

# Running the Liberty Web Container in CICS

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**WebSphere**® software

**CICS V5.1**

Operational Efficiency and Service  
Agility with Cloud Enablement



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## Agenda

- Background
  - CICS Transaction Server V5.1
  - The WAS Liberty Profile
  - Liberty Profile on z/OS
- Liberty in CICS
  - Why?
  - How?
- Demo - deploy & run a Web app in CICS
- Summary and Q&A

## Announcing the new CICS TS V5.1 release

### Operational Efficiency

- *Greater capacity* - achieve cost savings through consolidation
- *Managed operations* - control critical resource thresholds with policies
- *Increased availability* - reduce the need for planned downtime
- *Deeper insight* - extend performance and compliance information



100+  
requirements  
satisfied!

### Service Agility

- *First-class applications* - create agile services from existing assets
- *First-class platforms* - create agile service delivery platforms
- *Modern interfaces* - build rich web experiences for critical applications
- *Foundational enhancements* - extend core capabilities

### ... with Cloud Enablement

Consistent with the IBM Cloud Computing strategy  
Positioning customers for the next transformational era in technology  
Moving towards a cloud oriented service delivery platform

## Increasing service agility - Modern interfaces

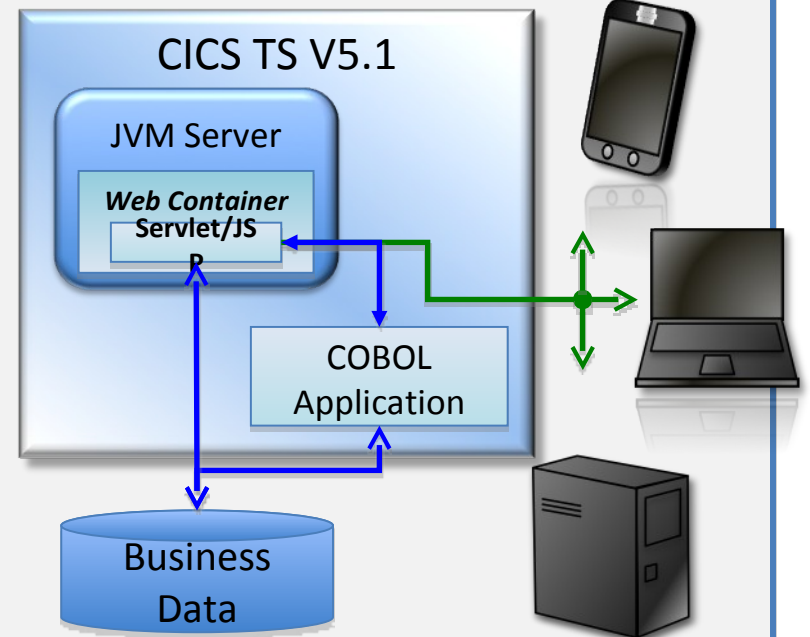


### *Build rich web experiences for critical applications*

#### *The web container enables...*

- A production-ready web container with CICS qualities of service
- Deployment of lightweight Java servlets and Java Server Pages (JSP)
- Improved performance through local access to CICS applications and data
- Rapid roll-out of interface updates through OSGi-packaged deployments
- Full integration with first-class applications and platforms
- Technology built on the WebSphere Application Server Liberty profile

*The best connector is no connector!*

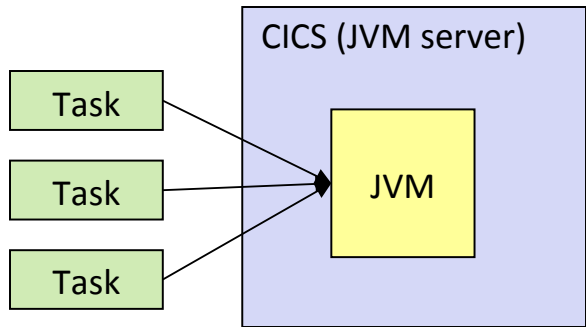


## CICS TS - Service & Upgrade Planning

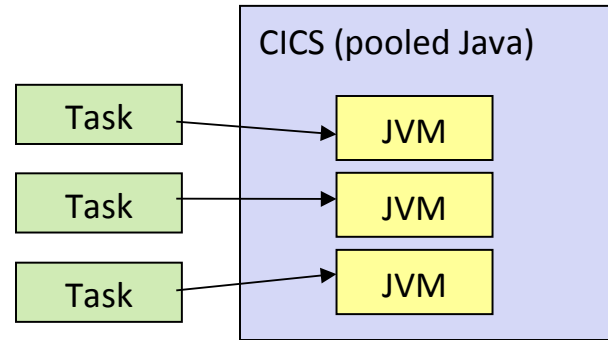


<u>Release</u>	<u>Availability</u>	<u>End of Service</u>
<b>CICS TS V5.1</b>	14 <sup>th</sup> December 2012	
<b>CICS TS V4.2</b>	24 <sup>th</sup> June 2011	not before Q3 2017
<b>CICS TS V4.1</b>	withdrawn from marketing	not before Q3 2017
<b>CICS TS V3.2</b>	withdrawn from marketing	not before Q3 2014
<b>CICS TS V3.1</b>	withdrawn from marketing	not before Q3 2014

## CICS V5.1 & V4.2 JVM server



## CICS TS V3 pooled JVMs



Single JVM - serves many tasks (reduced storage)	Pool of JVMs - each serves only a single task.
Concurrent, multi-threaded, up to 256 threads per JVM server	Java Program Isolation
T8 (CICS key)	J8 (CICS key), J9 (User key)
MAXTHRDTCBS (automatically calculated), up to max of 1024 per region	MAXJVMTCBS, SIT parm
More standard Server model (+ data-sharing)	Difficult, convoluted to share data and state.
Dynamic update and replace of modules	JVMs must be restarted to effect changes
Java SDK 7 (CICS V5.1) or Java SDK 6.0.1 (CICS V4.2)	Java SDK 5
64-bit JVMs only	31-bit JVMs only



# zEC12 – Java as a workload-optimized system

*Continued aggressive investment in Java on z*  
*Significant set of new hardware features tailored and co-designed with Java*

## Hardware Transaction Memory (HTM)

Better concurrency for multi-threaded applications  
 eg. ~2X improvement to  `juc.ConcurrentLinkedQueue`

## Run-time Instrumentation (RI)

Innovative new h/w facility designed for managed runtimes  
 Enables new expanse of JRE optimizations

## 2GB page frames

Improved performance targeting 64-bit heaps

## Pageable 1MB large pages using flash

Better versatility of managing memory

## New software hints/directives

Data usage intent improves cache management  
 Branch pre-load improves branch prediction

## New trap instructions

Reduce over-head of implicit bounds/null checks

New **5.5 GHz** 6-Core Processor Chip  
**Large caches** to optimize data serving  
 Second generation **OOO design**

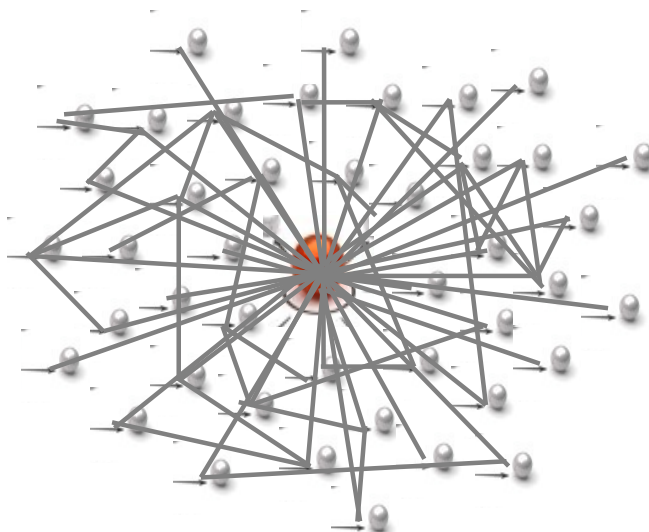


*Up-to 45% improvement in throughput amongst Java workloads measured with zEC12*

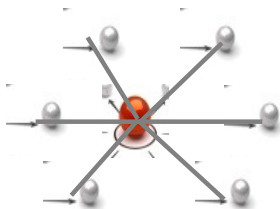
IBM SDK7 for z/OS Service Refresh3 (IBM Java 7 SR3) –**Xaggressive** command-line option enables a variety of new optimizations and zEC12 exploitations

WebSphere®

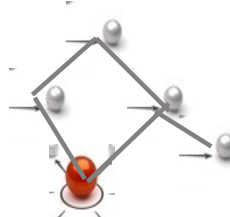
If this is tWAS...



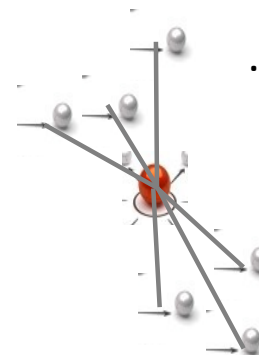
...this is Liberty (WAS)



...so is this



...or even this!



