



jPOSTM Project Guide

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Contents

Abstract.....	5
Copyright.....	7
Status.....	9
Part I: The jPOS Project.....	11
Chapter 1: Resources.....	13
Mailing lists.....	14
Blogs and Feeds.....	14
Downloading.....	14
Chapter 2: Build System.....	17
jPOS Directory Structure.....	18
Module Directory Structure.....	18
Ant Targets.....	20
IDE support.....	21
Running jPOS.....	21
Part II: jPOS.....	23
Chapter 3: Q2.....	25
Running Q2 in Standalone mode.....	26
Running Q2 in Embedded mode.....	26
Q2 Command line arguments.....	26
QBean Descriptors.....	27
QBean Life cycle.....	28
QBean Loggeable.....	30
QBean Configurable.....	31
QBean Optional Attributes.....	31
GNU AGPL License.....	33
CREDITS.....	45
Revision History.....	47

Abstract

jPOS is an ISO-8583 library/framework that can be used to implement financial interchanges, protocol converters, payment gateways, credit card verification clients and servers (merchant/issuer/acquirer roles), etc.

jPOS Extended Edition (jPOS-EE) goes one step beyond jPOS by providing a development environment with a continuously growing set of proven, ready-to-deploy components based on jPOS' best practices.

This document describes jPOS, jPOS-EE and related projects managed by jPOS.org.

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jPOS Copyright notice



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Status

Status of this document

This document is work in progress. At some point, it will replace the *jPOS Programmer's Guide* as well as the *jPOS-EE guide*, but there's a long way to go. If you need to use jPOS now, you may consider purchasing the existing documentation, which in addition is part of the program to support jPOS.org projects.

 **Tip:** The latest version of this document can be downloaded at <http://jpos.org/doc/jPOS-Project-Guide.pdf>

 **Note:** This is version 1.3, \$Revision: 5349 \$, \$Date: 2009-11-15 20:08:42 -0200 (Sun, 15 Nov 2009) \$. See [Revision History](#) on page 47 for details.

Part

I

The jPOS Project

Topics:

- [Resources](#)
- [Build System](#)

jPOS.org manages several projects, such as jPOS-EE, jPOS CMF, jCard, jPTS, etc. This part provides general information about all of them.


Chapter 1

Resources

Topics:

- [Mailing lists](#)
- [Blogs and Feeds](#)
- [Downloading](#)

Project related resources


 **Tip:** Up-to-date links to jPOS related resources, including a link to the latest version of this document can be found online at <http://jpos.org/resources>

Mailing lists

At the beginning, we just had one mailing list, **jpos-dev** which has over 1600 members.

At some point we decided to split development related stuff from user related support questions and opened a new mailing list, **jpos-users**, hosted at Google Groups.

Although **jpos-dev** is still available, **jpos-users** has better and faster search capabilities, so we are discouraging the use of **jpos-dev** and moving to a single list: **jpos-users**.

 **Tip:** If you are searching the archives, you probably want to search both of them. If you are posting new comments or questions, we suggest you use the latter.

In addition to **jpos-dev** and **jpos-users**, we have **jpos-commits** where we post commit notifications.

Table 1: Mailing list info

List	Information
jpos-users	http://groups.google.com/group/jpos-users
jpos-commits	http://groups.google.com/group/jpos-commits
jpos-dev	http://www.yahoogroups.com/group/jpos-dev

Blogs and Feeds

We regularly post project related news to the jPOS blog.

