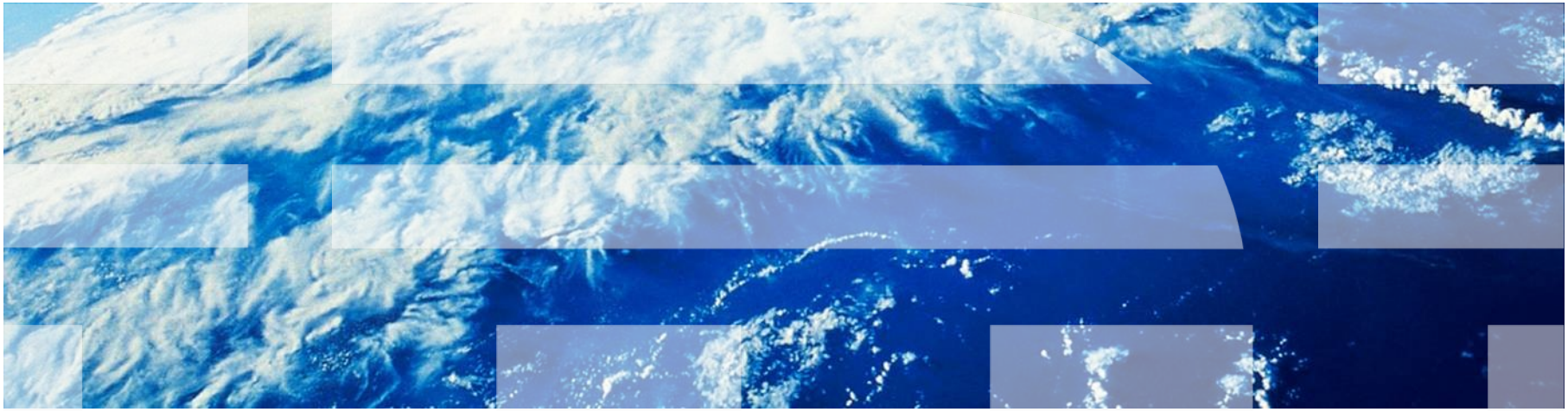
WebSphere Application Server Support for OSGi Applications



Agenda

- Standards and Open Source
- WAS v7 OSGi Feature Pack
- WAS v8 Beta OSGi Applications Support
- WAS v8 Beta Demo

Duane Appleby - applebyd@uk.ibm.com

Standards and Open Source

Duane Appleby - applebyd@uk.ibm.com

Standards and Open Source

- OSGi Enterprise Specification
  - OSGi Enterprise Expert Group (EEG)
  - First release 22 March 2010
  - Brings Enterprise technologies and OSGi together
  - Adds Spring-derived *Blueprint* component model and DI container

Duane Appleby - applebyd@uk.ibm.com

Standards and Open Source

- OSGi Enterprise Specification
  - OSGi Enterprise Expert Group (EEG)
  - First release 22 March 2010
  - Brings Enterprise technologies and OSGi together
  - Adds Spring-derived *Blueprint* component model and DI container

- Apache Aries
  - http://aries.apache.org/
  - Provide enterprise OSGi spec implementations
  - Collaborative environment to experiment and drive further standardisation
  - Integrated into numerous projects and products

Duane Appleby - applebyd@uk.ibm.com

WebSphere Application Server V7
OSGi Applications Feature Pack

Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi & JPA 2.0 Feature Pack

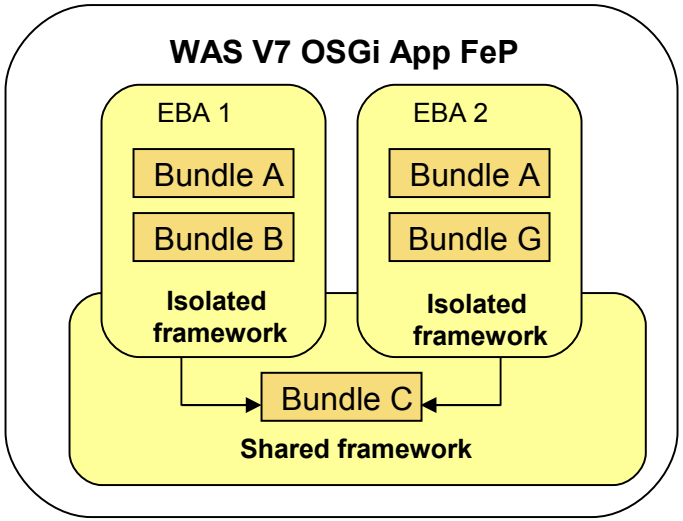
WebSphere Application Server V7 Feature Pack for OSGi Applications and Java Persistence API (JPA) 2.0

http://www-01.ibm.com/software/webservers/appserv/was/featurepacks/

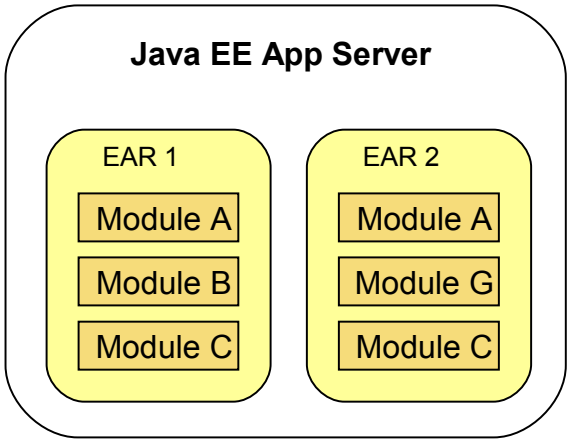
- Early Access November 2009
- Most rapidly downloaded v7 FEP
  Beta release
- General Availability May 2010

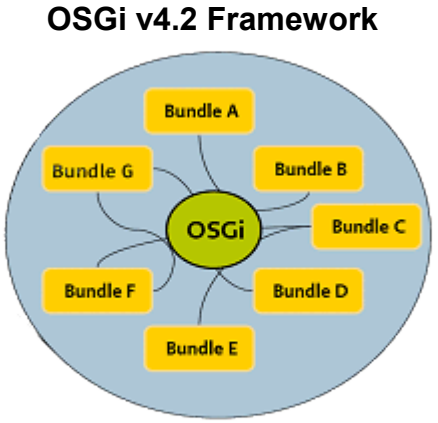
Duane Appleby - applebyd@uk.ibm.com

Isolation and Sharing



ISOLATED



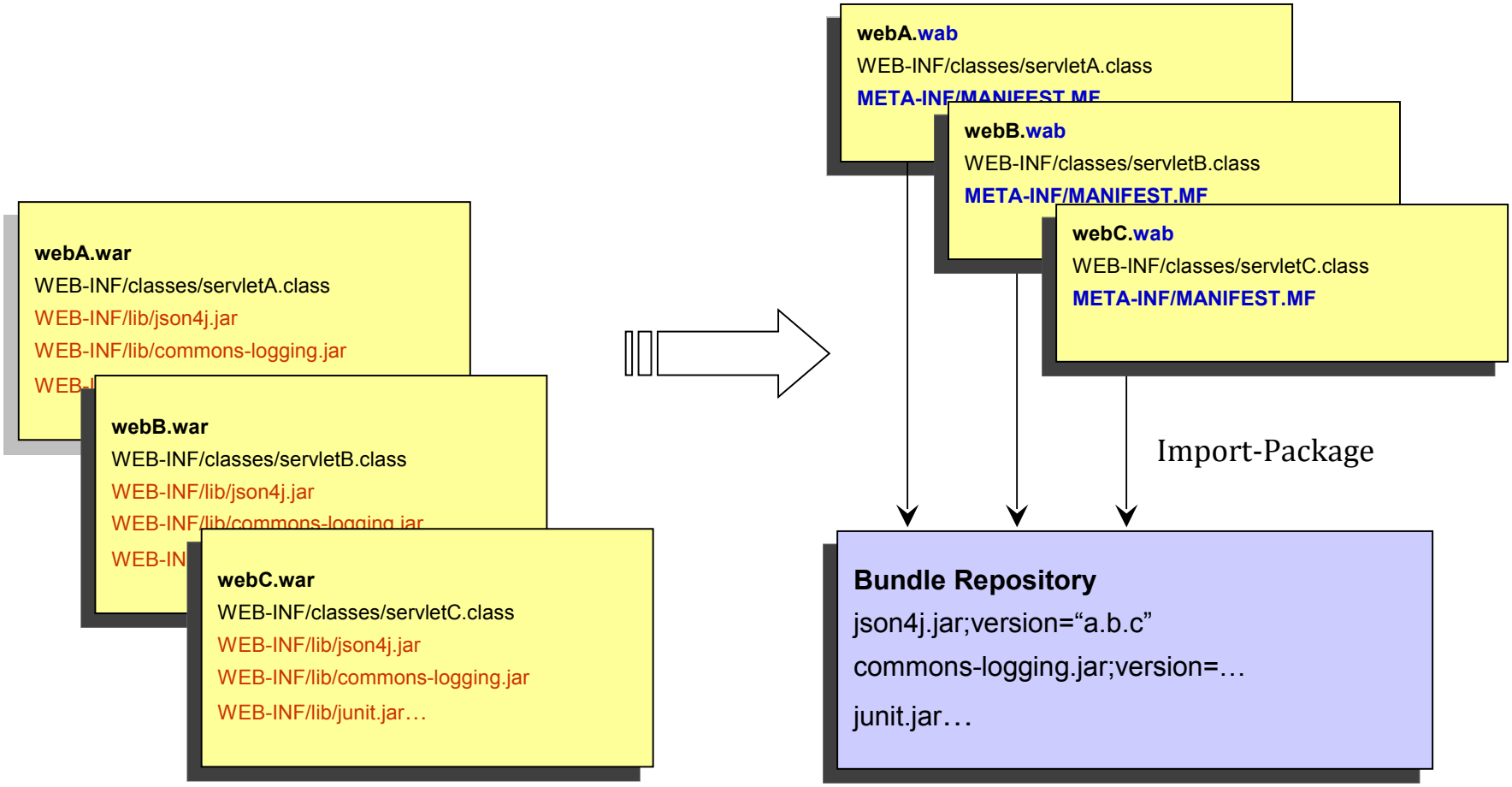


SHARED

Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : Getting Started WARs to WABs

- No java code change : war modules → bundles
- Common bundles factored out and used at specific versions



Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : Enterprise Bundle Archive (“OSGi Applications”)

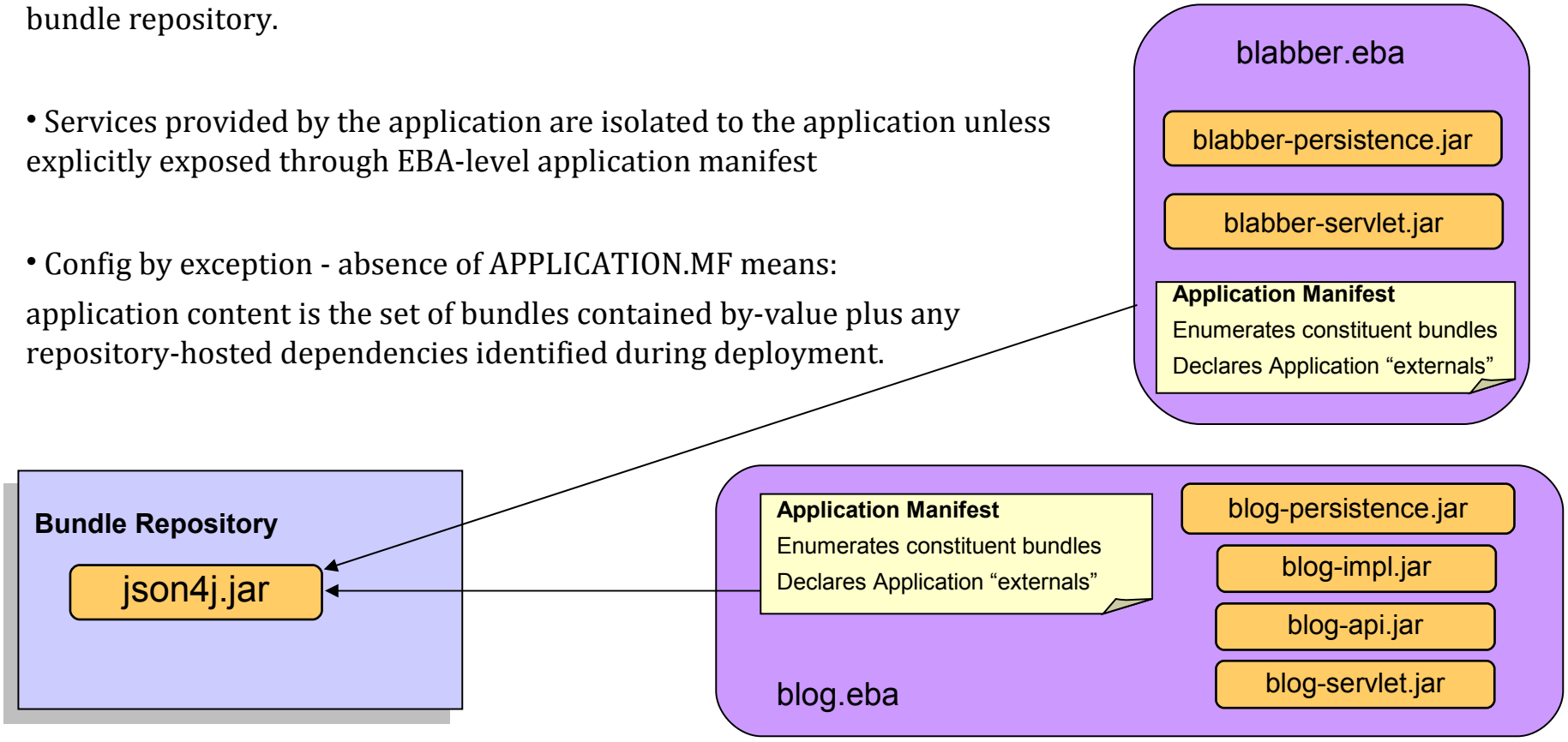
- An isolated, cohesive application consisting of a collection of bundles, is deployed as a logical unit in a “.eba” archive

- Constituent bundles may be contained (“by-value”) or referenced from a bundle repository.

- Services provided by the application are isolated to the application unless explicitly exposed through EBA-level application manifest

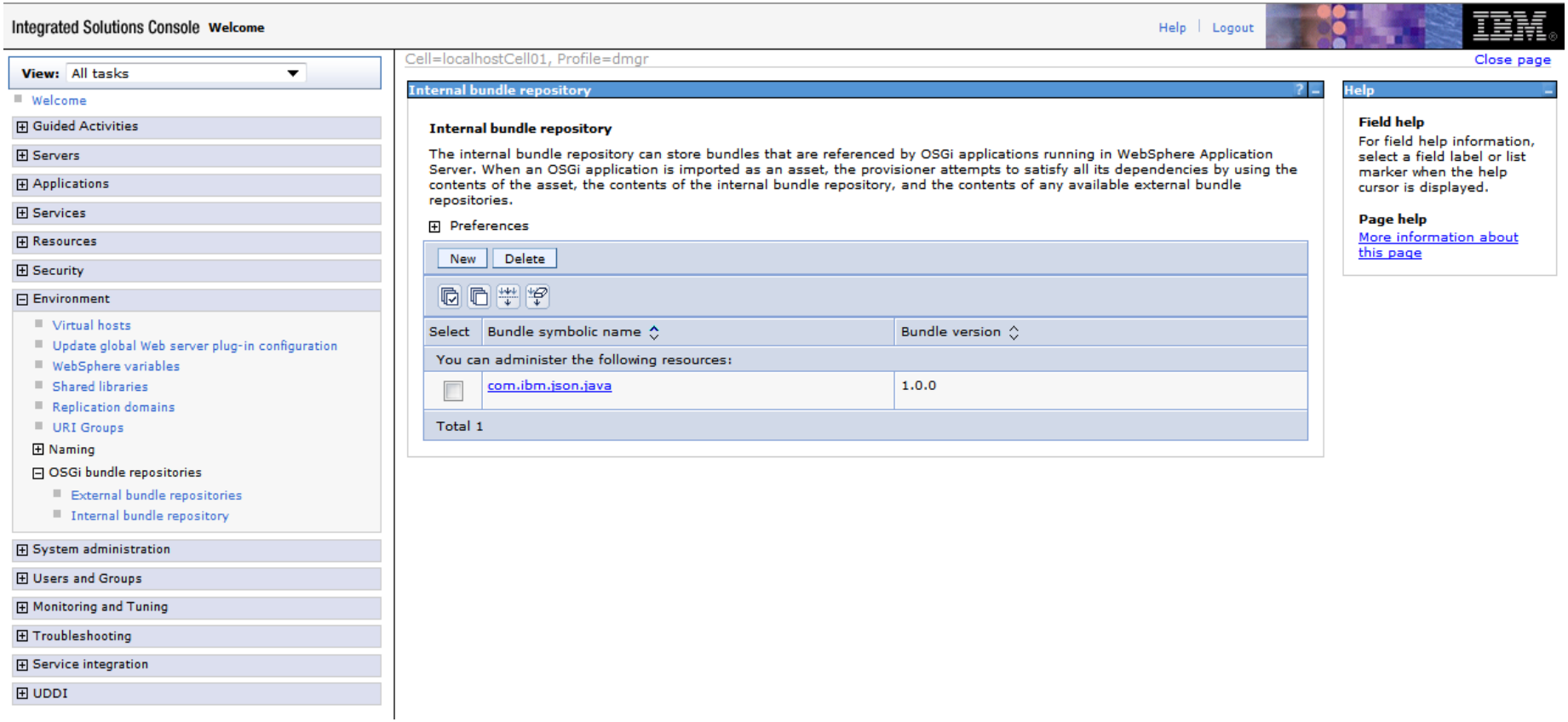
- Config by exception - absence of APPLICATION.MF means:

application content is the set of bundles contained by-value plus any repository-hosted dependencies identified during deployment.



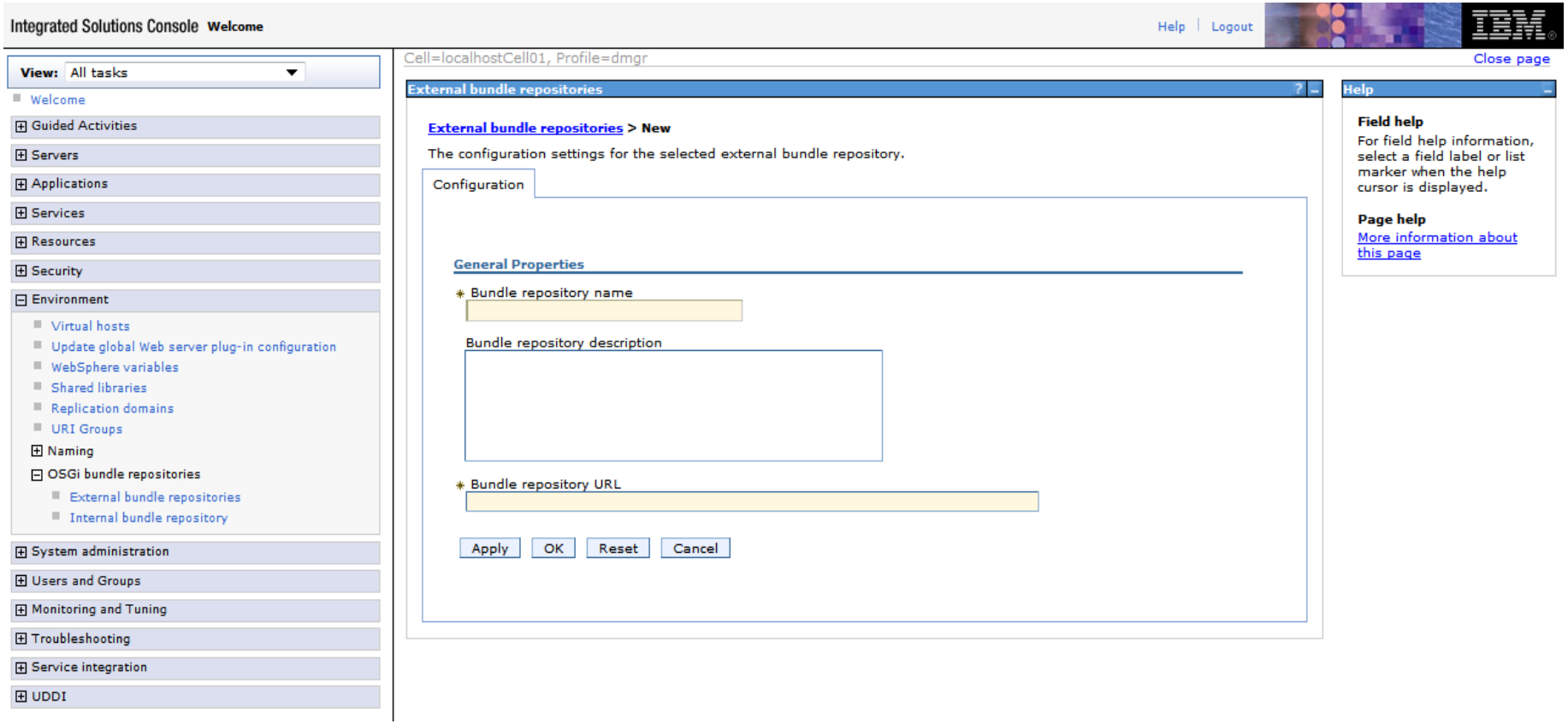
Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : Internal Bundle Repository



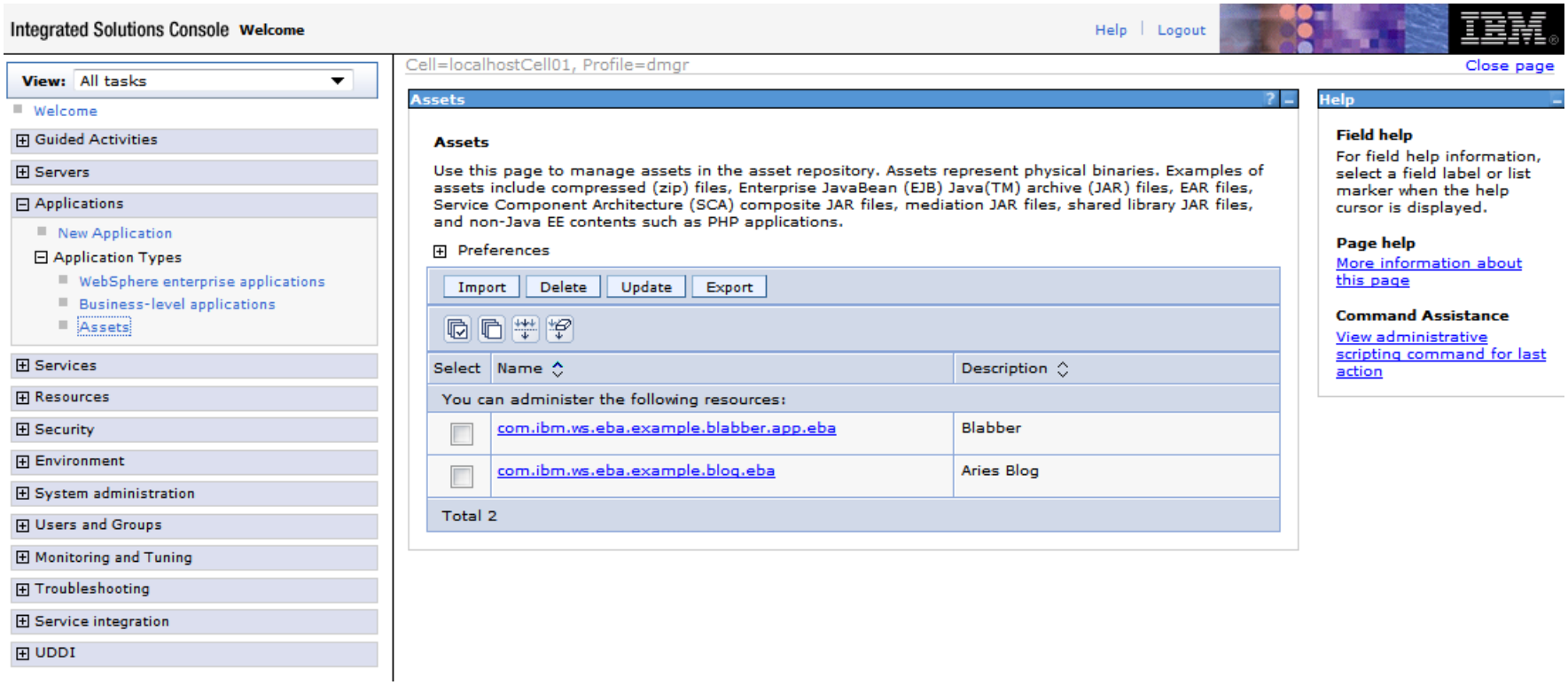
Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : External Bundle Repository



Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : Deploying an OSGi Application (EBA)

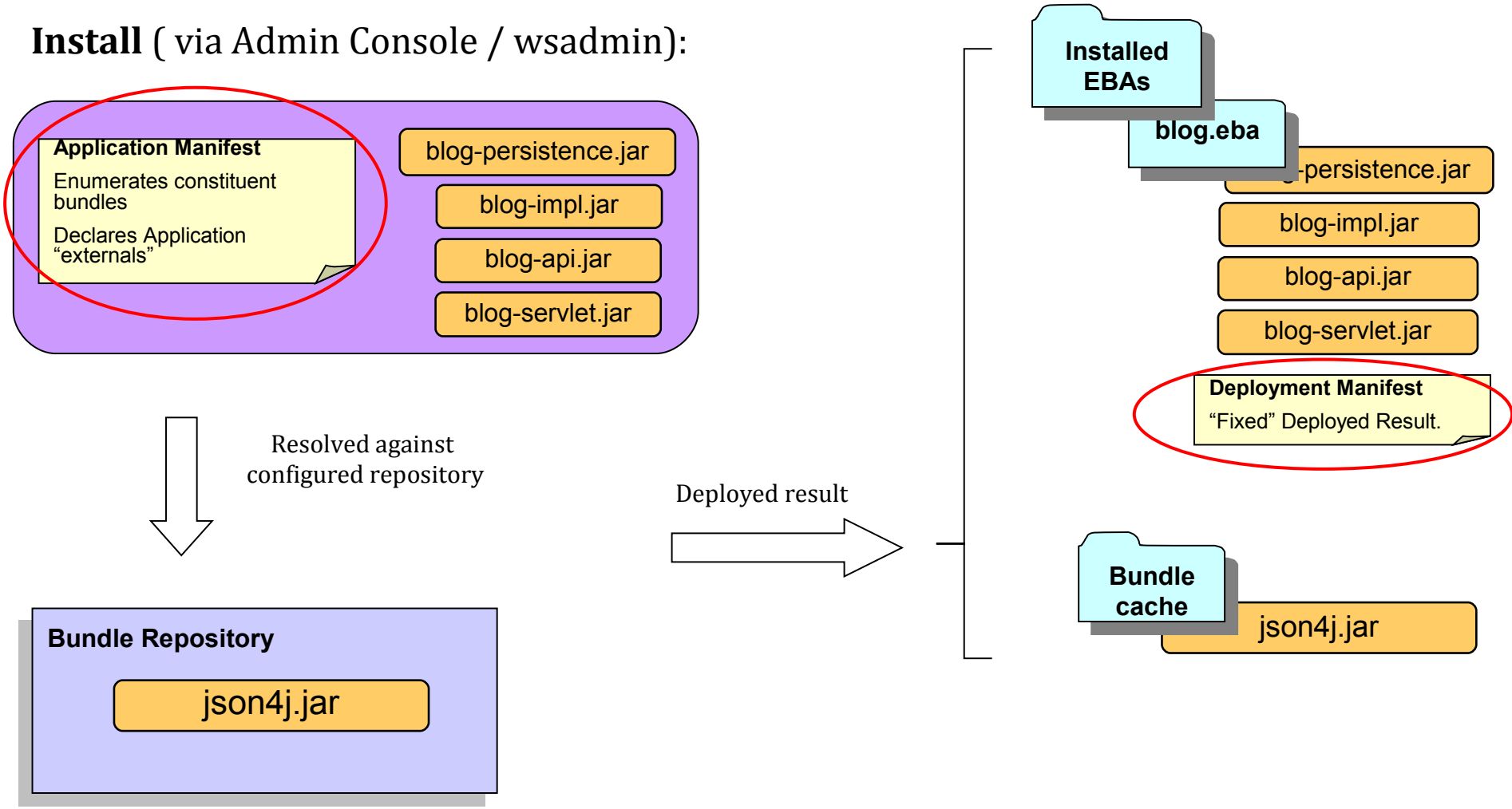


1) Import the asset (eba)

Duane Appleby - applebyd@uk.ibm.com

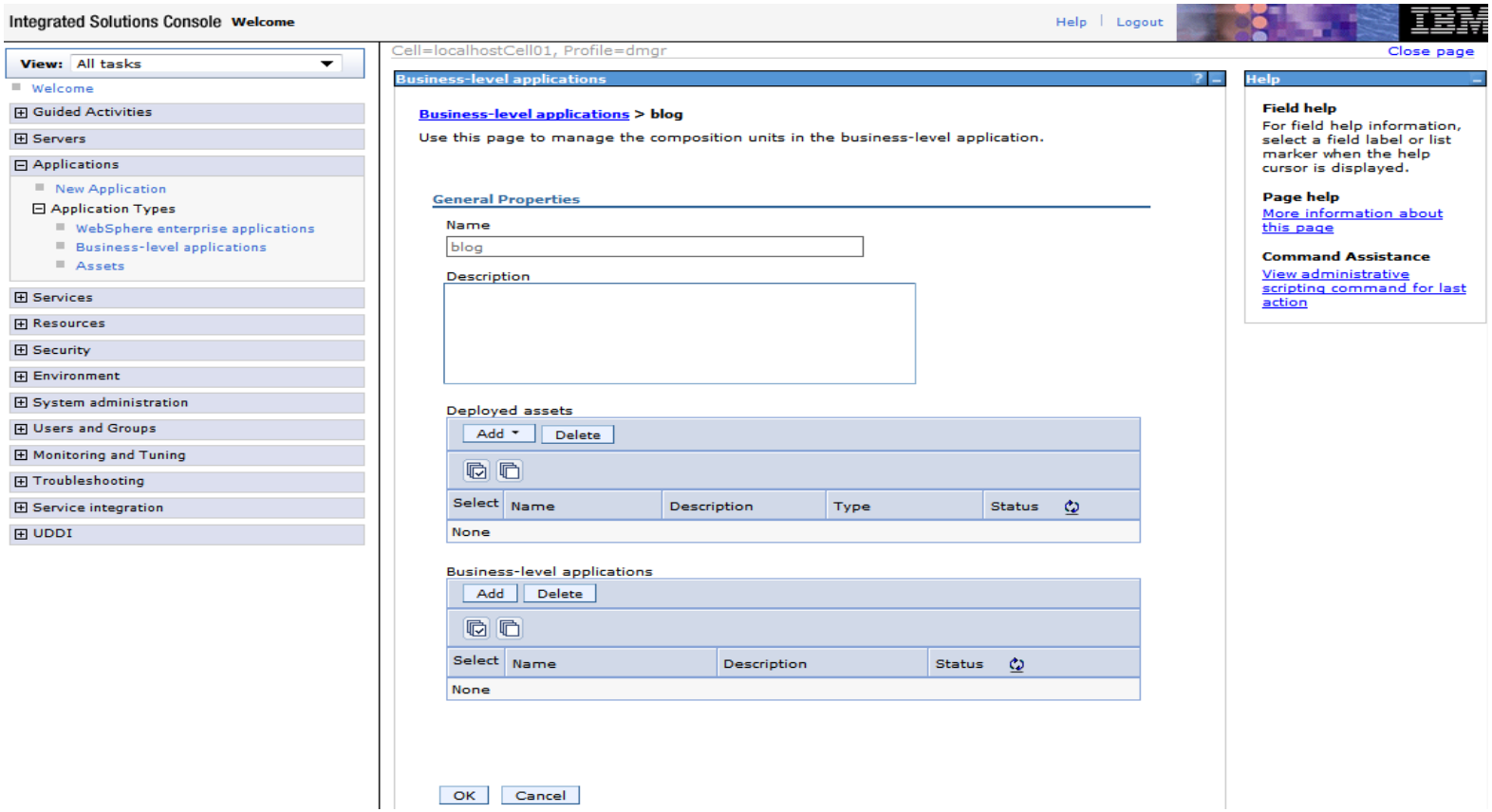
WAS v7 OSGi : Application-centric Bundle Management

Install (via Admin Console / wsadmin):



Duane Appleby - applebyd@uk.ibm.com

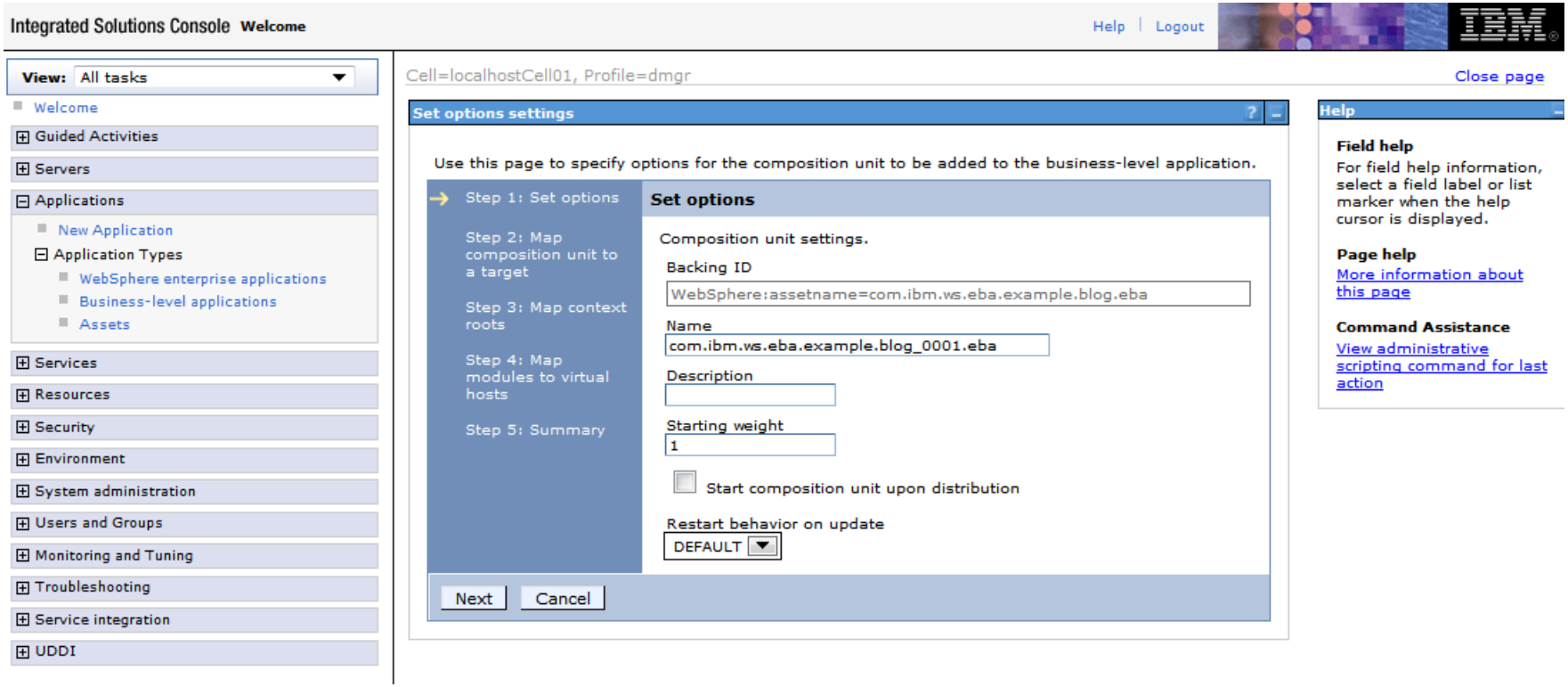
WAS v7 OSGi : Deploying an OSGi Application (EBA)



1) Import the asset (eba)
2) Create Business-level Application (BLA)
3) Add Deployed asset

Duane Appleby - applebyd@uk.ibm.com

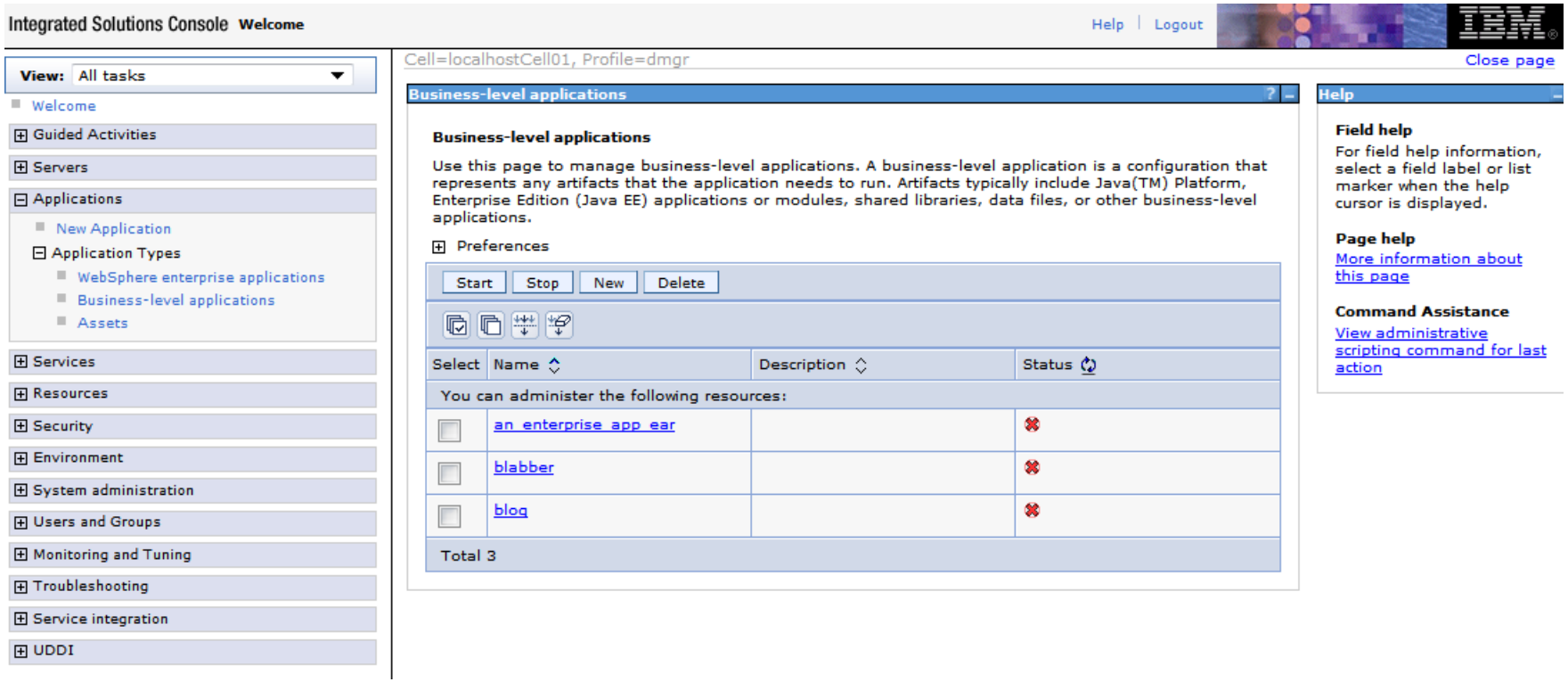
WAS v7 OSGi : Deploying an OSGi Application (EBA)



1) Import the asset (eba)
2) Create Business-level Application (BLA)
3) Add Deployed asset
4) Configure in wizard

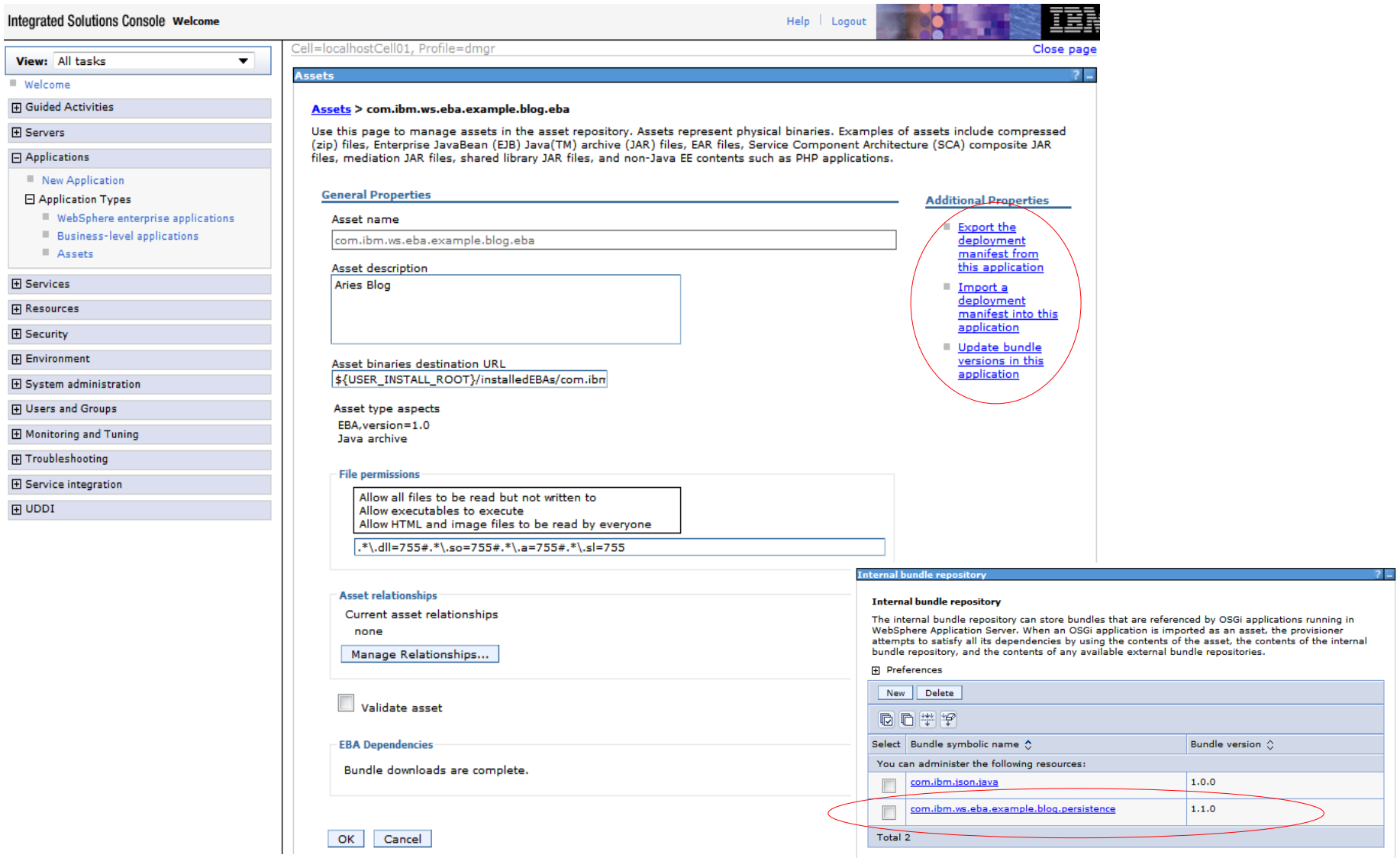
Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : Controlling OSGi and Enterprise Applications



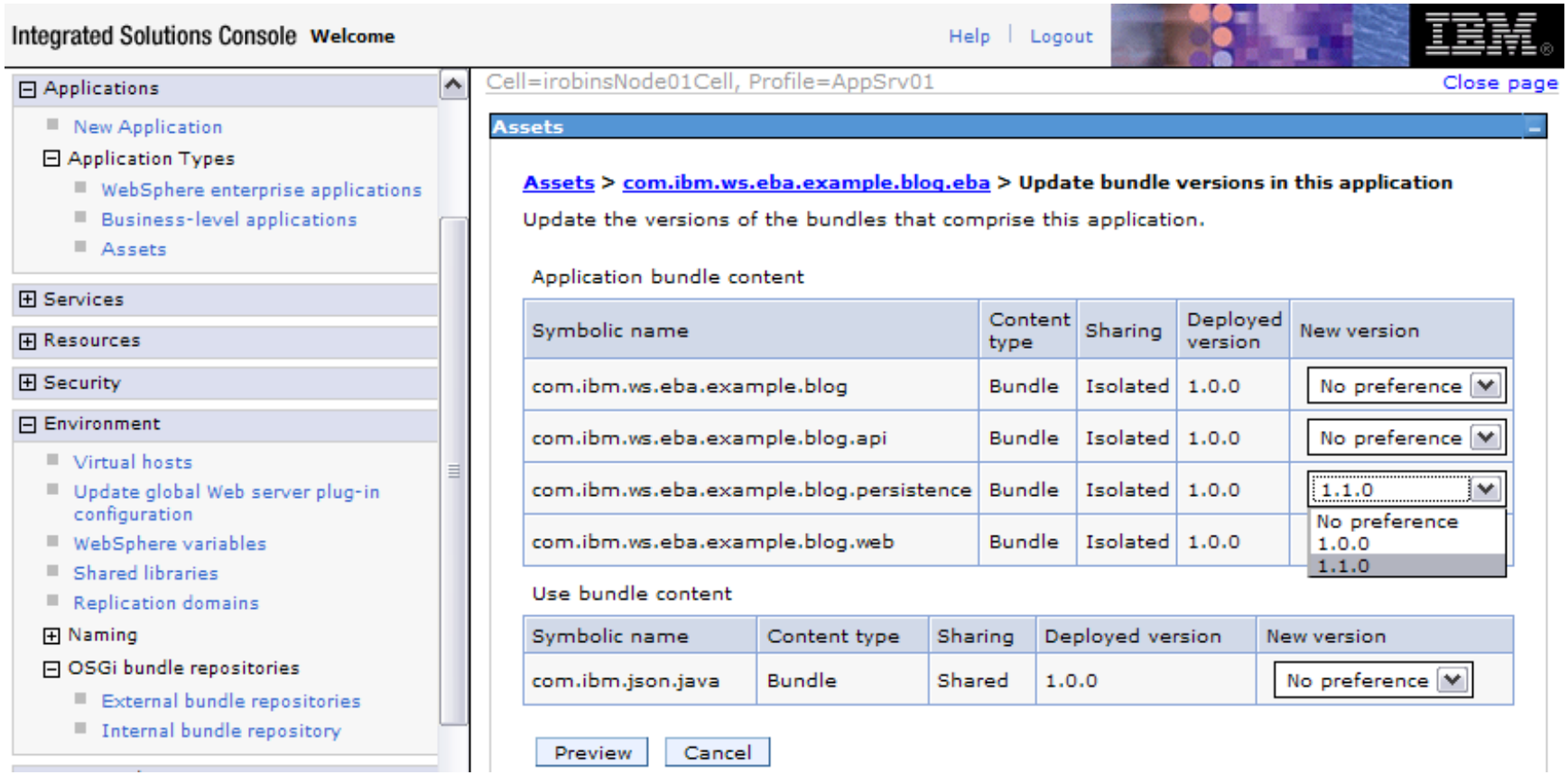
Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : Application-centric Bundle Management



