

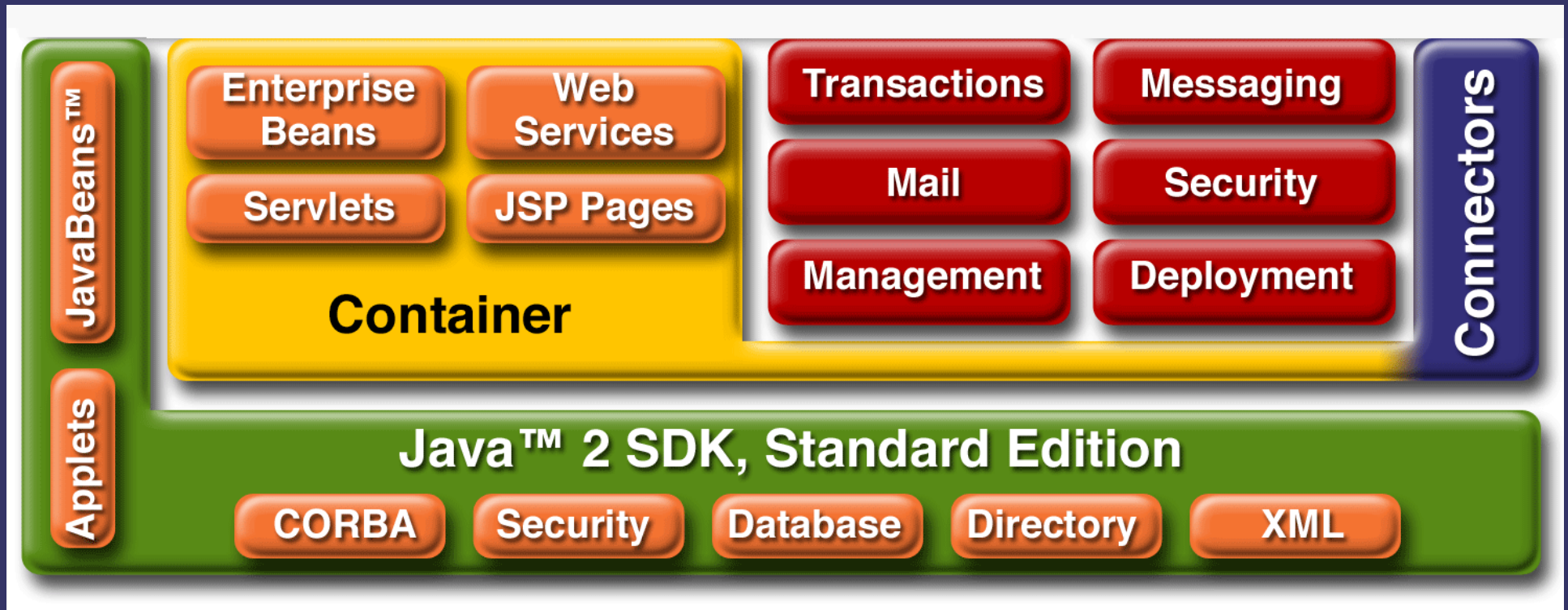
Daemon Infrastructure: *An Overview of Technical Design*

Andrey Petrov

Functions of a Daemon Server

- Dynamic deployment of daemons as plain Java objects
- Lifecycle management
 - Automatic and manual
- Configuration management
 - During startup and at runtime
- Monitoring, restarting, providing notifications
- Logging
- *DAQ-specific functions (not discussed today)*

J2EE Application Server



Examples of J2EE Services

- Servlet container
- Enterprise Java Beans container
- Transactions
- Mail
- Messaging
- Security
- Object Persistence
- Deployment