In addition, there's some activity in Twitter tagged as **#jPOS**

Table 2: Blogs and Feeds

Feed	URL	RSS
Blog	jpos.org/blog	feeds2.feedburner.com/jpos
Commits	groups.google.com/group/jpos-commits	feeds2.feedburner.com/jpos-commits
Tweets	search.twitter.com/search?q=jpos	search.twitter.com/search.atom?q=jpos
Commit Tweets	twitter.com/jposcommits	twitter.com/statuses/user_timeline/69335521.rss

Downloading

From time to time, we post new jPOS releases at <http://jpos.org/download> but if you want to stay up to date with jPOS development and you want to get the latest features and bug fixes, we **strongly suggest** you to take the time to install a Subversion client and get the latest and greatest version from <http://sf.net/projects/jpos> and <http://code.google.com/p/jposee>.

jPOS via subversion

Instructions to get the latest version of jPOS using Subversion

Use your favorite subversion client to perform the following steps:

1. `svn checkout https://jpos.svn.sourceforge.net/svnroot/jpos/trunk/jpos6 jpos`
2. Open a shell and change your working directory to the newly created 'jpos' directory.
3. Call `ant clean run` in order to verify your setup

You should see output like this:

```
...
...
<log realm="Q2.system" at="Tue Jul 21 09:41:51 UYT 2009.168">
  <info>
    Q2 started, deployDir=/opt/svn/jpos6/build/deploy
  </info>
</log>
...
...
```

jPOS via standard download

Instructions to get the latest stable release via standard download

Use your favorite browser to visit:

1. <http://jpos.org/download>
2. After completing the form there, you will be provided with download instructions.
3. Once you complete your download, unzip/untar your jpos-x.x.x.zip/tgz file into a new directory, open a shell, cd there and,
4. call `ant clean run` in order to verify your setup

You should see output like this:

```
...
...
run:
[java] <log realm="Q2.system" at="Tue Jul 21 09:41:51 UYT 2009.168">
[java]   <info>
[java]     Q2 started, deployDir=/opt/svn/jpos6/build/deploy
[java]   </info>
[java] </log>
...
...
```

jPOS-EE via subversion

Instructions to get the latest version of jPOS-EE using Subversion

Use your favorite subversion client to perform the following steps:

1. `svn checkout http://jposee.googlecode.com/svn/trunk/ jposee`
2. Open a shell and change your working directory to the newly created 'jposee' directory.
3. Call `ant clean run` in order to verify your setup

You should see output like this:

```
...
...
<log realm="Q2.system" at="Tue Sep 08 14:51:49 PDT 2009.168">
  <info>
    Q2 started, deployDir=/opt/jposee/build/deploy
  </info>
```

```

</log>
...
...

```

Since the default jPOS-EE configuration deploys the SystemMonitor QBean (see `modules/system/deploy/99_sysmon.xml`), you will also see an initial SystemMonitor log event.

```

...
...
<log realm="org.jpos.q2.qbean.SystemMonitor" at="Tue Sep 08 14:51:48 PDT
2009.230">
  <info>
    Starting SystemMonitor
  </info>
</log>
<log realm="org.jpos.q2.qbean.SystemMonitor" at="Tue Sep 08 14:51:48 PDT
2009.231">
  <info>
    <release>1.6.5 $Revision: 2771 $</release>
    <memory>
      freeMemory=4640568
      totalMemory=5177344
      inUseMemory=536776
    </memory>
    <threads>
      delay=0 ms
      threads=4
      Thread[Reference Handler,10,system]
      Thread[Finalizer,8,system]
      Thread[Signal Dispatcher,9,system]
      Thread[Thread-0,5,main]
      Thread[DestroyJavaVM,5,main]
      Thread[Timer-0,5,main]
      Thread[SystemMonitor,5,main]
    </threads>
    --- name-registrar ---
    logger.Q2: org.jpos.util.Logger
  </info>
</log>
...
...

```

Chapter

2

Build System

Topics:

- [jPOS Directory Structure](#)
- [Module Directory Structure](#)
- [Ant Targets](#)
- [IDE support](#)
- [Running jPOS](#)

The jPOS Project build system uses [Apache's Ant](#)¹ to combine multiple modules into a single application.