Duane Appleby - applebyd@uk.ibm.com

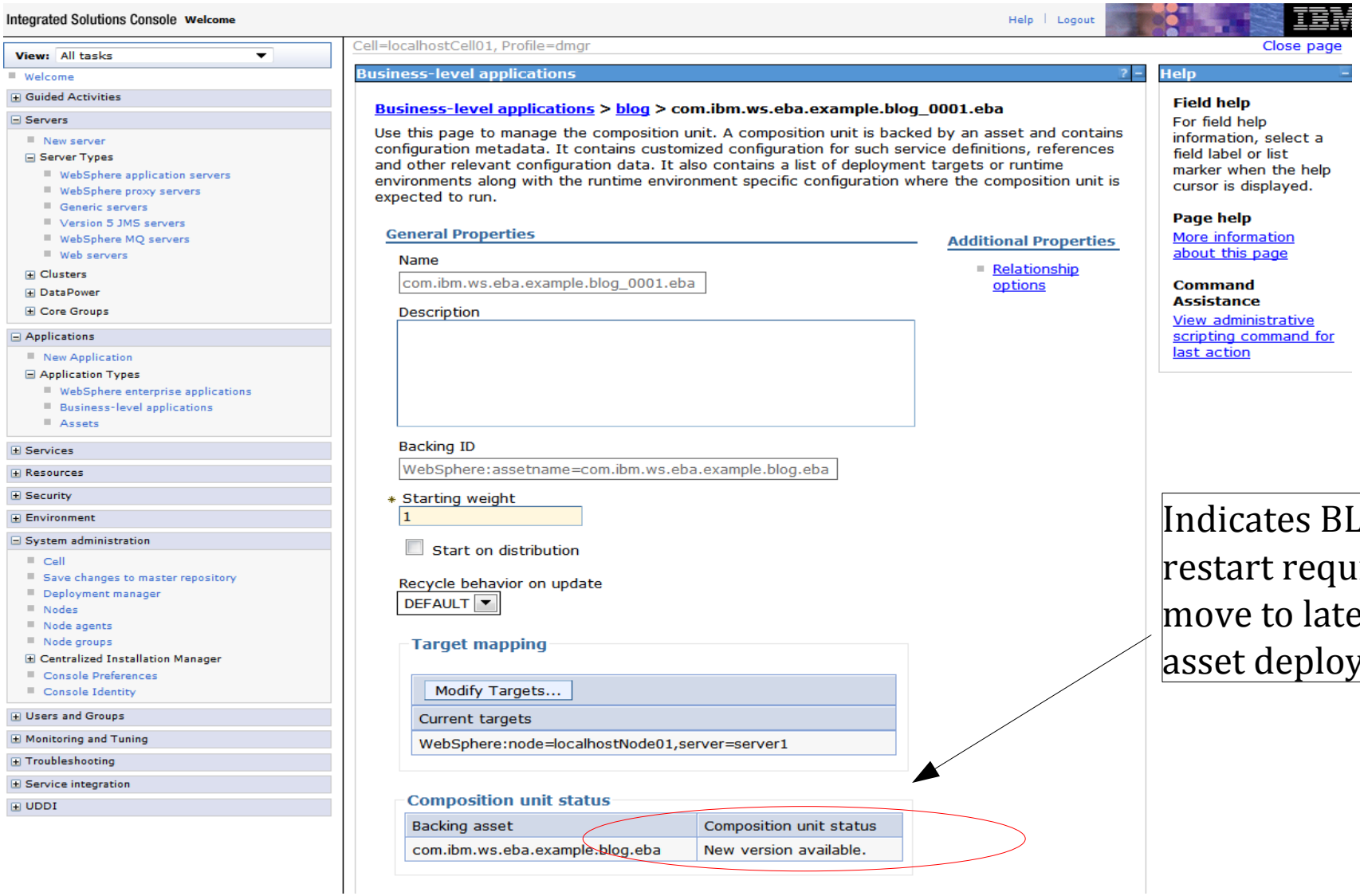
WAS v7 OSGi : Application-centric Bundle Management



- Preview changes
- Commit changes
- Restart BLA

Duane Appleby - applebyd@uk.ibm.com

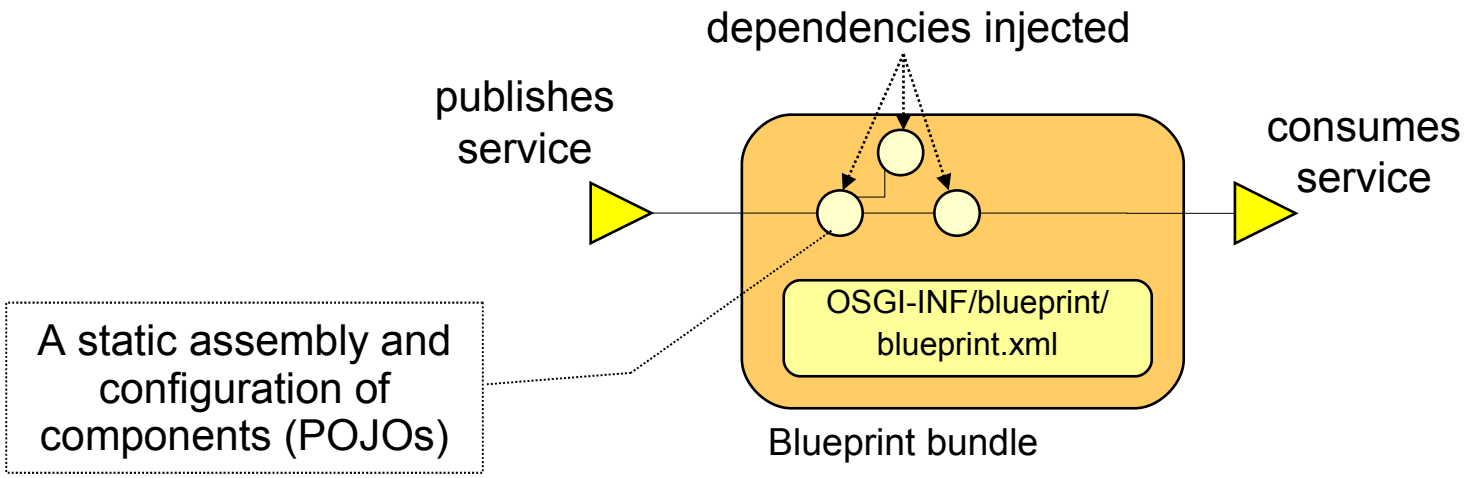
WAS v7 OSGi : Application-centric Bundle Management



Indicates BLA restart required to move to latest asset deployment

Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : Blueprint Components and Services



The Blueprint Dependency Injection container is a part of the server runtime (compared to the Spring container which is part of the application.)

- Standardised established Spring conventions
- Configuration and dependencies declared in XML 'module blueprint' (standardisation of Spring 'application context' XML)
  - Extended for OSGi: publishes and consumes components as OSGi services
- Simplifies unit test outside either Java EE or OSGi runtime

Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : Blueprint

Components and Services

- injected service references
- services can change over time can be temporarily absent without the bundle caring
- managed by Blueprint container

```
<blueprint>
  <bean id="shop" class="org.example.ecomm.ShopImpl">
    <property name="billingService" ref="billingService" />
  </bean>
  <reference id="billingService"
          interface="org.example.bill.BillingService" />
</blueprint>
```

- "prototype" scope indicates a new instance is created by the container for each use.
- "singleton" scope is the default.

```
<blueprint>
  <service ref="service" interface =
                    "org.example.bill.BillingService" />
  <bean id="service" scope="prototype"
          class="org.example.bill.impl.BillingServiceImpl" />
</blueprint>
```

Persistence and Transactions

- OpenJPA is default persistence provider in WebSphere
- Container managed JPA support integrated into Blueprint container:
  - @PersistenceUnit or @PersistenceContext (managed)
  - or <jpa:unit>, <jpa:context> bean property injection
  - Familiar development experience for JPA developers
  - Load-time enhancement of Entity classes
- Same container managed transaction attributes as EJBs:
  - Required, RequiresNew, Mandatory, NotSupported, Supports, Never

```
<blueprint>
  <bean id="shop" class="org.example.ecomm.ShopImpl">
      <jpa:context property="em" unitname="myUnit"/>
      <tx:transaction method="*" value="Required"/>
  </bean>
</blueprint>
```

Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : OSGi Service Registry and JNDI

- OSGi services are published to and looked up from OSGi service registry.
  - Declarations in Blueprint XML
- Interactions with the OSGi service registry:
  - Services also available in JNDI via the osgi:service URL scheme (additionally as aries:services)
  - Resources bound to JNDI published as services in the OSGi the Service Registry. Published as a service property called “osgi.jndi.service.name”

Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : OSGi Service Registry and JNDI

```
.........

<service ref="bloggingServiceComponent"
interface="com.ibm.ws.eba.example.blog.api.BloggingService"/>

.........
```

```
Public static final getBloggingService() {
    ......
    InitialContext ic = new InitialContext();
    return (BloggingService) ic.lookup("aries:services/"
       + BloggingService.class.getName());
     ......
}
```

```
<persistence-unit name="blogExample" transaction-type="JTA">

  ..........

  <provider>
    org.apache.openjpa.persistence.PersistenceProviderImpl
  </provider>

  <jta-data-source>
    aries:services/javax.sql.DataSource/(osgi.jndi.service.name=jdbc/blogdb)
  </jta-data-source>

  <non-jta-data-source>
    aries:services/javax.sql.DataSource/(osgi.jndi.service.name=jdbc/blogdbnojta)
  </non-jta-data-source>

  ..........

</persistence-unit>
```

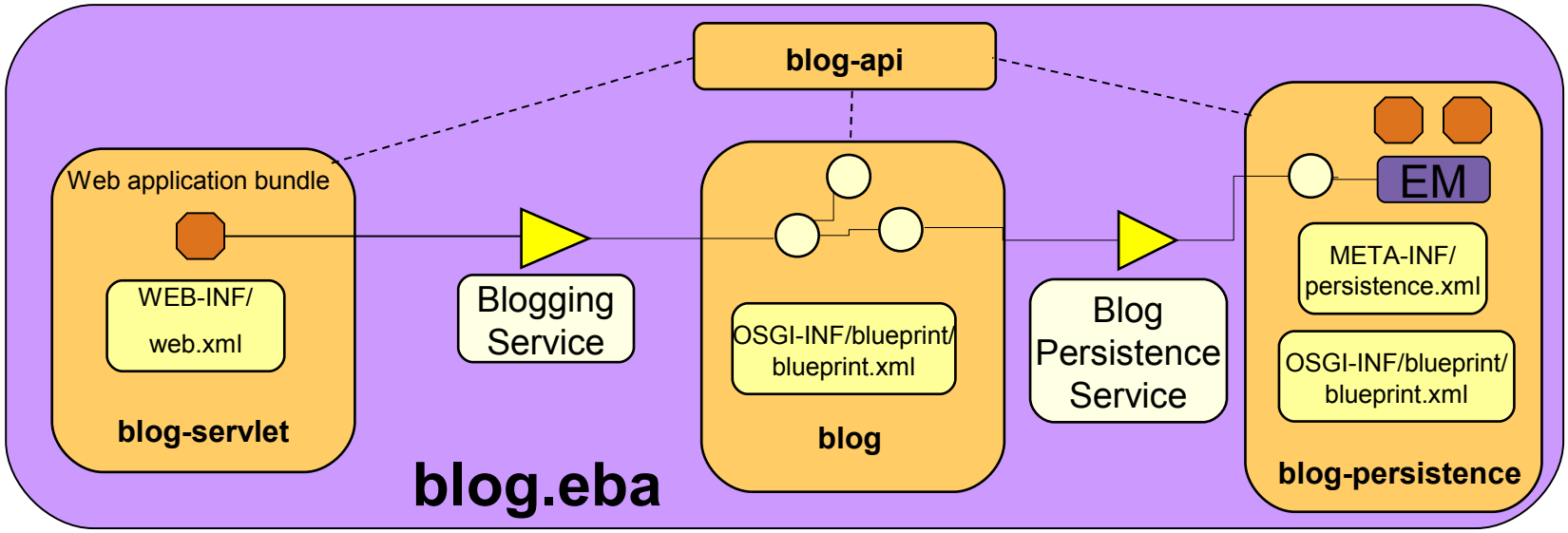
Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : Sample Application Architecture

```
Manifest-Version: 1.0
Application-ManifestVersion: 1.0
Application-Name: Aries Blog
Application-SymbolicName: com.ibm.ws.eba.example.blog.app
Application-Version: 1.0
Application-Content:
 com.ibm.ws.eba.example.blog.api;version=1.0.0,
 com.ibm.ws.eba.example.blog.persistence;version=1.0.0,
 com.ibm.ws.eba.example.blog.web;version=1.0.0,
 com.ibm.ws.eba.example.blog;version=1.0.0
Use-Bundle:
 com.ibm.json.java;version="[1.0.0,2.0.0)"
```

isolated content

shared content



Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi : Composite Bundle Archive (CBA)

- Composite Bundle Manifest
- All bundles placed into internal bundle repository
- Preference to resolve against CBAs

```
Manifest-Version: 1.0
CompositeBundle-ManifestVersion: 1
Bundle-Name: Blog Application
Bundle-SymbolicName: com.ibm.ws.osgi.example.Blog
Bundle-Version: 1.0
CompositeBundle-Content:
        com.ibm.ws.osgi.example.blog;version="[1.0,1.0]",
        com.ibm.ws.osgi.example.blog.persistence;version="[1.0,1.0]"
Import-Package: com.ibm.ws.other.pkge;version=1.0.0
Export-Package: com.ibm.ws.osgi.example.blog;version=1.0.0
CompositeBundle-ExportService: com.ibm.ws.osgi.example.blog.BloggingService;filter="(blog.type=community)"
CompositeBundle-ImportService: com.ibm.ws.osgi.example.auth.UserAuthService
```

Duane Appleby - applebyd@uk.ibm.com

WAS v7 OSGi Summary

- Isolation and Sharing
- Classpath Control
- Versioning Control
- Integration of established technologies JPA/JNDI/JTA
- Blueprint dependency injection – publish and consume services
- EBA
- Bundle Repositories
- CBA

Duane Appleby - applebyd@uk.ibm.com

WebSphere Application Server V8 Beta

Duane Appleby - applebyd@uk.ibm.com

Disclaimer

IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.

Duane Appleby - applebyd@uk.ibm.com

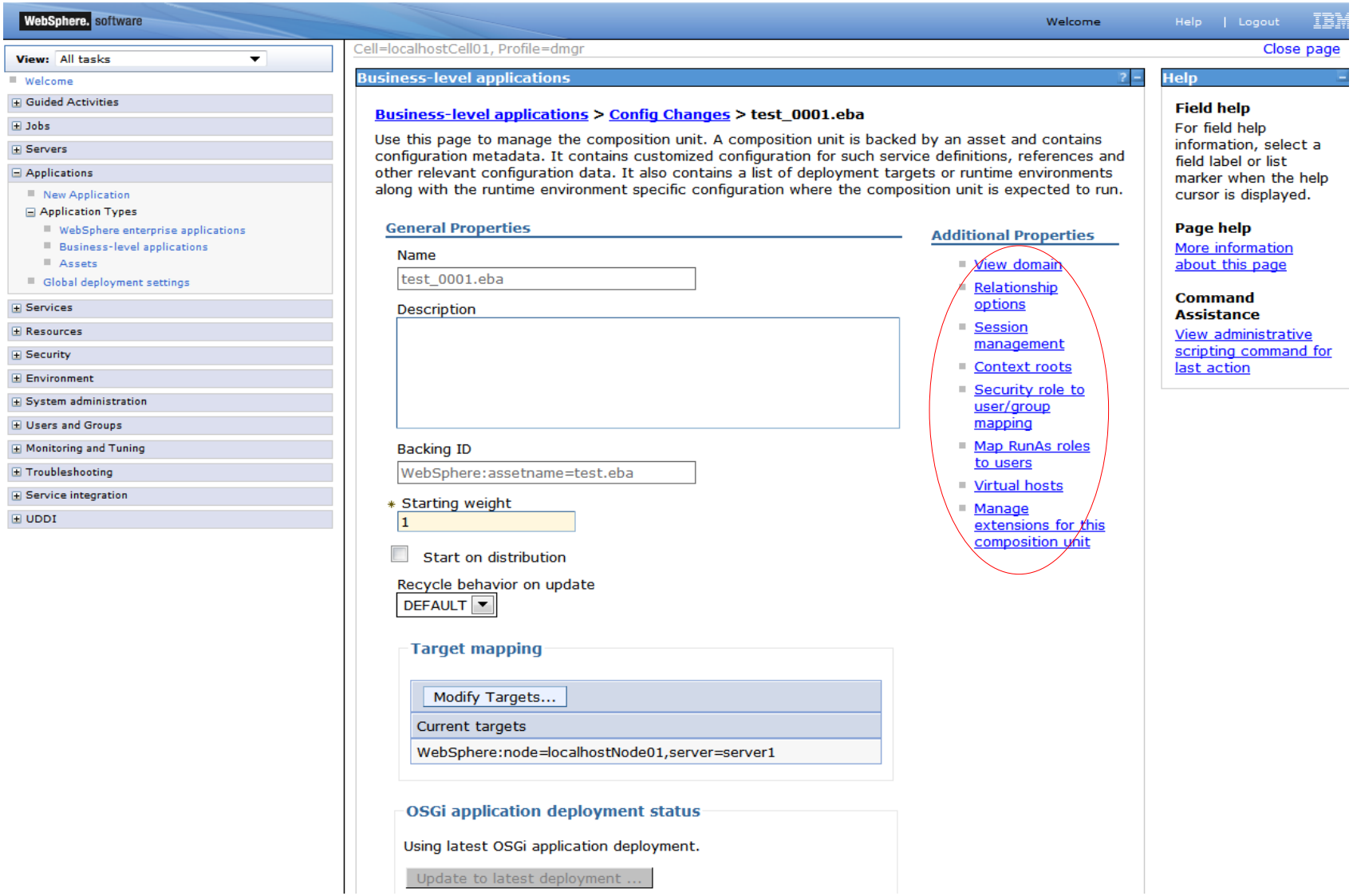
WebSphere Application Server V8 Beta

https://www14.software.ibm.com/iwm/web/cc/earlyprograms/websphere/wsasoa/index.shtml

