WebSphere Application Server V7 OSGi, JPA, and Modern Batch Feature Packs

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IBM Corporation

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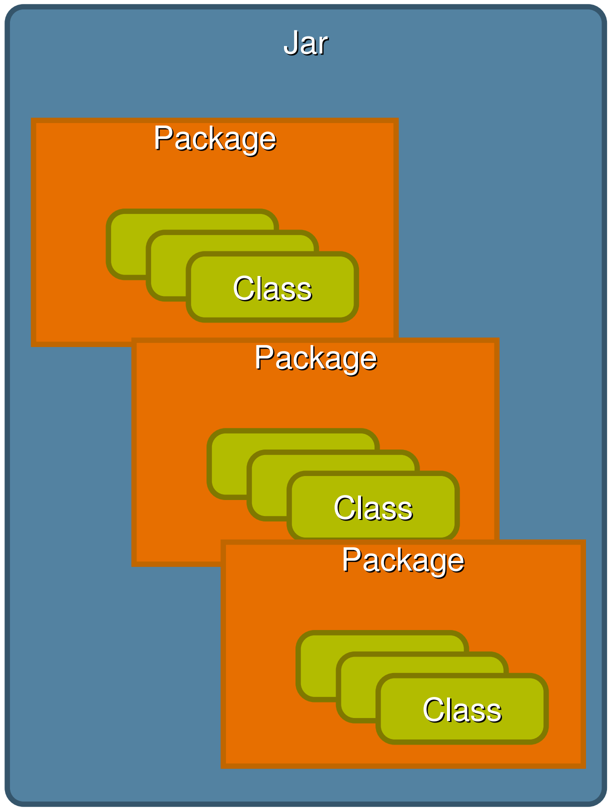
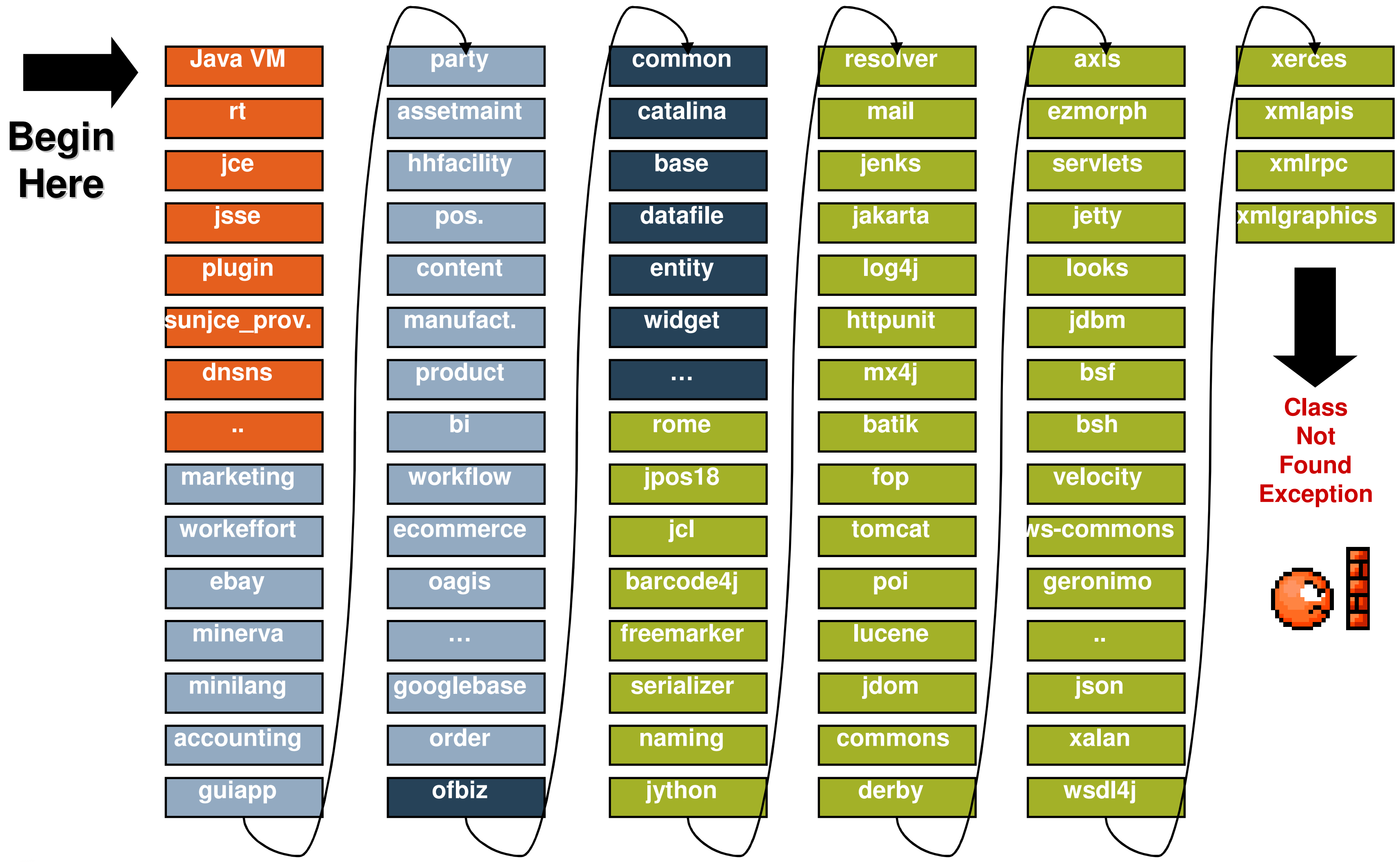
OSGi Feature Pack

Modularization in Java – Problems with Jars

- Java Platform Modularity
  - Classes encapsulate data
  - Packages contain classes
  - Jars contain packages
- Class visibility:
  - private, package private, protected, public
- No “jar scoped” access modifiers.
- No means for a jar to declare its dependencies.
- No versioning.
- Jars have no modularization characteristics
  - At runtime there is just a collection of classes on a global classpath



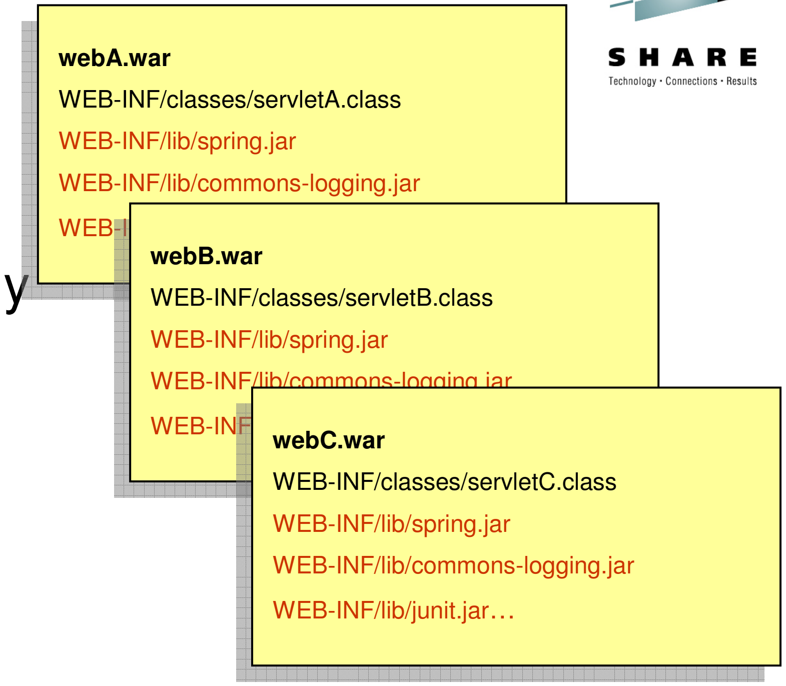
Problems with Global Java ClassPath



Problems with EARs/WARs

Enterprise Apps have isolated
classpaths but…

- *Across applications* - each archive typically contains all the libraries required by the application
  - Common libraries/frameworks get installed with each application
  - Multiple copies of libraries in memory

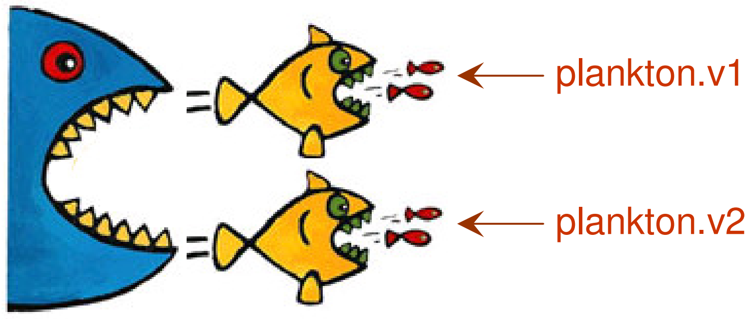


webA.war
WEB-INF/classes/servletA.class
WEB-INF/lib/spring.jar
WEB-INF/lib/commons-logging.jar
WEB-I

webB.war
WEB-INF/classes/servletB.class
WEB-INF/lib/spring.jar
WEB-INF/lib/commons-logging.jar
WEB-INF

webC.war
WEB-INF/classes/servletC.class
WEB-INF/lib/spring.jar
WEB-INF/lib/commons-logging.jar
WEB-INF/lib/junit.jar…

- *Within applications* – third party libraries consume other third party libraries leading to version conflicts

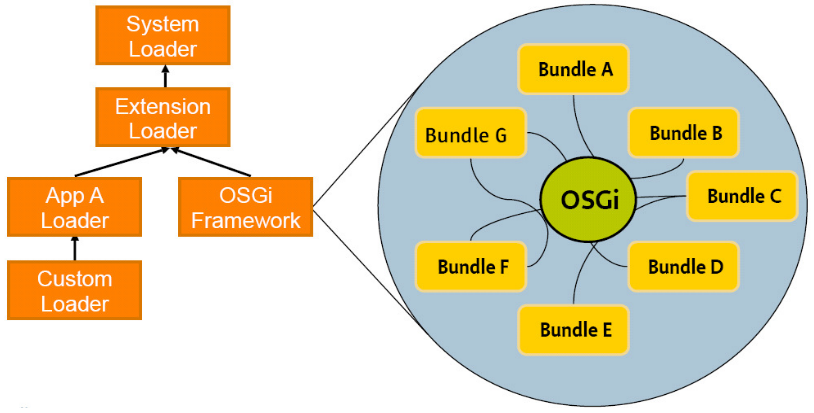


OSGi Bundles and Class Loading

- OSGi Bundle – A jar containing:
  - Classes and resources.
  - OSGi Bundle manifest.
- What's in the manifest:
  - Bundle-Version: Multiple versions of bundles can live concurrently.
  - Import-Package: What packages from other bundles does this bundle depend upon?
  - Export-Package: What packages from this bundle are visible and reusable outside of the bundle?

