



Java Plays : Migration Lab 1

From Apache Tomcat to IBM Blumix

Presented by:

IBM

ECOD

IBM Cloud

AGENDA

- ❑ Purpose of This Lab
- ❑ Pre-Requisites
- ❑ Sample Application Overview
- ❑ Lab Exercise 1: Test the Application on Tomcat Before Migration
- ❑ Lab Exercise 2: Prepare the Forum Application for Bluemix
- ❑ Lab Exercise 3: Migrate the Forum Application to Bluemix
- ❑ Summary

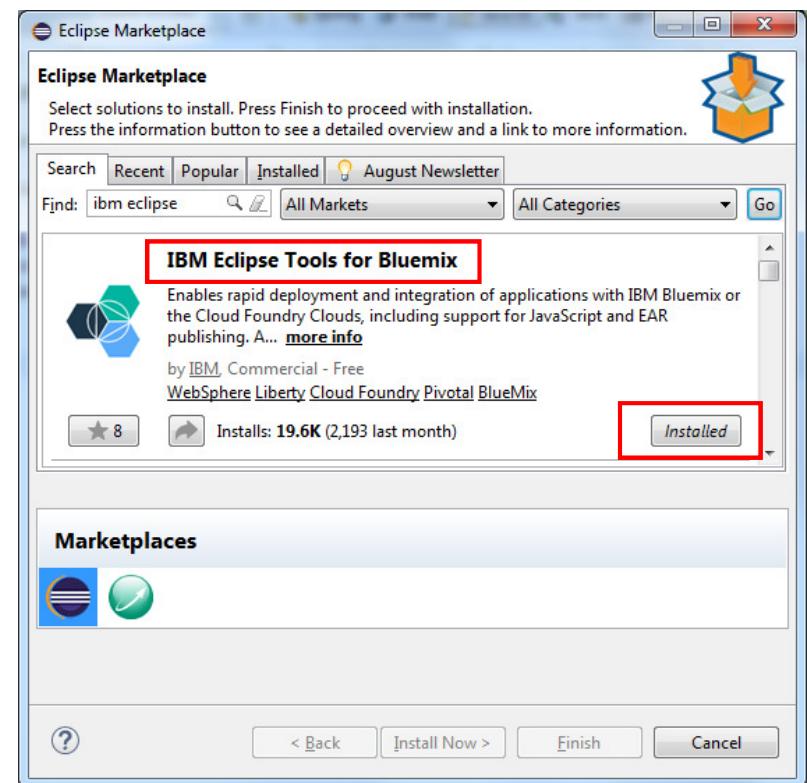
Purpose of This Lab

In this lab, you will learn how to resolve incompatibilities in migrating an application targeted for Apache Tomcat to IBM Bluemix, Platform as a service cloud offering. Bluemix allows developers and businesses to focus on their application development and data while providing the platform to develop, run, manage web & mobile applications.

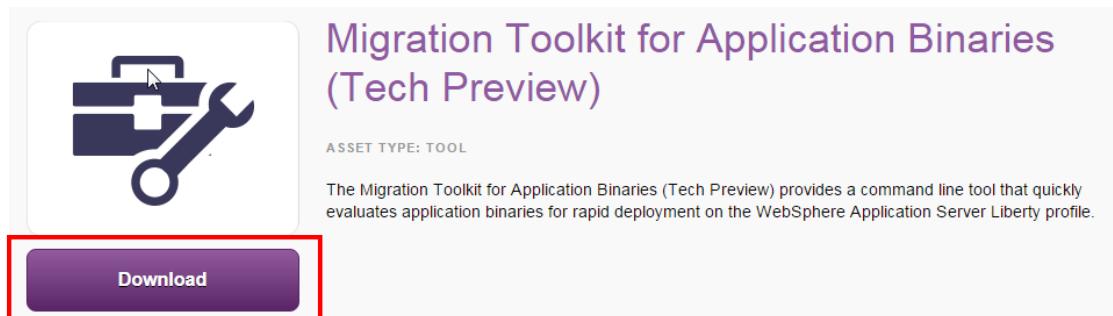
Under the hood, Bluemix uses Liberty server to run Java Applications.

Pre-Requisite

- Install JDK 1.7 +
- Install Mars Eclipse (v 4.5).
Download Site: <https://www.eclipse.org/downloads/>
- Install IBM Eclipse Tools for Bluemix from Eclipse Marketplace.
Eclipse >> Help >> Eclipse Market Place



- Install Application Assessment Tool from [https://developer.ibm.com/wasdev/downloads/#asset/tools-
Migration Toolkit for Application Binaries Tech Preview](https://developer.ibm.com/wasdev/downloads/#asset/tools-Migration_Toolkit_for_Application_Binaries_Tech_Preview)



Installation

1. Download the Migration Toolkit for Application Binaries (Tech Preview) by clicking Download.
2. Run the following command and follow the prompts to install the tool:

```
java -jar binaryAppScannerInstaller.jar
```

After accepting the license agreement, and specifying the target directory for the installation, the tool is installed in the <target directory>/wamt directory.

□ Install Apache Tomcat 7: <http://tomcat.apache.org/download-70.cgi>

Choose an installation based on your operating system. All you need to do is to unzip.

[Binary Distributions](#)

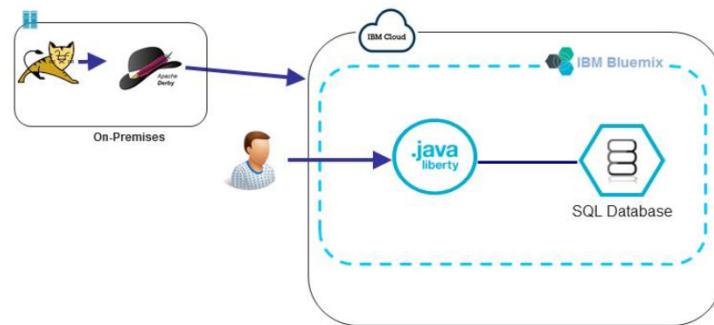
- Core:
 - [zip \(pgp, md5, sha1\)](#)
 - [tar.gz \(pgp, md5, sha1\)](#)
 - [32-bit Windows zip \(pgp, md5, sha1\)](#)
 - [64-bit Windows zip \(pgp, md5, sha1\)](#)
 - [64-bit Itanium Windows zip \(pgp, md5, sha1\)](#)
 - [32-bit/64-bit Windows Service Installer \(pgp, md5, sha1\)](#)

□ Download a zip file containing application written for Tomcat: <https://github.com/ibmecod/MigrationScenario1>
Unzip. This folder will be referred as <APP_DIR> during the lab exercises.

□ Download Apache Derby DB 10.11.1.1 from <http://db.apache.org/derby/releases/release-10.11.1.1.cgi>
Unzip. This folder will be referred as <DERBY_HOME> during the lab exercises.

Sample Application Overview

- ❑ Easy JSP Forum is based on an open source project that resembles a forum where users can sign in, edit member information, post, and reply to threads.
- ❑ Prior to migration: On-premises application running on Tomcat application server with Derby DB.
- ❑ Post migration to IBM Bluemix: Application running in Cloud using Liberty for Java runtime and SQLDB cloud service.

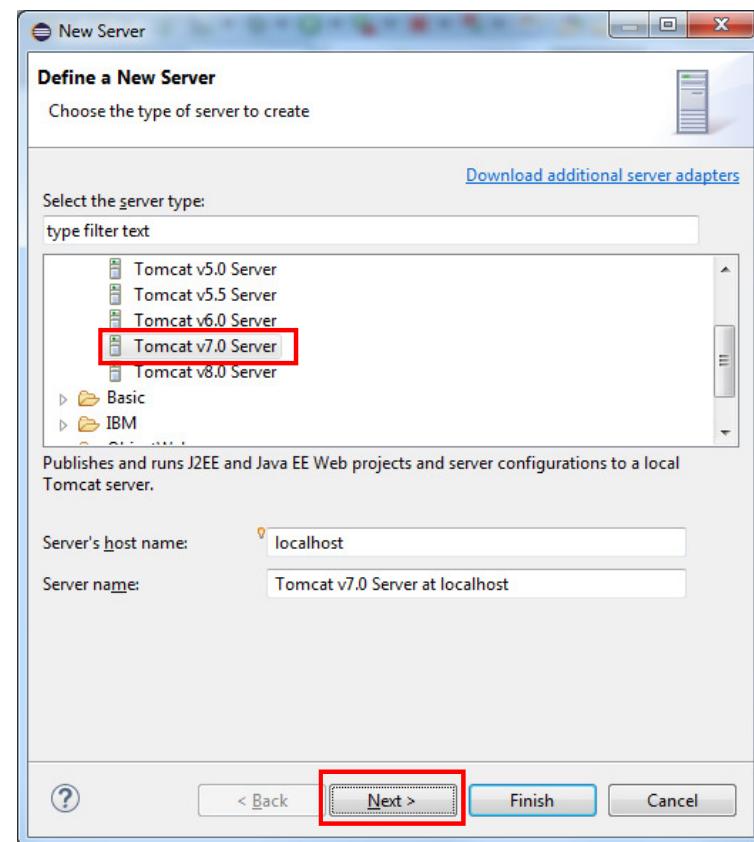


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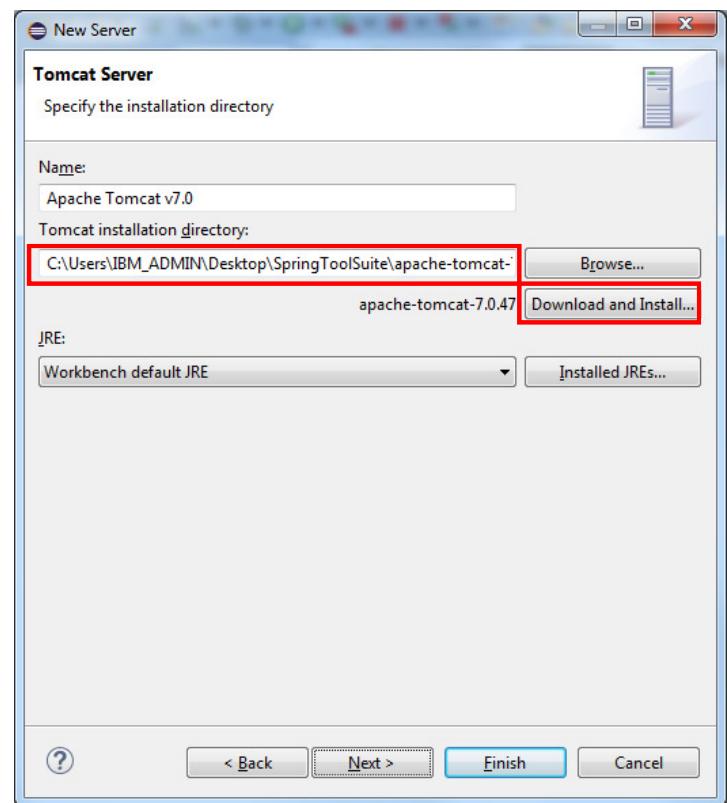
Lab Exercise 1: Test the Application on Tomcat Before Migration

Setup Tomcat 7.0 Server in Eclipse

- Go to Servers view in Eclipse.
- Right click >> Select New >> Select Server.
- Select Apache >> Tomcat v7.0 Server.
- Click Next.



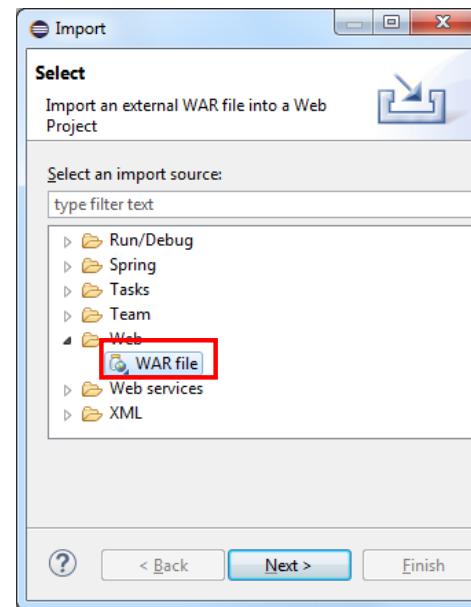
- If Tomcat is not installed, Click Download and Install Otherwise, point to your Tomcat installation location.
- Choose a JDK 1.7+ from Installed JREs.
- Click Next.
- Click Finish.