- Latest Beta refresh 11th March 2011

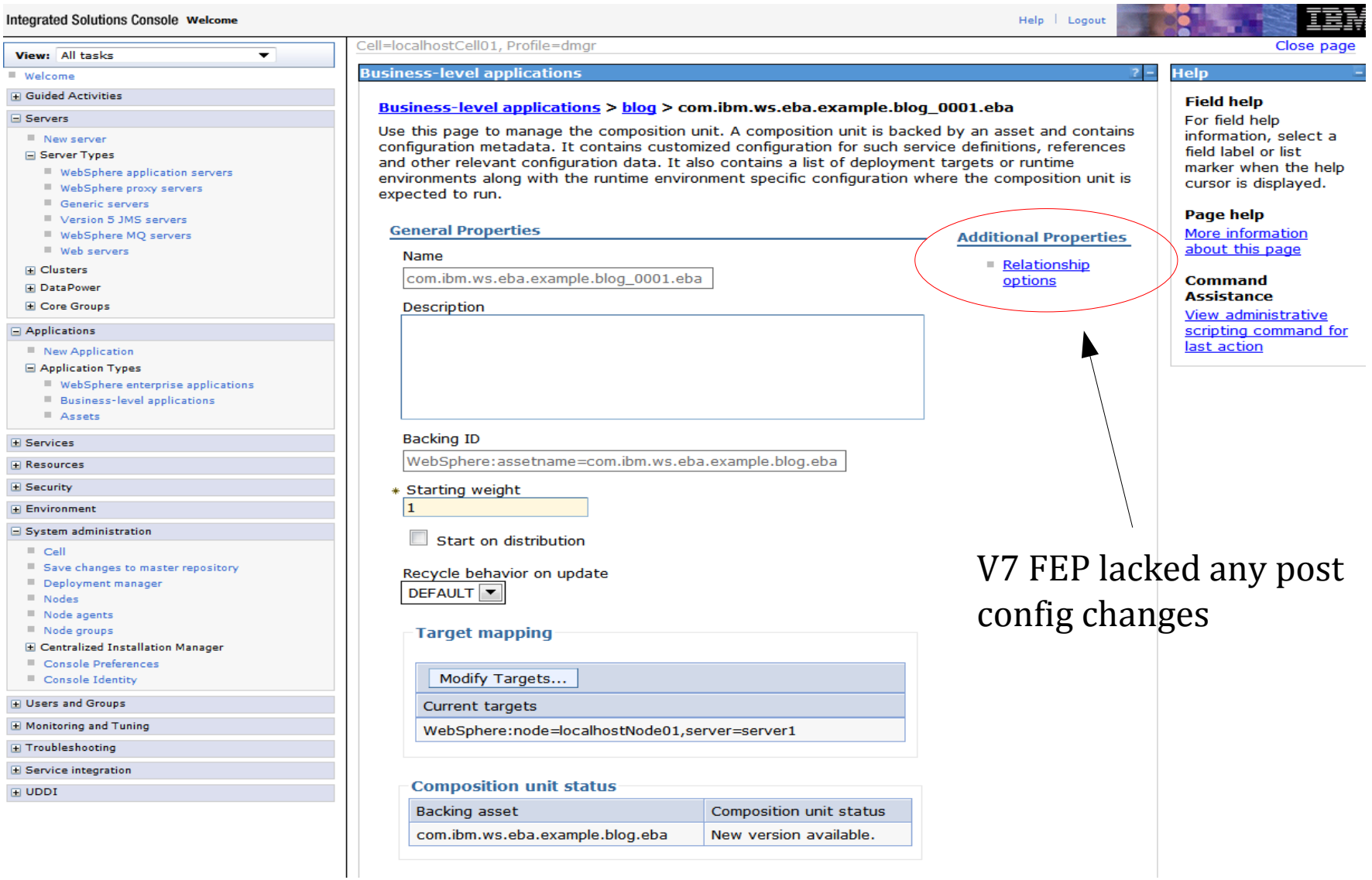
Duane Appleby - applebyd@uk.ibm.com

WAS v8 Beta : Post Install Configuration Changes



Duane Appleby - applebyd@uk.ibm.com

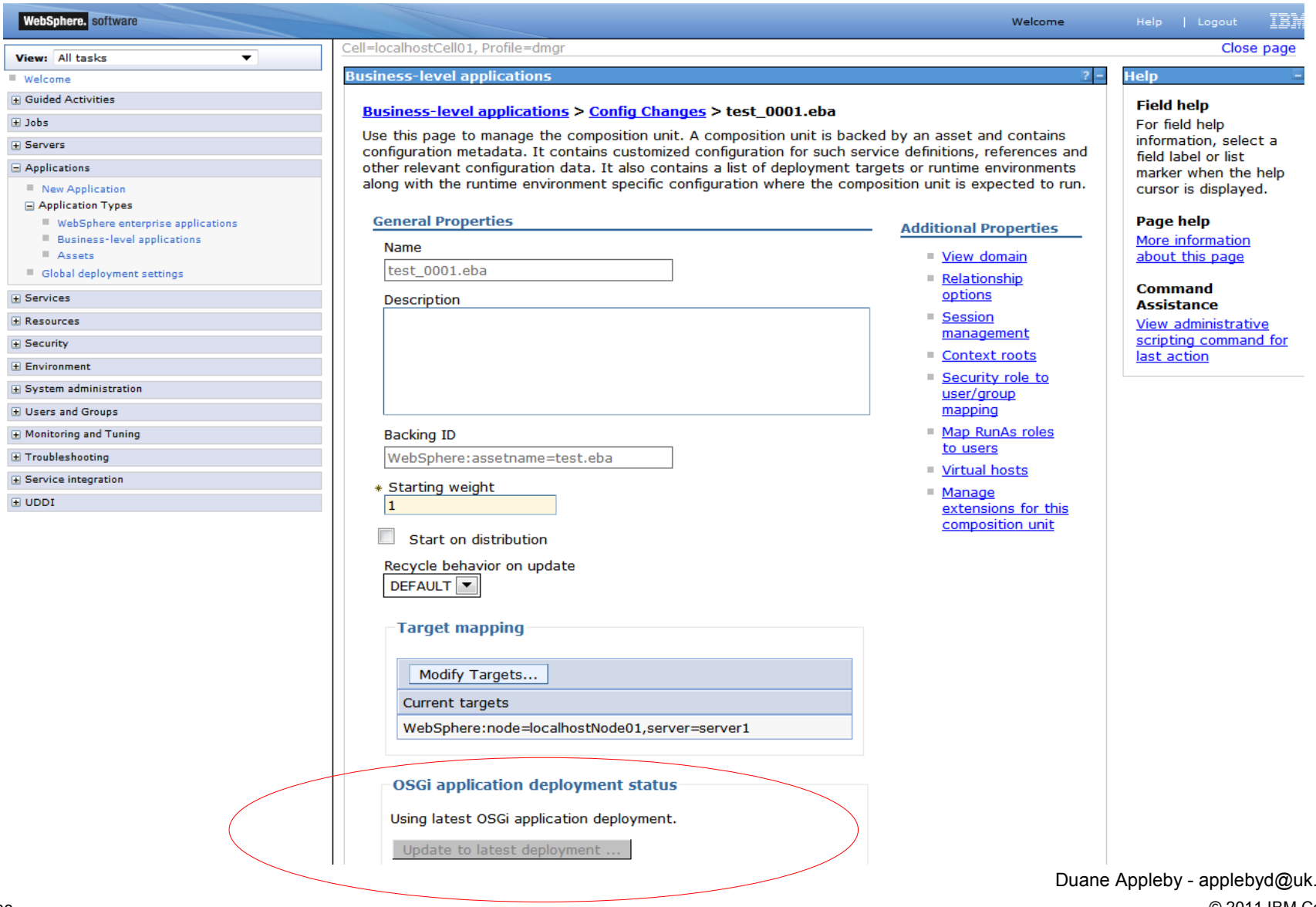
WAS v7 OSGi : Screen shot



V7 FEP lacked any post config changes

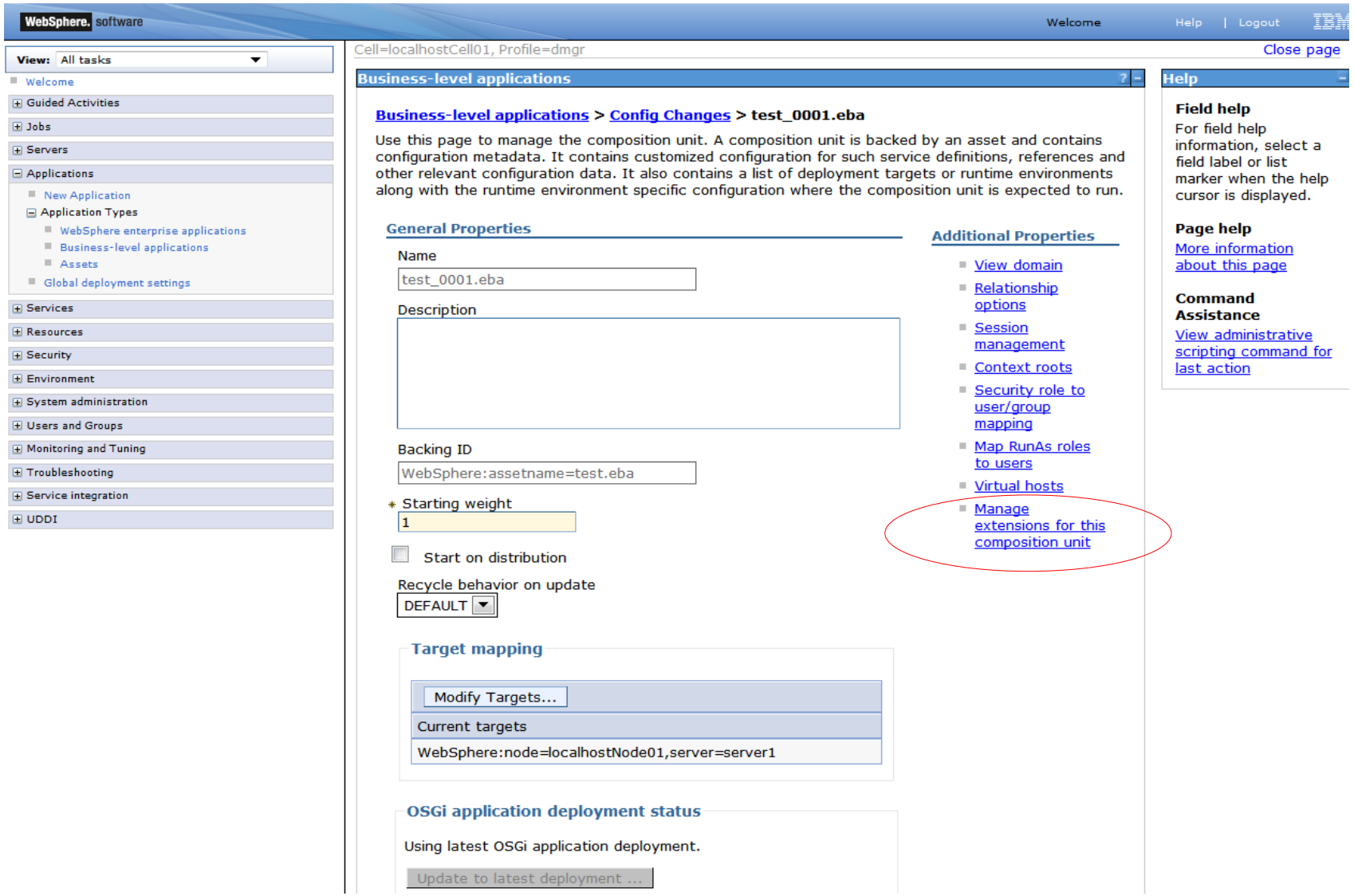
Duane Appleby - applebyd@uk.ibm.com

WAS v8 Beta : In-place Update



Duane Appleby - applebyd@uk.ibm.com

WAS v8 Beta : Application Extensions



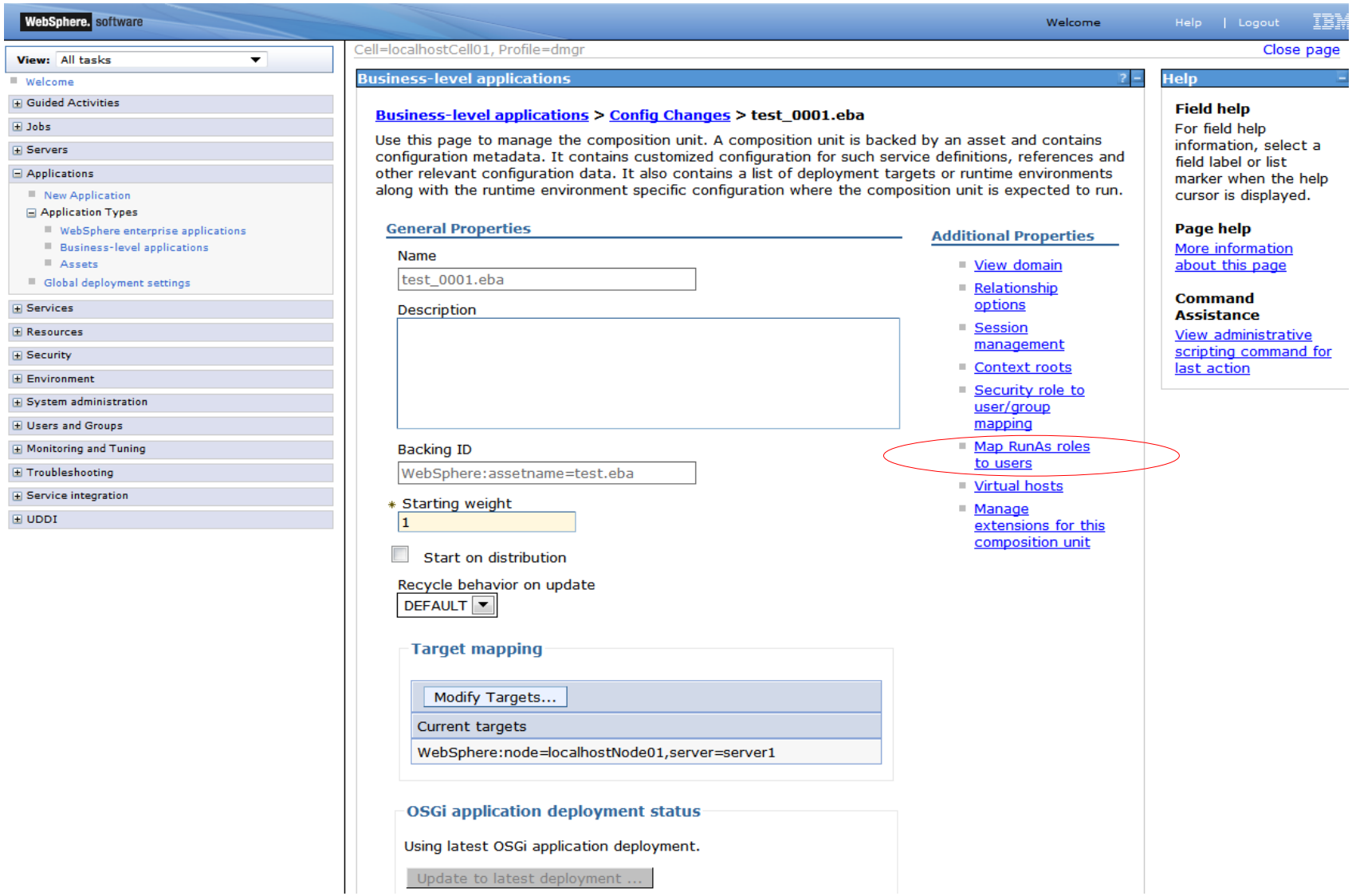
Duane Appleby - applebyd@uk.ibm.com

WAS v8 Beta : Composite Bundle Archive (changes)

- Content Hiding
- Can be specified on Application-Content
- Can contain WABs
  - *Configurable during 'addAsset'*
- Exported assets now contain their CBA content
- Support for bulk bundle uploads via zip archives

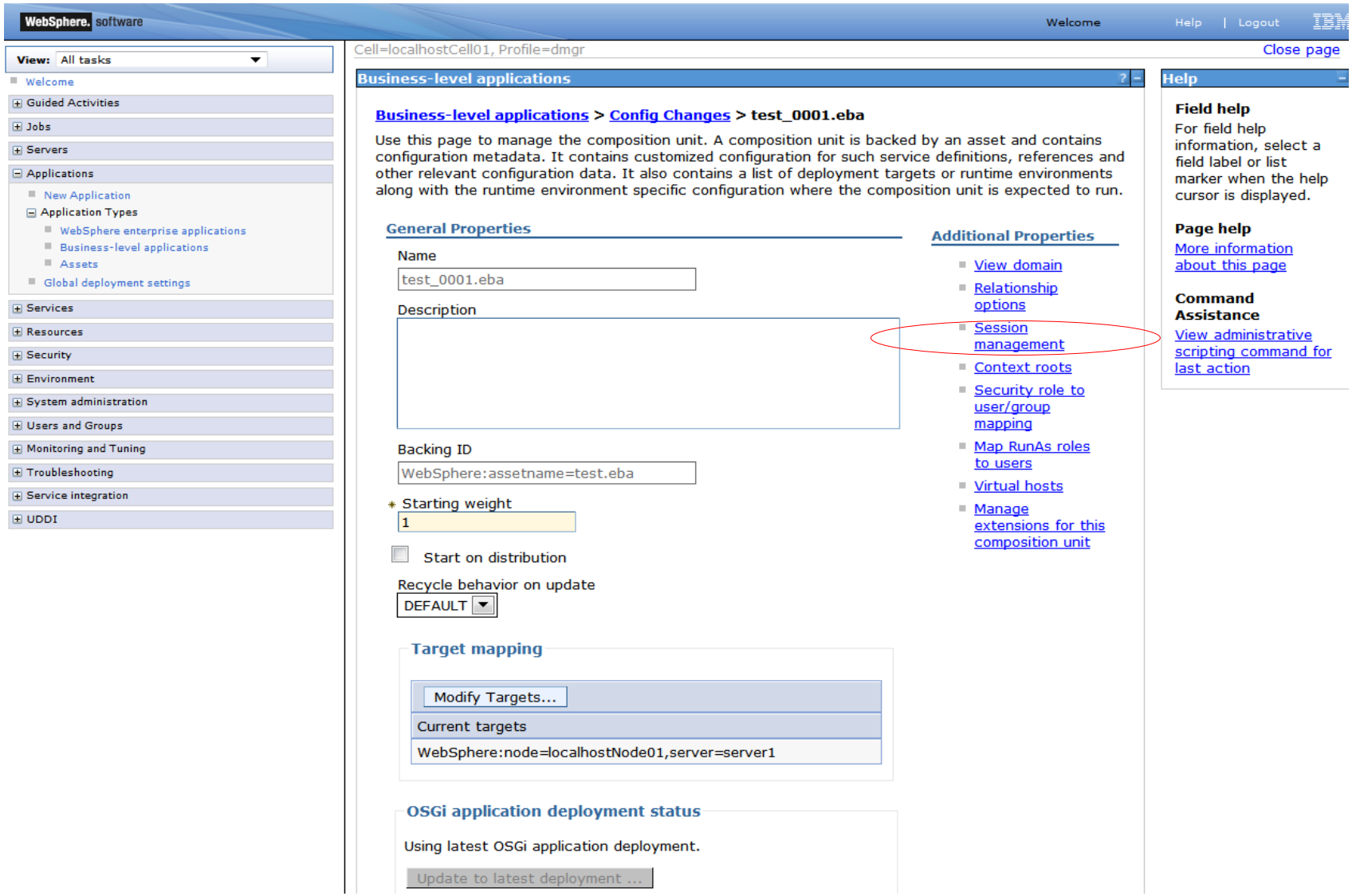
Duane Appleby - applebyd@uk.ibm.com

WAS v8 Beta : Map RunAs roles to users



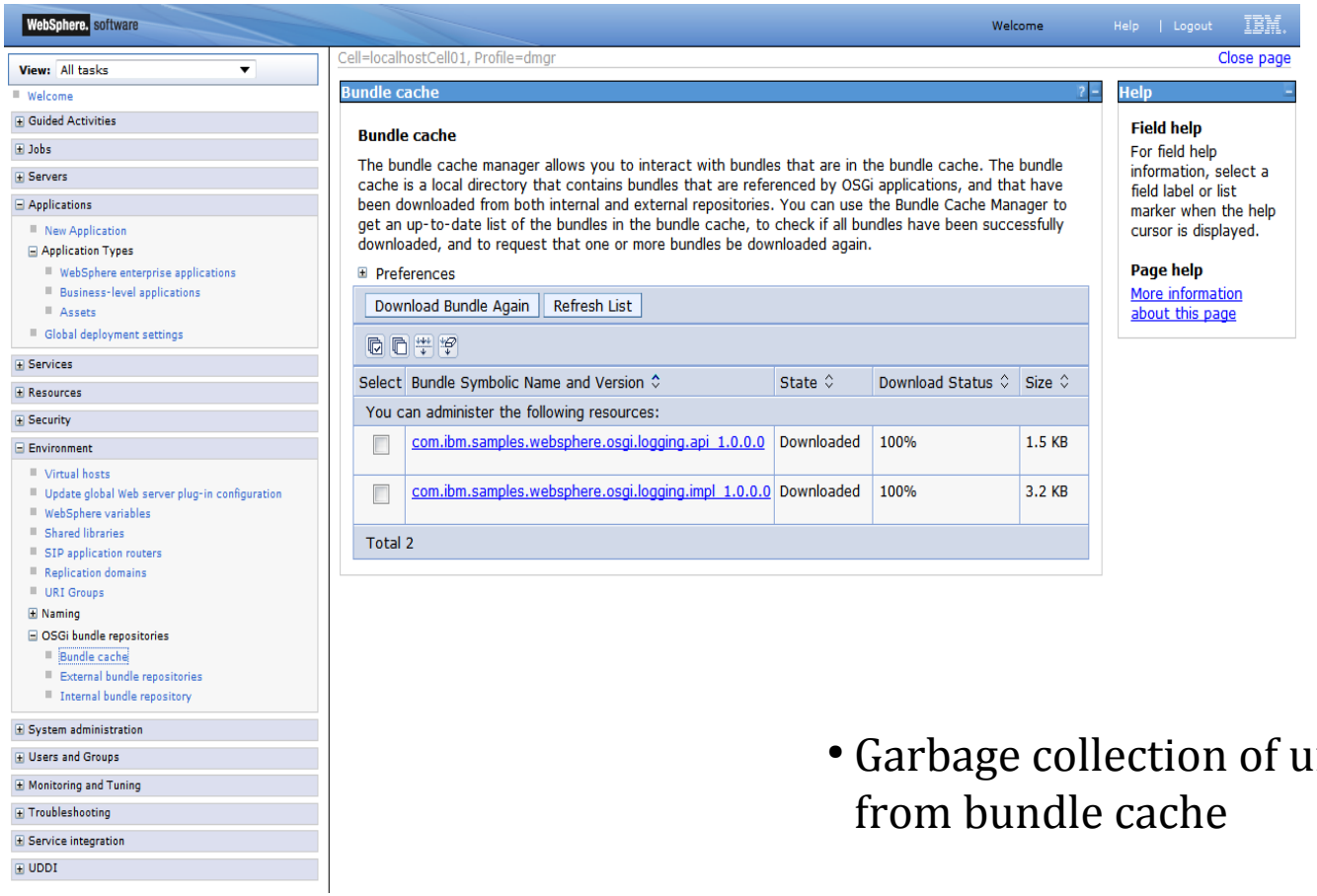
Duane Appleby - applebyd@uk.ibm.com

WAS v8 Beta : Session Replication



Duane Appleby - applebyd@uk.ibm.com

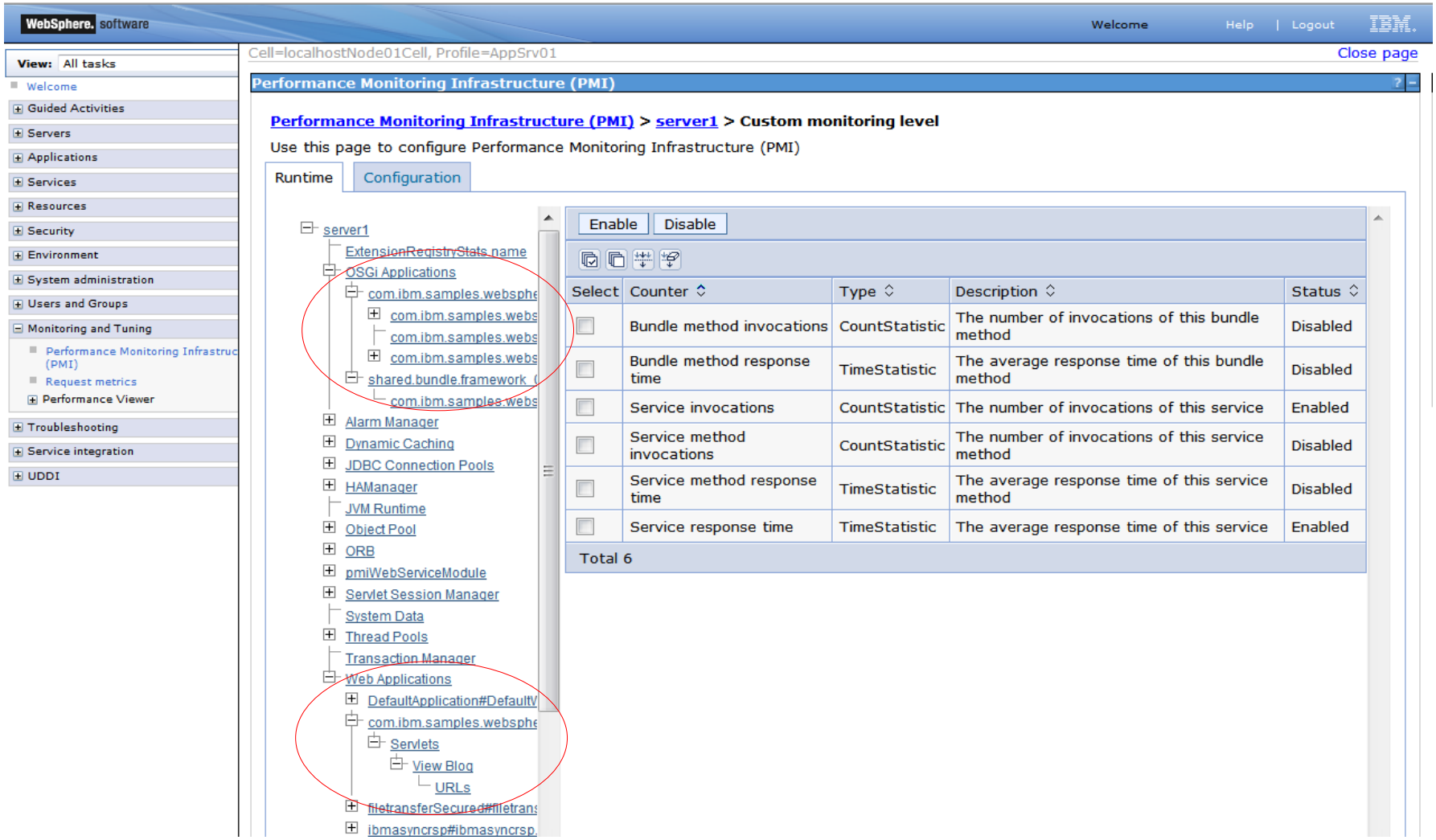
WAS v8 Beta : Bundle Cache



- Garbage collection of unused bundles from bundle cache
- New panel showing download status previously MBean only

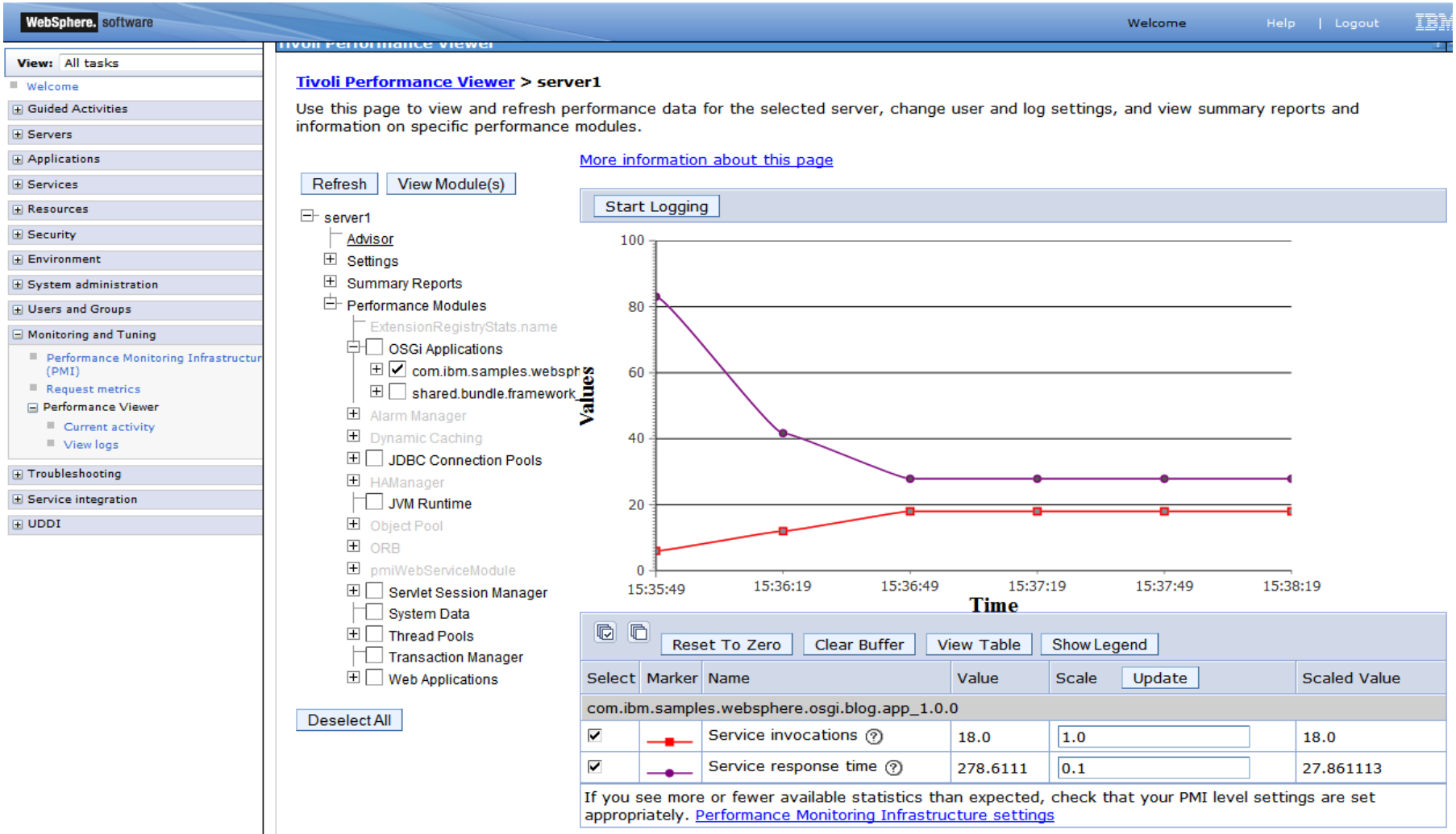
Duane Appleby - applebyd@uk.ibm.com

WAS v8 Beta : Performance Monitoring Infrastructure (PMI)



Duane Appleby - applebyd@uk.ibm.com

WAS v8 Beta : Performance Monitoring Infrastructure (PMI)



Duane Appleby - applebyd@uk.ibm.com

Summary – WAS v8 Beta additional OSGi support

- Post deployment configuration changes
- In-place application update
- In-place application extension
- Composite Bundle Archive
- Run As roles
- Session replication management
- Bundle cache administration
- PMI
- Servlet 3.0

Duane Appleby - applebyd@uk.ibm.com

Additional Info
v7 FEP & v8 Beta

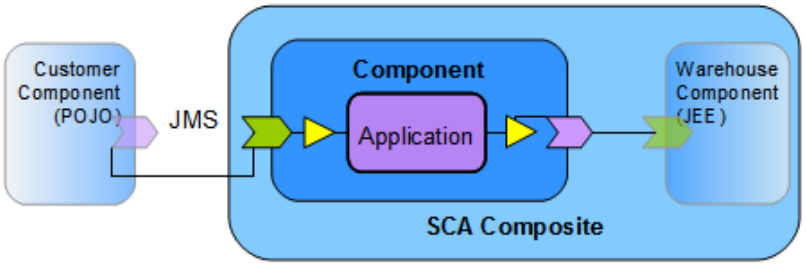
Duane Appleby - applebyd@uk.ibm.com

Additional OSGi Integration (SCA)

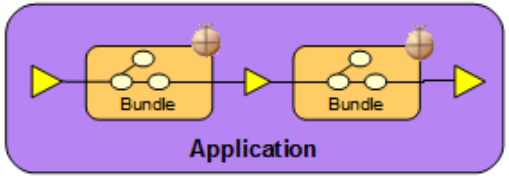
- Service Component Architecture (SCA)

  - Assembly into heterogeneous composites of OSGi and non-OSGi components

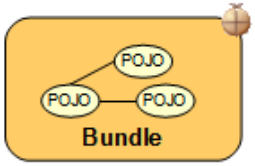
  - Remoting of OSGi application services through SCA services with a variety of bindings including JMS, SOAP/HTTP, IIOP and JSON-RPC.