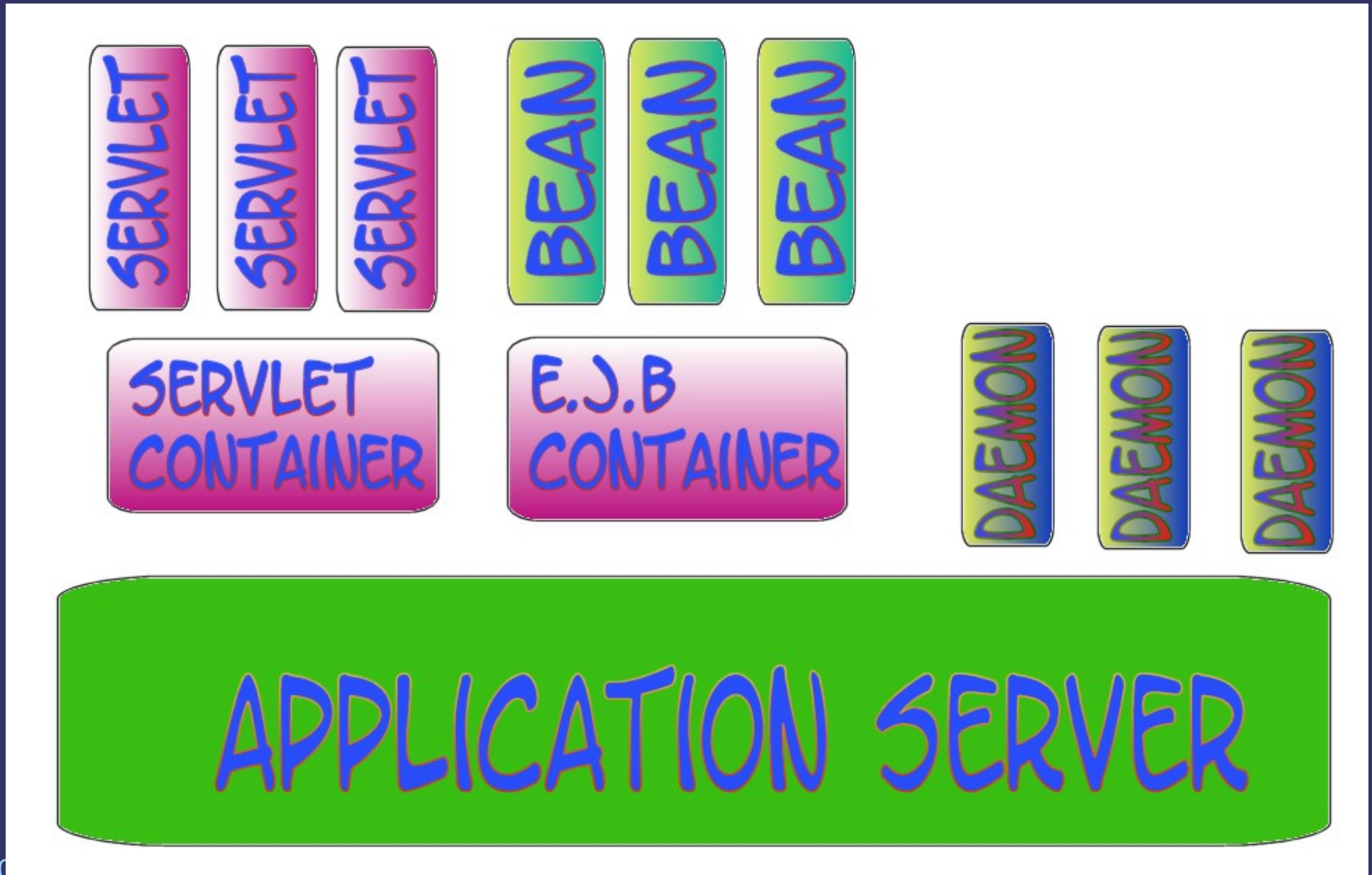
Standard J2EE Containers

- Servlet Container (Tomcat, Jetty):
 - Implements different kind of lifecycle
 - Servlets can't be used standalone
- Enterprise Java Beans (EJB) Container:
 - The concept of EJB is complex, not well suited for daemons
 - EJB can't create internal threads (?)
- Both:
 - Rudimentary configuration management

Application Server Organization

- Sun specifies which services must be implemented by a compliant server, provides abstract API.
- Many J2EE implementers choose modular design, in which individual services can be deployed, undeployed, and reconfigured, according to the users' needs.
- **Services resemble daemons.**