- Class Loading
  - Each bundle has its own loader.
  - No flat or monolithic classpath.
  - Class sharing and visibility decided by declarative dependencies, not by class loader hierarchies.
  - OSGi framework works out the dependencies including versions.

```
Manifest-Version: 1.0
Bundle-ManifestVersion: 2
Bundle-Name: MyService bundle
Bundle-SymbolicName: com.sample.myservice
Bundle-Version: 1.0.0
Bundle-Activator: com.sample.myservice.Activator
Import-Package: com.something.i.need;version="1.1.2"
Export-Package: com.myservice.api;version="1.0.0"
```



OSGi Enterprise Specification

- Released 22 March 2010
  - The product of the OSGi Enterprise Expert Group (EEG)
- Brings Enterprise technologies and OSGi together
- Using existing Java SE/EE specifications:
  - JTA, JPA, JNDI, JMX, WebApps…
- Adds Spring-derived *Blueprint* component model and DI container

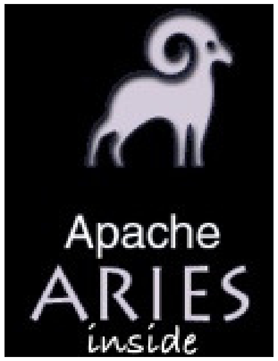
- **Java EE provides the core enterprise application programming model**
- **Deploying modules as OSGi bundles simplifies reuse between applications, provides versioning, encourages (and enforces) modular design and enables dynamic module updates.**

Enterprise OSGi in Open Source

- Apache “Aries” created as a new Apache incubator project in Sep 2009:
  - to provide enterprise OSGi spec implementations http://incubator.apache.org/aries/
  - to provide an environment to collaborate and experiment with new technologies to inform further EEG standardization.
    - In particular the programming model aspects of OSGi applications in an enterprise environment such as the Blueprint container and multi-bundle composites.
  - to build a broad development community to encourage implementation and adoption of EEG specs
- Aries componentry supporting an enterprise OSGi programming model are being integrated into both Geronimo and WebSphere Application Server.
  - As well as Apache Felix Karaf, JBossOSGi and others

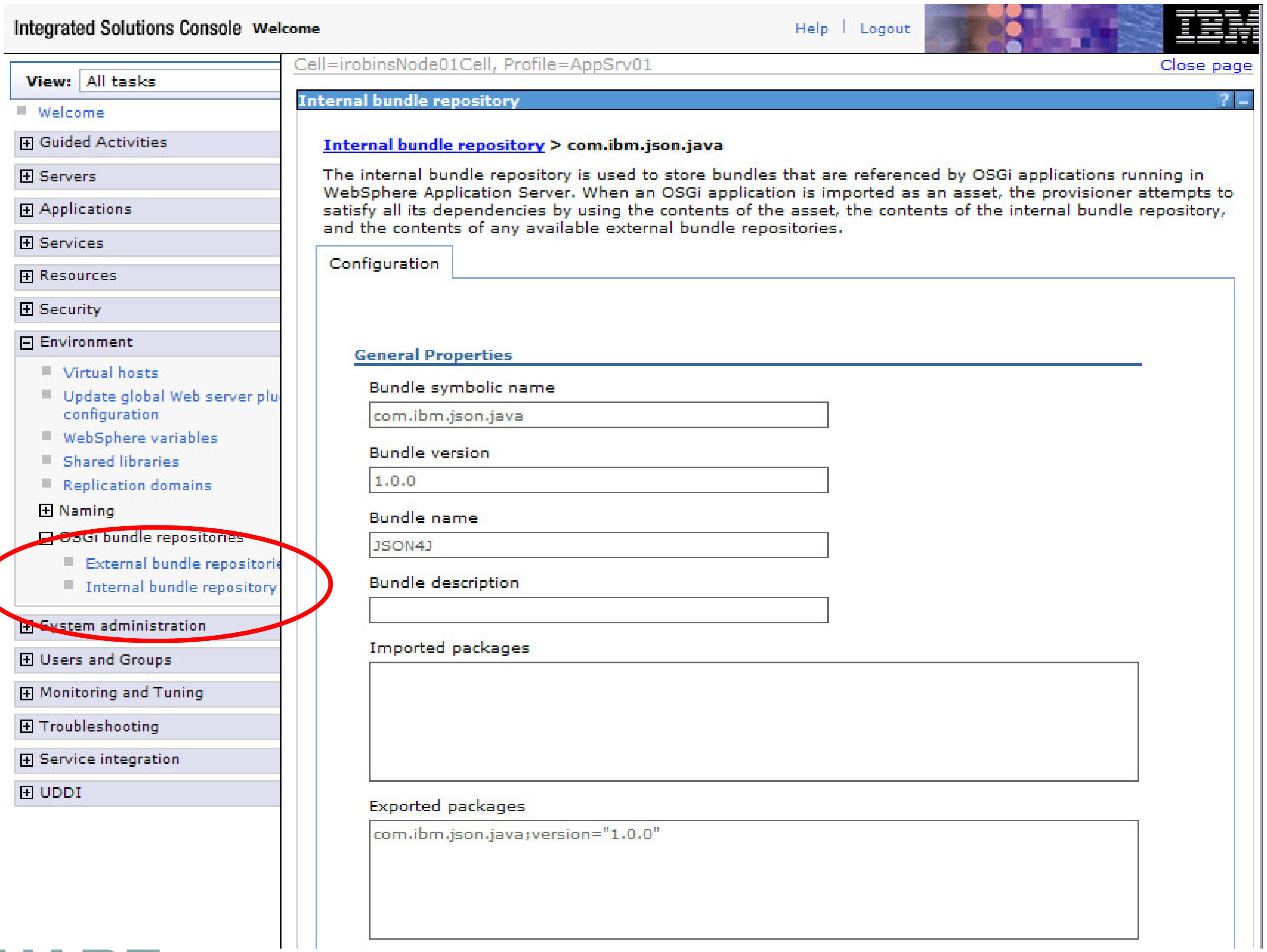
Application exploitation of OSGi in WebSphere

- OSGi has been used internally in WebSphere Application Server since V6.1 and in Eclipse since R3.
- Application-level exploitation is introduced in the **WebSphere Application Server Feature Pack for OSGi Applications and Java Persistence API (JPA) 2.0**
    - http://www-01.ibm.com/software/webservers/appserv/was/featurepacks/
    - Generally available May 2010
- Early Program available since Nov 2009
    - https://www14.software.ibm.com/iwm/web/cc/earlyprograms/websphere/wasfposgiajp
    - More downloads in a shorter period of time than any previous WebSphere Application Server v7 feature pack open beta



- Two installable features:
    - OSGi Application feature simplifies the development, assembly, and deploy of enterprise applications
    - JPA 2.0 feature introduces Java EE 6 JPA 2.0 enhancements to object-relational persistence to simplify data access and optimize performance

New: Bundle Repository Configuration in WebSphere Application Server



Cell=irobinsNode01Cell, Profile=AppSrv01

Internal bundle repository

Internal bundle repository > com.ibm.json.java

The internal bundle repository is used to store bundles that are referenced by OSGi applications running in WebSphere Application Server. When an OSGi application is imported as an asset, the provisioner attempts to satisfy all its dependencies by using the contents of the asset, the contents of the internal bundle repository, and the contents of any available external bundle repositories.

Configuration

General Properties

Bundle symbolic name: com.ibm.json.java

Bundle version: 1.0.0

Bundle name: JSON4J

Bundle description:

Imported packages:

Exported packages: com.ibm.json.java;version="1.0.0"

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JPA Overview

What is JPA?

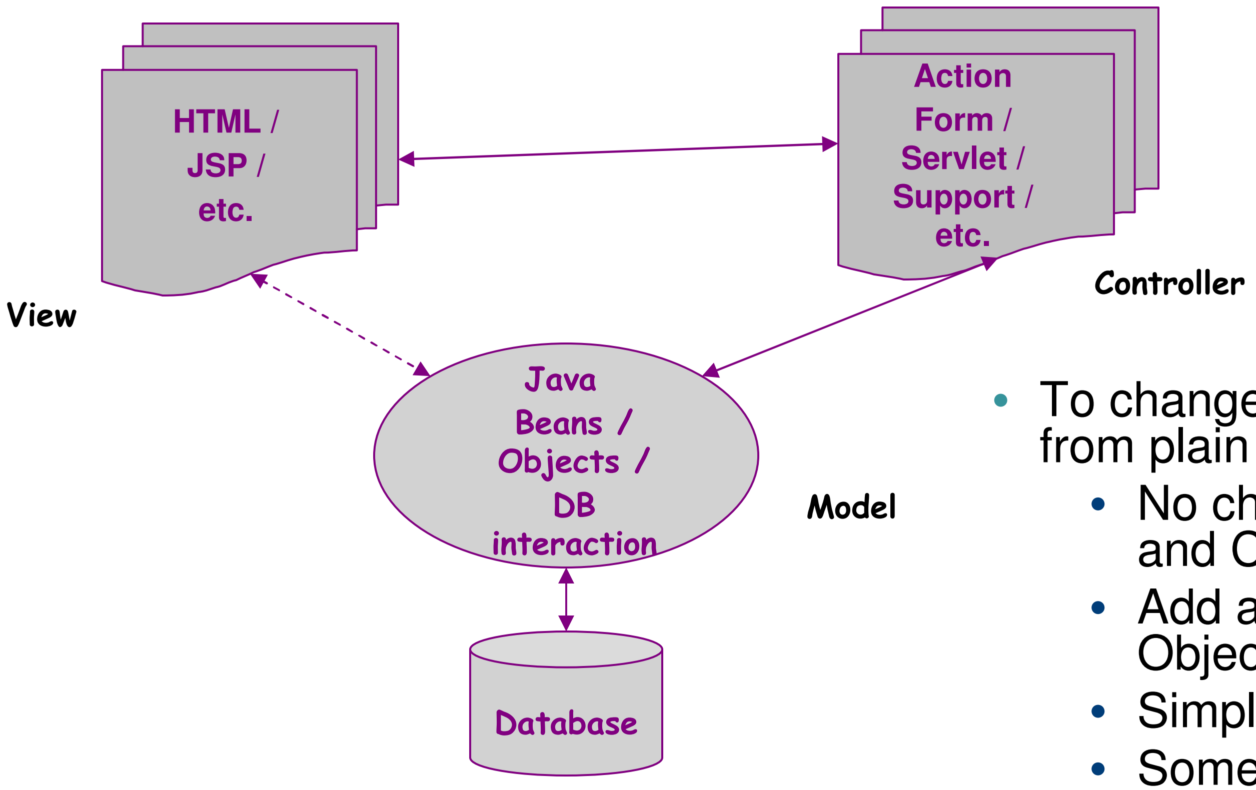
- Standard persistence technology
  - JPA 1.0 introduced in Java EE 5
  - JPA 2.0 is part of Java EE 6 standards
  - Object/Relational Mapping
  - Designed for highly distributed applications
    - Especially web-enabled applications
  - Life cycle manageable by application server to increase quality of service