¹ Version 1.7.1 or later

jPOS Directory Structure

<code>jpos6</code>	The root directory
-- <code>COPYRIGHT</code>	Copyright notice
-- <code>CREDITS</code>	Due credit to jPOS contributors
-- <code>LICENSE</code>	License information
-- <code>README</code>	The README file
-- <code>bin</code>	Unix based shell scripts
-- <code>q2</code>	Starts Q2 (same as <code>java -jar jpos.jar</code>)
-- <code>bsh</code>	Starts a BeanShell ² Interpreter with the jPOS classpath.
-- <code>build.xml</code>	Main Ant tasks configuration
-- <code>build.properties</code>	Additional Ant properties used by <code>build.xml</code>
-- <code>lib</code>	Support libraries required to build jPOS
-- <code>bsh-2.0b4.jar</code>	BeanShell
-- <code>jdbm-1.0.jar</code>	JDBM
-- <code>jdom-1.0.jar</code>	JDOM
...	Additional support libraries
-- <code>modules</code>	Modules directory
-- <code>include.list</code>	Optional list of modules to include at compile time
-- <code>exclude.list</code>	Optional list of modules to exclude at compile time
-- <code>jpos</code>	Main jPOS module
-- <code>q2</code>	The Q2 System
-- <code>q2mod_jpos</code>	Set of Q2 wrappers for jPOS components (jPOS adapters)
-- <code>security</code>	org.jpos.security related classes
-- <code>txnmgr</code>	jPOS Transaction Manager
! -- <code>compat_1_5_2</code>	Compatibility classes from jPOS 1.5.2 ³

Module Directory Structure

jPOS modules can have zero or more directories using the following naming convention.

<code>src</code>	The source code for this module
<code>lib</code>	Supporting libraries (jars and dynamic libraries)
<code>deploy</code>	QBean descriptors
<code>cfg</code>	Configuration files
<code>webapps</code>	exploded WAR
<code>test</code>	Unit tests

² Lightweight Scripting for Java - <http://www.beanshell.org>

³ To be deprecated

The jPOS ant-based build subsystem **merges** these directories off the available modules and **flattens** them inside the automatically created **build** directory.

If we have the files

```
module/mymoduleA/src/org/jpos/MyClassA.java  
module/mymoduleA/lib/mydepl.jar
```

and

```
module/mymoduleB/src/org/jpos/MyClassB.java  
module/mymoduleB/lib/mydep2.jar
```

and we call ant in order to build a jPOS (or jPOS-EE) application, as a first step ant will copy the files to the build/src directory and build/lib directory in order to end up with a directory structure like this:

```
build/src/org/jpos/MyClassA.java  
build/src/org/jpos/MyClassB.java  
build/lib/mydepl.jar  
build/lib/mydep2.jar
```

The same goes for other directories such as cfg, deploy, webapps, etc.