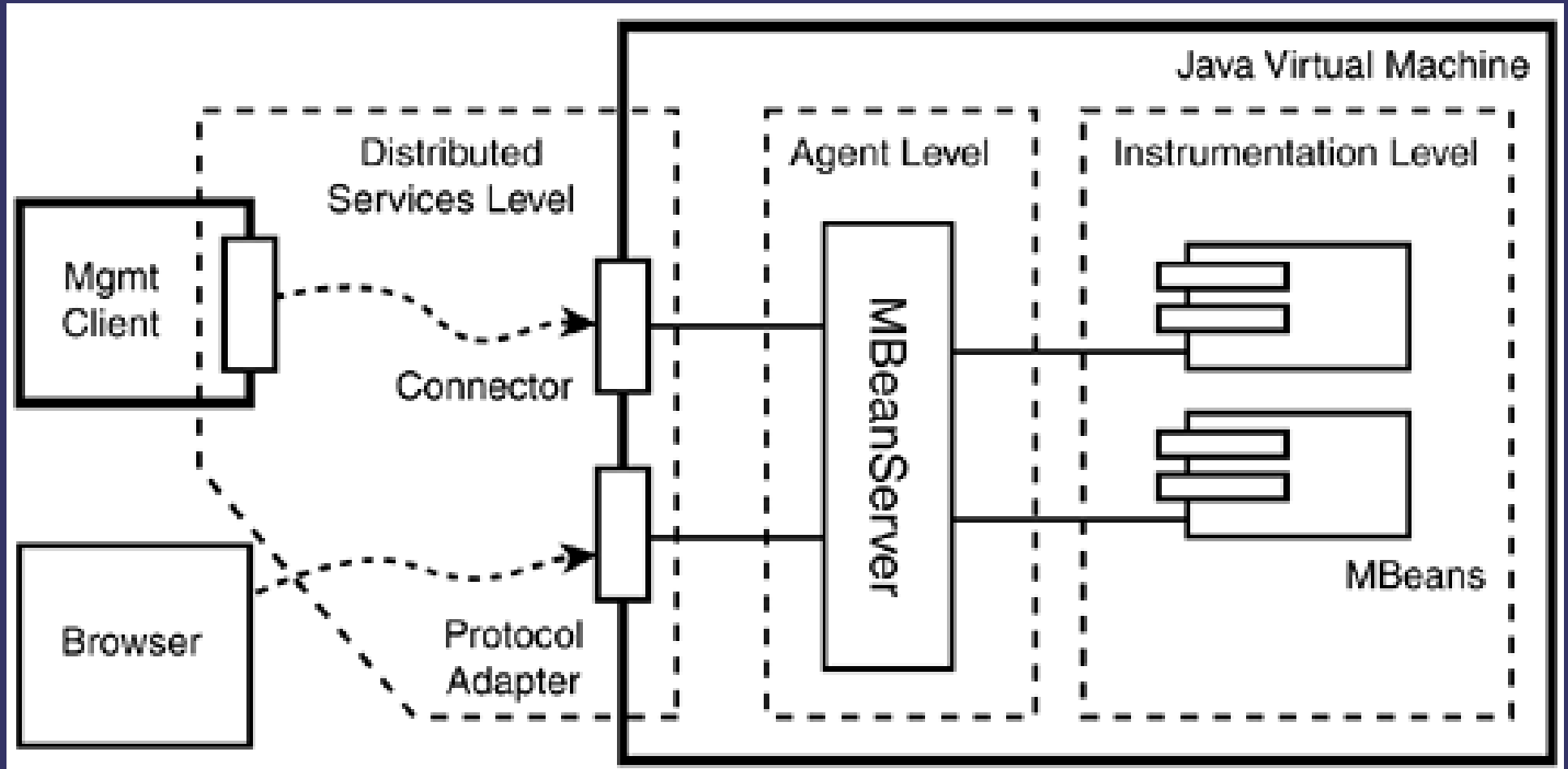
Standard Services vs. Daemons



Service Mgmt. Frameworks

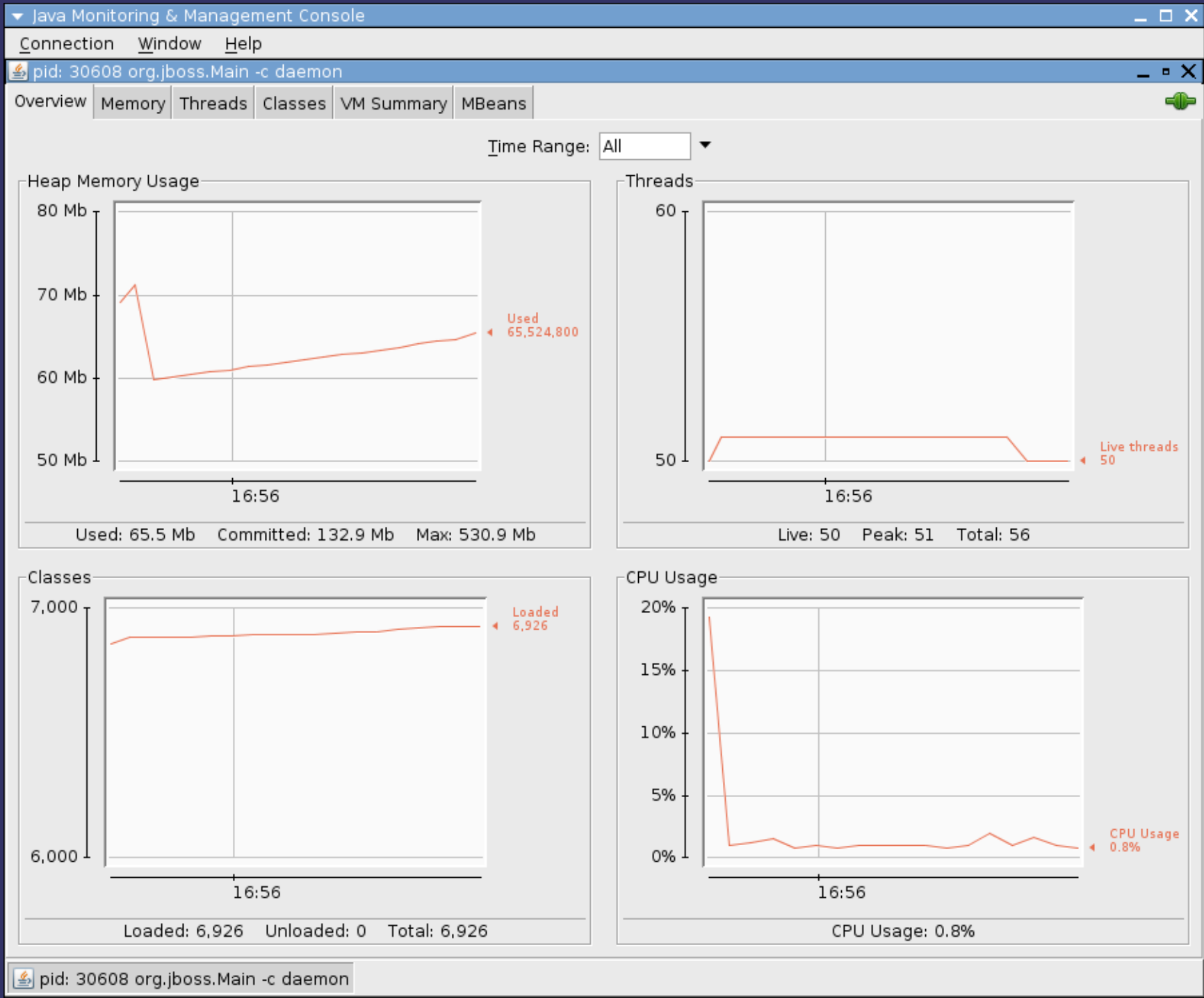
- Java Management Extension (JMX)
 - Developed by Sun; JMX API is part of Java SE
 - Used by Java VM for internal diagnostics
 - Used in Red Hat **JBoss** AS
- Open Service Gateway Initiative (OSGi)
 - Used in Eclipse IDE, Apache **Geronimo** AS, IBM **WebSphere** AS (?)
- GBeans
 - Used in OpenWeb **JOOnAS**
 - Superseded by JMX (?)