- Simplifies development
  - Provides framework/ tools around providing automatic persistence
  - Objects are mapped to Tables using Metadata
  - Metadata is used to transform data from one representation to another

What is JPA? (continued)

- JPA specifications made very significant simplifications:
  - Standardizes O/R mapping metadata (not the case for EJB 2.x)
  - Java SE 5.0 Annotations can be used instead of XML deployment descriptor
  - No deploy code implementing abstract classes— Entities are POJOs
  - Application Server is not required
    - The Java Persistence API is available outside of Containers
    - Unit testing greatly simplified
  - Removal of checked exceptions (for instance, remote exceptions)
  - No bean (or business) interface required

Web Application Example – MVC Framework


HTML / JSP / etc.
View
Action Form / Servlet / Support / etc.
Controller
Java Beans / Objects / DB interaction
Model
Database

- To change existing applications from plain JDBC to use JPA
  - No change required to View and Controller
  - Add annotations to Java Objects
  - Simplify DB interaction code
  - Some configuration changes (for example, persistence.xml)

Annotate Entity Object Class

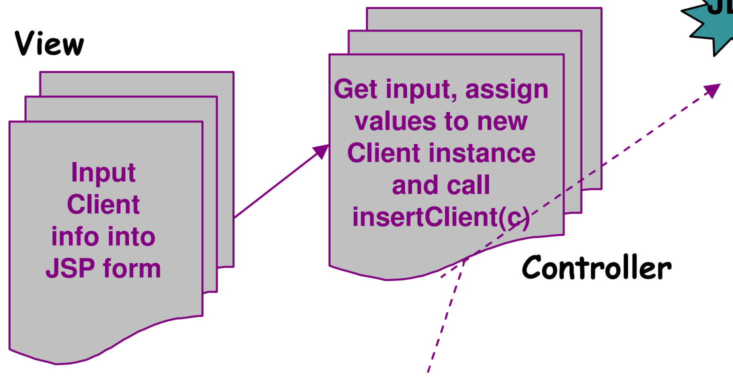
Import the javax.persistence packages

Declare the class as an entity

Identify a property as a primary key

```
import javax.persistence.*;

@Entity
public class Client {

@Id
@GeneratedValue(strategy=GenerationType.AUTO)
private int ID;

private String name;
private String industry;
private String headquarterLocation;
private String cepClient;
private String betaClient;
private String productsInUse;
private String wasVersions;

public Client() {
          …
}

//all necessary getter and setter methods
          ...

}
```

JPA compared to Plain JDBC – Insert


View
Input Client info into JSP form
Get input, assign values to new Client instance and call insertClient(c)
Controller

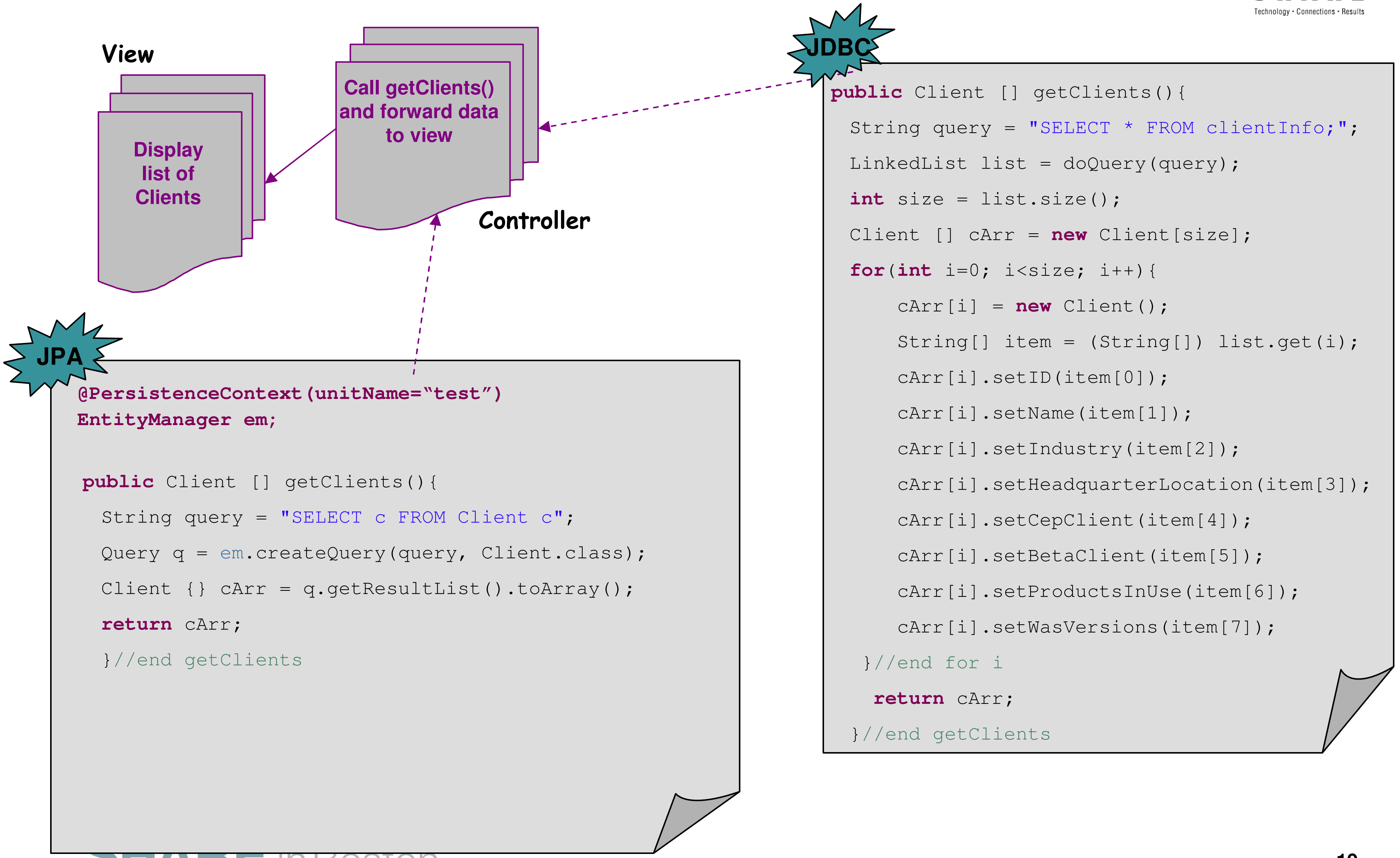
JDBC

```
public void insertClient(Client client){
   String insert ="INSERT INTO clientInfo ("name, industry,"+
     "headquarterLocation, cepClient, betaClient,"+
     "productsInUse, wasVersions) VALUES('" +
     client.getName()+"', '"+client.getIndustry()+"', '"+
     client.getHeadquarterLocation()+"', '"+
     client.getCepClient()+"','"+ client.getBetaClient()+"', '"+
     client.getProductsInUse()+"', '"+client.getWasVersions()+"');" ;
  doInsert(insert);
}//end insertClient

public void doInsert(String insert){
 Statement stmt;
 Connection conn;
 CONSTANTS c = new CONSTANTS();
 try {
  java.lang.Class.forName(c.DRIVER).newInstance();
 }catch (Exception E) {
     System.err.println("Unable to load driver.");
     E.printStackTrace();
 }
 try{
   conn = DriverManager.getConnection(c.DB_CONNECTION);
   stmt = conn.createStatement();
   stmt.executeUpdate(insert);
   stmt.close();
   conn.close();
  }catch (SQLException E) {
     System.out.println("SQLException: " + E.getMessage());
  }
}//end doInsert
```

JPA

```
@PersistenceContext(unitName="test")
EntityManager em;

public void insertClient(Client client){
  doInsert(Client)
}//end insertClient

public void doInsert(Object newObject){
   em.persist(newObject);
}//end doInsert
```

JPA compared to Plain JDBC – Retrieve



JPA:

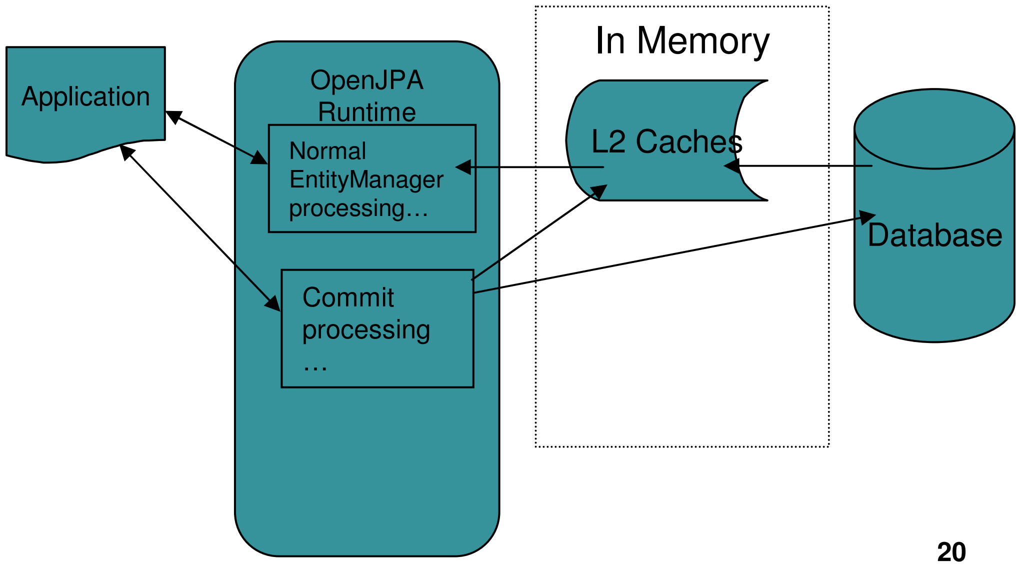
```
@PersistenceContext(unitName=“test”)
EntityManager em;

 public Client [] getClients(){
   String query = "SELECT c FROM Client c";
   Query q = em.createQuery(query, Client.class);
   Client {} cArr = q.getResultList().toArray();
   return cArr;
   }//end getClients
```

JDBC:

```
public Client [] getClients(){
  String query = "SELECT * FROM clientInfo;";
  LinkedList list = doQuery(query);
  int size = list.size();
  Client [] cArr = new Client[size];
  for(int i=0; i<size; i++){
      cArr[i] = new Client();
      String[] item = (String[]) list.get(i);
      cArr[i].setID(item[0]);
      cArr[i].setName(item[1]);
      cArr[i].setIndustry(item[2]);
      cArr[i].setHeadquarterLocation(item[3]);
      cArr[i].setCepClient(item[4]);
      cArr[i].setBetaClient(item[5]);
      cArr[i].setProductsInUse(item[6]);
      cArr[i].setWasVersions(item[7]);
   }//end for i
   return cArr;
  }//end getClients
```

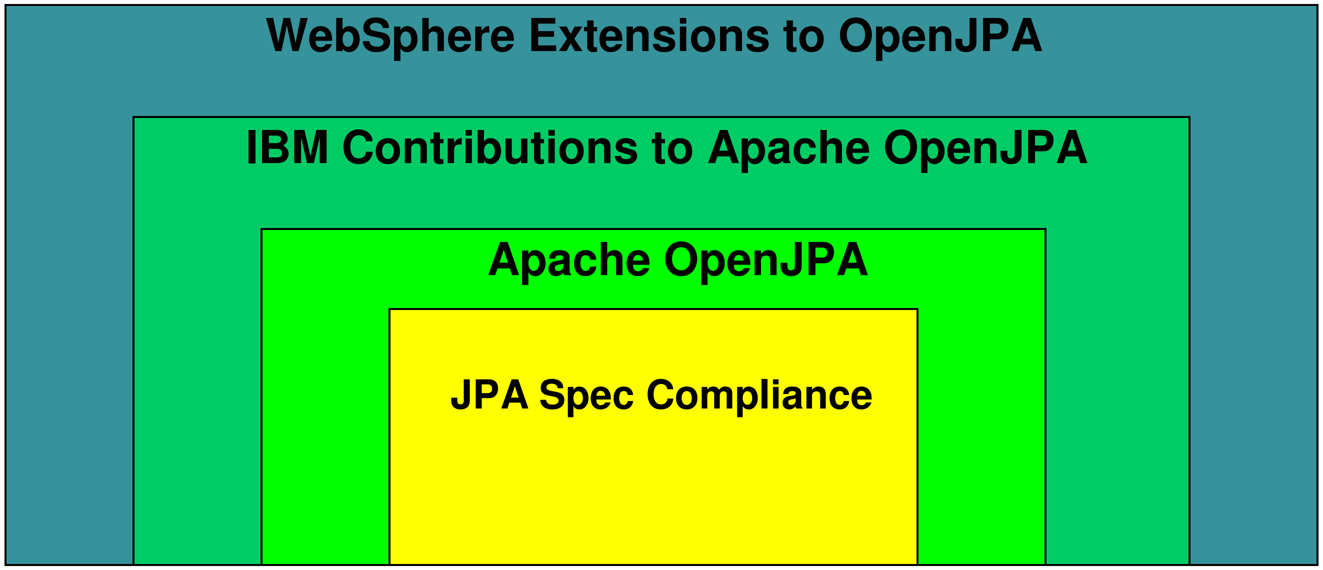
Advantages to using OpenJPA

- Object level programming model
  - More natural for programmers
- Container “free”
  - No requirement on an application server
  - JEE, JSE, and now OSGi
- Common programming model across databases
  - No database-specific SQL or JDBC
- Ability to Cache database records in memory
  - Fewer trips to the database



WebSphere's JPA Architecture

- WebSphere's JPA Solution
  - Spec Compliant
  - Feature Rich
  - Extensible
  - Competitive with Hibernate and EclipseLink
  - Production Ready


WebSphere Extensions to OpenJPA
IBM Contributions to Apache OpenJPA
Apache OpenJPA
JPA Spec Compliance

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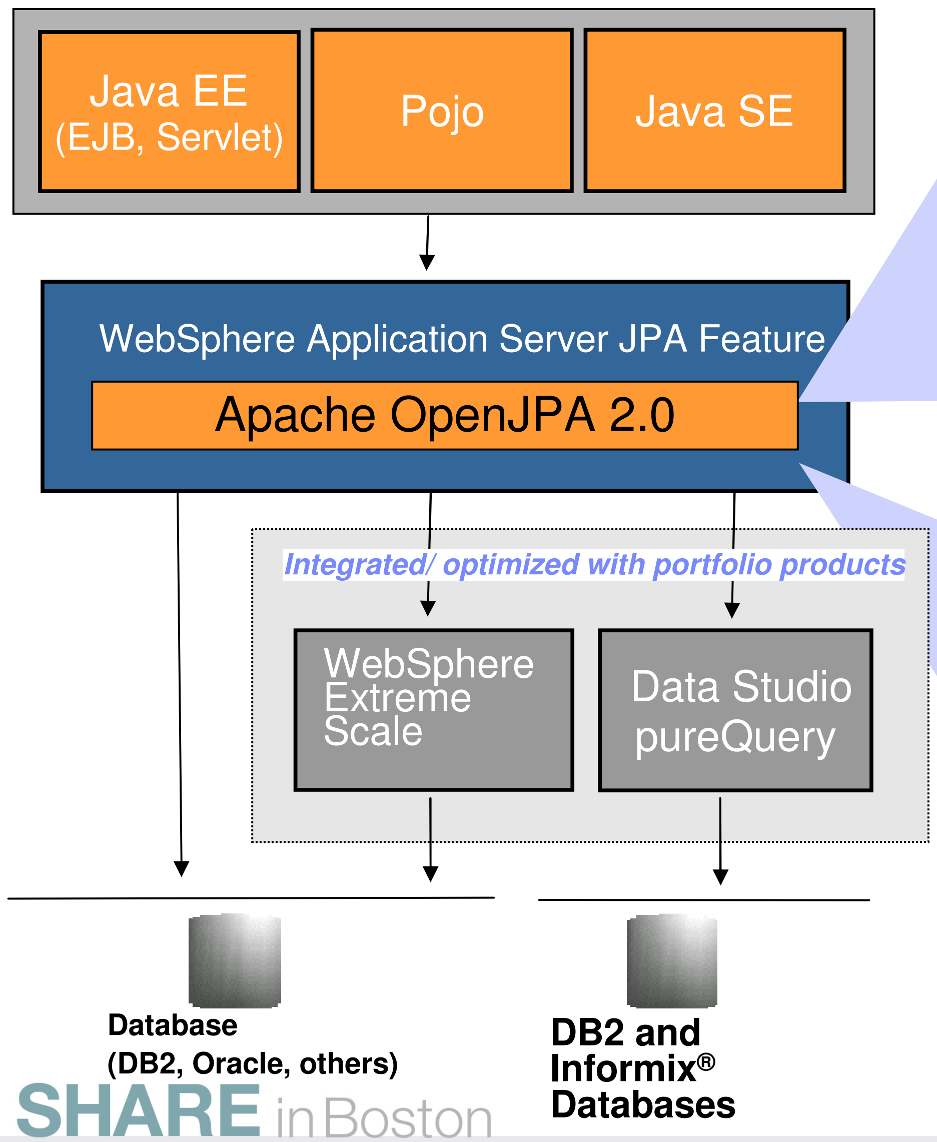
JPA 2.0 Feature Pack

The WebSphere Application Server V7 Feature Pack for OSGi Applications and Java Persistence API 2.0

- Based on Apache OpenJPA, a leading open source Java persistence framework.
- Provides the Apache OpenJPA 2.0 implementation with IBM enhancements to benefit integration with WebSphere Application Server.
- The Apache OpenJPA 2.0 implementation includes improvements and benefits over previous releases and even beyond the JPA 2.0 specification.