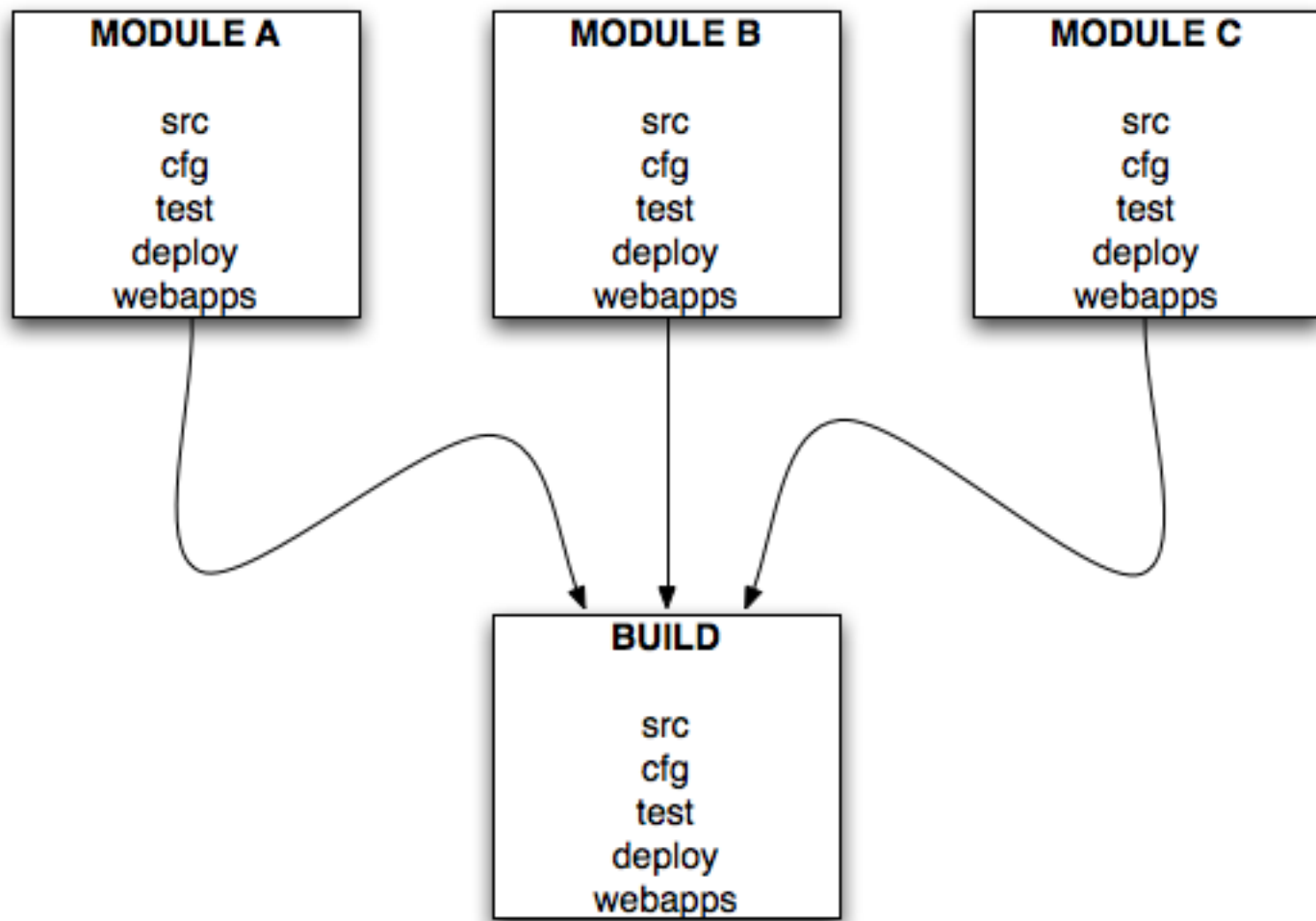



Figure 1: jPOS build merge process

 **Note:** jPOS-EE uses a similar merge process. The main difference is that in jPOS-EE, jPOS core becomes just one pre-compiled module

The typical jPOS-EE application has a directory `modules/jpos` with just a `lib` directory containing a precompiled `jpos.jar` along with its supporting jars.

As of jPOS-EE r171, the `modules/jpos/lib` directory looks like this:

```

jposee/trunk/modules/jpos/lib$ ls -l
total 2912
-rw-r--r--  1 apr  apr   281694 Oct  9  2007 bsh-2.0b4.jar
-rw-r--r--  1 apr  apr    36174 Oct  9  2007 commons-cli.jar
-rw-r--r--  1 apr  wheel  31731 May 14  2008 cweb-extser-0.1-b2-dev.jar
-rw-r--r--  1 apr  apr   207499 Dec  5  2008 jdbm-1.0.jar
-rw-r--r--  1 apr  apr   153253 Oct  9  2007 jdom-1.0.jar
-rw-r--r--  1 apr  apr    61125 Oct  9  2007 jline-0.9.91.jar
-rw-r--r--  1 apr  apr   708947 Sep  9 18:04 jpos.jar
  
```

Ant Targets

Calling `ant -projecthelp` provides information about the available targets:

```

Buildfile: build.xml

Main targets:

clean      clean up build and dist directories
compile    compile all
dist       Builds source distribution
jar        creates jpos.jar
javadoc    generate javadocs
run        invoke jPOS under Ant's JVM
singlejar  creates a single jpos.jar including all supporting jars
srcjar     creates jpos-src.jar for source browsing and debugging in
           IDEs like Eclipse
test       perform unit tests
zip        create zip distribution
Default target: compile

```

Installed modules can in turn have their own build.xml in order to perform module-specific tasks at build time.