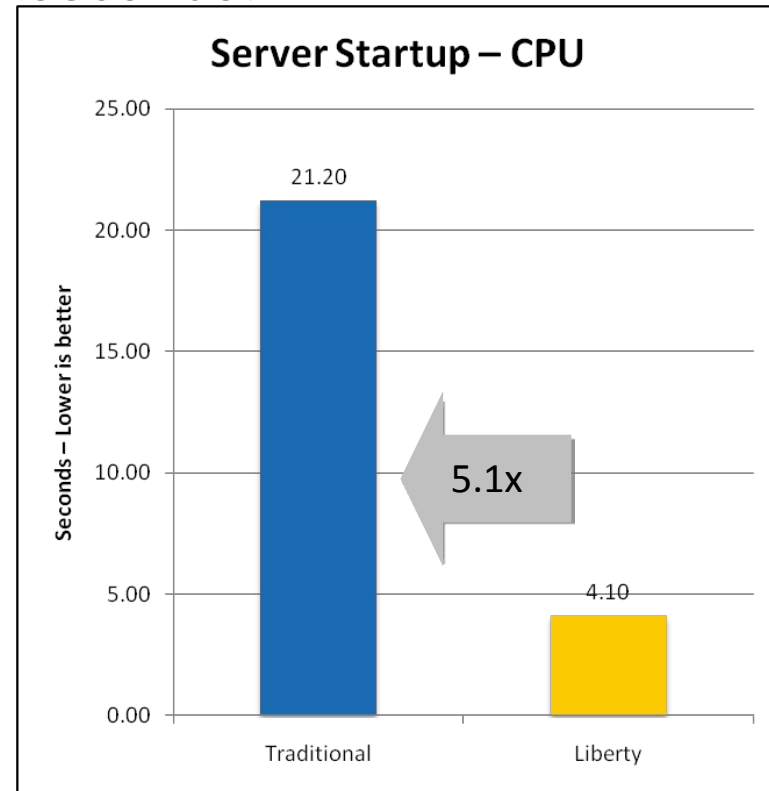
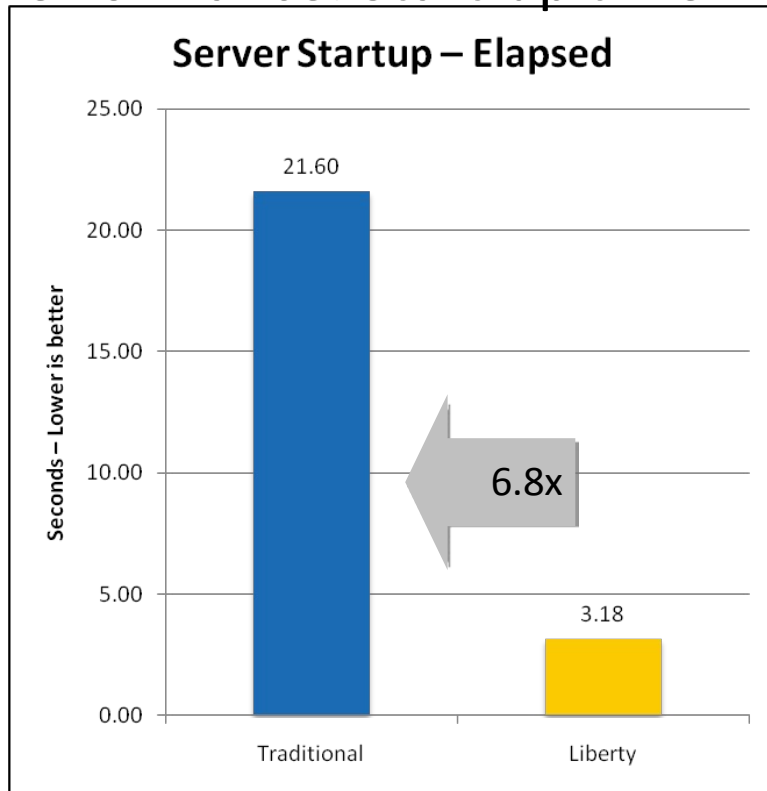
# What is the 'Liberty' Profile?

## *A lightweight, dynamic, composable runtime*

- **Lightweight**
  - Server install is only about 55 MB
  - Extremely fast server starts – typically well under 5 seconds
- **Dynamic**
  - Available features are user selected and can change at runtime
  - Restarts are not required for server configuration changes
- **Composable**
  - Features are implemented as loosely coupled components with lazily resolved optional and mandatory dependencies
  - The availability of features and components determines what *Liberty can do and what's available to applications*

# Liberty on z/OS – start-up time

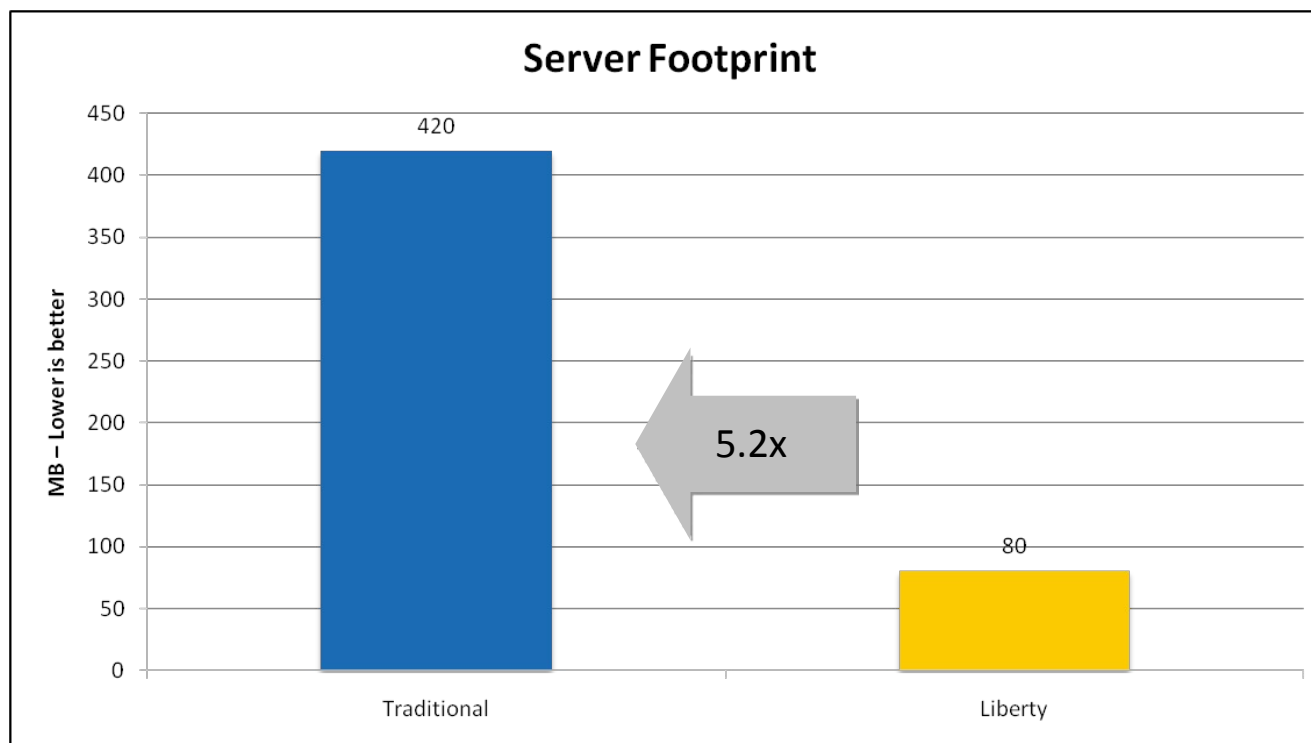
Performance: Start-up time – 3.2 seconds!



- Liberty – 64bit IBM Java 6.0.1, 64/64MB min/max heap, 60MB shared class cache, TradeLite installed
- Traditional – 64bit IBM Java 6.0.1, 1SR,128/256MB min/max CR heap, 256/512MB min/max SR heap, 75MB CR shared class cache, 75MB SR shared class cache, no applications installed

# Liberty on z/OS – memory footprint

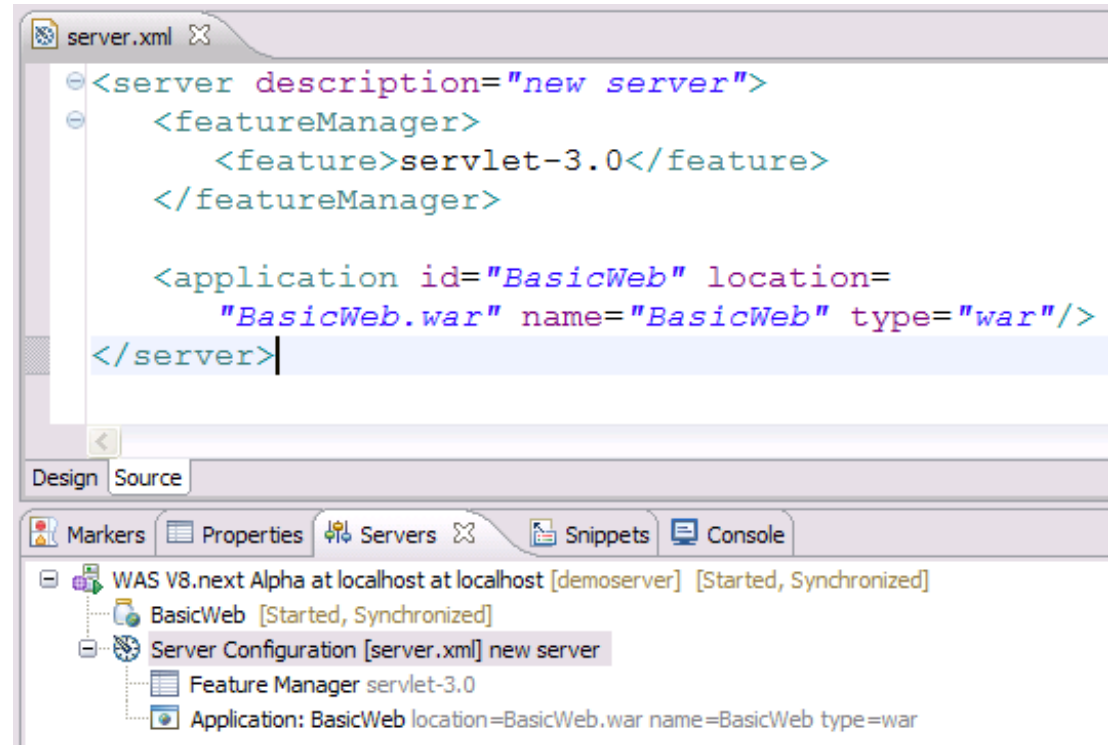
Performance: Memory footprint – 80% reduction



