6.1.2	Individual Range-Based Buckets.....	A-10

A.6.1.3	Equal-Ranged Buckets	A-11
A.6.2	Color Scheme Styles	A-11
A.6.3	Variable Marker Styles.....	A-12
A.6.4	Dot Density Marker Styles	A-12
A.6.5	Bar Chart Marker Styles.....	A-13
A.6.6	Collection Styles.....	A-14
A.6.7	Variable Pie Chart Styles	A-14
A.6.8	Heat Map Styles	A-15
A.7	Themes: Styling Rules	A-17
A.8	Base Maps.....	A-21
A.9	Map Tile Layers.....	A-22

B JavaScript Functions for SVG Maps

B.1	Navigation Control Functions.....	B-1
B.2	Display Control Functions.....	B-2
B.3	Mouse-Click Event Control Functions.....	B-2
B.3.1	Predefined Mouse-Click Control Functions	B-2
B.3.2	User-Defined Mouse Event Control Functions	B-3
B.3.2.1	Map-Level Functions	B-3
B.3.2.2	Theme-Level Functions	B-4
B.3.2.3	Selection Event Control Functions	B-5
B.4	Other Control Functions	B-5

C Creating and Registering a Custom Image Renderer

D Creating and Registering a Custom Spatial Data Provider

D.1	Implementing the Spatial Provider Class.....	D-2
D.2	Registering the Spatial Provider with MapViewer	D-5
D.3	Rendering the External Spatial Data	D-5

E OGC WMS Support in MapViewer

E.1	Setting Up the WMS Interface for MapViewer.....	E-1
E.1.1	Required Files.....	E-1
E.1.2	Data Source Named wms	E-2
E.1.3	SDO to EPSG SRID Mapping File	E-2
E.2	WMS Specification and Corresponding MapViewer Concepts.....	E-2
E.2.1	Supported GetMap Request Parameters	E-2
E.2.1.1	BASEMAP Parameter (MapViewer-Only).....	E-3
E.2.1.2	BBOX Parameter	E-4
E.2.1.3	BGCOLOR Parameter	E-4
E.2.1.4	DATASOURCE Parameter (MapViewer-Only).....	E-4
E.2.1.5	DYNAMIC_STYLES Parameter (MapViewer-Only).....	E-4
E.2.1.6	EXCEPTIONS Parameter.....	E-4
E.2.1.7	FORMAT Parameter	E-4
E.2.1.8	HEIGHT Parameter.....	E-4
E.2.1.9	LAYERS Parameter	E-4

E.2.1.10	LEGEND_REQUEST Parameter (MapView-Only).....	E-5
E.2.1.11	MVTHEMES Parameter (MapView-Only).....	E-5
E.2.1.12	REQUEST Parameter	E-5
E.2.1.13	SERVICE Parameter	E-5
E.2.1.14	SRS (1.1.1) or CRS (1.3.0) Parameter	E-5
E.2.1.15	STYLES Parameter.....	E-5
E.2.1.16	TRANSPARENT Parameter.....	E-5
E.2.1.17	VERSION Parameter.....	E-6
E.2.1.18	WIDTH Parameter.....	E-6
E.2.2	Supported GetCapabilities Request and Response Features	E-6
E.2.3	Supported GetFeatureInfo Request and Response Features.....	E-8
E.2.3.1	GetMap Parameter Subset for GetFeatureInfo Requests	E-9
E.2.3.2	EXCEPTIONS Parameter.....	E-9
E.2.3.3	FEATURE_COUNT Parameter	E-9
E.2.3.4	INFO_FORMAT Parameter	E-9
E.2.3.5	QUERY_LAYERS Parameter	E-10
E.2.3.6	QUERY_TYPE Parameter (MapView-Only)	E-10
E.2.3.7	RADIUS Parameter (MapView-Only).....	E-10
E.2.3.8	UNIT Parameter (MapView-Only).....	E-10
E.2.3.9	X and Y or I and J Parameters	E-10
E.2.3.10	Specifying Attributes to Be Queried for a GetFeatureInfo Request	E-10
E.3	Adding a WMS Map Theme.....	E-11
E.3.1	XML API for Adding a WMS Map Theme	E-11
E.3.2	Predefined WMS Map Theme Definition.....	E-13
E.3.3	Authentication with WMS Map Themes.....	E-14
E.3.4	JavaBean-Based API for Adding a WMS Map Theme	E-15
E.3.5	Customizing GetCapabilities Responses: Additional Options	E-16
E.3.5.1	Custom WMS Capabilities Parameters (<custom_parameters> Element)	E-17
E.3.5.2	Custom WMS Capabilities Service Attributes (<service_attributes> Element)	E-17
E.3.5.3	Custom WMS Layer Attributes (<layer_attributes> Element)	E-18
E.3.5.4	Custom WMS Feature Information (<get_feature_info> Element).....	E-20

F OGC WMPS Support in MapViewer

F.1	WMTS Service for MapViewer	F-1
F.2	WMTS Operations	F-3
F.2.1	GetCapabilities Operation Support.....	F-3
F.2.2	GetTile Operation Support.....	F-11
F.2.2.1	Map tiles in WMTS Layer and in Map Cache Tile Layer	F-12
F.2.3	GetFeatureInfo Operation Support.....	F-13
F.2.3.1	OGC GetFeatureInfo Request	F-15
F.2.3.2	MapView GetFeatureInfo Request at an (x,y) Point	F-16
F.2.3.3	MapView GetFeatureInfo Request within a Bounding Box	F-17
F.3	Preparing the WMTS Service for MapViewer	F-19
F.3.1	Prepare Predefined Geometry Themes	F-19
F.3.2	Prepare the Base Map.....	F-19
F.3.3	Prepare Tile Layers.....	F-19
F.3.4	Publish Tile Layers in the wmtsConfig.xml Policy File	F-23

F.3.5	Verify the MapViewer WMTS Service.....	F-23
-------	--	------

Index

List of Examples

1–1	Sample MapViewer Configuration File.....	1-21
1–2	Restricting Administrative Requests.....	1-29
1–3	Configuring the mds.xml File	1-40
1–4	PL/SQL Package for Secure Map Rendering	1-50
1–5	View for Secure Map Rendering.....	1-51
1–6	Data Source Definition for Secure Map Rendering.....	1-51
1–7	Data Source Definition Specifying Cookie Name	1-52
2–1	Scalable Marker Style	2-4
2–2	Scalable Line Style.....	2-4
2–3	Advanced Style with Text Label Style for Each Bucket	2-5
2–4	Labeling an Oriented Point.....	2-7
2–5	Text Style with Sticky Attribute.....	2-9
2–6	XML Definition of Styling Rules for an Airport Theme.....	2-13
2–7	Styling Rules Using the <rendering> Element	2-17
2–8	Theme Styling Rules with Stacked Styles.....	2-17
2–9	JDBC Theme in a Map Request.....	2-22
2–10	JDBC Theme Based on Columns	2-23
2–11	JDBC Theme Based on Columns, with Query Window.....	2-23
2–12	Complex Query in a Predefined Theme	2-24
2–13	Creating a Predefined Image Theme.....	2-26
2–14	GeoRaster Theme Containing a SQL Statement.....	2-29
2–15	GeoRaster Theme Specifying a Raster ID and Raster Data Table.....	2-29
2–16	Creating a Predefined GeoRaster Theme	2-30
2–17	Preparing GeoRaster Data for Use with a GeoRaster Theme.....	2-30
2–18	Bitmap Mask in Predefined GeoRaster Theme.....	2-35
2–19	Reprojection Mode in Predefined GeoRaster Theme	2-35
2–20	Network Theme	2-39
2–21	Creating a Predefined Network Theme.....	2-39
2–22	Network Theme for Shortest-Path Analysis	2-41
2–23	Network Theme for Within-Cost Analysis	2-41
2–24	Topology Theme	2-42
2–25	Topology Theme Using Debug Mode.....	2-43
2–26	Creating a Predefined Topology Theme.....	2-43
2–27	WFS Request with a Dynamic WFS Theme	2-46
2–28	Creating a Predefined WFS Theme	2-47
2–29	Map Request with Predefined WFS Theme	2-47
2–30	Request with a Dynamic WMTS Theme.....	2-53
2–31	Creating a Predefined WMTS Theme	2-54
2–32	Map Request with Predefined WMTS Theme	2-54
2–33	Defining a Dynamic Custom Geometry Theme	2-58
2–34	Storing a Predefined Custom Geometry Theme	2-59
2–35	Styling Rules for a Predefined Annotation Text Theme	2-61
2–36	Dynamic Annotation Text Theme Definition	2-61
2–37	Dynamic Annotation Text Theme with Default Annotation Column	2-62
2–38	Script to Generate Annotation Text Data	2-62
2–39	Creating an LRS Theme	2-65
2–40	Map Request with Predefined LRS Theme	2-66
2–41	XML Definition of Styling Rules for an Earthquakes Theme	2-68
2–42	Advanced Style Definition for an Earthquakes Theme	2-69
2–43	Mapping Population Density Using a Graduated Color Scheme.....	2-69
2–44	Mapping Average Household Income Using a Graduated Color Scheme	2-70
2–45	Mapping Average Household Income Using a Color for Each Income Range	2-71
2–46	Advanced Style Definition for Gasoline Stations Theme.....	2-71
2–47	Styling Rules of Theme Definition for Gasoline Stations.....	2-72

2-48	Nonspatial (External) Data Provider Implementation	2-74
2-49	XML Definition of a Base Map.....	2-77
2-50	Legend Included in a Map Request.....	2-80
2-51	Map Request with Automatic Legend	2-81
2-52	Automatic Legend with Themes Specified	2-82
2-53	Cross-Schema Access: Geometry Table	2-88
2-54	Cross-Schema Access: GeoRaster Table	2-88
2-55	Cross-Schema Access: Topology Feature Table	2-89
2-56	Cross-Schema Access: Network Tables	2-90
2-57	Workspace Manager-Related Attributes in a Map Request	2-91
2-58	<list_workspace_name> Element in an Administrative Request.....	2-91
2-59	<list_workspace_session> Element in an Administrative Request.....	2-92
2-60	Finding Styles Owned by the MDSYS Schema.....	2-94
3-1	Simple Map Request ("Hello World")	3-3
3-2	Simple Map Request with a Dynamically Defined Theme.....	3-3
3-3	Map Request with Base Map, Center, and Additional Predefined Theme	3-3
3-4	Map Request with Center, Base Map, Dynamically Defined Theme, Other Features.....	3-4
3-5	Map Request for Point Features with Attribute Value and Dynamically Defined Variable Marker Style 3-5	
3-6	Map Request with an Image Theme	3-7
3-7	Map Request for Image of Map Legend Only	3-7
3-8	Map Request with SRID Different from Data SRID.....	3-8
3-9	Map Request Using a Pie Chart Theme	3-10
3-10	JDBC Theme Using a Pie Chart Style.....	3-11
3-11	Map Request Using Ratio Scale and Mixed Theme Scale Modes	3-11
3-12	Map Request Using Predefined Theme (Binding Parameter and Custom Type)	3-12
3-13	Map Request Using Advanced Styles and Rendering Rules.....	3-13
3-14	Map Request Using Stacked Styles	3-14
3-15	Map Request Using Predefined WFS Theme.....	3-16
3-16	Map Request Using Dynamic WFS Theme	3-16
3-17	Map Request Using Dynamic WFS Theme with an Advanced Style.....	3-17
3-18	Java Program That Interacts with MapViewer	3-18
3-19	PL/SQL Program That Interacts with MapViewer.....	3-20
3-20	North Arrow	3-46
3-21	Normalization Operation with a GeoRaster Theme	3-46
3-22	Styling Rules with Normalization Operation in a GeoRaster Theme	3-47
3-23	Scale Bar	3-49
3-24	MapViewer Information Request	3-55
3-25	Map Response	3-56
3-26	Streaming Tiles Without Storing Them	3-73
3-27	XML Definition of an Internal Map Tile Layer Based on a Base Map	3-78
3-28	XML Definition of an Internal Map Tile Layer Based on Themes	3-78
3-29	XML Definition of an External Map Tile Layer	3-79
3-30	External Map Source Adapter.....	3-101
3-31	MapSourceAdapter.getTileImageBytes Implementation	3-102
5-1	Adding a Data Source by Specifying Detailed Connection Information.....	5-3
5-2	Adding a Data Source by Specifying the Container Data Source.....	5-3
5-3	Removing a Data Source	5-4
6-1	XML Styling Rules for Predefined Theme Used for FOI Layer	6-2
6-2	XML Styling Rules for a Templated Predefined Theme	6-3
6-3	Theme for Dynamic JDBC Query	6-3
6-4	Transformation Rules Defined in the csdefinition.sql Script	6-16
C-1	Custom Image Renderer for ECW Image Format.....	C-2
D-1	Implementing the Spatial Provider Class.....	D-2
D-2	Map Request to Render External Spatial Data	D-6

E-1	GetMap Requests	E-3
E-2	GetCapabilities Response (Excerpt)	E-7
E-3	GetFeatureInfo Request.....	E-8
E-4	GetFeatureInfo Response.....	E-9
E-5	Adding a WMS Map Theme (XML API)	E-13
E-6	Creating a Predefined WMS Theme.....	E-14
E-7	WMS Theme with Authentication Specified	E-15
E-8	Custom WMS Layer Attributes	E-18
E-9	GetCapabilities Response with Custom Attributes	E-19
F-1	WMTS Policy File (wmtConfig.xml)	F-1
F-2	Tile Layer Definition in the Data Source	F-2
F-3	Response from GetCapabilities Request in KVP Encoding.....	F-4
F-4	Response from GetCapabilities Request in REST Encoding.....	F-9
F-5	Base Map Definition for Tile Layer TEST_TL	F-14
F-6	Theme Names and Styling Rules for Tile Layer TEST_TL	F-14
F-7	Response from OGC GetFeatureInfo Request	F-16
F-8	Response from MapViewer GetFeatureInfo Request within a Bounding Box	F-18
F-9	Tile Definition of Scale Set GlobalCRS84Scale.....	F-20
F-10	Tile Definition of Scale Set GlobalCRS84Pixel.....	F-21
F-11	Tile Definition of Scale Set GoogleCRS84Quad.....	F-21
F-12	Tile Definition of Scale Set GoogleMapsCompatible.....	F-22
F-13	Publishing Tile Layers.....	F-23

List of Figures

1-1	Basic Flow of Action with MapViewer	1-3
1-2	MapViewer Architecture	1-3
1-3	MapViewer Welcome Page	1-19
1-4	MapViewer Administration Page.....	1-20
1-5	Selecting the Server Instance	1-43
1-6	Displaying JDBC Data Sources	1-44
1-7	Creating a GridLink Data Source	1-44
1-8	Selecting the Server Instance	1-45
1-9	Displaying JDBC Data Sources	1-46
1-10	Creating a Multi Data Source.....	1-46
1-11	Create a New Authentication Provider	1-54
2-1	Varying Label Styles for Different Buckets	2-6
2-2	Map Display of the Label for an Oriented Point	2-8
2-3	Oriented Marker.....	2-8
2-4	Sample Image of a Specified Marker Style.....	2-10
2-5	Sample Image of a Specified Line Style	2-10
2-6	Text Style with allow-overlap="true".....	2-11
2-7	Specifying a Resource Bundle for a Theme	2-20
2-8	Image Theme and Other Themes Showing Boston Roadways.....	2-25
2-9	snap_to_tile_scale Attribute	2-51
2-10	unbiased tile_resizing_option Value.....	2-52
2-11	expand_biased tile_resizing_option Value	2-52
2-12	contract_biased tile_resizing_option Value	2-52
2-13	Thematic Mapping: Advanced Style and Theme Relationship	2-68
2-14	Map with Legend.....	2-81
2-15	Architecture for Oracle Maps Applications.....	2-98
3-1	Map Display Using a Pie Chart Theme	3-10
3-2	Bounding Themes	3-34
3-3	Orientation Vector	3-36
3-4	Map with <geoFeature> Element Showing Two Concentric Circles	3-38
3-5	Two-Column Map Legend	3-43
3-6	Workflow of the Map Tile Server	3-70
3-7	Tiling with a Longitude/Latitude Coordinate System	3-73
3-8	Tile Mesh Codes	3-74
3-9	Internal Mesh Code and XYZ Map Tile Storage Schemes	3-84
4-1	MapViewer Bean Usage Scenarios	4-2
7-1	Oracle Map Builder Main Window	7-3
8-1	MapViewer Editor Main Window.....	8-2
8-2	Open an Edit Session.....	8-6
8-3	Select Data Source	8-7
8-4	Add Spatial Data	8-8
8-5	Feature Selected.....	8-10
8-6	Resolve Conflicts.....	8-11
8-7	Navigation Panel.....	8-17
8-8	Scale Bar	8-18
A-1	Shield Symbol Marker for a Highway	A-5
A-2	Text Style with White Background.....	A-8
A-3	Heat Map Showing Pizza Restaurant Concentration.....	A-15
D-1	Map Image Using Custom Geometry Theme and External Spatial Data.....	D-7
E-1	Using Map Builder to Specify Authentication with a WMS Theme	E-15
F-1	Image Tile as Response to GetTile Request.....	F-12
F-2	Response from MapViewer GetFeatureInfo Request at an (x,y) Point	F-17
F-3	Bounding Box for MapViewer GetFeatureInfo Request	F-18

List of Tables

1-1	Protected and Public URIs to Configure for MapViewer Application Domain.....	1-56
2-1	Style Types and Applicable Geometry Types.....	2-3
2-2	Table Used with Gasoline Stations Theme.....	2-72
2-3	xxx_SDO_STYLES Views.....	2-94
2-4	xxx_SDO_THEMES Views	2-95
2-5	xxx_SDO_MAPS Views.....	2-96
2-6	xxx_SDO_CACHED_MAPS Views.....	2-96
3-1	Image processing Options for GeoRaster Theme Operations.....	3-47
6-1	Correspondence Between V1 and V2 API Classes.....	6-8

Preface

Oracle Fusion Middleware User's Guide for Oracle MapViewer describes how to install and use Oracle MapViewer (MapViewer), a tool that renders maps showing different kinds of spatial data.

Audience

This document is intended primarily for programmers who develop applications that require maps to be drawn. You should understand Oracle database concepts and the major concepts associated with XML, including DTDs. You should also be familiar with Oracle Spatial or Oracle Locator concepts, or at least have access to *Oracle Spatial and Graph Developer's Guide*.

This document is not intended for end users of websites or client applications.

Documentation Accessibility

For information about Oracle's commitment to accessibility, visit the Oracle Accessibility Program website at
<http://www.oracle.com/pls/topic/lookup?ctx=acc&id=docacc>.

Access to Oracle Support

Oracle customers that have purchased support have access to electronic support through My Oracle Support. For information, visit
<http://www.oracle.com/pls/topic/lookup?ctx=acc&id=info> or visit
<http://www.oracle.com/pls/topic/lookup?ctx=acc&id=trs> if you are hearing impaired.

Related Documentation

For more information, see the following documents in the Oracle Database documentation set:

- *Oracle Spatial and Graph Developer's Guide*
- *Oracle Spatial and Graph GeoRaster Developer's Guide*
- *Oracle Spatial and Graph Topology Data Model and Network Data Model Graph Developer's Guide*
- *Oracle Database Concepts*
- *Oracle Database SQL Language Reference*

See also the following document in the Oracle Fusion Middleware documentation set:

- Oracle Fusion Middleware High Availability Guide

Acknowledgments

This product includes color specifications and designs developed by Cynthia Brewer (<http://colorbrewer.org/>).

Use of OpenStreetMap (OSM) tiles is subject to their copyright (© OpenStreetMap contributors) and terms of use. For more information, see
<http://www.openstreetmap.org/copyright> and
http://wiki.openstreetmap.org/wiki/Tile_usage_policy.

The MVDEMO dataset is from Natural Earth (<http://www.naturalearthdata.com>).
See the terms of use at: <http://www.naturalearthdata.com/about/terms-of-use/>

Conventions

The following text conventions are used in this document:

Convention	Meaning
boldface	Boldface type indicates graphical user interface elements associated with an action, or terms defined in text or the glossary.
<i>italic</i>	Italic type indicates book titles, emphasis, or placeholder variables for which you supply particular values.
<code>monospace</code>	Monospace type indicates commands within a paragraph, URLs, code in examples, text that appears on the screen, or text that you enter.

New and Changed Features

This section describes major features that are new or changed since the previous release of MapViewer. This section groups the new features into [MapViewer Core](#) and [Oracle Maps HTML Javascript API \(V2\)](#) subsections.

MapViewer Core

This section describes features related to MapViewer generally, including the Map Builder Tool.

Upgrading MapViewer from Release 11g to Release 12.2.1.x

If you have an existing MapViewer Release 11g installation, and if you want to use its MapViewer configuration on Oracle Fusion Middleware Release 12.2.1.x, see [Section 1.5, "Upgrading MapViewer"](#).

UTFGrid for Map Tiles

When a tile layer has UTFGrid enabled, a data set named UTFGrid becomes a "companion" of an image tile, containing text information about feature properties in the image tile. This text information can be displayed by the updated Oracle Maps HTML5 API as a tooltip or info window in a web application.

For more information, see [Section 2.3.11, "LRS \(Linear Referencing System\) Themes"](#).

GeoRaster Virtual Mosaic support

Support has been added to the MapViewer server so that you can now create a predefined theme based on the virtual mosaic functions in Oracle Spatial and Graph GeoRaster databases.

Exporting Spatial and Graph Data into a geoJson in Map Builder

Map Builder now has an option to export vector data stored in a Spatial and Graph database into a geoJson file, using either ad hoc queries or predefined themes.

Rewritten Web Admin Console

MapViewer now comes with a lightweight Web Admin Console written in pure HTML and JavaScript. This enables easy deployment of the MapViewer server to virtually all JavaEE containers.

Map Builder Support for Exporting Data to a JSON File

You can use the Map Builder tool to export data to a JSON file. The source data can be from a database table, or from the spatial providers that access external data in its

original format. The JSON file can be used with the Oracle Maps V2 API in disconnected mode applications.

Map Builder Option to Export Map to a JSON File

For geometry themes, you can use the Map Builder tool to export the displayed map area in preview panel to a JSON file.

Map Builder Support for Dropping and Reprojecting Geometry Columns

In the Map Builder tool, operations to drop and to reproject a geometry column are available from the geometry table popup menu.

Oracle Maps HTML Javascript API (V2)

This section describes features for the Oracle Maps HTML5 Javascript API (V2), which is documented in [Chapter 6](#).

Dynamic Tile Layers

The new Oracle Maps HTML5 JavaScript API lets you easily create dynamic tile layers based on ad hoc queries or any valid MapViewer XML map requests. These tiles are client-side only and do not require the creation of metadata in a database.

Advanced Editing Functions

The redline tool in Oracle Maps JavaScript API has been enhanced to provide more powerful functions, such as shared boundary editing.

SVG File-Based Markers

The `OM.style.Marker` class can now take any SVG file as its `image src` attribute. Previously, only PNG and GIF images could be used as `src` for an image-based marker.

Server-Side Style Support Enhancements

You can now load styles from MapViewer running on a different domain.

toXMLString Method

Style classes now have the `toXMLString` method for easy conversion into server-side style definitions. The External Map Server Support example in [Section 3.3.5, "External Map Source Adapter"](#) uses the `toXMLString` method.

Introduction to MapViewer

Oracle Fusion Middleware Mapviewer (MapViewer) is a programmable tool for rendering maps using spatial data managed by Oracle Spatial and Graph or Oracle Locator (also referred to as Locator). MapViewer provides tools that hide the complexity of spatial data queries and cartographic rendering, while providing customizable options for more advanced users. These tools can be deployed in a platform-independent manner and are designed to integrate with map-rendering applications.

This chapter contains the following major sections:

- [Section 1.1, "Overview of MapViewer"](#)
- [Section 1.2, "Getting Started with MapViewer"](#)
- [Section 1.3, "Prerequisite Software for MapViewer"](#)
- [Section 1.4, "Installing and Deploying MapViewer in WebLogic Server 12c"](#)
- [Section 1.5, "Upgrading MapViewer"](#)
- [Section 1.6, "Administering MapViewer"](#)
- [Section 1.7, "Oracle Real Application Clusters and MapViewer"](#)
- [Section 1.8, "High Availability and MapViewer" \(for advanced users\)](#)
- [Section 1.9, "Secure Map Rendering"](#)
- [Section 1.10, "MapViewer Demos and Tutorials"](#)

Note: If you have an existing MapViewer Release 11g installation, and if you want to use its MapViewer configuration on the latest Oracle Fusion Middleware release, see [Section 1.5, "Upgrading MapViewer"](#)

1.1 Overview of MapViewer

MapViewer is shipped as part of Oracle Fusion Middleware. Its main deliverable is a Java EE (Java Platform, Enterprise Edition) application that can be deployed to a Java EE container, such as that for Oracle Fusion Middleware. MapViewer includes the following main components:

- A core rendering engine (Java library) named `SDOVIS` that performs cartographic rendering. A servlet is provided to expose the rendering functions to web applications.

- A suite of application programming interfaces (APIs) that allow programmable access to MapViewer features. These APIs include XML, Java, and an AJAX-based JavaScript API.
- A graphical map builder tool that enables you to create map symbols, define spatial data rendering rules, and create and edit MapViewer objects.
- Oracle Maps, which includes map cache and FOI (feature of interest) servers that facilitate the development of interactive geospatial web applications.

The core rendering engine connects to the Oracle database through Java Database Connectivity (JDBC). It also reads the map metadata (such as map definitions, styling rules, and symbology created through the Map Builder tool) from the database, and applies the metadata to the retrieved spatial data during rendering operations.

The XML API provides application developers with a versatile interface for submitting a map request to MapViewer and retrieving the map response. The JavaBean-based API provides access to MapViewer's rendering capabilities. The JavaScript API enables you to create highly interactive web applications that use the Oracle Maps feature of MapViewer.

The Map Builder tool simplifies the process of creating and managing map, theme, and symbology metadata in a spatial database. For information about this tool, see [Chapter 7](#).

Oracle Maps, built on core MapViewer features, uses a map tile server that caches map image tiles, and a feature of interest (FOI) server that streams live data out of a database to be displayed as interactive features on a map. You can use the AJAX-based JavaScript API with Oracle Maps to provide sophisticated mapping solutions. Oracle Maps also allows for advanced customization and querying capabilities.

The primary benefit of MapViewer is its integration with Oracle Spatial and Graph, Oracle Locator, and Oracle Fusion Middleware. MapViewer supports two-dimensional vector geometries stored in Oracle Spatial and Graph, as well as GeoRaster data and data in the Oracle Spatial and Graph topology and network data models. Oracle MapViewer is also an Open Geospatial Consortium (OGC)-compliant web map service (WMS) and web map tile service (WMTS) server.

1.1.1 Basic Flow of Action with MapViewer

With MapViewer, the basic flow of action follows a two-step request/response model, whether the client requests a map or some MapViewer administrative action.

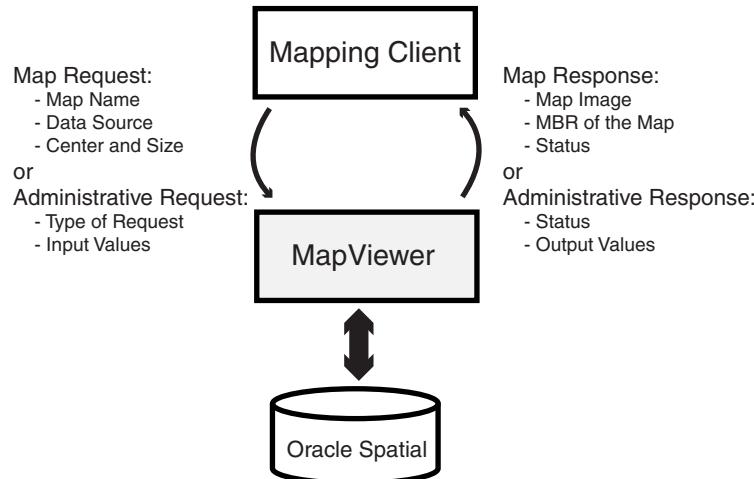
For a map request:

1. The client requests a map, passing in the map name, data source, center location, map size, and, optionally, other data to be plotted on top of a map.
2. The server returns the map image (or a URL for the image) and the minimum bounding rectangle (MBR) of the map, and the status of the request.

For a MapViewer administrative request:

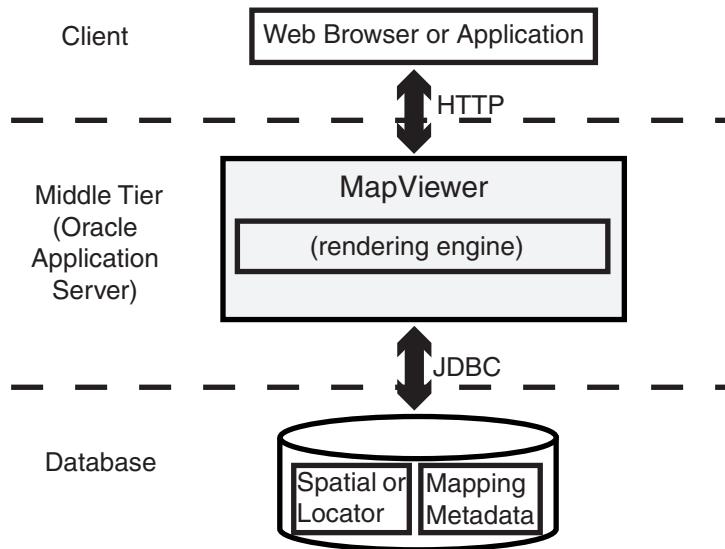
1. The client requests a MapViewer administrative action, passing in the specific type of request and appropriate input values.
2. The server returns the status of the request and the requested information.

[Figure 1–1](#) shows the basic flow of action with MapViewer.

Figure 1–1 Basic Flow of Action with MapViewer

1.1.2 MapViewer Architecture

Figure 1–2 illustrates the architecture of MapViewer.

Figure 1–2 MapViewer Architecture

As shown in Figure 1–2:

- MapViewer is part of the Oracle Fusion Middleware middle tier.
- MapViewer includes a rendering engine.
- MapViewer can communicate with a client web browser or application using the HTTP protocol.
- MapViewer performs spatial data access (reading and writing Oracle Spatial and Graph or Oracle Locator data) through JDBC calls to the database.
- The database includes Oracle Spatial and Graph or Oracle Locator, as well as mapping metadata.

1.2 Getting Started with MapViewer

To get started using MapViewer, follow these steps:

1. Either before or after you install and deploy MapViewer, read [Chapter 2](#) to be sure you understand important terms and concepts.
2. Ensure that you have the prerequisite software (see [Section 1.3](#)).
3. Install (if necessary) and deploy MapViewer (see [Section 1.4](#)).
4. Use MapViewer for some basic tasks. For example, create an Oracle Maps application (see [Chapter 6](#)).
5. Optionally, use the Map Builder tool (described in [Chapter 7](#)) to familiarize yourself with styles, themes, and maps, and the options for each, and optionally to preview spatial data.

1.3 Prerequisite Software for MapViewer

To use MapViewer, you must have the following software:

- A Java EE server supported by Oracle MapViewer (see <http://www.oracle.com/technetwork/middleware/mapviewer/j2ee-server-support-097757.html>)
- Oracle Database with Spatial and Graph option or Locator (Release 10g or later)
- Oracle Client (Release 10g or later), if you need to use JDBC Oracle Call Interface (OCI) features. In general, though, the JDBC thin driver is recommended for use with MapViewer, in which case Oracle Client is not required.
- Java SDK 1.6 or later

MapViewer also supports the headless AWT mechanism in J2SE SDK, which enables MapViewer to run on Linux or UNIX systems without setting any X11 DISPLAY variable. To enable AWT headless mode on Linux or UNIX systems, specify the following in the command line to start MapViewer:

```
-Djava.awt.headless=true
```

1.4 Installing and Deploying MapViewer in WebLogic Server 12c

You can install and deploy MapViewer to run in the WebLogic Server 12c middle tier by using one of the following approaches:

- Use the WebLogic Server universal installer, as explained in [Section 1.4.1](#).
- Manually deploy an exploded MapViewer EAR folder, as explained in [Section 1.4.2](#).
- Manually deploy an unexploded MapViewer EAR file, as explained in [Section 1.4.3](#).

Because MapViewer uses ADF components, the required components must be installed as part of the whole installation. MapViewer is a Java EE web application, and after the installation it listens for incoming map requests on its container's HTTP port.

1.4.1 Deploying MapViewer Using the Universal Installer

This section explains how to use the universal installer to deploy MapViewer to WebLogic Server 12c. If WebLogic Server 12c has not been installed, then you need to install it first before installing MapViewer. This section covers the following topics:

- [Installing WebLogic Server](#)
- [Creating Required JRF Components Using the Repository Creation Utility \(if necessary\)](#)
- [Installing MapViewer Using the Universal Installer](#)
- [Configuring WebLogic Server](#)
- [Starting WebLogic Server and Configuring MapViewer](#)

1.4.1.1 Installing WebLogic Server

If you need to install WebLogic Server, follow these steps.

1. Check if the Java environment is set properly. It needs to be JDK8 or later. For example:

```
java -version
```

The result should look something like the following

```
java version "1.8.0_65"
Java(TM) SE Runtime Environment (build 1.8.0_65-b17)
Java HotSpot(TM) 64-Bit Server VM (build 25.65-b01, mixed mode)
```

2. Go to

<http://www.oracle.com/technetwork/middleware/fusion-middleware/download-s/index.html>.

3. Read and accept the license agreement.
4. Under Oracle WebLogic Server 12cR2 (12.2.1.x), select the Fusion Middleware Infrastructure Installer.
5. Click **Download File** and save the file in a location of your choice, such as a temporary folder.
6. Launch the installation program. For example (and replace *x* with the appropriate number):

```
java -jar fmw_12.2.1.x.0_infrastructure.jar
```

For more information, see the WebLogic Server installation documentation for your operating system.

1.4.1.2 Creating Required JRF Components Using the Repository Creation Utility

Note: If you are using WebLogic Server 12.2.1.x.0 or later, you can skip the steps in this section, unless any other applications (besides MapViewer) need to have the JRF components installed in the WebLogic Server domain. (The JRF components do not need to be installed for MapViewer.)

The repository creation utility (RCU) loads into the database some Java Runtime Framework (JRF) components needed for configuring WebLogic Server. If you do not already have these JRF components loaded, follow the instructions in this section.

This RCU program can be found in the \$Oracle_Home/oracle_common/bin folder (for example, /scratch/Oracle/Middleware/Oracle_Home/oracle_common/bin). (The Oracle_Home folder was specified in [Section 1.4.1.1, "Installing WebLogic Server"](#).) Go to the folder containing the RCU program and then follow these steps:

1. Launch the RCU program. For example:

```
./rcu
```

2. When you see the Welcome page, click **Next**.
3. On the Create Repository page, accept the default (System Load and Product Load).

The database user for creating this database connection must have DBA privileges.

Click **Next**.

4. On the Database Details page, enter information for the fields.
The database user for this connection must have the SYSDBA role.
Click **Next**. (A pop-up window displays the progress of the prerequisites checking.)

5. On the Select Components Page:

- For the unique prefix for all schemas created in this session, either select an existing prefix or create a new prefix of your choice.
- For repository components, ensure that the following are selected: Metadata Services, Audit Services, Audit Services Append, Audit Services Viewer, and Oracle Platform Security Services.
- In the Common Infrastructure Services row (which you cannot edit), note the Schema Owner name (DEV_STB), because you will need to enter it when you configure WebLogic Server (in [Section 1.4.1.4, "Configuring WebLogic Server"](#)).

Click **Next**.

6. On the Schema Passwords page, set the passwords for the schemas to be created in the database. You can use the same password for all the schemas or different passwords. The passwords will be required when retrieving the components when configuring WebLogic Server.

Click **Next**.

7. On the Map Tablespaces page, accept the defaults and click **Next**.
8. On the Summary page, review the information, and click **Create**.
9. On the Completion Summary page, review the information. You will need to provide the Component Infrastructure Services schema owner (DEV_STB) and the password or passwords that you specified.

When you are finished, close the window to complete the repository creation utility (RCU).

1.4.1.3 Installing MapViewer Using the Universal Installer

After installing WebLogic Server, you are ready to install MapViewer using its universal installer.

Download the `fmw_12.2.1.x.0_mapviewer_generic.jar` file (replace *x* with the appropriate number) from the Oracle Technology Network, put it in a folder of your choice, such as `/scratch/tmp`, and follow these steps:

1. Go to the folder where the `mapviewer_generic.jar` file is. For example:

```
cd /scratch/tmp
```

2. Check if the Java environment is set properly. It needs to be JDK8 or later. For example:

```
java -version
```

The result should look something like the following

```
java version "1.8.0_65"
Java(TM) SE Runtime Environment (build 1.8.0_65-b17)
Java HotSpot(TM) 64-Bit Server VM (build 25.65-b01, mixed mode)
```

3. Launch the installation program. For example (replace *x* with the appropriate number):

```
java -jar fmw_12.2.1.x.0_mapviewer_generic.jar
```

You will see a Welcome page for the MapViewer 12c Installation.

Click **Next**.

4. On the Installation Location page, specify the Oracle_Home installation location that you specified in [Section 1.4.1.1, "Installing WebLogic Server"](#). For example:

```
/scratch/Oracle/Middleware/Oracle_Home
```

Click **Next**.

5. On the Prerequisites Check page, the installation program checks the operating system and the Java version. When it completes, click **Next**.

6. The Installation Summary page displays a summary report of this installation. Review it before you click **Install**.

The Installation Progress page shows the steps and progress of the installation.

7. On the Installation Complete page, note the **Create MapViewer** domain option.

- If you enable (check) this option, when you click **Finish** you are taken to the WebLogic Server configuration program to start deploying MapViewer.
- If you disable (uncheck) this option, when you click **Finish** you are not automatically taken to the WebLogic Server configuration program, but must launch that program manually later.

1.4.1.4 Configuring WebLogic Server

To configure WebLogic Server to deploy MapViewer, follow these steps.

1. If you did not enable the **Create MapViewer** domain option in the last step in [Section 1.4.1.3, "Installing MapViewer Using the Universal Installer"](#), go to `$Oracle_Home/wlserver/common/bin` and launch the configuration wizard (`config.sh` file). For example:

```
cd /scratch/Oracle/Middleware/Oracle_Home/oracle_common/common/bin  
./config.sh
```

2. On the Configuration Type page, specify the Create new domain option because you need to create a new domain for MapViewer.

Either specify a domain location or accept the default location (which may be similar to /scratch/Oracle/Middleware/Oracle_Home/user_projects/domains/base_domain), and click **Next**.

3. On the Templates page:

- Select **Create Domain Using Product Templates**.
- Template Categories: All Categories
- Available Templates: Ensure that the following are selected if you installed JRF components. If you did not need to install JRF components for MapViewer, then just select the first (Mapviewer) template.

```
Oracle MapViewer-12.2.1.x.0 [oracle_common]  
Oracle JRF 12.2.1.x.0 [oracle_common]  
WebLogic Coherence Cluster Extension-12.2.1.x.0 [wlserver]
```

Click **Next**.

4. On the Administrator Account page, enter the name for the account or accept the default name, enter and confirm the password, and click **Next**. (You will need the name and password when you log in to the administrator account.)
5. On the Domain Mode and JDK page, select the appropriate domain mode (Development or Production) and the JDK location, and click **Next**.
6. (Only if the Oracle JRF template was selected in step 3:) On the Database Configuration Type page, specify the required information. For Schema Owner and Schema Password, specify the values from [Section 1.4.1.2, "Creating Required JRF Components Using the Repository Creation Utility"](#) (if you ran that utility) -- for example, DEV_STB for Schema Name.

After entering the information, click **Get RCU Configuration** to retrieve the schema data that was loaded into the database by the repository creation utility. When this operation completes, click **Next**.

7. (Only if the Oracle JRF template was selected in step 3:) On the JDBC Component Schema page, select all listed schemas (LocalSvcTbl Schema, OPSS Audit Schema, OPSS Audit Viewer Schema, and OPSS Schema), and click **Next**.
8. On the Advanced Configuration page, select **Administration Server**, and click **Next**. (Optionally, before clicking Next select any other advanced configuration options that you want to specify in subsequent wizard pages.)
9. On the Administration Server page, for each option either accept the default value or specify a different one. Examples of default values: **Server Name** as AdminServer, **Listen Address** as All Local Addresses, and **Listen Port** as 7001.

In **Server Groups**, check options JRF-MAN-SVR (if the Oracle JRF template was selected in step 3) and MAPVIEWER-MAN-SVR in order for MapViewer to be deployed in AdminServer

Click **Next**.

10. On the Configuration Summary page, you can select among several Views (Deployment, Application, Service) to see configuration details, then click **Create** to create the domain for MapViewer.

11. On the Configuration Progress page, view the progress and steps for domain creation, then click **Next**.
12. On the Configuration Success page, note the **Domain Location** (where you will need to go to start WebLogic Server) and the **Admin Server URL** (where you will need to go to manage the MapViewer server). (You do not need to click those links now.)

If you selected additional options on the Advanced Configuration page, there will be more steps in the configuration. In particular, if you deploy to a *managed server with Oracle JRF (Java Required Files) using an Oracle RAC data source*, note the following:

- When JRF (or Enterprise Manager) is being extended to the domain, ensure that both the MDS and OPSS schemas are created by the repository creation utility (RCU). (These schemas are not used by MapViewer itself; rather, they are dependencies of JRF.)
- The Enterprise Manager or JRF templates must target the same managed server or servers to which MapViewer is being deployed. In other words, JRF libraries and related services must be available on the target managed server or servers.
- Ensure all the JRF-related data sources used to connect to the RCU schemas, such as MDS and OPSS, are deployed to the same managed server or servers. When Multi type data sources are used (as is often the case with Oracle RAC databases), ensure all the Multi type data sources and their child Generic type data sources are deployed to the managed server or servers. (These data sources are not used by MapViewer; rather, they are required by JRF during server startup and for application deployment.)

1.4.1.5 Starting WebLogic Server and Configuring MapViewer

To start WebLogic Server and perform some MapViewer administration tasks, follow these steps:

1. Start WebLogic Server, go to the domain location, and run `startWebLogic.sh`. For example:

```
cd /scratch/Oracle/Middleware/Oracle_Home/user_projects/domains/base_domain
./startWebLogic.sh
```

If you are prompted for the WebLogic Administrator user name and password, enter the values you specified in [Section 1.4.1.4, "Configuring WebLogic Server"](#).

2. When the server is running, open a browser window and enter the Admin Server URL (see the last step in [Section 1.4.1.4, "Configuring WebLogic Server"](#)).
3. On the WebLogic Server Administration Console, notice `mapViewer` under Deployments, and click the `mapViewer` name to display the MapViewer settings page.
4. On the MapViewer settings page, click the **Testing** tab, expand the `mapviewer` node, and click the default MapViewer URL to open the application in a browser.
5. Enter the user name and password for MapViewer administration (typically the same as for WebLogic Server administration).
6. On the MapViewer Administration home page, there are many administrative tasks that you can perform. For example, you can configure a map data source, as follows:
 - a. Click **Configuration** (upper left part on the page).

- b.** In the displayed XML text area, find the commented-out <map_data_source> element, and remove the comment characters and change the element definition to be one valid for the data source you want to define.
- c.** Click **Save** and then **Restart** to apply the changes. (You should see a progress bar display while MapViewer is restarting.)
- d.** After MapViewer has restarted, you can click the **Admin** link and see that your data source has been added.

1.4.2 Manually Deploying an Exploded MapViewer EAR Folder in WebLogic Server

This section describes how to deploy MapViewer manually from an exploded EAR folder in WebLogic Server. It contains the following topics:

- [Prerequisites for Manually Deploying MapViewer](#)
- [Unpacking the MapViewer EAR File into a Folder](#)
- [Deploying MapViewer from an Exploded EAR File](#)

1.4.2.1 Prerequisites for Manually Deploying MapViewer

Before you can manually deploy MapViewer, you must have done the following:

1. Installed WebLogic Server 12c, as explained in [Section 1.4.1.1, "Installing WebLogic Server"](#)
2. Created the necessary Java Runtime Framework (JRF) components, as explained in [Section 1.4.1.2, "Creating Required JRF Components Using the Repository Creation Utility"](#)
3. Configured WebLogic Server, as explained in [Section 1.4.1.4, "Configuring WebLogic Server"](#)
(If you cannot see and select MapViewer and MapViewer Samples templates, it is because you skipped the steps in [Section 1.4.1.3, "Installing MapViewer Using the Universal Installer"](#).)
4. Started WebLogic Server, as explained in [Section 1.4.1.5, "Starting WebLogic Server and Configuring MapViewer"](#)

1.4.2.2 Unpacking the MapViewer EAR File into a Folder

You must download the MapViewer archived file, `mapviewer.ear`, from the Oracle Technology Network, and then unpack it to a directory on the server where WebLogic is running. This directory will become the working folder of your MapViewer installation, where MapViewer will (by default) read the configuration file and save generated map images into some subdirectories. It is recommended that the directory be a permanent (not temporary) one. It can be a shared directory if you want the same MapViewer binaries to be deployed to multiple WebLogic servers running on multiple hosts.

The MapViewer directory is typically named `mapviewer.war` or `mapviewer` (or the same as the context path under which MapViewer is deployed).

In the following instructions, assume that you have created a directory named `/scratch/u1/mapviewer` as the top MapViewer directory. If you create another directory, adapt the instructions accordingly. Follow these steps to unpack the `mapviewer.ear` file into that directory:

1. Copy `mapviewer.ear` into `/scratch/u1/mapviewer`.

2. If /scratch/u1/mapviewer is not already your current directory, go there.
3. Rename mapviewerrm.ear to mapviewer.ear.
4. Create a subdirectory named mapviewer.ear.
5. Unpack mapviewer1.ear into mapviewer.ear (that is, into /scratch/u1/mapviewer/mapviewer.ear).
6. Go to the mapviewer.ear directory.
7. Rename web.war to web1.war.
8. Create a subdirectory named web.war.
9. Unzip web1.war into web.war (that is, into /scratch/u1/mapviewer/mapviewer.ear/web.war).

The mapviewer.ear file is now unpacked and configured. Under its deployment directory, which is mapviewer.ear folder, there are many subdirectories. You may want to explore a bit and familiarize yourself with some of the subdirectories in case you want to perform debugging, administration, or manual configuration. The following show some of the main subdirectories of this MapViewer deployment example:

```
/mapviewer.ear
  META-INF/
  web.war/
    console/
    css/
    fsmc/
    css/
    images/
    jslib
    icons/
    jet/
    jslib/
      v2/
  META-INF/
  scripts/
  templates/
  WEB-INF/
    admin/
    catalogs/
    classes/
    conf/
    lib/
    tags/
    xsd/
```

The /web.war/fsmc directory contains the Oracle Maps JavaScript V1 API library, and the /web.war/jslib directory contains the Oracle Maps JavaScript V2 API library. The /web.war/WEB-INF directory and its subdirectories contain libraries and MapViewer administration and configuration files.

Because you have unpacked MapViewer's EAR file into an exploded folder, you can start deploying the folder to WebLogic Server. You must ensure that WebLogic Server is properly configured and up and running before moving onto the next MapViewer deployment stage.

1.4.2.3 Deploying MapViewer from an Exploded EAR File

Follow these steps to deploy the exploded MapViewer EAR folder to WebLogic Server:

1. Log in to the WebLogic Server Administration Console page.
2. If WebLogic Server was configured in Production mode, lock the server: go to **Change Center > View changes and restarts**, and click **Lock & Edit**.
3. Go to **Domain Structure > Deployments**.
4. On the Deployments page, click **Install** (above the list of deployments).
5. In the Install Application Assistant, under **Locate deployment to install and prepare for deployment**, for **Path** specify `/scratch/u1.mapviewer`, for **Current Location** select `mapviewer.ear` (the exploded EAR folder), and click **Next**.
6. Under **Choose targeting style**, accept the default (Install this deployment as an application), and click **Next**.
7. Under **Optional Settings**, accept the defaults except under **Service Accessibility**, select I will make this deployment accessible from the following location.

This option causes the unpacked MapViewer location to become the "working" directory of MapViewer. It also makes it easier if you want to upgrade MapViewer in the future, in which case you simply unpack the new `mapviewer.ear` file to this directory and restart WebLogic Server. Click the **Finish** button to go to the Summary of deployment page.

Click **Finish**.

8. On the Summary of Deployments page for the `mapviewer` deployment, under **Change Center > View changes and restarts**, click **Activate Changes** to activate the deployment.
9. Start MapViewer as follows:
 - a. Go to **Change Center > View changes and restarts**, and click **Lock & Edit**.
 - b. Go to **Domain Structure > Deployments**.
 - c. In the Deployments list, select `mapviewer`.
 - d. Click **Start > Servicing all requests** (below the Deployments list).

MapViewer is now started (its State is Active).

If you want, you can log in to the MapViewer Administration Console to perform some administrative tasks (for example, see [Section 1.4.1.5, "Starting WebLogic Server and Configuring MapViewer"](#)).

1.4.3 Manually Deploying an Unexploded MapViewer EAR File in WebLogic Server

This section discusses how to prepare and manually deploy the MapViewer archive file, the `mapviewer.ear` file, in WebLogic Server 12c. It covers the following topics:

- [Preparing to Install MapViewer From an Unexploded EAR File](#)
- [Installing MapViewer from an Unexploded EAR File](#)

1.4.3.1 Preparing to Install MapViewer From an Unexploded EAR File

Before deploying MapViewer from an un-exploded (archived) file, you need to create a folder and copy some configuration files into that folder. There is no requirements as to where you should create the folder, but it is recommended that you designate a folder that serves as MapViewer's private folder, and copy the configuration files under the exploded `WEB-INF/conf` folder into a subfolder also named `conf`. This private folder should be outside any temporary deployment folders, and outside any

other locations that might be overwritten during a system installation or upgrade. Configuration files must be copied from the WEB-INF/conf folder into this private folder's conf subdirectory. (See [Section 1.4.2.2, "Unpacking the MapViewer EAR File into a Folder"](#) for the exploded folder structure and to see what is in the WEB-INF/conf folder).

The files to copy to WEB-INF/conf/conf are the following:

```
afwRules.xml  
mapViewerConfig.xml  
wmsConfig.xml  
wmtsConfig.xml
```

If the Java EE servers are running as a cluster, it is strongly recommended that the private folder for MapViewer be placed on a shared drive, so that all deployed MapViewer binaries can see and use it. This private folder should never be accessible to the public. Note that at runtime, MapViewer also creates and modifies several folders and files inside the private folder, such as log files and cached map tiles.

Creating such a private folder to store the editable configuration files also applies to the case when MapViewer is deployed from an exploded EAR folder, but you want to make the folder read-only so that MapViewer does not create or change any files in the exploded EAR folder during runtime.

For both cases, either MapViewer is deployed from an unexploded EAR file or from a read-only exploded-EAR folder, you must specify where the external mapViewerConfig.xml file is, so that at runtime MapViewer can determine the private folder and load configuration parameters from its appropriate configuration files. The default private folder is the MapViewer EAR archive's WEB-INF/ folder, and WEB-INF/conf/ is the folder containing the configuration files.

In this example, the external folder is set to /scratch/_maps/. A subfolder, /scratch/_maps/conf, is created to contain the configuration files that were copied from the EAR file's WEB-INF/conf folder into WEB-INF/conf/conf.

You must tell MapViewer where to look for the external mapViewerConfig.xml file. You can use several methods for this, but for all methods you specify the absolute path to this mapViewerConfig.xml file, and then MapViewer derives the private folder based on this path. For example, assume external folder is at /scratch/_maps/conf/ and that you have copied the mapViewerConfig.xml, afwRules.xml, wmsConfig.xml, and wmtsConfig.xml files into it. In this case, during startup MapViewer checks in the locations for the preceding methods *in the order listed*, and uses whichever mapViewerConfig.xml file it finds first. When MapViewer finds the location (in this example /scratch/_maps/), it uses the folder as the private folder.:.

If MapViewer still cannot find an external mapViewerConfig.xml file after trying locations for all of the preceding methods, it attempts to find the default mapViewerConfig.xml file in the EAR file's WEB-INF/conf/folder. Consequently, this will no longer be a read-only deployment, because MapViewer will be writing files into the exploded EAR folder from its deployment, just as in the traditional deployment (be deployed from an exploded EAR folder).

For all methods in which an external mapViewerConfig.xml file is being used, you must also specify a public folder for MapViewer to save the generated map images, as explained in section "Specifying a Public Folder for Generated Map Images".

Use one of the following methods to tell MapViewer where to look for the external mapViewerConfig.xml file:

- Method 1: Use a JVM option.

This method specifies the location of the external `mapViewerConfig.xml` file using a JVM option, `oracle.maps.config`, which is typically added to the Java EE server startup script. For example, for WebLogic server you can add this option to the domain's `setDomainEnv.sh` script (right after the `-Djavax.management.builder.initial=weblogic.management.jmx.mbeanserver.WLSMBeanServerBuilder` option in that script):

```
EXTRA_JAVA_PROPERTIES=
" ... -Doracle.maps.config=/scratch/_maps/conf/mapViewerConfig.xml ... "
```

After making the change, you must restart WebLogic Server before attempting the MapViewer deployment.

- Method 2: Use : Use a `<context-param>` element in `web.xml`.

This method requires modifying the included `web.xml` file in the MapViewer EAR archive file's `WEB-INF/` folder before deployment. In the `web.xml` file, add a new `<context-param>` element just after the `<description>` element to specify the location of the external configuration file. For example:

```
<context-param>
    <param-name>oracle.maps.config</param-name>
    <param-value>/scratch/_maps/conf/mapViewerConfig.xml</param-value>
</context-param>
```

- Method 3: Use a properties file in the classpath.

This method involves creating a properties file and placing it in the MapViewer classpath, as follows:

1. Create a text file named `config.properties` containing a single line referring to the location of the `mapViewerConfig.xml` file. For example:

```
oracle.maps.config=/scratch/_maps/conf/mapViewerConfig.xml
```

2. Create an empty folder `oracle/` and a subfolder `maps/`, and save `config.properties` file in the `maps/` subfolder. In other words, you should have a path like this:

```
oracle/maps/config.properties
```

3. Create a JAR archive that contains this path and file, and run the `jar` command from inside the parent folder of `oracle`. (The name of the `.jar` file can be anything you want.) For example

```
jar cvf maps_config.jar oracle
```

4. Place this newly created JAR file in the MapViewer classpath. For example, in WebLogic Server you can place this jar in the domain's `lib` folder. For example, in:

```
/scratch/Oracle/Middleware/Oracle_Home/user_projects/domains/base_
domain/lib
```

1.4.3.1.1 Specifying a Public Folder for Generated Map Images When an external `mapViewerConfig.xml` file is to be used, you must also specify a public folder for MapViewer to save generated map images so that users and MapViewer client applications can access them over the web. To do this, specify an appropriate path attribute in the `<save_images_at>` element of the external `mapViewerConfig.xml` file.

Be sure that the `<save_images_at>` element is not commented out. (By contrast, in the traditional deployment you can often leave the `<save_images_at>` element

commented out, in which case MapViewer uses the images folder of the exploded WAR file for saving generated map images.)

The specified path must not point to any location inside the MapViewer EAR archive or folder.

If you have multiple MapViewer instances running in a cluster, this public folder must be on a shared drive.

1.4.3.2 Installing MapViewer from an Unexploded EAR File

This section covers the steps when you manually deploy MapViewer from an archived (unexploded) EAR file.

Note: Before you perform the steps in this section, you must also be sure you have downloaded the mapviewer.ear file from the Oracle Technology Network to a folder, such as /scratch/u1/mapviewer, and that you have met the prerequisites explained in [Section 1.4.2.1, "Prerequisites for Manually Deploying MapViewer"](#).

1. Log in to the WebLogic Server Administration Console page.
 2. If WebLogic Server was configured in Production mode, lock the server: go to **Change Center > View changes and restarts**, and click **Lock & Edit**.
 3. Go to **Domain Structure > Deployments**.
 4. On the Deployments page, click **Install** (above the list of deployments).
 5. In the Install Application Assistant, under **Locate deployment to install and prepare for deployment**, for **Path** specify /scratch/u1.mapviewer, for **Current Location** select mapviewer.ear (the exploded EAR folder), and click **Next**.
 6. Under **Choose targeting style**, accept the default (Install this deployment as an application), and click **Next**.
 7. Under **Optional Settings**, accept the defaults and click **Finish**.
 8. On the Summary of Deployments page for the mapviewer deployment, under **Change Center > View changes and restarts**, click **Activate Changes**.to activate the deployment.
 9. Start MapViewer as follows:
 - a. Go to **Change Center > View changes and restarts**, and click **Lock & Edit**.
 - b. Go to **Domain Structure > Deployments**.
 - c. In the Deployments list, select mapviewer.
 - d. Click **Start > Servicing all requests** (below the Deployments list).
- MapViewer is now started (its State is Active).

1.4.4 After Deploying MapViewer

After deploying MapViewer, you may need or want to perform one or more actions:

- [Verifying If the Deployment Was Successful](#)
- [Running SQL Scripts](#)
- [Creating MapViewer Array Types \(If Necessary\)](#)

1.4.4.1 Verifying If the Deployment Was Successful

To test if the MapViewer server has started correctly, point your browser to the MapViewer instance. For example, if MapViewer is installed on a system named `www.example.com` and the HTTP port is 7001, enter the following URL to invoke the MapViewer server with a simple get-version request:

```
http://www.example.com:8888/mapviewer/omserver?getv=t
```

If MapViewer is running correctly, it should immediately send back a response text string indicating the version number, such as:

```
12.2.1.1.0
```

If the server has not been started or initialized correctly, there will be no response, or the message `500 internal server error` will be displayed.

If the response message includes wording like *MapServer is not ready*, try again later. This could mean that the MapViewer server is initializing, but the process will take some additional time (for example, because the system is slow or because multiple predefined data sources are specified in the configuration file and MapViewer is attempting to connect to these databases). In this case, you can wait for at least a few seconds and try the preceding request again.

However, if you continue to get this response message, there may be a problem with the deployment. You then need to look into the log file to identify the underlying cause.

1.4.4.2 Running SQL Scripts

If the target Oracle Database version is 12.1 or later, you do not need to run any scripts described in this topic.

If the target database is earlier than Oracle Database 12.1, you need to run at least one script and possibly more. For each script that you run, you must run it on each target Oracle database from which MapViewer will render spatial data.

MapViewer uses a set of system views to store necessary mapping metadata in a target database. A target database is a database with Oracle Spatial and Graph or Oracle Locator (Release 10g or later) installed and from which you want MapViewer to render maps. MapViewer requires the following system views:

- `USER_SDO_MAPS`
- `USER_SDO_THEMES`
- `USER_SDO_STYLES`
- `USER_SDO_CACHED_MAPS`

The `USER_SDO_CACHED_MAPS` view is used by the Oracle Maps feature. It stores definitions of map tile cache instances. If the target database is earlier than Oracle Database 12.1, you must create this view manually by running the following script while connected as the `SYS` user:

```
SQL> @$MV_HOME/WEB-INF/admin/mcsdefinition.sql
```

- `USER_SDO_EDIT_SESSIONS`

The `USER_SDO_EDIT_SESSIONS` view is used to store editing sessions for the Map editor application. It stores definitions of data that can be edited. Verify if your database has this editing view, and if not then run the following script while connected as the `SYS` user:

```
SQL> @$MV_HOME/WEB-INF/admin/sdedefinition.sql
```

If the target database is Release 9.2 or later, the USER_SDO_MAPS, USER_SDO_THEMES, and USER_SDO_STYLES views are created and populated automatically. However, if the target database has a release number lower than 9.2, you must manually create and populate these views by running the following scripts while connected as the MDSYS user:

```
SQL> @$MV_HOME/WEB-INF/admin/mapdefinition.sql
SQL> @$MV_HOME/WEB-INF/admin/defaultstyles.sql
```

1.4.4.3 Creating MapViewer Array Types (If Necessary)

For each database schema that it connects to, MapViewer checks for the existence of the following SQL array types that support array-type binding variables that might exist in some predefined themes:

- MV_STRINGLIST
- MV_NUMBERLIST
- MV_DATELIST

If these types do not exist, MapViewer attempts to create them in the database schema associated with the MapViewer data source. However, if the user associated with that schema does not have sufficient privileges to create new types, a privileged user must create the types by connecting to the data source schema and entering the following statements:

```
CREATE or REPLACE type MV_STRINGLIST as TABLE of VARCHAR2(1000);
CREATE or REPLACE type MV_NUMBERLIST as TABLE of NUMBER;
CREATE or REPLACE type MV_DATELIST as TABLE of DATE;
```

1.5 Upgrading MapViewer

Upgrading MapViewer enables you to use an existing MapViewer configuration in WebLogic Server on Oracle Fusion Middleware Release 12.2.1.x.0. If you have an existing MapViewer installation (11g or 12c) with a Fusion Middleware release before 12.2.1.x.0, and if you want to continue to use your existing MapViewer configuration, follow the instructions in this section.

The main upgrade steps are:

1. [Shutting Down the Old WebLogic Server](#)
2. [Deploying MapViewer in WebLogic Server 12c](#)
3. [Running the Upgrade Assistant Wizard](#)

1.5.1 Shutting Down the Old WebLogic Server

Before starting deployment of the new MapViewer 12c version in WebLogic 12c, it is recommended that you shut down the old WebLogic Server, for example, WebLogic Server 11g.

You can shut down the WebLogic Server using the administration console page or using a command line in the command line window.

1.5.2 Deploying MapViewer in WebLogic Server 12c

Follow the guidelines in [Section 1.4, "Installing and Deploying MapViewer in WebLogic Server 12c"](#) to deploy the new MapViewer 12c in Weblogic Server 12c. The new MapViewer can be deployed in any deployment option in [Section 1.4](#). When the deployment is done, MapViewer needs to be up and running.

1.5.3 Running the Upgrade Assistant Wizard

After the old WebLogic Server has been shut down and the newly deployed MapViewer is up and running, follow these step to perform the upgrade. In these steps, assume that the Oracle Home of the new WebLogic Server 12c is `/scratch/Oracle/Middleware12c/Oracle_Home`.

1. Go to `$Oracle_Home/oracle_common/upgrade/bin`, and run the `ua` (Upgrade Assistant Wizard) program:
`./ua`
2. When you see the Upgrade Assistant Welcome page, click **Next**.
3. On the Weblogic Components page, for type of upgrade select **All Configurations Used by a Domain**.
For **Domain Directory**, specify the `12.2.1.x.0` domain directory.
Click **Next**.
4. On the Component List page, ensure that **Oracle MapViewer** is in the list of components to be upgraded, and click **Next**.
5. On the Prerequisites page, check (select) all boxes.
6. On the MapViewer Upgrade page, select the MapViewer configuration file version.
 - For Release 11, specify the path for `mapViewerConfig.xml` for the old MapViewer deployment. (Usually it is located at the folder of the unpacked EAR configuration, for example, `$EAR_FOLDER/web.war/WEB-INF/conf.`) Then click **Next**.
 - For Release 12, the default path on the wizard page points to the `12.2.1.x.0` domain configuration file to be upgraded; however, you can specify another path. Then click **Next**.
7. On the Examine page, view the status of a pre-check of the components before any upgrade occurs (for example, succeeded indicating upgrade of the component can proceed, or upgrade not necessary), and click **Next**.
8. On the Upgrade Summary page, view the list of configurations that will be upgraded, and click **Upgrade**.
9. On the Upgrade Progress page, view the progress of the upgrade and the status of any components that were upgraded.

After closing Upgrade Assistant, you can either restart MapViewer using its administration console or go back to the WebLogic Server Administration Console to restart MapViewer server. If you use the MapViewer's administration console, go to the Configuration page and click **Restart**. If you use the WebLogic Server administration console, from the Deployments table, **Stop** and then **Start** MapViewer to have the upgrade take effect.

If you now log in to the MapViewer's Administration Console (see [Section 1.6, "Administering MapViewer"](#)) and view the Configuration and Datasources, you will notice that the old MapViewer has been successfully migrated into the newly deployed MapViewer.

1.6 Administering MapViewer

This section introduces the MapViewer Administration page and some administrative and configuration tasks that you can perform, such as adding new data sources, managing map tile layers used by Oracle Maps, and setting logging levels. It includes the following topics:

- [Logging in to the MapViewer Administration Page](#)
- [Configuring MapViewer](#)
- [Performing MapViewer Administrative Tasks](#)

1.6.1 Logging in to the MapViewer Administration Page

After you have verified that MapViewer is running properly, it is suggested that you log in to the MapViewer Administration page. To do this, go first to the MapViewer Welcome page, which is typically `http://<host>:<port>/mapviewer`, where `<host>` and `<port>` should be replaced by the correct value for your installation. [Figure 1–3](#) shows the MapViewer Welcome page

Figure 1–3 MapViewer Welcome Page

The screenshot shows the Oracle MapViewer Administration Console 12c welcome page. The top navigation bar includes links for Home, Admin, Metadata, Configuration, About, and Logout. A user 'Signed in As weblogic' is logged in. The main content area has a 'Home' section with a message about the server being running and a 'Getting Started' section with three bullet points: 'Use MapBuilder to import some spatial data into an Oracle database that you have access to.', 'Create a data source so that MapViewer can connect to the database. Please log into the Admin page to do so.', and 'Start developing your first MapViewer applications.' Below this is a 'What is Oracle Maps' section with a brief description of Oracle Maps as a new feature. The 'Demos and tutorials' section notes that all demos and tutorials have been removed. At the bottom, there is a copyright notice and a note to click the Admin link.

Click the **Admin** link at the top right.

The MapViewer administration page is displayed, as shown in [Figure 1–4](#).

Figure 1–4 MapViewer Administration Page

Name	User	Type	JDBC url	TNS name	Mappers	Maximum connections	Editable
oraclemaps_pub		CATALOG			3	0	false

You can use this administration page to perform administrative tasks, such as clearing cached data, creating tile layers, managing tile layers, and restarting the server (use the Monitoring link to restart).

1.6.2 Configuring MapViewer

If the default configuration settings for running MapViewer are not adequate, you can configure MapViewer by editing the MapViewer configuration file, `mapViewerConfig.xml`, which is located in the `$MAPVIEWER_HOME/WEB-INF/conf` directory. To modify this file, you can use a text editor, or you can use the MapViewer Administration page.

After you modify this file, you must restart the container to have the changes take effect; however, you can instead use the MapViewer Administration page to restart only the MapViewer servlet (instead of the entire Java EE instance, which may have other applications deployed and running) if you installed MapViewer with a standalone Glassfish instance.

If you deployed MapViewer to a WebLogic Server instance with multiple processes (thus with multiple physical JVMs on the same host), or if you deployed to a WebLogic Server instance that is in a clustered island (with multiple WLS instances running on multiple hosts), you must restart the WebLogic Server instance itself for the changes to the MapViewer configuration file to take effect in all MapViewer servers. In the latter case (clustered WebLogic Server instances), you may also need to modify the MapViewer configuration file in the MapViewer directory hierarchy for each host's WebLogic Server instance in the cluster. For more information about repository-based middle-tier clustering, see *Oracle Fusion Middleware High Availability Guide*.

The MapViewer configuration file defines the following information in XML format:

- Logging information, defined either through container-controlled logging (recommended) or in the `<logging>` element (see [Section 1.6.2.1](#))
- Map image file information, defined in the `<save_images_at>` element (see [Section 1.6.2.2](#))
- Administrative request restrictions, defined in the `<ip_monitor>` element (see [Section 1.6.2.3](#))

- Web proxy information for accessing external information across a firewall, defined in the <web_proxy> element (see [Section 1.6.2.4](#))
- Global map "look and feel" configuration, defined in the <global_map_config> element (see [Section 1.6.2.5](#))
- Internal spatial data cache settings, defined in the <spatial_data_cache> element (see [Section 1.6.2.6](#))
- Custom image renderer registration, defined in the <custom_image_renderer> element (see [Appendix C](#))
- Permanent map data sources, defined in the <map_data_source> element (see [Section 1.6.2.15](#))
- Security configurations, defined in the <security_config> element
- WMS services configurations, defined in the <wms_config> element
- External attribute data provider registration, defined in <ns_data_provider> elements
- Map tile server configurations, defined in the <map_tile_server> element
- UTF grid lifecycle parameters, defined in the <utfgrid_life_cycle> element
- External spatial data provider registration, defined in the <s_data_provider> element
- Map data sources, defined in the <map_data_source> element
- Map data server stream parameters, defined in the <mds_config> element
- OAM logout parameters, defined in the <oam_logout> element

All path names in the `mapViewerConfig.xml` file are relative to the directory in which the file is stored, unless otherwise specified.

[Example 1–1](#) shows a sample `mapViewerConfig.xml` file.

Example 1–1 Sample MapViewer Configuration File

```
<?xml version="1.0" ?>
<!!-- This is the configuration file for MapViewer. -->
<!!-- Note: All paths are resolved relative to this directory (where
      this config file is located), unless specified as an absolute
      path name.
-->

<MapperConfig>

<!!-- **** Logging Settings **** -->
<!!-- **** Logging Settings **** -->
<!!-- **** Logging Settings **** -->

<!!-- Uncomment the following to modify logging. Possible values are:
    log_level = "fatal"|"error"|"warn"|"info"|"debug"|"finest"
                default: info) ;
    log_thread_name = "true" | "false" ;
    log_time = "true" | "false" ;
    one or more log_output elements.
-->
<!!--
<logging log_level="info" log_thread_name="false"
        log_time="true">
```

```

<log_output name="System.err" />
<log_output name="..../log/mapviewer.log" />
</logging>
-->

<!-- **** Map Image Settings **** -->
<!-- **** Map Image Settings **** -->
<!-- **** Map Image Settings **** -->

<!-- Uncomment the following only if you want generated images to
     be stored in a different directory, or if you want to customize
     the life cycle of generated image files.

By default, all maps are generated under
$ORACLE_HOME/lbs/mapviewer/web/images.

Images location-related attributes:
file_prefix: image file prefix, default value is "omsmap"
url: the URL at which images can be accessed. It must match the 'path'
      attribute below. Its default value is "%HOST_URL%/mapviewer/images"
path: the corresponding path in the server where the images are
      saved; default value is "%ORACLE_HOME%/lbs/mapviewer/web/images"

Images life cycle-related attributes:
life: the life period of generated images, specified in minutes.
      If not specified or if the value is 0, images saved on disk will
      never be deleted.
recycle_interval: this attribute specifies how often the recycling
      of generated map images will be performed. The unit is minute.
      The default interval (when not specified or if the value is 0)
      is 8*60, or 8 hours.

-->
<!--
<save_images_at  file_prefix="omsmap"
                  url="http://mypc.mycorp.com:8888/mapviewer/images"
                  path="../web/images"
/>
-->

<!-- **** IP Monitoring Settings **** -->
<!-- **** IP Monitoring Settings **** -->
<!-- **** IP Monitoring Settings **** -->

<!-- Uncomment the following to enable IP filtering for administrative
     requests.

Note:
- Use <ips> and <ip_range> to specify which IPs (and ranges) are allowed.
  Wildcard form such as 20.* is also accepted. Use a comma-delimited
  list in <ips>.

- Use <ips_exclude> and <ip_range_exclude> for IPs and IP ranges
  prohibited from accessing eLocation.

- If an IP falls into both "allowed" and "prohibited" categories, it is
  prohibited.

- If you put "*" in an <ips> element, then all IPs are allowed, except
  those specified in <ips_exclude> and <ip_range_exclude>.
  On the other hand, if you put "*" in an <ips_exclude> element, no one

```

will be able to access MapViewer (regardless of whether an IP is in <ips> or <ip_range>).

- You can have multiple <ips>, <ip_range>, <ips_exclude>, and <ip_range_exclude> elements under <ip_monitor>.
- If no <ip_monitor> element is present in the XML configuration file, then no IP filtering will be performed (all allowed).
- The way MapViewer determines if an IP is allowed is:

```

        if(IP filtering is not enabled) then allow;
        if(IP is in exclude-list) then not allow;
        else if(IP is in allow-list) then allow;
        else not allow;
-->

<!--
<ip_monitor>
    <ips> 138.1.17.9, 138.1.17.21, 138.3.* , 20.* </ips>
    <ip_range> 24.17.1.3 - 24.17.1.20 </ip_range>
    <ips_exclude> 138.3.29.* </ips_exclude>
    <ip_range_exclude> 20.22.34.1 - 20.22.34.255 </ip_range_exclude>
</ip_monitor>
-->

<!-- **** Web Proxy Setting **** -->
<!-- Uncomment and modify the following to specify the web proxy setting.
     This is only needed for passing background image URLs to
     MapViewer in map requests or for setting a logo image URL, if
     such URLs cannot be accessed without the proxy.
-->

<!--
<web_proxy host="www-proxy.my_corp.com" port="80" />
-->

<!-- **** Security Configuration **** -->
<!-- Here you can set various security related configurations of MapViewer.
-->

<security_config>
    <disable_direct_info_request> false </disable_direct_info_request>
</security_config>

<!-- **** Global Map Configuration **** -->
<!-- Uncomment and modify the following to specify systemwide parameters
     for generated maps. You can specify your copyright note, map title, and
     an image to be used as a custom logo shown on maps. The logo image must
     be accessible to this MapViewer and in either GIF or JPEG format.
Notes:
    - To disable a global note or title, specify an empty string ("") for
      the text attribute of <note> and <title> element.
    - position specifies a relative position on the map where the

```

```

        logo, note, or title will be displayed. Possible values are
        NORTH, EAST, SOUTH, WEST, NORTH_EAST, SOUTH_EAST,
        SOUTH_WEST, NORTH_WEST, and CENTER.
        - image_path specifies a file path or a URL (starts with "http://")
          for the image.

<rendering> element attributes:
- Local geodetic data adjustment: If allow_local_adjustment="true",
  MapViewer automatically performs local data
  "flattening" with geodetic data if the data window is less than
  3 decimal degrees. Specifically, MapViewer performs a simple
  mathematical transformation of the coordinates using a tangential
  plane at the current map request center.
  If allow_local_adjustment="false" (default), no adjustment is
  performed.
- Automatically applies a globular map projection (geodetic data only):
  If use_globular_projection="true", MapViewer will
  apply a globular projection on the fly to geometries being displayed.
  If use_globular_projection="false" (the default), MapViewer does no map
  projection to geodetic geometries. This option has no effect on
  non-geodetic data.

-->

<!--
<global_map_config>
  <note text="Copyright 2009, Oracle Corporation"
    font="sans serif"
    position="SOUTH_EAST" />
  <title text="MapViewer Demo"
    font="Serif"
    position="NORTH" />
  <logo image_path="C:\\images\\a.gif"
    position="SOUTH_WEST" />

  <rendering allow_local_adjustment="false"
    use_globular_projection="false" />
</global_map_config>
-->

<!-- **** Spatial Data Cache Setting **** -->
<!-- Uncomment and modify the following to customize the spatial data cache
     used by MapViewer. The default is 64 MB for in-memory cache.

To disable the cache, set max_cache_size to 0.

max_cache_size: Maximum size of in-memory spatial cache of MapViewer.
  Size must be specified in megabytes (MB).
report_stats: If you would like to see periodic output of cache
  statistics, set this attribute to true. The default
  is false.

-->

<!--
<spatial_data_cache  max_cache_size="64"
  report_stats="false"
/>
-->

```

```

<!-- **** Custom Image Renderers **** -->
<!-- **** Custom WMS Capabilities Info **** -->
<!-- **** Custom Non-Spatial Data Provider **** -->
<!-- Uncomment and add as many custom image renderers as needed here,
    each in its own <custom_image_renderer> element. The "image_format"
    attribute specifies the format of images that are to be custom
    rendered using the class with full name specified in "impl_class".
    You are responsible for placing the implementation classes in the
    MapViewer's classpath.
-->
<!--
<!--
<custom_image_renderer image_format="ECW"
                      impl_class="com.my_corp.image.ECWRenderer" />
-->

<!-- **** Custom WMS Capabilities Info **** -->
<!--
<!--
<!-- Uncomment and modify the following tag if you want MapViewer to
    use the following information in its getCapabilities response.
    Note: all attributes and elements of <wms_config> are optional.
-->
<!--
<!--
<wms_config host="www.my_corp.com" port="80">
    <title>
        WMS 1.1 interface for Oracle Mapviewer
    </title>
    <abstract>
        This WMS service is provided through MapViewer.
    </abstract>
    <keyword_list>
        <keyword>bird</keyword>
        <keyword>roadrunner</keyword>
        <keyword>ambush</keyword>
    </keyword_list>
    <sdo_epsg_mapfile>
        ../config/epsg_srids.properties
    </sdo_epsg_mapfile>
</wms_config>
-->

<!-- **** Custom Non-Spatial Data Provider **** -->
<!--
<!--
<!-- Uncomment and add as many custom non-spatial data provider as
    needed here, each in its own <ns_data_provider> element.
    You must provide the id and full class name here. Optionally you
    can also specify any number of global parameters, which MapViewer
    will pass to the data provider implementation during initialization.
    The name and value of each parameter is interpreted only by the
    implementation.
-->

<!-- this is the default data provider that comes with MapViewer; please
    refer to the MapViewer User's Guide for instructions on how to use it.

<ns_data_provider
    id="defaultNSDP"
    class="oracle.sdovis.NSDataProviderDefault"
/>

```

```
-->

<!-- this is a sample NS data provider with parameters:
<ns_data_provider
  id="myProvider1" class="com.mycorp.bi.NSDataProviderImpl" >

  <parameters>
    <parameter name="myparam1" value="value1" />
    <parameter name="p2"      value="v2"      />
  </parameters>

</ns_data_provider>
-->

<!-- **** Map Tile Server Setting **** -->
<!-- **** Uncomment and modify the following to customize the map tile server.

<tile_storage> specifies the default root directory under which the
cached tile images are to be stored if the cache instance configuration
does not specify the root directory for the cache instance. If the
default root directory is not set or not valid, the default root
direcotry will be set to be $MAPVIEWER_HOME/web/tilecache

  default_root_path: The default root directory under which the cached
                     tile images are stored.

-->

<!--
  <map_tile_server>
    <tile_storage default_root_path="/scratch/tilecachetest/">
  </map_tile_server>
-->

<!-- **** Predefined Data Sources **** -->
<!-- **** Uncomment and modify the following to predefined one or more data
     sources.
     Note: You must precede the jdbc_password value with a '!'
           (exclamation point), so that when MapViewer starts the next
           time, it will encrypt and replace the clear text password.
-->

<!--
<map_data_source name="mvdemo"
  jdbc_host="elocation.example.com"
  jdbc_sid="orcl"
  jdbc_port="1521"
  jdbc_user="scott"
  jdbc_password="!password"
  jdbc_mode="thin"
  number_of_mappers="3"
/>
-->

</MapperConfig>
```

This MapViewer configuration topic includes the following subtopics:

- [Specifying Logging Information](#)
- [Specifying Map File Storage and Life Cycle Information](#)
- [Restricting Administrative \(Non-Map\) Requests](#)
- [Specifying a Web Proxy](#)
- [Specifying Global Map Configuration Options](#)
- [Customizing the Spatial Data Cache](#)
- [Specifying the Security Configuration](#)
- [Registering a Custom Image Renderer](#)
- [Registering a Custom Spatial Provider](#)
- [Registering Custom Nonspatial Data Providers](#)
- [Customizing SRS Mapping](#)
- [Customizing WMS GetCapabilities Responses](#)
- [Customizing WMTS GetCapabilities Responses](#)
- [Configuring the Map Tile Server for Oracle Maps](#)
- [Defining Permanent Map Data Sources](#)
- [Configuring and Securing the Map Data Server for the HTML5 API](#)

1.6.2.1 Specifying Logging Information

MapViewer provides a flexible logging mechanism to record runtime information and events. You can configure the granularity, volume, format, and destination of the log output. You can also configure the maximum size of log files as well as automatic log file rotation.

There are two ways to configure MapViewer's logging: container-controlled logging, and using the `<logging>` element in the configuration file.

Container-Controlled Logging

If the `<logging>` element in the `mapViewerConfig.xml` file is commented out or missing, MapViewer uses container-controlled logging, specifically using the following loggers:

- `oracle.mapviewer.ws` for all web server (maps, tiles, features) messages
- `oracle.mapviewer.access` for all user access
- `oracle.mapviewer.sdoVis` for all rendering (maps, themes, features) messages
- `oracle.mapviewer.webconsole` for all administrative console log messages

Using the `<logging>` Element

If the `<logging>` element in the `mapViewerConfig.xml` file is in use (that is, if the `<logging>` element is not commented out or missing), MapViewer uses that information instead of using container-controlled logging. The `<logging>` element can have the following attributes and subelements:

- The `console_log_level` attribute controls the levels of information that are recorded in the log, which in turn affect the log output volume. Set the `console_log_level` attribute value to one of the following, listed from most restrictive logging to least restrictive logging: FATAL, ERROR, WARN, INFO, DEBUG, and FINEST.

The FATAL level outputs the least log information (only unrecoverable events are logged), and the other levels are progressively more inclusive, with the FINEST level causing the most information to be logged. For production work, a level of WARN or more restrictive (ERROR or FATAL) is recommended; however, for debugging you may want to set a less restrictive level.

- The `file_limit` attribute controls the maximum file size of a log file. The unit is Mb and the default value is 50 (that is, by the default value for the maximum log file size is 50Mb).
- The `file_count` attribute determines the number of log files created. The files are rotated (that is, when the last log file reaches its maximum size, the first log file is reused). The default value is 10.
- The `<logger>` subelement specifies the log level for a particular logger.
- The `<log_output>` subelement identifies output for the logging information. By default, log records are written to the system error console. You can change this to the system output console or to one or more files, or some combination. If you specify more than one device through multiple `<log_output>` subelements, the logging records are sent to all devices, using the same logging level and attributes.

1.6.2.2 Specifying Map File Storage and Life Cycle Information

Map image file information is specified in the `<save_images_at>` element. By default, images are stored in the `$ORACLE_HOME/lbs/mapviewer/web/images` directory. You do not need to modify the `<save_images_at>` element unless you want to specify a different directory for storing images.

A mapping client can request that MapViewer send back the URL for an image file instead of the actual map image data, by setting the `format` attribute of the `<map_request>` element (described in [Section 3.1.2.1.1](#)) to `GIF_URL` or `PNG_URL`. In this case, MapViewer saves the requested map image as a file on the host system where MapViewer is running and sends a response containing the URL of the image file back to the map client.

You can specify the following map image file information as attributes of the `<save_images_at>` element:

- The `file_prefix` attribute identifies the map image file prefix. A map image file name will be a fixed file prefix followed by a serial number and the image type suffix. For example, if the map image file prefix is `omsmap`, a possible GIF map image file could be `omsmap1.gif`.

Default value: `file_prefix=omsmap`

- The `url` attribute identifies the map image base URL, which points to the directory under which all map image files are saved on the MapViewer host. The map image URL sent to the mapping client is the map image base URL plus the map image file name. For example, if the map image base URL is `http://dev04.example.com:1521/mapviewer/images`, the map image URL for `omsmap1.gif` will be `http://dev04.example.com:1521/mapviewer/images/omsmap1.gif`.

Default value: `url=$HOST_URL/mapviewer/images`

- The `path` attribute identifies the path of the directory where all map image files are saved on the MapViewer host system. This directory must be accessible by HTTP and must match the map image URL. Map image files saved in the directory specified by the `path` attribute should be accessible from the URL specified by the `url` attribute.

However, if you are deploying MapViewer to WebLogic Server, the default value for the path attribute (`../web/images`) is not correct. The path attribute value in this case should be `../../images`, because the physical "images" directory is `mapviewer.ear/web.war/images`; so using relative path, the value should be `../../images` for the path attribute to resolve to the physical directory.

- The `life` attribute specifies the number of minutes that a generated map image is guaranteed to stay on the file system before the image is deleted. If the `life` attribute is specified, the `recycle_interval` attribute controls how frequently MapViewer checks for possible files to delete.

Default: MapViewer never deletes the generated map images.

- The `recycle_interval` attribute specifies the number of minutes between times when MapViewer checks to see if it can delete any image files that have been on the file system longer than the number of minutes for the `life` attribute value.

Default value: 480 (8 hours)

1.6.2.3 Restricting Administrative (Non-Map) Requests

In addition to map requests, MapViewer accepts administrative (non-map) requests, such as requests to list all data sources and to add and delete data sources. ([Chapter 5](#) describes the administrative requests.) By default, all MapViewer users are permitted to make administrative requests.

However, if you want to restrict the ability to submit administrative requests, you can edit the MapViewer configuration file to allow administrative requests only from users with specified IP addresses.

To restrict administrative requests to users at specified IP addresses, add the `<ip_monitor>` element to the MapViewer configuration file (or uncomment and modify an existing element, if one is commented out). [Example 1–2](#) shows a sample `<ip_monitor>` element excerpt from a configuration file.

Example 1–2 Restricting Administrative Requests

```
<MapperConfig>
    ...
    <ip_monitor>
        <ips> 138.1.17.9, 138.1.17.21, 138.3.* , 20.* </ips>
        <ip_range> 24.17.1.3 - 24.17.1.20 </ip_range>
        <ips_exclude> 138.3.29.* </ips_exclude>
        <ip_range_exclude>20.22.34.1 - 20.22.34.255</ip_range_exclude>
    </ip_monitor>
    ...
</MapperConfig>
```

In [Example 1–2](#):

- The following IP addresses are explicitly included as able to submit administrative requests (unless excluded by an `<ips_exclude>` element): 138.1.17.9, 138.1.17.21, all that start with 138.3., all that start with 20., and all in the range (inclusive) of 24.17.1.3 to 24.17.1.20.
- The following IP addresses are explicitly excluded from submitting administrative requests: all starting with 138.3.29., and all in the range (inclusive) of 20.22.34.1 to 20.22.34.255.
- All other IP addresses that are not explicitly included cannot submit administrative requests.

Syntax notes for the <ip_monitor> element:

- Use <ips> and <ip_range> elements to specify which IP addresses (and ranges) are allowed. Asterisk wildcards (such as 20.*.) are acceptable. Use a comma-delimited list for addresses.
- Use <ips_exclude> and <ip_range_exclude> elements to exclude IP addresses and address ranges from submitting administrative requests. If an address falls into both the included and excluded category, it is excluded.
- If you specify the asterisk wildcard in an <ips> element, all associated IP addresses are included except any specified in <ips_exclude> and <ip_range_exclude> elements.

1.6.2.4 Specifying a Web Proxy

Sometimes the MapViewer server needs to make HTTP connections to external web servers, such as to obtain a background image through a URL or to contact an external WMS server to fetch its map images. In such cases, if there is a firewall between the MapViewer server and the target web server, you may need to specify the HTTP proxy information to MapViewer so that it will not be blocked by the firewall. The following example specifies web proxy information:

```
<web_proxy host="www-proxy.mycorp.com" port="80" />
```

If the web proxy requires authentication, you can specify the user and password attributes. If the password value is preceded by the exclamation mark (!) character, the password value will be encrypted on the first loading of the configuration file. For example:

```
<web_proxy host="www-proxy.mycorp.com" port="80" user="uservalue"
password="!pwdvalue" />
```

1.6.2.5 Specifying Global Map Configuration Options

You can specify the following global "look and feel" options for the display of each map generated by MapViewer:

- Title
- Note (such as a copyright statement or a footnote)
- Logo (custom symbol or corporate logo)
- Local geodetic data adjustment
- Splitting geometries along the 180 meridian

To specify any of these options, use the <global_map_config> element. For example:

```
<global_map_config>
    <note text="Copyright (c) 2009, Example Corporation"
          font="sans serif"
          position="SOUTH_EAST"/>
    <title text="Map Courtesy of Example Corp."
           font="Serif"
           position="NORTH"/>
    <logo image_path="C:\\images\\a.gif"
          position="SOUTH_WEST"/>

    <rendering allow_local_adjustment="false"
               use_globular_projection="false"/>
</global_map_config>
```

Set the map title through the `<title>` element of the `<global_map_config>` element. You can also set the map title in an individual map request by specifying the `title` attribute with the `<map_request>` element, and in this case, the title in the map request is used instead of the global title in the MapViewer configuration file. Note the following information about the attributes of the `<title>` element:

- The `text` attribute specifies the title string.
- The `font` attribute specifies a font. The font must exist on the system where MapViewer is running.
- The `position` attribute provides a positioning hint to MapViewer when determining where the map title will be drawn on a map. Possible values are: NORTH, EAST, SOUTH, WEST, NORTH_EAST, SOUTH_EAST, SOUTH_WEST, NORTH_WEST, and CENTER.

Default value: NORTH

Set the map note through the `<note>` element of the `<global_map_config>` element. Note the following information about the attributes of the `<note>` element:

- The `text` attribute specifies the note string.
- The `font` attribute specifies a font. The font must exist on the system where MapViewer is running.
- The `position` attribute provides a positioning hint to MapViewer when determining where the map note will be drawn on a map. Possible values are: NORTH, EAST, SOUTH, WEST, NORTH_EAST, SOUTH_EAST, SOUTH_WEST, NORTH_WEST, and CENTER.

Default value: SOUTH_EAST

Set the map logo through the `<logo>` element of the `<global_map_config>` element. The map logo image must be in either JPEG or GIF format. The image can be stored in a local file system where the MapViewer instance will have access to it, or it can be obtained from the web by specifying its URL. To specify a map logo, uncomment the `<map_logo>` element in the MapViewer configuration file and edit its attributes as needed.

Note the following information about the attributes of the `<logo>` element:

- The `image_path` attribute must specify a valid file path name, or a URL starting with `http://`.
- The `position` attribute provides a positioning hint to MapViewer when determining where the map logo will be drawn on a map. Possible values are: NORTH, EAST, SOUTH, WEST, NORTH_EAST, SOUTH_EAST, SOUTH_WEST, NORTH_WEST, and CENTER.

Default value: SOUTH_WEST

If the logo image is obtained through a URL that is outside your firewall, you may need to set the web proxy in order for MapViewer to retrieve the logo image. For information about specifying a web proxy, see [Section 1.6.2.4](#).

If you also specify a map legend, be sure that its position is not the same as any position for a map title, note, or logo. (Map legends are explained in [Section 2.4.2](#) and [Section 3.1.2.11](#). The default position for a map legend is SOUTH_WEST.)

To have MapViewer automatically project geodetic data to a local non-geodetic coordinate system before displaying it if the map data window is less than 3 decimal degrees, specify `allow_local_adjustment="true"` in the `<rendering>` element.

To have MapViewer automatically apply a globular map projection (that is, a map projection suitable for viewing the world, and specifically the azimuthal equidistant projection for MapViewer), specify `use_globular_projection="true"` in the `<rendering>` element. This option applies to geodetic data only.

1.6.2.6 Customizing the Spatial Data Cache

You can customize the in-memory cache that MapViewer uses for spatial data by using the `<spatial_data_cache>` element. For example:

```
<spatial_data_cache    max_cache_size="64"
                      report_stats="true"
/>
```

You can specify the following information as attributes of the `<spatial_data_cache>` element:

- The `max_cache_size` attribute specifies the maximum number of megabytes (MB) of in-memory cache.
Default value: 64
- The `report_stats` attribute, if set to `true`, instructs the MapViewer server to periodically (every 5 minutes) output cache statistics, such as the number of objects cached, the total size of cache objects, and data relating to the efficiency of the internal cache structure. The statistics are provided for each data source and for each predefined theme. They can help you to determine the optimal setting of the in-memory cache. For example, if you want to pin all geometry data for certain themes in the memory cache, you need to specify a `max_cache_size` value that is large enough to accommodate these themes.
Default value: false

The spatial data cache is always enabled by default, even if the element is commented out in the configuration file. To completely disable the caching of spatial data, you must specify the `max_cache_size` attribute value as 0 (zero).

Note: The disk-based spatial cache, which was supported in the previous release, is no longer supported, because performance tests have shown that disk-based spatial caching was often less efficient than fetching spatial objects directly from the database when needed (that is, in cases where the cached objects frequently did not need to be retrieved again after caching).

For detailed information about the caching of predefined themes, see [Section 2.3.1.6](#).

1.6.2.7 Specifying the Security Configuration

You can use the `<security_config>` element to specify whether MapViewer should reject `<info_request>` elements in requests. An `<info_request>` element is a type of request from a client that asks MapViewer to execute a simple SQL statement and return the result rows in plain text or XML format. This request is often used by MapViewer applications to identify features displayed on a map, or to run simple spatial search queries.

However, if the MapViewer data source information is exposed, malicious attackers might be able to abuse this capability and obtain sensitive information. To prevent this from happening, you can make sure MapViewer always connects to a database schema that has very limited access rights and hosts only non-sensitive information, and you

can also reject all <info_request> requests by specifying the <security_config> element as follows:

```
<security_config>
  <disable_direct_info_request> true </disable_direct_info_request>
</security_config>
```

Note, however, that this setting affects some Mapviewer features. For example, the `identify()` method of the MapViewer Java API will no longer work, and applications will need to implement their own `identify()` method through other means.

You can also define remote URLs that the MapViewer built-in proxy servlet is allowed to communicate with. Use commas to separate such URLs. You can end a URL with the * (asterisk) wildcard character to allow multiple URLs that start with a path. The following example specifies one remote URL:

```
<security-config>
  ...
  <proxy_enabled_hosts>
    foo.com:8080/mapviewer
  </proxy_enabled_hosts>
  ...
</security-config>
```

To facilitate MapViewer's HTTPS (SSL) connection with external web sites that use self-signed certificates, you may register those certificates here. Use one entry for each server that requires an HTTPS connection. The following example shows an excerpt specifying one entry:

```
<security_config>
  ...
  <certificates>
    <entry>
      <host_name>fooserver.com</host_name>
      <keystore_file>/scratch/fooserver.jks</keystore_file>
      <key>123456</key>
    </entry>
  </certificates>
  ...
</security_config>
```

The subelements for each certificate's <entry> element are the following.

The `host_name` attribute specifies the IP address or domain name of the server that requires an HTTPS connection.

The `keystore_file` attribute specifies the file containing a single self-signed certificate. After you obtain the certificate (typically a `.pem` file) from the server site, you can create a key store by using the Java `keytool` command. For example:

```
keytool -import -file fooserver.pem -alias fooserver -keystore fooserver.jks
```

The `key` attribute specifies the password that you provided when creating the key store file. (It is used to ensure the integrity of the key store file itself.)

1.6.2.8 Registering a Custom Image Renderer

MapViewer can display images stored in a database BLOB through its image theme capability. When the image data stored in the BLOB is in a format unknown to MapViewer, such as ECW, you can register a custom image renderer so that MapViewer can use it to display such images. For information about creating and

registering a custom image renderer, see [Appendix C](#).

To specify a custom image renderer, use the `<custom_image_renderer>` element, as shown in the following example:

```
<custom_image_renderer image_format="ECW"
                      impl_class="com.my_corp.image.ECWRenderer" />
```

The `image_format` attribute specifies the image format name with which this custom image renderer should be associated.

The `impl_class` attribute specifies the name of the class that implements the custom image renderer.

1.6.2.9 Registering a Custom Spatial Provider

MapViewer can render spatial data that is in an external (non-Oracle Spatial and Graph) native format, such as shapefile, if there is a spatial provider implementation registered for the format. For information about implementing an external spatial data provider (in connection with custom geometry themes), see [Section 2.3.9](#).

To register an external spatial data provider, use the `<s_data_provider>` element, as shown in the following example:

```
<s_data_provider
  id="shapefileSDP"
  class="oracle.sdoovis.ShapefileDataProvider"
>
<parameters>
  <parameter name="datadir" value="/temp/data" />
</parameters>
</s_data_provider>
```

The `class` attribute specifies the name of the class that implements the external spatial data provider.

The `<parameters>` element specifies a set of initialization parameters that are used by the data provider during its initialization process. In this example, the shapefile provider has a data directory ("datadir") parameter that points to directory where MapViewer can look for the data.

1.6.2.10 Registering Custom Nonspatial Data Providers

When generating thematic map layers, MapViewer can dynamically join nonspatial attribute data (such as sales for each region) that originates from an external source with the base geometries (boundaries of all the regions) that are stored in the database. For information about thematic mapping using external attribute data from nonspatial data providers, see [Section 2.3.12.1](#).

To register a nonspatial data provider, use the `<ns_data_provider>` element, as shown in the following example:

```
<ns_data_provider id="testProvider"
  class="com.mycorp.GetSalesData" >
<parameters>
  <parameter name="bi_database" value="stadb32.mycorp.com" />
  <parameter name="sid" value="bidata" />
</parameters>
</ns_data_provider>
```

The `id` attribute uniquely identifies a nonspatial data provider. Use this `id` value in any map request that involves the provider.

The `class` attribute specifies the name of the class that implements the nonspatial data provider.

The `<parameters>` element specifies a set of initialization parameters that are used by the nonspatial data provider during its initialization process.

1.6.2.11 Customizing SRS Mapping

You can use the `<srs_mapping>` element to specify an SDO to EPSG SRID mapping file, which define mappings between Oracle Spatial and Graph SDO_SRID values and EPSG codes. As explained in [Section E.1.3](#), each line in the specified mapping file must contain an SDO_SRID value and the corresponding EPSG code. The `<srs_mapping>` element can be used with WMS and WFS themes.

The following example uses the `<srs_mapping>` element to specify an SDO to EPSG SRID mapping file:

```
<srs_mapping>
  <sdo_epsg_mapfile>
    ../config/epsg_srids.properties
  </sdo_epsg_mapfile>
</srs_mapping>
```

1.6.2.12 Customizing WMS GetCapabilities Responses

MapViewer can be used as an Open Geospatial Consortium WMS (Web Map Server) 1.1.1 compliant server. As such, a WMS client can send MapViewer the `GetCapabilities` request. In response, MapViewer will send back the list of themes that it hosts and other important information, such as the data provider's name and a list of keywords that might of interest to the requesting client.

Note: Effective with MapViewer 12.n, there is a separate WMS configuration file (`wmsConfig.xml`) that contains more information than is in the `<wms_config>` element in the MapViewer configuration file. It is recommended that you define any custom WMS configuration parameters in this separate WMS configuration file; any settings there will override any conflicting settings in the `<wms_config>` element in the MapViewer configuration file.

For more information about the `wmsConfig.xml` file, see [Section E.3.5, "Customizing GetCapabilities Responses: Additional Options"](#).

You can use the `<wms_config>` element to customize the descriptive information sent back to the client as part of the `GetCapabilities` response, as shown in the following example:

```
<wms_config host="www.my_corp.com" port="80"
            protocol="http" default_datasource="dsrcl"
            public_datasources="dsrcl,dsrc2">
  <title>
    WMS 1.1 interface for Oracle Application Server 10g MapViewer
  </title>
  <abstract>
    This WMS service is provided through Oracle MapViewer.
  </abstract>
  <keyword_list>
    <keyword>bird</keyword>
    <keyword>roadrunner</keyword>
    <keyword>ambush</keyword>
```

```

</keyword_list>
<sdo_epsg_mapfile>
    ../config/epsg_srids.properties
</sdo_epsg_mapfile>
</wms_config>

```

The host attribute specifies the host part of the service request URL that the client should use for future WMS requests made to this MapViewer server.

The port attribute specifies the port part of the service request URL that the client should use for future WMS requests made to this MapViewer server.

The protocol attribute specifies the protocol part of the service request URL that the client should use for future WMS requests made to this MapViewer server.

The default_datasource attribute specifies the base data source used to retrieve the capabilities response. If this attribute is not defined, the data source WMS is used, and that data source must exist in this MapViewer server.

The public_datasources attribute specifies which data source contents are to be listed in the GetCapabilities response. If this attribute is not defined, all data source contents will be listed.

The <title> element specifies the service title to be included as part of the response.

The <abstract> element specifies the abstract to be included as part of the response.

The <keyword_list> element specifies a list of keywords that best describe the types of layers served by this MapViewer server.

The <sdo_epsg_mapfile> element specifies a text file that defines mappings from Oracle Spatial and Graph (SDO) SRID values to the corresponding EPSG SRID values that are typically used in most WMS requests and responses. For information about this mapping file, see [Section E.1.3](#).

1.6.2.13 Customizing WMTS GetCapabilities Responses

MapViewer can be used as an Open Geospatial Consortium WMTS (Web Map Tile Service) 1.0.0 compliant server, enabling tile layers defined in the USER_SDO_CACHED_MAPS metadata view to be retrieved through WMTS requests. A WMTS client can send MapViewer the GetCapabilities request. In response, MapViewer will send back the list of tile layers that it hosts and other important information, such as the data provider's name and a list of keywords that might of interest to the requesting client. You can edit the WMTS configuration file, which is stored in the same folder as that for mapViewerConfig.xml with a name of wmtsConfig.xml, to provide such customized information.

In the wmtsConfig.xml file, you can use the <wmts_config> element to customize the descriptive information sent back to the client as part of the GetCapabilities response, as shown in the following example:

```

<wmts_config>
    <public_datasources>
        <public_datasource name="MVDEMO" include_all_tile_layers="true"/>
        <public_datasource name="ELOCATION">
            <tile_layers>
                <tile_layer name="WORLD_MAP" />
            </tile_layers>
        </public_datasource>
    </public_datasources>
    <sdo_epsg_mapfile>
        ../config/epsg_srid.properties

```

```

        </sdo_epsg_mapfile>
        <ServiceAttributes>
            <ServiceIdentification>
                <Title>Web Map Tile Service by myCorp</Title>
                <Abstract> U.S. maps for state and county boundaries and big
                cities</Abstract>
                <Keywords>
                    <Keyword>Maps, U.S. State Boundaries, Cities</Keyword>
                </Keywords>
            </ServiceIdentification>
            <ServiceProvider>
                <ProviderName>provider's name</ProviderName>
                <ProviderSite url="http://www.myCorp.com/mySite"/>
            </ServiceProvider>
        </ServiceAttributes>
    </wmts_config>

```

The `<public_datasources>` element can contain `<public_datasource>` subelements, which specify which data sources' tile layers to list in the WMTS GetCapabilities response. If this `<public_datasources>` element is not defined, all data sources' tile layers will be listed; if this element is defined but contains no `<public_datasource>` subelement, then no tile layers from any data source will be listed in the response.

The `<public_datasource>` element must contain a `name` attribute, which indicates the name of the data source.

The `include_all_tile_layers` attribute is optional, and the default is `false`. When set to `true`, it indicates that all tile layers in that data source are to be listed in the response.

The `<tile_layer>` element must contain a `name` attribute, which indicates the name of the tile layer to be included in the response from the data source defined in its parent element.

The `<sdo_epsg_mapfile>` element specifies a text file that defines mappings from Oracle Spatial and Graph (SDO) SRID values to the corresponding EPSG SRID values that are typically used in most WMTS requests and responses. For information about this mapping file, see [Section E.1.3, "SDO to EPSG SRID Mapping File"](#).

The `<Title>` element specifies the service title to be included as part of the response.

The `<Abstract>` element specifies the abstract to be included as part of the response.

The `<Keywords>` element specifies a collection of keywords (from its `<Keyword>` subelements) that best describe the types of layers served by this MapViewer server.

More information can be found in the comments in the `wmtsConfig.xml` file.

1.6.2.14 Configuring the Map Tile Server for Oracle Maps

The Oracle Maps feature of MapViewer can pre-generate base map image tiles and cache them through the map tile server. You can use the `<map_tile_server>` element to provide configuration information to the map tile server, such as default location for map tile file storage, and logging information, as shown in the following example:

```

<map_tile_server>
    <tile_storage default_root_path="/scratch/tilecache/" />
    <logging log_level="finest" log_thread_name="false" log_time="true">
        <log_output name="System.err"/>
    </logging>
</map_tile_server>

```

The `<tile_storage>` element specifies the default root directory where all map image tiles generated by this MapViewer server will be stored.

The `<logging>` element specifies logging information specific to the map tile server.

1.6.2.15 Defining Permanent Map Data Sources

Every map request must have a data source attribute that specifies a map data source, which is a database user with geospatial data. You can predefine available map data sources by using the `<map_data_source>` element. For example:

```
<map_data_source name="mvdemo"
    jdbc_host="mapsrus.example.com"
    jdbc_sid="orcl"
    jdbc_port="1521"
    jdbc_user="scott"
    jdbc_password="!password"
    jdbc_mode="thin"
    number_of_mappers="5"
    allow_jdbc_theme_based_foi="true"
    plsql_package="web_user_info"
/>
```

You can specify the following information as attributes of the `<map_data_source>` element:

- The `name` attribute specifies a unique data source name to MapViewer. You must specify the data source name in all map requests that identify a data source.
- You must specify all necessary connection information, or a container data source name, or a net service name (TNS name). That is, you must specify only one of the following, which are described in this section: `jdbc_host`, `jdbc_sid`, `jdbc_port`, and `jdbc_user`; or `container_ds`; or `jdbc_tns_name`.

If the database on which you defined a data source on is restarted, and if the data source is created from `jdbc_host/jdbc_sid/jdbc_port` or `jdbc_tns_name` attributes, MapViewer will resume normal operation (for example responding to map requests with properly created maps) as soon as the database is back online.

- The `jdbc_host`, `jdbc_sid`, `jdbc_port`, and `jdbc_user` attributes specify the database connection information and the database user name. (As an alternative to specifying these attributes and the `jdbc_password` and `jdbc_mode` attributes, you can specify the `container_ds` attribute, described later in this section.)
- The `jdbc_password` attribute specifies the database user's login password. It must be prefixed with an exclamation point (!) when you specify the password for the first time. When MapViewer next restarts, it will automatically obfuscate and replace the clear text password.

MapViewer does not change this password string in any way; no conversion to upper or lower case is performed. If the database uses case-sensitive passwords, the specified password must exactly match the password in the database.

- The `jdbc_mode` attribute tells MapViewer which Oracle JDBC driver to use when connecting to the database. The default is `thin` (for the "thin" driver). The other possible value is `oci8`, which requires that you also have the Oracle Database client installed on the same host on which MapViewer is running.
- The `container_ds` attribute lets you specify the Java EE container name (JNDI name) instead of specifying the `jdbc_host`, `jdbc_sid`, `jdbc_port`, `jdbc_user`, `jdbc_password`, and `jdbc_mode` attributes. For example, assume you created a JDBC data source using the WebLogic Server console and gave it a JNDI name of

`jdbc/OracleDS`. You can then define the permanent MapViewer data source as follows:

```
<map_data_source name="mvdemo"
                  container_ds="jdbc/OracleDS"
                  number_of_mappers="5"
/>
```

If you use the `container_ds` attribute, and if you want MapViewer to resume normal operation (for example, responding to map requests with properly created maps) automatically after the database on which you defined a data source is restarted, you must instruct the container data source to always validate a connection before it can be returned to the application. Check your middleware documentation for whether this option is supported and, if it is supported, how to enable it.

- The `jdbc_tns_name` attribute identifies a net service name that is defined in the `tnsnames.ora` file.
- The `number_of_mappers` attribute identifies the maximum number of map renderers available (and thus the maximum number of map requests that MapViewer can process in parallel for the data source) for this data source. Any unprocessed map requests are queued and eventually processed. For example, if the value is 3, MapViewer will be able to process at most three mapping requests concurrently. If a fourth map request comes while three requests are being processed, it will wait until MapViewer has finished processing one of the current requests.

Specifying a large `number_of_mappers` value (such as 50 or 100) can improve the overall throughput, but it will also increase runtime memory and CPU usage at times of peak loads, since MapViewer will attempt to process more concurrent map requests. It will also increase the number of active database sessions. Therefore, be sure that you do not set too large a number for this attribute.

Note: The obsolete `max_connections` attribute no longer affects rendering and is ignored. The `number_of_mappers` attribute value affects the actual maximum number of database connections or sessions open for the data source at any given time.

- The `allow_jdbc_theme_based_foi` attribute lets you specify whether to allow JDBC theme-based FOI requests to be performed against this data source. A JDBC theme-based FOI request is based on a dynamic SQL query constructed by the JavaScript client application.

By default, such FOI requests are not allowed unless you set this attribute to `true`. Due to the potential security threat, JDBC theme-based FOI requests should be used with caution. You should only allow JDBC theme-based FOI requests on database connections that are granted very low privilege and contain only data that you want to expose. See [Section 6.1.1.3](#) for more information about JDBC theme-based FOI requests.

- The `plsql_package` attribute lets you specify a PL/SQL package to be used for secure map rendering, as explained in [Section 1.9](#).
- The `web_user_type` attribute (not shown in the example in this section) lets you specify the source for the authenticated user's name. It is especially useful for getting the authenticated user's name from a cookie, in conjunction with specifying a PL/SQL package to be used for secure map rendering. For more

information about the `web_user_type` attribute and an example of its use, see [Section 1.9.2](#).

1.6.2.16 Configuring and Securing the Map Data Server for the HTML5 API

Starting with Mapviewer for Oracle Fusion Middleware Release 11.1.1.7, themes can be streamed by default, and the only way to protect them is by adding authentication, that is, by adding a security constraint in the MapViewer `web.xml` file and by configuring the `<mds_config>` element in the configuration file to authorize access to various themes.

The Map Data Server (MDS) server component facilitates the streaming of geospatial data in vector format to the Oracle Maps V2 API (described in [Section 6.2.2, "JavaScript API V2"](#) and [Section 6.3.2, "Using the V2 API"](#)). The MDS provides a RESTful API for browser clients to request the vector data of any predefined or dynamic (JDBC) theme from a MapViewer server instance. The only way to secure or protect the access to this service is by adding a security constraint in the MapViewer `web.xml` deployment file, as in the following example:

```
<security-constraint>
<web-resource-collection>
  . .
<url-pattern>/dataserver/*</url-pattern>
</web-resource-collection>
<auth-constraint>
<role-name>map_admin_role</role-name>
</auth-constraint>
</security-constraint>
```

The preceding example adds a security constraint to any incoming URL with the relative path `/dataserver/` in it. Because the MDS servlet responds only to URLs with `/dataserver` in its path, this constraint effectively protects all access to the MDS. This means that any application or web client accessing the Map Data Server will require proper authentication, and only those users with the role `map_admin_role` will be granted access. (For more information on how to secure a Java EE servlet such as MDS, check the Java EE and WebLogic Server documentation.)

Starting with MapViewer version 11.1.1.7.1, access to any predefined or dynamic (JDBC) theme's vector data is blocked by default, regardless of whether you added a security constraint on the MDS URL patterns. In other words, for example, even if the `/dataserver/*` URLs are protected and an HTML5 application has passed authentication, it still cannot access a theme's data without proper authorization. When an Oracle Maps HTML5 application attempts to load or display a theme without proper authorization, the error message typically contains a statement like "This data source does not allow streaming access."

To grant access to a data source's themes, you must explicitly configure the `<mds_config>` element in the configuration file.

[Example 1–3](#) shows an `<mds_config>` element in which two MapViewer data sources, `mvdemo` and `my-data`, are configured such that certain themes of theirs can be streamed to clients.

Example 1–3 Configuring the `mds.xml` File

```
<mds_config>

<data_source name="mvdemo">
<allow_predefined_themes>true</allow_predefined_themes>
<deny>my_secret_theme</deny>
```

```

<allow_dynamic_themes>true</allow_dynamic_themes>
</data_source>

<data_source name="my-data">
<allow_predefined_themes>false</allow_predefined_themes>
<allow>
<theme>public_points_theme</theme>
<theme>office_locations*</theme>
</allow>
<allow_dynamic_themes>false</allow_dynamic_themes>
</data_source>

</mds_config>

```

In Example 1–3:

- Each data source authorizes its themes in its own `<data_source>` element. With this element, the two tags `<allow_predefined_themes>` and `<allow_dynamic_themes>` provide the overall or default access control on these two types of themes. Note that for dynamic/JDBC themes, you can also disable them in the data source definition (in the main `mapViewerConfig.xml` file). If a dynamic theme is disabled in the data source definition, then that setting always has precedence (regardless of how it is set in the `<mds_config>` element.).
- The `mvdemo` data source grants all clients with access to both predefined and dynamic (JDBC) theme vector data by default; this is a reasonable choice given the nature of the data (data from publicly available samples). An exception is added, however, for the `my_secret_theme` theme, through the use of the `<deny>` tag.
- For the `my-data` data source, access to both types of themes is blocked by default. In this case exceptions (to open certain themes to streaming) are added through the `<allow>` tag. In both `<allow>` and `<deny>` tags, the theme names or patterns are case insensitive, and the wild card character * (asterisk) can be used to match multiple themes. The example uses the `<allow>` tag to open the theme `public_points_theme` and all the themes whose name starts with `office_locations` to streaming, while all other themes are blocked. No dynamic/SQL theme is allowed on this data source.

If you modify the `<mds_config>` element, you must restart the deployed MapViewer instance for the modifications to take effect.

1.6.3 Performing MapViewer Administrative Tasks

Besides knowing how to configure MapViewer, you should also know how to perform other important administrative tasks using the MapViewer administration page. To log in to this page, see the instructions in [Section 1.6.1](#).

The tasks you can do as a MapViewer administrator include the following:

- Editing the configuration file
Click **Configuration**.
- Refreshing the list of data sources
Click **Admin** to refresh the list automatically, or click **Refresh** to perform a manual refresh.
- Clearing cached definitions of MapViewer styles, themes, and base maps
Click **Admin**, select the data source, then click **Purge Cached Metadata**.

- Clearing cached geometry data for predefined themes
Click **Admin**, then **Geometry Cache**, then **Purge** for a selected theme or all themes.
- Creating map tile layers for Oracle Maps
Click **Admin**, then **Create Tile Layer**, select the tile layer type, and click **Next**.
Internal map source: Enter the map cache name, then select the data source and base map. Also define parameters for cache storage (where tiles will be stored), zoom levels, minimum and maximum scale, spatial reference ID (SRID), data bounding box (MBR), and tile size and format. Click **Next** and **Submit** to create the map tile layer. You can also define the map cache properties in XML by clicking **XML**.
External map source: Enter the map cache name, then select the data source. To provide access to the external source, define parameters such as the map service URL, the request method (GET or POST), the proxy information (if needed), the java adapter class name and its location on the server, and additional adapter properties. Also define parameters for cache storage (where tiles will be stored), zoom levels, minimum and maximum scale, spatial reference ID (SRID), data bounding box (MBR), and tile size and format. Click **Next** and **Submit** to create the map tile layer. You can also define the map cache properties in XML by clicking **XML**.
For other types of tile layers (Oracle Maps, Bing, Here, Google, TomTom), follow similar steps.
- Managing map tile layers for Oracle Maps
Click **Admin**, then **Manage Tile Layers**. Then do any of the following:
To manually refresh the tile layer list, click **Refresh**.
To edit a map tile layer, select the row for that layer and click **Edit/View Details**.
To view and manage map tile layer, select the row for that layer and click **View Map/Manage Tiles**.

1.7 Oracle Real Application Clusters and MapViewer

When the database is an Oracle Real Application Cluster (Oracle RAC), you can connect to the Oracle RAC database using either of the following options:

- Let MapViewer connect to the database through the data source of the Java EE container, such as WebLogic Server 12c.
Create a JDBC data source in WebLogic Server Enterprise Manager that connects to the Oracle RAC database, as explained in [Section 1.7.1](#). The data source can then be used by MapViewer and other applications through JNDI lookup.
This option is often used at sites where administrators create and monitor these kinds of connections for WebLogic Server, and/or where connections are used by multiple applications. This option also hides the database connection details (such as database user name and password) from the applications.
- Enable MapViewer to connect to the database service directly.
Define a MapViewer data source directly using the Oracle RAC service name (not the database SID), as explained in [Section 1.7.2](#).
This option is simpler to implement than the preceding option.

After doing either of these options, restart MapViewer, as explained in [Section 1.7.3](#).

1.7.1 Creating a Container Oracle RAC Data Source for the MapViewer Server

You can create a JDBC data source in the MapViewer container for Oracle RAC, and then use that container data source in the MapViewer configuration file, as follows:

1. [Create a Container Oracle RAC Data Source](#).
2. [Create a MapViewer Data Source Using a Container Data Source](#).

1.7.1.1 Create a Container Oracle RAC Data Source

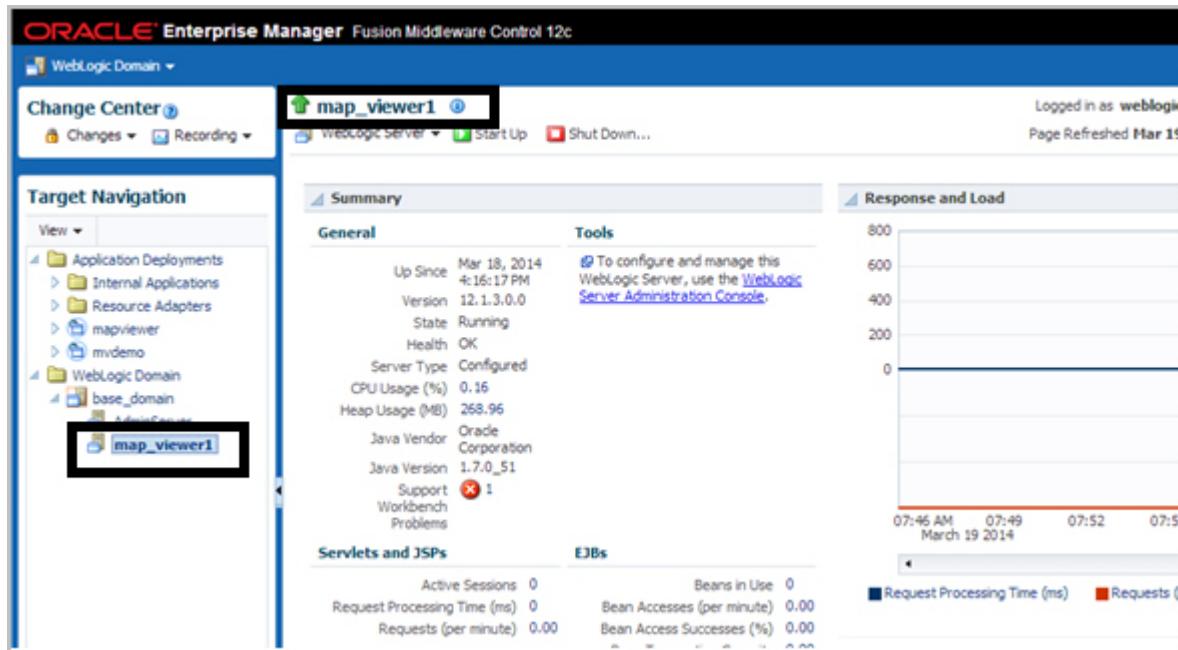
You can use Oracle Enterprise Manager 12c or later to create a data source that connects to the Oracle RAC database.

The following steps show how to create GridLink data source. (These are followed by steps showing how to create a Multi data source.)

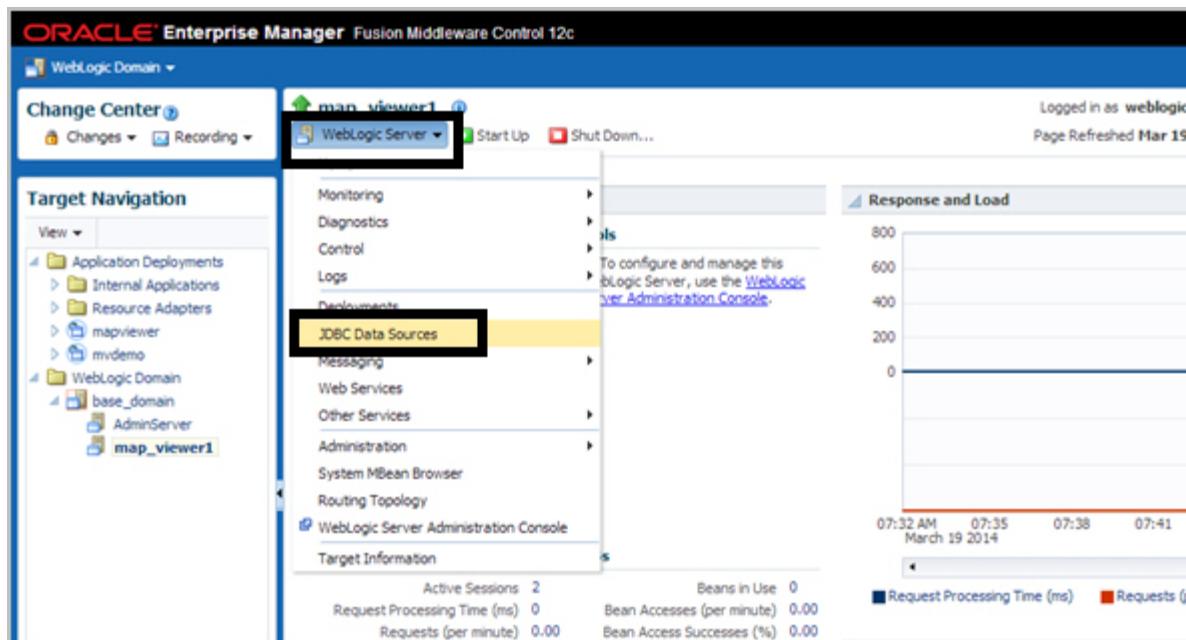
1. Log in to Enterprise Manager and in the Target Navigation pane, click the server instance that contains the MapViewer server.

In [Figure 1–5](#), clicking **map_viewer1** under WebLogic Domain causes the **map_viewer1** server information to appear in the main area of the window.

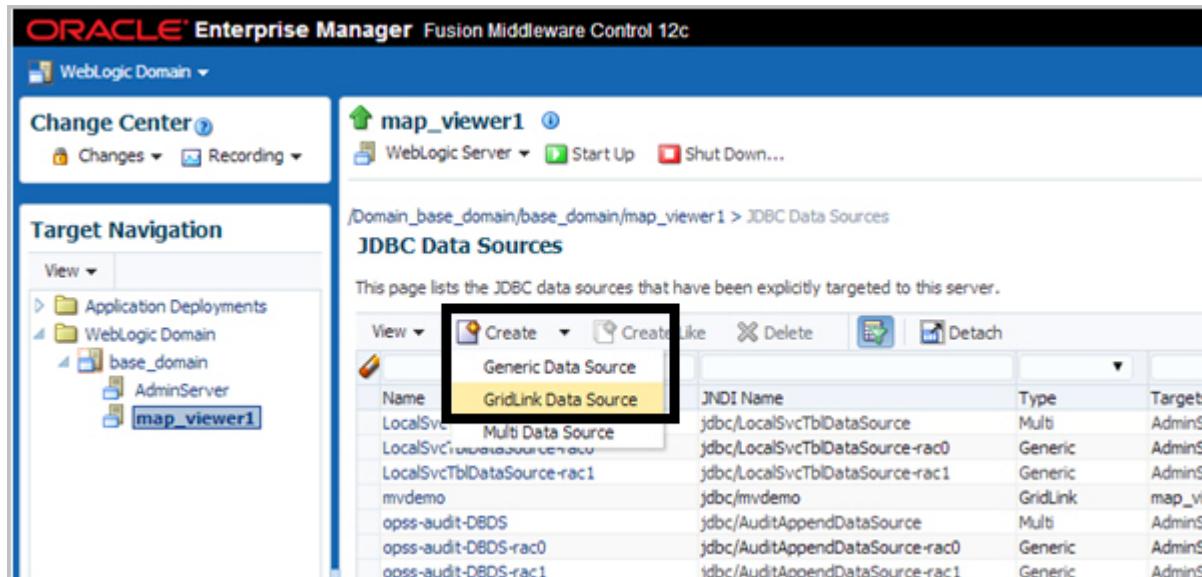
Figure 1–5 Selecting the Server Instance



2. Click **WebLogic Server** and select **JDBC Data Sources**, as shown in [Figure 1–6](#).

Figure 1–6 Displaying JDBC Data Sources

3. Under JDBC Data Sources, click **Create** and select **GridLink Data Source**, as shown in [Figure 1–7](#).

Figure 1–7 Creating a GridLink Data Source

4. Enter any necessary information in the Creating New JDBC Data Source wizard. For example, to create a container data source named `jdbc/mvdemo`:
 - a. **Data Source Properties:** Specify **Data Source Name** as `mvdemo`, **Driver Service Name** as Oracle Driver (Thin XA) for GridLink Connections Versions: Any, and **JNDI Name** as `jdbc/mvdemo`.
 - b. **Connection Properties:** Generate the URL for database user `mvdemo` on the appropriate host.

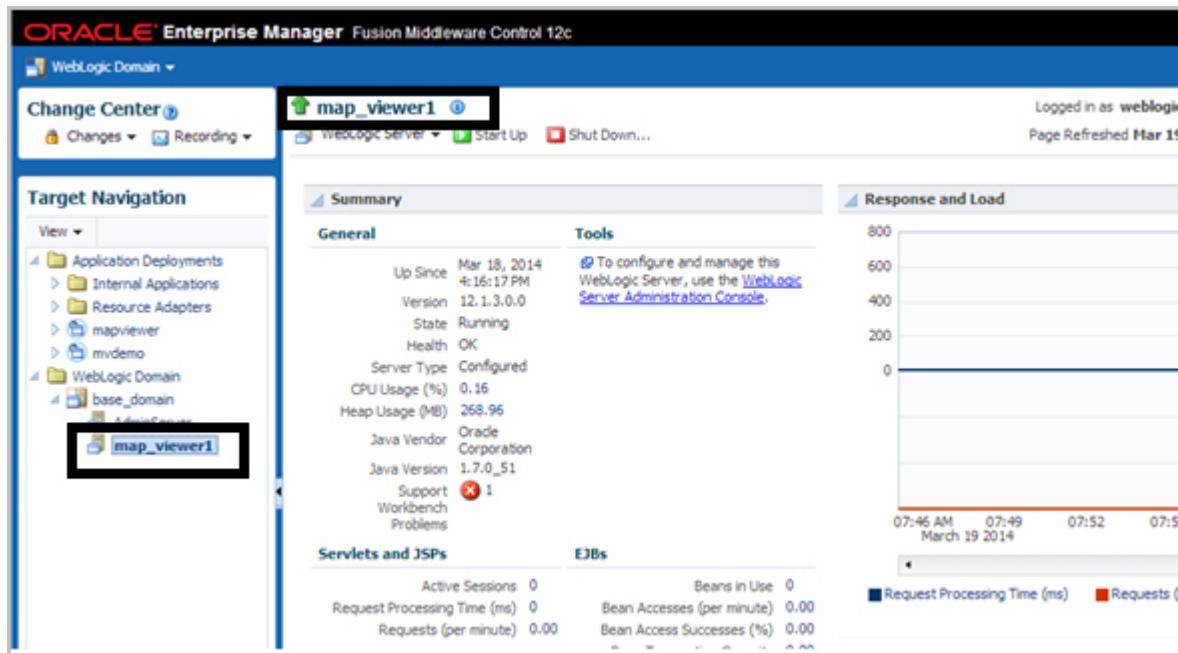
- c. **Transaction Properties:** Accept the displayed transaction properties.
- d. **ONS Properties:** Accept the displayed transaction properties, or make any changes as needed.
- e. **Select Targets:** Select (check) **map_viewer1** under **Name** to deploy the JDBC data source on the desired server.
- f. **Review:** Review the properties for the new data source to be created. If you need to make any changes, go back and make them and then return to this page.

To create a Multi data source instead of a GridLink data source as in the preceding instructions, adapt the steps as appropriate. For example:

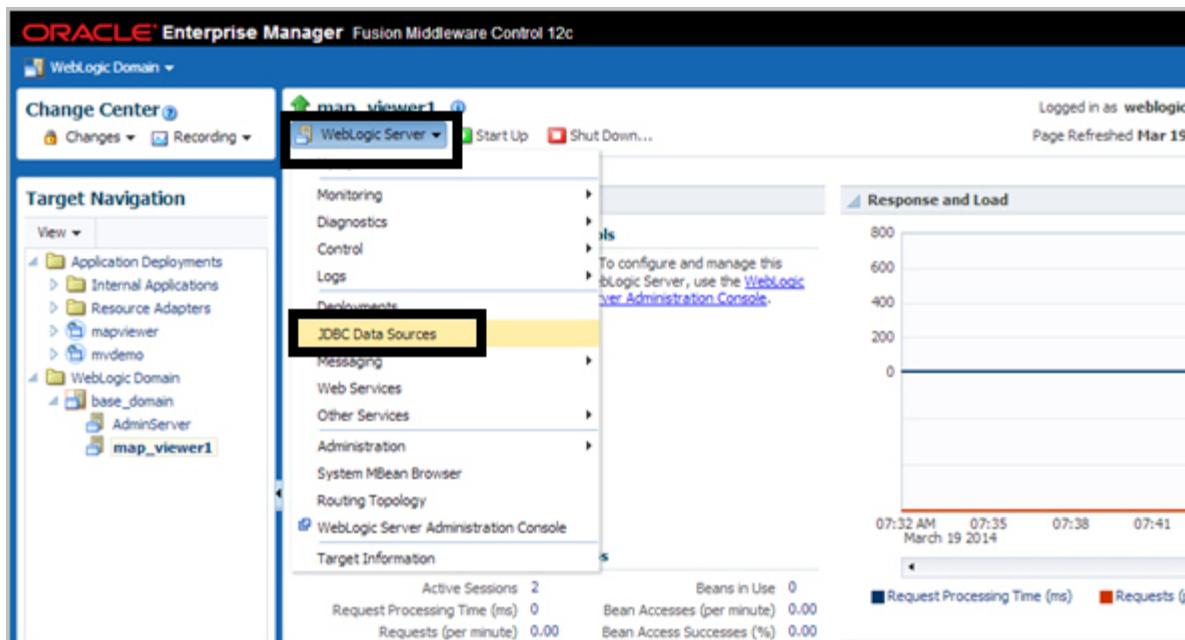
1. Log in to Enterprise Manager and in the Target Navigation pane, click the server instance that contains the MapViewer server.

In **Figure 1–8**, clicking **map_viewer1** under WebLogic Domain causes the **map_viewer1** server information to appear in the main area of the window.