IDE support

jPOS is IDE-agnostic. If you want to use it in your favorite IDE we recommend that you create the `jpos.jar` using `ant` once and then add that jar as a library.

In addition, you can call `ant srcjar` to create a `jpos-src.jar` that you can drop into your IDE source classpath.

The same holds true for jPOS-EE, you can install `jpos-ee.jar` as well as `jpos-ee-src.jar` in your IDE.

Running jPOS

Depending on how you get to use jPOS, you can consider it a Library, a Framework or an Application.

While using it as a library, running jPOS boils down to running your application, which in turns will use jPOS.

When you use it as an Application/Framework what you are actually running is **Q2**, jPOS' JMX Micro-Kernel.

Running Q2 is as simple as calling:


```
java -jar jpos.jar
```

Once started, Q2 will produce output like this:

```

<log realm="Q2.system" at="Sat Sep 19 19:51:39 UYT 2009.386">
  <info>
    Q2 started, deployDir=/opt/jpos/deploy
  </info>
</log>

```

 **Note:** You can run Q2 off the "build" directory (for testing purposes) but you want to move it to another destination for a production setup.

You may want to investigate the `bin` directory where you'll find a unix shell script -- that you can run in Windows inside Cygwin or you can use as a sample to create your own .BAT file -- called `bin/q2` that can be used to start Q2.

In addition, there's an Ant task called "run" that you can use to run Q2 under Ant's control. See `ant -projecthelp` for details.

Part II

jPOS

Topics:

- [Q2](#)

jPOS is a Java® platform-based, mission-critical, ISO-8583 based financial transaction library/framework that can be customized and extended in order to implement financial interchanges.

Chapter

3

Q2

Topics:

- [Running Q2 in Standalone mode](#)
- [Running Q2 in Embedded mode](#)
- [Q2 Command line arguments](#)
- [QBean Descriptors](#)
- [QBean Life cycle](#)
- [QBean Loggeable](#)
- [QBean Configurable](#)
- [QBean Optional Attributes](#)

Q2 is jPOS' component assembler / JMX Micro-Kernel.

It provides an extremely simple life-cycle to its components (interchangeable called **QBeans** or **Q2 Services**). It allows to easily configure, start, and connect jPOS standard components as well as user defined ones.

Among Q2's salient features are its ability to **hot deploy** and manage its services via **JMX**, **dynamic [remote] classloading** and **push** as well as **pull** configuration.

Q2 reads the 'deploy' directory looking for configuration files (called 'QBean descriptors') and instantiates 'services' (called 'QBeans'). Q2 provides a very simple life-cycle to its QBeans: `init`, `start`, `stop`, `destroy` and takes care of registering the newly created Object with the jPOS [NameRegistrar](#) as well as the JMX MBeanServer.

QBeans are MBeans (see JMX specs) that implement the Q2's lifecycle set of operations as defined in the [QBean](#) interface.

Running Q2 in Standalone mode

We recommend using jPOS by launching Q2 in standalone mode. That's the way we use it in our production applications and the way most jPOS mission critical applications operate.


Running Q2 in standalone mode is as simple as calling:

1. `java -jar jpos.jar`, or if you are running jPOS-EE
2. `java -jar jpos-ee.jar`

There's a handy Unix shell script called `bin/q2` that you can use to start Q2, or `bin/start` and `bin/stop` in order to run it as a daemon service.

If you are running in a Windows environment, you can use jPOS-EE's `wrapper` module in order to run as an NT Service.

Running Q2 in Embedded mode

 **Important:** While jPOS' Q2 can be embedded in other Java applications, we strongly recommend to run it in *standalone mode*. Q2 handles its own MBeanServer and creates several Threads in order to run its services and can have conflicts with some controlled/sandboxed environments.