- Liberty – 64bit IBM Java 6.0.1, 64/64MB min/max heap, 60MB shared class cache, TradeLite installed
- Traditional – 64bit IBM Java 6.0.1, 1SR, 128/256MB min/max CR heap, 256/512MB min/max SR heap, 75MB CR shared class cache, 75MB SR shared class cache, no applications installed

## Configuration by exception

- Simplest case: 1 XML file for all server config
- Editable within the workspace
- Exportable, shareable, versionable

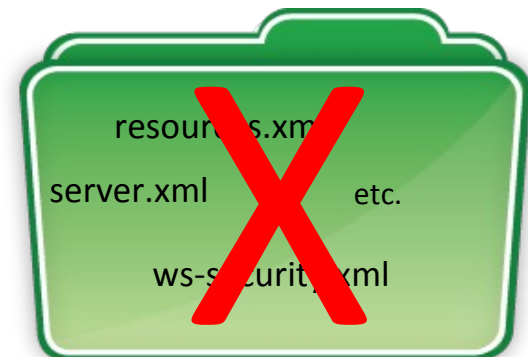


```
<server description="new server">
  <featureManager>
    <feature>servlet-3.0</feature>
  </featureManager>

  <application id="BasicWeb" location=
    "BasicWeb.war" name="BasicWeb" type="war"/>
</server>
```

The screenshot shows the 'server.xml' file in the source editor. Below the editor, the 'Servers' view displays the configuration for 'WAS V8.next Alpha at localhost at localhost [demoser] [Started, Synchronized]'. Underneath, it shows 'BasicWeb [Started, Synchronized]' and 'Server Configuration [server.xml] new server'. The configuration details are: 'Feature Manager servlet-3.0' and 'Application: BasicWeb location=BasicWeb.war name=BasicWeb type=war'.

No need for Admin Console, wsadmin, or extended EARs



## Simplified Configuration

```
<server>
  <featureManager>
    <feature>jsp-2.2</feature>
    <feature>derby-10.5</feature>
  </featureManager>

  <logging trace.specification="webcontainer=all=enabled:*=info=enabled" />

  <application type="war" id="tradelite" name="tradelite"
    location="tradelite.war" />

  <datasource id="ds" jndiName="jdbc/TradeDataSource"
    databaseName="${shared.resource.dir}/data/tradedb"/>

</server>
```

features control which capabilities (bundles) are installed in the server

'singleton' configurations specify properties for a runtime service like logging

'instance' configurations specify multiple resources like applications and datasource definitions

Any of this configuration could be put into a separate xml file and 'included' in this 'master' configuration file

## Liberty and traditional/full profile

*There are functional differences between traditional WAS and the Liberty profile – Liberty provides a useful subset of traditional WAS*

### Liberty Profile

- Bean validation
- Blueprint
- Java API for RESTful Web Services
- Java Database Connectivity (JDBC)
- Java Naming and Directory Interface (JNDI)
- Java Persistence API (JPA)
- Java Server Faces (JSF)
- Java Server Pages (JSP)
- JMX
- Monitoring
- OSGi JPA
- Remote connector
- Secure Sockets Layer (SSL)
- Security
- Servlet
- Session Persistence
- Transaction
- Web application bundle (WAB)
- z/OS Security (SAF)
- z/OS Transactions (RRS)
- z/OS Workload Management

### Traditional WAS Profile

Everything Liberty has...



- Enterprise Java Beans (EJBs)
- Messaging (JMS)
- Web Services
- Service Component Arch (SCA)
- Java Connector Architecture (JCA)
- Clustering
- WebSphere Optimized Local Adapters
- Administrative Console
- WSADMIN scripting
- Multi-JVM Server Model**

*And much more ...*



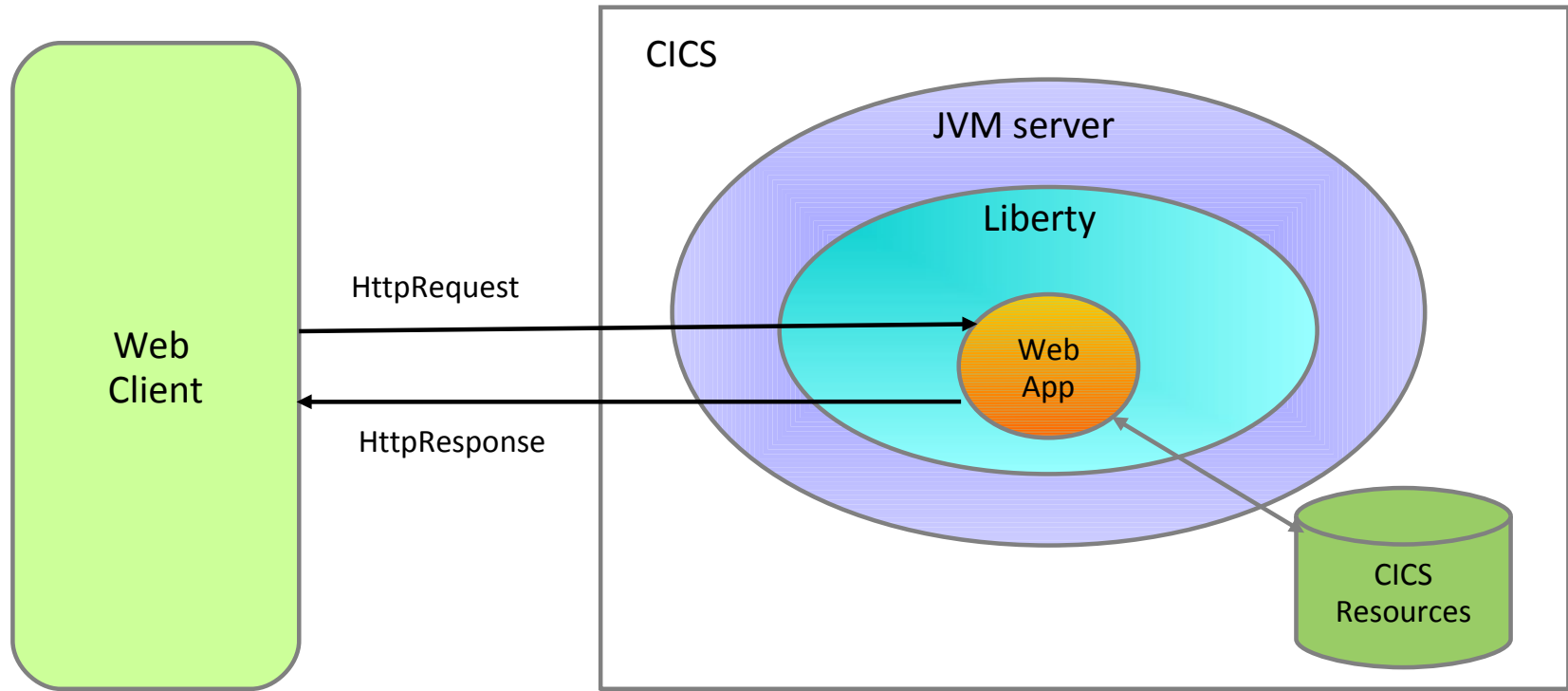
# Liberty Features (as of WAS 8.5.0)

- Bean validation
- Blueprint
- Java Database Connectivity (JDBC)
- Java Management Extensions (JMX)
- Java Persistence API (JPA)
- JavaServer Faces (JSF)
- JavaServer Pages (JSP)
- Secure Sockets Layer (SSL)
- Security, supported by either the basic user registry or a Lightweight Directory Access Protocol (LDAP) user registry
- Servlet
- Web application bundle (WAB)
- Web security
- zOS Security
- zOS Transactions
- zOS WLM

# Liberty Features ( for CICS TS V5.1)

- Bean validation
- Blueprint
- **Java Database Connectivity (JDBC)**
- Java Management Extensions (JMX)
- Java Persistence API (JPA)
- **JavaServer Faces (JSF)**
- **JavaServer Pages (JSP)**
- **Secure Sockets Layer (SSL)**
- Security, supported by either the basic user registry or a Lightweight Directory Access Protocol (LDAP) user registry
- **Servlet**
- Web application bundle (WAB)
- **Web security**
- zOS Security – **CICS Security**
- zOS Transactions – **CICS Transactions**
- zOS Transactions – **CICS WLM**