SCA Composite assembled from heterogeneous components including an **OSGi Application** component, and integrated through SCA services with configurable bindings (JMS, web services...).



OSGi Bundles assembled in an **OSGi Application** and integrated through services in the OSGi service registry



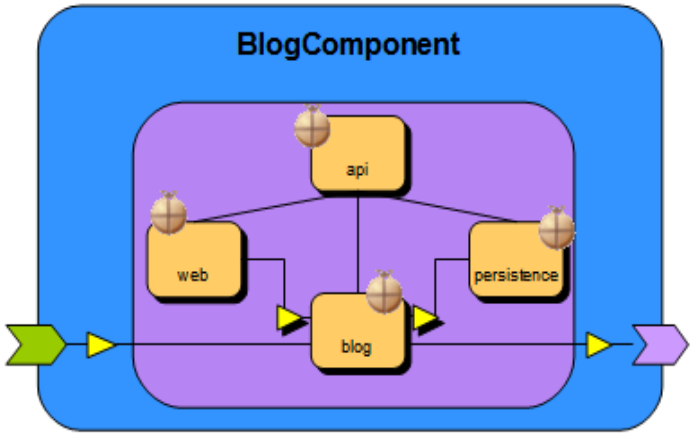
POJOs assembled using a Blueprint context and scoped by an **OSGi Bundle**.

Duane Appleby - applebyd@uk.ibm.com

Additional OSGi Integration (SCA)

- SCA Integration : implementation.osgiapp

```
Manifest-Version: 1.0
Application-ManifestVersion: 1.0
Application-Name: Aries Blog
Application-SymbolicName: com.ibm.ws.eba.example.blog.app
Application-Version: 1.0
Application-Content:
 com.ibm.ws.eba.example.blog.api;version="1.0.0",
 com.ibm.ws.eba.example.blog.persistence;version="1.0.0",
 com.ibm.ws.eba.example.blog.web;version="1.0.0",
 com.ibm.ws.eba.example.blog;version="1.0.0"
Use-Bundle: com.ibm.json.java;version="[1.0.0,2.0.0)"
Application-ExportService:
 com.ibm.ws.eba.example.blog.Blog
Application-ImportService:
 com.ibm.ws.eba.example.blog.UserAuthorization
```




```
<component name="com.ibm.ws.aries.example.BlogComponent">
  <service name="bloggingService">
    <interface.java interface="com.ibm.ws.eba.example.blog.Blog" />
    <binding.ws
      port="http://www.blogging.org/BlogService#wsdl.endpoint(BlogService/BlogServiceSOAP)" />
  </service>
  <reference name="userAuthorization">
    <interface.java interface="com.ibm.ws.eba.example.blog.UserAuthorization" />
  </reference>
  <sfp:implementation.osgiapp applicationSymbolicName="com.ibm.ws.aries.example.blog.app"
    applicationVersion="1.0.0" />
</component>
```

Duane Appleby - applebyd@uk.ibm.com

Additional OSGi Integration (Tooling)

- Free Eclipse Plugin for

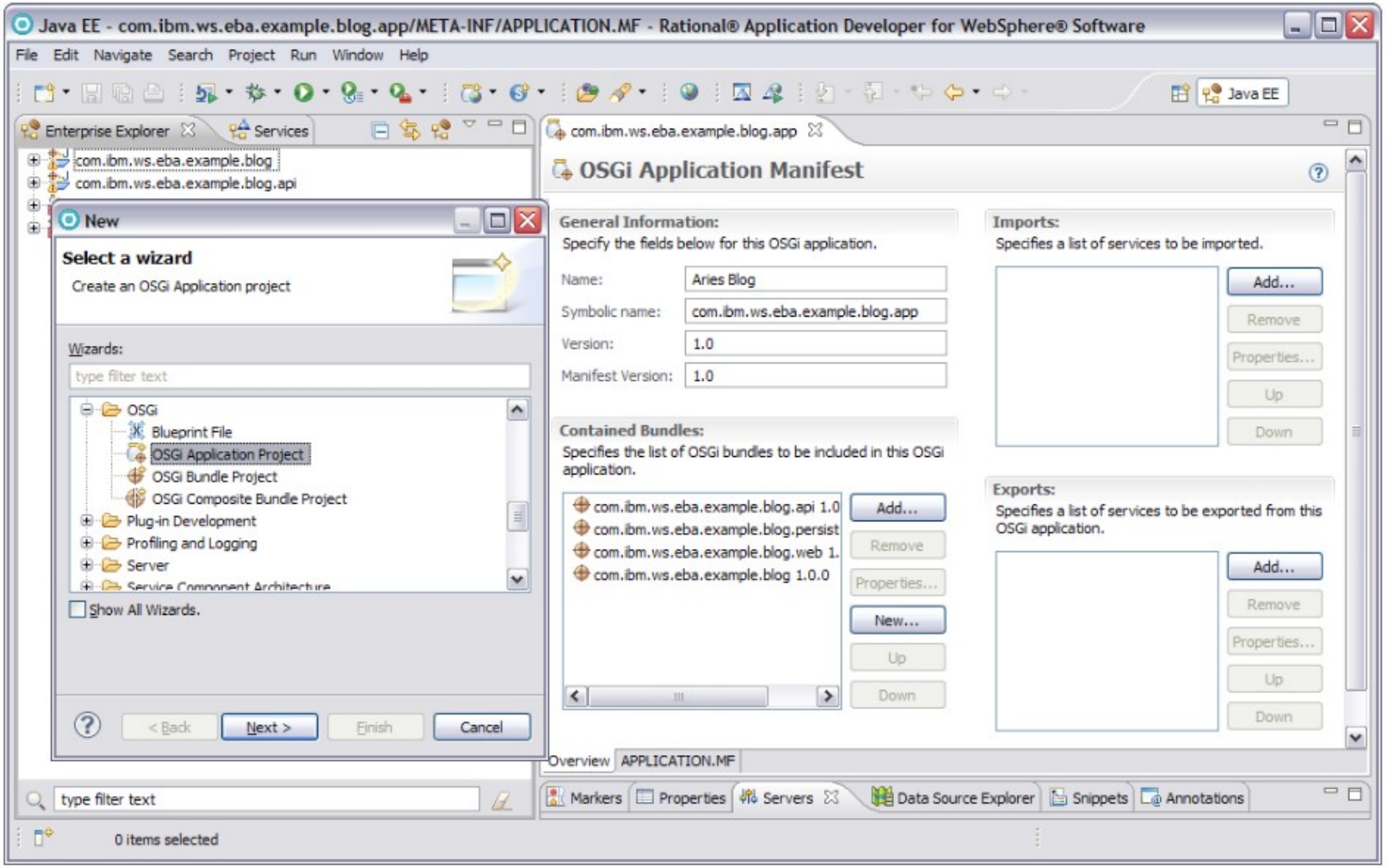
  - Includes features that increase developer productivity
  - Creates OSGi Applications for any Aries-based server runtime.
  - Eclipse WTP 3.6 (Helios) M6 or later required

- RAD Tooling (v8.0.2)

  - Integrated with Web Tools, JEE productivity tools, and other capabilities in RAD
  - Supports deployment to WAS v8 Beta
  - Supports deployment to WAS v7 OSGi FeP
  - Enhanced validation

Duane Appleby - applebyd@uk.ibm.com

Additional OSGi Integration (RAD)



Duane Appleby - applebyd@uk.ibm.com

Further Information

Resource Hub (articles, tutorials, redbooks, forums)

http://www.ibm.com/software/websphere/osgi

Team Blogs/Twitter

www.ianrobinson.blogspot.com

www.devangelist.blogspot.com

@sjmaple @notatibm @TimothyWard

Email

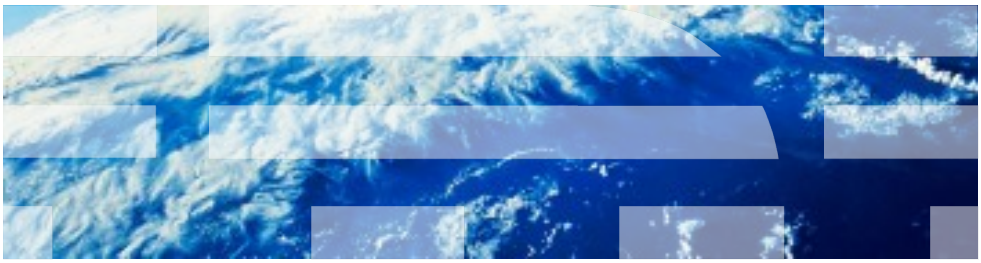
applebyd@uk.ibm.com

Duane Appleby - applebyd@uk.ibm.com

WAS v8 Beta
Demo

Duane Appleby - applebyd@uk.ibm.com

WebSphere Application Server Support for OSGi Applications



Agenda

- Standards and Open Source
- WAS v7 OSGi Feature Pack
- WAS v8 Beta OSGi Applications Support
- WAS v8 Beta Demo

Duane Appleby - applebyd@uk.ibm.com

- Standards and Open Source
  Covers some historical aspects about the use of OSGi in WebSphere and the various standards and open source projects that have emerged and encouraged the exposing of OSGi applications support.

- WAS v7 OSGi Feature Pack
  Looks at the functionality provided and supported for OSGi applications and the administrative processes to install, run and monitor these applications.

- WAS v8 Beta
  Looks at the advancements in functionality, the new administrative processes available and the benefits they provide.

Standards and Open Source

Duane Appleby - applebyd@uk.ibm.com

Standards and Open Source

- OSGi Enterprise Specification
  - OSGi Enterprise Expert Group (EEG)
  - First release 22 March 2010
  - Brings Enterprise technologies and OSGi together
  - Adds Spring-derived *Blueprint* component model and DI container

Duane Appleby - applebyd@uk.ibm.com

OSGi has been with us for many years and in 2006 WAS v6.1 introduced the use of OSGi internally, however, there have been many issues surrounding how enterprise java applications make use of the benefits of OSGi in commercial enterprise Java runtimes like WebSphere, especially when we have many years of investment in Java EE where we have tools, runtimes and administrative processes.

These issues have been the primary concern of the OSGi Alliance Enterprise Expert Group and March 2010 saw the release of the first OSGi Enterprise Specification (v4.2)

The resulting specification describes how Java SE/EE technologies like JTA, JPA, JNDI, JMX, WebApps and so on run in an OSGi environment. There is no significant invention of new programming models, only the adaptation of what is already familiar into a more modular and dynamic runtime environment.

The one extension beyond pure Java EE is the specification of the Blueprint component model and dependency injection container, an evolution of the Spring framework as an OSGi standard

Java EE provides the core enterprise application programming model

Deploying modules as OSGi bundles simplifies reuse between applications, provides versioning, encourages (and enforces) modular design and enables dynamic module updates.

Standards and Open Source

- OSGi Enterprise Specification
  - OSGi Enterprise Expert Group (EEG)
  - First release 22 March 2010
  - Brings Enterprise technologies and OSGi together
  - Adds Spring-derived *Blueprint* component model and DI container
- Apache Aries
  - http://aries.apache.org/
  - Provide enterprise OSGi spec implementations
  - Collaborative environment to experiment and drive further standardisation
  - Integrated into numerous projects and products

Duane Appleby - applebyd@uk.ibm.com

- There are a number of open source projects with a focus on Enterprise OSGi, the most complete is the Apache Aries project, formed in September 2009.

- The objectives of Apace Aries:

- To provide free, open source implementation of the enterprise OSGi technologies
- To provide an environment to collaborate and experiment with new technologies to inform EEG standardization, in particular around those technologies that affect the application programming model such as the Blueprint container.
- To establish a broad and open community with an interest in enterprise OSGi to encourage implementation and adoption of OSGi in enterprise applications.

- The Apache Aries project has grown to almost 50 contributors from companies including IBM, Progress, SAP, Redhat, Ericsson, LinkedIn, and others as well as individual contributors.

- Aries does not intend to provide a server runtime environment for enterprise OSGi but rather components that can be used in such an environment. The Apache Aries project provides implementations of

- Blueprint container
- JPA integration
- JTA integration
- JMX integration
- JNDI integration
- Application assembly and deployment

These have been integrated into Apache Geronimo and WebSphere Application Server as well as a number of other projects and products including Apache Felix Karaf and JBossOSGi.

WebSphere Application Server V7
OSGi Applications Feature Pack

Duane Appleby - applebyd@uk.ibm.com

WebSphere Application Server V7 Feature Pack for OSGi Applications and Java Persistence API (JPA) 2.0

http://www-01.ibm.com/software/webservers/appserv/was/featurepacks/

- Early Access November 2009
- Most rapidly downloaded v7 FEP Beta release
- General Availability May 2010

Duane Appleby - applebyd@uk.ibm.com

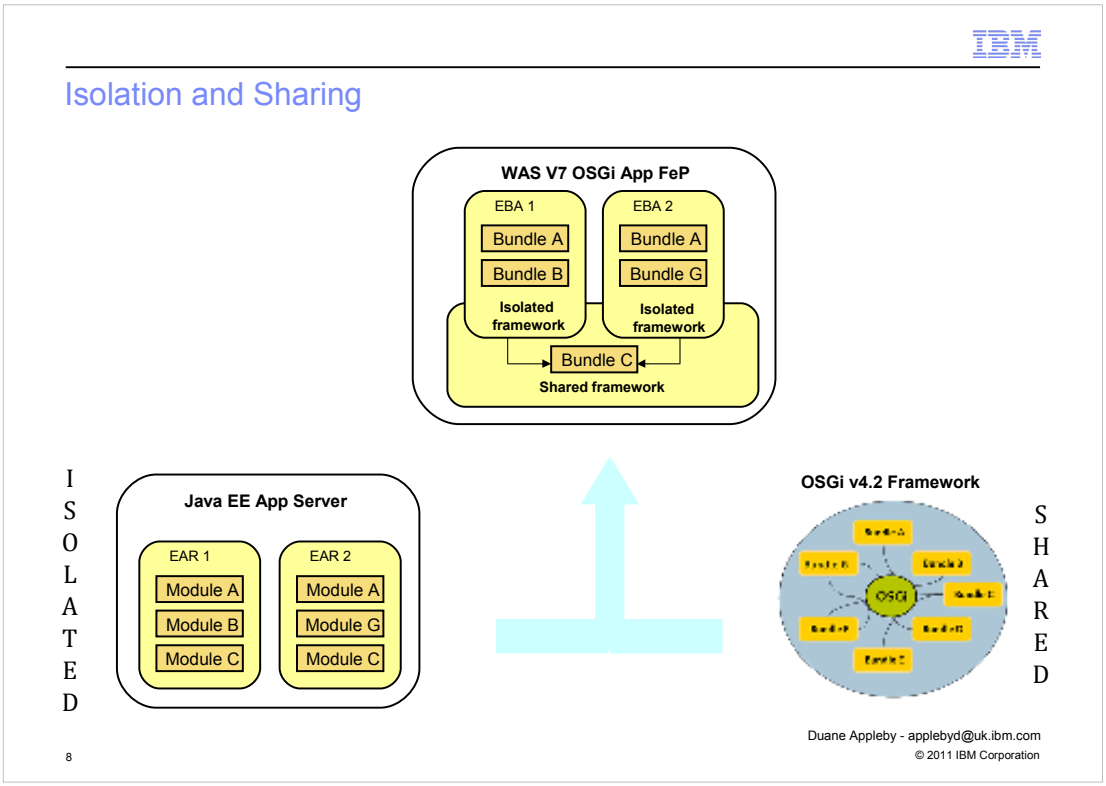
Points to note about feature pack releases :-

- Same level of support as the base product

- Released to bring new technologies to customers at the earliest available opportunity and to give capabilities for the current release, not just to see if there is a market for the technology.

- The WAS commitment is that all feature packs must be available on future release (subject to any deprecation notices) as either:

    - a feature pack installable or,
    - integrated as part of the base product



In Java EE, modules are isolated within an application and applications are isolated from one another which makes sharing modules difficult

In OSGi 4.2 all bundles have shared visibility to the externals of all others bundles within an OSGi framework (JVM) which makes isolating applications difficult though eliminates the shortcomings of plain Java classloading:

1. Only declared exports are visible outside the bundle

2. Dependencies are resolved to specific versions and multiple versions of packages can be available concurrently for different client bundles

3. Dependencies are explicit so that bundles will not start if all dependencies cannot be resolved

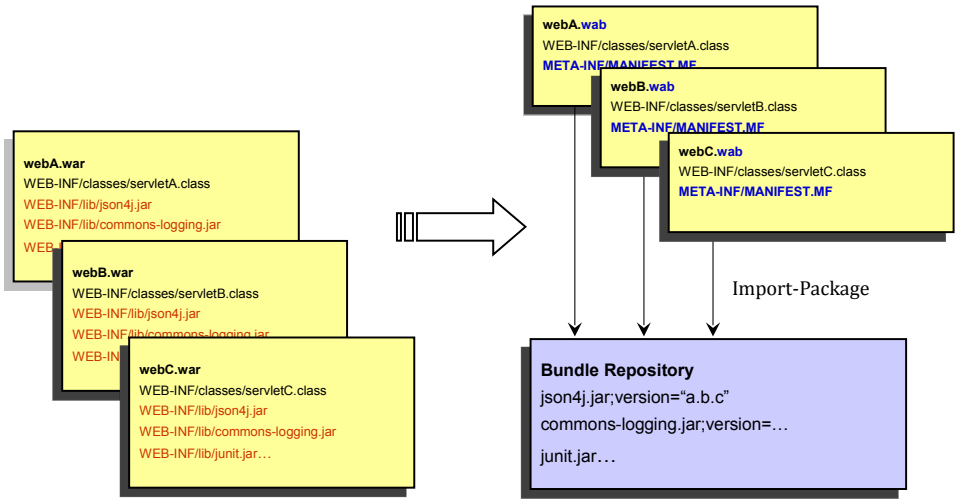
Application Isolation is an important consideration. At one extreme, Java EE provides no portable notion of module sharing between enterprise applications – everything is isolated and sharing libraries is difficult.

At the other extreme, OSGi bundles have shared visibility to the externals of all other bundles within an OSGi framework, which typically means within a JVM. This makes isolating applications difficult.

The current version of Equinox, which is used inside WAS and is the reference implementation of OSGi 4.2, supports the notion of nested frameworks whereby multiple peer frameworks are isolated from one another but may share a common parent framework. WAS OSGi Feature Pack exploits this by deploying the isolated content of each OSGi Application into its own isolated child framework. Whilst any bundles intended to be shared between applications can be deployed into the single parent framework.

WAS v7 OSGi : Getting Started WARs to WABs

- No java code change : war modules ➙ bundles
- Common bundles factored out and used at specific versions

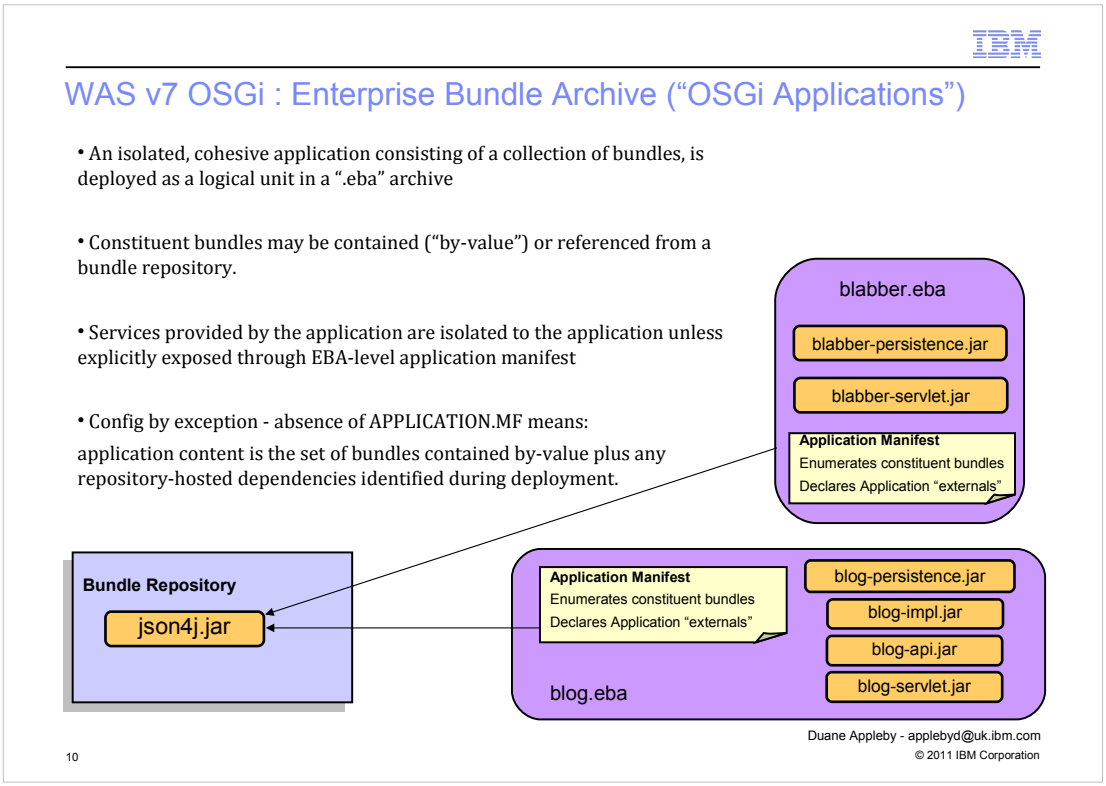


Duane Appleby - applebyd@uk.ibm.com

Getting started with OSGi application support in WAS is made very simple with no need to make any changes to web application implementation.

WAR modules can be deployed to WAS as web application bundles with no change of runtime behaviour. On its own this is not all that interesting but it becomes interesting when you have multiple applications that use common libraries. What we can do now is place versioned, common libraries in an OSGi bundle repository so that each application using these libraries delivers only their unique modules.

Remember - a bundle is just a jar with additional OSGi metadata and a classloader which respects that metadata. Throughout this presentation I use the bundle symbol to indicate a jar that is actually a bundle. In the illustration here we can take 3 web application archives which include using a number of common libraries and refactor these as 3 web application bundles containing only the unique content with the common libraries installed once into an OSGi bundle repository.



The WAS OSGi Feature Pack makes use of many concepts and reference implementations from the Apache Aries open source project

One such concept is that of 'OSGi applications' which are packaged in a new type of archive called an “enterprise bundle archive” or “EBA” for short. This is similar to an EAR but its modules are deployed as bundles to the desired target servers. The EBA archive represents a single isolated OSGi application consisting of one of more modules and is the unit of deployment for an enterprise OSGi application.

Like an EAR file, an EBA archive may contain all the constituent modules/bundles that make up the application but it may just contain the metadata required to locate those bundles from a configured bundle repository.