Java Management Extension (JMX)



Functions of JMX

- Registers user's objects (called *MBeans*)
 - Defines 4 standard types of MBeans
- Acquires an object's description, including its management interface
- Allows clients—local and remote—to address objects by name and call their management interfaces
- [Not part of the framework] General-purpose management clients are readily available; examples will follow...



Java Monitoring & Management Console

Connection Window Help

pid: 30608 org.jboss.Main -c daemon

Overview Memory Threads Classes VM Summary MBeans

VM Summary

Friday, March 28, 2008 4:57:07 PM CDT

Connection name: pid: 30608 org.jboss.Main -c daemon	Uptime: 6 minutes
Virtual Machine: Java HotSpot(TM) Server VM version 10.0-b19	Process CPU time: 59.600 seconds
Vendor: Sun Microsystems Inc.	JIT compiler: HotSpot Tiered Compilers
Name: 30608@ctf041pc.fnal.gov	Total compile time: 21.905 seconds

Live threads: 50	Current classes loaded: 6,926
Peak: 51	Total classes loaded: 6,926
Daemon threads: 29	Total classes unloaded: 0
Total threads started: 56	

Current heap size: 64,937 kbytes	Committed memory: 129,792 kbytes
Maximum heap size: 518,464 kbytes	Pending finalization: 0 objects
Garbage collector: Name = 'Copy', Collections = 174, Total time spent = 1.542 seconds	
Garbage collector: Name = 'MarkSweepCompact', Collections = 4, Total time spent = 1.841 seconds	

Operating System: Linux 2.6.22-14-generic	Total physical memory: 1,035,444 kbytes
Architecture: i386	Free physical memory: 26,544 kbytes
Number of processors: 1	Total swap space: 3,028,212 kbytes
Committed virtual memory: 907,552 kbytes	Free swap space: 2,924,640 kbytes

VM arguments: -Dprogram.name=run.sh -Xms128m -Xmx512m -XX:MaxPermSize=256m -Dorg.jboss.resolver.warning=true -Dsun.rmi.dgc.client.gcInterval=3600000 -Dsun.rmi.dgc.server.gcInterval=3600000 -Dsun.lang.ClassLoader.allowArraySyntax=true -Dcom.sun.management.jmxremote -Djava.net.preferIPv4Stack=true -Djava.endorsed.dirs=/usr/local/jboss-5.0.0.Beta4/lib/endorsed

Class path: /usr/local/jboss-5.0.0.Beta4/bin/run.jar:/usr/jdk1.6.0_05/lib/tools.jar

Library path: /usr/jdk1.6.0_05/jre/lib/i386/server:/usr/jdk1.6.0_05/jre/lib/i386:/usr/jdk1.6.0_05/jre/../lib/i386:/usr/java/packages/lib/i386:/lib:/usr/lib

Boot class path: /usr/local/jboss-5.0.0.Beta4/lib/endorsed/jaxb-api.jar:/usr/local/jboss-5.0.0.Beta4/lib/endorsed/xml-apis.jar:/usr/local/jboss-5.0.0.Beta4/lib/endorsed/xercesImpl.jar:/usr/local/jboss-5.0.0.Beta4/lib/endorsed/xalan.jar:/usr/local/jboss-5.0.0.Beta4/lib/endorsed/resolver.jar:/usr/local/jboss-5.0.0.Beta4/lib/endorsed/serializer.jar:/usr/jdk1.6.0_05/jre/lib/resources.jar:/usr/jdk1.6.0_05/jre/lib/rt.jar:/usr/jdk1.6.0_05/jre/lib/sunrsasign.jar:/usr/jdk1.6.0_05/jre/lib/jsse.jar:/usr/jdk1.6.0_05/jre/lib/jce.jar:/usr/jdk1.6.0_05/jre/lib/charsets.jar:/usr/jdk1.6.0_05/jre/classes

pid: 30608 org.jboss.Main -c daemon

Java Monitoring & Management Console

Connection Window Help

pid: 30608 org.jboss.Main -c daemon

Overview Memory Threads Classes VM Summary MBeans

- JMImplementation
 - MBeanServerDelegate
 - Attributes
 - MBeanServerId
 - SpecificationName
 - SpecificationVersion
 - SpecificationVendor
 - ImplementationName
 - ImplementationVersion
 - ImplementationVendor
 - Notifications
 - com.sun.management
 - HotSpotDiagnostic
 - Attributes
 - DiagnosticOptions**
 - Operations
 - java.lang
 - java.util.logging
 - Logging
 - Attributes
 - Operations

Attribute value

Name	Value
DiagnosticOptions	javax.management.openmbean.Composi...