# Liberty Technology in CICS JVM Server



# Liberty in CICS

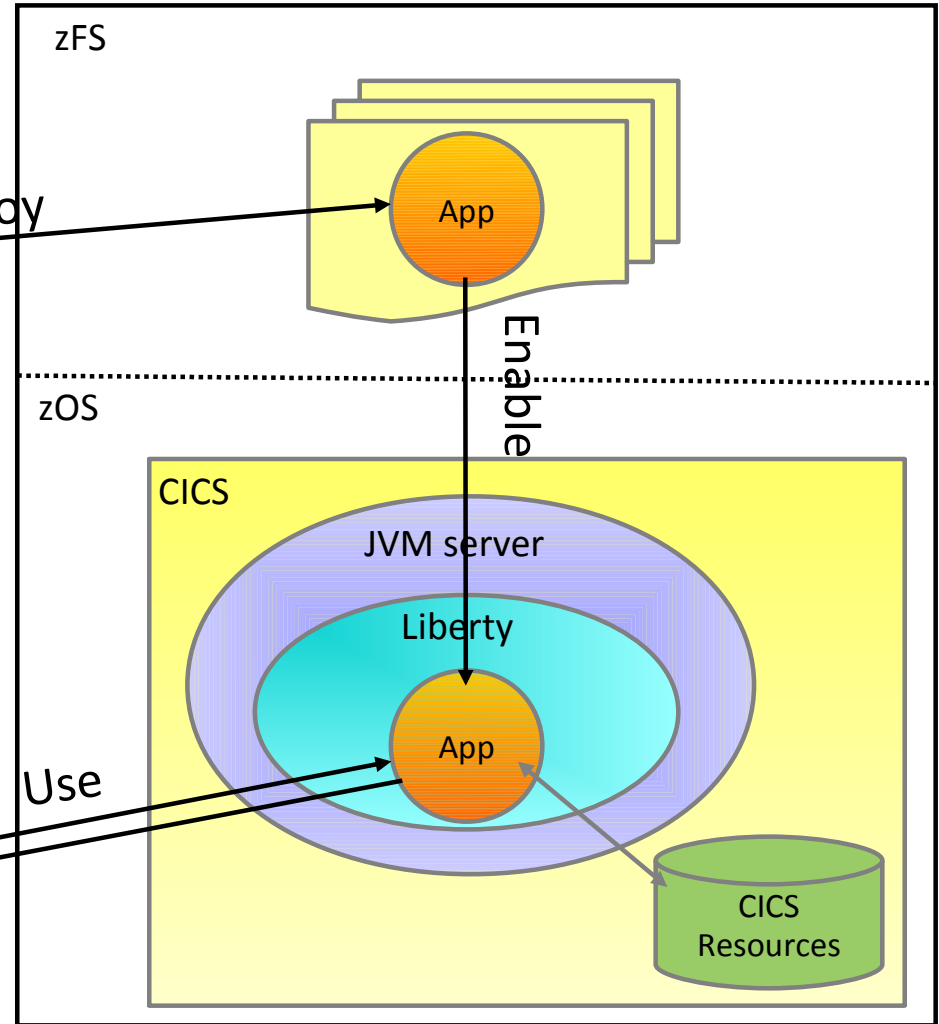
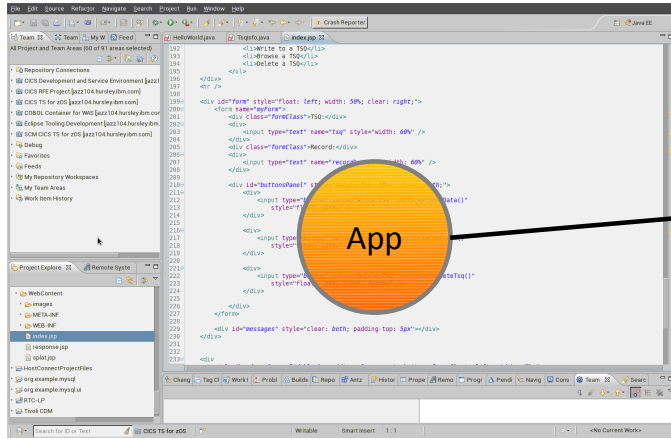
- Provides “off the shelf” Web-server capabilities (JSPs and Servlets)
- JSP and Web servlets have direct, local, access to CICS data and resources
- Servlets can take advantage of existing CICS OSGi applications to provide a Dynamic Web front end

## Design Approach

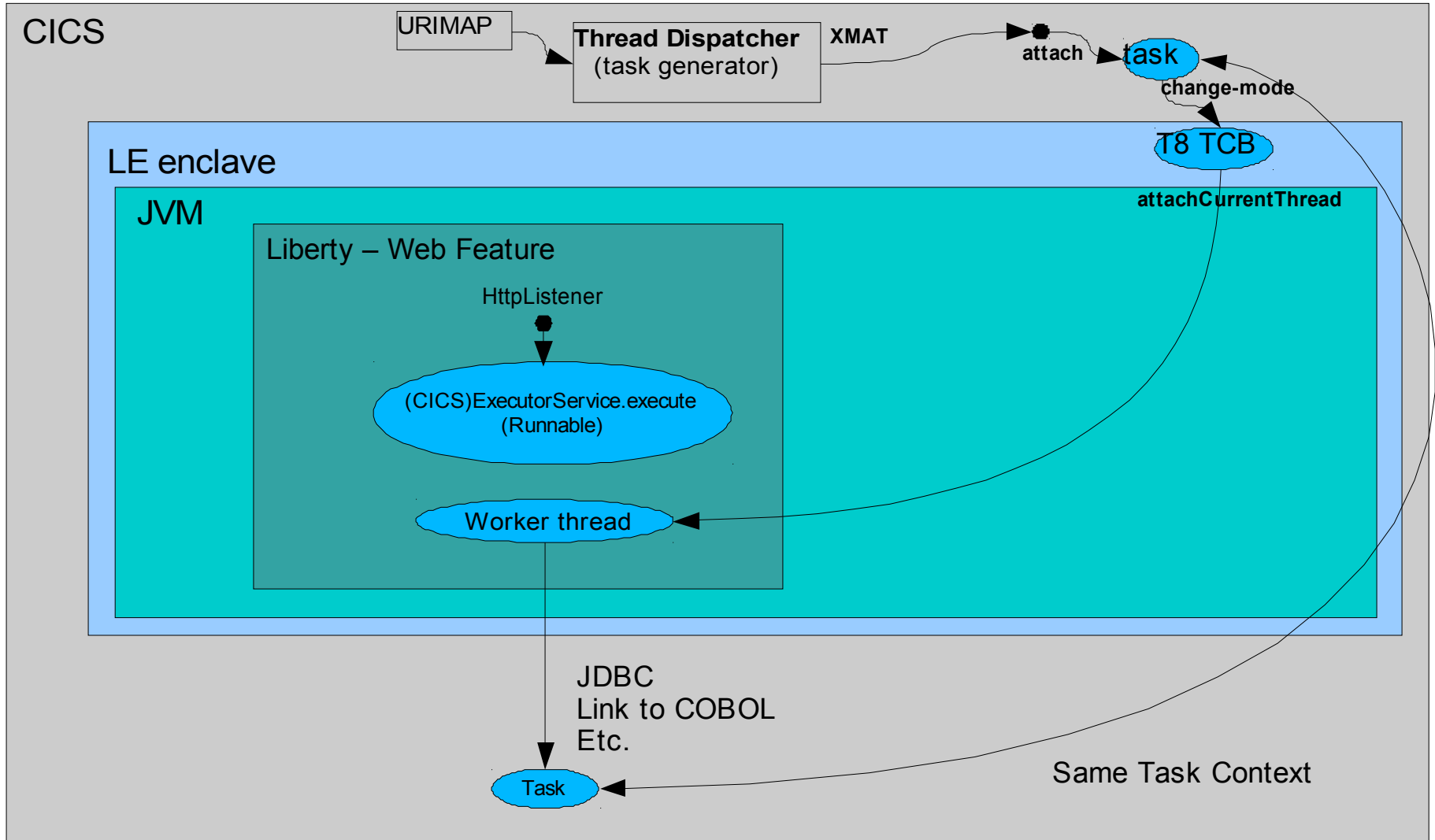
- As little customization as possible.
  - Do things the Liberty way first, and if appropriate, only the Liberty way
  - Ensure Server.xml can be configured dynamically by the user
  - Support Liberty monitored drop-ins directory for applications
- Provide CICS enhancements only where absolutely necessary (security, tasks, JDBC, MQ)
- Provide End-to-end Development and Deployment experience to enable non-mainframe professionals to develop for CICS
- Fully compatible with existing CICS OSGi Java applications running within the same JVM server