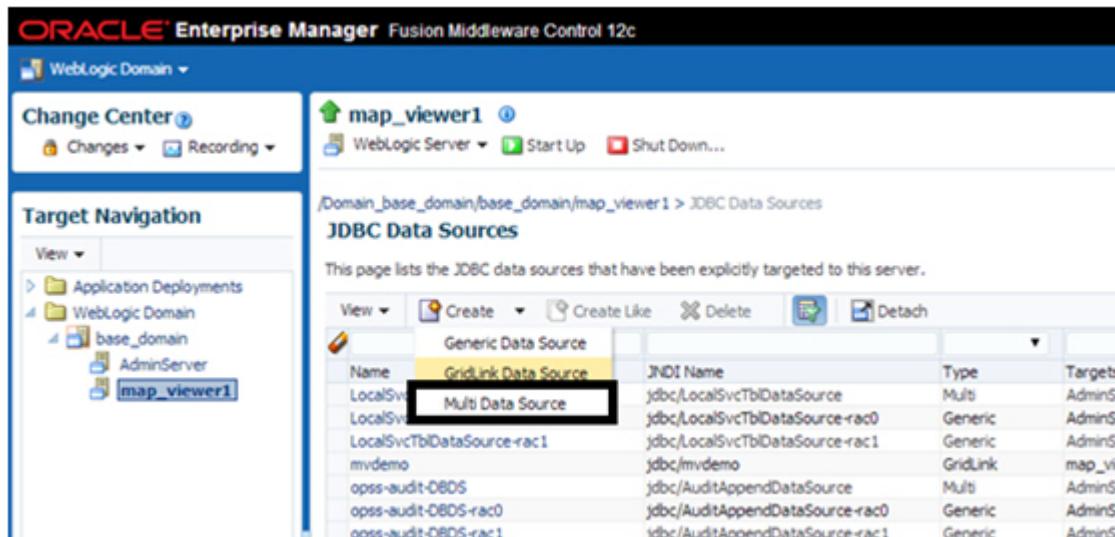
Figure 1–8 Selecting the Server Instance



2. Click **WebLogic Server** and select **JDBC Data Sources**, as shown in [Figure 1–9](#).

Figure 1–9 Displaying JDBC Data Sources

3. Under JDBC Data Sources, click **Create** and select **Multi Data Source**, as shown in Figure 1–10.

Figure 1–10 Creating a Multi Data Source

4. Enter any necessary information. For example:
 - a. **Data Source Properties:** Specify **Data Source Name** as `mvdemo`, **JNDI Name** as `jdbc/mvdemo`, and **Algorithm Type** as `Failover`.
 - b. **Select Targets:** Select (check) `map_viewer1` under **Name**.
 - c. **Select Data Source Type:** Accept the default values (non-XA Driver).
 - d. Click **Create New Data Source**.

- e. Specify properties for the first data source node, such as: **Name:** mvdemo-rac0, **JNDI Name:** jdbc/mvdemo-rac0, **Database Type:** Oracle.
- f. For **Database Driver**, select Oracle's Driver (Thin) for Oracle RAC Service-Instance connections: Versions: Any.
- g. Accept the default values (Supports Global Transactions and One-Phase Commit).
- h. Define the connection properties for Node 1. Provide values for Service Name, Database Name, Host Name, Port, Database User Name, Password, and Protocol.
- i. Verify the properties and click **Test Configuration**. If it succeeds, click **Next**.
- j. Select (check) the server in which MapViewer is deployed (map_viewer1), and click **Finish**.
- k. On the next page, click **Create a New Data Source** to create and configure the second node.
- l. Specify properties for the second data source node, such as: **Name:** mvdemo-rac1, **JNDI Name:** jdbc/mvdemo-rac1, **Database Type:** Oracle.
- m. For **Database Driver**, select Oracle's Driver (Thin) for Oracle RAC Service-Instance connections: Versions: Any.
- n. Accept the default values (Supports Global Transactions and One-Phase Commit).
- o. Define the connection properties for Node 2. Provide values for Service Name, Database Name, Host Name, Port, Database User Name, Password, and Protocol.
- p. Verify the properties and click **Test Configuration**. If it succeeds, click **Next**.
- q. Select (check) the server in which MapViewer is deployed (map_viewer1), and click **Finish**.
- r. If you need to add more nodes, click **Create a New Data Source** and create each in the same way as before.

1.7.1.2 Create a MapViewer Data Source Using a Container Data Source

After creating a container data source in the MapViewer container (explained in [Section 1.7.1.1](#)), create a new MapViewer data source that enables it to connect to the Oracle RAC database by adding the `container_ds` attribute in the MapViewer data source. For example:

```
<map_data_source name="mvdemo"
                  container_ds="jdbc/mvdemo"
                  number_of_mappers="7" />
```

In the preceding example:

- The `name` attribute specifies the MapViewer data source name, which is required for map requests.
- The value for the `container_ds` attribute must match the JNDI Name that you specified on the Data Source Properties page of the Creating New JDBC Data Source wizard.
- The `number_of_mappers` attribute specifies the maximum number of supported concurrent map requests that can target this data source.

For more information about these attributes, see [Section 1.6.2.15, "Defining Permanent Map Data Sources"](#).

1.7.2 Creating a MapViewer Data Source Using the Oracle RAC Service Name

As an alternative to creating a JDBC container data source for use with the `container_ds` attribute in the MapViewer configuration file (as explained in [Section 1.7.1](#)), you can create a MapViewer data source directly in the MapViewer configuration file by specifying the connection parameters to the Oracle RAC data service. (This type of connection works only with Oracle Database Release 11.2 and later.) For example:

```
<map_data_source name="mvdemo"
    jdbc_host="rac.mycompany.com"
    jdbc_sid="//srv.mycompany.com"
    jdbc_port="1521"
    jdbc_user="mvdemo"
    jdbc_password="!mypassword"
    jdbc_mode="thin"
    number_of_mappers="8"
    allow_jdbc_theme_based_foi="true"
    editable="false"
/>
```

In the preceding example:

- The `jdbc_host` attribute must be the Oracle RAC SCAN IP address or host name.
- The `jdbc_sid` attribute (note the leading `//` characters in `jdbc_sid="//srv.mycompany.com"`) specifies the Oracle RAC database service name, not the SID value.

For more information about the attributes in this example, see [Section 1.6.2.15, "Defining Permanent Map Data Sources"](#).

1.7.3 Restarting MapViewer

After performing the instructions in [Section 1.7.1, "Creating a Container Oracle RAC Data Source for the MapViewer Server"](#) or [Section 1.7.2, "Creating a MapViewer Data Source Using the Oracle RAC Service Name"](#), you must restart MapViewer to have the newly created data source take effect.

After you have restarted MapViewer, whenever you request a map from the data source, MapViewer obtains the necessary database connections (from the container if you chose the option in [Section 1.7.1](#), or directly from the connection parameters if you chose the option in [Section 1.7.2](#)).

1.8 High Availability and MapViewer

Note: This section is intended for advanced users who want to take full advantage of the high availability features of Oracle Fusion Middleware with MapViewer. You must have a strong understanding of high availability features, which are described in *Oracle Fusion Middleware High Availability Guide*.

MapViewer users can benefit from the high availability features of Oracle Database and Oracle Fusion Middleware.

1.8.1 Deploying MapViewer on a Middle-Tier Cluster

MapViewer can be deployed to a WebLogic Server cluster. You must take care, however, about how the generated image files on each host are named and referenced through URLs by client applications.

Consider the following sample scenario. When a map request is sent to the front web server, it reaches the MapViewer server running on host A. MapViewer on host A then sends back the URL for the generated map image, and the client then sends a second request to fetch the actual image. This second request might be received by WebLogic Server running on host B, which has no such image (or which will send back an incorrect image with the same name).

There is no single best solution for this problem in all environments. One option is to have the hosts share common networked storage, so that the map images are deposited in the same virtual (networked) file system by different MapViewer servers running on different hosts. You must configure the map file storage information (see [Section 1.6.2.2](#)) for each MapViewer instance so that the images are deposited in different subdirectories or so that they have different file prefixes. Otherwise, the image files generated by the multiple MapViewer servers might overwrite each other on the disk. By properly configuring the map file storage information, you ensure that each URL sent back to the client uniquely identifies the correct map on the network drive.

If you cannot use networked drives, consider using a load balancer. You may first need to configure the map file storage information for each MapViewer instance (as explained in the preceding paragraph), so that each MapViewer instance names its generated images using an appropriate scheme to ensure uniqueness. You can then specify rules in the load balancer to have it redirect image requests to a certain host if the URL matches a certain pattern, such as containing a specified map image file prefix.

1.9 Secure Map Rendering

This section describes how to implement secure map rendering based on a web user's identity. Users with different roles or permissions will see different feature sets when viewing the same theme. The basic idea is that MapViewer will always invoke a specified PL/SQL package to set the web user's identity in the database whenever accessing the database for any themes. This user information can be used by the database to enforce data access control.

Note: In this section, the terms *user* and *authenticated user* refer to the application or web user that logs into Oracle Fusion Middleware or Oracle Single Sign-On (SSO). It is *not* the same as the database user. MapViewer itself will connect directly to a database schema that stores all the geospatial data.

MapViewer will connect directly to a database schema that stores all the geospatial data. To enforce access control for MapViewer on the data in this schema, you must perform the following steps:

1. Create a PL/SQL package in the database schema. The package must have at least two named procedures: `set_user(username)` and `clear_user()`.
2. Create views, set access rights on database objects, and perform other tasks, based on the user identity stored in the PL/SQL package (which is set by MapViewer through the `set_user` procedure for each database session).

3. Create a MapViewer data source to the schema, providing the name of the PL/SQL package as part of the data source definition. This is considered a secured data source.
4. Create MapViewer themes that are based on the views created in step 2.
5. Establish web authentication for users accessing your MapViewer application page or pages, so that when a map request reaches the MapViewer servlet, the web session object should contain an authenticated user's identity.
6. Issue map and FOI (feature of interest) requests that view the themes defined in step 4, either directly or through the use of base maps and Oracle Maps.

MapViewer will automatically pass the user identity to the database using the PL/SQL package before it executes any query for these themes. Only those rows that are visible to the identified user will be returned from the database and rendered by MapViewer.

[Section 1.9.1](#) explains how secure map rendering works and provides implementation details and examples. [Section 1.9.3](#) describes some options for authenticating users and refers to a supplied demo.

1.9.1 How Secure Map Rendering Works

MapViewer, as a Java EE application, can obtain the identity of a web user that has been authenticated to Oracle Fusion Middleware or Oracle Single Sign-On (SSO). This user information can then be preserved and propagated to the database, where secure access to map layers and tables can be set up based on the user identity. For example, a database administrator (DBA) can create a view of a base table that selects only those spatial features visible to a specific user.

To pass the web user identity from Oracle Fusion Middleware or Oracle Single Sign-On (SSO) to the database, use a secure PL/SQL package that sets the user identity in the database. This PL/SQL package is created by a DBA or application developer and installed in the data source schema. Such a package can have any number of procedures and functions, but it must contain at least the following two procedures:

- `set_user(username)`
- `clear_user()`

Whenever a theme is requested from a secured data source, MapViewer invokes the `set_user` procedure in the associated PL/SQL package before it executes any data query for the theme, and it invokes the `clear_user` procedure when the querying process is complete for the theme.

[Example 1–4](#) shows a PL/SQL package that you can use for secure map rendering. You can create this package in the example MVDEMO schema.

Example 1–4 PL/SQL Package for Secure Map Rendering

```
CREATE OR REPLACE PACKAGE web_user_info
AS
    PROCEDURE set_user (p_name IN VARCHAR2);
    PROCEDURE clear_user;
    FUNCTION get_user
        RETURN VARCHAR2;
END;
CREATE OR REPLACE PACKAGE BODY web_user_info
AS
    w_name VARCHAR2 (32767);
```

```

PROCEDURE set_user (p_name IN VARCHAR2)
AS
BEGIN
    w_name := LOWER (p_name);
END;

PROCEDURE clear_user
AS
BEGIN
    w_name := null;
END;

FUNCTION get_user
    RETURN VARCHAR2
AS
BEGIN
    RETURN w_name;
END;
END;
/

```

In [Example 1–4](#), set_user and clear_user are two required methods, and get_user is a convenience function that can be used in creating views or for other data access control purposes.

After you create the package (which essentially contains the user identity for the current database session), you can set up an elaborate virtual private database that uses this user information (see *Oracle Database Security Guide* for information about using Oracle Virtual Private Database, or VPD). For simplicity, however, this section does not discuss VPD creation, but shows that you can create views that use this user information to enforce data access control.

For example, in the example MVDEMO schema you can add a column named ACCOUNT_MGR to the existing CUSTOMERS table, and assign an account manager to each customer stored in this table. You can then create a view that returns only customer rows for a specific account manager, as shown in [Example 1–5](#).

Example 1–5 View for Secure Map Rendering

```

CREATE OR REPLACE VIEW customers_view
AS
    SELECT * FROM customers
    WHERE account_mgr = web_user_info.get_user;

```

You can now define a MapViewer theme based on this view, so that whenever account managers log in and want to view customer data on a map, each will only see his or her own customers.

After you have installed the PL/SQL package, you can pass the name of this package to MapViewer as part of the definition of a data source by using the plsql_package attribute, as shown in [Example 1–6](#).

Example 1–6 Data Source Definition for Secure Map Rendering

```

<map_data_source name="mvdemo"
                  jdbc_host="system32.example.com"
                  jdbc_sid="mv"
                  jdbc_port="15214"
                  jdbc_user="mvdemo"
                  jdbc_password="password"

```

```
    jdbc_mode="thin"
    number_of_mappers="3"
    allow_jdbc_theme_based_foi="true"
    plsql_package="web_user_info"
  />
```

When you specify a PL/SQL package name in a data source definition, MapViewer flags the data source as a secure data source, and it automatically invokes the package's `set_user` and `clear_user` procedures whenever performing any theme queries on the data source.

1.9.2 Getting the User Name from a Cookie

Sometimes the authenticated user's name is not passed to MapViewer through a Java EE or OSSO session, such as when you integrate MapViewer within Application Express (APEX), where authentication is carried out by APEX and the user name is not available through a Java EE or OSSO session. To enable you to work around this issue, MapViewer also supports getting the user name from a cookie. It is your responsibility to set up the cookie within APEX to hold the authenticated user name.

To ensure that MapViewer picks up the user name from a named cookie, you must specify the `web_user_type` attribute in the data source definition (in addition to the mandatory `plsql_package` attribute). For example, if you want MapViewer to pick up the user name from a cookie named `MON_USER`, your secure data source definition should look like [Example 1-7](#).

Example 1-7 Data Source Definition Specifying Cookie Name

```
<map_data_source name="mvdemo"
    jdbc_host="system32.example.com"
    jdbc_sid="mv"
    jdbc_port="25650"
    jdbc_user="mvdemo"
    jdbc_password="LfCDQ6NH59nuV7zbeY5QY06sqN7XhiUQ"
    jdbc_mode="thin"
    number_of_mappers="3"
    allow_jdbc_theme_based_foi="true"
    plsql_package="web_user_info"
    web_user_type="MON_USER"
  />
```

The possible values for the `web_user_type` attribute are:

- `J2EE_USER`: tells MapViewer to get the authenticated user name from a Java EE session
- `OSSO_USER`: tells MapViewer to get the authenticated user from an OSSO session.
- `<cookie-name>`: tells MapViewer to get the authenticated user from a cookie with the specified name. The cookie name is not case sensitive.

If `web_user_type` is not specified, MapViewer first looks for the user name in the Java EE session; and if none is found, it looks for the user name in the OSSO session (if present).

1.9.3 Authenticating Users: Options and Demo

How, when, and where users are authenticated depend on the requirements of your application and the setup of your installation. For example, your options include the following:

- Deploy MapViewer as part of an enterprise portal site, so that end users always first log onto the portal before performing any mapping functions through MapViewer.
- Deploy MapViewer on a separate system, and have users authenticate to a central Oracle SSO server.

As long as the HTTP requests reaching MapViewer contain the authenticated user information, MapViewer will be able to pass the requests on to the database, and the secure data access approach will work as expected.

1.9.4 Using Single Sign-On (SSO) with MapViewer

If you want to set up Single Sign-On to authenticate users who want to view maps with MapViewer, follow these major steps:

1. [Install Oracle Access Manager](#).
2. [Configure MapViewer](#).
3. [Configure Oracle Access Manager](#).
4. [Configure MapViewer Oracle Access Manager Logout Parameters](#)
5. [Configure Oracle HTTP Server](#).

1.9.4.1 Install Oracle Access Manager

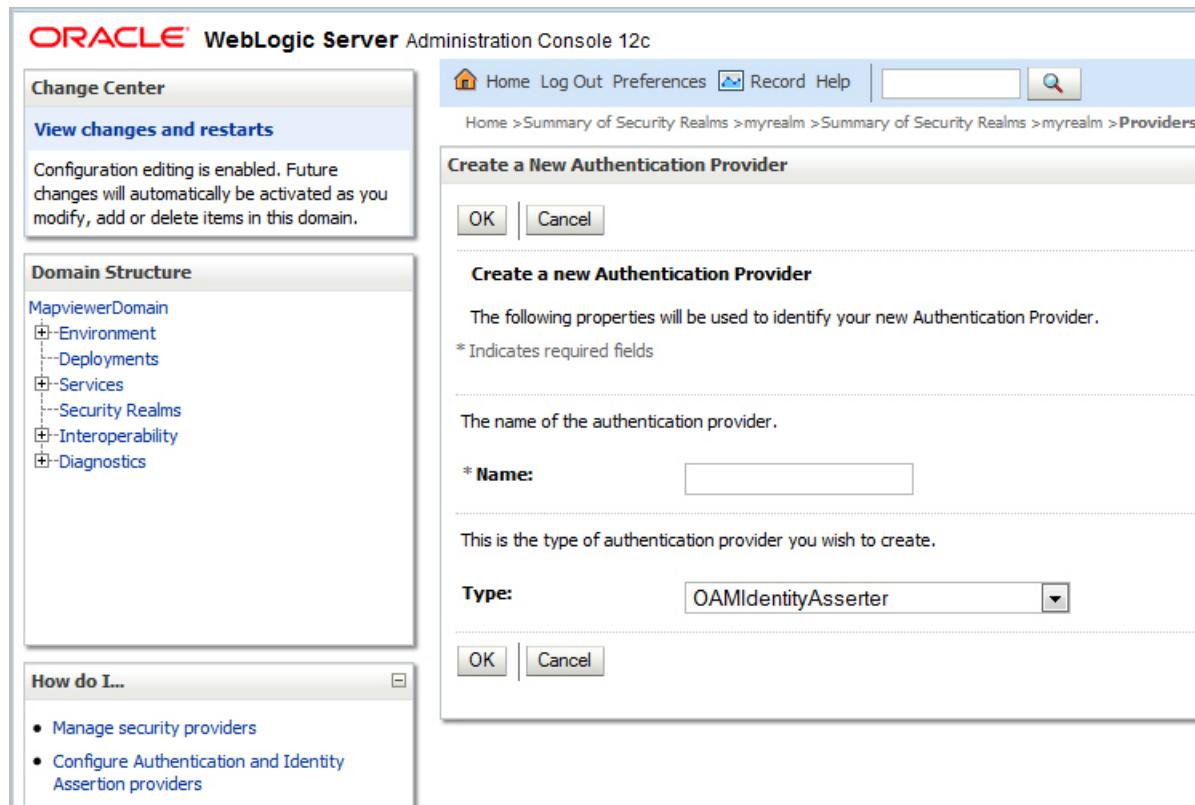
Oracle Access Manager (also referred to as Access Manager) provides the core functionality of Web Single Sign On (SSO), authentication, authorization, centralized policy administration and agent management, real-time session management and auditing.

If Oracle Access Manager is not already installed, follow the instructions in the chapter about installing Oracle Identity and Access Management for your Oracle Identity Management release in *Oracle Fusion Middleware Installation Guide for Oracle Identity Management*.

1.9.4.2 Configure MapViewer

To configure MapViewer for use with SSO, follow these steps:

1. Add and configure the Oracle Access Management Asserter.
 - a. Using the WebLogic Server console for your domain, go to **Security Realms**, click the Name link for your realm, click **Providers**, then **Authentication**.
 - b. Under Authentication Providers, click **New** to display the Create a New Authentication Provider page, shown in [Figure 1-11](#).

Figure 1-11 Create a New Authentication Provider

For **Name**, specify a name of your choice for this authentication provider. For example: OAM Id Asserter

For **Type**, select OAMIdentityAsserter.

- c. Click **OK**.
 - d. In the Authentication Providers table, click the Name link for the provider you just created.
 - e. Under Settings for the provider, on the Common tab, set **Control Flag** to REQUIRED.
 - f. Under **Active Types**, add ObSSOCookie and OAM_REMOTE_USER to the Chosen list.
 - g. Click **Save**.
2. Add and configure the authentication provider for OID.
 - a. Using the WebLogic Server console for your domain, go to **Security Realms**, click the Name link for your realm, click **Providers**, then **Authentication**.
 - b. Under Authentication Providers, click **New** to display the Create a New Authentication Provider page.
- For **Name**, specify a name of your choice for this authentication provider. For example: OID Authenticator
- For **Type**, select OracleInternetDirectoryAuthenticator.
- c. Click **OK**.

- d. In the Authentication Providers table, click the Name link for the provider you just created.
 - e. Under Settings for the provider, on the Common tab, set **Control Flag** to **SUFFICIENT**, and click **Save**.
 - f. Click the **Provider Specific** tab, and specify the provider-specific configuration for this Oracle Internet Directory Authentication provider:
 - Host:** The host name or IP address of the LDAP server.
 - Port:** The port number on which the LDAP server is listening.
 - Principal:** The Distinguished Name (DN) of the LDAP user that WebLogic Server should use to connect to the LDAP server.
 - Credential and Confirm Credential:** The credential (usually a password) used to connect to the LDAP server.
 - User Base DN:** The base distinguished name (DN) of the tree in the LDAP directory that contains users.
 - User Name Attribute:** The attribute of an LDAP user object class that specifies the name of the user. The user name attribute specified must match the one specified in the All Users Filter and User From Name Filter attributes.
 - Group Base DN:** The base distinguished name (DN) of the tree in the LDAP directory that contains groups.
 - g. Click **Save**.
3. Reorder the providers.
- a. Go to the page with the list of providers (Home > Summary of Security Realms > realm-name >Providers)
 - b. Click **Reorder** (below the list of providers).
 - c. On the Reorder Authentication Providers page, order the **Available** providers to place the ones you created at the top of the list, as follows:
 - (Your specified OAM Identity Asserter)
 - (Your specified Authentication provider for OID)
 - DefaultAuthenticator
 - DefaultIdentityAsserter
 - d. Click **OK**.
4. Configure the Oracle Access Manager (OPSS) SSO provider.
- a. Execute the **addOAMSSOProvider()** WLST command, replacing some parameters with the appropriate values for your server. The statements to run have the following format:

```
$ ORACLE_HOME/common/bin/wlst.sh
connect('weblogic', 'welcome1' [,host,port])
addOAMSSOProvider(loginuri="/${app.context}/adfAuthentication",
logouturi="/oamsso/logout.html")
disconnect()
```

Note that the host and port parameters for `connect()` default to `localhost:7001`; so if you need to override these default values, specify those parameter.

- b. Restart your domain (the administration server and all managed servers).

1.9.4.3 Configure Oracle Access Manager

Create an application domain in Oracle Access Manager. An **application domain** is used to protect your application URIs so that single sign-on processing is triggered. [Table 1–1](#) shows the protected and public URIs that must be configured for MapViewer.

Table 1–1 Protected and Public URIs to Configure for MapViewer Application Domain

Protected URIs	Public URIs
/mapviewer/console	/mapviewer/dataserver
/mapviewer/mapadmin	/mapviewer/foi
/mapviewer/mcsadmin	/mapviewer/mcserver
/mapviewer	/mapviewer/wms /mapviewer/wmts

Each protected and public URI of the application must be configured. For detailed conceptual information and instructions, see the "Configuring Oracle Access Manager (OAM)" topic in *Oracle Fusion Middleware Administering Oracle WebCenter Portal*.

1.9.4.4 Configure MapViewer Oracle Access Manager Logout Parameters

Effective with Version 12.2. in addition to the Oracle Access Manager (OAM) configuration described in [Section 1.9.4.3](#), if you are using MapViewer with SSO sign-on, you must define the logout parameters in the MapViewer configuration file. The OAM logout URL parameter can be found in the WebGate properties using the OAM console. The relevant section of the configuration file is:

```
<!-- **** OAM centralized logout -->
<!-- Uncomment the <oam_logout> tag to configure the logout URL
      for MapViewer JET web console. The parameters should be related with
      the OAM logout redirect URL value registered in OAM installation:
      protocol: http, https, ...
      host: OAM host
      port: OAM logout port
      mv_webgate_port: OAM MapViewer server port (Webgate port). It is optional,
                      but is recommended to allow a correct logout of the
                      non OAM MapViewer that is setup in the OAM environment
-->
<!--
<oam_logout
    protocol="http"
    host="oam.host.com"
    port="7001"
    mv_webgate_port="0001"
/>-->
```

1.9.4.5 Configure Oracle HTTP Server

Configure the Oracle HTTP Server to forward HTTP requests to your applications. For details, see the topic about installing and configuring the Oracle HTTP Server in *Oracle Fusion Middleware Administering Oracle WebCenter Portal*.

1.10 MapViewer Demos and Tutorials

Several MapViewer demos and tutorials are included in a separate application archive named `mvdemo.ear`, and deployed to the same Java EE container where `mapviewer.ear` is deployed.

Once deployed the demos and tutorials will be accessible from a URL in this format:
`http://host:port/mvdemo/`

See also the resources available at:

<http://www.oracle.com/technetwork/middleware/mapviewer/downloads/>

2

MapViewer Concepts

This chapter explains concepts that you should be familiar with before using MapViewer.

Some fundamental concepts include *style*, *theme*, *base map*, *mapping metadata*, and *map*.

- Styles define rendering properties for features that are associated with styles. For example, a text style determines how such a feature is labeled on a map, while a line style determines the rendition of a linear feature such as a road.
- A theme is a collection of features (entities with spatial and nonspatial attributes) that are associated with styles through the use of styling rules.
- A base map consists of one or more themes. (A base map should not have the same name as any theme.)
- Mapping metadata consists of a repository of styles, themes, and base maps stored in a database.
- A map is one of the components that MapViewer creates in response to a map request. The map can be an image file, the object representation of an image file, or a URL referring to an image file.

This chapter contains the following major sections:

- [Section 2.1, "Overview of MapViewer"](#)
- [Section 2.2, "Styles"](#)
- [Section 2.3, "Themes"](#)
- [Section 2.4, "Maps"](#)
- [Section 2.5, "Data Sources"](#)
- [Section 2.6, "How a Map Is Generated"](#)
- [Section 2.8, "Workspace Manager Support in MapViewer"](#)
- [Section 2.9, "MapViewer Metadata Views"](#)

2.1 Overview of MapViewer

When an application uses MapViewer, it applies specific styles (such as colors and patterns) to specific themes (that is, collections of spatial features, such as cities, rivers, and highways) to render a map (such as a GIF image for display on a web page). For example, the application might display a map in which state parks appear in green and restaurants are marked by red stars. A map typically has several themes representing political or physical entities, or both. For example, a map might show

national and state boundaries, cities, mountain ranges, rivers, and historic sites. When the map is rendered, each theme represents a layer in the complete image.

MapViewer lets you define styles, themes, and base maps, including the rules for applying one or more styles to each theme. These styles, themes, base maps, and associated rules are stored in the database in map definition tables under the MDSYS schema, and they are visible to you through metadata views. All styles in a database instance are shared by all users. The mapping metadata (the set of styles, themes, and base maps) that you can access is determined by the MapViewer metadata views described in [Section 2.9](#) (for example, USER_SDO_STYLES, USER_SDO_THEMES, and USER_SDO_MAPS). The set of map definition objects that a given user can access is sometimes called that user's *mapping profile*. You can manage styles, themes, and base maps with the standalone Map Builder tool, described in [Chapter 7](#).

2.2 Styles

A **style** is a visual attribute that can be used to represent a spatial feature. The basic map symbols and labels for representing point, line, and area features are defined and stored as individual styles. Each style has a unique name and defines one or more graphical elements in an XML syntax.

Each style is of one of the following types:

- **Color:** a color for the fill or the stroke (border), or both.
- **Marker:** a shape with a specified fill and stroke color, or an image. Markers are often icons for representing point features, such as airports, ski resorts, and historical attractions.
- **Line:** a line style (width, color, end style, join style) and optionally a center line, edges, and hash mark. Lines are often used for linear features such as highways, rivers, pipelines, and electrical transmission lines. You can also use cased line styles, which are useful for drawing streets and highways.
- **Area:** a color or texture, and optionally a stroke color. Areas are often used for polygonal features such as counties and census tracts.
- **Text:** a font specification (size and family) and optionally highlighting (bold, italic) and a foreground color. Text is often used for annotation and labeling (such as names of cities and rivers).
- **Advanced:** a composite used primarily for thematic mapping, which is described in [Section 2.3.12](#). The key advanced style is BucketStyle, which defines the relationship between a set of simple rendering (and optionally labeling) styles and a set of buckets. For each feature to be plotted, a designated value or set of values from that feature is used to determine which bucket the feature falls into, and then the style associated with that bucket is used to plot the feature. Bucket styles are described in [Section A.6.1](#).

Two special types of bucket styles are also provided: color scheme (described in [Section A.6.2](#)) and variable (graduated) marker (described in [Section A.6.3](#)). Other advanced styles are dot density (described in [Section A.6.4](#)), bar chart (described in [Section A.6.5](#)), collection (described in [Section A.6.6](#)), variable pie chart (described in [Section A.6.7](#)), and heat map (described in [Section A.6.8](#)).

[Table 2-1](#) lists the applicable geometry types for each type of style.

Table 2–1 Style Types and Applicable Geometry Types

Style Type	Applicable Geometry Types
Color	(any type)
Marker	point, line
Line	line
Area	polygon
Text	(any type)
Advanced	(any type)

All styles for a database user are stored in that user's USER_SDO_STYLES view, which is described in [Section 2.9](#) and [Section 2.9.1](#).

You can also create **dynamically defined styles** (that is, temporary styles) of any style type as part of a map request. The way to create them depends on which API you are using:

- With the native XML API, define the style using its XML elements within the <map_request> element.
- With the JavaBean API, add a dynamically defined style to a map request, as explained in [Section 4.3.4](#).
- With the Oracle Maps JavaScript API, use classes and methods to create all types of styles dynamically.

In each case, what you are actually creating is the XML definition of the styles; it is the MapViewer server that actually creates such dynamically defined styles from the definitions when it processes the map request, and it discards the dynamically created styles when the request is completed.

For more detailed information about the types of styles, including information about the XML format for defining each type, see [Appendix A](#).

This section contains the following major subsections:

- [Section 2.2.1, "Scaling the Size of a Style \(Scalable Styles\)"](#)
- [Section 2.2.2, "Specifying a Label Style for a Bucket"](#)
- [Section 2.2.3, "Orienting Text Labels and Markers"](#)
- [Section 2.2.4, "Making a Text Style Sticky"](#)
- [Section 2.2.5, "Getting a Sample Image of Any Style"](#)

2.2.1 Scaling the Size of a Style (Scalable Styles)

If you specify a unit other than the default of pixels (px) in a style definition, the style becomes scalable: that is, the size of features associated with the style is scaled as users zoom in or out on a map. For example, if you specify a marker style's width and height as 100m, the marker is displayed as a square 100 meters on each side according to the map scale at the current zoom level.

The following are style types and the attributes that can have an associated size unit:

- Marker styles: marker size (height and width) and text attributes (font size, label offsets)

- Line styles: overall line width, center line width and dash pattern, wing line width and dash pattern, hash mark, and marker pattern (size, offset, interval)
- Text styles: font size, halo width
- Bar chart styles: bar width and height
- Dot density styles: dot width and height
- Pie chart styles: pit radius

Example 2–1 defines a star-shaped marker within a bounding box 15 kilometers (15.0km) on each side. This definition might be useful for identifying capital cities of states on a map showing all or a large part of a country; however, it would not be useful for a display zoomed in on a specific city and its local surrounding area.

Example 2–1 Scalable Marker Style

```
<style name="M.STAR_CAPITAL_CITY">
  <svg width="1in" height="1in">
    <desc/>
    <g class="marker"
      style="stroke:#000000;fill:#FF0000;fill-opacity:0;width:15.0km;height:15.0km;font-
      family:Dialog;font-size:12;font-fill:#FF0000">
      <polyline
        points="138.0,123.0,161.0,198.0,100.0,152.0,38.0,198.0,61.0,123.0,0.0,76.0,76.0,76
        .0,100.0,0.0,123.0,76.0,199.0,76.0"/>
    </g>
  </svg>
</style>
```

Example 2–2 defines a line style with an overall line width of 10 meters (10.0m) and a border line width of 1 meter (1.0m). This definition might be useful for identifying capital cities of primary highways.

Example 2–2 Scalable Line Style

```
<style name="L.PRIMARY_HIGHWAY">
  <svg width="1in" height="1in">
    <desc></desc>
    <g class="line" cased="true" style="fill:#33a9ff;stroke-width:10.0m">
      <line class="parallel" style="fill:#aa55cc;stroke-width:1.0m" />
    </g>
  </svg>
</style>
```

When MapViewer renders or labels styles that have size units other than pixel, it first transforms the size units into screen pixels based on the current map area and display area, and it then renders the or labels the style. The size of a scalable style changes as users zoom in or out on a map. If zooming out results in an overall style size less than or equal to zero, the style is not rendered or labeled.

Size units can be used only with data associated with a known spatial reference system (SRS). If the data has no SRS or an unknown SRS, pixels are used for all size values. Note also that pixel values are used instead of any specified size unit in legends and in previews rendered by the Map Builder utility. (Legends are explained in [Section 2.4.2](#).)

Scalable styles work with MapViewer Release 11g (11.1.1) or later; they cannot be used with earlier releases of MapViewer.

2.2.2 Specifying a Label Style for a Bucket

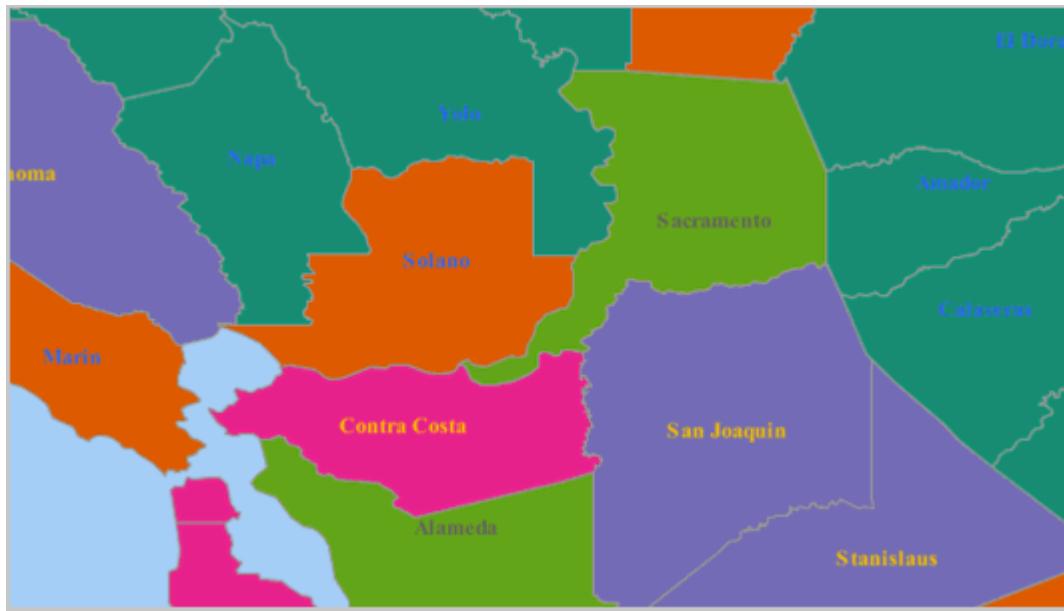
For collection-based bucket styles and individual range-based bucket styles (described in [Section A.6.1.1](#) and [Section A.6.1.2](#), respectively), you can specify a labeling style by using the `label_style` attribute in each bucket element. [Example 2–3](#) creates an advanced style named `V.COUNTY_POP_DENSITY` in which each bucket is assigned a text label style (using the `label_style` attribute), with some styles being used for several buckets.

Example 2–3 Advanced Style with Text Label Style for Each Bucket

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <BucketStyle>
    <Buckets>
      <RangedBucket seq="0" label="<150k"
        low="-Infinity" high="150000"
        style="C.CB_QUAL_8_CLASS_DARK2_1"
        label_style="T.BLUE_SERIF_12"/>
      <RangedBucket seq="1" label="150k - 350k"
        low="150000" high="350000"
        style="C.CB_QUAL_8_CLASS_DARK2_2"
        label_style="T.BLUE_SERIF_12"/>
      <RangedBucket seq="2" label="350k - 600k"
        low="350000" high="600000"
        style="C.CB_QUAL_8_CLASS_DARK2_3"
        label_style="T.BROWN_SERIF_12"/>
      <RangedBucket seq="3" label="600k - 1000k"
        low="600000" high="1000000"
        style="C.CB_QUAL_8_CLASS_DARK2_4"
        label_style="T.BROWN_SERIF_12"/>
      <RangedBucket seq="4" label="1000k - 1500k"
        low="1000000" high="1500000"
        style="C.CB_QUAL_8_CLASS_DARK2_5"
        label_style="T.GREY_SERIF_12"/>
      <RangedBucket seq="5" label="1500k - 2500k"
        low="1500000" high="2500000"
        style="C.CB_QUAL_8_CLASS_DARK2_6"
        label_style="T.GREY_SERIF_12"/>
      <RangedBucket seq="6" label="2500k - 5000k"
        low="2500000" high="5000000"
        style="C.CB_QUAL_8_CLASS_DARK2_7"
        label_style="T.GREEN_SERIF_12"/>
      <RangedBucket seq="7" label=">=5000k"
        low="5000000" high="Infinity"
        style="C.CB_QUAL_8_CLASS_DARK2_8"
        label_style="T.GREEN_SERIF_12"/>
    </Buckets>
  </BucketStyle>
</AdvancedStyle>
```

For individual range-based buckets, the lower-bound value is inclusive, while the upper-bound value is exclusive (except for the range that has values greater than any value in the other ranges; its upper-bound value is inclusive). No range is allowed to have a range of values that overlaps values in other ranges.

If the `V.COUNTY_POP_DENSITY` style in [Example 2–3](#) is used in a map request, it displays a map that might look like the display in [Figure 2–1](#), where the county names are shown with labels that reflect various text styles (in this case depending on the county's total population).

Figure 2–1 Varying Label Styles for Different Buckets

In [Example 2–3](#), all buckets except the last one specify a label style. For any features that fall into a bucket that has no specified label style, the label style (if any) applied to the feature depends on the following:

- If the `<label>` element of the theme's styling rules specifies a label style other than the advanced style itself, the specified label style is used to label the feature. In the following example, because the `<label>` element's style specification (`T.STATE_NAME`) is different from the `<features>` element's style specification (`V.COUNTY_POP_DENSITY`), features that fall into a bucket with no specified label style are labeled using the `T.STATE_NAME` style:

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <rule column="TOTPOP">
    <features style="V.COUNTY_POP_DENSITY">
    </features>
    <label column="county" style="T.STATE_NAME">
      1
    </label>
  </rule>
</styling_rules>
```

- If the `<label>` element of the theme's styling rules specifies the advanced style as its label style, the feature is *not* labeled. (This is why some counties in [Figure 2–1](#) are not labeled.) In the following example, because the `<features>` and `<label>` elements both specify the advanced style `V.COUNTY_POP_DENSITY`, features that fall into a bucket with no specified label style are not labeled:

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <rule column="TOTPOP">
    <features style="V.COUNTY_POP_DENSITY">
    </features>
    <label column="county" style="V.COUNTY_POP_DENSITY">
      1
    </label>
  </rule>
```

```
</styling_rules>
```

2.2.3 Orienting Text Labels and Markers

You can control the orientation of text labels and markers on a map by using oriented points. The oriented point is a special type of point geometry in Oracle Spatial and Graph. In an oriented point, the coordinates represent both the location of the point and a virtual end point, to indicate an orientation vector. The text is aligned or the marker symbol is rotated according to the orientation vector, which is explained in [Section 3.1.2.5](#) and illustrated in [Figure 3–3](#) in that section. For more information about oriented points, see *Oracle Spatial and Graph Developer's Guide*.

2.2.3.1 Controlling Text Style Orientation

To orient the text label of a point in the direction of an orientation vector, you can specify the point as an Oracle Spatial and Graph oriented point in the map request. When MapViewer labels an oriented point, it automatically centers the text label on the point position, and aligns the label so that it points in the direction of the orientation vector.

For each feature to be so labeled, you must specify its location as an oriented point. You can group these oriented points in a single table and create a spatial index on the column containing the point geometries. You can then create a theme based on the table, specifying a desired text style as the labeling, and specifying transparent color style as the rendering style so that the points themselves are not displayed on the map.

[Example 2–4](#) is a map request that labels a single oriented point with coordinates (12,14, 0.3,0.2), where (12,14) represents the X and Y coordinates of the point and (0.3,0.2) represents the orientation vector. It renders the point using a dynamically defined transparent color style (named `transparent_color`) to ensure that the text is displayed but the underlying point is not displayed.

Example 2–4 Labeling an Oriented Point

```
<map_request
    title="Labeling Oriented Points"
    datasource="my_datasource"    width="400"    height="300"
    antialias="true"
    format="PNG_STREAM">

    <themes>
        <theme name="theme1">
            <jdbc_query
                spatial_column="geom"    jdbc_srid="8265"
                render_style="transparent_color"
                label_column="label"    label_style="t.street_name"
                datasource="tilsmenv">
                SELECT SDO_Geometry(2001, 8265, NULL,
                    SDO_ELEM_INFO_ARRAY(1, 1, 1, 3, 1, 0),
                    SDO_ORDINATE_ARRAY(12, 14, .3, .2))
                geom, 'Oriented Point' label FROM dual
            </jdbc_query>
        </theme>
    </themes>

    <styles>
        <style name="transparent_color">
            <svg width="1in" height="1in">
                <g class="color" style="stroke:#ff0000;stroke-opacity:0">
```

```

<rect width="50" height="50"/>
</g>
</svg>
</style>
</styles>
</map_request>

```

[Figure 2–2](#) shows part of the map generated by the request in [Example 2–4](#). (The label is the phrase *Oriented Point*.)

Figure 2–2 Map Display of the Label for an Oriented Point

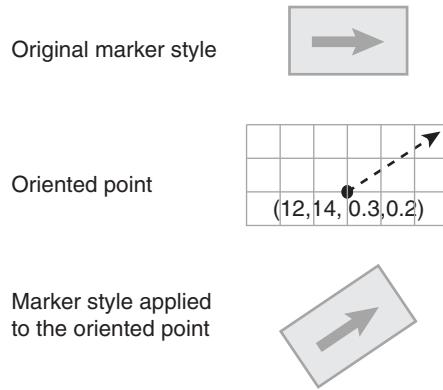


2.2.3.2 Controlling Marker Orientation

When a marker style is applied to an oriented point, MapViewer automatically rotates the marker style so that it points to the orientation vector. Any necessary rotation of the marker style is around the center of the marker.

[Figure 2–3](#) shows how you can use an oriented point to control the orientation of marker styles. In this figure, the original marker style is first shown without any rotation. However, when the marker is applied to the same oriented point shown in [Example 2–4](#) in [Section 2.2.3.1](#), the marker style is rotated accordingly (in this case about 34 degrees counterclockwise) to reflect the orientation vector.

Figure 2–3 Oriented Marker



2.2.4 Making a Text Style Sticky

You can specify that a text style is "sticky," which means that any feature that uses it as a label style will always have its text label drawn on a map. [Example 2–5](#) shows an XML definition of a style with the `sticky` attribute set to true.

Example 2–5 Text Style with Sticky Attribute

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
<desc></desc>
<g class="text" sticky="true" style =
"font-style:plain;font-family:Serif;font-size:11pt;font-weight:bold;fill:#000000">
    Hello World!
</g>
</svg>
```

2.2.5 Getting a Sample Image of Any Style

To get a sample image for any pre-defined style stored in a database, you can issue a simple HTTP request to the MapViewer server. This request can specify the size of the sample image, the background color, and the format of the returned image. Such requests are useful if you want to display a visual list of styles on a web page, to build a custom map legend, or just to see how various styles will appear.

The HTTP request has the following parameters, all of which are optional except for `sty`:

- `sty` (required) specifies the name of the style.
- `ds` specifies the data source where the style can be accessed. By default, the default MapViewer data source is used.
- `w` specifies the width of the sample image in pixels. The default value is 20.
- `h` specifies the height of the sample image in pixels. The default value is 20.
- `f` specifies the format of the sample image. Possible values are `png` for direct PNG image stream, `png_url` for the URL of a PNG image, `gif` for direct GIF image stream, or `gif_url` for the URL of a GIF image. The default value is `png`, which means the MapViewer server will directly stream the generated PNG image data back to the client without first saving it to the server disk.
- `bg` specifies the background color of the sample image. The format must be a hexadecimal string in the form of `0xrrggbb`, such as `0x808080` for a gray color. The default value is `0xffffffff` (white).

For a transparent background, specify `bg` as an extended hexadecimal string to include the alpha values, in the format of `0xaarrggbb`. For example, `0x00ffff` will make the style image's background completely transparent, while `0x55ffff` is a white background with a transparency value of `0x55` (decimal value 80). The alpha value can range from `0x00` (completely transparent) to `0xff` (completely opaque).

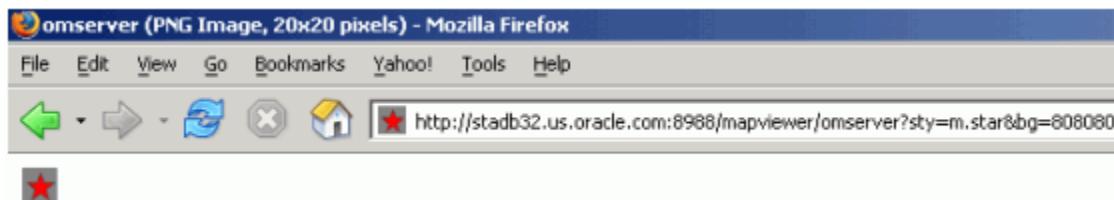
- `aa` specifies whether the sample image should be rendered in antialiasing mode. The default value is the string `true`. Specify the string `false` if you do not want to use antialiasing.

The following example generates an antialiased PNG image with a gray background with the default size of 20x20 pixels, displaying the marker style named `M.STAR` from the MapViewer default data source:

<http://www.mycorp.com/mapviewer/omserver?sty=m.star&bg=808080>

The preceding request generates a display similar to that in [Figure 2–4](#).

Figure 2–4 Sample Image of a Specified Marker Style

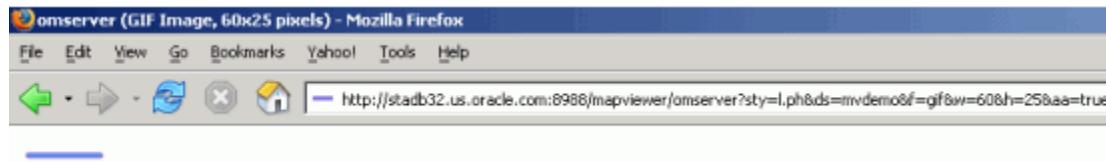


The following example generates an antialiased GIF image with the default white background, a width of 60 pixels, and a height of 25 pixels, displaying the line style named L.PH from the MapViewer data source named mvdemo:

`http://www.mycorp.com/mapviewer/omserver?sty=l.ph&ds=mvdemo&f=gif&w=60&h=25&aa=true`

The preceding request generates a display similar to that in [Figure 2–5](#).

Figure 2–5 Sample Image of a Specified Line Style



2.2.6 Allowing a Text Style to Overlap or Be Overlapped

You can specify that a text style allow-overlap, which means that any area feature, such as a polygon that uses it as a label style, will allow its text label be overlapped on a map. The following example shows an XML definition of a style with the allow-overlap attribute set to true.

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
<desc></desc>
<g class="text" allow-overlap="true" style =
"font-style:plain;font-family:Serif;font-size:11pt;font-weight:bold;fill:#000000">
    Hello World!
</g>
</svg>
```

For example, if a country's name is used as a label text, and if its style has the attribute value `allow-overlap="true"`, then other features' labels (such as state names) are allowed to overlap with it. The following figure shows part of a rendered map in which the country label "United States" overlaps slightly with the state labels "Colorado" and "Kansas".

Figure 2–6 Text Style with allow-overlap="true"



2.3 Themes

Theme is perhaps the most important concept in MapViewer. A **theme** is a visual representation of a particular data layer. Conceptually, a theme is a collection of geographic features that share similar attributes, plus the rendering and labeling rules that tell MapViewer what styles to use to render and label the features. To be more exact, when you define a theme, you are actually providing MapViewer with the following information: where and how to get the data, and how to render and label the data.

Depending on how a theme is created, it can also be categorized as either a predefined theme or a dynamic (JDBC) theme. For a **predefined theme**, the theme's definition is created in the standalone Map Builder tool and stored in the database. For a **dynamic theme**, the theme's definition (XML) is created in real time by an application. Dynamic themes typically employ a custom SQL query constructed by the application to get its data.

Typically, the data for a theme comes from a spatially enabled table, that is, a database table or view with a column of type SDO_GEOMETRY. For example, a theme named US_STATES might be based on a STATES table that has a column named GEOMETRY, plus any other nonspatial attribute columns. This type of theme is often called a geometry theme. Besides geometric data, other types of database-managed geographic data can be associated with corresponding types of themes; for example:

- Georeferenced images stored in BLOBs (image themes)
- Oracle Spatial and Graph GeoRaster data (GeoRaster themes)
- Oracle Spatial and Graph network data model (network themes)
- Oracle Spatial and Graph topology data model (topology themes)
- Cartographic annotation text (annotation themes)

MapViewer themes can be used to render not only geographic data stored in a database, but also data originating from other sources, such as web services (WFS, WMS, and WMTS) or the local file system (through the custom spatial data provider interface).

Regardless of what type of data is associated with a theme (except for WMS and WMTS themes, which represent externally rendered map layers), the MapViewer styling rules still need to be defined for each theme, and the styles referenced by the styling rules must exist and be stored in the database as part of the mapping metadata.

This section contains the following major subsections:

- [Section 2.3.1, "Predefined Themes"](#)
- [Section 2.3.2, "JDBC Themes"](#)

- [Section 2.3.3, "Image Themes"](#)
- [Section 2.3.4, "GeoRaster Themes"](#)
- [Section 2.3.5, "Network Themes"](#)
- [Section 2.3.6, "Topology Themes"](#)
- [Section 2.3.7, "WFS Themes"](#)
- [Section 2.3.8, "WMTS Themes"](#)
- [Section 2.3.9, "Custom Geometry Themes"](#)
- [Section 2.3.10, "Annotation Text Themes"](#)
- [Section 2.3.11, "LRS \(Linear Referencing System\) Themes"](#)
- [Section 2.3.12, "Thematic Mapping"](#)
- [Section 2.3.13, "Attributes Affecting Theme Appearance"](#)

2.3.1 Predefined Themes

A **predefined theme** is a theme whose definition is stored in a user's database schema. All predefined themes for a database user are stored in that user's `USER_SDO_THEMES` view (described in [Section 2.9](#), especially [Section 2.9.2](#)). When you include a predefined theme in a map request, you need to specify only the theme name. MapViewer automatically finds the theme's definition, constructs a query based on it, retrieves the relevant spatial and attribute data, and renders the data according to the styling rules for the theme.

Each predefined theme must have an associated base table or view. If you base a theme on a view, you must insert a row in the view owner's `USER_SDO_GEOM_METADATA` view (described in *Oracle Spatial and Graph Developer's Guide*) specifying the view and its spatial column. If the view is a join view (that is, if it is based on multiple tables), you must specify the `key_column` attribute (described in [Section A.7](#)) in the theme's styling rules. The reason for this requirement is that MapViewer by default caches geometries for a predefined theme based on the `rowid` in the base table; however, for a join view there is no `ROWID` pseudocolumn, so you must specify a key column.

For most types of predefined themes (but not WMS themes), you can use the Map Builder tool to create and preview themes. For information about the Map Builder tool, see [Chapter 7](#).

2.3.1.1 Styling Rules in Predefined Spatial Geometry Themes

Each predefined theme is always associated with one or more **styling rules**, specifications in XML format that control aspects of how the theme is displayed. This section describes styling rules for predefined spatial geometry themes, such as the airport theme shown in [Example 2–6](#). Other types of themes, such as image, GeoRaster, network, and topology themes, have their own distinct styling rules requirements, and these are discussed in sections that explain these themes. However, the styling rules for all types of themes are grouped under the `<styling_rules>` element in an XML document, which is stored in the `STYLING_RULES` column for each predefined theme in the `USER_SDO_THEMES` view. (The `<styling_rules>` DTD is described in [Section A.7](#).)

Note: The following naming conventions are used for prefixes in style names in the examples in this chapter: v . indicates variable (advanced style), m . indicates marker, c . indicates color, l . indicates line, and t . indicates text. (If the style is not under the current user's schema, you must specify the owner's schema name followed by a colon. For example: mdsys:c.red.)

In the content (character data) of an XML document, < and > must be used to represent < and >, respectively. Otherwise, < or >, such as in WHERE CATEGORY > 'B', will be interpreted by the XML parser as part of an XML tag.

Example 2–6 XML Definition of Styling Rules for an Airport Theme

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <rule>
    <features style="c.black gray">
      runway_number &gt; 1
    </features>
    <label column="name" style="t.airport name">
      1
    </label>
  </rule>
  <rule>
    <features style="m.airplane">
      runway_number = 1
    </features>
  </rule>
</styling_rules>
```

Each styling rule has a required <features> element and an optional <label> element. The <features> element specifies which row or rows (features) in the table or view will be selected based on the user-defined predicate and on the style to be used for the selected features. You can specify any valid SQL predicate as the value of this element. The <label> element specifies whether or not to annotate the selected features, and if so, which column in the table or view to use for text labels.

In Example 2–6, there are two styling rules associated with the Airport theme:

- The first rule specifies that only those rows that satisfy the condition runway_number > 1 (that is, runway number greater than 1) will be selected, and these will be rendered using the style named c.black gray. If no value is supplied, no WHERE clause condition is applied. For example, assume that the definition had been the following (that is, omitting the runway_number > 1 condition):

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <rule>
    <features style="c.black gray"/>
    <label column="name" style="t.airport name">
      1
    </label>
  </rule>
</styling_rules>
```

In this case, all airport features would be selected and would be rendered using the color style named c.black gray.

The first rule also has a `<label>` element, which specifies that the NAME column in the table or view will be used to annotate each airport, using the text style `t.airport name`. The value of the `<label>` element, which can be any SQL expression that evaluates to a numeric value, is used to determine whether or not a feature will be annotated. If the numeric value is greater than zero, the feature will be annotated. In this case, because the value is the constant 1, all features specified by the `<features>` element will be annotated, using the values in the NAME column. If the value is less than or equal to zero for a feature, that feature will not be annotated.

- The second rule, which applies to those airports with only one runway, does not have a `<label>` element, thus preventing all such airports from being annotated. In addition, the features that satisfy the second rule will be rendered using a different style (`m.airplane`), as specified in its `<features>` element.

You can think of each styling rule as a filter into the base table or view of the theme, because it selects only a subset of the rows and applies the rendering and labeling styles of that rule. In fact, MapViewer formulates a complete SQL query for each styling rule. This query string follows a fixed format, as described in [Section 2.3.1.2](#).

2.3.1.2 How MapViewer Formulates a SQL Query for a Styling Rule

To see how MapViewer formulates a SQL query for a styling rule, consider the first styling rule from the airport theme example ([Example 2–6](#) in [Section 2.3.1.1](#)):

```
<styling_rules>
  <rule>
    <features style="c.black gray">
      runway_number &gt; 1
    </features>
    <label column="name" style="t.airport name">
      1
    </label>
  </rule>
  . .
</styling_rules>
```

When MapViewer processes this theme, it formulates a query string for this styling rule that looks like this:

```
SELECT ROWID, GEOMETRY, 'C.BLACK GRAY', NAME, 'T.AIRPORT NAME', 1, 'rule#0'
  FROM AIRPORT_POINT
 WHERE MDSYS.SDO_FILTER(GEOMETRY,
   MDSYS.SDO_GEOMETRY(2003, 8265, NULL, MDSYS.SDO_ELEM_INFO_ARRAY(1, 1003, 3),
   MDSYS.SDO_ORDINATE_ARRAY(:mvqboxx1, :mvqboxy1, :mvqboxxh, :mvqboxyh)),
   'querytype=WINDOW') = 'TRUE'
```

In the preceding query string:

- The base table name of the theme, `AIRPORT_POINT`, appears in the `FROM` clause
- The `SELECT` list includes `ROWID` as the first column. `ROWID` is the default key_ column attribute of a predefined theme.
- The next column in the `SELECT` list is `GEOMETRY`. This is the geometry column of this theme.
- The next column in the `SELECT` list is the literal string '`C.BLACK GRAY`', which is the rendering style name for this rule.
- The next column in the `SELECT` list is the column `NAME`, which will provide the label text. It is specified in the `<label>` element of this styling rule.

- The next column in the SELECT list is the literal string 'T.AIRPORT NAME', which is the labeling style name specified in the <label> element.
- The next column in the SELECT list is the literal value 1, which is the value of the <label> element itself.
- The next column in the SELECT list is the literal string 'rule#0'. This is used internally by MapViewer only.
- The large WHERE clause is essentially an Oracle Spatial and Graph filtering operator, SDO_FILTER. This WHERE clause is automatically added by MapViewer (and is *not* something you need to specify when defining a theme). It ensures that only those geographic features that are in contact with the current map viewing window will be fetched from the base table. The four binding variables, mvqboxx1, mvqboxy1, mvqboxxh and mvqboxyh, will be automatically filled in with the coordinates for the current map viewing window.

MapViewer always uses the preceding format when constructing SQL queries for the styling rules of a predefined geometry theme's styling rules. It uses different formats for the queries for other types of themes, such as a topology or GeoRaster theme. The formats for these other queries are not described here; however, if you are interested, you can set the logging level of your MapViewer instance to FINEST, submit a map request containing a particular type of theme, and check the MapViewer log file to see the exact query that MapViewer constructs.

Each row (or feature) in the query's result set now contains all the information MapViewer needs: the spatial data, the rendering and labeling style names, the label text, and the labeling conditions. MapViewer then constructs an in-memory feature object for each row and sends them to the rendering pipeline to be displayed on the map.

If two or more styling rules are specified for a theme, a UNION ALL operation is performed on the SQL queries for the rules (from first to last) to fetch the qualified features from the table or view.

If an advanced style is specified in a rule, the SELECT list of the query for that rule will include the additional attribute column or columns that are required by the advanced style.

2.3.1.3 Styling Rules with Binding Parameters

As explained in [Section 2.3.1.2](#), the <features> element of a styling rule can define a query condition to select features from the base table or view. This query condition typically contains hard-coded SQL expressions, such as runway_num > 1 in the airport theme. However, you can instead include binding variables in the query predicate. Such a theme is often called a *templated theme*, because it is essentially defining a template for how to display certain features, and the exact set of features is determined at runtime by providing a binding value to the query predicate.

The concept of templated theme allows you to define a single theme and to have the binding values change between map requests. For example, consider the following styling rule:

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <rule>
    <features style="C.RED"> (state_abrv=:1) </features>
    <label column="STATE" style="T.STATE NAME"> 1 </label>
  </rule>
</styling_rules>
```

The preceding styling rule defines a `<features>` element with a query condition based on the value of the `state_abrv` attribute, which the application must supply. In MapViewer requests, the binding parameter must be defined on the theme section, and each binding parameter is defined by a value and by a SQL type. In the following theme definition on a map request, the state abbreviation value is `ME` and the variable SQL type is `String`. The value `ME` will be used with the predefined theme styling rule.

```
<theme name="THEME_US_DYN_STATES" >
  <binding_parameters>
    <parameter value="ME" type="String"/>
  </binding_parameters>
</theme>
```

2.3.1.4 Applying Multiple Rendering Styles in a Single Styling Rule

The `<feature>` element of a styling rule allows you to specify only one rendering style using the `style` attribute. If you want to apply multiple rendering styles to a feature without using multiple themes, you cannot specify multiple styling rules, because each rule selects a different subset of features. To apply multiple rendering styles to a feature without using multiple themes, you must use the `<rendering>` element instead of the `style` attribute of the `<features>` element.

The `<rendering>` element has the format shown in the following example:

```
<rendering>
  <style name="V.POIMVK" value_columns="FEATURE_CODE">
    <substyle name="V.POIVBKT" value_columns="POINT_ID" changes="FILL_COLOR" />
  </style>
</rendering>
```

In the `<rendering>` element, the `<style>` element specifies the name of the style to use when rendering features, and one or more value columns (comma-delimited) for use with advanced styles. In the preceding example, the style name is `V.POIMVK` and the value column is `FEATURE_CODE`.

In the `<style>` element, the `<substyle>` element enables rendering of a feature using a combination of two attribute values, such as defining the feature shape by the `<style>` element and the feature color by the `<substyle>` element. This is useful for rendering point features once but based on two attribute values. You can specify one or more value columns (comma-delimited), and the change to be applied (only `FILL_COLOR` is currently supported).

You can specify multiple `<style>` elements with a `<rendering>` element, to achieve the following goals:

- To create an advanced style in which a base advanced style, associated with some attributes (columns), can have its rendering affected by some other attributes through the use of a substyle. For example, an advanced style can display markers of different sized based on one value column, while using a secondary color style to change the fill color of those markers based on another value column.
- To use multiple styles to render a feature (achieving the effect of stacked styles).

[Example 2-7](#) shows a predefined theme styling rule that uses the `<rendering>` element. The `<features>` element is part of the rules and must be define, because it also specified the query condition, but no style attribute is specified. The `<rendering>` element defines how to render the features.

Note: The use of styling rules with the `<rendering>` element, as shown in [Example 2–7](#), is not compatible with MapViewer release 10.1.3.1 and earlier releases.

Example 2–7 Styling Rules Using the `<rendering>` Element

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <rule>
    <features> </features>
    <label column="NAME" style="T.STREET2"> 1 </label>
    <rendering>
      <style name="V.POIVMK" value_columns="FEATURE_CODE">
        <substyle name="V.POIVBKT" value_columns="POINT_ID" changes="FILL_COLOR"/>
      </style>
    </rendering>
  </rule>
</styling_rules>
```

See also [Section 3.1.1.12](#), which contains an example that uses the `<rendering>` element.

The `<rendering>` element can also be used with dynamic themes, geometry themes, and topology themes.

2.3.1.5 Using Multiple Rendering Styles with Scale Ranges

The `<rendering>` element (see [Section 2.3.1.4, "Applying Multiple Rendering Styles in a Single Styling Rule"](#)) can have multiple `<style>` elements defined. You can also assign scale ranges for each `<style>` element. By using multiple stacked styles with scale ranges, you can define a single theme with different representations for different scales.

[Example 2–8](#) shows the theme styling rules with stacked styles. Each style has a scale range defined.

Example 2–8 Theme Styling Rules with Stacked Styles

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <rule>
    <features> </features>
    <label column="STATE" style="T.S02_STATE_ABBREVS"> 1 </label>
    <rendering>
      <style name="C.COUNTIES" max_scale="5.0E7" scale_mode="RATIO"/>
      <style name="C.RB13_1" min_scale="5.0E7" max_scale="1.0E7" scale_
mode="RATIO"/>
      <style name="L.DPH" min_scale="1.0E7" scale_mode="RATIO"/>
    </rendering>
  </rule>
</styling_rules>
```

2.3.1.6 Caching of Predefined Themes

By default, MapViewer automatically caches the spatial data for a predefined theme when it is fetched from the database for processing by the MapViewer rendering engine. By contrast, data for dynamic (JDBC) themes is never cached in MapViewer. If you do not want any data for a predefined theme to be cached (such as for a theme whose underlying base table is constantly being updated), you can set the caching

attribute to `NONE` in the `<styling_rules>` element for the theme. (The `<styling_rules>` element, including the `caching` attribute, is described in [Section A.7](#).)

For frequently used themes whose base data is static or read-only, specify `caching ALL` for the best performance. This causes MapViewer, when it first accesses the theme definition, to fetch all the features (including spatial data, attribute data, and styling information associated with them) and cache them in the MapViewer memory, creating an in-memory R-tree for the theme's spatial data. All subsequent requests requiring that theme occur locally instead of going to the database.

If the `caching` attribute value is `NORMAL` (the default), each time a map involving that theme is requested, MapViewer queries the database to get the spatial data and any associated attribute data. However, if any of the spatial geometry data, as referenced by `rowid` or a user-specified key column, has already been cached, the unpickling process (the conversion from the raw database geometry format to a Java geometry object) is skipped. Still, if memory is not an issue and if a frequently used theme can completely fit in the cache, you should specify `caching ALL`, to eliminate virtually all database access for that theme after the initial loading.

Because the MapViewer spatial data cache is global, all predefined themes that are accessed by MapViewer compete for a global fixed-sized memory cache. The cache resides completely in memory, and you can specify the maximum size of the cache as explained in [Section 1.6.2.6](#). When the cache limit is reached, older cached data is removed from the cache to make room for the most recently accessed data, except that data for themes specified with `caching ALL` is not removed from the cache, and MapViewer does not requery the database for these themes.

Caching is currently disabled for predefined annotation and custom geometry themes. For custom geometry themes, you can implement a caching mechanism in your provider implementation. However, for each request, a new instance of your provider is created; and if you implement a local caching mechanism, it will be lost.

2.3.1.7 Feature Labels and Internationalization

MapViewer includes support for translated theme labels. Typically with a predefined MapViewer theme, you can specify a label column that will provide all the text strings for labeling each feature of the theme. These text strings are string values stored in the database table column, in a specific language (such as English). However, you can also supply different translations of these stored string values by using a *resource bundle*. When such translated text strings are available, you can instruct MapViewer to label the features of a theme using a specific language or locale.

Note: Only predefined geometry themes support resource bundles at this time.

The steps for supplying translations and instructing MapViewer to label a theme using a specific user language are as follows:

1. Prepare the translations.

A typical MapViewer predefined geometry theme gets all the underlying data from a table. You can specify one of the (string type) columns as the labeling column for this theme. This is called the label column. When a label column needs to be translated into different languages, you extract all the values from the table, and store them in a properties file, such as `StringResources.properties`. (Note that the file name `StringResources.properties` assumes that the extracted texts are all in English. If they are not, then the properties file name needs to follow a

convention where the language code, and an optional region or country code, is a suffix in the file name. For example, `StringResources_fr.properties` will contain French translations only, while `StringResources_zh_CN.properties` is for simplified Chinese.)

A properties file is a plain text file that follows a very simple format. For example, a simple `StringResources.properties` file might contain the following:

```
# This is the English version of the strings.
California = California
Nevada = Nevada
Montana = Montana
```

The first line is a comment, and starts with the # character. Each subsequent line contains one pair of key (first string) and value (second string). The keys come directly from the label column, whereas the values are corresponding translations. Because this particular file contains the default English text strings, the key and the value (translation) are the same in each case. Note that the keys should always be in English.

From this default properties file, your translation specialists should create a set of property files, one file for each translation. Using the preceding simple example, the translated file for simplified Chinese (`StringResources_zh_CN.properties`) should look like the following, in which the value of each key has been replaced by the Chinese translation of the key, encoded as a Unicode string:

```
# This is the Chinese version of the strings.
California = \u6CA1\u6709\u8981\u5448\u73B0\u7684\u4E3B\u9898\u3002
Nevada = \u65E0\u6CD5\u52A0\u8F7D\u4E3B\u9898\u3002
Montana = \u65E0\u6CD5\u52A0\u8F7D\u6837\u5F0F\u3002
```

The default properties file, `StringResources.properties`, plus all the language specific files that share the same file name (except for the language and region suffixes) collectively form what is called a *resource bundle*. In this case the resource bundle is named `StringResources`. You can name your resource bundles with any name you like, but different bundles (containing different set of keys) should always use different base names.

For more information about Java resource bundles and properties files, see the Java language documentation.

2. Supply the translated text strings as a Java Resource Bundle, which can be based on either Java resource classes or plain properties files.

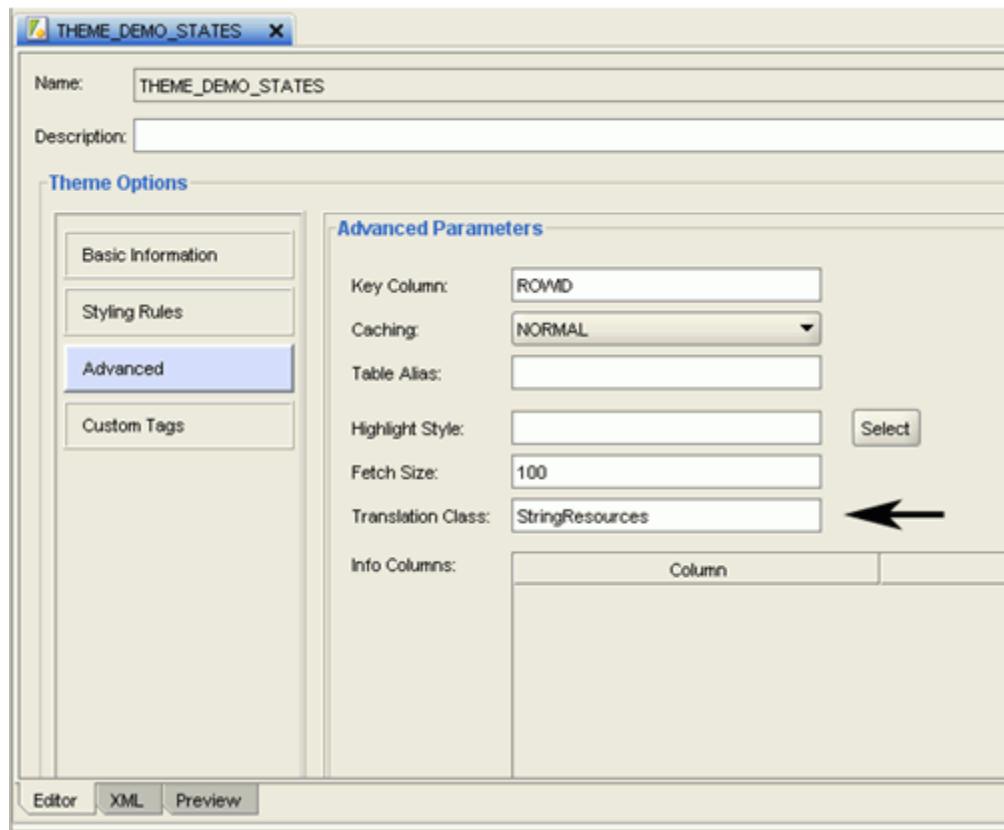
After all the label text strings have been translated, you must place all the files (the resource bundle) in the MapViewer CLASSPATH so that MapViewer can find these files at runtime. Typically, you can use the MapViewer WEB-INF/classes folder: copy all the files including the base `StringResources.properties` and language-specific files (such as `StringResources_fr.properties` and `StringResources_zh_CN.properties`) into this folder.

If you place all the files of a resource bundle into a subfolder under WEB-INF/classes, then the name of the resource bundle (as known to MapViewer) will need to be prefixed with this subfolder name. This is similar to how one places a Java class in a directory structure that follows the package names. For example, if you put all the `StringResources*.properties` files in WEB-INF/classes/i18n/, then later when you register the resource bundle with MapViewer, the actual name of your resource bundle should be `i18n.StringResources`.

3. Specify the name of the resource bundle in the theme definition by registering the resource bundle with MapViewer.

For MapViewer to find your translated classes, you must specify the complete name of your resource bundle in the theme definition. The easiest way to do this is with the Map Builder utility, specifying the resource bundle name as the Translation Class in the Advanced Parameters pane of the theme editor. [Figure 2–7](#) shows `StringResources` being specified for the Translation Class.

Figure 2–7 Specifying a Resource Bundle for a Theme



As mentioned in the preceding step, if your resource bundle files are located in a subfolder of , then the subfolder name must be the base name of your resource bundle, separated by a period, as if the resource bundle files were Java classes in a package.

4. Specify a language parameter when requesting a map or theme.

Specify the preferred language for each map request the Oracle Maps JavaScript API (described in [Section 6.2](#)) or the XML map request API (described in [Chapter 3](#)).

- In JavaScript code, specify the label language code in the call to the MVThemeBasedFOI class. The following example causes the FOI theme to display its labels in simplified Chinese:

```
themebasedfoi = new MVThemeBasedFOI('themebasedfoi1','mvdemo.theme_demo_states');
themebasedfoi.setLabelLanguageCode("zh-cn");
themebasedfoi.enableLabels(true);
```

With the `setLabelLanguageCode(lang_code)` method, you can specify a language code so that MapViewer labels the features using the text strings for the specified language, which must be a 2 letter language code (such as zh), followed optionally a hyphen (-) and a 2-letter country code (such as zh-cn). The language codes are defined by the ISO 639 standards and are listed at several websites, such as

http://www.loc.gov/standards/iso639-2/php/English_list.php. If no translated text strings for the specified language code are found, the English text strings (or whatever the default strings are for the theme) will be used for labeling.

- In an XML map request, specify the language in the `lang` attribute. The following example causes the labels to be displayed in simplified Chinese:

```
<map_request title="Oracle LBS MAP"
  basemap="demo_map"
  datasource = "mvdemo"
  width="640" height="480"
  lang="zh-CN"
  format="PNG_STREAM">

<center size="5.15">
  <geoFeature> <geometricProperty typeName="center">
    <Point> <coordinates>-122.2615, 37.5266</coordinates>
    </Point> </geometricProperty>
  </geoFeature>
</center>
</map_request>
```

Only language codes and country codes specified by the ISO 639 standards can be used as possible `lang` values. If an optional country code is used, it must be connected to the language code by a hyphen (-). Country codes and language codes are not case sensitive.

If the `lang` attribute is specified as part of the XML map request, every theme rendered to the result map it checked to see if it has an associated resource bundle. If a theme does not have an associated resource bundle, or the translated text strings for the specified language cannot be found, the default values (those stored in the table column) are used.

If the `lang` attribute is not specified as part of the XML map request, the default text string values (those stored in the table column) are always used, regardless of which locale in effect for MapViewer itself (or rather, its containing JVM).

2.3.1.8 Primary and Secondary Labels for Linear Features

MapViewer includes support for labeling a linear feature with a primary and a secondary label. For example, a street name can be labeled with its English name as the primary label and with its local (native) language as the secondary label or vice versa. When labeling a linear feature, the primary and secondary labels are labeled alternatively along the feature when applicable.

When you specify a label column for a MapViewer theme, that column will provide both the primary and secondary text strings, delimited by "|||". For example, a text string of "Heping Lu|||???" contains the primary text string of "Heping Lu" and secondary text string of "???". In practice, that label column may be a concatenation of

two existing columns, and database triggers can be employed to maintain its consistency with its two base columns.

2.3.2 JDBC Themes

A **JDBC theme** is a theme that is dynamically defined with a map request. JDBC themes are not stored permanently in the database, as is done with predefined themes.

For a JDBC theme, you must specify a valid SQL query that retrieves all the necessary spatial data (geometries or other types of data, such as image, GeoRaster, network, or topology). If attribute data is needed, such as for thematic mapping or spatial data analysis, the query must also select it. In other words, you must provide a correct and complete query for a JDBC theme. In addition to the query, you can also specify the rendering and labeling styles to be used for the theme.

For a JDBC theme based on spatial geometries, MapViewer processed the columns specified in the query according to the following rules:

- The column of type SDO_GEOMETRY is treated as the spatial data column.
- Any column whose name or alias matches that specified in the JDBC theme's `label_column` attribute is treated as the labeling column, whose values are used as text for labels.
- Any other columns are treated as attribute data columns, which may or may not be used by MapViewer. For example, if the rendering style is an advanced style, any attribute columns are processed by that style in the order in which they appear in the SELECT list in the query. Thus, if you are performing thematic mapping and using an advanced style, you must specify all attribute columns that are needed for the thematic mapping, in addition to the geometry column and optional labeling column. (A labeling column can also be an attribute column, in which case you do not need to specify that column in the SELECT list.)

[Example 2–9](#) is a map request that includes a JDBC theme.

Example 2–9 JDBC Theme in a Map Request

```
<?xml version="1.0" standalone="yes"?>
<map_request title="My MAP" datasource = "mvdemo">

    <themes>
        <theme name="jdbc_theme_1">
            <jdbc_query
                datasource="mvdemo"
                jdbc_srid="41052"
                spatial_column="geometry"
                render_style="C.RED">
                SELECT geometry from states where name='MA'
            </jdbc_query>
        </theme>
    </themes>
</map_request>
```

The full query that MapViewer executes for the JDBC theme in [Example 2–9](#) is:

```
SELECT geometry FROM states WHERE name='MA' ;
```

For this request, MapViewer generates a map that contains only the selected geometry as a result of executing this JDBC theme's query. In a more typical case, however, the map request will need to use several JDBC themes to plot additional dynamic data on

top of the base map. Furthermore, the map request may have a query window associated with it; that is, the user may want to see only a portion of the area included in the whole base map. In this case, the SQL queries in the JDBC themes will be subjected to a spatial window query, to eliminate any unwanted results.

For more information about JDBC themes, see the information about the `<jdbc_query>` element in [Section 3.1.2.9](#).

2.3.2.1 Defining a Point JDBC Theme Based on Two Columns

If a database table uses two columns (such as longitude and latitude) to represent a point coordinate, you can define a JDBC theme based on the two columns to render points. The table does not need to have a spatial geometry column, but it can have one; however, if the theme request defines the point columns and also the geometry column, MapViewer will try to render the points using the two columns, not the geometry column.

[Example 2–10](#) is a JDBC theme that renders points from two columns, named LONG_LOC and LAT_LOC, of a table named POI. The `x_column` and `y_column` attributes specify the columns containing the point coordinate values. In this example, the points are rendered using the C.RED style, and the table values from the NAME column are rendered using the T.POI_NAME style.

Example 2–10 JDBC Theme Based on Columns

```
<map_request>
  ...
  <center>
    ...
  </center>
  <themes>
    <theme name="theme1" >
      <jdbc_query
        datasource="mvdemo"
        jdbc_srid="8265"
        x_column="long_loc"
        y_column="lat_loc"
        render_style="C.RED"
        label_column="name"
        label_style="T.POI_NAME"
        >SELECT long_loc, lat_loc, name FROM poi
      </jdbc_query>
    </theme>
  </themes>
</map_request>
```

If the request specifies a valid query window (that is, not the full extent), a WHERE expression based on the size of the request window is automatically added to the query.

If the table has a geometry column, you can specify SQL code to use the geometry column as a filter. [Example 2–11](#) is similar to [Example 2–10](#), but it adds the use of the SDO_FILTER operator to specify a query window based on the geometry in the column named GEOMETRY. In [Example 2–11](#), the question mark (?) characters indicate that the lower-left and upper-right coordinates of the query window rectangle are taken from values supplied at runtime (not shown in this example).

Example 2–11 JDBC Theme Based on Columns, with Query Window

```
<map_request>
```

```

. . .
<center>
. . .
</center>
<themes>
    <theme name="theme1" >
        <jdbc_query
            datasource="mvdemo"
            jdbc_srid="8265"
            x_column="long_loc"
            y_column="lat_loc"
            render_style="C.RED"
            label_column="name"
            label_style="T.POI_NAME"
            >SELECT long_loc, lat_loc FROM poi WHERE
                SDO_FILTER(geometry, MDSYS.SDO_GEOMETRY(2003, 8265, NULL,
                MDSYS.SDO_ELEM_INFO_ARRAY(1, 1003, 3),
                MDSYS.SDO_ORDINATE_ARRAY(?, ?, ?, ?)),
                'querytype=WINDOW') = 'TRUE'
        </jdbc_query>
    </theme>
</themes>
</map_request>

```

2.3.2.2 Storing Complex JDBC Themes in the Database

Sometimes the SQL query for a JDBC theme is so complex that you may want to save the query. In such cases, you can define a predefined theme (whose definition is stored in the database's `USER_SDO_THEMES` view), and then include the full SQL query as the content of the `<features>` element in the styling rules for that theme.

The feature style specified in the `<features>` element is then used to render the geometries retrieved using the full query. The base table as defined for such a theme is ignored because the full SQL query already includes a `FROM` clause. The geometry column defined in the `USER_SDO_THEMES` view is still needed, and it must be the same as the geometry column selected in the user-supplied SQL query. If you have a `<label>` element for a styling rule, the label style specified is used to label the geometries, as long as the query selects a column that contains label text.

[Example 2-12](#) is a sample `<styling_rules>` element of a predefined theme with a complex SQL query.

Example 2-12 Complex Query in a Predefined Theme

```

<?xml version="1.0" standalone="yes"?>
<styling_rules>
    <rule>
        <features style="L.POOR_ROADS" asis="true">
            select sdo_lrs.clip_geom_segment(geometry,start_measure,end_measure)
                  geometry
            from (select /*+ no_merge use_hash(a b) */
                  a.street_id, name, start_measure, end_measure, geometry
                  from (select /*+ no_merge */ a.street_id, name, geometry
                        from philly_roads a
                        where sdo_filter(geometry,sdo_geometry(2002,41124,null,
                        sdo_elem_info_array(1,2,1),
                        sdo_ordinate_array(?, ?, ?, ?)),
                        'querytype>window')='TRUE') a,
            philly_road_conditions b
            where condition='POOR' and a.street_id = b.street_id)
        </features>
    </rule>
</styling_rules>

```

```
</features>
</rule>
</styling_rules>
```

Even though [Example 2-12](#) is defined as a predefined theme, MapViewer still treats it as a JDBC theme at runtime when a user requests a map that includes this theme. As with a normal JDBC theme, MapViewer by default imposes a window filtering process (if a query window was included in the map request) on top of the SQL query. To override this default behavior and have the supplied query string executed without any modification, specify `asis="true"` in the `<features>` element, as shown in [Example 2-12](#). (For information about the `asis` attribute, see [Section 3.1.2.9](#).)

2.3.3 Image Themes

An **image theme** is a special kind of MapViewer theme useful for visualizing geographically referenced imagery (raster) data, such as from remote sensing and aerial photography.

You can define an image theme dynamically or permanently (as a predefined theme) in the database. You can use image themes with vector (nonimage) themes in a map. [Figure 2-8](#) shows a map in which an image theme (showing an aerial photograph of part of the city of Boston) is overlaid with themes showing several kinds of roadways in the city.

Figure 2-8 Image Theme and Other Themes Showing Boston Roadways



Before you can define an image theme, you must follow these rules in organizing your image data:

- Store image data in its original format (such as JPEG) in a BLOB column in a database table, or as an Oracle Multimedia object (ORDSYS.ORDImage) that

points to the original image file. For information about creating an ORDSYS.ORDImage object, see *Oracle Multimedia User's Guide*.

- Add a geometry (SDO_GEOOMETRY) column to the same table, and store the minimum bounding rectangle (MBR) for each image in that column.

Each geometry in the MBR column contains the geographic bounds for an image, not its size in the pixel space. For example, if an orthophoto image is 2000 by 2000 pixels in size, but covers a ground rectangle starting at the corner of (936000, 248000) and having a width and height of 8000 meters, the MBR for the geometry column should be populated with (936000, 248000, 944000, 256000).

- Insert an entry for the geometry column in the USER_SDO_GEOM_METADATA view.
- Create a spatial index on the geometry column.

To predefine an image theme, follow the guidelines in [Section 2.3.3.1](#). To define a dynamic image theme in a map request, follow the guidelines for defining a JDBC theme, as explained in [Section 2.3.2](#) and [Section 3.1.2.9](#), but note the following additional considerations with dynamic image themes:

- You must provide the original image resolution information when defining an image theme.
- MapViewer by default automatically scales the image data when generating a map with an image theme, so that it fits the current query window. To disable this automatic scaling, specify `imagescaling="false"` in the map request.

For any image theme definition, MapViewer supports only GIF, JPEG, PNG, and TIFF image formats. To enable MapViewer to visualize data in any other image format, you must implement a custom image renderer using the `oracle.sdovis.CustomImageRenderer` interface in Java, and then register your implementation class in the `mapViewerConfig.xml` file (to tell MapViewer which custom image renderer to use for image data in a specific format). For detailed information about implementing and registering a custom image renderer, see [Appendix C](#).

For an example of a map request specifying an image theme, including an explanation of how MapViewer processes the request, see [Example 3–6](#) in [Section 3.1.1.6](#).

2.3.3.1 Creating Predefined Image Themes

To create a predefined image theme, you must store the definition of the image theme in the database by inserting a row into the `USER_SDO_THEMES` view (described in [Section 2.9.2](#)). [Example 2–13](#) stores the definition of an image theme.

Example 2–13 Creating a Predefined Image Theme

```
INSERT INTO user_sdo_themes  VALUES (
    'IMAGE_LEVEL_2',
    'Orthophotos at pyramid level 2',
    'IMAGES',
    'IMAGE_MBR',
    '<?xml version="1.0" standalone="yes"?>
     <styling_rules theme_type="image" image_column="image"
                    image_format="JPEG" image_resolution="2"
                    image_unit="M">
      <rule >
        <features style="C.RED"> plevel=2 </features>
      </rule>
    </styling_rules>' );
```

[Example 2–13](#) creates an image theme named `IMAGE_LEVEL_2`. The base table (where all image data and associated MBRs are stored) is named `IMAGES`, and the minimum bounding rectangles (MBRs) for the images are stored in the column named `IMAGE_MBR`. In the `STYLING_RULES` column of the `USER_SDO_THEMES` view, an XML document with one `<styling_rules>` element is inserted.

The `<styling_rules>` element for an image theme has the following attributes:

- `theme_type` must be `image` in order for this theme to be recognized as an image theme.
- `image_column` specifies the column in the base table or view that stores the actual image data.
- `image_format` is a string identifying the format of the image data. If you specify `GIF` or `JPEG`, MapViewer can always render the image data. If you specify any other value, such as `ECW`, you must have implemented a custom image renderer and registered it to MapViewer in order for the image to be rendered properly. For information about implementing a custom image renderer, see [Appendix C](#).
- `image_resolution` is an optional attribute that identifies the original image resolution (number of `image_unit` units for each pixel).
- `image_unit` is an optional attribute, except it is required if you specify the `image_resolution` attribute. The `image_unit` attribute specifies the unit of the resolution, such as `M` for meter. The value for this attribute must be one of the values in the `SDO_UNIT` column of the `MDSYS.SDO_DIST_UNITS` table. In [Example 2–13](#), the image resolution is 2 meters per pixel.

The DTD for the `<styling_rules>` element is presented in [Section A.7](#).

2.3.4 GeoRaster Themes

A **GeoRaster theme** is a special kind of MapViewer theme useful for visualizing GeoRaster objects. GeoRaster is a feature of Oracle Spatial and Graph that lets you store, index, query, analyze, and deliver raster image and gridded data and its associated metadata. GeoRaster objects are defined using the `SDO_GEORaster` data type. For detailed information about GeoRaster, see *Oracle Spatial and Graph GeoRaster Developer's Guide*.

Before you can use MapViewer with GeoRaster themes, you must ensure that the Java Advanced Imaging (JAI) library files (`jai_core.jar` and `jai_codec.jar`) are in the MapViewer library path, as explained in [Section 1.4](#). You must also perform the following actions with the GeoRaster data:

1. Georeference the GeoRaster data to establish the relationship between cell coordinates of the GeoRaster data and real-world ground coordinates (or some other local coordinates).
If you are using Oracle Database Release 10.1, you must also set the spatial resolution values.
2. Generate or define the spatial extent (footprint) associated with the raster data.
3. Optionally, generate pyramid levels that represent the raster image or data at different sizes and degrees of resolution.
4. Insert a row into the `USER_SDO_GEOM_METADATA` view that specifies the name of the GeoRaster table and the `SPATIALEXENT` attribute of the GeoRaster column (that is, the column of type `SDO_GEORaster`). The following example

inserts a row for a table named GEOR_TABLE with a GeoRaster column named GEOR_COLUMN:

```
INSERT INTO USER_SDO_GEOM_METADATA VALUES
( 'geor_table',
  'geor_column.spatialextent',
  SDO_DIM_ARRAY(
    SDO_DIM_ELEMENT('X', 496602.844, 695562.844, 0.000005),
    SDO_DIM_ELEMENT('Y', 8788409.499, 8973749.499, 0.000005)
  ),
  82279 -- SRID
);
```

5. Create a spatial index on the spatial extent of the GeoRaster table. The following example creates a spatial index named GEOR_IDX on the spatial extent of the table named GEOR_TABLE:

```
CREATE INDEX geor_idx ON geor_table(geor_column.spatialextent)
INDEXTYPE IS MDSYS.SPATIAL_INDEX;
```

[Example 2–17 in Section 2.3.4.1](#) prepares GeoRaster data for use and stores a GeoRaster theme in the database.

MapViewer supports two types of map requests with objects from a GeoRaster table:

- A request containing a SQL statement to select one or more GeoRaster objects
- A request specifying a single GeoRaster object by the combination of its raster data table name and its rasterID attribute value in the SDO_GEOASTER object. (The rasterID attribute value in the SDO_GEOASTER object is distinct from and unrelated to any primary key or ID column in the GeoRaster table.)

The following elements and attributes apply to the definition of a GeoRaster theme:

- <jdbc_georaster_query> element: Specifies that this is a dynamically defined GeoRaster theme. For a theme that uses a SQL statement to select one or more GeoRaster objects, this element contains the SQL query statement (without a terminating semicolon). The complete DTD for this element is included in the map request DTD in [Section 3.1.2](#).
- georaster_table attribute: Specifies the name of the GeoRaster table.
- georaster_column attribute: Specifies the name of the column of type SDO_GEOASTER in the GeoRaster table.
- polygon_mask attribute (optional): Specifies a set of two-dimensional coordinates representing a polygon, to be used as a mask to make transparent the part of the GeoRaster image that is outside the polygon mask. The coordinates are defined as x1,y1,x2,y2,.... The mask coordinates must be in the data coordinate space.
- raster_bands attribute (optional): Specifies the band composition to be assigned to the red, green, and blue channels. If you specify only one value, the resulting image uses one band (gray levels for monochromatic images). If you specify two values, they are used for the red and green channels, and the default blue band stored in the GeoRaster metadata is used for the blue channel. If you do not specify this attribute, MapViewer uses the default values stored in the GeoRaster metadata.
- raster_pyramid attribute (optional): Specifies the pyramid level (level of resolution). If you do not specify this attribute, MapViewer calculates the best pyramid level for the current window query and device area.

- `raster_id` attribute (only if the definition does not include a SQL statement): Specifies the `rasterID` attribute value in the `SDO_GEOASTER` object definition of the single `GeoRaster` object for the map request.
- `raster_table` attribute (optional, and only if the definition does not include a SQL statement): Specifies the raster data table associated with the single `GeoRaster` object for the map request.
- `transparent_nodata` attribute (optional): Specifies if any `GeoRaster` NODATA value is to be rendered as transparent. The default value is "false".

[Example 2–14](#) defines a `GeoRaster` theme that contains a SQL statement that selects a single `GeoRaster` object. The theme assigns band 1 to the red channel, band 2 to the green channel, and band 3 to the blue channel. Because the `raster_pyramid` attribute is not specified, MapViewer calculates the best pyramid level by using the spatial resolution values set during or after the georeferencing process. (In [Example 2–14](#), `georid=1` in the WHERE clause refers to a column named `GEORID` in the `GeoRaster` table named `PCI_IMAGE`.)

Example 2–14 GeoRaster Theme Containing a SQL Statement

```
<theme name="georaster_theme">
  <jdbc_georaster_query>
    georaster_table="pci_image"
    georaster_column="georaster"
    raster_bands="1,2,3"
    jdbc_srid="82301"
    datasource="mvdemo"
    asis="false"> SELECT georaster FROM pci_image WHERE georid =1
  </jdbc_georaster_query>
</theme>
```

[Example 2–15](#) defines a `GeoRaster` theme that specifies the single `GeoRaster` object whose `rasterID` attribute value in the `SDO_GEOASTER` object is 1 (`raster_id="1"`) and associated with the raster data table named `RDT_PCI`. The theme specifies 2 as the pyramid level.

Example 2–15 GeoRaster Theme Specifying a Raster ID and Raster Data Table

```
<theme name="georaster_theme">
  <jdbc_georaster_query>
    georaster_table="pci_image"
    georaster_column="georaster"
    raster_id="1"
    raster_table="rdt_pci"
    raster_pyramid="2"
    raster_bands="1,2,3"
    jdbc_srid="82301"
    datasource="mvdemo"
    asis="false">
  </jdbc_georaster_query>
</theme>
```

Subtopics:

- [Creating Predefined GeoRaster Themes](#)
- [Using Bitmap Masks with GeoRaster Themes](#)
- [Reprojection of GeoRaster Themes](#)
- [Virtual Mosaic Themes](#)

2.3.4.1 Creating Predefined GeoRaster Themes

To create a predefined GeoRaster theme, you must store the definition of the GeoRaster theme in the database by inserting a row into the USER_SDO_THEMES view (described in [Section 2.9.2](#)). [Example 2–16](#) stores the definition of a GeoRaster theme.

Example 2–16 Creating a Predefined GeoRaster Theme

```
INSERT INTO user_sdo_themes VALUES (
    'GEOR_BANDS_012',
    'Band 0 for red, 1 for green, 2 for blue',
    'GEOR_TABLE',
    'GEOR_COLUMN',
    '<?xml version="1.0" standalone="yes"?>
    <styling_rules theme_type="georaster" raster_table="RDT_PCI"
        raster_id="1" raster_bands="0,1,2">
    </styling_rules>' );
```

[Example 2–16](#) creates a GeoRaster theme named GEOR_BANDS_012, in which band 0 is assigned to the red channel, band 1 to the green channel, and band 2 to the blue channel. The GeoRaster table name (GEOR_TABLE in this example) is inserted in the BASE_TABLE column of the USER_SDO_THEMES view, the GeoRaster column name (GEOR_COLUMN in this example) is inserted in the GEOMETRY_COLUMN column, and an XML document with one <styling_rules> element is inserted in the STYLING_RULES column.

In the <styling_rules> element for a GeoRaster theme, theme_type must be georaster in order for this theme to be recognized as a GeoRaster theme.

The <styling_rules> element for a GeoRaster theme can contain the attributes described in [Section 2.3.4](#), including raster_bands, raster_pyramid, raster_id, and raster_table, as shown in [Example 2–16](#). Alternatively, the <styling_rules> element for a GeoRaster theme can be a rule definition. For example, to create a GeoRaster theme that selects a GeoRaster object from the GeoRaster table satisfying the WHERE clause condition georid=1, replace the <styling_rules> element in [Example 2–16](#) with the following:

```
<styling_rules theme_type="georaster">
    <rule>
        <features> georid=1
        </features>
    </rule>
</styling_rules>
```

The <styling_rules> element for a GeoRaster theme can also specify one or more bitmap masks, as explained in [Section 2.3.4.2](#).

The DTD for the <styling_rules> element is presented in [Section A.7](#).

[Example 2–17](#) prepares GeoRaster data for use with a GeoRaster theme that is stored in the database. Comments in the code example briefly describe the main steps. For detailed information about requirements and steps for using GeoRaster data, see *Oracle Spatial and Graph GeoRaster Developer's Guide*.

Example 2–17 Preparing GeoRaster Data for Use with a GeoRaster Theme

```
connect scott
Enter password: password

SET ECHO ON
```

```
SET FEEDBACK 1
SET NUMWIDTH 10
SET LINESIZE 100
SET PAGESIZE 10000
SET SERVEROUTPUT ON SIZE 5000
SET LONG 20000
SET TIMING ON
call dbms_java.set_output(5000);

-----
-- Create a GeoRaster table (a table that has a
-- column of SDO_GEOASTER object type).
-----

create table georaster_table
  (georid      number primary key,
   type        varchar2(32),
   georaster   sdo_georaster);

-----
-- Create the GeoRaster DML trigger on the GeoRaster table, if
-- the Oracle Database release is before 11.1. (In Release 11.1 and later
-- this trigger is created automatically, so you do not need to create
-- it manually.)
-----

call sdo_geor_utl.createDMLTrigger('georaster_table', 'georaster');

-----
-- Create a raster data table (RDT).
--
-- It is used to store cell data of GeoRaster objects.
-- This step is not a requirement. If the RDT table does not
-- exist, the GeoRaster procedures or functions will generate it
-- automatically whenever needed.
-- However, for huge GeoRaster objects, some tuning and setup on those
-- tables can improve the scalability and performance significantly.
-- In those cases, it is better for users to create the RDTs.
-- The primary key must be added to the RDT if you create it.
-----

create table rdt_geor of sdo_raster
  (primary key (rasterId, pyramidLevel, bandBlockNumber,
                 rowBlockNumber, columnBlockNumber))
lob(rasterblock) store as (nocache nologging);

commit;

-----
-- Import the image.
-----

connect system;
Enter password: password

call dbms_java.grant_permission('MDSYS','SYS:java.io.FilePermission',
                                'lbs/demo/images/17_ms.tif', 'read' );

call dbms_java.grant_permission('SCOTT','SYS:java.io.FilePermission',
                                'lbs/demo/images/17_ms.tif', 'read' );
```

```
connect scott;
Enter password: password

declare
  geor SDO_GEORASTER;
begin
  delete from georaster_table where georid = 1;
  insert into georaster_table
    values( 1, 'TIFF', sdo_geor.init('rdt_geor', 1) );
  select georaster into geor
    from georaster_table where georid = 1 for update;
  sdo_geor.importFrom(geor, '', 'TIFF', 'file',
    'lbs/demo/images/17_ms.tif');
  update georaster_table set georaster = geor where georid = 1;
  commit;
end;
/

connect system;
Enter password: password

call dbms_java.revoke_permission('MDSYS','SYS:java.io.FilePermission',
  'lbs/demo/images/17_ms.tif', 'read' );

call dbms_java.revoke_permission('SCOTT','SYS:java.io.FilePermission',
  'lbs/demo/images/17_ms.tif', 'read' );

connect scott;
Enter password: password

-----
-- Change the GeoRaster format, if needed.
-- To do this, you can call SDO_GEO.changeFormatCopy.
-- The following operations for pyramiding, spatial resolution setup, and
-- spatial extent generation can also be combined into one PLSQL block.
-----

declare
  gr1 sdo_georaster;
begin
  --
  -- Using changeFormat with a GeoRaster object:
  --

  -- 1. Select the source GeoRaster object.
  select georaster into gr1
    from georaster_table where georid = 1;

  -- 2. Make changes. (Interleaving is application-dependent. For TIFF images,
  --     the default interleaving is BSQ.)
  sdo_geor.changeFormat(gr1, 'blocksize=(512,512,3) interleaving=BIP');

  -- 3. Update the GeoRaster object in the GeoRaster table.
  update georaster_table set georaster = gr1 where georid = 1;

  commit;
end;
/
```

```

-----
-- Generate pyramid levels (strongly recommended, but optional).
-----

declare
  gr sdo_georaster;
begin

  -- 1. Select the source GeoRaster object.
  select georaster into gr
    from georaster_table where georid = 1 for update;

  -- 2. Generate pyramids.
  sdo_geor.generatePyramid(gr, 'resampling=NN');

  -- 3. Update the original GeoRaster object.
  update georaster_table set georaster = gr where georid = 1;

  commit;
end;
/

-----
-- Georeference the GeoRaster object.
-----

DECLARE
  gr sdo_georaster;
BEGIN
  SELECT georaster INTO gr FROM georaster_table WHERE georid = 1 FOR UPDATE;
  sdo_geor.georeference(gr, 82216, 1,
                        sdo_number_array(30, 0, 410000.000000),
                        sdo_number_array(0, -30, 3759000.000000));
  UPDATE georaster_table SET georaster = gr WHERE georid = 1;
  COMMIT;
END;
/

-----
-- Set the spatial resolutions (required for 10gR1 only)
-----

-- If you are using Oracle Database Release 10.1, set spatial resolutions. (Not
-- required if you are using Release 10.2.) The spatial resolution values of
-- (30, 30) are from the ESRI world file or from the georeferencing information;
-- however, you may have to compute these values if they are not part of
-- the original georeferencing metadata.
DECLARE
  gr sdo_georaster;
BEGIN
  SELECT georaster INTO gr FROM georaster_table WHERE georid = 1 FOR UPDATE;
  sdo_geor.setSpatialResolutions(gr, sdo_number_array(30, 30));
  UPDATE georaster_table SET georaster = gr WHERE georid = 1;
  COMMIT;
END;
/

-----
-- Update the spatial extent.
-----

```

```

DECLARE
    sptext sdo_geometry;
BEGIN
    SELECT sdo_geor.generateSpatialExtent(a.georaster) INTO sptext
        FROM georaster_table a WHERE a.georid=1 FOR UPDATE;
    UPDATE georaster_table a SET a.georaster.spatialextent = sptext WHERE
a.georid=1;
    COMMIT;
END;
/
commit;

-----
-- Create metadata information for the GeoRaster spatial extent column.
-----

INSERT INTO USER_SDO_GOM_METADATA
VALUES (
    'GEORASTER_TABLE',
    'georaster.spatialextent',
    SDO_DIM_ARRAY(
        SDO_DIM_ELEMENT('X', 410000.0, 470000.0, 0.000005),
        SDO_DIM_ELEMENT('Y', 3699000.0, 3759000., 0.000005)
    ),
    82216 -- SRID
);

-----
-- Create a spatial index on the spatial extent.
-----

CREATE INDEX georaster_idx ON georaster_table(georaster.spatialextent)
INDEXTYPE IS MDSYS.SPATIAL_INDEX;

-----
-- Create a predefined GeoRaster theme for MapViewer.
-----

INSERT INTO user_sdo_themes VALUES (
    'GEORASTER_TABLE',
    'GeoTiff image',
    'GEORASTER_TABLE',
    'GEORASTER',
    '<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="georaster" raster_table="RDT_GEOR"
    raster_id="1" raster_bands="0,1,2">
</styling_rules>');
commit;

```

2.3.4.2 Using Bitmap Masks with GeoRaster Themes

In Oracle Spatial and Graph GeoRaster, bitmap masks can be assigned to GeoRaster layers stored in the database. A **bitmap mask** is a special one-bit deep rectangular raster grid with each pixel having either the value of 0 or 1. It is used to define an irregularly shaped region inside another image. The 1-bits define the interior of the region, and the 0-bits define the exterior of the region. For more information about bitmap masks, see *Oracle Spatial and Graph GeoRaster Developer's Guide*.

To specify a bitmap mask with a GeoRaster theme, use the `<bitmap_masks>` element in the `<styling_rules>` element for the predefined theme, as shown in [Example 2-18](#).

Example 2-18 Bitmap Mask in Predefined GeoRaster Theme

```
<styling_rules theme_type="georaster" raster_id="1"
    raster_table="RDT_MASS_COLOR_MOSAIC">
    <bitmap_masks>
        <mask layers="1,2" zeromapping="0" onemapping="255"/>
    </bitmap_masks>
</styling_rules>
```

The `<bitmap_masks>` element contains one or more `<mask>` elements, each with a mask definition for a specific GeoRaster object. In [Example 2-18](#), a mask is defined for layers 1 and 2 of the GeoRaster object with the raster ID of 1 in the RDT_MASS_COLOR_MOSAIC table. The `<mask>` element has the following attributes:

- `raster_id` specifies the raster ID value of the GeoRaster object.
- `raster_table` specifies the raster data table (RDT).
- `layers` specifies the layer numbers in the GeoRaster object to be used for the mask.
- `zeromapping` specifies the transparency value to be applied during rendering on bitmap pixels with a value of 0 (zero). The attribute value can be from 0 (completely transparent) to 255 (completely opaque).
- `onemapping` specifies the transparency value to be applied during rendering on bitmap pixels with a value of 1. The attribute value can be from 0 (completely transparent) to 255 (completely opaque).

2.3.4.3 Reprojection of GeoRaster Themes

Effective with Oracle Spatial and Graph GeoRaster for Release 11.2.0.1, GeoRaster objects can be reprojected into a different SRID. It is recommended that you apply Oracle Database patch 10259201, to avoid black boundaries for adjacent reprojected GeoRaster objects when the objects are rendered in MapViewer. For more information, see My Oracle Support document ID 1272931.1, *Black Lines After Reprojection Of Georaster Data Via Wms In Oracle Mapviewer*.

In MapViewer, a GeoRaster theme will be reprojected if its SRID is different from the map request SRID. The reprojection is just for rendering, with no changes made to the original GeoRaster object. For older databases without reprojection support, the GeoRaster object will not be reprojected.

The reprojection modes available are BILINEAR (used as default), NN, CUBIC, AVERAGE4, AVERAGE16. For more information about reprojection, see *Oracle Spatial and Graph GeoRaster Developer's Guide*.

To specify a reprojection mode with a GeoRaster theme, use the `reproj_mode` keyword in the `<styling_rules>` element for the predefined theme, as shown in [Example 2-19](#).

Example 2-19 Reprojection Mode in Predefined GeoRaster Theme

```
<styling_rules theme_type="georaster" reproj_mode="CUBIC">
</styling_rules>
```

2.3.4.4 Virtual Mosaic Themes

In Oracle Spatial and Graph GeoRaster, a virtual mosaic is defined as any large collection of georeferenced GeoRaster objects, rectified or unrectified, from one or more GeoRaster tables or views that is treated as if it is a single GeoRaster object.

The virtual mosaic can be defined in different ways, like using a single or multiple GeoRaster tables (or views with a GeoRaster column), and using a full SQL query statement that results in a collection of GeoRaster objects.

MapViewer supports the creation of the following types of predefined GeoRaster virtual mosaic themes:

- A theme based on table with a GeoRaster column and possibly containing a query condition. A list of tables with GeoRaster column can also be defined. The following XML definition defines a virtual mosaic theme based table LANDSAT5_IMAGES and GeoRaster column IMAGE:

```
<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="georaster" virtual_mosaic="true">
    <virtual_mosaic srid="32617" nodata_cell="true">
        <tables>
            <table name="LANDSAT5_IMAGES" georaster_column="IMAGE" />
        </tables>
    </virtual_mosaic>
</styling_rules>
```

- A theme based on a full SQL query. The following XML definition specifies a virtual mosaic theme based on a SQL query:

```
<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="georaster" virtual_mosaic="true">
    <virtual_mosaic srid="32617" nodata_cell="true">
        <sql>select image from landsat5_images</sql>
    </virtual_mosaic>
</styling_rules>
```

The following parameters can be defined for a virtual mosaic theme.

srid: The spatial reference system (coordinate system) value.

nodata_cell: Specifies whether or not to consider NODATA (NODATA value or NODATA bitmap mask) when handling the overlap area. TRUE causes any cell with NODATA values to be considered as a NODATA cell, and the cell value is not involved in the overlap area calculation; FALSE causes any cell with NODATA values to be considered as normal cell, and the cell value is involved in the overlap area calculation.

The default value is FALSE. If the value is TRUE and the resampling method is BILINEAR, BIQUADRATIC, CUBIC, AVERAGE4, or AVERAGE16, whenever a cell value involved in the resampling calculation is a NODATA value, the result of the resampling is also a NODATA value. The resulting NODATA value is the minimum NODATA value associated with the current raster layer, if multiple NODATA values or value ranges exist.

common_point_rule: The method for getting the cell value at the overlapping area. Can have one of the following values:

- OLDEST: The value from the GeoRaster object that has the oldest EndDataTime in the metadata is used.
- END: The value from the last encountered GeoRaster object is used.
- LATEST: The value from the GeoRaster object that has the most recent EndDataTime in the metadata is used.
- OLDEST: The value from the GeoRaster object that has the oldest EndDataTime in the metadata is used.

- CTC: The value from the GeoRaster object that is closest to the center of the output window is used.
 - HIGH: The maximum cell value of all the overlapping GeoRaster objects is used.
 - LOW: The minimum cell value of all the overlapping GeoRaster objects is used
 - AVERAGE: The average of all cell values from the overlapping GeoRaster objects is used.
 - HISHRES: The value from the GeoRaster object that has the highest spatial resolution is used.
- `resampling_mode`: Specifies the resampling method (if resampling is involved or rectification is needed) to be used during the mosaic operation. Can have one of the following values: NN, BILINEAR, BIQUADRATIC, CUBIC, AVERAGE4, or AVERAGE16.
- `resampling_tolerance`: Specifies the tolerance for not doing resampling when the source GeoRaster objects are not perfectly aligned. The value should be between 0 and 0.5, where the unit is pixel or cell (for example, 0.5 meaning one-half pixel or cell). If not specified, 0.5 is used, which means no resampling will occur.
- `color_balance`: Specifies the method for color balancing. Can have one of the following values: NONE, LINEARSTRETCHING, NORMALIZATION.
- `min_stretch_value`: Ignored if `color_balance` is not LINEARSTRETCHING; otherwise, specifies the lowest value in the range of the linear stretching method. Defaults to 0.
- `max_stretch_value`: Ignored if `color_balance` is not LINEARSTRETCHING; otherwise, specifies the highest value in the range of the linear stretching method. Defaults to 255.
- `mean`: Ignored if `color_balance` is not NORMALIZATION; otherwise, specifies the reference mean for the normalization method.
- `standard_deviation`: Ignored if `color_balance` is not NORMALIZATION; otherwise, specifies the reference standard deviation for the normalization method.

2.3.5 Network Themes

A **network theme** is a special kind of MapViewer theme useful for visualizing networks defined using the Oracle Spatial and Graph network data model. A network consists of a set of nodes and links. A network can be directed or undirected, although links and paths typically have direction. A network can be organized into different levels of abstraction, called a network hierarchy. MapViewer assumes that network spatial tables in a network use the same coordinate system, and that these tables are indexed and registered as described in *Oracle Spatial and Graph Topology Data Model and Network Data Model Graph Developer's Guide*.

Network node, link, and path tables store geometries of type SDO_GEOMETRY. You can create JDBC themes that use these geometries. In addition, you can define dynamic themes that consider aspects of the network, such as the direction of links for a directed network.

The following elements and attributes apply to the definition of a network theme:

- `<jdbc_network_query>` element: Specifies that this is a dynamically defined network theme. The complete DTD for this element is included in the map request DTD in [Section 3.1.2](#).
- `network_name` attribute: Specifies the name of the network.

- `network_level` attribute (optional): Specifies the network hierarchy level to which this theme applies. (For a nonhierarchical network, specify 1, which is the default value.)
- `link_style` attribute (optional): Specifies the style name to be used for links.
- `direction_style` attribute (optional): Specifies the style name to be used for a link direction marker (for example, a directional arrow image).
- `bidirection_style` attribute (optional): Specifies the style name to be used for a bidirected link.
- `direction_position` attribute (optional): Specifies the position of the direction marker relative to the link start, as a number between 0 and 1. For example, 0.85 indicates 85 percent of the way between the link start and end points.
- `direction_markersize` attribute (optional): Specifies the size (number of pixels) of the direction marker.
- `direction_multimarker` attribute (optional): Specifies if the direction marker should be repeated over the link: `true` repeats the marker at a specified start position and each subsequent interval of that distance; `false` (the default) does not repeat the marker.
- `link_labelstyle` attribute (optional): Specifies the style name to be used for link labels in the column specified in the `link_labelcolumn` attribute.
- `link_labelcolumn` attribute (optional): Specifies the name of the column containing link labels to be rendered using the style specified in the `link_labelstyle` attribute.
- `node_style` attribute (optional): Specifies the style name to be used for nodes.
- `node_markersize` attribute (optional): Specifies the size (number of pixels) of the node marker.
- `node_labelstyle` attribute (optional): Specifies the style name to be used for node labels in the column specified in the `node_labelcolumn` attribute.
- `node_labelcolumn` attribute (optional): Specifies the name of the column containing node labels to be rendered using the style specified in the `node_labelstyle` attribute.
- `path_ids` attribute (optional): Specifies one or more path ID values of stored paths to be rendered. For more than one path, use commas to delimit the path ID values. For example, `path_ids="1,3,4"` specifies that the paths with path ID values 1, 3, and 4 are to be rendered.
- `path_styles` attribute (optional): Specifies one or more style names associated with the paths specified in the `path_ids` attribute. For example, `path_styles="C.RED,C.GREEN,C.BLUE"` specifies styles to be used to render the first, second, and third paths (respectively) specified in the `path_ids` attribute.
- `path_labelstyle` attribute (optional): Specifies the style name to be used for path labels in the column specified in the `path_labelcolumn` attribute.
- `path_labelcolumn` attribute (optional): Specifies the name of the column containing path labels to be rendered using the style specified in the `path_labelstyle` attribute.

Additional network theme attributes related to network analysis are described in [Section 2.3.5.2](#).

A network theme can combine attributes for links, nodes, and paths, or any combination. In such cases, MapViewer first renders the links, then the paths, and then the nodes.

[Example 2–20](#) defines a network theme that specifies attributes for the display of links and nodes in the network named NYC_NET.

Example 2–20 Network Theme

```
<theme name="net_theme" user_clickable="false">
  <jdbc_network_query
    network_name="NYC_NET"
    network_level="1"
    jdbc_srid="8307"
    datasource="mvdemo"
    link_style="C.RED"
    direction_style="M.IMAGE105_BW"
    direction_position="0.85"
    direction_markersize="8"
    node_style="M.STAR"
    node_markersize="5"
    asis="false">
  </jdbc_network_query>
</theme>
```

2.3.5.1 Creating Predefined Network Themes

To create a predefined network theme, you must store the definition of the network theme in the database by inserting a row into the USER_SDO_THEMES view (described in [Section 2.9.2](#)). [Example 2–21](#) stores the definition of a network theme.

Example 2–21 Creating a Predefined Network Theme

```
INSERT INTO user_sdo_themes VALUES (
  'NYC_NET_1',
  'New York City network',
  'NYC_NET_LINK_TABLE',
  'GEOMETRY',
  '<?xml version="1.0" standalone="yes"?>
<styling_rules
  theme_type="network"
  network_name="NYC_NET"
  network_level="1">
<rule>
  <features>
    <link
      style="C.RED"
      direction_style="M.IMAGE105_BW"
      direction_position="0.85"
      direction_markersize="8">
    </link>
    <path
      ids="1,3"
      styles="C.BLUE,C.GREEN">
    </path>
    <node
      style="M.CIRCLE"
      markersize="5">
    </node>
  </features>
  <label>
```

```

        <link column="LINK_ID" style="T.STREET NAME"> 1 </link>
    </label>
</rule>
</styling_rules>' );

```

[Example 2-21](#) creates a network theme named NYC_NET_1 for level 1 of the network named NYC_NET. The network table name (NYC_NET_LINK_TABLE in this example) is inserted in the BASE_TABLE column of the USER_SDO_THEMES view, the link geometry column name (GEOMETRY in this example) is inserted in the GEOMETRY_COLUMN column, and an XML document with one `<styling_rules>` element is inserted in the STYLING_RULES column.

In the `<styling_rules>` element for a network theme, `theme_type` must be `network` in order for this theme to be recognized as a network theme. Elements for links, paths, and nodes can be specified in the same `<features>` element, as is done in

[Example 2-21:](#)

- The link feature rule specifies the style C.RED and direction marker attributes for all links.
- The path feature rule specifies the style C.BLUE for paths with the path ID value 1, and the style C.GREEN for paths with the path ID value 3.
- The node feature rule specifies the style M.CIRCLE and a marker size of 5.

[Example 2-21](#) also contains a `<label>` element for links, specifying the link column LINK_ID and the label style T.STREET NAME.

The DTD for the `<styling_rules>` element is presented in [Section A.7](#).

2.3.5.2 Using MapViewer for Network Analysis

The network model Java API provides several network analysis capabilities. You can define MapViewer network themes that support the shortest-path and within-cost analysis capabilities. Some attributes apply to both capabilities, and some attributes apply only to the relevant associated capability.

For all network analysis capabilities, the `<jdbc_network_query>` element and the network-related attributes described in [Section 2.3.5](#) apply to the definition of the network theme.

For shortest-path analysis, the following attributes apply to the definition of the network theme:

- `analysis_algorithm` attribute: Specifies the shortest-path analysis algorithm to use. Must be either DIJKSTRA or ASEARCH.
- `shortestpath_style` attribute: Specifies the style name to be used for the shortest path.
- `shortestpath_startnode` attribute: Specifies the start node to be used for the analysis.
- `shortestpath_endnode` attribute: Specifies the end node to be used for the analysis.
- `shortestpath_startstyle` attribute (optional): Specifies the style name to be used for the start node.
- `shortestpath_endstyle` attribute (optional): Specifies the style name to be used for the end node.

[Example 2-22](#) defines a network theme that can be used for shortest-path analysis.

Example 2–22 Network Theme for Shortest-Path Analysis

```
<theme name="shortest_path_theme" user_clickable="false">
  <jdbc_network_query
    network_name="BI_TEST"
    network_level="1"
    jdbc_srid="0"
    datasource="mvdemo"
    analysis_algorithm="DIJKSTRA"
    shortestpath_style="L.PH"
    shortestpath_startnode="20"
    shortestpath_endnode="101"
    shortestpath_startstyle="M.STAR"
    shortestpath_endstyle="M.CIRCLE"
    asis="false">
  </jdbc_network_query>
</theme>
```

For within-cost analysis, the following attributes apply to the definition of the network theme:

- `analysis_algorithm` attribute: Must be `WITHINCOST`.
- `withincost_startnode` attribute: Specifies the start node to be used for the analysis.
- `withincost_cost` attribute: Specifies the cost cutoff value for nodes to be included. All nodes that can be reached from the start node at a cost less than or equal to the specified value are included in the resulting display. Nodes that cannot be reached from the start node or that can be reached only at a cost greater than the specified value are not included.
- `withincost_startstyle` attribute (optional): Specifies the style name to be used for the start node.
- `withincost_style` attribute: Specifies the style name to be used for links in the displayed paths between the start node and each node that is within the specified cost cutoff value.

[Example 2–23](#) defines a network theme that can be used for within-cost analysis.

Example 2–23 Network Theme for Within-Cost Analysis

```
<theme name="within_cost_theme" user_clickable="false">
  <jdbc_network_query
    network_name="BI_TEST"
    network_level="1"
    jdbc_srid="0"
    datasource="mvdemo"
    analysis_algorithm="WITHINCOST"
    withincost_startnode="20"
    withincost_style="L.PH"
    withincost_cost="1"
    withincost_startstyle="M.STAR"
    asis="false">
  </jdbc_network_query>
</theme>
```

2.3.6 Topology Themes

A **topology theme** is a special kind of MapViewer theme useful for visualizing topologies defined using the Oracle Spatial and Graph topology data model. The

topology data model lets you work with data about nodes, edges, and faces in a topology. The spatial representations of nodes, edges, and faces are spatial geometries of type SDO_Geometry. For nodes and edges, the geometries are explicitly stored; for faces, the initial lines (exterior and interior) are stored, allowing the face geometry to be generated.

In addition to the spatial representation of nodes, edges, and faces, a topology can have features. A feature (also called a topology geometry) is a spatial representation of a real-world object. Each feature is defined as an object of type SDO_TOPO_Geometry, which identifies the topology geometry type, topology geometry ID, topology geometry layer ID, and topology ID. For detailed information, see *Oracle Spatial and Graph Topology Data Model and Network Data Model Graph Developer's Guide*.

MapViewer can render topology features. It can also render a theme in debug mode (explained later in this section) to show the nodes, edges, and faces of a topology. For each topology theme, MapViewer uses the topology metadata information stored in the USER_SDO_TOPO_METADATA view.

The following elements and attributes apply to the definition of a topology theme:

- <jdbc_topology_query> element: Specifies that this is a dynamically defined topology theme. The element can specify a SQL query statement (without a terminating semicolon). The complete DTD for this element is included in the map request DTD in [Section 3.1.2](#).
- topology_name attribute: Specifies the name of the topology.
- feature_table attribute: Specifies the name of the feature table.
- spatial_column attribute: Specifies the name of the spatial feature column of type SDO_TOPO_Geometry.
- label_column attribute: Specifies the column in the feature table that contains the text label to be used with each feature.
- label_style attribute: Specifies the name of the text style to be used to render the labels in the label column.
- render_style attribute: Specifies the name of the style to be used to render the topology.

[Example 2-24](#) defines a topology theme that specifies attributes for the display of features and labels from the LAND_PARCELS table in the CITY_DATA topology. The SQL statement specifies the spatial feature column and the label column, and it includes all rows in the feature table.

Example 2-24 Topology Theme

```
<theme name="topo_theme" user_clickable="false">
  <jdbc_topology_query
    topology_name="CITY_DATA"
    feature_table="LAND_PARCELS"
    label_column="FEATURE_NAME"
    spatial_column="FEATURE"
    label_style="T.CITY_NAME"
    render_style="C.COUNTIES"
    jdbc_srid="0"
    datasource="topology"
    asis="false">select feature, feature_name from land_parcel
  </jdbc_topology_query>
</theme>
```

MapViewer also supports a **debug mode** that renders the nodes, edges, and faces of a topology. To specify debug mode, include the `mode="debug"` attribute in the `<theme>` element. In addition to the `<jdbc_topology_query>` attributes mentioned earlier in this section, the following attributes can be used in debug mode:

- `edge_style` attribute: Specifies the name of the style to be used to render edges.
- `edge_label_style` attribute: Specifies the name of the text style to be used to render edge labels.
- `edge_marker_style` attribute: Specifies the name of the marker style to be used for edge markers.
- `edge_marker_size` attribute: Specifies the size (number of pixels) of for edge markers.
- `node_style` attribute: Specifies the name of the style to be used to render nodes.
- `node_label_style` attribute: Specifies the name of the text style to be used to render node labels.
- `face_style` attribute: Specifies the name of the style to be used to render faces.
- `face_label_style` attribute: Specifies the name of the text style to be used to render face labels.

[Example 2–25](#) defines a debug-mode topology theme for rendering features, edges, nodes, and faces from all feature tables in the CITY_DATA topology.

Example 2–25 Topology Theme Using Debug Mode

```
<theme name="topo_theme" mode="debug" user_clickable="false">
  <jdbc_topology_query
    topology_name="CITY_DATA"
    edge_style="C.RED"
    edge_marker_style="M.IMAGE105_BW"
    edge_marker_size="8"
    edge_label_style="T.EDGE"
    node_style="M.CIRCLE"
    node_label_style="T.NODE"
    face_style="C.BLUE"
    face_label_style="T.FACE"
    jdbc_srid="0"
    datasource="topology"
    asis="false">
  </jdbc_topology_query>
</theme>
```

2.3.6.1 Creating Predefined Topology Themes

To create a predefined topology theme, you must store the definition of the topology theme in the database by inserting a row into the `USER_SDO_THEMES` view (described in [Section 2.9.2](#)). [Example 2–26](#) stores the definition of a topology theme.

Example 2–26 Creating a Predefined Topology Theme

```
INSERT INTO user_sdo_themes VALUES (
  'LANDPARCELS',
  'Topology theme for land parcels',
  'LAND_PARCELS',
  'FEATURE',
  '<?xml version="1.0" standalone="yes"?>
  <styling_rules theme_type="topology" topology_name="CITY_DATA">
```

```

<rule>
  <features style="C.RED"></features>
  <label column="FEATURE_NAME" style="T.TEXT STYLE"> </label>
</rule>
</styling_rules>' );

```

[Example 2-26](#) creates a topology theme named `LANDPARCELS` for the topology named `CITY_DATA`. The feature table name (`LAND_PARCELS` in this example) is inserted in the `BASE_TABLE` column of the `USER_SDO_THEMES` view, the feature column name (`FEATURE` in this example) is inserted in the `GEOMETRY_COLUMN` column, and an XML document with one `<styling_rules>` element is inserted in the `STYLING_RULES` column.

In the `<styling_rules>` element for a topology theme, `theme_type` must be `topology` in order for this theme to be recognized as a topology theme. The theme in [Example 2-26](#) defines one styling rule that renders all land parcel features from the `CITY_DATA` topology using the `C.RED` style and using the `T.TEXT STYLE` label style for values in the `FEATURE_NAME` column of the feature table.

The DTD for the `<styling_rules>` element is presented in [Section A.7](#).

2.3.7 WFS Themes

A **WFS theme** is a special kind of MapViewer theme that supports the rendering of data delivered using the Open GIS Consortium (OGC) Web Feature Service (WFS) protocol, specifically the WFS 1.0.0 implementation specification.

WFS themes are conceptually similar to geometry themes, and users are able to render and label features. The WFS operations `GetCapabilities`, `DescribeFeatureType`, and `GetFeature` are used when rendering a WFS theme. When a WFS service is accessed, MapViewer caches the information about capabilities and feature types.

- `GetCapabilities` retrieves the server general information, including the URL addresses to issue requests and the features available. In general, a WFS capability request has the form:

```
http://localhost:1979/geoserver/wfs/GetCapabilities?SERVICE=WFS&VERSION=1.0.0&REQUEST=GetCapabilities
```

The result includes a `<Capabilities>` element with the URL addresses for the WFS requests. For example, the following includes the `GetCapabilities` URLs for HTTP GET and POST requests.

```

<Capability>
  <Request>
    <GetCapabilities>
      <DCPType>
        <HTTP>
          <Get onlineResource="http://localhost:1979/geoserver/wfs/GetCapabilities?" />
        </HTTP>
      </DCPType>
      <DCPType>
        <HTTP>
          <Post
            onlineResource="http://localhost:1979/geoserver/wfs/GetCapabilities?" />
          </HTTP>
        </DCPType>
      </GetCapabilities>
    . . .

```

```
</Capability>
```

- `DescribeFeatureType` retrieves the feature information, including attributes and types.
- `GetFeature` retrieves the feature geometries and attributes. The output format for `GetFeature` requests is GML2.

The following attributes apply to the definition of a WFS theme:

- `datasource` attribute: Specifies the MapViewer data source from which styles will be loaded.
- `feature_attributes` attribute: Specifies feature attributes (besides geometry and label columns) that can be used with advanced styles.
- `feature_ids` attribute: Specifies the WFS feature IDs to be retrieved. Feature IDs are represented with the `fid` name in the WFS responses. If feature IDs are specified, spatial filter and query conditions are not used in the WFS request.
- `feature_name` attribute: Specifies the WFS feature name.
- `key_column` attribute: Specifies the attribute to be used as a key column. Applies to predefined themes, and can be used in Oracle Maps applications. If `key_column` is not specified, `fid` is used as the key column.
- `label_column` attribute: Specifies the column in the feature table that contains the text label to be used with each WFS feature.
- `label_style` attribute: Specifies the name of the text style to be used to render the labels in the label column.
- `query_condition` attribute: Specifies a `WHERE` clause condition to be applied to the WFS theme. Cannot be a complex condition with a hierarchy of expressions defined using multiple parentheses. Each string in the query must be separated by a blank space. If the condition cannot be parsed, it is ignored on the WFS request. Any query conditions are ignored if you specify the `feature_ids` attribute. The following are examples of valid expressions:

```
state_name = 'New Hampshire' or state_name = 'New York'  
(state_name = 'New Hampshire' or state_name = 'New York') and top_pop > 700000  
(state_name = 'New Hampshire' or state_name = 'New York') and (top_pop >  
700000)
```

- `render_style` attribute: Specifies the name of the style to be used to render the geometry.
- `service_url` attribute: Corresponds to the capabilities address for HTTP GET requests. The `service_url` parameter for MapViewer must be the online resource address for HTTP GET in the `<GetCapabilities>` element. In the preceding example, the value to be used is:
`http://localhost:1979/geoserver/wfs/GetCapabilities?`

Do not include the Capabilities parameters `SERVICE`, `VERSION`, and `REQUEST`; use just the URL from the capabilities information.

- `spatial_column` attribute: Specifies the name of the spatial feature column of type `SDO_TOPO_GEOMETRY`.
- `srs` attribute: Specifies the spatial reference system (coordinate system) name for the WFS feature, in EPSG or Oracle Spatial and Graph format. For example, `EPSG:4325`, `SDO:8307`, and `8307` (the Spatial and Graph SRID value) specify the same SRS. If an EPSG SRS value is specified, MapViewer tries to identify an

equivalent Spatial and Graph (SDO) SRID; and if no matching SRID is found, the SRID for the theme is assumed to be zero (0). MapViewer looks for matching SRID values as follows:

1. Use any custom mapping specified in an SDO to EPSG SRID mapping file specified MapViewer configuration file, as explained in [Section 1.6.2.11](#).
 2. Use the Spatial and Graph function SDO_CS.MAP_EPSG_SRID_TO_ORACLE to get the equivalent SDO code (if this function is available in the version of Oracle Database used to store the data).
 3. Use the EPSG code that is in the MDSYS.CS_SRS table, if a match can be found.
- user and password attributes can be defined to access a secured WFS server that uses basic authentication.

If the WFS server is deployed in WebLogic Application Server, the parameter -DUseSunHttpHandler=true must be added to the startup script of WebLogic server.

[Example 2-27](#) shows a request with a dynamic WFS theme. The WFS service is geoserver, and it is installed on the local system.

