
JMX: Managing J2EE with Java Management Extensions

Juha Lindfors, Marc Fleury, and The JBoss Group, LLC



201 West 103rd St., Indianapolis Indiana, 46290 USA

Contents

Introduction	1
What is JMX?	1
Why JMX for J2EE?	1
Part I: Java Management Extensions Specification	1
Part II: JMX in the J2EE Platform	2
 Part I Java Management Extensions Specification	
1 Getting Started	7
MBean Component Types	8
Writing Your First MBean	9
Management Interface Declaration	10
Implementing the MBean	12
Deploying the HelloMBean	13
Deployment with Sun JMX Reference Implementation	16
Deployment with Tivoli JMX Implementation	19
Summary	23
2 Architecture	25
History	27
Overview	28
Instrumentation Level	29
Agent Level	30
Invocation Mechanism	32
Distributed Services Level	33
Summary	33
3 Standard MBeans	35
MBean Definition	36
Implementing Standard MBeans	37
Standard MBean Attributes	37
Management Operations	39
Exceptions in the Management Interface	39
Standard MBean Example	40
Inheritance Patterns	50
MBean Notification Mechanism	53
Notification	54
NotificationBroadcaster and NotificationFilter	55
NotificationListener	60
Attribute Change Notifications	65
Summary	70

4 Dynamic MBeans	71
DynamicMBean Interface	72
GetAttribute and GetAttributes	73
SetAttribute and SetAttributes	75
MBean Metadata Classes	79
MBeanInfo	80
MBeanFeatureInfo	81
MBeanAttributeInfo	81
MBeanParameterInfo	83
MBeanOperationInfo	83
MBeanConstructorInfo	84
MBeanNotificationInfo	85
Attribute and AttributeList	86
Inheritance Patterns	87
DynamicUser Example	87
Hot Deploying Resources	98
Summary	103
5 Model MBeans	105
ModelMBean Interface	106
Descriptors	107
Notification Logging Policy	109
Persistence Policy	109
Value Caching Policy	110
Export Policy	110
Model MBean Metadata	111
ModelMBeanInfo	112
ModelMBeanAttributeInfo	117
ModelMBeanOperationInfo	120
ModelMBeanNotificationInfo	122
ModelMBeanConstructorInfo	124
Attribute Caching	125
Model MBean Example	129
Summary	134
6 MBean Server	135
Invocation Mechanism	136
ObjectName Class.....	138
MBeanServerFactory Class	139
MBeanServer Interface	140
invoke()	140
createMBean	141
addNotificationListener and removeNotificationListener	143

getAttribute and setAttribute	144
registerMBean and unregisterMBean	144
queryMBeans and queryNames	145
Other MBeanServer Methods	145
MBeanRegistration Interface	146
preRegister and postRegister	146
preDeregister and postDeregister	148
MBeanServerDelegate	148
Queries	149
Scope of Queries	150
Building Queries	150
Summary	155
7 Standard Agent Services	157
M-Let Service	159
MLetMBean	159
MLET Tag	160
Hot Deployment Revisited	162
Timer Service	170
Timer MBean	171
Monitoring Service	177
Monitor	178
MonitorNotification	179
Counter Monitor	179
Gauge Monitor	181
StringMonitor	188
Relation Service	189
Relation Service Metadata	189
Relation Service MBean	191
RelationNotification	192
Role and RoleList	192
Relation Example	192
Summary	197
Part II JMX in the J2EE Platform	
8 XMBean: Model MBean Implementation	201
ModelMBean Interface Implementation	202
MBeanRegistration Interface	208
DynamicMBean Interface	210
invoke	210
getAttribute and getAttributes	213
setAttribute and setAttributes	216

Persistence	221
ModelMBeanNotificationBroadcaster Implementation	223
Metadata Generation	233
XML Document Instances and DTD	233
Parsing the XML Document	236
Summary	247
9 Connectors and Protocol Adaptors	249
RMI Connector	250
RMI Connector Client	251
RMI Connector Server	261
MethodInvocation	264
Connector Example	271
SNMP Adaptor	273
A Comparison Between SNMP and JMX	274
Overview of Sun and AdventNet Adaptors	275
Creating an SNMP Adaptor	276
Summary	286
10 JMX Distribution Layer with J2EE Services	287
Location Transparency	288
MBean Handle	289
Export Manager	292
SOAP Connector	297
SOAP Example	304
Asynchronous JMS Connector	310
Design of the JMS Connector	311
Asynchronous MBeanServer Interface	312
Callback	314
ConnectorFactory	315
JMSConnector	324
JMS Connector Example	328
Summary	332
11 JMX for the Administrator	333
Management of Server Farms	334
Federation of Servers	334
Logical Views	336
JSR-77—J2EE Management	336
Management Model	339
Event Model	339
State Management Model	340
Performance Monitoring Model	340
Management EJB Component (MEJB)	340
J2EE Management SNMP	341
Summary	342

12 JMX Use Case: The JBoss Server	343
Microkernel Architecture	344
Adapt to Changing System Requirements	345
Minimal Core	345
Extended Functionality and Customer-Specific Parts	346
Collaboration Between Components	346
The Server Spine	346
Configuration Service	348
Remote Management	353
Extending the JBoss Server	353
Integration and Development Process	359
Summary	360
 Part III Appendixes	
A Environment Setup	363
Java SDK Installation	364
Sun JMX Reference Implementation Installation	364
IBM Tivoli JMX Implementation	365
Example Source Code	365
JBoss Setup	366
SOAP Configuration	368
JDOM Configuration	369
SNMP Configuration	369
B Open MBeans	371
Overview of Open MBeans	372
Predefined Data Types	372
Summary	373
C References and Resources	375
D JBossMX	379
Project Goals	380
Agent Level	381
Instrumentation Level	381
Distributed Services Level	381
Summary	381
Index	383