# Web app Development and Deployment with CICS

## Eclipse with Liberty Tools



# Hybrid Threads



# Benefits of Hybrid Threads

- Each 'Invocation' (Servlet Request) on a Hybrid Thread **is also** a CICS Transaction (Has a Tranid, Task Context etc).
- This gives you
  - A single common Transaction (UOW) and CICS Managed JDBC
    - Which can cross between Java and Cobol
  - Full JCICS API Access
    - In particular, LINK and access to VSAM
  - WLM (CICS WLM, Performance Classes etc).
  - Monitoring / Statistics
  - CICS Transaction Tracking / Association Data

## CICS Security with Liberty profile



- Servlets run under default transaction CJSA with CICS default userid
  - Can override transaction (and userid) using URIMAP
  - Can use different transactions to authorize different users
- **SEC=YES** turns Security ON in Liberty JVM server
- Basic-auth only (http or https) – Client certificates not yet supported
- **Client Application:** Web.xml needs <security\_constraint> to run with Security
- **Liberty:** Server.xml will be updated by CICS automatically
  - <application-bnd>
- Role based Security not currently supported



## URIMAP enhancements



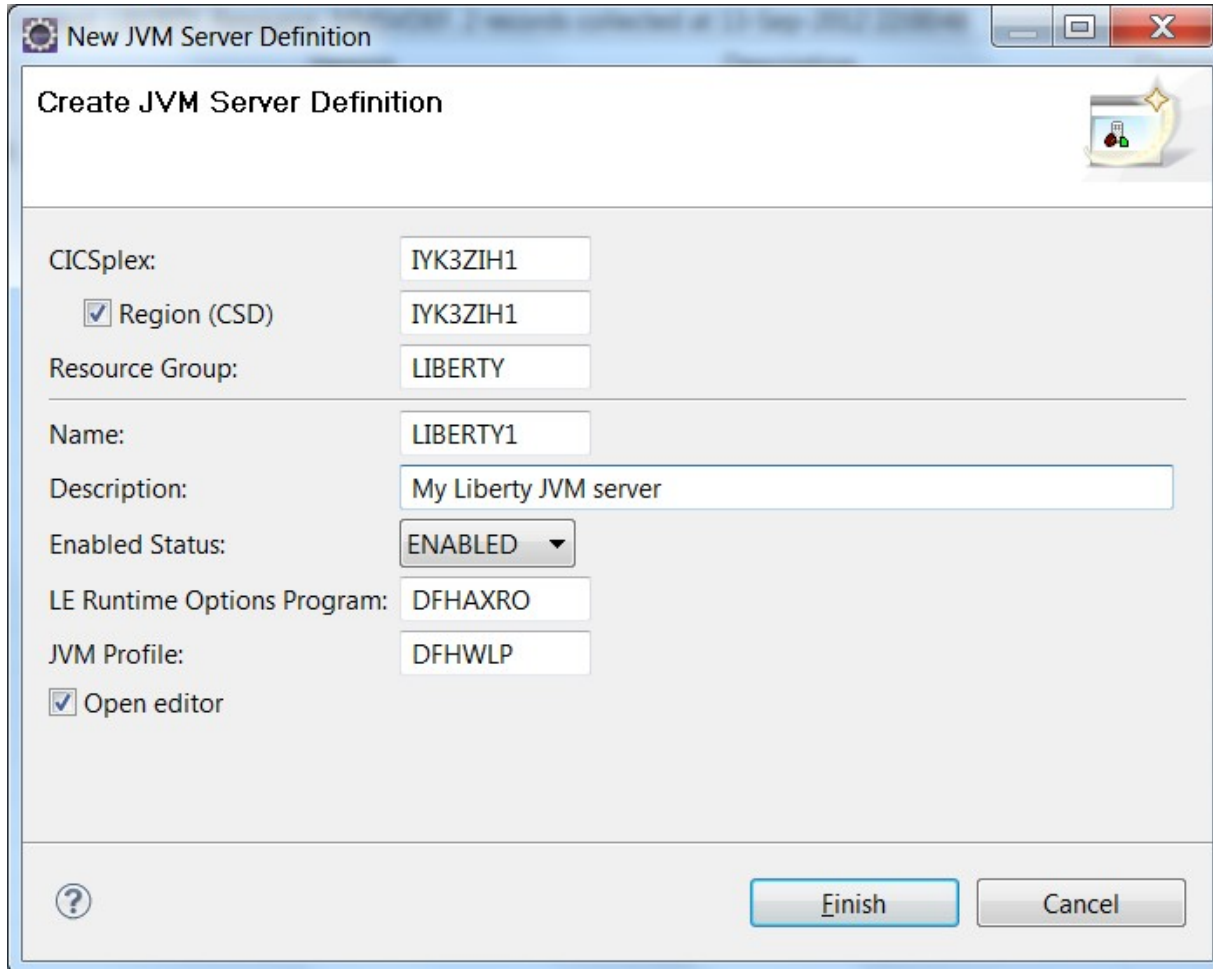
- URIMAP provides CICS authorization via Transaction Security
  
- URIMAP allows context switch to a 'user' transaction
  - Transaction Security (URL mapped to transaction)
  - Monitoring and audit purposes
  - “Transaction class” support



## DEMO

- 1) Configure Liberty server in CICS
- 2) Deploy & Run Servlet in CICS
  - a) using Liberty dropin directory
  - b) using CICS lifecycle management

# 1) Create a JVM server resource in CICS Explorer, CEDA, or CICSplex SM BAS



**New JVM Server Definition**

**Create JVM Server Definition**

CICSplex: IYK3ZIH1

Region (CSD) IYK3ZIH1

Resource Group: LIBERTY

Name: LIBERTY1

Description: My Liberty JVM server

Enabled Status: ENABLED

LE Runtime Options Program: DFHAXRO

JVM Profile: DFHWLP

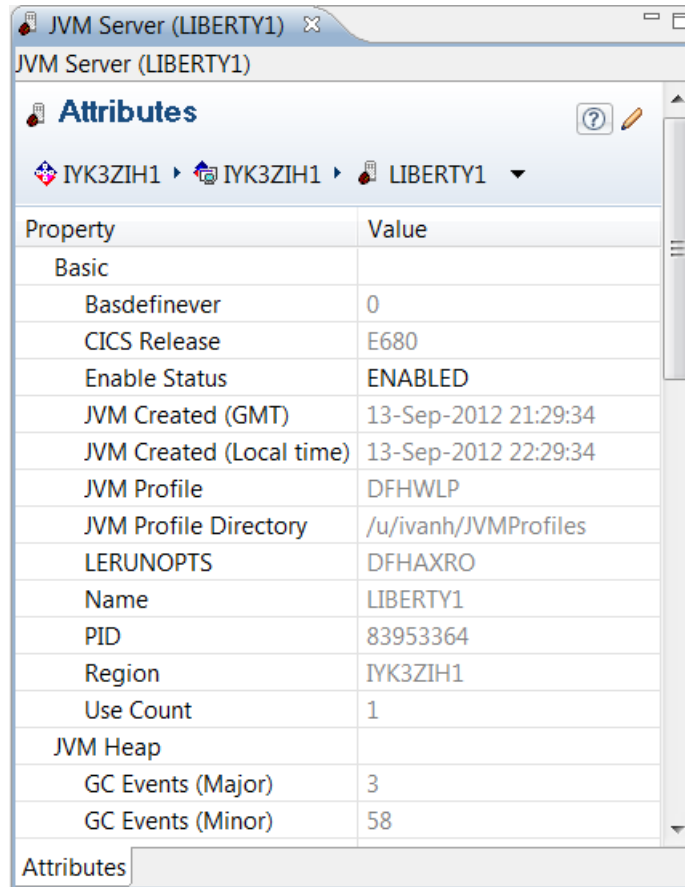
Open editor

Finish Cancel

## 2) Configure the JVMProfile

- Copy the sample JVM profile DFHWLP
- Check JAVA\_HOME is correct
- Use 'autoconfigure' for easier set-up on a non-Production system
  - Dcom.ibm.cics.jvmserver.wlp.autoconfigure=true*
- Configure a unique port number
  - Dcom.ibm.cics.jvmserver.wlp.server.https.port=27245*
- Point your JVM server definition at the new JVMProfile

### 3) Enable the JVM server



JVM Server (LIBERTY1)

**Attributes**

YK3ZIH1 ▶ YK3ZIH1 ▶ LIBERTY1 ▼

Property	Value
Basic	
Basdefinever	0
CICS Release	E680
Enable Status	ENABLED
JVM Created (GMT)	13-Sep-2012 21:29:34
JVM Created (Local time)	13-Sep-2012 22:29:34
JVM Profile	DFHWLP
JVM Profile Directory	/u/ivanh/JVMProfiles
LERUNOPTS	DFHAXRO
Name	LIBERTY1
PID	83953364
Region	YK3ZIH1
Use Count	1
JVM Heap	
GC Events (Major)	3
GC Events (Minor)	58

Attributes

#### 4) Liberty is running! (check the logs).

##### **Server defaultServer created.**

Launching defaultServer (wlp-1.0.0.20120428-1251/websphere-kernel\_1.0.0) on IBM J9 VM, version pmz6470sr1-20120302\_01 (SR1) (en\_US)

[AUDIT ] CWWKE0001I: The server defaultServer has been launched.

[AUDIT ] CWWKG0028A: Processing included configuration resource:  
file:/u/ivanh/IYK3ZIH1/LIBERTY1/wlp/usr/servers/defaultServer/installedApps.xml

[AUDIT ] CWWKG0028A: Processing included configuration resource:  
file:/u/ivanh/IYK3ZIH1/LIBERTY1/wlp/usr/servers/defaultServer/cicsSecurity.xml

[AUDIT ] CWWKZ0058I: Monitoring dropins for applications.