Example 2-27 WFS Request with a Dynamic WFS Theme

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="WFS MAP"
    datasource = "mvdemo"
    width="640"
    height="480"
    bgcolor="#a6cae0"
    antialiase="true"
    mapfilename="wfs_map"
    format="PNG_URL">
<center size="20.">
    <geoFeature>
        <geometricProperty typeName="center">
            <Point>
                <coordinates>-70., 44.</coordinates>
            </Point>
        </geometricProperty>
    </geoFeature>
</center>

<themes>
    <theme name="wfs" >
        <wfs_feature_request
            service_url="http://localhost:1979/geoserver/wfs/GetCapabilities?"
            srs="EPSG:4326"
            feature_name="states"
            spatial_column="the_geom"
            render_style="C.COUNTIES"
            label_column="STATE_NAME"
            label_style="T.STATE NAME"
            datasource="mvdemo" />
    </theme>
</themes>
</map_request>
```

2.3.7.1 Creating Predefined WFS Themes

To create a predefined WFS theme, you must store the definition of the WFS theme in the database by inserting a row into the USER_SDO_THEMES view (described in [Section 2.9.2](#)). [Example 2–28](#) stores the definition of a WFS theme.

Example 2–28 Creating a Predefined WFS Theme

```
INSERT INTO user_sdo_themes VALUES (
    'WFS_THEME1',
    'WFS',
    'POI',
    'THE_GEOM',
    '<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="wfs" service_
url="http://localhost:1979/geoserver/wfs/GetCapabilities?" srs="EPSG:4326">
    <hidden_info>
        <field column="NAME" name="name"/>
        <field column="MAINPAGE" name="mainpage"/>
    </hidden_info>
    <rule>
        <features style="M.STAR"> </features>
        <label column="NAME" style="T.STREET NAME"> 1 </label>
    </rule>
</styling_rules>' );
```

In [Example 2–28](#), the WFS feature POI is used as the base table, and the attribute THE_GEOM is the spatial column. The styling rule information contains the service_url and srs information; and although not shown in [Example 2–28](#), it can also specify a key_column value. The <features> and <label> elements of the styling rules are similar to the rules used in geometry themes. Hidden information (<hidden_info> element) can also be defined and used in Oracle Maps applications.

[Example 2–29](#) shows a map request that uses the predefined theme created in [Example 2–28](#).

Example 2–29 Map Request with Predefined WFS Theme

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="Predefined WFS MAP"
    datasource = "mvdemo"
    width="640"
    height="480"
    bgcolor="#a6cae0"
    antialiase="true"
    format="PNG_STREAM">

    <themes>
        <theme name="wfs_theme1" />
    </themes>
</map_request>
```

See also the WFS map request examples in [Section 3.1.1.14](#).

In some cases, proxy information may affect the access to WFS servers. If this occurs, specify the appropriate proxy parameters in the MapViewer configuration file.

2.3.8 WMTS Themes

A **WMTS theme** supports the rendering of data delivered using the Open GIS Consortium (OGC) Web Map Tile Service (WMTS) standard, specifically the WMTS 1.0.0 implementation standard.

A WMTS theme fetches tile images from a WMTS-enabled server over the Internet and renders the images. The tile images on a WMTS-enabled server are spatially referenced with predefined content, extent, and resolution.

The WMTS operations `GetCapabilities`, `GetTile`, and `GetFeatureInfo` are used when rendering a WMTS theme. When a WMTS service is accessed by MapViewer, it caches the capabilities information of that WMTS service. You may need to specify a proxy server in Map Builder when creating a WMTS theme and to edit the MapViewer configuration file (`MapViewerConfig.xml`) when a WMTS theme is being used.

- A `GetCapabilities` operation retrieves the server's general information, including the URL addresses to issue requests and the features available. In general, a WMTS capability request has the form:

```
http://maps.opengeo.org/geowebcache/service/wmts?service=WMTS&version=1.0.0&request=GetCapabilities
```

The result includes a `<Capabilities>` element with the URL addresses for the WMTS requests. For example, the following includes the `GetCapabilities` URLs for HTTP GET or POST requests:

```
<?xml version="1.0" encoding="UTF-8"?>
<Capabilities xmlns="http://www.opengis.net/wmts/1.0"
  xmlns:ows="http://www.opengis.net/ows/1.1"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:gml="http://www.opengis.net/gml"
  xsi:schemaLocation="http://www.opengis.net/wmts/1.0
    http://schemas.opengis.net/wmts/1.0/wmtsGetCapabilities_response.xsd"
  version="1.0.0">
  <ows:ServiceIdentification>
    <ows:Title>Web Map Tile Service - GeoWebCache</ows:Title>
    <ows:ServiceType>OGC WMTS</ows:ServiceType>
    <ows:ServiceTypeVersion>1.0.0</ows:ServiceTypeVersion>
  </ows:ServiceIdentification>
  <ows:ServiceProvider>

    <ows:ProviderName>http://maps.opengeo.org/geowebcache/service/wmts</ows:ProviderName>
    <ows:ProviderSite
      xlink:href="http://maps.opengeo.org/geowebcache/service/wmts" />
    <ows:ServiceContact>
      <ows:IndividualName>GeoWebCache User</ows:IndividualName>
    </ows:ServiceContact>
  </ows:ServiceProvider>
  <ows:OperationsMetadata>
    <ows:Operation name="GetCapabilities">
      <ows:DCP>
        <ows:HTTP>
          <ows:Get
            xlink:href="http://maps.opengeo.org/geowebcache/service/wmts?">
              <ows:Constraint name="GetEncoding">
                <ows:AllowedValues>
                  <ows:Value>KVP</ows:Value>
                </ows:AllowedValues>
              </ows:Constraint>
            </ows:Get>
          </ows:HTTP>
        </ows:DCP>
      </ows:Operation>
    </ows:OperationsMetadata>
  </ows:ServiceProvider>
</Capabilities>
```

```

        </ows:Constraint>
    </ows:Get>
</ows:HTTP>
</ows:DCP>
</ows:Operation>
<ows:Operation name="GetTile">
    <ows:DCP>
        <ows:HTTP>
            <ows:Get
xlink:href="http://maps.opengeo.org/geowebcache/service/wmts?">
                <ows:Constraint name="GetEncoding">
                    <ows:AllowedValues>
                        <ows:Value>KVP</ows:Value>
                    </ows:AllowedValues>
                </ows:Constraint>
                <ows:Get>
            </ows:HTTP>
        </ows:DCP>
</ows:Operation>
<ows:Operation name="GetFeatureInfo">
    <ows:DCP>
        <ows:HTTP>
            <ows:Get
xlink:href="http://maps.opengeo.org/geowebcache/service/wmts?">
                <ows:Constraint name="GetEncoding">
                    <ows:AllowedValues>
                        <ows:Value>KVP</ows:Value>
                    </ows:AllowedValues>
                </ows:Constraint>
                <ows:Get>
            </ows:HTTP>
        </ows:DCP>
</ows:Operation>
</ows:OperationsMetadata>
<Contents>
    <Layer>
        <ows:Title>bluemarble</ows:Title>
        <ows:WGS84BoundingBox>
            <ows:LowerCorner>-180.0 -90.0</ows:LowerCorner>
            <ows:UpperCorner>180.0 90.0</ows:UpperCorner>
        </ows:WGS84BoundingBox>
        <ows:Identifier>bluemarble</ows:Identifier>
        <Style isDefault="true">
            <ows:Identifier>_null</ows:Identifier>
        </Style>
        <Format>image/png</Format>
        <Format>image/jpeg</Format>
        <TileMatrixSetLink>
            <TileMatrixSet>EPSG:4326</TileMatrixSet>
        </TileMatrixSetLink>
        <TileMatrixSetLink>
            <TileMatrixSet>EPSG:900913</TileMatrixSet>
        </TileMatrixSetLink>
    </Layer>
    ...
<TileMatrixSet>
    <ows:Identifier>EPSG:4326</ows:Identifier>
    <ows:SupportedCRS>urn:ogc:def:crs:EPSG::4326</ows:SupportedCRS>
    <TileMatrix>
        <ows:Identifier>EPSG:4326:0</ows:Identifier>

```

```

<ScaleDenominator>2.795411320143589E8</ScaleDenominator>
<TopLeftCorner>90.0 -180.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>2</MatrixWidth>
<MatrixHeight>1</MatrixHeight>
</TileMatrix>
...
</TileMatrixSet>
...
</Contents>
<ServiceMetadataURL
xlink:href="http://maps.opengeo.org/geowebcache/service/wmts?REQUEST=getcapabilities&VERSION=1.0.0"/>
<Capabilities>
```

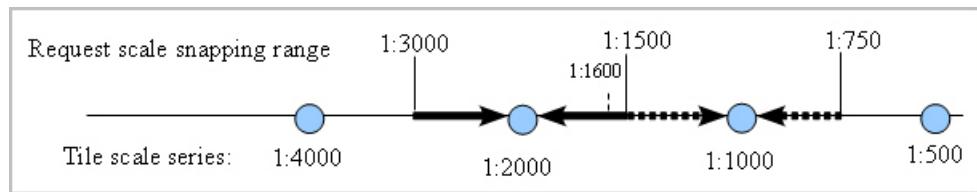
- A GetTile operation retrieves a tile image from a WMTS server. A request to the server contains parameters of key-value pairs (KVP) that define the tile image.
- A GetFeatureInfo operation allows WMTS clients to request information at a specific position of a specific tile for a specific query layer.

Detailed descriptions of these operations can be found at
<http://www.opengeospatial.org/standards/wmts>.

The following attributes apply to the definition of a WMTS theme:

- **current_threads** attribute (optional): an integer (int) variable; the default is 8. It is the number of concurrent threads for retrieving tile images from a WMTS server. In general, a larger number of concurrent threads allows more threads to retrieve image tiles in parallel from a map server. Other constraining factors may prevent you from using a number in the hundreds, but you may try to set it 16, 32, or a slightly larger value for faster processing.
- **format** attribute: Specifies the tile image formats stored in the WMTS server. The tif, jpeg, png, and png8 formats are supported in MapViewer.
- **layer** attribute: Specifies the layer name for which the tile images are to be fetched.
- **matrix_set_id** attribute: Specifies the ID of the matrix set from which the tile images are to be fetched.
- **service_url** attribute: Corresponds to the capabilities address for HTTP GET requests. The **service_url** parameter for MapViewer must be the online resource address for HTTP GET in the **<GetCapabilities>** element. In the preceding example, the value to be used is:
<http://maps.opengeo.org/geowebcache/service/wmts>
- **snap_to_tile_scale** attribute (optional): a Boolean value (true or false); the default is false.

When **snap_to_tile_scale** is set to true, a request scale (derived from a device-window size and a request-data-window size) is snapped to a closest tile scale; the map scale will be in the tile scale. For example, if there are tiles in scale series of ..., 1:4000, 1:2000, 1.1000, 1:500,, a request scale of 1:1600 will be snapped to the 1:2000 tile scale, and the map will be using the same 1:2000 scale, as shown in [Figure 2-9](#).

Figure 2-9 snap_to_tile_scale Attribute

If a map request has more than one WMTS theme that specifies `snap_to_tile_scale` as true, then only the first WMTS `snap_to_tile_scale` specification is set to true and all others are reset to false. This is the logical behavior. For example, if two such themes both have the attribute set to true, but the two WMTS tile scale series are different from each other (the two map servers may be from different institutions using different scale series), the first theme will then use its closest tile scale to retrieve tile data and for the final request scale; at the same time, the second theme has to reset its `snap_to_tile_scale` to false, then has to find its own tile scale according to its `tile_resizing_option`, then retrieve tiles, and finally resize the tiles to match the first theme's tile scale.

- `style` attribute: Currently not used in MapViewer; the default is the string `default`.
- `tile_resizing_option` attribute (optional): the string `unbiased`, `expand_biased`, or `contract_biased`; the default is `unbiased`. If `snap_to_tile_scale` is set to true, `tile_resizing_option` is ignored.

For more information, see [Section 2.3.8.1, "How the tile_resizing_option Attribute Works"](#).

- `timeout` attribute (optional): an integer specifying a request's timeout period in milliseconds; the default is 0, (that is, no limit for a request to wait for a response).

Specifying this attribute ensures that a map request is terminated when the map server does not respond within the specified time period, and thus frees the resources. You might try a value of 30000 (30,000 milliseconds, or 30 seconds).

- `top_left_corner_x` attribute (optional): the x coordinate value of the top left corner of the whole tile images' extent that is served by a WMTS server. If not specified, the value retrieved from the WMTS server is used. If you specify this attribute, also specify the `top_left_corner_y` attribute.
- `top_left_corner_y` attribute (optional): the y coordinate value of the top left corner of the whole tile images' extent that is served by a WMTS server. If not specified, the value retrieved from the WMTS server is used. If you specify this attribute, also specify the `top_left_corner_x` attribute.
- `version` attribute: the version of the WMTS specification implemented by the WMTS server.

See Also: [Appendix F, "OGC WMTS Support in MapViewer"](#) for information about the WMTS service for MapViewer, WMTS Operations, and preparing the WMTS service for MapViewer.

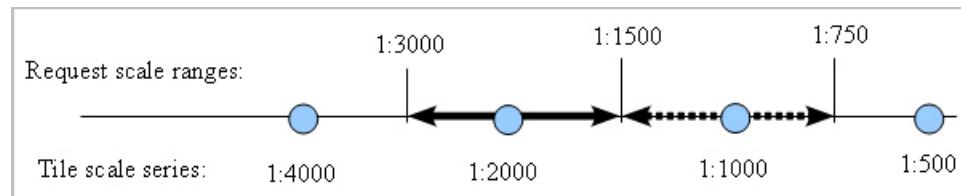
2.3.8.1 How the tile_resizing_option Attribute Works

If a WMTS theme's `snap_to_tile_scale` attribute is false (the default) or omitted, a request scale is always honored and the `tile_resizing_option` attribute value (specified or defaulted) is used when choosing a proper tile scale. However, if `snap_to_tile_scale` is true, the `tile_resizing_option` attribute value is ignored.

The `tile_resizing_option` attribute value can be one of the following string values: `string_unbiased` (the default), `expand_biased`, or `contract_biased`.

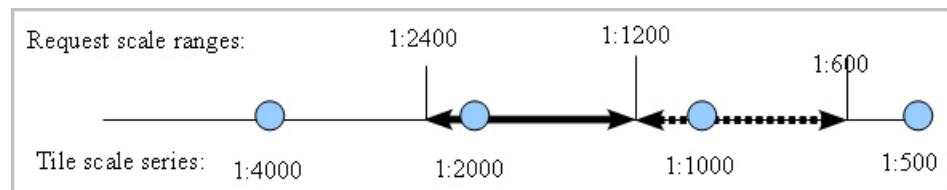
- `unbiased` (the default): The closest tile scale level is chosen, and then the tile images are expanded or contracted to generate a map in the request scale. For example, in [Figure 2–10](#) the tile scale 1:2000 is used to generate any request scale map if a request scale falls within a scale range of 1:3000 and 1:1500.

Figure 2–10 unbiased tile_resizing_option Value



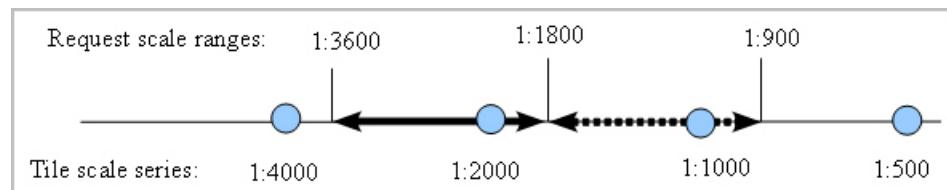
- `expand_biased`: When identifying a proper tile scale to generate a map in a request scale, a preference for expanding tile images to render a request map is used. In other words, you prefer to use a smaller tile scale to generate a map for a request scale. An 8:2 preference ratio for expanding is currently implemented. For example, in [Figure 2–11](#) the tile scale 1:2000 is used for generating a request map if its scale is in the range of 1:2400 to 1:1200.

Figure 2–11 expand_biased tile_resizing_option Value



- `contract_biased`: When identifying a proper tile scale to generate a map in a request scale, a preference for contracting tiles to render a request map is used. In other words, you prefer to use a larger tile scale to generate a map for a request scale. An 8:2 preference ratio for contracting is currently implemented. For example, in [Figure 2–12](#) the tile scale 1:2000 is used for generating a request map if its scale is in the range of 1:3600 to 1:1800.

Figure 2–12 contract_biased tile_resizing_option Value



See also [Section 2.3.8.2, "snap_to_tile_scale and tile_resizing_option Attribute Usage Guidelines"](#).

2.3.8.2 snap_to_tile_scale and tile_resizing_option Attribute Usage Guidelines

This section presents general guidelines for using the `snap_to_tile_scale` and `tile_resizing_option` attributes to generate better quality maps. Because mapping has a wide variety of applications, you may also use your domain knowledge to set attribute values that best meet your needs.

Whenever possible, set `snap_to_tile_scale` to `true` to use a closest tile scale instead of a request scale, because original tile maps have the best map quality.

However, if you must honor a request scale, consider the following when setting the attributes:

- If you set a `tile_resizing_option` value, omit the `snap_to_tile_scale` attribute or set it to `false` (the default). If `snap_to_tile_scale` is set to `true`, a request scale will not be honored, and instead the closest tile scale will be used.
- If a map is a topographic map with annotations and thin linear features, you may want to use the `expand_biased` option.
- If a map is a thematic map, such as a land cover map, you may want to use the `contract_biased` option.
- If a map is a satellite image, you may want to use the `unbiased` or `contract_biased` option.

Regarding the `tile_resizing_option` possible values:

- In general, a `contract_biased` option may generate maps with more details, but these maps may need more tiles than maps from an `expand_biased` option, and retrieving more tiles takes more time.
- If a request scale is honored (when the `snap_to_tile_scale` attribute is set to `false`), when a request scale is close enough to a tile scale, then the same operation will be employed (either expanding or contracting), regardless of the specified `tile_resizing_option`. For example, if a request scale is 1:1900 in the figures in [Section 2.3.8.1, "How the tile_resizing_option Attribute Works"](#), tile maps in 1:2000 will be retrieved and expanded to render the request map in a map scale of 1:1900, regardless of whether the `unbiased`, `expand_biased`, or `contract_biased` option is specified; similarly, if a request scale is 1:2100, then tile maps in 1:2000 will also be retrieved and then contracted to render the requested map in a scale of 1:2100.

[Example 2–30](#) shows a request with a dynamic WMTS theme, in which `snap_to_tile_scale="true"` is specified.

Example 2–30 Request with a Dynamic WMTS Theme

```
<?xml version="1.0" standalone="yes"?>
<map_request title="OpenGeo wmts theme (bluemarble)"
  datasource="mvdemo"
  width="1024"
  height="900"
  mapfilename="Bluemarble"
  format="PNG_STREAM">
  <center size="80.0">
    <geoFeature>
      <geometricProperty typeName="center">
        <Point>
          <coordinates>-112, 42.0</coordinates>
        </Point>
      </geometricProperty>
    </geoFeature>
  </center>
```

```

<themes>
  <theme name="wmtstheme: Earth" timeout="10000" snap_to_tile_scale="true">
    <wmts_gettile_request>
      <service_url> http://maps.opengeo.org/geowebcache/service/wmts </service_
      url>
      <version> 1.0.0 </version>
      <layer> bluemarble </layer>
      <matrix_set_id> EPSG:4326 </matrix_set_id>
      <format> image/png </format>
      <style> default </style>
      <top_left_corner_x> -180.0 </top_left_corner_x>
      <top_left_corner_y> 90.0 </top_left_corner_y>
    </wmts_gettile_request>
  </theme></themes>
</map_request>

```

2.3.8.3 Creating Predefined WMTS Themes

To create a predefined WMTS theme, you must store the definition of the WMTS theme in the database by inserting a row into the USER_SDO_THEMES view (described in [Section 2.9.2](#)). [Example 2-31](#) stores the definition of a WMTS theme.

Example 2-31 Creating a Predefined WMTS Theme

```

INSERT INTO user_sdo_themes VALUES (
  'earth_image',
  'Opengeo.org demo',
  'table_spaceholder',
  'geom_col_spaceholder',
  '<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="wmts">
  <version> 1.0.0 </version>
  <service_url> http://maps.opengeo.org/geowebcache/service/wmts </service_url>
  <layer> bluemarble </layer>
  <matrix_set_id> EPSG:4326 </matrix_set_id>
  <format> image/png </format>
  <style> default </style>
</styling_rules>');

```

In [Example 2-31](#), earth_image is the name of the WMTS theme, and table_spaceholder and geom_col_spaceholder are dummy values to fill the BASE_TABLE and GEOMETRY_COLUMN columns in the USER_SDO_THEMES view. The styling rule information contains the service_url, layer, matrix_set_id, format, and style information. The top_left_corner_x and top_left_corner_y attributes are not specified, so by default the values retrieved from the WMTS server are used.

[Example 2-32](#) shows a map request that uses the predefined theme created in [Example 2-31](#).

Example 2-32 Map Request with Predefined WMTS Theme

```

<?xml version="1.0" standalone="yes"?>
<map_request
  title="OpenGeo predefined wmts theme"
  datasource="mvdemo"
  width="1024"
  height="768"  mapfilename="Bluemarble: Earth"
  format="PNG_STREAM">
  <center size="10.0">
    <geoFeature>

```

```

<geometricProperty typeName="center">
    <Point>
        <coordinates>-75.0,42.0</coordinates>
    </Point>
</geometricProperty>
</geoFeature>
</center>
<themes>
    <theme name="earth_image" />
</themes>
</map_request>

```

2.3.9 Custom Geometry Themes

Custom geometry themes are associated with external spatial data (spatial data in a native format other than Oracle Spatial and Graph, such as shapefile). A custom geometry theme uses a spatial provider class to retrieve the native data, and the external provider must use the spatial data provider plug-in mechanism. MapViewer provides a spatial provider interface class that the external provider must implement. The interface implementation has the following methods (some of them mainly provide information that can be used in user interfaces of applications like Map Builder):

```

public interface SDataProvider
{
    /**
     * Returns the initialization parameters for the provider.
     * @return String[] - array with initialization parameter names
     */
    public String[] getInitParameterNames();

    /**
     * Returns runtime parameter names. Runtime parameters are additional parameters
     * that the provider may use when retrieving the data objects.
     * @return String[] - array with runtime parameter names
     */
    public String[] getRuntimeParameterNames();

    /**
     * Returns a value that gives a hint for the runtime parameter value.
     * This hint can be used as a tooltip in user interfaces.
     * @param runtimeParam
     * @return a String representing the hint value, or null if no hint is
     * available
     */
    public String getRuntimeParameterHintValue(String runtimeParam);

    /**
     * This method is used to set the initialization parameters for the specific
     * data provider.
     * @param params - parameters to be used by the initialization method.
     * @return boolean - true if success; false otherwise
     */
    public boolean init(Properties params);

    /**
     * This method creates and returns an instance of SDataSet which contains
     * all the Spatial data produced by this provider, based on
     * the given parameters for a specific incoming map request.
     * <br>
     */
}

```

```
* MapViewer calls this method on the custom theme producer implementation.  
*  
* @param queryWin the search area to retrieve spatial objects. The window is  
* assumed to be already on data provider spatial reference system.  
* @param nonSpatialColumns - the list of attributes that will return with  
objects.  
* @param queryCondition - query condition expression (may have binding  
parameters).  
* @param bindingParameters - binding variables for query condition with binding  
parameters.  
* @param params - parameters that the provider may use to retrieve the data.  
* @return SDataObject - an instance of SDataSet class; null if failed.  
*/  
public SDataSet buildDataSet(Rectangle2D queryWin, String []nonSpatialColumns,  
                           String queryCondition, Object[] bindingParameters,  
                           Properties params);  
  
/**  
 * Returns the list of existing attributes for this data provider.  
 * @param params parameters that the provider may use to get the attribute  
list.  
 * @return Field[] - array of attributes for this provider.  
*/  
public Field[] getAttributeList(Properties params);  
  
/**  
 * Returns the data set spatial extent MBR.  
 * @param params parameters that the provider may use to get the data extents  
* @return Rectangle2D - data spatial extent for this provider.  
*/  
public Rectangle2D getDataExtents(Properties params);  
  
/**  
 * Returns if provider can build spatial indexes.  
 * If true, means that buildSpatialIndex method can be called.  
 * @return  
*/  
public boolean canBuildSpatialIndex();  
  
/**  
 * Builds a spatial index on the data set.  
 * @param params parameters that the provider may use to build the spatial  
index.  
 * @return boolean - true if saptial index creation is successful.  
*/  
public boolean buildSpatialIndex(Properties params);  
  
/**  
 * Clears provider internal caches (if provider implement caches).  
*/  
public void clearCache();  
  
/**  
 * Returns the parameter names that can be used to query for spatial tables.  
 * Can be used more as information for user interfaces.  
 * @return  
*/  
public String[] getParametersToQuerySpatialMetadata();
```

```

    /**
     * Returns the spatial tables and spatial columns.
     * @param params must define the parameters returned from
     * getParametersToQuerySpatialMetadata.
     * @return an array list defining the table name(index [0])
     *         and spatial column (index[1])
     */
    public String[][] getSpatialTables(Properties params);
}

```

The init and buildDataSet methods must be implemented. The other method implementations can be empty; however applications (such as the Oracle Map Builder Tool) can make use of these methods to handle the information about spatial data providers. A provider can implement its own spatial indexing mechanism; MapViewer offers an implementation for the shapefile provider, and the buildSpatialIndex method creates an indexing file with the .oix extension in the shapefile directory. [Appendix D](#) contains an example of how to implement and register a sample spatial provider with MapViewer.

To render native data in MapViewer with custom geometry themes, follow these steps:

1. Implement a spatial provider class based on the plug-in interface, and generate a jar file with the provider implementation. Copy the jar file to a directory that is part of the MapViewer CLASSPATH definition.
2. Register the provider in the MapViewer configuration. MapViewer and Map Builder ships with a shapefile provider to access ESRI shapefiles, a GDAL-OGR provider to access data formats supported by OGR, and a Teradata provider to access data stored in a Teradata database. (See the GDAL-OGR and Teradata documentation for detailed information about handling spatial data in these environments.) The GDAL-OGR library `gdal.jar`, and Teradata libraries `terajdbc4.jar` and `tdgssconfig.jar`, must be on server classpath. The registration section in MapViewer configuration file looks like this:

```

<s_data_provider
  id="shapefileSDP"
  class="oracle.sdovis.ShapefileDataProvider"
>
<parameters>
  <parameter name="datadir" value="/temp/data" />
</parameters>
</s_data_provider>

```

Each provider must have `id` and `class` names defined: `id` is a unique name that identifies the provider, and `class` corresponds to the Java class implementation. The `<parameters>` element defines the initialization parameters of the provider.

For the shapefile provider, the initialization parameter `datadir` defines where MapViewer will look for the data files, and thus it should be a directory that is accessible to MapViewer. MapViewer first looks for data files based on the theme definition information; and if the data path defined in the theme definition is not accessible, MapViewer looks for the data path defined in the configuration file.

3. Create custom geometry themes associated with the external spatial data provider.

Although the external spatial data is outside the Oracle database, you still need to have a database connection to render this data. The database is used to store the metadata information related with the theme, as well as the styling information used to render and to label the data.

Example 2–33 shows the definition for a dynamic custom geometry theme. The XML element `<custom_geom_theme>` identifies a custom geometry theme. The `<parameters>` element defines the runtime parameters to be used by the provider. In this case `"filename"` is a runtime parameter, and `"/lbs/demo/shapefile/parcel.shp"` defines the file path. MapViewer first attempts to use this file path definition; but if it is not accessible, it uses the data directory value defined in the configuration file for the shapefile spatial provider.

The runtime parameters for the available spatial providers are as follows (note that Map Builder provides the option to encrypt parameter values):

- For a shapefile provider:
 - `filename`: full path to the shapefile (.shp) on disk
- For GDAL-OGR:
 - `datasource`: a full OGR data source string. Depending on the data source format, this string can vary.(see the GDAL-OGR documentation for detailed information about connecting to different formats supported by GDAL-OGR.)

For file formats, this parameter's value is usually the full path to the archive.

For database connections, enter the full connection string to access the spatial table and spatial column. For example, for a Postgis table name STATES with one spatial column, the value might be:

```
datasource = PG:dbname='template_postgis' host='localhost' port='5432'
user='postgres' password='manager' tables=states
```

- For a Teradata provider:
 - `jdbcurl`: the JDBC connection to Teradata database. The string format is:
`jdbc:teradata://<host_address>/DATABASE=<db_name>,DBS_PORT=<db_port>,TMODE=ANSI,CHARSET=UTF8`
 - `user`: database user.
 - `password`: database password.
 - `containerds`: Optional. Name of Teradata container data source defined on the application server (WebLogic, for example). If defined, this will be used first in MapViewer, instead of the `jdbcurl` value.
 - `basetable`: name of the spatial table.
 - `geomcolumn`: name of the spatial column.
 - `fetchsize`: Optional. Number of rows to be prefetched.

Example 2–33 Defining a Dynamic Custom Geometry Theme

```
<theme name="custom_geom_theme_1" >
  <custom_geom_theme
    provider_id="shapefileSDP"
    srid="26986"
    render_style="C.RED"
    label_column="parcel_id"
    label_style="T.CITY_NAME"
    datasource="mvdemo">
    <parameters>
      <parameter name="filename" value="/lbs/demo/shapefile/parcel.shp"/>
    </parameters>
  </custom_geom_theme>
```

```
</theme>
```

The available attributes for a dynamic custom geometry theme are:

- provider_id specifies the spatial provider.
- datasource specifies the Oracle database connection. This connection is used to retrieve the styles to render the spatial data.
- srid specifies the spatial reference system (Oracle Spatial and Graph coordinate system).
- render_style specifies the style to be used when rendering the features.
- label_column specifies the name of the column containing label text to be used with the theme.
- label_style specifies the style to be used when labeling the features.
- feature_attributes specifies additional attributes that can be used with advanced styles.
- key_column specifies a key attribute that can be used in Oracle Maps applications.
- query_condition specifies the WHERE clause to filter feature selection. Shapefile providers do not support a query condition; however an OGR provider can be used to render shapefiles with a query condition. The query condition expression can define binding parameters (for example, attr = :1).

Example 2-34 shows how to store a predefined custom geometry theme definition. Use GEOMETRY as the geometry column name, and you can specify any name for the base table name. The "theme_type=geom_custom" attribute identifies the theme as a custom theme. The <rule> element has the same function as for an Oracle Spatial and Graph geometry theme. The <parameters> element defines the runtime parameters that the provider accepts. For the shapefile provider, the runtime parameter filename defines the path to the shapefile data.

Example 2-34 Storing a Predefined Custom Geometry Theme

```
insert into user_sdo_themes values (
  'SHAPE_THEME',
  'Shapefile theme',
  'CUSTOM_TABLE',
  'GEOMETRY',
  '<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="geom_custom" srid="26986" provider_id="shapefileSDP">
  <rule>
    <features style="C.RED"> </features>
    <label column="PARCEL_ID" style="T.CITY NAME"> 1 </label>
  </rule>
  <parameters>
    <parameter name="filename" value="/lbs/demo/shapefile/parcel.shp"/>
  </parameters>
</styling_rules>');

```

You can override the runtime parameters section of a predefined custom geometry theme by specifying the parameters in a map_request. For example, you can include the following in a <map_request> element:

```
<theme name="CUSTOM_THEME" >
  <parameters>
    <parameter name="filename" value="/lbs/demo/shapefile/counties.shp"/>
```

```
</parameters>
</theme>
```

2.3.10 Annotation Text Themes

Oracle Spatial and Graph supports annotation text as specified in the *OpenGIS Implementation Specification for Geographic information - Simple feature access - Part 1: Common architecture*, which defines **annotation text** as "simply placed text that can carry either geographically-related or ad-hoc data and process-related information as displayable text. This text may be used for display in editors or in simpler maps. It is usually lacking in full cartographic quality, but may act as an approximation to such text as needed by any application."

Oracle Spatial and Graph provides the ST_ANNOTATION_TEXT object type for storing annotation text, and the USER_ANNOTATION_TEXT_METADATA and ALL_ANNOTATION_TEXT_METADATA views for storing metadata related to annotation text. For more information about annotation text support, see *Oracle Spatial and Graph Developer's Guide*.

Each annotation text object may have one or more elements, and each element is defined by the following:

- Value: Text associated with element. If the value is null, the text is derived from the first non-null preceding element value. If all preceding elements have null values, the text is a text expression value derived from the metadata.
- Location: Spatial location associated with the annotation text object.
- Leader line: Linear feature associated with the annotation text object.
- Attributes: Graphic attributes used to display the text. If the value is null, graphic attributes are derived from the attributes value in the metadata.

The text expression in the metadata views can be any of the following:

- A column name.
- A function applied to a column name. For example: substr(my_col,1,3)
- The concatenation of two or more column names. For example: column_1 || column_2 || column_3
- A text value that is unrelated to a column name. In this case, it is treated as a simple text string that is used for any text element that has a null value.

Annotation text themes in MapViewer are associated with database tables that have a column of type ST_ANNOTATION_TEXT. For each annotation text element, MapViewer will render:

- The value (if not null) of the annotation text element as a string, using a text style that is created at real time based on the element attributes.
- The leader line (if not null) associated with the annotation text element. In this case, users can select a MapViewer style to render the leader line.

Each annotation text element has an envelope represented by a geometry, and which is used for spatial indexing. Therefore, you must do the following to use spatial indexing with annotation text tables in MapViewer:

1. Insert a row into the USER_ANNOTATION_TEXT_METADATA view that specifies the name of the annotation text table and the PRIVATEENVELOPE attribute of the annotation text column (that is, the column of type ST_ANNOTATION_TEXT).

The following example inserts a row for a table named ANNOTEXT_TABLE with an annotation text column named TEXTOBJ:

```
INSERT INTO USER_SDO_GEOM_METADATA
VALUES (
  'ANNOTTEXT_TABLE',
  'TEXTOBJ.PRIVATEENVELOPE',
  SDO_DIM_ARRAY(
    SDO_DIM_ELEMENT('X', 0.0, 10.0, 0.0005),
    SDO_DIM_ELEMENT('Y', 0.0, 10.0, 0.0005)
  ),
  null -- SRID
);
```

2. Create a spatial index on the annotation text envelope of the annotation text table.

The following example creates a spatial index named ANNO_TEXT_IDX on the annotation envelope of the table named ANNOTTEXT_TABLE:

```
CREATE INDEX anno_text_idx ON annotext_table(textobj.privateenvelope)
INDEXTYPE IS mdsys.spatial_index;
```

For themes with valid SRID information, if the metadata base map scale is defined, the element text sizes will be scaled as maps zoom in or out.

Example 2–35 defines the styling rules for a predefined annotation text theme in MapViewer. The structure is similar to other MapViewer themes. Currently, just one styling rule is processed for each annotation theme. In this example, the theme type is annotation, the feature style L.PH is used to render leader lines, and the query condition (id = 1 or id = 2) is appended on the final query.

Example 2–35 Styling Rules for a Predefined Annotation Text Theme

```
<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="annotation">
  <rule>
    <features style="L.PH"> (id = 1 or id = 2) </features>
  </rule>
</styling_rules>
```

Example 2–36 shows the theme definition for a dynamic annotation text theme. The parameters defined are:

- datasource: the data source name
- jdbc_srid: the spatial reference identifier
- annotation_table: the annotation text table
- annotation_column: the annotation text column
- leaderline_style: the leader line style to be used

Example 2–36 Dynamic Annotation Text Theme Definition

```
<themes>
  <theme name="theme1" >
    <jdbc_annotation_query
      datasource="tilsmenv"
      jdbc_srid="0"
      annotation_table="ANNOTTEXT_TABLE"
      annotation_column="textobj"
      leaderline_style="L.PH"
```

```

        >select textobj from annotext_table
      </jdbc_annotation_query>
    </theme>
</themes>
```

[Example 2-37](#) is similar to [Example 2-36](#), but it adds the behavior that if the annotation_column column contains a null value, then the value in the textexpr_column is used for the annotation instead. In [Example 2-37](#), assume that the ANNOTATION_TABLE table contains a column named DEFAULT_ANNOTATION (which is used in [Example 2-38](#)). This additional column is specified in the textexpr_column attribute and in the SELECT statement.

Example 2-37 Dynamic Annotation Text Theme with Default Annotation Column

```

<themes>
  <theme name="theme1" >
    <jdbc_annotation_query
      datasource="tilsmenv"
      jdbc_srid="0"
      annotation_table="ANNOTEXT_TABLE"
      annotation_column="textobj"
      textexpr_column="default_annotation"
      leaderline_style="L.PH"
      >select textobj, default_annotation from annotext_table
    </jdbc_annotation_query>
  </theme>
</themes>
```

[Example 2-38](#) creates an annotation text table and prepares it to be used with MapViewer.

Example 2-38 Script to Generate Annotation Text Data

```

SET ECHO ON
SET FEEDBACK 1
SET NUMWIDTH 10
SET LINESIZE 100
SET PAGESIZE 10000
SET SERVEROUTPUT ON SIZE 5000
SET LONG 20000
SET TIMING ON
call dbms_java.set_output(5000);

-----
-- Create an annotation text table (a table that has a
-- column of ST_ANNOTATION_TEXT object type), and insert some records.
-----

create table annotext_table (
  id number,
  default_annotation varchar2(32),
  textobj ST_ANNOTATION_TEXT);

insert into annotext_table values (1,'Text_1',
ST_ANNOTATION_TEXT(
  ST_ANNOTATIONTEXTELEMENT_ARRAY(
    ST_ANNOT_TEXTELEMENT_ARRAY(
      ST_ANNOTATIONTEXTELEMENT('Sample Label 1',
        SDO_Geometry(2001, null, sdo_point_type(1,1,null),null,null),
        SDO_Geometry(2002,null,null,
```

```

        SDO_ELEM_INFO_ARRAY(1,2,1),
        SDO_ORDINATE_ARRAY(0,0, 1,1)), NULL))));

insert into annotext_table values (2,'Text_2',
ST_ANNOTATION_TEXT(
    ST_ANNOTATIONTEXTELEMENT_ARRAY(
        ST_ANNOT_TEXTELEMENT_ARRAY(
            ST_ANNOTATIONTEXTELEMENT('Sample Label 2',
                SDO_GEOOMETRY(2001,null,sdo_point_type(10,10,null),null,null),
                SDO_GEOOMETRY(2002,null,null,
                    SDO_ELEM_INFO_ARRAY(1,2,1),
                    SDO_ORDINATE_ARRAY(5,10, 10,10)), NULL))));

insert into annotext_table values (3, 'Text_3',
ST_ANNOTATION_TEXT(
    ST_ANNOTATIONTEXTELEMENT_ARRAY(
        ST_ANNOT_TEXTELEMENT_ARRAY(
            ST_ANNOTATIONTEXTELEMENT(null,
                SDO_GEOOMETRY(2002, null, null,
                    SDO_ELEM_INFO_ARRAY(1,2,1),
                    SDO_ORDINATE_ARRAY(2,5,4,5,6,5)),
                SDO_GEOOMETRY(2002,null,null,
                    SDO_ELEM_INFO_ARRAY(1,2,1),
                    SDO_ORDINATE_ARRAY(4,3, 4,5)),
                '<?xml version="1.0" encoding="UTF-8" ?>
<textAttributes xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
               xsi:noNamespaceSchemaLocation=".../annotation_text.xsd">
<textStyle fontFamily="Dialog" fontSize="14" fill="blue"/>
<textlayout/>
</textAttributes>
)))));

-----
-- Register the annotation text table in the user metadata view.
-----

insert into USER_ANNOTATION_TEXT_METADATA values(
    'ANNOBJECT_TABLE', 'TEXTOBJ', null, null, null);

-----
-- Update the metadata information.
-----

update user_annotation_text_metadata set
text_expression='default_annotation',
text_attributes =
'<?xml version="1.0" encoding="UTF-8" ?>
<textAttributes xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
               xsi:noNamespaceSchemaLocation=".../annotation_text.xsd">
<textStyle fontFamily="Serif" fontSize="14" fill="#ff0000"/>
<textlayout/>
</textAttributes>';

-----
-- Register the annotation text geometry envelope on the user
-- metadata view of geometries.
-----

INSERT INTO USER_SDO_GEOM_METADATA
VALUES (

```

```

'ANNOTEXT_TABLE',
'TEXTOBJ.PRIVATEENVELOPE',
SDO_DIM_ARRAY(
    SDO_DIM_ELEMENT('X', 0.0, 10.0, 0.0005),
    SDO_DIM_ELEMENT('Y', 0.0, 10.0, 0.0005)
),
null -- SRID
);

-----
-- Create a spatial index on the annotation text envelope.
-----

create index anno_text_idx on annotext_table(textobj.privateenvelope)
    indextype is mdsys.spatial_index;

-----
-- Insert a predefined theme into MapViewer's theme view.
-----

INSERT INTO user_sdo_themes VALUES (
    'ANNOTEXT_THEME',
    'Annotation text',
    'ANNOTEXT_TABLE',
    'TEXTOBJ',
    '<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="annotation">
    <rule>
        <features style="L.PH"> </features>
    </rule>
</styling_rules>' );
commit;

```

2.3.11 LRS (Linear Referencing System) Themes

An LRS theme is a special kind of MapViewer theme useful for visualizing features defined using the linear referencing system (LRS) of Oracle Spatial and Graph, which is explained in *Oracle Spatial and Graph Developer's Guide*.

Two tables are needed by an LRS theme: one (the **LRS table**) has an LRS geometry column, and the other (the **join table**) has one or two **measure columns**. Point events must have one measure column in the join table (for example, a road sign located at a measure of m_1 , and an accident that occurred at a measure of m_2); while linear events must have two measure columns, one for a starting measure and one for an end measure (for example, from measure m_1 to measure m_2 the road pavement condition is poor, and from measure n_1 to measure n_2 the condition is fair). Each event is stored in one row in the join table.

After an LRS theme is defined, you only need to specify the theme name in a map request when you use the theme. MapViewer automatically finds the theme's definition and constructs a query that joins these two specified tables; it then generates the geometry data by internally using an LRS function, either SDO_LRS.LOCATE_PT for point events or SDO_LRS.CLIP_GEOM_SEGMENT for linear events. MapViewer then renders the generated point or linear segment, together with their attribute data, according to the styling rules for the theme.

To create a predefined LRS theme, you must store the definition of the LRS theme in the database by inserting a row into the USER_SDO_THEMES view. [Example 2–39](#) stores the definition of an LRS theme named LRS_THEME.

Example 2–39 Creating an LRS Theme

```
INSERT INTO user_sdo_themes (name, description, base_table, geometry_column,
styling_rules)
VALUES (
'LRS_THEME',
'LRS theme example with 3 rules, 2 measure columns',
'INTERSTATES_LRS',
'GEOM',
'<?xml version="1.0" standalone="yes"?>
<styling_rules key_column="id" theme_type="lrs">
    <rule>
        <features asis="true">
            condition='good'
        </features>
        <label column="condition" style="T.STREET NAME"/>
        <rendering>
            <style name="L.PTH"/>
        </rendering>
    </rule>
    <rule>
        <features asis="true">
            condition='fair'
        </features>
        <label column="condition" style="T.STREET NAME"/>
        <rendering>
            <style name="L.SH"/>
        </rendering>
    </rule>
    <rule>
        <features asis="true">
            condition='poor'
        </features>
        <label column="condition" style="T.STREET NAME"/>
        <rendering>
            <style name="L.MAJOR STREET"/>
        </rendering>
    </rule>
    <hidden_info>
        <field column="highway"      name="highway name"/>
        <field column="routen"       name="highway number"/>
        <field column="condition"   name="pavement condition"/>
    </hidden_info>
    <join_table
        name="pavement_condition"
        start_measure="from_measure"
        end_measure="to_measure"
    />
    <join_columns
        lrs_table_column="highway"
        join_table_column="seg_id"
    />
</styling_rules>
);
```

In [Example 2–39](#), the LRS table name (INTERSTATES_LRS, which has three columns, GEOM, HIGHWAY, and ROUTEN) is inserted in the BASE_TABLE column of the USER_SDO_THEMES view, the LRS geometry column (GEOM) is inserted in the GEOMETRY_COLUMN column, and XML document with one <styling_rules> element is inserted into the STYLING_RULES column.

In the <styling_rules> element for an LRS theme, theme_type must be lrs in order for this theme to be recognized as an LRS theme.

If the optional key_column attribute is omitted, no key column is included when constructing a query string to fetch data from a database. This is different from a predefined geometry theme, in which the ROWID column is the default key column.

The child elements <rule>, <hidden_info>, <join_table>, and <join_columns> can be included within the <styling_rules> element. The <join_table> and <join_columns> child elements are specific to LRS themes.

The <rule> element for an LRS theme is similar to the definition in a predefined themes, but its child element <features> must contain an asis attribute with its value set to true (asis="true"). There can be 0, 1, or more <rule> elements within a <styling_rules> element.

The <hidden_info> element is optional for an LRS theme. It is defined for use in Oracle Maps applications. It specifies a list of attributes from either the LRS table or the join table, or both. (For more information, see [Section 3.1.2.9, "jdbc_query Element"](#).)

In <join_table> element, the name attribute (pavement_condition in this example) specifies the join table name. In this example, the join table contains columns such as id, seg_id, condition, from_measure, and to_measure. If two measure columns are used to define linear events in the join table, then attributes start_measure and end_measure (from_measure and to_measure in this example) must be specified, which indicate column names of measurements in the join table. If the join table contains one measure for point events, then a measure attribute is specified in this <join_table> element.

In the <join_columns> element, the lrs_table_column and join_table_column attributes must be specified, where lrs_table_column defines the column from the LRS table, and join_table_column specifies the column from the join table to join these two tables.

[Example 2–40](#) shows a map request that uses the predefined LRS theme from [Example 2–39](#).

Example 2–40 Map Request with Predefined LRS Theme

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="LRS Theme test"
    datasource="mvdemo"
    width="640"
    height="480"
    bgcolor="#a6caf0"
    antialiase="true"
    format="PNG_STREAM">
    <center size="45">
        <geoFeature>
            <geometricProperty typeName="center">
                <Point>
                    <coordinates>-95, 35</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>
</map_request>
```

```

        </geometricProperty>
    </geoFeature>
</center>
<themes>
    <theme name="LRS_THEME"/>
</themes>
</map_request>

```

See Also: [Appendix A, "XML Format for Styles, Themes, Base Maps, and Map Tile Layers"](#) for reference information about elements and attributes specific to LRS themes (such as the `<join_table>` and `<join_columns>` elements).

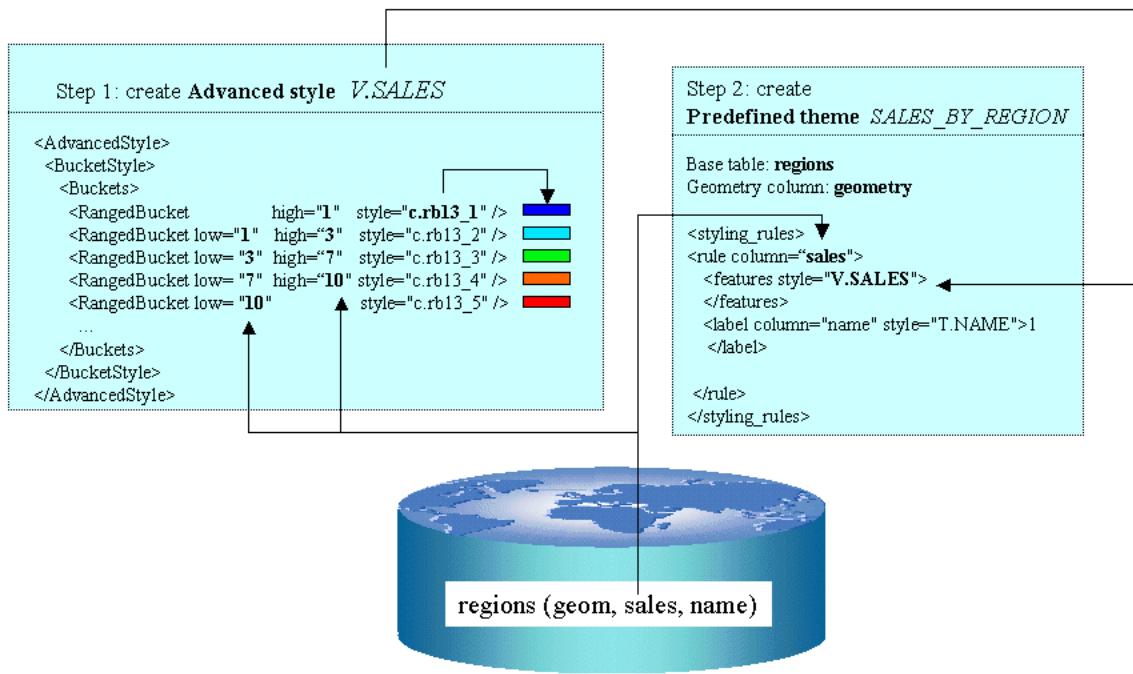
2.3.12 Thematic Mapping

Thematic mapping refers to the drawing of spatial features based on their attribute values. MapViewer uses thematic mapping to create maps in which colors or symbols are applied to features to indicate their attributes. For example, a Counties theme can be drawn using colors with different hues that map directly to the population density of each county, or an Earthquakes theme can be plotted with filled circles whose sizes map to the scale or damage of each earthquake.

To achieve thematic mapping, you must first create an advanced style that is suitable for the type of thematic map, and then create a theme for the features specifying the advanced style as the rendering style. In the styling rules for the theme, you must also specify attribute columns in the table or view whose values will be used to determine exactly how a feature will be rendered thematically by the advanced style.

For example, assume that you wanted to display a map in which the color used for each region reflects the level of sales for a particular product. To do this, create an advanced style that defines a series of individual range-based buckets (see [Section A.6.1.2](#)), where each bucket contains a predefined range of sales values for a product, and each bucket has an associated rendering style. (Each region will be rendered using the style associated with the range in which that region's sales value falls.) Also specify the name of the column or columns that provide the attribute values to be checked against the ranges. In other words, the advanced style defines how to map regions based on their sales values, and the theme's styling rules tie together the advanced style and the attribute column containing the actual sales values.

[Figure 2–13](#) shows the relationship between an advanced style and a theme, and how the style and the theme relate to the base table. In this figure, the advanced style named `V.SALES` defines the series of buckets. The predefined theme named `SALES_BY_REGION` specified the `V.SALES` style in its styling rules. The theme also identifies the `SALES` column in the `REGIONS` table as the column whose value is to be compared with the bucket ranges in the style. (Each bucket could be associated with a labeling style in addition to or instead of a rendering style, as explained in [Section 2.2.2](#).)

Figure 2–13 Thematic Mapping: Advanced Style and Theme Relationship

In addition to the individual range-based buckets shown in Figure 2–13, MapViewer supports other bucket styles, as explained in [Section A.6.1](#). You can also use more than one attribute column for thematic mapping, such as when drawing pie charts (explained in [Section 3.1.1.9](#)).

The rest of this section presents additional examples of thematic mapping.

[Example 2–41](#) is the XML definition for an Earthquakes theme.

Example 2–41 XML Definition of Styling Rules for an Earthquakes Theme

```
<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="nature">
  <rule column="RICHTER_SCALE">
    <features style="v.earthquakes" />
  </features>
  </rule>
</styling_rules>
```

The theme in [Example 2–41](#) has only one rule. The **<rule>** element includes an attribute named **column** that does not appear in the Airport theme in [Example 2–6](#). The **column** attribute specifies one or more columns (comma-delimited) that provide the attribute values needed for thematic mapping. The style specified for the **<features>** element is named **v.earthquakes**, and it is an advanced style.

Another part of the definition of the Earthquakes theme specifies the table that contains the data to be rendered. This table must contain a column named **RICHTER_SCALE** in addition to a column (of type **SDO_GEOOMETRY**) for the spatial data. (The table and the column of type **SDO_GEOOMETRY** must be identified in the **BASE_TABLE** and **GEOMETRY_COLUMN** columns, respectively, of the **USER_SDO_THEMES** view, which is described in [Section 2.9.2](#).) The **RICHTER_SCALE** column must be of type **NUMBER**. To understand why, look at the advanced style definition in [Example 2–42](#).

Example 2–42 Advanced Style Definition for an Earthquakes Theme

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <VariableMarkerStyle basemarker="m.circle" startsize="7" increment="4">
    <Buckets>
      <RangedBucket seq="0" label="less than 4" high="4"/>
      <RangedBucket seq="1" label="4 - 5" low="4" high="5"/>
      <RangedBucket seq="2" label="5 - 6" low="5" high="6"/>
      <RangedBucket seq="3" label="6 - 7" low="6" high="7"/>
      <RangedBucket seq="4" label="7 and up" low="7" />
    </Buckets>
  </VariableMarkerStyle>
</AdvancedStyle>
```

This style specifies that the marker named `m.circle` is used to indicate the location of an earthquake. The size of the marker to be rendered for an earthquake depends on the numeric value of the RICHTER_SCALE column for that row. In this example there are five buckets, each covering a predetermined range of values. For example, if an earthquake is of magnitude 5.7 on the Richter scale, the marker size will be 15 pixels ($7 + 4 + 4$), because the value 5.7 falls in the third bucket (5 - 6) and the starting marker size is 7 pixels (`startsize="7"`) with an increment of 4 for each range (`increment="4"`).

Note: The `label` attribute value (for example, `label="less than 4"`) is not displayed on the map, but is used only in a label that is compiled for an advanced style.

The `seq` attribute value (for example, `seq="0"`) is ignored by MapViewer, which determines sequence only by the order in which elements appear in a definition.

[Example 2–42](#) used the `<VariableMarkerStyle>` tag. The following examples use the `<ColorSchemeStyle>` tag in creating thematic maps of census blocks in California.

[Example 2–43](#) illustrates the use of a graduated color scale for a thematic mapping of population density. [Example 2–44](#) is a thematic mapping of average household income using a graduated color scale. [Example 2–45](#) is also a thematic mapping of average household income, but it uses a specific color style for each income range rather a graduated scale.

Example 2–43 Mapping Population Density Using a Graduated Color Scheme

```
# ca pop density usbg_hhinfo
<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="political">
<rule column="densitycy">
  <features style="v.CA Pop density">
    </features>
  </rule>
</styling_rules>
```

The table named USBG_HHINFO includes a column named DENSITYCY (used in [Example 2–43](#)). The definition of the style (`v.CA Pop density`) that corresponds to this population density theme is as follows:

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <ColorSchemeStyle basecolor="#ffff00" strokecolor="#00aaaa">
```

```

<Buckets low="0.0" high="20000.0" nbuckets="10"/>
</ColorSchemeStyle>
</AdvancedStyle>
```

The base color (`basecolor`) and the stroke color (`strokecolor`) are 24-bit RGB (red-green-blue) values specified using a hexadecimal notation. The base color value is used for the first bucket. The color value for each subsequent bucket is obtained by first converting the base color from the RGB to the HSB (hue-saturation-brightness) model and then reducing the brightness by a fixed increment for each bucket. Thus, the first bucket is the brightest and the last is the darkest.

As in [Example 2–43](#), [Example 2–44](#) illustrates the use of a base color and a graduated color scheme, this time to show household income.

Example 2–44 Mapping Average Household Income Using a Graduated Color Scheme

```

<?xml version="1.0" standalone="yes"?>
<!!-- # ca hh income theme table = usbg_hhinfo -->
<styling_rules>
<rule column="avghhicy">
  <features style="v.ca income">
    </features>
  </rule>
</styling_rules>
```

The table named USBG_HHINFO includes a column named AVGHHICY (used in [Example 2–44](#) and [Example 2–45](#)). The definition of the style (`v.ca income`) that corresponds to this average household income theme is as follows:

```

<?xml version="1.0" ?>
<AdvancedStyle>
  <ColorSchemeStyle basecolor="#ffff00" strokecolor="#00aaaa">
    <!!-- # income range with a color gradient -->
    <Buckets>
      <RangedBucket seq="0" label="less than 10k" high="10000"/>
      <RangedBucket seq="1" label="10-15k" low="10000" high="15000"/>
      <RangedBucket seq="2" label="15-20k" low="15000" high="20000"/>
      <RangedBucket seq="3" label="20-25k" low="20000" high="25000"/>
      <RangedBucket seq="4" label="25-35k" low="25000" high="35000"/>
      <RangedBucket seq="5" label="35-50k" low="35000" high="50000"/>
      <RangedBucket seq="6" label="50-75k" low="50000" high="75000"/>
      <RangedBucket seq="7" label="75-100k" low="75000" high="100000"/>
      <RangedBucket seq="8" label="100-125k" low="100000" high="125000"/>
      <RangedBucket seq="9" label="125-150k" low="125000" high="150000"/>
      <RangedBucket seq="10" label="150-250k" low="150000" high="250000"/>
      <RangedBucket seq="11" label="250-500k" low="250000" high="500000"/>
      <RangedBucket seq="12" label="500k and up" low="500000"/>
    </Buckets>
  </ColorSchemeStyle>
</AdvancedStyle>
```

For individual range-based buckets, the lower-bound value is inclusive, while the upper-bound value is exclusive (except for the range that has values greater than any value in the other ranges; its upper-bound value is inclusive). No range is allowed to have a range of values that overlaps values in other ranges.

[Example 2–45](#) uses specific color styles for each average household income range.

Example 2–45 Mapping Average Household Income Using a Color for Each Income Range

```
<?xml version="1.0" standalone="yes"?>
<!-- # ca hh income theme table = usbg_hhinfo -->
<styling_rules>
<rule column="avghhicy">
  <features style="v.ca income 2">
  </features>
</rule>
</styling_rules>
```

The definition of the v.ca income 2 style is as follows:

```
<?xml version="1.0" ?>
<AdvancedStyle>
<BucketStyle>
<Buckets>
  <!-- # income ranges with specific colors -->
  <RangedBucket seq="0" label="less than 10k" high="10000" style="c.rb13_1"/>
  <RangedBucket seq="1" label="10-15k" low="10000" high="15000" style="c.rb13_2"/>
  <RangedBucket seq="2" label="15-20k" low="15000" high="20000" style="c.rb13_3"/>
  <RangedBucket seq="3" label="20-25k" low="20000" high="25000" style="c.rb13_4"/>
  <RangedBucket seq="4" label="25-35k" low="25000" high="35000" style="c.rb13_5"/>
  <RangedBucket seq="5" label="35-50k" low="35000" high="50000" style="c.rb13_6"/>
  <RangedBucket seq="6" label="50-75k" low="50000" high="75000" style="c.rb13_7"/>
  <RangedBucket seq="7" label="75-100k" low="75000" high="100000" style="c.rb13_8"/>
  <RangedBucket seq="8" label="100-125k" low="100000" high="125000" style="c.rb13_9"/>
  <RangedBucket seq="9" label="125-150k" low="125000" high="150000" style="c.rb13_10"/>
  <RangedBucket seq="10" label="150-250k" low="150000" high="250000" style="c.rb13_11"/>
  <RangedBucket seq="11" label="250-350k" low="250000" high="350000" style="c.rb13_12"/>
  <RangedBucket seq="12" label="350k and up" low="350000" style="c.rb13_13"/>
</Buckets>
</BucketStyle>
</AdvancedStyle>
```

Each <RangedBucket> definition has a specified style.

The following examples create an advanced style to identify gasoline stations operated by different oil companies, and a theme that uses the style. A <CollectionBucket> tag is used to associate a column value (Shell; Esso; Texaco; BP; any of Avia, Benzinex, Q8, Total, Witte Pomp; and all others for a default category) with a style appropriate for that company's stations, as shown in [Example 2–46](#).

Example 2–46 Advanced Style Definition for Gasoline Stations Theme

```
<?xml version="1.0" ?>
<AdvancedStyle>
<BucketStyle>
<Buckets>
  <CollectionBucket seq="0" label="Shell" style="m.shell gasstation">
    Shell
  </CollectionBucket>
  <CollectionBucket seq="1" label="Esso" style="m.esso gasstation">
    Esso
  </CollectionBucket>
  <CollectionBucket seq="2" label="Texaco" style="m.texaco gasstation">
    Texaco
  </CollectionBucket>
  <CollectionBucket seq="3" label="BP" style="m.bp gasstation">
    BP
  </CollectionBucket>
  <CollectionBucket seq="4" label="Other" style="m.generic gasstation">
```

```

Avia,Benzinex,Q8,Total,Witte Pomp
</CollectionBucket>
<CollectionBucket seq="5" label="DEFAULT" style="m.default_gasstation">
#DEFAULT#
</CollectionBucket>
</Buckets>
</BucketStyle>
</AdvancedStyle>
```

Notes on [Example 2–46](#):

- `m.esso gasstation`, `m.texaco gasstation`, and the other style names have a space between the words in their names.
- The names are not case-sensitive. Therefore, be sure not to use case as a way of differentiating names. For example, `m.esso gasstation` and `M.ESSO GASSTATION` are considered the same name.
- A default collection bucket can be specified by using `#DEFAULT#` as its value. This bucket is used for any column values (gas station names) that are not specified in the other buckets.

A theme (`theme_gasstation`) is then defined that specifies the column (`MERK`) in the table that contains company names. The styling rules of the theme are shown in [Example 2–47](#).

Example 2–47 Styling Rules of Theme Definition for Gasoline Stations

```

<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <rule column="merk">
    <features style="v.gasstations">
    </features>
    <label column="merk" style="t.SansSerif red 10">
      1
    </label>
  </rule>
</styling_rules>
```

This theme depends on a table named `NED_GASSTATIONS`, which has the columns shown in [Table 2–2](#) (with column names reflecting the fact that the developer's language is Dutch).

Table 2–2 Table Used with Gasoline Stations Theme

Column	Data Type
FID	NOT NULL NUMBER
ID	NUMBER
NAAM	VARCHAR2(31)
STRAAT_	VARCHAR2(30)
NR	NUMBER
TV	VARCHAR2(1)
AAND	VARCHAR2(2)
PCODE	VARCHAR2(6)
PLAATS	VARCHAR2(10)
GEOM	SDO_Geometry

Table 2–2 (Cont.) Table Used with Gasoline Stations Theme

Column	Data Type
MERK	VARCHAR2(40)

In this table, the GEOM column contains spatial geometries, and the MERK column contains company names (Shell, Esso, and so on).

The styling rules for the theme_gasstation theme specify that the marker (style v.gasstations) at a location specified by the content of the GEOM column is determined by the value of the MERK column for that row. The style v.gasstations (see [Example 2–46](#)) specifies that if the column value is Shell, use the style m.shell_gasstation; if the column value is Esso, use the style m.esso_gasstation; and so on, including if the column value is any one of Avia, Benzinex, Q8, Total, and Witte Pomp, use the style m.generic_gasstation; and if the column value is none of the preceding, use the style m.default_gasstation.

2.3.12.1 Thematic Mapping Using External Attribute Data

Previous discussion of thematic mapping has assumed that both the attribute data (such as population of sales totals) and the geospatial data (geometry objects representing boundaries, locations, and so on) are in the same database. However, the attribute data can come from a source outside the current database; for example, the attribute data might reflect aggregated results of a business intelligence (BI) query performed on a different database, or the attribute data might come from a comma-delimited list of sales values exported from a spreadsheet. Such attribute data, from outside the database that contains the geospatial data, is called **external attribute data**.

To use external attribute data with MapViewer, you must use the **nonspatial data provider** plug-in mechanism, in which a custom data provider is associated with a MapViewer theme (predefined or dynamic) in the same map request. When MapViewer processes the theme, it calls the nonspatial data provider to join nonspatial attribute data with the spatial data that has been fetched for the theme.

To use a nonspatial data provider, follow these steps:

1. Implement your Java nonspatial data provider by implementing the MapViewer defined interface `oracle.mapviewer.share.ext.NSDataProvider`.
2. Register the nonspatial data provider implementation with MapViewer (in its configuration file). There you can also specify a set of global parameters that your implementation may depend on. Each custom data provider implementation class must have a unique ID that you assign.
3. Place a library containing the nonspatial data provider implementation classes in the library path of MapViewer, such as its `web/WEB-INF/lib` directory.
4. Include the nonspatial data provider implementation in a map request by invoking the following method on the MapViewer Java client API class `MapViewer`:

```
addNSDataProvider(java.lang.String providerId,
                 java.lang.String forTheme,
                 java.lang.String spatialKeyColumn,
                 java.lang.String customRenderingStyle,
                 java.util.Properties params,
                 long timeout)
```

For information about the addNSDataProvider parameters, see the Javadoc reference information for MapViewer, available at a URL in the form `http://host:port/mapviewer/mapclient`, where *host* and *port* indicate where Oracle Fusion Middleware listens for incoming requests. For example: `http://www.mycorp.com:8888/mapviewer/mapclient`

[Example 2–48](#) shows a simple nonspatial data provider implementation. This implementation is also supplied with MapViewer as a default nonspatial data provider.

Example 2–48 Nonspatial (External) Data Provider Implementation

```
import java.io.BufferedReader;
import java.io.FileReader;
import java.util.Properties;
import java.util.Vector;

import oracle.mapviewer.share.ext.NSDataset;
import oracle.mapviewer.share.ext.NSDataProvider;
import oracle.mapviewer.share.ext.NSRow;
import oracle.lbs.util.Logger;

import oracle.mapviewer.share.Field;

/**
 * A simple implementation of the NSDataProvider interface. When invoked, it
 * supplies tabular attribute data to MapViewer out
 * of a file or URL. The data in the file must be orgazined as following: <br>
 * <UL>
 *   <LI> The first line contain a single character which is the delimiter
 *       between columns in the subsequent lines.
 *   <LI> Each line after the first in the file represent one data row
 *   <LI> Each field in the row must be separated by the delimiter char only
 *   <LI> The first field in each line must be a string (key) that serves as the
 *       key; the rest of the fields must be numeric values
 * </UL>
 *
 * When incorporating this data provider in a map request, one of the following
 * two parameters must be specified:
 * <UL>
 *   <LI> file if the custom data is stored in a local file; this parameter
 *       specifies the full path to that file
 *   <LI> url if the custom data can be accessed from a web; this parameter
 *       specifeis the full URL to the data file.
 * </UL>
 *
 */
public class NSDataProviderDefault implements NSDataProvider
{
    private static Logger log = Logger.getLogger("oracle.sdovis.nsdpDefault");

    public boolean init(Properties params)
    {
        return true;
    }

    public NSDataset buildDataSet(Properties params)
    {
        String file = params.getProperty("file");
        ...
    }
}
```

```

        if(file!=null)
            return readFromFile(file);

        String url = params.getProperty("url");
        if(url!=null)
            return readFromUrl(url);

        log.error("Must supply either file or url for default NS data provider.");
        return null;
    }

    public void destroy()
    {
    }

    protected NSDataSet readFromFile(String file)
    {
        BufferedReader in = null;
        try{
            in = new BufferedReader(new FileReader(file));
            String line = in.readLine();
            String delimiter = line.substring(0,1);

            Vector rows = new Vector();

            while ( (line=in.readLine()) != null)
            {
                NSRow row = buildRow(line, delimiter);
                if(row!=null)
                    rows.add(row);
            }

            NSDataSet res = new NSDataSet(rows);
            return res;
        }catch(Exception ex)
        {
            log.error(ex);
            return null;
        } finally
        {
            try{
                if(in!=null)
                    in.close();
            }catch(Exception e){}
        }
    }

    protected NSDataSet readFromUrl(String url)
    {
        log.error("url not supported yet.");
        return null;
    }

    protected NSRow buildRow(String line, String delimiter)
    {
        if(line==null || line.length()<1)
            return null;

        String[] fields = line.split(delimiter);
        if(fields==null || fields.length==0)

```

```
        return null;

Field[] row = new Field[fields.length];

Field a = new Field(fields[0]);
a.setKey(true);

row[0] = a;

for (int i = 1; i < fields.length; i++)
{
    try{
        double d = Double.parseDouble(fields[i]);
        a = new Field(d);
        row[i] = a;
    }catch(Exception e)
    {
        log.warn("invalid row field (key="+fields[0]+")");
        return null;
    }
}

return new NSRow(row);
}
```

2.3.13 Attributes Affecting Theme Appearance

Some attributes of the `<theme>` element affect only the appearance of the map display, rather than determining the data to be associated with the theme. These appearance-related attributes control whether and how the theme is processed and rendered when a map is generated. Examples include the following attributes:

- `min_scale` and `max_scale` determine whether or not a theme is displayed at various map scales (levels of resolution). For example, if you are displaying a map of streets, there are certain map scales at which the streets would become too dense for a usable display, such as when viewing an entire state or province. In this case, you should create a theme for streets, and specify minimum and maximum scale values to ensure that individual streets affected by the theme are displayed when the scale is appropriate and otherwise are not displayed.
 - `labels_always_on` determines whether or not labels for the theme will be displayed if they would overlap another label. By choosing appropriate `labels_always_on` values and choosing an appropriate order of themes to be processed within a map request, you can control how cluttered the labels might become and which labels have priority in getting displayed.
 - `fast_unpickle` determines the unpickling (unstreaming) method to be used, which can involve a trade-off between performance and precision in the display.
 - `fixed_svglabel`, `visible_in_svg`, `selectable_in_svg`, `onclick`, `onmousemove`, `onmouseover`, and `onmouseout` affect the appearance of SVG maps.

To specify any appearance-related attributes, use the `<theme>` element (described in [Section 3.1.2.20](#)) with the XML API or the JavaBean-based API (see especially [Section 4.3](#)).

2.4 Maps

A map can consist of a combination of elements and attributes, such as the following:

- Background image
- Title
- Legend
- Query window
- Footnote (such as for a copyright notice)
- Base map
- Predefined themes (in addition to any in the base map)
- JDBC themes (with dynamic queries)
- Dynamically defined (temporary) styles

These elements and attributes, when specified in a map request, define the content and appearance of the generated map. [Chapter 3](#) contains detailed information about the available elements and attributes for a map request.

A map can have a base map and a stack of themes rendered on top of each other in a window. A map has an associated coordinate system that all themes in the map must share. For example, if the map coordinate system is 8307 (for *Longitude / Latitude (WGS 84)*, the most common system used for GPS devices), all themes in the map must have geometries defined using that coordinate system.

You can add themes to a map by specifying a base map name or by using the programming interface to add themes. The order in which the themes are added determines the order in which they are rendered, with the last specified theme on top, so be sure you know which themes you want in the background and foreground.

All base map names and definitions for a database user are stored in that user's USER_SDO_MAPS view, which is described in [Section 2.9](#) and [Section 2.9.3](#). The DEFINITION column in the USER_SDO_MAPS view contains an XML definition of a base map.

[Example 2–49](#) shows a base map definition.

Example 2–49 XML Definition of a Base Map

```
<?xml version="1.0" ?>
<map_definition>
  <theme name="theme_us_states"      min_scale="10"  max_scale="0"/>
  <theme name="theme_us_parks"       min_scale="5"   max_scale="0"/>
  <theme name="theme_us_highways"    min_scale="5"   max_scale="0"/>
  <theme name="theme_us_streets"     min_scale="0.05" max_scale="0"/>
</map_definition>
```

Each theme in a base map can be associated with a visible scale range within which it is displayed. In [Example 2–49](#), the theme named theme_us_streets is not displayed unless the map request is for a map scale of 0.05 or less and greater than 0 (in this case, a scale showing a great deal of detail). If the min_scale and max_scale attributes are not specified, the theme is displayed whenever the base map is displayed. (For more information about map scale, see [Section 2.4.1](#).)

The display order of themes in a base map is the same as their order in the base map definition. In [Example 2–49](#), the theme_us_states theme is rendered first, then theme_

`us_parks`, then `theme_us_highways`, and finally (if the map scale is within all specified ranges) `theme_us_streets`.

This section contains the following major subsections:

- [Section 2.4.1, "Map Size and Scale"](#)
- [Section 2.4.2, "Map Legend"](#)

2.4.1 Map Size and Scale

Map size is the height of the map in units of the map data space. For example, if the map data is in WGS 84 geographic coordinates, the map center is (-120.5, 36.5), and the size is 2, then the height of the map is 2 decimal degrees, the lower Y (latitude) value is 35.5 degrees, and the upper Y value is 37.5 decimal degrees.

Map scale is expressed as units in the user's data space that are represented by 1 inch on the screen or device. Map scale for MapViewer is actually the denominator value in a popular method of representing map scale as $1/n$, where:

- 1, the numerator, is 1 unit (1 inch for MapViewer) on the displayed map.
- n , the denominator, is the number of units of measurement (for example, decimal degrees, meters, or miles) represented by 1 unit (1 inch for MapViewer) on the displayed map.

For example:

- If 1 inch on a computer display represents 0.5 decimal degree of user data, the fraction is $1/0.5$. The decimal value of the fraction is 2.0, but the scale value for MapViewer is 0.5.
- If 1 inch on a computer display represents 2 miles of user data, the fraction is $1/2$. The decimal value of the fraction is 0.5, but the scale value for MapViewer is 2.
- If 1 inch on a computer display represents 10 miles of user data, the fraction is $1/10$. The decimal value of the fraction is 0.1, but the scale value for MapViewer is 10.

The `min_scale` and `max_scale` attributes in a `<theme>` element describe the visible scale range of a theme. These attributes control whether or not a theme is displayed, depending on the current map scale. The default scale value for `min_scale` is positive infinity, and the default value for `max_scale` is negative infinity (or in other words, by default display the theme for all map scales, if possible given the display characteristics).

- `min_scale` is the value to which the display must be zoomed in for the theme to be displayed. For example, if parks have a `min_scale` value of 5 and if the current map scale value is 5 or less but greater than the `max_scale` value, parks will be included in the display; however, if the display is zoomed out so that the map scale value is greater than 5, parks will not be included in the display.
- `max_scale` is the value beyond which the display must be zoomed in for the theme not to be displayed. For example, if counties have a `max_scale` value of 3 and if the current map scale value is 3 or less, counties will not be included in the display; however, if the display is zoomed out so that the map scale value is greater than 3, counties will be included in the display.

A high `min_scale` value is associated with less map detail and a smaller scale in cartographic terms, while a high `max_scale` value is associated with greater map detail and a larger scale in cartographic terms. (Note that the MapViewer meaning of map scale is different from the popular meaning of cartographic map scale.) The `min_scale`

value for a theme should be larger than the `max_scale` value. [Example 2–49](#) in [Section 2.4](#) includes `min_scale` and `max_scale` values.

You also assign scale values for theme labels, to enable the showing or hiding of labels with values different from the base theme scales, by using the theme label scale parameters `label_min_scale` and `label_max_scale`. These parameters are similar to the `min_scale` and `max_scale` parameters, but the labels are shown if the map scale is in the visible range defined by `label_min_scale` and `label_max_scale`. (The label scale values are ignored if the theme is not in the visible scale range defined by `min_scale` and `max_scale`.) The following is a theme definition with label scale values; the labels will be shown when the map scale is between 5 and 2, but the theme features will be shown when the map scale is between 10 and 0:

```
<theme name="theme_us_states" min_scale="10" max_scale="0"
      label_min_scale="5" label_max_scale="2"/>
```

To determine the current map scale for a map returned by MapViewer, first find the map size, namely the height (vertical span) of the map in terms of the coordinate system associated with the map data. For example, assume that a map with a height of 10 (miles, meters, decimal degrees, or whatever unit of measurement is associated with the data) is requested, and that the map is drawn on a device with a size of 500 by 350 pixels, where 350 is the height. MapViewer assumes a typical screen resolution of 96 dpi. Because 96 pixels equals 1 inch, the height of the returned map is 3.646 inches ($350/96 = 3.646$). In this example, the size of the map is 10, and therefore the map scale is approximately 2.743 ($10/3.646 = 2.743$).

Alternatively, you can request a map using a map scale value without specifying a unit, such as 50000 for a scale of 1:50000, by specifying the `scale_mode` theme attribute value as `ratio`. (If the `scale_mode` theme attribute value is `screen_inch`, the scale refers to a unit.) To use a scale defined without a unit, request the map specifying the center and ratio scale.

To find the equivalent MapViewer screen inch scale for a ratio scale, follow these steps:

1. Find the numerical fraction of a meter associated with one screen pixel. For example, if the screen resolution is 96 dpi (dots per inch), the number of meters on the screen for each screen pixel is 0.000265 (that is, $0.0254/96$).
2. Find the map scale for one screen pixel (the `mapdotScale` value), as follows:
 - For projected data (meters), multiply the result of step 1 by the ratio scale. For example, if the ratio scale is 50000 (50 thousand) and the screen resolution is 96 dpi, the result is 13.25 meters for each pixel ($50000 * 0.000265$).
 - For geodetic data (degrees), multiply the result of step 1 by the number of meters (on the surface of the Earth) for each degree. (This number will depend on the coordinate system associated with the data.) For example, if one degree = 111195 meters and if the screen resolution is 96 dpi, the result is 29.466675 meters for each pixel ($111195 * 0.000265$).
 - For data using any other unit, use the approach for projected data using meters.
3. Because the MapViewer scale is per screen inch instead of per screen pixel, multiply the result of step 2 by the dpi value. For example, if the result of step 2 is 13.25 meters at 96 dpi, the number of meters for each screen inch is 1272 ($13.25 * 96$).

2.4.2 Map Legend

A **map legend** is an inset illustration drawn on top of the map and describing what various colors, symbols, lines, patterns, and so on represent. You have flexibility in specifying the content and appearance of the legend. You can:

- Customize the background, border style, and font
- Have one or more columns in the legend
- Add space to separate legend entries
- Indent legend entries
- Use any MapViewer style, including advanced styles

[Example 2–50](#) is an excerpt from a request that includes a legend.

Example 2–50 Legend Included in a Map Request

```
<?xml version="1.0" standalone="yes"?>
<map_request
    basemap="density_map"
    datasource = "mvdemo"
    width="640"
    height="480"
    bgcolor="#a6cae0"
    antialiase="false"
    format="PNG_STREAM">
    <center size="4.2">
        <geoFeature render_style="m.image134_bw">
            <geometricProperty typeName="center">
                <Point srsName="SDO:8307">
                    <coordinates>-121.2615, 37.5266</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>

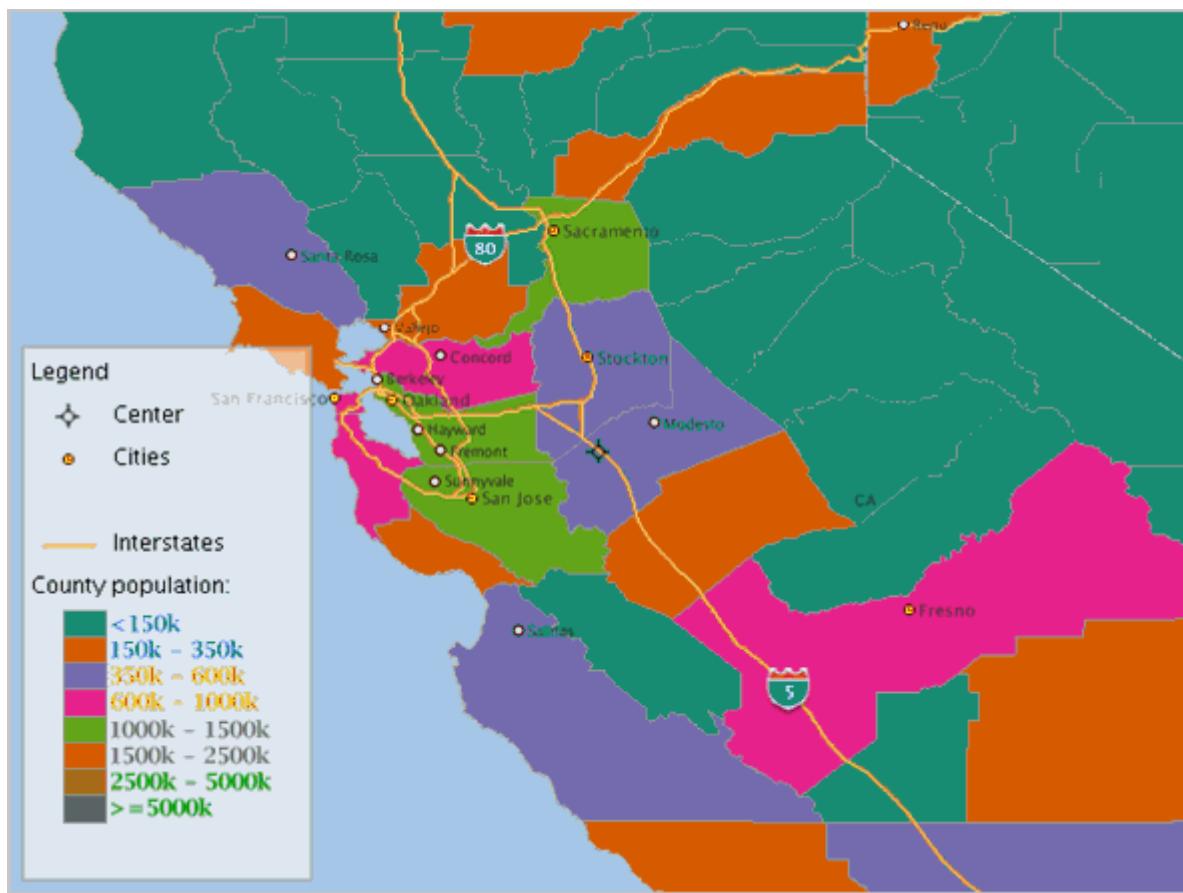
    <legend bgstyle="fill:#ffffff;fill-opacity:100;stroke:#a3a3a3" profile="MEDIUM"
position="SOUTH_WEST">
        <column>
            <entry text="Legend" is_title="true" />
            <entry style="M.IMAGE134_BW" text="Center" />
            <entry style="M.ALL_CITY_L2" text="Cities" />
            <entry is_separator="true" />
            <entry style="L.S04_ROAD_INTERSTATE" text="Interstates" />
            <entry text="County population:" />
            <entry style="V.COUNTY_POP_DENSITY_8" tab="1" />
        </column>
    </legend>

    <!--
    <themes>

        </themes>
    -->
</map_request>
```

[Figure 2–14](#) shows a map with the legend specified in [Example 2–50](#).

Figure 2–14 Map with Legend



Notes on Example 2–50 and Figure 2–14:

- This example shows a legend with a single column, although you can create multiple columns in a legend.
- Each entry in the column definition can identify label text and whether the text is the legend title (`is_title="true"`), a style name and associated text, or a separator (`is_separator="true"`) for vertical blank space to be added (after the `cities` entry in this example).

As an alternative to specifying the legend content in one or more `<column>` elements, you can request an **automatic legend** based on the map request. With an automatic legend, you specify the legend header, and MapViewer generates the legend based on the themes that have any interaction with the map area. Themes from the map request and from the base map are considered. (Some legend items might not be visible, though, such as if a theme interacts with the query window but no features of the theme are visible on the map.)

[Example 2–51](#) is a map request that requests an automatic legend (because the `<legend>` element does not include any `<column>` elements).

Example 2–51 Map Request with Automatic Legend

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="Automatic legend"
    datasource = "mvdemo"
    width="640"
```

```

        height="480"
        bgcolor="#a6cae0"
        antialiase="false"
        format="PNG_STREAM">
<center size="4.5">
    <geoFeature >
        <geometricProperty typeName="center">
            <Point>
                <coordinates>-122.2615, 37.5266</coordinates>
            </Point>
        </geometricProperty>
    </geoFeature>
</center>

<themes>
    <theme name="THEME_COUNTIES_3397829" />
    <theme name="THEME_US_ROAD1" />
    <theme name="THEME_US_AIRPORT" />
</themes>

<legend bgstyle="fill:#ffffff;fill-opacity:128;stroke:#ff0000;stroke-opacity:128"
profile="medium" font="Courier">
    <themes>
</map_request>

```

[Example 2–52](#) requests an automatic legend in which the `<legend>` elements specifies the themes to be used to generate the legend items. In this example, even if the map result shows more themes, the legend items are based on the `THEME_COUNTIES_3397829` and `THEME_US_AIRPORT` themes specified in the `<legend>` element.

Example 2–52 Automatic Legend with Themes Specified

```

<map_request
        title="Legend with themes defined"
        datasource = "mvdemo"
        width="640"
        height="480"
        bgcolor="#a6cae0"
        antialiase="false"
        format="PNG_STREAM">
<center size="4.5">
    <geoFeature >
        <geometricProperty typeName="center">
            <Point>
                <coordinates>-122.2615, 37.5266</coordinates>
            </Point>
        </geometricProperty>
    </geoFeature>
</center>

<themes>
    <theme name="THEME_COUNTIES_3397829" />
    <theme name="THEME_US_ROAD1" />
    <theme name="THEME_US_AIRPORT" />
</themes>

<legend bgstyle="fill:#ffffff;fill-opacity:128;stroke:#ff0000;stroke-opacity:128"
profile="medium" font="Courier">
    <themes>
</map_request>

```

```

<theme name="THEME_COUNTIES_3397829" />
<theme name="THEME_US_AIRPORT" />
</themes>
</legend>

</map_request>

```

You cannot combine an automatic legend with the use of <column> elements. If the <legend> element contains any <column> elements, a column/entry legend is created.

MapViewer used the following considerations when it builds automatic legend items:

- Each legend column has a maximum of five entries (an advanced style is considered one entry).
- The legend text for simple rendering styles comes from the theme description if defined, otherwise from the theme name.
- If a rendering style is used in more than one theme, the style is repeated in the legend but with text related to the theme to which it applies.
- Labeling styles are not repeated in the legend. The style text for labeling styles comes from the style description.
- Advanced styles are not repeated in the legend.

For detailed information about adding a legend to a map request, see [Section 3.1.2.11](#).

If you also specify a map title, note, or logo (or any combination), be sure that the legend and the other features have different positions. (Map titles, notes, and logos are explained in [Section 1.6.2.5](#).) The default position for a legend is SOUTH_WEST.

2.5 Data Sources

A data source corresponds to a database schema or user. Before you can draw any spatial data in a database schema, you must first define (create) a data source for the schema, either permanently or dynamically:

- You can define a data source permanently by specifying its connection information and user login credentials in the MapViewer configuration file (`mapViewerConfig.xml`).
- You can define or modify a data source dynamically using the MapViewer administration (Admin) page.

Each map request must specify a master data source. You can, however, specify a different data source for individual themes added to the map request. This makes it easy to aggregate data stored across different database schemas. If a theme has no specified data source, it is associated with the master data source. A base map (and thus the themes included in it) is always associated with the master data source. When a theme is processed, all of its underlying data, as well as the styles referenced in its definition, must be accessible from the data source or sources associated with the theme.

Each data source has associated renderers (sometimes called mappers or map makers), the number of which is determined by the `number_of_mappers` attribute in the <map_data_source> element. This attribute (described in [Section 1.6.2.15](#)) affects the number of database connections created for each data source when map requests are processed. The number of renderers specified in a data source also is the maximum number of concurrent requests that can be processed for that data source. Each additional renderer requires only a small amount of memory, so the main potential

disadvantage of specifying a large number of renderers (such as 100) is that the underlying CPU resource might be strained if too many map requests are allowed to come through, thus affecting the performance of the entire MapViewer server.

Each data source has its own internal metadata cache. The metadata cache holds the definitions of all accessed styles, as well as of all predefined themes that originate from the data source. This eliminates the need to query the database repeatedly for the definition of a style or predefined theme whenever it is needed.

Related:

- [Catalog Data Sources](#)

2.5.1 Catalog Data Sources

A catalog data source gets all of its data from local files. The local directory where the data files are stored is relative to where the `mapViewerConfig.xml` file is stored. From another perspective, a catalog data source does not need the Oracle database, because all necessary data (the spatial geometry data and its attributes, as well as the metadata for how to rend the spatial data, such as styles and themes) is stored in local files.

The following are the general steps for creating and using a catalog data source:

1. [Export the Necessary Metadata from an Oracle Database](#)
2. [Export the Necessary Spatial Tables](#)
3. [Edit the MapViewer Configuration File to Add the Catalog Data Source](#)
4. [Restart the MapViewer Server](#)

2.5.1.1 Export the Necessary Metadata from an Oracle Database

Before creating a catalog data source, you must use the Map Builder utility to export the metadata to `USER_SDO_CACHED_MAPS.xml`, `USER_SDO_THEMES.xml`, and `USER_SDO_STYLES.xml` files. The following considerations apply:

- Only external tile layers are supported in catalog data source. So, the tile layers exported into `USER_SDO_CACHED_MAPS.xml` must be external tile layers, such as Bing Maps or Oracle eLocation map services.
 - All styles needed by the themes in `USER_SDO_THEMES.xml` must be exported in to the `USER_SDO_STYLES.xml` file.
 - You need note all required spatial data tables (themes' base tables from which to fetch spatial data) used by all of the exported themes, so that you can export each base table into a GeoJSON file (explained in [Export the Necessary Spatial Tables](#)).
1. In the Map Builder utility, select **Tools**, then **Export Metadata to XML**.
 2. Select a temporary directory to store the metadata.
 3. Accept the default prefix (`USER_SDO_`) for the table names.
 4. Select the tile layers, themes, and styles to export. (If you are not sure which styles are needed for the desired themes, you may export all styles.)
 5. Click **OK** to perform the export operation.

The `USER_SDO_CACHED_MAPS.xml`, `USER_SDO_THEMES.xml`, and `USER_SDO_STYLES.xml` files are created in the specified directory.

2.5.1.2 Export the Necessary Spatial Tables

For a catalog data source, the spatial data sets are stored in GeoJSON files. One GeoJSON file corresponds to one spatial table in the database. To export spatial tables, you send requests to the MapViewer server.

For example, if a spatial table called OBIEE_COUNTRY is needed by a catalog data source theme (assume that the theme is also called OBIEE_COUNTRY) in the USER_SDO_THEMES.xml file, then this spatial table needs to be exported as a GeoJSON file. As a convention, you may name it with the same name as the name of the spatial table. In this case, it is named as OBIEE_COUNTRY.json.

1. Check the themes definition from the USER_SDO_THEMES.xml file. For example, if a theme named OBIEE_COUNTRY uses the OBIEE_COUNTRY spatial table, then the spatial table needs to be exported. The table's columns and expected names must be identified, and the column names are the same as the name attributes in the theme definition. In the following example, the ISO_COUNTRY_CODE column is mapped as Country Code:

```
<theme>
  <name>OBIEE_COUNTRY</name>
  <description><! [CDATA[OBIEE Country]]></description>
  <base_table>OBIEE_COUNTRY</base_table>
  <geometry_column>GEOMETRY</geometry_column>
  <styling_rules><! [CDATA[<?xml version="1.0" standalone="yes"?><styling_
rules>
  <hidden_info>
    <field column="ISO_COUNTRY_CODE" name="Country Code"/>
    <field column="NAME" name="Country Name"/>
    <field column="NAME_INIT" name="Country Name (Init)"/>
  </hidden_info>
  <rule>
    <features style="C.AIRPORTS"> </features>
    <label column="NAME_LABEL" style="T.COUNTRY_NAME_10"> 1 </label>
  </rule>
</styling_rules>]]></styling_rules>
</theme>
.
.
```

2. Identify the spatial table columns. In the following example, base table OBIEE_COUNTRY has the spatial geometry column named GEOMETRY:

```
SQL> describe obiee_country
Name          Null?    Type
-----
NAME           VARCHAR2(255 CHAR)
NAME_INIT      VARCHAR2(1020 CHAR)
OBIEE_LOWER    VARCHAR2(1020 CHAR)
ISO_COUNTRY_CODE VARCHAR2(5)
SQKM           NUMBER(11)
NAME_LABEL     VARCHAR2(255 CHAR)
GEOMETRY       MDSYS.SDO_Geometry
```

3. Create request strings to the MapViewer data server. For example, if OBIEE_COUNTRY is the base table, and MapViewer is running at localhost:8080, and if the data source name is my_ds_name with spatial data retrieval enabled, you can send a request string like the following:

```
http://localhost:8080/mapviewer/dataserver/my_ds_name?t=obiee_
country&sql=select iso_country_code as id, iso_country_code as "country Code",
name as "Country Name", name_init as "Country Name (Init)", name_label,
```

```
geometry from obiee_country&id_col=id&simplify=true&threshold=90&include_label_box=true
```

You can save the data set with a name OBIEE_COUNTRY.json in this case to the temporary folder where the exported metadata (the USER_SDO_CACHED_MAPS.xml, USER_SDO_THEMES.xml, and USER_SDO_STYLES.xml files) is stored.

2.5.1.3 Edit the MapViewer Configuration File to Add the Catalog Data Source

Edit the mapViewerConfig.xml file and add the catalog data source. For example:

```
<map_data_source name="catalogds1"
    catalog_dir="../catalogs/datafolder1"
    private="true"
    number_of_mappers="3"
    allow_jdbc_theme_based_foi="true"
    editable="false"/>
```

For the preceding catalog data source definition, you must create the specified catalog_dir folder relative to where the mapViewerConfig.xml file is stored, and then copy all data files into the folder: that is, the three exported metadata files (USER_SDO_CACHED_MAPS.xml, USER_SDO_THEMES.xml, and USER_SDO_STYLES.xml) and all exported GeoJSON files, such as OBIEE_COUNTRY.json in this example.

2.5.1.4 Restart the MapViewer Server

Restart the MapViewer server.

After the MapViewer server is restarted, all the exported tile layers and themes should be accessible from this catalog data source. For example, you should see a map image if you send a map request like the following:

```
http://localhost:8080/mapviewer/omserver?xml_request=<?xml version="1.0"
standalone="yes"?> <map_request datasource = "catalogds1" width="1024"
height="768" format="PNG_STREAM"> <center size="200">
<geoFeature><geometricProperty typeName="center"> <Point> <coordinates>0,
0</coordinates> </Point> </geometricProperty></geoFeature> </center> <themes>
<theme name="OBIEE_COUNTRY"> </theme> </themes> </map_request>
```

2.6 How a Map Is Generated

When a map request arrives at the MapViewer server, the server picks a free renderer associated with the master data source in the request. This section describes the process that the MapViewer server follows to generate a map. In brief, MapViewer performs the following steps:

1. Parse and process the incoming XML map request.
2. Prepare the data for each theme (executed in parallel).
3. Render and label each theme.
4. Generate final images or files.

Each map generated by MapViewer results from its receiving a valid XML map request. (If you use the JavaBean-based API, the request is automatically converted to an XML document and passed to the MapViewer server.) The XML map request is parsed and its content is validated. MapViewer then creates any dynamic styles specified in the XML request. It builds a theme list from all themes included in the base map (if a base map is specified), as well as any specified predefined or JDBC themes. All individual features in the request are grouped into a single temporary

theme. In other words, after parsing the incoming request, all data that must be shown on the map is presented in a list of themes to the MapViewer rendering engine.

The ordering of the themes in the list is important, because it determines the order in which the themes are rendered. All themes included in the base map (when present) are added to the list first, followed by all specified themes (predefined or JDBC). The theme that contains all the individual features is added as the last theme on the list. Any other requested features of a map (such as legend, map title, or footnote), are created and saved for rendering later.

For each theme in the request, MapViewer then creates a separate execution thread to prepare its data, so that preparation of the themes takes place in parallel. For a predefined theme, this means formulating a query based on the theme's definition and any other information, such as the current map request window. This query is sent to the database for execution, and the result set is returned. MapViewer creates individual renderable objects based on the result set.

- For predefined themes that are fully cached, no query is sent to the database, because all renderable objects are readily available.
- For JDBC themes, the query supplied by the user is either executed as is (when the `asis` attribute value is `TRUE` in the JDBC theme definition) or with a spatial filter subquery automatically applied to it. The spatial filter part is used to limit the results of the user's query to those within the current requested window.
- For themes that already have renderable features (such as the one containing all individual features in a request), there is no need to create renderable objects.

After all themes for the map request have been prepared and all necessary data has been collected, MapViewer starts to render the map. It creates an empty new in-memory image to hold the result map, and paints the empty image with the necessary backgrounds (color or image). It then renders all of the themes in the theme list.

Note: All image or GeoRaster themes are always rendered first, regardless of their position in the theme list. All other themes, however, are rendered in the order in which they appear in the theme list.

For each theme, features are rendered in an order determined internally by MapViewer. The rendering of each feature involves invoking the drawing methods of its rendering style. After all themes have been rendered, the labeling process starts. For each theme whose features must be labeled with text, MapViewer invokes algorithms to label each feature, with the specific algorithm depending on the type of feature (such as polygon or line).

After all themes have been rendered and (when needed) labeled, MapViewer plots any additional map features (such as a legend) on the internal map image. MapViewer then converts that image into the desired format (such as PNG or GIF) specified in the original map request; however, for SVG maps, instead of using an internal image, MapViewer initially creates an empty SVG map object, then creates an SVG document as a result of the rendering process, and inserts it into the map object.

2.7 Cross-Schema Map Requests

A database user can issue a map request specifying a theme that uses data associated with another database user, to select data from tables that the other data source user is

authorized to access. For example, assume that user SCOTT wants to issue a map request using data associated with user MVDEMO. In general, user SCOTT must be granted SELECT access on relevant tables owned by user MVDEMO, and the `<theme>` element should generally specify any tables in *schema-name.table-name* format. In this example scenario:

- For a geometry table, grant the SELECT privilege on the geometry table of MVDEMO to SCOTT (see [Example 2–53](#)).
- For a GeoRaster table, grant the SELECT privilege on the GeoRaster table and raster data table or tables of MVDEMO to SCOTT (see [Example 2–54](#)).
- For a topology data model table, grant the SELECT privilege on the topology table, topology column index table, and related topology information tables (*topology-name_EDGE\$*, *topology-name_NODE\$*, *topology-name_FACE\$*, *topology-name_RELATION\$*) of MVDEMO to SCOTT (see [Example 2–55](#)).
- For network data model tables, grant the SELECT privilege on the network link, node, path, and path-link tables of MVDEMO to SCOTT (see [Example 2–56](#)).

[Example 2–53](#) shows a dynamic theme that accesses the MVDEMO.STATESTES geometry table from a data source defined on the SCOTT user.

Example 2–53 Cross-Schema Access: Geometry Table

```
SQL> grant select on STATES to SCOTT;
. . .
<themes>
  <theme name="themel">
    <jdbc_query
      datasource="scottds"
      spatial_column="geom"
      render_style="MVDEMO:C.COUNTIES"
      jdbc_srid="8265"
      >SELECT geom from MVDEMO.STATESTES</jdbc_query>
  </theme>
</themes>
```

[Example 2–54](#) shows a dynamic theme that accesses the MVDEMO.GEORASTER_TABLE GeoRaster table and its RDT from a data source defined on the SCOTT user. Specify the base (GeoRaster) table in *schema-name.table-name* format.

Example 2–54 Cross-Schema Access: GeoRaster Table

```
SQL> grant select on GEORASTER_TABLE to SCOTT;
SQL> grant select on RDT_GEO1 to SCOTT;
. . .
<themes>
  <theme name="georaster_theme">
    <jdbc_georaster_query
      georaster_table="MVDEMO.georaster_table"
      georaster_column="georaster"
      raster_table="rdt_geor1"
      raster_id="1"
      jdbc_srid="8307"
      datasource="scottds"
      asis="false">
    </jdbc_georaster_query>
  </theme>
</themes>
```

[Example 2–55](#) shows a dynamic theme that accesses the MVDEMO.LAND_PARCELS topology table and information tables for the CITY_DATA topology from a data source defined on the SCOTT user. Specify the feature table and the topology in *schema-name.object-name* format, if they are owned by a different schema than the one associated with the data source.

Example 2–55 Cross-Schema Access: Topology Feature Table

```
SQL> grant select on CITY_DATA_FACE$ to SCOTT;
SQL> grant select on CITY_DATA_EDGE$ to SCOTT;
SQL> grant select on CITY_DATA_NODE$ to SCOTT;
SQL> grant select on CITY_DATA_RELATION$ to SCOTT;
SQL> grant select on LAND_PARCELS to SCOTT;
SQL> grant select on <topology-column-index-table-name> to SCOTT;
. . .
<themes>
  <theme name="topo_theme" >
    <jdbc_topology_query
      topology_name="MVDEMO.CITY_DATA"
      feature_table="MVDEMO.LAND_PARCELS"
      spatial_column="FEATURE"
      render_style="MVDEMO:C.COUNTIES"
      jdbc_srid="0"
      datasource="scottds"
      asis="false">select feature from MVDEMO.land_parcels
    </jdbc_topology_query>
  </theme>
</themes>
```

In [Example 2–55](#), you must grant SELECT on the topology column index table name (<topology-column-index-table-name>) because the spatial index table associated with the feature table topology column is used by MapViewer in topology queries. You can determine the topology column index table name as follows. Assume the following information:

- Topology feature table owner: MVDEMO
- Topology feature table name: LAND_PARCELS
- Topology feature table topology column name: FEATURE

The following query returns the index table name (in this example, MDTP_14E60\$):

```
SQL> select sdo_index_table from all_sdo_index_info
  where table_owner = 'MVDEMO'
    and table_name = 'LAND_PARCELS'
    and column_name = 'FEATURE'

SDO_INDEX_TABLE
-----
MDTP_14E60$
```

Then, modify the last GRANT statement in [Example 2–55, "Cross-Schema Access: Topology Feature Table"](#) to specify the <topology-column-index-table-name>. In this case:

```
SQL> grant select on MDTP_14E60$ to SCOTT;
```

[Example 2–56](#) shows a dynamic theme that accesses the MVDEMO.BI_TEST network and its link, node, path, and path-link tables. Specify the network name in *schema-name.network-name* format.

Example 2–56 Cross-Schema Access: Network Tables

```

SQL> grant select on BI_TEST_LINK$ to SCOTT;
SQL> grant select on BI_TEST_NODE$ to SCOTT;
SQL> grant select on BI_TEST_PATH$ to SCOTT;
SQL> grant select on BI_TEST_PLINK$ to SCOTT;
. . .
<themes>
  <theme name="net_theme" >
    <jdbc_network_query
      network_name="MVDEMO.BI_TEST"
      network_level="1"
      jdbc_srid="0"
      datasource="scottds"
      link_style="MVDEMO:C.RED"
      node_style="MVDEMO:M.CIRCLE"
      node_markersize="5"
      asis="false">
    </jdbc_network_query>
  </theme>
</themes>

```

2.8 Workspace Manager Support in MapViewer

Workspace Manager is an Oracle Database feature that lets you version-enable one or more tables in the database. After a table is version-enabled, users in a workspace automatically see the correct version of database rows in which they are interested. For detailed information about Workspace Manager, see *Oracle Database Workspace Manager Developer's Guide*.

You can request a map from a specific workspace, at a specific savepoint in a workspace, or at a point close to a specific date in a workspace. The following attributes of the `<theme>` element are related to support for Workspace Manager:

- `workspace_name` attribute: specifies the name of the workspace from which to get the map data.
- `workspace_savepoint` attribute: specifies the name of the savepoint to go to in the specified workspace.
- `workspace_date` attribute: specifies the date to go to (that is, a point at or near the specified date) in the specified workspace.
- `workspace_date_format` attribute: specifies the date format. The default is `mmddyyyyhh24miss`. This attribute applies only if you specified the `workspace_date` attribute.
- `workspace_date_nlsparam` attribute: specifies globalization support options. The options and default are the same as for the `nlsparam` argument to the `TO_CHAR` function for date conversion, which is described in *Oracle Database SQL Language Reference*.
- `workspace_date_tswtz` attribute: specifies a Boolean value. `TRUE` means that the input date is in timestamp with time zone format; `FALSE` (the default) means that the input date is a date string.

The `workspace_name` attribute is required for the use of Workspace Manager support in MapViewer.

If you specify neither the `workspace_savepoint` nor `workspace_date` attribute, MapViewer goes to the latest version of the workspace defined. If you specify both the

`workspace_savepoint` and `workspace_date` attributes, MapViewer uses the specified date instead of the savepoint name.

[Example 2–57](#) shows the definition of a dynamic theme that uses attributes (shown in bold) related to Workspace Manager support. In this example, MapViewer will render the data related to workspace `wsp_1` at the savepoint `sp1`.

Example 2–57 Workspace Manager-Related Attributes in a Map Request

```
<?xml version="1.0" standalone="yes"?>
<map_request
  . . .
  <themes>
    <theme name="wmtheme" user_clickable="false"
      workspace_name="wsp_1" workspace_savepoint="sp1" >
      <jdbc_query
        spatial_column="GEOM"
        render_style="stylename"
        jdbc_srid="8307"
        datasource="mvdemo"
        asis="false"> select GEOM,ATTR from GEOM_TABLE
      </jdbc_query>
    </theme>
  </themes>
  . . .
</map_request>
```

The following considerations apply to MapViewer caching of predefined themes (explained in [Section 2.3.1.6](#)) and the use of Workspace Manager-related MapViewer attributes:

- The Workspace Manager-related attributes are ignored for predefined themes if the `caching` attribute is set to `ALL` in the `<styling_rules>` element for the theme.
- No caching data is considered if you specify the `workspace_name` attribute.

For MapViewer administrative requests (discussed in [Chapter 5](#)), the following elements are related to Workspace Manager support:

- `<list_workspace_name>`
- `<list_workspace_session>`

The `<list_workspace_name>` element returns the name of the current workspace, as specified with the `workspace_name` attribute in the most recent map request. If no workspace has been specified (that is, if the `workspace_name` attribute has not been specified in a map request in the current MapViewer session), or if the `LIVE` workspace has been specified, the `LIVE` workspace is returned. If Workspace Manager is not currently installed in Oracle Database, the request fails.

[Example 2–58](#) uses the `<list_workspace_name>` element in an administrative request.

Example 2–58 `<list_workspace_name>` Element in an Administrative Request

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
  <list_workspace_name data_source="mvdemo"/>
</non_map_request>
```

If `wsp_1` is the current workspace, the response for [Example 2–58](#) will be:

```
<?xml version="1.0" ?>
<non_map_response>
```

```
<workspace_name succeed="true" name="wsp_1"/>
</non_map_response>
```

If no workspace has been specified or if the LIVE workspace has been specified, the response for [Example 2-58](#) will be:

```
<?xml version="1.0" ?>
<non_map_response>
    <workspace_name succeed="true" name="LIVE"/>
</non_map_response>
```

If Workspace Manager is not currently installed in Oracle Database, the response for [Example 2-58](#) will be:

```
<?xml version="1.0" ?>
<non_map_response>
    <workspace_name succeed="false"/>
</non_map_response>
```

The `<list_workspace_session>` element returns the names of the current workspace and current context. If no workspace has been specified (that is, if the `workspace_name` attribute has not been specified in a map request in the current MapViewer session), or if the LIVE workspace has been specified, information for the LIVE workspace is returned. If Workspace Manager is not currently installed in Oracle Database, the request fails.

[Example 2-59](#) uses the `<list_workspace_session>` element in an administrative request.

Example 2-59 <list_workspace_session> Element in an Administrative Request

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
    <list_workspace_session data_source="mvdemo"/>
</non_map_request>
```

If `wsp_1` is the current workspace and if the context is LATEST, the response for [Example 2-59](#) will be:

```
<?xml version="1.0" ?>
<non_map_response>
    <workspace_session succeed="true" name="wsp_1" context="LATEST"
        context_type="LATEST"/>
</non_map_response>
```

If no workspace has been specified or if the LIVE workspace has been specified, and if the context is LATEST, the response for [Example 2-59](#) will be:

```
<?xml version="1.0" ?>
<non_map_response>
    <workspace_session succeed="true" name="LIVE" context="LATEST"
        context_type="LATEST"/>
</non_map_response>
```

If Workspace Manager is not currently installed in Oracle Database, the response for [Example 2-59](#) will be:

```
<?xml version="1.0" ?>
<non_map_response>
    <workspace_session succeed="false"/>
</non_map_response>
```

2.9 MapViewer Metadata Views

The mapping metadata describing base maps, themes, and styles is stored in the global tables SDO_MAPS_TABLE, SDO_THEMES_TABLE, and SDO_STYLES_TABLE, which are owned by MDSYS. However, you should never directly update these tables. Each MapViewer user has the following views available in the schema associated with that user:

- USER_SDO_STYLES and ALL_SDO_STYLES contain information about styles. These views are described in [Section 2.9.1](#).
- USER_SDO_THEMES and ALL_SDO_THEMES contain information about themes. These views are described in [Section 2.9.2](#).
- USER_SDO_MAPS and ALL_SDO_MAPS contain information about base maps. These views are described in [Section 2.9.3](#).
- USER_SDO_CACHED_MAPS and ALL_SDO_CACHED_MAPS contain information about configuration settings for map tile layers. These views are described in [Section 2.9.4](#).

Note: You can use the Map Builder tool (described in [Chapter 7](#)) to manage most mapping metadata. However, for some features you must use SQL statements to update the MapViewer metadata views.

The USER_SDO_xxx views contain metadata information about mapping elements (styles, themes, base maps, cached maps) owned by the user (schema), and the ALL_SDO_xxx views contain metadata information about mapping elements on which the user has SELECT permission.

The ALL_SDO_xxx views include an OWNER column that identifies the schema of the owner of the object. The USER_SDO_xxx views do not include an OWNER column.

All styles defined in the database can be referenced by any user to define that user's themes, markers with a text style, or advanced styles. However, themes and base maps are not shared among users; so, for example, you cannot reference another user's themes in a base map that you create.

The following rules apply for accessing the mapping metadata:

- If you need to add, delete, or modify any metadata, you must perform the operations using the USER_SDO_xxx views. The ALL_SDO_xxx views are automatically updated to reflect any changes that you make to USER_SDO_xxx views.
- If you need only read access to the metadata for all styles, you should use the ALL_SDO_STYLES view. Both the OWNER and NAME columns make up the primary key; therefore, when you specify a style, be sure to include both the OWNER and NAME.

The preceding MapViewer metadata views are defined in the following file:

```
$ORACLE_HOME/lbs/admin/mapdefinition.sql
```

MapViewer also uses some other metadata views, which may be defined in other files. You should never modify the contents of these views, which include the following:

- MDSYS.USER_SDO_TILE_ADMIN_TASKS includes information about long tasks related to map tile management. If you stop a long map tile layer task such as

prefetching and then restart the task, MapViewer uses the information in the USER_SDO_TILE_ADMIN_TASKS view to resume the task rather than start over at the beginning.

2.9.1 *xxx_SDO_STYLES* Views

The USER_SDO_STYLES and ALL_SDO_STYLES views have the columns listed in [Table 2–3](#).

Table 2–3 *xxx_SDO_STYLES* Views

Column Name	Data Type	Description
OWNER	VARCHAR2	Schema that owns the style (ALL_SDO_STYLES only)
NAME	VARCHAR2	Unique name to be associated with the style
TYPE	VARCHAR2	One of the following values: COLOR, MARKER, LINE, AREA, TEXT, or ADVANCED
DESCRIPTION	VARCHAR2	Optional descriptive text about the style
DEFINITION	CLOB	XML definition of the style
IMAGE	BLOB	Image content (for example, <i>airport.gif</i>) for marker or area styles that use image-based symbols (for markers) or fillers (for areas)
GEOMETRY	SDO_Geometry	(Reserved for future use)

Depending on the Oracle Database release, the ALL_SDO_STYLES view may contain sample styles owned by the MDSYS schema. If these styles are defined on your system, you can specify them in theme definitions and map requests, and you can examine the XML definitions for ideas to use in defining your own styles.

To specify a style (or other type of MapViewer object) that is owned by a schema other than the one for the current user, you must specify the schema name, and you must use a colon (:), not a period, between the schema name and the object name. The following excerpt from a <jdbc_query> element refers to the style named C.RED owned by the MDSYS schema:

```
<jdbc_query . . . render_style="MDSYS:C.RED">
. .
</jdbc_query>
```

[Example 2–60](#) finds the names of all currently defined styles owned by the MDSYS schema, and it displays the type, description, and XML definition of one of the styles. (The example output is reformatted for readability.)

Example 2–60 Finding Styles Owned by the MDSYS Schema

```
SELECT owner, name FROM all_sdo_styles
WHERE owner = 'MDSYS';
```

OWNER	NAME
MDSYS	C.BLACK
MDSYS	C.BLACK GRAY
MDSYS	C.BLUE
MDSYS	C.COUNTIES
MDSYS	C.FACILITY
. . .	

```

MDSYS          L.MAJOR STREET
MDSYS          L.MAJOR TOLL ROAD
MDSYS          L.MQ_ROAD2
MDSYS          L.PH
MDSYS          L.POOR_ROADS
MDSYS          L.PTH
MDSYS          L.RAILROAD
MDSYS          L.RAMP
MDSYS          L.SH
MDSYS          L.STATE BOUNDARY
. . .
MDSYS          M.REDSQ
MDSYS          M.SMALL TRIANGLE
MDSYS          M.STAR
MDSYS          M.TOWN HALL
MDSYS          M.TRIANGLE
MDSYS          T.AIRPORT NAME
MDSYS          T.CITY NAME
MDSYS          T.MAP TITLE
MDSYS          T.PARK NAME
MDSYS          T.RED STREET
MDSYS          T.ROAD NAME
MDSYS          T.SHIELD1
MDSYS          T.SHIELD2
MDSYS          T.STATE NAME
MDSYS          T.STREET NAME
. . .

-- Display the type, description, and XML definition of one style.
SET LONG 4000;
SELECT owner, name, type, description, definition
  FROM all_sdo_styles WHERE name = 'L.PH';

OWNER    NAME      TYPE      DESCRIPTION
-----  -----
MDSYS    L.PH     LINE      Primary highways

DEFINITION
-----
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
<desc></desc>
<g class="line" style="fill:#33a9ff;stroke-width:4">
<line class="parallel" style="fill:#aa55cc;stroke-width:1.0"/>
</g>
</svg>

```

2.9.2 xxx_SDO_THEMES Views

The USER_SDO_THEMES and ALL_SDO_THEMES views have the columns listed in [Table 2–4](#).

Table 2–4 xxx_SDO_THEMES Views

Column Name	Data Type	Description
OWNER	VARCHAR2	Schema that owns the theme (ALL_SDO_THEMES only)
NAME	VARCHAR2	Unique name to be associated with the theme
DESCRIPTION	VARCHAR2	Optional descriptive text about the theme

Table 2–4 (Cont.) xxx_SDO_THEMES Views

Column Name	Data Type	Description
BASE_TABLE	VARCHAR2	Table or view containing the spatial geometry column
GEOMETRY_COLUMN	VARCHAR2	Name of the spatial geometry column (of type SDO_GEOMETRY)
STYLING_RULES	CLOB	XML definition of the styling rules to be associated with the theme

2.9.3 xxx_SDO_MAPS Views

The USER_SDO_MAPS and ALL_SDO_MAPS views have the columns listed in [Table 2–5](#).

Table 2–5 xxx_SDO_MAPS Views

Column Name	Data Type	Description
OWNER	VARCHAR2	Schema that owns the base map (ALL_SDO_MAPS only)
NAME	VARCHAR2	Unique name to be associated with the base map
DESCRIPTION	VARCHAR2	Optional descriptive text about the base map
DEFINITION	CLOB	XML definition of the list of themes and their scale value range information to be associated with the base map

2.9.4 xxx_SDO_CACHED_MAPS Views

The USER_SDO_MAPS and ALL_SDO_MAPS views have the columns listed in [Table 2–6](#).

Table 2–6 xxx_SDO_CACHED_MAPS Views

Column Name	Data Type	Description
NAME	VARCHAR2	Unique name of the cached map source
DESCRIPTION	VARCHAR2	Optional descriptive text about the cached map source
TILES_TABLE	VARCHAR2	(Not currently used)
IS_ONLINE	VARCHAR2	YES if the map tile layer is online, or NO if the map tile layer is offline. When a tile is missing from the cache and the map tile layer is online, the map tile server will fetch the tile and return the fetched tile to the client. When a tile is missing and the map tile layer is offline, the map tile server will not fetch the tile but will return a blank image to the client.
IS_INTERNAL	VARCHAR2	YES if the map source is an internal map source, or NO if the map source is an external map source
DEFINITION	CLOB	XML definition of the map tile layer, as described later in this section.
BASE_MAP	VARCHAR2	Name of the cached MapViewer base map, if the map source is an internal map source
MAP_ADAPTER	BLOB	The jar file that contains the adapter Java classes of the external map services provider, as described later in this section.

For detailed information about using the USER_SDO_CACHED_MAPS view, see [Section 3.3.2, "Map Tile Server Configuration"](#).

2.10 Oracle Maps

Oracle Maps is the name for a suite of technologies for developing high-performance interactive web-based mapping applications. It consists of components from both the server side and the client side.

Topics:

- [Overview of Oracle Maps](#)
- [Architecture for Oracle Maps Applications](#)

2.10.1 Overview of Oracle Maps

Oracle Maps consists of the following main components:

- A map tile server that caches and serves pregenerated map image tiles upon a map image tile request
- A map server that generates maps from spatial data to the mapping client upon a client map image request
- A map data server that fetches spatial data from a spatial data provider to the mapping client
- An Ajax-based JavaScript mapping client. (Ajax is an acronym for asynchronous JavaScript and XML.) This client provides functions for browsing and interacting with maps, as well as a flexible application programming interface (API).

The map tile server (map image caching engine, described in [Section 3.3, "Map Tile Server"](#)) automatically fetches and caches map image tiles rendered by Oracle MapViewer or other web-enabled map providers. It also serves cached map image tiles to the clients, which are web applications developed using the Oracle Maps client API. The clients can then automatically stitch multiple map image tiles into a seamless large map. Because the map image tiles are normally pregenerated and cached, the application users will experience fast map viewing performance.

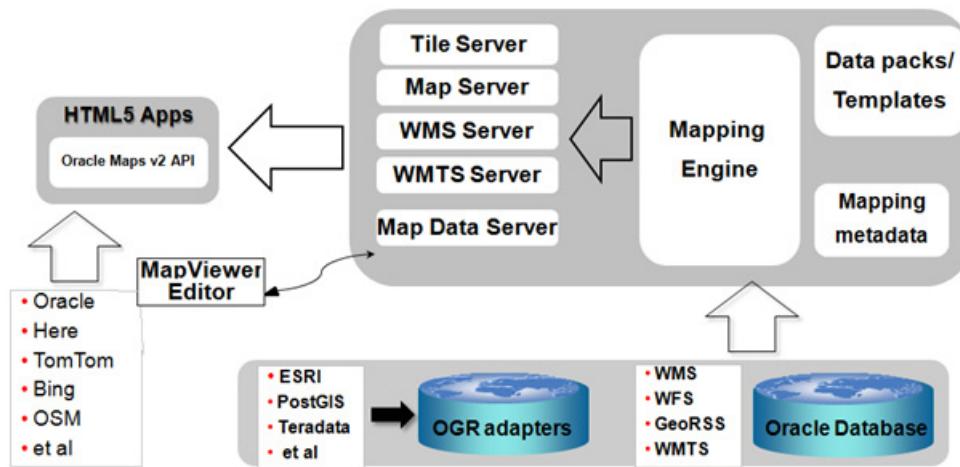
The JavaScript mapping client is a browser side map display engine that fetches map content from the servers, and presents it to client applications. It:

- Fetches map images tiles from a MapViewer server, from a third party map service provider, or from its local disk-storage
- Retrieves spatial data from a MapViewer server, from a third party spatial data provider, or from its local disk-storage and then renders the spatial data into map images by itself on the client side
- Provides customizable map-related user interaction controls, such as map dragging and clicking, for the application
- Provides other built-in features and utilities to customize the map contents and map layout design

The JavaScript mapping client can be easily integrated with any web application or portal.

2.10.2 Architecture for Oracle Maps Applications

[Figure 2-15](#) shows the architecture of web mapping applications that are developed using Oracle Maps.

Figure 2–15 Architecture for Oracle Maps Applications

Referring to [Figure 2–15](#), applications interact with the Oracle Maps architecture as follows:

- The application is developed using JavaScript, and it runs inside the JavaScript engine of the web browser.
- The application invokes the JavaScript map client to fetch the map image tiles from the map tile server, and then it displays the map in the web browser.
- The application invokes the JavaScript map client to fetch the map image in other form of map services (such as WMS and WMPS) from the server and then displays the map image.
- The application invokes the JavaScript map client to fetch spatial data from the map data server and then renders the map image to display.
- The JavaScript map client controls map-related user interaction for the application.
- When the MapViewer server receives a map image request, the request can be one of its several supported types: a map image tile request to its map tile server, a map image request to its map server, a WMS map request to its WMS server, or a WMPS map image tile request to its WMPS server. Each request will be handled by the server accordingly.

Example 1: When the map tile server receives a map image tile request, it first checks to see if the requested tile is already cached. If the tile is already in the cache, the cached tile is then returned to the client. If the tile is not in the cache, then the map tile server fetches the tile into the cache and returns it to the client. Tiles can be fetched either directly from the MapViewer map rendering engine or from an external web map provider.

Example 2: When the server receives a map image request (instead of a map tile request) to its map server, the map server renders the image and returns it to the client. Note that in contrast to the map tile server, the map server generates a map according to a specified data bounds and renders the data onto an image with specified dimension, but it does not cache the map image.

- When the map data server receives a map data request, it retrieves the spatial data and returns the spatial data, not map images, to the client.

3

MapViewer Servers

MapViewer, as a set of Java Enterprise Edition packages, contains a collection of servers to provide mapping services, such as a map server, a map data server, a map tile server, a WMS server (see [Appendix E](#)), and a WMTS server (see [Appendix F](#)).

When you develop Oracle Maps applications, the Oracle Maps API and MapViewer server will identify the needed service and then issue map service request to the proper server. You normally do not need to send service requests explicitly in your map applications; however, if you are familiar with the MapViewer servers described in this chapter, it can help if you need to debug or optimize the application.

Major topics:

- [MapViewer Map Server](#)
- [MapViewer Map Data Server](#)
- [Map Tile Server](#)

3.1 MapViewer Map Server

This major topic explains how to submit map requests in XML format to MapViewer, and it describes the XML document type definitions (DTDs) for the map requests (input) and responses (output). XML is widely used for transmitting structured documents using the HTTP protocol. If an HTTP request (GET or POST method) is used, it is assumed the request has a parameter named `xml_request` whose value is a string containing the XML document for the request.

(In addition to map requests, the MapViewer XML API can be used for administrative requests, such as adding new data sources. Administrative requests are described in [Chapter 5](#).)

As shown in [Figure 1-1](#) in [Section 1.1.1](#), the basic flow of action with MapViewer is that a client locates a remote MapViewer instance, binds to it, sends a map request, and processes the map response returned by the MapViewer instance.

A request to the MapViewer servlet has the following format:

`http://hostname[:port]/MapViewer-servlet-path?xml_request=xml-request`

In this format:

- `hostname` is the network path of the server on which MapViewer is running.
- `port` is the port on which the web server listens.
- `MapViewer-servlet-path` is the MapViewer servlet path (for example, `mapviewer/omserver`).

- *xml-request* is the URL-encoded XML request submitted using the HTML GET or POST method.

The input XML is required for all requests. The output depends on the content of the request: the response can be either an XML document, or a binary object containing the (generated image) file requested by the user.

In an input request, you must specify a data source, and you can specify one or more of the following:

- Themes and styles.
- A center point or a box for the map display, and options such as highlight, label, and styles.
- A predefined base map, which can be reused and overlaid with custom data.
- A custom theme with the user data points (or any geometry) retrieved dynamically and plotted directly from an accessible database.
- Custom features (point, circles, or any geometry) specified in the XML request string to be plotted. These require that you provide the dynamic data in the format of the `<geoFeature>` element (described in [Section 3.1.2.5](#)), as defined in the DTD. The geometry portion of the `<geoFeature>` element adopts the Geometry DTD as specified in Open GIS Consortium Geography Markup Language Version 1.0 (OGC GML v1.0).
- Thematic mapping.

You can manage the definition of base maps, themes, and styles (individual symbolologies) using the Map Builder tool, which is described in [Chapter 7](#).

For the current release, MapViewer accepts only a coordinate pair to identify the location for a map request; it cannot take a postal address as direct input for a map.

This topic first presents some examples of map requests (see [Section 3.1.1](#)), and then presents detailed explanations of the following XML DTDs for requests and other operations:

- [Map Request DTD](#)
- [Information Request DTD](#)
- [Map Response DTD](#)
- [MapViewer Exception DTD](#)
- [Geometry DTD \(OGC\)](#)

3.1.1 Map Request Examples

This section provides examples of map requests. It refers to concepts, elements, and attributes that are explained in detail in [Section 3.1.2](#). It contains sections with the following examples:

- [Section 3.1.1.1, "Simple Map Request"](#)
- [Section 3.1.1.2, "Map Request with Dynamically Defined Theme"](#)
- [Section 3.1.1.3, "Map Request with Base Map, Center, and Additional Predefined Theme"](#)
- [Section 3.1.1.4, "Map Request with Center, Base Map, Dynamically Defined Theme, and Other Features"](#)

- [Section 3.1.1.5, "Map Request for Point Features with Attribute Value and Dynamically Defined Variable Marker Style"](#)
- [Section 3.1.1.6, "Map Request with an Image Theme"](#)
- [Section 3.1.1.7, "Map Request for Image of Map Legend Only"](#)
- [Section 3.1.1.8, "Map Request with SRID Different from Data SRID"](#)
- [Section 3.1.1.9, "Map Request Using a Pie Chart Theme"](#)
- [Section 3.1.1.15, "Java Program Using MapViewer"](#)
- [Section 3.1.1.16, "PL/SQL Program Using MapViewer"](#)

3.1.1.1 Simple Map Request

[Example 3-1](#) is a very simple map request. It requests a map consisting of a blank blue image (from the `mvdemo` data source) with the string *Hello World* drawn on top. (The `datasource` attribute is required for a map request, even though this specific map request does not retrieve any map data from the data source.)

Example 3-1 Simple Map Request ("Hello World")

```
<?xml version="1.0" standalone="yes"?>
<map_request title="Hello World" datasource = "mvdemo" />
```

3.1.1.2 Map Request with Dynamically Defined Theme

[Example 3-2](#) is a simple map request with one dynamically defined theme. It requests a map of all Oracle Spatial and Graph geometries from the COUNTIES table.

Example 3-2 Simple Map Request with a Dynamically Defined Theme

```
<?xml version="1.0" encoding="UTF-8" ?>
<map_request datasource="lbs_data">
  <themes>
    <theme name="t1">
      <jdbc_query spatial_column = "GEOM"
                   datasource = "lbs_data">
        SELECT geom FROM counties
      </jdbc_query>
    </theme>
  </themes>
</map_request>
```

3.1.1.3 Map Request with Base Map, Center, and Additional Predefined Theme

[Example 3-3](#) requests a map with a specified center for the result map, and specifies a predefined theme (`poi_theme_us_restaurants`) to be rendered in addition to the predefined themes that are part of the base map (`basemap="us_base"`).

Example 3-3 Map Request with Base Map, Center, and Additional Predefined Theme

```
<?xml version="1.0" encoding="UTF-8" ?>
<map_request datasource="lbs_data" title="LBS CUSTOMER MAP"
             basemap="us_base" width="500" height="375"
             bgcolor="#a6cae0" format="GIF_URL">
  <center size="1">
    <geoFeature typeName="mapcenter" label="Motel 1" text_style="T.MOTEL"
                render_style="M.MOTEL" radius="300">
      <geometricProperty>
        <Point>
```

```
        <coordinates>-122.2615, 37.5266</coordinates>
    </Point>
</geometricProperty>
</geoFeature>
</center>
<srs>SDO:8265</srs>
<themes>
    <theme name="poi_theme_us_restaurants" />
</themes>
</map_request>
```

Notes on [Example 3–3](#):

- Because basemap is specified, MapViewer first draws all predefined themes for that base map before drawing the specified theme (poi_theme_us_restaurants).
- The center will be drawn with a marker of the M.MOTEL style and the label Motel 1 in the T.MOTEL style.
- A circle with a radius of 300 meters will be drawn around the center.

3.1.1.4 Map Request with Center, Base Map, Dynamically Defined Theme, and Other Features

[Example 3–4](#) requests a map with a specified center, a predefined theme named theme_lbs_customers, a dynamically defined theme named sales_by_region, and all base themes in the base map us_base_road, plus two features: a polygon representing the top sales region, and a point. The requested map will be stored at the MapViewer host and a URL to that GIF image (format="GIF_URL") will be returned to the requester.

Example 3–4 Map Request with Center, Base Map, Dynamically Defined Theme, Other Features

```
<?xml version="1.0" encoding="UTF-8" ?>
<map_request datasource="lbs_data2" title="LBS CUSTOMER MAP 2"
    width="400" height="300" format="GIF_URL" basemap="us_base_road">
    <center size="1.5">
        <geoFeature typeName="nil">
            <geometricProperty>
                <Point>
                    <coordinates>-122.2615, 37.5266</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>
    <themes>
        <theme name="theme_lbs_customers" />
        <theme name="sales_by_region">
            <jdbc_query spatial_column = "region"
                label_column="manager"
                render_style="V.SALES COLOR"
                label_style="T.SMALL TEXT"
                jdbc_host="data.my_corp.com"
                jdbc_sid="orcl"
                jdbc_port="1521"
                jdbc_user="scott"
                jdbc_password="password"
                jdbc_mode="thin"
            > select region, sales, manager from my_corp_sales_2001
            </jdbc_query>
        </theme>
    </themes>
</map_request>
```

```

</themes>
<geoFeature typeName="nil" label="TopSalesRegion"
    text_style="9988" render_style="2837">
    <geometricProperty>
        <Polygon srsName="SDO:8265">
            <outerBoundaryIs>
                <LinearRing>
                    <coordinates>42.9,71.1 43.2,72.3 39.2,73.0 39.0,
                    73.1 42.9,71.1</coordinates>
                </LinearRing>
            </outerBoundaryIs>
        </Polygon>
    </geometricProperty>
</geoFeature>
<geoFeature render_style="1397" text_style="9987">
    <geometricProperty>
        <Point>
            <coordinates>-122.5615, 37.3266</coordinates>
        </Point>
    </geometricProperty>
</geoFeature>
</map_request>

```

In [Example 3–4](#), sales_by_region is a dynamically defined theme. For information about dynamically defining a theme, see [Section 3.1.2.20](#) and [Section 3.1.2.9](#).

3.1.1.5 Map Request for Point Features with Attribute Value and Dynamically Defined Variable Marker Style

[Example 3–5](#) shows a map request to render point features with a dynamically defined variable marker style. The attribute_values attribute defines the value that will be used to find the appropriate bucket (for the range into which the value falls), as defined in the variable marker style.