In order to start Q2 from your application, you just need to:

1. `import org.jpos.q2.Q2;`
2. `Q2 q2 = new Q2 ("/path/to/your/deploy/directory);`
3. `q2.start();`

As a result, Q2 starts running and monitoring the `deploy` directory.

Q2 can be stopped using the command `q2.stop()`.

Q2 Command line arguments

`bin/q2 --help` provides the following output:

```
usage: Q2
  -c,--command <arg>      Command to execute
  -C,--config <arg>       Configuration bundle
  -d,--deploydir <arg>    Deployment directory
  -e,--encrypt <arg>      Encrypt configuration bundle
  -h,--help                Usage information
  -i,--cli                 Command Line Interface
  -r,--recursive           Deploy subdirectories recursively
  -v,--version             Q2's version
```

Q2 uses `commons-cli` which supports POSIX-like as well as GNU long options.

Table 3: Command Line Arguments

Argument	Description
-c, --command	A CLI command to execute. 'CLI' is Q2's Command Line Interface
-C, --config	Deploy a single file (called a Configuration Bundle) containing a set of QBean descriptors
-d, --deploydir	Path to the deploy directory (defaults to 'deploy' in the current working directory)
-e, --encrypt	It is possible to encrypt an MBean deployment descriptor in order to protect it from an occasional lurker
-h, --help	dumps help screen
-i, --cli	launches interactive command line interface (press 'tab' to see available commands)
-r, --recursive	recursively scans for QBean descriptors in the deploy children directories
-v, --version	shows current jPOS version and revision

QBean Descriptors

This section describes the anatomy of a QBean descriptor.

Q2 regularly scans the 'deploy' directory, and eventually its subdirectories, looking for QBean descriptors.


Those are simple and flexible XML files with the following requirements:

- The outer element has to either have an unique name, or it needs an unique 'name' attribute.
- Unless the outer element is a well know name defined in the `QFactory.properties` ResourceBundle, a `class` attribute has to be provided in order to specify the QBean implementation classname.

```
<qbean name="mybean" class="org.jpos.test.MyBean" />
```

In the previous example, an instance of `org.jpos.test.MyBean` would be created and registered with the `MBeanServer` as well as the `NameRegistrar` under the name `mybean`.

If we omit the 'name' attribute, then the root element name (in this case `qbean`) would be used instead.

 **Attention:** Names, either picked from the root element or the 'name' attribute have to be unique across a Q2 instance.

In addition to the `class` and `name` attributes, **Q2** supports two additional attributes:

- `logger`
- `realm`

i.e.:

```
<qbean name="mybean" class="org.jpos.test.MyBean" logger="Q2" realm="mybean" />
```

The ResourceBundle `QFactory.properties` provides some handy shortcuts for some well know stock QBeans, namely:

```
shutdown=org.jpos.q2.qbean.Shutdown
script=org.jpos.q2.qbean.BSH
jython=org.jpos.q2.qbean.Jython
```

```
spacelet=org.jpos.q2.qbean.SpaceLet
sysmon=org.jpos.q2.qbean.SystemMonitor
txnmgr=org.jpos.transaction.TransactionManager
transaction-manager=org.jpos.transaction.TransactionManager
qmux=org.jpos.q2.iso.QMUX
channel-adaptor=org.jpos.q2.iso.ChannelAdaptor
```

This allows you to use a configuration like this:

```
<script name="myscript">
  ...
  ...
</script>
```

Without having to specify:

```
<script name="myscript" class="org.jpos.q2.qbean.BSH">
  ...
  ...
</script>
```



Caution: Although you can omit the 'name' attribute, it is good practice to use it, otherwise, you'd have a name conflict on your second descriptor using the same shortcut.



Tip: shutdown is a useful shortcut, a simple descriptor with a single element called shutdown will initiate a Q2 clean shutdown, stopping all deployed services. Look at `bin/stop` for an example.