**[AUDIT ] CWWKF0011I: The server defaultServer is ready to run a smarter planet.**

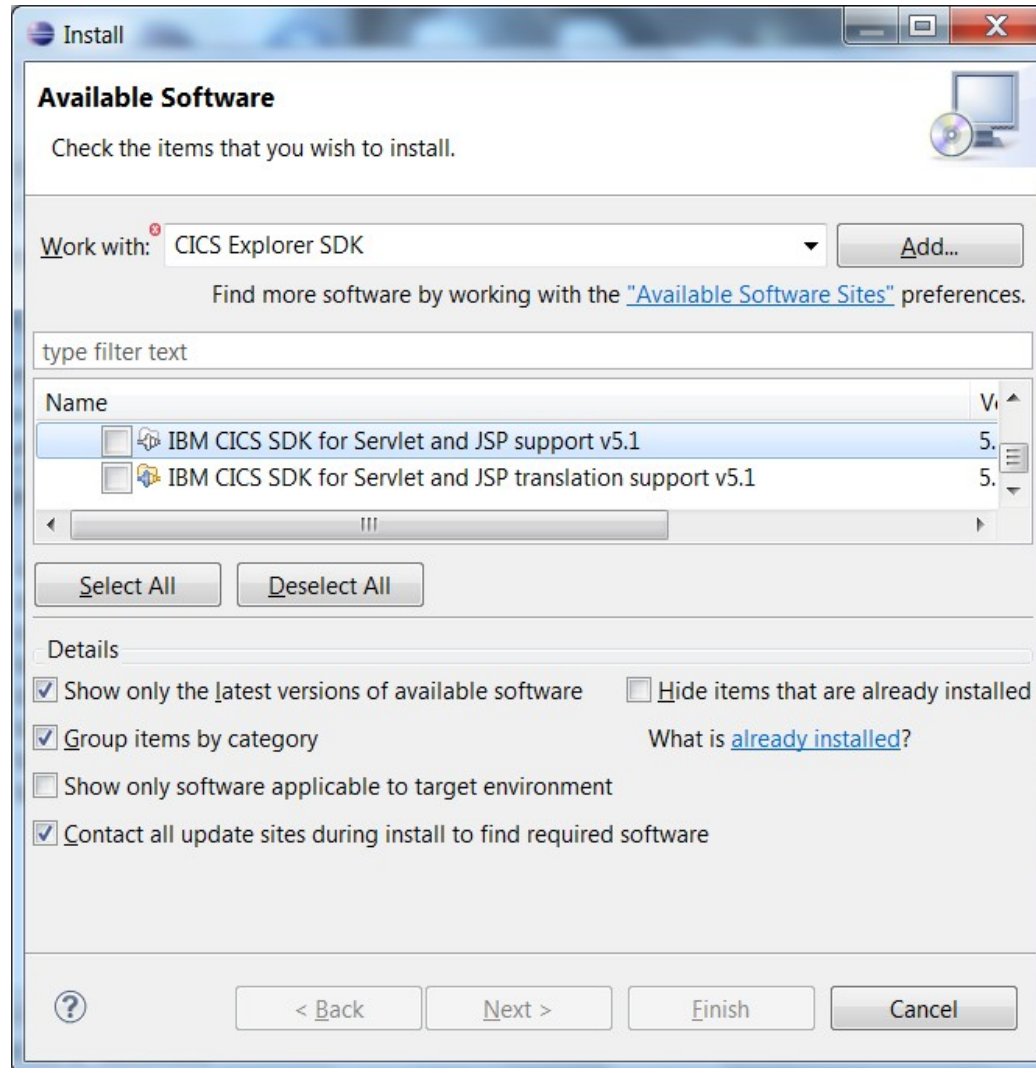
5) Install Eclipse 3.6 / 3.7 - preferably JEE version, but Classic will suffice.

<http://www.eclipse.org/downloads/packages/release/helios/sr2>

<http://www.eclipse.org/downloads/packages/release/indigo/sr2>



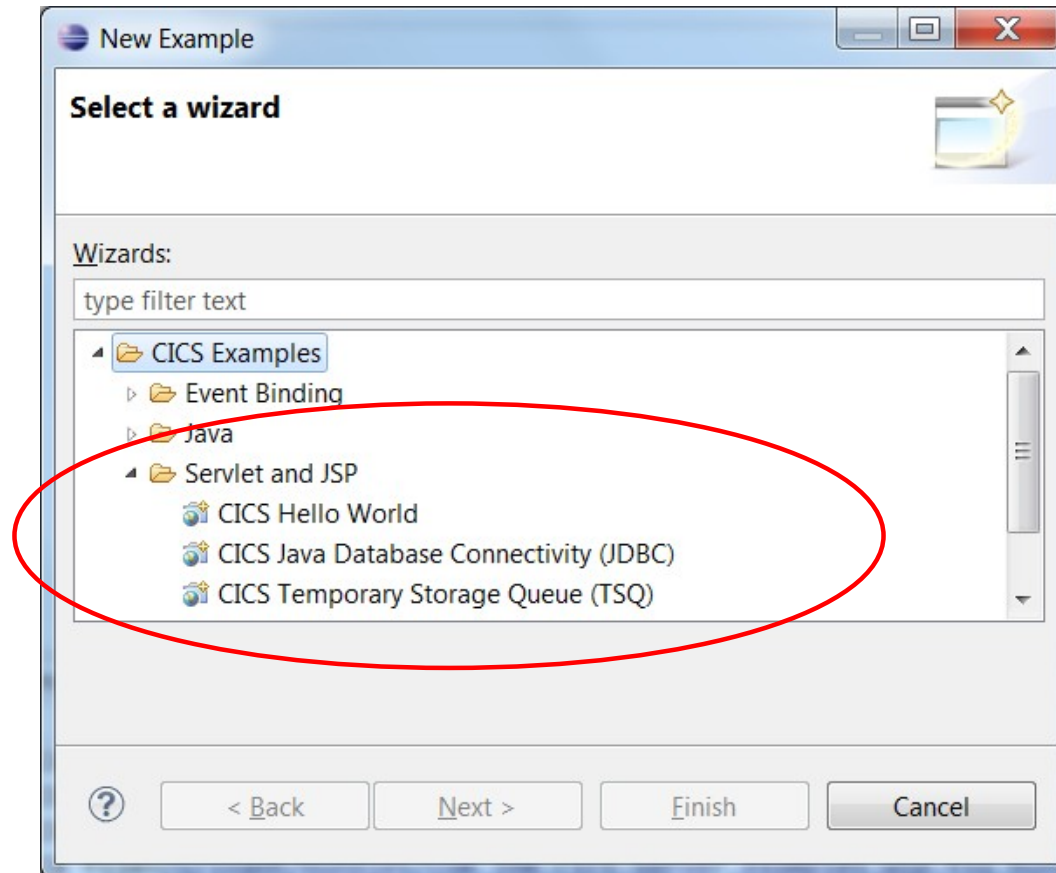
## 6) Install IBM CICS Explorer SDK for Servlet and JSP support v5.1





7) In the CICS Explorer SDK, open the Java perspective.

Create a Dynamic Web Project, or choose one of the Servlet Examples (by opening the 'New Example' wizard):