Example 3–5 Map Request for Point Features with Attribute Value and Dynamically Defined Variable Marker Style

```

<?xml version="1.0" standalone="yes"?>
<map_request
    title="Point Features with Variable Marker Style"
    datasource="mvdemo"
    srid="0"
    width="500"
    height="375"
    bgcolor="#a6caf0"
    antialias="true"
    format="PNG_URL">
    <center size="19.2">
        <geoFeature>
            <geometricProperty typeName="center">
                <Point>
                    <coordinates>-116.65,38.92</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>
    <geoFeature
        render_style="varmarkerpf"
        attribute_values="50000.0">
        <geometricProperty>

```

```
<Point>
  <coordinates>-112.0,43.0</coordinates>
</Point>
</geometricProperty>
</geoFeature>
<geoFeature
  render_style="varmarkerpf"
  attribute_values="125000.0">
<geometricProperty>
  <Point>
    <coordinates>-123.0,40.0</coordinates>
  </Point>
</geometricProperty>
</geoFeature>
<geoFeature
  render_style="varmarkerpf"
  attribute_values="200000.0">
<geometricProperty>
  <Point>
    <coordinates>-116.64,38.92</coordinates>
  </Point>
</geometricProperty>
</geoFeature>
<geoFeature
  render_style="varmarkerpf"
  attribute_values="300000.0">
<geometricProperty>
  <Point>
    <coordinates>-112.0,35.0</coordinates>
  </Point>
</geometricProperty>
</geoFeature>
<styles>
  <style name="varmarkerpf">
    <AdvancedStyle>
      <VariableMarkerStyle basemarker="mkcircle" startsize="10"
                           increment="5">
        <Buckets>
          <RangedBucket label="less than 100k" high="100000.0"/>
          <RangedBucket label="100k - 150k" low="100000.0" high="150000.0"/>
          <RangedBucket label="150k - 250k" low="150000.0" high="250000.0"/>
          <RangedBucket label="250k - 350k" low="250000.0" high="350000.0"/>
        </Buckets>
      </VariableMarkerStyle>
    </AdvancedStyle>
  </style>

  <style name="mkcircle">
    <svg>
      <g class="marker" style="stroke:blue;fill:red;">
        <circle r="20"/>
      </g>
    </svg>
  </style>
</styles>
</map_request>
```

3.1.1.6 Map Request with an Image Theme

[Example 3–6](#) requests a map in which an image theme is to be plotted underneath all other regular vector data. The image theme is specified in the `<jdbc_image_query>` element as part of the `<theme>` element in a map request. (For an explanation of image themes, see [Section 2.3.3](#).)

Example 3–6 Map Request with an Image Theme

```
<?xml version="1.0" encoding="UTF-8" ?>
<map_request datasource="lbs_data" title="LBS Image MAP"
    basemap="us_roads" format="GIF_STREAM">
    <center size="1">
        <geoFeature>
            <geometricProperty>
                <Point>
                    <coordinates>-122.2615, 37.5266</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>
    <themes>
        <theme name="anImageTheme">
            <jdbc_image_query image_format="ECW"
                image_column="image"
                image_mbr_column="img_extent"
                jdbc_srid="33709"
                datasource="lbs_data">
                SELECT image, img_extent, image_id FROM my_images
            </jdbc_image_query>
        </theme>
    </themes>
</map_request>
```

MapViewer processes the request in [Example 3–6](#) as follows:

1. MapViewer retrieves the image data by executing the user-supplied query (`SELECT image, img_extent, image_id FROM my_images`) in the current map window context.
2. MapViewer checks its internal list of all registered image renderers to see if one supports the ECW format (`image_format="ECW"`). Because MapViewer as supplied by Oracle does not support the ECW format, you must implement and register a custom image renderer that supports the format, as explained in [Appendix C](#).
3. MapViewer calls the `renderImages` method, and image data retrieved from the user-supplied query is passed to the method as one of its parameters.
4. MapViewer retrieves and renders any requested vector data on top of the rendered image.

3.1.1.7 Map Request for Image of Map Legend Only

[Example 3–7](#) requests a map with just the image of the map legend, but without rendering any spatial data. In this example, the legend explains the symbology used for identifying cities, state boundaries, interstate highways, and county population density. (Map legends are explained in [Section 3.1.2.11](#).)

Example 3–7 Map Request for Image of Map Legend Only

```
<?xml version="1.0" standalone="yes"?>
```

```

<map_request
    datasource = "mvdemo"
    format="PNG_URL">

    <legend bgstyle="fill:#ffffff;stroke:#ff0000" profile="MEDIUM" position="SOUTH_EAST">
        <column>
            <entry text="Map Legend" is_title="true"/>
            <entry style="M.STAR" text="center point"/>
            <entry style="M.CITY HALL 3" text="cities"/>
            <entry is_separator="true"/>
            <entry style="C.ROSY BROWN STROKE" text="state boundary"/>
            <entry style="L.PH" text="interstate highway"/>
            <entry text="County population:"/>
            <entry style="V.COUNTY_POP_DENSITY" tab="1"/>
        </column>
    </legend>
</map_request>

```

Generating just the map legend image, as in [Example 3-7](#), can save processing time if you display the stored map legend image on a web page separately from the actual displayed maps. This avoids the need to generate a legend each time there is a map request.

3.1.1.8 Map Request with SRID Different from Data SRID

[Example 3-8](#) requests a map displayed in a coordinate system (`srid="32775"` for US - Equal Area Projection) that is different from the coordinate system associated with the county theme data (`jdbc_srid="8265"` for Longitude/Latitude - NAD 83). As a result, during the rendering process, MapViewer converts all geometries from the data SRID to the map request SRID.

If no coordinate system is associated with the theme data, MapViewer assumes that the data is associated with the coordinate system of the map request, and no conversion occurs.

Example 3-8 Map Request with SRID Different from Data SRID

```

<?xml version="1.0" standalone="yes"?>
<map_request
    title="US Counties: Equal-Area Projection (SRID=32775)"
    datasource="mvdemo"
    srid="32775"
    width="500"
    height="375"
    bgcolor="#a6caf0"
    antialiase="true"
    format="PNG_URL">
    <center size="4000000.0">
        <geoFeature>
            <geometricProperty typeName="center">
                <Point>
                    <coordinates>-218191.9643,1830357.1429</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>
    <themes>
        <theme name="county_th" user_clickable="false">

```

```

<jdbc_query
    spatial_column="geom"
    render_style="C.COUNTIES"
    jdbc_srid="8265"
    datasource="mvdemo"
    asis="false">select geom from counties</jdbc_query>
</theme>
</themes>
</map_request>

```

3.1.1.9 Map Request Using a Pie Chart Theme

This section shows how to use thematic mapping with a pie chart theme. The result is a map in which each county contains a pie chart in which the size of each slice reflects the proportion of the population in a specified household income level category (low, medium, or high) in the county.

The basic steps are as follows.

1. Create an advanced style that defines the characteristics of the pie charts to be used. The following example creates an advanced style named V.PIECHART1.

```

INSERT INTO user_sdo_styles VALUES (
    'V.PIECHART1', 'ADVANCED', null,
    '<?xml version="1.0" ?>
<AdvancedStyle>
    <PieChartStyle pieradius="10">
        <PieSlice name="low" color="#ff0000"/>
        <PieSlice name="medium" color="#ffff00"/>
        <PieSlice name="high" color="#00ff00"/>
    </PieChartStyle>
</AdvancedStyle>', null, null);

```

When the style defined in the preceding example is applied to a geographic feature, a pie chart is created with three slices. The pieradius attribute specifies the size of each pie chart in pixels. Each slice (`<PieSlice>` element) has a color defined for it. The name attribute for each slice is ignored by MapViewer.

2. Create a new theme that uses the style that you created, as in the following example:

```

INSERT INTO user_sdo_themes VALUES (
    'THEME_PIE_CHART', null, 'COUNTIES', 'GEOM',
    '<?xml version="1.0" standalone="yes"?>
<styling_rules>
    <rule column="INC_LOW,INC_MED,INC_HIGH">
        <features style="C.US MAP YELLOW"> </features>
        <label column="''dummy''" style="V.PIECHART1"> 1 </label>
    </rule>
</styling_rules>');

```

In the theme definition in the preceding example, the `<label>` element of the styling rule specifies `style="V.PIECHART1"`, to indicate that this pie chart style (the style created in Step 1) is used to label each geometry displayed on the map.

The `column` attribute (`column="''dummy''` in this example) is required, even though it has no effect on the resulting map. The `column` attribute value can be `dummy` or any other string, and the value must be enclosed on both sides by two single quotation marks.

Because the V.PIECHART1 style is defined with three slices, the preceding example must specify the names of three columns from the COUNTIES table, and these

columns must have a numeric data type. The column names are INC_LOW, INC_MED, and INC_HIGH. These columns will supply the value that will be used to determine the size of each pie slice.

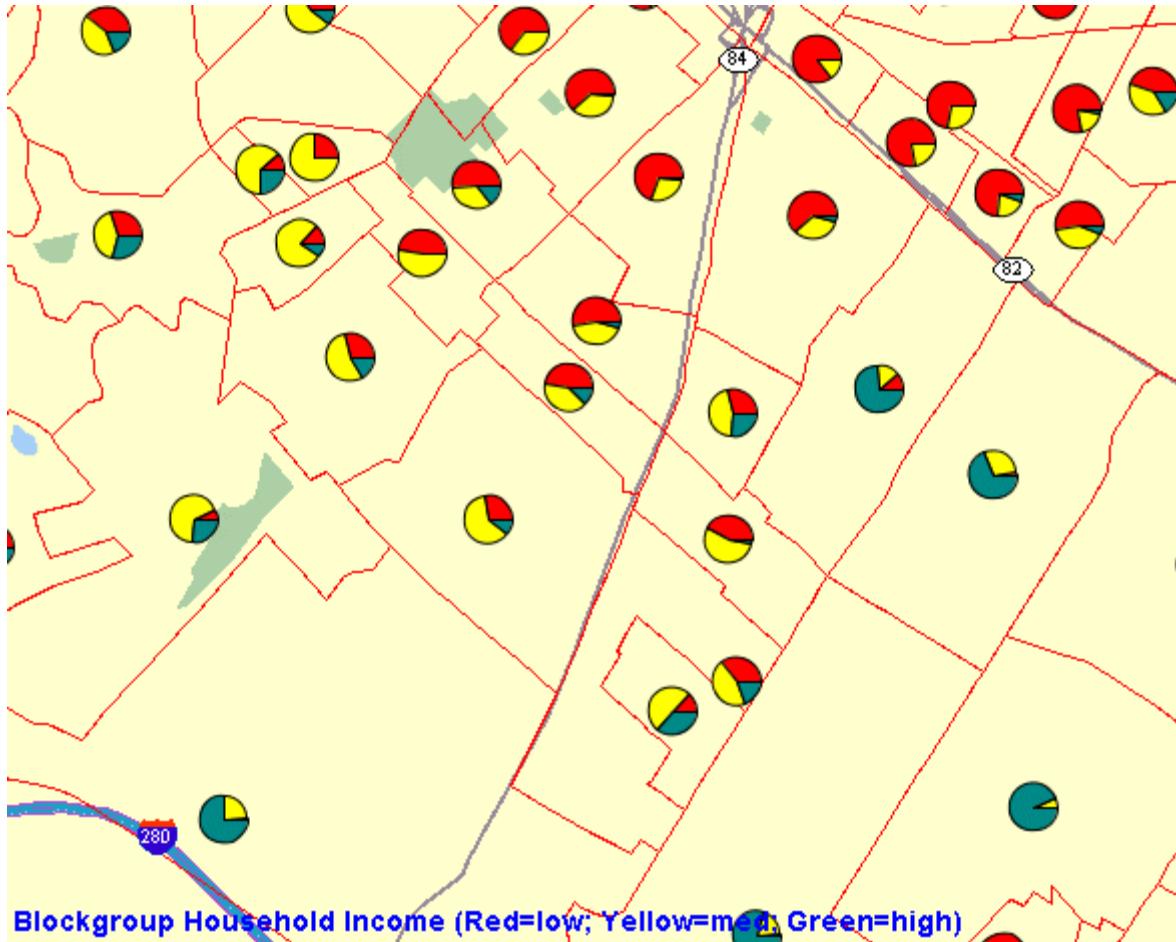
3. Issue a map request that uses the theme that you created. [Example 3–9](#) requests a map that uses the THEME_PIE_CHART theme that was created in Step 2.

Example 3–9 Map Request Using a Pie Chart Theme

```
<?xml version="1.0" standalone="yes"?>
<map_request datasource = "mvdemo"
              format="PNG_STREAM">
  <themes>
    <theme name="THEME_PIE_CHART" />
  </themes>
</map_request>
```

[Figure 3–1](#) shows part of a display resulting from the map request in [Example 3–9](#).

Figure 3–1 Map Display Using a Pie Chart Theme



You can also use the pie chart style in a dynamic (JDBC) theme when issuing a map request. You must specify the complete SQL query for a JDBC theme in the map request, because you must identify the attribute columns that are needed by the pie chart style. Any columns in the SELECT list that are not SDO_GEOOMETRY columns or

label columns are considered to be attribute columns that can be used by an advanced style.

Example 3–10 is a sample request with a JDBC theme using a pie chart style. The SQL query (SELECT geom, 'dummy', sales, service, training FROM support_centers) is included in the theme definition.

Example 3–10 JDBC Theme Using a Pie Chart Style

```
<?xml version="1.0" standalone="yes"?>
<map_request
    basemap="CA_MAP"
    datasource = "mvdemo"
    format="PNG_URL">

    <themes>
        <theme name="support_center">
            <jdbc_query spatial_column="geom" datasource="tilsmenv"
                label_column="dummy",
                label_style="V.PIECHART1">
                SELECT geom, 'dummy', sales, service, training
                FROM support_centers
            </jdbc_query>
        </theme>
    </themes>
</map_request>
```

3.1.1.10 Map Request Using Ratio Scale and Mixed Theme Scale Modes

Example 3–11 requests a map specifying a center and a ratio scale to define the map area. Two themes are used: a predefined theme named THEME_US_COUNTIES1, which uses the default screen inch scale mode, and a JDBC theme names STATES_TH, which uses the ratio mode.

Example 3–11 Map Request Using Ratio Scale and Mixed Theme Scale Modes

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="States (ratio), counties (screen inch), center and scale"
    datasource="tilsmenv"
    width="500"
    height="400"
    bgcolor="#a6caf0"
    antialiase="true"
    format="PNG_URL">
    <center scale="5000000">
        <geoFeature>
            <geometricProperty typeName="center">
                <Point>
                    <coordinates>-90.0,32.0</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>
    <themes>
        <theme name="STATES_TH" min_scale="5.0E7" max_scale="1.0E7" scale_mode="ratio">
            <jdbc_query
                label_column="STATE"
                spatial_column="geom"
                label_style="T.STATE NAME"
```

```
render_style="C.COUNTIES"
jdbc_srid="8265"
datasource="tilsmenv"
asis="false">select geom,state from states
</jdbc_query>
</theme>
<theme name="THEME_US_COUNTIES1" min_scale="2.286" />
</themes>
</map_request>
```

3.1.1.11 Map Request Using Predefined Theme (Binding Parameter and Custom Type)

[Example 3–12](#) requests a map using a predefined theme with a styling rule that selects all counties where a state abbreviation is in the selection list. When the predefined theme is created, the selection list is represented as a binding parameter, as follows:

```
INSERT INTO user_sdo_themes VALUES (
    'COUNTIES_BY_STATES', null, 'COUNTIES', 'GEOM',
    '<styling_rules>
    <rule>
        <features style="C.COUNTIES"> (state_abrv in (select column_value from
table(:1))) </features>
        <label column="COUNTY" style="T.CITY NAME"> 1 </label>
    </rule>
</styling_rules>');
```

This binding parameter can accept one or more values, for which you can create a custom SQL data type that represents this set of values, as follows:

```
CREATE OR REPLACE TYPE string_array AS TABLE OF VARCHAR2(64);
```

Then, you can use this custom data type on the binding parameter of the map request, as shown in [Example 3–12](#).

Example 3–12 Map Request Using Predefined Theme (Binding Parameter and Custom Type)

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="Binding Parameters and STRING_ARRAY type"
    datasource = "mvdemo"
    width="640"
    height="480"
    bgcolor="#a6cae0"
    antialiase="false"
    format="PNG_STREAM">

    <themes>
        <theme name="COUNTIES_BY_STATES" >
            <binding_parameters>
                <parameter value="FL,ME,CA,OH" type="STRING_ARRAY"/>
            </binding_parameters>
        </theme>
    </themes>
</map_request>
```

3.1.1.12 Map Request Using Advanced Styles and Rendering Rules

[Example 3-13](#) requests a map using the <rendering> element, and it combines two advanced styles that are based on different columns. In this example, an advanced style named POPVMK is based on column POP90, and another advanced style named EQRBRANK is based on column RANK90. Point features (from the CITIES table) are rendered. The shape of the feature is defined by the advanced style associated with column POP90, and the feature color is defined by the advanced style associated with column RANK90.

Example 3-13 Map Request Using Advanced Styles and Rendering Rules

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="Cross advanced styles"
    datasource="mvdemo"
    width="640"
    height="480"
    bgcolor="#a6caf0"
    antialias="false"
    format="PNG_STREAM"
>
    <center size="7.7">
        <geoFeature>
            <geometricProperty typeName="center">
                <Point>
                    <coordinates>-72.96,41.25</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>

    <themes>
        <theme name="cities">
            <jdbc_query
                label_column="city"
                spatial_column="location"
                label_style="T.CITY NAME"
                jdbc_srid="8265"
                datasource="mvdemo"
                asis="false">select location,city,pop90,rank90 from cities
            </jdbc_query>
            <rendering>
                <style name="POPVMK" value_columns="POP90">
                    <substyle name="EQRBRANK" value_columns="RANK90" changes="FILL_COLOR"/>
                </style>
            </rendering>
        </theme>
    </themes>

    <styles>
        <style name="STAR_TRANSP">
<svg width="1in" height="1in">
    <desc/>
    <g class="marker"
style="stroke:#000000;fill:#FF0000;fill-opacity:0;width:15;height:15;font-family:DIALOG;font-size:12;font-fill:#FF0000">
        <polyline
            points="138.0,123.0,161.0,198.0,100.0,152.0,38.0,198.0,61.0,123.0,0.0,76.0,76.0,76

```

```

        .0,100.0,0.0,123.0,76.0,199.0,76.0"/>
    </g>
</svg>
</style>

<style name="POPVMK">
<AdvancedStyle>
<VariableMarkerStyle basemarker="STAR_TRANSP" startsize="7" increment="5">
<Buckets>
    <RangedBucket seq="0" label="100217 - 1905803.75" low="100217"
high="1905803.75"/>
    <RangedBucket seq="1" label="1905803.75 - 3711390.5" low="1905803.75"
high="3711390.5"/>
    <RangedBucket seq="2" label="3711390.5 - 5516977.25" low="3711390.5"
high="5516977.25"/>
    <RangedBucket seq="3" label="5516977.25 - 7322564" low="5516977.25"
high="7322565"/>
</Buckets>
</VariableMarkerStyle>
</AdvancedStyle>
</style>

<style name="EQRBRANK">
<AdvancedStyle>
<BucketStyle>
<Buckets low="1" high="196" nbuckets="4" styles="C.RED,C.RB13_1,C.RB13_
6,C.SEQ6_01"/>
</BucketStyle>
</AdvancedStyle>
</style>
</styles>

<legend bgstyle="fill:#ffffff;fill-opacity:50;stroke:#ff0000" profile="SMALL"
position="SOUTH_EAST">
<column>
    <entry text="Map Legend" is_title="true" />
    <entry text="POP90:" />
    <entry style="POPVMK" tab="1" />
    <entry text="RANK90:" />
    <entry style="EQRBRANK" tab="1" />
</column>
</legend>
</map_request>

```

3.1.1.13 Map Request Using Stacked Styles

[Example 3–14](#) requests a map using the `<rendering>` element, and it defines multiple styles (C.COUNTIES and PIECHART1) to be applied on each theme feature.

Example 3–14 Map Request Using Stacked Styles

```

<?xml version="1.0" standalone="yes"?>
<map_request
    title="Theme with Stacked Styles"
    datasource="mvdemo"
    width="600"
    height="450"
    bgcolor="#a6caf0"
    antialiase="true"
    format="PNG_STREAM"

```

```

>
<center size="18">
  <geoFeature>
    <geometricProperty typeName="center">
      <Point>
        <coordinates>-122.729,40.423</coordinates>
      </Point>
    </geometricProperty>
  </geoFeature>
</center>
<themes>
  <theme name="STACKEDSTYLES">
    <jdbc_query
      label_column="state"
      spatial_column="geom"
      label_style="T.STATE NAME"
      jdbc_srid="8265"
      datasource="mvdemo"
      asis="false">select geom,state,HHI0_10,HHI10_15,HHI100UP,HHI15_25,HHI25_
35 from states
    </jdbc_query>
    <rendering>
      <style name="C.COUNTIES"/>
      <style name="PIECHART1" value_columns="HHI0_10,HHI10_15,HHI100UP,HHI15_
25,HHI25_35"/>
    </rendering>
  </theme>
</themes>

<styles>
  <style name="piechart1">
    <AdvancedStyle>
      <PieChartStyle pieradius="10">
        <PieSlice name="A" color="#FFFF00"/>
        <PieSlice name="B" color="#000000"/>
        <PieSlice name="H" color="#FF00FF"/>
        <PieSlice name="I" color="#0000FF"/>
        <PieSlice name="W" color="#FFFFFF"/>
      </PieChartStyle>
    </AdvancedStyle>
  </style>
</styles>

</map_request>

```

3.1.1.14 WFS Map Requests

This section contains examples of WFS map requests, one using a predefined theme and one using a dynamic theme.

[Example 3–15](#) requests a map using a predefined WFS theme named BC_MUNICIPALITY, which is defined as follows:

```

INSERT INTO user_sdo_themes VALUES (
  'BC_MUNICIPALITY',
  'WFS theme',
  'BC_MUNICIPALITY',
  'THE_GEOM',
  '<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="wfs" service_
url="http://www.refractions.net:8080/geoserver/wfs/GetCapabilities?">
```

```
srs="EPSG:3005">
<rule>
  <features style="C.BLUE"> </features>
  <label column="name" style="T.CITY NAME"> 1 </label>
</rule>
</styling_rules>');
```

[Example 3–15](#) shows a map request that renders this predefined WFS theme.

Example 3–15 Map Request Using Predefined WFS Theme

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="Predefined WFS MAP"
    datasource = "mvdemo"
    width="640"
    height="480"
    bgcolor="#a6cae0"
    antialiase="true"
    format="PNG_STREAM">

    <center size="76000">
        <geoFeature>
            <geometricProperty typeName="center">
                <Point>
                    <coordinates>1260500,470000</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>

    <themes>
        <theme name="bc_municipality" />
    </themes>
</map_request>
```

[Example 3–16](#) shows a map request that uses a dynamic WFS theme.

Example 3–16 Map Request Using Dynamic WFS Theme

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="WFS MAP"
    datasource = "mvdemo"
    width="640"
    height="480"
    bgcolor="#a6cae0"
    antialiase="true"
    format="PNG_STREAM">

    <center size="76000">
        <geoFeature>
            <geometricProperty typeName="center">
                <Point>
                    <coordinates>1260500,470000</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>
```

```

<themes>
<theme name="wfs" >
    <wfs_feature_request
        service_
        url="http://www.refractions.net:8080/geoserver/wfs/GetCapabilities?"
        srs="EPSG:3005"
        feature_name="bc_hospitals"
        spatial_column="the_geom"
        render_style="M.STAR"
        label_column="name"
        label_style="T.CITY NAME"
        datasource="mvdemo" />
    </theme>
</themes>

</map_request>

```

[Example 3–17](#) shows a map request for a dynamic WFS theme with an advanced style to render features.

Example 3–17 Map Request Using Dynamic WFS Theme with an Advanced Style

```

<?xml version="1.0" standalone="yes"?>
<map_request
    title="WFS Theme with Advanced Style"
    datasource = "mvdemo"
    width="640"
    height="480"
    bgcolor="#a6cae0"
    antialiase="true"
    format="PNG_STREAM">
<center size="10.">
    <geoFeature >
        <geometricProperty typeName="center">
            <Point>
                <coordinates>-70., 44.</coordinates>
            </Point>
        </geometricProperty>
    </geoFeature>
</center>

<themes>
<theme name="wfs" >
    <wfs_feature_request
        service_url="http://199.29.1.81:8181/miwfs/GetFeature.ashx?"
        srs="EPSG:4326"
        feature_name="usa"
        spatial_column="obj"
        render_style="CBSTATES"
        label_column="STATE_NAME"
        label_style="T.CITY NAME"
        feature_attributes="state"
        datasource="mvdemo" />
    </theme>
</themes>

<styles>
<style name="CBSTATES">
    <AdvancedStyle>

```

```
<BucketStyle>
  <Buckets default_style="C.COUNTIES">
    <CollectionBucket seq="0" type="string" style="C.RB13_
13">MA</CollectionBucket>
    <CollectionBucket seq="1" type="string" style="C.RB13_
1">NH</CollectionBucket>
    <CollectionBucket seq="2" type="string" style="C.RB13_
7">ME</CollectionBucket>
  </Buckets>
</BucketStyle>
</AdvancedStyle>
</style>
</styles>
</map_request>
```

3.1.1.15 Java Program Using MapViewer

[Example 3–18](#) uses the `java.net` package to send an XML request to MapViewer and to receive the response from MapViewer. (Note, however, most programmers will find it more convenient to use the JavaBean-based API, described in [Chapter 4](#).)

Example 3–18 Java Program That Interacts with MapViewer

```
import java.net.*;
import java.io.*;

/**
 * A sample program that shows how to interact with MapViewer
 */
public class MapViewerDemo
{
    private HttpURLConnection mapViewer = null;

    /**
     * Initializes this demo with the URL to the MapViewer server.
     * The URL is typically http://my_corp.com:8888/mapviewer/omserver.
     */
    public MapViewerDemo(String mapViewerURLString)
    {
        URL url;

        try
        {
            url = new URL(mapViewerURLString);
            mapViewer = (HttpURLConnection) url.openConnection();
            mapViewer.setDoOutput(true);
            mapViewer.setDoInput(true);
            mapViewer.setUseCaches(false);
        }
        catch (Exception e)
        {
            e.printStackTrace(System.err);
            System.exit(1);
        }
    }

    /**
     * Submits an XML request to MapViewer.
     * @param xmlreq    the XML document that is a MapViewer request
     */
}
```

```

public void submitRequest(String xmlreq)
{
    try
    {
        mapViewer.setRequestMethod("POST"); //Use HTTP POST method.
        OutputStream os = mapViewer.getOutputStream();
        //MapViewer expects to find the request as a parameter
        //named "xml_request".
        xmlreq = "xml_request=" + URLEncoder.encode(xmlreq);
        os.write(xmlreq.getBytes());
        os.flush();
        os.close();
    }
    catch (Exception e)
    {
        e.printStackTrace(System.err);
        System.exit(1);
    }
}

/**
 * Receives an XML response from MapViewer.
 */
public String getResponse()
{
    ByteArrayOutputStream content = new ByteArrayOutputStream();
    InputStream is = null;
    try
    {
        is = mapViewer.getInputStream();
        int c;
        while ((c = is.read()) != -1)
            content.write(c);
        is.close();
        content.flush();
        content.close();
        return content.toString();
    }
    catch (Exception e)
    {
        e.printStackTrace(System.err);
        return null;
    }
}

// A simple main program that sends a list_data_sources XML
// request to MapViewer through HTTP POST
public static void main(String[] args)
{
    if(args.length<1)
    {
        System.out.println("Usage: java MapViewerDemo <mapviewer url>");
        System.out.println("Example: java MapViewerDemo http://my_
corp.com/mapviewer/omserver");
        System.exit(1);
    }

    // A sample XML request for MapViewer
    String
listDataSources = "<?xml version=\"1.0\" standalone=\"yes\"?>" +

```

```

        "  <non_map_request>" +
        "    <list_data_sources/>" +
        "  </non_map_request>";

MapViewerDemo tester = null;
tester = new MapViewerDemo(args[0]);
System.out.println("submitting request:\n"+listDataSources);
tester.submitRequest(listDataSources);
String response = tester.getResponse();
System.out.println("response from MapViewer: \n" + response);
}
}
}

```

3.1.1.16 PL/SQL Program Using MapViewer

[Example 3-19](#) is a sample PL/SQL program that sends an XML request to the MapViewer server.

Example 3-19 PL/SQL Program That Interacts with MapViewer

```

set serverout on size 1000000;

--
-- Author: Clarke Colombo
--
declare

    l_http_req    utl_http.req;
    l_http_resp   utl_http.resp;
    l_url         varchar2(4000) := 'http://my_corp.com:8888/mapviewer/omserver';

    l_value        varchar2(4000);
    img_url       varchar2(4000);
    response      sys.xmltype;

    output         varchar2(255);

    map_req        varchar2(4000);

begin

    utl_http.set_persistent_conn_support(TRUE);

    map_req := '<?xml version="1.0" standalone="yes"?>
<map_request title="MapViewer Demonstration"
              datasource="mvdemo"
              basemap="course_map"
              width="500"
              height="375"
              bgcolor="#a6cae0"
              antialiasing="false"
              format="GIF_URL">
<center size="5">
<geoFeature>
<geometricProperty>
<Point>
<coordinates>-122.2615, 37.5266</coordinates>
</Point>
</geometricProperty>

```

```

        </geoFeature>
    </center>
</map_request>';

l_http_req := utl_http.begin_request(l_url, 'POST', 'HTTP/1.0');

--
-- Sets up proper HTTP headers.
--
utl_http.set_header(l_http_req, 'Content-Type',
'application/x-www-form-urlencoded');
utl_http.set_header(l_http_req, 'Content-Length', length('xml_request=' || map_
req));
utl_http.set_header(l_http_req, 'Host', 'my_corp.com');
utl_http.set_header(l_http_req, 'Port', '8888');
utl_http.write_text(l_http_req, 'xml_request=' || map_req);
--
l_http_resp := utl_http.get_response(l_http_req);

utl_http.read_text(l_http_resp, l_value);

response := sys.xmltype.createxml (l_value);

utl_http.end_response(l_http_resp);

img_url := response.extract('/map_response/map_image/map_
content@url').getstringval();

dbms_output.put_line(img_url);

end;
/

```

3.1.2 Map Request DTD

The following is the complete DTD for a map request, which is followed by reference sections that describe each element and its attributes.

```

<?xml version="1.0" encoding="UTF-8"?>
<!-- &lt;box&gt; is defined in OGC GML v1.0 --&gt;
&lt;!ELEMENT map_request ((box | center | bounding_themes)?, srs?, legend?, themes?,
styles?, scale_bar?, north_arrow?, geoFeature*)&gt;
&lt;!ATTLIST map_request
  datasource   CDATA #REQUIRED
  srid         CDATA #IMPLIED
  basemap      CDATA #IMPLIED
  width        CDATA #IMPLIED
  height       CDATA #IMPLIED
  antialiasing (TRUE|FALSE) "FALSE"
  imagescaling (TRUE|FALSE) "TRUE"
  format       (GIF|GIF_URL|GIF_STREAM|JAVA_IMAGE|
                PNG_STREAM|PNG_URL|PNG8_STREAM|PNG8_URL|
                JPEG_STREAM|JPEG_URL|PDF_STREAM|PDF_URL|
                SVG_STREAM|SVGZ_STREAM|SVGTINY_STREAM|
                SVG_URL|SVGZ_URL|SVGTINY_URL) "GIF_URL"
  transparent  (TRUE|FALSE) "FALSE"
  title        CDATA #IMPLIED
  bgcolor      (CDATA) "#A6CAF0"
  bgimage      CDATA #IMPLIED
  zoomlevels   CDATA #IMPLIED
</pre>

```

```

zoomfactor      CDATA #IMPLIED
zoomratio       CDATA #IMPLIED
initscale       CDATA #IMPLIED
navbar          (TRUE|FALSE) "TRUE"
infoon          (TRUE|FALSE) "TRUE"
onclick         CDATA #IMPLIED
onmousemove     CDATA #IMPLIED
rasterbasemap   (TRUE|FALSE) "FALSE"
onrectselect    CDATA #IMPLIED
onpolyselect    CDATA #IMPLIED
use_cached_basemap (TRUE|FALSE) "FALSE"
snap_to_cache_scale (TRUE|FALSE) "FALSE"
title_style     CDATA #IMPLIED
footnote        CDATA #IMPLIED
footnote_style  CDATA #IMPLIED
rotation        CDATA #IMPLIED*
>
<!ELEMENT center (geoFeature)>
<!ATTLIST center
      size CDATA #REQUIRED
>
<!ELEMENT box (coordinates) >
<!ATTLIST box
      ID          CDATA #IMPLIED
      srsName     CDATA #REQUIRED
      preserve_aspect_ratio (TRUE|FALSE) "FALSE"
>
<!ELEMENT bounding_themes (#PCDATA) >
<!ATTLIST bounding_themes
      border_margin    CDATA #IMPLIED
      preserve_aspect_ratio CDATA "TRUE"
      size_hint        CDATA #IMPLIED
>
<!ELEMENT srs (#PCDATA) >

<!ELEMENT themes (theme+) >
<!ELEMENT theme (jdbc_query | jdbc_image_query | jdbc_georaster_query
                  | jdbc_network_query | jdbc_topology_query
                  | map_tile_theme
)? >
<!ATTLIST theme
      name          CDATA #REQUIRED
      datasource    CDATA #IMPLIED
      max_scale     CDATA #IMPLIED
      min_scale     CDATA #IMPLIED
      label_always_on (TRUE|FALSE) "FALSE"
      fast_unpickle (TRUE|FALSE) "TRUE"
      mode          CDATA #IMPLIED
      min_dist      CDATA #IMPLIED
      fixed_svglabel (TRUE|FALSE) "FALSE"
      visible_in_svg (TRUE|FALSE) "TRUE"
      selectable_in_svg (TRUE|FALSE) "FALSE"
      part_of_basemap (TRUE|FALSE) "FALSE"
      simplify_shapes (TRUE|FALSE) "TRUE"
      onclick        CDATA #IMPLIED
      onmousemove    CDATA #IMPLIED
      onmouseover    CDATA #IMPLIED
      onmouseout     CDATA #IMPLIED
      workspace_name CDATA #IMPLIED
      workspace_savepoint CDATA #IMPLIED

```

```

workspace_date      CDATA #IMPLIED
workspace_date_format CDATA #IMPLIED
>
<!ELEMENT jdbc_query (#PCDATA, hidden_info?)>
<!ATTLIST jdbc_query
    asis          (TRUE|FALSE) "FALSE"
    spatial_columnn  CDATA #REQUIRED
    key_columnn    CDATA #IMPLIED
    label_columnn  CDATA #IMPLIED
    label_style    CDATA #IMPLIED
    render_style   CDATA #IMPLIED
    datasource     CDATA #IMPLIED
    jdbc_host      CDATA #IMPLIED
    jdbc_port      CDATA #IMPLIED
    jdbc_sid       CDATA #IMPLIED
    jdbc_user      CDATA #IMPLIED
    jdbc_password  CDATA #IMPLIED
    jdbc_srid      CDATA #IMPLIED
    jdbc_mode      (thin|oci8) "thin"
>
<!ELEMENT hidden_info (field+)>
<!ELEMENT field (#PCDATA)>
<!ATTLIST field
    column  CDATA #REQUIRED
    name    CDATA #IMPLIED
>
<!ELEMENT jdbc_image_query (#PCDATA) >
<!ATTLIST jdbc_image_query
    asis          (TRUE|FALSE) "FALSE"
    image_format  CDATA #REQUIRED
    image_columnn CDATA #REQUIRED
    image_mbr_columnn CDATA #REQUIRED
    image_resolution CDATA #IMPLIED
    image_unit    CDATA #IMPLIED
    datasource    CDATA #IMPLIED
    jdbc_host      CDATA #IMPLIED
    jdbc_port      CDATA #IMPLIED
    jdbc_sid       CDATA #IMPLIED
    jdbc_user      CDATA #IMPLIED
    jdbc_password  CDATA #IMPLIED
    jdbc_srid      CDATA #IMPLIED
    jdbc_mode      (thin|oci8) "thin"
>
<!ELEMENT jdbc_georaster_query (#PCDATA) >
<!ATTLIST jdbc_georaster_query
    asis          (TRUE|FALSE) "FALSE"
    georaster_table CDATA #REQUIRED
    georaster_columnn CDATA #REQUIRED
    raster_id      CDATA #IMPLIED
    raster_table    CDATA #IMPLIED
    raster_pyramid  CDATA #IMPLIED
    raster_bands    CDATA #IMPLIED
    datasource     CDATA #IMPLIED
    polygon_mask    CDATA #IMPLIED
    transparent_nodata CDATA #IMPLIED
    jdbc_host      CDATA #IMPLIED
    jdbc_port      CDATA #IMPLIED
    jdbc_sid       CDATA #IMPLIED
    jdbc_user      CDATA #IMPLIED
    jdbc_password  CDATA #IMPLIED

```

```
        jdbc_srid          CDATA #IMPLIED
        jdbc_mode          (thin|oci8) "thin">
<!ELEMENT jdbc_network_query (#PCDATA) >
<!ATTLIST jdbc_network_query
    asis              (TRUE|FALSE) "FALSE"
    network_name      CDATA #REQUIRED
    network_level     CDATA #IMPLIED
    link_style        CDATA #IMPLIED
    direction_style   CDATA #IMPLIED
    direction_position CDATA #IMPLIED
    direction_markersize CDATA #IMPLIED
    link_labelstyle   CDATA #IMPLIED
    link_labelcolumnn CDATA #IMPLIED
    node_style        CDATA #IMPLIED
    node_markersize   CDATA #IMPLIED
    node_labelstyle   CDATA #IMPLIED
    node_labelcolumnn CDATA #IMPLIED
    path_ids          CDATA #IMPLIED
    path_styles       CDATA #IMPLIED
    path_labelstyle   CDATA #IMPLIED
    path_labelcolumnn CDATA #IMPLIED
    analysis_algorithm CDATA #IMPLIED
    shortestpath_style CDATA #IMPLIED
    shortestpath_startnode CDATA #IMPLIED
    shortestpath_endnode CDATA #IMPLIED
    shortestpath_startstyle CDATA #IMPLIED
    shortestpath_endstyle CDATA #IMPLIED
    withincost_startnode CDATA #IMPLIED
    withincost_style   CDATA #IMPLIED
    withincost_cost     CDATA #IMPLIED
    withincost_startstyle CDATA #IMPLIED
    datasource         CDATA #IMPLIED
    jdbc_host          CDATA #IMPLIED
    jdbc_port          CDATA #IMPLIED
    jdbc_sid           CDATA #IMPLIED
    jdbc_user          CDATA #IMPLIED
    jdbc_password      CDATA #IMPLIED
    jdbc_srid          CDATA #IMPLIED
    jdbc_mode          (thin|oci8) "thin"
>
<!ELEMENT jdbc_topology_query (#PCDATA)>
<!ATTLIST jdbc_topology_query
    asis              (TRUE|FALSE) "FALSE"
    topology_name     CDATA #REQUIRED
    feature_table     CDATA #REQUIRED
    spatial_column    CDATA #REQUIRED
    label_column      CDATA #IMPLIED
    label_style        CDATA #IMPLIED
    render_style       CDATA #IMPLIED
    datasource         CDATA #IMPLIED
    edge_style         CDATA #IMPLIED
    edge_marker_style CDATA #IMPLIED
    edge_marker_size   CDATA #IMPLIED
    edge_label_style   CDATA #IMPLIED
    node_style         CDATA #IMPLIED
    node_label_style   CDATA #IMPLIED
    face_style         CDATA #IMPLIED
    face_label_style   CDATA #IMPLIED
    jdbc_host          CDATA #IMPLIED
    jdbc_port          CDATA #IMPLIED
```

```

    jdbc_sid          CDATA #IMPLIED
    jdbc_user         CDATA #IMPLIED
    jdbc_password    CDATA #IMPLIED
    jdbc_srid         CDATA #IMPLIED
    jdbc_mode         (thin|oci8) "thin"
  >
<!ELEMENT map_tile_theme (#PCDATA)>
<!ATTLIST map_tile_theme
  map_tile_layer   CDATA # REQUIRED
  snap_to_tile_scale (TRUE|FALSE) "FALSE"
>
<!ELEMENT geoFeature (description?, property*,
geometricProperty)>
<!ATTLIST geoFeature
  typeName          CDATA #IMPLIED
  id               CDATA #IMPLIED
  render_style     CDATA #IMPLIED
  text_style       CDATA #IMPLIED
  label            CDATA #IMPLIED
  label_always_on  (TRUE|FALSE) "FALSE"
  marker_size      CDATA #IMPLIED
  radius           CDATA #IMPLIED
  attribute_values CDATA #IMPLIED
  orient_x         CDATA #IMPLIED
  orient_y         CDATA #IMPLIED
  orient_z         CDATA #IMPLIED
  selectable_in_svg (TRUE|FALSE) "FALSE"
  onclick          CDATA #IMPLIED
  hidden_info      CDATA #IMPLIED
>
<!ELEMENT legend column+ >
<!ATTLIST legend
  bgstyle          CDATA #implied
  font             CDATA #implied
  location_x      CDATA #implied
  location_y      CDATA #implied
  offset_x        CDATA #implied
  offset_y        CDATA #implied
  profile          (MEDIUM|SMALL|LARGE) "MEDIUM"
  position         (SOUTH_WEST|SOUTH_EAST|SOUTH|NORTH|
                     NORTH_WEST|NORTH_EAST|EAST|WEST|CENTER) "SOUTH_WEST"
>
<!ELEMENT column entry+ >
<!ATTLIST entry
  is_title         (true|false) "false"
  is_separator     (true|false) "false"
  tab              CDATA "0"
  style            CDATA #implied
  text             CDATA #implied
>
<!ELEMENT scale_bar >
<!ATTLIST scale_bar
  mode             (METRIC_MODE|US_MODE|DUAL_MODES) "METRIC_MODE"
  position         (SOUTH_WEST|SOUTH_EAST|SOUTH|NORTH|
                     NORTH_WEST|NORTH_EAST) "NORTH_EAST"
  offset_y        CDATA #implied
  offset_y        CDATA #implied
  color1          CDATA #implied
  color1_opacity  CDATA #implied
  color2          CDATA #implied

```

```
color2_opacity      CDATA #IMPLIED
length_hint        CDATA #IMPLIED
label_color        CDATA #IMPLIED
label_font_family  CDATA #IMPLIED
label_font_size    CDATA #IMPLIED
label_halo_size   CDATA #IMPLIED
label_position     (TOP|BOTTOM) "TOP"
>
<!ELEMENT styles (style+)
<!ELEMENT style (svg | AdvancedStyle)?
<!ATTLIST style
  name CDATA #REQUIRED
>
<!ELEMENT north_arrow (style, location?, size?)>
```

The main elements and attributes of the map request DTD are explained in sections that follow. The `<map_request>` element is described in [Section 3.1.2.1](#). The remaining related elements are described, in alphabetical order by element name, in the following sections:

- [Section 3.1.2.2, "bounding_themes Element"](#)
- [Section 3.1.2.3, "box Element"](#)
- [Section 3.1.2.4, "center Element"](#)
- [Section 3.1.2.5, "geoFeature Element"](#)
- [Section 3.1.2.6, "jdbc_georaster_query Element"](#)
- [Section 3.1.2.7, "jdbc_image_query Element"](#)
- [Section 3.1.2.8, "jdbc_network_query Element"](#)
- [Section 3.1.2.9, "jdbc_query Element"](#)
- [Section 3.1.2.10, "jdbc_topology_query Element"](#)
- [Section 3.1.2.11, "legend Element"](#)
- [Section 3.1.2.12, "map_tile_theme Element"](#)
- [Section 3.1.2.13, "north_arrow Element"](#)
- [Section 3.1.2.14, "operation Element"](#)
- [Section 3.1.2.15, "operations Element"](#)
- [Section 3.1.2.16, "parameter Element"](#)
- [Section 3.1.2.17, "scale_bar Element"](#)
- [Section 3.1.2.18, "style Element"](#)
- [Section 3.1.2.19, "styles Element"](#)
- [Section 3.1.2.20, "theme Element"](#)
- [Section 3.1.2.21, "themes Element"](#)

3.1.2.1 `map_request` Element

The `<map_request>` element has the following definition:

```
<!ELEMENT map_request ((box | center | bounding_themes)?, srs?, legend?, themes?,
  styles?, geoFeature*)>
<!ELEMENT map_request ((box | center | bounding_themes)?, srs?, legend?, themes?,
  styles?, geoFeature*, north_arrow?)>
```

The root element of a map request to MapViewer is always named `map_request`.

`<map_request>` can have a child element that is `<box>` (see [Section 3.1.2.3](#)), `<center>` (see [Section 3.1.2.4](#)), or `<bounding_themes>` (see [Section 3.1.2.2](#)), which specifies the range of the user data to be plotted on a map. If none of these child elements is specified, the result map is drawn using all data available to MapViewer.

The optional `<srs>` child element is ignored by the current version of MapViewer.

The optional `<legend>` element (see [Section 3.1.2.11](#)) is used to draw a legend (map inset illustration) on top of a generated map, to make the visual aspects of the map more meaningful to users.

The optional `<themes>` element (see [Section 3.1.2.21](#)) specifies predefined or dynamically defined themes.

The optional `<styles>` element (see [Section 3.1.2.19](#)) specifies dynamically defined styles.

The `<geoFeature>` element (see [Section 3.1.2.5](#)) can be used to specify any number of individual geometries and their rendering attributes.

The optional `<north_arrow>` element (see [Section 3.1.2.13](#)) is used to draw a north arrow marker based on the request rotation.

MapViewer first draws the themes defined in a base map (if a base map is specified as an attribute in the root element), then any user-provided themes, and finally any `geoFeature` elements.

3.1.2.1.1 `map_request` Attributes The root element `<map_request>` has a number of attributes, some required and the others optional. The attributes are defined as follows:

```
<!ATTLIST map_request
  datasource   CDATA #REQUIRED
  srid        CDATA #IMPLIED
  basemap     CDATA #IMPLIED
  width       CDATA #IMPLIED
  height      CDATA #IMPLIED
  antialiasing (TRUE|FALSE) "FALSE"
  imagescaling (TRUE|FALSE) "TRUE"
  format      (GIF|GIF_URL|GIF_STREAM|JAVA_IMAGE|
               PNG_STREAM|PNG_URL|PNG8_STREAM|PNG8_URL|
               JPEG_STREAM|JPEG_URL|PDF_STREAM|PDF_URL|
               SVG_STREAM|SVGZ_STREAM|SVGTINY_STREAM|
               SVG_URL|SVGZ_URL|SVGTINY_URL) "GIF_URL"
  transparent (TRUE|FALSE) "FALSE"
  title       CDATA #IMPLIED
  title_style CDATA #IMPLIED
  footnote    CDATA #IMPLIED
  footnote_style CDATA #IMPLIED
  rotation    CDATA #IMPLIED*
  bgcolor    (CDATA) "#A6CAF0"
  bgimage    CDATA #IMPLIED
  zoomlevels CDATA #IMPLIED
  zoomfactor CDATA #IMPLIED
  zoomratio   CDATA #IMPLIED
  initscale   CDATA #IMPLIED
  navbar      (TRUE|FALSE) "TRUE"
  infoon      (TRUE|FALSE) "TRUE"
  onclick     CDATA #IMPLIED
```

```

onmousemove    CDATA #IMPLIED
rasterbasemap (TRUE|FALSE) "FALSE"
onrectselect   CDATA #IMPLIED
onpolyselect   CDATA #IMPLIED
keepthemesorder CDATA #IMPLIED
use_cached_basemap (TRUE|FALSE) "FALSE"
snap_to_cache_scale (TRUE|FALSE) "FALSE"
title_style    CDATA #IMPLIED
footnote       CDATA #IMPLIED
footnote_style CDATA #IMPLIED
rotation       CDATA #IMPLIED*
>

```

`datasource` is a required attribute that specifies a data source. A data source provides information to MapViewer about where to fetch the user data (and the mapping metadata) that is required to render a map.

`srid` is an optional attribute. If it is specified, it provides the SRID value of the coordinate system (spatial reference system) for the map request. If necessary, theme geometries will be converted to the specified coordinate system before being rendered, although geometries with an undefined coordinate system will not be converted. If this attribute is not specified, MapViewer uses the coordinate system of the first theme to be rendered as the coordinate system for the map request.

`basemap` is an optional attribute. When it is specified, MapViewer renders all themes that are specified for this base map. The definition of a base map is stored in the user's `USER_SDO_MAPS` view, as described in [Section 2.9.3](#). Use this attribute if you will always need a background map on which to plot your own themes and geometry features.

`width` and `height` are optional attributes that together specify the size (in device units) of the resulting map image. This size is different from the size specified in the `center` element or `box` element, which is the range of the window into a user's source data. The default width and height values are 500 and 375 pixels, respectively. The unit is in pixels except for PDF formats, in which case `pt` is used as the unit, and the relationship with pixels is approximately $1 \text{ pt} = 1.333 \text{ px}$ (or, $1\text{px} = 0.75 \text{ pt}$). Thus, for example, if you request a map with size `500x375 "pt"` in PDF format, this should generate an image of approximately 667x500 pixels.

`antialiasing` is an optional attribute. When its value is `TRUE`, MapViewer renders the map image in an antialiased manner. This usually provides a map with better graphic quality, but it may take longer for the map to be generated. The default value is `FALSE` (for faster map generation). (For backward compatibility, `antialiase` is a synonym for `antialiasing`, but you are encouraged to use `antialiasing`.)

`imagescaling` is an optional attribute. When its value is `TRUE` (the default), MapViewer attempts to scale the images to fit the current querying window and the generated map image size. When its value is `FALSE`, and if an image theme is included directly or indirectly (such as through a base map), the images from the image theme are displayed in their original resolution. This attribute has no effect when no image theme is involved in a map request.

`format` is an optional attribute that specifies the file format of the returned map image. The default value is `GIF_URL`, which is a URL to a GIF image stored on the MapViewer host system.

- If you specify `GIF`, the generated GIF image data is embedded in a `MapResponse` object and returned to the client. If you specify `GIF_STREAM`, the generated image map content is returned directly to the client through the HTTP MIME type `image/gif`.

- If you specify JAVA_IMAGE, a Java 2D BufferedImage object with a color model of TYPE_INT_RGB is embedded in a MapResponse object and returned to the client.
- If you specify PNG_STREAM, the stream of the image in nonindexed PNG format is returned directly; if you specify PNG_URL, a URL to a nonindexed PNG image stored on the MapViewer host system is returned. (The PNG image format has some advantages over the GIF format, including faster image encoding and true color support.)
- If you specify PNG8_STREAM, the stream of the image in indexed PNG format is returned directly; if you specify PNG8_URL, a URL to an indexed PNG image stored on the MapViewer host system is returned. (The PNG image format has some advantages over the GIF format, including faster image encoding and true color support. The indexed PNG format limits the total number of colors available for displaying the map to 256.)
- If you specify JPEG_STREAM, the stream of the image in JPEG format is returned directly; if you specify JPEG_URL, a URL to a JPEG image stored on the MapViewer host system is returned.
- If you specify PDF_STREAM, the stream of the image in PDF document format is returned directly; if you specify PDF_URL, a URL to a PDF document stored on the MapViewer host system is returned.
- If you specify SVG_STREAM, the stream of the image in SVG Basic (SVGB) format is returned directly; if you specify SVG_URL, a URL to an SVG Basic image stored on the MapViewer host system is returned.
- If you specify SVGZ_STREAM, the stream of the image in SVG Compressed (SVGZ) format is returned directly; if you specify SVGZ_URL, a URL to an SVG Compressed image stored on the MapViewer host system is returned. SVG Compressed format can effectively reduce the size of the SVG map by 40 to 70 percent compared with SVG Basic format, thus providing better performance.
- If you specify SVGTINY_STREAM, the stream of the image in SVG Tiny (SVGT) format is returned directly; if you specify SVGTINY_URL, a URL to an SVG Tiny image stored on the MapViewer host system is returned. (The SVG Tiny format is designed for devices with limited display capabilities, such as cell phones.)

`transparent` is an optional attribute that applies to indexed PNG (PNG8_STREAM or PNG8_URL) formats only. When its value is TRUE, MapViewer makes the map background color completely transparent. The default value is FALSE.

`title` is an optional attribute that specifies the map title to be displayed on the top of the resulting map image.

`title_style` is an optional attribute that specifies the name of the text style to be used when rendering the title.

`footnote` is an optional attribute that specifies the footnote text to be added on the final map.

`footnote_style` is an optional attribute that specifies the name of the text style to be used when rendering the footnote.

`bgcolor` is an optional attribute that specifies the background color in the resulting map image. The default is water-blue (RGB value #A6CAF0). It must be specified as a hexadecimal value.

`bgimage` is an optional attribute that specifies the background image (GIF or JPEG format only) in the resulting map image. The image is retrieved at runtime when a

map request is being processed, and it is rendered before any other map features, except that any `bgcolor` value is rendered before the background image.

`zoomlevels` is an optional attribute that specifies the number of zoom levels for an SVG map. The default is 4.

`zoomfactor` is an optional attribute that specifies the zoom factor for an SVG map. The zoom factor is the number by which to multiply the current zoom ratio for each integer increment (a `zoomin` operation) in the zoom level. The inverse of the `zoomfactor` value is used for each integer decrement (a `zoomout` operation) in the zoom level. For example, if the `zoomfactor` value is 2 (the default), zooming in from zoom level 4 to 5 will enlarge the detail by two; for example, if 1 inch of the map at zoom level 4 represents 10 miles, 1 inch of the map at zoom level 5 will represent 5 miles. The zoom ratio refers to the relative scale of the SVG map, which in its original size (zoom level 0) has a zoom ratio of 1.

`zoomratio` is an optional attribute that specifies the zoom ratio when an SVG map is initially displayed. The default value is 1, which is the original map size (zoom level 0). Higher zoom ratio values show the map zoomed in, and lower values show the map zoomed out.

`initscale` is an optional attribute that specifies the initial scale when an SVG map is first displayed. The default value is 1, which is the original map size (zoom level 0). Higher values will show the SVG map zoomed in when it is first displayed.

`navbar` is an optional attribute that specifies whether to display the built-in navigation bar on an SVG map. If its value is `TRUE` (the default), the navigation bar is displayed; if it is set to `FALSE`, the navigation bar is not displayed.

`infoon` is an optional attribute that specifies whether to display hidden information when the mouse moves over features for which hidden information is provided. If its value is `TRUE` (the default), hidden information is displayed when the mouse moves over such features; if it is set to `FALSE`, hidden information is not displayed when the mouse moves over such features. Regardless of the value, however, hidden information is always rendered in an SVG map; this attribute only controls whether hidden information can be displayed. (To specify the hidden information for a feature, use the `hidden_info` attribute in the `<geoFeature>` element, as explained in [Section 3.1.2.5](#).)

`onclick` is an optional attribute that specifies the name of the JavaScript function to be called when a user clicks on an SVG map. The JavaScript function must be defined in the HTML document outside the SVG definition. This function must accept two parameters: `x` and `y`, which specify the coordinates inside the SVG window where the click occurred. The coordinates are defined in the local SVG window coordinate system, which starts at $(0, 0)$ at the upper-left corner and ends at $(width, height)$ at the lower-right corner. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`onmousemove` is an optional attribute that specifies the name of the JavaScript function to be called when a user moves the mouse on an SVG map. The JavaScript function must be defined in the HTML document outside the SVG definition. This function must accept two parameters: `x` and `y`, which specify the coordinates inside the SVG window where the move occurred. The coordinates are defined in the local SVG window coordinate system, which starts at $(0, 0)$ at the upper-left corner and ends at $(width, height)$ at the lower-right corner. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`rasterbasemap` is an optional attribute. If the map format is SVG and the value of this attribute is `TRUE`, MapViewer renders the base map as a raster image. In this case, the

base map image becomes the background image for the SVG map, and all other vector features are rendered on top of it.

`onrectselect` is an optional attribute that specifies the name of the JavaScript function to be called when a user draws a rectangular selection area by clicking and dragging the mouse (to indicate two diagonally opposite corners) on an SVG map. The JavaScript function must be defined in the HTML document outside the SVG definition. This function must not accept any parameters. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`onpolyselect` is an optional attribute that specifies the name of the JavaScript function to be called when a user draws a polygon-shaped selection area by clicking and dragging the mouse (to indicate more than two vertices) on an SVG map. The JavaScript function must be defined in the HTML document outside the SVG definition. This function must not accept any parameters. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`keepthemesorder` is an optional attribute. If the map format is not SVG and the value of this attribute is TRUE, MapViewer always renders the themes in the order specified in the map request; if the value of this attribute is FALSE, raster themes will be rendered before vector themes.

`use_cached_basemap` is an optional attribute. If the value of this attribute is TRUE and if a map tile layer caches the same base map specified by the `basemap` attribute, MapViewer tries to use the map images cached by the map tile server to render the map specified by the map request. For information about the map tile server, see [Section 3.3](#).

`snap_to_cache_scale` is an optional attribute that is effective only when the `use_cached_basemap` attribute value is TRUE. It affects the behavior of MapViewer only when the map scale specified by the map request does not match that of any predefined cached zoom level. If this attribute is FALSE, MapViewer uses the cached map images to render the base map only when the map scale specified by the map request matches the scale of a cached predefined zoom level. If this attribute is TRUE, MapViewer always uses the cached map images to render the base map and adjusts the map scale to fit that of a cached predefined zoom level when the request map scale does not match any of the cached predefined zoom levels.

`title_style` is an optional attribute that defines the text style to be used for the title.

`footnote` is an optional attribute that defines the text for a footnote to be added to the map.

`footnote_style` is an optional attribute that defines the text style to be used for the footnote text.

`rotation` is an optional attribute defined in degrees to apply a rotation on the map. Positive values means counterclockwise rotation of the map. Rotation values are ignored if the request does not have a window defined (no center and size defined, or using bounding themes). Rotation is not supported for requests using base maps coming from the Oracle Maps cache.

3.1.2.2 `bounding_themes` Element

The `<bounding_themes>` element has the following definition:

```
<!ELEMENT bounding_themes (#PCDATA) >
<!ATTLIST bounding_themes
    border_margin      CDATA  #IMPLIED
    preserve_aspect_ratio CDATA  "TRUE"
    size_hint          CDATA  #IMPLIED
```

>

You can specify one or more themes as the bounding themes when you cannot predetermine the data size for a map. For example, you may have one dynamic theme that selects all data points that meet certain criteria, and you then want to plot those data points on a map that is just big enough to enclose all the selected data points. In such cases, you can use the `<bounding_themes>` element to specify the names of such dynamic themes. MapViewer first processes any themes that are specified in the `<bounding_themes>` element, generates a bounding box based on the resulting features of the bounding themes, and then prepares other themes according to the new bounding box.

The `<bounding_themes>` element is ignored if you specify the `<box>` or `<center>` element in the map request.

`border_margin` is an optional attribute that specifies the percentage to be added to each margin of the generated bounding box. For example, if you specify a value of 0.025, MapViewer adds 2.5% of the width to the left and right margins of the generated bounding box (resulting in a total 5% width expansion in the x-axis); similarly, 2.5% of the height is added to the top and bottom margins. The default value is 0.05, or 5% to be added to each margin.

`preserve_aspect_ratio` is an optional attribute that indicates whether or not the bounding box generated after processing the bounding themes should be further modified so that it has the same aspect ratio as the map image or device. The default is `TRUE`, which modifies the bounding box to preserve the aspect ratio, so as not to distort the resulting map image.

`size_hint` is an optional attribute that specifies the vertical span of the map in terms of the original data unit. For example, if the user's data is in decimal degrees, the `size_hint` attribute specifies the number of decimal degrees in latitude. If the user's data is projected with meter as its unit, MapViewer interprets `size_hint` in meters.

The `size_hint` attribute can be used to extend the boundary limit. This is useful when the bounding theme has just one point feature. For example, the bounding theme can be a point resulting from a geocoding query, and you want to place this point in the middle of the map and extend the boundary from that point. This attribute can also be used if you want to extend the data bounds when the map image is rendered. For example, if the bounding theme contains a county of a state that spans 0.2 degrees vertically, then the county will appear much smaller in the map image if you specify `size_hint="10"`. This attribute is ignored if its value is smaller than the actual data bounds. For example, if the actual spatial feature spans 0.2 degrees, then `size_hint="0.01"` is ignored.

The element itself contains a comma-delimited list of names of the bounding themes. The theme names must exactly match their names in the map request or the base map used in the map request. The following example shows a map request with two bounding themes, named `theme1` and `theme3`, and with 2.3 percent (`border_margin="0.023"`) added to all four margins of the minimum bounding box needed to hold features associated with the two themes:

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="Bounding Theme Example"
    title_style="titleText"
    datasource = "mvdemo"
    basemap="demo_map"
    width="600"
    height="500"
    bgcolor="#a6cae0"
```

```

        antialiase="false"
        mapfilename="tilsmq202"
        format="PNG_STREAM">

<bounding_themes border_margin="0.023">theme1, theme3</bounding_themes>
<themes>
    <theme name="theme1" min_scale="5.0E7" max_scale="0.0">
        <jdbc_query
            datasource="mvdemo"
            jdbc_srid="8307"
            spatial_column="geom" label_column="STATE"
            render_style="myPattern" label_style="myText"
            >SELECT geom, state from states where state_abrv='IL'</jdbc_query>
    </theme>
    <theme name="theme3" min_scale="5.0E7" max_scale="0.0">
        <jdbc_query
            datasource="mvdemo"
            jdbc_srid="8307"
            spatial_column="geom" label_column="STATE"
            render_style="myPattern" label_style="myText"
            >SELECT geom,state from states where state_abrv='IN'</jdbc_query>
    </theme>
</themes>
<styles>
    <style name="myPattern">
        <svg width="1in" height="1in">
        <desc></desc>
        <g class="area"
            style="stroke:#6666e0;fill:#d6ccff;fill-opacity:128;line-style:L.STATE
BOUNDARY">
            </g>
        </svg>
    </style>
    <style name="myText">
        <svg width="1in" height="1in">
        <g class="text" float-width="1.0"
            style="font-style:bold;font-family:Arial;font-size:16pt;fill:#6600ff">
            Hello World!
        </g>
        </svg>
    </style>
    <style name="titleText">
        <svg width="1in" height="1in">
        <g class="text" float-width="1.0"
            style="font-style:bold;font-family:Helvetica;font-size:18pt;fill:#333333">
            Hello World!
        </g>
        </svg>
    </style>
</styles>
</map_request>

```

The preceding example displays a map in which the states of Illinois and Indiana are displayed according to the specifications in the two `<theme>` elements, both of which specify a rendering style named `myPattern`. In the `myText` style, the text "Hello World!" is displayed only when the style is being previewed in a style creation tool, such as the Map Builder tool. When the style is applied to a map, it is supplied with an actual text label that MapViewer obtains from a theme.

Figure 3–2 shows the display from the preceding example.

Figure 3–2 Bounding Themes



3.1.2.3 box Element

The <box> element has the following definition:

```
<!ELEMENT box (coordinates) >
<!ATTLIST box
      ID          CDATA #IMPLIED
      srsName     CDATA #REQUIRED
      preserve_aspect_ratio (TRUE|FALSE) "FALSE"
    >
```

The <box> element is used to specify the bounding box of a resulting map. It uses a <coordinates> element to specify two coordinate value pairs that identify the lower-left and upper-right corners of the rectangle. The coordinate values are interpreted in terms of the user's data. For example, if the user's data is geodetic and is specified in decimal degrees of longitude and latitude, a <coordinates> specification of -72.84, 41.67, -70.88, 42.70 indicates a bounding box with the lower-left corner at longitude-latitude coordinates (-72.84, 41.67) and the upper-right corner at coordinates (-70.88, 42.70), which are in the New England region of the United States. However, if the data is projected with meter as its unit of measurement, the coordinate values are interpreted in meters.

`preserve_aspect_ratio` is an optional attribute that indicates whether or not the box coordinates should be further modified so that it has the same aspect ratio as the map

image or device. The default is FALSE, in order to keep compatibility with previous versions that do not have this attribute. If this value is set to TRUE, the box is modified to preserve the aspect ratio, so as not to distort the resulting map image.

3.1.2.4 center Element

The <center> element has the following definition:

```
<!ELEMENT center (geoFeature)>
<!ATTLIST center
    size CDATA #REQUIRED
>
```

The <center> element is used to specify the center of a resulting map. It has a required attribute named `size`, which specifies the vertical span of the map in terms of the original data unit. For example, if the user's data is in decimal degrees, the `size` attribute specifies the number of decimal degrees in latitude. If the user's data is projected with meter as its unit, MapViewer interprets the `size` in meters.

The center itself must embed a <geoFeature> element, which is specified in [Section 3.1.2.5](#).

3.1.2.5 geoFeature Element

The <geoFeature> element has the following definition:

```
<!ELEMENT geoFeature (description?, property*,
    geometricProperty)>
<!ATTLIST geoFeature
    typeName      CDATA #IMPLIED
    id           CDATA #IMPLIED
    render_style  CDATA #IMPLIED
    text_style    CDATA #IMPLIED
    label         CDATA #IMPLIED
    label_always_on (TRUE|FALSE) "FALSE"
    marker_size   CDATA #IMPLIED
    radius        CDATA #IMPLIED
    attribute_values CDATA #IMPLIED
    orient_x      CDATA #IMPLIED
    orient_y      CDATA #IMPLIED
    orient_z      CDATA #IMPLIED
    selectable_in_svg (TRUE|FALSE) "FALSE"
    onclick       CDATA #IMPLIED
    hidden_info   CDATA #IMPLIED
>
```

<geoFeature> elements are used to provide individual geospatial entities to be rendered on a map. The main part of a <geoFeature> element is the geometry (<geometricProperty> element), which must be supplied in compliance with the OGC GML v1.0 Geometry DTD (described in [Section 3.1.6](#)).

`typeName` is an optional attribute that is ignored by the current release of MapViewer.

`id` is an optional attribute that can be used to uniquely identify the feature among all the geospatial features on the SVG map. (See the explanation of the `selectable_in_svg` attribute.) Otherwise, this attribute is ignored by MapViewer.

`render_style` is an optional attribute. When it is omitted, the `geoFeature` is not rendered. If it is supplied, its value must be the name of a style stored in the user's `USER_SDO_STYLES` view.

`text_style` is an optional attribute. If it is supplied (and if the `render_style` and `label` attributes are present and valid), it identifies the style to be used in labeling the feature. If it is not specified, a default text style is used.

`label` is an optional attribute. If it is supplied (and if the `render_style` and `label` attributes are present and valid), it identifies text that is used to label the feature.

`label_always_on` is an optional attribute. If it is set to TRUE, MapViewer labels the features even if two or more labels will overlap in the display of a theme. (MapViewer always tries to avoid overlapping labels.) If `label_always_on` is FALSE (the default), when it is impossible to avoid overlapping labels, MapViewer disables the display of one or more labels so that no overlapping occurs. The `label_always_on` attribute can also be specified for a theme (`theme` element, described in [Section 3.1.2.20](#)). Specifying `label_always_on` as TRUE for a feature in the `geoFeature` element definition gives you control over which features will have their labels displayed if `label_always_on` is FALSE for a theme and if overlapping labels cannot be avoided.

`marker_size` is an optional attribute. If it is supplied with a point feature, and if `render_style` is a marker-type style, the specified size is used by MapViewer in rendering this feature. This provides a mechanism to override the default value specified for a marker style.

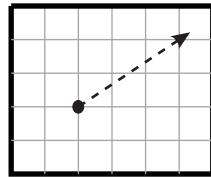
`radius` is an optional attribute. If it is supplied, it specifies a number or a comma-delimited list of numbers, with each number representing the radius of a circle to be drawn centered on this feature. For geodetic data, the unit is meters; for non-geodetic data, the unit is the unit of measurement associated with the data.

`attribute_values` is an optional attribute. If it is supplied, it specifies a value or a comma-delimited list of values to be used with bucket ranges of an advanced style (for example, values for pie chart segments or bucket values for variable markers).

`orient_x` and `orient_y` optionally specify a virtual end point to indicate an orientation vector for rotating a marker symbol (such as a shield symbol to indicate a highway) or text at a specified point. (`orient_z` is reserved for future use by Oracle.) The value for each must be from -1 to 1. The orientation start point is assumed to be (0,0), and it is translated to the location of the physical point to which it corresponds.

[Figure 3–3](#) illustrates an orientation vector of approximately 34 degrees (counterclockwise from the x-axis), resulting from specifying `orient_x="0.3"` `orient_y="0.2"`. (To have an orientation that more precisely matches a specific angle, refer to the cotangent or tangent values in the tables in a trigonometry textbook.)

Figure 3–3 Orientation Vector



`selectable_in_svg` is an optional attribute that specifies whether or not the feature is selectable on an SVG map. The default is FALSE; that is, the feature is not selectable on an SVG map. If this attribute is set to TRUE and if theme feature selection is allowed, the feature can be selected by clicking on it. If the feature is selected, its color is changed and its ID is recorded. You can get a list of the ID values of all selected features by calling the JavaScript function `getSelectedIdList()` defined in the SVG map. (For feature selection to work correctly, the `id` attribute value of the feature must

be set to a value that uniquely identifies it among all the geospatial features on the SVG map.) For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`onclick` is an optional attribute that specifies the name of the JavaScript function to be called when a user clicks on the feature. The JavaScript function must be defined in the HTML document outside the SVG definition. This function must accept only four parameters: the theme name, the key of the feature, and `x` and `y`, which specify the coordinates (in pixels) of the clicked point on the SVG map. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`hidden_info` is an optional attribute that specifies an informational note or tip to be displayed when the mouse is moved over the feature. To specify multiple lines, use "`\n`" between lines. For example, `hidden_info="State park with\nhistorical attractions"` specifies a two-line tip. (To enable the display of hidden information in the map, you must specify `infoon="true"` in the `<map_request>` element, as explained in [Section 3.1.2.1.1](#).)

The following example shows a `<geoFeature>` element specification for a restaurant at longitude and latitude coordinates (-78.1234, 41.0346). In this case, the feature will be invisible because the `render_style` and `text_style` attributes are not specified.

```
<geoFeature typeName="Customer" label="PizzaHut in Nashua">
  <geometricProperty>
    <Point srsName="SDO:8265">
      <coordinates>-78.1234,41.0346</coordinates>
    </Point>
  </geometricProperty>
</geoFeature>
```

The following example shows a `<geoFeature>` element specification for a point of interest at longitude and latitude coordinates (-122.2615, 37.5266). The feature will be rendered on the generated map because the `render_style` attribute is specified. The example specifies some label text (`A Place`) and a text style for drawing the label text. It also instructs MapViewer to draw two circles, centered on this feature, with radii of 1600 and 4800 meters. (In this case, the `srsName` attribute of the `<Point>` element must be present, and it must specify an Oracle Spatial and Graph SRID value using the format "SDO:<srid>". Because SRID value 8265 is associated with a geodetic coordinate system, the radius values are interpreted as 1600 and 4800 meters.)

```
<geoFeature render_style="m.star"
  radius="1600,4800"
  label="A Place"
  text_style="T.Name">
  <geometricProperty>
    <Point srsName="SDO:8265">
      <coordinates>-122.2615, 37.5266</coordinates>
    </Point>
  </geometricProperty>
</geoFeature>
```

[Figure 3–4](#) is a map drawn using the `<geoFeature>` element in the preceding example. The feature is labeled with the text `A Place`, and it is represented by a red star marker surrounded by two concentric circles.

Figure 3–4 Map with <geoFeature> Element Showing Two Concentric Circles



3.1.2.6 jdbc_georaster_query Element

The `<jdbc_georaster_query>` element, which is used to define a GeoRaster theme, has the following definition:

```
<!ELEMENT jdbc_georaster_query (#PCDATA) >
<!ATTLIST jdbc_georaster_query
    asis          (TRUE|FALSE) "FALSE"
    georaster_table CDATA #REQUIRED
    georaster_column CDATA #REQUIRED
    raster_id      CDATA #IMPLIED
    raster_table   CDATA #IMPLIED
    raster_pyramid CDATA #IMPLIED
    raster_bands   CDATA #IMPLIED
    datasource     CDATA #IMPLIED
    polygon_mask   CDATA #IMPLIED
    transparent_nodata CDATA #IMPLIED
    jdbc_host     CDATA #IMPLIED
    jdbc_port     CDATA #IMPLIED
    jdbc_sid      CDATA #IMPLIED
    jdbc_user     CDATA #IMPLIED
    jdbc_password CDATA #IMPLIED
    jdbc_srid     CDATA #IMPLIED
    jdbc_mode     (thin|oci8) "thin"
    >
```

For detailed usage and reference information about GeoRaster themes, see [Section 2.3.4](#).

3.1.2.7 jdbc_image_query Element

The `<jdbc_image_query>` element, which is used to define an image theme (described in [Section 2.3.3](#)), has the following definition:

```
<!ELEMENT jdbc_image_query (#PCDATA) >
<!ATTLIST jdbc_image_query
    asis          (TRUE|FALSE) "FALSE"
    image_format  CDATA #REQUIRED
    image_column  CDATA #REQUIRED
```

```

image_mbr_column  CDATA #REQUIRED
image_resolution  CDATA #IMPLIED
image_unit        CDATA #IMPLIED
datasource        CDATA #IMPLIED
jdbc_host         CDATA #IMPLIED
jdbc_port         CDATA #IMPLIED
jdbc_sid          CDATA #IMPLIED
jdbc_user         CDATA #IMPLIED
jdbc_password     CDATA #IMPLIED
jdbc_srid         CDATA #IMPLIED
jdbc_mode         (thin|oci8) "thin"
>

```

To define a theme dynamically, you must supply a valid SQL query as the content of the <jdbc_image_query> element. You must specify the JDBC connection information for an image theme (either datasource or the combination of jdbc_host, jdbc_port, jdbc_sid, jdbc_user, and jdbc_password).

jdbc_srid is an optional attribute that specifies the coordinate system (SDO_SRID value) of the data to be rendered.

jdbc_mode identifies the Oracle JDBC driver (thin or oci8) to use to connect to the database.

asis is an optional attribute. If it is set to TRUE, MapViewer does not attempt to modify the supplied query string. If asis is FALSE (the default), MapViewer embeds the SQL query as a subquery of its spatial filter query. For example, assume that you want a map centered at (-122, 37) with size 1, and the supplied query is:

```
SELECT geometry, sales FROM crm_sales WHERE sales < 100000;
```

If asis is FALSE, the actual query that MapViewer executes is similar to:

```
SELECT * FROM
  (SELECT geometry, sales FROM crm_sales WHERE sales < 100000)
WHERE sdo_filter(geometry, sdo_geometry(. . . -122.5, 36.5, -123.5, 37.5 . . . )
='TRUE';
```

In other words, the original query is further refined by a spatial filter query for the current map window. However, if asis is TRUE, MapViewer executes the query as specified, namely:

```
SELECT geometry, sales FROM crm_sales WHERE sales < 100000;
```

image_format identifies the format (such as GIF or JPEG) of the image data. If the image format is not supported by MapViewer, you must create and register a custom image renderer for the format, as explained in [Appendix C](#).

image_column identifies the column of type BLOB where each image is stored.

image_mbr_column identifies the column of type SDO_GEOMETRY where the footprint (minimum bounding rectangle, or MBR) of each image is stored.

image_resolution is an optional attribute that identifies the original image resolution (number of image_unit units for each pixel).

image_unit is an optional attribute, except it is required if you specify the image_resolution attribute. The image_unit attribute specifies the unit of the resolution, such as M for meter. The value for this attribute must be one of the values in the SDO_UNIT column of the MDSYS.SDO_DIST_UNITS table. In [Example 2–13](#) in [Section 2.3.3.1](#), the image resolution is 2 meters per pixel.

For an example of using the <jdbc_image_query> element to specify an image theme, see [Example 3–6](#) in [Section 3.1.1.6](#).

3.1.2.8 jdbc_network_query Element

The <jdbc_network_query> element, which is used to define a network theme, has the following definition:

```
<!ELEMENT jdbc_network_query (#PCDATA) >
<!ATTLIST jdbc_network_query
    asis          (TRUE|FALSE) "FALSE"
    network_name  CDATA #REQUIRED
    network_level CDATA #IMPLIED
    link_style    CDATA #IMPLIED
    direction_style CDATA #IMPLIED
    bidirection_style CDATA #IMPLIED
    direction_position CDATA #IMPLIED
    direction_markersize CDATA #IMPLIED
    direction_multimarker (TRUE|FALSE) "FALSE"
    link_labelstyle CDATA #IMPLIED
    link_labelcolumnn CDATA #IMPLIED
    node_style    CDATA #IMPLIED
    node_markersize CDATA #IMPLIED
    node_labelstyle CDATA #IMPLIED
    node_labelcolumnn CDATA #IMPLIED
    path_ids      CDATA #IMPLIED
    path_styles   CDATA #IMPLIED
    path_labelstyle CDATA #IMPLIED
    path_labelcolumnn CDATA #IMPLIED
    analysis_algorithm CDATA #IMPLIED
    shortestpath_style CDATA #IMPLIED
    shortestpath_startnode CDATA #IMPLIED
    shortestpath_endnode CDATA #IMPLIED
    shortestpath_startstyle CDATA #IMPLIED
    shortestpath_endstyle CDATA #IMPLIED
    withincost_startnode CDATA #IMPLIED
    withincost_style CDATA #IMPLIED
    withincost_cost CDATA #IMPLIED
    withincost_startstyle CDATA #IMPLIED
    datasource    CDATA #IMPLIED
    jdbc_host     CDATA #IMPLIED
    jdbc_port     CDATA #IMPLIED
    jdbc_sid      CDATA #IMPLIED
    jdbc_user     CDATA #IMPLIED
    jdbc_password CDATA #IMPLIED
    jdbc_srid     CDATA #IMPLIED
    jdbc_mode     (thin|oci8) "thin"
    >
```

For detailed usage and reference information about network themes, see [Section 2.3.5](#).

3.1.2.9 jdbc_query Element

The <jdbc_query> element is used to define a theme dynamically. This element and its associated <hidden_info> element have the following definitions:

```
<!ELEMENT jdbc_query (#PCDATA, hidden_info?)>
<!ATTLIST jdbc_query
    asis          (TRUE|FALSE) "FALSE"
    spatial_column CDATA #REQUIRED
    key_column    CDATA #IMPLIED
```

```

label_column      CDATA #IMPLIED
label_style       CDATA #IMPLIED
render_style      CDATA #IMPLIED
x_column          CDATA #IMPLIED
y_column          CDATA #IMPLIED
datasource        CDATA #IMPLIED
jdbc_host         CDATA #IMPLIED
jdbc_port         CDATA #IMPLIED
jdbc_sid          CDATA #IMPLIED
jdbc_user         CDATA #IMPLIED
jdbc_password     CDATA #IMPLIED
jdbc_srid          CDATA #IMPLIED
jdbc_mode          (thin|oci8) "thin"
>
<!ELEMENT hidden_info (field+)>
<!ELEMENT field (#PCDATA)>
<!ATTLIST field
  column  CDATA #REQUIRED
  name    CDATA #IMPLIED
>
```

To define a theme dynamically, you must supply a valid SQL query as the content of the `<jdbc_query>` element. You must specify the `spatial_column` (column of type `SDO_Geometry`) and the JDBC connection information for a dynamically defined theme (either `datasource` or the combination of `jdbc_host`, `jdbc_port`, `jdbc_sid`, `jdbc_user`, and `jdbc_password`).

If the `selectable_in_svg` attribute value is `TRUE` in the `<theme>` element, you must use the `key_column` attribute in the `<jdbc_query>` element to specify the name of a column that can uniquely identify each selected feature from the JDBC query. The specified column must also appear in the `SELECT` list in the JDBC query.

`render_style` and `label_style` are optional attributes. For `render_style`, for point features the default is a red cross rotated 45 degrees, for lines and curves it is a black line 1 pixel wide, and for polygons it is a black border with a semitransparent dark gray interior.

`x_column` and `y_column` are optional attributes. If specified, they are used to define a point JDBC theme based on two columns in a table, so that MapViewer can render a point theme based on values in these columns. For more information, see [Section 2.3.2.1](#).

`jdbc_srid` is an optional attribute that specifies the coordinate system (`SDO_SRID` value) of the data to be rendered.

`jdbc_mode` identifies the Oracle JDBC driver (`thin` or `oci8`) to use to connect to the database.

`asis` is an optional attribute. If it is set to `TRUE`, MapViewer does not attempt to modify the supplied query string. If `asis` is `FALSE` (the default), MapViewer embeds the SQL query as a subquery of its spatial filter query. For example, assume that you want a map centered at (-122, 37) with size 1, and the supplied query is:

```
SELECT geometry, sales FROM crm_sales WHERE sales < 100000;
```

If `asis` is `FALSE`, the actual query that MapViewer executes is similar to:

```
SELECT * FROM
  (SELECT geometry, sales FROM crm_sales WHERE sales < 100000)
WHERE sdo_filter(geometry, sdo_geometry(. . . -122.5, 36.5, -123.5, 37.5. . . )
='TRUE';
```

In other words, the original query is further refined by a spatial filter query using the current map window. However, if `asis` is `TRUE`, MapViewer executes the query as specified, namely:

```
SELECT geometry, sales FROM crm_sales WHERE sales < 100000;
```

The `<hidden_info>` element specifies the list of attributes from the base table to be displayed when the user moves the mouse over the theme's features. The attributes are specified by a list of `<field>` elements.

Each `<field>` element must have a `column` attribute, which specifies the name of the column from the base table, and it can have a `name` attribute, which specifies the display name of the column. (The `name` attribute is useful if you want a text string other than the column name to be displayed.)

For examples of using the `<jdbc_query>` element to define a theme dynamically, see [Example 3–2](#) in [Section 3.1.1.2](#) and [Example 3–4](#) in [Section 3.1.1.4](#).

3.1.2.10 `jdbc_topology_query` Element

The `<jdbc_topology_query>` element, which is used to define a topology theme, has the following definition:

```
<!ELEMENT jdbc_topology_query (#PCDATA)>
<!ATTLIST jdbc_topology_query
    asis          (TRUE|FALSE) "FALSE"
    topology_name CDATA #REQUIRED
    feature_table CDATA #REQUIRED
    spatial_column CDATA #REQUIRED
    label_column   CDATA #IMPLIED
    label_style    CDATA #IMPLIED
    render_style   CDATA #IMPLIED
    datasource     CDATA #IMPLIED
    edge_style     CDATA #IMPLIED
    edge_marker_style CDATA #IMPLIED
    edge_marker_size  CDATA #IMPLIED
    edge_label_style CDATA #IMPLIED
    node_style     CDATA #IMPLIED
    node_label_style CDATA #IMPLIED
    face_style     CDATA #IMPLIED
    face_label_style CDATA #IMPLIED
    jdbc_host      CDATA #IMPLIED
    jdbc_port      CDATA #IMPLIED
    jdbc_sid       CDATA #IMPLIED
    jdbc_user      CDATA #IMPLIED
    jdbc_password   CDATA #IMPLIED
    jdbc_srid      CDATA #IMPLIED
    jdbc_mode      (thin|oci8) "thin"
    >
```

For detailed usage and reference information about topology themes, see [Section 2.3.6](#).

3.1.2.11 `legend` Element

The `<legend>` element has the following definition:

```
<!ELEMENT legend (column,themes)? >
<!ATTLIST legend
    bgstyle      CDATA #implied
    font         CDATA #implied
    location_x   CDATA #implied
    location_y   CDATA #implied
```

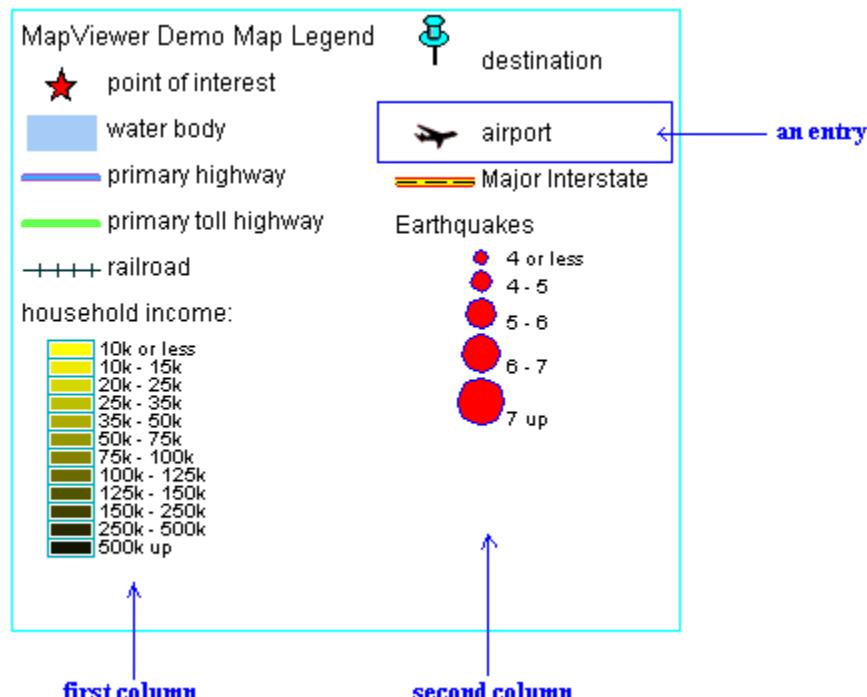
```

offset_x    CDATA #IMPLIED
offset_y    CDATA #IMPLIED
profile     (MEDIUM|SMALL|LARGE)  "MEDIUM"
position    (SOUTH_WEST|SOUTH_EAST|SOUTH|NORTH|
             NORTH_WEST|NORTH_EAST|EAST|WEST|CENTER)  "SOUTH_WEST"
>
<!ELEMENT column entry+ >
<!ATTLIST entry
  is_title      (true|false) "false"
  is_separator  (true|false) "false"
  tab          CDATA "0"
  style         CDATA #IMPLIED
  text          CDATA #IMPLIED
  text_size     CDATA #IMPLIED
  width         CDATA #IMPLIED
  height        CDATA #IMPLIED
>
<!ELEMENT themes theme+ >
<!ATTLIST theme
  name          CDATA #REQUIRED
>

```

<legend> elements are used to draw a legend (map inset illustration) on top of a generated map, to make the visual aspects of the map more meaningful to users. The main part of a <legend> element is one or more <column> elements, each of which defines a column in the legend. (If no <column> elements are present, an *automatic legend* is created, as explained in [Section 2.4.2](#).) A one-column legend will have all entries arranged from top to bottom. A two-column legend will have the two columns side by side, with the first column on the left, and each column having its own legend entries. [Figure 2-14](#) in [Section 2.4.2](#) shows a one-column legend. [Figure 3-5](#) shows a two-column legend.

Figure 3-5 Two-Column Map Legend



`bgstyle` is an optional attribute that specifies the overall background style of the legend. It uses a string with syntax similar to scalable vector graphics (SVG) to specify the fill and stroke colors for the bounding box of the legend. If you specify an opacity (`fill-opacity` or `stroke-opacity`) value, the fill and stroke colors can be transparent or partially transparent. The following example specifies a background that is white and half transparent, and a stroke (for the legend box boundary) that is red:

```
bgstyle="fill:#ffffff;fill-opacity:128;stroke:#ff0000"
```

`font` is an optional attribute that specifies the name of the font to be used for text that appears in the legend image. You can specify a logical font name that is supported by Java (`serif`, `sansserif`, `monospaced`, `dialog`, or `dialoginput`). You can also specify the name of a physical font that is available on the system where the MapViewer server is running.

`location_x` and `location_y` are optional attributes that specify the X and Y coordinates (in screen units) of the start of the legend. If you specify these attributes, they override any specification for the `position` attribute.

`offset_x` and `offset_y` are optional attributes to be used with the `position` attribute. The default distance from the borders for the position hint corresponds to 10 pixels. You can use these offset parameters to override the default value.

`profile` is an optional attribute that specifies a relative size of the legend on the map, using one of the following keywords: `SMALL`, `MEDIUM` (the default), or `LARGE`.

`position` is an optional attribute that specifies where the legend should be drawn on the map. The default is `SOUTH_WEST`, which draws the legend in the lower-left corner of the resulting map.

`is_title` is an optional attribute of the `<entry>` element. When its value is `TRUE`, the entry is used as the title for the column, which means that the description text appears in a more prominent font than regular legend text, and any other style attribute defined for the entry is ignored. The default is `FALSE`.

`is_separator` is an optional attribute of the `<entry>` element. When its value is `TRUE`, the entry is used to insert a blank line for vertical spacing in the column. The default is `FALSE`.

`tab` is an optional attribute of the `<entry>` element. It specifies the number of tab positions to indent the entry from the left margin of the column. The default is 0 (zero), which means no indentation.

`style` is an optional attribute of the `<entry>` element. It specifies the name of the MapViewer style (such as a color or an image) to be depicted as part of the entry.

`text` is an optional attribute of the `<entry>` element. It specifies the description text (for example, a short explanation of the associated color or image) to be included in the entry.

`text_size` is an optional attribute of the `<entry>` element. It specifies the size (in display units) of the description text to be included in the entry. The specified value overrides the MapViewer predefined profile size.

`width` and `height` are optional attributes that together specify the size (in device units) of the legend entry. Any specified values override the defaults, which depend on the MapViewer profile values for small, medium, and large text.

The following example shows the `<legend>` element specification for the legend in [Figure 2–14](#) in [Section 2.4.2](#).

```
<legend bgstyle="fill:#ffffff;fill-opacity:128;stroke:#ff0000">  
    position="NORTH_WEST">
```

```

<column>
  <entry text="Map Legend" is_title="true"/>
  <entry style="M.STAR" text="center point"/>
  <entry style="M.CITY HALL 3" text="cities"/>
  <entry is_separator="true"/>
  <entry style="C.ROSY BROWN STROKE" text="state boundary"/>
  <entry style="L.PH" text="interstate highway"/>
  <entry text="County population:"/>
  <entry style="V.COUNTY_POP_DENSITY" tab="1"/>
</column>
</legend>

```

In the preceding example:

- The background color has an opacity value of 128 (`fill-opacity:128`), which means that the white background will be half transparent.
- The legend boundary box will be red (`stroke:#ff0000`).
- The legend boundary box will be positioned in the upper-left part of the display (`position="NORTH_WEST"`).
- The legend will be the default size, because the `profile` attribute (which has a default value of `MEDIUM`) is not specified.
- The legend will have a single column, with entries arranged from top to bottom.
- The first entry is the legend title, with the text *Map Legend*.
- The fourth entry is a separator for adding a blank line.
- The seventh entry is description text (*County population:*) that users of the generated map will associate with the next (and last) entry, which specifies an advanced style. The *County population:* text entry is helpful because advanced styles usually have their own descriptive text, and you do not want users to become confused about which text applies to which parts of the legend.
- The last entry specifies an advanced style (`style="V.COUNTY_POP_DENSITY"`), and it is indented one tab position (`tab="1"`) so that the colors and text identifying various population density ranges will be easy for users to distinguish from the preceding *County population:* description text.

3.1.2.12 `map_tile_theme` Element

The `<map_tile_theme>` element is used to define a map tile theme, which produces a map image layer rendered by the map tile server with pregenerated map image tiles. The map image tiles can be served by any internal or external map service providers. This element has the following definition:

```

<!ELEMENT map_tile_theme (#PCDATA)>
<!ATTLIST map_tile_theme
  map_tile_layer      CDATA # REQUIRED
  snap_to_tile_scale (TRUE|FALSE) "FALSE"
>

```

`map_tile_name` specifies the name of the map tile layer that has been predefined with MapViewer.

`snap_to_tile_scale` is an optional attribute that specifies whether to adjust the map scale to fit that of one of the predefined map tile layer zoom levels. If this attribute is `FALSE`, the scale of the result map is always the same as what the map request specifies; and if the map request scale does not fit any of the predefined map tile layer zoom levels, the map tile images are scaled to fit the map request scale. If this attribute is

TRUE, the scale of the result map is adjusted to fit one of the predefined map tile layer zoom levels when the request map scale does not fit any of the predefined zoom levels.

3.1.2.13 north_arrow Element

The <north_arrow> element specifies a style (usually a marker) to point to the north direction on the map. It uses the map request rotation attribute to define its orientation. This element has the following definition:

```
<!ELEMENT north_arrow (style, location?, size?) >
```

The <style> element specifies the name of the style (typically a marker style) for the north arrow.

The <location> element is optional. It specifies the X and Y coordinate values (in pixels) of the position on the map for the north arrow. The default value is (25, 25).

The <size> element is optional. It specifies the width and height (in pixels) to be used by MapViewer in rendering the north arrow. The default value is (16, 32).

[Example 3–20](#) shows a north arrow definition using style m.image41_bw, located at position (35, 35) of the map image, and with width 16 and height 32.

Example 3–20 North Arrow

```
<north_arrow>
  <style> m.image41_bw </style>
  <location> 35,35 </location>
  <size> 16,32 </size>
</north_arrow>
```

3.1.2.14 operation Element

The <operation> element enables you to perform additional transformations on the original data during rendering. The <operation> element has the following definition:

```
<!ELEMENT operation (parameter+) >
<!ATTLIST parameter
  name  CDATA #REQUIRED
>
```

Currently this element is used in GeoRaster themes (described in [Section 2.3.4](#)). You can perform some image processing operations on the original image, such as normalization, equalization, linear stretch, piecewise linear stretch, brightness and contrast adjustment, and threshold change.

[Example 3–21](#) specifies the normalization operation with a GeoRaster theme.

Example 3–21 Normalization Operation with a GeoRaster Theme

```
<theme name="geor_theme" >
  <jdbc_georaster_query
    jdbc_srid="0"
    datasource="mvdemo"
    georaster_table="dem"
    georaster_column="georaster"
    asis="false"> select georaster from dem
  </jdbc_georaster_query>
  <operations>
    <operation name="normalize">
    </operation>
```

```
</operations>
</theme>
```

The following code segment shows a manual linear stretch operation. (For automatic linear stretch, include the `<operation>` element but no `<parameter>` elements.)

```
<operation name="linearstretch">
  <parameter name="autostretch" value="false"/>
  <parameter name="lowstretch" value="50"/>
  <parameter name="highstretch" value="150"/>
</operation>
```

Table 3–1 lists the image processing operations, their `<operation>` element name keyword values, and (where relevant) associated `<parameter>` element values.

Table 3–1 Image processing Options for GeoRaster Theme Operations

Operation	<code><operation></code> name value	<code><parameter></code> values
Normalization	normalize	(Not applicable)
Equalization	equalize	(Not applicable)
Linear stretch	linearstretch	name=autostretch (automatic) name=lowstretch (low stretch) name=highstretch (high stretch)
Piecewise linear stretch	piecewiselinearstretch	(Not applicable)
Brightness	brightness	value=[number]
Contrast	contrast	value=[number]
Change threshold	changethreshold	name=threshold (threshold) name=lowthreshold (low threshold) name=highthreshold (high threshold)

3.1.2.15 operations Element

The `<operations>` element specifies one or more `<operation>` elements (described in [Section 3.1.2.14](#)). The `<operations>` element has the following definition:

```
<!ELEMENT operations (oepration+)>
```

For a predefined GeoRaster theme, the `<operations>` element will be part of the styling rule definition. [Example 3–21](#) shows the styling rules for a GeoRaster theme that uses the normalization operation.

Example 3–22 Styling Rules with Normalization Operation in a GeoRaster Theme

```
<styling_rules theme_type="georaster" raster_table="RDT_DEM"
               raster_id="1">
  <operations>
    <operation name="normalize"/>
  </operations>
</styling_rules>
```

3.1.2.16 parameter Element

The `<parameter>` element defines values to be used in an operation to be applied on themes. (The operation is specified in an `<operations>` element, described in [Section 3.1.2.14](#).) The `<parameter>` element has the following definition:

```
<!ELEMENT parameter >
<!ATTLIST parameter
  name   CDATA #REQUIRED
  value  CDATA #REQUIRED
>
```

Each parameter must have a name and value associated with it.

3.1.2.17 scale_bar Element

The `<scale_bar>` element defines a scale bar (to show how many kilometers or miles are represented by a distance marked on the bar) to be added to the map request, if the map has a known spatial reference system (SRS). You can specify a single display mode (Metric or US) or dual mode (both Metric and US). The `<scale_bar>` element has the following definition:

```
<!ELEMENT scale_bar >
<!ATTLIST scale_bar
  mode          (METRIC_MODE|US_MODE|DUAL_MODES) "METRIC_MODE"
  position      (SOUTH_WEST|SOUTH_EAST|SOUTH|NORTH|
                 NORTH_WEST|NORTH_EAST) "NORTH_EAST"
  offset_x      CDATA #IMPLIED
  offset_y      CDATA #IMPLIED
  color1        CDATA #IMPLIED
  color1_opacity CDATA #IMPLIED
  color2        CDATA #IMPLIED
  color2_opacity CDATA #IMPLIED
  length_hint   CDATA #IMPLIED
  label_color   CDATA #IMPLIED
  label_font_family CDATA #IMPLIED
  label_font_size  CDATA #IMPLIED
  label_halo_size CDATA #IMPLIED
  label_position (TOP|BOTTOM) "TOP"
>
```

All `<scale_bar>` attributes are optional.

`mode` specifies if the scale bar should be in metric or US mode, or in both modes. The default is `METRIC_MODE`.

`position` defines the relative location on the map to place the scale bar. The default is `NORTH_EAST`.

`offset_x` and `offset_y` define the X and Y values to offset the scale bar position from the map margin. The default value for each is 0.

`color1`, `color1_opacity`, `color2`, and `color2_opacity` define the colors to be used when rendering the scale bar. `color1` and `color2` have a default value for red, green, blue; `color1_opacity` has a default value of (0x44, 0x44, 0x44, 210); and `color2_opacity` has a default value of (0xee, 0xee, 0xee, 210).

`length_hint` defines the preferred number of pixels to be used to render the scale bar. The default is approximately 17% of the map width.

`label_color`, `label_font_family`, `label_font_size`, and `label_halo_size` affect the scale bar text. The defaults are black color, Serif font family, 12pt font size, and no halo (0 halo size).

`label_position` defines the position of the text relative to the scale bar (TOP or BOTTOM). The default is TOP.

[Example 3-23](#) defines a scale bar.

Example 3–23 Scale Bar

```
<scale_bar
    position="SOUTH_WEST"
    mode="US_MODE"
    color1="#ff0000"
    color1_opacity="128"
    color2="#00ffff"
    label_font_family="Dialog"
    label_font_size="15"
    label_font_style="italic"
    label_font_weight="bold"
    label_halo_size="2.8"
    label_position="bottom"
    offset_y="5"
/>
```

3.1.2.18 style Element

The `<style>` element has the following definition:

```
<!ELEMENT style (svg | AdvancedStyle)?>
<!ATTLIST style
    name   CDATA #REQUIRED
>
```

The `<style>` element lets you specify a dynamically defined style. The style can be either of the following:

- An SVG description representing a color, line, marker, area, or text style
- An advanced style definition (see [Section A.6](#)) representing a bucket, a color scheme, or a variable marker style

The `name` attribute identifies the style name.

The following example shows an excerpt that dynamically defines two styles (a color style and an advanced style) for a map request:

```
<map_request . . .>
. . .
<styles>
    <style name="color_red">
        <svg width="1in" height="1in">
            <g class="color"
                style="stroke:red;stroke-opacity:100;fill:red;fill-opacity:100">
                <rect width="50" height="50"/>
            </g>
        </svg>
    </style>

    <style name="ranged_bucket_style">
        <AdvancedStyle>
            <BucketStyle>
                <Buckets>
                    <RangedBucket seq="0" label="less than 100k"
                        high="100000.0" style="C.RB13_13"/>
                    <RangedBucket seq="1" label="100k - 150k" low="100000.0"
                        high="150000.0" style="C.RB13_1"/>
                    <RangedBucket seq="2" label="150k - 250k" low="150000.0"
                        high="250000.0" style="C.RB13_4"/>
                    <RangedBucket seq="3" label="250k - 350k" low="250000.0"
                        high="350000.0" style="C.RB13_7"/>
                </Buckets>
            </BucketStyle>
        </AdvancedStyle>
    </style>
</styles>
```

```

        <RangedBucket seq="4" label="350k - 450k" low="350000.0"
                      high="450000.0" style="C.RB13_10"/>
      </Buckets>
    </BucketStyle>
  </AdvancedStyle>
</style>
</styles>
</map_request>

```

3.1.2.19 styles Element

The `<styles>` element has the following definition:

```
<!ELEMENT styles (style+)>
```

The `<styles>` element specifies one or more `<style>` elements (described in [Section 3.1.2.18](#)).

3.1.2.20 theme Element

The `<theme>` element has the following definition:

```

<!ELEMENT theme (jdbc_query | jdbc_image_query | jdbc_georaster_query
                  | jdbc_network_query | jdbc_topology_query | map_tile_theme)?,
operations? >

<!ATTLIST theme
  name          CDATA #REQUIRED
  datasource    CDATA #IMPLIED
  template_theme CDATA #IMPLIED
  max_scale     CDATA #IMPLIED
  min_scale     CDATA #IMPLIED
  label_max_scale CDATA #IMPLIED
  label_min_scale CDATA #IMPLIED
  label_always_on   (TRUE|FALSE) "FALSE"
  fast_unpickle    (TRUE|FALSE) "TRUE"
  mode           CDATA #IMPLIED
  min_dist        CDATA #IMPLIED
  fixed_svglabel  (TRUE|FALSE) "FALSE"
  visible_in_svg  (TRUE|FALSE) "TRUE"
  selectable_in_svg (TRUE|FALSE) "FALSE"
  part_of_basemap  (TRUE|FALSE) "FALSE"
  simplify_shapes (TRUE|FALSE) "TRUE"
  transparency     CDATA #IMPLIED
  minimum_pixels   CDATA #IMPLIED
  onclick          CDATA #IMPLIED
  onmousemove      CDATA #IMPLIED
  onmouseover       CDATA #IMPLIED
  onmouseout        CDATA #IMPLIED
  workspace_name    CDATA #IMPLIED
  workspace_savepoint CDATA #IMPLIED
  workspace_date     CDATA #IMPLIED
  workspace_date_format CDATA #IMPLIED
  fetch_size        CDATA #IMPLIED
  timeout           CDATA #IMPLIED
>

```

The `<theme>` element lets you specify a predefined or dynamically defined theme.

- For a predefined theme, whose definition is already stored in your `USER_SDO_THEMES` view, only the theme name is required.

- For a dynamically defined theme, you must provide the information in one of the following elements: <jdbc_query> (described in [Section 3.1.2.9](#)), <jdbc_image_query> (described in [Section 3.1.2.7](#)), <jdbc_georaster_query> (described in [Section 2.3.4](#)), <jdbc_network_query> (described in [Section 2.3.5](#)), or <jdbc_topology_query> (described in [Section 2.3.6](#)).
- For a GeoRaster theme, you can define some image processing options (described in [Section 3.1.2.14](#)).

The name attribute identifies the theme name. For a predefined theme, the name must match a value in the NAME column of the USER_SDO_THEMES view (described in [Section 2.9.2](#)). For a dynamically defined theme, this is just a temporary name for referencing the jdbc_query-based theme.

datasource is an optional attribute that specifies a data source for the theme. If you do not specify this attribute, the data source for the map request is assumed (see the datasource attribute explanation in [Section 3.1.2.1.1](#)). By specifying different data sources for different themes, you can use multiple data sources in a map request.

template_theme is an optional attribute that can be used to render two or more themes when a predefined theme has same name in multiple data sources. You cannot repeat theme names in a map request, but if you have two different data sources with same predefined theme name, you can use this attribute to render both themes. The following example specifies two themes that are based on a US_STATES theme that exists in two data sources, but that has a different content in each data source.

```
<themes>
  <theme name="US_STATES" datasource="dsr1"/>
  <theme name="OTHER_US_STATES" template_theme="US_STATES" datasource="other_dsrc"
/>
</themes>
```

The max_scale and min_scale attributes affect the visibility of this theme. If max_scale and min_scale are omitted, the theme is always rendered, regardless of the map scale. (See [Section 2.4.1](#) for an explanation of max_scale and min_scale.)

The label_max_scale and label_min_scale attributes affect the visibility of feature labels of this theme. If label_max_scale and label_min_scale are omitted, the theme feature labels are always rendered when the map scale is within the visible range of theme scales (that is, within the max_scale and min_scale range). (See [Section 2.4.1](#) for an explanation of label_max_scale and label_min_scale.)

label_always_on is an optional attribute. If it is set to TRUE, MapViewer labels all features of the theme even if two or more labels will overlap in the display. (MapViewer always tries to avoid overlapping labels.) If label_always_on is FALSE (the default), when it is impossible to avoid overlapping labels, MapViewer disables the display of one or more labels so that no overlapping occurs. The label_always_on attribute can also be specified for a map feature (geoFeature element, described in [Section 3.1.2.5](#)), thus allowing you to control which features will have their labels displayed if label_always_on is FALSE for a theme and if overlapping labels cannot be avoided.

fast_unpickle is an optional attribute. If it is TRUE (the default), MapViewer uses its own fast unpickling (unstreaming) algorithm instead of the generic JDBC conversion algorithm to convert SDO_GEOMETRY objects fetched from the database into a Java object accessible to MapViewer. This process improves performance, but occasionally the coordinates may lose some precision (around 0.00000005), which can be significant in applications where all precision digits of each coordinate must be kept. If fast_unpickle is set to FALSE, MapViewer uses the generic JDBC conversion algorithm. This

process is slower than MapViewer's fast unpickling process, but there is never any loss of precision.

`mode` is an optional attribute. For a topology theme, you can specify `mode= "debug"` to display edges, nodes, and faces, as explained in [Section 2.3.6](#). The `mode` attribute is ignored for other types of themes.

`min_dist` is an optional attribute. It specifies the minimum on-screen distance (number of pixels) between two adjacent shape points on a line string or polygon for rendering of separate shape points. If the on-screen distance between two adjacent shape points is less than the `min_dist` value, only one shape point is rendered. The default value is 0.5. You can specify higher values to reduce the number of shape points rendered on an SVG map, and thus reduce the size of the resulting SVG file. You can specify different values in different theme definitions, to allow for customized levels of detail in SVG maps.

`fixed_svglable` is an optional attribute that specifies whether to display the labels on an SVG map using the original "fixed" labels, but having them appear larger or smaller as the zoom level increases (zoomin) or decreases (zoomout), or to use different labels with the same text but different actual sizes so that the apparent size of each label remains the same at all zoom levels. If the `fixed_svglable` value is specified as `TRUE`, the same theme labels are displayed on the map at all zoom levels, with the labels zoomed in and out as the map is zoomed in and out. If the value is `FALSE` (the default), different theme labels are displayed at different zoom levels so that the size of each displayed label appears not to change during zoomin and zoomout operations.

`visible_in_svg` is an optional attribute that specifies whether or not to display the theme on an SVG map. If its value is `TRUE` (the default), the theme is displayed; if it is set to `FALSE`, the theme is not displayed. However, even if this attribute is set to `FALSE`, the theme is still rendered to the SVG map: the theme is initially invisible, but you can make it visible later by calling the JavaScript function `showTheme()` defined in the SVG map. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`selectable_in_svg` is an optional attribute that specifies whether or not the theme is selectable on an SVG map. The default is `FALSE`; that is, the theme is not selectable on an SVG map. If this attribute is set to `TRUE` and if theme feature selection is allowed, each feature of the theme displayed on the SVG map can be selected by clicking on it. If the feature is selected, its color is changed and its ID (its `rowid` by default) is recorded. You can get a list of the ID values of all selected features by calling the JavaScript function `getSelectedIdList()` defined in the SVG map. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`part_of_basemap` is an optional attribute. If the map format is SVG and the value of this attribute is `TRUE`, MapViewer renders the theme as part of and on top of the base map, which is rendered as a raster image.

`simplify_shapes` is an optional attribute that specifies whether or not the shapes are simplified before being rendered. Simplification is useful when you want a map display with less fine resolution than the original geometries. For example, if the display resolution cannot show the hundreds or thousands of turns in the course of a river or in a political boundary, better performance might result if the shapes were simplified to show only the major turns. The default is `TRUE`; that is, shapes are simplified before being rendered. If this attribute is set to `FALSE`, MapViewer attempts to render all vertices and line segments from the original geometries, and performance may be slower.

`transparency` is an optional parameter to define the basic alpha composing value to be applied on themes during rendering. The value can be from 0 to 1, with 0 meaning

completely transparent and 1 (the default) meaning completely opaque (no transparency).

`minimum_pixels` is an optional parameter that defines the level of resolution to be used on the spatial filter query. This may be useful to avoid rendering too many elements at the same position of the screen. (See the Oracle Spatial and Graph documentation about the `min_resolution` and `max_resolution` options for the SDO_FILTER operator.) The unit for `minimum_pixels` is screen pixels. For example, `minimum_pixels=1` means that the spatial filter query will not return features with a resolution less than the amount that 1 pixel represents for the current device window and current query window.

`onclick` is an optional attribute that specifies the name of the JavaScript function to be called when a user clicks on an SVG map and theme feature selection is allowed (see the `selectable_in_svg` attribute explanation). The JavaScript function must be defined in the HTML document that has the SVG map embedded. This function must accept only four parameters: the theme name, the key of the feature, and x and y, which specify the coordinates (in pixels) of the clicked point on the SVG map. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`onmousemove` is an optional attribute that specifies the name of the JavaScript function to be called when a user moves the mouse on top of any feature of the theme on an SVG map. The JavaScript function must be defined in the HTML document that has the SVG map embedded. This function must accept only four parameters: the theme name, the key of the feature, and x and y, which specify the coordinates (in pixels) of the point for the move on the SVG map. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`onmouseover` is an optional attribute that specifies the name of the JavaScript function to be called when a user moves the mouse into a feature of the theme on an SVG map. (Unlike the `onmousemove` function, which is called whenever the mouse moves inside the theme, the `onmouseover` function is called only once when the mouse moves from outside a feature of the theme to inside a feature of the theme.) The JavaScript function must be defined in the HTML document that has the SVG map embedded. This function must accept only four parameters: the theme name, the key of the feature, and x and y, which specify the coordinates (in pixels) of the point at which the mouse moves inside a feature on the SVG map. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`onmouseout` is an optional attribute that specifies the name of the JavaScript function to be called when a user moves the mouse out of a feature of the theme on an SVG map. The JavaScript function must be defined in the HTML document that has the SVG map embedded. This function must accept only four parameters: the theme name, the key of the feature, and x and y, which specify the coordinates (in pixels) of the point at which the mouse moves out of a feature on the SVG map. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

`workspace_name`, `workspace_savepoint`, `workspace_date`, and `workspace_date_format` are optional attributes related to support for Workspace Manager in Mapviewer, which is explained in [Section 2.8](#).

`fetch_size` is an optional attribute that specifies how many rows will be prefetched into memory. The default value is 100.

`timeout` is an optional attribute that specifies the number of milliseconds to wait for the connection to the WMS or WFS server.

3.1.2.21 themes Element

The `<themes>` element has the following definition:

```
<!ELEMENT themes (theme+) >
```

The `<themes>` element specifies one or more `<theme>` elements (described in [Section 3.1.2.20](#)). If you have specified a base map (`basemap` attribute of the `map_request` element), any themes that you specify in a `<themes>` element are plotted after those defined in the base map. If no base map is specified, only the specified themes are rendered.

Inside this `<themes>` element there must be one or more `<theme>` child elements, which are rendered in the order in which they appear.

3.1.2.22 theme_modifiers Element

The `<theme_modifiers>` element has the following definition:

```
<!ELEMENT theme_modifiers (theme_decorations)? >
```

The theme modifiers enable you to override the theme definition on a base map, without having to edit and change the base map definition. The `<theme_decorations>` element has the same attributes as the `<theme>` element (described in [Section 3.1.2.20](#)).

The following example overrides the `labels_always_on` attribute for the `theme_us_airport` theme on the base map `FORCED_LABELING`.

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="Override labeling on map definition"
    basemap="FORCED_LABELING"
    datasource="tilsmenv"
    width="500"
    height="375"
    bgcolor="#a6caf0"
    antialiase="true"
    format="PNG_URL">
    <center size="15.0">
        <geoFeature>
            <geometricProperty typeName="center">
                <Point>
                    <coordinates>-122.4,37.8</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>
    <theme_modifiers>
        <theme_decorations name="theme_us_airport" label_always_on="false"/>
    </theme_modifiers>
</map_request>
```

3.1.3 Information Request DTD

In addition to issuing map requests (see [Section 3.1.2](#)) and administrative requests (see [Chapter 5](#)), you can issue information requests to MapViewer. An information request is an XML request string that you can use to execute SQL queries and obtain the result as an array of strings or an XML document. The SQL query must be a `SELECT` statement and must select only primitive SQL types (for example, not LOB types or user-defined object types).

The following is the DTD for a MapViewer information request.

```
<!ELEMENT info_request (#PCDATA) >
<!ATTLIST info_request
```

```

    datasource CDATA #REQUIRED
    format      (strict | non-strict) "strict"
>

```

datasource is a required attribute that specifies the data source for which to get the information.

format is an optional attribute. If it is strict (the default), all rows are formatted and returned in an XML document. If format is set to non-strict, all rows plus a column heading list are returned in a comma-delimited text string.

Example 3–24 shows an information request to select the city, 1990 population, and state abbreviation from the CITIES table, using the connection information in the mvdemo data source and returning the information as an XML document (format="strict").

Example 3–24 MapViewer Information Request

```

<?xml version="1.0" standalone="yes"?>
<info_request datasource="mvdemo" format="strict">
    SELECT city, pop90 population, state_abrv state FROM cities
</info_request>

```

Example 3–24 returns an XML document that includes the following:

```

<?xml version="1.0" encoding="UTF-8"?>
<ROWSET>
    <ROW num="1">
        <CITY>New York</CITY>
        <POPULATION>7322564</POPULATION>
        <STATE>NY</STATE>
    </ROW>
    <ROW num="2">
        <CITY>Los Angeles</CITY>
        <POPULATION>3485398</POPULATION>
        <STATE>CA</STATE>
    </ROW>
    <ROW num="3">
        <CITY>Chicago</CITY>
        <POPULATION>2783726</POPULATION>
        <STATE>IL</STATE>
    </ROW>
    <ROW num="4">
        <CITY>Houston</CITY>
        <POPULATION>1630553</POPULATION>
        <STATE>TX</STATE>
    </ROW>
    .
    .
</ROWSET>

```

3.1.4 Map Response DTD

The following is the DTD for the map response resulting from normal processing of a map request. ([Section 3.1.5](#) shows the DTD for the response if there was an exception or unrecoverable error.)