Refresh

MBeanAttributeInfo

Name	Value
Attribute:	
Name	DiagnosticOptions
Description	DiagnosticOptions
Readable	true
Writable	false
Is	false
Type	[Ljava.management.openmbean.CompositeData;

Descriptor

Name	Value
Attribute:	
openType	javax.management.openmbean.ArrayType(name=[Ljava.manage...
originalType	java.util.List<com.sun.management.VMOption>

pid: 30608 org.jboss.Main -c daemon

JBoss JMX Management Console - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://localhost:8080/jmx-console/

@work tele lingvo google wikipedia safari builds appix cvs issues gov jdk localhost


Application Index JBoss JMX Management C...

JMX Agent View

ctl041pc.fnal.gov

ObjectName Filter (e.g. "jboss:*", "*:service=invoker,*"):

Apply Filter Clear Filter



Catalina

- [type=Server](#)
- [type=StringCache](#)

JMImplementation

- [name=Default,service=LoaderRepository](#)
- [type=MBeanRegistry](#)
- [type=MBeanServerDelegate](#)

com.arjuna.ats.properties

- [module=arjuna](#)
- [module=jta](#)
- [module=txoj](#)

fnal

- [service=FooBar](#)

jboss

- [database=localDB,service=Hypersonic](#)
- [id=ROOT.war,service=jacc](#)
- [id=console-mgr.sar,service=jacc](#)
- [id=jmx-console.war,service=jacc](#)
- [id=web-console.war,parent=console-mgr.sar,service=jacc](#)
- [name=PropertyEditorManager,type=Service](#)
- [name=SystemProperties,type=Service](#)
- [service=AttributePersistenceService](#)

Done

MBean Inspector - Mozilla Firefox

File Edit View History Bookmarks Tools Help


http://localhost:8080/jmx-console/HtmlAdaptor?act

@work tele lingvo google wikipedia safari builds appix cvs issues gov jdk localhost

Application Index MBean Inspector

JMX MBean View

fnal:service=FooBar



Name	Domain	fnal
	service	FooBar
Java Class	gov.fnal.controls.daemon.example.FooDaemon	
Description	<i>Something wierd</i>	

[Back to Agent View](#) [Refresh MBean View](#)

Attribute Name (Access) Type Description	Attribute Value
StartTime (R) java.util.Date <i>The time when this server was started</i>	Fri, 28 Mar 2008 16:43:36 -0500
Status (R) gov.fnal.controls.daemon.DaemonStatus <i>Current status of the daemon</i>	RUNNING
Value (RW) java.lang.String <i>bababa</i>	<input type="text" value="0"/>