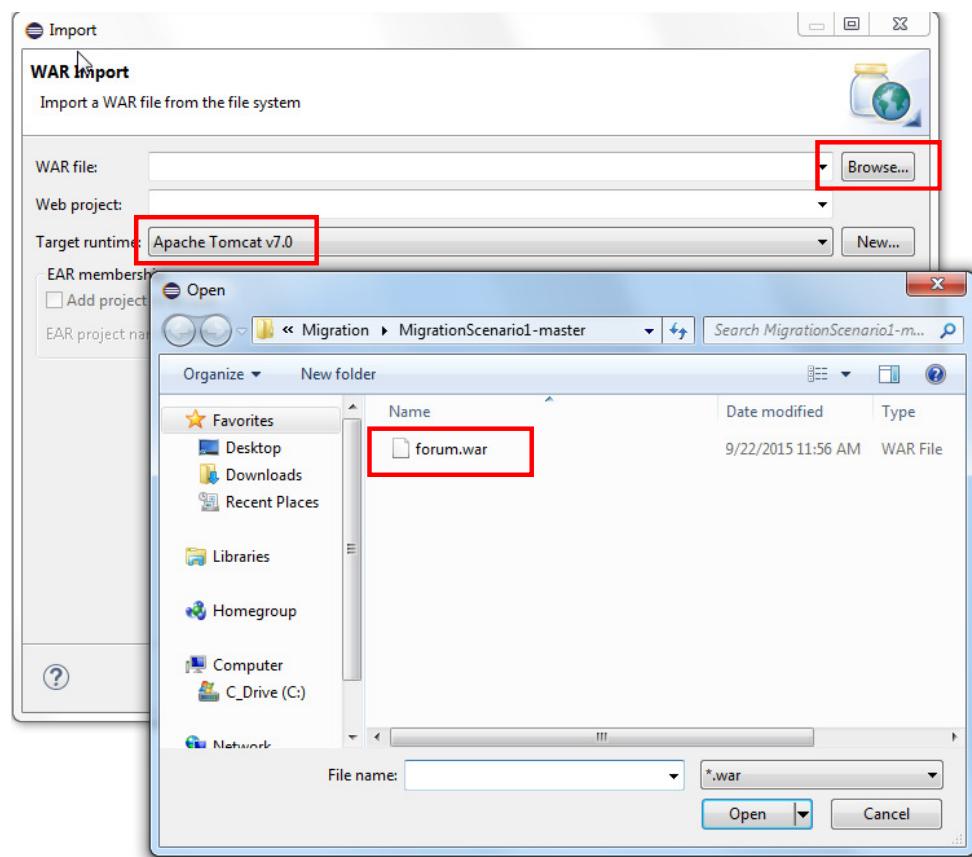
Now, you are ready to deploy and run an application on Tomcat v7 via Eclipse.

Import Easy JSP Forum Application Source Code into Eclipse

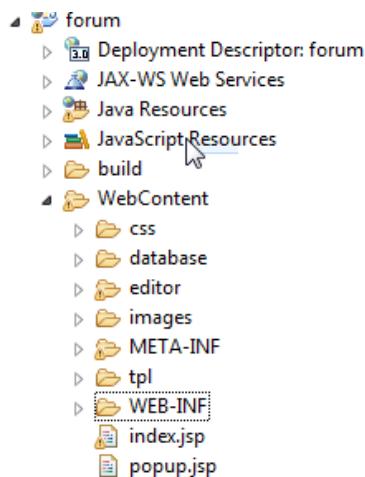
- ❑ Open Eclipse.
- ❑ File >> Import.
- ❑ Under Web, choose War file.
- ❑ Click Next.



- ❑ Select Target runtime: Apache Tomcat v7.0.
- ❑ Click Browse.
- ❑ Select forum.war from <APP_DIR>.
- ❑ Click Finish.



- ❑ An eclipse project, forum, is imported into Eclipse.

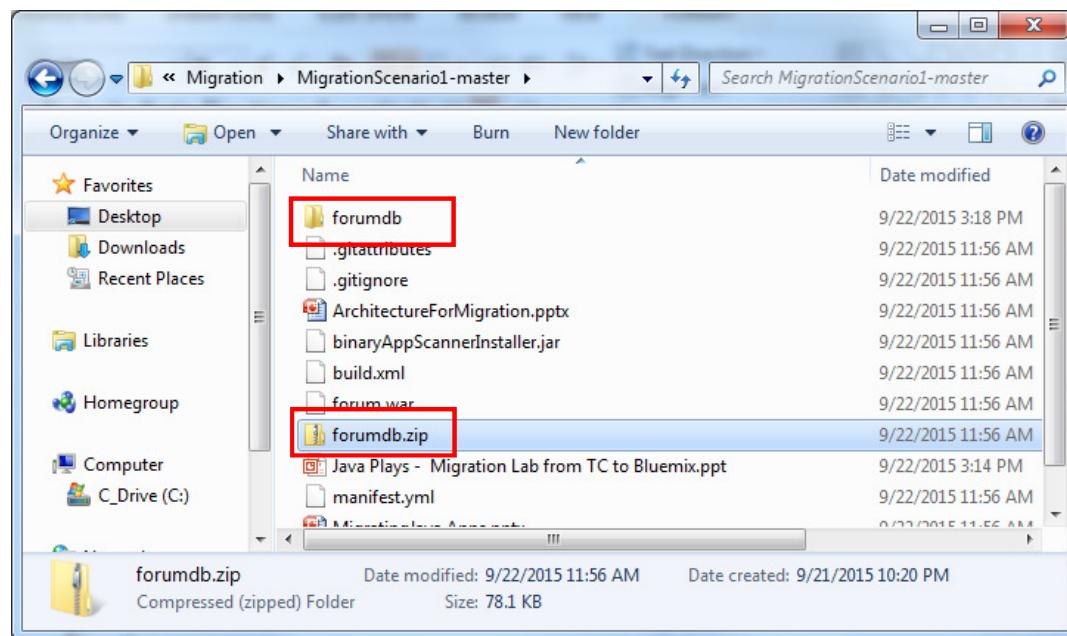


Configure Derby Database

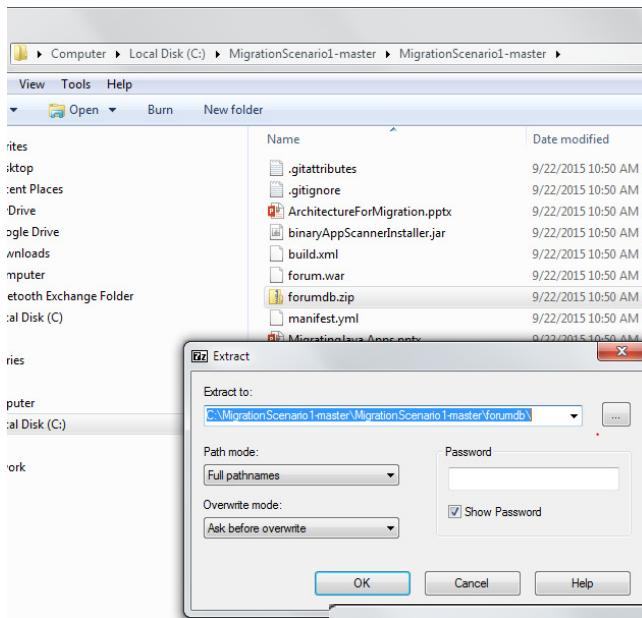
To run the Easy JSP Forum application, you will need a data source to access the user and forum data displayed by the application. To keep things simple, the application will use Derby, a very lightweight and easy to use database.

- ❑ Go to <APP_DIR> where lab materials are unzipped.

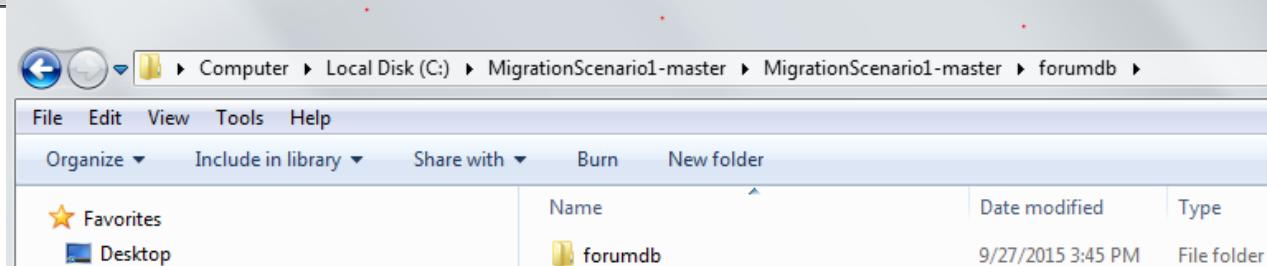
- ❑ Locate forumdb.zip



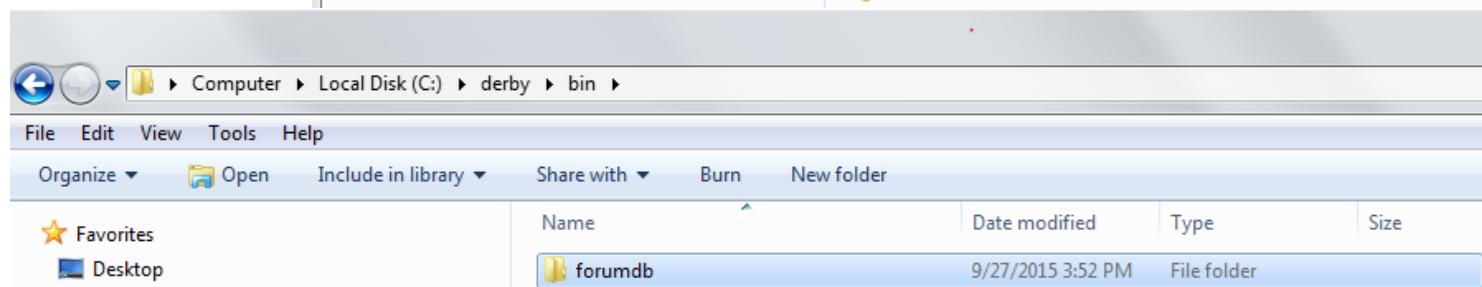
Extract forumdb.zip



Copy forumdb folder from extracted folder



To <DERBY_HOME>/bin



Start the Derby Database

- Open Command Line console.
- Go to <DERBY_HOME>/bin
- Run startNetworkServer script.

```
C:\derby\bin>
C:\derby\bin>dir
Volume in drive C has no label.
Volume Serial Number is 169F-E31F

Directory of C:\derby\bin

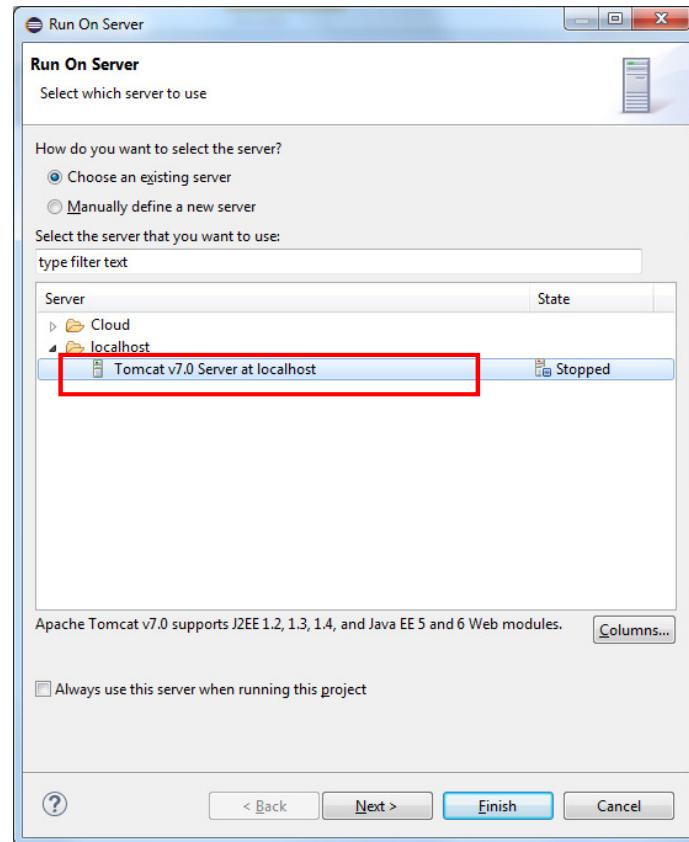
09/27/2015  03:52 PM    <DIR>          .
09/27/2015  03:52 PM    <DIR>          ..
08-07-2014   10:42 PM      5,740 dblook
08-01-2014   06:55 PM     1,387 dblook.bat
09-27-2015   04:00 PM      187 derby.log
08-01-2014   06:55 PM     2,426 derby_common.bat
09-27-2015   03:52 PM    <DIR>          forumdb
08-07-2014   10:42 PM      5,876 ij
08-01-2014   06:55 PM     1,379 ij.bat
08-07-2014   10:42 PM     5,801 NetworkServerControl
08-01-2014   06:55 PM     1,413 NetworkServerControl.bat
08-01-2014   06:55 PM     1,073 setEmbeddedCP
08-01-2014   06:55 PM     1,278 setEmbeddedCP.bat
08-01-2014   06:55 PM     1,079 setNetworkClientCP
08-01-2014   06:55 PM     1,284 setNetworkClientCP.bat
08-01-2014   06:55 PM     1,075 setNetworkServerCP
08-01-2014   06:55 PM     1,273 setNetworkServerCP.bat
08-07-2014   10:42 PM     5,807 startNetworkServer
08-01-2014   06:55 PM     1,397 startNetworkServer.bat
08-07-2014   10:42 PM     5,810 stopNetworkServer
08-01-2014   06:55 PM     1,403 stopNetworkServer.bat
08-07-2014   10:42 PM     5,789 sysinfo
08-01-2014   06:55 PM     1,389 sysinfo.bat
                           52,816 bytes
                           20 File(s)   52,816 bytes free
                           3 Dir(s)  225,411,670,016 bytes free

C:\derby\bin>startNetworkServer.bat
Sun Sep 27 16:01:08 IST 2015 : Security manager installed using the Basic server security policy.
Sun Sep 27 16:01:08 IST 2015 : Apache Derby Network Server - 10.11.1.1 - (1616546) started and ready to accept connections on port 1527
```

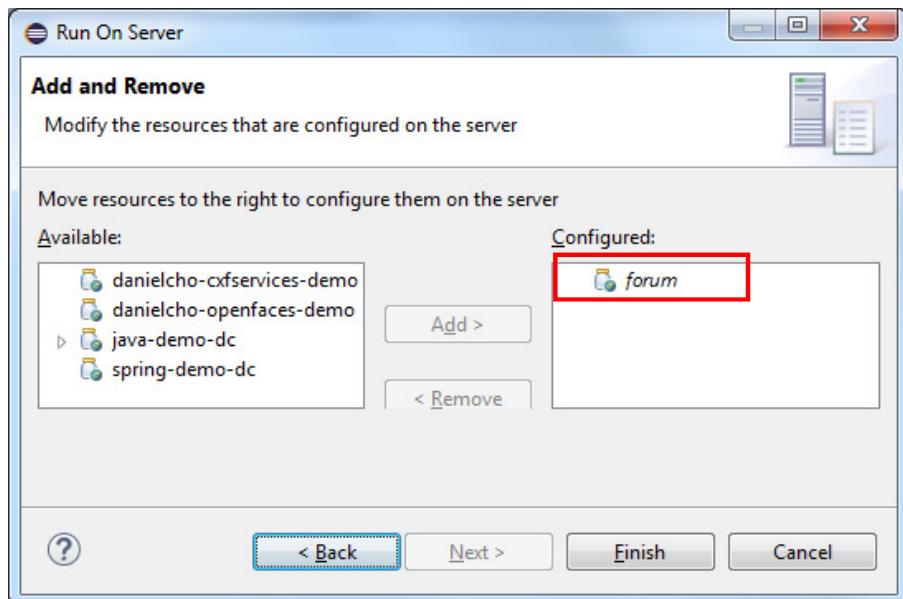
Deploy forum Application to Tomcat

Now the test environment is ready so that we can proceed with application deployment to Tomcat from Eclipse.