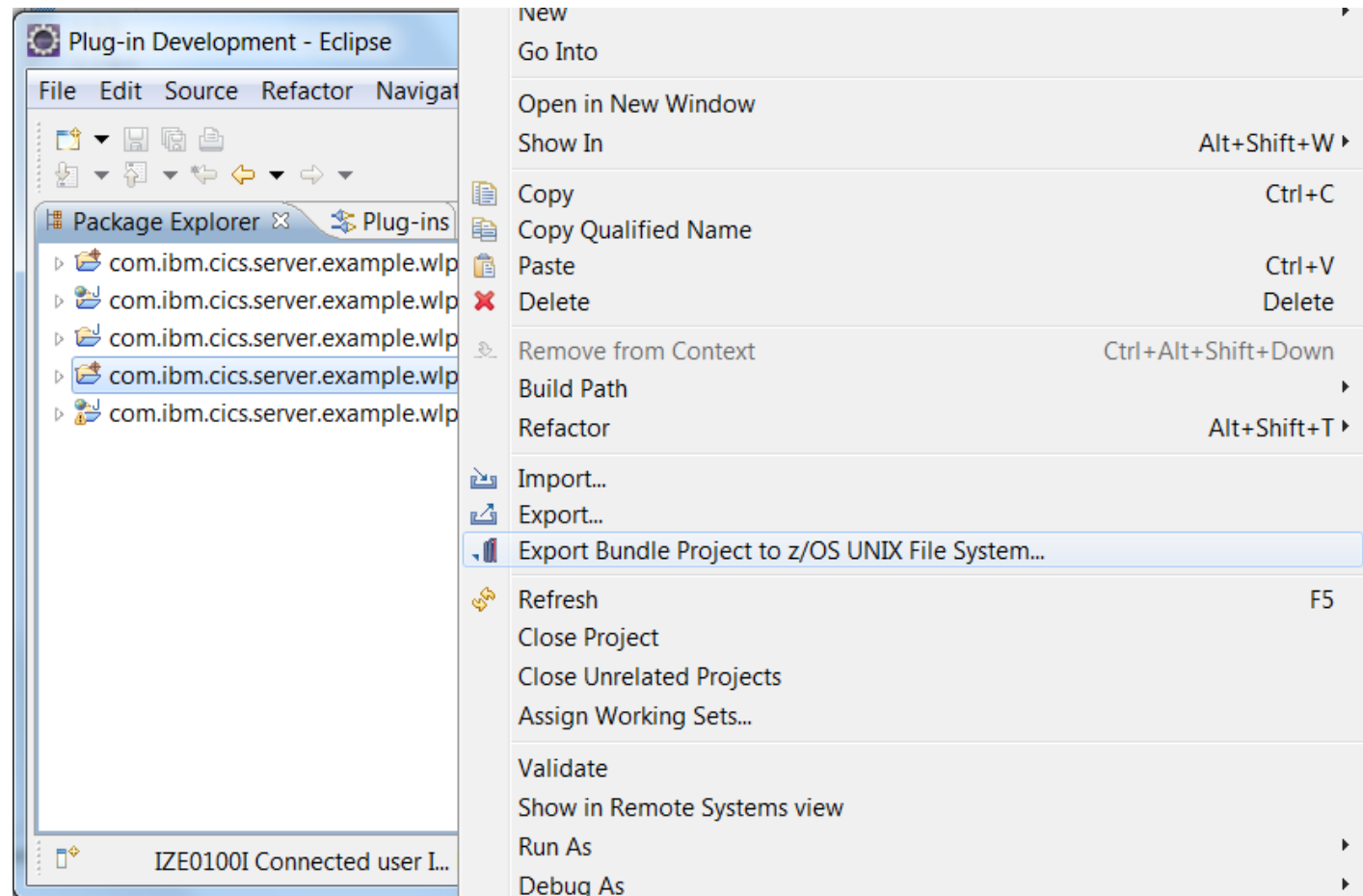


## 8) Select the CICS Temporary Storage Queue (TSQ) example.

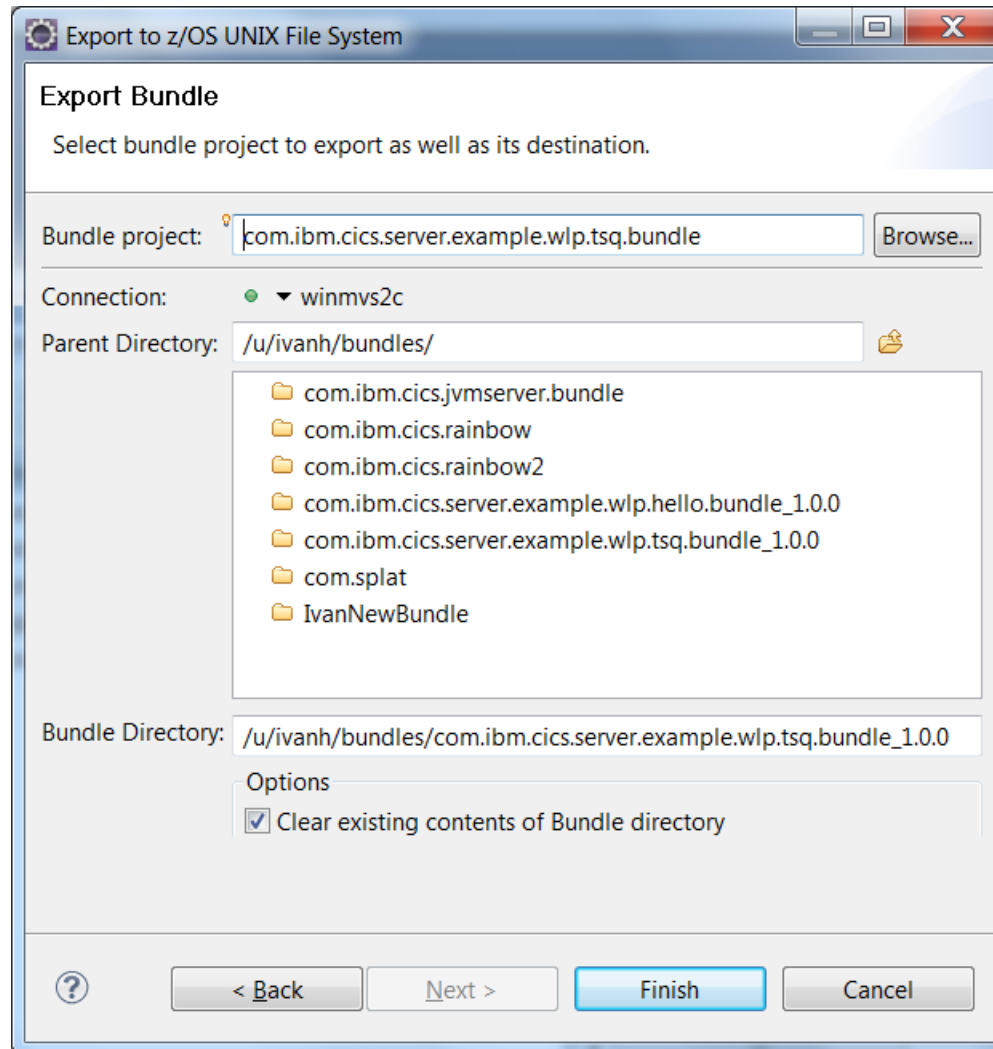
The wizard will create the appropriate projects for the example selected.

For the TSQ example, the wizard creates a plug-in project, a dynamic web project, and a CICS bundle project that references the plug-in project and the dynamic web project.

