This document describes the Java EE Management APIs which enable a software
developer to create a single Java program that can discover and browse resources,
such as JDBC connection pools and deployed applications, on any Java EE Web
application server.

1 Introduction and Roadmap

The Java EE Management specification describes a standard data model for
monitoring and managing the run-time state of any Java EE Web application server
and its resources. It includes standard mappings of the model through a Java EE
Management EJB Component (MEJB).

The following sections describe the contents and organization of this
guide—Monitoring and Managing With the Java EE Management APIs for Oracle WebLogic Server:

- Section 1.1, "Document Scope and Audience"
- Section 1.2, "Guide to This Document"
- Section 1.3, "Related Documentation"

1.1 Document Scope and Audience

This document is a resource for software developers who develop management
services for Java EE applications and for software vendors who develop
JMX-compatible management systems. It also contains information that is useful for
business analysts and system architects who are evaluating WebLogic Server or
considering the use of JMX for a particular application.

The information in this document is relevant during the design and development
phases of a software project. The document does not address production phase
administration, monitoring, or performance tuning topics. For links to WebLogic
Server documentation and resources for these topics, see Section 1.3, "Related
Documentation".

It is assumed that the reader is familiar with Java EE and general application
management concepts. This document emphasizes a hands-on approach to developing
a limited but useful set of JMX management services. For information on applying
JMX to a broader set of management problems, refer to the JMX specification or other
documents listed in Section 1.3, "Related Documentation".
1.2 Guide to This Document

This document is organized as follows:

- This section, Section 1, "Introduction and Roadmap," describes the scope and organization of this guide.
- Section 2, "Using the Java EE Management APIs on WebLogic Server," introduces JMX and describes common ways to use it in conjunction with other WebLogic Server management features.
- Section 3, "WebLogic Server Extensions," describes WebLogic-specific extensions to JSR 77.

1.3 Related Documentation

The Sun Developer Network includes a Web site that provides links to books, white papers, and additional information on JMX:

To view the JMX 1.2 specification and API documentation, download it from

To view the JMX Remote API 1.0 specification and API documentation, download it from

For guidelines on developing other types of management services for WebLogic Server applications, see the following documents:

- Using WebLogic Logging Services for Application Logging describes WebLogic support for internationalization and localization of log messages, and shows you how to use the templates and tools provided with WebLogic Server to create or edit message catalogs that are locale-specific.
- Configuring and Using the WebLogic Diagnostic Framework describes how system administrators can collect application monitoring data that has not been exposed through JMX, logging, or other management facilities.

For guidelines on developing and tuning WebLogic Server applications, see the following documents:

- Developing Applications with WebLogic Server is a guide to developing WebLogic Server applications.
- Developing Manageable Applications with JMX describes how to create and register custom MBeans.

2 Using the Java EE Management APIs on WebLogic Server

The Java EE Management APIs enable a software developer to create a single Java program that can discover and browse resources, such as JDBC connection pools and deployed applications, on any Java EE Web application server. The APIs are part of the Java EE Management Specification, which requires all Java EE Web application servers to describe their resources in a standard data model.
The following sections describe how to use the Java EE Management APIs on WebLogic Server:

- Section 2.1, "Understanding the Java EE Management Model and APIs"
- Section 2.2, "The Java EE Management Model on WebLogic Server"
- Section 2.3, "Accessing the MEJB on WebLogic Server"

2.1 Understanding the Java EE Management Model and APIs

In the Java EE Management data model, each instance of a Web application server resource type is represented by a Java EE Managed Object (JMO). The Java EE Management Specification describes exactly which types of resources must be represented by a JMO. JMOs themselves contain only a limited set of attributes, which are used to describe the location of the object in the data model.


2.1.1 JMO Hierarchy

The data model organizes JMOs hierarchically in a tree structure. The root JMO is J2EEDomain, which represents a collection of Web application server instances that are logically related. J2EEDomain contains the object names for all instances of the J2EEServer JMO, each of which represents a server instance in the collection.

Java applications can browse the hierarchy of JMOs, recursively querying for object names and looking up the JMOs that are named by the query results.

2.1.2 JMO Object Names

Each JMO instance is identified by a unique object name of type javax.management.ObjectName. The names follow this pattern:

domain:name=j2eeType=value,name=value,property=j2eeType[.property=value]*

For example, mydomain:J2EEtype=J2EEDomain,name=mydomain

The Java EE Management Specification describes exactly which name/value pairs must be in the object names for each JMO type.

The object name for each child JMO contains name/value pairs from its parent JMO’s object name. For example, if the JMO for a server instance is named

mydomain:j2eeType=J2EEServer,name=myserver

then the JMO for a servlet that is part of an application deployed on that server instance would be named:

mydomain:J2EEServer=myapplication,J2EEServer=myserver,WebModule=myapp_mywebmodule,j2eeType=Servlet,name=myserver.myapp_mywebmodule_myapp_mywebmodule_Servlet

The name/value pairs can appear in any order.

2.1.3 Optional Features of JMOs

The Java EE Management Specification, version 1.0, requires only that Web application servers implement JMOs and provide API access to the JMOs.
Optionally, you can implement the JMOs to provide performance statistics, management operations, and to emit notifications when specified events occur.

### 2.1.4 Accessing JMOs

A Java application accesses the JMOs through `javax.management.j2ee.Management`, which is the remote interface for the Management Enterprise Java Bean (MEJB).

The Java EE Management Specification requires that the MEJB’s home interface be registered in a server’s JNDI tree as `ejb_mgmt.MEJB`.