- Right click on forum project in Eclipse.
- Select Run As >> Run on Server.
- Choose Tomcat v7.0 Server.
- Click Next.

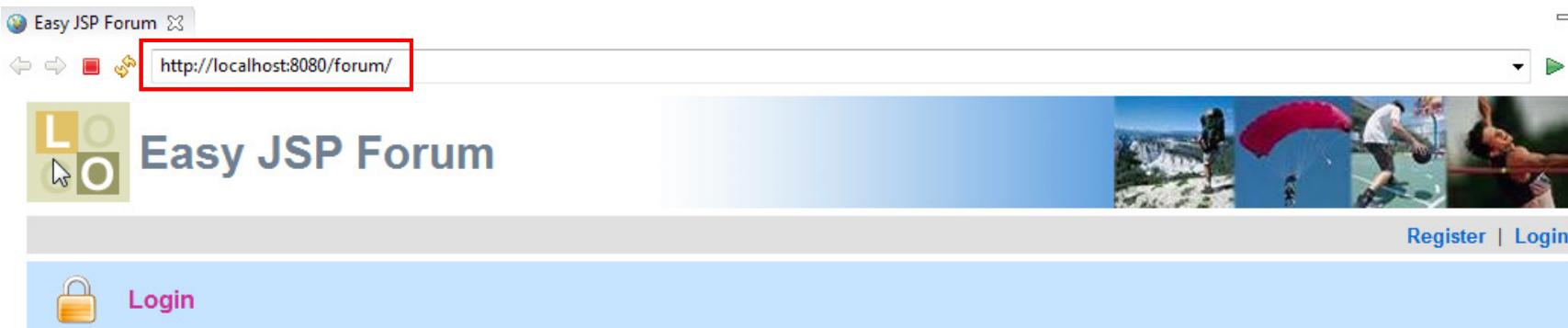


□ Verify forum project is under Configured.



- You should be able to see the following Welcome page at <http://localhost:8080/forum>

Note: Port (default connector port is 8080 by tomcat server.xml) may vary depending your installation configuration.



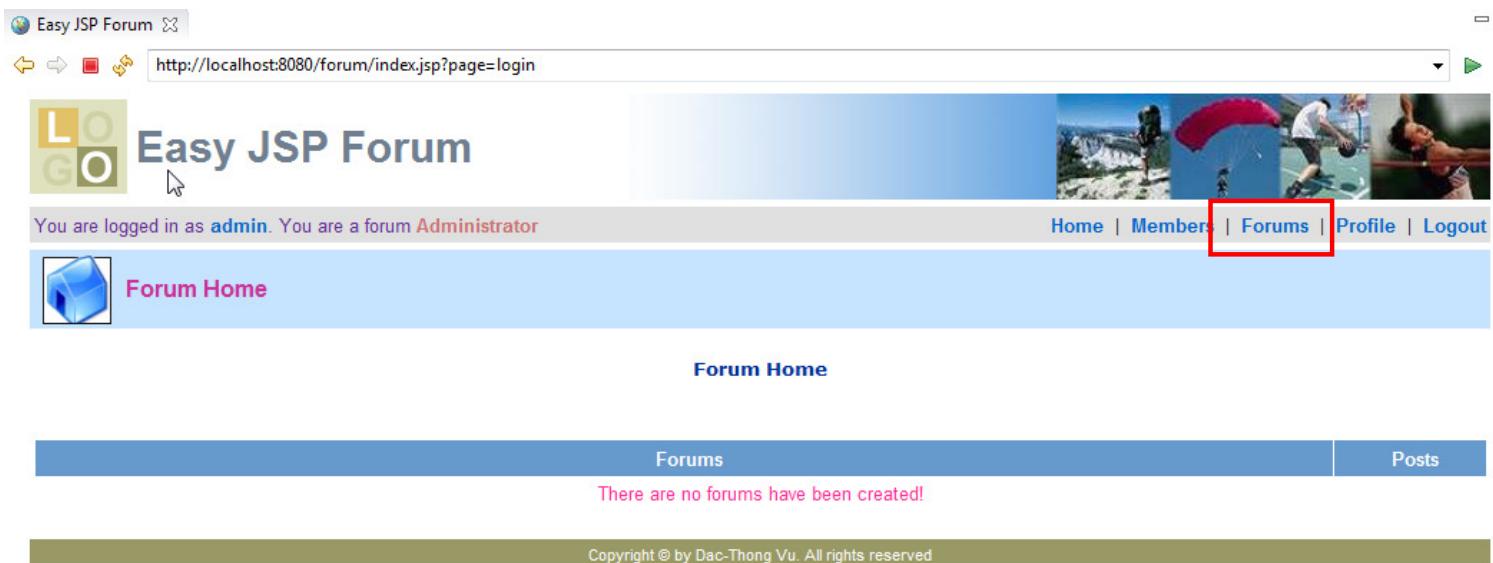
Login

Please login so that you can start viewing and posting your messages.
If you are new to this forum please [register](#) to create your free account.

Login Form	
Username:	<input type="text"/>
Password:	<input type="password"/>
<input type="button" value="Login"/>	

Test the Application on Tomcat

- Login to the application using admin as Username and Password.



- Click Forums to create a forum.

- In Edit Forums page, enter a forum name and description and click Create.

The screenshot shows the 'Edit Forums' interface. At the top, there's a navigation bar with a gear icon and the text 'Edit Forums'. Below it, the main title is 'Edit Forums'. The first section is 'Select Forum to Edit', which includes a dropdown menu labeled 'Forums:' and a 'Select' button. The second section is 'Create New Forum', which contains fields for 'Forum Name' (set to 'Bluemix Applications') and 'Forum Description' (set to 'How to build awesome applications on top of Bluemix'). Both of these fields are highlighted with red boxes. Below these fields is a 'Create' button, also highlighted with a red box. The third section is 'Unassigned Forums', which has a 'Select Forum' dropdown, an 'assign to:' dropdown, and a 'Select Member' dropdown, followed by an 'Assign' button.

- Click Home at the top right.

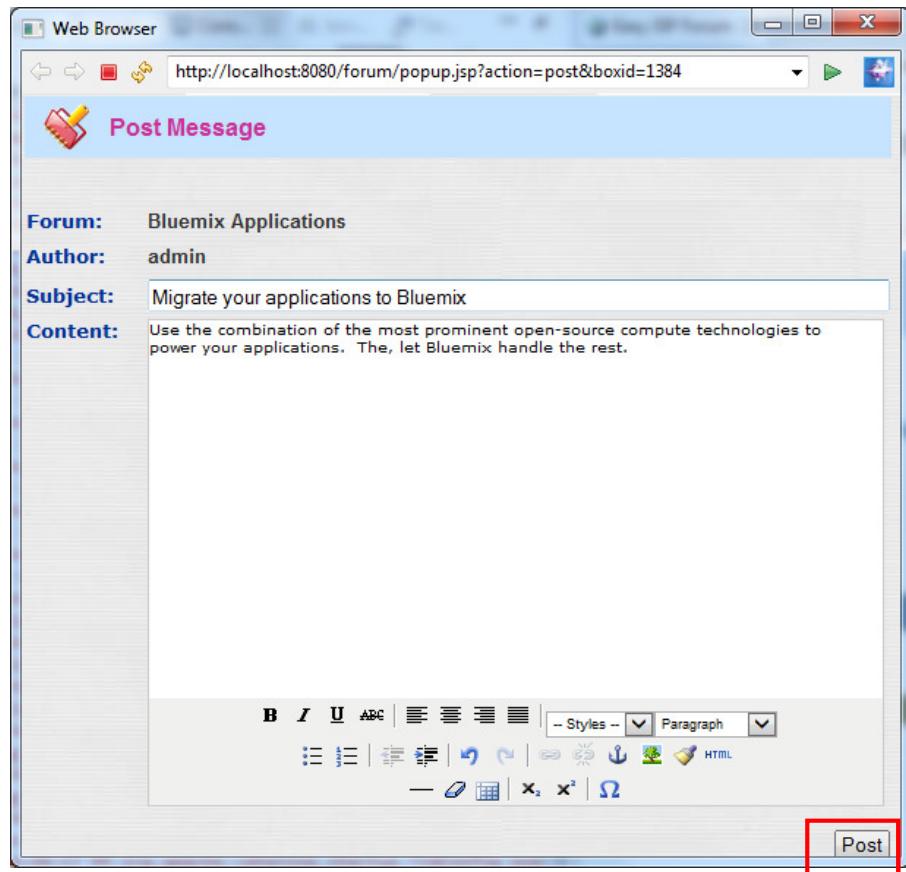
- You will see the newly created forum.

The screenshot shows the homepage of the 'Easy JSP Forum'. At the top left is a logo consisting of the letters 'L', 'O', and 'G' in a stylized font. Next to it is the text 'Easy JSP Forum'. A horizontal banner at the top features four small images: a person standing on a cliff, a person paragliding, a person playing basketball, and a person working on a computer. Below the banner, a message says 'You are logged in as admin. You are a forum Administrator'. To the right are links for 'Home', 'Members', 'Forums', 'Profile', and 'Logout'. A blue navigation bar contains a 'Forum Home' link with a blue cube icon. The main content area has a blue header with the text 'Forum Home'. Below this is a table with two columns: 'Forums' and 'Posts'. The first row shows 'Bluemix Applications' with 0 posts. A red box highlights the 'Bluemix Applications' link. Below the table, it says 'Moderator: admin', 'Description: How to build awesome applications on top of Bluemix', and 'Latest threads: none'.

- Click Blumix applications to start a thread. >> Click New Thread.

The screenshot shows the 'Bluemix Applications' forum page. At the top left is a blue navigation bar with a blue cube icon and the text 'View Forum'. Below it is a blue header with the text 'View Forum: Bluemix Applications'. Underneath is a breadcrumb trail 'Community Forum > Bluemix Applications' and a note 'Forum moderator: admin'. In the center is a red box around a 'New Thread' button. Below the button is a table with three columns: 'Threads', 'Author', and 'Date and Time'. A message at the bottom of the table says 'There are no threads in this forum!'. At the very bottom is a footer with the text 'Java Plays : Migration Lab 1 from Tomcat to Bluemix'.

- Fill out Subject and Content. >> Click Post.



- Ask your colleague to post a reply.

You will see the following Forum Activity similar to shown below.

The screenshot shows a forum interface with the following elements:

- Header:** A logo icon labeled "LOGO" and the text "Easy JSP Forum".
- User Information:** "You are logged in as **admin**. You are a forum **Administrator**".
- Navigation:** Links to "Home", "Members", "Forums", "Profile", and "Logout".
- Thread Buttons:** "View Thread" and "Reply Thread" buttons.
- Thread Title:** "View Thread: Migrate your applications to Bluemix".
- Thread Path:** "Community Forum > Bluemix Applications > Migrate your applications to Bluemix".
- Forum Moderator:** "Forum moderator: admin".
- Post 1 (Original):** Subject "Migrate your applications to Bluemix", Date "Tue Sep 22 16:46:46 EDT 2015", Content "Use the combination of the most prominent open-source compute technologies to power your applications. Then, let Bluemix handle the rest.", and two small icons.
- Post 2 (Reply):** Subject "RE: Migrate your applications to Bluemix", Date "Tue Sep 22 16:47:33 EDT 2015", Content "I totally agree !!", and two small icons.

Now, we have seen how the Forum application runs on Tomcat application server. It's time to migrate !

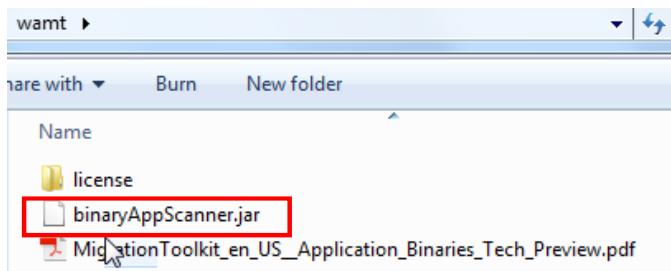
Lab Exercise 2: Prepare the Forum Application for Bluemix

This section describes the key steps for application migration from Tomcat to Bluemix.