```

<!ELEMENT map_response (map_image)>
<!ELEMENT map_image (map_content, box, themes, WMTEexception)>
<!ELEMENT map_content EMPTY>
<!ATTLIST map_content url CDATA #REQUIRED>
<!ELEMENT WMTEexception (#PCDATA)>

```

```
<!ATTLIST WMTEException version CDATA "1.0.0"
          error_code (SUCCESS|FAILURE) #REQUIRED
>
```

The response includes the URL for retrieving the image, as well as any error information. When a valid map is generated, its minimum bounding box is also returned, along with the list of themes that have features within the minimum bounding rectangle (MBR) that intersects with the bounding box.

[Example 3–25](#) shows a map response.

Example 3–25 Map Response

```
<?xml version="1.0" encoding="UTF-8" ?>
<map_response>
  <map_image>
    <map_content url="http://map.oracle.com/output/map029763.gif"/>
    <box srsName="default">
      <coordinates>-122.260443,37.531621 -120.345,39.543</coordinates>
    </box>
    <themes>
      <theme name="US_STATES" />
      <theme name="US_HIGHWAYS" />
    </themes>
    <WMTEException version="1.0.0" error_code="SUCCESS">
    </WMTEException>
  </map_image>
</map_response>
```

3.1.5 MapViewer Exception DTD

The following DTD is used by the output XML when an exception or unrecoverable error is encountered while processing a map request:

```
<!ELEMENT oms_error (#PCDATA)>
```

The exception or error message is embedded in this element.

3.1.6 Geometry DTD (OGC)

MapViewer supports the Geometry DTD as defined in the Open Geospatial Consortium (OGC) GML v1.0 specification. This specification has the following copyright information:

Copyright © 2000 OGC All Rights Reserved.

This specification includes the following status information, although its current official status is Deprecated Recommendation Paper:

This document is an OpenGIS® Consortium Recommendation Paper. It is similar to a proposed recommendation in other organizations. While it reflects a public statement of the official view of the OGC, it does not have the status of a OGC Technology Specification. It is anticipated that the position stated in this document will develop in response to changes in the underlying technology. Although changes to this document are governed by a comprehensive review procedure, it is expected that some of these changes may be significant.

The OGC explicitly invites comments on this document. Please send them to gml.rfc@opengis.org

The following additional legal notice text applies to this specification:

THIS DOCUMENT IS PROVIDED "AS IS," AND COPYRIGHT HOLDERS MAKE NO REPRESENTATIONS OR WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, NON-INFRINGEMENT, OR TITLE; THAT THE CONTENTS OF THE DOCUMENT ARE SUITABLE FOR ANY PURPOSE; NOR THAT THE IMPLEMENTATION OF SUCH CONTENTS WILL NOT INFRINGE ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADEMARKS OR OTHER RIGHTS.

COPYRIGHT HOLDERS WILL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF ANY USE OF THE DOCUMENT OR THE PERFORMANCE OR IMPLEMENTATION OF THE CONTENTS THEREOF.

The OGC Geometry DTD in this specification is as follows:

```
<!-- ===== -->
<!--      G e o g r a p h y      -->
<!--      M a r k u p      -->
<!--      L a n g u a g e      -->
<!--      ( G M L )      -->
<!--      G E O M E T R Y      D T D      -->
<!--      Copyright (c) 2000 OGC All Rights Reserved.      -->
<!-- ===== -->

<!-- the coordinate element holds a list of coordinates as parsed character
data. Note that it does not reference a SRS and does not constitute a proper
geometry class. -->
<!ELEMENT coordinates (#PCDATA) >
<!ATTLIST coordinates
    decimal   CDATA      #IMPLIED
    cs        CDATA      #IMPLIED
    ts        CDATA      #IMPLIED >

<!-- the Box element defines an extent using a pair of coordinates and a SRS name.
-->
<!ELEMENT Box (coordinates) >
<!ATTLIST Box
    ID        CDATA      #IMPLIED
    srsName   CDATA      #REQUIRED >

<!-- ===== -->
<!--      G E O M E T R Y      C L A S S      D e f i n i t i o n s      -->
<!-- ===== -->

<!-- a Point is defined by a single coordinate. -->
<!ELEMENT Point (coordinates) >
<!ATTLIST Point
    ID        CDATA      #IMPLIED
    srsName   CDATA      #IMPLIED >

<!-- a LineString is defined by two or more coordinates, with linear
interpolation between them. -->
<!ELEMENT LineString (coordinates) >
<!ATTLIST LineString
    ID        CDATA      #IMPLIED
    srsName   CDATA      #IMPLIED >

<!-- a Polygon is defined by an outer boundary and zero or more inner
boundaries. These boundaries are themselves defined by LinerRings. -->
<!ELEMENT Polygon (outerBoundaryIs, innerBoundaryIs*) >
```

```

<!ATTLIST Polygon
  ID          CDATA      #IMPLIED
  srsName    CDATA      #IMPLIED >
<!ELEMENT outerBoundaryIs (LinearRing) >
<!ELEMENT innerBoundaryIs (LinearRing) >

<!-- a LinearRing is defined by four or more coordinates, with linear
interpolation between them. The first and last coordinates must be
coincident. -->
<!ELEMENT LinearRing (coordinates) >
<!ATTLIST LinearRing
  ID          CDATA      #IMPLIED >

<!-- a MultiPoint is defined by zero or more Points, referenced through a
pointMember element. -->
<!ELEMENT MultiPoint (pointMember+) >
<!ATTLIST MultiPoint
  ID          CDATA      #IMPLIED
  srsName    CDATA      #IMPLIED >
<!ELEMENT pointMember (Point) >

<!-- a MultiLineString is defined by zero or more LineStrings, referenced
through a lineStringMember element. -->
<!ELEMENT MultiLineString (lineStringMember+) >
<!ATTLIST MultiLineString
  ID          CDATA      #IMPLIED
  srsName    CDATA      #IMPLIED >
<!ELEMENT lineStringMember (LineString) >

<!-- a MultiPolygon is defined by zero or more Polygons, referenced through a
polygonMember element. -->
<!ELEMENT MultiPolygon (polygonMember+) >
<!ATTLIST MultiPolygon
  ID          CDATA      #IMPLIED
  srsName    CDATA      #IMPLIED >
<!ELEMENT polygonMember (Polygon) >

<!-- a GeometryCollection is defined by zero or more geometries, referenced
through a geometryMember element. A geometryMember element may be any one of
the geometry classes. -->
<!ENTITY % GeometryClasses "(

  Point | LineString | Polygon |
  MultiPoint | MultiLineString | MultiPolygon |
  GeometryCollection )" >

<!ELEMENT GeometryCollection (geometryMember+) >
<!ATTLIST GeometryCollection
  ID          CDATA      #IMPLIED
  srsName    CDATA      #IMPLIED >
<!ELEMENT geometryMember %GeometryClasses; >

<!-- ===== -->
<!-- G E O M E T R Y   P R O P E R T Y   D e f i n i t i o n s   -->
<!-- ===== -->

<!-- GML provides an 'endorsed' name to define the extent of a feature. The
extent is defined by a Box element, the name of the property is boundedBy. -->
<!ELEMENT boundedBy (Box) >

<!-- the generic geometryProperty can accept a geometry of any class. -->

```

```

<!ELEMENT geometryProperty (%GeometryClasses;) >

<!-- the pointProperty has three descriptive names: centerOf, location and
position. -->
<!ELEMENT pointProperty (Point) >
<!ELEMENT centerOf (Point) >
<!ELEMENT location (Point) >
<!ELEMENT position (Point) >

<!-- the lineStringProperty has two descriptive names: centerLineOf and
edgeOf. -->
<!ELEMENT lineStringProperty (LineString) >
<!ELEMENT centerLineOf (LineString)>
<!ELEMENT edgeOf (LineString)>

<!-- the polygonProperty has two descriptive names: coverage and extentOf. -->
<!ELEMENT polygonProperty (Polygon) >
<!ELEMENT coverage (Polygon)>
<!ELEMENT extentOf (Polygon)>

<!-- the multiPointProperty has three descriptive names: multiCenterOf,
multiLocation and multiPosition. -->
<!ELEMENT multiPointProperty (MultiPoint) >
<!ELEMENT multiCenterOf (MultiPoint) >
<!ELEMENT multiLocation (MultiPoint) >
<!ELEMENT multiPosition (MultiPoint) >

<!-- the multiLineStringProperty has two descriptive names: multiCenterLineOf
and multiEdgeOf. -->
<!ELEMENT multiLineStringProperty (MultiLineString) >
<!ELEMENT multiCenterLineOf (MultiLineString) >
<!ELEMENT multiEdgeOf (MultiLineString) >

<!-- the multiPolygonProperty has two descriptive names: multiCoverage and
multiExtentOf. -->
<!ELEMENT multiPolygonProperty (MultiPolygon) >
<!ELEMENT multiCoverage (MultiPolygon) >
<!ELEMENT multiExtentOf (MultiPolygon) >

<!ELEMENT geometryCollectionProperty (GeometryCollection) >

<!-- ===== -->
<!--   F E A T U R E   M E T A D A T A   D e f i n i t i o n s   -->
<!-- ===== -->

<!-- Feature metadata, included in GML Geometry DTD for convenience; name and
description are two 'standard' string properties defined by GML. -->

<!ELEMENT name (#PCDATA)>
<!ELEMENT description (#PCDATA)>

```

3.2 MapViewer Map Data Server

The MapViewer map data server provides services for streaming live data from a database server to a client. The data can be consumed by the Oracle Maps JavaScript V2 API client, or be edited by the V2 API editing utilities. It is also used as the middle-tier component for handling data synchronization tasks.

At the most basic level, a client sends a request to the map data server, specifying the name of a theme and an optional bounding box. The server then returns the live data (including both geometries and attributes) in compressed GeoJSON format.

Topics:

- [Domains and Map Data Server URL Patterns](#)
- [Map Data Server Request Parameters](#)
- [Interpreting Data Returned from the Map Data Server](#)
- [Map Data Server Error Handling](#)

3.2.1 Domains and Map Data Server URL Patterns

The map data server uses domains, where each **domain** corresponds to a MapViewer data source. For example, to request data from the `mvdemo` data source, the URL must have the following pattern:

`http://example.com:8080/mapviewer/dataserver/mvdemo?`

In this URL request, `/dataserver` refers to the map data server. `/mvdemo` is the path information, which indicates which domain or data source this request is directed against. There is no need to specify the data source explicitly in the rest of the URL request. This URL pattern provides flexibility in terms of protection. A user or a web administrator can easily set up different levels of protection for different domains using such a URL pattern.

To get a quick help regarding the full list of supported HTTP request parameters, you can issue a request that includes the `help` parameter. For example:

`http://example:8080/mapviewer/dataserver/mvdemo?help=true`

This example returns a list of supported parameters. (Note that the `/mvdemo` path is still required even for this help request.)

3.2.2 Map Data Server Request Parameters

In a map data server request to get data, the URL must include appropriate query parameters. The data could be from a MapViewer predefined geometry theme or JDBC theme.

- [Getting Data from a Predefined Geometry Theme](#)
- [Getting Data from a JDBC Theme](#)
- [Getting Annotation Text from a JDBC Theme](#)
- [Getting Topology Data](#)

3.2.2.1 Getting Data from a Predefined Geometry Theme

The following parameters are available for a map data server request to get data from a MapViewer predefined geometry theme. The `t` (theme name) parameter is required; the others are optional.

- `t`: Name of the theme.
- `bbox`: Bounding box. Must be a comma-delimited list of `minx`, `miny`, `maxx`, `maxy`.
- `to_srid`: SRID (spatial reference system) in which to return the data.
- `bbox_srid`: SRID (spatial reference system) of the bounding box, if different from the native SRID of the data.

- `seq`: Sequence ID, to be used when getting data in multipart format.
- `dadp`: Digits after decimal point: the maximum number of digits after the decimal point for the coordinates in the returned data.
- `include_style_info`: Determines whether styling information (rendering/labeling style name and related columns) should be included with each feature. (The default is `true`.)
- `include_label_box`: Determines whether a label box should be included with each polygon feature. (The default is `true`.) A label box is a near maximum rectangle inside the polygon. A label placed inside this rectangle is guaranteed to be completely inside the polygon feature. This parameter is ignored for non-polygon features.

The following are some examples.

To get all the data from the CITIES table in the 3857 SRID:

```
http://example:8080/mapviewer/dataserver/mvdemo?t=theme_demo_cities&to_srid=3857
```

To get all the data from the CITIES table that interacts with a specified bbox in 3857 SRID:

```
http://example:8080/mapviewer/dataserver/mvdemo?t=theme_demo_cities&bbox=-122.0,25,-100,45&to_srid=3857
```

To get all the data from the CITIES table that interacts with a specified bbox in 3857 SRID, with 3 digits after the decimal points, and without styling information:

```
http://example:8080/mapviewer/dataserver/mvdemo?t=theme_demo_cities&bbox=-122.0,25,-100,45&to_srid=3857&dadp=3&include_style_info=no
```

To get all data from the COUNTIES table and include label boxes:

```
http://example:8080/mapviewer/dataserver/mvdemo?t=theme_demo_counties&include_label_box=yes
```

3.2.2.2 Getting Data from a JDBC Theme

The following parameters are available for a map data server request to get data from a MapViewer theme based on a dynamic JDBC theme. The `t` (theme name) and `sql` (SQL query) parameters are required; the others are optional.

- `t`: Name of the theme.
- `sql`: The complete SQL query, properly URL encoded.
- `asis`: Determines whether the query should be executed "as is". The default is `false`, which causes MapViewer to embed the SQL query as a subquery of its spatial filter query. If the value is `true`, MapViewer does not attempt to modify the supplied query string.
- `bbox`: Bounding box. Must be a comma-delimited list of `minx,miny,maxx,maxy`.
- `to_srid`: SRID (spatial reference system) in which to return the data.
- `bbox_srid`: SRID (spatial reference system) of the bounding box, if different from the native SRID of the data.
- `seq`: Sequence ID, to be used when getting data in multipart format.
- `dadp`: Digits after decimal point: the maximum number of digits after the decimal point for the coordinates in the returned data.

- `include_style_info`: Determines whether styling information (rendering/labeling style name and related columns) should be included with each feature. (The default is `true`.)
- `include_label_box`: Determines whether a label box should be included with each polygon feature. (The default is `true`.) A label box is a near maximum rectangle inside the polygon. A label placed inside this rectangle is guaranteed to be completely inside the polygon feature. This parameter is ignored for non-polygon features.

The following are some examples.

To get all the data of the CITIES table in SRID 3857:

```
http://example:8080/mapviewer/dataserver/mvdemo?t=theme1&sql=select*+from+cities&to_srid=3857
```

To get all the data of the table CITIES within a given bbox in SRID 3857:

```
http://example:8080/mapviewer/dataserver/mvdemo?t=theme1&sql=select*+from+cities&to_srid=3857&bbox=-122.0,25,-100,45
```

To run the query as is, without a bbox and return data in SRID 3857:

```
http://example:8080/mapviewer/dataserver/mvdemo?t=theme1&sql=select*+from+cities&to_srid=3857&bbox=-122.0,25,-100,45&asis=t
```

3.2.2.3 Getting Annotation Text from a JDBC Theme

A request to retrieve annotation text elements from a JDBC theme is similar to that in [Section 3.2.2.2, "Getting Data from a JDBC Theme"](#)

The following parameters are available for a map data server request to get data from a MapViewer theme based on a dynamic JDBC theme. The `t` (theme name), `sql` (SQL query), `geom_type`, and `base_table` parameters are required; the others are optional.

- `t`: Name of the theme.
- `sql`: The complete SQL query, properly URL encoded.
- `geom_type`: Must be specified as `annotation` to indicate that the spatial column is on annotation type.
- `base_table`: The database table (for the server to read annotation text metadata information for that table).
- `asis`: Determines whether the query should be executed "as is". The default is `false`, which causes MapViewer to embed the SQL query as a subquery of its spatial filter query. If the value is `true`, MapViewer does not attempt to modify the supplied query string.
- `bbox`: Bounding box. Must be a comma-delimited list of `minx,miny,maxx,maxy`.
- `to_srid`: SRID (spatial reference system) in which to return the data.
- `bbox_srid`: SRID (spatial reference system) of the bounding box, if different from the native SRID of the data.
- `seq`: Sequence ID, to be used when getting data in multipart format.
- `dadp`: Digits after decimal point: the maximum number of digits after the decimal point for the coordinates in the returned data.
- `include_style_info`: Determines whether styling information (rendering/labeling style name and related columns) should be included with each feature. (The default is `true`.)

- `include_label_box`: Determines whether a label box should be included with each polygon feature. (The default is true.) A label box is a near maximum rectangle inside the polygon. A label placed inside this rectangle is guaranteed to be completely inside the polygon feature. This parameter is ignored for non-polygon features.

The following example retrieves annotation text information:

```
http://example:8080/mapviewer/dataserver/tilsmenv?t=theme1&sql=select+*+from+annotext_table&geom_col=textobj&geom_type=annotation&base_table=annotext_table&bbox=0,0,10,10
```

A typical response includes the annotation text table metadata information plus the annotation text feature. Each annotation text feature can have one or more text elements. Each text element can be defined by a text value, a location, a leader line, and graphic attributes. Refer to OGC specification of annotation texts for additional information.

The response looks like the following:

```
{"type": "AnnotationText",
"collectionName": "theme1",
"srs": 0,
"geodetic": false,
"bbox": [0, 0, 10, 10],
"attr_names": ["ID"],
"attr_types": ["double"],
"default_text_attributes": {"fontWeight": "Normal", "fontStyle": "Normal", "textDecoration": "None", "letterSpacing": "Normal", "wordSpacing": "Normal", "fill": "black", "fill-opacity": 1.0, "stroke": "black", "strokeWidth": 1.0, "stroke-opacity": 1.0, "horizontalAlignment": "start", "verticalAlignment": "top", "multilineJustification": "left", "multilineSpacing": 0.0},
"metadata": {"textExpression": "name", "textAttributes": {"fontFamily": "Serif", "fontSize": 14.0, "fill": "#ff0000"}},
"features": [
{"type": "AnnoText", "elements": [{"location": {"type": "Point", "coordinates": [1, 1]}, "textValue": "Sample Label 1", "leaderLine": {"type": "LineString", "coordinates": [0, 0, 1, 1]}, "envelope": {"type": "Rectangle", "coordinates": [0, 0, 1, 1]}, "properties": {"ID": "1.0"}}, {"type": "AnnoText", "elements": [{"location": {"type": "LineString", "coordinates": [2, 5, 4, 5, 6, 5]}, "textAttributes": {"fontFamily": "Dialog", "fontSize": 14.0, "fill": "blue"}, "envelope": {"type": "Rectangle", "coordinates": [2, 3, 6, 5]}, "properties": {"ID": "3.0"}}, {"type": "AnnoText", "elements": [{"location": {"type": "Point", "coordinates": [10, 10]}, "textValue": "Sample Label 2", "leaderLine": {"type": "LineString", "coordinates": [5, 10, 10, 10]}, "envelope": {"type": "LineString", "coordinates": [5, 10, 10, 10]}, "properties": {"ID": "2.0"}]}]
```

3.2.2.4 Getting Topology Data

A topology set is defined by a set of topology primitives (faces, edges, and nodes). Each topology feature can be associated with one or more topology primitives.

A request to retrieve the topology primitives must contain the `topology` parameter, as in the following example:

```
http://example:8080/mapviewer/dataserver/tilsmenv?topology=city_data&bbox=10,10,35,35
```

The response includes all primitives that interact with input MBR:

```
{"type": "TopologyPrimitives",
"topology": "city_data",
"srs": 0,
"bbox": [0, 0, 62, 42],
"face_attr_names": ["FACE_ID", "BOUNDARY_EDGE_ID", "ISLAND_EDGE_ID_LIST", "ISLAND_NODE_ID_LIST"],
"face_attr_types": ["integer", "integer", "array:integer", "array:integer"],
"edge_attr_names": ["EDGE_ID", "START_NODE_ID", "END_NODE_ID", "NEXT_LEFT_EDGE_ID", "PREV_LEFT_EDGE_ID", "NEXT_RIGHT_EDGE_ID", "PREV_RIGHT_EDGE_ID", "LEFT_FACE_ID", "RIGHT_FACE_ID"],
"edge_attr_types": ["integer", "integer", "integer", "integer", "integer", "integer", "integer", "integer"],
"node_attr_names": ["NODE_ID", "EDGE_ID", "FACE_ID"],
"node_attr_types": ["integer", "integer", "integer"],
"primitives": [
{"type": "Face", "mbr_geometry": {"type": "Rectangle", "coordinates": [3, 30, 15, 38]}, "properties": {"FACE_ID": "1", "BOUNDARY_EDGE_ID": "1", "ISLAND_EDGE_ID_LIST": [25]}},
 {"type": "Face", "mbr_geometry": {"type": "Rectangle", "coordinates": [9, 14, 21, 22]}, "properties": {"FACE_ID": "3", "BOUNDARY_EDGE_ID": "19"}},
 {"type": "Face", "mbr_geometry": {"type": "Rectangle", "coordinates": [9, 6, 21, 14]}, "properties": {"FACE_ID": "6", "BOUNDARY_EDGE_ID": "20"}},
 {"type": "Face", "mbr_geometry": {"type": "Rectangle", "coordinates": [17, 30, 31, 40]}, "properties": {"FACE_ID": "2", "BOUNDARY_EDGE_ID": "2", "ISLAND_NODE_ID_LIST": [4]}},
 {"type": "Face", "mbr_geometry": {"type": "Rectangle", "coordinates": [21, 6, 35, 14]}, "properties": {"FACE_ID": "7", "BOUNDARY_EDGE_ID": "10"}},
 {"type": "Face", "mbr_geometry": {"type": "Rectangle", "coordinates": [21, 14, 35, 22]}, "properties": {"FACE_ID": "4", "BOUNDARY_EDGE_ID": "17"}},
 {"type": "Face", "mbr_geometry": {"type": "Rectangle", "coordinates": [35, 14, 47, 22]}, "properties": {"FACE_ID": "5", "BOUNDARY_EDGE_ID": "15"}},
 {"type": "Face", "mbr_geometry": {"type": "Rectangle", "coordinates": [35, 6, 47, 14]}, "properties": {"FACE_ID": "8", "BOUNDARY_EDGE_ID": "16"}},
 {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [8, 30, 16, 30, 16, 38, 3, 38, 3, 30, 8, 30]}, "properties": {"EDGE_ID": "1", "START_NODE_ID": "1", "END_NODE_ID": "1", "NEXT_LEFT_EDGE_ID": "1", "PREV_LEFT_EDGE_ID": "1", "NEXT_RIGHT_EDGE_ID": "-1", "PREV_RIGHT_EDGE_ID": "-1", "LEFT_FACE_ID": "1", "RIGHT_FACE_ID": "-1"}},
 {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [4, 31, 7, 31, 7, 34, 4, 34, 4, 31]}, "properties": {"EDGE_ID": "26", "START_NODE_ID": "20", "END_NODE_ID": "20", "NEXT_LEFT_EDGE_ID": "26", "PREV_LEFT_EDGE_ID": "26", "NEXT_RIGHT_EDGE_ID": "-26", "PREV_RIGHT_EDGE_ID": "-26", "LEFT_FACE_ID": "9", "RIGHT_FACE_ID": "1"}},
 {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [9, 22, 21, 22]}, "properties": {"EDGE_ID": "6", "START_NODE_ID": "16", "END_NODE_ID": "17", "NEXT_LEFT_EDGE_ID": "7", "PREV_LEFT_EDGE_ID": "21", "NEXT_RIGHT_EDGE_ID": "-21", "PREV_RIGHT_EDGE_ID": "19", "LEFT_FACE_ID": "-1", "RIGHT_FACE_ID": "3"}},
 {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [9, 14, 9, 22]}, "properties": {"EDGE_ID": "21", "START_NODE_ID": "15", "END_NODE_ID": "16", "NEXT_LEFT_EDGE_ID": "6", "PREV_LEFT_EDGE_ID": "22", "NEXT_RIGHT_EDGE_ID": "9", "PREV_RIGHT_EDGE_ID": "-6", "LEFT_FACE_ID": "-1", "RIGHT_FACE_ID": "3"}},
 {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [9, 14, 21, 14]}, "properties": {"EDGE_ID": "9", "START_NODE_ID": "15", "END_NODE_ID": "14", "NEXT_LEFT_EDGE_ID": "19", "PREV_LEFT_EDGE_ID": "-21", "NEXT_RIGHT_EDGE_ID": "-22", "PREV_RIGHT_EDGE_ID": "20", "LEFT_FACE_ID": "3", "RIGHT_FACE_ID": "6"}},
 {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [9, 6, 21, 6]}, "properties": {"EDGE_ID": "12", "START_NODE_ID": "8", "END_NODE_ID": "9", "NEXT_LEFT_EDGE_ID": "20", "PREV_LEFT_EDGE_ID": "-22", "NEXT_RIGHT_EDGE_ID": "22", "PREV_RIGHT_EDGE_ID": "-13", "LEFT_FACE_ID": "6", "RIGHT_FACE_ID": "-1"}},
 {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [9, 35, 13, 35]}}]
```

```

"properties": {"EDGE_ID": "25", "START_NODE_ID": "21", "END_NODE_ID": "22", "NEXT_LEFT_EDGE_ID": "-25", "PREV_LEFT_EDGE_ID": "-25", "NEXT_RIGHT_EDGE_ID": "25", "PREV_RIGHT_EDGE_ID": "25", "LEFT_FACE_ID": "1", "RIGHT_FACE_ID": "1"}, },
{"type": "Edge", "geometry": {"type": "LineString", "coordinates": [9, 6, 9, 14]}, "properties": {"EDGE_ID": "22", "START_NODE_ID": "8", "END_NODE_ID": "15", "NEXT_LEFT_EDGE_ID": "21", "PREV_LEFT_EDGE_ID": "-12", "NEXT_RIGHT_EDGE_ID": "12", "PREV_RIGHT_EDGE_ID": "-9", "LEFT_FACE_ID": "-1", "RIGHT_FACE_ID": "6"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [25, 30, 31, 30, 31, 40, 17, 40, 17, 30, 25, 30]}, "properties": {"EDGE_ID": "2", "START_NODE_ID": "2", "END_NODE_ID": "2", "NEXT_LEFT_EDGE_ID": "-3", "NEXT_RIGHT_EDGE_ID": "-2", "PREV_RIGHT_EDGE_ID": "-2", "LEFT_FACE_ID": "2", "RIGHT_FACE_ID": "-1"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [21, 6, 35, 6]}, "properties": {"EDGE_ID": "13", "START_NODE_ID": "9", "END_NODE_ID": "10", "NEXT_LEFT_EDGE_ID": "18", "PREV_LEFT_EDGE_ID": "-20", "NEXT_RIGHT_EDGE_ID": "-12", "PREV_RIGHT_EDGE_ID": "-14", "LEFT_FACE_ID": "7", "RIGHT_FACE_ID": "-1"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [21, 22, 35, 22]}, "properties": {"EDGE_ID": "7", "START_NODE_ID": "17", "END_NODE_ID": "18", "NEXT_LEFT_EDGE_ID": "8", "PREV_LEFT_EDGE_ID": "6", "NEXT_RIGHT_EDGE_ID": "-19", "PREV_RIGHT_EDGE_ID": "17", "LEFT_FACE_ID": "-1", "RIGHT_FACE_ID": "4"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [21, 6, 21, 14]}, "properties": {"EDGE_ID": "20", "START_NODE_ID": "9", "END_NODE_ID": "14", "NEXT_LEFT_EDGE_ID": "-9", "PREV_LEFT_EDGE_ID": "12", "NEXT_RIGHT_EDGE_ID": "13", "PREV_RIGHT_EDGE_ID": "10", "LEFT_FACE_ID": "6", "RIGHT_FACE_ID": "7"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [35, 14, 21, 14]}, "properties": {"EDGE_ID": "10", "START_NODE_ID": "13", "END_NODE_ID": "14", "NEXT_LEFT_EDGE_ID": "-20", "PREV_LEFT_EDGE_ID": "18", "NEXT_RIGHT_EDGE_ID": "17", "PREV_RIGHT_EDGE_ID": "-19", "LEFT_FACE_ID": "7", "RIGHT_FACE_ID": "4"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [21, 14, 21, 22]}, "properties": {"EDGE_ID": "19", "START_NODE_ID": "14", "END_NODE_ID": "17", "NEXT_LEFT_EDGE_ID": "-6", "PREV_LEFT_EDGE_ID": "9", "NEXT_RIGHT_EDGE_ID": "-10", "PREV_RIGHT_EDGE_ID": "-7", "LEFT_FACE_ID": "3", "RIGHT_FACE_ID": "4"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [25, 30, 25, 35]}, "properties": {"EDGE_ID": "3", "START_NODE_ID": "2", "END_NODE_ID": "3", "NEXT_LEFT_EDGE_ID": "-3", "PREV_LEFT_EDGE_ID": "2", "NEXT_RIGHT_EDGE_ID": "2", "PREV_RIGHT_EDGE_ID": "3", "LEFT_FACE_ID": "2", "RIGHT_FACE_ID": "2"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [35, 6, 47, 6]}, "properties": {"EDGE_ID": "14", "START_NODE_ID": "10", "END_NODE_ID": "11", "NEXT_LEFT_EDGE_ID": "16", "PREV_LEFT_EDGE_ID": "-18", "NEXT_RIGHT_EDGE_ID": "-13", "PREV_RIGHT_EDGE_ID": "-16", "LEFT_FACE_ID": "8", "RIGHT_FACE_ID": "-1"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [35, 14, 47, 14]}, "properties": {"EDGE_ID": "11", "START_NODE_ID": "13", "END_NODE_ID": "12", "NEXT_LEFT_EDGE_ID": "15", "PREV_LEFT_EDGE_ID": "-17", "NEXT_RIGHT_EDGE_ID": "-18", "PREV_RIGHT_EDGE_ID": "16", "LEFT_FACE_ID": "5", "RIGHT_FACE_ID": "8"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [35, 6, 35, 14]}, "properties": {"EDGE_ID": "18", "START_NODE_ID": "10", "END_NODE_ID": "13", "NEXT_LEFT_EDGE_ID": "10", "PREV_LEFT_EDGE_ID": "13", "NEXT_RIGHT_EDGE_ID": "14", "PREV_RIGHT_EDGE_ID": "-11", "LEFT_FACE_ID": "7", "RIGHT_FACE_ID": "8"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [35, 22, 47, 22]}, "properties": {"EDGE_ID": "8", "START_NODE_ID": "18", "END_NODE_ID": "19", "NEXT_LEFT_EDGE_ID": "-15", "PREV_LEFT_EDGE_ID": "7", "NEXT_RIGHT_EDGE_ID": "-17", "PREV_RIGHT_EDGE_ID": "15", "LEFT_FACE_ID": "-1", "RIGHT_FACE_ID": "5"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [35, 14, 35, 22]}, "properties": {"EDGE_ID": "17", "START_NODE_ID": "13", "END_NODE_ID": "18", "NEXT_LEFT_EDGE_ID": "-7", "PREV_LEFT_EDGE_ID": "-10", "NEXT_RIGHT_EDGE_ID": "11", "PREV_RIGHT_EDGE_ID": "-8", "LEFT_FACE_ID": "4", "RIGHT_FACE_ID": "5"}}, {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [36, 38, 38, 35, 41, 34, 42, 33, 45, 32, 47, 28, 50, 28, 52, 32, 57, 33]}, "properties": {"EDGE_ID": "4", "START_NODE_ID": "5", "END_NODE_ID": "6", "NEXT_LEFT_EDGE_ID": "-5", "PREV_LEFT_EDGE_ID": "-4", "NEXT_RIGHT_EDGE_ID": "4", "PREV_RIGHT_EDGE_ID": "-4"}]

```

```

EDGE_ID": "5", "LEFT_FACE_ID": "-1", "RIGHT_FACE_ID": "-1"}},  

{"type": "Edge", "geometry": {"type": "LineString",  

"coordinates": [41, 40, 45, 40, 47, 42, 62, 41, 61, 38, 59, 39, 57, 36, 57, 33]},  

"properties": {"EDGE_ID": "5", "START_NODE_ID": "7", "END_NODE_ID": "6", "NEXT_LEFT_EDGE_ID": "-4", "PREV_LEFT_EDGE_ID": "-5", "NEXT_RIGHT_EDGE_ID": "5", "PREV_RIGHT_EDGE_ID": "4", "LEFT_FACE_ID": "-1", "RIGHT_FACE_ID": "-1"}},  

{"type": "Edge", "geometry": {"type": "LineString", "coordinates": [47, 14, 47, 22]},  

"properties": {"EDGE_ID": "15", "START_NODE_ID": "12", "END_NODE_ID": "19", "NEXT_LEFT_EDGE_ID": "-8", "PREV_LEFT_EDGE_ID": "11", "NEXT_RIGHT_EDGE_ID": "-16", "PREV_RIGHT_EDGE_ID": "8", "LEFT_FACE_ID": "5", "RIGHT_FACE_ID": "-1"}},  

{"type": "Edge", "geometry": {"type": "LineString", "coordinates": [47, 6, 47, 14]},  

"properties": {"EDGE_ID": "16", "START_NODE_ID": "11", "END_NODE_ID": "12", "NEXT_LEFT_EDGE_ID": "-11", "PREV_LEFT_EDGE_ID": "14", "NEXT_RIGHT_EDGE_ID": "-14", "PREV_RIGHT_EDGE_ID": "-15", "LEFT_FACE_ID": "8", "RIGHT_FACE_ID": "-1"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [4, 31]},  

"properties": {"NODE_ID": "20", "EDGE_ID": "26", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [8, 30]},  

"properties": {"NODE_ID": "1", "EDGE_ID": "1", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [9, 6]},  

"properties": {"NODE_ID": "8", "EDGE_ID": "12", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [9, 35]},  

"properties": {"NODE_ID": "21", "EDGE_ID": "25", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [9, 14]},  

"properties": {"NODE_ID": "15", "EDGE_ID": "21", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [9, 22]},  

"properties": {"NODE_ID": "16", "EDGE_ID": "6", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [13, 35]},  

"properties": {"NODE_ID": "22", "EDGE_ID": "-25", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [20, 37]},  

"properties": {"NODE_ID": "4", "EDGE_ID": "0", "FACE_ID": "2"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [21, 14]},  

"properties": {"NODE_ID": "14", "EDGE_ID": "19", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [21, 22]},  

"properties": {"NODE_ID": "17", "EDGE_ID": "7", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [21, 6]},  

"properties": {"NODE_ID": "9", "EDGE_ID": "20", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [25, 30]},  

"properties": {"NODE_ID": "2", "EDGE_ID": "2", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [25, 35]},  

"properties": {"NODE_ID": "3", "EDGE_ID": "-3", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [35, 14]},  

"properties": {"NODE_ID": "13", "EDGE_ID": "17", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [35, 6]},  

"properties": {"NODE_ID": "10", "EDGE_ID": "18", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [35, 22]},  

"properties": {"NODE_ID": "18", "EDGE_ID": "8", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [36, 38]},  

"properties": {"NODE_ID": "5", "EDGE_ID": "4", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [41, 40]},  

"properties": {"NODE_ID": "7", "EDGE_ID": "5", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [47, 14]},  

"properties": {"NODE_ID": "12", "EDGE_ID": "15", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [47, 6]},  

"properties": {"NODE_ID": "11", "EDGE_ID": "-14", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [47, 22]},  

"properties": {"NODE_ID": "19", "EDGE_ID": "-15", "FACE_ID": "0"}},  

{"type": "Node", "geometry": {"type": "Point", "coordinates": [57, 33]},  

"properties": {"NODE_ID": "6", "EDGE_ID": "-4", "FACE_ID": "0"}}
]}

```

To retrieve topology features, the following example specifies the topology, base_table, and geom_col parameters (where geom_col refers to the topology column):

```
http://example:8080/mapviewer/dataserver/tilsmenv?topology=city_data&base_table=land_parcels&geom_col=feature
```

The response to this request is similar to the following:

```
{"type": "TopologyFeatures",
"topology": "CITY_DATA",
"topology_id": 5,
"topology_owner": "TILSZUSER",
"tolerance": 5.0E-5,
"srs": 0,
"table_schema": "TILSZUSER",
"table_name": "LAND_PARCELS",
"topo_column": "FEATURE",
"layer_id": 1,
"layer_type": "POLYGON",
"layer_level": 0,
"child_layer": 0,
"node_sequence": "CITY_DATA_NODE_S",
"edge_sequence": "CITY_DATA_EDGE_S",
"face_sequence": "CITY_DATA_FACE_S",
"feature_sequence": "CITY_DATA_TG_S",
"digits_right_decimal": 16,
"attr_names": ["FEATURE_NAME"],
"attr_types": ["string"],
"features": [
{"type": "topology", "tg_id": 4, "primitives": [{"topo_id": 3, "topo_type": 3}, {"topo_id": 6, "topo_type": 3}], "properties": {"FEATURE_NAME": "P1"}, {"type": "topology", "tg_id": 5, "primitives": [{"topo_id": 4, "topo_type": 3}, {"topo_id": 7, "topo_type": 3}], "properties": {"FEATURE_NAME": "P2"}, {"type": "topology", "tg_id": 6, "primitives": [{"topo_id": 5, "topo_type": 3}, {"topo_id": 8, "topo_type": 3}], "properties": {"FEATURE_NAME": "P3"}, {"type": "topology", "tg_id": 7, "primitives": [{"topo_id": 2, "topo_type": 3}], "properties": {"FEATURE_NAME": "P4"}, {"type": "topology", "tg_id": 8, "primitives": [{"topo_id": 1, "topo_type": 3}], "properties": {"FEATURE_NAME": "P5"}]
}]}
```

To specific primitive faces, edges, and nodes, the following example define the primitive identifiers:

```
http://example:8080/mapviewer/dataserver/tilsmenv?topology=city_data&face_ids=-1&edge_ids=3,4&node_ids=5
```

The response to this request is similar to the following:

```
{"type": "TopologyPrimitives",
"topology": "city_data",
"srs": 0,
"bbox": [0, 0, 57, 38],
"face_attr_names": ["FACE_ID", "BOUNDARY_EDGE_ID", "ISLAND_EDGE_ID_LIST", "ISLAND_NODE_ID_LIST"],
"face_attr_types": ["integer", "integer", "array:integer", "array:integer"],
"edge_attr_names": ["EDGE_ID", "START_NODE_ID", "END_NODE_ID", "NEXT_LEFT_EDGE_ID", "PREV_LEFT_EDGE_ID", "NEXT_RIGHT_EDGE_ID", "PREV_RIGHT_EDGE_ID", "LEFT_FACE_ID", "RIGHT_FACE_ID"],
"edge_attr_types": ["integer", "integer", "integer", "integer", "integer", "integer", "integer", "integer"]}
```

```

"node_attr_names": ["NODE_ID", "EDGE_ID", "FACE_ID"],
"node_attr_types": ["integer", "integer", "integer"],
"primitives": [
{"type": "Face", "properties": {"FACE_ID": "-1", "BOUNDARY_EDGE_ID": "0", "ISLAND_EDGE_ID_LIST": [-1, -2, 4, 6]}},
 {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [25, 30, 25, 35]}, "properties": {"EDGE_ID": "3", "START_NODE_ID": "2", "END_NODE_ID": "3", "NEXT_LEFT_EDGE_ID": "-3", "PREV_LEFT_EDGE_ID": "2", "NEXT_RIGHT_EDGE_ID": "2", "PREV_RIGHT_EDGE_ID": "3", "LEFT_FACE_ID": "2", "RIGHT_FACE_ID": "2"}},
 {"type": "Edge", "geometry": {"type": "LineString", "coordinates": [36, 38, 38, 35, 41, 34, 42, 33, 45, 32, 47, 28, 50, 28, 52, 32, 57, 33]}, "properties": {"EDGE_ID": "4", "START_NODE_ID": "5", "END_NODE_ID": "6", "NEXT_LEFT_EDGE_ID": "-5", "PREV_LEFT_EDGE_ID": "-4", "NEXT_RIGHT_EDGE_ID": "4", "PREV_RIGHT_EDGE_ID": "5", "LEFT_FACE_ID": "-1", "RIGHT_FACE_ID": "-1"}},
 {"type": "Node", "geometry": {"type": "Point", "coordinates": [36, 38]}, "properties": {"NODE_ID": "5", "EDGE_ID": "4", "FACE_ID": "0"}}
]
}

```

3.2.3 Interpreting Data Returned from the Map Data Server

The map data server returns data in a compressed GeoJSON format. Some minor changes and additions to the standard GeoJSON are made to improve performance and the usefulness of the information.

The following is a sample response:

```

{"type": "FeatureCollection",
"collectionName": "theme1",
"srs": 3857,
"geodetic": false,
"bbox": [-17566686.86258, 2414218.89842, -7905675.57465, 8629389.76988],
"attr_names": ["CITY", "STATE_ABRV", "POP90", "RANK90"],
"attr_types": ["string", "string", "double", "double"],
"features": [
 {"type": "Feature", "_id": "AAASQ3AAEAAAAMbAAA", "geometry": {"type": "Point", "coordinates": [-119.99823, 38.9052]}, "properties": {"CITY": "SOUTH LAKE TAHOE", "SALES": "125.8", "NAME": "FACTORY STORES AT THE Y", "_label_": "FACTORY STORES AT THE Y"}, "styles": {"rendering": {"style": "M.SMALL CIRCLE"}, "labeling": {"style": "T.RED STREET", "columns": ["_label_"]}}},
 {"type": "Feature", "_id": "AAASQ3AAEAAAAMbAAB", "geometry": {"type": "Point", "coordinates": [-121.95073, 37.53356]}, "properties": {"CITY": "FREMONT", "SALES": "186.8", "NAME": "OHLONE VILLAGE", "_label_": "OHLONE VILLAGE"}, "styles": {"rendering": {"style": "M.SMALL CIRCLE"}, "labeling": {"style": "T.RED STREET", "columns": ["_label_"]}}},
 {"type": "Feature", "_id": "AAASQ3AAEAAAAMbAAC", "geometry": {"type": "Point", "coordinates": [-118.48844, 34.02353]}, "properties": {"CITY": "SANTA MONICA", "SALES": "9.1", "NAME": "SANTA MONICA PLACE", "_label_": "SANTA MONICA PLACE"}, "styles": {"rendering": {"style": "M.SMALL CIRCLE"}, "labeling": {"style": "T.RED STREET", "columns": ["_label_"]}}},
 {"type": "Feature", "_id": "AAASQ3AAEAAAAMbAAD", "geometry": {"type": "Point", "coordinates": [-118.55093, 34.42104]}, "properties": {"CITY": "SANTA CLARITA", "SALES": "52.6", "NAME": "VALENCIA TOWN CENTER", "_label_": "VALENCIA TOWN CENTER"}, "styles": {"rendering": {"style": "M.SMALL CIRCLE"}, "labeling": {"style": "T.RED STREET", "columns": ["_label_"]}}},
 {"type": "Feature", "_id": "AAASQ3AAEAAAAMbAAE", "geometry": {"type": "Point", "coordinates": [-122.56007, 38.08187]}, "properties": {"CITY": "NOVATO", "SALES": "119.1", "NAME": "VINTAGE OAKS AT NOVATO", "_label_": "VINTAGE OAKS AT NOVATO"}, "styles": {"rendering": {"style": "M.SMALL CIRCLE"}, "labeling": {"style": "T.RED STREET", "columns": ["_label_"]}}}]
}

```

The response contains a minimal header plus an array of features. The header includes the spatial reference system (srs) ID and the minimum bounding box of the result data. The array of features includes attribute names and their types. Possible type names include:

```
"byte", "short", "int", "long", "float", "double", "char", "string", "boolean",
"date"
```

For each feature, the following fields apply:

- `type`: Always Feature.
- `_id`: Optional ID or key attribute.
- `geometry`: The actual geometry encoded in the modified GeoJSON format.
- `properties`: An object containing all the properties (name-value pairs) for the feature.
- `styles`: An optional styling information object. Contains two embedded objects, rendering and labeling, which share the same structure: basically an object containing a `style` field and an optional `columns` array. Currently only predefined themes support including styling information in the response; a dynamic theme's response contains no styling information.
- `label_box`: A 4-element array specifying the `minX`, `minY`, `maxX`, and `maxY` of the label box. Only a polygon can have a label box.

Note that the labeling text is always included as a pseudo-property with the name `_label_` in the property list.

3.2.4 Map Data Server Error Handling

If the map data server cannot process a data request, it will send a JSON response containing an error object. This JSON error object may look like the following:

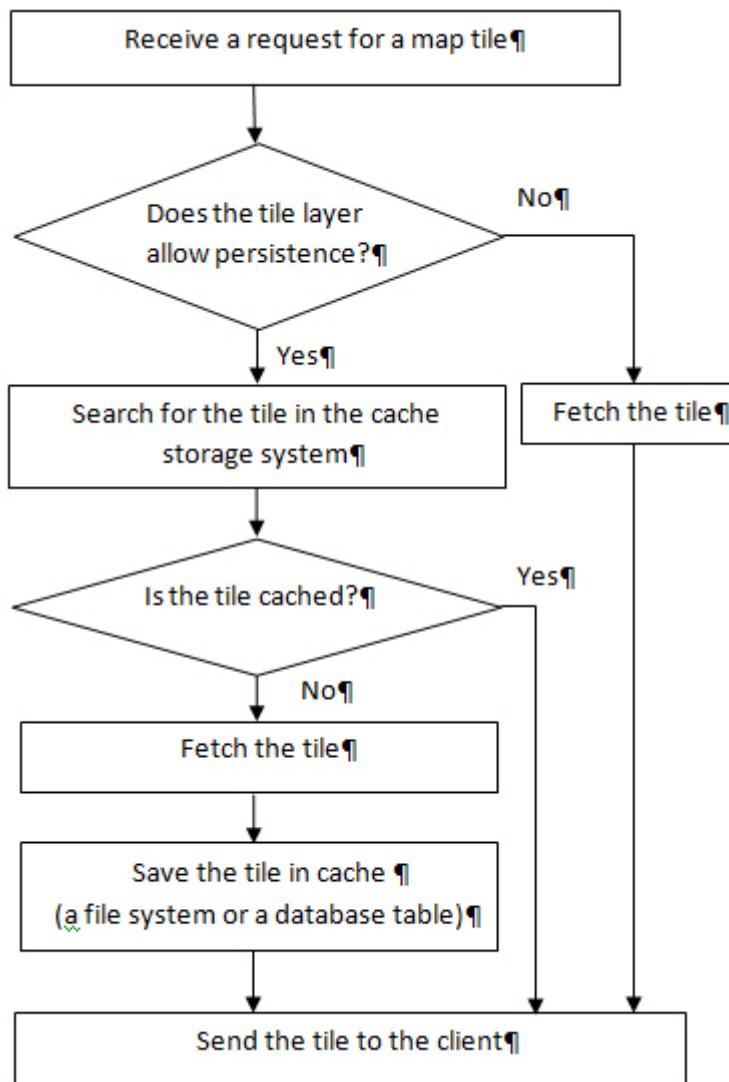
```
{"error": {
  "code": "ora-500",
  "message": "Table requested does not exist",
  "details": "maybe a stack trace here..."
}}
```

In the preceding JSON object, `code` is the error code known only to the map data server, `message` contains a short message that can be displayed to the end user in a warning dialog, and `details` is an optional field that may contain more details (such as the stack trace if included).

3.3 Map Tile Server

The map tile server is a map image caching engine that fetches, caches, and serves pregenerated, fixed-size map image tiles. It is implemented as a Java servlet that is part of the MapViewer server. The map tile server accepts requests that ask for map image tiles specified by tile zoom level and tile location (mesh code), and it sends the requested tiles back to clients.

[Figure 3–6](#) shows the basic workflow of the map tile server.

Figure 3–6 Workflow of the Map Tile Server

As shown in Figure 3–6, when the map tile server receives a request for a map tile, it searches for the tile in the cache storage system. If the tile is cached, the map tile server sends the tile to the client. If the tile is not cached, the map tile server fetches the tile, saves it in the cache, and sends it to the client.

You can use the MapViewer administration tool to manage the map tile server.

Related subtopics:

- [Section 3.3.1, "Map Tile Server Concepts"](#)
- [Section 3.3.2, "Map Tile Server Configuration"](#)
- [Section 3.3.3, "Map Cache Auto-Update"](#)
- [Section 3.3.4, "UTFGrid for Map Tiles: Including Text Information About Features"](#)
- [Section 3.3.5, "External Map Source Adapter"](#)

3.3.1 Map Tile Server Concepts

This section explains map tile server concepts that you need to know to be able to use Oracle Maps effectively.

Related subtopics:

- [Section 3.3.1.1, "Map Tile Layers and Map Tile Sources"](#)
- [Section 3.3.1.2, "Storage of Map Image Tiles"](#)
- [Section 3.3.1.3, "Coordinate System for Map Tiles"](#)
- [Section 3.3.1.4, "Tile Mesh Codes"](#)
- [Section 3.3.1.5, "Map Tile Requests"](#)
- [Section 3.3.1.6, "Tiling Rules"](#)
- [Section 3.3.1.7, "Tile Background Color and Out-of-Bounds Color"](#)

3.3.1.1 Map Tile Layers and Map Tile Sources

All map tile layers are managed by the map tile server. The **map tile server** fetches and stores the map image tiles that belong to the map tile layer and returns map image tiles to the client. The map tile server can manage multiple map tile layers.

Each map tile layer can have multiple predefined zoom levels. Each zoom level is assigned a zoom level number ranging from 0 to n-1, where n is the total number of zoom levels. Zoom level 0 is the most zoomed out level and zoom level n-1 is the most zoomed in level.

The map is evenly divided into same-sized small map image tiles on each zoom level. Clients specify a map tile by its zoom level and tile mesh code.

A map tile layer can come from two different types of sources:

- Internal MapViewer base maps rendered by the MapViewer map rendering engine. A MapViewer base map consists of a set of predefined themes and must be predefined in the database view `USER_SDO_MAPS`.
- Maps rendered by an external web map services providers. An external web map services provider is a server that renders and serves maps upon client requests over the web. If you properly configure an adapter that can fetch maps from the external map services provider, the map tile server can fetch and cache map tiles generated by the external map services provider. (A MapViewer instance other than the MapViewer inside which the map tile server is running is also considered an external map services provider.)

3.3.1.2 Storage of Map Image Tiles

Oracle Maps has three options for handling the storage of map image tiles:

- [Store the tiles using the local file system.](#)

If you use the local file system for caching, you can customize the path that is used for this storage as part of the map tile server configuration settings.

- [Store the tiles in a database table.](#)

If you use a database table for caching, you must create the database table, and set the `TILES_TABLE` column to that table for the tile layer in the `USER_SDO_CACHED_MAPS` view.

- [Stream the tiles directly without storing them.](#)

If you do not want to cache any image tiles, you must indicate that in the tile layer's definition.

3.3.1.2.1 Store the tiles using the local file system In a file system, each tile layer has its own storage root directory, which is specified by the `<cache_storage>` element's `root_path` attribute in the tile layer definition. If that attribute is not specified, then the default storage location specified in the `mapViewerConfig.xml` file `<tile_storage>` element is used as the root path. For example, if the root path is defined as `/scratch/tilecache/`, and a data source named MVDEMO has a tile layer named DEMO_MAP with 19 zoom levels, after the server is instantiated the folder `/scratch/tilecache/MVDEMO.DEMO_MAP` is created, and it contains 19 subfolders (`/0, /1, ..., /18`), each for storing the image tiles in that zoom level.

Under each zoom level, there are two options to organize its subfolders for map tiles. One is the default option, which uses a mesh code tree structure; the other, called xyz storage scheme, uses the tile's row and column values as subfolder and tile name to store the map tile. Both storage options start from the tile's mesh code value for each zoom level (see [Section 3.3.1.4, "Tile Mesh Codes"](#) for details about the tile mesh code). Each tile in a zoom level can be represented using its mesh code value pair (`mx, my`), where the `mx` and `my` are integer values in the horizontal and vertical directions respectively. The tile at the lower left corner has a value of `(0, 0)`. A tile can also be located using its tile row and tile column value pair (`tile_column, tile_row`). A tile at the upper left corner has a value of `(0, 0)`.

3.3.1.2.2 Store the tiles in a database table Image tiles can be stored in a database table, as follows.

1. Create a table for storing the image tiles. For example:

```
CREATE TABLE tile_dbt (
    tile_layer varchar2(64),
    zoom_level number,
    x number,
    y number,
    modified TIMESTAMP,
    data BLOB);
COMMIT;
```

2. Update the `TILES_TABLE` column in `USER_SDO_CACHED_MAPS` view for the tile layer. For example, if you have a tile layer DEMP_MAP and you want to use the table created in step 1 to store its map tiles, then update the tile layer's `TILES_TABLE` column as follows:

```
UPDATE user_sdo_cached_maps SET tiles_table='tiles_dbt' WHERE name='DEMP_MAP';
```

3. Restart the MapViewer server to make the changes take effect.

Using this example, the map image tiles for tile layer DEMP_MAP will be stored in the database table TILE_DBT.

3.3.1.2.3 Stream the tiles directly without storing them If the tile contents may change constantly (such as a real-time cloud cover satellite image map) or if you do not want to store the image tiles, you can stream the tiles directly without storing them.

To choose this option, set the `persistent_tiles` attribute to `false` in the `<map_tile_layer>` element in the tile layer's definition. (The default value for the `persistent_tiles` attribute is `true`.) [Example 3–26](#) inserts a tile layer named DEMO_MAP, with the `persistent_tiles` attribute sets to `false` so that no map image tiles will be cached for this tile layer.

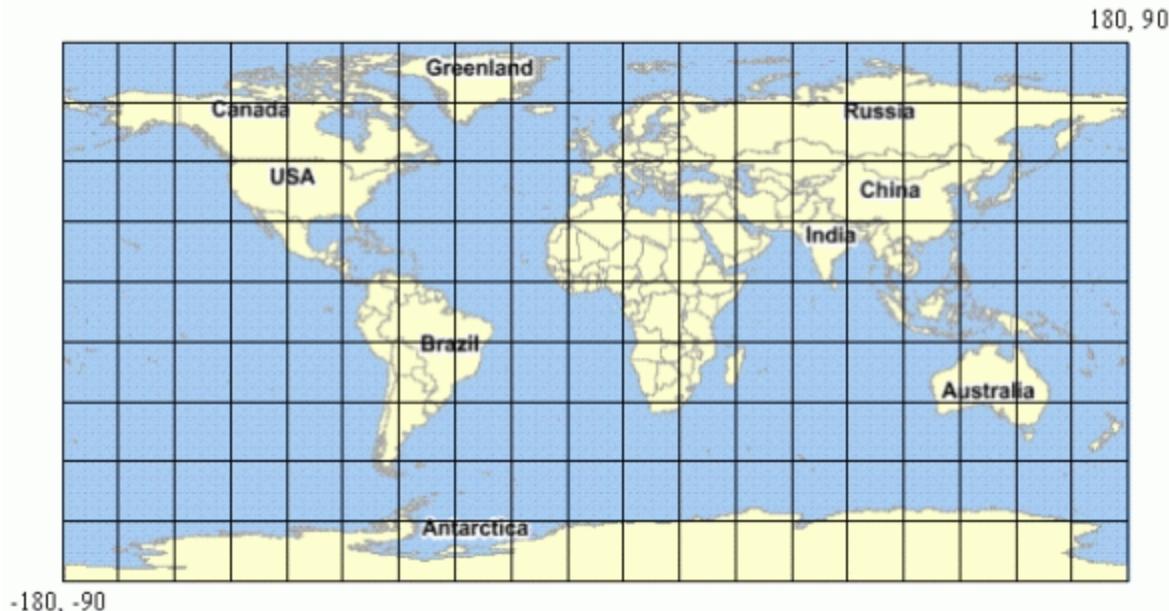
Example 3–26 Streaming Tiles Without Storing Them

```
INSERT INTO user_sdo_cached_maps values(
'DEMO_MAP',
'an example tile layer that does not cache image tiles',
 '',
'YES',
'YES',
'<map_tile_layer name="DEMO_MAP_TREEMESH" image_format="PNG" http_headerExpires="168.0"
concurrent_fetching_threads="3" persistent_tiles="false">
<internal_map_source data_source="mvdemo" base_map="DEMO_MAP" bgcolor="#dddddd" out_of_bounds_
color="#eeddff"/>
<tile_storage root_path="/temp" short_path="false" />
<coordinate_system srid="8307" minX="-180.0" maxX="180.0" minY="-90.0" maxY="90.0"/>
<tile_image width="256" height="256"/>
<tile_dpi value="90.7142857"/>
<tile_meters_per_unit value="111319.49079327358"/>
<zoom_levels levels="19" min_scale="2132.729583849784" max_scale="559082264.0287178"/>
</map_tile_layer>',
'DEMO_MAP',
 '');
COMMIT;
```

3.3.1.3 Coordinate System for Map Tiles

Map images are cached and managed by the map tile server as small same-size rectangular image tiles. Currently we support tiling on any two-dimensional Cartesian coordinate system. A geodetic coordinate system can also be supported when it is mapped as if it is a Cartesian coordinate system, where longitude and latitude are treated simply as two perpendicular axes, as shown in [Figure 3–7](#).

Figure 3–7 Tiling with a Longitude/Latitude Coordinate System



On each zoom level, the map tiles are created by equally dividing the whole map coordinate system along the two dimensions (X and Y, which in [Figure 3–7](#) represent latitude and longitude). The map tile server needs this dimensional information of the

map coordinate system in order to create map image tiles, and therefore you must include this information in the map tile layer configuration settings.

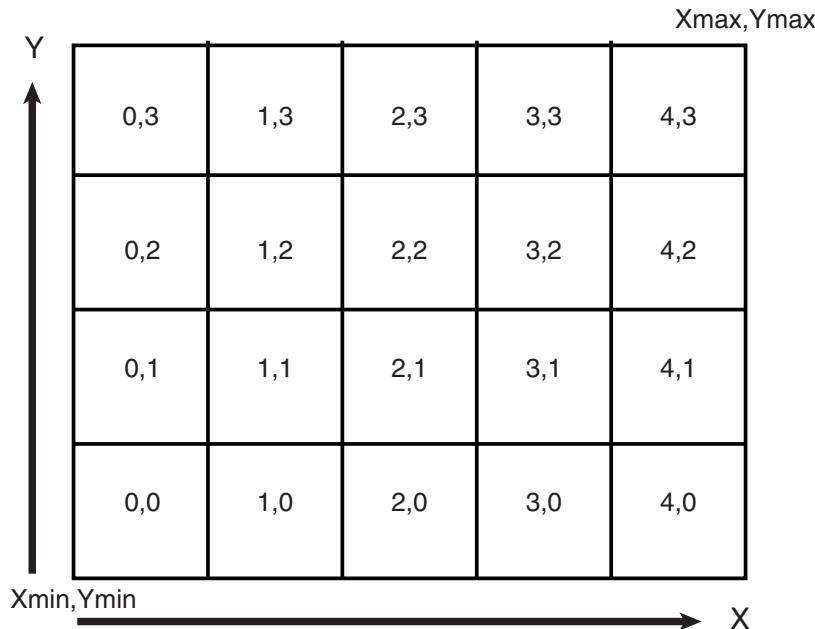
The whole map coordinate system can be represented by a rectangle, and its boundary is specified by (Xmin, Ymin) and (Xmax, Ymax), where Xmin is the minimum X value allowed in the coordinate system, Ymin is the minimum Y value allowed, Xmax is the maximum X value allowed and Ymax is the maximum Y value allowed. In [Figure 3–7](#), Xmin is –180, Ymin is –90, Xmax is 180, and Ymax is 90.

You must also specify the spatial referencing ID (SRID) of the coordinate system to enable the map tile server to calculate map scales.

3.3.1.4 Tile Mesh Codes

Each map tile is specified by a mesh code, which is defined as a pair of integers (Mx, My), where Mx specifies the X dimension index of the tile and My specifies the Y dimension index of the tile. If the tile is the *i*th tile on X dimension starting from Xmin, then Mx should be *i*-1. If the tile is the *j*th tile on Y dimension starting from Ymin, then My should be *j*-1. [Figure 3–8](#) shows the mesh codes of the tiles on a map.

Figure 3–8 Tile Mesh Codes



The JavaScript map client automatically calculates which tiles it needs for displaying the map in the web browser, and it sends requests with the mesh codes to the server. Mesh codes are transparent to the application, and application developers do not need to deal with mesh codes directly.

3.3.1.5 Map Tile Requests

The map tile server handles map tile requests. A map tile request can be in key/value pair format or REST format:

- Map tile request in key/value pair format

For example, if data source DS_NAME has a tile layer TL_NAME, then to get a map tile image in PNG format from zoom level 2 and mesh code (3.2), the URL may be formatted as:

```
http://localhost:8080/mapviewer/mcserver?request=gettile&format=PNG&zoomlevel=2
&mapcache=DS_NAME.TL_NAME&mx=3&my=2
```

- Map tile request in REST format

A general format of a request in REST format is:

```
http://localhost:8080/mapviewer/mcserver/DS_NAME/TL_
NAME/{zoom}/{row}/{column}.png
```

For example, to send the same map tile request shown in the preceding key/value pair example but in a REST format, the URL may be:

```
http://localhost:8080/mapviewer/mcserver/DS_NAME/TL_NAME/2/1/3.png
```

The mesh code in the key/value pair format has an origin of the lower-left corner, but the REST format requests a tile's row and column, and thus the origin is at the upper-right corner. Because the two formats have different origins, the my value is different from the row value, but the mx value is the same as the column value.

Normally, map tile requests are encapsulated in the MapViewer JavaScript API libraries, so the API handles map tile requests. However, if you are using a third party's JavaScript API to communicate with the MapViewer server, you may need to specify the map tile request format in your application. For example, if you use the Leaflet JavaScript API to get map tiles from a MapViewer server, you may need to set the URL template for its L.tileLayer as:

```
http://localhost:8080/mapviewer/mcserver/DS_NAME/TL_NAME/{z}/{y}/{x}.png.
```

3.3.1.6 Tiling Rules

You must create tiling rules that determine how the map is divided and how tiles are created. The map tile server uses these tiling rules to divide the map into small map image tiles that are stored in the tile storage system. These rules are also used by the JavaScript map client.

Because all tiles on a given zoom level are the same size, the map tile server needs to know the following information to perform the tile division:

- The map tile image size (width and height), specified in screen pixels. This is the physical size of the tile images.
- The tile size specified according to the map coordinate system. For example, if the map uses a geodetic coordinate system, the tile width and height should be defined in degrees. The size can be specified either explicitly by tile width and height or implicitly by map scale. (Map scale, combined with tile image size, can be used to derive the tile width and height according to the map coordinate system.)

The preceding information constitutes the tiling rule for a given zoom level. Each zoom level must have its own tiling rule. You must define the tiling rules when you specify the configuration settings for the map tile server, as described in [Section 3.3.2](#).

3.3.1.7 Tile Background Color and Out-of-Bounds Color

Two attributes in a tile layer metadata definition which affect a tile's color: bgcolor (background color) and out_of_bounds_color (out-of-bounds color). The bgcolor attribute value is used for filling areas within the valid data area of a tile layer (the

valid data area is defined by `minX`, `minY`, `maxX`, `maxY`), while the `out_of_bounds_color` attribute value is used for filling areas that are outside the valid data area. Both attributes have the same default values (`Color(192, 192, 192)`).

If a tile-fetching process failed due to an exception on the attempt to generate a tile, then the tile filled with out-of-bounds color is used as its substitute, regardless of whether it is within the valid data area. However, such a substitute tile due to tile-fetching exception is not permanently stored on disk; rather, it is streamed to the client on a temporary basis. MapViewer will retry the tile generation on subsequent requests, if the temporary tile data in the client browser's cache is purged or if a different client initiates the request.

If `bgcolor` is set to `none`, then the tile becomes transparent; that is, the background color of the HTML page replaces the attribute values for both `bgcolor` and `out_of_bounds_color`.

3.3.2 Map Tile Server Configuration

Map tile server configuration settings are stored in local configuration files and in database views. You can customize these settings.

Related subtopics:

- [Section 3.3.2.1, "Global Map Tile Server Configuration"](#)
- [Section 3.3.2.2, "Map Tile Layer Configuration"](#)
- [Section 3.3.2.3, "Map Tile Storage Schemes: Internal Mesh Code or XYZ"](#)
- [Section 3.3.2.4, "Creating a Map Tile Layer Using an External Web Map Source"](#)

3.3.2.1 Global Map Tile Server Configuration

Global map tile server settings, such as logging options and the default cache storage directory, are stored in the MapViewer configuration file `mapViewerConfig.xml`, which is under the directory `$MAPVIEWER_HOME/web/WEB-INF/conf`.

The map tile server configuration settings are defined in element `<map_tile_server>` inside the top-level `<mapperConfig>` element, as shown in the following example:

```
<map_tile_server>
  <tile_storage default_root_path="/scratch/tilecache/" />
</map_tile_server>
```

The `<tile_storage>` element specifies the map tiles storage settings. The `default_root_path` attribute specifies the default file system directory under which the cached tile images are to be stored. If the default root directory is not set or not valid, the default root directory is `$MAPVIEWER_HOME/web/tilecache`. A subdirectory under this directory will be created and used for a map tile layer if the map tile layer configuration does not specify the map tiles storage directory for itself. The name of the subdirectory will be the same as the name of the map tile layer.

3.3.2.2 Map Tile Layer Configuration

The configuration settings for a map tile layer are stored in the `USER_SDO_CACHED_MAPS` metadata view, which is described in [Section 2.9.4](#). You should normally not manipulate this view directly, but should instead use the MapViewer administration tool, which uses this view to configure map tile layers.

Each database user (schema) has its own `USER_SDO_CACHED_MAPS` view. Each entry in this view stores the configuration settings for one map tile layer. If the map

tile layer is based on an internal MapViewer base map or themes, the base map or themes associated with the map tile layer must be defined in the same database schema where the map tile layer configuration settings are stored.

The map tile server obtains the map source configuration by querying the USER_SDO_CACHED_MAPS view using the database connections specified by MapViewer data sources. This happens when the map tile server is started or a new data source is added to MapViewer as the result of a MapViewer administration request.

For the DEFINITION column in the USER_SDO_CACHED_MAPS view, the map source definition has the following general format:

```

<map_tile_layer
    name = "map tile layer name"
    image_format = "tile-image-format">
    <internal_map_source
        data_source="name-of-data-source"
        base_map="name-of-MapViewer-base-map"
        bgcolor="base-map-background-color"
        antialias="whether-to-turn-on-antialiasing"
    />
    </internal_map_source>
    <external_map_source
        url="external-map-service-url"
        adapter_class="name-of-adapter-class"
        proxy_host=" proxy-server-host "
        proxy_port="proxy-server-port"
        timeout="request-timeout"
        request_method="http-request-method: 'GET' | 'POST'">
        <properties>
            <property name="property-name" value="property-value"/>
            ...
        </properties>
    </external_map_source>
    <tile_storage
        root_path="disk-path-of-cache-root-directory">
    </tile_storage>
    <coordinate_system
        srid="coordinate-system-srid"
        minX="minimum-allowed-X-value"
        maxX="maximum-allowed-X-value"
        minY="minimum-allowed-Y-value"
        maxY="maximum-allowed-Y-value">
    </coordinate_system>
    <tile_image
        width="tile-image-width-in-screen-pixels"
        height="tile-image-height-in-screen-pixels" >
    </tile_image>
    <tile_bound>
        <coordinates> ... </coordinates>
    </tile_bound>
    <zoom_levels
        levels="number-of-zoom-levels"
        min_scale="map-scale-at-highest-zoom-level"
        max_scale="map-scale-at-lowest-zoom-level"
        min_tile_width="tile-width-specified-in-map-data-units-at-
                        highest-zoom-level"
        max_tile_width="tile-width-specified-in-map-data-units-at-
                        lowest-zoom-level">
        <zoom_level
            description="zoom-level-description">
    </zoom_level>

```

```

    level_name="zoom-level-name"
    scale="map-scale-of-zoom-level"
    tile_width ="tile-width-specified-in-map-data-units"
    tile_height ="tile-height-specified-in-map-data-units">
<tile_bound>
    <coordinates> ... </coordinates>
</tile_bound>
</zoom_level>
...
</zoom_levels>
</map_tile_layer>
```

The DTD of the map tile layer definition XML is listed in [Section A.9](#).

[Example 3–27](#) shows the XML definition of an internal map tile layer that is based on a base map; [Example 3–28](#) shows the XML definition of an internal map tile layer that is based on themes (not on a base map); and [Example 3–29](#) shows the XML definition of an external map tile layer. Explanations of the `<map_tile_layer>` element and its subelements follow these examples.

Example 3–27 XML Definition of an Internal Map Tile Layer Based on a Base Map

```

<?xml version = '1.0'?>
<!!-- XML definition of an internal map tile layer.
-->
<map_tile_layer image_format="PNG">
    <internal_map_source base_map="demo_map"/>
    <tile_storage root_path="/scratch/mapcache/" />
    <coordinate_system
        srid="8307"
        minX="-180" maxX="180"
        minY="-90" maxY="90"/>
    <tile_image width="250" height="250"/>
    <zoom_levels>
        <zoom_level description="continent level" scale="10000000"/>
        <zoom_level description="country level" scale="3000000"/>
        <zoom_level description="state level" scale="1000000"/>
        <zoom_level description="county level" scale="300000"/>
        <zoom_level description="city level" scale="100000"/>
        <zoom_level description="street level" scale="30000"/>
        <zoom_level description="local street level" scale="10000"/>
    </zoom_levels>
</map_tile_layer>
```

Example 3–28 XML Definition of an Internal Map Tile Layer Based on Themes

```

<?xml version = '1.0' encoding = 'UTF-8'?>
<map_tile_layer name="TL1" image_format="PNG" http_headerExpires="168.0"
utfgrid="true" utfgrid_resolution="4" concurrent_fetching_threads="3">
    <internal_map_source data_source="MVDEMO" bgcolor="none" out_of_bounds_
color="#ffffff" base_map="" db_tile_table="/" />
    <tile_storage root_path="/temp" xyz_storage_scheme="true"/>
    <coordinate_system srid="3857" minX="-2.0037508E7" minY="-2.0037508E7"
maxX="2.0037508E7" maxY="2.0037508E7"/>
    <tile_image width="256" height="256"/>
    <tile_dpi value="90.714"/>
    <tile_meters_per_unit value="1.0"/>
    <zoom_levels levels="19" min_scale="2132.72958384" max_
scale="5.59082264028E8" min_tile_width="152.874538064" max_tile_
width="4.00751429065E7">
        <zoom_level level="0" name="level0" tile_width="4.00751429065E7" tile_
```

```

height="4.00751429065E7"/>
    <zoom_level level="1" name="level1" tile_width="2.003757145325E7" tile_
height="2.003757145325E7"/>
    <zoom_level level="2" name="level2" tile_width="1.0018785726625258E7"
tile_height="1.001878572662E7"/>
    <zoom_level level="3" name="level3" tile_width="5009392.86331" tile_
height="5009392.86331"/>
    <zoom_level level="4" name="level4" tile_width="2504696.431656" tile_
height="2504696.431656"/>
    <zoom_level level="5" name="level5" tile_width="1252348.215828" tile_
height="1252348.215828"/>
    <zoom_level level="6" name="level6" tile_width="626174.1079140786" tile_
height="626174.107914"/>
    <zoom_level level="7" name="level7" tile_width="313087.0539570393" tile_
height="313087.053957"/>
    <zoom_level level="8" name="level8" tile_width="156543.5269785" tile_
height="156543.5269785"/>
    <zoom_level level="9" name="level9" tile_width="78271.763489" tile_
height="78271.763489"/>
    <zoom_level level="10" name="level10" tile_width="39135.8817446" tile_
height="39135.8817446"/>
    <zoom_level level="11" name="level11" tile_width="19567.9408723" tile_
height="19567.9408723"/>
    <zoom_level level="12" name="level12" tile_width="9783.9704361" tile_
height="9783.9704361"/>
    <zoom_level level="13" name="level13" tile_width="4891.9852180" tile_
height="4891.9852180"/>
    <zoom_level level="14" name="level14" tile_width="2445.9926090" tile_
height="2445.9926090"/>
    <zoom_level level="15" name="level15" tile_width="1222.99630451" tile_
height="1222.99630451"/>
    <zoom_level level="16" name="level16" tile_width="611.49815225" tile_
height="611.49815225"/>
    <zoom_level level="17" name="level17" tile_width="305.74907612" tile_
height="305.74907612"/>
    <zoom_level level="18" name="level18" tile_width="152.87453806" tile_
height="152.87453806"/>
</zoom_levels>
<auto_update finest_level_to_refresh="13" dirty_mbr_batch="100" dirty_mbr_
cap="1000">
    <dirty_mbr_table name="TL1MBR"/>
    <logtable name="TL1LOG"/>
</auto_update>
<themes>
    <theme name="UTFGRID_THEME_DEMO_STATES" from_level="0" to_level="18"/>
    <theme name="UTFGRID_THEME_DEMO_COUNTIES" from_level="0" to_level="18"/>
    <theme name="UTFGRID_THEME_DEMO_HIGHWAYS" from_level="0" to_level="18"/>
    <theme name="UTFGRID_THEME_DEMO_CITIES" from_level="0" to_level="18"/>
</themes>
</map_tile_layer>
```

Example 3-29 XML Definition of an External Map Tile Layer

```

<?xml version = '1.0'?>
<!-- XML definition of an external map tile layer.--&gt;
&lt;map_tile_layer name="TILELAYER1" image_format="PNG"&gt;
    &lt;external_map_source
        url="http://mycorp.com:7001/mapviewer/wms/"
        request_method="GET"
        adapter_class="oracle.lbs.mapcache.adapter.WMSAdapter"</pre>

```

```

        adapter_class_path="">
        <properties>
            <property name="datasource" value="mvdemo"/>
            <property name="version" value="1.1.1"/>
            <property name="srs" value="EPSG:4326"/>
            <property name="layers" value="THEME_DEMO_COUNTIES,THEME_DEMO_HIGHWAYS"/>
            <property name="format" value="image/png"/>
            <property name="transparent" value="true"/>
        </properties>
    </external_map_source>
    <tile_storage root_path="/scratch/tmp/" />
    <coordinate_system srid="8307" minX="-180.0" minY="-90.0" maxX="180.0"
maxY="90.0"/>
    <tile_image width="256" height="256"/>
    <!--
        The following <zoom_levels> element does not have any
        <zoom_level> element inside it. But since it has its levels,
        min_scale and max_scale attributes set, map tile server will
        automatically generate the <zoom_level> elements for the 10
        zoom levels.
    -->
    <zoom_levels levels="10" min_scale="1000.0" max_scale="2.5E8">
    </zoom_levels>
</map_tile_layer>
```

The top-level element is `<map_tile_layer>`. The `image_format` attribute specifies the tile image format; the currently supported values for this attribute are PNG, GIF, and JPG. PNG and GIF images are generally better for vector base maps, while JPG images are generally better for raster maps, such as satellite imagery, because of a better compression ratio. Currently, only tile images in PNG format can have transparent background.

- The `http_header_expires` attribute specifies the number of hours after which a cached tile layer can be considered stale.
- The `utfgrid` attribute, when set to `true`, indicates that a companion UTFGrid dataset for an image file will be generated. (The default value is `false`.)
- The `utfgrid_resolution` attribute specifies how fine the grid data is compared to the image tile. For example, a value of 4 (the default) indicates that one grid cell represents 4 by 4 pixels in its companion image tile.
- The `concurrent_fetching_threads` attribute defines the maximum number of concurrent tile fetching threads that may be created for fetching image tiles for this tile layer. (The default value is 3.)
- The `fetch_larger_tile` attribute, when `true` (the default), tells the tile server that if the tile is not available in the cache, the tile's adjacent tiles will also be generated. This parameter does not affect the `getTile` performance when the requested tiles are already available in the cache. The default setting (`true`) is intended to improve server response time.
- The `persistent_tiles` attribute, when `true` (the default), specifies that image tiles will be saved in the server's disk cache. If this attribute is set to `false`, then each `getTile` request invokes an image tile rendering process in the MapViewer server, and the newly acquired image tile is not cached for future use. Cases where you may want to specify `false` include (A) a GeoRaster theme is used by a tile layer and you do not want duplicate raster images in MapViewer's disk cache, or (B) you want the tile server always to provide up-to-date image tiles.

The `<internal_map_source>` element is required only if the map tiles are rendered by the local MapViewer instance.

- The `base_map` attribute is required and specifies the predefined MapViewer base map that is cached by the map tile server; its value should match an entry in the `BASE_MAP` column in the `USER_SDO_CACHED_MAPS` view.
- The `bgcolor` attribute is optional and specifies the background color of the map. If the value of this attribute is set to `NONE`, the background will be transparent. (Currently, only tile images in PNG format can have a transparent background.)
- The `out_of_bounds_color` attribute is optional and specifies the color for areas that are outside the data boundaries. The data boundaries are specified by the attributes of the `<coordinate_system>` element.
- The `db_tile_table` attribute is optional, specifies the database table in which to cache the tile layer's image tiles. If the attribute is not specified, the tiles are cached in MapViewer's disk cache.

The `<external_map_source>` element is required only if the map tiles are rendered by an external map services provider. This element has the following attributes:

- The `url` attribute is required and specifies the map service URL from which the map tiles can be fetched (for example, `http://myhost/mapviewer/omserver`).
- The `adapter_class` attribute is required and specifies the full name of the map adapter class, including the package names (for example, `mcsadapter.MVAdapter`).
- The `proxy_host` and `proxy_port` attributes are needed only if the external map provider server must be accessed through a proxy server; these attributes specify the host name and port number, respectively, of the proxy server. If `proxy_host` is specified as `NONE`, all map tile requests will be sent directly to the remote server without going through any proxy server. If `proxy_host` is omitted or specifies an empty string, the global MapViewer proxy setting defined in the `mapViewerConfig.xml` file will be used when map tile requests are sent.
- The `timeout` attribute is optional and specifies the number of milliseconds for which the map tile server must wait for an external map tile image before giving up the attempt. The default timeout value is 15000.
- The `request_method` attribute is optional and the HTTP request method for sending map tile requests; its value can be `POST` (the default) or `GET`.

For more information about external map tile layers and an example, see [Section 3.3.2.4, "Creating a Map Tile Layer Using an External Web Map Source"](#).

The `<properties>` element in the `<external_map_source>` element can include multiple `<property>` elements, each of which specifies a user-defined parameter for use by the map adapter when it fetches map tiles. The same map source adapter can use different set of parameters to fetch different map tile layers. For example, the sample MapViewer adapter `mcsadapter.MVAdapter` shipped with MapViewer accepts parameters defined as follows:

```
<properties>
  <property name="data_source" value="elocation"/>
  <property name="base_map" value="us_base_map"/>
</properties>
```

However, by changing the `value` attribute values, you can use this adapter to fetch a different base map from the same data source or a different data source.

The `<tile_storage>` element specifies storage settings for the map tile layer.

- The optional `root_path` attribute specifies the file system directory to be used as the root directory of the tile storage. If this attribute is omitted or invalid, the default root directory defined in the `mapViewerConfig.xml` file is used.
- The optional `xyz_storage_scheme` element controls how the directory structure of map tiles in the disk cache is organized. The default value (`false`) causes the MapViewer internal mesh code storage scheme to be used. The value `true` causes the XYZ storage scheme to be used. For more information, see [Section 3.3.2.3, "Map Tile Storage Schemes: Internal Mesh Code or XYZ"](#)

The `<coordinate_system>` element specifies the map coordinate system, and it has several required attributes. The `srid` attribute specifies the spatial reference ID of the coordinate system. The `minX` attribute specifies the lower bound of the X dimension; the `minY` attribute specifies the lower bound of the Y dimension; the `maxX` attribute specifies the upper bound of the X dimension; and the `maxY` attribute specifies the upper bound of the Y dimension. For the standard longitude/latitude (WGS 84) coordinate system, the `srid` value is 8307; and the `minX`, `minY`, `maxX`, and `maxY` values are -180, -90, 180, and 90, respectively.

For an internal map tile layer, the map coordinate system can be different from the data coordinate system. If the two are different, the map tile server transforms the map data into the coordinate system defined in the `<coordinate_system>` element and renders map tile images using this coordinate system.

The `<tile_image>` element specifies the tile image size settings, and it has the following required attributes: `width` specifies the width of the tile images in screen pixels, and `height` specifies the height of the tile images in screen pixels.

The optional `<tile_bound>` element specifies the bounding box of the cached map tiles. The map tile server only fetches tiles inside this box, and returns a blank tile if the requested tile is outside this box. The bounding box is specified by a rectangle in the map data coordinate system. The rectangle is specified by a `<coordinates>` element in the following format:

```
<coordinates>minX, minY, maxX, maxY</coordinates>
```

The default cache bounding box is the same bounding box specified in the `<coordinate_system>` element.

The optional `<tile_dpi>` element specifies the map display screen resolution as a "dots per inch" value. If this element is not specified, the value specified in the `mapViewerConfig.xml` file will be assigned to the tile layer. If MapViewer must comply with OGC standards in exposing the tile layer in its WMTS service, then you must specify this element with the following value: 90.714

The optional `<tile_meters_per_unit>` element specifies the meters per unit. The unit is defined indirectly by the `srid` attribute in the `<coordinate_system>` element. For example, if the `srid` is 3857, its unit is meters, and thus the value for this attribute must be 1.0; or if the `srid` is 8307, its unit is decimal degrees, and thus the value may be set to 111319.49. If this element is not specified, a MapViewer internal process calculates the value according to the data bounds, and the result is very close to 111319.49. If this tile layer is to be exposed by MapViewer to provide WMTS services, and if `srid` is 8307, then you must set this element's value to 111319.49 to comply with OGC standards.

The `<zoom_levels>` element specifies the predefined zoom levels. Only image files at predefined zoom levels will be cached and served by the map tile server. The `<zoom_levels>` element can have multiple `<zoom_level>` elements, each of which specifies one predefined zoom level. If there are no `<zoom_level>` elements, the map tile server automatically generates the `<zoom_level>` elements by using the following attributes

inside the `<zoom_levels>` element. (These attributes can be omitted and will be ignored if any `<zoom_level>` elements exist.)

- `levels` specifies the total number of zoom levels.
- `min_scale` specifies the scale of map images at the highest (zoomed in the most) zoom level.
- `max_scale` specifies the scale of map images at the lowest (zoomed out the most) zoom level.
- `min_tile_width` specifies the width of map tiles at the highest zoom level. The width is specified in map data units.
- `max_tile_width` specifies the width of the map tiles at the lowest zoom level. The width is specified in map data units.

For the map tile server to be able to generate the definitions of individual zoom levels automatically, you must specify either of the following combinations of the preceding attributes:

- `levels, min_scale, and max_scale`
- `levels, min_tile_width, and max_tile_width`

When the zoom levels are defined this way, the map tile server automatically derives the definition of all the individual zoom levels and updates the XML definition with the `<zoom_level>` elements generated for the zoom levels. You can then make adjustments to each zoom level if you want.

Each zoom level is assigned a zoom level number by the map tile server based on the order in which the zoom levels are defined. The first zoom level defined in the `<zoom_levels>` element is zoom level 0, the second zoom level is zoom level 1, and so on. These zoom level numbers are used in the tile requests to refer to the predefined zoom levels.

The `<zoom_level>` element specifies a predefined zoom level, and it has several attributes. The `description` attribute is optional and specifies the text description of the zoom level. The `level_name` attribute is optional and specifies the name of the zoom level. The `scale` attribute specifies the map scale of the zoom level; it is required if the attributes `tile_width` and `tile_height` are not defined. The `tile_width` and `tile_height` attributes specify the tile width and height, respectively, in map data units. The `fetch_larger_tiles` attribute is optional and specifies whether to fetch larger map images instead of the small map image tiles; a value of `TRUE` (the default) means that larger map images that may consist multiple map tiles will be fetched and broken into small map image tiles, which might save network round trips between the map tile server and the map services provider.

In the `<zoom_level>` element, you must specify either the `scale` attribute or both the `tile_width` and `tile_height` elements.

The `<tile_bound>` element within the `<zoom_level>` element optionally specifies the bounding box of the cached map tiles for the zoom level. The map tile server only fetches tiles inside this box, and returns a blank tile if the requested tile is outside this box. The bounding box is specified by a rectangle specified in map data coordinate system. The rectangle is specified by a `<coordinates>` element (explained earlier in this topic) If you specify the `<tile_bound>` element within the `<zoom_level>` element, it overrides the overall cache bounding box settings specified by the `<tile_bound>` element that is above it in the XML hierarchy.

The `<auto_update>` element defines how the tile layer's disk cache is to be automatically updated when spatial data in the base table is modified. For details, see

[Section 3.3.3.2, "Add the <auto_update> element to tile layer definition".](#)

The `<themes>` element defines a layer based on themes (as opposed to a layer based on a base map). The themes to be used to render image tiles are listed in its subelements. In each subelement `<theme>`, the `name` attribute is required to specify a predefined theme in the metadata. The other two optional attributes, `from_level` and `to_level`, define the visibility of the that theme. The default values for those two attributes are `from_level` of 0 (which contains the least map detail) and `to_level` of the last level (which contains the most map detail).

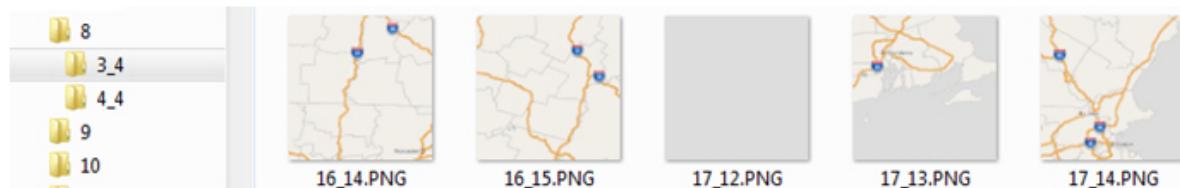
3.3.2.3 Map Tile Storage Schemes: Internal Mesh Code or XYZ

The `xyz_storage_scheme` attribute of the `<file_storage>` element (described in [Section 3.3.2.2](#)) controls how the directory structure of map tiles in the disk cache is organized. The default scheme uses MapViewer's internal mesh codes, but you can instead choose the XYZ storage scheme.

Figure [Figure 3–9](#) shows both storage schemes.

Figure 3–9 Internal Mesh Code and XYZ Map Tile Storage Schemes

MapViewer default mesh code storage:



MapViewer XYZ scheme storage:



The details of the MapViewer internal mesh code are nor important for users. You need only know that there are two different storage scheme options, and that the XYZ storage scheme is analogous to the scheme used by several map data providers.

Therefore, if you want to export tiles from some zoom levels for an offline project (local tile layer), if you find the XYZ storage scheme more intuitive, you can specify it.

In the MapViewer XYZ storage scheme, the naming of subdirectories is in the form `/z/y/x`, where `z` is the zoom level, `y` is the tile's row number, and `x` in the tile's column number. For example, in [Figure 3–9](#), the MapViewer XYZ storage scheme shows the images (`74.png`, `75.png`, `76.png`, `77.png`) in the tile columns for tile row 33 for zoom level 8.

3.3.2.4 Creating a Map Tile Layer Using an External Web Map Source

You can use an external web map source to create a map tile layer, as follows:

1. Log in to the MapViewer administrative console.
2. Click **Create Tile Layer**.
3. Select **External** as this tile layer's map image source, and click **Continue**.
4. On the Create a map tile layer for external map source page, enter the appropriate information:

Name: Tile layer name. Example: TILELAYER1

Data Source: Name of the data source for the tile layer. Example MVDEMO

Max browser tile cache age (hours): Maximum number of hours in the cache before a tile is refreshed. Example: 168

Map Service URL: Example: `http://mycorp.com:7001/mapviewer/wms`

Request Method: HTTP GET

Adapter class: oracle.lbs.mapcache.adapter.WMSAdapter

Jar file location: Example: adapterlibs/

Background: transparent

Adapter properties: (Check it and click **Add** multiple times as appropriate, entering the values for the following each time.)

- **datasource:** Example: mvdemo
- **version:** 1.1.1
- **srs:** EPSG:4326
- **layers:** Example: THEME_DEMO_COUNTIES, THEME_DEMO_HIGHWAYS
- **format:** image/png
- **transparent:** true

Tile storage: Example: C:\temp

SRID: 8307

Min X: -180.0

Max X: 180.0

Min Y: -90.0

Max Y: 90.0

Tile width (pixels): 256

Tile height (pixels): 256

File format: PNG

Zoom Levels: 10

Minimum map scale: 1000

Maximum map scale: 250000000

5. Click **Submit** to create the tile layer.

The message *Information: New map tile layer created successfully* is displayed.

To verify the created layer, you can click **Manage Tile Layers** on the left, select the tile layer, and click **View map / Manage tiles** to preview the map.

3.3.3 Map Cache Auto-Update

The map cache auto-update feature periodically updates cached map tiles when they become "dirty". A cached map tile becomes **dirty** when data in base tables is changed by an update, insert, or delete operation, because such changes may affect the shape, annotation, or choice of rendering style for the already cached map tiles.

Updating a dirty tile invokes one of the following operations: a) Refresh: delete the cached dirty tiles and then re-fetch them; or b) Clear: only delete the cached dirty tiles. To enable automatic updating for a tile layer, you perform the following major steps:

1. Add the `<dirty_tile_auto_update>` element to the `mapViewerConfig.xml` configuration file.
2. Add the `<auto_update>` element to tile layer definition.
3. Create the dirty MBR table, base tables' log table, and triggers.

To test the automatic tile updating, follow the instructions in [Section 3.3.3.4, "Start the MapViewer server and test the map cache auto-update feature"](#).

3.3.3.1 Add the `<dirty_tile_auto_update>` element to the `mapViewerConfig.xml` configuration file

Add the `<dirty_tile_auto_update>` element as a child element of the `<map_tile_server>` element. For example:

```
<map_tile_server>
  <tile_storage default_root_path="/scratch/tilecache/" />
  <dirty_tile_auto_update
    auto_update="true"
    auto_update_interval="1"
    recycle_interval="168"/>
</map_tile_server>
```

The `auto_update` attribute enables server's automatic update when set to `true` (the default is `false`). If this attribute is set to `true`, all qualified tile layers on the server will be automatically updated. To qualify, a tile layer must have a proper definition (see [Section 3.3.3.2](#)).

The `auto_update_interval` attribute sets the recurring interval for checking the base tables' log table and the dirty MBR table. Its value is in minutes, and the default value is 1. The value should not be more than a few minutes, and it should not be very large (even if you update the base tables far less frequently, such as daily or weekly). The base tables' log table and the dirty MBR table should be created before starting the MapViewer server. Sample scripts for creating these two tables and related sequences and triggers are included in [Section 3.3.3.3](#).

The `recycle_interval` attribute specifies how long to keep a processed row in the log table and dirty MBR table. Its value is in hours, and the default value is 168. Processed rows older than that will be deleted.

When MapViewer starts, it loads the `<dirty_tile_auto_update>` element from `mapViewerConfig.xml` configuration file, and the element is applied to all tile layers of this server. If that element is not found, then the server disables any tile layer's auto-update capability.

3.3.3.2 Add the <auto_update> element to tile layer definition

Add an <auto_update> element after the <zoom_levels> element in a tile layer definition. You can add this element manually or using the MapViewer web console. For example:

```
<auto_update
    finest_level_to_refresh="15"
    dirty_mbr_batch="100"
    dirty_mbr_cap="1000">
    <dirty_mbr_table name="mbr_mcau"/>
    <logtable name="log_mcau_t1"/>
</auto_update>
```

The `finest_level_to_refresh` attribute specifies the finest level to refresh. Levels starting from level 0, level 1, level 2, ..., until this specified level will be refreshed, and dirty tiles in the remaining zoom levels will be cleared. If the data modifications in the base tables are often geographically small features (as most data modifications should be), such as changing the name of a restaurant or inserting a newly developed street, the value can be the finest zoom level found in the tile layer definition. For example, if there are 19 zoom levels from 0 to 18, then this attribute can be set to 18.

The `dirty_mbr_batch` attribute specifies the maximum number of rows from the dirty MBR table for an update. The default value is 100. This value prevents the server from getting a very large number of tiles to update at one time. Instead, if a large number of dirty tiles need a refresh or clear operation, these tiles will be processed in many updates, and one interval processes just one batch. To determine an optimal value for this attribute, consider the following factors:

- The `auto_update_interval` value (see [Section 3.3.3.1](#)) and how many tiles the server is able finish in the interval
- The amount of memory that the server can use
- The number of tile layers that are enabled for map cache auto update and the frequency and magnitude of the changes in their base tables

Because there is no formula for a precise calculation of an optimal `dirty_mbr_batch` value, the best practice is to set up an environment to test different settings. When selecting a value, consider the worst case scenario. Two extreme scenarios to avoid are: a) the value is so small that the server is idling after finishing a refresh operation while the number of dirty MBR rows in the dirty MBR table keeps growing; or b) the value is so large that the server runs out of memory, throws an out-of-memory exception, and shuts down all services.

The `dirty_mbr_cap` attribute specifies the maximum number of dirty tiles for a log table to generate in one interval. This constraint may affect the finest zoom level for refresh operation, and the remaining zoom levels are then set for a clear operation. The accumulation counter for dirty tiles starts from zoom level 0, to level 1, level 2, and so on, until the cap is reached or the finest level to refresh is reached.

When a cap is reached at level n before reaching the specified finest level to refresh, the already counted tiles in level 0, level 1, level 2, ..., and level $n-1$ are for a refresh operation (delete and then re-fetch), and the current zoom level (level n in this example) and all other finer levels are for a clear operation (delete from the map tile cache and no re-fetch). For example, if the cap is given a value of 1000, the dirty tile counter reaches the cap at zoom level 4, then all the counted dirty tiles from level 0 to level 3 are for refresh. After that, each dirty tile in level 3 will be used to define a rectangle (the rectangular area the tile covers on the ground), and this rectangle is taken as an MBR to clear all zoom levels starting from level 4, level 5, and all other finer levels in this tile layer.

The <dirty_mbr_table> element specifies the name of the dirty MBR table, where the dirty MBRs are to be stored, retrieved, and updated. You need to manually create this table before starting the MapViewer server (see the example in [Section 3.3.3.3](#)).

The <logtable> element specifies the name of the base table's log table. If a tile layer depends on more than one base table (as is often the case), then every change in each base table should be inserted into this log table by its trigger; if the schema is accessed by more than one data source defined in mapViewerConfig.xml, then one change in a base table should insert one row for each data source.

It is recommended that each tile layer have its own log table and its own dirty MBR table. Both tables should be manually created before starting the server (see the example in [Section 3.3.3.3](#)).

3.3.3.3 Create the dirty MBR table, base tables' log table, and triggers

This section contains examples that, when taken together, show the actions to create the dirty MBR table, base tables' log table, and triggers. The example segments assume that a base map named DEMO_MAP is already defined and that there is one data source named MVDEMO accessing the schema.

The example code segments include explanatory comments, and they perform the following actions:

1. Create a tile layer that includes an <auto_update> element.

```
insert into user_sdo_cached_maps values(
  'MCAU_TL',
  'a test case for map cache auto update',
  '',
  'YES',
  'YES',
  '<map_tile_layer name="MCAU_TL" image_format="PNG" http_headerExpires="168.0"
concurrent_fetching_threads="3" fetch_larger_tiles="false">
  <internal_map_source data_source="mvdemo" base_map="DEMO_MAP"/>
  <coordinate_system srid="8307" minX="-180.0" maxX="180.0" minY="-90.0"
maxY="90.0"/>
  <tile_image width="256" height="256"/>
  <tile_dpi value="90.7142857"/>
  <tile_meters_per_unit value="111319.49079327358"/>
  <zoom_levels levels="19" min_scale="2132.729583849784" max_
scale="559082264.0287178">
  </zoom_levels>
<auto_update
  finest_level_to_refresh="15"
  dirty_mbr_batch="100"
  dirty_mbr_cap="1000">
  <dirty_mbr_table name="mbr_MCAU_TL"/>
  <logtable name="log_MCAU_TL"/>
</auto_update>
</map_tile_layer>',
  'DEMO_MAP',
  '');
commit;
```

2. Create a dirty MBR table and its trigger.

The dirty MBR table stores the dirty MBRs for refresh and clear operations. This table is populated using the geometries from the log table. There is also a sequence and a trigger created for generating unique IDs for this table's ID column.

```
-- create the dirty MBR table
```

```

CREATE TABLE mbr_MCAU_TL (      -- dirty MBR table name
    id          number,        -- id, used for tracking the status
    datasource  varchar2(32),  -- data source name
    tile_layer  varchar2(32),  -- tile layer name
    logtable    varchar2(32),  -- basetable's log-table
    refresh_status varchar2(1), -- n: not refreshed, y: refreshed, p:pending, f:
failed
    clear_status  varchar2(1), -- n: not cleared,   y: cleared,   p:pending, f:
failed
    mbr_to_clear  varchar2(1), -- y/n: use tile's mbr for clearing finer levels
    zoom_level    number,       -- zoom level of this tile
    mx            number,       -- mesh x ordinate
    my            number,       -- mesh Y ordinate
    minx          number,       -- tile's minimum x coordinate
    miny          number,       -- tile's minimum y coordinate
    maxx          number,       -- tile's maximum x coordinate
    maxy          number,       -- tile's maximum y coordinate
    insert_time   Date,         -- when the tile MBR was inserted into this
table
    update_time   Date,         -- most recent update (refresh/clear) time
);

-- create a sequence for mbr_MCAU_TL
CREATE SEQUENCE mbr_MCAU_TL_seq
    START WITH 1
    INCREMENT BY 1
    CYCLE
    MAXVALUE 9999999999;

-- create a trigger to get a unique id
create or replace trigger mbr_MCAU_TL_br
    before insert on mbr_MCAU_TL    -- before inserting the row
    referencing new as new old as old
    for each row -- for each row
begin
    select mbr_MCAU_TL_seq.nextval INTO :new.id FROM dual;
end;
/

```

3. Create a log table.

The base tables' log table is for recording the rows changed in the base tables of the tile layer. Because each tile layer depends on the data in its base tables when generating a map tile, any change made to the base table (such as modifications of geometries or changes to attributes values) may affect their representation in their corresponding map tile. The change log table records such changes through a trigger created on its base table.

The following statements create a log table, a sequence, and a trigger on the table using the sequence to generate unique ID values.

```

-- create the log table
create table log_MCAU_TL(
    id number,
    geom0 sdo_geometry,  -- the affected geometry or its attributes, original
geometry
    geomN sdo_geometry,  -- the affected geometry or its attributes, new geometry
modified Date,        -- when the modified occurred
    status varchar2(1),  -- y: processed, n: not processed
    datasource varchar2(32), -- data source name, more than one ds may access the
same log
    tile_layer varchar2(32), -- tile layer name

```

```

    basetable varchar2(32) -- base table name, more than one base table may
    insert into this log
);

-- create a sequence for log_MCAU_TL
CREATE SEQUENCE log_MCAU_TL_seq
    START WITH 1
    INCREMENT BY 1
    CYCLE
    MAXVALUE 9999999999;

-- create a trigger for log_MCAU_TL to create a unique id
create or replace trigger log_MCAU_TL_br
    before insert on log_MCAU_TL    -- before inserting
    referencing new as new old as old
    for each row                      -- for each row
begin
    select log_MCAU_TL_seq.nextval INTO :new.id FROM dual;
end;
/

```

4. Create a trigger on each base table to insert changes into the log table.

In a base table's trigger, any geometries inserted into the log table are transformed into the same spatial reference system (coordinate system) as the tile layer. If there are multiple data sources defined in the `mapViewerConfig.xml` configuration file accessing the same schema, then one `INSERT` statement should be used for each of these data sources in each trigger definition.

The following statements make these assumptions:

- One data source named MVDEMO is accessing the schema that contains the MCAU_TL tile layer. (Thus, there is only one `INSERT` statement in each trigger definition.)
- The tile layer's spatial reference system (SRID) is 8307 (WGS 84 longitude/latitude).
- There are four base tables to monitor for this tile layer: states, counties, interstates, and cities.

```

--states trigger
create or replace trigger states_MCAU_TL_ar
    after insert or update or delete on states    -- any change
    referencing new as new old as old
    for each row
    when (old.geom IS NOT NULL OR new.geom IS NOT NULL)
declare
    oldGeom SDO_Geometry;
    newGeom SDO_Geometry;
    tileSRID number;
begin
    tileSRID := 8307;
    oldGeom := :old.geom;
    if (:old.geom IS NOT NULL) then
        if (:old.geom.SDO_SRID != tileSRID) then
            select sdo_cs.transform(:old.geom, tileSRID) into oldGeom from dual;
        end if;
    end if;
    newGeom:=:new.geom;
    if (:new.geom IS NOT NULL) then
        if (:new.geom.SDO_SRID!= tileSRID) then

```

```

        select sdo_cs.transform(:new.geom, tileSRID)  into newGeom from dual;
    end if;
end if;

insert into log_MCAU_TL (id, geom0, geomN, modified, status, datasource,
tile_layer, basetable)
values(null, oldGeom, newGeom, sysdate, 'n', 'MVDEMO', 'MCAU_TL',
'states');
end;
/

--counties trigger
create or replace trigger counties_MCAU_TL_ar
after insert or update or delete on counties
referencing new as new old as old
for each row
when (old.geom IS NOT NULL OR new.geom IS NOT NULL)
declare
    oldGeom SDO_GEOMETRY;
    newGeom SDO_GEOMETRY;
    tileSRID number;
begin
    tileSRID := 8307;
    oldGeom := :old.geom;
    if (:old.geom IS NOT NULL) then
        if (:old.geom.SDO_SRID!=tileSRID) then
            select sdo_cs.transform(:old.geom, tileSRID)  into oldGeom from dual;
        end if;
    end if;
    newGeom:=:new.geom;
    if (:new.geom IS NOT NULL) then
        if (:new.geom.SDO_SRID!= tileSRID) then
            select sdo_cs.transform(:new.geom, tileSRID)  into newGeom from dual;
        end if;
    end if;
    insert into log_MCAU_TL (id, geom0, geomN, modified, status, datasource,
tile_layer, basetable)
values(null, oldGeom, newGeom, sysdate, 'n', 'MVDEMO', 'MCAU_TL',
'counties');
end;
/

--interstates trigger
create or replace trigger interstates_MCAU_TL_ar
after insert or update or delete on interstates
referencing new as new old as old
for each row
when (old.geom IS NOT NULL OR new.geom IS NOT NULL)
declare
    oldGeom SDO_GEOMETRY;
    newGeom SDO_GEOMETRY;
    tileSRID number;
begin
    tileSRID := 8307;
    oldGeom := :old.geom;
    if (:old.geom IS NOT NULL) then
        if (:old.geom.SDO_SRID!=tileSRID) then
            select sdo_cs.transform(:old.geom, tileSRID)  into oldGeom from dual;
        end if;
    end if;
end if;
```

```

newGeom:=:new.geom;
if (:new.geom IS NOT NULL) then
  if (:new.geom.SDO_SRID!= tileSRID) then
    select sdo_cs.transform(:new.geom, tileSRID)  into newGeom from dual;
  end if;
end if;

insert into log_MCAU_TL (id, geom0, geomN, modified, status, datasource,
tile_layer, basetable)
  values(null, oldGeom, newGeom, sysdate, 'n', 'MVDEMO', 'MCAU_TL',
'interstates');

end;
/

--cities trigger
create or replace trigger cities_MCAU_TL_ar
  after insert or update or delete on cities
  referencing new as new old as old
  for each row
  when (old.location IS NOT NULL OR new.location IS NOT NULL)
declare
  oldGeom SDO_GEOMETRY;
  newGeom SDO_GEOMETRY;
  tileSRID number;
begin
  tileSRID := 8307;
  oldGeom := :old.location;
  if (:old.location IS NOT NULL) then
    if (:old.location.SDO_SRID!=tileSRID) then
      select sdo_cs.transform(:old.location, tileSRID)  into oldGeom from
dual;
    end if;
  end if;
  newGeom:=:new.location;
  if (:new.location IS NOT NULL) then
    if (:new.location.SDO_SRID!= tileSRID) then
      select sdo_cs.transform(:new.location, tileSRID)  into newGeom from
dual;
    end if;
  end if;

  insert into log_MCAU_TL (id, geom0, geomN, modified, status, datasource,
tile_layer, basetable)
    values(null, oldGeom, newGeom, sysdate, 'n', 'MVDEMO', 'MCAU_TL',
'cities');
end;
/
commit;

```

3.3.3.4 Start the MapViewer server and test the map cache auto-update feature

To test the automatic tile updating, start the MapViewer server and then change one or more rows in the base table.

1. Modify a row in the base table. For example:

```
update cities set city='Worcester' where city='Worcester' and state_abrv='MA';
```

2. Check the log table. For example:

```
select * from log_mcau_tl;
```

The result should include a row that was just inserted by the base table's trigger.

3. Wait for about one interval (one minute in this example), then check the dirty MBR table. For example:

```
select count(*) from mbr_mcau_tl;
```

The result should include some dirty MBR rows inserted by the server.

You can also look for changes in the refresh_status column in the dirty MBR table. When rows are initially inserted, the status is set to n for *not processed*; then it changes to p for *pending* when they are being processed; and after the update is done, it changes to y for *processed*. Meanwhile, on the server you can see that the server has been updating the tiles (the server's logger needs to be set to finest level to see the finest logging information).

3.3.4 UTFGrid for Map Tiles: Including Text Information About Features

When a tile layer has UTFGrid enabled, a data set named UTFGrid becomes a "companion" of an image tile, containing text information about features in the image tile. This text information can be displayed by the browser when responding to a mouse event, such as mouse click on a map feature.

A UTFGrid data set is stored in JSON format, and has two components: (a) a grid data set that mirrors its companion image tile, and (b) attributes of all grid cells. The value at each grid cell serves as the key to link the image tile cell and its attributes. Each image pixel on a map is associated with a UTFGrid grid cell, and the cell's value indicates where its attributes (as text strings) can be retrieved. For storage efficiency, the value of each grid cell is encoded in a revised UTF-8 encoding scheme.

Topics:

- [Enabling the UTFGrid Option for a Tile Layer](#)
- [Encoding a Key and Decoding a Grid Cell's Value](#)
- [Building a UTFGrid Test Case](#)

3.3.4.1 Enabling the UTFGrid Option for a Tile Layer

To enable the UTFGrid option for a map tile layer, then in the USER_ADO_CACHED_MAPS row for the tile layer, specify `utfgrid="true"` in the `<map_tile_layer>` element, and optionally specify the UTFGrid resolution with the `utfgrid_resolution` attribute (the default is 4). For example:

```
insert into user_sdo_cached_maps values(
'UTFGRID_TL',
'utfgrid enabled test case ',
 '',
'YES',
'YES',
'<map_tile_layer name="UTFGRID_TL" image_format="PNG" http_headerExpires="168.0"
concurrent_fetching_threads="3" fetch_larger_tiles="false"
persistent_tiles="true" utfgrid="true" utfgrid_resolution="4">
<internal_map_source data_source="mvdemo" base_map="UTFGRID_BASEMAP"
bgcolor="#dddddd" out_of_bounds_color="#eeddff"/>
<tile_storage root_path="/temp" xyz_storage_scheme="true"/>
<coordinate_system srid="8307" minX="-180.0" maxX="180.0" minY="-90.0"
maxY="90.0"/>
<tile_image width="256" height="256"/>
```

```
<tile_dpi value="90.7142857"/>
<tile_meters_per_unit value="111319.49079327358"/>
<zoom_levels levels="19" min_scale="2132.729583849784" max_
scale="559082264.0287178">
</zoom_levels>
</map_tile_layer>',
'UTFGRID_BASEMAP',
 '');
commit;
```

The utfgrid_resolution attribute determines how fine the grid cells are in an UTFGrid data set, and the default value of 4 indicates that one grid cell represents 4 by 4 image pixels in its companion image tile. For example, if 256x256 is an image's dimension, then the grid's dimension will be 64x64, and a grid cell at row=10, column=20 represents the pixels in the tile image from row 40 to row 43 and from column 80 to column 83 (note that one grid cell represents 16 image tile pixels). When multiple features in the map image tile fall into one grid cell at the indicated resolution, then the feature with the majority or plurality of the pixels is assigned to the grid cell. The value stored in the grid cell is encoded using UTF-8 encoding.

If a tile layer has UTFGrid enabled, when the map server generates a map image tile, it will also generate an UTFGrid data set stored in JSON format. When a client requests a map image tile, both the image tile and its UTFGrid JSON file will be returned in the response.

In MapViewer server, the UTFGrid JSON files are stored in the same location with their image tiles. For example, if an image tile is cached at /mapcache/MVDEMO.UTFGRID_TL/0/1/2.PNG, you should also see its companion UTFGrid file /mapcache/MVDEMO.UTFGRID_TL/0/1/2.JSON.

This UTFGrid option is currently not supported if the image tiles are stored in a database table (see [Store the tiles in a database table](#)) when disk cache is disabled for a tile layer (see [Stream the tiles directly without storing them](#)).

3.3.4.2 Encoding a Key and Decoding a Grid Cell's Value

A tile layer can contain multiple data layers or themes. Each theme will have its own grid data set, and an UTFGrid JSON object may contain multiple grid data sets. In each theme's grid, features shown in its image tile are also "drawn" using styles to render each feature. As for its associated image tile, a feature is drawn using its key, and the key is an ordinal number assigned to each feature. This number is used to assign a UTF-8 encoded value for the cell's value.

When a mouse event is triggered on a feature in an image tile, the image pixel's corresponding grid cell can be located, and the cell's value (an UTF-8 encoded value) can then be retrieved. This UTF-8 encoded value can then be decoded to derive its key, an ordinal number. Using this key, the attribute stored can be obtained. (See the examples near the end of [Building a UTFGrid Test Case](#).)

3.3.4.3 Building a UTFGrid Test Case

This test case focuses on the server side. It has two major steps: creating a UTFGrid-enabled tile layer, and sending some hard-coded requests to the server. (In a real application, you need to have a client side map application to make use of the tile layer.)

1. Create a UTFGrid-enabled tile layer.

If all the spatial base tables and styles exist in the metadata, the following example creates four themes, a basemap, and an UTFGrid-enabled tile layer. Because the

feature attributes stored in an UTFGrid JSON object come from the <hidden_info> element of a theme, the <hidden_info> element is defined in three of the four themes. (If none of the four themes has the <hidden_info> element defined, then enabling this tile layer's UTFGrid option would not make sense, because the UTFGrid object would be empty and creating it would still consume server resources.)

```
-- insert theme 1
insert into USER_SDO_THEMES (name, description, base_table, geometry_column,
styling_rules)
values (
  'UTFGRID_THEME_DEMO_STATES',
  'for utfgrid testing',
  'STATES',
  'GEOM',
  '<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <hidden_info>
    <field column="STATE" name="State"/>
    <field column="STATE_ABRV" name="Abrv."/>
    <field column="TOTPOP" name="Population"/>
  </hidden_info>
  <rule>
    <features style="C.S02_COUNTRY_AREA"> </features>
    <label column="STATE_ABRV" style="T.S02_STATE_ABBREVS"> 1 </label>
  </rule>
</styling_rules>');
;

-- insert theme 2
insert into USER_SDO_THEMES (name, description, base_table, geometry_column,
styling_rules)
values (
  'UTFGRID_THEME_DEMO_COUNTIES',
  'for utfgrid testing',
  'COUNTIES',
  'GEOM',
  '<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <!--<hidden_info>
    <field column="COUNTY" name="County"/>
    <field column="FIPSSTCO" name="Fips"/>
    <field column="TOTPOP" name="Population"/>
    <field column="STATE_ABRV" name="State"/>
  </hidden_info>-->
  <rule>
    <features style="L.S06_BORDER_STATE"> </features>
  </rule>
</styling_rules>');
;

-- insert theme 3
insert into USER_SDO_THEMES (name, description, base_table, geometry_column,
styling_rules)
values (
  'UTFGRID_THEME_DEMO_HIGHWAYS',
  'for utfgrid testing',
  'INTERSTATES',
  'GEOM',
  '<?xml version="1.0" standalone="yes"?>
<styling_rules>
```

```

<hidden_info>
  <field column="HIGHWAY" name="Highway"/>
  <field column="ROUTEN" name="No. "/>
</hidden_info>
<rule>
  <features style="L.S04_ROAD_INTERSTATE"> </features>
  <label column="routen" style="M.HWY_USA_INTERSTATE_NARROW">
(3-length(routen)) </label>
</rule>
</styling_rules>');

-- insert theme 4
insert into USER_SDO_THEMES (name, description, base_table, geometry_column,
styling_rules)
values (
  'UTFGRID_THEME_DEMO_CITIES',
  'for utfgrid testing',
  'CITIES',
  'LOCATION',
  '<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <hidden_info>
    <field column="CITY" name="City"/>
    <field column="POP90" name="Population"/>
  </hidden_info>
  <rule>
    <features style="M.ALL_CITY_L2"> (pop90 between 200000 AND 1000000 )</features>
    <label column="city" style="T.S07_CITIES_L2"> 1 </label>
  </rule>
  <rule>
    <features style="M.ALL_CITY_L3"> (pop90 between 0 and 200000) </features>
    <label column="city" style="T.S07_CITIES_L3"> 1 </label>
  </rule>
</styling_rules>');

-- insert a basemap
INSERT INTO USER_SDO_MAPS (name, description, definition)
values (
  'UTFGRID_BASEMAP',
  'for utfgrid testing',
  '<?xml version="1.0" standalone="yes"?>
<map_definition>
  <theme name="UTFGRID_THEME_DEMO_STATES" min_scale="1.5E8" max_scale="0.0"
scale_mode="RATIO"/>
  <theme name="UTFGRID_THEME_DEMO_COUNTIES" min_scale="8500000.0" max_
scale="0.0" scale_mode="RATIO"/>
  <theme name="UTFGRID_THEME_DEMO_HIGHWAYS" min_scale="4.5E7" max_scale="0.0"
scale_mode="RATIO"/>
  <theme name="UTFGRID_THEME_DEMO_CITIES" min_scale="7500000.0" max_
scale="0.0" scale_mode="RATIO"/>
</map_definition>');

-- insert the UTFGrid enabled tile layer
insert into user_sdo_cached_maps values(
  'UTFGRID_TL',
  'a utfgrid ',
  '',
  'YES',
  'YES',

```

```
'<map_tile_layer name="UTFGRID_TL" image_format="PNG" http_header_
expires="168.0" concurrent_fetching_threads="3" fetch_larger_tiles="false"
persistent_tiles="true" utfgrid="true" utfgrid_resolution="8">
<internal_map_source data_source="mvdemo" base_map="UTFGRID_BASEMAP"
bgcolor="#dddddd" out_of_bounds_color="#eедdff"/>
<tile_storage root_path="/temp" xyz_storage_scheme="true"/>
<coordinate_system srid="8307" minX="-180.0" maxX="180.0" minY="-90.0"
maxY="90.0"/>
<tile_image width="256" height="256"/>
<tile_dpi value="90.7142857"/>
<tile_meters_per_unit value="111319.49079327358"/>
<zoom_levels levels="19" min_scale="2132.729583849784" max_
scale="559082264.0287178">
</zoom_levels>
</map_tile_layer>',
'UTFGRID_BASEMAP',
 '');
commit;
```

2. Request the map image and its UTFGrid object.

In an actual application, requesting a map image tile and its companion UTFGrid JSON file is handled by the MapViewer HTML5 V2 API; however, for illustration purposes, two substeps with hard-coded requests are shown here.

a. Request an image tile from the server. For example:

```
http://localhost:8080/mapviewer/mcserver?request=gettile&format=png
&zoomlevel=8&mapcache=MVDEMO.UTFGRID_TL&mx=77&my=94
```

The server's response:



b. Request the image tile's companion UTFGrid from the server. For example:

```
http://localhost:8080/mapviewer/mcserver?request=getutfgrid&format=
json&zoomlevel=8&mapcache=MVDEMO.UTFGRID_TL&mx=77&my=94
```

The server's response:

```
{"UTFGRID_THEME_DEMO_STATES":
{"keys": ["1", "2", "3"],
"data": {
"1": {"State": "New Hampshire", "Abrv.": "NH", "Population": "1109252"}, 
"2": {"State": "Maine", "Abrv.": "ME", "Population": "1227928"},
```


The preceding response shows a UTFGrid object that contains properties for the themes `UTFGRID_THEME_DEMO_STATES`, `UTFGRID_THEME_DEMO_HIGHWAYS`, and `UTFGRID_THEME_DEMO_CITIES`. (The theme `UTFGRID_THEME_DEMO_COUNTIES` did not define the `<hidden_info>` element, and so nothing about that theme is listed in the response.)

3.3.5 External Map Source Adapter

An external map source adapter is the interface between a map tile server and an external map services provider. When a map image tile needs to be fetched from the external map services provider, the map tile server calls the adapter with information about the zoom level, size, and location of the tile. The adapter then constructs a provider-specific request, sends the request to the external map services provider, and return the resulting image tile to the map tile server.

The external map source adapter is a Java class that must extends the abstract Java class `oracle.mapviewer.share.mapcache.MapSourceAdapter`, which is defined as follows:

```
public abstract class MapSourceAdapter
{
    public abstract String getMapTileRequest(TileDefinition tile);
    public byte[] getTileImageBytes(TileDefinition tile) ;
    public Properties getProperties() ;
}
```

An adapter that extends this class must implement the following method:

- `public String getMapTileRequest(TileDefinition tile)`

This method should implement the logic to construct the HTTP request string that can be sent to the map services provider to fetch the map image tile. For example, if the URL of a map tile is

`http://myhost/mymapserver?par1=v1&par2=v2&par3=v3`, the HTTP request string returned by this method should be `par1_v1&par2=v2&par3=v3`.

When the map tile server cannot find a specific map tile, it calls the `getTileImageBytes` method to fetch the binary data of the tile image, and that method calls the `getMapTileRequest` method to construct the map tile request before fetching the tile. The `getMapTileRequest` method takes one parameter: a `TileDefinition` object that specifies the zoom level, bounding box, image size and image format of the requested tile. This method returns the HTTP request string.

The map source adapter also inherits all methods implemented in class `MapSourceAdapter`. Among them, the following methods are more important than the others:

- `public byte[] getTileImageBytes(TileDefinition tile)`

This method fetches the actual binary map tile image data from the external map service provider. This method is already implemented. It calls the abstract method `getMapTileRequest` to construct the map tile request and sends the request to the external map services provider. If the map tiles cannot be fetched by sending HTTP requests, you can override this method to implement the appropriate logic to fetch an image tile from the map source. This method takes one parameter: a `TileDefinition` object that specifies the zoom level, bounding box, image size, and image format of the requested tile. This method returns the binary tile image data encoded in the image format specified in the map tile layer configuration settings.

- public Properties getProperties()

This method returns the provider-specific parameters defined in the map tile layer configuration settings explained in [Section 3.3.2.2](#).

The `MapSourceAdapter` and `TileDefinition` classes are packaged inside `mvclient.jar`, which can be found under the directory `$MAPVIEWER_HOME/web/WEB/lib`.

[Example 3-30](#) shows an external map source adapter.

Example 3-30 External Map Source Adapter

```
/*
 * This is a sample map source adapter that can be used to fetch map
 * tiles from a MapViewer instance.
 */
package mcsadapter ;

import java.awt.Dimension;
import java.net.URL;
import java.util.Properties;
import oracle.lbs.mapclient.MapViewer;
import oracle.lbs.mapcommon.MapResponse;
import oracle.mapviewer.share.mapcache.*;

/**
 * The map source adapter must extend class
 * oracle.lbs.mapcache.cache.MapSourceAdapter.
 */

public class MVAdapter extends MapSourceAdapter
{
    /**
     * Gets the map tile request string that is to be sent to the map
     * service provider URL.
     * @param tile tile definition
     * @return request string
     */
    public String getMapTileRequest(TileDefinition tile)
    {
        // Get map source specified parameters
        Properties props = this.getProperties() ;
        String dataSource = props.getProperty("data_source") ;
        String baseMap = props.getProperty("base_map") ;
        // Use oracle.lbs.mapclient.MapViewer to construct the request string
        MapViewer mv = new MapViewer(this.getMapServiceURL()) ;
        mv.setDataSourceName(dataSource) ;
        mv.setBaseMapName(baseMap) ;
        mv.setDeviceSize(new Dimension(tile.getImageWidth(),
                                       tile.getImageHeight()));
        mv.setCenterAndSize(tile.getBoundingBox().getCenterX(),
                            tile.getBoundingBox().getCenterY(),
                            tile.getBoundingBox().getHeight());
        int format = MapResponse.FORMAT_PNG_STREAM ;
        String req = null ;
        switch(tile.getImageFormat())
        {
            case TileDefinition.FORMAT_GIF:
                mv.setImageFormat(MapResponse.FORMAT_GIF_URL);
                req = mv.getMapRequest().toXMLString().replaceFirst(

```

```
        "format=\\"GIF_URL\\\"", "format=\\"GIF_STREAM\\\"") ;
    break ;
  case TileDefinition.FORMAT_PNG:
    mv.setImageFormat(MapResponse.FORMAT_PNG_URL);
    req = mv.getMapRequest().toXMLString().replaceFirst(
        "format=\\"PNG_URL\\\"", "format=\\"PNG_STREAM\\\"") ;
    break ;
  case TileDefinition.FORMAT_JPEG:
    mv.setImageFormat(MapResponse.FORMAT_JPEG_URL);
    req = mv.getMapRequest().toXMLString().replaceFirst(
        "format=\\"JPEG_URL\\\"", "format=\\"JPEG_STREAM\\\"") ;
    break ;
}
}

byte[] reqStr = null ;
try
{
  reqStr = req.getBytes("UTF8") ;
}
catch(Exception e)
{}
// Return the request string.
return "xml_request="+ new String(reqStr);
}
}
```

[Example 3–31](#) shows the implementation of the `MapSourceAdapter.getTileImageBytes` method.

Example 3–31 MapSourceAdapter.getTileImageBytes Implementation

```
/**
 * Fetches the map image tile from the external map service provider by
 * sending the HTTP map tile request to the map service provider, and
 * return the binary tile image data. You can rewrite this method so that
 * the adapter can fetch the tile from an external map service provider
 * that does not accept HTTP requests at all.
 * @param tile the tile definition
 * @return the binary tile image data.
 * @throws Exception
 */
public byte[] getTileImageBytes(TileDefinition tile)
  throws Exception
{
  // construct request string
  String request = getMapTileRequest(tile) ;

  if(request == null)
  {
    throw new Exception("Null map tile request string in map source adapter!") ;
  }

  // set proxy settings
  Proxy proxy = null ;

  /* If the proxyHost is "NONE", the request is sent directly to the
   * external server. If the proxyHost is a valid host, that host will
   * be used as the proxy server. If the proxyHost is empty or omitted,
   * the global proxy setting in mapViewerConfig.xml will be in effect.
   */
}
```

```

boolean noProxy = "NONE".equalsIgnoreCase(getProxyHost()) ;
if(getProxyHost()!=null && !noProxy)
{
    SocketAddress addr = new InetSocketAddress(proxyHost, proxyPort);
    proxy = new Proxy(Proxy.Type.HTTP, addr);
}

// send the request and get the tile image binary
PrintWriter wr = null ;
BufferedInputStream bis = null;
try
{
    String urlStr = mapServiceURL ;
    if("GET".equalsIgnoreCase(httpMethod))
        urlStr = mapServiceURL + "?" + request ;
    log.finest("http "+httpMethod+": "+urlStr);

    URL url = new URL(urlStr);
    // Open a URL connection based on current proxy setting
    URLConnection conn =
        proxy!=null? url.openConnection(proxy):
        (noProxy? url.openConnection(Proxy.NO_PROXY):
        url.openConnection()) ;
    conn.setConnectTimeout(timeOut);
    if("GET".equalsIgnoreCase(getHTTPMethod()))
        conn.connect();
    else
    {
        conn.setDoOutput(true);
        wr = new PrintWriter(conn.getOutputStream());
        wr.print(request);
        wr.flush();
        wr.close();
        wr = null ;
    }
    bis = new BufferedInputStream(conn.getInputStream());
    byte[] result = toBytes(bis) ;
    bis.close();
    bis = null ;
    return result;
}
catch(Exception ioe)
{
    throw new Exception("Failed to fetch external map tile.", ioe);
}
finally
{
    try
    {
        if(bis != null)
        {
            bis.close();
            bis = null;
        }
        if(wr != null)
        {
            wr.close();
            wr = null;
        }
    }
}

```

```
        catch(IOException ioee)
        {
            throw ioee;
        }
    }
```

4

MapViewer JavaBean-Based API

This chapter describes the JavaBean-based MapViewer API. This API exposes all capabilities of MapViewer through a single JavaBean, `oracle.lbs.mapclient.MapViewer`. This bean is a lightweight client that handles all communications with the actual MapViewer service running on the middle tier on behalf of a user making map requests.

All communications between the bean and the actual MapViewer service follow a request/response model. Requests are always sent as XML documents to the service. Depending on the type and nature of a request, the response received by the bean is either an XML document or some binary data. However, using the MapViewer bean is easier than manipulating XML documents for forming and sending MapViewer requests, as well as for extracting information from the responses.

The bean delegates most of map data processing and rendering to the MapViewer service. All the bean does is formulate user requests into valid MapViewer XML requests and send them to a MapViewer service for processing.

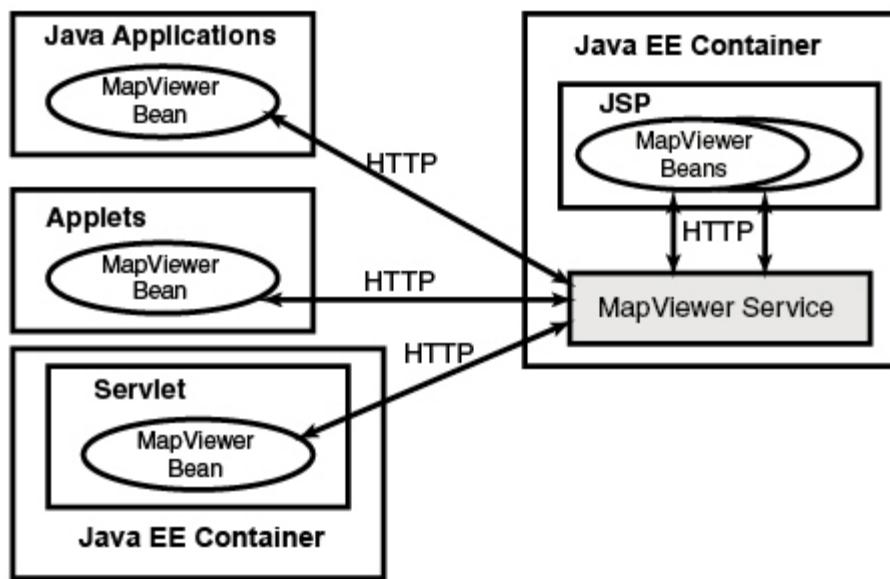
This chapter contains the following major sections:

- [Section 4.1, "Usage Model for the MapViewer JavaBean-Based API"](#)
- [Section 4.2, "Preparing to Use the MapViewer JavaBean-Based API"](#)
- [Section 4.3, "Using the MapViewer Bean"](#)

4.1 Usage Model for the MapViewer JavaBean-Based API

The MapViewer bean can be created and used in either server-side objects such as JavaServer Pages (JSP) and servlets, or in client-side objects such as Java applets or standalone Java applications. The bean is a lightweight class that maintains an active HTTP connection to the MapViewer service and the current map request and map response objects. In most cases, you will create only one MapViewer bean and use it for all subsequent tasks; however, you can create more than one bean and use these beans simultaneously. For example, you may need to create a web page where a small overview map displays the whole world and a large map image displays a more detailed map of the region that is selected on the overview map. In this case, it is probably easier to create two MapViewer beans, one dedicated to the smaller overview map, and the other to the larger detail map.

[Figure 4–1](#) shows some possible usage scenarios for the MapViewer bean.

Figure 4–1 MapViewer Bean Usage Scenarios

The MapViewer bean can communicate through the HTTP protocol with the MapViewer service in several usage scenarios, the following of which are shown in [Figure 4–1](#):

- In a Java application
- In a Java applet
- In a servlet within a Java EE (Java Platform, Enterprise Edition) container different from the Java EE container that contains the MapViewer service
- In JavaServer Pages (JSP) code within the Java EE container that contains the MapViewer service

In all usage models, the same JavaBean class is used, and most of its methods apply. However, some methods work or are useful only in a JSP HTML-based context, and other methods work or are useful only in an interactive standalone Java application or applet context (thick clients). For example, consider the following methods of the bean:

- `java.awt.Image getGeneratedMapImage`
- `String getGeneratedMapImageURL`

Both methods extract the generated map image information from a response received from a MapViewer service; however, the first method returns the actual binary image data that is a `java.awt.BufferedImage` class, and the second method returns an HTTP URL string to the generated map image that is stored in the host running the MapViewer service. Clearly, if your application is a JavaServer Page, you should use the second method, because otherwise the JSP page will not know how to handle the `BufferedImage`. However, if you are programming a standalone Java application where you have a Java panel or window for displaying the map, you can use the first method to get the actual image and render it inside your panel or window, plus any other features that you may have created locally and want to render on top of the map.

The set of methods that are only applicable in the thick client context, which are designed to achieve optimal performance for such clients, are described in more detail in [Section 4.3.10](#).

4.2 Preparing to Use the MapViewer JavaBean-Based API

Before you can use the MapViewer JavaBean, the MapViewer `mvclient.jar` library must be in a directory that is included in the CLASSPATH definition. After you deploy the `mapviewer.ear` file in Oracle Fusion Middleware, the `mvclient.jar` file is located in the `$MAPVIEWER/web/WEB-INF/lib` directory.

Before you use the MapViewer JavaBean, you should examine the Javadoc-generated API documentation and try the JSP demo:

- Javadoc documentation for the MapViewer bean API is available at a URL with the following format:

```
http://host:port/mapviewer/mapclient
```

In this format, `host` and `port` indicate where Oracle Fusion Middleware listens for incoming requests.

- A demo supplied with MapViewer shows how to use the bean. After you have set up the MapViewer demo data set (which can be downloaded from the Oracle Technology Network) by importing it into a database and running all necessary scripts, you can try the JSP demo. The URL for the JSP demo has the following format:

```
http://host:port/mapviewer/demo/mapinit.jsp
```

In this format, `host` and `port` indicate where Oracle Fusion Middleware listens for incoming requests. This JSP page confirms the MapViewer service URL and then proceeds to the real demo page, `map.jsp`.

4.3 Using the MapViewer Bean

To use the MapViewer bean, you must create the bean (see [Section 4.3.1](#)), after which you can invoke methods to do the following kinds of operations:

- Set up parameters of the current map request (see [Section 4.3.2](#))
- Add themes or features to the current map request (see [Section 4.3.3](#))
- Add dynamically defined styles to a map request (see [Section 4.3.4](#))
- Manipulate the themes in the current map request (see [Section 4.3.5](#))
- Send a request to the MapViewer service (see [Section 4.3.6](#))
- Extract information from the current map response (see [Section 4.3.7](#))
- Obtain information about data sources (see [Section 4.3.8](#))
- Query nonspatial attributes in the current map window (see [Section 4.3.9](#))
- Use optimal methods for thick clients (see [Section 4.3.10](#))

The sections about methods for kinds of operations provide introductory information about what the bean can do. For detailed descriptions of each method, including its parameters and return type, see the Javadoc-generated API documentation (described in [Section 4.2](#)).

4.3.1 Creating the MapViewer Bean

The first step in any planned use of the MapViewer bean is to create the bean, as shown in the following example:

```
import oracle.lbs.mapclient.MapViewer;
```

```
MapViewer mv = new MapViewer("http://my_corp.com:8888/mapviewer/omserver");
```

The only parameter to the constructor is a URL to an actual MapViewer service. Unless you change it to something else using `setServiceURL`, the MapViewer service at this URL will receive all subsequent requests from this bean. When a MapViewer bean is created, it contains an empty current map request. There are a few parameters in the current request that are initialized with default values, such as the width and height of the map image and the background color for maps. These default values are explained in the XML API element and attribute descriptions in [Chapter 3](#).

4.3.2 Setting Up Parameters of the Current Map Request

As explained in [Chapter 3](#), a map request can have many parameters that affect the final look of the generated map image. When you use the MapViewer JavaBean, such parameters can be set through a group of methods whose names start with `set`. Many of these parameters have a corresponding method that starts with `get`. For example, `setAntiAliasing` sets antialiasing on or off, and `getAntiAliasing` returns the current antialiasing setting.

The methods for setting parameters of the current map request include the following:

- `setAntiAliasing(boolean aa)` specifies whether or not the map should be rendered using the antialiasing technique.
- `setBackgroundColor(java.awt.Color bg)` sets the background color for the map to be generated.
- `setBackgroundImageURL(java.lang.String bgImgUrl)` sets the URL for the background image to be rendered in the map.
- `setBaseMapName(java.lang.String name)` sets the name of the base map to be rendered before any explicitly added themes.
- `setBoundingThemes(String[] themeNames, double borderMargin, boolean preserveAspectRatio)` sets the bounding themes for the current map request. Any previous center point and box settings will be cleared as a result of calling this method.
- `setBox(double xmin, double ymin, double xmax, double ymax)` sets the map query window box in the data coordinate space. Any previous center point and size settings will be lost as a result of calling this method.
- `setCenter(double cx, double cy)` sets the center point for this map request. The coordinates must be in the user data space.
- `setCenterAndSize(double cx, double cy, double size)` sets the map center and size for the map to be generated. All data must be in the user data space.
- `setDataSourceName(java.lang.String name)` sets the name of the data source to be used when loading data for the map.
- `setDefaultStyleForCenter(java.lang.String defRenderStyleName, java.lang.String defLabelStyleName, java.lang.String defLabel, double[] defRadii)` sets the default styling and labeling information for the center (point) of the map. Each subsequent map generated will have its center point rendered and optionally labeled with circles of the specified radii.
- `setDeviceSize(java.awt.Dimension dsz)` sets the image dimension of the map to be generated.
- `setFullExtent()` tells the MapViewer server not to impose any center and size restriction for the next map request. This effectively removes the current map

center and size settings. The resulting map will be automatically centered at the full extent of all features being displayed.

- `setImageFormat(int f)` sets the image format that MapViewer should use when generating the map. For JSP pages, you should always set it to `FORMAT_PNG_URL` or `FORMAT_GIF_URL`.
- `setImageScaling(boolean is)` specifies whether images in an image theme should automatically be rescaled to fit the current query window. The default is `TRUE`. If you specify `FALSE`, the images will be rendered without any scaling by MapViewer; however, the original query window may be slightly modified to allow other (vector) themes to overlay properly with the images. In all cases, the map center is not changed.
- `setMapLegend(java.lang.String legendSpec)` sets the map legend (in XML format) to be plotted with current map. The legend must be specified in the `legendSpec` parameter, in the format for the `<legend>` element that is documented in [Section 3.1.2.11](#).
- `setMapLegend(java.lang.String fill, java.lang.String fillopacity, java.lang.String stroke, java.lang.String profile, java.lang.String position, java.lang.String fontFamily, java.lang.String[][][] legenddata)` sets the map request legend to be plotted with current map. The `legenddata` attribute contains the legend items, and its structure is `String [x][y][z]` `legenddata`, where `x` is the number of legend columns, `y` is the number of column items, and `z` is the legend attributes (index 0 = legend text, index 1 = style name, index 2 = is title or not, index 3 = tab, index 4 = is separator or not).
- `setMapLegend(java.lang.String fill, java.lang.String fillopacity, java.lang.String stroke, java.lang.String profile, java.lang.String position, java.lang.String[][][] legenddata)` is the same as the preceding method, but without the `fontFamily` attribute.
- `setMapRequestSRID(int d)` sets the map request output SRID, which must match an SRID value in the `MDSYS.CS_SRS` table. Themes whose SRID value is different from the map request SRID will be automatically converted to the output SRID if the theme SRID is not null or not equal to 0. If no map request SRID is defined (equal to zero), MapViewer will use the theme's SRID as reference, but no transformation will be performed if the themes have different SRID values.
- `setMapResultFileName(String mapFile)` sets the name of the resulting map image file on the server side. If the name is set to null (the default), MapViewer will generate map image files based on the prefix `omsmap` and a counter value. You do not need to specify the extension (`.gif` or `.png`) when specifying a custom map file name.
- `setMapTitle(java.lang.String title)` sets the map title for the map to be generated.
- `setServiceURL(java.lang.String url)` sets the MapViewer service URL.
- `setSize(double size)` sets the height (size) in the user data space for the map to be generated.
- `setShowSVGNavBar(boolean s)` specifies whether or not to show the built-in SVG navigation bar. The default value is `TRUE` (that is, show the navigation bar).
- `setSVGonClick(java.lang.String onClick)` sets the `onClick` function for an SVG map. The `onClick` function is a JavaScript function defined in the web page in which the SVG map is embedded. The `onClick` function is called whenever the SVG map is clicked if both theme feature selection and window selection are

disabled. For information about using JavaScript functions with SVG maps, see [Appendix B](#).

- `setSVGShowInfo(boolean info)` specifies whether or not to display hidden information when the mouse moves over features for which hidden information is provided. If its value is TRUE (the default), hidden information is displayed when the mouse moves over such features; if it is set to FALSE, hidden information is not displayed when the mouse moves over such features. Regardless of the value, however, hidden information is always rendered in an SVG map; this method only controls whether hidden information can be displayed.
- `setSVGZoomFactor(double zfactor)` sets the zoom factor for an SVG map. The zoom factor is the number by which to multiply the current zoom ratio for each integer increment (a zoomin operation) in the zoom level. The inverse of the zoom factor value is used for each integer decrement (a zoomout operation) in the zoom level. For example, if the `zfactor` value is 2 (the default), zooming in from zoom level 4 to 5 will enlarge the detail by two; for example, if 1 inch of the map at zoom level 4 represents 10 miles, 1 inch of the map at zoom level 5 will represent 5 miles. The zoom ratio refers to the relative scale of the SVG map, which in its original size (zoom level 0) has a zoom ratio of 1.
- `setSVGZoomLevels(int zlevels)` sets the number of zoom levels for an SVG map.
- `setSVGZoomRatio(double s)` sets the zoom factor to be used when an SVG map is initially loaded. The default value is 1, which is the original map size (zoom level 0). Higher zoom ratio values show the map zoomed in, and lower values show the map zoomed out.
- `setWebProxy(java.lang.String proxyHost, java.lang.String proxyPort)` sets the web proxy to be used when connecting to the MapViewer service. This is needed only if there is a firewall between the web service and this bean.

You can remove the map legend from the current map request by calling the `deleteMapLegend` method.

4.3.3 Adding Themes or Features to the Current Map Request

Besides specifying a base map to be included in a map request, you can add themes or individual point and linear features, such as a point of interest or a dynamically generated route, to the current map request. The themes can be predefined themes whose definitions are stored in the database, or dynamic themes where you supply the actual query string when you add the theme to the current request.

There are several kinds of dynamic themes: to retrieve geometric data (JDBC theme), to retrieve image data (image theme), to retrieve GeoRaster data (GeoRaster theme), to retrieve network data (network theme), and to retrieve topology data (topology theme). For dynamic themes and features, you must explicitly specify the styles you want to be used when rendering them. Being able to add dynamic themes and features gives you flexibility in adapting to application development needs.

The methods for adding themes or features to the current map request have names that start with `add`, and they include the following:

- `addGeoRasterTheme` and its variants add GeoRaster data to the current map request. In some cases you supply the query string to retrieve the raster data; in other cases you supply the necessary GeoRaster information to retrieve a specific image. ([Section 2.3.4](#) explains GeoRaster themes.)

- `addImageTheme` and its variants add an image theme, for which you must supply the query string for retrieving the image data to be rendered as part of the map. ([Section 2.3.3](#) explains image themes.)
- `addJDBCTheme` and its variants add a JDBC theme, for which you must supply the query string for retrieving the geometric data. ([Section 2.3.2](#) explains JDBC themes.)
- `addLinearFeature` and its variants add a single linear feature (line string) to the current map request. You must specify a rendering style. You can specify the labeling text and text style for drawing the label, and you can also specify if the label will always be present regardless of any overlapping. The coordinates must be in the user data space. There is no limit to the number of linear features that you can add.
- `addLinksWithinCost` adds a network theme to the current map request; the theme will be a result of the within-cost analysis on network data. The within-cost analysis finds all nodes that are within a specified cost, and generates the shortest path to each node.
- `addNetworkLinks` adds network links to the current map request as a network theme, for which you must supply the rendering styles.
- `addNetworkNodes` adds the network nodes to the current map request as a network theme, for which you must supply the rendering styles.
- `addNetworkPaths` adds the network paths to the current map request as a network theme, for which you must supply the rendering styles.
- `addNetworkTheme` and its variants add the network links, nodes, and paths to the current map request as a network theme, for which you must supply the rendering styles. ([Section 2.3.5](#) explains network themes.)
- `addPointFeature` and its variants add a single feature that is a point to the current map request. This point will be rendered using the supplied rendering style on the map after all themes have been rendered. You can optionally supply a labeling text to be drawn alongside the point feature, and you can specify if the label will always be present regardless of any overlapping. You can also supply an array of radii (the units are always in meters), in which case a series of circles will be drawn centering on the point. The coordinates x and y must be in the user data space. You can assign attribute values to the point feature for use with an advanced style. For oriented point features, you can specify orientation parameters. There is no limit to the number of point features you can add.
- `addPredefinedTheme` and its variants add a predefined theme to the current map request.
- `addShortestPath` and its variants add a network theme to the current map request; the theme will be a result of the shortest-path analysis on a network data. You must supply the necessary parameters for the shortest-path algorithm.
- `addThemesFromBaseMap(java.lang.String basemap)` adds all predefined themes in the specified base map to the current map request. This has an advantage over `setBaseMapName`, in that you can manipulate the themes for the current map request, as explained in [Section 4.3.5](#).
- `addTopologyDebugTheme` and its variants add the topology data structure as a topology debug-mode theme to the current map request. You must supply the rendering styles for the edges, nodes, and faces. ([Section 2.3.6](#) explains topology themes, including the debug mode.)

- `addTopologyTheme` adds the topology features as a topology theme to the current map request. You must supply the query string. ([Section 2.3.6](#) explains topology themes.)

You can remove all added point and linear features by calling the `removeAllPointFeatures` and `removeAllLinearFeatures` methods, respectively.

4.3.4 Adding Dynamically Defined Styles to a Map Request

Besides the styles stored on the `USER_SDO_STYLES` view, you can also add dynamically defined (temporary) styles to a map request. These dynamically defined styles provide temporary information for the map request, and they should always be added to the map request before it is sent to the server.

The methods for adding dynamically defined styles to the map request have names that start with `add`. Effective with release 11g, you can add any kind of dynamically defined style to a map request with the single method `addStyle`, which has the following definition:

```
public void addStyle(java.lang.String name,  
                     StyleModel tempStyle)
```

In the preceding definition, `StyleModel` is an interface defined in the Java client package `oracle.mapviewer.share.style`. This package and the `oracle.mapviewer.share.stylex` package also contain concrete style model classes that represent the definitions of all types of styles supported by MapViewer. See the Javadoc reference documentation for information about these packages.

The following code excerpt shows how to use the `addStyle` method and the `ColorStyleModel` class to add a dynamic color style to a map request:

```
import oracle.lbs.mapclient.*;  
import oracle.mapviewer.share.*  
...  
ColorStyleModel csm = new ColorStyleModel();  
csm.setFillColor(new Color(255, 0, 0, 100));  
csm.setStrokeColor(new Color(0, 0, 255, 100));  
mapViewer.addStyle("my_color", csm);
```

As an alternative to using the `addStyle` method, you can use the following methods for adding specific types of styles:

- `addBucketStyle`(`java.lang.String name, java.lang.String low, java.lang.String high, int nbuckets, java.lang.String []styleName`) adds a bucket style with equal intervals, for which you specify the range values, the number of buckets, and the style name for each bucket.
- `addCollectionBucketStyle`(`java.lang.String name, java.lang.String []label, java.lang.String []styleName, java.lang.String [][]value`) adds a collection bucket style, for which you specify the label, the style name, and the values for each bucket.
- `addColorSchemeStyle`(`java.lang.String name, java.lang.String baseColor, java.lang.String strokeColor, java.lang.String low, java.lang.String high, int nbuckets`) adds a color scheme style with equal intervals, for which you specify the color parameters, the range values, and the number of buckets.
- `addColorSchemeStyle`(`java.lang.String name, java.lang.String baseColor, java.lang.String strokeColor, java.lang.String []label, java.lang.String []low, java.lang.String []high`) adds a color scheme style, for which you specify the color parameters and the range values.

- `addColorStyle(java.lang.String name, java.lang.String stroke, java.lang.String fill, int strokeOpacity, int fillOpacity)` adds a color style with the specified color parameters.
- `addImageAreaStyleFromURL(java.lang.String styleName, java.lang.String imgURL)` adds a GIF or JPEG image as an area symbol to the MapViewer client.
- `addImageAreaStyleFromURL(java.lang.String styleName, java.lang.String imgURL, java.lang.String lineStyle)` adds a GIF or JPEG image as an area symbol to the MapViewer client. You can also specify parameters for stroking the boundary of the area being filled.
- `addImageMarkerStyleFromURL(java.lang.String styleName, java.lang.String imgURL, java.lang.String strokeColor, float strokeWidth, int strokeOpacity)` adds a GIF image as a marker symbol to the MapViewer client.
- `addImageMarkerStyleFromURL(java.lang.String styleName, java.lang.String imgURL)` adds a GIF image as a marker symbol to the MapViewer client. You can also specify parameters for the desired width and height of the image when applied to features on a map, as well as the font properties of any text label that will go inside or on top of the marker.
- `addImageMarkerStyleFromURL(java.lang.String styleName, java.lang.String imgURL)` adds a GIF image as a marker symbol to the MapViewer client.
- `addImageMarkerStyleFromURL(java.lang.String styleName, java.lang.String imgURL, int desiredWidth, int desiredHeight, java.lang.String fontName, int fontSize, java.lang.String fontStyle, java.lang.String fontWeight, java.lang.String fontColor)` adds a GIF image as a marker symbol to the MapViewer client. You can also specify parameters for the desired width and height of the image when applied to features on a map, as well as the font properties of any text label that will go inside or on top of the marker.
- `addLineStyle(java.lang.String name, java.lang.String fill, java.lang.String strokeWidth, boolean hasBase, java.lang.String baseFill, java.lang.String baseStroke, java.lang.String baseDash, boolean hasParallel, java.lang.String fillParallel, java.lang.String strokeParallel, boolean hasHashMark, java.lang.String fillHash, java.lang.String dashHash)` adds a line style to the MapViewer client.
- `addLineStyle(java.lang.String name, java.lang.String fill, java.lang.String strokeWidth, boolean hasBase, java.lang.String baseFill, java.lang.String baseStroke, java.lang.String baseDash, boolean hasParallel, java.lang.String fillParallel, java.lang.String strokeParallel, boolean hasHashMark, java.lang.String fillHash, java.lang.String dashHash, java.lang.String measureMarker, double measurePosition, int measureSize)` adds a line style to the MapViewer client.
- `addMarkerStyle(java.lang.String name, int mktype, java.lang.String strokeColor, java.lang.String fillColor, java.lang.String markerWidth, java.lang.String markerHeight, java.lang.String coords, java.lang.String radius)` adds a vector marker style with the given parameters. The available vector marker style types are MARKER_POLYGON, MARKER_POLYLINE, MARKER_CIRCLE, and MARKER_RECT.
- `addTextStyle(java.lang.String name, java.lang.String style, java.lang.String family, java.lang.String size, java.lang.String weight, java.lang.String fill)` adds a text style with the specified parameters.
- `addVariableMarkerStyle(java.lang.String name, java.lang.String []label, java.lang.String baseMarker, int startSize, int increment,`

`java.lang.String []low, java.lang.String []high)` adds a variable marker style, for which you specify the parameters for the base marker, and also the label and the values for each bucket.

You can remove a dynamically defined style from the current map request by calling the `deleteStyle(java.lang.String name)` method, or you can remove all dynamically defined styles from the current map request by calling the `removeAllDynamicStyles` method.

4.3.5 Manipulating Themes in the Current Map Request

After you add themes using any of the methods that start with *add*, you can manipulate them, performing such operations as listing their names, moving them up or down in rendering order for the current request, and even disabling themes and enabling themes that had been disabled. However, you cannot manipulate themes that are implicitly included when you set a base map (using the `setBaseMapName` method), because the list of themes in the base map is not actually included until the MapViewer service processes the request.

The methods for manipulating themes in the current map request include the following:

- `deleteAllThemes` deletes all added themes from the current map request.
- `deleteTheme(java.lang.String name)` deletes an explicitly added theme from the current map request.
- `enableThemes(java.lang.String[] themes)` enables all themes whose names appear in the supplied list.
- `getActiveTheme(double currentScale)` gets the name of the active theme, that is, the top theme on the current display map.
- `getEnabledThemes` gets a list of all themes that are currently enabled.
- `getThemeEnabled(java.lang.String themeName)` determines whether or not a specified theme is currently enabled.
- `getThemeNames` returns an ordered list of names of themes that have been explicitly added to the current map request.
- `getThemePosition(java.lang.String name)` returns the position in the rendering sequence of an explicitly added theme.
- `getThemeVisibleInSVG(java.lang.String name)` determines whether or not a specified theme is currently visible in an SVG map. (If the theme is not visible, it is hidden.)
- `hasThemes` checks to see if the current map request has any explicitly added themes. For example, if you have only set the name of the base map in the current request, but have not added any other theme through one of the *add*Theme* methods, this method returns FALSE.
- `moveThemeDown(int index)` moves a theme down one position in the list of themes to be rendered, so that it is rendered later.
- `moveThemeUp(int index)` moves a theme up one position in the list of themes to be rendered, so that it is rendered sooner.
- `setAllThemesEnabled(boolean v)` sets all themes to be enabled or disabled.
- `setGeoRasterThemePolygonMask(java.lang.String name, double []coords)` sets the polygon mask to be applied on the GeoRaster theme. The GeoRaster area

outside the polygon mask will be transparent. The coordinates are defined as x1,y1,x2,y2, The mask coordinates must be in the data coordinate space.

- `setLabelAlwaysOn(boolean labelAlwaysOn, java.lang.String name)` controls whether or not MapViewer labels all features in a theme even if two or more labels will overlap in the display of a theme. (MapViewer always tries to avoid overlapping labels.) If `labelAlwaysOn` is TRUE, MapViewer displays the labels for all features even if two or more labels overlap. If `labelAlwaysOn` is FALSE, when it is impossible to avoid overlapping labels, MapViewer disables the display of one or more labels so that no overlapping occurs.
- `setNetworkThemeLabels(java.lang.String name, java.lang.String linkLabelStyle, java.lang.String linkLabelColumn, java.lang.String nodeLabelStyle, java.lang.String nodeLabelColumn, java.lang.String pathLabelStyle, java.lang.String pathLabelColumn)` sets network theme label parameters for links, nodes, and paths. The attribute column name must be an existing attribute of the link, node, and path tables.
- `setThemeAlpha(java.lang.String themeName, float alpha)` sets the transparency value for an image theme.
- `setThemeEnabled(boolean v, java.lang.String themeName)` sets a specified theme to be enabled or disabled in the current map request.
- `setThemeFastUnpickle(java.lang.String name, boolean noUnpickler)` specifies whether to use the MapViewer fast unpickling algorithm (TRUE, the default) or the generic JDBC conversion algorithm (FALSE) to convert SDO_GEOmetry objects fetched from the database into a Java object accessible to MapViewer. The MapViewer fast unpickling algorithm improves performance, but occasionally the coordinates may lose some precision (around 0.00000005), which can be significant in applications where all precision digits of each coordinate must be kept. The generic JDBC conversion algorithm is slower than the MapViewer fast unpickling process, but there is never any loss of precision.
- `setThemeOnClickInSVG (java.lang.String theme, java.lang.String onClickFunction)` sets the theme's `onClick` function for an SVG map. The `onClick` function is a JavaScript function defined in the web page in which the SVG map is embedded. The `onClick` function is called whenever the SVG map is clicked if both theme feature selection and window selection are disabled. For information about using JavaScript functions with SVG maps, see [Appendix B](#).
- `setThemeScale(java.lang.String name, double minScale, double maxScale)` sets the minimum and maximum scale values for displaying a theme.
- `setThemeSelectableInSVG (java.lang.String theme, boolean sel)` sets the theme to be selectable (TRUE) or not selectable (FALSE) in an SVG map. If the theme is set to selectable, any feature of the theme can be selected in the SVG map by clicking on it. If the feature is selected, its color is changed and its ID (its rowid by default) is recorded. You can get a list of the ID values of all selected features by calling the JavaScript function `getSelectedIdList()` defined in the SVG map. For information about using JavaScript functions with SVG maps, see [Appendix B](#).
- `setThemeUnitAndResolution(java.lang.String themeName, java.lang.String unit, double resolution)` sets the unit and resolution values for an image theme.
- `setThemeVisible(java.lang.String name, boolean vis)` sets the theme to be visible (TRUE) or hidden (FALSE) in an SVG map. If the theme is set to be hidden, the theme will be still rendered, but will be invisible.

4.3.6 Sending a Request to the MapViewer Service

As an application developer, you typically issue a new map request as a result of certain user input (such as a mouse click on the currently displayed map) or after you have modified some aspect of the map request (such as setting a new background color). In fact, you can issue a map request any time you want, as long as you do not overwhelm the middle-tier MapViewer service with too many rapid requests from the MapViewer bean or beans. The MapViewer service tries to process requests in the order in which they arrive; if you send a second request before receiving the response from the first one, MapViewer continues to process the first request completely before starting to process the second request.

Any modifications to the current map request, such as changing to a new background color or moving a theme down in the rendering sequence, do not take effect in the map display until you send the map request, at which time the MapViewer service actually receives the request and processes it.

The methods for sending a map request to the MapViewer service include the following:

- `run` sends the current map request to the MapViewer service, and obtains a map response as sent back by the MapViewer service.
- `pan(int x, int y)` pans to the specified device point. Each coordinate is in the screen or display unit, in this case, pixel.
- `zoomIn(double factor)` zooms in on the map without changing the other map request parameters.
- `zoomIn(int x, int y, double factor)` zooms in on the specified device point.
- `zoomIn(int x1, int y1, int x2, int y2)` zooms in on the specified device rectangle.
- `zoomOut(double factor)` zooms out on the current map without changing the other map request parameters.
- `zoomOut(int x, int y, double factor)` zooms out and recenters the current map.

Each of these methods assembles a single XML map request document based on all properties of the current map request, and then sends it to the MapViewer service. After the MapViewer bean receives the response from the MapViewer service, the bean does any necessary postprocessing and makes the response ready for your use.

As an alternative to using these methods, you can formulate an XML request string outside the bean, and then use the `sendXMLRequest(java.lang.String req)` method to send the request to the MapViewer service. However, if you use this method, you are responsible for receiving and unpacking the response using the `getXMLResponse` method, and for parsing and interpreting the response string yourself. The state of the bean remains unchanged, because the methods are only making use of the bean's capability to open an HTTP connection to send and receive documents over the connection.

All methods described in this section throw an exception if any unrecoverable error occurs during the transmission of the request or response, or in the MapViewer service during processing. You are responsible for taking care of such exceptions in any way you consider appropriate, such as by trying the request again or by reporting the problem directly to the user.

4.3.7 Extracting Information from the Current Map Response

You can extract information, such as the generated map image or the URL for the image, from the current map response. The methods for extracting information from the map response include the following:

- `getGeneratedMapImage` returns the actual map image data contained in the response from the MapViewer service. You must have set the image format to `FORMAT_RAW_COMPRESSED` using the `setImageFormat` method. The `getGeneratedMapImage` method is primarily used in thick clients, although you may also use it in a JavaServer Page or a servlet (for example, to save the image in a format that is not supported by MapViewer).
- `getGeneratedMapImageURL` returns the URL to the currently generated map image in the application server. You must have set the image format to `FORMAT_PNG_URL` or `FORMAT_GIF_URL` using the `setImageFormat` method.
- `getMapMBR` returns the MBR (minimum bounding rectangle) for the currently generated map, in the user's data space.
- `getMapResponseString` returns the last map response in XML format.

4.3.8 Obtaining Information About Data Sources

The MapViewer bean has methods that you can use to obtain information about data sources. These methods include the following:

- `dataSourceExists(java.lang.String dsr)` checks if a given data source exists in (that is, is known to) the MapViewer service.
- `getDataSources()` lists the currently available data sources in the server. This method lists only the names and no other details about each data source (such as database host or user login information).

4.3.9 Querying Nonspatial Attributes in the Current Map Window

It is often necessary to query nonspatial attributes that are associated with the spatial features being displayed in the current map image. For example, assume that you just issued a map request to draw a map of all customer locations within a certain county or postal code. The next logical step is to find more information about each customer being displayed in the resulting map image. In the JSP or HTML environment, because you get only an image back from the MapViewer service, you will need another round-trip to the service to fetch the nonspatial information requested by the user. This section describes a set of methods that can help you do just that. (You can, however, obtain both the nonspatial attribute values of a certain theme and the resulting map image in a single request when the bean is used in a standalone Java application or applet environment, as described in [Section 4.3.10](#).)

A typical situation is that the user clicks on a feature on the displayed map and then wants to find out more (nonspatial attributes) about the feature. This action can be essentially implemented using a query with the desired nonspatial attributes in its `SELECT` list, and a spatial filter as its `WHERE` clause. The spatial filter is an Oracle Spatial and Graph SQL operator that checks if the geometries in a table column (the column of type `SDO_GEOGRAPHY` in the customer table) spatially interact with a given target geometry (in this case, the user's mouse-click point). The spatial filter in the `WHERE` clause of the query selects and returns only the nonspatial attributes associated with the geometries that are being clicked on by the user.

You will need to call an Oracle Spatial and Graph operator to perform the filtering; however, you can use the MapViewer bean-based API to obtain information, and to

reassemble the spatial filter string to be appended to the WHERE clause of your query. The identify method simplifies the task even further.

The methods for querying nonspatial attributes in the current map window include the following:

- doQuery and variants execute a supplied SQL query and return an array of strings representing the result set. These are convenient methods to issue your own query without manually opening a JDBC connection to the database from the bean.
- doQueryInMapWindow and variants are extensions of doQuery and its variants. They automatically subject the user-supplied query to a spatial filtering process using the current map window.
- getSpatialFilter(java.lang.String spatialColumn, int srid, boolean pre9i) returns a spatial filter string that can be used as a WHERE clause condition in formulating your own queries in the current map window context. The spatial filter evaluates to TRUE for any geometries that are being displayed in the entire map window. You can use this method to obtain information about every spatial feature of a theme that is being displayed.
- getSpatialFilter(java.lang.String spatialColumn, int srid, double xl, double yl, double xh, double yh, boolean pre9i) returns a spatial filter string that can be used as a query condition in formulating your queries in the given window. This filter evaluates to TRUE for all geometries that interact with the supplied (xl,yl, xh,yh) data window. The window is not in device or screen coordinate space, but in the user's data space; therefore, you must first call the getUserPoint method to convert the user's mouse-click point to a point in the user data space before using the getSpatialFilter method.
- getUserPoint(int x, int y) returns the user data space point corresponding to the mouse click.
- getUserPoint(int x, int y, java.lang.String dataSource, int outSRID) returns the user data space point corresponding to the mouse click, using the specified coordinate system (SRID value).
- getUserPoint(int x, int y, java.lang.String dataSource, java.lang.String themeName) returns the user data space point corresponding to the mouse click, using the coordinate system (SRID value) associated with the specified theme.
- getWhereClauseForAnyInteract(java.lang.String spatialColumn, int srid, double x, double y) returns geometries that have any interaction with a specified point in the user's data space. This provides a WHERE clause string that will use a more precise spatial filtering method than the one provided by the getSpatialFilter method.
- getWhereClauseForAnyInteract(java.lang.String spatialColumn, int srid, double xl, double yl, double xh, double yh) returns the WHERE clause that can be used to find geometries that have any interaction with the specified user space window. It is similar to the getSpatialFilter method, but uses a more precise version of the Oracle Spatial and Graph filtering method.
- identify and variants provide a convenient method for identifying nonspatial attributes. This is desirable if you do not need more flexibility and control over how a nonspatial attribute query should be formulated. As with the doQuery methods, all identify methods return a double String array that contains the result set of the query.

4.3.10 Using Optimal Methods for Thick Clients

When you use the MapViewer bean in a JavaServer Page in an HTML file, a second round-trip to the MapViewer service is needed to obtain nonspatial attributes of features being displayed. It is also true that with a JavaServer Page in an HTML file, even if most themes remain unchanged from one map request to the next (such as when zooming in to the center of a map), all themes must still be reprocessed each time the MapViewer service processes the page, which causes the data for each theme to be retrieved again from the database. (This is mainly due to the stateless nature of the MapViewer service and the insufficient mechanism provided in the JSP context for handling user interaction, which must be based on the request/response model.)

However, when you are working in a thick client environment, such as with J2SE (Java 2 Platform Standard Edition) applications and applets, you can reduce the processing and bandwidth overhead when using the bean. This is primarily because in such environments you have greater control of how content (including the map) should be displayed, you can better respond to the user's interaction, and you can devote more resources to maintaining the states on the client side.

A key optimization available only to the thick client context is **live features**. Basically, a live feature is a spatial feature that originates from the MapViewer service but exists in the thick client. Each live feature contains the actual shape representing the geometry data, and a set of nonspatial attributes that the user might be interested in. To obtain live features, a thick client must set its parent theme to be clickable. When a map request is sent to the MapViewer service with a clickable theme, MapViewer does not attempt to render features for that theme in the resulting map. Rather, the set of features that would have been drawn as part of the map is returned to the requesting client as an array of live feature objects. The rest of the map is still rendered and transmitted as a single image to the client. After the client has received both the live features and the base image, it must render the live features on top of the accompanying map image, using one of the methods described later in this section.

One benefit of using live features is that the thick client will not need to issue a request for the clickable theme every time a map request is sent. For example, if the request is to zoom in to the current map, the client can determine for each live feature if it should be displayed in the zoomed-in map image. Another, and probably more significant, advantage is that the nonspatial attributes for all features displayed in the map are now readily available to the user. For example, as the user moves the mouse over a range of features on the map, the thick client can immediately get the corresponding nonspatial attributes and display them in a pop-up window that follows the mouse trail. No round-trip to the MapViewer service is needed for this type of action, and the feedback to the user is more responsive.

The methods that are optimal for thick clients include the following:

- `drawLiveFeatures(java.awt.Graphics2D g2, java.awt.Color stroke, java.awt.Color fill, double pointRadius, double strokeWidth)` draws all live features that are returned to this client from MapViewer.
- `getLiveFeatureAttrs(int x, int y, int tol)` gets the nonspatial attributes of the feature being clicked on by the user.
- `getNumLiveFeatures` returns the number of live features currently available.
- `hasLiveFeatures` checks if there are any live (clickable) features.
- `highlightFeatures` and variants highlight all live features that are intersecting the user-specified rectangle. These methods also let you specify the style for highlighting features.

- `isClickable(java.lang.String themeName)` checks if the specified theme is clickable (that is, if users can click on the theme to get its attributes).
- `setClickable(boolean v, java.lang.String themeName)` sets the theme clickable (so that its features will be available to the client as live features that users can click on and get attributes of).

To obtain a set of features and keep them live at the thick client, you must first call `setClickable` to set the theme whose features you want to be live. Then, after you issue the current map request, the bean processes the response from the MapViewer service, which (if it succeeded) contains both a base map image and an array of `LiveFeature` instances. You can then call `getGeneratedMapImage` to get and draw the base image, and use `drawLiveFeatures` to render the set of live features on top of the base map. If the user clicks or moves the mouse over a certain position on the map, you can use the `highlightFeatures` method to highlight the touched features on the map. You can also use the `getLiveFeatureAttrs` method to obtain the associated nonspatial attributes of the features being highlighted. You do not have direct access to the `LiveFeature` instances themselves.

The behavior of calling the methods described in this section in the context of JSP pages is not defined.

MapViewer XML Requests: Administrative and Other

The main use of MapViewer is for processing various map requests. However, MapViewer also accepts through its XML API various administrative (non-map) requests, such as to add a data source, as well as other (general-purpose) requests useful in developing applications, such as to list available themes, base maps, and tile layers. All MapViewer administrative requests require that you log in to the MapViewer administration (Admin) page, for which there is a link on the main MapViewer page; the general-purpose requests can be made from an application without the requirement to log in. This section describes the format for each request and its response.

All XML requests are embedded in either a <non_map_request> or <map_cache_admin_request> element, and all responses are embedded in a <non_map_response> or <map_cache_admin_response> element, respectively. However, for all requests an exception may occur, in which case the response is an <oms_error> or an <mcs_error> element (described in [Section 3.1.5](#)).

The administrative requests are described in sections according to the kinds of tasks they perform:

- [Managing Data Sources](#)
- [Managing Tile Layers](#)
- [Listing All Maps \(General-Purpose\)](#)
- [Listing Themes \(General-Purpose\)](#)
- [Listing Styles \(General-Purpose\)](#)
- [Listing Styles Used by a Predefined Theme \(General-Purpose\)](#)
- [Getting Style Definitions \(General-Purpose\)](#)
- [Managing In-Memory Caches](#)
- [Editing the MapViewer Configuration File \(Administrative\)](#)
- [Restarting the MapViewer Server \(Administrative\)](#)

The section titles often indicate whether a request is administrative or general-purpose.

5.1 Managing Data Sources

You can add, remove, redefine, and list data sources. (For information about data sources and how to define them, see [Section 1.6.2.15](#).)

5.1.1 Adding a Data Source (Administrative)

Note: This request is typically used during development or testing, when you want to add a data source quickly and dynamically without creating a permanent one (which would involve editing the `mapViewerConfig.xml` file). For production use, or to take full advantage of what MapViewer provides with a data source, you should always use a permanent data source.

The `<add_data_source>` element has the following definition:

```
<!ELEMENT non_map_request  add_data_source>
<!ELEMENT add_data_source  EMPTY>
<!ATTLIST add_data_source
  name          CDATA #REQUIRED
  container_ds  CDATA #IMPLIED
  jdbc_tns_name CDATA #IMPLIED
  jdbc_host     CDATA #IMPLIED
  jdbc_port     CDATA #IMPLIED
  jdbc_sid      CDATA #IMPLIED
  jdbc_user     CDATA #IMPLIED
  jdbc_password CDATA #IMPLIED
  jdbc_mode     (oci8 | thin) #IMPLIED
  number_of_mappers INTEGER #REQUIRED
  >
```

The `name` attribute identifies the data source name. The name must be unique among MapViewer data sources. (Data source names are not case-sensitive.)

You must specify a container data source name, a net service name (TNS name), or all necessary connection information. That is, you must specify only one of the following:

- `container_ds`
- `jdbc_tns_name`
- `jdbc_host`, `jdbc_port`, `jdbc_sid`, `jdbc_mode`, `jdbc_user`, and `jdbc_password`

The `container_ds` attribute identifies a data source name that is defined in the Java EE container's Java Naming and Directory Interface (JNDI) namespace.

The `jdbc_tns_name` attribute identifies a net service name that is defined in the `tnsnames.ora` file.

The `jdbc_host` attribute identifies the database host system name.

The `jdbc_port` attribute identifies the TNS listener port number.

The `jdbc_sid` attribute identifies the SID for the database.

The `jdbc_user` attribute identifies the user to connect to (`map`).

The `jdbc_password` attribute identifies the password for the user specified with the `jdbc_user` attribute. MapViewer does not change this password string in any way; no conversion to upper or lower case is performed. If the database uses case-sensitive passwords, the specified password must exactly match the password in the database.

The `jdbc_mode` attribute identifies the JDBC connection mode: `thin` or `oci8`. If you specify `oci8`, you must have Oracle Client installed in the middle tier in which MapViewer is running. You do not need Oracle Client if `thin` is used for all of your data sources.

The `number_of_mappers` attribute identifies the number of map renderers to be created (that is, the number of requests that MapViewer can process at the same time) for this data source. Any unprocessed map requests are queued and eventually processed. For example, if the value is 3, MapViewer will be able to process at most three mapping requests concurrently. If a fourth map request comes while three requests are being processed, it will wait until MapViewer has finished processing one of the current requests. The maximum number of mappers for a single data source is 64.

Example 5–1 adds a data source named `mvdemo` by specifying all necessary connection information.

Example 5–1 Adding a Data Source by Specifying Detailed Connection Information

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
  <add_data_source
    name="mvdemo"
    jdbc_host="elocation.example.com"
    jdbc_port="1521"
    jdbc_sid="orcl"
    jdbc_user="scott"
    jdbc_password="password"
    jdbc_mode="thin"
    number_of_mappers="5"/>
</non_map_request>
```

Example 5–2 adds a data source named `mvdemo` by specifying the container data source name.

Example 5–2 Adding a Data Source by Specifying the Container Data Source

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
  <add_data_source
    name="mvdemo"
    container_ds="jdbc/OracleDS"
    number_of_mappers="5"/>
</non_map_request>
```

The DTD for the response to an `add_data_source` request has the following format:

```
<!ELEMENT non_map_response add_data_source>
<!ELEMENT add_data_source EMPTY>
<!ATTLIST add_data_source
  succeed  (true | false) #REQUIRED
  comment  CDATA #IMPLIED
>
```

The `comment` attribute appears only if the request did not succeed, in which case the reason is in the `comment` attribute. In the following example, `succeed="true"` indicates that the user request has reached the server and been processed without any exception being raised regarding its validity. It does not indicate whether the user's intended action in the request was actually fulfilled by the MapViewer server. In this example, the appearance of the `comment` attribute indicates that the request failed, and the string associated with the `comment` attribute gives the reason for the failure ("data source already exists").

```
<?xml version="1.0" ?>
<non_map_response>
  <add_data_source succeed="true" comment="data source already exists"/>
```

```
</non_map_response>
```

5.1.2 Removing a Data Source (Administrative)

The `<remove_data_source>` element can be used to remove a permanent data source or a dynamically added data source. This element has the following definition:

```
<!ELEMENT non_map_request remove_data_source>
<!ELEMENT remove_data_source EMPTY>
<!ATTLIST remove_data_source
      data_source   CDATA #REQUIRED
      jdbc_password CDATA #REQUIRED
    >
```

The `data_source` attribute identifies the name of the data source to be removed.

The `jdbc_password` attribute identifies the login password for the database user in the data source. `jdbc_password` is required for security reasons (to prevent people from accidentally removing data sources from MapViewer).

Removing a data source only affects the ability of MapViewer to use the corresponding database schema; nothing in that schema is actually removed.

[Example 5–3](#) removes a data source named `mvdemo`.

Example 5–3 Removing a Data Source

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
  <remove_data_source data_source="mvdemo" jdbc_password="password" />
</non_map_request>
```

The DTD for the response to a `remove_data_source` request has the following format:

```
<!ELEMENT non_map_response remove_data_source>
<!ELEMENT remove_data_source EMPTY>
<!ATTLIST remove_data_source
      succeed  (true | false) #REQUIRED
    >
```

For example:

```
<?xml version="1.0" ?>
<non_map_response>
  <remove_data_source succeed="true" />
</non_map_response>
```

5.1.3 Redefining a Data Source

Note: You should use `request` only during development or testing, and not for production work.

For convenience, MapViewer lets you redefine a data source. Specifically, if a data source with the same name already exists, it is removed and then added using the new definition. If no data source with the name exists, a new data source is added. If an existing data source has the same name, host, port, SID, user name, password, mode, and number of mappers as specified in the request, the request is ignored.

The `<redefine_data_source>` element has the following definition:

```

<!ELEMENT non_map_request redefine_data_source>
<!ELEMENT redefine_data_source EMPTY>
<!ATTLIST redefine_data_source
      name          CDATA #REQUIRED
      container_ds  CDATA #IMPLIED
      jdbc_tns_name CDATA #IMPLIED
      jdbc_host     CDATA #IMPLIED
      jdbc_port     CDATA #IMPLIED
      jdbc_sid      CDATA #IMPLIED
      jdbc_user     CDATA #IMPLIED
      jdbc_password CDATA #IMPLIED
      jdbc_mode     (oci8 | thin) #IMPLIED
      number_of_mappers INTEGER #REQUIRED
    >

```

The attributes and their explanations are the same as for the `<add_data_source>` element, which is described in [Section 5.1.1](#).

The DTD for the response to a `redefine_data_source` request has the following format:

```

<!ELEMENT non_map_response redefine_data_source>
<!ELEMENT redefine_data_source EMPTY>
<!ATTLIST redefine_data_source
      succeed  (true | false) #REQUIRED
    >

```

For example:

```

<?xml version="1.0" ?>
<non_map_response>
  <redefine_data_source succeed="true" />
</non_map_response>

```

5.1.4 Listing All Data Sources (Administrative or General-Purpose)

The `<list_data_sources>` element lists all data sources known to the currently running MapViewer. It has the following definition:

```

<!ELEMENT non_map_request list_data_sources>
<!ELEMENT list_data_sources EMPTY>

```

For example:

```

<?xml version="1.0" standalone="yes" ?>
<non_map_request>
  <list_data_sources/>
</non_map_request>

```

The DTD for the response to a `list_data_sources` request has the following format:

```

<!ELEMENT non_map_response map_data_source_list>
<!ELEMENT map_data_source_list (map_data_source*) >
<!ATTLIST map_data_source_list
      succeed  (true|false) #REQUIRED
    >
<!ELEMENT map_data_source EMPTY>
<!ATTLIST map_data_source
      name          CDATA #REQUIRED
      container_ds  CDATA #IMPLIED
      host         CDATA #IMPLIED
      sid          CDATA #IMPLIED
    >

```

```
port      CDATA #IMPLIED
user      CDATA #IMPLIED
mode      CDATA #IMPLIED
numMappers CDATA #REQUIRED
>
```

For each data source:

- If the user issuing the request is logged in as a MapViewer administrator, all data source information except the password for the database user is returned.
- If the user issuing the request is *not* logged in as a MapViewer administrator, only the data source name is returned.

The following example is a response that includes information about two data sources when the request is issued by a MapViewer administrator.

```
<?xml version="1.0" ?>
<non_map_response>
<map_data_source_list succeed="true">
    <map_data_source name="mvdemo" host="elocation.example.com"
                      sid="orcl" port="1521" user="scott" mode="thin" numMappers="3"/>
    <map_data_source name="geomedia" host="geomedia.example.com"
                      sid="orcl" port="8160" user="scott" mode="oci8" numMappers="7"/>
</map_data_source_list>
</non_map_response>
```

The following example is a response when the same request is issued by a user that is *not* a MapViewer administrator.

```
<?xml version="1.0" ?>
<non_map_response>
<map_data_source_list succeed="true">
    <map_data_source name="mvdemo"/>
    <map_data_source name="geomedia"/>
</map_data_source_list>
</non_map_response>
```

5.1.5 Checking the Existence of a Data Source (General-Purpose)

The `<data_source_exists>` element lets you find out if a specified data source exists. It has the following definition:

```
<!ELEMENT non_map_request data_source_exists>
<!ELEMENT data_source_exists EMPTY>
<!ATTLIST data_source_exists
           data_source   CDATA #REQUIRED
           >
```

For example:

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
    <data_source_exists data_source="mvdemo" />
</non_map_request>
```

The DTD for the response to a `data_source_exists` request has the following format:

```
<!ELEMENT non_map_response data_source_exists>
<!ELEMENT data_source_exists EMPTY>
<!ATTLIST data_source_exists
           succeed   (true | false) #REQUIRED
```

```

exists      (true | false) #REQUIRED
>

```

The `succeed` attribute indicates whether or not the request was processed successfully.

The `exists` attribute indicates whether or not the data source exists.

For example:

```

<?xml version="1.0" ?>
<non_map_response>
  <data_source_exists succeed="true" exists="true"/>
</non_map_response>

```

5.2 Managing Tile Layers

All tile layer administration requests are embedded in a `<map_cache_admin_request>` element. Their responses are embedded in a `<map_tile_server_response>` element except for `<get_client_config>`, where the format for the response document can vary. When an error occurs, the response returns an `<mcs_error>` element containing corresponding error messages.

Two tile layer administration requests, `<get_client_config>` and `<get_cache_status>`, can also be sent in a non-administrative mode, in which cases you do not need to log in to the administration console.

Tile layer management tasks include the following:

- [Getting Client Side Configuration](#)
- [Getting Cache Status](#)
- [Clearing, Prefetching, or Refreshing Cache](#)
- [Exporting Tile Cache](#)
- [Stopping, Resuming, or Removing an Existing Cache Administrative Task](#)
- [Getting the Status of an Administrative Request](#)
- [Creating or Redefining a Cache Instance](#)
- [Removing a Cache Instance](#)
- [Restarting the Tile Layer Cache Server](#)
- [Taking a Tile Layer Offline or Bringing It Online](#)

5.2.1 Getting Client Side Configuration

The `<get_client_config>` element returns the configuration of a specified tile layer from the client side. It has the following definition:

```

<!ELEMENT map_cache_admin_request (get_client_config)>
<!ELEMENT get_client_config EMPTY>
<!ATTLIST get_client_config
  map_cache_names   CDATA #REQUIRED
  format           (JSON|XML|OLD_JS) #IMPLIED
>

```

The `map_cache_names` attribute lists the tile layer names for which configurations are requested.

The `format` attribute specifies the document format in the response.

The following example gets the configuration for one tile layer, MVDEMO.DEMO_MAP, in XML format:

```
<?xml version="1.0" standalone="yes"?>
<map_cache_admin_request>
  <get_client_config map_cache_names="MVDEMO.DEMO_MAP" format="XML" />
/>
```

The response may be the following:

```
<map_tile_server_response>
  <map_tile_layer_config>
    <map_tile_layer name="DEMO_MAP" data_source="MVDEMO" format="PNG"
transparent="false">
      <coordinate_system srid="8307" type="GEODETIC" distConvFactor="0.0"
minX="-180.0" minY="-90.0" maxX="180.0" maxY="90.0"/>
      <zoom_levels>
        <zoom_level level="0" name="" scale="1.0E7" tile_width="4.285714285714286"
tile_height="4.285714285714286" tile_image_width="189" tile_image_height="189"/>
      <zoom_level level="1" name="" scale="3000000.0" tile_width="1.0843373493975903"
tile_height="0.9608052463016623" tile_image_width="158" tile_image_height="140"/>
    </zoom_levels>
  </map_tile_layer>
  </map_tile_layer_config>
</map_tile_server_response>
```

The `<get_client_config>` request also works in non-administrative mode, and the request can be sent over an `xml_request` string. For example:

```
http://localhost:7001/mapviewer/mcserver?xml_request=<map_cache_admin_
request><get_client_config map_cache_names="MVDEMO.DEMO_MAP" format="XML" /></map_
cache_admin_request>
```

5.2.2 Getting Cache Status

The `<get_cache_status>` element lists the status of all tile layers on the server. It has the following definition:

```
<!ELEMENT map_cache_admin_request (get_cache_status)>
<!ELEMENT get_cache_status EMPTY>
```

The following example lists the status of all tile layers on the server:

```
<?xml version="1.0" standalone="yes"?>
<map_cache_admin_request>
  <get_cache_status/>
</map_cache_admin_request>
```

The DTD for the response to a `get_cache_status` request has the following format:

```
<!ELEMENT map_tile_server_response (tile_server_status)>
<!ELEMENT tile_server_status (cache_instance*)>
<!ELEMENT cache_instance EMPTY>
<!ATTLIST cache_instance
  data_source   CDATA #REQUIRED
  name         CDATA #REQUIRED
  type         (internal|external) #REQUIRED
  base_map     CDATA #REQUIRED
  zoom_levels  PCDATA #REQUIRED
  status       (ready|not ready) #REQUIRED
  online       (true|false) #REQUIRED
  >
```

- The name attribute identifies the name of the tile layer in that data source.
- The type attribute indicates if the map source is an internal or an external map source.
- The zoom_levels attribute indicates the total zoom levels in this tile layer.
- The base_map attribute specifies the base map name used by this tile layer for generating map tiles, if the type is an internal map source.
- The status attribute indicates if the tile layer is ready or not ready.
- The online attribute indicates if the tile layer is online (true) or offline (false).

The following is an example of a get_cache_status response:

```
<map_tile_server_response>
  <tile_server_status>
    <cache_instance data_source="MVDEMO_PC" name="DEMO_MAP" type="internal" base_
map="DEMO_MAP" zoom_levels="10" status="ready" online="true"/>
    <cache_instance data_source="MVDEMO" name="WMTS" type="internal" base_
map="WMTS" zoom_levels="15" status="ready" online="true"/>
  </tile_server_status>
</map_tile_server_response>
```

The <get_cache_status> request also works in non-administrative mode, and the request can be sent over an xml_request string. For example:

```
http://localhost:7001/mapviewer/mcserver?xml_request=<map_cache_admin_
request><get_cache_status /></map_cache_admin_request>
```

5.2.3 Clearing, Prefetching, or Refreshing Cache

The <tile_admin_task> element can be used to request the server to clear the cached tiles, fetch tiles for caching, or refresh tiles (that is, delete any existing tiles and then fetch tiles). For these purposes, it has the following definition:

```
<!ELEMENT map_cache_admin_request (tile_admin_task)>
<!ELEMENT tile_admin_task (schedule?)>
<!ELEMENT schedule EMPTY>
<!ATTLIST tile_admin_task
  operation (clear_tiles|fetch_tiles|refresh_tiles) #REQUIRED
  map_tile_layer CDATA #REQUIRED
  zoom_levels PCDATA #REQUIRED
  bounding_box PCDATA #REQUIRED
>
<!ATTLIST schedule
  start_time PCDATA #REQUIRED
  repeat_interval PCDATA #IMPLIED
  duration PCDATA #IMPLIED
>
```

The operation attribute identifies the operation to be performed: clear_tiles, fetch_tiles, or refresh_tiles.

The map_tile_layer attribute indicates the tile layer name. It takes the data source name as its prefix, followed by a period (.) and then the tile layer name. For example: mvdemo.demo_map

The zoom_levels attribute specifies a list of zoom levels for which to perform the operation.

The `bounding_box` attribute defines a rectangular region within which to perform the operation.

The `start_time` attribute indicates when the scheduled task will start.

The `repeat_interval` attribute indicates how often, in minutes, this operation will be performed. A value of 0 (zero) indicates that it is a one-time operation.

The `duration` attribute indicates how long, in minutes, an operation will last. If this attribute is empty or not specified, the task will take as long as it needs to finish.

The following example sends a `fetch_tiles` request:

```
<?xml version="1.0" standalone="yes"?>
<map_cache_admin_request>
  <tile_admin_task
    operation="fetch_tiles"
    map_tile_layer="mvdemo.demo_map"
    zoom_levels="7,8"
    bounding_box="-71.6,42.35,-71.58,42.37">
    <schedule start_time="2013-03-20 9:00:00" repeat_interval="0" duration="" />
  </tile_admin_task>
</map_cache_admin_request>
```

The DTD for the `fetch_tiles` response is as follows:

```
<!ELEMENT map_tile_server_response (request_status, request_id, estimates)>
<!ELEMENT request_status (#CDATA)>
<!ELEMENT request_id (#CDATA)>
<!ELEMENT estimates EMPTY>
<!ATTLIST estimates
  tile_remaining      CDATA #REQUIRED
  time_remaining      CDATA #REQUIRED
  disk_space_required CDATA #REQUIRED
>
```

The `tile_remaining` attribute indicates the number of tiles remaining to be fetched.

The `time_remaining` attribute indicates the estimated time, in seconds, needed to fetch the remaining tiles.

The `disk_space_required` attribute indicates the estimated storage space, in bytes, for the remaining tiles.

For example:

```
<map_tile_server_response>
  <request_status>Submitted</request_status>
  <request_id>62</request_id>
  <estimates tile_remaining="144" time_remaining="288" disk_space_
required="990576"/>
</map_tile_server_response>
```

5.2.4 Exporting Tile Cache

The `<tile_admin_task>` element can be used to request the server to generate a zip file containing map tiles for you to download. Its request definition is similar to a clearing, prefetching, or refreshing request (explained in [Section 5.2.3](#)), except that the `operation` attribute should set to `export_tiles`.

The following example sends a `export_tiles` request:

```
<?xml version="1.0" standalone="yes"?>
<map_cache_admin_request>
```

```

<tile_admin_task
    operation=" export_tiles "
    map_tile_layer="mvdemo.demo_map"
    zoom_levels="5,6,7,8,9,10,11,12,14,14,15"
    bounding_box="-71.6,42.35,-71.58,42.37">
</tile_admin_task>
</map_cache_admin_request>

```

The response includes the URL for downloading the zip file. The zip file includes the map tiles that are kept in the same tree structure as in the server's map tile cache for that tile layer.

The DTD for the `export_tiles` response is similar to that in [Section 5.2.3, "Clearing, Prefetching, or Refreshing Cache"](#), except that it has one additional child element: `<zipped_cache_url>`. The value of this element is the URL string for downloading the zip file.

For example, the response to the preceding request is:

```

<map_tile_server_response>
    <request_status>Submitted</request_status>
    <request_id>0</request_id>
    <zipped_cache_url>
        http://localhost:8088/mapviewer/images/zipcache/MVDEMO.DEMO_MAP_tozip1_6.zip
    </zipped_cache_url>
    <estimates tile_remaining="50" time_remaining="100" disk_space_
        required="238250"/>
</map_tile_server_response>
<map_tile_server_response>

```

5.2.5 Stopping, Resuming, or Removing an Existing Cache Administrative Task

The `<tile_admin_task>` element can be used to request the server to stop, resume, or remove tasks. For these purposes, it has the following definition:

```

<!ELEMENT map_cache_admin_request (tile_admin_task)>
<!ELEMENT tile_admin_task EMPTY>
<!ATTLIST tile_admin_task
    operations   (stop_task|resume_task|remove_task) #REQUIRED
    task_id      PCDATA #REQUIRED
>

```

The `operation` attribute identifies the operation to be performed: `stop_task`, `resume_task`, or `remove_task`.

The `task_id` attribute indicates the task identifier for which to perform the operation.

The following example sends a request to stop a task:

```

<?xml version="1.0" standalone="yes"?>
<map_cache_admin_request>
    <tile_admin_task
        operation="stop_task"
        task_id="12">
    </tile_admin_task>
</map_cache_admin_request>

```

The DTD for the `stop_task` response to a request is as follows:

```

<!ELEMENT map_tile_server_response (#CDATA)>

```

For example:

```
<map_tile_server_response>Succeeded.</map_tile_server_response>
```

5.2.6 Getting the Status of an Administrative Request

The `<get_admin_request_status>` element shows the status of a previously sent administrative request. It has the following definition:

```
<!ELEMENT map_cache_admin_request (get_admin_request_status)>
<!ELEMENT get_admin_request_status EMPTY>
<!ATTLIST get_admin_request_status
      data_source   CDATA #REQUIRED
      map_tile_layer CDATA #REQUIRED
    >
```

The following example gets the administrative request status of a specified tile layer:

```
<?xml version="1.0" standalone="yes"?>
<map_cache_admin_request>
  <get_admin_request_status data_source="mvdemo" map_tile_layer="demo_map" />
</map_cache_admin_request>
```

The DTD for the response to a `get_admin_request_status` request has the following format:

```
<!ELEMENT map_cache_admin_request (tile_admin_task)>
<!ELEMENT tile_admin_task (bound, schedule?, task_progress)>
<!ELEMENT bound (gml:Box)>
<!ELEMENT schedule EMPTY>
<!ELEMENT task_progress (zoom_level+)>
<!ELEMENT zoom_level EMPTY>
<!ATTLIST tile_admin_task
      id          PCDATA #REQUIRED
      type        (CLEAR, PREFETCH, REFRESH) #REQUIRED
      data_source  CDATA #REQUIRED
      map_tile_layer CDATA #REQUIRED
      zoom_levels PCDATA #REQUIRED
    >
<!ATTLIST schedule
      start_time    PCDATA #REQUIRED
      repeat_interval PCDATA #IMPLIED
      duration      PCDATA #IMPLIED
      cron_string   CDATA #IMPLIED
    >
<!ATTLIST zoom_level
      level         PCDATA #REQUIRED
      total_tile_number PCDATA #REQUIRED
      processed_tile_number PCDATA #REQUIRED
      failed_tile_number PCDATA #REQUIRED
      tile_x        PCDATA #REQUIRED
      tile_y        PCDATA #REQUIRED
    >
```

The `level` attribute indicates the current zoom level of this task.

The `total_tile_number` attribute indicates the total number of tiles of this task.

The `processed_tile_number` attribute indicates the already processed number of tiles.

The `failed_tile_number` attribute indicates the number of tiles that have failed in the operation.

The `tile_x` and `tile_y` attributes indicate the last processed tile's coordinates (x, y) in the tile mesh code coordinate system. A value of -1 indicates that the task has not been started.

For example:

```
<tile_admin_task id="67" type="PREFETCH" data_source="MVDEMO" map_tile_layer="DEMO_MAP" zoom_levels="8,9">
  <bound>
    <gml:Box xmlns:gml="http://www.opengis.net/gml" srsName="SDO:8307">
      <gml:coordinates decimal="." cs="," ts=" ">
        -71.60,42.35 -71.58,42.37
      </gml:coordinates>
    </gml:Box>
  </bound>
  <schedule repeat_interval="0" duration="0" start_time="2015-03-20 09:00:00" cron_string="" />
  <task_progress>
    <zoom_level level="8" total_tile_number="144" processed_tile_number="0" failed_tile_number="0" tile_x="-1" tile_y="-1" />
    <zoom_level level="9" total_tile_number="1122" processed_tile_number="0" failed_tile_number="0" tile_x="-1" tile_y="-1" />
  </task_progress>
</tile_admin_task>
```

5.2.7 Creating or Redefining a Cache Instance

The `<tile_admin_task>` element can be used to request the tile layer server to create or redefine a cache instance. For these purposes it has the following definition:

```
<!ELEMENT map_cache_admin_request (create_cache_instance, redefine_cache_instance)>
<!ELEMENT create_cache_instance (cache_instance)>
<!ELEMENT redefine_cache_instance (cache_instance)>
<!ELEMENT cache_instance (internal_map, cache_storage?|tile_storage?, coordinate_system, tile_image, zoom_levels)>
<!ELEMENT internal_map_source EMPTY>
<!ELEMENT cache_storage EMPTY>
<!ELEMENT coordinate_system EMPTY>
<!ELEMENT tile_image EMPTY>
<!ELEMENT zoom_levels EMPTY>
<!ATTLIST create_cache_instance
  data_source CDATA #REQUIRED
>
<!ATTLIST cache_instance
  name CDATA #REQUIRED
  image_format (PNG|GIF|JPG) "PNG"
>
<!ATTLIST internal_map_source
  base_map CDATA #REQUIRED
>
<!ATTLIST cache_storage
  root_path CDATA #IMPLIED
>
<!ATTLIST coordinate_system
  srid PCDATA #REQUIRED
  minX PCDATA #REQUIRED
  maxX PCDATA #REQUIRED
  minY PCDATA #REQUIRED
  maxY PCDATA #REQUIRED
>
```

```

<!ATTLIST tile_image
    width   PCDATA #REQUIRED
    height  PCDATA #REQUIRED
  >
<!ATTLIST zoom_levels
    levels   PCDATA #REQUIRED
    min_scale PCDATA #REQUIRED
    max_scale PCDATA #REQUIRED
  >

```

The `srid` attribute specifies the projection (coordinate system) of this tile layer.

The `minX`, `maxX`, `minY`, and `maxY` attributes specify the data bounds of this tile layer in the specified projection.

The `width` and `height` attributes specify the tile image width and height.

The `levels` attribute specifies the number of zoom levels of this tile layer.

The `min_scale` and `max_scale` attributes specify the smallest and largest values of the scale denominators. Zoom 0 is always assigned with the largest scale denominator, thus, a tile covers a larger geographic region with coarse map details.

5.2.8 Removing a Cache Instance

The `<remove_cache_instance>` element removes a tile layer instance from the server. It has the following definition:

```

<!ELEMENT map_cache_admin_request (remove_cache_instance)>
<!ELEMENT remove_cache_instance EMPTY>
<!ATTLIST remove_cache_instance
    map_cache_name   CDATA #REQUIRED
    clean_disk       (true|false) "false"
    remove_permanently (true|false) "false"
  >

```

The `clean_disk` attribute indicates if the already cached tiles are to be deleted.

The `remove_permanently` attribute indicates if tile layer is to be deleted from the `USER_SDO_CACHED_MAPS` view.

The following example removes a tile layer instance from the server.

```

<?xml version="1.0" standalone="yes"?>
<map_cache_admin_request>
  <remove_cache_instance
    map_cache_name="mvdemo.demo_map"
    clean_disk="true" remove_permanently="false"/>

```

The DTD for the `remove_cache_instance` response is as follows:

```
<!ELEMENT map_tile_server_response (#CDATA)>
```

For example:

```
<map_tile_server_response>Succeeded.</map_tile_server_response>
```

5.2.9 Restarting the Tile Layer Cache Server

The `<restart_cache_server>` element restarts the tile layer server. It has the following definition:

```
<!ELEMENT map_cache_admin_request (restart_cache_server)>
```

```
<!ELEMENT restart_cache_server EMPTY>
```

The following example restarts the server:

```
<?xml version="1.0" standalone="yes"?>
<map_cache_admin_request>
    <restart_cache_server />
</map_cache_admin_request>
```

5.2.10 Taking a Tile Layer Offline or Bringing It Online

The `<take_cache_offline>` element takes a tile layer instance offline from the server, and the `<bring_cache_online>` element brings an offline tile layer instance back online. The following is the DTD definition:

```
<!ELEMENT map_cache_admin_request (take_cache_offline, bring_cache_online)>
<!ELEMENT take_cache_offline EMPTY>
<!ATTLIST take_cache_offline
    map_cache_name CDATA #REQUIRED
>
<!ATTLIST bring_cache_online
    map_cache_name CDATA #REQUIRED
>
```

The following example takes a tile layer instance offline:

```
<?xml version="1.0" standalone="yes"?>
<map_cache_admin_request>
    <take_cache_offline map_cache_name="mvdemo.demo_map" />
</map_cache_admin_request>
```

5.3 Listing All Maps (General-Purpose)

The `<list_maps>` element lists all base maps in a specified data source. It has the following definition:

```
<!ELEMENT non_map_request list_maps>
<!ELEMENT list_maps EMPTY>
<!ATTLIST list_maps
    data_source CDATA #REQUIRED
>
```

The following example lists all base maps in the data source named mvdemo.

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
    <list_maps data_source="mvdemo" />
</non_map_request>
```

The DTD for the response to a `list_maps` request has the following format:

```
<!ELEMENT non_map_response map_list>
<!ELEMENT map_list (map*) >
<!ATTLIST map_list
    succeed (true | false) #REQUIRED
>
<!ATTLIST map
    name CDATA #REQUIRED
>
```

The `succeed` attribute indicates whether or not the request was processed successfully.

The name attribute identifies each map.

For example:

```
<?xml version="1.0" ?>
<non_map_response>
<map_list succeed="true">
  <map name="DEMO_MAP"/>
  <map name="DENSITY_MAP"/>
</map_list>
</non_map_response>
```

5.4 Listing Themes (General-Purpose)

The `<list_predefined_themes>` element lists either all themes defined in a specified data source or all themes defined in a specified data source for a specified map.

The DTD for requesting all themes defined in a data source regardless of the map associated with a theme has the following definition:

```
<!ELEMENT non_map_request list_predefined_themes>
<!ELEMENT list_predefined_themes EMPTY>
<!ATTLIST list_predefined_themes
  data_source CDATA #REQUIRED
>
```

The following example lists all themes defined in the data source named `mvdemo`.

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
  <list_predefined_themes data_source="mvdemo" />
</non_map_request>
```

The DTD for requesting all themes defined in a data source and associated with a specific map has the following definition:

```
<!ELEMENT non_map_request list_predefined_themes>
<!ELEMENT list_predefined_themes EMPTY>
<!ATTLIST list_predefined_themes
  data_source CDATA #REQUIRED
  map          CDATA #REQUIRED
>
```

The following example lists all themes defined in the data source named `tilsmenv` and associated with the map named `QA_MAP`.

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
  <list_predefined_themes data_source="tilsmenv" map="QA_MAP" />
</non_map_request>
```

The DTD for the response to a `list_predefined_themes` request has the following format:

```
<!ELEMENT non_map_response predefined_theme_list>
<!ELEMENT predefined_theme_list (predefined_theme*) >
<!ATTLIST predefined_theme_list
  succeed  (true | false) #REQUIRED
>
<!ELEMENT predefined_theme EMPTY>
<!ATTLIST predefined_theme
  name    CDATA #REQUIRED
```

>

The `succeed` attribute indicates whether or not the request was processed successfully.

The `name` attribute identifies each theme.

For example:

```
<?xml version="1.0" ?>
<non_map_response>
<predefined_theme_list succeed="true">
    <predefined_theme name="THEME_DEMO_CITIES"/>
    <predefined_theme name="THEME_DEMO_BIGCITIES"/>
    <predefined_theme name="THEME_DEMO_COUNTIES"/>
    <predefined_theme name="THEME_DEMO_COUNTY_POPDENSITY"/>
    <predefined_theme name="THEME_DEMO_HIGHWAYS"/>
    <predefined_theme name="THEME_DEMO_STATES"/>
    <predefined_theme name="THEME_DEMO_STATES_LINE"/>
</predefined_theme_list>
</non_map_response>
```

Note that the order of names in the returned list is unpredictable.

5.5 Listing Styles (General-Purpose)

The `<list_styles>` element lists styles defined for a specified data source. It has the following definition:

```
<!ELEMENT non_map_request list_styles>
<!ELEMENT list_styles EMPTY>
<!ATTLIST list_styles
    data_source   CDATA #REQUIRED
    style_type   (COLOR|LINE|MARKER|AREA|TEXT|ADVANCED) #IMPLIED
    >
```

If you specify a value for `style_type`, only styles of that type are listed. The possible types of styles are COLOR, LINE, MARKER, AREA, TEXT, and ADVANCED. If you do not specify `style_type`, all styles of all types are listed.

The following example lists only styles of type COLOR:

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
    <list_styles data_source="mvdemo" style_type="COLOR"/>
</non_map_request>
```

The DTD for the response to a `list_styles` request has the following format:

```
<!ELEMENT non_map_response style_list>
<!ELEMENT style_list (style*) >
<!ATTLIST style_list
    succeed   (true | false) #REQUIRED
    >
<!ELEMENT style EMPTY>
<!ATTLIST style
    name     CDATA #REQUIRED
    >
```

The following example shows the response to a request for styles of type COLOR:

```
<?xml version="1.0" ?>
<non_map_response>
```

```

<style_list succeed="true">
  <style name="SCOTT:C.BLACK"/>
  <style name="SCOTT:C.BLACK GRAY"/>
  <style name="SCOTT:C.BLUE"/>
  <style name="SCOTT:C.CRM_ADMIN AREAS"/>
  <style name="SCOTT:C.CRM_AIRPORTS"/>
</style_list>
</non_map_response>

```

Each style name in the response has the form *OWNER:NAME* (for example, SCOTT:C.BLACK), where *OWNER* is the schema user that owns the style.

5.6 Listing Styles Used by a Predefined Theme (General-Purpose)

The `<list_theme_styles>` element lists all the rendering styles that are referenced in a predefined theme. This is particularly useful if you want to build a legend for a theme yourself, where you need to know which styles are actually being used in that theme. This element has the following definition:

```

<!ELEMENT non_map_request list_theme_styles>
<!ELEMENT list_theme_styles EMPTY>
<!ATTLIST list_styles
  data_source CDATA #REQUIRED
  theme CDATA #REQUIRED
>

```

The following example requests the styles used by the THEME_DEMO_STATES predefined theme:

```

<non_map_request>
  <list_theme_styles data_source="mvdemo" theme="THEME_DEMO_STATES" />
</non_map_request>

```

The following example shows the response to the preceding request:

```

<non_map_response>
  <theme_style name="C.US MAP YELLOW" type="COLOR" render="true" label="false"
    highlight="false" description="Primary color for US maps."/>
  <theme_style name="T.STATE NAME" type="TEXT" render="false" label="true"
    highlight="false" description="name for states"/>
</non_map_response>

```

The DTD for the response to a `list_theme_styles` request has the following format:

```

<!ELEMENT non_map_response (theme_style*)>
<!ELEMENT theme_style EMPTY>
<!ATTLIST theme_style
  name CDATA #REQUIRED
  type CDATA (COLOR|LINE|MARKER|AREA|TEXT|ADVANCED) #REQUIRED
  render CDATA (true|false) #REQUIRED
  label CDATA (true|false) #REQUIRED
  highlight CDATA (true|false) #REQUIRED
  description CDATA #IMPLIED
>

```

In the preceding DTD:

- The `name` attribute identifies the name of the style.
- The `type` attribute identifies the MapViewer style type.

- The render attribute indicates whether or not the style is used as a rendering style by the theme.
- The label attribute indicates whether or not the style is used as a labeling style.
- The highlight attribute indicates whether or not the style is used as only a highlight style.
- The description attribute identifies the description as specified in the style definition.

5.7 Getting Style Definitions (General-Purpose)

The `<get_style_definition>` element returns the definition of a style in a data source. This element has the following definition:

```
<!ELEMENT non_map_request get_style_definition>
<!ELEMENT get_style_definition EMPTY>
<!ATTLIST get_style_definition
  data_source   CDATA #REQUIRED
  style        CDATA #REQUIRED
  >
```

The following example gets the definition of the M.AIRPORT style in the mvdemo data source:

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
  <get_style_definition data_source="mvdemo" style="M.AIRPORT"/>
</non_map_request>
```

The following example shows the response to the preceding request:

```
<non_map_response>
<style name="M.AIRPORT">
  <svg width="1in" height="1in">
    <desc/>

  <g class="marker" style="width:23;height:15;font-family:Dialog;font-size:12;font-f
  ill:#FFFFFF">
    <image x="0" y="0" width="1" height="1" markerType="gif" href="dummy.gif"/>
  </g>
  </svg>
</style>
</non_map_response>
```

5.8 Managing In-Memory Caches

MapViewer uses two types of in-memory cache:

- Metadata cache for mapping metadata, such as style, theme, and base map definitions, and the SRID value for SDO_GEOOMETRY columns in tables in the cache
- Spatial data cache for predefined themes (the geometric and image data used in generating maps)

The use of these caches improves performance by preventing MapViewer from accessing the database for the cached information; however, the MapViewer displays might reflect outdated information if that information has changed in the database since it was placed in the cache.

If you want to use the current information without restarting MapViewer, you can clear (invalidate) the content of either or both of these caches. If a cache is cleared, the next MapViewer request will retrieve the necessary information from the database, and will also store it in the appropriate cache.

5.8.1 Clearing Metadata Cache for a Data Source (Administrative)

As users request maps from a data source, MapViewer caches such mapping metadata as style, theme, and base map definitions for that data source, as well as the SRID value for SDO_Geometry columns in tables (such as when rendering a theme for the first time). This prevents MapViewer from unnecessarily accessing the database to fetch the mapping metadata. However, modifications to the mapping metadata, such as those you make using the Map Builder tool, do not take effect until MapViewer is restarted.

If you want to use the changed definitions without restarting MapViewer, you can request that MapViewer clear (that is, remove from the cache) all cached mapping metadata and cached table SRID values for a specified data source. Clearing the metadata cache forces MapViewer to access the database for the current mapping metadata.

The `<clear_cache>` element clears the MapViewer metadata cache. It has the following definition:

```
<!ELEMENT non_map_request clear_cache>
<!ELEMENT clear_cache EMPTY>
<!ATTLIST clear_cache
      data_source CDATA #REQUIRED
>
```

The `data_source` attribute specifies the name of the data source whose metadata is to be removed from the MapViewer metadata cache.

The following example clears the metadata for the `mvdemo` data source from the MapViewer metadata cache:

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
  <clear_cache data_source="mvdemo" />
</non_map_request>
```

The DTD for the response to a `clear_cache` request has the following format:

```
<!ELEMENT non_map_response clear_cache>
<!ELEMENT clear_cache EMPTY>
<!ATTLIST clear_cache
      succeed (true | false) #REQUIRED
>
```

For example:

```
<?xml version="1.0" ?>
<non_map_response>
  <clear_cache succeed="true" />
</non_map_response>
```

5.8.2 Clearing Spatial Data Cache for a Theme (Administrative)

MapViewer caches spatial data (geometries or georeferenced images) for a predefined theme as it loads the data from the database into memory for rendering, unless it is told not to do so. (MapViewer does not cache the data for dynamic or JDBC themes.)

Thus, if a predefined theme has been frequently accessed, most of its data is probably in the cache. However, if the spatial data for the theme is modified in the database, the changes will not be visible on maps, because MapViewer is still using copies of the data from the cache. To view the modified theme data without having to restart MapViewer, you must first clear the cached data for that theme.

The `<clear_theme_cache>` element clears the cached data of a predefined theme. It has the following definition:

```
<!ELEMENT non_map_request clear_theme_cache>
<!ELEMENT clear_theme_cache EMPTY>
<!ATTLIST clear_theme_cache
  data_source CDATA #REQUIRED
  theme      CDATA #REQUIRED
  >
```

The `data_source` attribute specifies the name of the data source. The `theme` attribute specifies the name of the predefined theme in that data source.

The following example clears the cached spatial data for the predefined theme named `STATES` in the `mvdemo` data source:

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
  <clear_theme_cache data_source="mvdemo" theme="STATES" />
</non_map_request>
```

The DTD for the response to a `clear_theme_cache` request has the following format:

```
<!ELEMENT non_map_response clear_theme_cache>
<!ELEMENT clear_theme_cache EMPTY>
<!ATTLIST clear_theme_cache
  succeed  (true | false) #REQUIRED
  >
```

For example:

```
<?xml version="1.0" ?>
<non_map_response>
  <clear_theme_cache succeed="true" />
</non_map_response>
```

5.9 Editing the MapViewer Configuration File (Administrative)

The `<edit_config_file>` element lets you edit the MapViewer configuration file (`mapViewerConfig.xml`). It has the following definition:

```
<!ELEMENT non_map_request edit_config_file>
<!ELEMENT edit_config_file EMPTY>
```

Note: Use the `<edit_config_file>` element only if you are running MapViewer in a standalone Java EE container or in a nonclustered WebLogic Server instance with only one process started. Otherwise, the modifications that you make will be applied only to one MapViewer instance, and inconsistencies may occur.

Specify the request as follows:

```
<?xml version="1.0" standalone="yes"?>
<non_map_request>
```

```
<edit_config_file/>
</non_map_request>
```

After you submit the request, you are presented with an HTML form that contains the current contents of the MapViewer configuration file. Edit the form to make changes to the content, and click the **Save** button to commit the changes. However, the changes will not take effect until you restart the MapViewer server (see [Section 5.10](#)).

5.10 Restarting the MapViewer Server (Administrative)

In general, the safest method for restarting the MapViewer server is to restart its container instance. However, if you are running MapViewer in a standalone environment, or if the container instance is not clustered and it has only one Java process started, you can use the `<restart>` element to restart MapViewer quickly without restarting the entire instance. The `<restart>` element has the following definition:

```
<!ELEMENT non_map_request edit_config_file>
<!ELEMENT restart EMPTY>
```

Specify the request as follows:

```
<?xml version="1.0" standalone="yes">
<non_map_request>
    <restart/>
</non_map_request>
```

6

Oracle Maps

Oracle Maps is the name for a suite of technologies for developing high-performance interactive web-based mapping applications. Oracle Maps is included with MapViewer.

This chapter contains the following major sections:

- [Section 6.1, "Feature of Interest \(FOI\) Server"](#)
- [Section 6.2, "Oracle Maps JavaScript API"](#)
- [Section 6.3, "Developing Oracle Maps Applications"](#)
- [Section 6.4, "Using Google Maps and Bing Maps"](#)
- [Section 6.5, "Transforming Data to a Spherical Mercator Coordinate System"](#)
- [Section 6.6, "Dynamically Displaying an External Tile Layer"](#)

6.1 Feature of Interest (FOI) Server

A feature of interest (FOI) is a business entity or geographical feature that can be manipulated or interacted with by a JavaScript map client running in the web browser. FOI data is dynamically displayed and is not part of the map tile layer. FOIs can be any spatial geometry type, such as points, line strings, and polygons. The ability to search, browse, inspect, and interact with FOIs is essential for location-based services.

The FOI server is a Java servlet running inside MapViewer. It responds to FOI requests from a JavaScript map client by querying the database, rendering FOI images, and sending the FOI images along with FOI attribute data to the client. The JavaScript map client displays the FOI images to the end user and provides interaction with the images.

The FOI server accepts the following types of FOI requests: theme-based and user-defined. Each type of FOI request returns a data layer appropriate for the request type.

Related subtopics:

- [Section 6.1.1, "Theme-Based FOI Layers"](#)
- [Section 6.1.2, "User-Defined FOI Requests"](#)

6.1.1 Theme-Based FOI Layers

A theme-based FOI layer is a collection of spatial features that have similar characteristics and that are stored in the database. The client fetches a theme-based FOI layer by sending a theme-based FOI layer request to the FOI server. The result of

this request is a collection of FOI data entries that meets certain query criteria. Each FOI data entry contains the FOI image, as well as FOI attributes that can be used by the JavaScript map client to implement client-side interactivity.

A theme-based FOI layer is based on a predefined MapViewer theme (see [Section 6.1.1.1](#)) or a dynamic JDBC query theme (see [Section 6.1.1.3](#), which defines all information necessary for FOI data rendering. The information includes the table in which the geometry features are stored, the criteria to use during the database query, the attributes that are part of the FOI data, and the style to use when rendering the FOI images. Predefined themes can be defined and configured using the Map Builder tool, which is described in [Chapter 7](#).

Related subtopics:

- [Section 6.1.1.1, "Predefined Theme-Based FOI Layers"](#)
- [Section 6.1.1.2, "Templated Predefined Themes"](#)
- [Section 6.1.1.3, "Dynamic JDBC Query Theme-Based FOI Layers"](#)

6.1.1.1 Predefined Theme-Based FOI Layers

When the client requests FOI data using a predefined theme-based FOI request, it must specify the name of a predefined theme, the scale of the feature images, and the query window used to query the geometry features. The theme name must be defined by the application, while the scale of the feature images and the query window are automatically calculated by the JavaScript map client.

For example, a predefined theme named CUSTOMERS could be defined on a table named CUSTOMERS, which has the following definition:

```
SQL> DESCRIBE CUSTOMERS
      Name          Null?    Type
-----  -----
NAME           VARCHAR2 (64 CHAR)
CITY           VARCHAR2 (64 CHAR)
COUNTY         VARCHAR2 (64 CHAR)
STATE          VARCHAR2 (64 CHAR)
LOCATION        SDO_Geometry
SALES          NUMBER
```

The LOCATION column is the spatial column that is used for rendering the customer markers.

The XML styling rules for the CUSTOMERS theme are shown in [Example 6–1](#).

Example 6–1 XML Styling Rules for Predefined Theme Used for FOI Layer

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <hidden_info>
    <field column="CITY" name="City"/>
    <field column="SALES" name="Sales"/>
  </hidden_info>
  <rule>
    <features style="M.CIRCLE"> </features>
    <label column="NAME" style="T.TEXT"> 1 </label>
  </rule>
</styling_rules>
```

The styling rules in [Example 6–1](#) specify the following. To see how these specifications affect the map display, see [figure moved to another location].

- The marker style M.CIRCLE is used to render the customers.
- The NAME column is used as the labeling attribute (label column="NAME"). The value in the NAME column (the name of the customer) is included in the information window that the JavaScript map client displays when the user moves the mouse over the customer marker.
- The information window also includes the values in columns specified in the <hidden_info> element (CITY and SALES in this example) for that customer. Each <field> element specifies two attributes: column to identify the database column and name to identify a text string to be used in the information window.

6.1.1.2 Templated Predefined Themes

The predefined MapViewer theme can be a standard predefined theme or a templated predefined theme. Both types of predefined themes are defined in the USER_SDO_THEMES view. However, the query conditions of a standard predefined theme are fixed, whereas the query conditions of a templated predefined theme can contain dynamic binding variables whose values can be changed when the theme request is issued.

[Example 6–2](#) shows the XML styling rules for a templated predefined theme that uses two binding variables (with the relevant text shown in bold in the <features> element).

Example 6–2 XML Styling Rules for a Templated Predefined Theme

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <hidden_info>
    <field column="NAME" name="Name"/>
    <field column="CITY" name="City"/>
    <field column="SALES" name="Sales"/>
  </hidden_info>
  <rule>
    <features style="M.CIRCLE">(city=:1 and sales>:2)</features>
    <label column="NAME" style="T.TEXT"> 1 </label>
  </rule>
</styling_rules>
```

In [Example 6–2](#), the binding variable :1 specifies the name of the city in which the qualifying features must be located, and the binding variable :2 specifies the minimum sales volume of the qualifying features. (That is, only customers in a specified city and with sales above a certain minimum will have store markers displayed.) The values of these two binding variables are not fixed when the theme is defined; instead, they are provided in the requests that the client sends to the server.

6.1.1.3 Dynamic JDBC Query Theme-Based FOI Layers

When the client requests FOI data using a dynamic JDBC theme-based FOI request, it must specify the complete definition of the JDBC theme. The theme definition must specify the rendering style and the SQL query that is to be used to query FOI data, including all geometry and non-geometry attributes.

[Example 6–3](#) shows some JavaScript client code to create an FOI layer that displays a buffer around each customer location.

Example 6–3 Theme for Dynamic JDBC Query

```
var theme = '<themes><theme name="JDBC_THEME" >' +
```

```
'<jdbc_query asis="true" spatial_column="location"
    jdbc_srid="8307" render_style="C.RED"
    datasource="mvdemo">' +
'select sdo_geom.sdo_buffer(A.location,1,0.005,' +
'\unit=mile arc_tolerance=0.005') location ' +
' from customers A' +
'</jdbc_query></theme></themes>' ;
buffertheme = new MVThemeBasedFOI('buffertheme',theme);
```

6.1.2 User-Defined FOI Requests

A user-defined FOI is a feature defined on the client side. Unlike the theme-based FOI layer, which is rendered as a collection of features, the user-defined FOI is requested and rendered on an individual basis.

All attributes of the user-defined FOI, including the geometry representation and rendering style, must be provided by the application. The JavaScript map client sends the request, with the geometry representation and rendering style information, to the FOI server. The FOI server renders the FOI image and returns it to the client. The rendering style must be predefined in the USER_SDO_STYLES view.

6.2 Oracle Maps JavaScript API

The Oracle Maps JavaScript client is a browser-based map visualization engine that works on top of the map tile server and the FOI server. It implements the following functions:

- Fetching map tiles from the map tile server and displaying them as a map tile layer in the web browser.
- Sending FOI requests to the FOI server, and overlaying user-defined features and Oracle Spatial and Graph query-based features on top of the map tile layer.
- Controlling user interaction, such as dragging for map navigation, clicking FOIs, drawing rectangles, and redlining.

Drawing a rectangle refers to the application user creating a rectangle by clicking and holding the mouse button at one corner of the rectangle, dragging the mouse to the diagonally opposite corner, and releasing the mouse button.

Redlining refers to the application user creating a polygon or polyline by clicking the mouse button and then moving the mouse and clicking multiple times, with each click extending the redline by a straight line. (Redline drawings are often rendered in red, although you can specify a line style that uses any color.)

To access these functions, use the JavaScript API, which consists of several JavaScript classes. The JavaScript API has two versions:

- Version 1 (V1), the traditional API that is still supported, and described in [Section 6.2.1, "JavaScript API V1"](#)
- Version 2 (V2), a new API introduced in Release 11.1.1.7, and described in [Section 6.2.2, "JavaScript API V2"](#)

For detailed information about all classes in the Oracle Maps JavaScript API (V1 and V2), see the Javadoc-style reference documentation, which is included in the mvdemo.ear file and is available at the following locations:

http://host:port/mvdemo/api/oracle_maps_api.jsp (for V1)

http://host:port/mvdemo/api/oracle_maps_html5_api.jsp (for V2)

Tutorials and demos for both the V1 and V2 APIs are available as a standalone packaged application with the root context path /mvdemo. The tutorials start with the basics (display a map tile layer, add a navigation panel, display interactive features and information windows) and move on to more complex topics such as registering event listeners, programmatically creating and using styles, and spatial filtering.

The tutorials are all based on the MVDEMO sample data set (available from the MapViewer page on the Oracle Technology Network) and assume a data source named mvdemo. The tutorial page has three panels. The left one lists the sample code, or demo, titles. Click on one and a map, or the result of executing that sample code, is displayed in the top right panel. The bottom panel has tabs titled JavaScript and HTML, which respectively show the JavaScript and HTML code fragments for the selected demo.

6.2.1 JavaScript API V1

To access the functions of the Oracle Maps JavaScript client, use the JavaScript API Version 1 (V1), which consists of several JavaScript classes, including the following:

- The `MVMapView` class is the main entry point of the API. It implements most of the map control interfaces.
- The `MVMapTileLayer` class (formerly called the `MVBaseMap` class) defines a map tile layer that displays map tiles rendered by the map tile server.
- The `MVThemeBasedFOI` class defines and controls the theme based FOI layers.
- The `FOI` class defines and controls user-defined FOIs.
- The `MVSdoGeometry` class defines a geometry object. The geometry can be in any geometry type that is supported by Oracle Spatial and Graph.
- The `MVRedLineTool` class defines and controls the redline utility.
- The `MVRectangleTool` class defines and controls the rectangle tool.
- The `MVOversetViewMap` class defines and controls the overview map that displays the miniature overview of the main map as a small rectangle (which is itself inside a rectangle tool).
- The `MVMapView` class defines and controls map decorations.

`MVMapView` is the main entry class for all map operations inside the web browser. `MVMapView` and the other classes provide all essential interfaces for adding logic to your web mapping applications. These logical operations can include the following:

- Create a map client instance and associate it with the map container DIV object created in the web page.
- Configure map parameters such as map center and map zoom level.
- Create and manipulate map tile layers.
- Create and manipulate theme-based FOI layers.
- Create and manipulate user-defined individual FOIs.
- Display an information window on the map.
- Create fixed map decorations, such as a map title, custom copyright notes, and control buttons.
- Access built-in utilities such as the navigation bar, scale bar, rectangle tool, redline tool, and overview map.

- Use event listeners to customize the event handling. You can add event listeners to the `MVMapView`, `MVThemeBasedFOI`, and `MVFOI` classes using the appropriate API methods.

6.2.2 JavaScript API V2

The Oracle Maps JavaScript API Version 2 (V2) takes advantage of the capabilities of modern browsers. Some of its features include:

- Built-in support of various third party map tile services, such as `maps.oracle.com`, Nokia Maps, Bing Maps, OpenStreet Maps, and other mapping service providers
- Rich client side rendering of geospatial data with on-the-fly application of rendering styles and effects such as gradients, animation, and drop-shadows
- Autoclustering of large number of points and client side heat map generation
- Client side feature filtering based on attribute values as well as spatial predicates (query windows)
- A rich set of built-in map controls and tools, including a customizable navigation bar and information windows, configurable layer control, and red-lining and distance measurement tools

The V2 API is *not* backward compatible with the existing Oracle Maps JavaScript V1 API applications. If you want to use V2-specific features with existing V1 applications (that is, applications written with the V1 API using classes such as `MVThemeBasedFOI`), those applications will need to be migrated first.

Note, however, that existing server-side predefined styles and themes will work with the V2 API. For example, the following code snippet creates an interactive vector layer based on a predefined theme `mvdemo.customers`, which has an associated predefined style:

```
var baseURL = "http://" + document.location.host + "/mapviewer";
var layer = new OM.layer.VectorLayer("layer1",
{
    def:{
        type:OM.layer.VectorLayer.TYPE_PREDEFINED,
        dataSource:"mvdemo",
        theme:"customers",
        url: baseURL
    }
});
```

The V2 API has the following top-level classes and subpackages, all of which are in the namespace `OM`:

- The `Map` class is the main class of the API.
- The `Feature` class represents individual geo features (or FOIs as they were known in V1).
- The `MapContext` class a top-level class encapsulating some essential contextual information, such as the current map center point and zoom level. It is typically passed into event listeners.
- The `control` package contains all the map controls, such as navigation bar and overview map.
- The `event` package contains all the map and layer event classes.

- The `filter` package contains all the client-side filters (spatial or relational) for selecting, or subsetting, the displayed vector layer features.
- The `geometry` package contains various geometry classes.
- The `layer` package contains various tile and vector layer classes. The tile layer classes include access to a few online map services such as Oracle, Nokia, Bing, and OpenStreetMap. The vector layers are interactive feature layers and correspond to the `MVThemeBasedFOI` and `MVFOI` classes of V1.
- The `infowindow` package contains the customizable information windows and their styles.
- The `style` package contains styles applicable to vector data on the client side. It also includes visual effects such as animation, gradients, and drop shadows.
- The `tool` package contains various map tools such as for distance measuring, red-lining, and geometry drawing.
- The `universe` package contains built-in, or predefined, *map universes*. A map universe defines the bounding box and set of zoom level definitions for the map content. It is similar to a tile layer configuration in the V1 API.
- The `util` package contains various utility classes.
- The `visualfilter` package provides an interface for the various visual effects, such as gradients and drop shadows.

`OM.Map` is the main entry class for all map operations inside the web browser. This and other classes provide interfaces for adding application-specific logic, operations, and interactivity in web mapping applications. The application logic and operations can include the following:

- Create a map client instance and associate it with the map container DIV object created in the web page.
- Configure map parameters such as map center and map zoom level.
- Optionally, create and manipulate map tile layers. Unlike in V1, a map tile layer is not required in V2. An application can have only interactive vector layers using a custom Universe that programmatically defines the zoom levels and scales.
- Create and manipulate vector layers (known as FOIs in V1).
- Display an information window on the map.
- Create fixed map decorations, such as a map title, a copyright note, and map controls.
- Access built-in utilities such as a navigation panel, rectangle or circle tool, scale bar, and overview map panel.
- Use event listeners to customize event handling and thus map interactions.

For information about developing applications using the V2 API, see [Section 6.3.2, "Using the V2 API"](#) and the Oracle-supplied tutorials and demos.

6.2.3 V1 and V2 APIs: Similarities and Differences

Both V1 and V2 APIs have major similarities:

- They have the same architecture and content organization. (was Figure 6-1, now moved] and [was Figure 6-4, now moved] apply to both versions.)

- They depend on Oracle Spatial and Graph or Locator for spatial analysis (proximity, containment, nearest neighbor, and distance queries) and coordinate system support (SRIDs and transformations).

However, there are some significant differences:

- The V2 client-side rendering of interactive features (that is, using HTML5 Canvas or SVG) provides for a richer client interactivity and user experience.
- The V1 "FOI server" is in V2 a data server that streams the vector geometries and attributes for features to the client for local rendering. Therefore, the V1 "FOI layers" and called **vector layers** in V2.
- In V2, a background map tile layer is not required in order to display interactive vector layers. So in V2, for example, an application can display a thematic map of states (such as color-filled by population quintile) with no background tile layer.
- The V2 API depends on and includes JQuery and JQueryUI. So, `oraclemapsv2.js` includes `jquery-1.7.2.min.js` and `jquery-ui-1.8.16.min.js`. If your application also uses JQuery and JQueryUI and includes them already, then use the file `oraclemapsv2_core.js` in the `<script>` tag instead to load the Oracle Maps V2 library. That is, use the following:

```
<script src="/mapviewer/jslib/v2/oraclemapsv2_core.js"></script>
```

instead of:

```
<script src="/mapviewer/jslib/v2/oraclemapsv2.js"></script>
```

Table 6–1 shows the general correspondence between the classes in V1 and V1, although the relationships are not always one-to-one.

Table 6–1 Correspondence Between V1 and V2 API Classes

V1 API Class	V2 API Class
MVMapView	OM.Map
MVMapTileLayer, MVBingTileLayer, built-in tile layers	OM.layer.TileLayer, OM.layer.BingTileLayer, ElocationTileLayer, NokiaTileLayer, OSMTileLayer
MVCustomMapTileLayer	Custom tile layers are not directly supported in the current release of V2. However, you can use custom tile layers by extending <code>OM.layer.TileLayer</code> and supplying a <code>getTileURL</code> callback function.
MVThemeBasedFOI	OM.layer.VectorLayer
MVFOI	OM.Feature
MVSdoGeometry	OM.geometry and its subclasses
MVEvent	OM.event and its subclasses
MVInfoWindowTab	OM.infowindow.MVInfoWindowTab
Styles (MVStyleColor, MVXMLStyle, MVBucketStyle, MVBarChartStyle, and so on)	OM.style and its subclasses
Tools (MVToolbar, MVDistanceTool, MVCircleTool, and so on)	OM.tool and its subclasses
Decorations and controls (MVNavigationPanel, MVMapDecoration, MVScaleBar, and so on)	OM.control and its subclasses

6.3 Developing Oracle Maps Applications

If you have all your map data stored in an Oracle database and have MapViewer deployed in Oracle Fusion Middleware, you can develop a web-based mapping application using Oracle Maps by following the instructions in the section relevant to the API version that you are using.:

- [Using the V1 API](#)
- [Using the V2 API](#)

6.3.1 Using the V1 API

To develop Oracle Maps applications using the Version 1 (V1) API, follow the instructions in these sections:

- [Creating One or More Map Tile Layers](#)
- [Defining FOI Metadata](#)
- [Creating the Client Application with the V1 API](#)

6.3.1.1 Creating One or More Map Tile Layers

For each map tile layer displayed on the client side that is served by MapViewer, you must create the corresponding map tile layer on the MapViewer server side. For example, for the sample application described in [was Section 6.1.2, now moved], you must create a map tile layer on the server side to display oceans, county boundaries, cities and highways as a map tile layer on the client. However, if the tile layer is a custom or built-in eternal tile layer, you do not need to define the tile layer on the server side.

Before you can create a map tile layer, you must ensure that the map source from which the map tiles images are to be rendered is ready. If the map tile images are rendered based on map data stored in the database, you must create a MapViewer base map that consists of a set of predefined themes. (You can create the base map using the Map Builder tool, which is described in [Chapter 7](#).) If the map tiles images are rendered by an external map provider, you must write a map source adapter that can fetch map images from the external server using the tile image definition specified by the map tile server.

When the map source is ready, you can create the map tile layer using the MapViewer administration page, as described in [Section 1.6.3](#). When you create the map tile layer, you must provide proper coordinate system definition, map source definition (internal or external), and zoom level definition (number of zoom levels and map scales).

After you create the map tile layer, you can test it by using a JavaServer Page (JSP) demo application shipped with MapViewer. The JSP demo application can be accessed at <http://host:port/mapviewer/fsmc/omaps.jsp>. Based on your input, this application can display maps served by any map tile layer defined with the MapViewer instance.

6.3.1.2 Defining FOI Metadata

If your application needs to display dynamic features based on database query results as theme-based FOI layers, you must create a predefined MapViewer theme for each theme-based FOI layer. If your application needs to display individual dynamic features as user-defined FOIs, you must define the rendering style or styles used by the FOI server to render the FOI images. You can use the Map Builder tool (described in [Chapter 7](#)) to create predefined themes and rendering styles.

6.3.1.3 Creating the Client Application with the V1 API

Oracle Maps client applications running inside web browsers are pure HTML and JavaScript pages that do not require any plug-ins. Therefore, you can build the application using any web technology that delivers content as pure HTML. Such technologies include JavaServer Pages, Java Servlets, ASP, and .NET C#. This section discusses client application development only in pure HTML format, but you can easily apply this information to other web technologies.

As shown in [was Example 6-1, now moved], the source code for an Oracle Maps application is typically packaged in an HTML page, which consists of the following parts:

- A <script> element that loads the Oracle Maps client library into the browser JavaScript engine. In [was Example 6-1, now moved], this element is:


```
<script language="Javascript" src="jslib/oraclemaps.js"></script>
```
- An HTML DIV element that is used as the map container in the web page. The size and positioning of the DIV element can be customized to suit your needs. In [was Example 6-1, now moved], this element is:


```
<div id="map" style="left:10; top:60; width: 600px; height: 500px"></div>
```
- JavaScript code that creates and initializes the map client instance. It creates the map client instance, sets up the initial map content (map tile layer, FOI layers, and so on), sets the initial map center and zoom level, implements application-specific logic, displays the map, and implements other application-specific logic.

This code should be packaged inside a JavaScript function, which is executed when the HTML page is loaded from the server to the client web browser. In [was Example 6-1, now moved], this function is named `on_load_mapview`:

```
function on_load_mapview()
{
    var baseURL = "http://" + document.location.host + "/mapviewer";
    // Create an MVMapView instance to display the map
    var mapview = new MVMapView(document.getElementById("map"), baseURL);
    // Add a map tile layer as background.
    mapview.addMapTileLayer(new MVMapTileLayer("mvdemo.demo_map"));
    // Add a theme-based FOI layer to display customers on the map
    var themebasedfoi = new MVThemeBasedFOI('themebasedfoi1', 'mvdemo.customers');
    themebasedfoi.setBringToTopOnMouseOver(true);
    mapview.addThemeBasedFOI(themebasedfoi);
    // Set the initial map center and zoom level
    mapview.setCenter(MVSdoGeometry.createPoint(-122.45, 37.7706, 8307));
    mapview.setZoomLevel(4);
    // Add a navigation panel on the right side of the map
    mapview.addNavigationPanel('east');
    // Add a scale bar
    mapview.addScaleBar();
    // Display the map.
    mapview.display();
}
```

This function is specified in the `onload` attribute of the <body> element, so that it is executed after the web page is loaded. In [was Example 6-1, now moved], this code is as follows:

```
<body onload= JavaScript:on_load_mapview() >
```

- Additional HTML elements and JavaScript code implement other application-specific user interfaces and control logic. In [was Example 6-1, now moved] in [was Example 6-1, now moved], a JavaScript function `setLayerVisible` is implemented to show or hide the theme-based FOI layer when the user checks or unchecks the **Show customers** check box. The `setLayerVisible` function is coded as follows:

```
function setLayerVisible(checkBox)
{
    // Show the theme-based FOI layer if the check box is checked
    // and hide the theme-based FOI layer otherwise.
    if(checkBox.checked)
        themebasedfoi.setVisible(true) ;
    else
        themebasedfoi.setVisible(false) ;
}
```

This function is specified in the `onclick` attribute of the `<INPUT>` element that defines the check box, so that it is executed whenever the user clicks on the check box. In [was Example 6-1, now moved], this code is as follows:

```
<INPUT TYPE="checkbox" onclick="setLayerVisible(this)" checked/>Show customers
```

6.3.2 Using the V2 API

Developing applications with the V2 API is similar to the process for the V1 API. If all the spatial data used for base maps, map tile layers, and interactive layers or themes is stored in an Oracle database, then the map authoring process using the Map Builder tool is the same for both APIs.

If the underlying base map and layers are managed in an Oracle database, each map tile layer displayed in the client application must have a corresponding database metadata entry in the `USER_SDO_CACHED_MAPS` metadata view (described in [Section 2.9.4](#)) . Similarly, if an interactive layer is based on database content, it must have a metadata entry in the `USER_SDO_THEMES` view (described in [Section 2.9](#), especially [Section 2.9.2](#)). These tile and interactive layers, and the styles and styling rules for them, can be defined using the Map Builder tool (described in [Chapter 7](#)).

To develop Oracle Maps applications using the Version 2 (V2) API, follow these basic steps:

1. Import the `oraclemapsv2.js` library.

The API is provided in a single JavaScript library packaged as part of the MapViewer EAR archive.

2. After MapViewer is deployed and started, load the library through a `<script>` tag, for example:

```
<script type="text/javascript"
url="http://localhost:8080/mapviewer/jslib/v2/oraclemapsv2.js"/>
```

3. Create a `<DIV>` tag in the HTML page, which will contain the interactive map. (This is the same as in the V1 API.)

4. Create a client-side map instance that will handle all map display functions.

The class is named `OM.Map` and is the main entry point of the V2 API. So, `OM.Map` in V2 is equivalent to `MVMApView` in V1.

5. Set up a map universe (unless you also do the optional next step).

A map universe basically defines the overall map extent, the number of zoom levels, and optionally the resolution (in map units per pixel) at each zoom level. In the V1 API, this information is contained in a tile layer definition. Those will continue to work in V2; however, in V2 a predefined tile layer is not necessary in order to display interactive vector layers or themes. For example, an interactive thematic map of sales by region does not need to have a background map, or tile layer.

6. (Optional) Add a tile layer that serves as the background map.

The tile layer can be from the database, such as `mvdemo.demo_map`, or from a supported service, such as Nokia Maps. Adding a tile layer also implicitly defines a map universe, and therefore the preceding step (setting up a map universe) is not necessary in this case.

7. Add one or more interactive vector layers.

An `OM.layer.VectorLayer` is equivalent to `MVThemeBasedFOI` in the V1 API. The main difference in that `OM.VectorLayer` uses HTML5 (Canvas or SVG) technology to render all the data in the browser. So, unless specified otherwise, all vector layer content is loaded once and there are no subsequent database queries, or data fetching, on map zoom or pan operations.

8. Add one or more map controls, tools, and other application-specific UI controls so that users can set the displayed layers, styling, and visual effects.

If you need to prevent themes from being streamed by default, you must protect them by adding authentication, that is, by adding a security constraint in the `MapView web.xml` file and by configuring the `mds.xml` file to authorize access to various themes. For information, see [Section 1.6.2.16, "Configuring and Securing the Map Data Server for the HTML5 API"](#).

For detailed instructions and related information about using the V2 API, see the Oracle-supplied tutorials and demos.

Related subtopics:

- [Section 6.3.2.1, "Creating the Client Application with the V2 API"](#)

6.3.2.1 Creating the Client Application with the V2 API

Oracle Maps V2 applications run inside web browsers and require only HTML5 (Canvas) support and JavaScript enabled. No additional plugins are required.

As shown in [was Example 6-1, now moved], the source for an Oracle Maps application is typically packaged in an HTML page, which consists of the following parts:

- A `<script>` element that loads the Oracle Maps V2 client library into the browser's JavaScript engine. For example:

```
<script src="/mapviewer/jslib/v2/oraclemapsv2.js"></script>
```

- An HTML `<div>` element that will contain the map. For example:

```
<div id="map" style="width: 600px; height: 500px"></div>
```

- JavaScript code that creates the map client instance and sets the initial map content (tile and vector layer), the initial center and zoom, and map controls. This code should be packaged inside a function which is executed when the HTML page is loaded or ready. The function is specified in the `onload` attribute of the `<body>` element of the HTML page. For example:

```

function on_load_mapview()
{
    var baseURL = "http://" + document.location.host + "/mapviewer";
    // Create an OM.Map instance to display the map
    var mapview = new OM.Map(document.getElementById("map"),
    {
        mapviewerURL:baseURL
    });
    // Add a map tile layer as background.
    var tileLayer = new OM.layer.TileLayer(
        "baseMap",
    {
        dataSource:"mvdemo",
        tileLayer:"demo_map",
        tileServerURL:baseURL + "/mcserver"
    });
    mapview.addLayer(tileLayer);
    // Set the initial map center and zoom level
    var mapCenterLon = -122.45;
    var mapCenterLat = 37.7706;
    var mapZoom = 4;
    var mpoint = new OM.geometry.Point(mapCenterLon, mapCenterLat, 8307);
    mapview.setMapCenter(mpoint);
    mapview.setMapZoomLevel(mapZoom);
    // Add a theme-based FOI layer to display customers on the map
    customersLayer = new OM.layer.VectorLayer("customers",
    {
        def:
        {
            type:OM.layer.VectorLayer.TYPE_PREDEFINED,
            dataSource:"mvdemo", theme:"customers",
            url: baseURL,
            loadOnDemand: false
        }
    });
    mapview.addLayer(customersLayer);
    // Add a navigation panel on the right side of the map
    var navigationPanelBar = new OM.control.NavigationPanelBar();
    navigationPanelBar.setStyle(
    {backgroundColor:"#FFFFFF",buttonColor:"#008000",size:12});
    mapview.addMapDecoration(navigationPanelBar);
    // Add a scale bar
    var mapScaleBar = new OM.control.ScaleBar();
    mapview.addMapDecoration(mapScaleBar);
    // Display the map.
    // Note: Change from V1. In V2 initialization and display is done just once
    mapview.init();
}

```

- Additional HTML elements and JavaScript code that implement other application-specific user interface and control logic. For example, the HTML <input> element and JavaScript function setLayerVisible together implement a layer visibility control. The setLayerVisible function is coded as follows:

```

function setLayerVisible(checkBox)
{
    // Show the customers vector layer if the check box is checked and
    // hide it otherwise.
    if(checkBox.checked)
        customersLayer.setVisible(true) ;

```

```
        else
            customersLayer.setVisible(false);
    }
```

The function is specified in the `onclick` attribute of the `<input>` element defining the checkbox. In the following example, the function is executed whenever the user clicks on the Show Customers check box:

```
<INPUT TYPE="checkbox" onclick="setLayerVisible(this)" checked/>Show Customers
```

6.4 Using Google Maps and Bing Maps

Applications can display Google Maps tiles or Microsoft Bing Maps tiles as a built-in map tile layer, by creating and adding to the map window an instance of `MVGoogleTileLayer` or `MVBingTileLayer`, respectively. Internally, the Oracle Maps client uses the official Google Maps or Bing Maps API to display the map that is directly served by the Google Maps or Microsoft Bing Maps server.

- To use the Google Maps tiles, your usage of the tiles must meet the terms of service specified by Google (see <https://developers.google.com/readme/terms>).
- To use the Bing Maps tiles, you must get a Bing Maps account. Your usage must meet the licensing requirement specified by Microsoft (see <http://www.microsoft.com/maps/>).

If you need to overlay your own spatial data on top of the Google Maps or Microsoft Bing Maps tile layer, see also [Section 6.5, "Transforming Data to a Spherical Mercator Coordinate System"](#).)

The following sections describe the two options for using built-in map tile layers:

- [Section 6.4.1, "Defining Google Maps and Bing Maps Tile Layers on the Client Side"](#)
- [Section 6.4.2, "Defining the Built-In Map Tile Layers on the Server Side"](#)

6.4.1 Defining Google Maps and Bing Maps Tile Layers on the Client Side

To define a built-in map tile layer on the client side, you need to create a `MVGoogleTileLayer` or `MVBingTileLayer` object, and add it to the `MVMapView` object. (As of Oracle Fusion Middleware Release 11.1.1.6, `MVGoogleTileLayer` uses the Google Maps Version 3 API by default, and `MVBingTileLayer` uses the Bing Maps Version 7 API by default.)

For example, to use Google tiles, add the Google tile layer to your map:

```
mapview = new MVMapView(document.getElementById("map"), baseURL);
tileLayer = new MVGoogleTileLayer();
mapview.addMapTileLayer(tileLayer);
```

In your application, you can invoke the method `MVGoogleTileLayer.setMapType` or `MVBingTileLayer.setMapType` to set the map type to be one of the types supported by the map providers, such as road, satellite, or hybrid.

For usage examples and more information, see the JavaScript API documentation for `MVGoogleTileLayer` and `MVBingTileLayer`, and the tutorial demos [Built-in Google Maps Tile Layer](#) and [Built-in Bing Maps Tile Layer](#).

6.4.2 Defining the Built-In Map Tile Layers on the Server Side

You can define a built-in map tile layer on the server side and use it as a regular MapViewer tile layer on the client side. To define a built-in map tile layer on the server side, follow these steps:

1. Log into the MapViewer Administration Page (explained in [Section 1.6.1](#)).
2. Select the Manage Map Tile Layers tab and click **Create**.
3. When you are asked to select the type of map source, choose **Google Maps** or **Bing Maps** and click **Continue**.
4. Select the data source where the tile layer is to be defined.
5. Set the license key that you have obtained from the map provider.
6. Click **Submit** to create the tile layer.

After you have created the built-in map tile layer on the server side, you can use it like any other tile layer served by MapViewer. You do not need to add any <script> tag to load the external JavaScript library.

The following example shows a Bing Maps tile layer defined on the server side:

```
mapview = new MVMapView(document.getElementById("map"), baseURL);
// The Bing tile layer is defined in data source "mvdemo".
tileLayer = new MVMapTileLayer("mvdemo.BING_MAP");
mapview.addMapTileLayer(tileLayer);
```

In your application, you can invoke the method `MVMapTileLayer.setMapType` to set the map type to be one of the types supported by the map providers, such as road, satellite, or hybrid.

6.5 Transforming Data to a Spherical Mercator Coordinate System

Popular online map services such as Google Maps and Microsoft Bing Maps use a spherical Mercator projection for their maps. If you are using an Oracle Database release earlier than 11.1.0.7, and if you need to overlay your own spatial data on top of such a tile layer, such as a Google Maps or Microsoft Bing Maps tile layer, you must set up the database to properly handle coordinate system transformation between the coordinate system of that tile layer and your own data coordinate system, if the two coordinate systems are not the same.

Note: To perform the actions in this section, your database must be Release 10.2.0.1 or later.

Google Maps uses a Spherical Mercator coordinate system (EPSG: 3785), which is also widely used among commercial API providers such as Yahoo! Maps and Microsoft Bing Maps. This coordinate system (SRID 3785) was not provided with Oracle Spatial and Graph before Release 11.1.0.7. In order to enable MapViewer and Oracle Spatial and Graph to transform your own data to this coordinate system, you must first add this coordinate system definition into your Oracle database if it is not already defined.

To check if this coordinate system is defined, you can enter the following statement:

```
SELECT srid FROM mdsys.cs_srs WHERE srid=3785;
```

If the preceding statement returns a row, you do not need to perform the actions in this section. If the preceding statement does not return a row, you must perform the actions

in this section in order to be able to overlay your own spatial data on top of the tile layer.

Follow these steps:

1. Connect to the database as a privileged user, such as one with the DBA role.
2. Run the `csdefinition.sql` script, as follows. (Replace `$MAPVIEWER_HOME` with the root directory of the WebLogic Server instance where your MapViewer is deployed, and enter the command on a single line.)
 - Linux: `$MAPVIEWER_HOME/j2ee/home/applications/mapviewer/web/WEB-INF/admin/csdefinition.sql`
 - Windows: `$MAPVIEWER_HOME\j2ee\home\applications\mapviewer\web\WEB-INF\admin\csdefinition.sql`
3. If necessary, create a transformation rule to cause Oracle Spatial and Graph to skip datum conversion when transforming data from a specified coordinate system to the Spherical Mercator system. To find out if you need to create such a transformation rule, see [Section 6.5.1](#).
4. Either pre-transform your spatial data for better performance, or let MapViewer transform the data at runtime ("on the fly"). Note that if your database release is earlier than 10.2.0.4, pre-transforming is the only option.
 - To pre-transform all your data into the Spherical Mercator coordinate system, use the `SDO_CS.TRANSFORM_LAYER` procedure on all the data, and use the transformed data for mapping. (See the `SDO_CS.TRANSFORM_LAYER` reference section in *Oracle Spatial and Graph Developer's Guide*.)
 - To let MapViewer transform the data at runtime, do not transform the data before using it for mapping.

6.5.1 Creating a Transformation Rule to Skip Datum Conversion

Spatial data is often in a coordinate system based on an ellipsoid datum, such as WGS84 or BNG. In such cases, Oracle Spatial and Graph by default applies datum conversion when transforming the data into the Spherical Mercator system. This will introduce a small amount of mismatch or error between your data and the Google Maps other map service tiles. If you want to address this issue, you can create transformation rules that tell Oracle Spatial and Graph to skip datum conversion when transforming data from a specified coordinate system to the Spherical Mercator system.

[Example 6–4](#) shows SQL statements that are included in the `csdefinition.sql` script and that create such transformations rules. However, if the coordinate system of your spatial data is not covered by the rules shown in [Example 6–4](#), you can create your own rule if the coordinate system of your data is not covered by these rules. (For more information about creating coordinate system transformation rules, see *Oracle Spatial and Graph Developer's Guide*.)

Example 6–4 Transformation Rules Defined in the csdefinition.sql Script

```
-- Create the tfm_plans, that is, the transformation rules.  
-- Note: This will result in an incorrect conversion since it ignores a datum  
-- datum between the ellipsoid and the sphere. However, the data will match  
-- up better on Google Maps.
```

```
-- For wgs84 (8307)
call sdo_cs.create_pref_concatenated_op( 83073785, 'CONCATENATED OPERATION 8307
3785', TFM_PLAN(SDO_TFM_CHAIN(8307, 1000000000, 4055, 19847, 3785)), NULL);

-- For 4326, EPSG equivalent of 8307
call sdo_cs.create_pref_concatenated_op( 43263785, 'CONCATENATED_OPERATION_4326_
3785', TFM_PLAN(SDO_TFM_CHAIN(4326, 1000000000, 4055, 19847, 3785)), NULL);

-- For OS BNG, Oracle SRID 81989
call sdo_cs.create_pref_concatenated_op( 819893785, 'CONCATENATED OPERATION 81989
3785', TFM_PLAN(SDO_TFM_CHAIN(81989, -19916, 2000021, 1000000000, 4055, 19847,
3785)), NULL);

-- For 27700, EPSG equivalent of 81989
call sdo_cs.create_pref_concatenated_op( 277003785, 'CONCATENATED_OPERATION_27700_
3785', TFM_PLAN(SDO_TFM_CHAIN(27700, -19916, 4277, 1000000000, 4055, 19847,
3785)), NULL);
commit;
```

6.6 Dynamically Displaying an External Tile Layer

The Oracle Maps JavaScript API supports dynamically defining an external tile layer without needing any server-side storage of either the definition or the tile images. Basically, you can use the class `MVCustomTileLayer` to reference and display tile layers served directly from any external map tile server on the web, such as the ESRI ArcGIS tile server, the OpenStreet map tile server, or other vendor-specific map tile servers.

To do so, you need to do the following when creating a new `MVCustomTileLayer` instance:

- Know the configuration of the map tile layer, specifically its coordinate system, boundary, and zoom level.
- Supply a function that can translate a tile request from Oracle Maps into a tile URL from the external tile server.

The configuration of a tile layer takes the form of a JSON object, and is generally in the format illustrated by the following example:

```
var mapConfig = {mapTileLayer:"custom_map", format:"PNG",
coordSys:{srid:8307,type:"GEODETIC",distConvFactor:0.0,
minX:-180.0,minY:-90.0,maxX:180.0,maxY:90.0},
zoomLevels:
[ {zoomLevel:0,name:"level0",tileWidth:15.286028158107968,tileHeight:15.28602815810
7968,tileImageWidth:256,tileImageHeight:256},
{zoomLevel:1,name:"level1",tileWidth:4.961746909541633,tileHeight:4.96174690954163
3,tileImageWidth:256,tileImageHeight:256},
{zoomLevel:2,name:"level2",tileWidth:1.6105512127664132,tileHeight:1.6105512127664
132,tileImageWidth:256,tileImageHeight:256},
{zoomLevel:3,name:"level3",tileWidth:0.5227742142726501,tileHeight:0.5227742142726
501,tileImageWidth:256,tileImageHeight:256},
{zoomLevel:4,name:"level4",tileWidth:0.16968897570090388,tileHeight:0.169688975700
90388,tileImageWidth:256,tileImageHeight:256},
{zoomLevel:5,name:"level5",tileWidth:0.05507983954154727,tileHeight:0.055079839541
54727,tileImageWidth:256,tileImageHeight:256},
{zoomLevel:6,name:"level6",tileWidth:0.017878538533723076,tileHeight:0.01787853853
3723076,tileImageWidth:256,tileImageHeight:256},
{zoomLevel:7,name:"level7",tileWidth:0.005803187729944108,tileHeight:0.00580318772
9944108,tileImageWidth:256,tileImageHeight:256},
{zoomLevel:8,name:"level8",tileWidth:0.0018832386690789012,tileHeight:0.0018832386
690789012,tileImageWidth:256,tileImageHeight:26},
```

```
{zoomLevel:9,name:"level9",tileWidth:6.114411263243185E-4,tileHeight:6.11441126324  
3185E-4,tileImageWidth:256,tileImageHeight:256} ]  
};
```

For the a function that can translate a tile request from Oracle Maps into a tile URL from the external tile server, specify a function such as the following example:

```
function getMapTileURL(minx, miny, width, height, level)  
{  
    var x = (minx-mapConfig.coordSys minX)/mapConfig.zoomLevels[level].tileWidth ;  
    var y = (miny-mapConfig.coordSys minY)/mapConfig.zoomLevels[level].tileHeight ;  
    return "http://localhost:8888/mapviewer/mcserver?request=gentile&format=" +  
mapConfig.format + "&zoomlevel=" + level + "&mapcache=mvdemo.demo_map&mx=" +  
Math.round(x) + "&my=" + Math.round(y) ;  
}
```

In the preceding example, the function `getMapTileURL()` is implemented by the application to supply a valid URL from the external tile server that fetches a map tile image whose top-left corner will be positioned at the map location (`minx, miny`) by the Oracle Maps client. Each map tile image is expected to have the specified size (`width, height`), and it should be for the specified zoom level (`level`). This specific example is actually returning a `gentile` URL from the local MapViewer tile server; however the approach also applies to any non-MapViewer tile servers.

The new custom tile layer is added to the client `mapViewer` just like a built-in map tile layer.

Oracle Map Builder Tool

This chapter briefly describes the MapViewer Map Builder tool, also referred to as Oracle Map Builder. It does not provide detailed information about the tool's interface; for that you should use see online help available when you use Oracle Map Builder.

Oracle Map Builder is a standalone application that lets you create and manage the mapping metadata (about styles, themes, and base maps) that is stored in the database. For example, use this tool to create a style or to modify the definition of a style. Besides handling the metadata, the tool provides interfaces to preview the metadata (for example, to see how a line style will appear on a map) and also spatial information.

Whenever possible, you should use Oracle Map Builder instead of directly modifying MapViewer metadata views to create, modify, and delete information about styles, themes, and maps. For any modifications made outside Oracle Map Builder, such as with SQL statements, you should refresh the database connection in Oracle Map Builder to get the current items.

To use Oracle Map Builder effectively, you must understand the MapViewer concepts explained in [Chapter 2](#) and the information about map requests in [Chapter 3](#).

This chapter contains the following major sections:

- [Section 7.1, "Running Oracle Map Builder"](#)
- [Section 7.2, "Oracle Map Builder User Interface"](#)
- [Section 7.3, "Map Builder Web Version"](#)

7.1 Running Oracle Map Builder

Oracle Map Builder is shipped as a JAR file (`mapbuilder.jar`). You can run it as a standalone Java application in a Java Development Kit (J2SE SDK) 1.5 or later environment, as follows:

```
% java -jar mapbuilder.jar [Options]
```

Options:

`-cache <cache_size>` specifies the size of the in-memory geometry cache. Example:
`-cache 64M`

`-config <config-file>` specifies the location of the file containing Map Builder configuration and preference information. If you do not specify this option, Map Builder looks for a file named `oasmapbuilder.xml` in your home Java directory. For more information about the configuration and preference file, see [Section 1.6.2](#).

-connect causes Map Builder at startup to register connections for all data sources specified in the `oasmapbuilder.xml` preferences file or the file specified with the `-config` option, and it automatically connects to the first available data source. This option increases the application startup time. If this option is not defined, startup is faster, but you must then use the File menu or an icon to connect to any data sources that you want to use (see [Section 7.2, "Oracle Map Builder User Interface"](#)).

-help displays information about the available options.

7.1.1 Java Libraries for Theme Creation with GDAL and Teradata

To create themes in Map Builder with GDAL-OGR (version 1.8 or later) or Teradata (version 13 or later), Map Builder must be started with GDAL-OGR (`gdal.jar`) and/or Teradata (`terajdbc4.jar` and `tdgssconfig.jar`) jar files on the class path. These Java libraries can be found in the GDAL installation on your system and on the Teradata website. (For GDAL, see the GDAL website for more information.)

The following example commands start Map Builder with additional libraries in the class path.

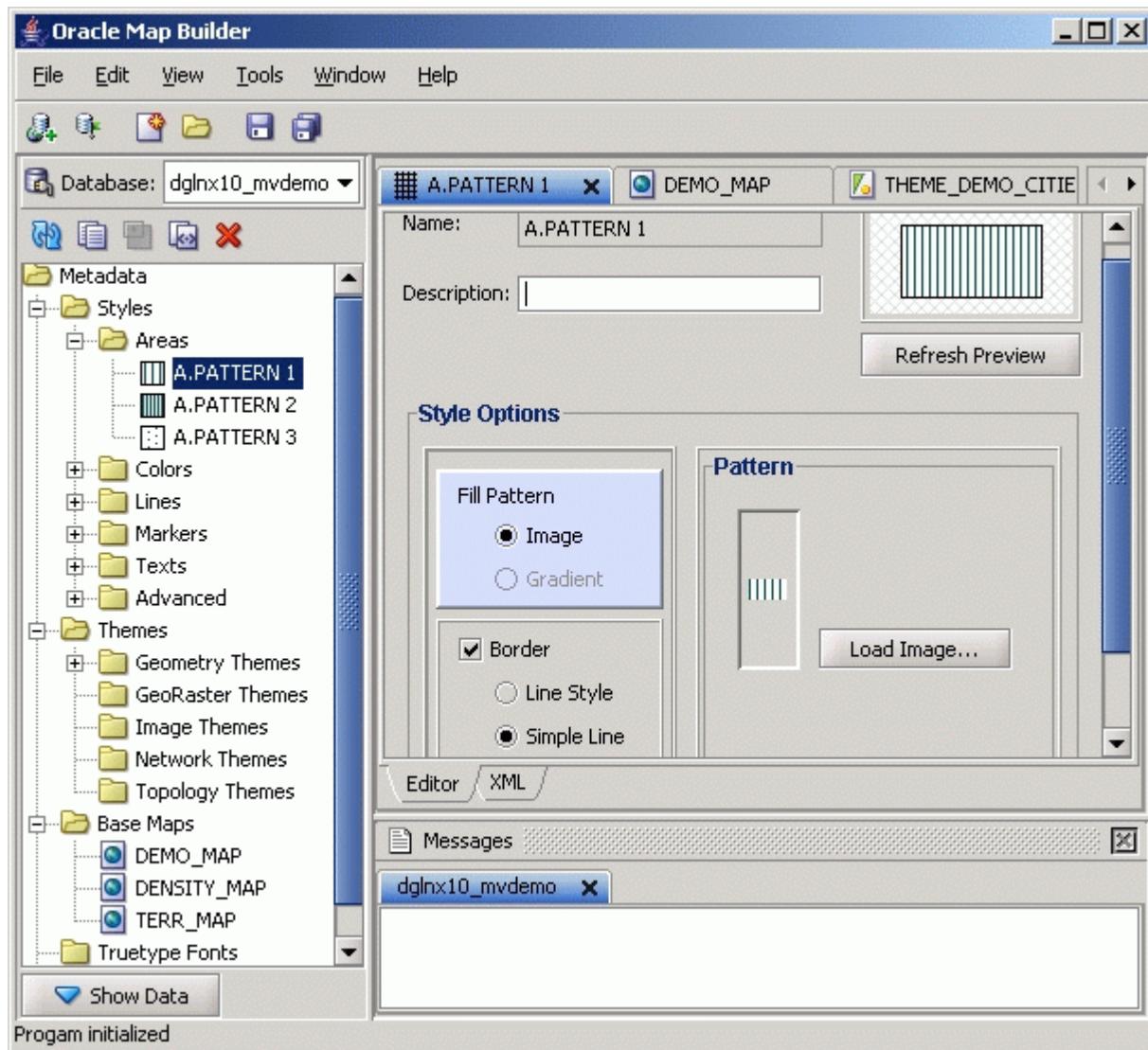
Windows: `java -Xmx512M -cp .\mapbuilder.jar;.\gdal.jar;.\terajdbc4.jar;.\tdgssconfig.jar oracle.mapviewer.builder.MapBuilder`

Linux: `java -Xmx512M -cp ./mapbuilder.jar:./gdal.jar:./terajdbc4.jar:./tdgssconfig.jar oracle.mapviewer.builder.MapBuilder`

7.2 Oracle Map Builder User Interface

Oracle Map Builder generally uses the left side for navigation to find and select objects, and the right side to display information about selected objects. [Figure 7-1](#) shows the main window of Oracle Map Builder, with the metadata navigation tree on the left and a detail pane for a selected area style on the right.

Figure 7–1 Oracle Map Builder Main Window



The menus at the top contain standard entries, plus entries for features specific to Oracle Map Builder.

You can use shortcut keys to access menus and menu items: for example Alt+F for the File menu and Alt+E for the Edit menu; or Alt+H, then Alt+A for Help, then About.

Icons under the menus perform the following actions:

- **Add new connection** creates a new database connection for Oracle Map Builder to use.
- **Load/Add/Remove connection** loads or adds database connection for Oracle Map Builder to use, or removes a database connection from the available connections that Oracle Map Builder can use.
- **Create new metadata** creates a new base map, theme, or style.
- **Open** opens a base map, theme, or style.
- **Save** saves any changes to the currently selected object.

- **Save All** saves any changes to all open objects.

The left side of the Oracle Map Builder window has the Metadata navigator, including a database connection selector, icons for performing actions, and a hierarchical tree display for the MapViewer metadata objects (categorized by object type) accessible to the currently selected database connection. To select an object, expand the appropriate tree node or nodes, then double-click the object.

The right side of the Oracle Map Builder window has tabs and panes for detail views of objects that you select or open.

To switch among objects, click the desired tabs; to close a tab, click the X in the tab. If you make changes to an object and click the X, you are asked if you want to save the changes.

The Messages area is used for feedback information as appropriate (for example, results of an action, or error or warning messages).

Detailed help is available within the Oracle Map Builder interface. See the online help for more information about Oracle Map Builder, including information about specific panes and dialog boxes.

7.3 Map Builder Web Version

A web version of the Map Builder can be accessed using the MapViewer web console (top-right corner link). The web user interface is modeled on the user interface of the traditional freestanding Map Builder tool. See the [Section 7.2](#) and the online help for detailed information about Map Builder features and operations.

This web version:

- Does not implement all features of the freestanding Map Builder tool.
- Includes metadata editor pages and wizards.
- Uses its own metadata cache, not the server metadata cache that is in use to service requests when metadata changes are saved. (If the metadata is already cached in MapViewer server cache, it clears the data source metadata cache in order for the changes to be active in service requests.)

Oracle MapViewer Editor

This chapter describes the Oracle MapViewer Editor, also referred to as the Map Editor. It contains essentially the same information as is available in the online help available when you use Oracle Map Editor.

To see the online help, click the **Help** (question mark) icon in the Map Canvas area toolbar:



Major Topics

[MapViewer Editor Concepts and Usage](#)

[MapViewer Editor Reference](#)

8.1 MapViewer Editor Concepts and Usage

The Related Topics cover important MapViewer Editor concepts and include a suggested typical workflow to help you get started editing spatial data.

Related Topics

[About the MapViewer Editor](#)

[MapViewer Editor Main Window](#)

[Editing Sessions](#)

[Getting Started: A Typical Workflow](#)

[Known Issues](#)

See Also

[MapViewer Editor Reference](#)

8.1.1 About the MapViewer Editor

Effective with Release 12.1.3, Oracle Map Editor is shipped as a JAR file (`mapeditor.jar`). You can run it as a standalone Java application if you have a J2SE JDK (Java Development Kit) 1.5 or later installed, by going to the directory containing `mapeditor.jar` and entering the following command:

```
% java -jar mapeditor.jar
```

The MapViewer Editor is a web-based spatial data editing tool. It is distributed as part of the MapViewer EAR file, and can be launched as a Java applet from any web browser once the MapViewer server is up and running. The MapViewer Editor supports multiuser, multisession online data editing capabilities across an enterprise.

The MapViewer Editor assume that the spatial data to be edited consists of two-dimensional (2D) geometries of type SDO_GEOmetry. Oriented points are supported. However, editing of 3D and LRS (Linear Referencing System) geometries is not fully supported, and editing operations on these objects may produce unknown results (that is, such data might be able to be visualized, but editing operations might not work).

To use the MapViewer Editor effectively, you must understand the concepts explained in the "Spatial Data Types and Metadata" chapter in *Oracle Spatial and Graph Developer's Guide*.

8.1.2 MapViewer Editor Main Window

The MapViewer Editor has the main window shown in Figure 8–1.

Figure 8–1 MapViewer Editor Main Window



The MapViewer Editor main window has three major areas:

- The [Edit Session Area](#) on the left side (labeled in the figure as STATES_SE, the current editing session name) enables you to specify operations and settings for the session and data layers, and to override the default rendering and labeling properties. The [Rendering Properties](#) and [Labeling Properties](#) panels can be expanded and collapsed.
- The [Map Canvas Area](#) in the middle is where the map is displayed. The content of this area changes to reflect properties or preferences that you set, tools that you select, and data editing operations that you perform.
- The [Tools Area](#) on the right side contains a set of collapsible panels, each containing a set of tools grouped according to their functions. The panels are for [Feature Tools](#), [Drawing Tools](#), [Vertex Tools](#), [Grouping Tools](#), [Geometry Tools](#), and [Transformation Tools](#).

8.1.3 Editing Sessions

With the MapViewer Editor, an **editing session** (also referred to as just a *session*) defines a personal workspace where you, the MapViewer Editor user, can edit spatial data. Each session can contain at least the following information:

- Name of the session (specified when you create a new session)
- List of data layers, including background layers and editable tables with spatial geometry data
- Data table display styles
- Name of the user that created the session (that is, the session owner)

The session definition is stored persistently in the database where edits for that session will occur. A user can have multiple editing sessions at any given time.

Within each session, you typically add one or more background layers (each of which can be any predefined theme, base map, or tile layer), plus one or more editing layers. The editing layers usually come from the same MapViewer data source (the database schema) or from published features of Web Feature Servers (WFS).

Editing sessions are stored in the `USER_SDO_EDIT_SESSIONS` view. Before you use the MapViewer Editor, a DBA must run the `sdedefinition.sql` script, as explained in [Section 8.1.4.1, "Installing the `USER_SDO_EDIT_SESSIONS` View"](#).

8.1.3.1 Editing Mode

To edit spatial data, you just perform certain basic steps as explained in [Section 8.1.4, "Getting Started: A Typical Workflow"](#), one of which is to enable **editing mode** for the session editable layer.

The editable data tables in a session may be rendered differently depending on whether the session editable layer is in editing mode. When you create or reopen a session, the layer is generally not in editing mode. When not in editing mode, the data layers are rendered by the MapViewer server, and the editor application simply displays an image generated by the server.

When you switch the layer session into editing mode, the editable data tables are rendered differently from the other layers (which are still rendered at the server side). These tables are rendered as live vector features ready to be edited. A good practice is to not set to editable mode when too many features are visible, because the application will try to load them on the client side. For editing it is recommended that you work on small areas to avoid bringing too much information to the client.

Any edits made within a session can be saved, and the saved changes, while persisted in the database, are only visible within the same session unless the session is being edited in `LIVE` workspace. If another user creates a new session that operates on the same data table but on a workspace that is not `LIVE`, that session will not see the changes made in the first session, and vice versa. Changes are only visible to others when a session with a workspace other than `LIVE` is merged.

When a session is **merged**, all the edits made within that session are published to the live data tables, and are visible by any user that queries the table. The session is effectively completed, but it is still stored in the database (for future editing), and it can be purged later.

If a session has saved edits but has not been merged, the editor can reopen it anytime from anywhere, and continue to make edits. It is typical for a session to be kept open for multiple days or even longer.

8.1.3.2 Security and Multiuser Editing Considerations

The MapViewer Editor is designed to be used by multiple users across an organization. The editor itself relies on the MapViewer server for user management and security. When a user launches the editor from the MapViewer home page, that user must be logged in to the server as a Java EE or middleware user with the `map_edit_role` role. New users can be added to the Java EE container by your administrator, and the required `map_edit_role` role must be granted. (The `map_admin_role` role also enables a user to log in and use the MapViewer Editor.)

Each user must create or reopen an editing session, where that user can make changes to the data tables. In a multiuser environment, conflicts between edits across sessions may be unavoidable unless all users coordinate their work and follow clear rules.

8.1.4 Getting Started: A Typical Workflow

This topic describes a typical workflow example that involves making some edits to a spatial data table, using the MVDEMO sample data schema. The basic steps are:

1. [Installing the USER_SDO_EDIT_SESSIONS View](#)
2. [Making a MapViewer Data Source Editable](#)
3. [Allowing Map Data Server Data Streaming](#)
4. [Launching the MapViewer Editor and Logging In](#)
5. [Selecting a Data Source and Creating a New Session](#)
6. [Adding Data Layers to a Session](#)
7. [Changing Data Layer Properties](#)
8. [Navigating the Map and Enabling Editing Mode](#)
9. [Selecting a Feature for Editing](#)
10. [Saving and Merging Session Edits](#)

These basic steps illustrate a typical work flow where you create a new session, load an existing geometry table, make a few edits then end the session and merge the changes to the live table if session is versioned.

(Alternatively, after creating a new session, you can also create a new table by clicking on the tree node to create a new geometry layer. You can then add a few background layers and start digitizing new features for your new table.)

8.1.4.1 Installing the USER_SDO_EDIT_SESSIONS View

This one-time task, which must be performed by a DBA, installs the `USER_SDO_EDIT_SESSIONS` system view that is required by the MapViewer Editor. To perform this installation, run the SQL script file `sdedefinition.sql`, which is in the MapViewer `WEB-INF/admin` directory.

The definitions of all editing sessions are stored in the `USER_SDO_EDIT_SESSION` view. Each session has the following attributes:

- `name`: name of the session.
- `description`: description of the session.
- `editor`: name of the owner of the session. This name is not the user schema name, but can be any name that identifies the person doing the editing.
- `area`: name of the area for the session (not currently used).

- workspace: name of the underlying Oracle workspace. The workspace name is automatically assigned when the session is created. If the session is not versioned, the name LIVE is assigned; if the session is versioned, the name is a combination of <editor-name>_<session-name>_<data-source-name>.
- definition: XML description of the session, including the general session attributes and the layer descriptions.

8.1.4.2 Making a MapViewer Data Source Editable

The MapViewer Editor will only load data sources that have been made editable. To make a data source editable, you must modify the <map_data_source> element of the MapViewer configuration file to specify `editable="true"`. For example:

```
<map_data_source name="mvdemo"
    jdbc_host="yourhost.com"
    jdbc_sid="lbsmain"
    jdbc_port="37407"
    jdbc_user="mvdemo"
    jdbc_password="!mvdemo"
    jdbc_mode="thin"
    number_of_mappers="3"
    allow_jdbc_theme_based_foi="true"
    editable="true"
/>
```

The default value for the `editable` attribute is `false`, which means that the data source is not editable.

8.1.4.3 Allowing Map Data Server Data Streaming

Editable data is streamed from the MapViewer Map Data Server to the client. By default any data source does not allow Map Data Server to stream data from it. In order to allow data to be streamed from a data source, you must modify the <mds_config> element of the MapViewer configuration file and define the subelement <data_source> with values equal to `true` for data source themes. For example:

```
<mds_config>
  <data_source name="mvdemo">
    <allow_predefined_themes>true</allow_predefined_themes>
    <allow_dynamic_themes>true</allow_dynamic_themes>
  </data_source>
</mds_config>
```

8.1.4.4 Launching the MapViewer Editor and Logging In

Before using the MapViewer Editor, ensure that MapViewer is deployed and the `mvdemo` data source is defined.

1. Go to the MapViewer home page, typically `http://<host>:<port>/mapviewer`.
2. Click the **Editor** link in the upper-right corner (between Admin and Help).
3. Log in as the administrative user for the application server (for example, `weblogic` for WebLogic Server).

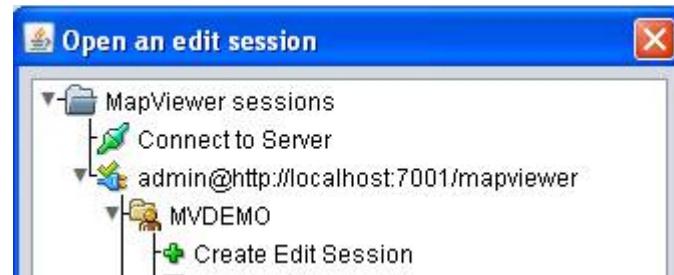
A loading screen is displayed with a large Java icon. After the loading is complete, the **MapViewer Editor Main Window** is displayed.

8.1.4.5 Selecting a Data Source and Creating a New Session

Select a data source and create a new editing session.

1. In the [Session and Data Layer Operations Toolbar](#) on the left in the [Edit Session Area](#), click the **Open an edit session** icon to display a dialog box with the editable data sources for this MapViewer server, shown in [Figure 8–2](#).

Figure 8–2 Open an Edit Session



2. To select a data source on a displayed available server, click it. For example, in the data sources display tree, under **MVDEMO**, click the **Create Edit Session** node.
3. In the Create Edit Session dialog box, enter the appropriate information:

Name: Name for the editing session. Example: `STATES_LIVE`

Description: Optional descriptive text about the session. Example: `Edit US states data`

Version Enabled: If this option is checked, a new workspace will be created for this session, and any changes can be merged later. If this option is not selected, the session edits will be applied directly to `LIVE` data without any version control. For versioned sessions (not `LIVE`), the workspace name will be on the form `<EDITOR_NAME>_<SESSION_NAME>_<DATASOURCE>`, so each versioned session will have its own workspace.

Note: Versioned sessions involve tables that have been version-enabled using Oracle Workspace Manager. For more information, see *Oracle Database Workspace Manager Developer's Guide*.

If the data source is not on a displayed available server, you can click **Connect to Server** to display the dialog box shown in [Figure 8–3](#).

Figure 8–3 Select Data Source

In the Select Data Source dialog box, enter the appropriate information:

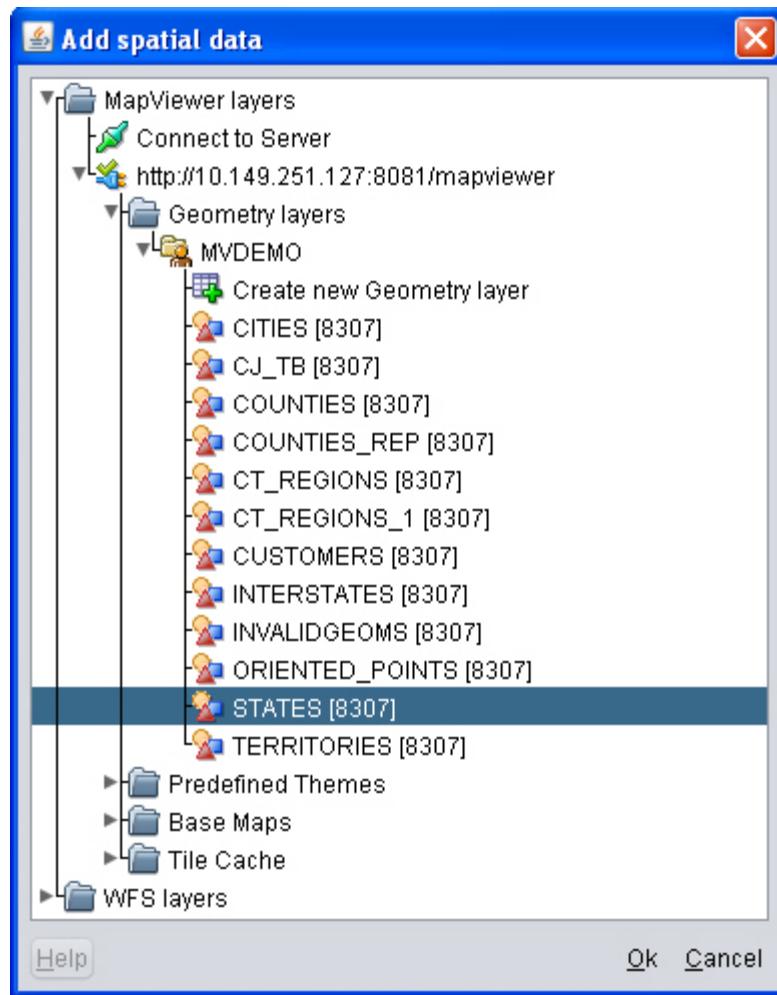
- **MapViewer Server:** URL of the MapViewer server for the data source.
- **Editor Name:** Name of the session owner (to be used to filter the sessions to be displayed).
- **Data Server Authentication (Form Type):** If the MapViewer server is a secured server.(with form authentication), check this option and enter the User and Password information.

After you click OK, all edit session names on the specified this server associated with the specified editor name will be loaded into the tree.

8.1.4.6 Adding Data Layers to a Session

Add one or more data layers to the editing session.

1. In the [Session and Data Layer Operations Toolbar](#) on the left in the [Edit Session Area](#), click the **Add spatial data** icon to display the Add Spatial Data dialog box.
2. In this dialog box, shown in [Figure 8–4](#), click the desired server, then **Geometry layers**, then the desired data source (**MVDEMO** in this example), and then the desired layer (**STATES** in this example).

Figure 8–4 Add Spatial Data

[8307] next to each layer indicates that the layer is based on SRID 8307, that is, the WGS 84 longitude-latitude coordinate system. All data used in an editing session must be based on the same SRID.

After you click **OK**, the MapViewer Editor sets an area for the map based on the metadata information for the layer table, retrieves the area covered by the data, and sets a subset area as the current map area. (If the map area does not contain data, enter other values on the map canvas, such as center X, center Y, and height or scale, and press the **Refresh** button to redraw the map.)

8.1.4.7 Changing Data Layer Properties

For editable layers based on Oracle tables, you must ensure that Key Column is correctly set for this data, and that it is not **ROWID**.

When the editable layer is added in the [Edit Session Area](#), the MapViewer Editor automatically checks if the layer table has a primary key, and it sets the Key Column property with this value. If Key Column is set to **ROWID**, the MapViewer Editor cannot edit the data. In this case, you must set the Key Column property to another column in the table that contains unique values. (It does not have to be the primary key of the table, but it must contain unique values.)

To change the Key Column value:, in the [Session and Data Layer Operations Toolbar](#) on the left in the [Edit Session Area](#), click **Edit session properties** to display a dialog box for editing [Session and Layer Preferences](#).

1. In the [Session and Data Layer Operations Toolbar](#) on the left in the [Edit Session Area](#), click **Edit session properties** to display a dialog box for editing [Session and Layer Preferences](#)
2. In the dialog box, for **Key Column** select a text column that contains unique values. For example, for STATES the key column could be STATE_ABRV (the two-character state abbreviation).

8.1.4.8 Navigating the Map and Enabling Editing Mode

You can use the [Navigation Panel](#) in the upper-left corner of the map canvas area to pan the map and to perform zoom (marquee, in, out) operations.

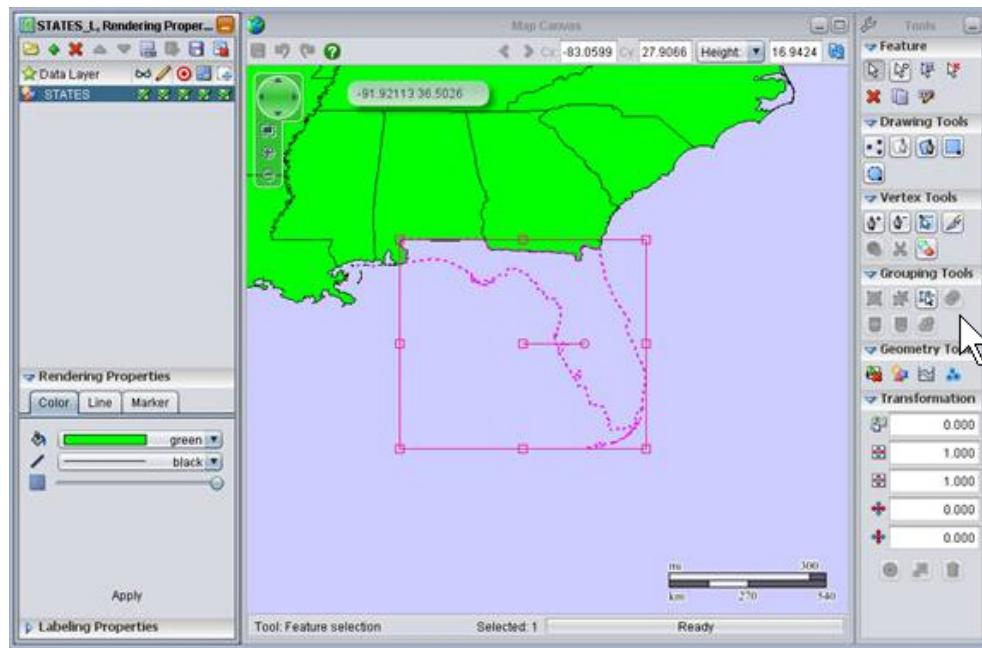
You can use the [Data Layers panel](#) in the [Edit Session Area](#) on the left to control layer visibility, make layers editable, specify or change the target layer on which editing operations are applied, and make other selections that affect the editing session behavior.