### 2.2 The Java EE Management Model on WebLogic Server

WebLogic Server implements only the required features of the Java EE Management Specification, version 1.1. Therefore, the following limitations are in place:

- None of the JMOs provide performance statistics, management operations, or emit notifications.
- There are no mappings to the Common Information Model (CIM).
- There are no mappings to an SNMP Management Information Base (MIB).

The MEJB and JMOs are available only on the Administration Server. This is consistent with the Java EE Management Model, which assumes that most Java EE Web servers exist within some logically connected collection and that there is a central point within the collection for accessing or managing the server instances. From the Administration Server, a Java application can browse to the JMO that represents any resource on any server instance in the WebLogic Server domain.

Because WebLogic Server implements its JMOs as a wrapper for its MBeans, any changes in a WebLogic Server MBean that corresponds to a JMO is immediately available through the Java EE Management APIs.

For all JMO object names on WebLogic Server, the `domain` portion of the object name corresponds to the name of the WebLogic Server domain.

### 2.3 Accessing the MEJB on WebLogic Server

To retrieve monitoring data through the MEJB:

1. Look up the `javax.management.j2ee.ManagementHome` interface through the Administration Servers JNDI tree under the name `ejb_mgmt.MEJB`.
2. Use `ManagementHome` to construct an instance of `javax.management.j2ee.Management`, which is the MEJB’s remote interface.

#### 2.3.1 Example: Querying Names of JMOs

The example class in Example 1 accesses the MEJB for a WebLogic Server domain and invokes `javax.management.j2ee.Management.queryNames` method. This method returns the object name for all JMOs in the domain.

```java
import java.io.IOException;
```
import java.net.MalformedURLException;
import java.util.Iterator;
import java.util.Set;
import java.util.Properties;
import javax.management.j2ee.Management;
import javax.management.j2ee.ManagementHome;
import javax.management.AttributeNotFoundException;
import javax.management.InstanceNotFoundException;
import javax.management.ObjectName;
import javax.management.QueryExp;
import javax.naming.Context;
import javax.naming.InitialContext;
import javax.naming.NamingException;
import javax.ejb.CreateException;

public class GetJMONames {
    static String url = "t3://localhost:7001";
    static String user = "weblogic";
    static String password = "weblogic";
    public static void main(String[] args) {
        try {
            getAllJMONames();
        } catch (Exception e) {
            System.out.println(e);
        }
    }

    public static Management getMEJBRemote() throws IOException, MalformedURLException, NamingException, CreateException {
        Context context = getInitialContext();
        ManagementHome home = (ManagementHome) context.lookup("ejb.mgmt.MEJB");
        Management bean = home.create();
        return bean;
    }

    public static Context getInitialContext() throws NamingException {
        Properties p = new Properties();
        p.put(Context.INITIAL_CONTEXT_FACTORY, "weblogic.jndi.WLInitialContextFactory");
        p.put(Context.PROVIDER_URL, url);
        if (user != null) {
            p.put(Context.SECURITY_PRINCIPAL, user);
            if (password == null) { "password = " +
                p.put(Context.SECURITY_CREDENTIALS, password);
            }
        }
        return new InitialContext(p);
    }

    public static void getAllJMONames() {
        try {
            Management rhome = getMEJBRemote();
            String string = "";
            ObjectName name = new ObjectName(string);
            QueryExp query = null;
            Set allNames = rhome.queryNames(name, query);
            Iterator nameIterator = allNames.iterator();
        }
    }
}
while(nameIterator.hasNext()) {
    ObjectName on = (ObjectName)nameIterator.next();
    System.out.println(on.getCanonicalName() + "\n");
} 
} catch (Exception ex) {
    ex.printStackTrace();
}

3 WebLogic Server Extensions

WebLogic Server implements an extension to JSR 77 that gives you access to WebLogic-specific deployment descriptors using the MEJB, just like the standard J2EE deployment descriptors. The productSpecificDeploymentDescriptor attribute returns the XML contents of the WebLogic-specific descriptor file. Example 2 illustrates calling the method.

Example 2  productSpecificDeploymentDescriptor

// Get the WLS specific deployment descriptor.
// This is similar to the call for the standard descriptor
// (i.e., the "deploymentDescriptor" attribute)
//
// dd = (String) managementBean.getAttribute(objName,
//    "productSpecificDeploymentDescriptor");

// It returns a string containing the contents of the WLS specific deployment
// descriptor. This is the XML file contents as a string.

4 Conventions

The following text conventions are used in this document:

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

5 Documentation Accessibility

Our goal is to make Oracle products, services, and supporting documentation accessible to all users, including users that are disabled. To that end, our documentation includes features that make information available to users of assistive technology. This documentation is available in HTML format, and contains markup to facilitate access by the disabled community. Accessibility standards will continue to evolve over time, and Oracle is actively engaged with other market-leading technology vendors to address technical obstacles so that our documentation can be accessible to all of our customers. For more information, visit the Oracle Accessibility Program Web site at http://www.oracle.com/accessibility/.
Accessibility of Code Examples in Documentation
Screen readers may not always correctly read the code examples in this document. The conventions for writing code require that closing braces should appear on an otherwise empty line; however, some screen readers may not always read a line of text that consists solely of a bracket or brace.

Accessibility of Links to External Web Sites in Documentation
This documentation may contain links to Web sites of other companies or organizations that Oracle does not own or control. Oracle neither evaluates nor makes any representations regarding the accessibility of these Web sites.

Access to Oracle Support
Oracle customers have access to electronic support through My Oracle Support. For information, visit http://www.oracle.com/support/contact.html or visit http://www.oracle.com/accessibility/support.html if you are hearing impaired.