Migration involves create and configure Bluemix database service instance, modify Source code to connect to the Bluemix database service, SQL query fixes, deploy and test the migrated application.

Use the Binary Assessment Tool on Application Binaries

- You have installed the binaryAppScanner.jar under wamt directory in the Pre-Requisites section.



- Go to wamt directory >> Type in java –jar binaryAppScanner.jar <directory containing the forum.war file>

```
C:\Users\IBM_ADMIN\Desktop\Java_Play\Migration\wamt>java -jar binaryAppScanner.jar ..\MigrationScenario1-master\forum.war
Scanning files...
The report was saved to the following file: C:\Users\IBM_ADMIN\Desktop\Java_Play\TechnologyReport.html
```

- Review a high level Application Evaluation Report in HTML format.

Application Evaluation Report

Your application uses technologies provided by these IBM platforms:

Product Edition	IBM Bluemix	WebSphere Application Server 8.5.5 Liberty Core	WebSphere Application Server 8.5.5	WebSphere Application Server 8.5.5	WebSphere Application Server Network Deployment 8.5.5	WebSphere Application Server Network Deployment 8.5.5	WebSphere Application Server for z/OS 8.5.5	WebSphere Application Server for z/OS 8.5.5
Profile	Liberty for Java	Liberty profile	Liberty profile	Full profile	Liberty profile	Full profile	Liberty profile	Full profile
Web application technologies								
Java Servlet	✓	✓	✓	✓	✓	✓	✓	✓
JavaServer Pages/Expression Language (JSP/EL)	✓	✓	✓	✓	✓	✓	✓	✓
Enterprise application technologies								
Java Transaction API (JTA)	✓	✓	✓	✓	✓	✓	✓	✓
Java EE-related specifications in Java SE								
Java API for XML Processing (JAXP)	✓	✓	✓	✓	✓	✓	✓	✓
Java Database Connectivity (JDBC)	✓	✓	✓	✓	✓	✓	✓	✓
Java Management Extensions (JMX)	✓	✓	✓	✓	✓	✓	✓	✓

This report was generated on 9/22/15 9:37 PM for the following modules:
C:\Users\IBM_ADMIN\Desktop\Java Play\Migration\MigrationScenario1-master\forum.war

- Next, Run a detailed analysis report. Result highlights potential issue as you move to the cloud. The source files, line numbers, and reference materials are included for handling problems.

- Go to wamt directory. Type in `java -jar binaryAppScanner.jar <directory containing the forum.war file> --analyzeMigrationDetails --targetAppServer=bluemix`

```
C:\Users\IBM_ADMIN\Desktop\Java Play\Migration\wamt>java -jar binaryAppScanner.jar ..\MigrationScenario1-master\forum.war --analyzeMigrationDetails --targetAppServer=bluemix
Scanning files.....
The report was saved to the following file: C:\Users\IBM_ADMIN\Desktop\Java Play\Migration\wamt\AnalysisReport.html
```

- Analyze results to choose your deployment topology / strategy.



AnalysisReport.html

The tech preview of the binary scanner provides important analysis information about the Forum application.

1. The high level analysis, Application Evaluation Report indicates which technology stack making up Forum application can be supported by the target environment, Liberty for Java in our case.

2. Java EE related specifications in Java SE section indicates that Forum application uses JDBC which can be supported by Liberty for Java target environment; however, a database in cloud is a service that must be connected via a binding process, which differs from on-premises application.
3. The detailed analysis report provides even more information. This report may be a little scary when you first look at it. Fortunately, most of areas flagged are from the local Derby database we used with Tomcat, and don't apply when we move to the cloud. You can easily see the rules that are flagged from Derby files by looking at the File name detail.

Avoid writing to the local file system [Help](#)

File name	Reference details	Match criteria	Line number
C:/Users/IBM_ADMIN/Desktop/Java Play/Migration/wamt/..Migration Scenario1-master/forum.war/WEB-INF/lib/derby.jar/org/apache/derby/impl/services/io/FileUtil.class	Method copyFile, 16 occurrences	java.io.FileOutputStream	
C:/Users/IBM_ADMIN/Desktop/Java Play/Migration/wamt/..MigrationScenario1-master/forum.war/WEB-INF/lib/derby.jar/org/apache/derby/impl/io/DirFile.class	Method getExclusiveFileLock	java.io.RandomAccessFile.writeInt(*)	
C:/Users/IBM_ADMIN/Desktop/Java Play/Migration/wamt/..MigrationScenario1-master/forum.war/WEB-INF/lib/derby.jar/org/apache/derby/impl/io/DirStorageFactory.class	Method getOutputStream, 2 occurrences Method sync, 2 occurrences	java.io.FileOutputStream	
C:/Users/IBM_ADMIN/Desktop/Java Play/Migration/wamt/..MigrationScenario1-master/forum.war/WEB-INF/lib/derby.jar/org/apache/derby/impl/load/ExportWriteData.class	Method openFiles, 6 occurrences	java.io.FileOutputStream	
C:/Users/IBM_ADMIN/Desktop/Java Play/Migration/wamt/..MigrationScenario1-master/forum.war/WEB-INF/lib/derby.jar/org/apache/derby/impl/services/monitor/StorageFactoryService\$7.class	Method run, 5 occurrences	java.io.FileOutputStream	
C:/Users/IBM_ADMIN/Desktop/Java Play/Migration/wamt/..MigrationScenario1-master/forum.war/WEB-INF/lib/derby.jar/org/apache/derby/impl/services/reflect/DatabaseClasses\$1.class	Class signature	java.io.FileOutputStream	
C:/Users/IBM_ADMIN/Desktop/Java Play/Migration/wamt/..MigrationScenario1-master/forum.war/WEB-INF/lib/derby.jar/org/apache/derby/impl/services/reflect/DatabaseClasses.class	Method run - Method return type Method WriteClassFile, 4 occurrences	java.io.FileOutputStream	
C:/Users/IBM_ADMIN/Desktop/Java Play/Migration/wamt/..MigrationScenario1-master/forum.war/WEB-INF/lib/derby.jar/org/apache/derby/impl/services/stream/RollingFileStream\$2.class	Class signature	java.io.FileOutputStream	
C:/Users/IBM_ADMIN/Desktop/Java Play/Migration/wamt/..MigrationScenario1-master/forum.war/WEB-INF/lib/derby.jar/org/apache/derby/impl/services/stream/RollingFileStream.class	Method run - Method return type Field lockStream	java.io.FileOutputStream	
C:/Users/IBM_ADMIN/Desktop/Java Play/Migration/wamt/..MigrationScenario1-master/forum.war/WEB-INF/lib/derby.jar/org/apache/derby/impl/services/stream/RollingFileStream.class	Method close, 3 occurrences Method open Method openFile - Method return type Method openFiles, 4 occurrences	java.io.FileOutputStream	
C:/Users/IBM_ADMIN/Desktop/Java Play/Migration/wamt/..MigrationScenario1-master/forum.war/WEB-	Method PMakeFileHPW, 4 occurrences	java.io.FileOutputStream	

- Once we eliminate the issues associated with Derby, we need to pay attention to Capture log information, Stopping Liberty Server, and Use SQL Database Service.

Detailed Results by Rule

- [Avoid creating new process instances](#)
- [Avoid writing to the local file system](#)
- [Behavior change in month name formatting for some languages](#)
- [Behavior change in most Collection.removeAll and Collection retainAll implementations](#)
- [Behavior change in rounding in NumberFormat and DecimalFormat format methods](#)
- [Capture log information](#)
- [Check for a behavior change for File setReadOnly, setWritable and canWrite methods](#)
- [Check for a behavior change for an empty TreeSet add and TreeMap put methods](#)
- [Check for a behavior change on Locale getDefault method](#)
- [Check for new methods on JDBC interfaces](#)
- [MBean and MXBean interfaces must be public](#)
- [OSGi bundles might need explicit package imports](#)
- [Review differences in WebSphere MBeans](#)
- [Stopping the Liberty server](#)
- [The use of java.sql.Driver and java.sql.DriverManager interfaces requires configuration](#)
- [Use SQL Database service](#)

5. Capture log information link indicates there is an important aspect to consider. Refer to Capture log information under Rules Help. “Applications can log to System.err / System.out so that Cloud Foundry’s Loggregator component picks up the log entries. Using Loggregator, you can tail application logs and dump a recent set of application logs.” In Forum application, it uses a standard Java logging facility and also logs to System.out. So it will be automatically picked up by the Loggregator.

Capture log information

Cloud Foundry application logs that are written to the local file system are not persisted. Because the file system is ephemeral, log files are deleted every time the application is restarted or updated.

Applications can log to System.err/System.out so that Cloud Foundry’s Loggregator component picks up the log entries. Using Loggregator, you can tail application logs and dump a recent set of application logs.

Additionally, in IBM Bluemix, applications that use the Monitoring and Analytics add-on have their log, trace, System.err, System.out, FFDC, and HTTP access log entries captured and forwarded to the Monitoring and Analytics server.

6. For the database, the recommendation is to use SQL Database service in Bluemix, which we will do in this lab.

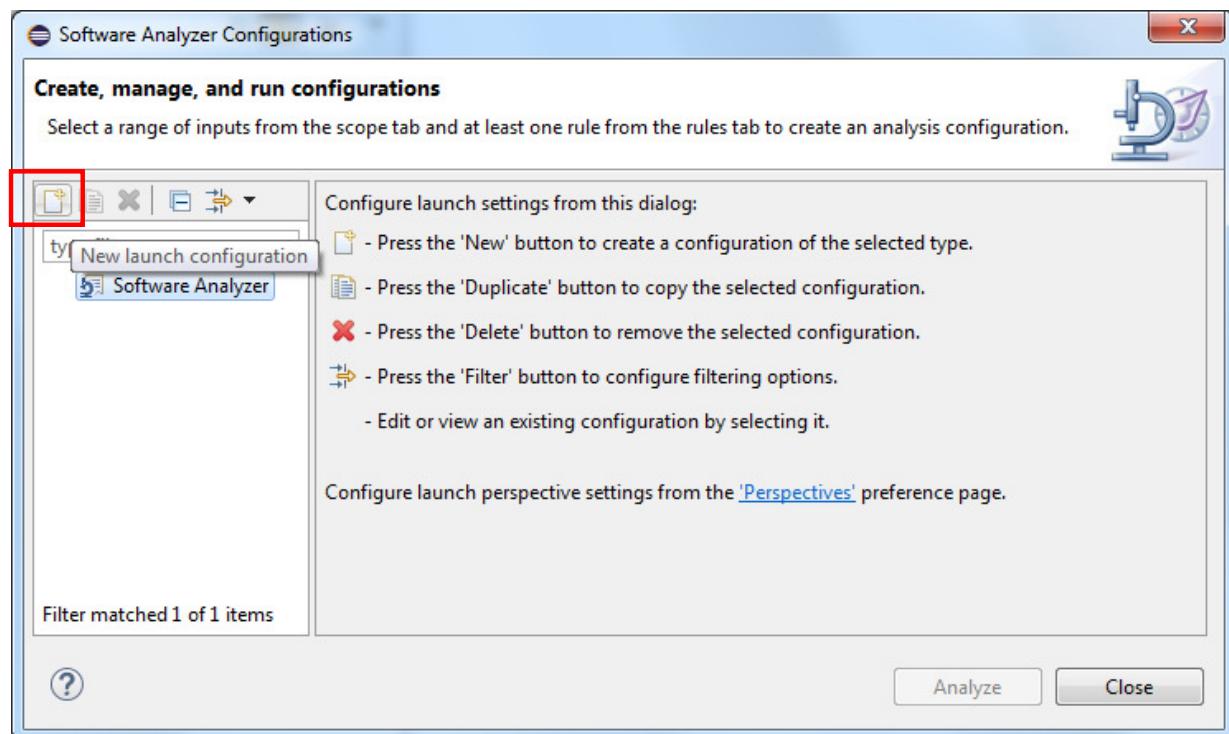
Use Migration Toolkit for Competitive Migration

Migration Toolkit for Competitive Migration is provided by IBM to assist migrations from third party application servers to WebSphere Application Server, Liberty, and Bluemix. The Migration Toolkit accelerates migrations, making them quick and cost efficient.