WebSphere Application Server JPA 2.0 feature Architecture



Java EE (EJB, Servlet)
Pojo
Java SE
WebSphere Application Server JPA Feature
Apache OpenJPA 2.0
Integrated/ optimized with portfolio products
WebSphere Extreme Scale
Data Studio pureQuery
Database (DB2, Oracle, others)
DB2 and Informix® Databases

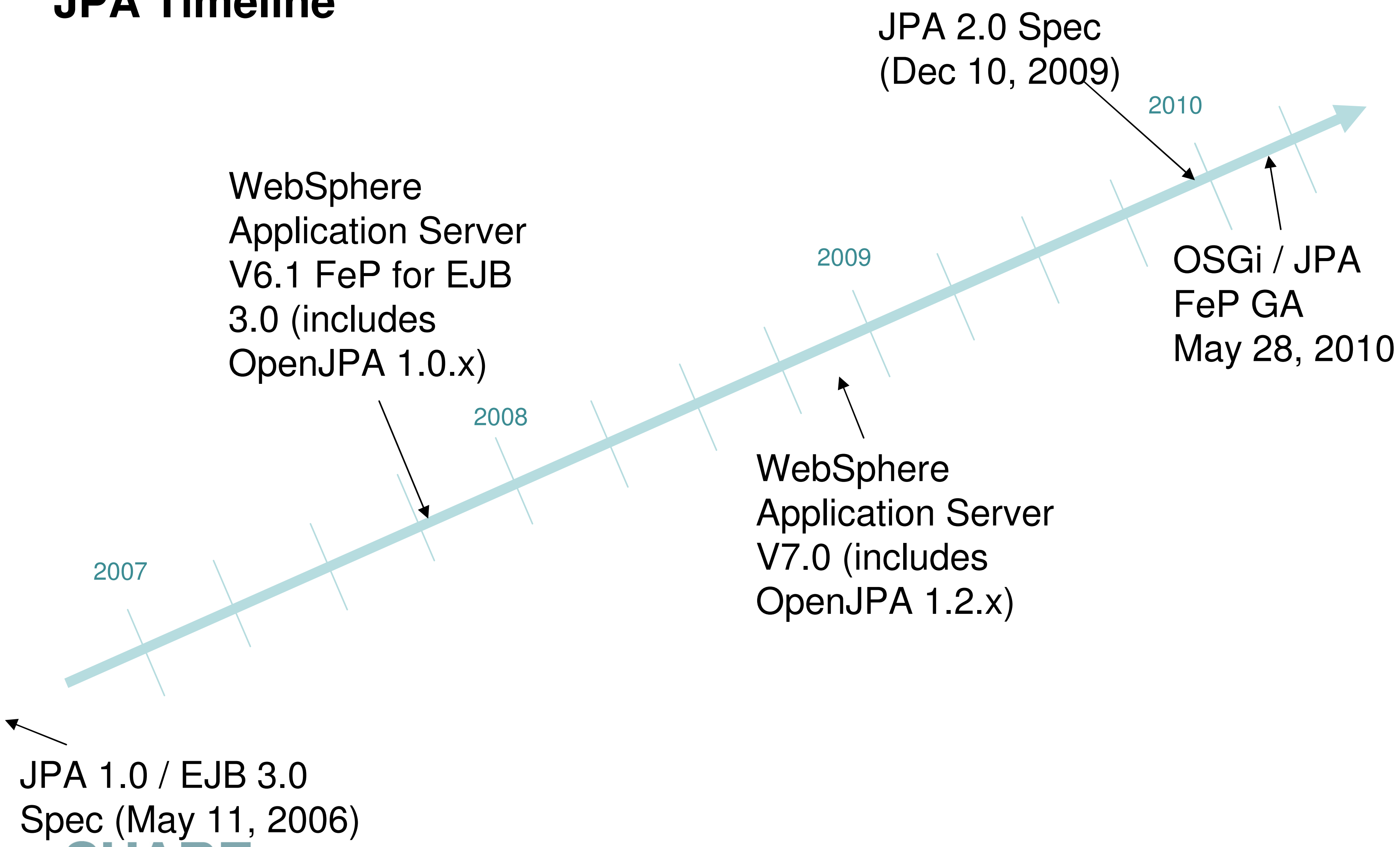
Apache OpenJPA 2.0 provides:

- JPA 2.0 standards currency: **JPA 2.0 (JSR 317) includes important improvements on the data persistence and relational database management capabilities. Early delivery of part of the JEE 6 standard.**
- WebSphere Application Server Integration: **Enhanced management, debugging, monitoring, and security for WAS.**
- WebSphere Extreme Scale Integration Enhancements: **Features that enable JPA to use WebSphere eXtreme Scale as a level2 cache in order to improve data access performance.**

WebSphere Application Server Feature Pack for OSGi Applications and Java Persistence API 2.0 JPA feature adds:

- Additional WebSphere Application Server Integration: **Install, Extended Debugging**
- Data Studio pureQuery Runtime optimization: **Performance and monitoring improvements for database access**

WebSphere Application Server V7 Feature Pack for JPA Timeline


JPA 2.0 Spec (Dec 10, 2009)
2010
WebSphere Application Server V6.1 FeP for EJB 3.0 (includes OpenJPA 1.0.x)
2009
OSGi / JPA FeP GA May 28, 2010
2008
WebSphere Application Server V7.0 (includes OpenJPA 1.2.x)
2007
JPA 1.0 / EJB 3.0 Spec (May 11, 2006)

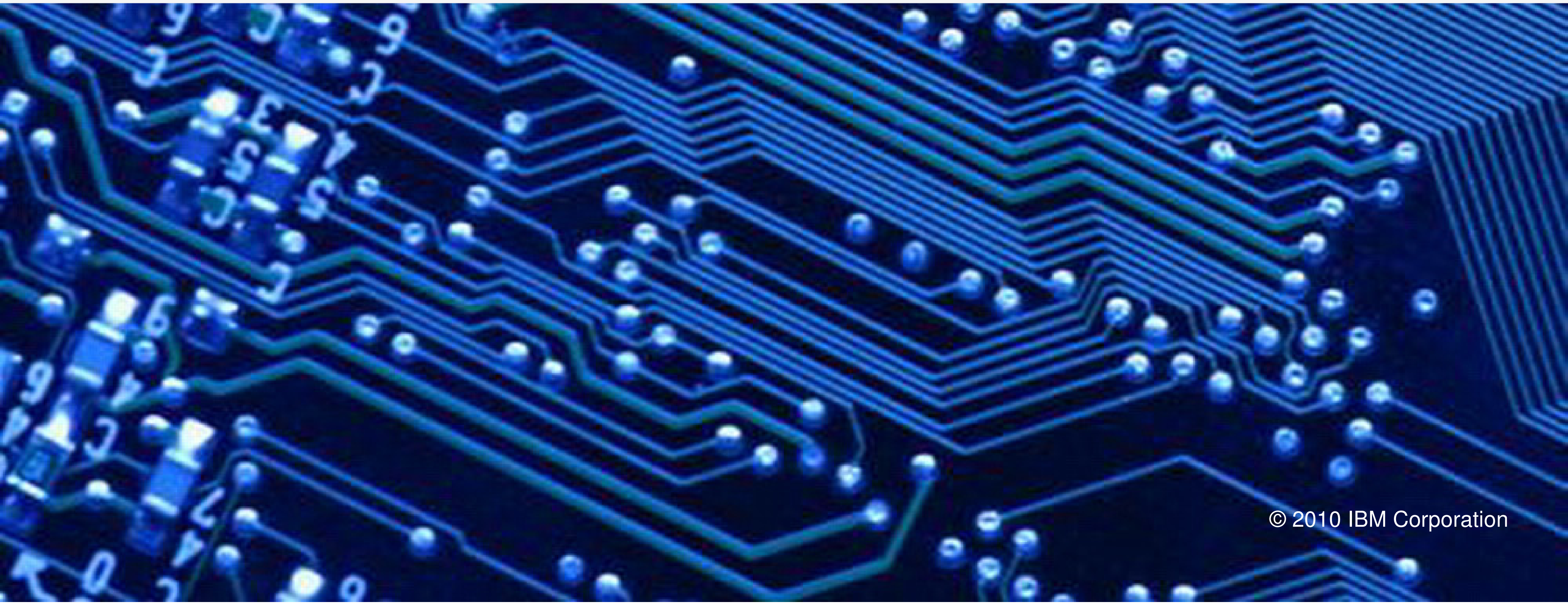
JPA 2.0 Highlights

- O/R Mapping and Domain Modeling
  - Embeddables
  - Access Types
  - Enhanced Map Collections
  - Derived Identities
  - JPQL Updates
- Runtime API Updates
  - EntityManagerFactory API, EntityManager API, Query API, Query Result API
- Metamodel and Criteria API
- Bean Validation
  - Provides entity validation based on JSR-303 semantics