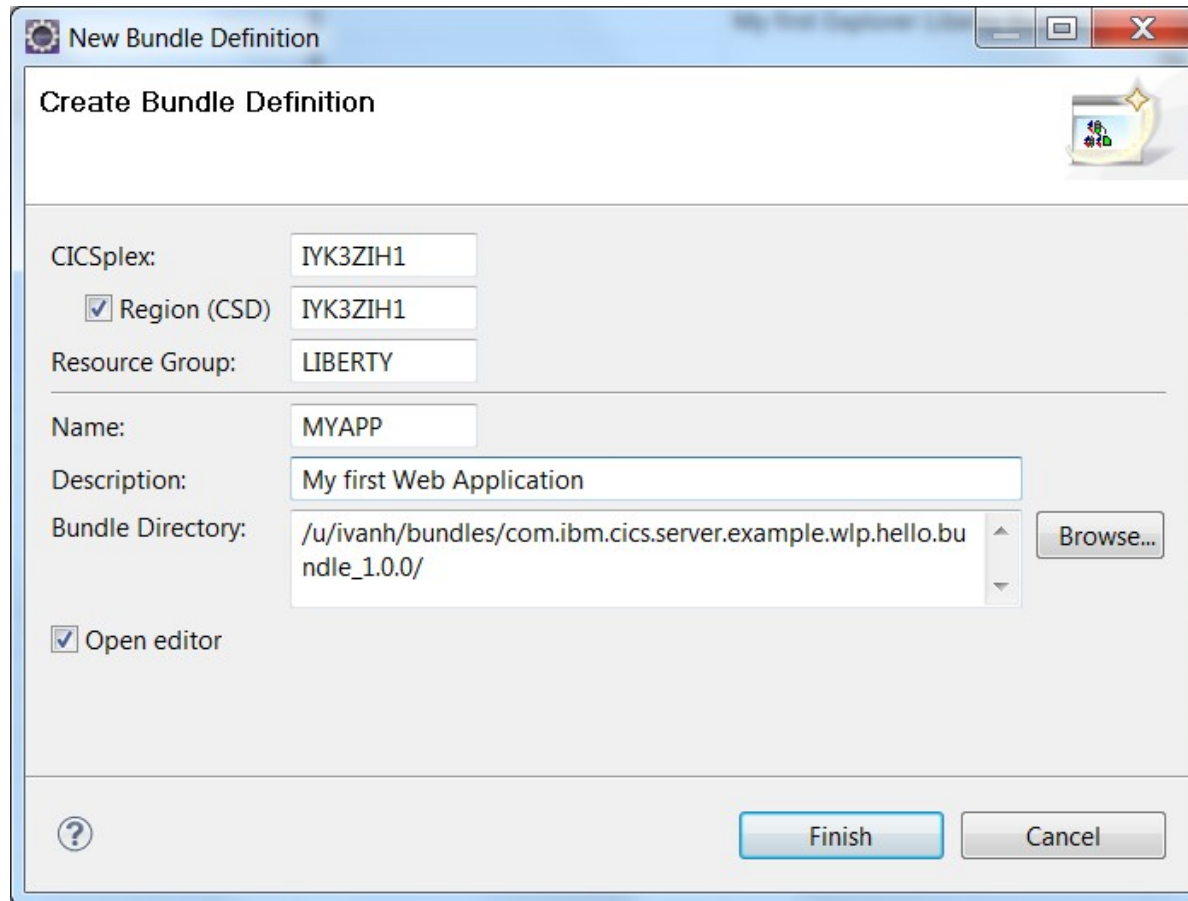
## 9) Export the CICS bundle project



## 10) Pick a zFS location for the CICS bundle project



## 11) Create a CICS bundle definition to control the life-cycle of the Application

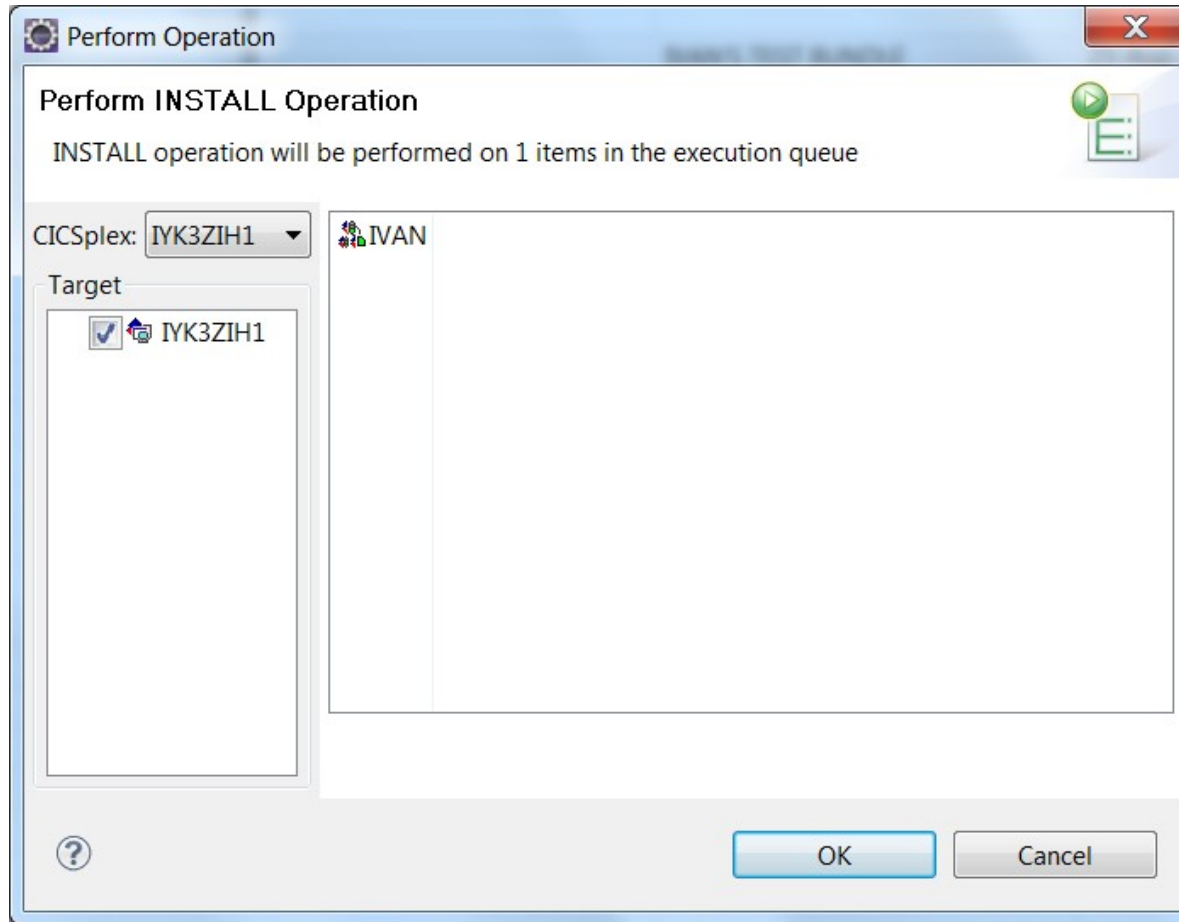


The screenshot shows a dialog box titled "New Bundle Definition" with the following fields and options:

- CICSplex:** IYK3ZI1
- Region (CSD):** IYK3ZI1
- Resource Group:** LIBERTY
- Name:** MYAPP
- Description:** My first Web Application
- Bundle Directory:** /u/ivanh/bundles/com.ibm.cics.server.example.wlp.hello.bundle\_1.0.0/ (with a "Browse..." button)
- Open editor**

At the bottom of the dialog, there is a help icon (question mark in a circle) on the left, and "Finish" and "Cancel" buttons on the right.

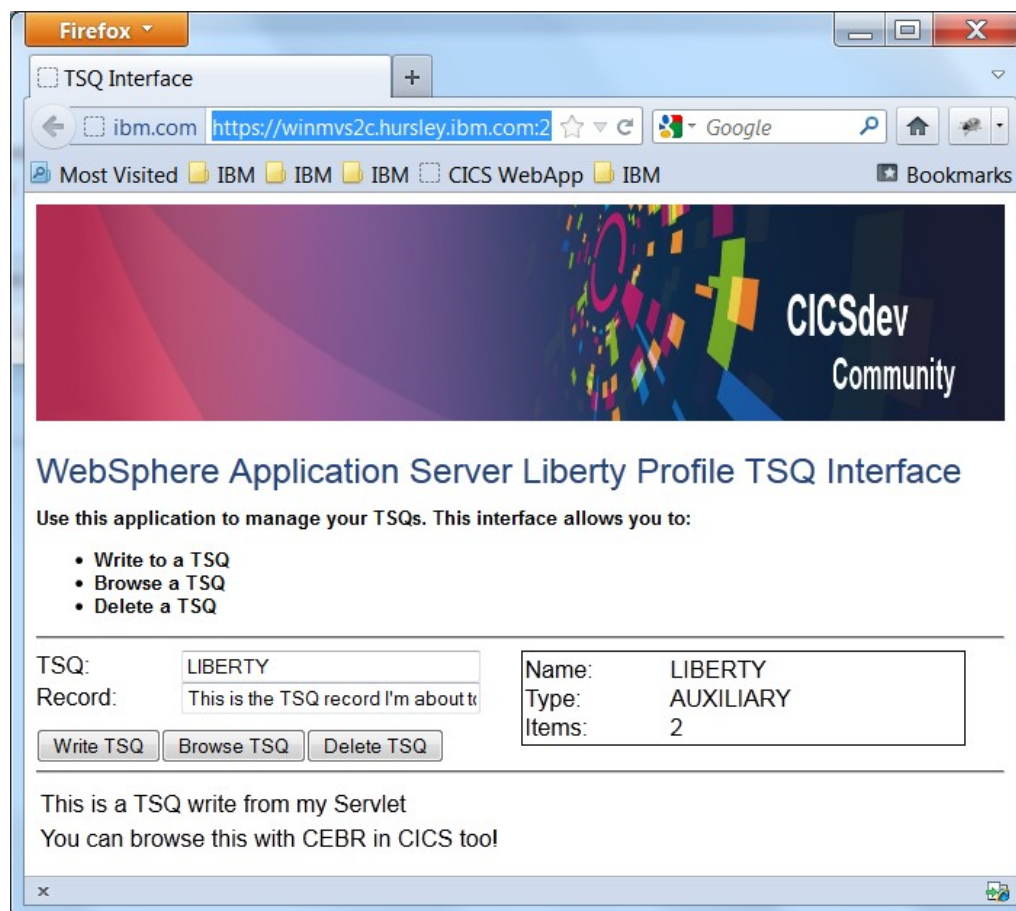
## 12) Install the CICS bundle definition



## 12) Run the application from your Web browser

CWWKT0016I: Web application available (default\_host):

<http://winmvs2c.hursley.ibm.com:27245/com.ibm.cics.server.example.wlp.tsq.web/>



## CICS Developer Trial



Announced Oct 3rd 2012, available from Jan 13<sup>th</sup> 2013

- No charge trial, fixed expiry date
- Does not start SVC period
- For non-production environments
- Order & download via IBM Shopz
- PID 5655-Y30

CICS TS V5.1 capabilities (with restrictions)

- Performance
- Capacity
- License

CICSDev Community:

<https://www.ibm.com/developerworks/connect/cicsdev>



## CICS Statement of Direction

**IBM intends to deliver enhanced support for mobile applications interacting with IBM CICS® Transaction Server for z/OS ( CICS TS) services, using the lightweight data-interchange format JavaScript™ Object Notation (JSON). \*\***

**In addition, IBM intends to introduce support for deploying qualified new CICS TS workloads on IBM System z New Application License Charges (zNALC) Logical Partitions (LPARs). Qualified new CICS TS applications, including approved mobile and service-enabled applications running in the CICS TS Java™ Virtual Machine (JVM) Server, will be eligible for CICS TS one-time-charge (OTC) pricing when deployed to a zNALC LPAR. \*\***

**\*\* IBM Software Announcement ZP13-0119, February 19, 2013**

## Summary - Liberty and CICS together

### Liberty provides

A lightweight, dynamic, composable Web container  
Support for Servlets, JSPs, JSF

### CICS provides

Thread level access to COBOL, PL/I, Java, DB2, VSAM, TSQs, etc.  
(no connectors, no adapters, no converters)  
Application lifecycle management  
Enterprise class qualities of service - transactions, security, WLM, etc.  
Enterprise class systems management

### Software licenses required

CICS Transaction Server V5.1  
(that's it)

### Get started with

CICS TS V5.1 Developer Trial (free download)  
CICS Explorer SDK Eclipse plug-in (free download)  
WAS V8.5 Liberty Profile Developer Tools (free download) (optional)

I ♥ CICS

I ♥ WAS



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