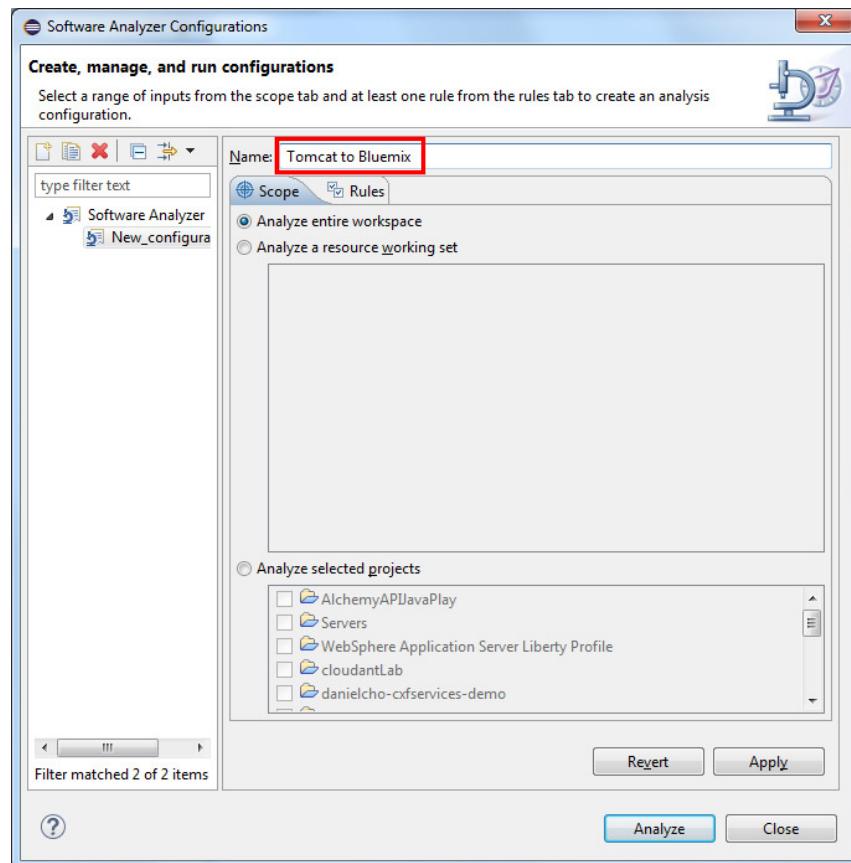
The Migration Toolkit scans applications and reports any potential migration problems. The tool has contextual help that explains the finding and provides suggestions on how to fix it. For some cases, quick fixes exist that can apply changes to the code on your behalf.

- ❑ Navigate back to Eclipse.
- ❑ Open Java EE perspective.
- ❑ Right click on forum Eclipse project.
- ❑ Select Software Analyzer >> Software Analyzer Configurations.

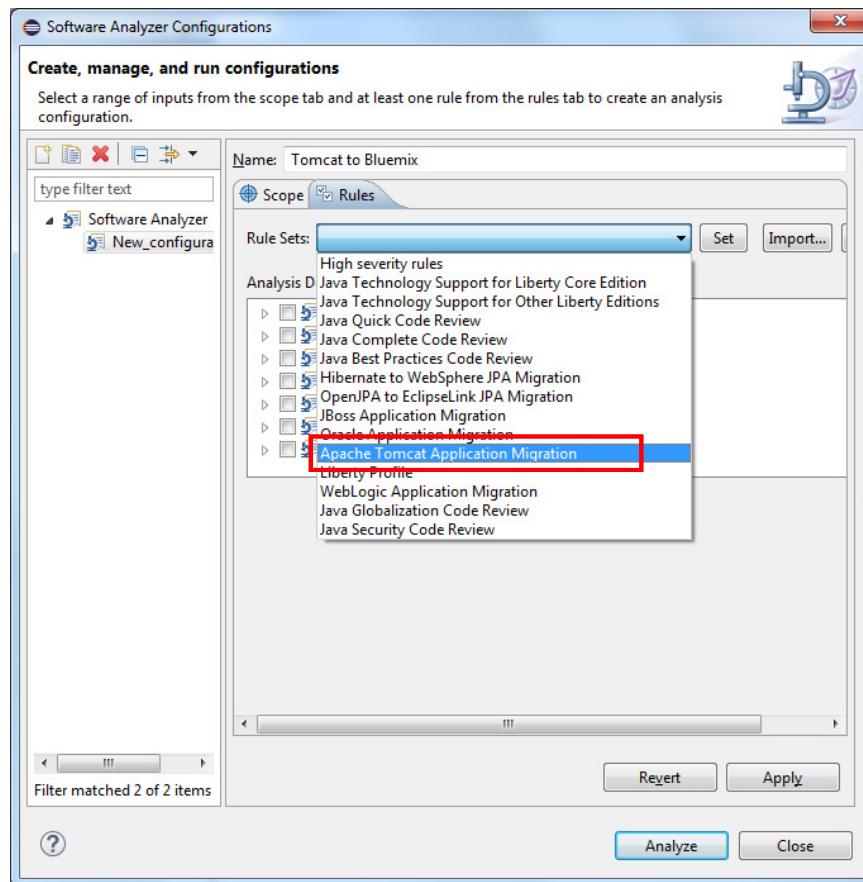
- Click Software Analyzer. >> Click New Launch Configuration icon.



- Enter a name for the configuration. E.g. Tomcat to Bluemix.

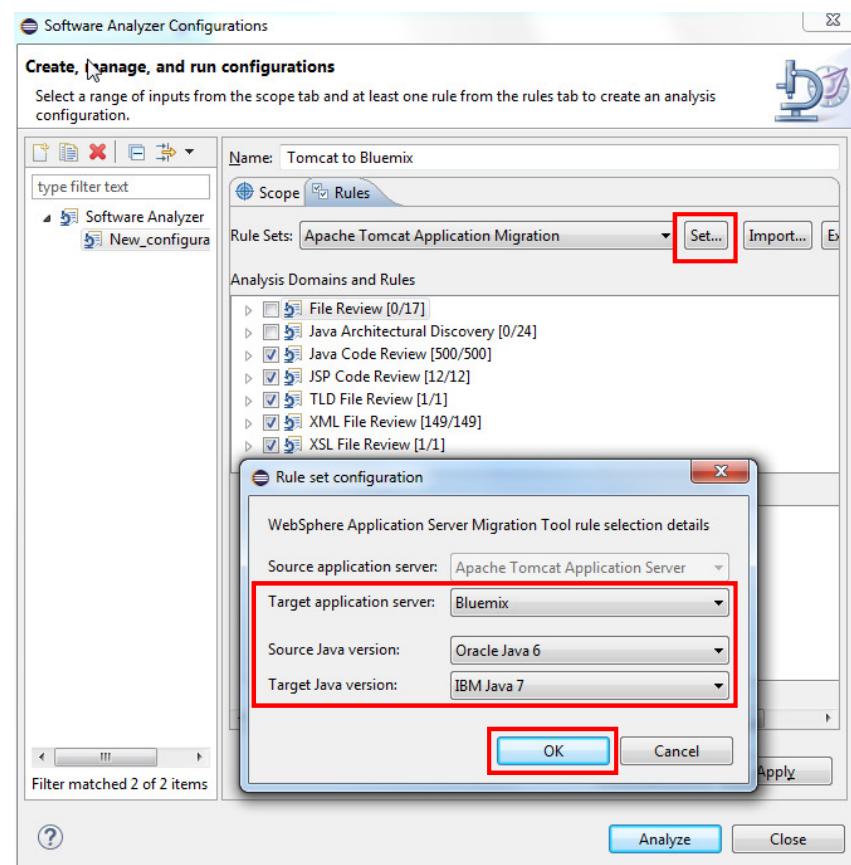


- ❑ Click on the Rules tab.
- ❑ Click Rule Sets drop down menu. >> Select Apache Tomcat Application Migration.

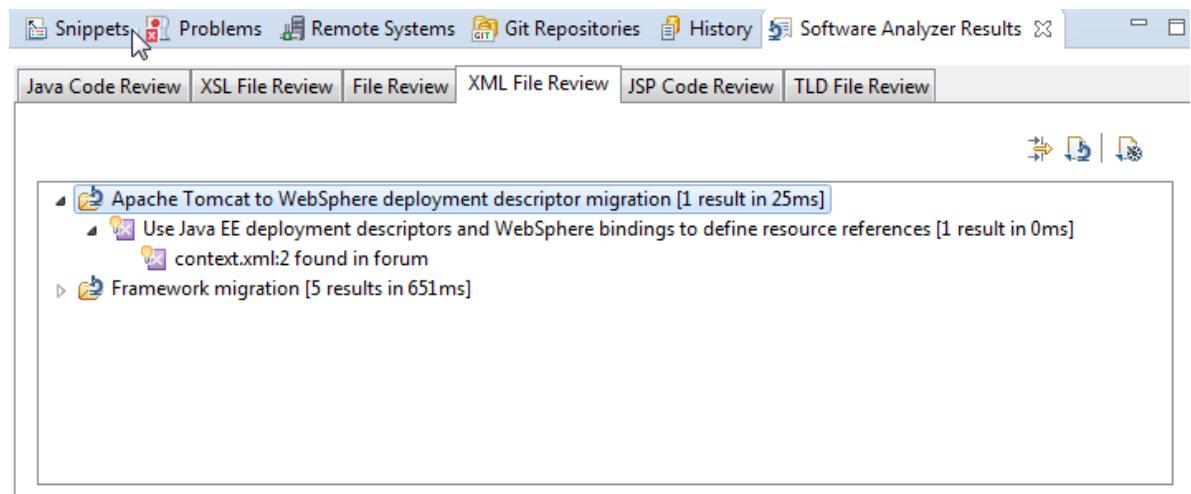
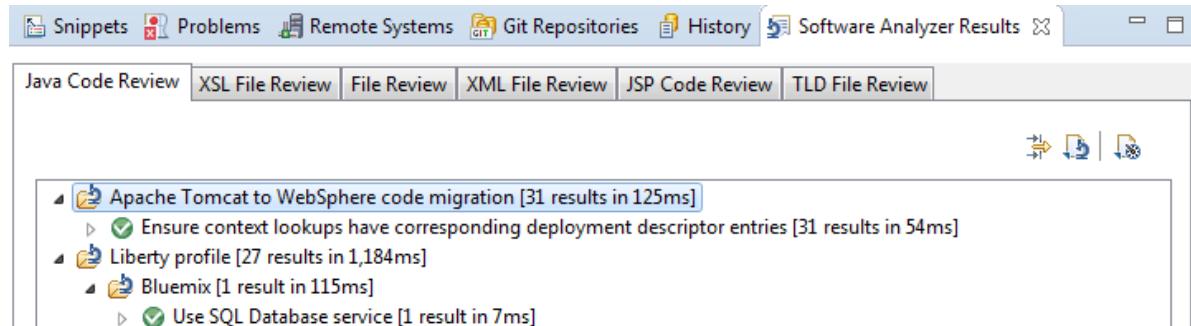


Java Plays : Migration Lab 1 from Tomcat to Bluemix

- ❑ Click Set.
- ❑ In the Rule set configuration, set Target Application server to Bluemix, Source Java version to Oracle Java 6, and Target Java version to IBM Java 7 >> Click OK.



- Click Analyze to start scanning the code and display the results in the Software Analyzer Result view.



- ❑ The results of analysis report indicates no problems in JSP, XSL or TLD files but shows 31 results in Java code review and 1 result in XML code review.
- ❑ Let's take some examples.

1. Click on Java Code Review.

The screenshot shows the 'Software Analyzer Results' interface. The top navigation bar includes 'Remote Systems', 'Git Repositories', 'History', 'Software Analyzer Results', 'Java Code Review' (which is highlighted with a red box), 'XSL File Review', 'File Review', 'XML File Review', 'JSP Code Review', and 'TLD File Review'. The main content area displays a hierarchical list of code review findings:

- Apache Tomcat to WebSphere code migration [31 results in 125ms]
 - Ensure context lookups have corresponding deployment descriptor entries [31 results in 54ms] (this item is also highlighted with a red box)
- Liberty profile [27 results in 1,164ms]
 - Bluemix [1 result in 115ms]
 - Bluemix and Cloud Foundry [20 results in 311ms]
 - Java technology support [6 results in 758ms]

This rule flags that there are 31 occurrences in source code where DB is referenced via JNDI call. Consequently, there should be a resource entry in Web deployment descriptor, web.xml.

This rule flags that there are 31 occurrences in source code where DB is referenced via JNDI call. Consequently, there should be a resource entry in Web deployment descriptor, web.xml.

We see the following entries; therefore, we can safely ignore the findings.

```
<resource-ref>
  <res-ref-name>jdbc/easy</res-ref-name>
  <res-type>javax.sql.DataSource</res-type>
  <res-auth>Container</res-auth>
  <res-sharing-scope>Shareable</res-sharing-scope>
</resource-ref>
```

2. Click Liberty Profile >> Click Bluemix. It suggests Use SQL Database service.

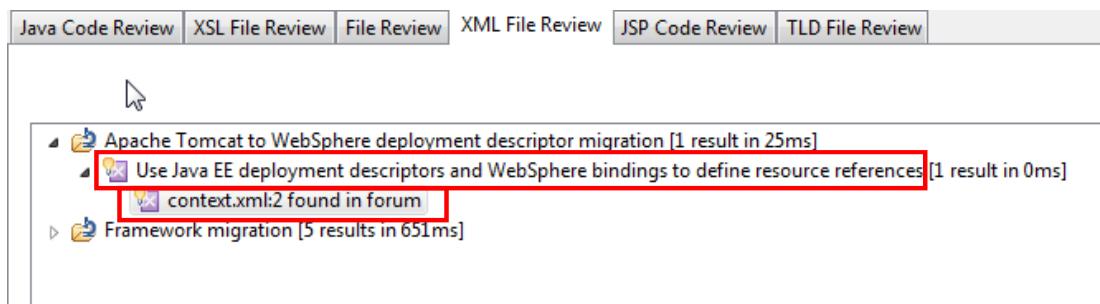
The screenshot shows a navigation bar with tabs: Java Code Review, XSL File Review, File Review, XML File Review, JSP Code Review, and TLD File Review. Below this is a tree view of migration results. The 'Apache Tomcat to WebSphere code migration' section has three items: 'Ensure context lookups have corresponding deployment descriptor entries' (31 results in 54ms), 'Liberty profile' (27 results in 1,184ms), and 'Bluemix' (1 result in 115ms). The 'Bluemix' item is highlighted with a red box. Under 'Bluemix', there is one item: 'Use SQL Database service' (1 result in 7ms). Other sections include 'Bluemix and Cloud Foundry' (20 results in 311ms) and 'Java technology support' (6 results in 758ms).