Some suggested steps:

1. Pan to the specific map area that you want to edit and optionally zoom, using the [Navigation Panel](#) in the upper-left corner of the map canvas area.
2. For the desired data layer, check the **Layer is editable** (pencil) icon in the [Data Layers](#) panel to enter in editing mode for the layer.
If the session is versioned and a data layer is made editable, the MapViewer Editor checks that the layer base table is versioned using Oracle Workspace Manager; and if it is not versioned, you will need to specify the table's primary key for versioning (if no primary key is defined).
3. For the desired data layer, check the **Current editing target** (target) icon in the [Data Layers](#) panel to specify that any editing will be applied to this layer.
4. Perform some editing operations using the tools in the [Tools Area](#). (See also [Selecting a Feature for Editing](#).)

8.1.4.9 Selecting a Feature for Editing

When the session is in editing or selection mode, as you mouse over the map area, the features are highlighted. When you click on a feature, it becomes selected (with an animated border and transparent interior area), for example, as the U.S. state of Florida is in [Figure 8-5](#).

Figure 8–5 Feature Selected

The rendering of the data layer is determined by the choices made in the [Rendering Properties](#) panel. The labeling is determined by the choices made in the [Labeling Properties](#) panel. Dynamic styles are created based on the choices made in those properties panels.

The MBR (minimum bounding rectangle) of the selected feature (Florida in the preceding figure) has a manipulator around it, with nine squares that you can use to drag and resize this feature. You can also use the small red circle to rotate the feature.

The [Tools Area](#) panels in the right side of the window have tools for selection, drawing, vertex editing, grouping, and other operations.

8.1.4.10 Saving and Merging Session Edits

After you have made desired edits, save them by clicking one of these buttons on the [Map Canvas Area](#) toolbar:

- **Save edited data in the target layer** applies unsaved changes that have been made in the current target layer
- **Save all edited data** applies all unsaved changes that have been made in the current session.

It is recommended that you save edits frequently while in editing mode. When a save is requested, the edited data is sent back to server to be committed.

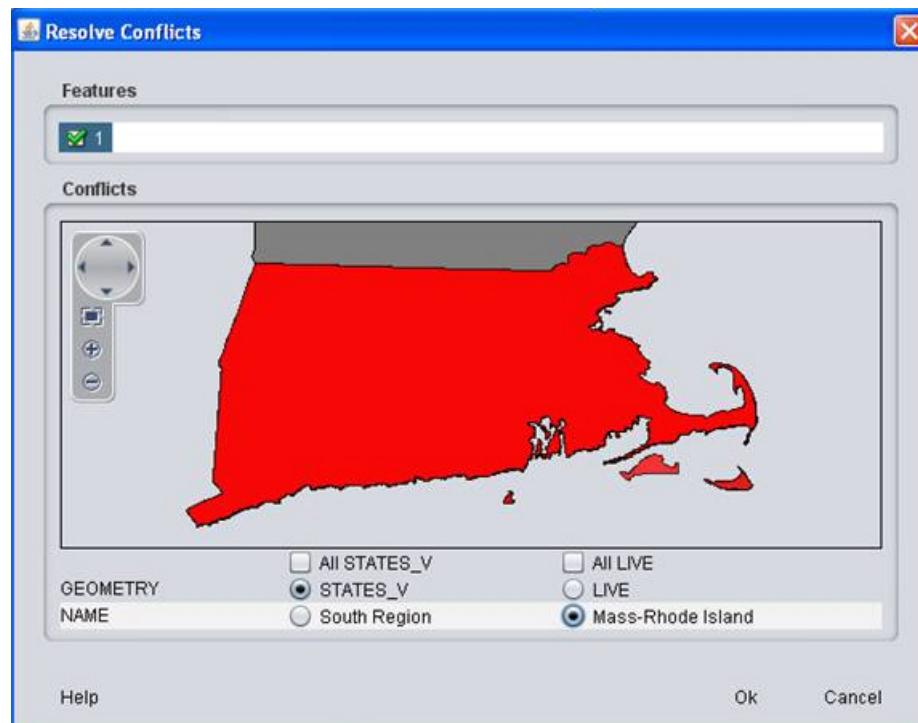
For a versioned session, remember that your edits so far are visible only in your own versioned session; they are not visible to any other users (or sessions).

Note: Versioned sessions involve tables that have been version-enabled using Oracle Workspace Manager. For more information, see *Oracle Database Workspace Manager Developer's Guide*.

If you are completely done with a versioned session, and ready to make the changes visible to the world, you will need to merge the session by clicking the **Merge session visible layers** icon in the [Session and Data Layer Operations Toolbar](#) near the top in the [Edit Session Area](#) on the left. (Only versioned layers are processed; therefore, if you have many layers in the session to be merged, you can work individually on layers by making them visible, while leaving edits on other (non-visible) layers for later.)

For a versioned editing session, once changes are saved, the editable layers base tables can be merged with LIVE data. For a merge, the editable layer the edit session workspace data is compared with current LIVE data; and if a conflict occurs, the Resolve Conflicts dialog box is displayed. For example, [Figure 8–6](#) shows that the large feature in red has a conflict for the GEOMETRY and NAME columns.

Figure 8–6 Resolve Conflicts



Define how to resolve the conflicts by selecting the version attribute to be used as LIVE data. Note that a feature can have conflicts on both spatial and nonspatial attributes, and you can select values from the different data to resolve the conflicts. In the preceding figure, conflicts are resolved using the GEOMETRY value from the STATES_V editing session and the NAME value from the LIVE data.

When the merge process is executed and finished, the versioned edit session features will have the values selected to resolve the conflicts. The versioned editing session will still exist, but it can be purged later after final merge.

If the layer has many conflicts, you do not need to resolve all of them at once. Every time you work in the Resolve Conflicts dialog box and click OK, the affected conflicts to be resolved are processed in the server; but if the data still has one or more other conflicts, then the merge operation is not executed until all conflicts have been resolved for the layer.

Click Yes to confirm that you want the changes to be merged to the live data table that is visible to all users on the map data. If there are conflicts between versioned data and

LIVE data, a merge tool dialog is displayed for resolving the conflicts and for merging the data.

8.1.5 Known Issues

See the "readme" file for any known problems and considerations with the current release.

8.2 MapViewer Editor Reference

The reference topics provide information about MapViewer Editor preferences (properties) and the areas of the main window.

Related Topics

[Session and Layer Preferences](#)
[Edit Session Area](#)
[Map Canvas Area](#)
[Tools Area](#)

See Also

[MapViewer Editor Concepts and Usage](#)

8.2.1 Session and Layer Preferences

You can edit certain preferences for session and layer properties, to specify the default values for the associated properties. The properties for which you can set preferences are in the following categories:

```
<session-name> Properties  
Control Layer Properties  
  Feature Selection  
  Drawing Tools  
  Vertex Tools  
  Background Layer  
  Scale Bar Layer  
  Manipulator Layer  
Data Layer Properties  
  <data-layer-name> (one for each data layer)
```

If you make any changes in any pane and if you want to save these changes, you *must* click **Apply** before you switch to another pane or before you click **Close** to close the Edit Preferences dialog box.

8.2.1.1 <session-name> Properties

Includes options for the editing session.

Logging Level: Level of information for logging: info for basic (limited) information or finest for detailed information. (finest provides more information, but takes longer and requires more disk storage.)

HTTP Timeout: Maximum time in seconds to wait for a response from an HTTP request (for example, when accessing the capabilities of a WFS server).

Use HTTP Proxy: If checked, specifies the host and port of the HTTP proxy server to be used.

8.2.1.2 Control Layer Properties

Includes options for the visual aspects of the editing session, such as colors and sizes for various objects.

For color-related options, click the small box that shows the current default color to display the Choose Color dialog box, in which you can specify a new color using one of several ways: Swatches, HSV, HSL, RGB, or CMYK. For each specification that you make, the Preview area of the dialog box shows how it will appear. To save a specification, click **Apply**.

8.2.1.2.1 Feature Selection **Mouse over feature color:** Color to be displayed for the feature under the mouse location.

Target feature color: Color of selected features of a target layer.

Non-target feature color: Color of selected features of a layer that is not a target layer

Feature element color: Color to highlight geometry elements of a feature. Used for validating and viewing feature geometries.

8.2.1.2.2 Drawing Tools **Cursor center color:** Cross marker color inside cursor symbol when drawing.

Cursor border color: Boundary color of cursor symbol when drawing.

Cursor point size: Cursor symbol size in pixels.

Snap point center color: Cross marker color inside cursor symbol when mouse location snaps with a snap layer.

Snap point border color: Boundary color of cursor symbol when mouse location snaps with a snap layer.

Line segment color: Segment color between points when digitizing lines or polygons.

Line segment width: Segment width between points when digitizing lines or polygons.

Rubberband segment color: Line segment color when moving the mouse to digitize points of lines or polygons.

Rubberband segment width: Line segment width when moving the mouse to digitize points of lines or polygons.

8.2.1.2.3 Vertex Tools **Show vertices:** Highlights selected feature vertices when moving the mouse around a feature boundary.

Vertex box color: Color of the rectangles representing the vertices.

Vertex box size: Size in pixels of the rectangles representing the vertices.

8.2.1.2.4 Background Layer Background color for the displayed map area.

8.2.1.2.5 Scale Bar Layer **Show scale bar:** Displays the [Map Scale Bar](#).

8.2.1.2.6 Manipulator Layer **Color:** Boundary color of the manipulator rectangle.

Snap Highlight Color: Color to highlight a snap point. When a feature is selected and the manipulator rectangle is visible, right-clicking provides an option to set a snap point on the selected feature. This snap point can be used when moving the feature to snap at another location.

Changed Feature Color: Color of the boundary of the feature when it is being moved.

Handle Size: Size in pixels of the manipulator rectangle corner markers.

Hide When Obstructed: Hides the manipulator rectangle when it is covered by another panel.

8.2.1.3 Data Layer Properties

For each data layer, the properties for which you can set preferences depend on the type of data layer:

- [Geometry Layer Properties](#)
- [WFS Layer Properties](#)

8.2.1.3.1 Geometry Layer Properties

Contains the Data Set and Rendering tabs.

Data Set tab:

MapViewer Server: URL of the MapViewer server where the layer is defined.

Key Column: Layer key column for editable features. Does not need to be the primary key, but the data values must be unique.

Geometry Column: Name of the geometry column associated with this layer.

Query Condition: Optional condition for filtering the layer features (SQL WHERE clause without the WHERE keyword).

Live Scale: (Not currently used.)

Label Column: If checked, specify the column containing text data to be used to label features.

Shared Boundary: Applies editing operations on other geometry objects that share a boundary with the object being edited.

For example, assume that two property lots share a boundary. If this option is checked and if you edit one property lot to make it larger by modifying the shared boundary, then the other property lot's definition is modified and its size becomes correspondingly smaller. If this option is not checked, then the second lot's definition is not changed (and the two lots' definitions will overlap spatially).

Create Sequence: Creates a new sequence on the MapViewer server.

Rendering tab:

Render in MapViewer when not editable: Displays the layer in MapViewer even when it is not editable. If this option is not checked, the layer is displayed only when it is editable.

8.2.1.3.2 WFS Layer Properties

Key Column: Layer key column for editable features. Does not need to be the primary key, but the data values must be unique. Always FID for WFS 1.0.0 layers,

Geometry Column: Name of the spatial attribute of the WFS feature type.

Label Column: If checked, specify the column containing text data to be used to label features.

Polygon outer ring orientation: Specifies the polygon outer ring orientation. For Oracle Spatial and Graph data, the outer ring orientation is counterclockwise, but for external data served by WFS servers this orientation may be different. This value will be considered when building new polygons. If the polygon outer boundary digitizing has a different orientation than this value, then the coordinates will be automatically reoriented.

Shared Boundary: Applies editing operations on other features that share a boundary with the feature being edited.

For example, assume that two property lots share a boundary. If this option is checked and if you edit one property lot to make it larger by modifying the shared boundary, then the other property lot's definition is modified and its size becomes correspondingly smaller. If this option is not checked, then the second lot's definition is not changed (and the two lots' definitions will overlap spatially).

Capabilities GET URL: URL on the WFS server for GetCapabilities requests.

Version: WFS server version. (Currently only 1.0.0 is supported.)

Authentication: Specifies whether to apply Basic-type Authentication (for a secured WFS server).

8.2.2 Edit Session Area

The Edit Session area on the left side of the MapViewer Editor window enables you to specify operations and settings for the session and data layers, and to override the default rendering and labeling properties. The [Rendering Properties](#) and [Labeling Properties](#) panels can be expanded and collapsed.

- [Session and Data Layer Operations Toolbar](#)
- [Data Layers](#)
- [Rendering Properties](#)
- [Labeling Properties](#)

8.2.2.1 Session and Data Layer Operations Toolbar

At the top of the Edit Session area is a toolbar with icons for the following operations:

- **Open an edit session:** Displays a dialog box in which you select the editing session to be opened.
- **Add spatial data layer:** Displays a dialog box where you can add a spatial data layer to your session. Geometry layers from spatial tables can be edited; predefined themes, base maps, and tile layers are generally used as background layers and cannot be edited.
Expand the MapViewer layers or WFS layers hierarchy to find the desired data layer, then click OK.
- **Remove data layer:** Removes the currently selected data layer from the [Data Layers](#) area.
- **Move data layer up:** Moves the currently selected data layer up one level in the [Data Layers](#) area.
- **Move data layer down:** Moves the currently selected data layer down one level in the [Data Layers](#) area.
- **Edit session properties:** Displays a dialog box for editing [Session and Layer Preferences](#).
- **Merge session visible layers** (active only for versioned editing sessions) Merges merge layer workspace with LIVE workspace. (See [Saving and Merging Session Edits](#).)
- **Save edit session definition:** Saves the current session definition to the `USER_SDO_EDIT_SESSIONS` view. (See [Editing Sessions](#) and [Installing the USER_SDO_](#)

[EDIT_SESSIONS View.\)](#)

- **Delete current edit session:** Removes the current session definition in the USER_SDO_EDIT_SESSIONS view.

For versioned sessions, this also removes the workspace associated with the session. However, as for versioned layer base tables, if the session layer base table has not been modified in any other workspace, a dialog box is displayed letting you choose whether to unversion the table; however, if the session layer base table has been modified in any other workspace, the table is kept versioned.

8.2.2.2 Data Layers

The Data Layers panel has a header row and a row for each spatial data layer that is available for editing (that has been added and not removed). The header row has columns with icons for each of the following operations, so that you can select and deselect options for individual layers.

- **Layer is visible** (glasses icon): Controls whether the layer is visible on the map canvas or not.
- **Layer is editable** (pencil icon): Controls whether the layer is editable (that is, is in editing mode for the current editing session).

A layer must be editable before you can modify its spatial data. One or more layers can be editable in a session. When you make a layer editable, the current features for the layer are loaded into the map area (if they are not already loaded) for editing.

- **Current editing target** (target icon): Identifies the layer on which editing operations are to be applied.

Only zero or one layers can be the editing target, and a layer must be the editing target before you can modify its spatial data.

- **Snapping to this layer** (snap icon): Controls whether the layer is a snap layer, namely, one that can be used to snap vertices when digitizing feature geometry points. In a snap layer, if the mouse pointer moves close enough to an existing vertex, the pointer automatically snaps over to that existing vertex.

Multiple layers can be used as snap layers.

- **Selection occurs on this layer** (selection icon): Controls whether the layer is a selection layer.

Selection tools are used in selection layers. Features from one selection layer can be used to generate features in a different target layer, using operations such as union, intersection, and difference. One or more layers can be selection layers. When you make a layer a selection layer, the current features for the layer are loaded into the map area (if they are not already loaded) for selection.

You can use the [Session and Data Layer Operations Toolbar](#) to add and remove data layers and to move layers up and down in the display.

8.2.2.3 Rendering Properties

Rendering properties affect the rendering of editable data. Select an editable layer row in the data layer panel, and the contents of the Rendering Properties panel will reflect the current style used by the layer. You can view and modify Color, Line, and Marker properties using the appropriate tabs.

- For **Color**, the attributes are fill color, stroke color, and color fill color transparency.

- For **Line**, the attributes are fill/stroke color, line width, and fill/stroke color transparency.
- For **Marker**, the attributes are marker type, fill color, stroke color, marker size, and fill color transparency.

8.2.2.4 Labeling Properties

Labeling properties affect the labeling of editable data. Select an editable layer row in the data layer panel, and the contents of the Labeling Properties panel will reflect the current style used by the layer.

For Labeling Properties, the attributes are text font, text color, text size, italics, and bold.

8.2.3 Map Canvas Area

The Map Canvas area in the middle of the window is where the map is displayed. The content of this area changes to reflect properties or preferences that you set, tools that you select, and data editing operations that you perform.

At the top of the Map Canvas area is a toolbar with icons for the following operations:

- **Save edited data in the target layer**
- **Save all edited data**
- **Undo** last change
- **Redo** last operation
- **Help** (question-mark icon)
- **Draw previous map** (not currently used)
- **Draw next map** (not currently used)
- **Cx** and **Cy** (map center X and Y coordinates in units of the spatial reference system, or SRID; for example, longitude and latitude for WGS 84 data)
- **Height** (in units of the SRID) or **Scale** (in meters for geodetic data) of the Y-axis for the area represented in the map canvas area. For example, at a particular map canvas size and zoom level, and with WGS 84 (longitude/latitude) data, the Height value might be 5.2657 (degrees of latitude) and the corresponding Scale value might be 5,750,861 (meters).
- **Refresh** the map preview

8.2.3.1 Navigation Panel

Below the Map Canvas area toolbar and on the left is a **navigation panel**, shown in [Figure 8-7](#).

Figure 8-7 *Navigation Panel*

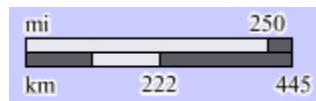


- Use the circle (spinning wheel) to pan the map (rotate and click an arrowhead to move the display in that direction).
- Use the rectangle to select (press, drag, release) an area to zoom to (sometimes called *marquee zoom*).
- Use the plus sign (+) to zoom in.
- Use the minus sign (-) to zoom out.

8.2.3.2 Map Scale Bar

If you have enabled the **Show scale bar** property for the **Scale Bar Layer**, then near the bottom of the map canvas area and on the right is a **map scale bar** that shows the distance in miles (mi) and kilometers (km) or meters (m) represented by various segments in the bar. [Figure 8–8](#) shows an example.

Figure 8–8 Scale Bar



The distances in the scale bar reflect the current zoom level.

8.2.4 Tools Area

The Tools area on the right side of the MapViewer Editor window contains a set of collapsible panels, each containing a set of tools grouped according to their functions. Specific panels and tools are enabled (visible and usable) depending on the application context. For example, if there is any active editable layer, the selection tools are enabled.

The Tools groups are:

- [Feature Tools](#) (select, deselect, delete, duplicate, and edit feature's attributes)
- [Drawing Tools](#) (create new features by drawing their shapes on the map)
- [Vertex Tools](#) (manipulate individual vertices; split a polygon or perform void-related operations; break an existing line)
- [Grouping Tools](#) (group and ungroup features)
- [Geometry Tools](#) (validate, inspect, simplify, and add a buffer around a geometry)
- [Transformation Tools](#) (scale, rotate, and translate features)

8.2.4.1 Feature Tools

Icons are available for the following tools:

- **Select a feature:** Acts both as a generic pointer tool and a single selection tool (when clicking on a feature). When clicking on an area with no feature, it also deselects any currently selected features. When a feature is selected, its outlines become animated and (when the entire feature is within the map viewport) a set of **manipulators** (small squares) will be displayed around it. The Shift key can be used with the mouse click to deselect a feature if it is selected or to add it to selected list if it is not selected.

The manipulators are a set of markers that can be used to move, scale, or rotate the feature. To move a feature, press and drag the center square mark. To scale feature, press and drag one of the outside square marks. To rotate feature, press and drag the circle mark. Multiple operations can be performed, and then click anywhere outside the feature to effectively apply the changes, or use the [Transformation Tools](#) tools to apply the changes.

- **Select multiple features:** Can be used to select multiple features by holding and dragging a rectangle on the map. Features that have any interaction with the rectangle are selected. The Shift key can be used with the mouse drag to deselect selected features or to add new selections to the existing selection set.
- **Select features by attribute values:** Allows the selection of features based on an attribute value. Displays the Feature Selection by Attribute dialog box, where you can specify the layer base table, the attribute column, the attribute value to be used in selection, and whether to add the result to the existing selections (if any) or to replace the existing selections with the result.
- **Unselect (deselect) features:** Deselects the currently selected features.
- **Delete selected features:** Deletes the currently selected features.
- **Duplicate selected features:**Duplicates selected features.
- **Edit feature attributes:** Edits the attributes of the selected feature.

8.2.4.2 Drawing Tools

To make the drawing tools active, check on a layer to be editable and check on a target layer. When creating a new feature using one of these tools, first deselect any selected features if you want the new geometry to be a separate new feature. If you use a feature creation tool while a feature is selected, the default behavior is to append the new geometry to the selected feature.

Icons are available for the following tools:

- **Draw a point:** Creates a new point feature. When you click on the map, a new point is created on the map, and a pop-up lets you enter the required key-column value, plus other attribute columns that you may want to populate. If a sequence name is assigned (can be changed in layers property panel), then the key value is automatically populated for the new feature.
- **Draw a line:** Creates a new line string feature (one or more linear segment). Use the left mouse button to digitize points, and the right button to end the line string.
- **Draw a polygon:** Creates a new polygon feature using linear segments. Use the left mouse button to digitize points, and the right button to end the polygon. The last point will be automatically linked to first point. To add holes (voids) to a polygon, use the corresponding tool under [Grouping Tools](#).
- **Draw a rectangle:** Creates a new rectangle feature. Press and drag to the diagonally opposite corner, then release to generate an optimized rectangle.
- **Draw a circle or ellipse:** Creates a new circle or ellipse feature. Press and drag, then release to generate the circle or ellipse.

8.2.4.3 Vertex Tools

Vertex tools can be used to manipulate individual vertices. To make the vertex tools active, check on a layer to be editable and check on a target layer.

Icons are available for the following tools:

- **Add a vertex point to a line string:** Adds a new vertex to an existing line segment. As you move pointer close to the target line segment, it automatically snaps onto the segment; the snapped highlighted circle is a valid location to add the vertex. Then click to add the new vertex.
- **Remove a vertex point from a line string:** Removes an existing vertex. Move the mouse to the vertex (will be highlighted) and click to remove it. You also can press and drag to remove multiple vertices inside the dragging area.
- **Select and move vertex:** Moves an existing vertex. Move the mouse to the vertex (snaps will highlight the vertex) and then press and drag the vertex to the new position.
- **Add a void polygon:** Creates a new void in an existing polygon. Select a polygon feature and digitize the new void polygon inside the feature polygon. Use the left mouse button to digitize points, and the right button to end the polygon. The last point will be automatically linked to first point.
- **Remove a void from a polygon:** Removes an existing void from a polygon. To remove the void, click anywhere inside the void boundary of the selected feature, or press and drag a rectangle that encloses the void polygon.
- **Break a line:** Breaks an existing feature line string (simple line) into two lines and generates a new feature. Move the mouse over the line (snaps will highlight break points), and then click to break at the location. A dialog box is displayed for selecting which part will be a new feature and defining the new feature's attributes.
- **Split a polygon:** Splits a polygon feature into two features. Move the mouse over polygon boundary (split point will be highlighted), click to get the split point (it turns blue), then click to the next split line points until you click on another boundary split point to end the split line (snaps shows the boundary point highlighted). If a polygon has void elements that are also in the split line path, when you get a split point at the void boundary, the next split line point must be at the same void element boundary. After ending the split, a dialog box is displayed for selecting which part will be a new feature and defining the new feature's attributes.

8.2.4.4 Grouping Tools

Grouping tools are used to perform operations on multiple features and elements. With some of these tools, the target layer may be different from the selection layer. Grouping tools use Oracle Spatial and Graph operations such as union, difference, and intersections.

Icons are available for the following tools:

- **Group features:** Groups features. Select one or more features and click this button to group the selected features into a new feature. (A union operation is performed.)
- **Ungroup feature element:** (Not currently used.)
- **Remove feature element:** Removes one or more feature elements from within a features. To specify multiple elements, drag a rectangle that encloses them, and release.
- **Generate a feature from a union of features:** Generates a new feature or updates an existing feature (in the target layer) based on a union of selected features. The selected features list must have features from a layer that is not the current target layer.

For example, assume that layer A is currently the target layer and you want to generate a new feature with the union of features from layer B.

1. Change the selection layer in Data layers panel on the left to layer B.
 2. Select one or more features in layer B.
 3. Click the **Generate a feature from a union of features** icon to perform the union operation between the selected features in layer B. If layer A also has a selected feature, then this feature will also be used in the union operation, and the target feature geometry will be updated.
- **Generate a feature from an intersection of features:** Generates a new feature or updates an existing feature (in the target layer) based on an intersection of selected features. The selected features list must have features from a layer that is not the current target layer.

For example, assume that layer A is currently the target layer and you want to generate a new feature with the intersection of features from layer B.

1. Change the selection layer in Data layers panel on the left to layer B.
 2. Select one or more features in layer B.
 3. Click the **Generate a feature from an intersection of features** icon to perform the intersection operation between the selected features in layer B. If layer A also has a selected feature, then this feature will also be used in the intersection operation, and the target feature geometry will be updated.
- **Generate a feature from a difference of features:** Generates a new feature or updates an existing feature (in the target layer) based on a difference of selected features. The selected features list must have features from a layer that is not the current target layer.
- For example, assume that layer A is currently the target layer and you want to generate a new feature with the difference of features from layer B.
1. Change the selection layer in Data layers panel on the left to layer B.
 2. Select one or more features in layer B.
 3. Click the **Generate a feature from a difference of features** icon to perform the difference operation between the selected features in layer B. If layer A also has a selected feature, then this feature will also be used in the difference operation, and the target feature geometry will be updated.
- **Update target layer geometries with union of features:** Updates features in the target layer with union of selected features from a different selection layer.

For example, assume there are two layers, one for States and another one for Counties, with each layer having its individual geometries. Each county feature has an attribute defining the State to which it belongs. You can make changes in county features, and then update the related state geometry with the union of the counties' changes. The results will include any necessary boundary adjustments in both geometry layers. Some sample steps:

1. Make Counties layer the target and the selection layer, and select all counties in State A.
2. Make some changes on these selected features (for example, scale all of them together).
3. Make the State layer the target layer and click the **Update target layer geometries with union of features** icon. A dialog box for defining the link

attributes between the two layers is displayed, where you specify the target layer, target key attribute column, selection layer, and selection join attribute column.

After you click **OK**, the geometries of the target layer State will be updated with the union of selected features based on the selection join attribute.

8.2.4.5 Geometry Tools

Geometry tools are used to perform Oracle Spatial and Graph operations on geometry objects.

Icons are available for the following tools:

- **Validate selected geometries:** Validates the selected feature geometries. If any invalid geometry is found, a dialog box is displayed with the invalid Oracle Spatial and Graph codes (For detailed information about geometry validation and error codes, see the reference material about the SDO_GEOM.VALIDATE_GEOMETRY_WITH_CONTEXT function in *Oracle Spatial and Graph Developer's Guide*.)

Selecting a table row in the dialog box highlights the geometry segment section related to the error. You may be able to use the available MapViewer Editor tools to fix any errors.

- **View geometry elements:** Displays a dialog box showing the geometry elements of the selected feature. You can click on a geometry node or one of the elements will highlight its border. You cannot edit the geometry information in this dialog box.
- **Simplify selected geometries:** Simplifies selected geometries. For polygon features, it first builds an internal topology to generate single edges between adjacent geometries. Depending on the number of selected geometries, this step may take a while for building the topology. A dialog box with two algorithm options is then shown, and you can simplify all edges or select a subset of edges to simplify. When selecting specific edges, you can also use the Shift key to deselect any previous selection. The available options depend on whether you select the Douglas-Peucker or Visvalingham-Whyatt algorithm.

For Douglas-Peucker (uses the SDO_UTIL.SIMPLIFY function, described in *Oracle Spatial and Graph Developer's Guide*):

- **Threshold:** Minimum distance between vertices to be considered. For geodetic data, this value is in meters; otherwise, it is in data units. Use the bar to define a range of points to be removed. (However, this does not necessarily mean that the algorithm will remove precisely this amount of data.)
- **Simplify:** Simplifies the selected geometries.
- **Reset:** Undoes the last simplification operation.
- **o% Points:** The percentage of original vertices retained after simplification.

For Visvalingham-Whyatt (uses the SDO_UTIL.SIMPLIFYVW function, described in *Oracle Spatial and Graph Developer's Guide*):

- **o% of points to remove:** use bar to define a range of points to be removed. (However, this does not necessarily mean that the algorithm will remove precisely this amount of data.)
- **Taller triangles:** Allows taller triangles when applying the flatness filter.
- **o% Points:** The percentage of original vertices retained after simplification.

- **Generate a buffer feature from the selected feature:** Generates a buffer feature around the selected feature. Enter the distance value to generate the buffer. If the data is geodetic, enter the value in meters; otherwise, enter the value in data units.

8.2.4.6 Transformation Tools

Icons are available for the following transformation tools:

- **Rotate selected geometries:** Rotates the selected feature geometries with a specified value in degrees.
- **Scale selected geometries in X:** Scales the selected feature geometry with a specified factor in the X direction.
- **Scale selected geometries in Y:** Scales the selected feature geometry with a specified factor in the Y direction.
- **Translate selected geometries in X:** Translates the selected geometries with a specified value in data units in X direction.
- **Translate selected geometries in Y:** Translates the selected geometries with a specified value in data units in Y direction.
- **Apply transformation to selected features in target layer:** Applies the current transformation to just the selected features of the target layer.
- **Apply transformation to all selected features:** Applies the current transformation to all selected features.
- **Reset transformation:** Clears the current transformation.

A

XML Format for Styles, Themes, Base Maps, and Map Tile Layers

This appendix describes the XML format for defining style, themes, and base maps using the MapViewer metadata views described in [Section 2.9](#).

The metadata views for MapViewer styles (USER_SDO_STYLES and related views) contain a column named DEFINITION. For each style, the DEFINITION column contains an XML document that defines the style to the rendering engine.

Each style is defined using a syntax that is similar to SVG (scalable vector graphics). In the MapViewer syntax, each style's XML document must contain a single `<g>` element, which must have a `class` attribute that indicates the type or class of the style. For example, the following defines a color style with a filling color component:

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
    <desc> red </desc>
    <g class="color" style="fill:#ff1100"/>
</svg>
```

The MapViewer XML parser looks only for the `<g>` element in a style definition; other attributes such as the `<desc>` element are merely informational and are ignored.

Scalable Styles: You can make the size of a style scalable by specifying a unit other than the default pixel (px) -- for example, `width:15.0km` or `stroke-width:10.0m`. For information about using scalable styles, see [Section 2.2.1](#).

The metadata views for MapViewer themes (USER_SDO_THEMES and related views) contain a column named STYLING_RULES. For each theme in these views, the STYLING_RULES column contains an XML document (a CLOB value) that defines the styling rules of the theme.

The metadata views for MapViewer base maps (USER_SDO_MAPS and related views) contain a column named DEFINITION. For each base map in these views, the DEFINITION column contains an XML document (a CLOB value) that defines the base map.

The following sections describe the XML syntax for each type of mapping metadata:

- [Section A.1, "Color Styles"](#)
- [Section A.2, "Marker Styles"](#)
- [Section A.3, "Line Styles"](#)

- [Section A.4, "Area Styles"](#)
- [Section A.5, "Text Styles"](#)
- [Section A.6, "Advanced Styles"](#)
- [Section A.7, "Themes: Styling Rules"](#)
- [Section A.8, "Base Maps"](#)
- [Section A.9, "Map Tile Layers"](#)

A.1 Color Styles

A color style has a fill color, a stroke color, or both. When applied to a shape or geometry, the fill color (if present) is used to fill the interior of the shape, and the stroke color (if present) is used to draw the boundaries of the shape. Either color can also have an alpha value, which controls the transparency of that color.

For color styles, the `class` attribute of the `<g>` element must be set to "color". The `<g>` element must have a `style` attribute, which specifies the color components and their optional alpha value. For example:

- `<g class="color" style="fill:#ff0000">` specifies a color style with only a fill color (whose RGB value is #ff0000).
- `<g class="color" style="fill:#ff0000;stroke:blue">` specifies a color style with a fill color and a stroke color (blue).

You can specify a color value using either a hexadecimal string (such as #00ff00) or a color name from the following list: black, blue, cyan, darkGray, gray, green, lightGray, magenta, orange, pink, red, white, yellow.

To specify transparency for a color style, you can specify `fill-opacity` and `stroke-opacity` values from 0 (completely transparent) to 255 (opaque). The following example specifies a fill component with half transparency:

```
<g class="color" style="fill:#ff00ff;fill-opacity:128">
```

The following example specifies both stroke and fill opacity:

```
<g class="color" style= "stroke:red;stroke-opacity:70;
fill:#ff00aa;fill-opacity:129">
```

The syntax for the `style` attribute is a string composed of one or more `name:value` pairs delimited by semicolons. (This basic syntax is used in other types of styles as well.)

For stroke colors, you can define a stroke width. The default stroke width when drawing a shape boundary is 1 pixel. To change that, add a `stroke-width:value` pair to the `style` attribute string. The following example specifies a stroke width of 3 pixels:

```
<g class="color" style="stroke:red;stroke-width:3">
```

A.2 Marker Styles

A marker style represents a marker to be placed on point features or on label points of area and linear features. A marker can be either a vector marker or raster image marker. A marker can also have optional notational text. For a vector marker, the coordinates of the vector elements must be defined in its XML document. For a marker

based on a raster image, the XML document for the style indicates that the style is based on an external image.

The marker XML document specifies the preferred display size: the preferred width and height are defined by the `width:value; height:value` pairs in the `style` attribute of the `<g>` element. The `class` attribute must be set to "marker". Some markers must be overlaid with some notational text, such as a U.S. interstate highway shield marker, which, when rendered, must also have a route number plotted on top of it. The style for such notational text is a `style` attribute with one or more of the following name-value pairs: `font-family:value`, `font-style:value`, `font-size:value`, and `font-weight:value`.

The following example defines an image-based marker that specifies font attributes (shown in bold) for any label text that may be drawn on top of the marker:

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
<desc></desc>
<g class="marker"
  style="width:20;height:18;font-family:sans-serif;font-size:9pt;fill:#ffffff">
  <image x="0" y="0" width="9999" height="9999" type="gif"
    href="dummy.gif"/>
</g>
</svg>
```

In the preceding example, when the marker is applied to a point feature with a labeling text, the label text is drawn centered on top of the marker, using the specified font family and size, and with the fill color (white in this case) as the text foreground. The label text (495) in [Figure A-1](#) in [Section A.2.4](#) has the text attributes specified in this example.

A.2.1 Vector Marker Styles

A vector marker can be a simple polygon, an optimized rectangle (defined using two points), a single polyline, or a circle, but not any combination of them. For each type of vector marker, its `<g>` element must contain a corresponding subelement that specifies the geometric information (coordinates for the polygon, optimized rectangle, or polyline, or radius for the circle):

- A polygon definition uses a `<polygon>` element with a `points` attribute that specifies a list of comma-delimited coordinates. For example:

```
<g class="marker">
  <polygon points="100,20,40,50,60,80,100,20"/>
</g>
```

- An optimized rectangle definition uses a `<rect>` element with a `points` attribute that specifies a list of comma-delimited coordinates. For example:

```
<g class="marker">
  <rect points="0,0, 120,120"/>
</g>
```

- A polyline definition uses a `<polyline>` element with a `points` attribute that specifies a list of comma-delimited coordinates. For example:

```
<g class="marker">
  <polyline points="100,20,40,50,60,80"/>
</g>
```

- A circle definition uses a `<circle>` element with an `r` attribute that specifies the radius of the circle. For example:

```
<g class="marker">
  <circle r="50"/>
</g>
```

You can specify a stroke or fill color, or both, for any vector-based marker. The syntax is the same as for the style attribute for a color style. The following example defines a triangle marker that has a black border and that is filled with a half-transparent yellow:

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
<g class="marker" style="stroke:#000000;fill:#ffff00;fill-opacity:128">
  <polygon points="201.0,200.0, 0.0,200.0, 101.0,0.0"/>
</g>
</svg>
```

If a marker is scalable, you can set the marker's maximum size in pixels on a map by using the `max_size_in_px` attribute. Setting this attribute to an appropriate value will prevent the marker from getting so large as to block other map features when the user zooms in to view fine map details. The following example sets the marker's maximum size to 64 pixels:

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
  <g class="marker" max_size_in_px="64"
    style="stroke:#0000BB;fill:#0033FF;width:3.0mile;height:3.0mile;font-family:Dialog
    ;font-size:12;font-fill:#FF0000">
    <polygon points="0.0,0.0,0.0,100.0,100.0,100.0,100.0,0.0,0.0,0.0"/>
  </g>
</svg>
```

A.2.2 Image Marker Styles

For an image marker, its XML document contains an `<image>` element that identifies the marker as based on an image. The image must be in GIF format, and is stored in the IMAGE column in the styles metadata views.

The following example is an XML document for an image marker:

```
<?xml version="1.0" standalone="yes"?>
<svg>
  <g class="marker"
    style="width:20;height:18;font-family:sansserif;font-size:9pt">
    <image x="0" y="0" width="9999" height="9999" type="gif" href="dummy.gif"/>
  </g>
</svg>
```

Note that in the preceding example, it would be acceptable to leave the `<image>` element empty (that is, `<image/>`) to create a valid definition with the image to be specified later.

A.2.3 TrueType Font-Based Marker Styles

For a TrueType font-based marker, its marker symbol is stored in a TrueType font file, which has the `.ttf` file extension and which typically contains many individual symbols or glyphs. Many GIS software packages come with TrueType font files that contain symbols useful for mapping.

Before MapViewer can use a symbol in a TrueType font file, you must do the following:

1. Import the TrueType font file into the database, preferably by using the Map Builder tool (described in [Chapter 7](#)), which causes the symbols in the font file to be inserted into a single row in the system view `USER_SDO_STYLES`. In this new row, the `TYPE` column contains the string `TTF`, and the `IMAGE` column contains the contents of the TrueType font file. After the import operation, you can use the Map Builder tool to view all the glyphs or symbols contained inside the TrueType font file. Also, because the font file is now physically stored inside a database, it can be shared by all MapViewer users.
2. Create a MapViewer marker style based on a glyph or symbol inside an imported TrueType font, preferably using the Map Builder tool.

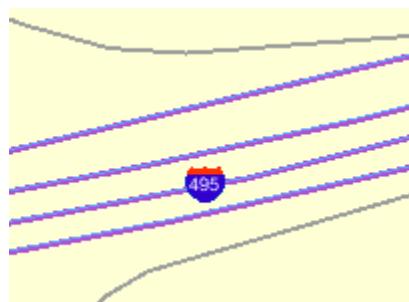
The following example shows the use of a TrueType font-based marker (with TrueType-specific material in bold):

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
<g class="marker" style="fill:#ff0000;width:25;height:25">
  <ttsSymbol fontName="ERS INCIDENTS" charCode="118" />
</g>
</svg>
```

A.2.4 Using Marker Styles on Lines

Marker styles are usually applied to point features, in which case the marker style is rendered on the point location that represents the feature. However, with line (line string) features such as highways, the marker must be placed at some point along the line to denote some information about the feature, such as its route number. For example, on maps in the United States, a shield symbol is often placed on top of a highway, with a route number inside the symbol, as shown with Route 495 in [Figure A-1](#).

Figure A-1 *Shield Symbol Marker for a Highway*



To achieve the result shown in [Figure A-1](#), you must do the following:

1. Choose a marker style, and add a text style definition (font family, font size, fill color, and so on), as shown in the example in [Section A.2](#).
2. Specify the marker style as the labeling style in the styling rules for the theme. The following example shows the XML document with the styling rules for a theme to show highways. A marker style (shown in bold in the example) is specified. The label text (495 in [Figure A-1](#)) is a value from the label column, which is named `LABEL` in this example.

```
<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="political">
<rule>
  <features style="L.PH"> (name_class = 'I' and TOLL=0) </features>
  <label column="label" style="M.SHIELD1">1</label>
</rule>
<styling_rules>
```

MapViewer automatically determines the optimal position on the line for placement of the marker style (the shield in this example).

A.3 Line Styles

A line style is applicable only to a linear feature, such as a road, railway track, or political boundary. In other words, line styles can be applied only to Oracle Spatial and Graph geometries with an SDO_GTYPE value ending in 2 (line) or 6 (multiline). (For information about the SDO_GEOMETRY object type and SDO_GTYPE values, see *Oracle Spatial and Graph Developer's Guide*.)

When MapViewer draws a linear feature, a line style tells the rendering engine the color, dash pattern, and stroke width to use. A line style can have a base line element which, if defined, coincides with the original linear geometry. It can also define two edges parallel to the base line. Parallel line elements can have their own color, dash pattern, and stroke width. If parallel lines are used, they must be located to each side of the base line, with equal offsets to it.

To draw railroad-like lines, you need to define a third type of line element in a line style called *hashmark*. For a `<line>` element of class hashmark, the first value in the dash array indicates the gap between two hash marks, and the second value indicates the length of the hash mark to either side of the line. The following example defines a hash mark line with a gap of 8.5 screen units and a length of 3 screen units at each side of the base line:

```
<line class="hashmark" style="fill:#003333" dash="8.5,3.0"/>
```

The following example defines a complete line style.

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
  <g class="line" style="fill:#ffff00;stroke-width:5">
    <line class="parallel" style="fill:#ff0000;stroke-width:1.0"/>
    <line class="base" style="fill:black;stroke-width:1.0" dash="10.0,4.0"/>
  </g>
</svg>
```

In the preceding example, `class="line"` identifies the style as a line style. The overall fill color (#ffff00) is used to fill any space between the parallel lines and the base line. The overall line width (5 pixels) limits the maximum width that the style can occupy (including that of the parallel lines).

The line style in the preceding example has both base line and parallel line elements. The parallel line element (`class="parallel"`) is defined by the first `<line>` element, which defines its color and width. (Because the definition does not provide a dash pattern, the parallel lines or edges will be solid.) The base line element (`class="base"`) is defined by the second `<line>` element, which defines its color, width, and dash pattern.

A marker (such as a direction marker) can be defined for a line style. The `marker-name` parameter specifies the name of a marker style, the `marker-position` parameter

specifies the proportion (from 0 to 1) of the distance along the line from the start point at which to place the marker, and the `marker-size` parameter specifies the number of display units for the marker size. The marker orientation follows the orientation of the line segment on which the marker is placed.

The following example defines a line style with direction marker:

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
  <g class="line" style="fill:#33a9ff;stroke-width:4;
    marker-name:M.IMAGE105_BW;marker-position:0.15;marker-size=8">
    <line class="parallel" style="fill:red;stroke-width:1.0"/>
  </g>
</svg>
```

To get multiple markers, add the `multiple-marker` attribute to the style definition. In this case the `marker-position` will define the position for the first marker and the space in between markers. The following example defines a line style with a direction marker that starts at position 0.15 and that is repeated continually with a space of 0.15 between each occurrence.

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
  <g class="line" style="fill:#33a9ff;stroke-width:4;
    marker-name:M.IMAGE105_BW; marker-position:0.15;
    marker-size=8; multiple-marker=true">
    <line class="parallel" style="fill:red;stroke-width:1.0"/>
  </g>
</svg>
```

A.4 Area Styles

An area style defines a pattern to be used to fill an area feature. In the current release, area styles must be image-based. That is, when you apply an area style to a geometry, the image defining the style is plotted repeatedly until the geometry is completely filled.

The definition of an area style is similar to that of an image marker style, which is described in [Section A.2.2](#).

The following example defines an area style:

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
  <g class="area" style="stroke:#000000">
    <image/>
  </g>
</svg>
```

In the preceding example, `class="area"` identifies the style as an area style. The stroke color (`style="stroke:#000000"`) is the color used to draw the geometry boundary. If no stroke color is defined, the geometry has no visible boundary, although its interior is filled with the pattern image.

You can also specify any line style to be used as the boundary for an area style. The following area style definition uses the `line-style` keyword (shown in bold in the example) to specify a line style to be used for the borders of features:

```
<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
  <g class="area" style="line-style:L.DPH">
```

```

<image x="0" y="0" width="9999" height="9999" type="gif" href="dummy.gif"/>
</g>
</svg>

```

As with the image marker style, the image for an area style must be stored in a separate column (identified in the IMAGE column in the USER_SDO_STYLES and ALL_SDO_STYLES metadata views, which are described in [Section 2.9.1](#)).

A.5 Text Styles

A text style defines the font and color to be used in labeling spatial features. The class attribute must have the value "text". For the font, you can specify its style (plain, italic, and so on), font family, size, and weight. To specify the foreground color, you use the fill attribute.

The following example defines a text style:

```

<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
  <g class="text" style="font-style:plain; font-family:Dialog; font-size:14pt;
    font-weight:bold; fill:#0000ff">
    Hello World!
  </g>
</svg>

```

In the preceding example, the text "Hello World!" is displayed only when the style itself is being previewed in a style creation tool, such as the Map Builder tool. When the style is applied to a map, it is always supplied with an actual text label that MapViewer obtains from a theme.

A text style can provide a floating white background around the rendered text, to make the labels easier to read on a map that has many features. [Figure A-2](#) shows the label Vallejo with a white background wrapping tightly around the letters.

Figure A-2 Text Style with White Background



To achieve the result shown in [Figure A-2](#), you must specify the float-width attribute in the `<g>` element of the text style definition. The following example uses the float-width attribute (shown in bold in the example) to specify a white background that extends 3.5 pixels from the boundary of each letter. (The Hello World! text is ignored when the style is applied to the display of labels.)

```

<?xml version="1.0" standalone="yes"?>
<svg width="1in" height="1in">
<desc></desc>
<g class="text" float-width="3.5"
  style="font-style:plain; font-family:Dialog; font-size:12pt; font-weight:bold;
    fill:#000000">
    Hello World!
  </g>
</svg>

```

A.6 Advanced Styles

Advanced styles are structured styles made from simple styles. Advanced styles are used primarily for thematic mapping. The core advanced style is the bucket style (`BucketStyle`), and every advanced style is a form of bucket style. A bucket style is a one-to-one mapping between a set of primitive styles and a set of buckets. Each bucket contains one or more attribute values of features to be plotted. For each feature, one of its attributes is used to determine which bucket it falls into or is contained within, and then the style assigned to that bucket is applied to the feature.

Two special types of bucket styles are also provided: color scheme (described in [Section A.6.2](#)) and variable (graduated) marker (described in [Section A.6.3](#)).

Other advanced styles are dot density (described in [Section A.6.4](#)), bar chart (described in [Section A.6.5](#)), collection (described in [Section A.6.6](#)), and variable pie chart (described in [Section A.6.7](#)).

A.6.1 Bucket Styles

A bucket style defines a set of buckets, and assigns one primitive style to each bucket. The content of a bucket can be either of the following:

- A collection of discrete values (for example, a bucket for all counties with a hurricane risk code of 1 or 2, a bucket for all counties with a hurricane risk code of 3, and so on).
- A continuous range of values (for example, a bucket for all counties with average family income less than \$30,000, a bucket for all counties with average family income from \$30,000 through \$39,999, and so on). In this case, the ranges of a series of buckets can be individually defined (each defined by an upper-bound value and lower-bound value) or equally divided among a master range.

The following code excerpt shows the basic format of a bucket style:

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <BucketStyle>
    <Buckets>
      . . .
    </Buckets>
  </BucketStyle>
</AdvancedStyle>
```

In contrast with the other (primitive) styles, an advanced style always has a root element identified by the `<AdvancedStyle>` tag.

For bucket styles, a `<BucketStyle>` element is the only child of the `<AdvancedStyle>` element. Each `<BucketStyle>` element has one or more `<Buckets>` child elements, whose contents vary depending on the type of buckets.

A.6.1.1 Collection-Based Buckets with Discrete Values

If each bucket of a bucket style contains a collection of discrete values, use a `<CollectionBucket>` element to represent each bucket. Each bucket contains one or more values. The values for each bucket are listed as the content of the `<CollectionBucket>` element, with multiple values delimited by commas. The following example defines three buckets.

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <BucketStyle>
```

```

<Buckets>
  <CollectionBucket seq="0" label="commercial"
    style="10015">commercial</CollectionBucket>
  <CollectionBucket seq="1" label="residential"
    style="10031">residential, rural</CollectionBucket>
  <CollectionBucket seq="2" label="industrial"
    style="10045">industrial, mining, agriculture</CollectionBucket>
</Buckets>
</BucketStyle>
</AdvancedStyle>

```

In the preceding example:

- The values for each bucket are one or more strings; however, the values can also be numbers.
- The name of the style associated with each bucket is given.
- The label attribute for each `<CollectionBucket>` element (*commercial*, *residential*, or *industrial*) is used only in a label that is compiled for the advanced style.
- The order of the `<CollectionBucket>` elements is significant. However, the values in the `seq` (sequence) attributes are informational only; MapViewer determines sequence only by the order in which elements appear in a definition.

Although not shown in this example, if you want a bucket for all other values (if any other values are possible), you can create a `<CollectionBucket>` element with `#DEFAULT#` as its attribute value. It should be placed after all other `<CollectionBucket>` elements, so that its style will be rendered last.

To apply label styles to collection-based buckets with discrete values, see [Section 2.2.2](#).

A.6.1.2 Individual Range-Based Buckets

If each bucket of a bucket style contains a value range that is defined by two values, use a `<RangedBucket>` element to represent each bucket. Each bucket contains a range of values. The following example defines four buckets.

```

<?xml version="1.0" ?>
<AdvancedStyle>
  <BucketStyle>
    <Buckets>
      <RangedBucket high="10" style="10015"/>
      <RangedBucket low="10" high="40" style="10024"/>
      <RangedBucket low="40" high="50" style="10025"/>
      <RangedBucket low="50" style="10029"/>
    </Buckets>
  </BucketStyle>
</AdvancedStyle>

```

For individual range-based buckets, the lower-bound value is inclusive, while the upper-bound value is exclusive (except for the range that has values greater than any value in the other ranges; its upper-bound value is inclusive). No range is allowed to have a range of values that overlaps values in other ranges.

For example, the second bucket in this example (`low="10" high="40"`) will contain any values that are exactly 10, as well as values up to but not including 40 (such as 39 and 39.99). Any values that are exactly 40 will be included in the third bucket.

As with the `<CollectionBucket>` element, the style associated with each `<RangedBucket>` element is specified as an attribute.

To apply label styles to individual range-based buckets, see [Section 2.2.2](#).

A.6.1.3 Equal-Ranged Buckets

If a bucket style contains a series of buckets that contain an equally divided range of a master range, you can omit the use of `<RangedBucket>` elements, and instead specify in the `<Buckets>` element the master upper-bound value and lower-bound value for the overall range, the number of buckets in which to divide the range, and a list of style names (with one for each bucket). The following example defines five buckets (`nbuckets=5`) of equal range between 0 and 29:

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <BucketStyle>
    <Buckets low="0" high="29" nbuckets="5"
      styles="10015,10017,10019,10021,10023"/>
  </BucketStyle>
</AdvancedStyle>
```

In the preceding example:

- If all values are integers, the five buckets hold values in the following ranges: 0 to 5, 6 to 11, 12 to 17, 18 to 23, and 24 to 29.
- The first bucket is associated with the style named 10015, the second bucket is associated with the style named 10017, and so on.

The number of style names specified must be the same as the value of the `nbuckets` attribute. The buckets are arranged in ascending order, and the styles are assigned in their specified order to each bucket.

A.6.2 Color Scheme Styles

A color scheme style automatically generates individual color styles of varying brightness for each bucket based on a base color. The brightness is equally spaced between full brightness and total darkness. Usually, the first bucket is assigned the brightest shade of the base color and the last bucket is assigned the darkest shade.

You can include a stroke color to be used by the color style for each bucket. The stroke color is not part of the brightness calculation. So, for example, if a set of polygonal features is rendered using a color scheme style, the interior of each polygon is filled with the color (shade of the base color) for each corresponding bucket, but the boundaries of all polygons are drawn using the same stroke color.

You can include an opacity value (0 to 255, for transparent to opaque) for the base color (using the `basecolor_opacity` attribute) and for the stroke color (using the `strokecolor_opacity` attribute).

The following example defines a color scheme style with a black stroke color and four buckets associated with varying shades of the base color of blue.

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <ColorSchemeStyle basecolor="blue" strokecolor="black">
    <Buckets>
      <RangedBucket label="<10" high="10"/>
      <RangedBucket label="10 - 20" low="10" high="20"/>
      <RangedBucket label="20 - 30" low="20" high="30"/>
      <RangedBucket label=">=30" low="30"/>
    </Buckets>
  </ColorSchemeStyle>
</AdvancedStyle>
```

Note: For the following special characters, use escape sequences instead.

For <, use: <

For >, use: >

For &, use: &

A.6.3 Variable Marker Styles

A variable marker style generates a series of marker styles of varying sizes for each bucket. You specify the number of buckets, the start (smallest) size for the marker, and the size increment between two consecutive markers.

Variable marker styles are conceptually similar to color scheme styles in that both base buckets on variations from a common object: with a color scheme style the brightness of the base color varies, and with a variable marker style the size of the marker varies.

The following example creates a variable marker style with four buckets, each associated with different sizes (in increments of 4) of a marker (`m.circle`). The marker for the first bucket has a radius of 10 display units, the marker for the second bucket has a radius of 14 display units, and so on. This example assumes that the marker named `m.circle` has already been defined.

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <VariableMarkerStyle basemarker="m.circle" startsize="10" increment="4">
    <Buckets>
      <RangedBucket label="&lt;10" high="10"/>
      <RangedBucket label="10 - 20" low="10" high="20"/>
      <RangedBucket label="20 - 30" low="20" high="30"/>
      <RangedBucket label="&gt;=30" low="30"/>
    </Buckets>
  </VariableMarkerStyle>
</AdvancedStyle>
```

A.6.4 Dot Density Marker Styles

A dot density advanced marker style, when applied to an area feature such as states or counties, randomly draws a set of dots inside the area. The number of dots drawn inside each area is determined by the count value associated with the area. When you define a dot density style, you must specify a marker style that will be used for each of the dots.

The following example shows the XML definition of a simple dot density style:

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <DotDensityStyle MarkerStyle="M.STAR" DotWidth="8" DotHeight="8">
  </DotDensityStyle>
</AdvancedStyle>
```

In the preceding example, the marker style M.STAR is used for each dot, and the size of each dot is 8 pixels wide and high.

When you use a dot density style, you should "scale" the count value to a proper range. For example, if you want to apply a dot density style based on the population count for each county, you would not want to use the population count directly (one dot for each person), because this will result in an unacceptable number of drawn dots.

(for example, if a county has 15,000 people). Instead, supply a scaled down value or expression, such as population/1000, when you define the styling rules for the theme. (MapViewer does not perform any scaling-down internally, so you must do it at the SQL query level.)

A.6.5 Bar Chart Marker Styles

A bar chart advanced marker style is similar to a pie chart style, except that it draws a bar graph for each feature to which it is applied. The following example shows the XML definition of a bar chart style:

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <BarChartStyle width="30" height="25" show_x_axis="true">
    <Bar name="1990" color="#FF0000" />
    <Bar name="1995" color="#FFC800" />
    <Bar name="1998" color="#0000FF" />
    <Bar name="2000" color="#00FF00" />
    <Bar name="2002" color="#00FFFF" />
  </BarChartStyle>
</AdvancedStyle>
```

In the preceding example, width and height specify the overall size of the bar chart, including all individuals bars within it.

When a bar chart is drawn on a feature based on a set of values associated with that feature, the height of each bar can be determined by either of two approaches: locally scaled or globally scaled. A locally scaled bar chart determines the height of each bar only from the associated values for that feature; and thus, for example, you cannot compare the second bar of one chart to the second bar on another chart on the same theme. A globally scaled bar chart uses the same bar scale for all charts on the map; and thus, for example, you can compare the second bar of one chart to the second bar on another chart on the same theme.

So, if you want to compare bars not only within the same chart, but also among all the charts showing on the map, you must use globally scaled bar chart style by specifying `share_scale="true"` in the definition of the bar chart style, as shown in the following example:

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <BarChartStyle width="40" height="30" share_scale="true"
    min_value="0.0" max_value="100">
    <Bar name="1990" color="#FF0000" />
    <Bar name="1995" color="#FFC800" />
    <Bar name="1998" color="#0000FF" />
    <Bar name="2000" color="#00FF00" />
    <Bar name="2002" color="#00FFFF" />
  </BarChartStyle>
</AdvancedStyle>
```

When the bar chart style in the preceding example is applied to a theme, MapViewer considers the global range of values of all features in that theme, and then determines the height of each bar based on where a specific value falls in the global range from the minimum value to the maximum value.

A.6.6 Collection Styles

A collection advanced style is simply a collection of other types of styles that are applied together to a feature. This can result in faster rendering of a collection theme compared to using multiple themes based on different styles.

For example, a bar chart style, when applied to a county, draws only the bar chart somewhere inside the county, but the county itself (its boundary and interior area) is not drawn. However, you probably want to see the underlying boundaries of the counties, to see which bar chart belongs to which county. To do this without a collection style, you would have to define a second theme in which each county is being associated with a color or area style. This approach would result in two rendering passes (because two themes are involved) for essentially the same group of features.

However, by using a collection style in this example, you can define a single style that refers to both the bar chart and the color or area style, and then apply the collection style to the theme for the counties. This theme, when rendered by MapViewer, will show both the bar charts and the boundaries on the map.

Another typical use of a collection style is for rendering collection type topology features, each of which can contain multiple types of geometries, such as polygons (areas), points, and lines. In such cases, a collection style can include styles that are most appropriate for each type of geometry in a collection topology feature.

The following example shows the XML definition of a collection style:

```
<?xml version="1.0" standalone="yes"?>
<AdvancedStyle>
  <CollectionStyle>
    <style name="C.COUNTIES" shape="polygon" />
    <style name="L.PH" shape="line" />
    <style name="M.CIRCLE" shape="point" />
  </CollectionStyle>
</AdvancedStyle>
```

A.6.7 Variable Pie Chart Styles

A variable pie chart generates a series of pie circles of varying sizes for each bucket. You specify the pie slice information, the start (smallest) radius size for a pie circle, and the radius size increment between two consecutive circles.

Variable pie chart styles are conceptually similar to variable marker styles. With a variable marker style the base marker size varies, whereas with the variable pie chart style the circle radius varies.

The following example creates a definition for a variable pie chart style with four buckets, each associated with different sizes (in increments of 4) of a circle with start radius of 5. The circle radius for the first bucket has a radius of 5 display units, the circle for the second bucket has a radius of 9 display units, and so on.

```
<?xml version="1.0" ?>
<AdvancedStyle>
  <VariablePieChartStyle startradius="5" increment="4">
    <PieSlice name="WHITE" color="#FFFFFF" />
    <PieSlice name="BLACK" color="#000000" />
    <PieSlice name="HISPANIC" color="#FF0000" />
    <Buckets>
      <RangedBucket seq="0" label="0 - 6194757.2" low="0" high="6194757.2" />
      <RangedBucket seq="1" label="6194757.2 - 1.23895144E7" low="6194757.2" high="1.23895144E7" />
    </Buckets>
  </VariablePieChartStyle>
</AdvancedStyle>
```

```

<RangedBucket seq="2" label="1.23895144E7 - 1.85842716E7" low="1.23895144E7"
high="1.85842716E7"/>
<RangedBucket seq="3" label="1.85842716E7 - 2.47790288E7" low="1.85842716E7"
high="2.47790288E7"/>
<RangedBucket seq="4" label="2.47790288E7 - 3.0973786E7" low="2.47790288E7"
high="3.0973786E7"/>
</Buckets>
</VariablePieChartStyle>
</AdvancedStyle>

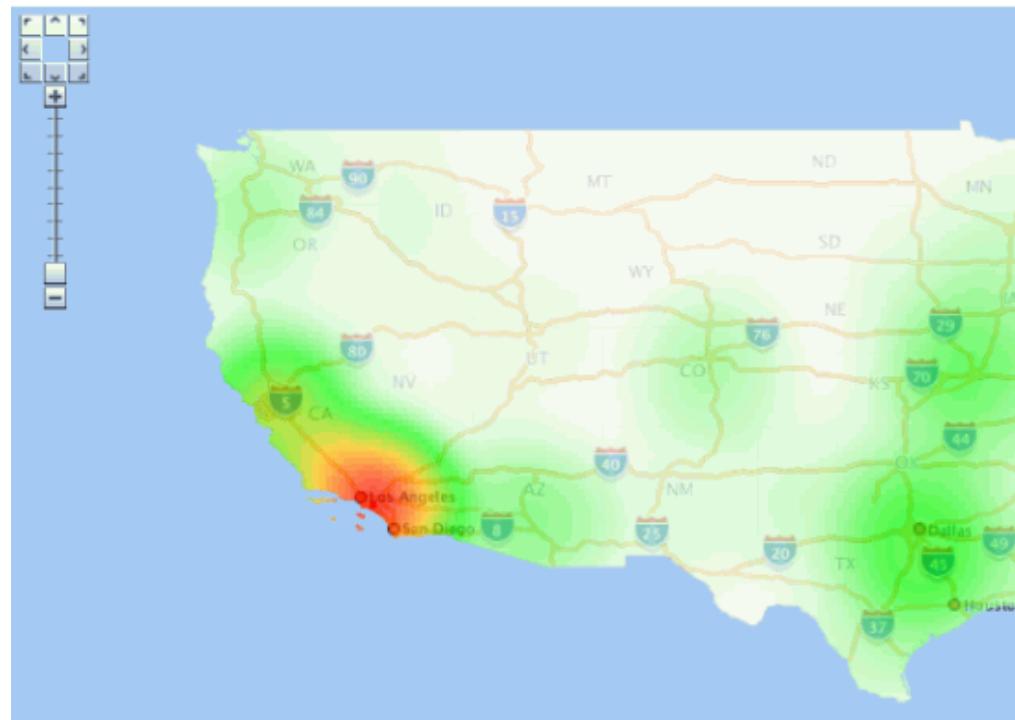
```

A.6.8 Heat Map Styles

A heat map style can be used to generate a two-dimensional (2D) color map of any point-type data set. The colors represent the distribution density or pattern of the points or events across the region. Internally, MapViewer creates a 2D matrix and assigns a value to each grid cell based on the result of a distance-weighted algorithm run against the point data set.

You can create a heat map style using the Map Builder tool, and assign it as the rendering style for a point-type geometry theme. You can then add this theme to a base map, or add it as a theme-based FOI layer to an interactive Oracle Maps application. [Figure A-3](#) shows a map displayed using a theme based on a heat map style. This map shows the concentration of pizza restaurants: red areas have the highest concentration of pizza restaurants, with concentrations progressively lower for orange, yellow, dark green, lighter green, pale green, and white areas.

Figure A-3 Heat Map Showing Pizza Restaurant Concentration



The following example creates a definition for a heat map style.

```

<?xml version="1.0" ?>
<AdvancedStyle>
  <HeatMapStyle>

```

```

<color_stops num_steps="200" alpha="128">
    FFFFFF,00FF00, FFC800,FF0000
</color_stops>
<spot_light_radius>75.0mile</spot_light_radius>
<grid_sample_factor>2.5</grid_sample_factor>
<container_theme>THEME_DEMO_STATES</container_theme>
</HeatMapStyle>
</AdvancedStyle>

```

The preceding example defines these essential aspects of the heat map:

- **Color stops.** Color stops are used to generate a color gradient. In this example, the color gradient will go from white (maps to grid cells with a zero value) to green, to orange, and finally to full red (maps to grid cells with highest values). The gradient will have 200 colors that span these 4 color stops. All the colors will have an alpha value of 128 (half transparent, where 0 would be fully transparent and 255 would be opaque).
- **Spot light radius.** The spot light radius defines the radius around each grid cell where events or points within this radius will be contributing to the final aggregated value of that cell. The contribution of each point decreases as its distance from the cell center increases, and becomes zero beyond this radius.

You can specify the radius in pixels or in a real ground unit such as `mile`. When you specify the radius in pixels (the default if you do not specify a unit), the mapping from the color gradient to the grid cells will vary as the user zooms in and out on the map. This occurs because the number of points fall within the radius is constantly changing as the user zooms in and out. To achieve a fixed heat map regardless of map scale, you must specify the spotlight radius in a ground unit such as `meter`, `km`, or `mile`. The preceding example uses `mile`.

- **Grid sample factor.** The grid sample factor is used to sample the current map window size when creating the internal matrix or grid for heat map calculation. For example, a sample factor of 4 means that the internal heat map grid will be one-fourth (0.25) the actual map window size. So, if the map is 1000x1000 pixels, the internal heat map grid is 250x250. Thus, the lower the grid sample factor value, the larger the internal heat map grid will be; and the higher the value, the smaller the internal heat map grid will be.

The grid sample factor value probably has more effect on heat map rendering performance than any other attribute, because a large internal heat map grid (resulting from a low grid sample factor value) will significantly increase the overall computation time. A good general guideline is to specify a grid sample factor value high enough so that the internal heat map grid will be 512x512 pixels or smaller.

- **Container theme name.** The container theme name specifies the name of a theme (predefined geometry theme in the same database schema) that defines the boundary of the map for the heat map theme. For example, if you are generating a heat map for a point data set that scatters all over the entire United States of America, choose a theme that represents the US national boundary or all the states as its container theme.

The specified container theme does not affect how the heat map itself is calculated (which is solely based on the point distribution and the spotlight radius). Instead, the container theme it masks out all colored cells that are outside the boundary of the study region. This helps to ensure a "clean" look for the heat map.

After you create a heat map style, you can create a theme for point data and assign the new heat map style as the rendering style for the theme.

Unlike other types of advanced styles, heat map styles do not require any attribute or value columns.

Labels are not supported for themes rendered using heat map styles.

A.7 Themes: Styling Rules

A theme definition contains one `<styling_rules>` element, which may have several other elements depending on the theme type. This `<styling_rules>` element is specified in the STYLING_RULES column of the USER_SDO_THEMES metadata view, using the following DTD:

```

<!ELEMENT styling_rules (rule+, hidden_info?, join_table?, join_columns?,
operations?, bitmap_masks?, parameters?)>
<!ATTLIST styling_rules theme_type      CDATA #IMPLIED
          key_column       CDATA #IMPLIED
          caching          CDATA #IMPLIED "NORMAL"
          image_format     CDATA #IMPLIED
          image_column     CDATA #IMPLIED
          image_resolution CDATA #IMPLIED
          image_unit       CDATA #IMPLIED
          raster_id        CDATA #IMPLIED
          raster_table     CDATA #IMPLIED
          raster_pyramid   CDATA #IMPLIED
          raster_bands     CDATA #IMPLIED
          polygon_mask     CDATA #IMPLIED
          transparent_nodata CDATA #IMPLIED
          network_name     CDATA #IMPLIED
          network_level    CDATA #IMPLIED
          topology_name   CDATA #IMPLIED
          service_url     CDATA #IMPLIED
          srs              CDATA #IMPLIED
          feature_ids     CDATA #IMPLIED
          provider_id     CDATA #IMPLIED
          srid             CDATA #IMPLIED>

<!ELEMENT rule (features, label?, rendering?)>
<!ATTLIST rule column CDATA #IMPLIED>

<!ELEMENT features (#PCDATA?, link?, node?, path?)>
<!ATTLIST features style CDATA #REQUIRED>

<!ELEMENT label (#PCDATA?, link?, node?, path?)>
<!ATTLIST label column CDATA #REQUIRED
          style  CDATA #REQUIRED>

<!ELEMENT link (#PCDATA)>
<!ATTLIST link style      CDATA #REQUIRED
          direction_style CDATA #IMPLIED
          direction_position CDATA #IMPLIED
          direction_markersize CDATA #IMPLIED
          column          CDATA #REQUIRED>

<!ELEMENT node (#PCDATA)>
<!ATTLIST node style      CDATA #REQUIRED
          markersize CDATA #IMPLIED
          column      CDATA #REQUIRED>

<!ELEMENT path (#PCDATA)>
<!ATTLIST path ids      CDATA #REQUIRED

```

```
        styles CDATA #REQUIRED
        style  CDATA #REQUIRED
        column CDATA #REQUIRED>

<!ELEMENT hidden_info (field+)>

<!ELEMENT field (#PCDATA)>
<!ATTLIST field column CDATA #REQUIRED
          name    CDATA #IMPLIED>

<!ELEMENT join_table EMPTY>
<!ATTLIST join_table name      CDATA #REQUIRED
          start_measure CDATA #IMPLIED
          end_measure   CDATA #IMPLIED
          measure       CDATA #IMPLIED>

<!ELEMENT join_columns EMPTY>
<!ATTLIST columns lrs_table_column  CDATA #REQUIRED
          join_table_column CDATA #REQUIRED>

<!ELEMENT rendering (style+)>

<!ELEMENT style (substyle?)>
<!ATTLIST style name      CDATA #REQUIRED
          value_columns CDATA #IMPLIED>

<!ELEMENT substyle (#PCDATA)>
<!ATTLIST substyle name      CDATA #REQUIRED
          value_columns CDATA #REQUIRED
          changes      CDATA #IMPLIED>

<!ELEMENT operations (operation?)>

<!ELEMENT operation (parameter?)>
<!ATTLIST operation name CDATA #REQUIRED>

<!ELEMENT parameters (parameter?)>

<!ELEMENT parameter (#PCDATA)>
<!ATTLIST parameter name  CDATA #REQUIRED
          value DATA #REQUIRED>

<!ELEMENT bitmap_masks (mask+)>

<!ELEMENT mask (#PCDATA)>
<!ATTLIST mask raster_id    CDATA #REQUIRED
          raster_table  CDATA #REQUIRED
          layers       CDATA #REQUIRED
          zeromapping  CDATA #IMPLIED
          onemapping   CDATA #IMPLIED>
```

The `<styling_rules>` element can have a `theme_type` attribute, which is used mainly for certain types of predefined themes. (The default `theme_type` attribute value is `geometry`, which indicates that the theme is based on spatial geometries.) The `theme_type` attribute values for these special types of predefined themes are as follows:

- annotation specifies an annotation text theme. Annotation text themes are explained in [Section 2.3.10](#).

- `geom_custom` specifies a custom geometry theme. You must also specify the `provider_id` and `srid` attributes. Custom geometry themes are explained in [Section 2.3.9](#).
- `georaster` specifies a GeoRaster theme. To use specified GeoRaster data (but not if you use a query condition to retrieve the GeoRaster data), you must also specify the `raster_id` and `raster_table` attributes. You can also specify the `raster_pyramid`, `raster_bands`, `polygon_mask`, and `transparent_nodata` attributes. GeoRaster themes are explained in [Section 2.3.4](#).
- `image` specifies an image theme. You must also specify the `image_format` and `image_column` attributes, and you can specify the `image_resolution` and `image_unit` attributes. Image themes are explained in [Section 2.3.3](#).
- `network` specifies a network theme. You must also specify the `network_name` attribute. You can specify the `network_level` attribute, but the default value (1) is the only value currently supported. Network themes are explained in [Section 2.3.5](#).
- `topology` specifies a topology theme. You must also specify the `topology_name` attribute. Topology themes are explained in [Section 2.3.6](#).
- `wfs` specifies a WFS theme. You must also specify the `service_url` and `srs` attributes. WFS themes are explained in [Section 2.3.7](#).

The `<styling_rules>` element can have a `key_column` attribute. This attribute is needed only if the theme is defined on a join view (a view created from multiple tables). In such a case, you must specify a column in the view that will serve as the key column to uniquely identify the geometries or images in that view. Without this key column information, MapViewer will not be able to cache geometries or images in a join view.

The `<styling_rules>` element can have a `caching` attribute, which specifies the caching scheme for each predefined theme. The `caching` attribute can have one of the following values: `NORMAL` (the default), `NONE`, or `ALL`.

- `NORMAL` causes MapViewer to try to cache the geometry data that was just viewed, to avoid repeating the costly unpickling process when it needs to reuse the geometries. Geometries are always fetched from the database, but they are not used if unpickled versions are already in the cache.
- `NONE` means that no geometries from this theme will be cached. This value is useful when you are frequently editing the data for a theme and you need to display the data as you make edits.
- `ALL` causes MapViewer to pin all geometry data of this theme entirely in the cache before any viewing request. In contrast to the default value of `NORMAL`, a value of `ALL` caches all geometries from the base table the first time the theme is viewed, and the geometries are not subsequently fetched from the database.

For detailed information about the caching of predefined themes, see [Section 2.3.1.6](#).

Each `<rule>` element must have a `<features>` element and can have a `<label>` element and a `<rendering>` element. The `<rendering>` element can be used to define multiple render styles, and in this case the render style in the `<features>` element may be undefined. If the render style in the `<features>` element is defined and `<rendering>` element is also defined, MapViewer will first render the style in the `<features>` element and then render the styles in `<rendering>` element. (The `<rendering>` element is explained later in this section.)

The optional `column` attribute of a `<rule>` element specifies one or more attribute columns (in a comma-delimited list) from the base table to be put in the SELECT list of the query generated by MapViewer. The values from such columns are usually

processed by an advanced style for this theme. The following example shows the use of the column attribute:

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <rule column="TOTPOP">
    <features style="V.COUNTY_POP_DENSITY"> </features>
  </rule>
</styling_rules>
```

In the preceding example, the theme's geometry features will be rendered using an advanced style named V.COUNTY_POP_DENSITY. This style will determine the color for filling a county geometry by looking up numeric values in the column named TOTPOP in the base table for this theme.

Each `<features>` element for a network theme must have a `<link>`, `<node>`, or `<path>` element, or some combination of them. (The `<link>`, `<node>`, and `<path>` elements apply only to network themes, which are explained in [Section 2.3.5](#).) The following example shows the styling rules for a network theme to render links and nodes.

```
<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="network"
  network_name="LRS_TEST" network_level="1">
  <rule>
    <features>
      <link style="C.RED"
        direction_style="M.IMAGE105_BW"
        direction_position="0.85"
        direction_markersize="8"></link>
      <node style="M.CIRCLE" markersize="5"></node>
    </features>
  </rule>
</styling_rules>
```

A `<label>` element must have a SQL expression as its element value for determining whether or not a label will be applied to a feature. The `column` attribute specifies a SQL expression for text values to label features, and the `style` attribute specifies a text style for rendering labels.

The `<rendering>` element can be used to define multiple rendering styles. The styles are rendered in the order that they appear. Each style in a `<rendering>` element is defined by a `<style>` element, which must specify the `name` attribute and can specify the `value_columns` attribute. (The `value_columns` attribute is used with advanced styles, and the column names are added to the list of attributes defined in the `column` attribute of `<rule>` element.)

In the `<rendering>` element, each `<style>` element can have a `<substyle>` element that defines the attributes for filling the feature. A `<substyle>` element must specify the `name` attribute and can specify the `value_columns` and `changes` attributes. For the `changes` attribute, only the `FILL_COLOR` value is supported.

The following example shows the styling rules for a geometry theme using the `<rendering>` element. It defines an advanced style named V.POIVMK to render the feature shape and an advanced substyle named V.POIBKT to fill the feature shape.

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <rule>
    <features> </features>
    <label column="NAME" style="T.STREET2"> 1 </label>
    <rendering>
```

```

<style name="V.POIVMK" value_columns="FEATURE_CODE">
  <substyle name="V.POIVBKT" value_columns="POINT_ID" changes="FILL_COLOR"/>
</style>
</rendering>
</rule>
</styling_rules>

```

For more information about using the `<rendering>` element to apply multiple rendering styles in a single styling rule, see [Section 2.3.1.4](#).

The `<hidden_info>` element specifies the list of attributes from the base table to be displayed when the user moves the mouse over the theme's features. The attributes are specified by a list of `<field>` elements.

Each `<field>` element must have a `column` attribute, which specifies the name of the column from the base table, and it can have a `name` attribute, which specifies the display name of the column. (The `name` attribute is useful if you want a text string other than the column name to be displayed.)

The `<join_table>` element specifies the table name and its one or two columns for the measurements. It may contain one measure column for features of point type or two measure columns for features of line string type. The measure column or columns are used for the linear referencing process when joining with a LRS table, which has an LRS geometry column.

The `<join_columns>` element specifies one column of the LRS table (which has a LRS geometry column), and one column from the join table (which has one or two measure columns). These two columns are used to join the LRS table and the join table.

The `<operations>` element specifies the list of image processing operations to be applied on a GeoRaster theme. The operations are specified by a list of `<operation>` elements.

The `<operation>` element specifies the image processing operator and its parameters to be applied on a GeoRaster theme. Each `<operation>` element may have a list of `<parameters>` elements.

The `<parameters>` element defines a list of parameters to be used on a specific task. The parameters are specified by a list of `<parameter>` elements.

The `<parameter>` element must have the `name` and `value` attributes defined.

The `<bitmap_masks>` element defines the image mask attributes to be used with a GeoRaster theme. The bitmap masks are specified by a list of `<mask>` elements.

The `<mask>` element specifies a bitmap mask to be applied on a GeoRaster object. The `raster_id`, `raster_table`, and `layers` attributes must be defined, while the `zeromapping` and `onemapping` attributes are optional.

See [Section 2.3.1.1](#) for more information about styling rules and for an example.

A.8 Base Maps

A base map definition consists of one or more themes. The XML definition of a base map is specified in the DEFINITION column of the USER_SDO_MAPS metadata view, using the following DTD:

```

<!ELEMENT map_definition (theme+)>

<!ELEMENT theme EMPTY>
<!ATTLIST theme name CDATA #REQUIRED
      name          CDATA #REQUIRED

```

```
  datasource          CDATA #IMPLIED
  template_theme     CDATA #IMPLIED
  max_scale          CDATA #IMPLIED
  min_scale          CDATA #IMPLIED
  label_always_on    (TRUE|FALSE) "FALSE"
  fast_unpickle      (TRUE|FALSE) "TRUE"
  mode               CDATA #IMPLIED
  min_dist           CDATA #IMPLIED
  fixed_svglabel     (TRUE|FALSE) "FALSE"
  visible_in_svg     (TRUE|FALSE) "TRUE"
  selectable_in_svg   (TRUE|FALSE) "FALSE"
  part_of_basemap    (TRUE|FALSE) "FALSE"
  simplify_shapes    (TRUE|FALSE) "TRUE"
  transparency        CDATA #IMPLIED
  minimum_pixels     CDATA #IMPLIED
  onclick             CDATA #IMPLIED
  onmousemove         CDATA #IMPLIED
  onmouseover         CDATA #IMPLIED
  onmouseout          CDATA #IMPLIED
  workspace_name      CDATA #IMPLIED
  workspace_savepoint CDATA #IMPLIED
  workspace_date      CDATA #IMPLIED
  workspace_date_format CDATA #IMPLIED
  fetch_size          CDATA #IMPLIED
  timeout             CDATA #IMPLIED
>
```

The `<map_definition>` element contains one or more `<theme>` elements. Themes are rendered on a map on top of each other, in the order in which they are specified in the definition.

The `<theme>` element and its attributes are described in [Section 3.1.2.20](#)

See [Section 2.4](#) for more information about defining base maps and for an example.

A.9 Map Tile Layers

An Oracle Maps map tile layer which assembles and displays pregenerated map image tiles from the map tile server, as described in [Section 3.3.2.2, "Map Tile Layer Configuration"](#). The XML configuration settings of a map tile layer is defined using the following DTD:

```
<!ELEMENT map_tile_layer ((internal_map_source|external_map_source), tile_storage,
  coordinate_system, tile_image, , tile_dpi?, tile_meters_per_unit?, zoom_levels,
  auto_update?, themes?)>
<!ATTLIST map_tile_layer
  name CDATA #REQUIRED
  image_format CDATA #IMPLIED
  http_headerExpires CDATA #IMPLIED
  utfgrid (TRUE|FALSE) "FALSE"
  utfgrid_resolution CDATA #IMPLIED
  concurrent_fetching_threads CDATA #IMPLIED
  fetch_larger_tile (TRUE|FALSE) "TRUE"
  persistent_tiles (TRUE|FALSE) "TRUE">

<!ELEMENT internal_map_source EMPTY>
<!ATTLIST internal_map_source
  data_source CDATA #REQUIRED
  base_map CDATA #REQUIRED
  bgcolor CDATA #IMPLIED
```

```

        out_of_bounds_color CDATA #IMPLIED
        antialias (TRUE|FALSE) "TRUE">

<!ELEMENT external_map_source (properties?)>
<!ATTLIST external_map_source
    url CDATA #REQUIRED
    request_method CDATA #REQUIRED
    timeout CDATA #IMPLIED
    adapter_class CDATA #REQUIRED
    proxy_host CDATA #IMPLIED
    proxy_port CDATA #IMPLIED
    clipping_buffer CDATA #IMPLIED>

<!ELEMENT properties (property+)>

<!ELEMENT property EMPTY>
<!ATTLIST property
    name CDATA #REQUIRED
    value CDATA #REQUIRED>

<!ELEMENT tile_storage EMPTY>
<!ATTLIST tile_storage
    root_path CDATA #REQUIRED
    xyz_storage_scheme (TRUE|FALSE) "FALSE">

<!ELEMENT coordinate_system EMPTY>
<!ATTLIST coordinate_system
    srid CDATA #REQUIRED
    minX CDATA #REQUIRED
    minY CDATA #REQUIRED
    maxX CDATA #REQUIRED
    maxY CDATA #REQUIRED>

<!ELEMENT tile_bound (coordinates)>
<!ELEMENT coordinates (#PCDATA)>

<!ELEMENT tile_image EMPTY>
<!ATTLIST tile_image
    width CDATA #REQUIRED
    height CDATA #REQUIRED>

<!ELEMENT tile_dpi EMPTY>
<!ATTLIST tile_dpi
    value CDATA #REQUIRED>

<!ELEMENT tile_meters_per_unit EMPTY>
<!ATTLIST tile_meters_per_unit
    value CDATA #REQUIRED>

<!ELEMENT zoom_levels (zoom_level+)>
<!ATTLIST zoom_levels
    levels CDATA #REQUIRED
    min_scale CDATA #IMPLIED
    max_scale CDATA #IMPLIED
    min_tile_width CDATA #IMPLIED
    min_tile_height CDATA #IMPLIED>

<!ELEMENT zoom_level (tile_bound?)>
<!ATTLIST zoom_level
    level CDATA #REQUIRED

```

```
level_name CDATA #IMPLIED
description CDATA #IMPLIED
scale CDATA #REQUIRED
tile_width CDATA #REQUIRED
tile_height CDATA #REQUIRED>

<!ELEMENT auto_update (dirty_mbr_table_name,logtable_name)>
<!ATTLIST auto_update
    finest_level_to_refresh CDATA #REQUIRED
    dirty_mbr_batch CDATA #REQUIRED
    dirty_mbr_cap CDATA #REQUIRED>

<!ELEMENT dirty_mbr_table_name EMPTY>
<!ATTLIST dirty_mbr_table_name
    name CDATA #REQUIRED>

<!ELEMENT logtable_name EMPTY>
<!ATTLIST logtable_name
    name CDATA #REQUIRED>

<!ELEMENT themes (theme)>
<!ATTLIST auto_update
    finest_level_to_refresh CDATA #REQUIRED
    dirty_mbr_batch CDATA #REQUIRED
    dirty_mbr_cap CDATA #REQUIRED>

<!ELEMENT theme EMPTY>
<!ATTLIST theme
    name CDATA #REQUIRED
    from_level CDATA #REQUIRED
    to_level CDATA #REQUIRED>
```

B

JavaScript Functions for SVG Maps

This appendix describes the MapViewer JavaScript application programming interface (API) for SVG maps. This API contains predefined functions that can be called from outside the SVG map, typically from the HTML document in which the SVG map is embedded. In addition, you can create JavaScript functions to be called when certain mouse-click actions occur. The predefined and user-defined functions can be used to implement sophisticated client-side interactive features, such as customized navigation.

If you use any of the JavaScript functions described in this appendix, end users must use Microsoft Internet Explorer to view the SVG maps, and Adobe SVG Viewer 3.0 or a later release must be installed on their systems.

This appendix contains the following major sections:

- [Section B.1, "Navigation Control Functions"](#)
- [Section B.2, "Display Control Functions"](#)
- [Section B.3, "Mouse-Click Event Control Functions"](#)
- [Section B.4, "Other Control Functions"](#)

B.1 Navigation Control Functions

The MapViewer JavaScript functions for controlling navigation include the following:

- `recenter(x, y)` sets the center point of the current SVG map.

The input `x` and `y` values specify the coordinates (in pixels) of the new center point, which is the point inside the SVG map to be displayed at the center of the SVG viewer window. The SVG viewer window is the graphical area in the web browser displayed by the SVG viewer. The coordinates of the center point are defined in the SVG map screen coordinate system, which starts from (0, 0) at the upper-left corner of the map and ends at (width, height) at the lower-right corner.

- `setZoomRatio(zratio)` sets the current map display zoom ratio.

This function can be used to zoom in or zoom out in the SVG map. (It does not change the center point of the map.) The original map zoom ratio without any zooming is 1, and higher zoom ratio values show the SVG map zoomed in. The map zoom ratio should be set to those values that fit predefined zoom levels. For example, if the `zoomlevels` value is 4 and `zoomfactor` value is 2, map zoom ratios at zoom level 0, 1, 2, and 3 will be 1, 2, 4, and 8, respectively; thus, in this example the `zratio` parameter value should be 1, 2, 4, or 8. For more information about predefined zoom levels, see the descriptions of the `zoomlevels`, `zoomfactor`, and `zoomratio` attributes in [Section 3.1.2.1.1](#).

B.2 Display Control Functions

MapViewer provides functions to enable and disable the display of informational tips, the map legend, hidden themes, and the animated loading bar. The display control functions include the following:

- `switchInfoStatus()` enables or disables the display of informational tips. (Each call to the function reverses the previous setting.)
You can control the initial display of informational tips by using the `<hidden_info>` element in theme styling rule definition (see [Section A.7](#)) and the `infoon` attribute in a map request (see [Section 3.1.2.1.1](#)). The `switchInfoStatus()` function toggles (reverses) the current setting for the display of informational tips.
- `switchLegendStatus()` enables or disables the display of the map legend. (Each call to the function reverses the previous setting.) The legend is initially hidden when the map is displayed.
- `showTheme(theme)` sets the specified theme to be visible on the map, and `hideTheme(theme)` sets the specified theme to be invisible on the map.
- `showLoadingBar()` displays the animated loading bar. The animated loading bar provides a visible indication that the loading of a new map is in progress. The bar is removed from the display when the loading is complete.

B.3 Mouse-Click Event Control Functions

MapViewer provides several predefined mouse-click event control functions, which are explained in [Section B.3.1](#). You can also create user-defined mouse event control functions, as explained in [Section B.3.2](#).

B.3.1 Predefined Mouse-Click Control Functions

MapViewer provides functions to enable and disable theme feature, rectangle, and polygon selection in SVG maps. It also provides functions to get information about selections and to toggle the selection status on and off. The functions for customizing mouse-click event control on an SVG map include the following:

- `enableFeatureSelect()` enables theme feature selection, and `disableFeatureSelect()` disables theme feature selection.
Theme feature selection can be enabled if the `selectable_in_svg` attribute in the `<theme>` element is TRUE either in the map request (see [Section 3.1.2.20](#)) or in the base map (see [Section A.8](#)) definition. If the theme is selectable and theme feature selection is enabled, each feature of the theme displayed on the SVG map can be selected by clicking on it. If the feature is selected, its color is changed and its ID (rowid by default) is recorded. Clicking on an already selected feature deselects the feature. The list of IDs of all selected features can be obtained by calling the `getSelectedIdList()` function, described in this section.
When theme feature selection is enabled, polygon selection and rectangle selection are automatically disabled.
- `enablePolygonSelect()` enables polygon selection, and `disablePolygonSelect()` disables polygon selection.
If polygon selection is enabled, a polygon selection area can be defined by clicking and moving the mouse on the SVG map. Each click creates a shape point for the polygon. The coordinates of the polygon are recorded, and can be obtained by calling the `getSelectPolygon()` function, described in this section.

When polygon selection is enabled, theme feature selection and rectangle selection are automatically disabled.

- `enableRectangleSelect()` enables rectangle selection, and `disableRectangleSelect()` disables rectangle selection.

If rectangle selection is enabled, a rectangular selection window can be defined by clicking and dragging the mouse on the SVG map. The coordinates of the rectangle are recorded, and can be obtained by calling the `getSelectRectangle()` function, described in this section.

When rectangle selection is enabled, theme feature selection and polygon selection are automatically disabled.

- `getInfo(theme, key)` returns the informational note or tip string of the feature identified by theme name and key.
- `getSelectedIdList(theme)` returns an array of all feature IDs that are selected on the SVG map.
- `getSelectPolygon()` returns an array of the coordinates of all shape points of the selection polygon, using the coordinate system associated with the original user data.
- `getSelectRectangle()` returns an array of the coordinates of the upper-left corner and the lower-right corner of the selection rectangle, using the coordinate system associated with the original user data.
- `selectFeature(theme, key)` toggles the selection status of a feature (identified by its key value) in a specified theme.
- `setSelectPolygon(poly)` sets the coordinates of all shape points of the selection polygon, using the coordinate system associated with the original user data. The coordinates are stored in the array `poly`. Calling this function after `enablePolygonSelect()` draws a polygon on the SVG map.
- `setSelectRectangle(rect)` sets the coordinates of the upper-left corner and the lower-right corner of the selection rectangle, using the coordinate system associated with the original user data. The coordinates are stored in the array `rect`. Calling this function after `enableRectangleSelect()` draws a rectangle on the SVG map.

B.3.2 User-Defined Mouse Event Control Functions

User-defined JavaScript mouse-event control functions can be combined with predefined JavaScript functions (described in [Section B.3.1](#)) to implement further interactive customization. You can create map-level, theme-level, and selection event control functions.

B.3.2.1 Map-Level Functions

Map-level mouse event control functions can be defined for mouse-click events and mouse-move events.

A mouse-click event function is called whenever a click occurs anywhere in the SVG map, if both theme feature selection and window selection are disabled. The name of the function is defined by the `onclick` attribute in the map request (see [Section 3.1.2.1.1](#)).

A mouse-move event function is called whenever the mouse moves anywhere in the SVG map. The name of the function is defined by the `onmousemove` attribute in the map request (see [Section 3.1.2.1.1](#)).

These JavaScript functions must be defined in the web page that has the SVG map embedded. Mouse-click and mouse-move event functions must accept two parameters, *x* and *y*, which specify the coordinates inside the SVG viewer window where the mouse click or move occurred. The coordinate is defined in the local SVG viewer window coordinate system, which starts from (0,0) at the upper-left corner and ends at (width, height) at the lower-right corner.

B.3.2.2 Theme-Level Functions

Theme-level mouse event control functions can be defined for mouse-click, mouse-move, mouse-over, and mouse-out events.

A mouse-click event control function is called when theme feature selection is enabled and a feature of the theme is clicked. Each theme in the map can have its own mouse-click event control function. A theme-level mouse-click event control function is specified by the `onclick` attribute in the `<theme>` element in the map request or base map definition.

A mouse-move event control function is called whenever the mouse moves inside any feature of the theme. Each theme in the map can have its own mouse-move event control function. A theme-level mouse-move event control function is specified by the `onmousemove` attribute in the `<theme>` element in the map request or base map definition.

A mouse-over event control function is called whenever the mouse moves from outside a feature of the theme to inside a feature of the theme. Each theme in the map can have its own mouse-over event control function. A theme-level mouse-over event control function is specified by the `onmouseover` attribute in the `<theme>` element in the map request or base map definition.

A mouse-out event control function is called whenever the mouse moves out of a feature of the theme. Each theme in the map can have its own mouse-out event control function. A theme-level mouse-out event control function is specified by the `onmouseout` attribute in the `<theme>` element in the map request or base map definition.

These JavaScript functions must be defined in the web page that has the SVG map embedded. They take the following parameters:

- Theme name
- Key of the feature
- X-axis value of the point in the SVG viewer window where the mouse click occurred
- Y-axis value of the point in the SVG viewer window where the mouse click occurred

The key of the feature is the value of the key column from the base table, which is specified by the `key_column` attribute of the `<theme>` element in the map request or base map definition. ROWID is used as the default key column. For example, if the `onclick` attribute is set to `selectCounty` for the COUNTY theme, the following JavaScript function call is executed if the feature with rowid AAAHQDAABAAALk6Abm of the COUNTY theme is clicked on the SVG map at (100,120): `selectCounty('COUNTY', 'AAAHQDAABAAALk6Abm', 100, 120)`.

The x-axis and y-axis values specify the coordinates inside the SVG viewer window where the mouse event occurred. The coordinate is defined in the local SVG viewer window coordinate system, which starts from (0,0) at the upper-left corner and ends at (width, height) at the lower-right corner.

B.3.2.3 Selection Event Control Functions

You can define a selection event control function for rectangle selection or polygon selection, or for both.

A rectangle selection event control function is called whenever rectangle selection is enabled and a rectangular selection area has been created by clicking and dragging the mouse (to indicate two diagonally opposite corners) on an SVG map. The function is called immediately after the selection of the rectangle is completed and the mouse key is released. The function name is specified with the `onrectselect` attribute in the map request (see [Section 3.1.2.1.1](#)).

A polygon selection event control function is called whenever polygon selection is enabled and a polygon-shaped selection area has been created by clicking and dragging the mouse at least four times on an SVG map, with the last click on the same point as the first click to complete the polygon. The function is called immediately after the selection of the polygon is completed. The function name is specified with the `onpolyselect` attribute in the map request (see [Section 3.1.2.1.1](#)).

B.4 Other Control Functions

MapViewer provides other useful functions for working with SVG maps. These functions include the following:

- `getUserCoordinate(x,y)` converts the screen coordinates into the original map data coordinates. This function returns the converted result in an array. The first element of the array is the converted X coordinate, and the second element of the array is the converted Y coordinate.
- `getScreenCoordinate(x,y)` converts the original map data coordinates into the screen coordinates. This function returns the converted result in an array. The first element of the array is the converted X coordinate, and the second element of the array is the converted Y coordinate.

C

Creating and Registering a Custom Image Renderer

This appendix explains how to implement and register a custom image renderer for use with an image theme. (Image themes are described in [Section 2.3.3](#).)

If you want to create a map request specifying an image theme with an image format that is not supported by MapViewer, you must first implement and register a custom image renderer for that format. For example, the ECW format in [Example 3–6](#) in [Section 3.1.1.6](#) is not supported by MapViewer; therefore, for that example to work, you must first implement and register an image renderer for ECW format images.

The interface `oracle.sdoovis.CustomImageRenderer` is defined in the package `sdoovis.jar`, which is located in the `$ORACLE_HOME/lbs/lib` directory in an Oracle Fusion Middleware environment. The following is the source code of this interface.

```
/*
 * An interface for a custom image painter that supports user-defined image
 * formats. An implementation of this interface can be registered with
 * MapViewer to support a custom image format.
 */
public interface CustomImageRenderer
{
    /**
     * The method is called by MapViewer to find out the image format
     * supported by this renderer. <br>
     * This format string must match the one specified in a custom image renderer
     * element defined in the configuration file (mapViewerConfig.xml).
     */
    public String getSupportedFormat() ;

    /**
     * Renders the given images. MapViewer calls this method
     * to tell the implementor the images to render, the current map
     * window in user space, and the MBR (in the same user space) for each
     * image.
     * <br>
     * The implementation should not retain any reference to the parameters
     * permanently.
     * @param g2 the graphics context to draw the images onto.
     * @param images an array of image data stored in byte array.
     * @param mbrs an array of double[4] arrays containing one MBR for each
     *           image in the images array.
     * @param dataWindow the data space window covered by the current map.
     * @param deviceView the device size and offset.
     * @param at the AffineTransform using which you can transform a point
     *           in the user data space to the device coordinate space. You can
```

```

        *
        *      ignore this parameter if you opt to do the transformation
        *      yourself based on the dataWindow and deviceView information.
        * @param scaleImage a flag passed from MapViewer to indicate whether
        *      the images should be scaled to fit the current device window.
        *      If it is set to false, render the image as-is without
        *      scaling it.
        */
    public void    renderImages(Graphics2D g2, byte[][][] images, double[][][] mbrs,
                                Rectangle2D dataWindow, Rectangle2D deviceView,
                                AffineTransform at, boolean scaleImage) ;
}

```

After you implement this interface, you must place your implementation class in a directory that is part of the MapViewer CLASSPATH definition, such as the \$MAPVIEWER/web/WEB-INF/lib directory. If you use any native libraries to perform the actual rendering, you must ensure that any other required files (such as .dll and .so files) for these libraries are accessible to the Java virtual machine (JVM) that is running MapViewer.

After you place your custom implementation classes and any required libraries in the MapViewer CLASSPATH, you must register your class with MapViewer in its configuration file, mapViewerConfig.xml (described in [Section 1.6.2](#)). Examine, and edit as appropriate, the following section of the file, which tells MapViewer which class to load if it encounters a specific image format that it does not already support.

```

<!-- **** Uncomment and add as many custom image renderers as needed here,
     each in its own <custom_image_renderer> element. The "image_format"
     attribute specifies the format of images that are to be custom
     rendered using the class with the full name specified in "impl_class".
     You are responsible for placing the implementation classes in the
     MapViewer classpath.
-->
<!--
<custom_image_renderer image_format="ECW"
                      impl_class="com.my_corp.image.ECWRenderer"/>
-->

```

In this example, for any ECW formatted image data loaded through the <jdbc_image_query> element of an image theme, MapViewer will load the class com.my_corp.image.ECWRenderer to perform the rendering.

[Example C-1](#) is an example implementation of the oracle.sdovis.CustomImageRenderer interface. This example implements a custom renderer for the ECW image format. Note that this example is for illustration purposes only, and the code shown is not necessarily optimal or even correct for all system environments. This implementation uses the ECW Java SDK, which in turn uses a native C library that comes with it. For MapViewer to be able to locate the native dynamic library, you may need to use the command-line option -Djava.library.path when starting the instance that contains MapViewer.

Example C-1 Custom Image Renderer for ECW Image Format

```

package com.my_corp.image;
import java.io.*;
import java.util.Random;
import java.awt.*;
import java.awt.geom.*;

```

```

import java.awt.image.BufferedImage;

import oracle.sdovis.CustomImageRenderer;
import com.ermapper.ecw.JNCSFile; // from ECW Java SDK

public class ECWRenderer implements CustomImageRenderer
{
    String tempDir = null;
    Random random = null;

    public ECWRenderer()
    {
        tempDir = System.getProperty("java.io.tmpdir");
        random = new Random(System.currentTimeMillis());
    }

    public String getSupportedFormat()
    {
        return "ECW";
    }

    public void renderImages(Graphics2D g2, byte[][][] images,
                           double[][] mbrs,
                           Rectangle2D dataWindow,
                           Rectangle2D deviceView,
                           AffineTransform at)
    {
        // Taking the easy way here; you should try to stitch the images
        // together here.
        for(int i=0; i<images.length; i++)
        {
            String tempFile = writeECWToFile(images[i]);
            paintECWFile(tempFile, g2, mbrs[i], dataWindow, deviceView, at);
        }
    }

    private String writeECWToFile(byte[] image)
    {
        long l = Math.abs(random.nextLong());
        String file = tempDir + "ecw"+l+".ecw";
        try{
            FileOutputStream fos = new FileOutputStream(file);
            fos.write(image);
            fos.close();
            return file;
        }catch(Exception e)
        {
            System.err.println("cannot write ecw bytes to temp file: "+file);
            return null;
        }
    }

    private void paintECWFile(String fileName, Graphics2D g,
                           double[] mbr,
                           Rectangle2D dataWindow,
                           Rectangle2D deviceView,
                           AffineTransform at)
    {
        JNCSFile ecwFile = null;
        boolean bErrorOnOpen = false;

```

```

BufferedImage ecwImage = null;
String errorMessage = null;

try {
    double dFileAspect, dWindowAspect;
    double dWorldTLX, dWorldTLY, dWorldBRX, dWorldBRY;
    int bandlist[];
    int width = (int)deviceView.getWidth(),
        height = (int)deviceView.getHeight();
    int line, pRGBArray[] = null;

    ecwFile = new JNCSFile(fileName, false);

    // Work out the correct aspect for the setView call.
    dFileAspect = (double)ecwFile.width/(double)ecwFile.height;
    dWindowAspect = deviceView.getWidth()/deviceView.getHeight();

    if (dFileAspect > dWindowAspect) {
        height =(int)((double)width/dFileAspect);
    } else {
        width = (int)((double)height*dFileAspect);
    }

    // Create an image of the ecw file.
    ecwImage = new BufferedImage(width, height,
                                 BufferedImage.TYPE_INT_RGB);
    pRGBArray = new int[width];

    // Set up the view parameters for the ecw file.
    bandlist = new int[ecwFile.numBands];
    for (int i=0; i< ecwFile.numBands; i++) {
        bandlist[i] = i;
    }
    dWorldTLX = ecwFile.originX;
    dWorldTLY = ecwFile.originY;
    dWorldBRX = ecwFile.originX +
                (double)(ecwFile.width-1)*ecwFile.cellIncrementX;
    dWorldBRY = ecwFile.originY +
                (double)(ecwFile.height-1)*ecwFile.cellIncrementY;

    dWorldTLX = Math.max(dWorldTLX, dataWindow.getMinX());
    dWorldTLY = Math.max(dWorldTLY, dataWindow.getMinY());
    dWorldBRX = Math.min(dWorldBRX, dataWindow.getMaxX());
    dWorldBRY = Math.min(dWorldBRY, dataWindow.getMaxY());

    // Set the view.
    ecwFile.setView(ecwFile.numBands, bandlist, dWorldTLX,
                   dWorldTLY, dWorldBRX, dWorldBRY, width, height);

    // Read the scan lines.
    for (line=0; line < height; line++) {
        ecwFile.readLineRGBA(pRGBArray);
        ecwImage.setRGB(0, line, width, 1, pRGBArray, 0, width);
    }

} catch(Exception e) {
    e.printStackTrace(System.err);
    bErrorOnOpen = true;
    errorMessage = e.getMessage();
    g.drawString(errorMessage, 0, 50);
}

```

```
    }

    // Draw the image (unscaled) to the graphics context.
    if (!bErrorOnOpen) {
        g.drawImage(ecwImage, 0, 0, null);
    }

}
```


D

Creating and Registering a Custom Spatial Data Provider

This appendix shows a sample implementation of a spatial data provider, and explains how to register this provider to be used with MapViewer. The complete implementation can be found under the MapViewer web/demo/spatialprovider directory. The implementation uses the following files:

- us_biggcities.xml: sample XML file that the provider parses
- customSpatialProviderSample.java: Java implementation of the spatial data provider
- spatialprovider.jar: jar file with the compiled version of the customSpatialProviderSample.java source file

The us_biggcities.xml file has sections to define the data attributes, the data extents, and the feature information, including the geometry (in GML format) and the attribute values. This file includes the following:

```
<?xml version="1.0" standalone="yes"?>
<spatial_data>

<data_attributes>
    <attribute name="city" type="string" />
    <attribute name="state_abrv" type="string" />
    <attribute name="pop90" type="double" />
</data_attributes>

<data_extents>
    <xmin> -122.49586 </xmin>
    <ymin> 29.45765 </ymin>
    <xmax> -73.943849 </xmax>
    <ymax> 42.3831 </ymax>
</data_extents>

<geoFeature>
    <attributes> New York,NY,7322564 </attributes>
    <geometricProperty>
        <Point>
            <coordinates>-73.943849, 40.6698</coordinates>
        </Point>
    </geometricProperty>
</geoFeature>

. . .

</spatial_data>
```

This appendix contains the following major sections:

- [Section D.1, "Implementing the Spatial Provider Class"](#)
- [Section D.2, "Registering the Spatial Provider with MapViewer"](#)
- [Section D.3, "Rendering the External Spatial Data"](#)

D.1 Implementing the Spatial Provider Class

The provider must implement the class interface shown in [Section 2.3.9, Example D-1](#) contains the partial code for the spatial provider in the supplied demo. Note that this sample code is deliberately simplified; it is not optimized, and the provider does not create any spatial indexing mechanism.

Example D-1 Implementing the Spatial Provider Class

```
package spatialprovider.samples;

import java.awt.geom.Point2D;
import java.awt.geom.Rectangle2D;
import java.io.File;
import java.util.ArrayList;
import java.util.Properties;
import java.util.StringTokenizer;
import java.util.Vector;
import javax.xml.parsers.DocumentBuilder;
import javax.xml.parsers.DocumentBuilderFactory;
import oracle.mapviewer.share.Field;
import oracle.mapviewer.share.ext.SDataProvider;
import oracle.mapviewer.share.ext.SDataSet;
import oracle.mapviewer.share.ext.SObject;
import org.w3c.dom.Document;
import org.w3c.dom.NamedNodeMap;
import org.w3c.dom.Node;
import org.w3c.dom.NodeList;
import oracle.spatial.geometry.JGeometry;
import oracle.spatial.util.GML;

public class CustomSpatialProviderSample implements SDataProvider
{
    ...

    /**
     * Constructor.
     */
    public CustomSpatialProviderSample()
    {
        ...
    }

    /**
     * Returns the initialization parameters for the provider.
     * The "datadir" parameter should be registered on MapViewer
     * configuration file and can be used to access the data.
     * @return
     */
    public String[] getInitParameterNames()
    {
        return new String[]{ "datadir" };
    }
}
```

```

}

/**
 * Returns runtime parameter names. Runtime parameters are additional parameters
 * that the provider may use when retrieving the data objects.
 * @return
 */
public String[] getRuntimeParameterNames()
{
    return new String[]{ "filename" };
}

/**
 * Initializes the provider
 * @param params  init properties
 * @return
 */
public boolean init(Properties params)
{
    dataDirectory = null;
    if(params == null)
        return true;
    dataDirectory = params.getProperty("datadir");
    if(dataDirectory == null || dataDirectory.trim().length() == 0)
    {
        // try upper case
        dataDirectory = params.getProperty("DATADIR");
        if(dataDirectory == null || dataDirectory.trim().length() == 0)
            System.out.println("FINE: Init properties does not define \"datadir\" parameter.");
    }
    return true;
}

/**
 * Returns the data set (geometries plus attributes) that intersects the
 * query window. In this sample the data is parsed just once and
 * there is no spatial index for searching. The search is sequential.
 * @param queryWin  search area
 * @param nonSpatialColumns  attribute columns
 * @param params      runtime properties
 * @return
 */
public SDataSet buildDataSet(Rectangle2D queryWin,
                             String []nonSpatialColumns,
                             Properties params)
{
    if(!dataParsed)
    {
        dataParsed = parseData(params);
        if(!dataParsed)
            return null;
    }
    if(geometries.size() == 0)
        return null;

    SDataSet dataset = new SDataSet();
    boolean fullExtent = isFullExtent(queryWin);
    if(fullExtent)
    {
        for(int i=0;i<geometries.size();i++)

```

```

        {
            JGeometry geom = (JGeometry)geometries.get(i);
            SObject obj = new SObject(geom,getGeometryAttributes(nonSpatialColumns,i));
            dataset.addObject(obj); }
        }
    else
    {
        for(int i=0;i<geometries.size();i++)
        {
            JGeometry geom = (JGeometry)geometries.get(i);
            double []mbr = geom.getMBR();
            if(mbr == null)
                continue;
            Rectangle2D.Double rect = new Rectangle2D.Double(mbr[0],mbr[1],
                mbr[2]-mbr[0],
                mbr[3]-mbr[1]);
            if(rect.getWidth() == 0. && rect.getHeight() == 0.)
            {
                Point2D.Double pt = new Point2D.Double(mbr[0],mbr[1]);
                if(queryWin.contains(pt))
                {
                    SObject obj = new SObject(geom,getGeometryAttributes(nonSpatialColumns,i));
                    dataset.addObject(obj); }
                }
            else if(queryWin.contains(rect) || queryWin.intersects(rect))
            {
                SObject obj = new SObject(geom,getGeometryAttributes(nonSpatialColumns,i));
                dataset.addObject(obj); }
            }
        }
        if(dataset.getSize() == 0)
            return null;
        return dataset;
    }

    /**
     * Returns the data provider attribute list.
     * @return
     */
    public Field[] getAttributeList(Properties params)
    {
        if(!dataParsed)
        {
            dataParsed = parseData(params);
            if(!dataParsed)
                return null;
        }
        if(attributes.size() == 0)
            return null;

        return (Field[])attributes.toArray(new Field[attributes.size()]);
    }

    /**
     * Returns the data extents.
     * @return
     */
    public Rectangle2D getDataExtents(Properties params)
    {
        if(!dataParsed)

```

```

{
    dataParsed = parseData(params);
    if(!dataParsed)
        return null;
}
if(extents == null || extents.length < 4)
    return null;
else
    return new Rectangle2D.Double(extents[0],extents[1],
                                extents[2]-extents[0],
                                extents[3]-extents[1]);
}

/**
 * Builds a spatial index for the data. In this sample there is no
 * spatial index. The data is loaded into memory when data is parsed.
 * @return
 */
public boolean buildSpatialIndex(Properties params)
{
    return true;
}
}

```

After you have implemented the provider code, compile it and generate a jar file with this compiled class. The file `spatialprovider.jar` in the demo directory contains the compiled version of this sample code, and you can use it directly. Copy this jar file to a directory that is part of MapViewer's CLASSPATH definition, such as the `web/WB-INF/lib` directory.

D.2 Registering the Spatial Provider with MapViewer

To register the spatial provider with MapViewer, add the following in the spatial provider section of the MapViewer configuration file, and then restart MapViewer:

```

<s_data_provider
    id="xmlProvider"
    class="spatialprovider.samples.CustomSpatialProviderSample"
>
<parameters>
    <parameter name="datadir" value="/temp/data" />
</parameters>
</s_data_provider>

```

When you restart MapViewer, you should see a console message that the spatial provider has been registered. For example:

```
2007-10-01 14:30:31.109 NOTIFICATION Spatial Provider xmlProvider has been registered.
```

D.3 Rendering the External Spatial Data

To enable you to render the sample external spatial data that comes with MapViewer kit., create a data source pointing to this data [Example D-2](#) is an XML request that contains a dynamic custom geometry theme.

Example D–2 Map Request to Render External Spatial Data

```
<?xml version="1.0" standalone="yes"?>
<map_request
    title="Custom Geometry Theme"
    datasource="mvdemo"
    width="500"
    height="400"
    bgcolor="#a6caf0"
    antialiase="true"
    format="PNG_STREAM"
>
    <center size="40">
        <geoFeature>
            <geometricProperty typeName="center">
                <Point>
                    <coordinates>-90,32</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>
</map_request>

<themes>
    <theme name="custom_theme" >
        <custom_geom_theme
            provider_id="xmlProvider"
            srid="8307"
            render_style="M.CIRCLE"
            label_column="city"
            label_style="T.CITY NAME"
            datasource="mvdemo">
            <parameters>
                <parameter name="filename" value="/lbs/demo/spatialprovider/us_bigcities.xml"/>
            </parameters>
        </custom_geom_theme>
    </theme>
</themes>
</map_request>
```

In [Example D–2](#), the file name in the `<parameter>` element points to `/lbs/demo/spatialprovider/us_bigcities.xml`. If the file path is not accessible to MapViewer, the map request may generate error messages in the log file, such as the following:

```
07/09/28 10:26:47 ParseData: Can not access file: /lbs/demo/spatialprovider/us_
bigcities.xml
07/09/28 10:26:47 ParseData: File to be parsed: /temp/data\us_bigcities.xml
07/09/28 10:26:47 ParseData: File can not be accessed on provider data directory.
Copy files there.
```

When MapViewer searches for the file, it first tries to access the file using the original theme definition parameter; and if that fails, it tries the data directory defined in the MapViewer configuration file (`/temp/data` in the preceding example error messages). Therefore, if the original theme definition data path is not accessible to MapViewer, copy the data files to the directory defined in the configuration file before you issue the map request.

If MapViewer can find the data file, the map request in[Example D–2](#) should generate an image like the one in [Figure D–1](#).

Figure D-1 Map Image Using Custom Geometry Theme and External Spatial Data



OGC WMS Support in MapViewer

MapViewer supports the rendering of data delivered using the Open GIS Consortium (OGC) Web Map Service (WMS) protocol, specifically the WMS 1.1.1 and 1.3.0 implementation specifications. MapViewer supports the GetMap, GetFeatureInfo, and GetCapabilities requests as defined in the OGC document 01-068r3 and 06-042.

MapViewer does not currently support the optional Styled Layer Descriptor capability, and MapViewer will not function as a Cascading Map Server in this release.

This appendix contains the following major sections:

- [Section E.1, "Setting Up the WMS Interface for MapViewer"](#)
- [Section E.2, "WMS Specification and Corresponding MapViewer Concepts"](#)
- [Section E.3, "Adding a WMS Map Theme"](#)

E.1 Setting Up the WMS Interface for MapViewer

MapViewer is preconfigured to run as a WMS service. Internally, MapViewer translates all incoming WMS requests into proper XML requests to the MapViewer server. For example, the following HTTP request invokes the GetCapabilities service of a MapViewer server:

```
http://localhost:8888/mapviewer/wms?REQUEST=GetCapabilities&SERVICE=WMS&VERSION=1.1.1  
or  
http://localhost:8888/mapviewer/wms?REQUEST=GetCapabilities&SERVICE=WMS&VERSION=1.3.0
```

As shown in this example, the URL for the MapViewer WMS service is typically `http://host:port/mapviewer/wms?`, where *host* and *port* refer to the host and HTTP port of the MapViewer server. The context path `/mapviewer/wms` refers to the WMS interface of MapViewer.

Note: All WMS requests must be on a single line, so ignore any line breaks that might appear in WMS request examples in this chapter.

E.1.1 Required Files

The following files are required for MapViewer WMS support: `WMSFilter.jar` and `classgen.jar`.

- The servlet filter and its required classes are packaged in `WMSFilter.jar`. This should be located in the `$MAPVIEWER_HOME/web/WEB-INF/lib` directory.
- The servlet filter also requires `classgen.jar`, which is part of the XML Developer's Kit (XDK) for Java. An Oracle Database or full Oracle Fusion Middleware installation will already have this file.

If your system does not already have the `classgen.jar` file, use a `classgen.jar` file from the same XDK for Java version as the one that ships with your standalone WebLogic Server version. Place this file in the `$MAPVIEWER_HOME/web/WEB-INF/lib` directory or in a directory that is in the library path for WebLogic Server.

The `classgen.jar` and `xmlparserv2.jar` files must be from the same XDK release, because the `classgen.jar` file depends on the `xmlparserv2.jar` file.

E.1.2 Data Source Named wms

You must define a MapViewer data source named `wms`, unless every incoming WMS request explicitly specifies a `datasource` CGI parameter. All requests that do not specify the `datasource` parameter are by default directed to the data source named `wms`. For example, the `GetCapabilities` request will by default list all the available themes that are in the `wms` data source. (To configure the information returned by a `GetCapabilities` request, see [Section 1.6.2.12](#).)

E.1.3 SDO to EPSG SRID Mapping File

By default, MapViewer uses the Oracle Spatial and Graph (SDO) native SRID (spatial reference ID) values when such information is requested in a WMS request such as `GetCapabilities`. The EPSG SRID values, however, are more widely used in WMS applications. To have MapViewer use EPSG SRID values when processing WMS requests and generating responses, specify a mapping file. This mapping file is a text file that tells MapViewer which SDO SRID values map to which EPSG SRID values. (Each pair of matching SRID values refers to the same spatial reference system.)

The mapping file contains lines where each line defines one pair of equivalent SRID values in the following format:

`sdo_srid=epsg_srid`

For example, the following lines define SDO SRID 8307 as equivalent to EPSG SRID 4326, and SDO SRID 81922 as equivalent to EPSG SRID 20248:

8307=4326
81922=20248

After you have created an SDO to EPSG mapping file, you can save it on the server where MapViewer is running, and specify its location in the MapViewer configuration file using the `<sdo_epsg_mapfile>` element in the `<wms_config>` element, as explained in [Section 1.6.2.12](#).

E.2 WMS Specification and Corresponding MapViewer Concepts

This section describes the association between, or interpretation of, terms and concepts used in the WMS 1.1.1 and 1.3.0 specifications and MapViewer. It also includes some parameters that are specific to MapViewer but that are not in the WMS 1.1.1 and 1.3.0 specifications.

E.2.1 Supported GetMap Request Parameters

This section describes the supported GetMap request parameters and their interpretation by MapViewer. (Parameters that are specific to MapViewer and not mentioned in the WMS 1.1.1 and 1.3.0 specifications are labeled MapViewer-Only.) The supported parameters are in alphabetical order, with each in a separate subsection.

[Example E-1](#) shows some GetMap requests. (Each URL should be entered as a single string.)

Example E-1 GetMap Requests

```
http://localhost:8888/mapviewer/wms?REQUEST=GetMap&VERSION=1.1.1&FORMAT=image/gif&SERVICE=WMS&BBOX=-121,37,-119,35&SRS=EPSG:4326&LAYERS=theme_demo_states,theme_demo_counties,theme_demo_highways,theme_demo_cities&WIDTH=580&HEIGHT=500

http://localhost:8888/mapviewer/wms?REQUEST=GetMap&VERSION=1.3.0&FORMAT=image/gif&SERVICE=WMS&BBOX=-121,37,-119,35&CRS=EPSG:4326&LAYERS=theme_demo_states,theme_demo_counties,theme_demo_highways,theme_demo_cities&WIDTH=580&HEIGHT=500

http://localhost:8888/mapviewer/wms?request=GetMap&version=1.3.0&crs=none&bbox=-122,36,-121,37&width=600&height=400&format=image/png&layers=theme_us_states&mvthemes=<themes><theme%20name="theme_us_counties"/><theme%20name="theme_us_road1"/></themes>&legend_request=<legend%20bgstyle="fill:%23ffffff;stroke:%23ff0000"%20profile="medium"%20position="SOUTH_EAST"><column><entry%20style="v.rb1"%20tab="1"/></column></legend>&
```

The default data source for a GetMap request is WMS. That is, if you do not specify the DATASOURCE parameter in a GetMap request, it is assumed that a data source named WMS was previously created using the <add_data_source> element (described in [Section 5.1.1](#)) in a MapViewer administrative request.

The following optional GetMap parameters are not supported in the current release of MapViewer:

- TIME (time dimension)
- ELEVATION (elevation dimension)
- SLD and WFS URLs

The MapViewer-only parameters must contain valid XML fragments. Because these are supplied in an HTTP GET request, they must be appropriately encoded using a URL encoding mechanism. For example, replace each space () with %20 and each pound sign (#) with %23. The following example shows the use of such encoding:

```
http://localhost:8888/mapviewer/wms?request=GetMap&version=1.1.1&srs=none&bbox=-122,36,-121,37&width=600&height=400&format=image/png&layers=theme_us_states&mvthemes=<themes><theme%20name="theme_us_counties"/><theme%20name="theme_us_road1"/></themes>&legend_request=<legend%20bgstyle="fill:%23ffffff;stroke:%23ff0000"%20profile="medium"%20position="SOUTH_EAST"><column><entry%20style="v.rb1"%20tab="1"/></column></legend>&
```

E.2.1.1 BASEMAP Parameter (MapViewer-Only)

The BASEMAP parameter specifies a named base map for the specified (or default) data source. If you specify both the BASEMAP and LAYERS parameters, all themes specified in the LAYERS parameters are added to the base map. Therefore, if you just want to get a map using a named base map, specify the BASEMAP parameter but specify an empty LAYERS parameter, as in the following examples:

```
REQUEST=GetMap&VERSION=1.1.1&BASEMAP=demo_map&LAYERS=&WIDTH=500&HEIGHT=560&SRS=SDO:8307&BBOX=-122,36,-120,38.5&FORMAT=image/png
```

```
REQUEST=GetMap&VERSION=1.3.0&BASEMAP=demo_map&LAYERS=&WIDTH=500&HEIGHT=560&CRS=SDO:8307&BBOX=-122,36,-120,38.5&FORMAT=image/png
```

The base map name can also be part of the LAYERS parameter. In this case, the BASEMAP parameter does not need to be defined in the URL (see [Section E.2.1.9, "LAYERS Parameter"](#) for additional details).

E.2.1.2 BBOX Parameter

The BBOX parameter specifies the lower-left and upper-right coordinates of the bounding box for the data from the data source to be displayed. It has the format BBOX=minX,minY,maxX,maxY. For example: BBOX=-122,36,-120,38.5

E.2.1.3 BGCOLOR Parameter

The BGOLOR parameter specifies background color for the map display using the RGB color value. It has the format 0xHHHHHH (where each H is a hexadecimal value from 0 to F). For example: BGOLOR=0xF5F5DC (beige).

E.2.1.4 DATASOURCE Parameter (MapViewer-Only)

The DATASOURCE parameter specifies the name of the data source for the GetMap or GetFeatureInfo request. The default value is WMS. The specified data source must exist prior to the GetMap or GetFeatureInfo request. That is, it must have been created using the <add_data_source> MapViewer administrative request or defined in the MapViewer configuration file (mapViewerConfig.xml).

E.2.1.5 DYNAMIC_STYLES Parameter (MapViewer-Only)

The DYNAMIC_STYLES parameter specifies a <styles> element as part of the GetMap request. For information about the <styles> element, see [Section 3.1.2.19](#).

E.2.1.6 EXCEPTIONS Parameter

For the EXCEPTIONS parameter, the only supported value is the default: EXCEPTIONS=application/vnd.ogc.se_xml for WMS 1.1.1 and EXCEPTIONS=XML for WMS 1.3.0. The exception is reported as an XML document conforming to the Service Exception DTD available at the following URLs:

http://schemas.opengis.net/wms/1.1.1/WMS_exception_1_1_1.dtd

http://schemas.opengis.net/wms/1.3.0/exceptions_1_3_0.xsd

The application/vnd.ogc.se_inimage (image overwritten with Exception message), and application/vnd.ogc.se_blank (blank image because Exception occurred) options are not supported.

E.2.1.7 FORMAT Parameter

The FORMAT parameter specifies the image format. The supported values are image/gif, image/jpeg, image/png, image/png8, and image/svg+xml.

The default value is image/png.

E.2.1.8 HEIGHT Parameter

The HEIGHT parameter specifies the height for the displayed map in pixels.

E.2.1.9 LAYERS Parameter

The LAYERS parameter specifies a comma-delimited list of predefined theme names to be used for the display. The specified values are considered to be a case-sensitive, ordered, comma-delimited list of predefined theme names in a default data source (named WMS) or in a named data source specified by the parameter DATASOURCE=<name>. For example, LAYERS=THEME_demo_STATES,theme_demo_counties,THEME_demo_HIGHWAYS translates to the following <themes> element in a MapViewer map request:

```
<themes>
```

```
<theme name="THEME_DEMO_STATES"/>
<theme name="theme_demo_counties"/>
<theme name="THEME_demo_HIGHWAYS"/>
/>/themes>
```

The base map name can also be part of the LAYERS list. The following example retrieves the image from a base map named DEMO_MAP:

```
http://localhost:7001/mapviewer/wms?VERSION=1.1.1&REQUEST=GetMap&SRS=EPSG:4326&BBOX
X=-101.19489559164734,27.0,-78.80510440835268,37.0&WIDTH=965&HEIGHT=431&FORMAT=ima
ge/gif&BGCOLOR=0xA6CAF0&TRANSPARENT=TRUE&LAYERS=DEMO_
MAP&STYLES=&EXCEPTIONS=application/vnd.ogc.se_xml&datasource=mvdemo
```

See also [Section E.2.1.1, "BASEMAP Parameter \(MapViewer-Only\)"](#).

E.2.1.10 LEGEND_REQUEST Parameter (MapViewer-Only)

The LEGEND_REQUEST parameter specifies a <legend> element as part of the GetMap request. For information about the <legend> element, see [Section 3.1.2.11](#).

E.2.1.11 MVTHEMES Parameter (MapViewer-Only)

The MVTHEMES parameter specifies a <themes> element as part of the GetMap request. For information about the <themes> element, see [Section 3.1.2.21](#). The primary purpose for the MVTHEMES parameter is to support JDBC themes in a MapViewer request. The MVTHEMES parameter is not a substitute or synonym for the LAYERS parameter; you still must specify the LAYERS parameter.

E.2.1.12 REQUEST Parameter

The REQUEST parameter specifies the type of request. The value must be GetMap, GetFeatureInfo, or GetCapabilities.

E.2.1.13 SERVICE Parameter

The SERVICE parameter specifies the service name. The value must be WMS.

E.2.1.14 SRS (1.1.1) or CRS (1.3.0) Parameter

The SRS parameter (WMS 1.1.1) or the CRS parameter (WMS 1.3.0) specifies the spatial reference system (coordinate system) for MapViewer to use. The value must be one of the following: SDO:srid-value (where srid-value is a numeric Oracle Spatial and Graph SRID value), EPSG:4326 (equivalent to SDO:8307), or none (equivalent to SDO:0).

Except for EPSG:4326 (the standard WGS 84 longitude/latitude coordinate system), EPSG numeric identifiers are not supported. The namespace AUTO (WMS 1.1.1) or AUTO2 (WMS 1.3.0), for projections that have an arbitrary center of projection, is not supported.

E.2.1.15 STYLES Parameter

The STYLES parameter is ignored. Instead, use the LAYERS parameter to specify predefined themes for the display.

E.2.1.16 TRANSPARENT Parameter

The TRANSPARENT=TRUE parameter (for a transparent image) is supported for PNG images, that is, with FORMAT=image/png, or FORMAT=image/png8 for indexed (8-bit) PNG format. MapViewer does not support transparent GIF (GIF89) images.

E.2.1.17 VERSION Parameter

The VERSION parameter specifies the WMS version number. The value must be 1.1.1 or 1.3.0.

E.2.1.18 WIDTH Parameter

The WIDTH parameter specifies the width for the displayed map in pixels.

E.2.2 Supported GetCapabilities Request and Response Features

A WMS GetCapabilities request to MapViewer should specify only the following parameters:

- REQUEST=GetCapabilities
- VERSION=1.1.1 or VERSION=1.3.0
- SERVICE=WMS

For example:

```
http://localhost:8888/mapviewer/wms?REQUEST=GetCapabilities&VERSION=1.1.1&SERVICE=WMS  
or  
http://localhost:8888/mapviewer/wms?REQUEST=GetCapabilities&VERSION=1.3.0&SERVICE=WMS
```

The response is an XML document conforming to the WMS Capabilities DTD available at the following, depending on the value of the VERSION parameter (1.1.1 or 1.3.0):

http://schemas.opengis.net/wms/1.1.1/WMS_MS_Capabilities.dtd

http://schemas.opengis.net/wms/1.3.0/capabilities_1_3_0.xsd

However, the current release of MapViewer returns an XML document containing the <Service> and <Capability> elements with the following information:

- The <Service> element is mostly empty, with just the required value of OGC:WMS for the <Service.Name> element. Support for more informative service metadata is planned for a future release of MapViewer.
- The <Capability> element has <Request>, <Exception>, and <Layer> elements.
- The <Request> element contains the GetCapabilities and GetMap elements that describe the supported formats and URL for an HTTP GET or POST operation.
- The <Exception> element defines the exception format. The Service Exception XML is the only supported format in this release. The <Exception> element returns an XML document compliant with the Service Exception DTD, but it does not report exceptions as specified in the implementation specification. The current release simply uses the CDATA section of a <ServiceException> element to return the OMSException returned by the MapViewer server.
- The <Layer> element contains a nested set of <Layer> elements. The first (outermost) layer contains a name (WMS), a title (Oracle WebMapServer Layers by data source), and one <Layer> element for each defined data source. Each data source layer contains a <Layer> element for each defined base map and one entry for each valid theme (layer) not listed in any base map. Each base map layer contains a <Layer> element for each predefined theme in the base map.

Themes that are defined in the USER_SDO_THEMES view, that have valid entries in the USER_SDO_GEOM_METADATA view for the base table and geometry column, and that are not used in any base map will be listed after the base maps

for a data source. These themes will have no `<ScaleHint>` element. They will have their own `<LatLonBoundingBox>` and `<BoundingBox>` elements.

The Content-Type of the response is set to `application/vnd.ogc.wms_xml`, as required by the WMS implementation specification.

Because the list of layers is output by base map, a given layer or theme can appear multiple times in the GetCapabilities response. For example, the theme `THEME_DEMO_STATES`, which is part of the base maps named `DEMO_MAP` and `DENSITY_MAP`, appears twice in [Example E-2](#), which is an excerpt (reformatted for readability) from a GetCapabilities response.

Example E-2 GetCapabilities Response (Excerpt)