WebSphere Application Server

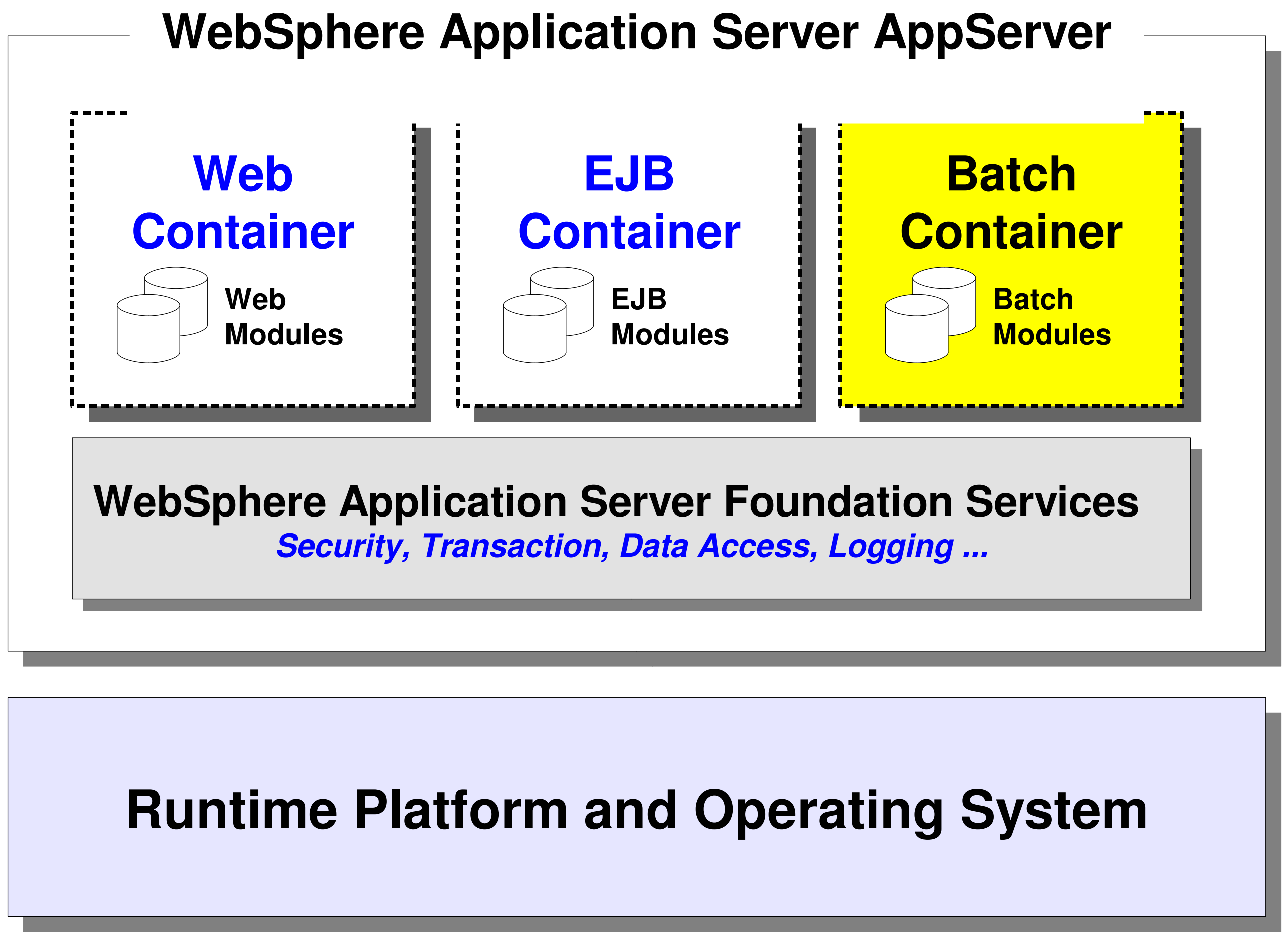
Feature Pack for Modern Batch

Currently in Open Beta



What is the "Feature Pack for Modern Batch?"

It is a batch execution framework within the WebSphere Application Server runtime platform:



WebSphere Application Server AppServer
Web Container
Web Modules
EJB Container
EJB Modules
Batch Container
Batch Modules
WebSphere Application Server Foundation Services
Security, Transaction, Data Access, Logging ...
Runtime Platform and Operating System

Feature Pack adds function to an existing WebSphere Application Server runtime environment

Available for all platforms

Currently in Open Beta

What's the Objective?

In a picture and a few words:

Allows you to maintain a focus on your core business objectives while leveraging Java as a batch execution language

Helps you avoid writing expensive and hard-to-maintain custom batch middleware functionality

Makes you a hero in the eyes of management, who's focused on the business imperatives

Funny pictures ... *serious point*. Countless hours and dollars have been spent by companies pursuing custom middleware solutions. It's costly, time consuming and may lead to disparate islands of Java batch processes

What Does it Provide?

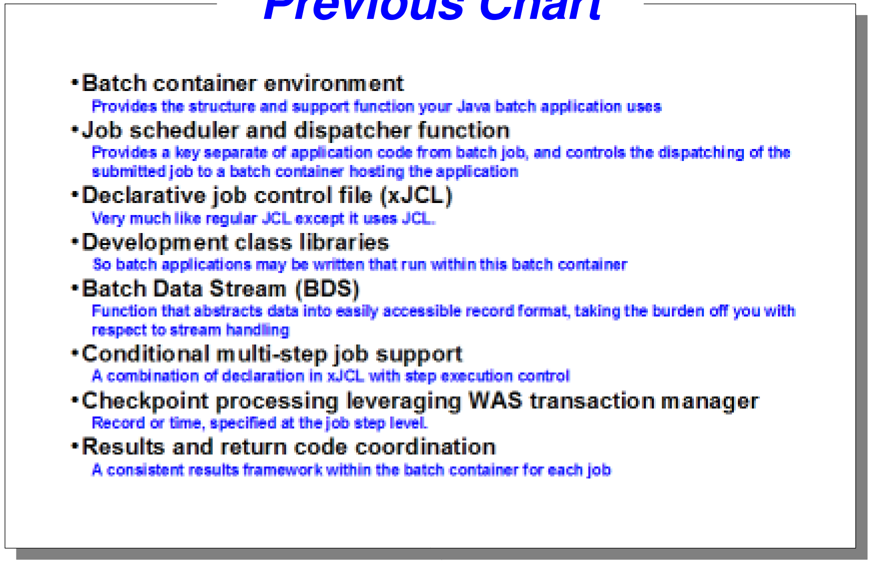
Here's a summary of the key features the Feature Pack provides:

- **Batch container environment**
  Provides the structure and support function your Java batch application uses
- **Job scheduler and dispatcher function**
  Provides a key separate of application code from batch job, and controls the dispatching of the submitted job to a batch container hosting the application
- **Declarative job control file (xJCL)**
  Very much like regular JCL except it uses JCL.
- **Development class libraries**
  So batch applications may be written that run within this batch container
- **Batch Data Stream (BDS)**
  Function that abstracts data into easily accessible record format, taking the burden off you with respect to stream handling
- **Conditional multi-step job support**
  A combination of declaration in xJCL with step execution control
- **Checkpoint processing leveraging WAS transaction manager**
  Record or time, specified at the job step level.
- **Results and return code coordination**
  A consistent results framework within the batch container for each job

Relationship to WebSphere Compute Grid

It's a matter of degree of functional sophistication. The Feature Pack is a subset of the much more powerful WebSphere Compute Grid product:

Previous Chart



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  A consistent results framework within the batch container for each job

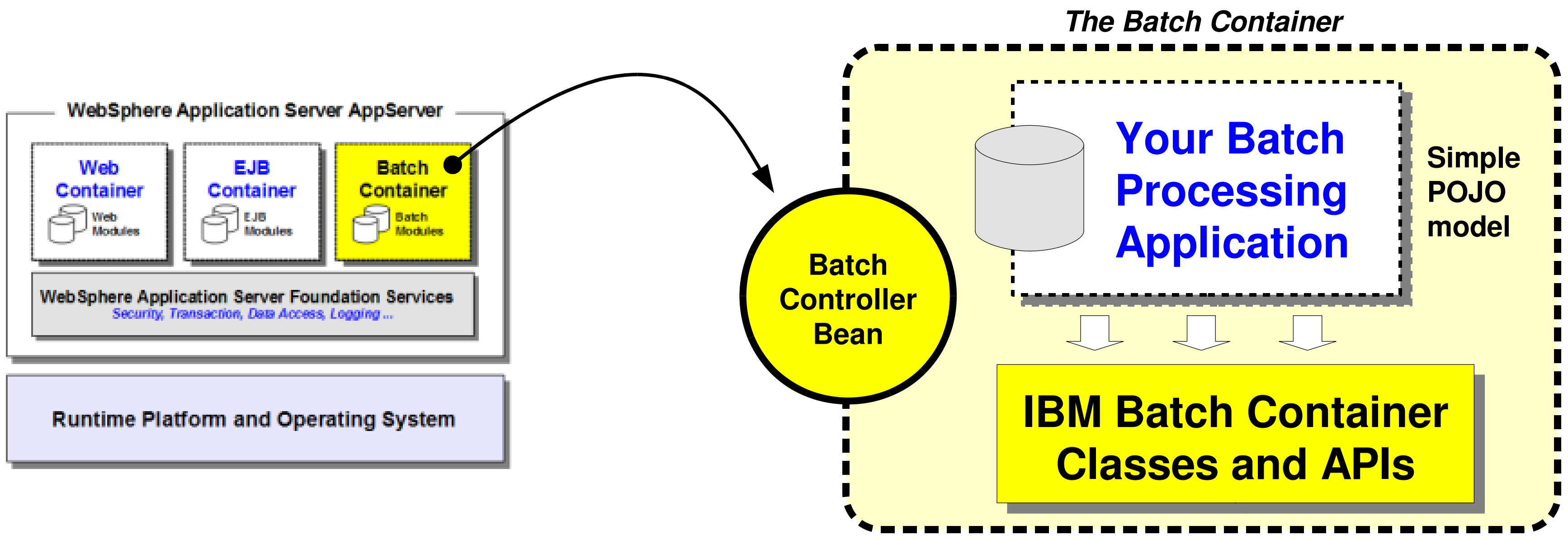
- **Calendar and clock scheduling of jobs from repository of xJCL**
- **Out of the box integration with enteprise schedulers**
- **Usage reporting with SMF 120.20 records (z/OS only)**
- **WLM transaction classification *by job* (z/OS only)**
- **Application quiesce and update**
- **Job submission pacing and job execution throttling**
- **Parallel job management and dispatching**

Feature Pack is designed to introduce you to WAS container processing of Java batch

WebSphere Compute Grid completes the picture with enterprise functionality

How Does it Provide This Function?