- Java Code Review
- XSL File Review
- File Review
- XML File Review
- JSP Code Review
- TLD File Review

- Apache Tomcat to WebSphere code migration [31 results in 125ms]
 - Ensure context lookups have corresponding deployment descriptor entries [31 results in 54ms]
 - Liberty profile [27 results in 1,184ms]**
 - Bluemix [1 result in 115ms]**
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 - Bluemix and Cloud Foundry [20 results in 311ms]
 - Java technology support [6 results in 758ms]

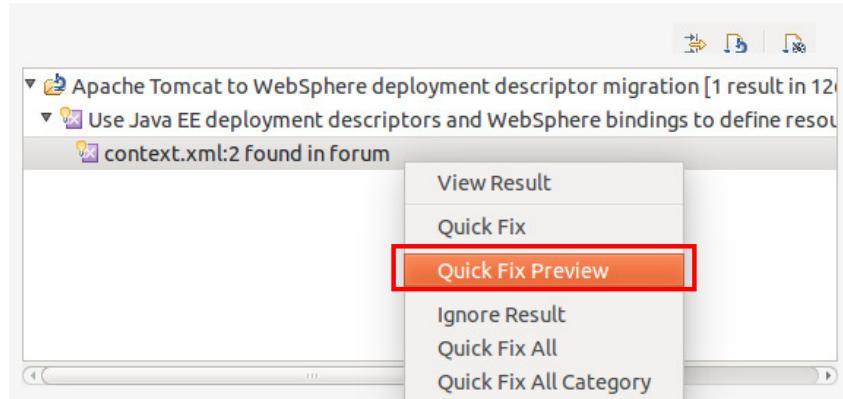
3. Click XML File Review. Notice the recommendation is to Use Java EE deployment descriptors and WebSphere bindings to define resources.

It indicates that DB related resource captured in META-INF/context.html should be migrated to web.xml and WebSphere bindings.

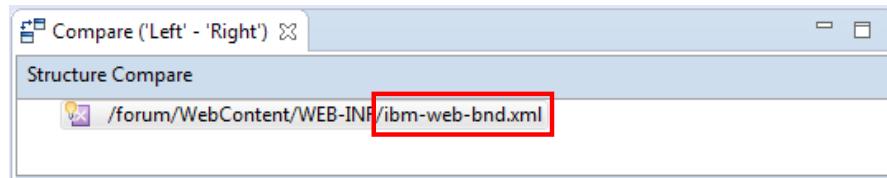


Notice icon next to the recommendation. This means a quick fix exists for this finding and Eclipse can make that change for you.

Right Click the recommendation and choose Quick Fix Preview.



Quick Fix Preview shows to make changes in web.xml and ibm-web-bnd.xml.



4. Right click on recommendations to allow the toolkit to make changes. Quick Fix All.

- Remove libraries at WEB-INF\lib.

Now, we prepared the Forum Application for Migration to Bluemix. In the next section, we are going to deploy and configure a DB service instance, and start the Forum Application in Cloud.

Lab Exercise 3: Migrate the Forum Application to Bluemix

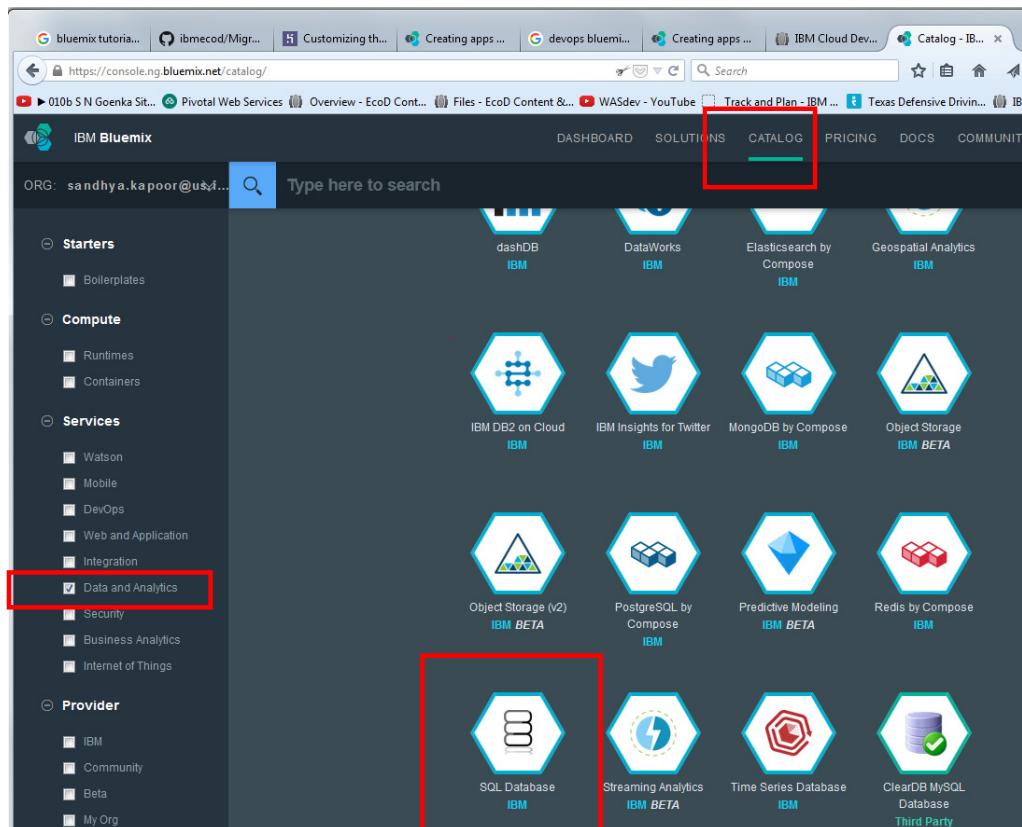
In this section, you will use Eclipse IBM Bluemix tool built on Cloud Foundry API to deploy the Forum application to Bluemix.

Create SQL Database Service

We will create a service instance of SQL Database based on the software analyzer recommendation in the previous section. SQL Database as a Service in Bluemix is an on demand relational database, powered by DB2. We will need to provide initial setup for Forum application to use.

- Login to Bluemix. <https://bluemix.net>

- ❑ Click Catalog at the top menu.
- ❑ Select Data and Analytics on the left navigation panel.
- ❑ Click SQL Database.



- SQL Database service initial setup panel opens. Name the DB, ForumDB.

- Click Create.

The screenshot shows the 'Add Service' interface. It includes fields for 'Space' (set to 'dev'), 'App' (set to 'Leave unbound'), 'Service name' (containing 'ForumDB' with a red box around it), and 'Selected Plan' (set to 'Free Beta'). At the bottom is a large green 'CREATE' button, also with a red box around it.

- After the service instance is created, click Launch to open SQL Database web console.

- Click Work with Tables.

Welcome to the SQL Database console

Choose a topic below to get started.



- Click + sign to add a database and table.

A screenshot of the 'Work with Tables' section of the SQL Database console. At the top, there's a navigation bar with tabs for 'Getting Started' and 'Work with Tables'. The 'Work with Tables' tab is active. Below the tabs, it says 'Create, drop, and work with tables' and 'For existing tables, you can view details, browse data, and export data.' On the left, there's a table list with columns 'Schema' and 'Table Name', and a '+' sign icon. A red box highlights the '+' sign icon. To the right, there's a section for creating a new table: 'Select an Excel file or a CSV file to define the table.' with a 'Browse' button, and a text area for 'Edit the DDL statements. Use the semicolon character ; as the statement terminator.' containing the following DDL statement:

```
CREATE TABLE MYTABLE
(
    COL1 INT,
    COL2 VARCHAR(5)
);
```

- Copy the below SQL statements. >> Paste them into the text area.

```
CREATE TABLE BOXES ( "BOX_NAME" VARCHAR(100) , "SORT_DESC" VARCHAR(100) , "BOX_ID" INTEGER , "MEMBER_ID" INTEGER );
```

```
CREATE TABLE LEVELS ("GRADE" VARCHAR(100) , "MIN_POST" INTEGER , "MAX_POST" INTEGER , "DESCRIPTION" VARCHAR(100) );
```

```
CREATE TABLE MEMBERS ("MEMBER_ID" BIGINT NOT NULL , "USERNAME" VARCHAR(100) NOT NULL , "PASSWORD" VARCHAR(100) NOT NULL , "FIRSTNAME" VARCHAR(100) NOT NULL , "LASTNAME" VARCHAR(100) NOT NULL , "EMAIL" VARCHAR(100) NOT NULL , "REGDATE" VARCHAR(100) NOT NULL , "TYPE" VARCHAR(100) NOT NULL );
```

```
CREATE TABLE "THREADS" ("THREAD_ID" BIGINT NOT NULL , "BOX_ID" BIGINT NOT NULL , "PARENT_ID" BIGINT NOT NULL , "MEMBER_ID" BIGINT NOT NULL , "SUBJECT" VARCHAR(100) NOT NULL , "POST_TEXT" VARCHAR(1000) NOT NULL , "POST_DATE" BIGINT NOT NULL );
```

```
INSERT INTO MEMBERS VALUES(1,'admin','admin','Forum','Admin','fxavier@br.ibm.com','Fri May 07 10:44:38 ICT 2010','Administrator');
```

```
INSERT INTO MEMBERS VALUES (2,'mod','mod','Forum','Moderator','dt@test.com','Fri May 07 10:44:38 ICT 2010','Moderator');
```

```
INSERT INTO MEMBERS VALUES (3,'member','member','Forum','Member','dt@test.com','Fri May 07 10:44:38 ICT 2010','Member');
```

- Click Run DDL.

Edit the DDL statements. Use the semicolon character ; as the statement terminator.

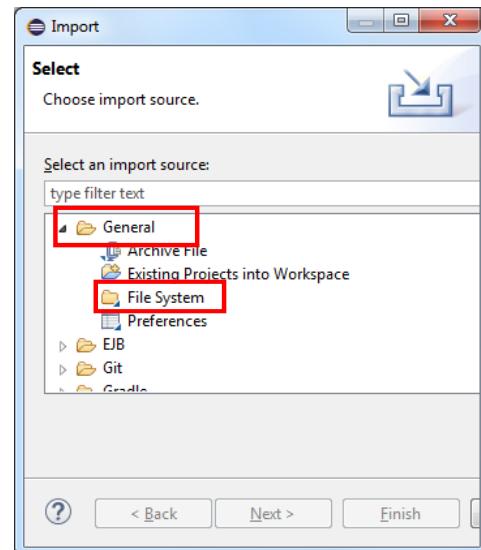
```
CREATE TABLE BOXES ( "BOX_NAME" VARCHAR(100) , "SORT_DESC" VARCHAR(100) , "BOX_ID" INTEGER , "MEMBER_ID" INTEGER );  
  
CREATE TABLE LEVELS ("GRADE" VARCHAR(100) , "MIN_POST" INTEGER , "MAX_POST" INTEGER , "DESCRIPTION" VARCHAR(100) );  
  
CREATE TABLE MEMBERS ("MEMBER_ID" BIGINT NOT NULL , "USERNAME" VARCHAR(100) NOT NULL , "PASSWORD" VARCHAR(100) NOT NULL  
, "FIRSTNAME" VARCHAR(100) NOT NULL , "LASTNAME" VARCHAR(100) NOT NULL , "EMAIL" VARCHAR(100) NOT NULL , "REGDATE" VARCHAR(100)  
NOT NULL , "TYPE" VARCHAR(100) NOT NULL );  
  
CREATE TABLE "THREADS" ("THREAD_ID" BIGINT NOT NULL , "BOX_ID" BIGINT NOT NULL , "PARENT_ID" BIGINT NOT NULL , "MEMBER_ID"  
BIGINT NOT NULL , "SUBJECT" VARCHAR(100) NOT NULL , "POST_TEXT" VARCHAR(1000) NOT NULL , "POST_DATE" BIGINT NOT NULL );  
  
INSERT INTO MEMBERS VALUES(1,'admin','admin','Forum','Admin','fxavier@br.ibm.com','Fri May 07 10:44:38 ICT  
2010','Administrator');  
INSERT INTO MEMBERS VALUES (2,'mod','mod','Forum','Moderator','dt@test.com','Fri May 07 10:44:38 ICT 2010','Moderator');  
INSERT INTO MEMBERS VALUES (3,'member','member','Forum','Member','dt@test.com','Fri May 07 10:44:38 ICT 2010','Member');
```

Run DDL

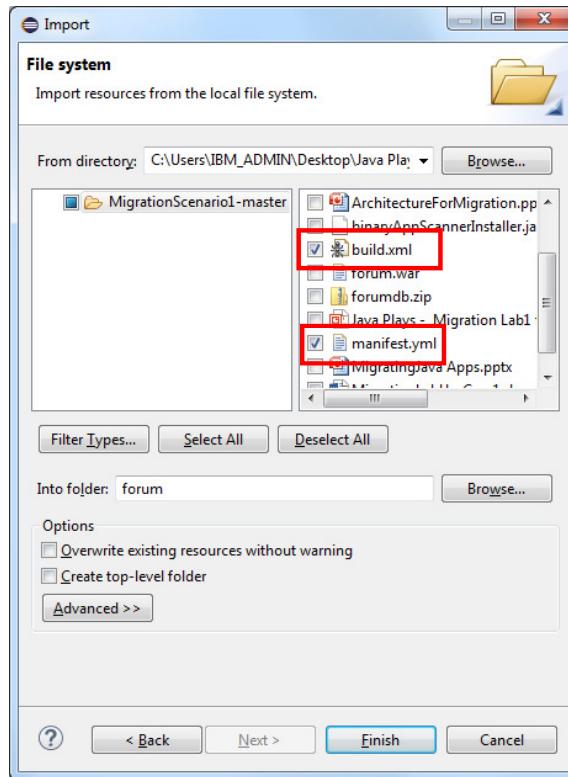
Configure Forum Application for Bluemix

The next step is to prepare Forum Application for Bluemix deploy.