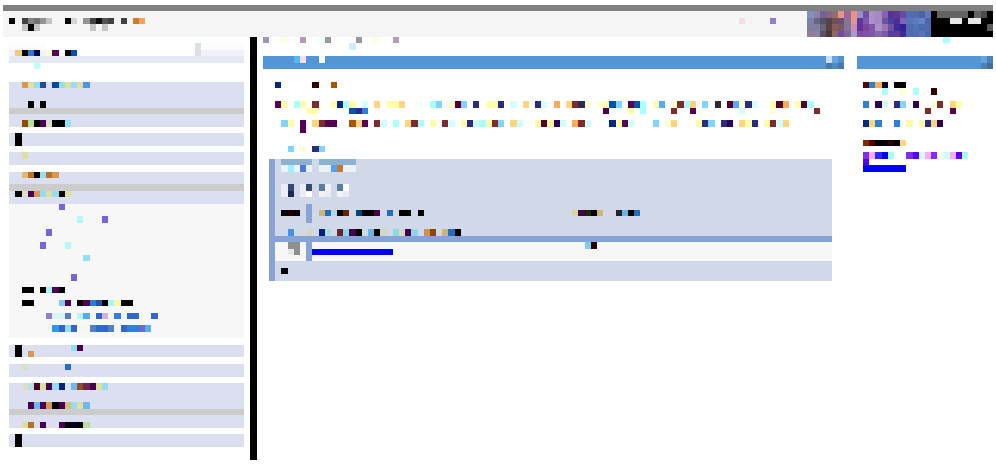
The metadata is in the form of an EBA-level “APPLICATION MANIFEST” file which describes the content of the application and whether the application exposes any external services and references. Just like a bundle manifest describes the modularity characteristics of a bundle, the application manifest describes the modularity characteristics of the application as well as the deployable content of the application.

The example here shows 2 OSGi Applications packaged as EBAs which contain various application bundles and an APPLICATION MANIFEST which refers to an additional “json4j.jar” bundle. When the application is deployed the json4j.jar is obtained from the configured bundle repository and doesn't have to be packaged inside the EBA.

NOTE:

Configuration is by exception – the absence of an application manifest indicates that application content is contained within the archive and the app exposes no services or references externally.

WAS v7 OSGi : Internal Bundle Repository



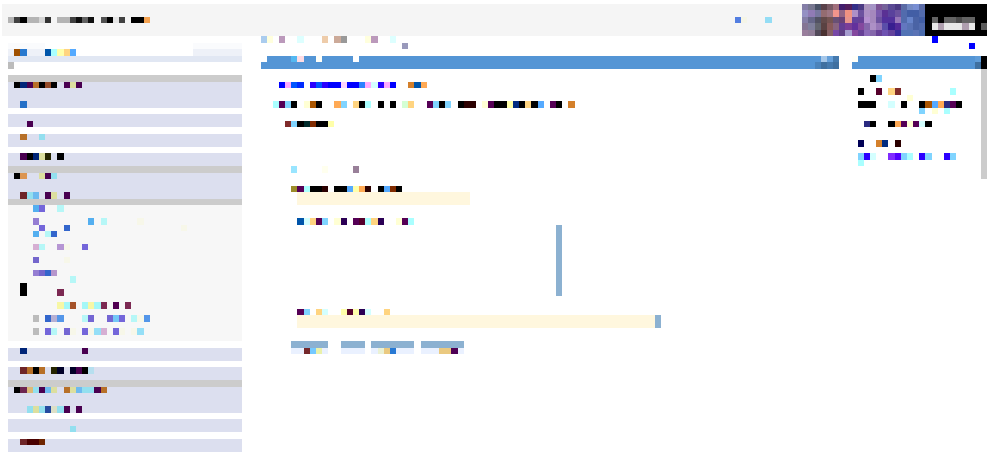
Duane Appleby - applebyd@uk.ibm.com

The WAS OSGi Feature Pack introduces new administrative support for using OSGi bundle repositories to simplify deploying common libraries as OSGi bundles.

It is possible to configure an externally managed repository or, more conveniently, a WAS specific internal bundle repository. Whilst external repositories have to supply there own tools for population and maintenance, the contents of the internal repository can be managed through the admin console or through scripting.

By placing common bundles into a configured repository we are able to reduce disk usage and memory footprint.

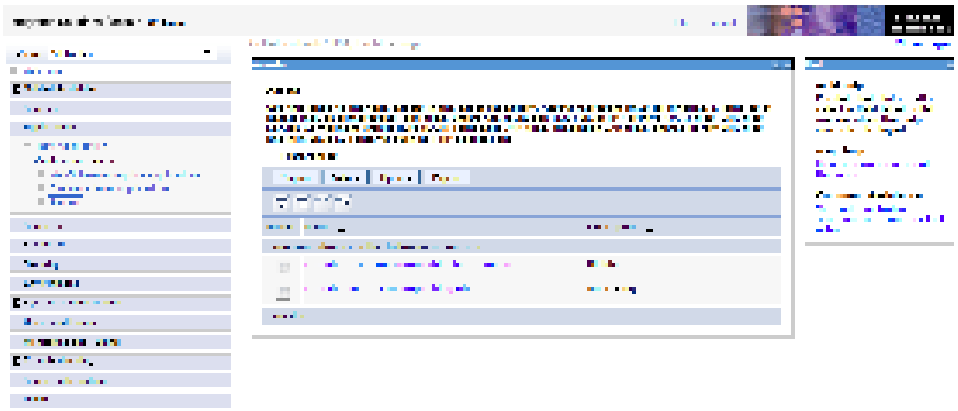
WAS v7 OSGi : External Bundle Repository



Duane Appleby - applebyd@uk.ibm.com

The external bundle repository configuration panel. External repositories contents must be managed by external tooling to WAS.

WAS v7 OSGi : Deploying an OSGi Application (EBA)



1) Import the asset (eba)

Duane Appleby - applebyd@uk.ibm.com

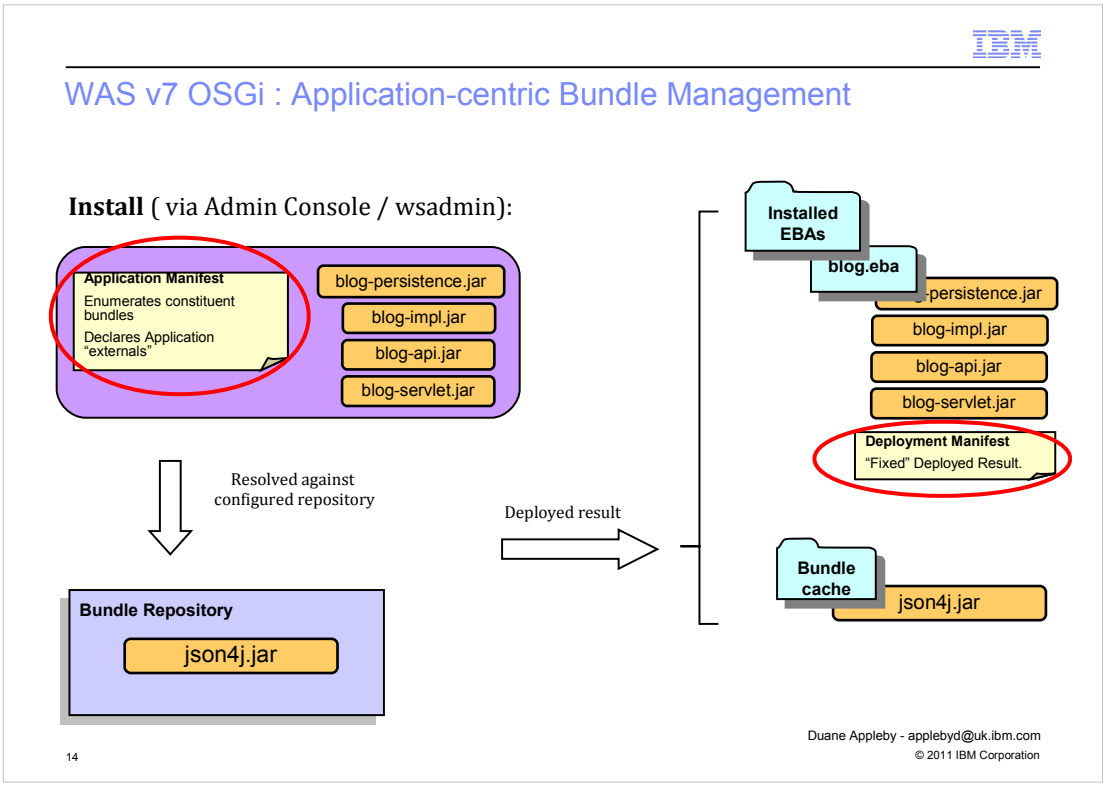
To install OSGi applications we have to follow the same routine as for other enterprise applications, although this may look slightly unfamiliar if you have only ever used the 'WebSphere enterprise applications' shortcut which is provided as a convenience.

When using this WebSphere enterprise application install shortcut, you will find WAS;

- imports the application as an asset
- creates a business level application (BLA)
- deploys the asset to the BLA

and these are precisely the steps we follow when installing OSGi applications. We need to note however, that any bundles that are provisioning content to our application from the shard bundle space and are **not** contained within the EBA, **must** already be present in a bundle repository or our asset import will not resolve and a warning about the missing dependencies will be shown.

This resolution ensures we never receive a ClassNotFoundException from the application at runtime if our manifests have been correctly constructed.



Since other applications, deployed at a later date to the same servers, could contribute shared bundles whose Java packages influence the dependency resolution that occurs when the application is started, WebSphere generates a “deployment manifest” that “freeze dries” the deployment of an application.

This means that each time the application is restarted, the resolution process always calculates the same result regardless of other applications. Unlike the authored application manifest, the generated deployment manifest does contain the transitively closed content – the result of the deploy-time resolution.

The deployment manifest is the description of the deployed application. This can be exported from one deployment to another to ensure that an application moving from a Test to a Production system continues to resolve in exactly the same way it did during testing.

WAS v7 OSGi : Deploying an OSGi Application (EBA)

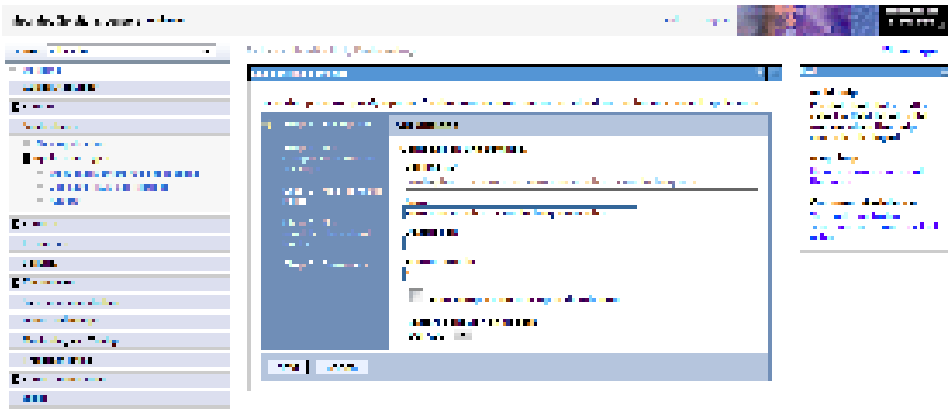
1) Import the asset (eba)
2) Create Business-level Application (BLA)
3) Add Deployed asset

Duane Appleby - applebyd@uk.ibm.com

After importing our EBA as an asset, we can add it to either a new or an existing BLA by selecting the ''Add Asset" option from the drop down in the Deployed Asset section.

On selecting this option, we will be displayed with a list of assets from which to choose.

WAS v7 OSGi : Deploying an OSGi Application (EBA)



1) Import the asset (eba)
2) Create Business-level Application (BLA)
3) Add Deployed asset
4) Configure in wizard

Duane Appleby - applebyd@uk.ibm.com

After having selected to add our EBA asset to a BLA we progress through a configuration wizard where we can modify/set various aspects of our application.

The set of wizard steps displayed will depend on the content of your application and any configuration files contained with that application and bundles, web.xml, bindings and extension files.

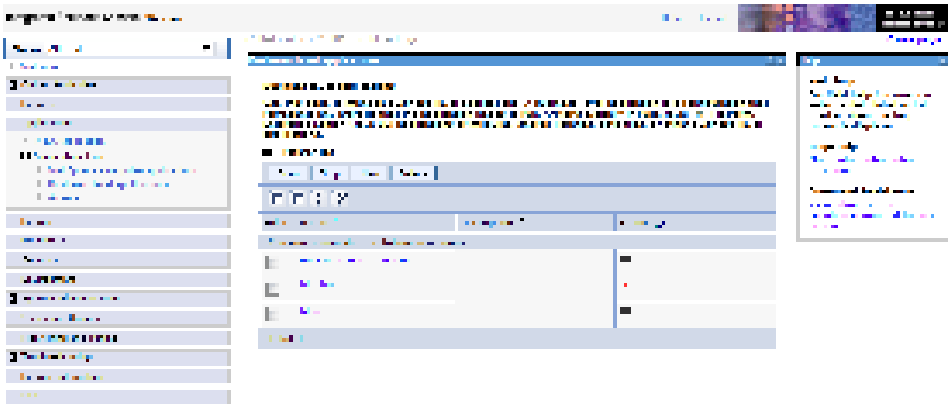
Once an OSGi application has been successfully deployed then all its constituent bundles are pushed out to the appropriate target servers and the application can be administratively started. Starting the application causes its constituent bundles to go through the OSGi lifecycle states “installed”, “resolved” and “active”.

NOTE

- On single server topologies, bundles are pushed out to the config tree on 'save'.

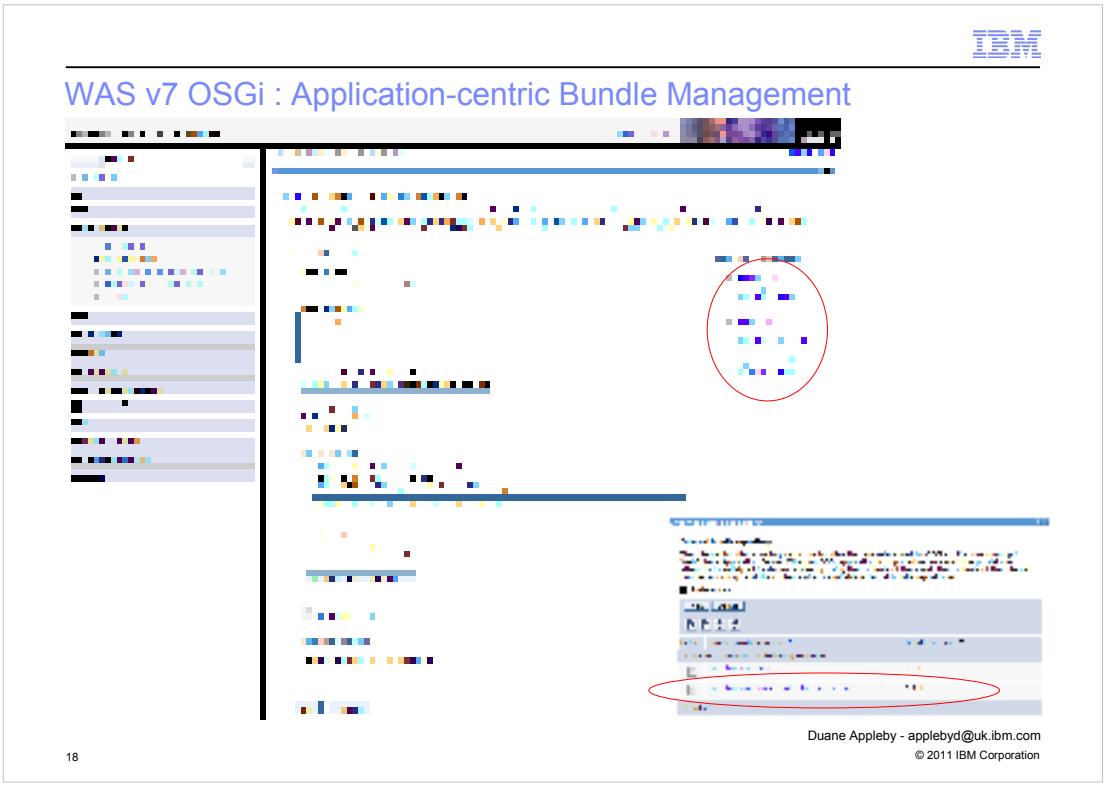
- On network deployed topologies, bundles are pushed out to the relevant nodes config trees on 'sync node' after having performed a 'save'.

WAS v7 OSGi : Controlling OSGi and Enterprise Applications



Duane Appleby - applebyd@uk.ibm.com

You can start/stop and explore all you applications from the Business level applications panel, you will also see BLAs for standard WebSphere enterprise applications installed via the shortcut previously discussed, as well as the newly created BLAs for you OSGi applications.



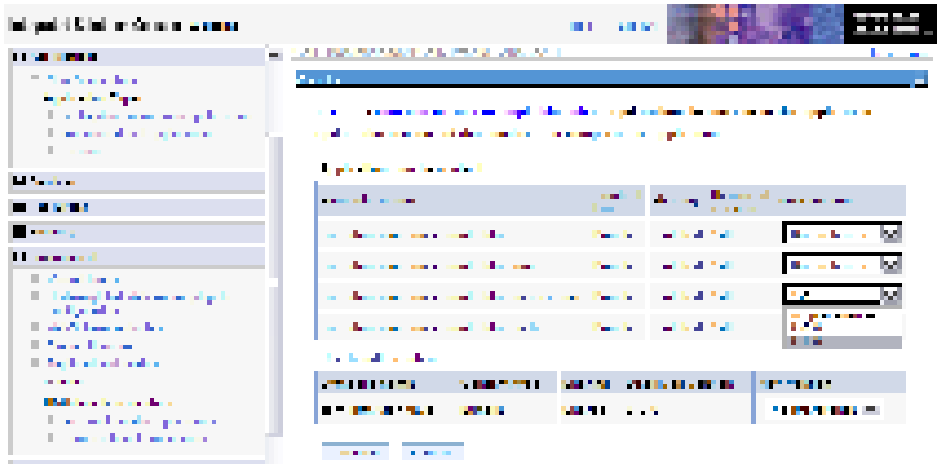
Exporting/Importing of a deployment manifest as previously discussed is done from the asset detail panel.

One of the other key functions available from this panel is updating of bundle versions in use by an application. By placing new versions of bundles in the IBR we are able to use a configuration wizard to wire our application into using these new bundles on an application by application basis.

This is particularly useful for:

- Testing and using new application functionality
- Applying security updates/fixes to particular exposures in a given bundle

WAS v7 OSGi : Application-centric Bundle Management



- Preview changes
- Commit changes
- Restart BLA

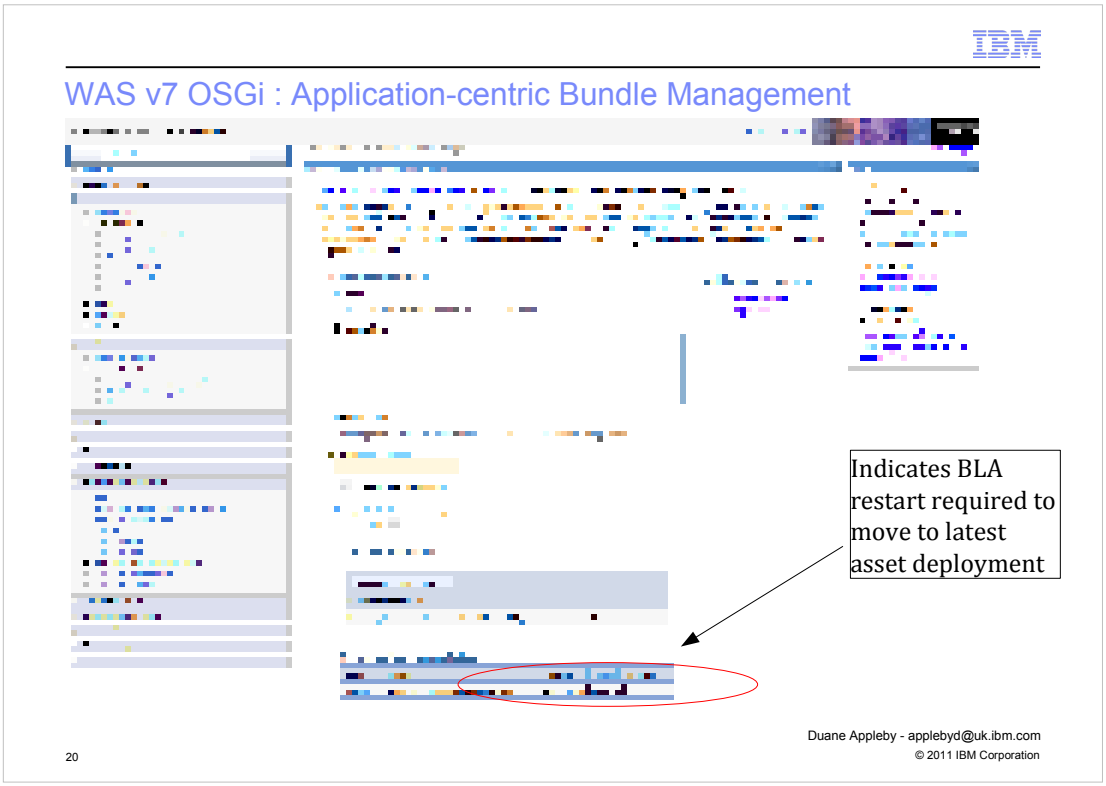
Duane Appleby - applebyd@uk.ibm.com

On selecting the update option in the asset details panel, we are able to configure a custom configuration of bundle versions from those available.

On previewing this configuration a re-resolve of the entire application takes place to test whether the configuration is valid. (Note that this **does not** affect the running application)

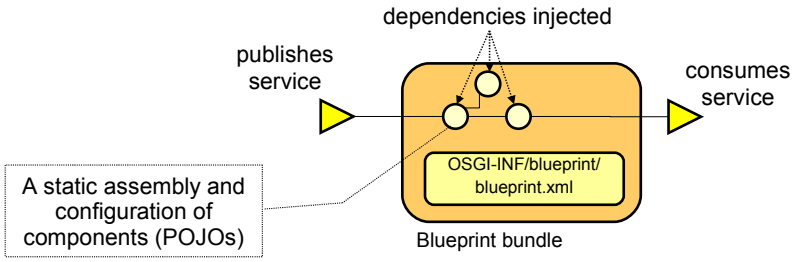
If the configuration is not valid, we are not permitted to commit the changes and are informed of resolution problems.

If the configuration is valid we commit the change to disk. This writes out a new frozen deployment manifest to the config tree. This new configuration becomes active after the restart of the BLA to which the asset is deployed.



The BLA detail panel for a given compositional unit indicates whether a new deployment is available and a BLA restart required.

WAS v7 OSGi : Blueprint Components and Services



The Blueprint Dependency Injection container is a part of the server runtime (compared to the Spring container which is part of the application.)

- Standardised established Spring conventions
- Configuration and dependencies declared in XML 'module blueprint' (standardisation of Spring 'application context' XML)
  - Extended for OSGi: publishes and consumes components as OSGi services
- Simplifies unit test outside either Java EE or OSGi runtime

Duane Appleby - applebyd@uk.ibm.com

One of the significant features of the WebSphere OSGi Application feature pack is its introduction of the Blueprint component model. This is the result of the standardization activity around the Spring framework in the OSGi Alliance.

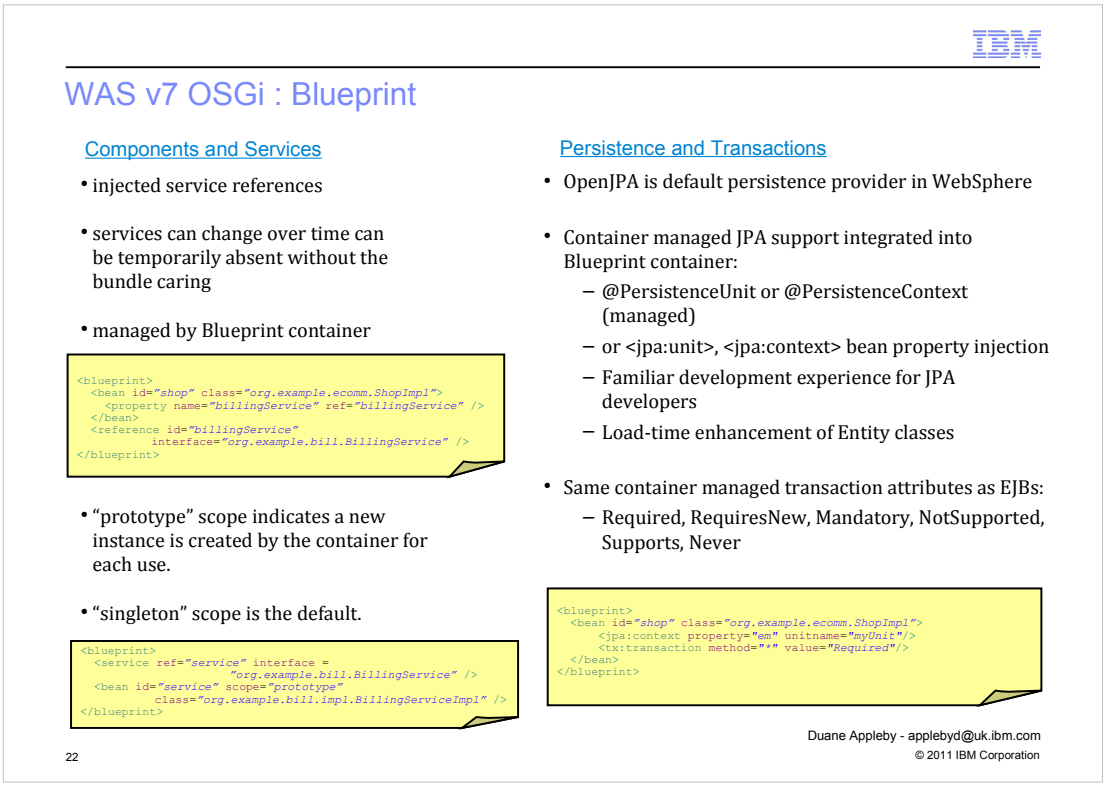
Spring provides a convenient way for business logic to be encapsulated into POJO components, which have all their dependencies injected into them by the Spring container. The Spring framework is a container that is packaged as a library with the application. In a Java EE environment the Spring container delegates to the underlying Application server for the management of resources such as database connections and for the application of qualities of service such as transactions and security. Spring is essentially a proxy container to the native web container provided by the Application server and can add a significant amount of pathlength.