```

<Title>Oracle WebMapServer Layers by data source</Title>
<Layer>
  <Name>mvdemo</Name>
  <Title>Datasource mvdemo</Title>
  <Layer>
    <Name>DEMO_MAP</Name>
    <Title>Basemap DEMO_MAP</Title>
    <SRS>SDO:8307</SRS>
    <LatLonBoundingBox>-180,-90,180,90</LatLonBoundingBox>
    .
    .
    <Layer>
      <Name>DENSITY_MAP</Name>
      <Title>Basemap DENSITY_MAP</Title>
      <SRS>SDO:8307</SRS>
      <LatLonBoundingBox>-180,-90,180,90</LatLonBoundingBox>
      <Layer>
        <Name>THEME_DEMO_STATES</Name>
        <Title>THEME_DEMO_STATES</Title>
        <SRS>SDO:8307</SRS>
        <BoundingBox SRS="SDO:8307" minx="-180" miny="-90" maxx="180"
                   maxy="90" resx="0.5" resy="0.5"/>
        <ScaleHint min="50.0" max="4.0"/>
      </Layer>
      .
      .
    </Layer>
    <Layer>
      <Name>IMAGE_MAP</Name>
      <Title>Basemap IMAGE_MAP</Title>
      <SRS>SDO:41052</SRS>
      <LatLonBoundingBox>-180,-90,180,90</LatLonBoundingBox>
      <Layer>
        <Name>IMAGE_LEVEL_2</Name>
        <Title>IMAGE_LEVEL_2</Title>
        <SRS>SDO:41052</SRS>
        <BoundingBox SRS="SDO:41052" minx="200000" miny="500000" maxx="750000"
                   maxy="950000" resx="0.5" resy="0.5"/>
        <ScaleHint min="1000.0" max="0.0"/>
      </Layer>
      .
      .
    </Layer>
  
```

In [Example E-2](#), the innermost layer describes the `IMAGE_LEVEL_2` theme. The `<ScaleHint>` element lists the `min_scale` and `max_scale` values, if any, for that theme in the base map definition. For example, the base map definition for `IMAGE_MAP` is as follows:

```
SQL> select definition from user_sdo_maps where name='IMAGE_MAP' ;
```

DEFINITION

```
-----  
<?xml version="1.0" standalone="yes"?>  
<map_definition>  
  <theme name="IMAGE_LEVEL_2" min_scale="1000.0" max_scale="0.0"/>  
  <theme name="IMAGE_LEVEL_8" min_scale="5000.0" max_scale="1000.0"/>  
  <theme name="MA_ROAD3" />  
  <theme name="MA_ROAD2" />  
  <theme name="MA_ROAD1" />  
  <theme name="MA_ROAD0" />  
</map_definition>
```

In the innermost layer, the `<SRS>` and `<BoundingBox>` elements identify the SRID and the DIMINFO information for that theme's base table, as shown in the following Spatial and Graph metadata query:

```
SQL> select srid, diminfo from user_sdo_geom_metadata, user_sdo_themes  
  2  where name='IMAGE_LEVEL_2' and  
  3  base_table=table_name and  
  4  geometry_column=column_name ;  
  
        SRID  
-----  
DIMINFO(SDO_DIMNAME, SDO_LB, SDO_UB, SDO_TOLERANCE)  
-----  
          41052  
SDO_DIM_ARRAY(SDO_DIM_ELEMENT('X', 200000, 500000, .5), SDO_DIM_ELEMENT('Y', 750  
000, 950000, .5))
```

In [Example E-2](#), the `<Layer>` element for a base map has an `<SRS>` element and a `<LatLonBoundingBox>` element. The `<SRS>` element is empty if all layers in the base map definition do not have the same SRID value specified in the `USER_SDO_GEOM_METADATA` view. If they all have the same SRID value (for example, 41052), the `SRS` element contains that value (for example, `SDO:41052`). The required `<LatLonBoundingBox>` element currently has default values (-180, -90, 180, 90). When this feature is supported by MapViewer, this element will actually be the bounds specified in the `DIMINFO` column of the `USER_SDO_GEOM_METADATA` view for that layer, converted to geodetic coordinates if necessary and possible.

All layers are currently considered to be opaque and queryable. That is, all layers are assumed to be vector layers, and not GeoRaster, logical network, or image layers.

E.2.3 Supported GetFeatureInfo Request and Response Features

This section describes the supported GetFeatureInfo request parameters and their interpretation by MapViewer. [Example E-3](#) shows some GetFeatureInfo requests.

Example E-3 GetFeatureInfo Request

```
http://localhost:8888/mapviewer/wms?REQUEST=GetFeatureInfo&VERSION=1.1.1&BBOX=-0  
.0020,0.0040&SRS=EPSG:4326&LAYERS=cite:Lakes,cite:Forests&WIDTH=200&HEIGHT=100&INFO  
_FORMAT=text/xml&QUERY_LAYERS=cite:Lakes,cite:Forests&X=60&Y=60
```

```
http://localhost:8888/mapviewer/wms?REQUEST=GetFeatureInfo&VERSION=1.3.0  
&BBOX=-0,-0.0020,0.0040&CRS=EPSG:4326&LAYERS=cite:Lakes,cite:Forests&WIDTH=200&HEIGHT=100  
&INFO_FORMAT=text/xml&QUERY_LAYERS=cite:Lakes,cite:Forests&I=60&J=60
```

The response is an XML document and the Content-Type of the response is text/xml. [Example E-4](#) is a response to a GetFeatureInfo request in [Example E-3](#).

Example E-4 GetFeatureInfo Response

```
<?xml version="1.0" encoding="UTF-8" ?>
<GetFeatureInfo_Result>
  <ROWSET name="cite:Lakes">
    <ROW num="1">
      <ROWID>AAAK22AAGAAACU1AAA</ROWID>
    </ROW>
  </ROWSET>
  <ROWSET name="cite:Forests">
    <ROW num="1">
      <FEATUREID>109</FEATUREID>
    </ROW>
  </ROWSET>
</GetFeatureInfo_Result>
```

Most of the following sections describe parameters supported for a GetFeatureInfo request. (Parameters that are specific to MapViewer and not mentioned in the WMS 1.1.1 specification are labeled MapViewer-Only.) [Section E.2.3.10](#) explains how to query attributes in a GetFeatureInfo request.

E.2.3.1 GetMap Parameter Subset for GetFeatureInfo Requests

A GetFeatureInfo request contains a subset of a GetMap request (BBOX, SRS [1.1.1] or CRS [1.3.0], WIDTH, HEIGHT, and optionally LAYERS parameters). These parameters are used to convert the X, Y (1.1.1) or I, J (1.3.0) point from screen coordinates to a point in the coordinate system for the layers being queried. It is assumed all layers are in the same coordinate system, the one specified by the SRS parameter.

E.2.3.2 EXCEPTIONS Parameter

The only supported value for the EXCEPTIONS parameter is the default: application/vnd.ogc.se_xml for WMS 1.1.1 or xml for WMS 1.3.0. That is, only Service Exception XML is supported. The exception is reported as an XML document conforming to the Service Exception DTD available at the following, depending on the version (1.1.1 or 1.3.0):

http://schemas.opengis.net/wms/1.1.1/WMS_exception_1_1_1.dtd
http://schemas.opengis.net/wms/1.3.0/exceptions_1_3_0.xsd

E.2.3.3 FEATURE_COUNT Parameter

The FEATURE_COUNT parameter specifies the maximum number of features in the result set. The default value is 1. If more features than the parameter's value interact with the query point (X, Y), then an arbitrary subset (of the size of the parameter's value) of the features is returned in the result set. That is, a GetFeatureInfo call translates into a query of the following general form:

```
SELECT <info_columns> FROM <layer_table>
  WHERE SDO_RELATE(<geom_column>,
    <query_point>, 'mask=ANYINTERACT')='TRUE'
    AND ROWNUM <= FEATURE_COUNT;
```

E.2.3.4 INFO_FORMAT Parameter

The value of the INFO_FORMAT parameter is always text/xml.

E.2.3.5 QUERY_LAYERS Parameter

The QUERY_LAYERS parameter specifies a comma-delimited list of layers to be queried. If the LAYERS parameter is specified, the QUERY_LAYERS specification must be a subset of the list specified in the LAYERS parameter.

If the QUERY_LAYERS parameter is specified, any BASEMAP parameter value is ignored.

E.2.3.6 QUERY_TYPE Parameter (MapViewer-Only)

The QUERY_TYPE parameter limits the result set to a subset of possibly qualifying features by specifying one of the following values:

- at_point: returns only the feature at the specified point.
- nn: returns only the nearest neighbor features, with the number of results depending on the value of the FEATURE_COUNT parameter value (see [Section E.2.3.3](#)). The result set is not ordered by distance.
- within_radius (or within_distance, which is a synonym): returns only results within the distance specified by the RADIUS parameter value (see [Section E.2.3.7](#)), up to the number matching the value of the FEATURE_COUNT parameter value (see [Section E.2.3.3](#)). The result set is an arbitrary subset of the answer set of potential features within the specified radius. The result set is not ordered by distance.

E.2.3.7 RADIUS Parameter (MapViewer-Only)

The RADIUS parameter specifies the radius of the circular search area for a query in which the QUERY_TYPE parameter value is within_radius (see [Section E.2.3.6](#)). If you specify the RADIUS parameter, you must also specify the UNIT parameter (see [Section E.2.3.8](#)).

E.2.3.8 UNIT Parameter (MapViewer-Only)

The UNIT parameter specifies the unit of measurement for the radius of the circular search area for a query in which the QUERY_TYPE parameter value is within_radius (see [Section E.2.3.6](#)). The value must be a valid linear measure value from the SHORT_NAME column of the SDO_UNITS_OF_MEASURE table, for example: meter, km, or mile.

If you specify the UNIT parameter, you must also specify the RADIUS parameter (see [Section E.2.3.7](#)).

E.2.3.9 X and Y or I and J Parameters

The X and Y (WMS 1.1.1) or I and J (WMS 1.3.0) parameters specify the x-axis and y-axis coordinate values (in pixels), respectively, of the query point.

E.2.3.10 Specifying Attributes to Be Queried for a GetFeatureInfo Request

In a GetFeatureInfo request, the styling rule for each queryable layer (theme) must contain a <hidden_info> element that specifies which attributes are queried and returned in the XML response. The <hidden_info> element is the same as the one used for determining the attributes returned in an SVG map request.

An example of such a styling rule as follows:

```
SQL> select styling_rules from user_sdo_themes where name='cite:Forests';
```

```
STYLING_RULES
```

```
<?xml version="1.0" standalone="yes"?>
```

```

<styling_rules>
    <hidden_info>
        <field column="FID" name="FeatureId" />
    </hidden_info>
    <rule>
        <features style="C.PARK FOREST">   </features>
        <label column="NAME" style="T.PARK NAME"> 1 </label>
    </rule>
</styling_rules>

```

This styling rule specifies that if `cite:Forests` is one of the `QUERY_LAYERS` parameter values in a `GetFeatureInfo` request, the column named `FID` is queried, and its tag in the response document will be `<FEATUREID>`. The tag is always in uppercase. If no `<hidden_info>` element is specified in the styling rules for the theme's query layer, then the rowid is returned. In [Example E-4](#), the styling rule for the `cite:Lakes` layer has no `<hidden_info>` element; therefore, the default attribute `ROWID` is returned in the XML response. The `cite:Forests` layer, however, does have a `<hidden_info>` element, which specifies that the attribute column is `FID`, and that its tag name, in the response document, should be `<FEATUREID>`.

E.3 Adding a WMS Map Theme

You can add a WMS map theme to the current map request. The WMS map theme is the result of a `GetMap` request, and it becomes an image layer in the set of layers (themes) rendered by MapViewer.

To add a WMS map theme, use the WMS-specific features of either the XML API (see [Section E.3.1](#)) or the JavaBean-based API (see [Section E.3.4](#)).

E.3.1 XML API for Adding a WMS Map Theme

To add a WMS map theme to the current map request using the MapViewer XML API, use the `<wms_getmap_request>` element in a `<theme>` element.

For better performance, the `<wms_getmap_request>` element should be used only to request a map image from a Web Map Server (WMS) implementation. That is, the `<service_url>` element in a `<wms_getmap_request>` element should specify a WMS implementation, not a MapViewer instance. If you want to specify a MapViewer instance (for example, specifying `<service_url>` with a value of `http://mapviewer.mycorp.com:8888/mapviewer/wms`), consider using a MapViewer predefined theme or a JDBC theme in the `<themes>` element instead of using a `<wms_getmap_request>` element.

The following example shows the general format of the `<wms_getmap_request>` element within a `<theme>` element, and it includes some sample element values and descriptive comments:

```

<themes>
    <theme>
        <wms_getmap_request isBackgroundTheme="true">
            <!-- The wms_getmap_request theme is rendered in the order it
                appears in the theme list unless isBackgroundTheme is "true".
            -->
            <service_url> http://wms.mapsrus.com/mapserver </service_url>
            <version> 1.1.1 </version>
            <!-- version is optional. Default value is "1.1.1".
            -->
            <layers> Administrative+Boundaries,Topography,Hydrography </layers>
            <!-- layers is a comma-delimited list of names.
    </theme>
</themes>

```

```
If layer names contain spaces, use '+' instead of a space -->
<!-- styles is optional. It is a comma-delimited list, and it must
     have the same number of names as the layer list, if specified.
     If style names contain spaces, use '+' instead of a space -->
<styles/>
<srs> EPSG:4326 </srs>
<format> image/png </format>
<transparent> true </transparent>
<bgcolor> 0xffffffff </bgcolor>
<exceptions> application/vnd.ogc.se_inimage </exceptions>
<vendor_specific_parameters>
    <!-- one or more <vsp> elements each containing
         a <name> <value> pair -->
    <vsp>
        <name> datasource </name>
        <value> mvdemo </value>
    </vsp>
    <vendor_specific_parameters>
        <wms_getmap_request>
    </theme>
</themes>
```

The following attribute and elements are available with the `<wms_getmap_request>` element:

- The `isBackgroundTheme` attribute specifies whether or not this theme should be rendered before the vector layers. The default value is `false`.
- The `<service_url>` element specifies the URL (without the service parameters) for the WMS service. Example: `http://my.webmapserver.com/wms`
- The `<version>` element specifies the WMS version number. The value must be one of the following: `1.0.0`, `1.1.0`, `1.1.1` (the default), or `1.3.0`.
- The `<layers>` element specifies a comma-delimited list of layer names to be included in the map request.
- The `<styles>` element specifies a comma-delimited list of style names to be applied to the layer names in `layers`.
- The `<srs>` element specifies the coordinate system (spatial reference system) name. The default value is `EPSG:4326`.
- The `<format>` element specifies the format for the resulting map image. The default value is `image/png`.
- The `<transparent>` element specifies whether or not the layer or layers being added should be transparent in the resulting map image. The default value is `false`. To make the layer or layers transparent, specify `true`.
- The `<bgcolor>` element specifies the RGB value for the map background color. Use hexadecimal notation for the value, for example, `0xAE75B1`. The default value is `0xFFFFFFFF` (that is, white).
- The `<exceptions>` element specifies the format for server exceptions. The default value is `application/vnd.ogc.se_inimage`.
- The `<vendor_specific_parameters>` element contains one or more `<vsp>` elements, each of which contains a `<name>` element specifying the parameter name and a `<value>` element specifying the parameter value.

[Example E-5](#) shows the `<wms_getmap_request>` element in a map request.

Example E-5 Adding a WMS Map Theme (XML API)

```

<?xml version="1.0" standalone="yes"?>
<map_request
    title="Raster WMS Theme and Vector Data"
    datasource="mvdemo" srid="0"
    width="500"
    height="375"
    bgcolor="#a6caf0"
    antialiase="true"
    mapfilename="wms_georaster" format="PNG_URL">
    <center size="185340.0">
        <geoFeature>
            <geometricProperty typeName="center">
                <Point>
                    <coordinates>596082.0,8881079.0</coordinates>
                </Point>
            </geometricProperty>
        </geoFeature>
    </center>
    <themes>
        <theme name="WMS_TOPOGRAPHY" user_clickable="false" >
            <wms_getmap_request isBackgroundTheme="true">
                <service_url> http://wms.mapservers.com:8888/mapserver/wms </service_url>
                <layers> TOPOGRAPHY </layers>
                <srs> EPSG:29190 </srs>
                <format> image/png </format>
                <bgcolor> 0xa6caf0 </bgcolor>
                <transparent> true </transparent>
                <vendor_specific_parameters>
                    <vsp>
                        <name> ServiceType </name>
                        <value> mapserver </value>
                    </vsp>
                </vendor_specific_parameters>
            </wms_getmap_request>
        </theme>
        <theme name="cl_theme" user_clickable="false">
            <jdbc_query spatial_columnn="geom" render_style="ltblue"
                jdbc_srid="82279" datasource="mvdemo"
                asis="false">select geom from classes where vegetation_type = 'forests'
            </jdbc_query>
        </theme>
    </themes>
    <styles>
        <style name="ltblue">
            <svg width="1in" height="1in">
                <g class="color"
                    style="stroke:#000000;stroke-opacity:250;fill:#33ffff;fill-opacity:100">
                    <rect width="50" height="50"/>
                </g>
            </svg>
        </style>
    </styles>
</map_request>

```

E.3.2 Predefined WMS Map Theme Definition

The predefined XML definition for a WMS theme uses the same structure of the parameters in [Section E.3.1](#), and adds the optional capabilities_url attribute, which

is used by Map Builder when editing a WMS theme. If the `capabilities_url` attribute is defined, Map Builder will issue a GetCapabilities request to populate some UI elements in the editor page.

Example E–6 shows how to create a predefined WMS theme in the metadata. The base table and base column names can be any values, and in this example 'WMS' is used for both.

Example E–6 Creating a Predefined WMS Theme

```
INSERT INTO user_sdo_themes VALUES (
    'PRED_WMS_THEME',
    'WMS data',
    'WMS',
    'WMS', '<?xml version="1.0" standalone="yes"?>
    <styling_rules theme_type="wms">
        <service_url>
            http://sampleserver1b.arcgisonline.com/arcgis/services/Specialty/ESRI_
            StateCityHighway_USA/MapServer/WMSServer </service_url>
        <layers> 0,1,2 </layers>
        <version> 1.3.0 </version>
        <srs> CRS:84 </srs>
        <format> image/png </format>
        <bgcolor> 0xA6CAF0 </bgcolor>
        <transparent> false </transparent>
        <styles> +,+,+ </styles>
        <exceptions> xml </exceptions>
        <capabilities_url>
            http://sampleserver1.arcgisonline.com/ArcGIS/services/Specialty/ESRI_
            StateCityHighway_USA/MapServer/WMSServer? </capabilities_url>
        </styling_rules>');
)
```

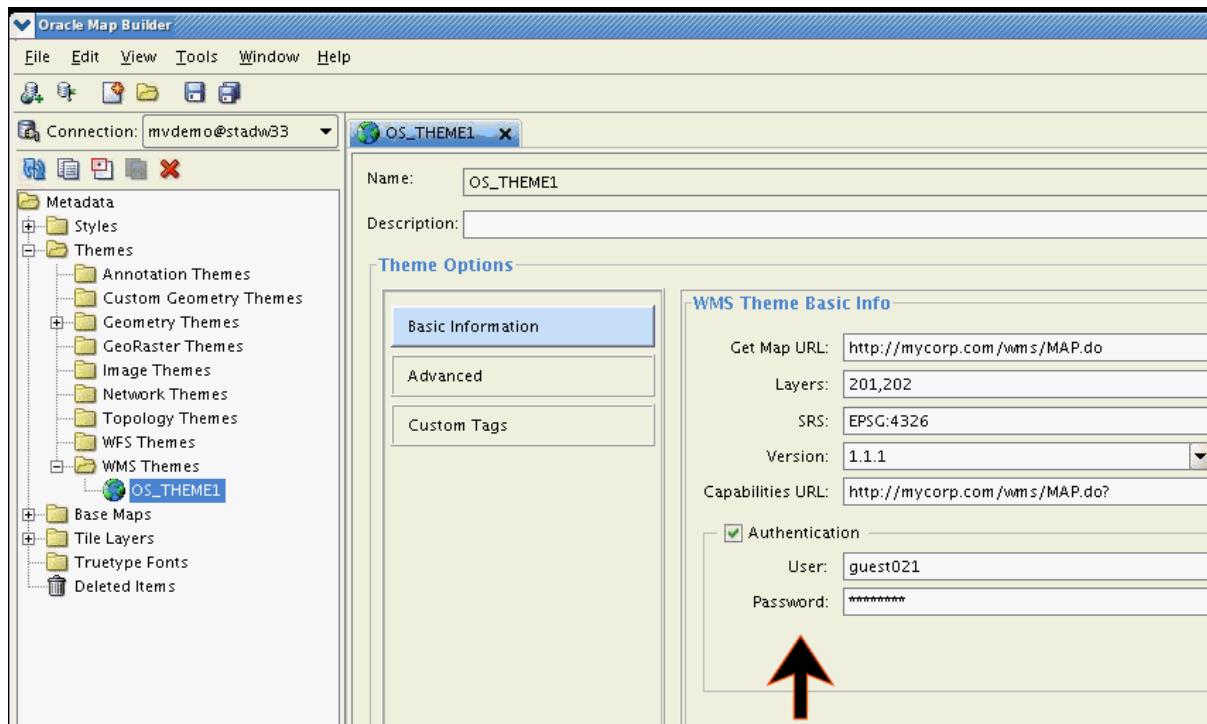
E.3.3 Authentication with WMS Map Themes

For a WMS server that requires authentication for access to the WMS data, the following must be included in the theme definition:

- `<user>` element specifying the user name
- `<password>` element specifying the user password

If you use the Map Builder tool to create a WMS map theme, the password value will be automatically encrypted. **Figure E–1** shows the use of the Map Builder tool to create a WMS theme with authentication information. In this figure, the Authentication option is checked (enabled), and User and Password are specified.

Figure E-1 Using Map Builder to Specify Authentication with a WMS Theme



Example E-7 shows how to create a WMS theme that includes authentication information.

Example E-7 WMS Theme with Authentication Specified

```
<?xml version="1.0" standalone="yes"?>
<styling_rules theme_type="wms">
    <service_url> http://localhost:7001/mapviewer/wms </service_url>
    <user> wmsuser </user>
    <password> ***** </password>
    <layers> THEME_DEMO_STATES </layers>
    <version> 1.1.1 </version>
    <srs> EPSG:4326 </srs>
    <format> image/png </format>
    <bcolor> 0xA6CAF0 </bcolor>
    <transparent> true </transparent>
    <exceptions> application/vnd.ogc.se_xml </exceptions>
    <vendor_specific_parameters>
        <vsp>
            <name> datasource </name>
            <value> mvdemo </value>
        </vsp>
    </vendor_specific_parameters>
    <capabilities_url> http://localhost:7001/mapviewer/wms? </capabilities_url>
</styling_rules>
```

E.3.4 JavaBean-Based API for Adding a WMS Map Theme

To add a WMS map theme to the current map request using the MapViewer JavaBean-based API, use the addWMSSMapTheme method.

This method should be used only to request a map image from a Web Map Server (WMS) implementation. That is, the serviceURL parameter should specify a WMS implementation, not a MapViewer instance.

The addWMSMapTheme method has the following format:

```
addWMSMapTheme(String name, String serviceURL, String isBackgroundTheme,  
                String version, String[] layers, String[] styles,  
                String srs, String format, String transparent,  
                String bgcolor, String exceptions,  
                Object[] vendor_specific_parameters  
);
```

The name parameter specifies the theme name.

The serviceURL parameter specifies the URL (without the service parameters) for the WMS service. Example: <http://my.webmapserver.com/wms>

The isBackgroundTheme parameter specifies whether or not this theme should be rendered before the vector layers. The default value is false.

The version parameter specifies the WMS version number. The value must be one of the following: 1.0.0, 1.1.0, or 1.1.1 (the default).

The layers parameter specifies a comma-delimited list of layer names to be included in the map request.

The styles parameter specifies a comma-delimited list of style names to applied to the layer names in layers.

The srs parameter specifies the coordinate system (spatial reference system) name. The default value is EPSG:4326.

The format parameter specifies the format for the resulting map image. The default value is image/png.

The transparent parameter specifies whether or not the layer or layers being added should be transparent in the resulting map image. The default value is false. To make the layer or layers transparent, specify true.

The bgcolor parameter specifies the RGB value for the map background color. Use hexadecimal notation for the value, for example, 0xAE75B1. The default value is 0xFFFFFFFF (that is, white).

The exceptions parameter specifies the format for server exceptions. The default value is application/vnd.ogc.se_inimage.

The vendor_specific_parameters parameter specifies a list of vendor-specific parameters. Each element in the object array is a String array with two strings: parameter name and value. Example: vsp = new Object[]{new String[]{"DATASOURCE", "mvdemo"}, //param 1 new String[]{"antialiasing", "true"} //param 2}

E.3.5 Customizing GetCapabilities Responses: Additional Options

The main MapViewer configuration file has a section to customize some information for GetCapabilities responses (see [Section 1.6.2.12, "Customizing WMS GetCapabilities Responses"](#)). However only a limited number of properties that can be defined in that main MapViewer configuration file, and no customization can be done for several attributes that a layer can have in GetCapabilities response.

Effective with Release 12.1.3, a WMS configuration file (`wmsConfig.xml`) has been added to MapViewer. Any settings defined in this WMS configuration file will override similar WMS settings defined in the main MapViewer configuration file.

The `wmsConfig.xml` can include the following elements:

- `<custom_parameter>` (see [Section E.3.5.1](#))
- `<service_attributes>` (see [Section E.3.5.2](#))
- `<layer_attributes>` (see [Section E.3.5.3](#))
- `<get_feature_info>` (see [Section E.3.5.4](#))

E.3.5.1 Custom WMS Capabilities Parameters (`<custom_parameters>` Element)

The following attributes are available with the `<custom_parameters>` element:

- The `host` attribute specifies the host part of the service request URL that the client should use for future WMS requests made to this MapViewer server.
- The `port` attribute specifies the port part of the service request URL that the client should use for future WMS requests made to this MapViewer server.
- The `protocol` attribute specifies the protocol part of the service request URL that the client should use for future WMS requests made to this MapViewer server.
- The `default_datasource` attribute specifies the base data source to be used for retrieving the capabilities response. If this attribute is not defined, the data source `WMS` is used, and that data source must exist in this MapViewer server.
- The `public_datasources` attribute specifies which data source contents are to be listed in the `getCapabilities` response. If this attribute is not defined, all data source contents that exist in server will be listed.
- The `use_text_xml` attribute by default uses standard `text/xml` even for `getCapabilities`. If this attribute is set to `false`, then the OGC 1.1.1 specification is used (for example, `application/vnd.ogc.wms_xml`).

For example:

```
<custom_parameters
    host="www.my_corp.com" port="80" protocol="http"
    default_datasource="mvdemo"
    public_datasources="mvdemo, wms">
</custom_parameters>
```

E.3.5.2 Custom WMS Capabilities Service Attributes (`<service_attributes>` Element)

The `<service_attributes>` element overrides any of these values defined in main MapViewer configuration file. For example:

```
<service_attributes>
<title>
    WMS interface provided by OracleFMW MapViewer
</title>
<abstract>
    This WMS service is for demonstration.
</abstract>
<keyword_list>
    <keyword>Oracle</keyword>
    <keyword>MapViewer</keyword>
    <keyword>Spatial and Graph</keyword>
</keyword_list>
<online_resource>
```

```

http://localhost:7001/mapviewer/wms
</online_resource>
<contact_information>
  <ContactPersonPrimary>
    <ContactPerson>John Doe</ContactPerson>
    <ContactOrganization>My Corp.</ContactOrganization>
  </ContactPersonPrimary>
  <ContactPosition>Sr. Manager</ContactPosition>
  <ContactAddress>
    <AddressType>US Street</AddressType>
    <Address>1 MyCorp drv</Address>
    <City>Nashua</City>
    <StateOrProvince>NH</StateOrProvince>
    <PostCode>03062</PostCode>
    <Country>USA</Country>
  </ContactAddress>
  <ContactVoiceTelephone>18001122333</ContactVoiceTelephone>
  <ContactFacsimileTelephone></ContactFacsimileTelephone>
  <ContactElectronicEmailAddress>jdoe@my_corp.com</ContactElectronicEmailAddress>
</contact_information>
<Fees>None</Fees>
<AccessConstraints>None whatsoever</AccessConstraints>
</service_attributes>

```

E.3.5.3 Custom WMS Layer Attributes (<layer_attributes> Element)

The WMS OGC specification defines several attributes for Layers. The layer attribute list includes abstract, keyword list, SRS list, style, attribution, and others.

The <layer_attributes> element lets you define custom attributes for MapViewer metadata (base maps and themes). WMS Layers are associated with MapViewer themes and base maps. All Layer attributes are optional, and if defined they will complement the GetCapabilities response.

[Example E-8](#) shows a <layer_attributes> element with custom parameters for a base map and for a theme. In this example, for the base map DEMO_MAP the custom element <abstract> is defined, while for the theme THEME_DEMO_STATES the custom elements <abstract>, <keywordlist>, <srs>, and <style> are defined. In the <metadata> element, use the value *theme* for MapViewer themes and the value *basemap* for MapViewer base maps in the type attribute. If the type attribute is not defined or value is not equal to theme or basemap, then theme is used by default.

Example E-8 Custom WMS Layer Attributes

```

<layer_attributes>
  <datasource name="mvdemo">
    <metadata name="DEMO_MAP" type="basemap">
      <abstract>Collection of US States</abstract>
    </metadata>
    <metadata name="THEME_DEMO_STATES" type="theme">
      queryable="1" cascaded="0" opaque="1" noSubsets="0"
      fixedWidth="500" fixedHeight="400">
        <abstract>US States</abstract>
        <keywordlist>keyword1,keyword2,keyword3</keywordlist>
        <srs>EPSG:4203,EPNG:20248</srs>
        <style>

```

```

<title>Style title</title>
<name>Style name</name>
<abstract>Style abstract</abstract>
<stylesheeturl>
    <format>Stylesheet format</format>
    <onlineresource>
        <href>http://www.yoururl.com/styledata.html</href>
        <type>simple</type>
    </onlineresource>
</stylesheeturl>
<styleurl>
    <format>Styles format</format>
    <onlineresource>
        <href>http://www.yoururl.com/style.html</href>
        <type>simple</type>
    </onlineresource>
</styleurl>
<legendurl>
    <format>Legend format</format>
    <width>500</width>
    <height>500</height>
    <onlineresource>
        <href>http://www.yoururl.com/legendurl.html</href>
        <type>simple</type>
    </onlineresource>
</legendurl>
</style>
...
</metadata>
</datasource>
</layer_attributes>

```

Example E–9 shows part of a GetCapabilities response that includes these custom attributes.

Example E–9 GetCapabilities Response with Custom Attributes

```

<Layer>
    <Name>DEMO_MAP</Name>
    <Title>Basemap DEMO_MAP</Title>
    <Abstract>Collection of US States</Abstract>
    <SRS>EPSG:4326</SRS>
    <LatLonBoundingBox maxy="90.0" maxx="180.0" miny="-90.0" minx="-180.0"/>
    <Layer fixedHeight="400" fixedWidth="500" noSubsets="0" opaque="1" cascaded="0"
queryable="1">
        <Name>THEME_DEMO_STATES</Name>
        <Title>THEME_DEMO_STATES</Title>
        <Abstract>US States</Abstract>
        <KeywordList>
            <Keyword>keyword1</Keyword>
            <Keyword>keyword2</Keyword>
            <Keyword>keyword3</Keyword>
        </KeywordList>
        <SRS>EPSG:4326</SRS>
        <SRS>EPSG:4203</SRS>
        <SRS>EPSG:20248</SRS>
        <BoundingBox resy="5.0E-8" resx="5.0E-8" maxy="71.33268128071118" maxx="180.0"
miny="-14.605189123107024" minx="-180.0" SRS="EPSG:4326"/>
        <BoundingBox resy="5.0E-8" resx="5.0E-8" maxy="2.06926736125942E7"

```

```
maxx="5.5812377162013E7" miny="-1.54158038049741E9" minx="-5.74425799715062E8"
SRS="EPSG:4203"/>
    <BoundingBox resy="5.0E-8" resx="5.0E-8" maxy="2.06929693795843E7"
maxx="6.15958436393193E7" miny="-1.74609707025816E9" minx="-6.32398501646291E8"
SRS="EPSG:20248"/>
    <Style>
        <Name>Style name</Name>
        <Title>Style title</Title>
        <Abstract>Style abstract</Abstract>
        <LegendURL height="500" width="500">
            <Format>Legend format</Format>
            <OnlineResource xlink:href="http://www.yoururl.com/legendurl.html"
xlink:type="simple"/>
        </LegendURL>
        <StyleSheetURL>
            <Format>Stylesheet format</Format>
            <OnlineResource xlink:href="http://www.yoururl.com/styledata.html"
xlink:type="simple"/>
        </StyleSheetURL>
        <StyleURL>
            <Format>Stylesheet format</Format>
            <OnlineResource xlink:href="http://www.yoururl.com/style.html"
xlink:type="simple"/>
        </StyleURL>
        <ScaleHint max="1.5E8" min="0.0"/>
    </Style>
</Layer>
...
</Layer>
```

E.3.5.4 Custom WMS Feature Information (<get_feature_info> Element)

The following attributes, available with the <get_feature_info> element, can be used define the default radius (value and unit) for predefined MapViewer themes:

- The name attribute specifies the name of the predefined theme.
- The datasource attribute specifies MapViewer data source.
- The radius attribute specifies the default radius value for theme to be used in within_radius GetFeatureInfo requests when the radius parameter is not defined.
- The unit attribute specifies default radius unit (default is m for meters).

For example:

```
<get_feature_info>
    <theme name="theme_demo_states" datasource="mvdemo" radius="500" unit="km" />
</get_feature_info>
```

OGC WMTS Support in MapViewer

MapViewer supports the rendering of data delivered using the Open GIS Consortium (OGC) Web Map Tile Service (WMTS) protocol, specifically the WMS 1.0.0 implementation specifications. MapViewer supports the GetCapabilities, GetTile, and GetFeatureInfo requests as defined in the OGC document 07-057r7.

This appendix contains the following major sections:

- [Section F.1, "WMTS Service for MapViewer"](#)
- [Section F.2, "WMTS Operations"](#)
- [Section F.3, "Preparing the WMTS Service for MapViewer"](#)

F.1 WMTS Service for MapViewer

A Web Map Tile Service (WMTS) service in MapViewer is provided through its WMTS server, which is built on MapViewer's map cache server. That is, this WMTS server delegates a client's WMTS request to MapViewer's map cache server. The OGC operations GetCapabilities, GetTile, and GetFeatureInfo are supported. Two kinds of encoding, KVP and REST, are supported for GetCapabilities and GetTile operations, but for GetFeatureInfo operations only KVP encoding is supported. For a GetFeatureInfo request, the response is encoded in one of the three formats (specified with the `infoformat` attribute): `text/xml`, `text/html`, and `application/json`.

In general, all map cache tile layers in MapViewer can be accessed through its WMTS service. You can customize each map cache tile layer's accessibility by editing a WMTS service policy file, `wmtsConfig.xml`, stored in the same folder as the `mapViewerConfig.xml` file. In WMTS service policy file, you can limit MapViewer's WMTS service by only publishing a subset of all map cache tile layers in MapViewer server (see [Section 1.6.2.13](#) for details).

[Example F-1](#) and [Example F-2](#) show how to publish a tile layer to MapViewer's WMTS server using a policy file. The first example shows the policy file that specifies a tile layer, and the second shows the tile layer definition.

- [Example F-1](#) is a WMTS policy file. In this file, only one map cache tile layer named TEST_TL in data source MVDEMO is published to MapViewer's WMTS service. This policy file may also contain service provider related information.

Example F-1 WMTS Policy File (`wmtConfig.xml`)

```
<wmts_config>
    <public_datasources>
        <public_datasource name="MVDEMO">
            <tile_layers>
                <tile_layer name="TEST_TL"/>
```

```

        </tile_layers>
    </public_datasource>
</public_datasources>
<ServiceAttributes>
    <ServiceIdentification>
        <Title>Web Map Tile Service by myCorp</Title>
        <Abstract> U.S. maps for state and county boundaries, highway
networks, and big cities.</Abstract>
        <Keywords>
            <Keyword>Maps</Keyword>
            <Keyword>U.S. State, County Boundaries</Keyword>
            <Keyword>U.S. Interstate Highways</Keyword>
            <Keyword>U.S. Cities</Keyword>
        </Keywords>
        <Fees>none</Fees>
        <AccessConstraints>none</AccessConstraints>
    </ServiceIdentification>
    <ServiceProvider>
        <ProviderName>provider's name</ProviderName>
        <ProviderSite url="http://www.myCorp.com/mySite"/>
        <ServiceContact>
            <IndividualName>my name</IndividualName>
            <PositionName>technical support specialist</PositionName>
            <ContactInfo>
                <Phone>
                    <Voice>+1 800 321 1234</Voice>
                    <Facsimile>+1 800 321 1235</Facsimile>
                </Phone>
                <Address>
                    <DeliveryPoint>123 My Street</DeliveryPoint>
                    <City>Nashua</City>
                    <AdministrativeArea>New Hampshire</AdministrativeArea>
                    <PostalCode>12345-4321</PostalCode>
                    <Country>U.S.</Country>
                    <ElectronicMailAddress>myname@mycompany.com</ElectronicMailAddress>
                </Address>
            </ContactInfo>
        </ServiceContact>
    </ServiceProvider>
</ServiceAttributes>
</wmts_config>

```

- **Example F-2** is the map tile layer definition for the TEST_TL tile layer in the schema for data source MVDEMO.

Example F-2 Tile Layer Definition in the Data Source

```

SQL> select definition from user_sdo_cached_maps where name='TEST_TL';

DEFINITION
-----
<map tile_layer name="TEST_TL" image_format="PNG" http_headerExpires="168.0" concurrent_fetching_
threads="3">
    <internal_map_source base_map="DEMO_MAP" data_source="MVDEMO"/>
    <coordinate_system srid="8307" minX="-180" maxX="180" minY="-90" maxY="90"/>
    <tile_image width="256" height="256"/>
    <tile_dpi value="90.7142857"/>
    <tile_meters_per_unit value="111319.49079327358"/>
    <zoom_levels levels="19" min_scale="2132.729583849784" max_scale="559082264.0287178">
        <zoom_level tile_width="360.0000" tile_height="360.0000" scale="5.590822640287178E8"/>

```

```

<zoom_level tile_width="180.0000" tile_height="180.0000" scale="2.795411320143589E8"/>
<zoom_level tile_width="90.0000" tile_height="90.00000" scale="1.3977056600717944E8"/>
<zoom_level tile_width="45.0000" tile_height="45.00000" scale="6.988528300358972E7"/>
<zoom_level tile_width="22.5000" tile_height="22.50000" scale="3.494264150179486E7"/>
<zoom_level tile_width="11.2500" tile_height="11.25000" scale="1.747132075089743E7"/>
<zoom_level tile_width="5.6250" tile_height="5.62500" scale="8735660.375448715"/>
<zoom_level tile_width="2.8125" tile_height="2.81250" scale="4367830.1877243575"/>
<zoom_level tile_width="1.40625" tile_height="1.40625" scale="2183915.0938621787"/>
<zoom_level tile_width="0.703125" tile_height="0.703125" scale="1091957.5469310894"/>
<zoom_level tile_width="0.3515625" tile_height="0.3515625" scale="545978.7734655447"/>
<zoom_level tile_width="0.17578125" tile_height="0.17578125" scale="272989.38673277234"/>
<zoom_level tile_width="0.087890625" tile_height="0.087890625" scale="136494.693366386"/>
<zoom_level tile_width="0.0439453125" tile_height="0.0439453125" scale="68247.34668319"/>
<zoom_level tile_width="0.02197265625" tile_height="0.02197265625" scale="34123.6733415"/>
<zoom_level tile_width="0.010986328126" tile_height="0.010986328126" scale="17061.8366707"/>
<zoom_level tile_width="0.0054931640633" tile_height="0.0054931640633"
scale="8530.91833539"/>
    <zoom_level tile_width="0.00274658203168" tile_height="0.00274658203168"
scale="4265.45916769"/>
        <zoom_level tile_width="0.001373291015841" tile_height="0.001373291015841"
scale="2132.72958384"/>
    </zoom_levels>
</map_tile_layer>

```

Regardless of whether there are additional data sources in the MapViewer server, or additional map cache tile layers in the specified data source, if the policy file is specified as in [Example F-1, "WMTS Policy File \(wmtsConfig.xml\)"](#), the only published WMTS layer is map cache tile layer TEST_TL in data source MVDEMO (shown in [Example F-2, "Tile Layer Definition in the Data Source"](#)).

F.2 WMTS Operations

MapViewer supports the GetCapabilities, GetTile, and GetFeatureInfo operations specified in the OGC WMTS 1.0.0 standard. It also supports some MapViewer-specific parameters that are not defined in that standard, but which make WMTS operations in MapViewer more flexible.

This section includes the following topics:

- [GetCapabilities Operation Support](#)
- [GetTile Operation Support](#)
- [GetFeatureInfo Operation Support](#)

F.2.1 GetCapabilities Operation Support

When the MapViewer server receives a WMTS GetCapabilities request, its WMTS server translates the definition of available map cache tile layers into an XML document according to the OGC WMTS specification. (The accessible cache tile layers are defined by the `wmtsConfig.xml` policy file if it exists; otherwise, all map cache tile layers from all data sources are available to WMTS server are used.) Then the XML document is returned to the client. Within this returned XML document, the information about the service provider, if specified in the `wmtsConfig.xml` policy file, is provided.

This topic includes a GetCapabilities request in KVP encoding and its response, and a GetCapabilities request in REST encoding and its response. Regardless of whether the request is in KVP or REST encoding, the base URL must be in the following format:

`http://<host>:<port>/mapviewer/wmts`

where `<host>` and `<port>` refer to the host and HTTP port of the MapViewer server. The context path `/mapviewer/wmts` refers to the WMTS interface of MapViewer.

Example F-3 is the response from the following example GetCapabilities request in KVP coding:

`http://localhost:8088/mapviewer/wmts?REQUEST=GetCapabilities&SERVICE=WMTS&VERSION=1.0.0`

Example F-3 Response from GetCapabilities Request in KVP Encoding

```
<?xml version="1.0" encoding="UTF-8"?>
<Capabilities xmlns="http://www.opengis.net/wmts/1.0"
  xmlns:ows="http://www.opengis.net/ows/1.1"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:gml="http://www.opengis.net/gml"
  xsi:schemaLocation="http://www.opengis.net/wmts/1.0
    http://schemas.opengis.net/wmts/1.0/wmtsGetCapabilities_response.xsd"
  version="1.0.0">
  <ows:ServiceIdentification>
    <ows:Title>Web Map Tile Service by myCorp</ows:Title>
    <ows:Abstract>U.S. maps for state and county boundaries, highway networks, and
big cities.</ows:Abstract>
    <ows:Keywords>
      <ows:Keyword>Maps</ows:Keyword>
      <ows:Keyword>U.S. State and County Boundaries</ows:Keyword>
      <ows:Keyword>U.S. Interstate Highways</ows:Keyword>
      <ows:Keyword>U.S. Cities</ows:Keyword>
    </ows:Keywords>
    <ows:ServiceType>OGC WMTS</ows:ServiceType>
    <ows:ServiceTypeVersion>1.0.0</ows:ServiceTypeVersion>
    <ows:Fees>none</ows:Fees>
    <ows:AccessConstraints>none</ows:AccessConstraints>
  </ows:ServiceIdentification>
  <ows:ServiceProvider>
    <ows:ProviderName>provider's name</ows:ProviderName>
    <ows:ProviderSite xlink:href="http://www.myCorp.com/mySite" />
    <ows:ServiceContact>
      <ows:PositionName>technical support specialist</ows:PositionName>
      <ows>ContactInfo>
        <ows:Phone>
          <ows:Voice>+1 800 321 1234</ows:Voice>
          <ows:Facsimile>+1 800 321 1235</ows:Facsimile>
        </ows:Phone>
        <ows:Address>
          <ows:DeliveryPoint>123 My Street</ows:DeliveryPoint>
          <ows:City>Nashua</ows:City>
          <ows:AdministrativeArea>New Hampshire</ows:AdministrativeArea>
          <ows:PostalCode>12345-4321</ows:PostalCode>
          <ows:Country>U.S.</ows:Country>
        </ows:Address>
      </ows>ContactInfo>
    </ows:ServiceContact>
  </ows:ServiceProvider>
  <ows:OperationsMetadata>
    <ows:Operation name="GetCapabilities">
      <ows:DCP>
```

```

<ows:HTTP>
  <ows:Get xlink:href="http://localhost:8088/mapviewer/wmts?">
    <ows:Constraint name="GetEncoding">
      <ows:AllowedValues>
        <ows:Value>KVP</ows:Value>
      </ows:AllowedValues>
    </ows:Constraint>
  </ows:Get>
</ows:HTTP>
</ows:DCP>
</ows:Operation>
<ows:Operation name="GetTile">
  <ows:DCP>
    <ows:HTTP>
      <ows:Get xlink:href="http://localhost:8088/mapviewer/wmts?">
        <ows:Constraint name="GetEncoding">
          <ows:AllowedValues>
            <ows:Value>KVP</ows:Value>
          </ows:AllowedValues>
        </ows:Constraint>
      </ows:Get>
    </ows:HTTP>
  </ows:DCP>
</ows:Operation>
<ows:Operation name="GetFeatureInfo">
  <ows:DCP>
    <ows:HTTP>
      <ows:Get xlink:href="http://localhost:8088/mapviewer/wmts?">
        <ows:Constraint name="GetEncoding">
          <ows:AllowedValues>
            <ows:Value>KVP</ows:Value>
          </ows:AllowedValues>
        </ows:Constraint>
      </ows:Get>
    </ows:HTTP>
  </ows:DCP>
</ows:Operation>
</ows:OperationsMetadata>
<Contents>
  <Layer>
    <ows:Title>TEST_TL</ows:Title>
    <ows:Abstract>datasource: MVDEMO, layer: TEST_TL</ows:Abstract>
    <ows:WGS84BoundingBox>
      <ows:LowerCorner>-180.0 -90.0</ows:LowerCorner>
      <ows:UpperCorner>180.0 90.0</ows:UpperCorner>
    </ows:WGS84BoundingBox>
    <ows:Identifier>MVDEMO:TEST_TL</ows:Identifier>
    <Style isDefault="true">
      <ows:Identifier>_null</ows:Identifier>
    </Style>
    <Format>image/png</Format>
    <TileMatrixSetLink>
      <TileMatrixSet>MVDEMO:TEST_TL:EPSG:4326</TileMatrixSet>
      <TileMatrixSetLimits>
        <TileMatrixLimits>
          . . . . . <!-- omitted to save space -->
        <TileMatrixLimits>
          <TileMatrix>MVDEMO:TEST_TL:EPSG:4326:8</TileMatrix>
          <MinTileRow>0</MinTileRow>
          <MaxTileRow>128</MaxTileRow>
        </TileMatrixLimits>
      </TileMatrixSetLimits>
    </TileMatrixSetLink>
  </Layer>
</Contents>

```

```
        <MinTileCol>0</MinTileCol>
        <MaxTileCol>256</MaxTileCol>
    </TileMatrixLimits>
    . . . . . <!-- omitted to save space -->
</TileMatrixSetLimits>
</TileMatrixSetLink>
</Layer>
<TileMatrixSet>
    <ows:Identifier>MVDEMO:TEST_TL:EPSG:4326</ows:Identifier>
    <ows:SupportedCRS>urn:ogc:def:crs:EPSG:4326</ows:SupportedCRS>
    <TileMatrix>
        <ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:0</ows:Identifier>
        <ScaleDenominator>5.590822641167623E8</ScaleDenominator>
        <TopLeftCorner>-180.0 90.0</TopLeftCorner>
        <TileWidth>256</TileWidth>
        <TileHeight>256</TileHeight>
        <MatrixWidth>2</MatrixWidth>
        <MatrixHeight>2</MatrixHeight>
    </TileMatrix>
    <TileMatrix>
        <ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:1</ows:Identifier>
        <ScaleDenominator>2.7954113205838114E8</ScaleDenominator>
        <TopLeftCorner>-180.0 90.0</TopLeftCorner>
        <TileWidth>256</TileWidth>
        <TileHeight>256</TileHeight>
        <MatrixWidth>3</MatrixWidth>
        <MatrixHeight>2</MatrixHeight>
    </TileMatrix>
    <TileMatrix>
        <ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:2</ows:Identifier>
        <ScaleDenominator>1.3977056602919057E8</ScaleDenominator>
        <TopLeftCorner>-180.0 90.0</TopLeftCorner>
        <TileWidth>256</TileWidth>
        <TileHeight>256</TileHeight>
        <MatrixWidth>5</MatrixWidth>
        <MatrixHeight>3</MatrixHeight>
    </TileMatrix>
    <TileMatrix>
        <ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:3</ows:Identifier>
        <ScaleDenominator>6.988528301459529E7</ScaleDenominator>
        <TopLeftCorner>-180.0 90.0</TopLeftCorner>
        <TileWidth>256</TileWidth>
        <TileHeight>256</TileHeight>
        <MatrixWidth>9</MatrixWidth>
        <MatrixHeight>5</MatrixHeight>
    </TileMatrix>
    <TileMatrix>
        <ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:4</ows:Identifier>
        <ScaleDenominator>3.494264150729764E7</ScaleDenominator>
        <TopLeftCorner>-180.0 90.0</TopLeftCorner>
        <TileWidth>256</TileWidth>
        <TileHeight>256</TileHeight>
        <MatrixWidth>17</MatrixWidth>
        <MatrixHeight>9</MatrixHeight>
    </TileMatrix>
    <TileMatrix>
        <ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:5</ows:Identifier>
        <ScaleDenominator>1.747132075364882E7</ScaleDenominator>
        <TopLeftCorner>-180.0 90.0</TopLeftCorner>
        <TileWidth>256</TileWidth>
```

```
<TileHeight>256</TileHeight>
<MatrixWidth>33</MatrixWidth>
<MatrixHeight>17</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:6</ows:Identifier>
<ScaleDenominator>8735660.37682441</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>65</MatrixWidth>
<MatrixHeight>33</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:7</ows:Identifier>
<ScaleDenominator>4367830.188412205</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>129</MatrixWidth>
<MatrixHeight>65</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:8</ows:Identifier>
<ScaleDenominator>2183915.0942061027</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>257</MatrixWidth>
<MatrixHeight>129</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:9</ows:Identifier>
<ScaleDenominator>1091957.5471030513</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>513</MatrixWidth>
<MatrixHeight>257</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:10</ows:Identifier>
<ScaleDenominator>545978.7735515257</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>1025</MatrixWidth>
<MatrixHeight>513</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:11</ows:Identifier>
<ScaleDenominator>272989.38677576283</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>2049</MatrixWidth>
<MatrixHeight>1025</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:12</ows:Identifier>
```

```
<ScaleDenominator>136494.69338788142</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>4097</MatrixWidth>
<MatrixHeight>2049</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:13</ows:Identifier>
<ScaleDenominator>68247.34669394071</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>8193</MatrixWidth>
<MatrixHeight>4097</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:14</ows:Identifier>
<ScaleDenominator>34123.673346970354</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>16385</MatrixWidth>
<MatrixHeight>8193</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:15</ows:Identifier>
<ScaleDenominator>17061.836673485177</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>32769</MatrixWidth>
<MatrixHeight>16385</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:16</ows:Identifier>
<ScaleDenominator>8530.918336742589</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>65537</MatrixWidth>
<MatrixHeight>32769</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:17</ows:Identifier>
<ScaleDenominator>4265.459168371294</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>131073</MatrixWidth>
<MatrixHeight>65537</MatrixHeight>
</TileMatrix>
<TileMatrix>
<ows:Identifier>MVDEMO:TEST_TL:EPSG:4326:18</ows:Identifier>
<ScaleDenominator>2132.729584185647</ScaleDenominator>
<TopLeftCorner>-180.0 90.0</TopLeftCorner>
<TileWidth>256</TileWidth>
<TileHeight>256</TileHeight>
<MatrixWidth>262145</MatrixWidth>
<MatrixHeight>131073</MatrixHeight>
```

```

        </TileMatrix>
    </TileMatrixSet>
</Contents>
<ServiceMetadataURL
xlink:href="http://localhost:8088/mapviewer/wmts?SERVICE=WMTS&amp;VERSION=1.0.0&amp;p;REQUEST=getCapabilities"/>
</Capabilities>

```

Example F-4 is the response from the following example GetCapabilities request in REST coding:

<http://localhost:8088/mapviewer/wmts/1.0.0/WMTSCapabilities.xml>

Example F-4 Response from GetCapabilities Request in REST Encoding

```

<?xml version="1.0" encoding="UTF-8"?>
<Capabilities xmlns="http://www.opengis.net/wmts/1.0"
  xmlns:ows="http://www.opengis.net/ows/1.1"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:gml="http://www.opengis.net/gml"
  xsi:schemaLocation="http://www.opengis.net/wmts/1.0
    http://schemas.opengis.net/wmts/1.0/wmtsGetCapabilities_response.xsd"
  version="1.0.0">
  <ows:ServiceIdentification>
    <!-- omitted to save space, the same as in KVP encoding -->
  </ows:ServiceIdentification>
  <ows:ServiceProvider>
    <!-- omitted to save space, the same as in KVP encoding -->
  </ows:ServiceProvider>
  <ows:OperationsMetadata>
    <ows:Operation name="GetCapabilities">
      <ows:DCP>
        <ows:HTTP>
          <ows:Get xlink:href="http://localhost:8088/mapviewer/wmts">
            <ows:Constraint name="GetEncoding">
              <ows:AllowedValues>
                <ows:Value>RESTful</ows:Value>
              </ows:AllowedValues>
            </ows:Constraint>
            <ows:Get>
              </ows:HTTP>
            </ows:DCP>
          </ows:Operation>
          <ows:Operation name="GetTile">
            <ows:DCP>
              <ows:HTTP>
                <ows:Get xlink:href="http://localhost:8088/mapviewer/wmts">
                  <ows:Constraint name="GetEncoding">
                    <ows:AllowedValues>
                      <ows:Value>RESTful</ows:Value>
                    </ows:AllowedValues>
                  </ows:Constraint>
                  <ows:Get>
                    </ows:HTTP>
                  </ows:DCP>
                </ows:Operation>
                <ows:Operation name="GetFeatureInfo">
                  <ows:DCP>
                    <ows:HTTP>
                      <ows:Get xlink:href="http://localhost:8088/mapviewer/wmts?">

```

```

<ows:Constraint name="GetEncoding">
  <ows:AllowedValues>
    <ows:Value>KVP</ows:Value>
  </ows:AllowedValues>
</ows:Constraint>
</ows:Get>
</ows:HTTP>
</ows:DCP>
</ows:Operation>
</ows:OperationsMetadata>
<Contents>
  <Layer>
    <ows:Title>TEST_TL</ows:Title>
    <ows:Abstract>datasource:MVDEMO,layer:TEST_TL</ows:Abstract>
    <ows:WGS84BoundingBox>
      <ows:LowerCorner>-180.0 -90.0</ows:LowerCorner>
      <ows:UpperCorner>180.0 90.0</ows:UpperCorner>
    </ows:WGS84BoundingBox>
    <ows:Identifier>MVDEMO:TEST_TL</ows:Identifier>
    <Style isDefault="true">
      <ows:Identifier>_null</ows:Identifier>
    </Style>
    <Format>image/png</Format>
    <TileMatrixSetLink>
      <TileMatrixSet>MVDEMO:TEST_TL:EPSG:4326</TileMatrixSet>
      <TileMatrixSetLimits>
        . . . . . <!-- omitted to save space -->
      <TileMatrixLimits>
        <TileMatrix>8</TileMatrix>
        <MinTileRow>0</MinTileRow>
        <MaxTileRow>128</MaxTileRow>
        <MinTileCol>0</MinTileCol>
        <MaxTileCol>256</MaxTileCol>
      </TileMatrixLimits>
        . . . . . <!-- omitted to save space -->
      </TileMatrixSetLimits>
    </TileMatrixSetLink>
    <ResourceURL format="image/png"
template="http://localhost:8088/mapviewer/wmts/MVDEMO:TEST_
TL/{TileMatrixSet}/{TileMatrix}/{TileRow}/{TileCol}.png" resourceType="tile"/>
  </Layer>
  <TileMatrixSet>
    <ows:Identifier>MVDEMO:TEST_TL:EPSG:4326</ows:Identifier>
    <ows:SupportedCRS>urn:ogc:def:crs:EPSG:4326</ows:SupportedCRS>
    <TileMatrix>
      <ows:Identifier>0</ows:Identifier>
      <ScaleDenominator>5.590822641167623E8</ScaleDenominator>
      <TopLeftCorner>-180.0 90.0</TopLeftCorner>
      <TileWidth>256</TileWidth>
      <TileHeight>256</TileHeight>
      <MatrixWidth>2</MatrixWidth>
      <MatrixHeight>2</MatrixHeight>
    </TileMatrix>
    . . . . . <!-- omitted to save space -->
  </TileMatrixSet>
</Contents>
<ServiceMetadataURL
xlink:href="http://localhost:8088/mapviewer/wmts?SERVICE=WMTS&VERSION=1.0.0&am
p;REQUEST=getCapabilities"/>

```

```
</Capabilities>
```

In [Example F-3](#) and [Example F-4](#), bold text for `<ows:Value>` elements shows differences in their responses when requests are in different encodings. (The encoding to use is an application-specific preference.) In these example responses, the GetTile operations are given in the same encoding as that of the GetCapabilities request's encoding; but the GetFeatureInfo operations are always in KVP encoding.

With the MapViewer WMTS server, there is no significant performance difference between use of the two encodings.

F.2.2 GetTile Operation Support

When the MapViewer server receives a WMTS GetTile request, its WMTS server asks the map cache server for that requested tile. The map cache server first checks the WMTS layer's accessibility; and if the layer is accessible, it translates the requested WMTS tile's tile-row, tile-column, and other parameters into MapViewer map cache tile layer's specification. The map cache server then prepares that tile and returns it to the MapViewer's WMTS server. In other words, a MapViewer WMTS layer published in the WMTS GetCapabilities XML document can be seen as a "virtual" layer physically mapped to the MapViewer map cache tile layer, which is managed by the MapViewer map cache server.

Whenever the WMTS server receives a GetTile request, it requests the MapViewer map cache server to make that tile, and then the WMTS server returns it to the client. When the map cache server receives such requests from the WMTS server, it always generates an image according to the specifications, such as an image's size and bounding box. The map cache server's image generation process can be as easy as getting the needed tiles from cache to "assemble" the requested WMTS tile (by mosaicking and cutting); or if tiles are not available in the cache, the map cache server requests another sever (MapViewer's map server) to generate the tiles.

This topic includes GetTile requests in KVP and REST encodings, and the response.

The following is a GetTile request in KVP coding (note that any WMTS request must be on a single line):

```
http://localhost:8088/mapviewer/wmts?SERVICE=WMTS&REQUEST=GetTile&VERSION=1.0.0&LAYER=MVDEMO:TEST_TL&STYLE=_null&format=image/png&TileMatrixSet=MVDEMO:TEST_TL:EPSG:4326&TileMatrix=MVDEMO:TEST_TL:EPSG:4326:8&TileRow=33&TileCol=77
```

[Figure F-1](#) shows the response tile image for the preceding request.

Figure F–1 Image Tile as Response to GetTile Request



The following is the same basic GetTile request but in REST encoding (note that any WMTS request must be on a single line):

```
http://localhost:8088/mapviewer/wmts/MVDEMO:TEST_TL/MVDEMO:TEST_TL:EPSG:4326/8/33/77.png
```

The response image is the same as shown in [Figure F–1, "Image Tile as Response to GetTile Request"](#).

F.2.2.1 Map tiles in WMTS Layer and in Map Cache Tile Layer

The MapViewer map cache server may cache its tile layer's map tiles, but its WMTS server does not cache any WMTS layer's map tiles. In other words, the WMTS server's map tiles do not physically exist, but rather are mapped to a MapViewer map cache tile layer.

For example, if a map cache tile layer's cache has been emptied before you send the WMTS GetTile request in [Section F.2.2.1, "Map tiles in WMTS Layer and in Map Cache Tile Layer"](#), then the following will occur:

1. WMTS server receives the request, then it passes it to the map cache server.
2. The map cache server converts the request into an internal image map request to generate the tile image (with a spatial dimension defined by the tile's bounding box, and an image dimension defined by the image size, such as 256x256).
3. The needed map cache tile layer's tiles are identified.
4. For each map cache tile layer's tile, the map cache server tries to get it from its cache. If the tile is not available from its cache (which is the case in this scenario because you just emptied the cache), a map request is sent to another server, the MapViewer map server, to generate that tile image.
5. After all the necessary map cache tile layer's map tiles are fetched, the WMTS tile image is then rendered (by mosaicking and cutting if applicable) and returned.

If the client sends a request for the same WMTS tile afterward, the preceding steps will be repeated, and the only difference is in step 4, where the required map cache tile layer's tiles will be available from the cache. Because the most expensive processing in step 4 is avoided, your second request to the same tile should be much faster.

In general, there is no one-to-one match between a tile in the map cache tile layer and a tile in a WMTS layer specified by a GetTile request. This is because a MapViewer map cache tile layer uses a coordinate system with its origin at the lower left corner (`tile_x`, `tile_y`), while WMTS uses a coordinate system that uses the upper left corner as its origin (`tile_column`, `tile_row`). For example, a MapViewer's image tile at (`tile_x=0`, `tile_y=0`) is the tile at the lower left corner, while the WMTS tile at (`tile_column=0`, `tile_row=0`) is located at the upper left corner.

The entire data area is partitioned into tiles starting from its corresponding origin, and the last tile in (`tile_x`, `tile_y`) or in (`tile_column`, `tile_row`) for each zoom level might not always align exactly with the data's upper bound (for the MapViewer tile coordinate system) or lower bound (for the WMTS tile coordinate system). Therefore, there might be no one-to-one match for tiles between the two systems. However, when the last tile does align exactly with the data boundary, then a one-to-one match does exist.

Using the GetTile request in [Section F.2.2.1, "Map tiles in WMTS Layer and in Map Cache Tile Layer"](#) as an example, if you request a WMTS tile (`tile_column=77`, `tile_row=33`) at zoom level 8, that tiles matches exactly with a map cache tile layer's tile at: (`tile_x=77`, `tile_y=94`). These two tiles match because:

- The tile layer definition (see [Example F-2, "Tile Layer Definition in the Data Source"](#)) ensures that there is a one-to-one match for the WMTS tile and the map cache tile layer's tile because the last tile in either coordinate system aligned with the data boundary exactly.
- WMTS's `tile_row` 33 complements map cache server's `tile_y` 94 to make the total tile rows to be 128 (note that one's origin is the upper-left corner and the other is the lower-left). As shown in [Example F-3, "Response from GetCapabilities Request in KVP Encoding"](#), the `<MaxTileRow>` element value is 128.

Note also that the `tile_x` and `tile_column` values are the same, because they start from the western boundary and works their way to the right.

When creating a tile layer in MapViewer for the WMTS service, be sure that the `<tile_dpi>` element is given a value of 0.28 mm, which is equivalent in dots per inch (dpi) notation to `<tile_dpi value="90.7142857"/>`. If this element is not provided, then MapViewer's map cache tile layer may use a different value (for example, setting dpi to 96) for the tile layer when generating tiles. This different value may slow the WMTS service and degrade the quality of its map tiles, because WMTS uses a dpi value of 90.7142857.

When creating a tile layer using the WGS84 (longitude/latitude) geodetic reference system in MapViewer for the WMTS service, you need to make sure that the `<tile_meters_per_unit>` element is given this value corresponding to an arc length of 1 degree along the equator: `<tile_meters_per_unit value="111319.49079327358"/>`. If the `<tile_meters_per_unit>` element is not provided, then MapViewer internally calculates a value; however, because the 111319.49079327358 value is commonly used by other WMTS service providers for the WGS84 geodetic reference system, specifying `<tile_meters_per_unit value="111319.49079327358"/>` will ensure that MapViewer's WMTS layer matches others service provider's tile layers.

F.2.3 GetFeatureInfo Operation Support

MapViewer supports the following GetFeatureInfo operation options:

- The standard OGC GetFeatureInfo request
- A MapViewer-specific GetFeatureInfo request at point (x,y)
- A MapViewer-specific GetFeatureInfo request within a bounding box

The feature information returned by these operations is based on the MapViewer base map and theme definitions, and on features selected according to the area of interest. The base map may define the visible scale ranges for each theme; and each theme defines its information columns in the `<field>` child element of `<hidden_info>`, which is a child element in the `<styling_rules>` element. If no information columns are specified in a theme's `<styling_rules>` element, then GetFeatureInfo response will not include any information about the features of that theme.

The area of interest is calculated in a GetFeatureInfo process for each option as follows:

- For a standard OGC GetFeatureInfo request, the pixel's column and row and its tile's location at a given zoom level can be translated into a (x,y) point in the map cache tile layer's coordinate system at the pixel's centroid. Centered at that point, a 5 by 5 pixel window at that zoom level defines the area of interest.
- For a MapViewer-specific (x, y) point request, it also uses a 5 by 5 pixel window at that level centered at the given (x,y) value as the area of interest.
- For a MapViewer-specific bounding box GetFeatureInfo request option, it uses the specified bounding box (`min_x`, `min_y`, `max_x`, `max_y`) and their corresponding (column, row) values in the image tile at the zoom level as the area of interest.

MapViewer lets you provide an additional MapViewer-specific parameter in a GetFeatureInfo request: a `childLayer` attribute (for example, `childLayer=myTheme1, myTheme2`). When this parameter is provided, MapViewer only includes the features information in the specified themes (in this example, only `myTheme1` and `myTheme2`). If this parameter is not provided, then all themes in the base map definition are considered for a GetFeatureInfo request.

This topic includes the following subtopics:

- [OGC GetFeatureInfo Request](#)
- [MapViewer GetFeatureInfo Request at an \(x,y\) Point](#)
- [MapViewer GetFeatureInfo Request within a Bounding Box](#)

These subtopics have examples that use the base map and theme definitions in [Example F-5](#) and [Example F-6](#) for a tile layer named TEST_TL.

Example F-5 Base Map Definition for Tile Layer TEST_TL

```
<?xml version="1.0" standalone="yes"?>
<map_definition>
  <theme name="THEME_DEMO_STATES" min_scale="" max_scale="0.0" scale_mode="RATIO"/>
  <theme name="THEME_DEMO_COUNTIES" min_scale="8500000.0" max_scale="0.0" scale_mode="RATIO"/>
  <theme name="THEME_DEMO_HIGHWAYS_LINE" min_scale="1.0E8" max_scale="4.5E7" scale_mode="RATIO"/>
  <theme name="THEME_DEMO_HIGHWAYS" min_scale="4.5E7" max_scale="0.0" scale_mode="RATIO"/>
  <theme name="THEME_DEMO_BIGCITIES" min_scale="" max_scale="0.0" scale_mode="RATIO"/>
  <theme name="THEME_DEMO_CITIES" min_scale="7500000.0" max_scale="0.0" scale_mode="RATIO"/>
</map_definition>
```

Example F-6 Theme Names and Styling Rules for Tile Layer TEST_TL

```
THEME_DEMO_STATES
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <hidden_info>
    <field column="STATE" name="Name" />
    <field column="STATE_ABRV" name="Abrv." />
    <field column="TOTPOP" name="Population" />
  </hidden_info>
  <rule>
```

```

<features style="C.S02_COUNTRY_AREA"> </features>
<label column="STATE_ABRV" style="T.S02_STATE_ABBREVS"> 1 </label>
</rule>
</styling_rules>

THEME_DEMO_COUNTIES
<?xml version="1.0" standalone="yes"?>
<styling_rules>
<hidden_info>
  <field column="COUNTY" name="County"/>
  <field column="FIPSSTCO" name="Fips"/>
  <field column="TOTPOP" name="Population"/>
  <field column="STATE_ABRV" name="State"/>
</hidden_info>
<rule>
  <features style="L.S06_BORDER_STATE"> </features>
</rule>
</styling_rules>

THEME_DEMO_CITIES
<?xml version="1.0" standalone="yes"?>
<styling_rules>
<hidden_info>
  <field column="CITY" name="City"/>
  <field column="POP90" name="Population"/>
</hidden_info>
<rule>
  <features style="M.ALL_CITY_L2"> (pop90 between 200000 AND 1000000 ) </features>
</rule>
<rule>
  <label column="city" style="T.S07_CITIES_L2"> 1 </label>
</rule>
<rule>
  <features style="M.ALL_CITY_L3"> (pop90 < 200000) </features>
  <label column="city" style="T.S07_CITIES_L3"> 1 </label>
</rule>
</styling_rules>

THEME_DEMO_HIGHWAYS
<?xml version="1.0" standalone="yes"?>
<styling_rules>
<hidden_info>
  <field column="HIGHWAY" name="Name"/>
  <field column="ROUTEN" name="No."/>
</hidden_info>
<rule>
  <features style="L.S04_ROAD_INTERSTATE"> </features>
  <label column="routen" style="M.HWY_USA_INTERSTATE_NARROW"> (3-length(routen
)) </label>
</rule>
</styling_rules>

```

F.2.3.1 OGC GetFeatureInfo Request

The following is a sample GetFeatureInfo request using the OGC standard (note that any WMTS request must be on a single line):

```

http://localhost:8088/mapviewer/wmts?SERVICE=WMTS&REQUEST=GetFeatureInfo&VERSION=1
.0.0&LAYER=MVDEMO:TEST_TL&STYLE=_null&format=image/png&TileMatrixSet=MVDEMO:TEST_
TL:EPSG:4326&TileMatrix=MVDEMO:TEST_
TL:EPSG:4326:8&TileRow=33&TileCol=76&I=238&J=240&InfoFormat=application/gml%2bxml;

```

```
version=3.1
```

[Example F-7](#) shows the response from this request.

Example F-7 Response from OGC GetFeatureInfo Request

```
<?xml version="1.0" encoding="UTF-8"?>
<layers>
  <layer name="THEME_DEMO_CITIES">
    <feature id="1">
      <City>Worcester</City>
      <Population>169759</Population>
    </feature>
  </layer>
  <layer name="THEME_DEMO_BIGCITIES">
  </layer>
  <layer name="THEME_DEMO_HIGHWAYS">
  </layer>
  <layer name="THEME_DEMO_HIGHWAYS_LINE">
  </layer>
  <layer name="THEME_DEMO_COUNTIES">
    <feature id="1">
      <County>Worcester</County>
      <Fips>25027</Fips>
      <Population>709705</Population>
      <State>MA</State>
    </feature>
  </layer>
  <layer name="THEME_DEMO_STATES">
    <feature id="1">
      <State>Massachusetts</State>
      <Abrv.>MA</Abrv.>
      <Population>6016424</Population>
    </feature>
  </layer>
</layers>
```

F.2.3.2 MapViewer GetFeatureInfo Request at an (x,y) Point

The following is a sample MapViewer GetFeatureInfo request for information for all themes in text/html format at a point identified by its longitude and latitude (x and y) values, in this case a point in the city of Boston (note that any WMTS request must be on a single line):

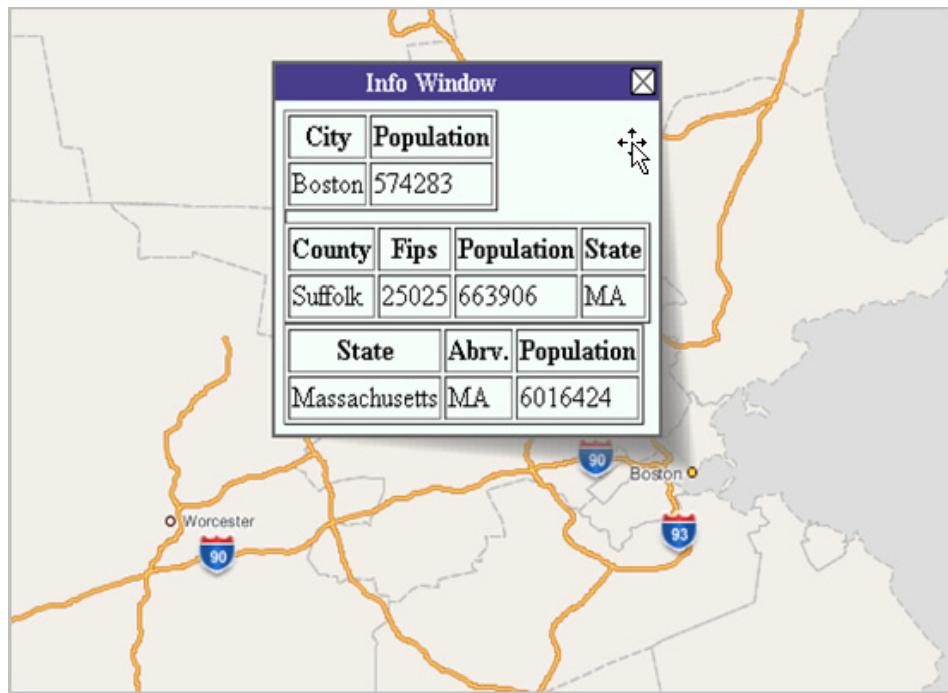
```
http://localhost:8088/mapviewer/wmts?SERVICE=WMTS&REQUEST=GetFeatureInfo&VERSION=1
.0.0&infoformat=text/html&LAYER=MVDEMO:TEST_
TL&zoomlevel=8&x=-71.01522133879438&y=42.33731136863662&SRID=8307
```

In this request, the point's (x,y) coordinates are specified as the parameters. MapViewer translates the point into a 5 by 5 pixel rectangular area at the given zoom level (8 in this example), centered at that point, as an area of interest for getting the feature information. Because there is no childLayer parameter in the request, by default all features in the area of interest are considered.

If the (x, y) coordinates are in a different coordinate system (spatial reference system) than that used by the tile layer, then the optional SRID parameter must be specified for converting the coordinates into the tile layer's system. Its default value is the tile layer's SRID value.

[Figure F-2](#) shows the response from this request.

Figure F-2 Response from MapViewer GetFeatureInfo Request at an (x,y) Point



F.2.3.3 MapViewer GetFeatureInfo Request within a Bounding Box

The following is a sample MapViewer GetFeatureInfo request for information for two themes (THEME_DEMO_CITIES and THEME_DEMO_COUNTIES) within an area of interest defined by a bounding box, in this case a rectangular area including the city of Boston and some surrounding communities (note that any WMTS request must be on a single line):

```
http://localhost:8088/mapviewer/wmts?SERVICE=WMTS&REQUEST=GetFeatureInfo&VERSION=1
.0.0&infoformat=text/xml&LAYER=MVDEMO:TEST_TL&childLayer=THEME_DEMO_
COUNTIES,THEME_DEMO_
CITIES&zoomlevel=8&bbox=-71.32151786220001,42.19361670333521,-70.96354167846667,42
.52386233762441&SRID=8307
```

If the (x, y) coordinates are in a different coordinate system (spatial reference system) than that used by the tile layer, then the optional SRID parameter must be specified for converting the bounding box coordinates into the tile layer's system. Its default value is the tile layer's SRID value.

[Figure F-2](#) shows the bounding box for this request.

Figure F–3 Bounding Box for MapViewer GetFeatureInfo Request



[Example F–8](#) shows the response in XML format from this request.

Example F–8 Response from MapViewer GetFeatureInfo Request within a Bounding Box

```
<layers>
  <layer name="THEME_DEMO_CITIES">
    <feature id="1">
      <City>Boston</City>
      <Population>574283</Population>
    </feature>
  </layer>
  <layer name="THEME_DEMO_COUNTIES">
    <feature id="1">
      <County>Middlesex</County>
      <Fips>25017</Fips>
      <Population>1398468</Population>
      <State>MA</State>
    </feature>
    <feature id="2">
      <County>Norfolk</County>
      <Fips>25021</Fips>
      <Population>616087</Population>
      <State>MA</State>
    </feature>
    <feature id="3">
      <County>Suffolk</County>
      <Fips>25025</Fips>
      <Population>663906</Population>
      <State>MA</State>
    </feature>
    <feature id="4">
      <County>Essex</County>
      <Fips>25009</Fips>
      <Population>670080</Population>
      <State>MA</State>
    </feature>
  </layer>
</layers>
```

F.3 Preparing the WMTS Service for MapViewer

To prepare for using the WMTS Service for MapViewer, follow these major steps:

1. [Prepare Predefined Geometry Themes](#).
2. [Prepare the Base Map](#).
3. [Prepare Tile Layers](#).
4. [Publish Tile Layers in the wmtsConfig.xml Policy File](#).
5. [Verify the MapViewer WMTS Service](#).

F.3.1 Prepare Predefined Geometry Themes

If the getFeatureInfo service must get feature information from a predefined geometry theme , you must use the `<hidden_info>` element with one or more `<field>` child elements. The `column` attribute in the `<field>` element will be returned in a getFeatureInfo response.

The `<hidden_info>` element must be in the `<styling_rules>` element. For example:

```
<?xml version="1.0" standalone="yes"?>
<styling_rules>
  <hidden_info>
    <field column="NAME" name="name" />
    <field column="MAINPAGE" name="mainpage" />
  </hidden_info>
  .
  .
  .
</styling_rules>
```

For information using styling rules in a predefined geometry theme, see [Section 2.3.1.1, "Styling Rules in Predefined Spatial Geometry Themes"](#)

F.3.2 Prepare the Base Map

To prepare a base map (which is just a collection of themes) to use a WMTS theme, add the theme to the base map.

For information about adding themes to a base map, see [Section 2.4, "Maps"](#).

For information about WMTS themes, see [Section 2.3.8, "WMTS Themes"](#).

F.3.3 Prepare Tile Layers

A MapViewer tile layer becomes a WMTS layer in the MapViewer WMTS server if there are no constraints in the `wmtsConfig.xml` policy file. For example, assume that a base map named DEMO_MAP has been created as in [Example F-2, "Tile Layer Definition in the Data Source"](#), then tile layers can be created using that base map. This topic contains the following examples, each using a well-known scale set found in OGC WMTS 1.0.0 implementation standard Annex E:

- [Example F-9, "Tile Definition of Scale Set GlobalCRS84Scale"](#)
- [Example F-10, "Tile Definition of Scale Set GlobalCRS84Pixel"](#)
- [Example F-11, "Tile Definition of Scale Set GoogleCRS84Quad"](#)
- [Example F-12, "Tile Definition of Scale Set GoogleMapsCompatible"](#)

In these examples, the <tile_dpi> and <tile_meters_per_unit> elements are specified, to comply with the OGC WMTS 1.0.0 implementation standard where pixel size is 0.28mm. If the coordinate (spatial reference) system is WGS84, then 1 degree on the equator equals 111319.49 meters.

Example F-9 Tile Definition of Scale Set GlobalCRS84Scale

```
insert into user_sdo_cached_maps values(
'WMTS_E1',
'wmts annex e1 scale set for GlobalCRS84Scale',
 '',
'YES',
'YES',
'<map_tile_layer name="WMTS_E1" image_format="PNG" http_header_expires="168.0" concurrent_fetching_
threads="3">
  <internal_map_source base_map="DEMO_MAP" data_source="MVDEMO" />
  <coordinate_system srid="8307" minX="-180" maxX="180" minY="-90" maxY="90" />
  <internal_map_source base_map="DEMO_MAP" data_source="MVDEMO" db_tile_table=" " />
  <cache_storage root_path="/" />
  <coordinate_system srid="8307" minX="-180" maxX="180" minY="-90" maxY="90" />
  <tile_image width="256" height="256" />
  <tile_dpi value="90.7142857" />
  <tile_meters_per_unit value="111319.49079327358" />
  <zoom_levels levels="21" min_scale="100" max_scale="5.0E8">
    <zoom_level scale="5.0E8" tile_width="321.9561978791382" tile_height="321.9561978791382" />
    <zoom_level scale="2.5E8" tile_width="160.9780989395691" tile_height="160.9780989395691" />
    <zoom_level scale="1.0E8" tile_width="64.39123957582764" tile_height="64.39123957582764" />
    <zoom_level scale="5.0E7" tile_width="32.19561978791382" tile_height="32.19561978791382" />
    <zoom_level scale="2.5E7" tile_width="16.09780989395691" tile_height="16.09780989395691" />
    <zoom_level scale="1.0E7" tile_width="6.439123957582764" tile_height="6.439123957582764" />
    <zoom_level scale="5.0E6" tile_width="3.219561978791382" tile_height="3.219561978791382" />
    <zoom_level scale="2.5E6" tile_width="1.609780989395691" tile_height="1.609780989395691" />
    <zoom_level scale="1.0E6" tile_width="0.6439123957582763" tile_height="0.6439123957582763" />
    <zoom_level scale="5.0E5" tile_width="0.32195619787913815" tile_
height="0.32195619787913815" />
    <zoom_level scale="2.5E5" tile_width="0.16097809893956908" tile_
height="0.16097809893956908" />
    <zoom_level scale="1.0E5" tile_width="0.06439123957582764" tile_
height="0.06439123957582764" />
    <zoom_level scale="5.0E4" tile_width="0.03219561978791382" tile_
height="0.03219561978791382" />
    <zoom_level scale="2.5E4" tile_width="0.01609780989395691" tile_
height="0.01609780989395691" />
    <zoom_level scale="1.0E4" tile_width="0.006439123957582764" tile_
height="0.006439123957582764" />
    <zoom_level scale="5.0E3" tile_width="0.003219561978791382" tile_
height="0.003219561978791382" />
    <zoom_level scale="2.5E3" tile_width="0.001609780989395691" tile_
height="0.001609780989395691" />
    <zoom_level scale="1.0E3" tile_width="6.439123957582763E-4" tile_
height="6.439123957582763E-4" />
    <zoom_level scale="5.0E2" tile_width="3.2195619787913813E-4" tile_
height="3.2195619787913813E-4" />
    <zoom_level scale="2.5E2" tile_width="1.6097809893956906E-4" tile_
height="1.6097809893956906E-4" />
    <zoom_level scale="1.0E2" tile_width="6.439123957582763E-5" tile_
height="6.439123957582763E-5" />
  </zoom_levels>
</map_tile_layer>',
'DEMO_MAP','');
```

Example F-10 Tile Definition of Scale Set GlobalCRS84Pixel

```

insert into user_sdo_cached_maps values(
'WMTS_E2',
'wmts annex e2 scale GlobalCRS84Pixel',
 '',
'YES',
'YES',
'<map_tile_layer name="WMTS_E2" image_format="PNG" http_header_expires="168.0" concurrent_fetching_
threads="3">
  <internal_map_source base_map="DEMO_MAP" data_source="MVDEMO"/>
  <coordinate_system srid="8307" minX="-180" maxX="180" minY="-90" maxY="90"/>
  <tile_image width="256" height="256"/>
  <tile_dpi value="90.7142857"/>
  <tile_meters_per_unit value="111319.49079327358"/>
  <zoom_levels levels="19" min_scale="1104.360027711047" max_scale="795139219.9519541">
    <zoom_level scale="795139219.9519541" tile_width="512.000000" tile_height="512.000000"/>
    <zoom_level scale="397569609.9759771" tile_width="256.000000" tile_height="256.000000"/>
    <zoom_level scale="198784804.9879885" tile_width="128.000000" tile_height="128.000000"/>
    <zoom_level scale="132523203.3253257" tile_width="85.333333" tile_height="85.333333"/>
    <zoom_level scale="66261601.66266284" tile_width="42.666666" tile_height="42.666666"/>
    <zoom_level scale="33130800.83133142" tile_width="21.333333" tile_height="21.333333"/>
    <zoom_level scale="13252320.33253257" tile_width="8.533333" tile_height="8.533333"/>
    <zoom_level scale="6626160.166266284" tile_width="4.266666" tile_height="4.266666"/>
    <zoom_level scale="3313080.083133142" tile_width="2.133333" tile_height="2.133333"/>
    <zoom_level scale="1656540.041566571" tile_width="1.066666" tile_height="1.066666"/>
    <zoom_level scale="552180.0138555236" tile_width="0.3555555" tile_height="0.3555555"/>
    <zoom_level scale="331308.0083133142" tile_width="0.2133333" tile_height="0.2133333"/>
    <zoom_level scale="110436.0027711047" tile_width="0.0711111" tile_height="0.0711111"/>
    <zoom_level scale="55218.00138555237" tile_width="0.0355555" tile_height="0.0355555"/>
    <zoom_level scale="33130.80083133142" tile_width="0.0213333" tile_height="0.0213333"/>
    <zoom_level scale="11043.60027711047" tile_width="0.00711111" tile_height="0.00711111"/>
    <zoom_level scale="3313.080083133142" tile_width="0.00213333" tile_height="0.00213333"/>
    <zoom_level scale="1104.360027711047" tile_width="7.111111E-4" tile_height="7.111111E-4"/>
  </zoom_levels>
</map_tile_layer>',
'DEMO_MAP',
 '');

```

Example F-11 Tile Definition of Scale Set GoogleCRS84Quad

```

insert into user_sdo_cached_maps values(
'WMTS_E3',
'wmts annex e3 scale set GoogleCRS84Quad',
 '',
'YES',
'YES',
'<map_tile_layer name="WMTS_E3" image_format="PNG" http_header_expires="168.0" concurrent_fetching_
threads="3">
  <internal_map_source base_map="DEMO_MAP" data_source="MVDEMO"/>
  <coordinate_system srid="8307" minX="-180" maxX="180" minY="-90" maxY="90"/>
  <tile_image width="256" height="256"/>
  <tile_dpi value="90.7142857"/>
  <tile_meters_per_unit value="111319.49079327358"/>
  <zoom_levels levels="19" min_scale="2132.729583849784" max_scale="559082264.0287178">
    <zoom_level tile_width="360.0000" tile_height="360.0000" scale="5.590822640287178E8"/>
    <zoom_level tile_width="180.0000" tile_height="180.0000" scale="2.795411320143589E8"/>
    <zoom_level tile_width="90.0000" tile_height="90.0000" scale="1.3977056600717944E8"/>
    <zoom_level tile_width="45.0000" tile_height="45.0000" scale="6.988528300358972E7"/>
    <zoom_level tile_width="22.5000" tile_height="22.5000" scale="3.494264150179486E7"/>
    <zoom_level tile_width="11.2500" tile_height="11.2500" scale="1.747132075089743E7"/>
  </zoom_levels>
</map_tile_layer>',
'DEMO_MAP',
 '');

```

```

<zoom_level tile_width="5.6250" tile_height="5.62500" scale="8735660.375448715"/>
<zoom_level tile_width="2.8125" tile_height="2.81250" scale="4367830.1877243575"/>
<zoom_level tile_width="1.40625" tile_height="1.40625" scale="2183915.0938621787"/>
<zoom_level tile_width="0.703125" tile_height="0.703125" scale="1091957.5469310894"/>
<zoom_level tile_width="0.3515625" tile_height="0.3515625" scale="545978.7734655447"/>
<zoom_level tile_width="0.17578125" tile_height="0.17578125" scale="272989.38673277234"/>
<zoom_level tile_width="0.087890625" tile_height="0.087890625" scale="136494.693366386"/>
<zoom_level tile_width="0.0439453125" tile_height="0.0439453125" scale="68247.34668319"/>
<zoom_level tile_width="0.02197265625" tile_height="0.02197265625" scale="34123.6733415"/>
<zoom_level tile_width="0.010986328126" tile_height="0.010986328126" scale="17061.8366707"/>
<zoom_level tile_width="0.0054931640633" tile_height="0.0054931640633"
scale="8530.91833539"/>
<zoom_level tile_width="0.00274658203168" tile_height="0.00274658203168"
scale="4265.45916769"/>
<zoom_level tile_width="0.001373291015841" tile_height="0.001373291015841"
scale="2132.72958384"/>
</zoom_levels>
</map_tile_layer> ,
'DEMO_MAP',
'');

```

Example F–12 Tile Definition of Scale Set GoogleMapsCompatible

```

insert into user_sdo_cached_maps values(
'WMTS_E4',
'wmts annex e4 scale set',
 '',
'YES',
'YES',
'<map_tile_layer name="WMTS_E4" image_format="PNG" http_header_expires="168.0" concurrent_fetching_
threads="3">
<internal_map_source base_map="DEMO_MAP" data_source="MVDEMO"/>
<coordinate_system srid="3857" minX="-20037508" maxX="20037508" minY="-20037508"
maxY="20037508"/>
<tile_image width="256" height="256"/>
<tile_dpi value="90.7142857"/>
<tile_meters_per_unit value="1"/>
<zoom_levels levels="19" min_scale="2132.729583849784" max_scale=" 559082264.0287178">
<zoom_level tile_width="4.0075016692E7" tile_height="4.0075016692E7"
scale="5.5908226403E8"/>
<zoom_level tile_width="2.0037508346E7" tile_height="2.0037508346E7"
scale="2.7954113201E8"/>
<zoom_level tile_width="1.0018754173E7" tile_height="1.0018754173E7"
scale="1.3977056601E8"/>
<zoom_level tile_width="5009377.086486" tile_height="5009377.086486"
scale="6.9885283004E7"/>
<zoom_level tile_width="2504688.543243" tile_height="2504688.543243"
scale="3.4942641502E7"/>
<zoom_level tile_width="1252344.27162" tile_height="1252344.27162"
scale="1.747132075089E7"/>
<zoom_level tile_width="626172.135810" tile_height="626172.135810"
scale="8735660.3754487"/>
<zoom_level tile_width="313086.067905" tile_height="313086.067905"
scale="4367830.1877243"/>
<zoom_level tile_width="156543.033952" tile_height="156543.033952"
scale="2183915.0938621"/>
<zoom_level tile_width="78271.5169763" tile_height="78271.5169763"
scale="1091957.5469311"/>
<zoom_level tile_width="39135.7584882" tile_height="39135.7584882"
scale="545978.77346554"/>
```

```

<zoom_level tile_width="19567.8792441" tile_height="19567.8792441"
scale="272989.38673277"/>
<zoom_level tile_width="9783.93962204" tile_height="9783.93962204"
scale="136494.69336638"/>
<zoom_level tile_width="4891.96981102" tile_height="4891.96981102"
scale="68247.346683193"/>
<zoom_level tile_width="2445.98490551" tile_height="2445.98490551"
scale="34123.673341596"/>
<zoom_level tile_width="1222.99245275" tile_height="1222.99245275"
scale="17061.836670798"/>
<zoom_level tile_width="611.496226378" tile_height="611.496226378"
scale="8530.9183353991"/>
<zoom_level tile_width="305.748113189" tile_height="305.748113189"
scale="4265.4591676995"/>
<zoom_level tile_width="152.874056594" tile_height="152.874056594"
scale="2132.7295838498"/>
</zoom_levels>
</map_tile_layer>,
'DEMO_MAP',
 '');

```

F.3.4 Publish Tile Layers in the wmtsConfig.xml Policy File

To publish tile layers, you can edit and add information in the `<public_datasources>` element in the `wmtsConfig.xml` policy file, which is stored in the same location as `mapViewerConfig.xml`. [Example F-13](#) shows the entries for publishing five tiles in data source MVDEMO (TEST_EL, WMTS_E1, WMTS_E2, WMTS_E3, and WMTS_E4) and all tile layers in data source TILSMENV.

Example F-13 Publishing Tile Layers

```

<public_datasources>
  <public_datasource name="MVDEMO">
    <tile_layers>
      <tile_layer name="TEST_TL" />
      <tile_layer name="WMTS_E1" />
      <tile_layer name="WMTS_E2" />
      <tile_layer name="WMTS_E3" />
      <tile_layer name="WMTS_E4" />
    </tile_layers>
  </public_datasource>
  <public_datasource name="TILSMENV" include_all_tile_layers="TRUE">
  </public_datasources>

```

F.3.5 Verify the MapViewer WMTS Service

To verify that the MapViewer WMTS service is working properly, follow these steps:

1. Restart the MapViewer server to let MapViewer retrieve the tile layer definitions from the data source and apply the WMTS policy file.
2. Issue a GetCapabilities request in the following format, to check that the tile layers are published and that all scale sets are shown as expected:

```
http://<url>:<port>/mapviewer/wmts?REQUEST=GetCapabilities&SERVICE=WMTS&VERSION=1.0.0
```

Index

A

accelerator keys
 for Map Builder tool menus, 7-3
active theme
 getting, 4-10
add_data_source element, 5-2
addBucketStyle method, 4-8
addCollectionBucketStyle method, 4-8
addColorSchemeStyle method, 4-8
addColorStyle method, 4-8
addGeoRasterTheme method, 4-6
addImageAreaStyleFromURL method, 4-9
addImageMarkerStyleFromURL method, 4-9
addImageTheme method, 4-6
adding themes to a map, 2-77
addJDBCTheme method, 4-7
addLinearFeature method, 4-7
addLineStyle method, 4-9
addLinksWithinCost method, 4-7
addMarkerStyle method, 4-9
addNetworkLinks method, 4-7
addNetworkNodes method, 4-7
addNetworkPaths method, 4-7
addNetworkTheme method, 4-7
addPointFeature method, 4-7
addPredefinedTheme method, 4-7
addShortestPath method, 4-7
addStyle method, 4-8
addTextStyle method, 4-9
addThemesFromBaseMap method, 4-7
addTopologyDebugTheme method, 4-7
addTopologyTheme method, 4-7
addVariableMarkerStyle method, 4-9
addWMSMapTheme method, E-15
administrative requests, 5-1
 getting status of, 5-12
 restricting, 1-29
 Workspace Manager support, 2-91
administrative tasks
 stopping, resuming, or removing, 5-11
advanced style, 2-2
 pie chart example, 3-9
 thematic mapping and, 2-67
 XML format for defining, A-9
advanced styles

example, 3-13
ALL_SDO_CACHED_MAPS view, 2-96
ALL_SDO_MAPS view, 2-93, 2-96
ALL_SDO_STYLES view, 2-93, 2-94
ALL_SDO_THEMES view, 2-93, 2-95
allow_jdbc_theme_based_foi attribute, 1-39
allow_local_adjustment attribute, 1-31
animated loading bar, B-2
annotation text themes, 2-60
antialiasing
 attribute of map request, 3-28
 setAntiAliasing method, 4-4
APIs
 JavaScript for Oracle Maps, 6-4
 MapViewer JavaBean, 4-1
 adding a WMS map theme, E-15
 MapViewer JavaScript for SVG maps, B-1
 MapViewer XML, 3-1
 adding a WMS map theme, E-11
appearance
 attributes affecting theme appearance, 2-76
area style, 2-2
 XML format for defining, A-7
asis attribute, 3-41
aspect ratio
 preserving, 3-32, 3-34
authentication
 WMS map themes, E-14
automatic legends, 2-81
auto-update of cached map tiles, 3-86
AWT headless mode support, 1-4
azimuthal equidistant projection
 used by MapViewer for globular map
 projection, 1-32

B

background color
 for WMS requests, E-4
 setting, 4-4
background image URL
 setting, 4-4
bar chart marker style
 XML format for defining, A-13
base maps, 2-77
 adding themes from base map to current map

request, 4-7
 definition (example), 2-77
 for WMS requests, E-3
 listing for a data source, 5-15
 part_of_basemap attribute for theme, 3-52
 setting name of, 4-4
 use_cached_basemap attribute, 3-31
 XML format, A-1
 XML format for defining, A-21
basemap
 attribute of map request, 3-28
BASEMAP parameter (WMS), E-3
BBOX parameter (WMS), E-4
bean
 MapViewer API for, 4-1
bgcolor
 attribute of map request, 3-29
BGCOLOR parameter (WMS), E-4
bgimage
 attribute of map request, 3-29
binding parameters, 2-15
 example, 3-12
Bing Maps
 built-in map tile layers, 6-14
 transforming data to the Microsoft Bing Maps coordinate system, 6-15
bitmap masks
 with GeoRaster themes, 2-34
border margin
 for bounding themes, 3-32
bounding box
 for WMS requests, E-4
 specifying for map, 3-34
bounding themes
 specifying for map, 3-31, 4-4
bounding_themes element, 3-31
box element, 3-34
bring_cache_online element, 5-15
bucket style
 adding to map request, 4-8
 specifying labels for buckets, 2-5
 XML format for defining, A-9
bugs, 8-12
built-in map tile layers, 6-14

C

cache
 auto-update of cached map tiles, 3-86
 metadata, 2-84, 5-20
 spatial data, 1-32, 5-20
 with predefined themes, 2-17
cache instance
 creating or redefining, 5-13
 removing, 5-14
cache status
 getting, 5-8
caching attribute
 for predefined theme, 2-18, A-19
catalog data sources, 2-84

center element, 3-35
center point
 setting, 4-4
classgen.jar file, E-1
clear_cache element, 5-20
clear_theme_cache element, 5-21
clickable (live) features, 4-15
cluster
 deploying MapViewer on middle-tier cluster, 1-49
collection bucket style
 adding to map request, 4-8
 with discrete values, A-9
collection style
 XML format for defining, A-14
color scheme style
 adding to map request, 4-8
 XML format for defining, A-11
color stops (heat map), A-16
color style, 2-2
 adding to map request, 4-8
 XML format for defining, A-2
configuring MapViewer, 5-21
conflicts during merge
 resolving, 8-11
connection information
 for adding a data source, 5-2
container data source, 1-38, 5-2
container theme name (heat map), A-16
container_ds attribute, 1-38, 5-2
container-controlled logging, 1-27
cookie
 getting authenticated user's name from, 1-52
coordinate system, 2-77
 conversion by MapViewer for map request, 3-8
coordinate system ID
See SRID
cost analysis
 of network nodes, 4-7
cross-schema map requests, 2-87
custom image renderer
 creating and registering, C-1
 custom_image_renderer element, 1-33
custom spatial provider
 creating and registering, D-1
 s_data_provider element, 1-34

D

data providers
 nonspatial, 1-34
data source methods
 using, 4-13
data sources
 adding, 5-2
 catalog, 2-84
 checking existence of, 4-13, 5-6
 clearing metadata cache, 5-20
 container_ds attribute, 1-38, 5-2
 explanation of, 2-83

for WMS requests, E-4
listing, 5-5
listing base maps in, 5-15
listing names of, 4-13
listing themes in, 5-16
managing, 5-1
redefining, 5-4
removing, 5-4
setting name of, 4-4
using multiple data sources in a map request
 (datasource attribute for theme), 3-51
data types supported, 8-2
data_source_exists element, 5-6
datasource
 attribute of map request, 3-28
 attribute of theme specification in a map
 request, 3-51
DATASOURCE parameter (WMS), E-4
dataSourceExists method, 4-13
DBA_SDO_STYLES view, 2-94
debug mode
 topology themes, 2-43
 adding theme, 4-7
decorative aspects
 attributes affecting theme appearance, 2-76
deleteAllThemes method, 4-10
deleteMapLegend method, 4-6
deleteStyle method, 4-10
deleteTheme method, 4-10
demo
 MapViewer JavaBean API, 4-3
deploying MapViewer, 1-4
dirty cached map tiles, 3-86
dirty_tile_auto_update element, 3-86
disableFeatureSelect function, B-2
disablePolygonSelect function, B-2
disableRectangleSelect function, B-3
doQuery method, 4-14
doQueryInMapWindow method, 4-14
dot density marker style
 XML format for defining, A-12
drawing tools, 8-19
drawLiveFeatures method, 4-15
DTD
 exception, 3-56
 Geometry (Open GIS Consortium), 3-56
 information request, 3-54
 map request, 3-21
 examples, 3-2
 map response, 3-55
dynamic themes
 adding to map request, 4-6
DYNAMIC_STYLES parameter (WMS), E-4
dynamically defined styles, 2-3, 3-49
 adding to map request, 4-8
 for WMS requests, E-4
 removing, 4-10
dynamically defined themes, 2-22, 3-40, 3-50
 See also JDBC themes

E

Edit Session area, 8-15
edit_config_file element, 5-21
editing mode, 8-3
editing sessions, 8-3
enableFeatureSelect function, B-2
enablePolygonSelect function, B-2
enableRectangleSelect function, B-3
enableThemes method, 4-10
EPSG
 in SRS parameter (WMS), E-5
example programs using MapViewer
 Java, 3-18
 PL/SQL, 3-20
exception DTD, 3-56
EXCEPTIONS parameter (WMS)
 for GetFeatureInfo request, E-9
 for GetMap request, E-4
external attribute data, 2-73

F

fast_unpickle attribute, 3-51
feature labels
 support for translation, 2-18
feature of interest (FOI), 6-1
feature selection
 enabling and disabling, B-2
feature tools, 8-18
FEATURE_COUNT parameter (WMS), E-9
features
 new, xxi
features of interest (FOIs)
 allow_jdbc_theme_based_foi attribute, 1-39
field element
 for hidden information, 3-42, A-21
filter (spatial)
 getting, 4-14
fixed_svglabel attribute, 3-52
FOI (feature of interest), 6-1
FOIs
 allow_jdbc_theme_based_foi attribute, 1-39
footnote attribute, 3-29, 3-31
 map request, 3-29
footnote_style attribute, 3-29, 3-31
 map request, 3-29
format
 attribute of map request, 3-28
FORMAT parameter (WMS), E-4

G

geodetic data
 projecting to local non-geodetic coordinate
 system, 1-31
geoFeature element, 3-35
Geometry DTD (Open GIS Consortium), 3-56
geometry tools, 8-22
GeoRaster themes, 2-27
 adding to current map request, 4-6

bitmap masks, 2-34
defining with `jdbc_georaster_query` element, 3-38
reprojection, 2-35
setting polygon mask, 2-28, 4-10
theme_type attribute in styling rules, A-18
`get_admin_request_task` element, 5-12
`get_cache_status` element, 5-8
`get_client_config` element, 5-7
`get_style_definition` element, 5-19
`getActiveTheme` method, 4-10
`getAntiAliasing` method, 4-4
`GetCapabilities` request and response, E-6
`getDataSources` method, 4-13
`getEnabledThemes` method, 4-10
`GetFeatureInfo` request
 specifying attributes to be queried, E-10
 supported features, E-8
`getGeneratedMapImage` method, 4-13
`getGeneratedMapImageURL` method, 4-13
`getInfo` function, B-3
`getLiveFeatureAttrs` method, 4-15
`GetMap` request
 parameters, E-2
`getMapMBR` method, 4-13
`getMapResponseString` method, 4-13
`getNumLiveFeatures` method, 4-15
`getScreenCoordinate` function, B-5
`getSelectedIdList` function, B-3
`getSelectPolygon` function, B-3
`getSelectRectangle` function, B-3
`getSpatialFilter` method, 4-14
`getThemeEnabled` method, 4-10
`getThemeNames` method, 4-10
`getThemePosition` method, 4-10
`getThemeVisibleInSVG` method, 4-10
getting started, 8-4
`getUserCoordinate` function, B-5
`getUserPoint` method, 4-14
`getWhereClauseForAnyInteract` method, 4-14
`getXMLResponse` method, 4-12
GIF format, 3-28
GIF_STREAM format, 3-28
GIF_URL format, 3-28
globular map projection, 1-32
Google Maps
 built-in map tile layers, 6-14
 transforming data to the Google Maps coordinate system, 6-15
grid sample factor (heat map), A-16
GridLink data source, 1-43
grouping tools, 8-20

H

`hasLiveFeatures` method, 4-15
`hasThemes` method, 4-10
headless AWT mode support, 1-4
heat map style
 XML format for defining, A-15
height

attribute of map request, 3-28
HEIGHT parameter (WMS), E-4
hidden information (SVG maps)
 displaying when mouse moves over, 3-30, 4-6
 `hidden_info` element, 3-40, 3-42, A-21
hidden themes
 `getThemeVisibleInSVG` method, 4-10
 `setThemeVisible` method, 4-11
`hidden_info` attribute, 3-37
`hidden_info` element, 3-40, 3-42, A-21
`hideTheme` function, B-2
high availability
 using MapViewer with, 1-48
`highlightFeatures` method, 4-15

I

`identify` method, 4-14
image area style
 adding to map request, 4-9
image format
 for WMS requests, E-4
 setting, 4-5
image marker style
 adding to map request, 4-9
 XML format for defining, A-4
image renderer
 creating and registering, C-1
 `custom_image_renderer` element, 1-33
image scaling
 setting automatic rescaling, 4-5
image themes, 2-25
 adding, 4-6
 defining with `jdbc_image_query` element, 3-38
 example, 3-7
 setting scale values, 4-11
 setting transparency value, 4-11
 setting unit and resolution values, 4-11
 theme_type attribute in styling rules, A-18
images
 getting sample image for a style, 2-9
imagescaling
 attribute of map request, 3-28
indexed PNG format support, 3-29
INFO_FORMAT parameter (WMS), E-9
`info_request` element, 3-54
infoon attribute, 3-30
information request DTD, 3-54
initial scale, 3-30
initscale attribute, 3-30
installing MapViewer, 1-4
internationalization
 translation of feature labels, 2-18
isClickable method, 4-16
issues, 8-12

J

Java example program using MapViewer, 3-18
JAVA_IMAGE format, 3-28

JavaBean-based API for MapViewer, 4-1
 demo, 4-3
 Javadoc, 4-3
 Javadoc
 MapViewer JavaBean API, 4-3
 JavaScript API for Oracle Maps, 6-4
 JavaScript functions for SVG maps, B-1
 JDBC theme-based features of interest, 1-39
 JDBC themes, 2-22
 adding, 4-7
 saving complex SQL queries, 2-24
 using a pie chart style, 3-10
 jdbc_georaster_query element, 3-38
 jdbc_host attribute, 5-2
 jdbc_image_query element, 3-38
 jdbc_mode attribute, 5-2
 jdbc_network_query element, 3-40
 jdbc_password attribute, 5-2
 jdbc_port attribute, 5-2
 jdbc_query element, 3-40
 jdbc_sid attribute, 5-2
 jdbc_tns_name attribute, 5-2
 jdbc_topology_query element, 3-42
 jdbc_user attribute, 5-2
 join view
 key_column styling rule attribute required for
 theme defined on join view, A-19
 JPEG image format support, 3-29

K

keepthemesorder attribute, 3-31
 key_column attribute
 for theme defined on a join view, A-19
 known issues, 8-12

L

label attribute, 2-69
 label_always_on attribute, 3-51
 label_max_scale attribute, 2-79
 label_min_scale attribute, 2-79
 labeling of spatial features, 2-14
 label styles for individual buckets, 2-5
 primary and secondary labels, 2-21
 translation of feature labels, 2-18
 LAYERS parameter (WMS), E-4
 legend, 2-80
 automatic, 2-81
 deleting, 4-6
 element, 3-42
 example, 2-80
 for WMS requests, E-5
 setting, 4-5
 LEGEND_REQUEST parameter (WMS), E-5
 legendSpec parameter, 4-5
 line style, 2-2
 adding to map request, 4-9
 XML format for defining, A-6
 linear features

adding, 4-7
 removing, 4-8
 Linear Referencing System (LRS) themes, 2-64
 list_data_sources element, 5-5
 list_maps element, 5-15
 list_predefined_themes element, 5-16
 list_styles element, 5-17
 list_theme_styles element, 5-18
 list_workspace_name element, 2-91
 list_workspace_session element, 2-92
 live features, 4-15
 load balancer
 using MapViewer with, 1-49
 loading bar, B-2
 local geodetic data adjustment
 specifying for map, 1-31
 logging element, 1-27
 logging information, 1-27
 container-controlled, 1-27
 logo
 specifying for map, 1-30
 longitude/latitude coordinate system, 2-77
 LRS (Linear Referencing System) themes, 2-64

M

main window, 8-2
 Map Builder tool, 7-1
 running, 7-1
 user interface (UI), 7-2
 web version, 7-4
 map cache auto-update, 3-86
 map canvas, 8-17
 map data server, 3-59
 Map Data Server (MDS), 1-40
 map image file information, 1-28
 map legend, 2-80
 deleting, 4-6
 example, 2-80
 legend element, 3-42
 setting, 4-5
 map logo, 1-30
 map note, 1-30
 map rendering, 1-49
 map request DTD, 3-21
 examples, 3-2
 map requests
 cross-schema, 2-87
 sending to MapViewer service, 4-12
 XML API, 3-1
 map response
 extracting information from, 4-13
 map response DTD, 3-55
 map response string
 getting, 4-13
 map result file name
 setting, 4-5
 map scale bar, 8-18
 map server, 3-1
 map size

setting, 4-5
 map tile layers
 built-in, 6-14
 XML format for defining, A-22
 map tile server, 3-69
 configuring, 1-37
 map title, 1-30
 setting, 4-5
 map_request element, 3-26
 attributes, 3-27
 map_tile_server element, 1-37
 map_tile_theme element, 3-45
 mapbuilder.jar file, 7-1
 mapdefinition.sql file, 2-93
 map-level mouse-click event control functions, B-3
 mappers (renderers), 2-83
 number of, 1-39, 5-3
 mapping profile, 2-2
 maps, 1-49, 2-77
 creating by adding themes and rendering, 2-77
 explanation of, 2-77
 how they are generated, 2-86
 listing, 5-15
 metadata view, 2-93
 scale, 2-78
 size, 2-78
 MapViewer configuration file
 editing, 5-21
 sample, 1-21
 MapViewer Editor
 about, 8-1
 main window, 8-2
 MapViewer exception DTD, 3-56
 MapViewer information request DTD, 3-54
 MapViewer map data server, 3-59
 MapViewer map server, 3-1
 MapViewer map tile server, 3-69
 MapViewer server
 restarting, 5-22
 MapViewer servers, 3-1
 mapViewerConfig.xml configuration file
 editing, 5-21
 sample, 1-21
 marker style, 2-2
 adding to map request, 4-9
 orienting, 2-8
 using on lines, A-5
 XML format for defining, A-2
 marquee zoom, 8-17
 masks
 bitmap (GeoRaster themes), 2-34
 max_scale attribute, 2-78
 MBR
 getting for map, 4-13
 MDS (Map Data Server), 1-40
 mds.xml file, 1-40
 merging edits, 8-10
 metadata cache, 2-84
 clearing, 5-20
 metadata views, 2-93
 mapdefinition.sql file, 2-93
 Microsoft Bing Maps
 built-in map tile layers, 6-14
 transforming data to the Microsoft Bing Maps coordinate system, 6-15
 middle-tier cluster
 deploying MapViewer on, 1-49
 min_dist attribute, 3-52
 min_scale attribute, 2-78
 minimum bounding rectangle (MBR)
 getting for map, 4-13
 minimum_pixels attribute, 3-53
 mixed theme scale mode, 3-11
 mode attribute, 3-52
 mouse click
 event control functions for SVG maps, B-2
 getting point associated with, 4-14
 mouse-click event control function, 3-53, B-4
 mouse-move event control function, 3-53, B-4
 mouse-out event control function, 3-53, B-4
 mouse-over event control function, 3-53, B-4
 moveThemeDown method, 4-10
 moveThemeUp method, 4-10
 Multi data source, 1-45
 MVTHEMES parameter (WMS), E-5

N

navbar attribute, 3-30
 navigation bar (SVG map), 3-30, 4-5
 navigation panel, 8-17
 network analysis
 shortest-path, 2-40, 4-7
 within-cost, 2-41, 4-7
 network connection information
 for adding a data source, 5-2
 network themes, 2-37
 adding, 4-7
 defining with jdbc_network_query element, 3-40
 setting labels, 4-11
 theme_type attribute in styling rules, A-18
 networked drives
 using MapViewer with, 1-49
 new features, xxi
 non_map_request element, 5-1
 non_map_response element, 5-1
 non-map requests
 See administrative requests
 nonspatial attributes
 identifying, 4-14
 querying, 4-13
 nonspatial data provider, 2-73
 nonspatial data providers
 registering, 1-34
 north_arrow element, 3-46
 note
 specifying for map, 1-30
 ns_data_provider element, 1-34
 number_of_mappers attribute, 1-39, 2-83, 5-3

O

OGC (Open GIS Consortium)
 Geometry DTD, 3-56
 WMS support by MapViewer, E-1
 WMTS support by MapViewer, F-1
oms_error element, 3-56
omserver (in URL)
 getting a sample image of a style, 2-9
onclick attribute, 3-37, 3-53
 map request, 3-30
onClick function (SVG map), 4-5, 4-11
onmousemove attribute, 3-53
 map request, 3-30
onmouseout attribute, 3-53
onmouseover attribute, 3-53
onpolyselect attribute, B-5
 map request, 3-31
onrectselect attribute, B-5
 map request, 3-31
Open GIS Consortium
 Geometry DTD, 3-56
 WMS support by MapViewer, E-1
 WMTS support by MapViewer, F-1
operation element, 3-46
operations element, 3-47
Oracle Map Builder tool, 7-1
Oracle Maps, 2-97, 6-1
 feature of interest server, 6-1
 JavaScript API, 6-4
 map tile server, 3-69
Oracle Real Application Clusters (RAC)
 using MapViewer with, 1-42
orientation vector, 3-36
 using with an oriented point, 2-7
oriented points
 pointing label or marker in direction of orientation
 vector, 2-7
out-of-bounds color (tile), 3-75
overlapping text style, 2-10

P

pan method, 4-12
parameter element, 3-47
parameters
 binding, 2-15
part_of_basemap attribute, 3-52
PDF image format support, 3-29
pickling
 fast_unpickle theme attribute, 3-51
 setThemeFastUnpickle method, 4-11
pie chart
 map request using, 3-9
PL/SQL example program using MapViewer, 3-20
plsql_package attribute, 1-39
PNG image format support, 3-29
PNG8 (indexed) image format support, 3-29
point features
 adding, 4-7
 removing, 4-8

polygon mask
 setting for GeoRaster theme, 2-28, 4-10
polygon selection
 enabling and disabling, B-2
polygon_mask attribute, 2-28
predefined mouse-click event control functions, B-2
predefined themes, 2-12, 3-50
 adding, 4-7
 binding parameters example, 3-12
 caching of, 2-17
 LAYERS parameter (WMS), E-4
 listing, 5-16
 listing styles used by, 5-18
 WMS map, E-13
preferences, 8-12
prerequisite software for using MapViewer, 1-4
preserve_aspect_ratio attribute, 3-32, 3-34
primary labels
 linear features, 2-21
problems, 8-12
progress indicator
 loading of map, B-2
projection of geodetic data to local non-geodetic
 coordinate system, 1-31
properties, 8-12
proxy (web) for MapViewer service
 setting, 4-6

Q

query type
 for WMS requests, E-10
query window
 setting, 4-4
QUERY_LAYERS parameter (WMS), E-10
QUERY_TYPE parameter (WMS), E-10

R

RAC (Oracle Real Application Clusters)
 using MapViewer with, 1-42
radius
 for WMS requests, E-10
RADIUS parameter (WMS), E-10
rasterbasemap attribute, 3-30
ratio scale mode
 example, 3-11
Real Application Clusters (Oracle RAC)
 using MapViewer with, 1-42
recenter function, B-1
rectangle selection
 enabling and disabling, B-3
 redefine_data_source element, 5-4
redlining, 6-4
remove_cache_instance element, 5-14
remove_data_source element, 5-4
removeAllDynamicStyles method, 4-10
removeAllLinearFeatures method, 4-8
removeAllPointFeatures method, 4-8
renderer

creating and registering custom image renderer, C-1
 custom_image_renderer element, 1-33
 renderers (mappers), 2-83
 number_of_mappers attribute, 1-39, 5-3
 rendering a map, 2-77
 secure map rendering, 1-49
 rendering rules
 example, 3-13
 rendering styles
 with scale ranges, 2-17
 reprojection
 with GeoRaster themes, 2-35
 REQUEST parameter (WMS)
 GetMap or GetCapabilities, E-5
 required software for using MapViewer, 1-4
 resolution
 setThemeUnitAndResolution method, 4-11
 Resolve Conflicts dialog box, 8-11
 response string for map
 getting, 4-13
 restart element, 5-22
 restart_cache_server element, 5-14
 restarting the MapViewer server, 5-22
 restrictions, 8-12
 rotation attribute, 3-31
 rules
 styling, 2-12
 run method, 4-12

S

sample image
 getting for a style, 2-9
 save_images_at element, 1-28
 saving edits, 8-10
 scalable styles, 2-3
 scale bar, 3-48, 8-18
 scale mode
 mixed theme example, 3-11
 ratio example, 3-11
 scale of map, 2-78
 setting for theme, 4-11
 scale ranges
 with rendering styles, 2-17
 scale_bar element, 3-48
 scaling
 of image, 3-28
 SDO_Geometry 2D data support, 8-2
 secondary labels
 linear features, 2-21
 secure, 1-49
 secure map rendering, 1-49
 plsql_package attribute, 1-39
 web_user_type attribute, 1-39
 secure rendering, 1-49
 security
 security_config element, 1-32
 security_config element, 1-32
 selectable themes (SVG map), 4-11
 selectable_in_svg attribute, 3-36, 3-52
 selectFeature function, B-3
 selection event mouse-click event control functions, B-5
 sendXMLRequest method, 4-12
 seq attribute, 2-69
 SERVICE parameter (WMS), E-5
 setAllThemesEnabled method, 4-10
 setAntiAliasing method, 4-4
 setBackgroundColor method, 4-4
 setBackgroundImageURL method, 4-4
 setBaseMapName method, 4-4
 setBoundingThemes method, 4-4
 setBox method, 4-4
 setCenter method, 4-4
 setCenterAndSize method, 4-4
 setClickable method, 4-16
 setDataSourceName method, 4-4
 setDefaultStyleForCenter method, 4-4
 setDeviceSize method, 4-4
 setFullExtent method, 4-4
 setGeoRasterThemePolygonMask method, 4-10
 setImageFormat method, 4-5
 setImageScaling method, 4-5
 setLabelAlwaysOn method, 4-11
 setMapLegend method, 4-5
 setMapRequestSRID method, 4-5
 setMapResultFileName method, 4-5
 setMapTitle method, 4-5
 setNetworkThemeLabels method, 4-11
 setSelectPolygon function, B-3
 setSelectRectangle function, B-3
 setServiceURL method, 4-5
 setShowSVGNNavBar method, 4-5
 setSize method, 4-5
 setSVGOnClick method, 4-5
 setSVGShowInfo method, 4-6
 setSVGZoomFactor method, 4-6
 setSVGZoomLevels method, 4-6
 setSVGZoomRatio method, 4-6
 setThemeAlpha method, 4-11
 setThemeEnabled method, 4-11
 setThemeFastUnpickle method, 4-11
 setThemeOnClickInSVG method, 4-11
 setThemeScale method, 4-11
 setThemeSelectableInSVG method, 4-11
 setThemeUnitAndResolution method, 4-11
 setThemeVisible method, 4-11
 setWebProxy method, 4-6
 setZoomRatio function, B-1
 shortcut keys
 for Map Builder tool menus, 7-3
 shortest-path analysis, 2-40
 addShortestPath method, 4-7
 showLoadingBar function, B-2
 showTheme function, B-2
 simplify_shapes attribute, 3-52
 size (map)
 setting, 4-5
 size of map, 2-78

size_hint attribute, 3-32
snap_to_cache_scale attribute, 3-31
spatial data cache
 clearing, 5-20
 customizing, 1-32
spatial data provider
 custom, 1-34
spatial filter
 getting, 4-14
spatial reference ID
 See SRID
spatial_data_cache element, 1-32
spot light radius (heat map), A-16
SRID
 conversion by MapViewer for map request, 3-8
 setting, 4-5
srid
 attribute of map request, 3-28
SRS mapping
 customizing, 1-35
SRS parameter (WMS), E-5
srs_mapping element, 1-35
stacked styles
 example, 3-14
sticky attribute for text style, 2-8
style element, 3-49
styles, 2-2
 adding to map request, 4-8
 advanced, 2-2
 pie chart example, 3-9
 thematic mapping and, 2-67
 XML format for defining, A-9
 allowing text style overlapping, 2-10
area, 2-2
 XML format for defining, A-7
bar chart
 XML format for defining, A-13
bucket
 adding to map request, 4-8
 specifying labels for buckets, 2-5
 XML format for defining, A-9
collection
 XML format for defining, A-14
color, 2-2
 adding to map request, 4-8
 XML format for defining, A-2
color scheme
 adding to map request, 4-8
 XML format for defining, A-11
dot density
 XML format for defining, A-12
dynamically defined, 2-3, 3-49
 adding to map request, 4-8
getting sample image, 2-9
getting style definition, 5-19
heat map
 XML format for defining, A-15
image marker
 adding to map request, 4-9
 XML format for defining, A-4
label styles for buckets, 2-5
line, 2-2
 adding to map request, 4-9
 XML format for defining, A-6
listing, 5-17
listing those used by a predefined theme, 5-18
marker, 2-2
 adding to map request, 4-9
 XML format for defining, A-2
metadata view, 2-93
removing, 4-10
scaling size of, 2-3
stacked
 example, 3-14
text, 2-2
 adding to map request, 4-9
 XML format for defining, A-8
TrueType font-based marker
 XML format for defining, A-4
variable marker
 adding to map request, 4-9
 XML format for defining, A-12
vector marker
 adding to map request, 4-9
 XML format for defining, A-3
 XML format, A-1
styles element, 3-50
STYLES parameter (WMS), E-5
styling rules, 2-12, A-1
 XML format for specifying, A-17
SVG Basic (SVGB) image format support, 3-29
SVG Compressed (SVGZ) image format
 support, 3-29
SVG maps
 display control functions, B-2
 fixed_svglabel attribute, 3-52
 hidden themes, 4-11
 hidden_info attribute, 3-37
 infoon attribute, 3-30
 initscale attribute, 3-30
 JavaScript functions, B-1
 mouse-click event control functions, B-2
 navbar attribute, 3-30
 navigation bar, 4-5
 navigation control functions, B-1
 onclick attribute, 3-30, 3-37, 3-53
 onClick function, 4-5, 4-11
 onmousemove attribute, 3-30, 3-53
 onmouseout attribute, 3-53
 onmouseover attribute, 3-53
 onpolyselect attribute, 3-31, B-5
 onrectselect attribute, 3-31, B-5
 other control functions, B-5
 part_of_basemap attribute, 3-52
 rasterbasemap attribute, 3-30
 selectable themes, 4-11
 selectable_in_svg attribute, 3-36, 3-52
 setSVGShowInfo method, 4-6
 setSVGZoomFactor method, 4-6
 setSVGZoomLevels method, 4-6

setSVGZoomRatio method, 4-6
setThemeOnClickInSVG method, 4-11
setThemeSelectableInSVG method, 4-11
setThemeVisible method, 4-11
SVG_STREAM and SVG_URL format attribute values, 3-29
SVGTINY_STREAM and SVGTINY_URL format attribute values, 3-29
SVGZ_STREAM and SVGZ_URL format attribute values, 3-29
visible themes, 4-11
visible_in_svg attribute, 3-52
zoomfactor attribute, 3-30
zoomlevels attribute, 3-30
zoomratio attribute, 3-30
SVG Tiny (SVGT) image format support, 3-29
switchInfoStatus function, B-2
switchLegendStatus function, B-2

T

take_cache_offline element, 5-15
templated themes, 2-15
temporary styles
 See dynamically defined styles
text style, 2-2
 adding to map request, 4-9
 orienting, 2-7
 sticky attribute, 2-8
 XML format for defining, A-8
thematic mapping, 2-67
 using external attribute data, 2-73
theme element, 3-50
theme_modifiers element, 3-54
theme_type attribute
 for certain types of predefined themes, A-18
theme-level mouse-event control functions, B-4
themes, 2-11
 adding to a map, 2-77
 annotation text, 2-60
 attributes affecting appearance, 2-76
 checking for, 4-10
 clearing spatial data cache, 5-20
 deleting, 4-10
 disabling, 4-10, 4-11
 dynamic
 adding to map request, 4-6
 dynamically defined, 2-22, 3-40, 3-50
 enabling, 4-10, 4-11
 fast unpickling, 3-51, 4-11
 feature selection
 enabling and disabling, B-2
 fixed SVG label, 3-52
 for WMS requests, E-5
GeoRaster, 2-27
 adding to current map request, 4-6
 defining with jdbc_georaster_query element, 3-38
 setting polygon mask, 2-28, 4-10
 theme_type attribute in styling rules, A-18

getting, 4-10
hidden information display, 3-30
image, 2-25
 adding, 4-6
 defining with jdbc_image_query element, 3-38
 setting transparency value, 4-11
 setting unit and resolution values, 4-11
 theme_type attribute in styling rules, A-18
initial scale, 3-30
JavaScript function to call on click, 3-37, 3-53
JavaScript function to call on mouse-move event, 3-53
JavaScript function to call on mouse-out event, 3-53
JavaScript function to call on mouse-over event, 3-53
JavaScript function to call on polygon selection, B-5
JavaScript function to call on rectangle selection, B-5
JDBC, 2-22
keeping in order, 3-31
listing, 4-10, 5-16
LRS (Linear Referencing System), 2-64
map_tile_theme element, 3-45
metadata view, 2-93
minimum distance, 3-52
moving down, 4-10
moving up, 4-10
navigation bar, 3-30
network, 2-37
 adding, 4-7
 defining with jdbc_network_query element, 3-40
 setting labels, 4-11
 theme_type attribute in styling rules, A-18
north_arrow element, 3-46
part of base map, 3-52
predefined, 2-12, 3-50
raster base map, 3-30
resolution value
 setting, 4-11
selectable in SVG maps, 3-36, 3-52, 4-11
setting GeoRaster theme polygon mask, 2-28, 4-10
setting labels always on, 3-51, 4-11
setting network theme labels, 4-11
setting scale values, 4-11
setting visible or hidden, 4-11
styling rules, A-17
templated, 2-15
topology, 2-41
 adding, 4-7
 debug mode, 2-43
 debug mode (adding theme), 4-7
 defining with jdbc_topology_query element, 3-42
 theme_type attribute in styling rules, A-18
unit value
 setting, 4-11

virtual mosaic, 2-35
 visibility in SVG maps, 3-52
 WFS, 2-44
 WMS map
 adding, E-11
 adding (JavaBean-based API), E-15
 adding (XML API), E-11
 authentication with, E-14
 WMTS, 2-48
 Workspace Manager support, 2-90
 XML format, A-1
 zoom factor, 3-30
 zoom levels, 3-30
 zoom ratio, 3-30
 themes element, 3-53
 thick clients
 using optimal MapViewer bean methods
 for, 4-15
 tile background color, 3-75
 tile layer cache server
 restarting, 5-14
 tile layer instance
 bringing online, 5-15
 taking offline, 5-15
 tile layers
 getting cache status, 5-8
 getting client configuration, 5-7
 managing, 5-7
 tile out-of-bounds color, 3-75
 tile server (MapViewer), 3-69
 tile_admin_task element, 5-9, 5-11, 5-13
 tiles
 clearing, 5-9
 prefetching, 5-9
 refreshing, 5-9
 tiny SVG images
 SVG Tiny (SVGT) image format support, 3-29
 tips
 specifying using hidden_info attribute, 3-37
 title
 attribute of map request, 3-29
 specifying for map, 1-30
 title_style attribute, 3-29, 3-31
 map request, 3-29
 Tools area, 8-18
 topology themes, 2-41
 adding, 4-7
 debug mode, 2-43
 adding theme, 4-7
 defining with jdbc_topology_query element, 3-42
 theme_type attribute in styling rules, A-18
 transformation tools, 8-23
 translation
 of feature labels, 2-18
 transparency
 setThemeAlpha method, 4-11
 transparency attribute, 3-52
 transparent
 attribute of map request, 3-29
 TRANSPARENT parameter (WMS)

supported for PNG format, E-5
 TrueType font-based marker style
 XML format for defining, A-4

U

unit
 setThemeUnitAndResolution method, 4-11
 unit of measurement
 for WMS requests, E-10
 UNIT parameter (WMS), E-10
 unpickling
 fast_unpickle theme attribute, 3-51
 setThemeFastUnpickle method, 4-11
 use_cached_basemap attribute, 3-31
 use_globular_projection option, 1-32
 user interface (UI) main window, 8-2
 USER_SDO_CACHED_MAPS view, 2-96
 USER_SDO_EDIT_SESSIONS view, 8-4
 USER_SDO_GEOM_METADATA view
 entry for predefined theme based on a view, 2-12
 inserting row into, 2-12
 USER_SDO_MAPS view, 2-93, 2-96
 USER_SDO_STYLES view, 2-93, 2-94
 USER_SDO_THEMES view, 2-93, 2-95
 USER_SDO_TILE_ADMIN_TASKS view, 2-93
 user-defined mouse event control functions, B-3
 theme-level, B-4
 user-defined mouse-click event control functions
 map-level, B-3
 selection event, B-5

V

variable marker style
 adding to map request, 4-9
 XML format for defining, A-12
 vector marker style
 adding to map request, 4-9
 XML format for defining, A-3
 VERSION parameter (WMS), E-6
 vertex tools, 8-19
 views
 key_column styling rule attribute required for
 theme defined on join view, A-19
 metadata, 2-93
 virtual mosaic themes, 2-35
 visible themes
 getThemeVisibleInSVG method, 4-10
 setThemeVisible method, 4-11
 visible_in_svg attribute, 3-52

W

Web Map Service (WMS) protocol, E-1
 adding a WMS map theme, E-11
 setting up for MapViewer, E-1
 See also entries starting with "WMS"
 Web Map Service (WMTS) protocol
 See also entries starting with "WMTS"
 Web Map Tile Service (WMTS) protocol, F-1

web proxy for MapViewer service
 setting, 4-6

web_user_type attribute, 1-39

WFS map requests
 examples, 3-15

WFS themes, 2-44

WGS 84 coordinate system, 2-77

WHERE clause
 getting, 4-14

width
 attribute of map request, 3-28

WIDTH parameter (WMS), E-6

within-cost analysis, 2-41
 addLinksWithinCost method, 4-7

WMS Capabilities responses
 customizing, 1-35

WMS data source
 default for GetMap requests, E-3

WMS map themes
 adding, E-11
 JavaBean-based API, E-15
 XML API, E-11
 authentication with, E-14
 predefined, E-13

wms_config element, 1-35

wms_getmap_request element, E-11

WMSFilter.jar file, E-1

WMTS Capabilities responses
 customizing, 1-36

WMTS themes, 2-48

wmts_config element, 1-36

workflow (typical), 8-4

Workspace Manager
 support in MapViewer, 2-90

workspace_date attribute, 2-90

workspace_date_format attribute, 2-90

workspace_date_nlsparam attribute, 2-90

workspace_date_tswtz attribute, 2-90

workspace_name attribute, 2-90

workspace_savepoint attribute, 2-90

Z

zoom, 8-17

zoom factor, 3-30, 4-6

zoom levels, 3-30, 4-6

zoom ratio, 3-30, 4-6
 setting, B-1

zoomfactor attribute, 3-30

zoomIn method, 4-12

zoomlevels attribute, 3-30

zoomOut method, 4-12

zoomratio attribute, 3-30

X

X parameter (WMS), E-10

X11 DISPLAY variable
 no need to set when using AWT headless mode, 1-4

XML
 API for MapViewer, 3-1
 format for base maps, map tile layers
 XML format, A-1
 format for map tile layers, A-1
 format for styles, A-1
 format for themes, A-1

xmlparserv2.jar file, E-2

Y

Y parameter (WMS), E-10