Batch by its nature has an long running execution profile. Therefore it can't be run under the traditional request / response model. So it uses asynchronous beans: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Web Container
Web Modules
EJB Container
EJB Modules
Batch Container
Batch Modules
WebSphere Application Server Foundation Services
Security, Transaction, Data Access, Logging ...
Runtime Platform and Operating System
The Batch Container
Batch Controller Bean
Your Batch Processing Application
Simple POJO model
IBM Batch Container Classes and APIs

This is an asynchronous bean

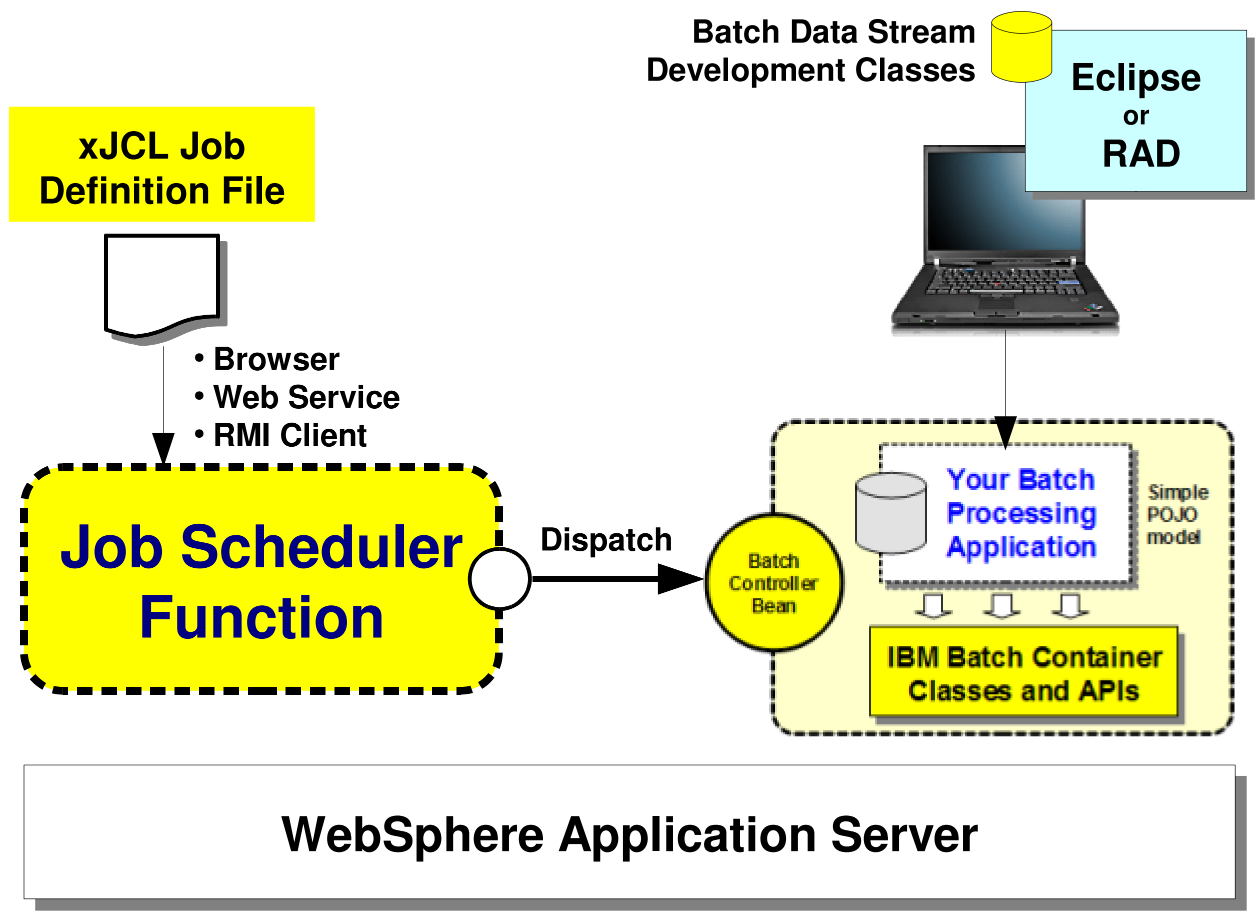
Your batch application runs under the control of this bean

You can think of this as a container-managed thread

It processes the job definition and carries it from start to finish

Applications, Jobs and Job Control Definition

A key concept to appreciate the differentiation of this over other Java batch models:



- Application deployed into AppServer
- Job is an invocation of that application
- The job execution characteristics defined in job control file (xJCL)
- xJCL submitted to scheduler function
- Scheduler determines location of named application
- Scheduler dispatches job to the batch end point with application
- Application runs according to xJCL definition

The Job Control Definition File -- "xJCL"

Syntax different than traditional JCL, but the concepts are very similar:

```
<?xml version="1.0" encoding="UTF-8" ?>
<job name="name" ... >
  <jndi-name>batch_controller_bean_jndi</jndi-name>
    <substitution-props>
      <prop name="property_name" value="value" />
    </substitution-props>

    <job-step name="name">
    <classname>package.class</classname>
      <checkpoint-algorithm-ref name="chkpt"/>
      <results-ref name="jobsum"/>
        <batch-data-streams>
          <bds>
            <logical-name>input_stream</logical-name>
              <props>
                <prop name="name" value="value"/>
              </props>
          </bds>
      </batch-data-streams>
    </job-step>

</job>
```

Roughly analogous to the JOB card

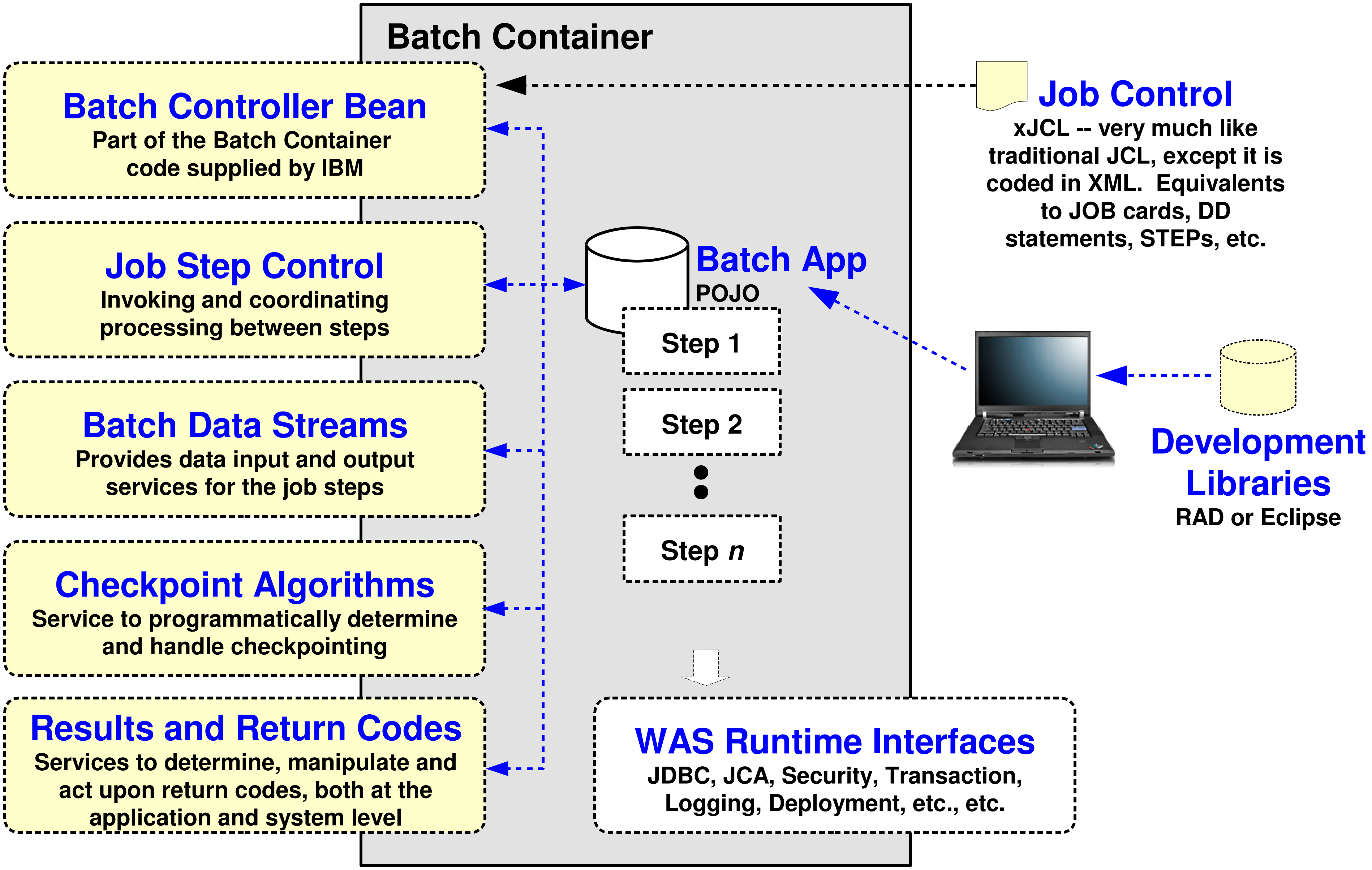
A job step

Like the EXEC PGM= statement in JCL

Similar to DD statements

Batch Programming Framework

Provides key functional structures for use by your batch application:

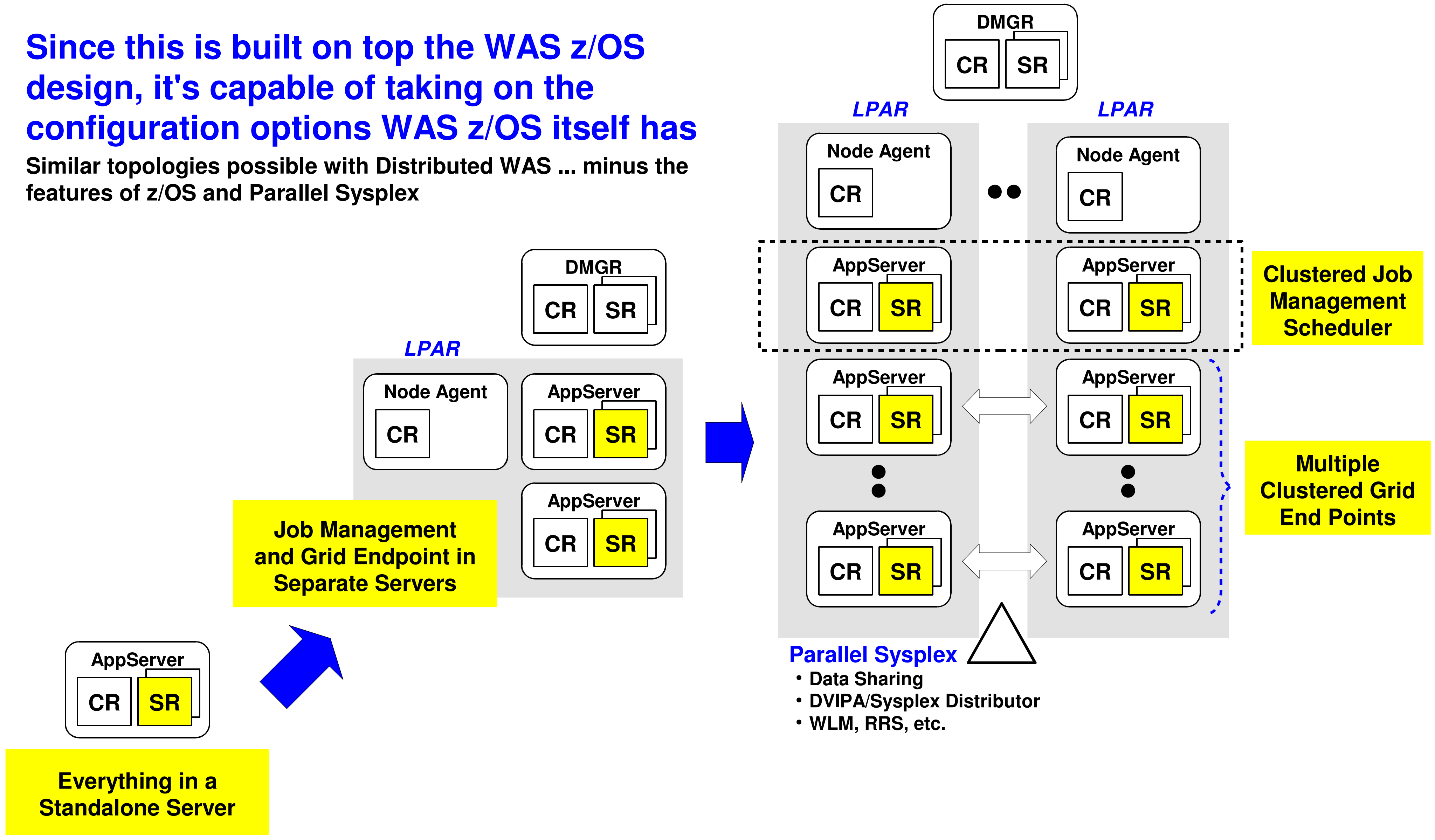

Batch Container
Batch Controller Bean
Part of the Batch Container code supplied by IBM
Job Step Control
Invoking and coordinating processing between steps
Batch Data Streams
Provides data input and output services for the job steps
Checkpoint Algorithms
Service to programmatically determine and handle checkpointing
Results and Return Codes
Services to determine, manipulate and act upon return codes, both at the application and system level
Batch App
POJO
Step 1
Step 2
Step *n*
WAS Runtime Interfaces
JDBC, JCA, Security, Transaction, Logging, Deployment, etc., etc.
Job Control
xJCL -- very much like traditional JCL, except it is coded in XML. Equivalents to JOB cards, DD statements, STEPs, etc.
Development Libraries
RAD or Eclipse

WAS z/OS Topologies for Batch Feature Pack

As you might expect from WAS z/OS:

Since this is built on top the WAS z/OS design, it's capable of taking on the configuration options WAS z/OS itself has

Similar topologies possible with Distributed WAS ... minus the features of z/OS and Parallel Sysplex


DMGR
CR
SR
LPAR
LPAR
Node Agent
CR
Node Agent
CR
AppServer
CR
SR
Clustered Job Management Scheduler
Multiple Clustered Grid End Points
DMGR
LPAR
Node Agent
AppServer
Job Management and Grid Endpoint in Separate Servers
Parallel Sysplex
• Data Sharing
• DVIPA/Sysplex Distributor
• WLM, RRS, etc.
AppServer
CR
SR
Everything in a Standalone Server

Implementing the Feature Pack

A relatively simple process:

Install the Product Files

- Feature Pack for Modern Batch -- typical WAS feature pack, installs under the "Optional Materials" mount point
- WebSphere Compute Grid -- separate FMID, installs under `/usr/lpp/zWebSphereXD` mount point (default)

Augment the WAS z/OS Runtime Nodes

- A WebSphere Customization Tools (WCT) extension file is supplied
- Generate augmentation job to indicate what node to augment and where batch installation is located
- Run the job -- one job for the DMGR and one for each node where batch will run

Create JDBC Provider, Data Sources and Database

- JDBC provider and data source is standard WAS configuration task
- Product comes with DDL to create database in DB2 z/OS, DB2 LUW, Oracle or Derby

Configure the Job Scheduler and the Grid End Points

- An almost entirely automated process. A few mouse-clicks and it does the rest

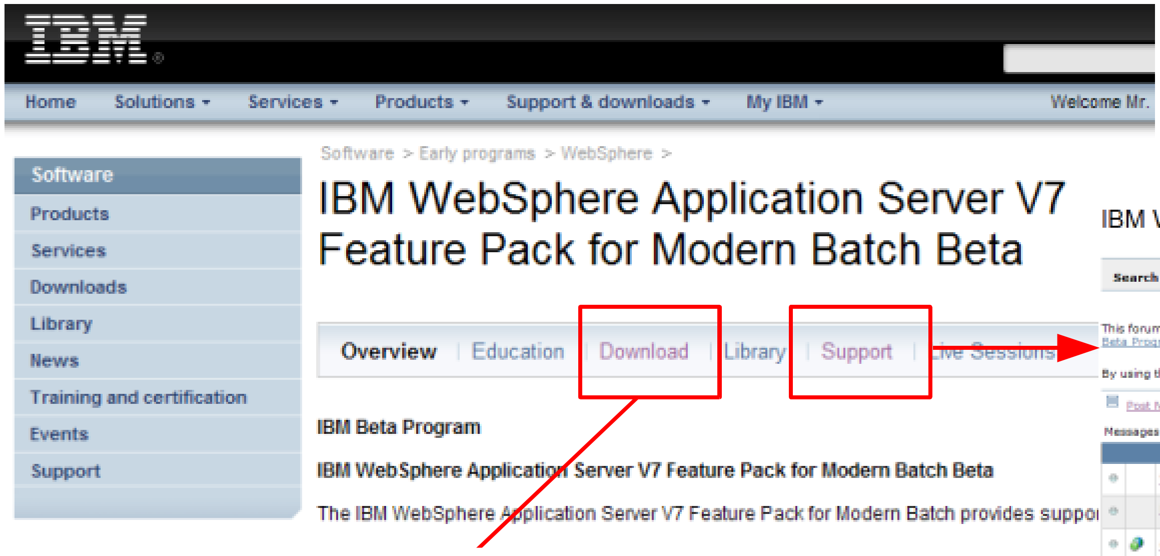
Validation

- "Test Connection" button on the JDBC data sources
- Several sample applications are supplied

Draft step-by-step Techdoc available on the Beta forum

Open Beta Website

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



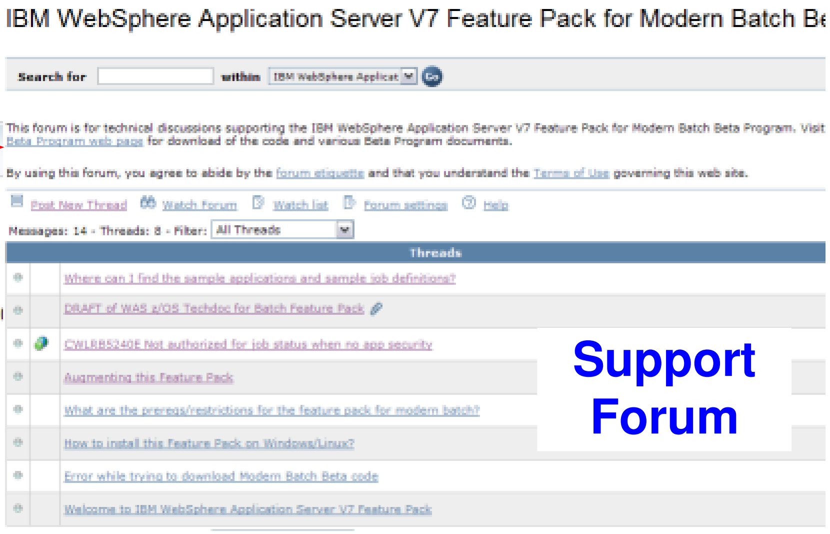
IBM WebSphere Application Server V7 Feature Pack for Modern Batch Beta

IBM Beta Program

IBM WebSphere Application Server V7 Feature Pack for Modern Batch Beta

The IBM WebSphere Application Server V7 Feature Pack for Modern Batch provides suppo

Download Code



IBM WebSphere Application Server V7 Feature Pack for Modern Batch Be

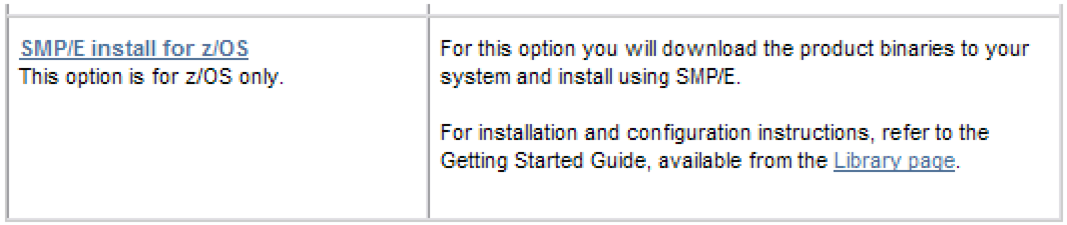
This forum is for technical discussions supporting the IBM WebSphere Application Server V7 Feature Pack for Modern Batch Beta Program. Visit Beta Program web page for download of the code and various Beta Program documents.

By using this forum, you agree to abide by the forum etiquette and that you understand the Terms of Use governing this web site.

Messages: 14 - Threads: 8 - Filter: All Threads

- Where can I find the sample applications and sample job definitions?
- DRAFT of WAS z/OS Techdoc for Batch Feature Pack
- CWLRB5240E Not authorized for job status when no app security
- Augmenting this Feature Pack
- What are the prereqs/restrictions for the feature pack for modern batch?
- How to install this Feature Pack on Windows/Linux?
- Error while trying to download Modern Batch Beta code
- Welcome to IBM WebSphere Application Server V7 Feature Pack

Support Forum



SMP/E install for z/OS This option is for z/OS only.	For this option you will download the product binaries to your system and install using SMP/E. For installation and configuration instructions, refer to the Getting Started Guide, available from the Library page.