By standardizing the Spring XML configuration format in the OSGi Alliance and delivering the container as an OSGi bundle, it has become possible to pull the dependency injection container out of the application and into the middleware. The standards-based evolution of the DI container is called the Blueprint container and the WebSphere OSGi feature pack integrates this container as part of the Application sever.

The Blueprint XML configuration file has the same structure as the Spring XML configuration file but in an OSGi namespace. The Blueprint XML is a bean definition file for all the beans provided by a single bundle. In addition to the bean definitions that will be familiar to Spring developers, the Blueprint model adds new service and reference elements as part of the integration with the OSGi environment. Service elements direct the Blueprint container to expose a service interface for a component outside the bundle and a reference element directs the Blueprint container to locate a service that can be consumed from outside the bundle. The yellow arrows in the figure indicate OSGi services that are published to and discovered from the OSGi Service Registry by the blueprint container. The OSGi service registry is a standard part of OSGi and provides a mechanism akin to JNDI for the publication of OSGi services, although the underlying use of the service registry is abstracted from application developers by the Blueprint container.

Ultimately, the Blueprint container manages the lifecycle and dependencies of the POJO beans that contain the application logic as well as the services and references each bundle provides, and ensures references are wired to available services.

Unit test for Blueprint components is simplified by the dependency injection pattern, which allows one bean to access another bean without having to implement any code to create the bean instance. The Blueprint Container creates the required bean instance, using information contained in the Blueprint configuration file. This eliminates compiled dependencies on either the OSGi Framework or the application server runtime environment.



Blueprint Components and Services

Top left, is a simple example of the blueprint.xml for an eCommerce bundle which contains a "shop" bean which uses a BillingService provided by another bundle. The Blueprint container locates the Billing Service provider and injects it into the shop bean at runtime.

OSGi services are dynamic so if the service provider can be changed then the blueprint container is able to dynamically rewire the reference to a new service without impacting the shop bean instance.

On the provider side, the BillingServiceImpl is another POJO implementing a Java interface for which a service is registered by the Blueprint container when the Billing bundle is started.

By default beans are created with "singleton" scope which means only a single instance is created by the container. If the bean maintains any state then it can be declared with "prototype" scope so that the container creates a new instance each time it needs to inject the dependency into a client.

Blueprint Transactions and Persistence

The WebSphere Blueprint container does a lot more than the spring framework for managing JPA contexts. It understands standard JPA annotations in the blueprint components it manages and will inject an EntityManagerFactory or EntityManager into annotated components or components whose bean definition contains a "jpa" element as illustrated in the example.

For the managed JPA case, the Blueprint container will manage the association between the EntityManager and the transaction context so the application does not have to. The WebSphere Blueprint container also provides full declarative transaction support using the same container-managed transaction attributes as EJBs.

You don't *need* to use Blueprint components in your OSGi applications just like you don't *need* Spring in Java EE but the Blueprint container model provides significant ease of use benefits to developers, is based on an OSGi industry standard, is well-integrated with the server runtime

WAS v7 OSGi : OSGi Service Registry and JNDI

- OSGi services are published to and looked up from OSGi service registry.
  - Declarations in Blueprint XML
- Interactions with the OSGi service registry:
  - Services also available in JNDI via the osgi:service URL scheme (additionally as aries:services)
  - Resources bound to JNDI published as services in the OSGi the Service Registry. Published as a service property called “osgi.jndi.service.name”

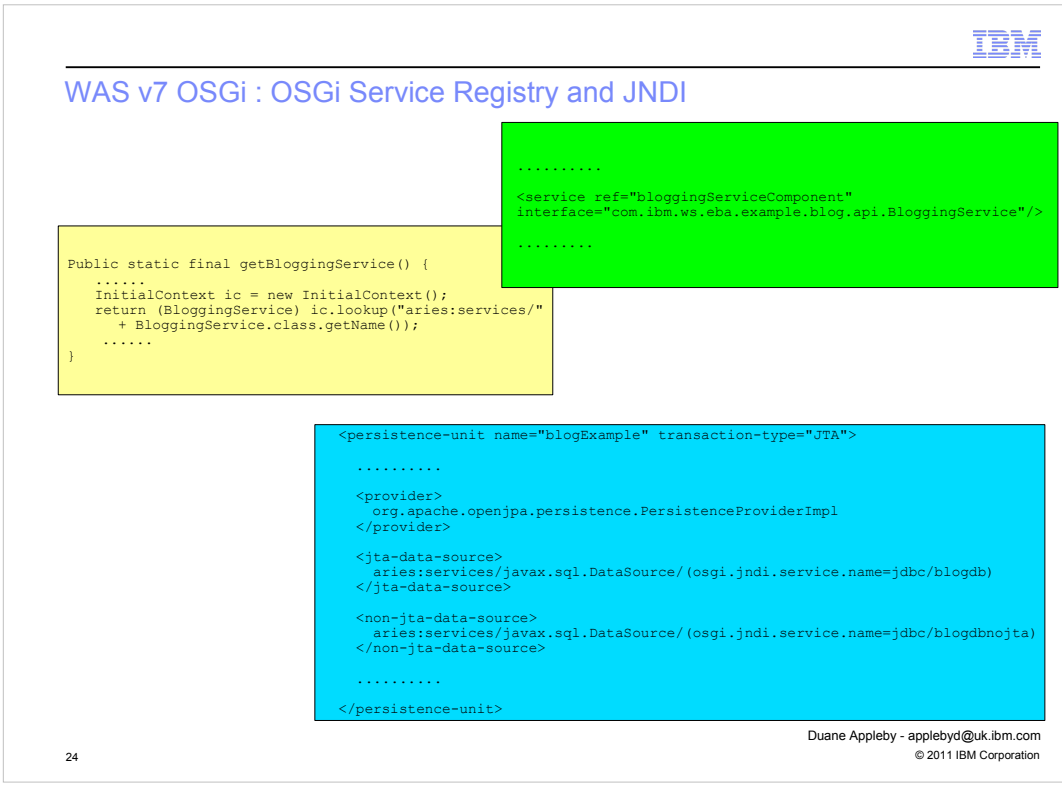
Duane Appleby - applebyd@uk.ibm.com

The OSGi Service Registry is a standard part of OSGi and is where services are registered by service providers for consumption by other bundles.

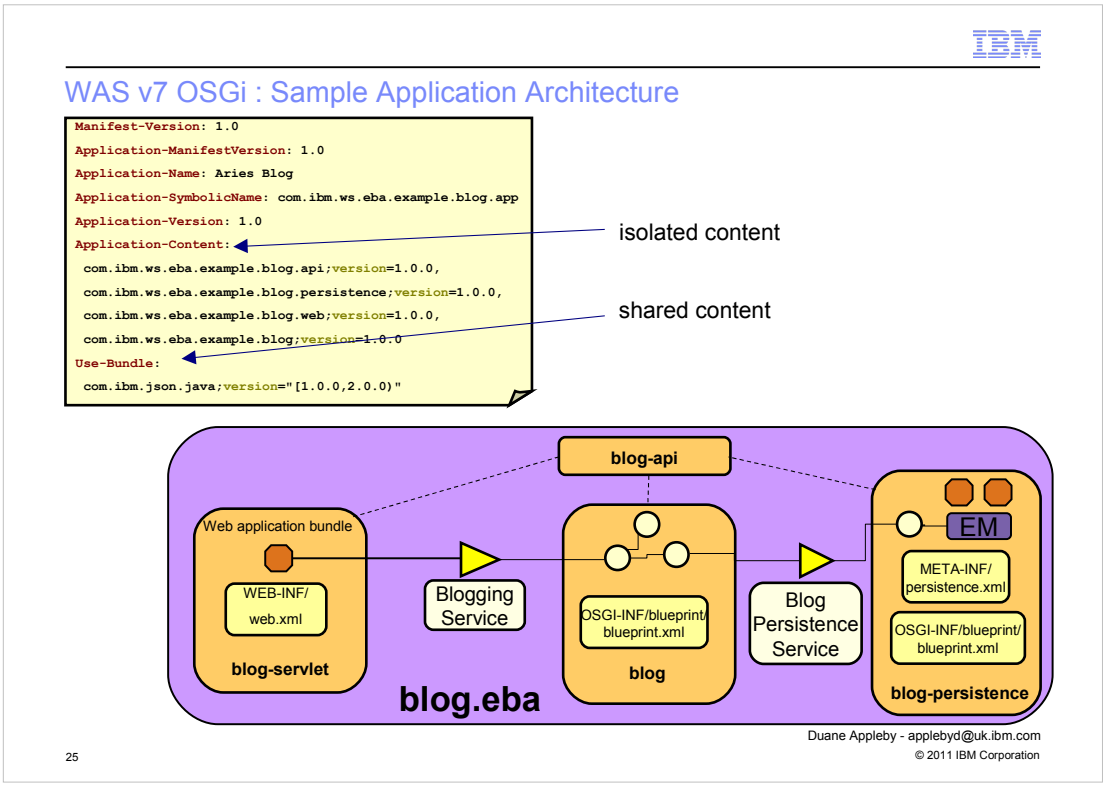
Existing web components are not aware of the OSGi service registry and use JNDI for service lookups.

To enable existing Java EE mechanisms to interact with OSGi services, and vice versa, the Enterprise OSGi integration of JNDI defines a mechanism for OSGi services to be made available through JNDI and vice versa.

In the WebSphere OSGi Application feature pack, services published in the SR are available to JNDI clients using the osgi:service URL scheme for the lookup. This is the primary method by which web applications discover Blueprint services. Equally, administered resources bound to JNDI are also published as services in the OSGi SR with the JNDI name contained in a service property called osgi.jndi.service.name.



Examples of JNDI lookups

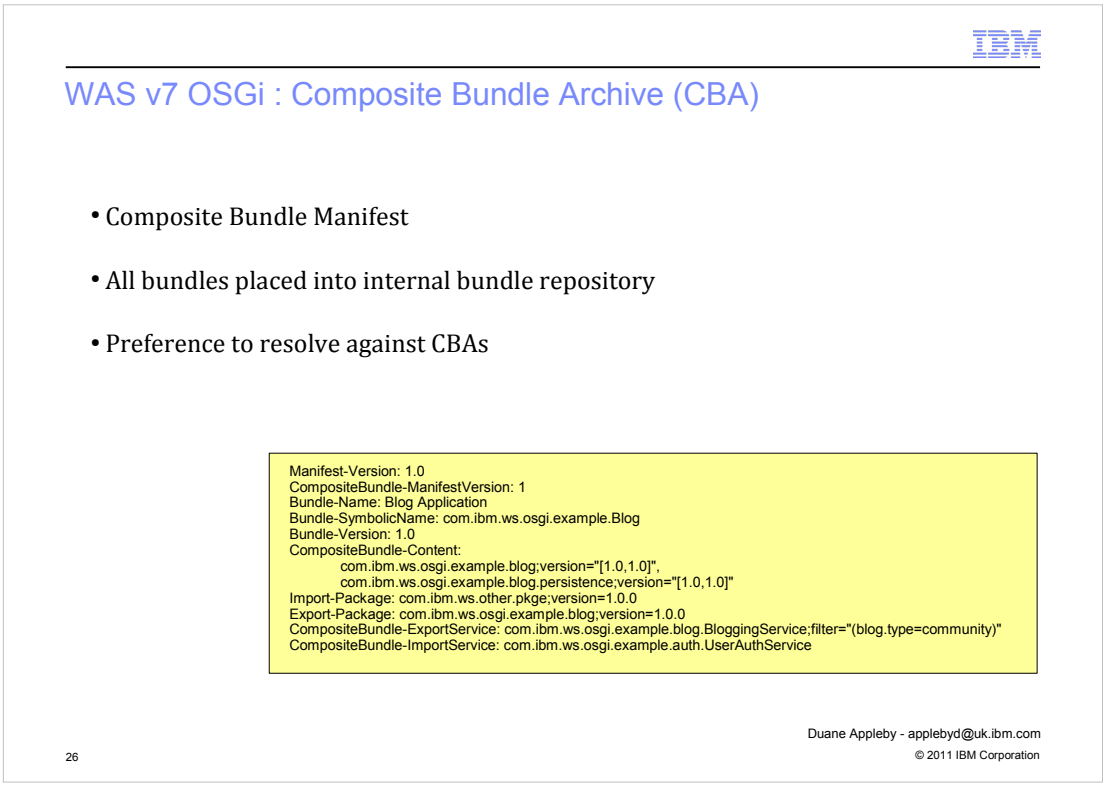


The APPLICATION MANIFEST here shows how isolated content is defined by the Application-Content header and how shared content is defined by the Use-Bundle header.

The figure describes one of the sample applications shipped with the OSGi Application feature pack. It is a web application that provides a Blog. It consists of:

- A web bundle to provide the user interface via standard servlets and dojo.
- A blueprint bundle containing 3 beans which encapsulate the business logic. The entry point is a Blogging Service which is accessed through JNDI by the web app.
- A persistence bundle containing a standard persistence.xml and entities representing the persistent data
- A database where blog entries and author information are read from and written to through JPA.

The sample can be used to learn how OSGi applications are deployed as a set of bundles to WAS and also illustrates the isolated and shared frameworks and the placement of bundles in each.



WebSphere also introduces the notion of a 'Composite Bundle Archive' (CBA). A CBA groups shared bundles together into aggregates. It can either directly contain OSGi bundles, or reference bundles that are hosted in the internal bundle repository.

You create a CBA when you want to ensure consistent behavior from a set of shared bundles and you can use the CBA to wire that set of bundles to an application.

A CBA is a zip archive with a .cba file extension. It contains a composite manifest, which is located at META-INF/COMPOSITEBUNDLE.MF which defines the CBA and optionally some OSGi bundles with which to seed the repository. The bundles that a CBA contains or references are defined with exact versions, in contrast to an EBA, where bundle can be defined with version ranges.

You install a composite bundle in the internal bundle repository. If the CBA directly contains OSGi bundles, these bundles are installed into the repository as though they are individually uploaded, and the CBA is also added to the bundle repository. If the CBA references OSGi bundles, these bundles must be present in the internal bundle repository.

After a CBA is installed in the internal bundle repository, its bundles are available to all applications that want to use them when the application is resolved. If a required package or service is available at the same version from both a bundle and a CBA, the provisioning process selects the package or service from the CBA.

WAS v7 OSGi Summary

- Isolation and Sharing
- Classpath Control
- Versioning Control
- Integration of established technologies JPA/JNDI/JTA
- Blueprint dependency injection – publish and consume services
- EBA
- Bundle Repositories
- CBA

Duane Appleby - applebyd@uk.ibm.com

So to summarize, we have seen how with the WAS v7 OSGi feature pack we can;

- Create 'OSGi applications'
- Exploit both isolation and sharing
- Ability to share common bundles outside of applications
- Deploy and use multiple versions of packages within an application
- Upgrade deployed applications
- Provide a cohesive locked down composite bundle configuration using CBAs
- Use dependency injection from the blueprint container
- Consume and publish services via blueprint to the OSGi service registry
- Use JNDI to look-up resources and services from the OSGi service registry

We will now cover the way this initial functionality has been extended and is trialled in the WAS v8 beta download available from the ibm website.

Disclaimer

IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.

Duane Appleby - applebyd@uk.ibm.com

One point I **MUST** make clear, is that everything I am about to talk about refers to a beta product and there is no guarantee that this beta will become a shipped product or contain all the functionality we discuss herein.

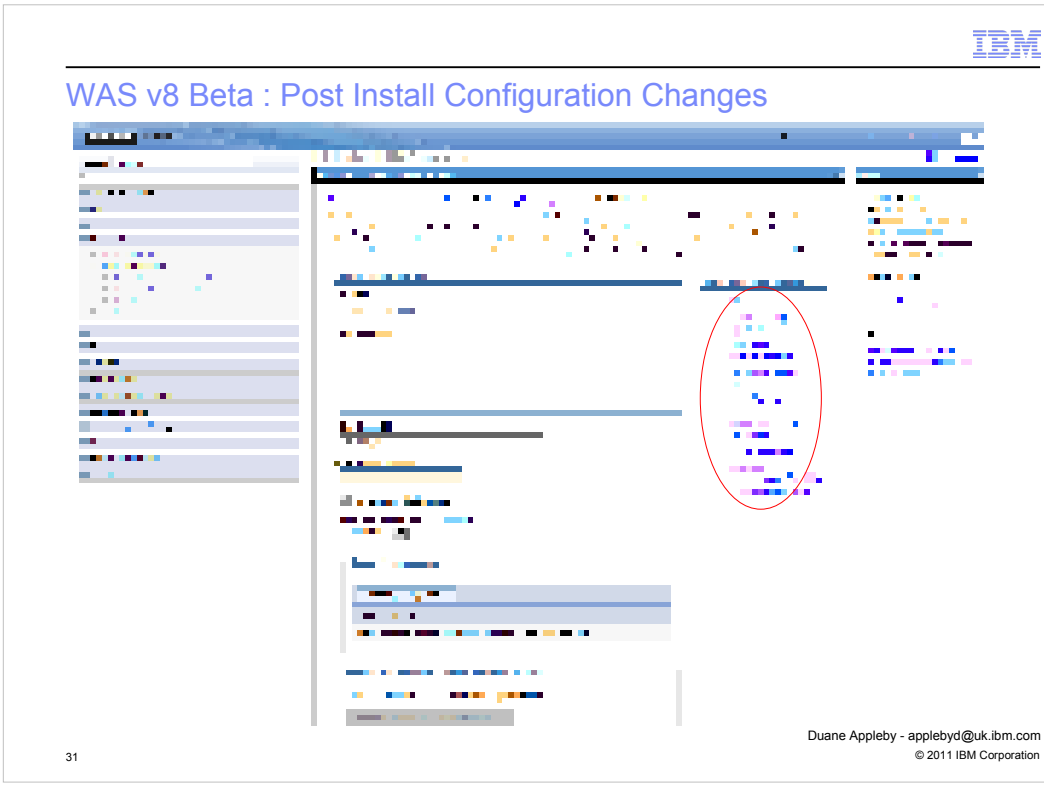
As previously mentioned however, WAS ensures all feature packs are available on future WAS releases as either feature pack installables or as part of the base product. So all we have seen up to this point would be available.

WebSphere Application Server V8 Beta

https://www14.software.ibm.com/iwm/web/cc/earlyprograms/websphere/wsasoa/index.shtml

- Latest Beta refresh 11th March 2011

Duane Appleby - applebyd@uk.ibm.com

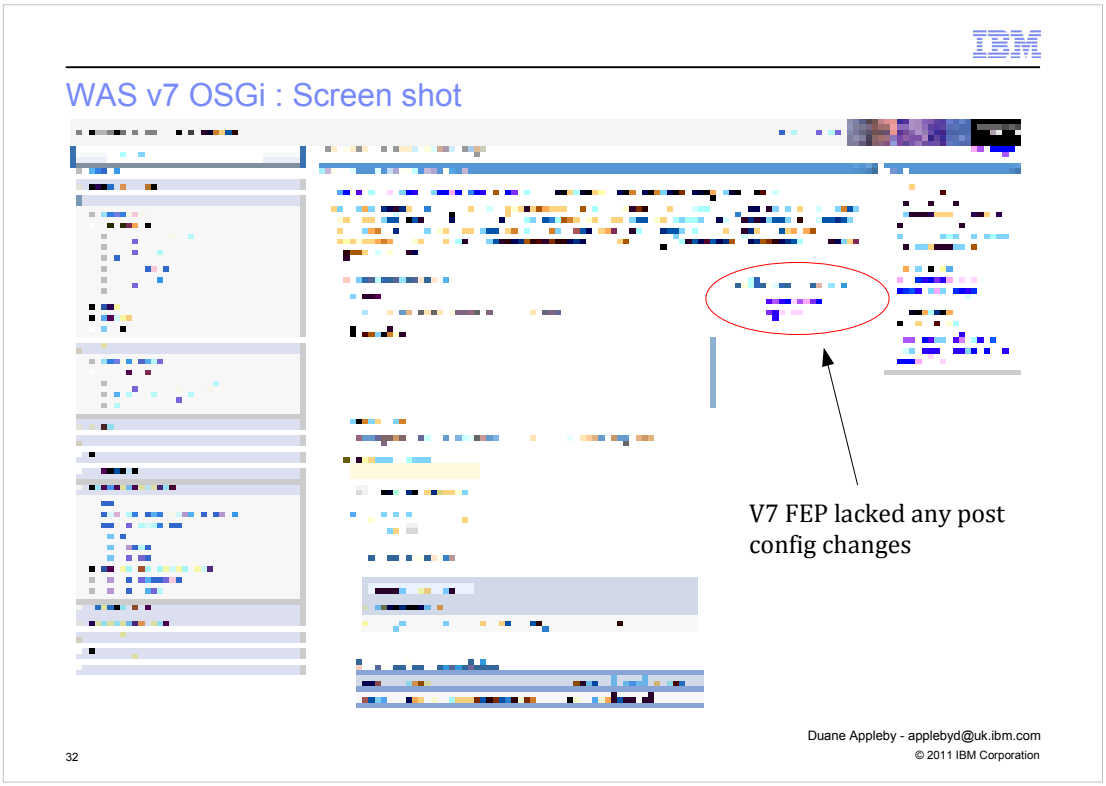


One noticeably large improvement in the beta compared to the feature pack is the ability to post configure a deployed application.

Post configuration panels are accessed on the composition unit detail panel and we are now able to modify the properties set during deployment time; virtual host mappings, context roots, security settings etc...

When you modify your configuration, these changes take effect;

- on save for a single server topology
- on sync (after a save) on network deployed (nd) topologies.

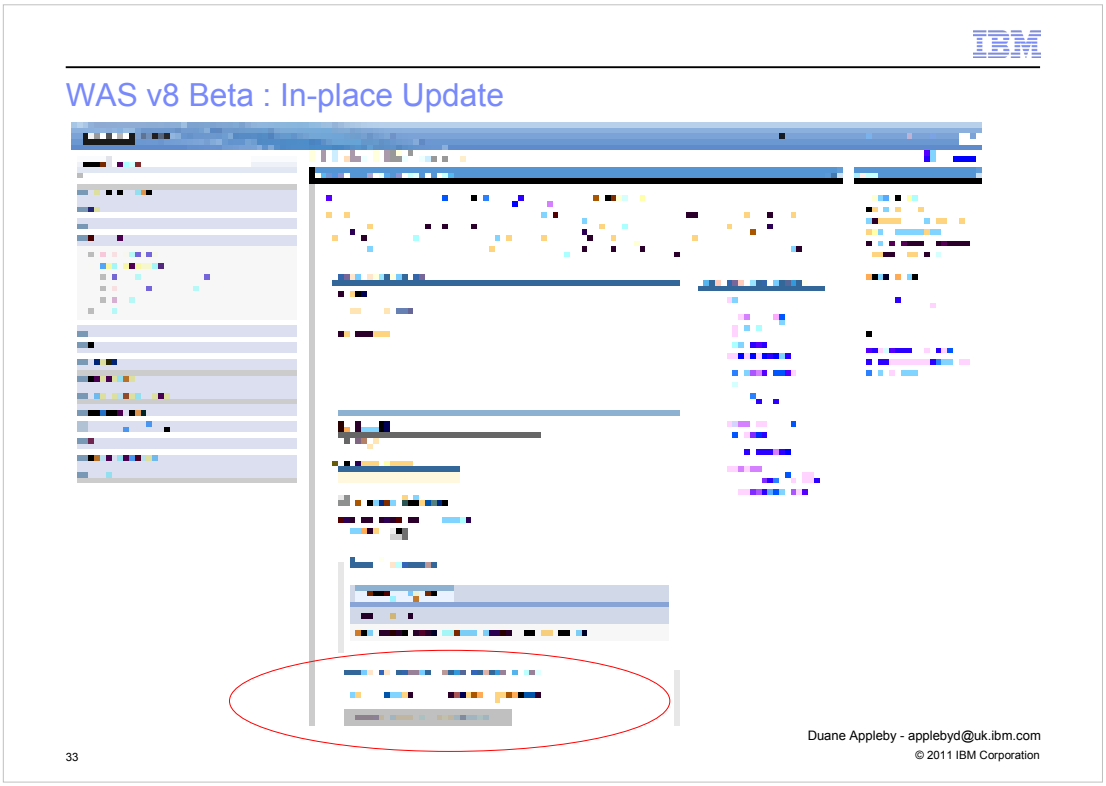


One noticeably large improvement in the beta compared to the feature pack is the ability to post configure a deployed application.