- ❑ Go to Eclipse. >> Locate forum project.
- ❑ Right Click on the project. >> Import.
- ❑ Click General >> File System.

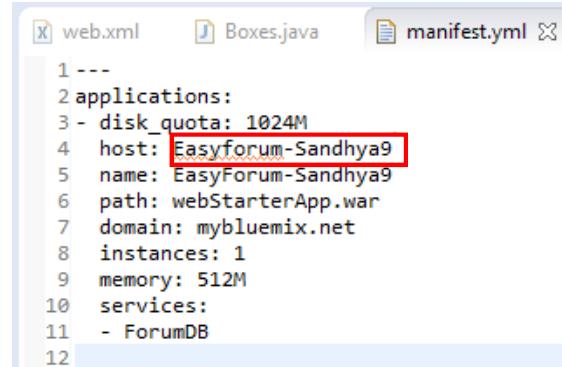


- ❑ Click Browse next to From Directory.
- ❑ Go to <APP_DIR> where you unzipped the lab material.
- ❑ Select build.xml and manifest.yml.
- ❑ Click Finish.



- ❑ Open manifest.yml file. It is a configuration file to instruct Bluemix how to deploy.

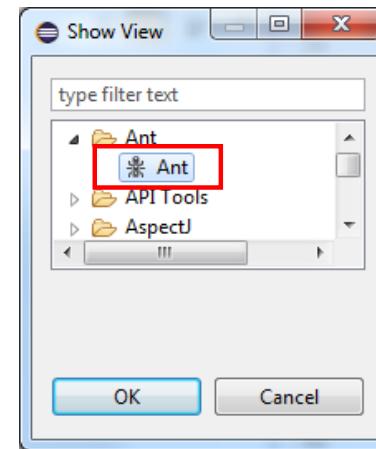
Give a unique name to host. e.g. easyForum-your initial



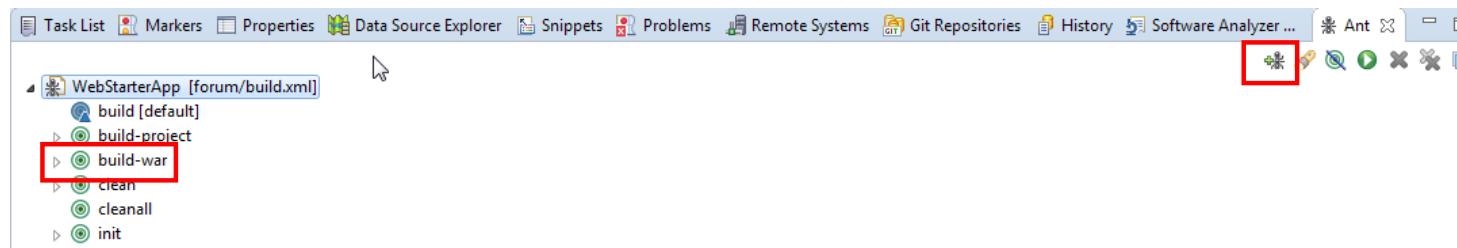
```
1 ---
2 applications:
3 - disk_quota: 1024M
4 host: Easyforum-Sandhya9
5 name: EasyForum-Sandhya9
6 path: webStarterApp.war
7 domain: mybluemix.net
8 instances: 1
9 memory: 512M
10 services:
11 - ForumDB
12
```

- ❑ build.xml contains Ant script to create a WAR file from the source.

Go to Window >> Show View >> Select Ant view.



- Click add build icon and select build.xml from the forum project.



- Double click the build-war target. This will trigger building a WAR file.

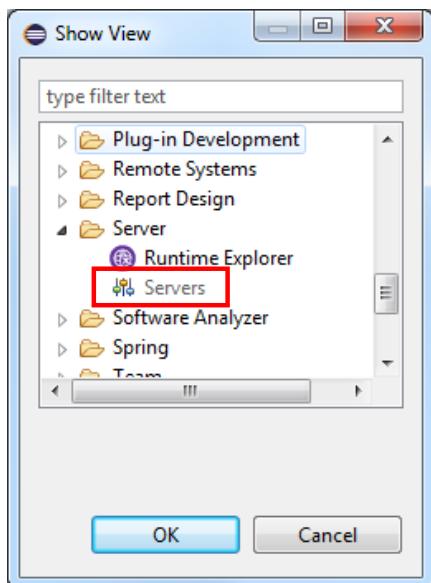
```
<terminated> forum build.xml [Ant Build] C:\Program Files\Java\jdk1.8.0_51\bin\javaw.exe (Sep 24, 2015, 12:06:35 AM)
Buildfile: C:\Users\IBM ADMIN\Desktop\SpringToolSuite\workspace\forum\build.xml
clean:
init:
[mkdir] Created dir: C:\Users\IBM_ADMIN\Desktop\SpringToolSuite\workspace\forum\bin
build-project:
[echo] WebStarterApp: C:\Users\IBM_ADMIN\Desktop\SpringToolSuite\workspace\forum\build.xml
[javac] Compiling 3 source files to C:\Users\IBM_ADMIN\Desktop\SpringToolSuite\workspace\forum\bin
[javac] warning: [options] bootstrap class path not set in conjunction with -source 1.5
[javac] warning: [options] source value 1.5 is obsolete and will be removed in a future release
[javac] warning: [options] target value 1.5 is obsolete and will be removed in a future release
[javac] warning: [options] To suppress warnings about obsolete options, use -Xlint:-options.
[javac] Note: Some input files use unchecked or unsafe operations.
[javac] Note: Recompile with -Xlint:unchecked for details.
[javac] 4 warnings
build-war:
[war] Building war: C:\Users\IBM_ADMIN\Desktop\SpringToolSuite\workspace\forum\webStarterApp.war
BUILD SUCCESSFUL
Total time: 10 seconds
```

- ❑ Right click on forum project in Eclipse. >> Refresh.

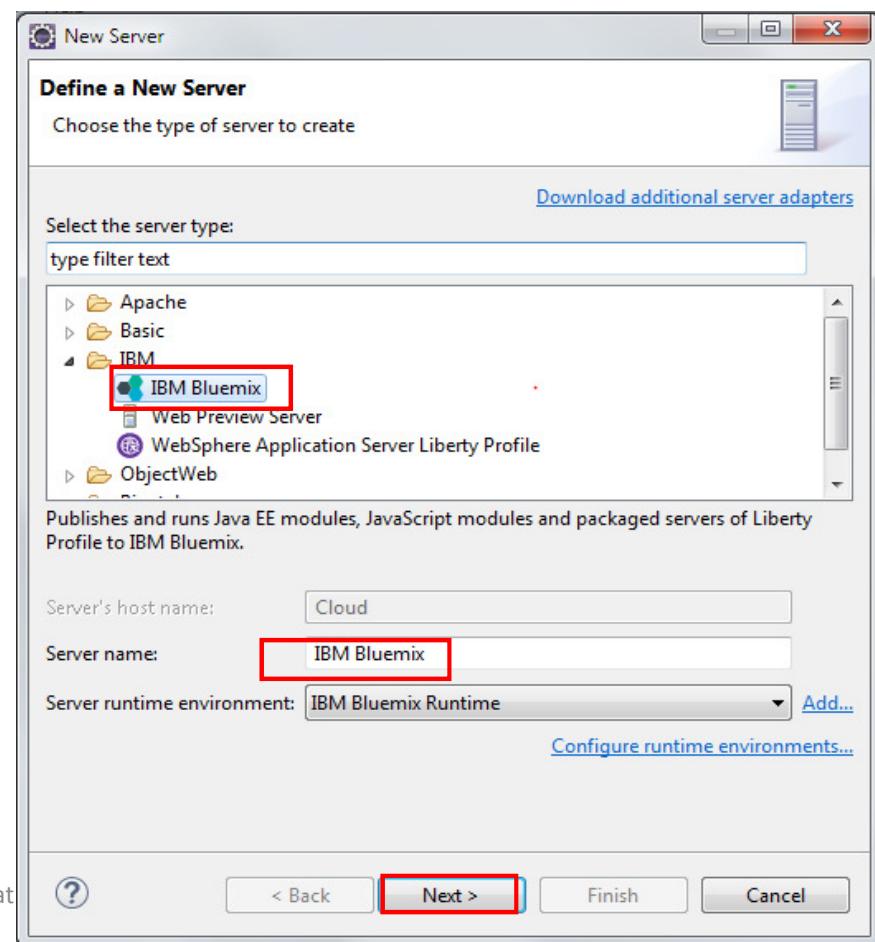
Verify if webStartApp.war is created.

Deploy Forum Project to Bluemix

- ❑ Go to Window. >> Show View. >> Select Servers.

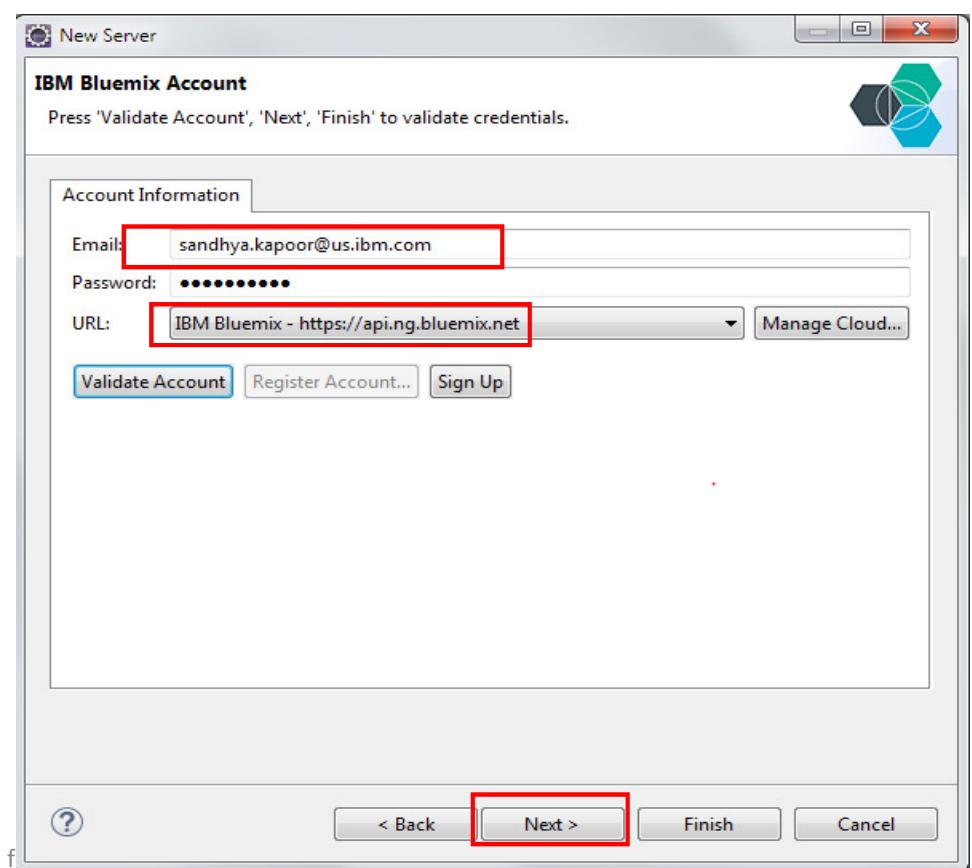


- ❑ Right click on Server view. >> New >> Server.
- ❑ Choose IBM Bluemix for runtime and give Server Name, IBM Bluemix.
- ❑ Click Next.