QBean Life cycle

Q2 provides a very simple life cycle to the **QBeans**, it basically calls four methods:

- init
- start
- stop
- destroy

Writing a QBean is as easy as implementing the [org.jpos.q2.QBean](#) interface which in addition to the aforementioned life cycle operations has a couple of additional

```
int getState(); String
getStateAsString();
```

methods required for housekeeping and JMX-based monitoring.

A Minimal QBean implementation



Attention: Actually a minimal QBean implementation that **DOESN'T WORK**, please keep reading, there's a minor final tweak.

```
package org.jpos.q2.qbean;

import org.jpos.q2.QBean;

public class Test implements QBean {
  int state;
  public void init () throws Exception {
    state = QBean.STARTING;
    System.out.println ("init");
  }
}
```

```

    }
    public void start () throws Exception {
        state = QBean.STARTED;
        System.out.println ("start");
    }

    public void stop () throws Exception {
        state = QBean.STOPPING;
        System.out.println ("stop");
    }


    public void destroy () throws Exception {
        state = QBean.STOPPED;
        System.out.println ("destroy");
    }
    public int getState () {
        return state;
    }
    public String getStateAsString () {
        return state >= 0 ? stateString[state] : "Unknown";
    }
}

```

In order to deploy our Test QBean, we need to place an XML descriptor, which is just a simple XML file in the deploy directory (i.e.: 10_test.xml)

```
<qbean name="" class="org.jpos.q2.qbean.Test" />
```

When Q2 detects the new XML descriptor, it attempts to instantiate the service, and this is what you'll see (several errors).

 **Note:** We believe that showing you these errors is good so you understand how JMX gets into play.


First, we'll see that Q2 is trying to deploy your new QBean:

```

<log realm="Q2.system" at="Sun Nov 15 19:17:06 UYST 2009.73">
  <info>
    deploy:/opt/jpos/build/deploy/10_test.xml
  </info>
</log>

```

Then a noisy error will basically tell us that:

 **Attention:** Class org.jpos.q2.qbean.Test is **not a JMX compliant MBean**

The full message looks like this:

```

<log realm="Q2.system" at="Sun Nov 15 19:17:06 UYST 2009.77">
  <warn>
    deploy
    <exception name="MBean class org.jpos.q2.qbean.Test does not implement
DynamicMBean,
    neither follows the Standard MBean conventions
    ...
    ...
    ...
  </exception>

```

```
</warn>
</log>
```

Then we'll see something useful, when **Q2** detects a problem with a descriptor, it renames it either to a file name ending in `.BAD`, or a file name ending in `.DUP` if the problem is related to a duplicate QBean name.

```
<log realm="Q2.system" at="Sun Nov 15 19:17:06 UYST 2009.83">
  <warn>
    Tidying /opt/jpos/deploy/10_test.xml out of the way, by adding .BAD
    It will be called: /opt/jpos/deploy/10_test.xml.BAD see log above
    for detail of problem.
  </warn>
</log>
```

Fixing the problem with the minimal QBean implementation

QBeans are also **JMX MBeans**, so in addition to implementing `org.jpos.q2.QBean`, our `org.jpos.q2.qbean.Test` class has to implement an interface called `org.jpos.q2.qbean.TestMBean` which in turn has to extend `org.jpos.q2.QBean`.

So our `org.jpos.q2.qbean.TestMBean` will look like this:

```
package org.jpos.q2.qbean;

import org.jpos.q2.QBean;

public interface TestMBean extends QBean { }
```

and our `org.jpos.q2.qbean.Test` class, instead of implementing `QBean`, it will implement our `TestMBean`. The definition will look like this:


```
package org.jpos.q2.qbean;
import org.jpos.q2.QBean;
public class Test implements TestMBean {
    ...
    ...
}
```

The reason for the previous requirement is that **Q2** instantiates QBean implementations using the **JMX MBeanServer**, and it calls the life cycle operations `init`, `start`, `stop` and `destroy` **via JMX**.