Post configuration panels are accessed on the composition unit detail panel and we are now able to modify the properties set during deployment time; virtual host mappings, context roots, resource references, security settings etc...

When you modify your configuration, these changes take effect;

- on save for a single server topology
- on sync (after a save) on network deployed (nd) topologies.



In-place update is an extension to capabilities in the v7 Feature Pack. In the feature pack, after changing the versions of bundles that composed an applications deployment, the entire application required a restart.

In the v8 Beta, after changing bundle versions (via the wizard available through the asset's detail panel), we can now navigate through our BLA to our deployed asset/composition unit and rather than seeing a notice informing us of a new deployment, we have the opportunity to press a button to move us to the latest deployment.

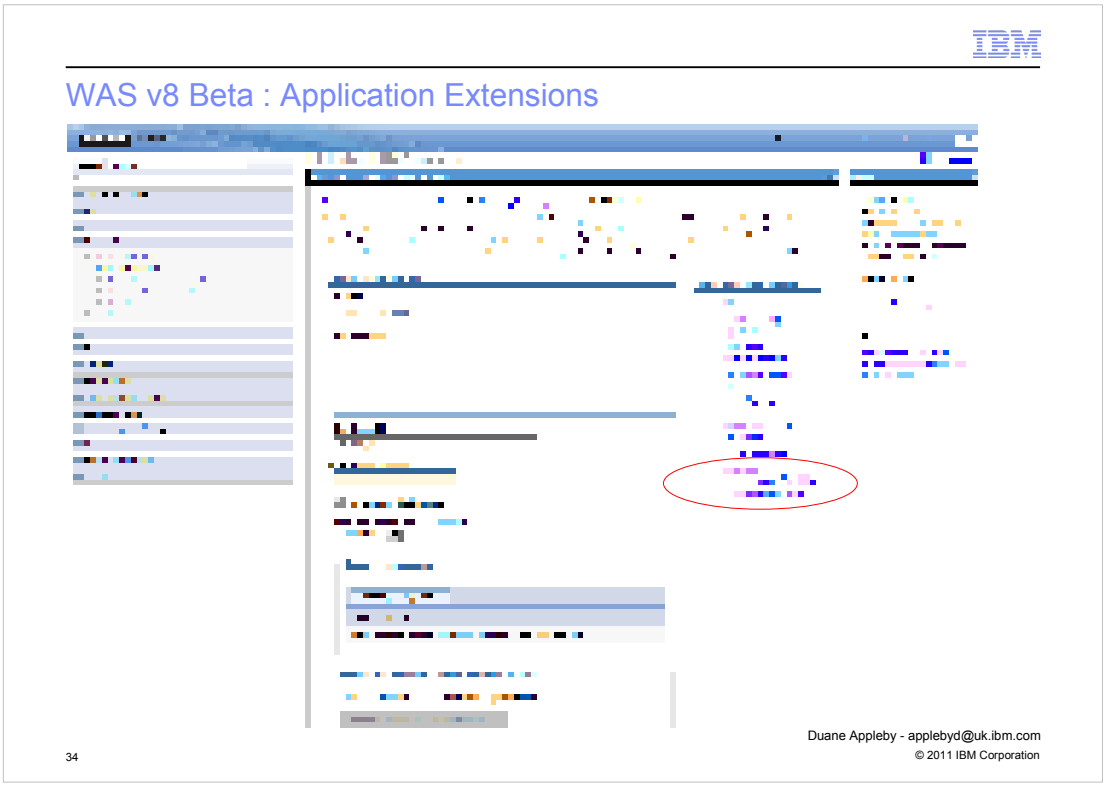
Rather than restarting the entire application, this button recycles only those bundles that are affected by changes to the deployment.

Note however that major changes which include package and service imports and exports may well trigger a restart of the entire application.

Configuration wizards may be displayed at this point depending on the nature of the update and the ability to modify/specify new configuration information such as virtual hosts or security bindings.

JNDI support for the 'blueprint:comp' namespace is added in the v8 beta which allows injection of blueprint components by id.

If we have a reference injected, rather than just using an 'osgi:service' lookup, our web applications are able to handle services coming and going during in-place bundle updates, rather than throwing ServiceUnavailableExceptions as we are given a damped reference.



Application extensions are functional extensions to a given application and are implemented through the use of CBAs.

When we select the “Manage extensions for this composition unit” option from the composition unit detail panel, we can choose a CBA to add as an extension our application.

Application extensions, are similar to in-pace update (bundle version) changes, in that they can become active in-place, without application restarts.

Application extensions may be useful in situations where you have deployed a core application where you know you may want to use and remove different service providers.

For example, the core application is written to use various payment providers, and each of these providers is deployed as their own CBA providing their payment service capability through the OSGi service registry. The core application is written to be able to use a number of providers (via a reference list in its blueprint xml for example) thus allowing us to add or remove providers as needed.

Another example would be where your web design/skin is provided via some service mechanism and you can add and remove those skins as required .... ie different Christmas, Easter/ summer etc...

WAS v8 Beta : Composite Bundle Archive (changes)

- Content Hiding
- Can be specified on Application-Content
- Can contain WABs
  - *Configurable during 'addAsset'*
- Exported assets now contain their CBA content
- Support for bulk bundle uploads via zip archives

Duane Appleby - applebyd@uk.ibm.com

Composite bundle archives have undergone a quite significant rework between the WAS v7 feature pack and this Was v8 Beta.

In the v8 Beta the first significant change for CBAs is the aspect of content hiding. Where previously CBAs had their content explode out into the internal bundle repository (IBR) where it was possible for other applications to access said content, this is not the v8 Beta behavior.

CBAs in the Beta act as a more cohesive unit – as a set of bundles with a united purpose or as a strictly regulated set of dependencies.

It is now possible to specify a CBA on the Application-Content stanza of the EBAs application manifest – where previously we could only Use-Bundle the CBA or Import-Package from a bundle in the CBA and depend on the resolution preference of CBAs to resolve correctly. By specifying the CBA on Application-Content we bring the CBA out of the shared framework and into our applications isolated framework.

In addition to these benefits, you can now also include WABs in CBAs, as you will be presented with configuration options during deployment of you asset for the WABs contained within the CBAs. This is also a useful benefit for application extensions as just mentioned.

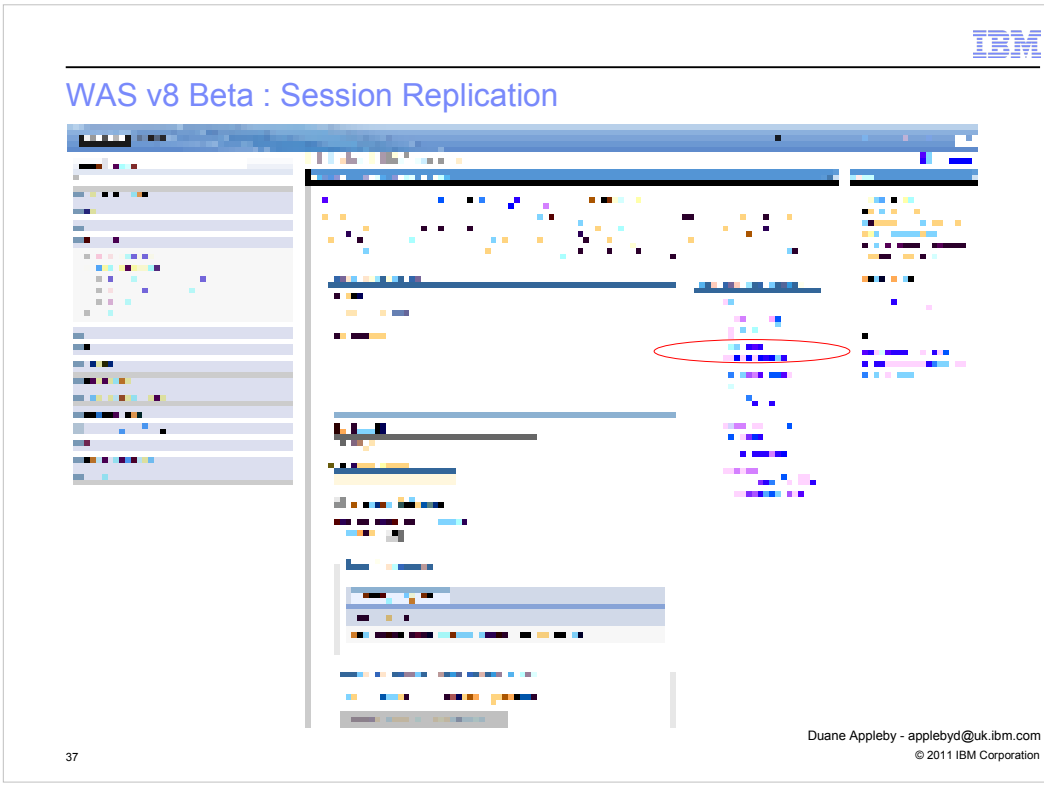
Other points to note are that when exporting an EBA asset in the Beta, the binary product now also contains the requisite CBA content and that bulk bundle uploads to the IBR are still possible by providing a zip (.zip) file of bundles to the IBR upload dialog, or respective wsadmin command.

WAS v8 Beta : Map RunAs roles to users

Duane Appleby - applebyd@uk.ibm.com

Support for run as roles is now included during deployment and as a post deployment configuration change option.

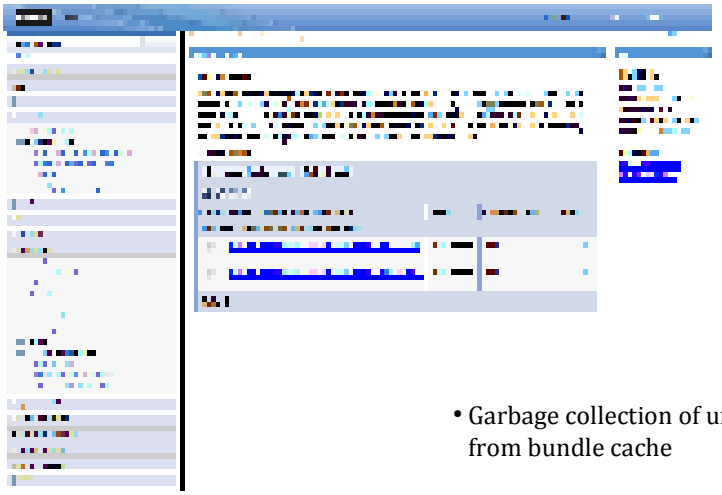
This enables you to specify OSGi application-specific privileges for individual users to run specific tasks using another user identity in precisely the same manner as for enterprise applications.



Again, bringing OSGi application options inline with enterprise applications, we can now override session management/replication options from the topology defaults. To do this we again navigate to the composition unit detail panel and select the “Session management” link.

From this link we can select to override set options with our own custom settings.

WAS v8 Beta : Bundle Cache



- Garbage collection of unused bundles from bundle cache
- New panel showing download status previously MBean only

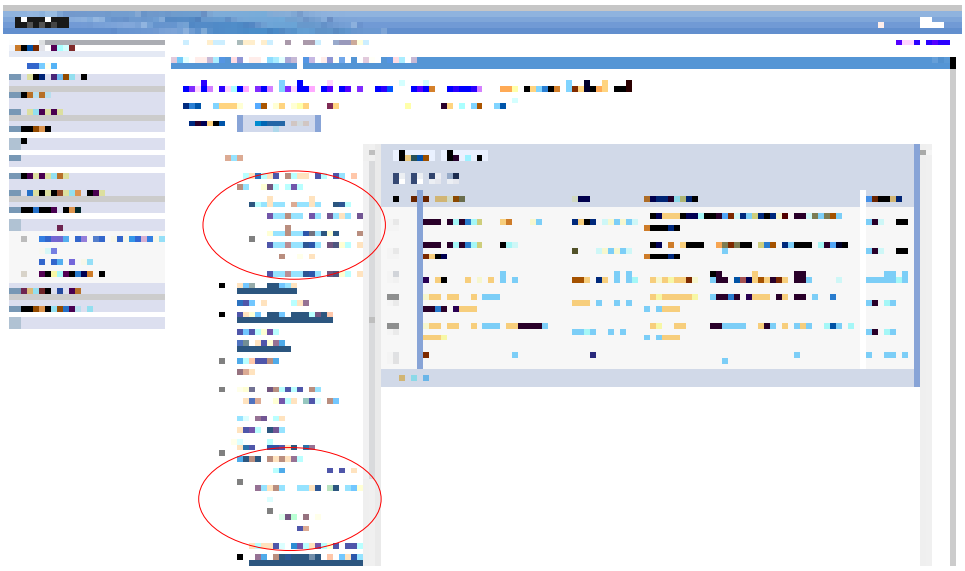
Duane Appleby - applebyd@uk.ibm.com

As we have previously discussed, artifacts in the internal bundle repository and downloaded into a bundle cache, a runtime store if you will, of bundles in use by installed assets (EBAs).

In the feature pack on WAS v7 these bundles, once downloaded, resided permanently in the bundle cache unless manually cleared using scripting and the bundle cache manager Mbean. In the WAS v8 Beta we provide an admin console interface for controlling the contents of the bundle cache, as well as the Mbean should you wish to use scripting.

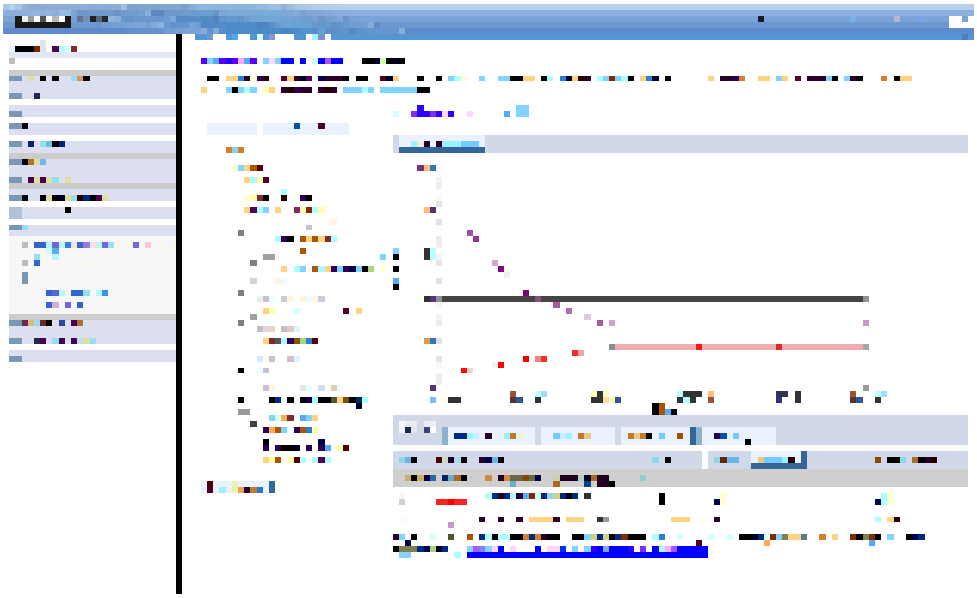
Further to this new panel interface is the inclusion of a bundle cache garbage collection. When all assets (EBAs) that were using a bundle in the bundle cache and deleted, then the bundle cache garbage collector removes this bundle from the runtime cache. It will still exist in the internal bundle repository as this is a administratively configured store, not a runtime location.

WAS v8 Beta : Performance Monitoring Infrastructure (PMI)



Duane Appleby - applebyd@uk.ibm.com

WAS v8 Beta : Performance Monitoring Infrastructure (PMI)



Duane Appleby - applebyd@uk.ibm.com

Summary – WAS v8 Beta additional OSGi support

- Post deployment configuration changes
- In-place application update
- In-place application extension
- Composite Bundle Archive
- Run As roles
- Session replication management
- Bundle cache administration
- PMI
- Servlet 3.0

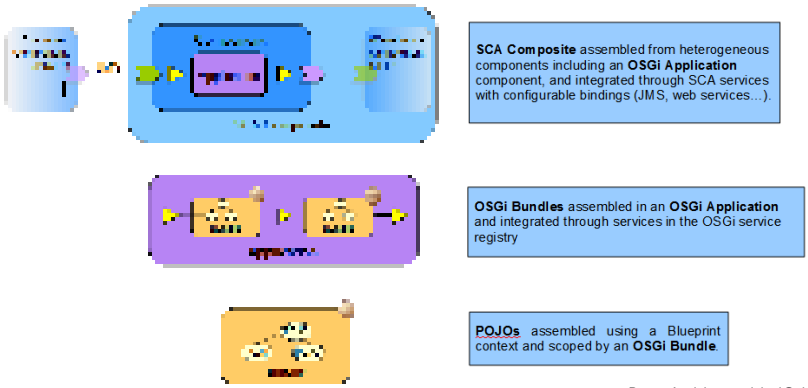
Duane Appleby - applebyd@uk.ibm.com

Additional Info
v7 FEP & v8 Beta

Duane Appleby - applebyd@uk.ibm.com

Additional OSGi Integration (SCA)

- Service Component Architecture (SCA)
  - Assembly into heterogeneous composites of OSGi and non-OSGi components
  - Remoting of OSGi application services through SCA services with a variety of bindings including JMS, SOAP/HTTP, IIOP and JSON-RPC.



Duane Appleby - applebyd@uk.ibm.com

The SCA feature pack for WAS v7 and subsequent integration into the WAS v8 Beta allows a further level of assembly for OSGi applications. With SCA we can assemble OSGi applications into an SCA composite to provide an SOA abstraction.

Within an SCA composite the OSGi Application is a component that can be wired to other components with different implementation types. For example, an SCA composite could contain an osgi-application component, a JEE component containing EJBs, a BPEL component and so on.

Each component within an SCA composite declares abstract services and references to which concrete bindings can be applied and it is through these services and references that the components of an SCA's composites are wired together.

The OSGi Application architecture was designed with this form of assembly in mind so that the services and references declared in a Blueprint XML configuration can be exposed through the Application manifest to be visible outside the application. Such exposed services and references can then be mapped to SCA services and references with the full range of available SCA bindings applied to them.

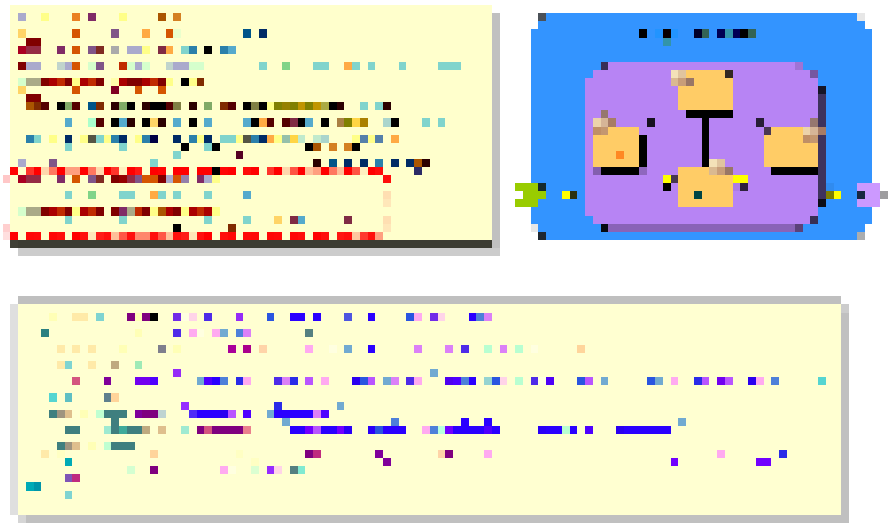
This enables OSGi applications to participate in two new scenarios:

1) Assembly into heterogeneous composites of OSGi and non-OSGi components

2) Remoting of OSGi application services through SCA services with a variety of bindings including JMS, SOAP/HTTP, IIOP and JSON-RPC.

Additional OSGi Integration (SCA)

- SCA Integration : implementation.osgiapp



Duane Appleby - applebyd@uk.ibm.com

Additional OSGi Integration (Tooling)

- Free Eclipse Plugin for
  - Includes features that increase developer productivity
  - Creates OSGi Applications for any Aries-based server runtime.
  - Eclipse WTP 3.6 (Helios) M6 or later required
- RAD Tooling (v8.0.2)
  - Integrated with Web Tools, JEE productivity tools, and other capabilities in RAD
  - Supports deployment to WAS v8 Beta
  - Supports deployment to WAS v7 OSGi FeP
  - Enhanced validation

Duane Appleby - applebyd@uk.ibm.com

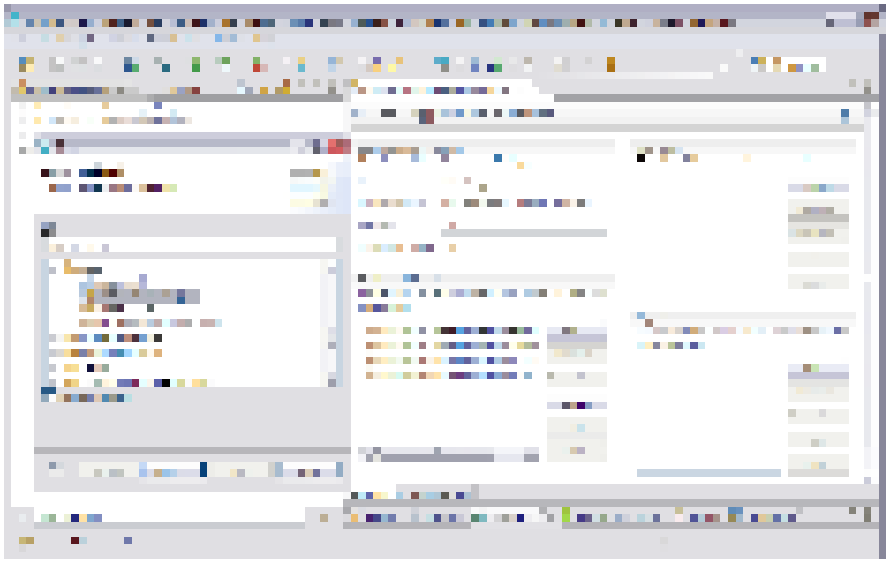
Tooling support for OSGi Applications is available in RAD v8.0.2 .

The new tooling is structured so that server-independent development and assembly tooling can be installed as a plugin into any Eclipse WTP 3.6 environment. While this is pre-integrated in RAD, the availability of the new tools in Eclipse WTP configurations other than RAD, better enables these common tools to be used to develop OSGi Applications for deployment to Geronimo and, in the future, other non-WAS servers that integrate the Apache Aries runtime components.

The common development tooling includes new project type for OSGi Applications, the ability to import and export .eba archives, form-based editors for bundle manifests, application manifests and Blueprint configuration files as well as tutorials and documentation.

Additionally integrated into the RAD are WebSphere deployment tools, a WAS v8 Beta test environment, enhanced validation tools as well as integration with Web and JEE productivity tools.

Additional OSGi Integration (RAD)



Duane Appleby - applebyd@uk.ibm.com

.

Further Information

Resource Hub (articles, tutorials, redbooks, forums)

http://www.ibm.com/software/websphere/osgi

Team Blogs/Twitter

www.ianrobinson.blogspot.com

www.devangelist.blogspot.com

@sjmaple @notatibm @TimothyWard

Email

applebyd@uk.ibm.com

Duane Appleby - applebyd@uk.ibm.com

WAS v8 Beta
Demo

Duane Appleby - applebyd@uk.ibm.com

NO FURTHER SLIDES