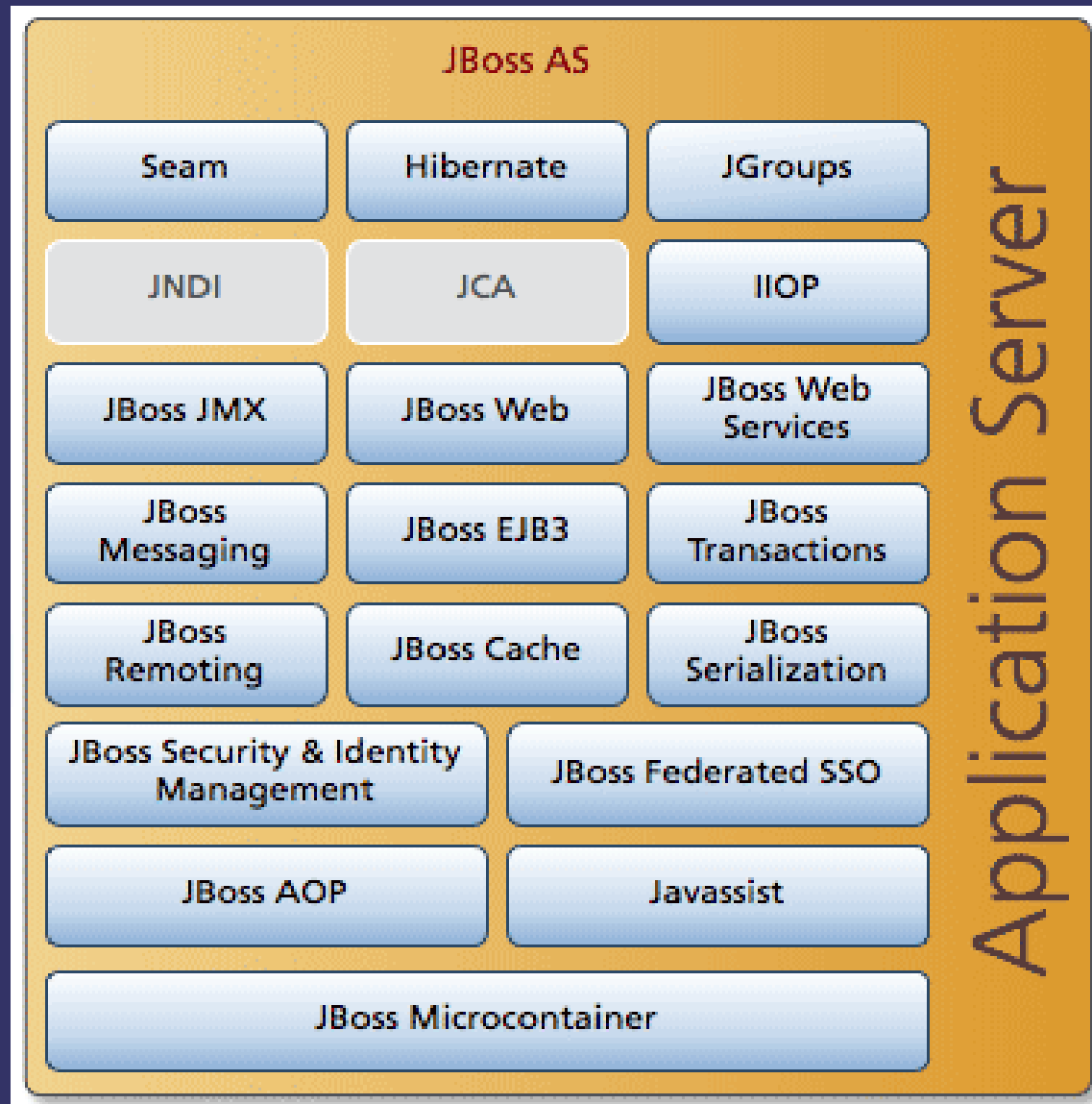
Operation Name Return Type Description	Parameters
print java.lang.String <i>(no description)</i>	x0 java.lang.String <i>(no description)</i> <input type="text"/> x1 <i>Initial Luminocity</i> <input type="text"/> <input type="button" value="Invoke"/>

Done

Not implemented in JMX

- Dynamic deployment of user's objects
- Classpath segregation (and all related business of hierarchical class loading)
- Standard agent services: Timer MBean, Monitoring MBean, etc.

JBoss Application Server



JBoss Microcontainer

- A foundation of JBoss Application Server—loads and manages all its services
- Includes a comprehensive set of deployers (from plain file system, from an archives, from a remote URL (?))
- Implements hierarchical classloading
- Large number of additional services (most of them will have to be disabled)
- Compliant to JMX specification—can load arbitrary Mbeans as a new service

Back to daemons...

My Proposal

- Organize daemons as Dynamic MBeans.
- Develop an AbstractDaemon, which shall be extended by all concrete daemons.
- Use annotations to describe management interface and store daemon's metainformation.
- Not to use any vendor-specific API, only JMX from Java SE.
- Provisionally, use JBoss AS 5 as an MBean server; remove unneeded services.
- Set up custom deployment procedure connected to the building system in place.

Things To Worry About

- MBean unloading: misbehaving or badly designed daemon can make hot undeployment impossible.
- JBoss performance and reliability?
- JBoss 5 doesn't officially support Java 6, however there is a workaround.
- Version transition at JBoss: should stay away of creating code dependencies.