QBean Loggeable

if a QBean implements the *Loggeable* interface, and its QBean descriptor has a `logger` attribute, **Q2** will take care of calling its `setLogger` method, i.e:

```
<qbean name="my-qbean"
      class="org.jpos.q2.qbean.Test"
      logger="Q2" realm="Test" />
```

 **Tip:** **Q2** is the default logger name, usually defined in the `00_logger.xml` QBean descriptor.

QBean Configurable


if a QBean implements the *Configurable* interface, and its QBean descriptor has property entries, Q2 will create a Configuration object and call its `setConfiguration` method, i.e:

```
<qbean name="my-qbean"
  class="org.jpos.q2.qbean.Test"
  logger="Q2" realm="Test">
  <property name="my-prop-1" value="1" />
  <property name="my-prop-2" value="3" />
  <property file="my-prop-file.cfg" />
</qbean>
```

QBean Optional Attributes

Before calling its 'init' method, Q2 attempts to push several well known attributes via JMX:

Table 4: QBean Optional Attributes

Attribute	Description
logger	If the QBean descriptor has a 'logger' attribute, and the the QBean implementation has a void <code>setLogger (Logger)</code> method, then Q2 will set a logger.
realm	Same goes for 'realm', if the QBean descriptor has a 'realm' attribute and the QBean implementation has a void <code>setRealm (String)</code> method, Q2 will call it and set the appropriate realm.
server	Ideally, and in order to honor IoC ⁴ , QBean implementations doesn't need a reference to their server, but just in case we need it, if the QBean implementation has a void <code>setServer (Q2 server)</code> method, Q2 will push a reference to itself.
persist	If a QBean implementation has a void <code>setPersist (Element e)</code> method, Q2 will push the QBean descriptor represented by an <code>org.jdom.Element</code> Object.  Note: The name 'persist' is not a very good choice, it was named after the fact that this Element object basically represent the persistent representation of a QBean, including its attributes and properties. We definitely need a better name for this.

⁴ Inversion of Control

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Short reference description.

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Revision History

Version	Date	Description
1.0	2009-09-19	Initial revision, general project information
1.1	2009-09-28	Added Q2 chapter
1.2	2009-11-04	Added jPOS part, placed Q2 chapter there
1.3	2009-11-15	Added <i>QBean Life cycle</i> on page 28, <i>QBean Loggeable</i> on page 30, <i>QBean Configurable</i> on page 31 and <i>QBean Optional Attributes</i> on page 31.

Index

A

Abstract 5
 AGPL 33
 Ant 18
 Ant Targets 20

B

Blogs 14
 Build system 18
 Build System 17, 18, 20, 21

C

Component Assembler 25, 26, 27, 28, 30, 31
 Configurable 31
 Contributors 45
 Credits 45

D

Daemon 26
 Directory Structure 18
 Directory Structure (module) 18
 Distribution 15
 Download 14, 15

E

Embedded mode 26

F

Feeds 14
 Forums 14

G

GNU 33
 Google Code 15

J

jCard 11, 13, 14, 15, 17, 18, 20, 21
 JMX Micro-Kernel 25, 26, 27, 28, 30, 31
 jPOS 11, 13, 14, 15, 17, 18, 20, 21, 23, 25, 26, 27, 28, 30, 31

jPOS CMF 11, 13, 14, 15, 17, 18, 20, 21
 jPOS-EE 11, 13, 14, 15, 17, 18, 20, 21
 jPTS 11, 13, 14, 15, 17, 18, 20, 21

L

License 33
 Life cycle 28, 30
 Loggeable 30

M

Mailing lists 14
 MBeanServer 25, 26, 27, 28, 30, 31

N

NT Service 26

Q

Q2 25, 26, 27, 28, 30, 31
 QBean 25, 26, 27, 28, 30, 31
 QBean Configurable 31
 QBean Descriptors 27
 QBean Life cycle 28, 30
 QBean Loggeable 30
 QBean Optional Attributes 31

R

Resources 13, 14, 15
 RSS 14

S

Service, NT 26
 Source Control 14, 15
 Source-Forge 14
 Standalone mode 26
 Subversion 14, 15

T

Tarball 15
 Targets 20