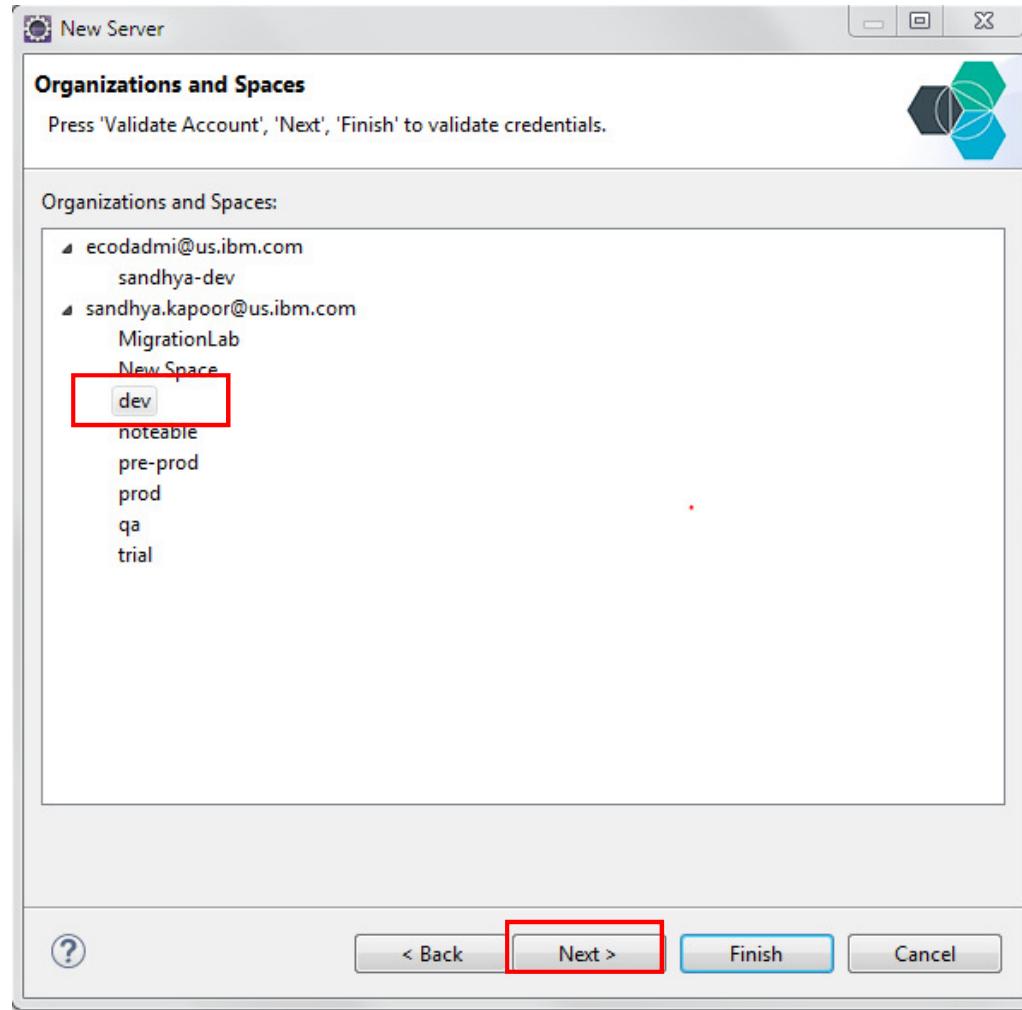


Java Plays : Migration Lab 1 from Tomcat

- Enter your email account id and password used for Bluemix log in.
- Select URL, where you want to deploy forum application to.
- Click Next. It should validate your account at this point.

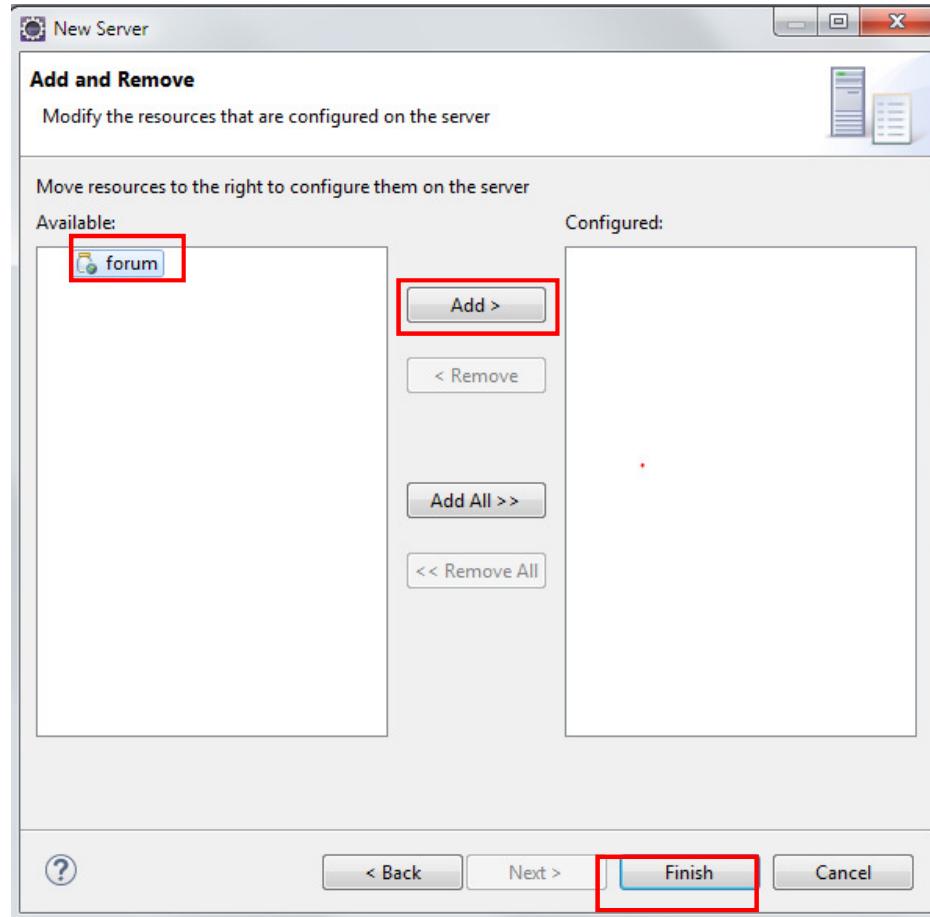


- Select the space where you created **ForumDB** database, in my case I am selecting **dev**.



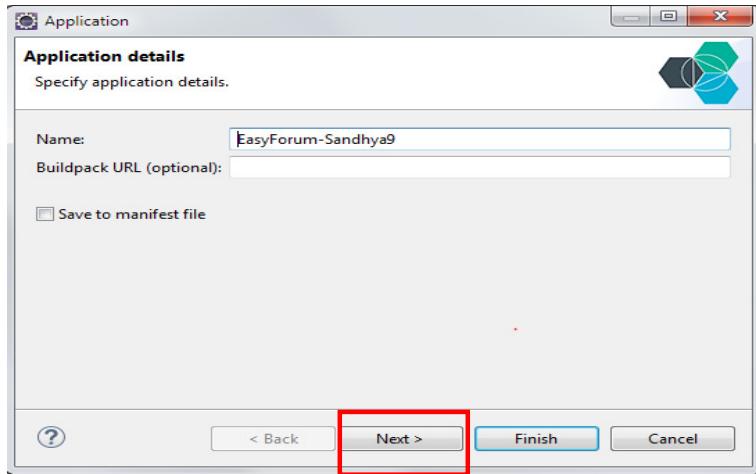
- Click Next.

- Select forum project from the Available list. >> Click Add.

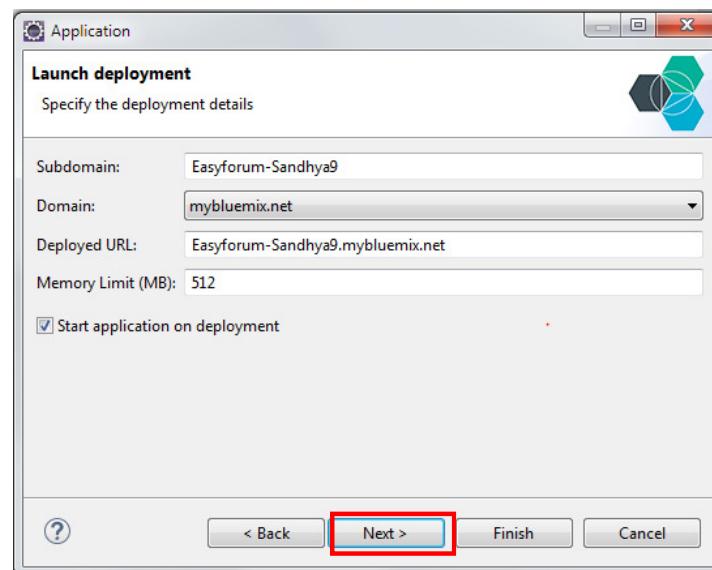


- Click Finish.

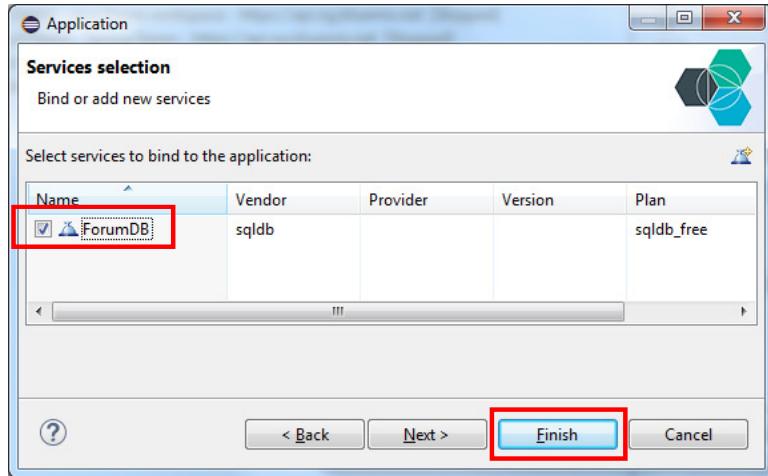
- Right click on IBM Bluemix server in Servers view. >> Click Publish.



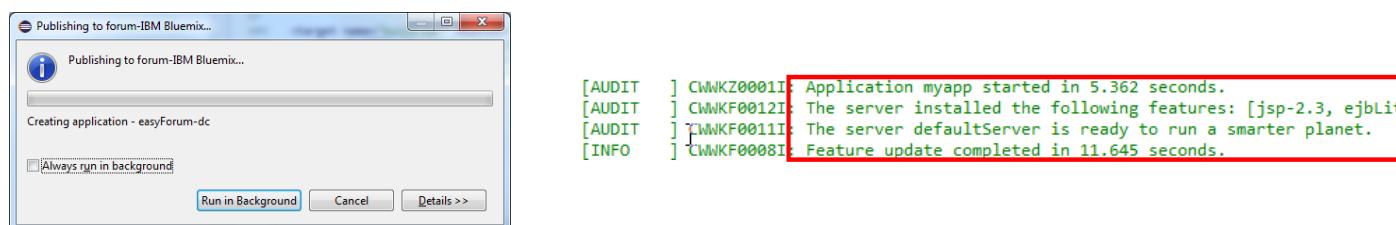
- Click Next. >> Click Next.



- Select ForumDB for binding the DB service to forum application.



- Click Finish. This will push forum application to Bluemix.



Forum application is deployed to Bluemix at this point and ready for test.

Test Forum Application on Bluemix

- Go to Bluemix Dashboard. >> Go to **dev** space. >> Click on the URL next to **JSPForum-Sandhya**.

The screenshot shows the Bluemix Dashboard interface. On the left, a sidebar lists spaces: 'Create a Space' (with '+ Create a Space' button), 'dev' (selected and highlighted with a red box), 'CF APPS (4)', 'SERVICES (29)', 'CONTAINERS (1)', 'VIRTUAL MACHINES (0)', 'MigrationLab', 'New Space', 'noteable', 'pre-prod', 'prod', 'qa', and 'trial'. The main area displays four cards: 'Cloud Foundry Apps' (2.625 GB/3 GB Used), 'Containers' (512 MB/2 GB | 1/2 Public IPs), 'Virtual Machines' (0 B/0 B | 0/0 Public IPs), and 'Services & APIs' (36/40 Used). Below these are sections for 'Applications' and 'Services'. The 'Applications' section shows five applications: 'IndiaT3JavaApp' (Running), 'javaplays-restjava-basic' (Running), 'javaplays-restjava-mobile...' (Running), 'JSPForum-Sandhya' (highlighted with a red box), and another application whose name is partially visible. The 'Services' section shows six services: 'Application Server on Clo...' (Application Server on Cloud), 'books' (SQL Database), 'CloudAMQP-r3' (CloudAMQP), 'Concept Expansion-1x' (Concept Expansion), 'elephantsqlspring' (ElephantSQL), and 'ForumDB' (SQL Database).

- ❑ Initially you will see 404 resource not found error since the URL is mapped to index.html which may have been registered through web.xml. Forum project does not have one.
- ❑ Add /forum root context to the URL.

The screenshot shows a web browser displaying the 'Easy JSP Forum' website. The URL 'jspforum-sandhya.mybluemix.net/forum/' is highlighted with a red box. The page title is 'Easy JSP Forum'. The navigation bar includes links for Home, Members, Forums, Profile, and Logout. A banner image shows people paragliding. The main content area displays a forum topic titled 'Java Plays' with 2 posts, moderated by admin, with a description about creating applications using Liberty for Java runtime. The footer contains copyright information.

- ❑ Enter admin for User name. >> Enter admin for Password. >> Click Login.
- ❑ Create forum and threads to test out the application running in IBM Bluemix.

The screenshot shows a web browser displaying the 'Easy JSP Forum' website. The URL in the address bar is `jspforum-sandhya.mybluemix.net/forum/index.jsp?page=thread&threadid=1540`. The page title is 'Easy JSP Forum'. The header includes a logo, a search bar, and navigation links for Home, Profile, and Logout. A banner image at the top right shows two people paragliding over a landscape. The main content area displays a thread titled 'View Thread: Autowiring in Liberty buildpack versus Java buildpack'. The thread was posted by 'member' on 'Sun Sep 27 13:22:04 UTC 2015'. The post content is 'How many services in Bluemix can be autowired using Liberty buildpack'. Below this is a reply from 'admin' posted on 'Sun Sep 27 13:23:02 UTC 2015', stating '14 services in IBM Bluemix can be autowired by Liberty buildpack'. At the bottom of the page is a copyright notice: 'Copyright © by Dac-Thong Vu. All rights reserved'.

Summary

In this lab, you learned how to migrate on-premises application running on Apache Tomcat 7 server to Liberty for Java runtime in Bluemix after refactoring the application based on output from the Competitive Migration Toolkit. To learn more about the Migration Toolkit, please check the developerWorks article at
http://www.ibm.com/developerworks/websphere/library/techarticles/1404_vines1/1404_vines1.html

We discussed refactoring the Tomcat application to be Cloud ready and illustrated SQL Database service binding as a part of deployment to Bluemix.

This ends the Migration Lab 1 from Tomcat to Bluemix.

Thank you !