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Best Practices for Application Development The OSGi Framework

& the problems in our project

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May 12, 2009

OSGi Alliance: Who are they?

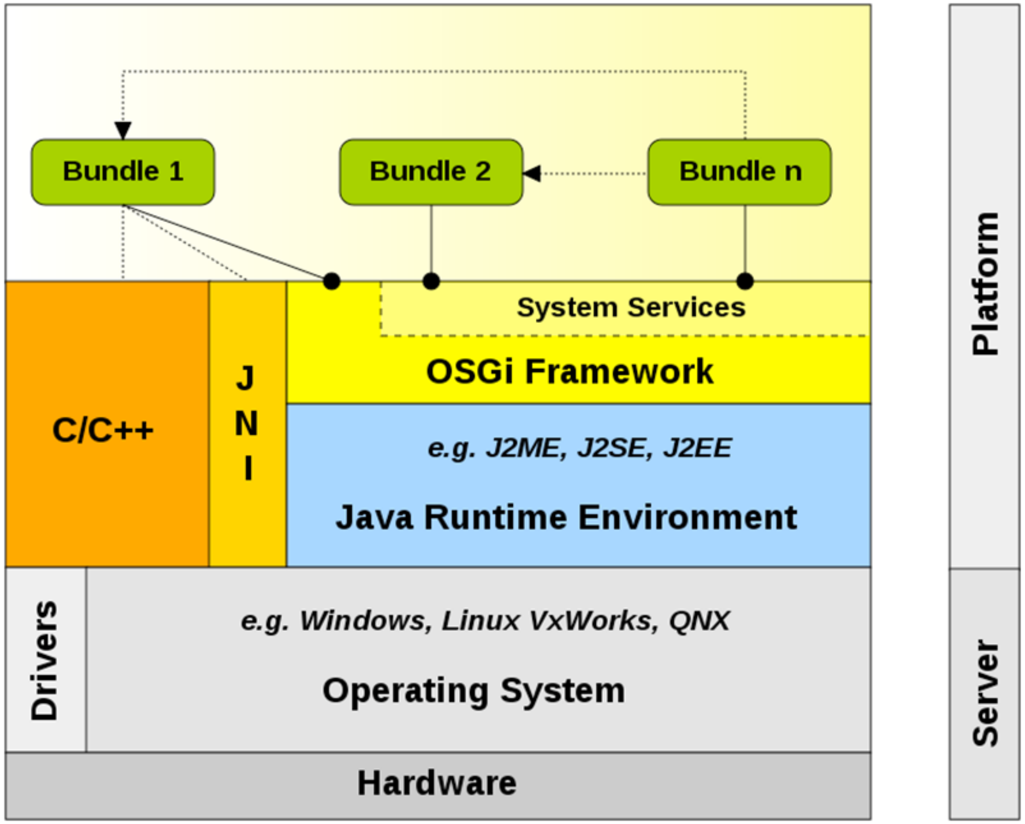
- Open Services Gateway initiative
  → OSGi Alliance
- Founded by Ericsson, IBM, Oracle, Sun Microsystems et al. in March 1999
- Non-profit organization
- Mission: To promote the OSGi technology (specifications, reference implementations, test suites, certification procedures) cross-industry
- Expert Groups: Core Platform, Vehicle, Mobile, Enterprise, Residential

See also:
http://www.osgi.org

OSGi Service Platform (or Framework): What is it?

- Java-based runtime environment for services & applications

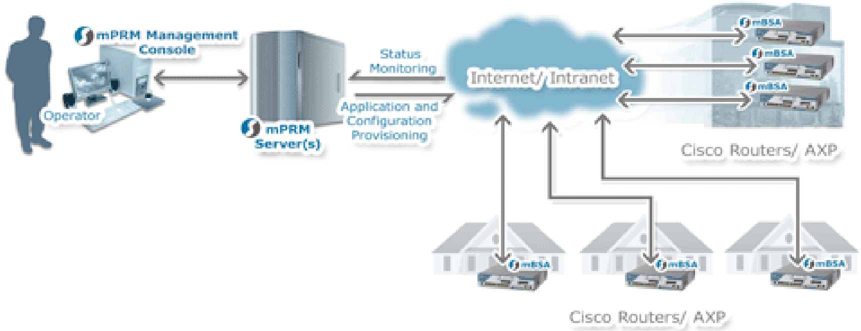
- **Terms:**
- Framework = dynamic environment for services & applications
- Service = interface + implementation
- Bundle = deployment unit

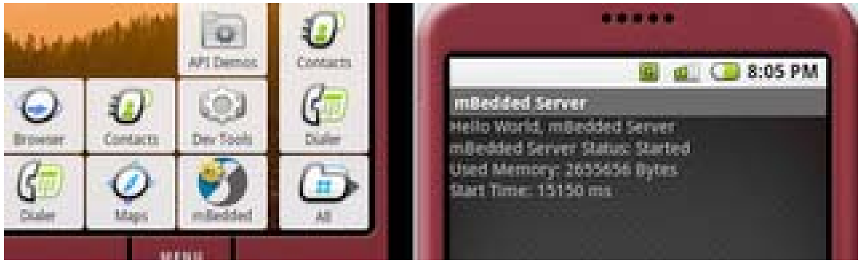


Source:
http://en.wikipedia.org/wiki/File:Osgi.svg

OSGi Frameworks: Where can you find them?

- Eclipse
- Enterprise
  - IBM Websphere Application / Portal Server
  - JBoss Application Server
- Electronics
  - Router (Cisco AXP, Arcom ZyWAN)
- Mobile Phones
  - Third-party installations (Android et al.)
  - min. J2ME CDC





8:05 PM

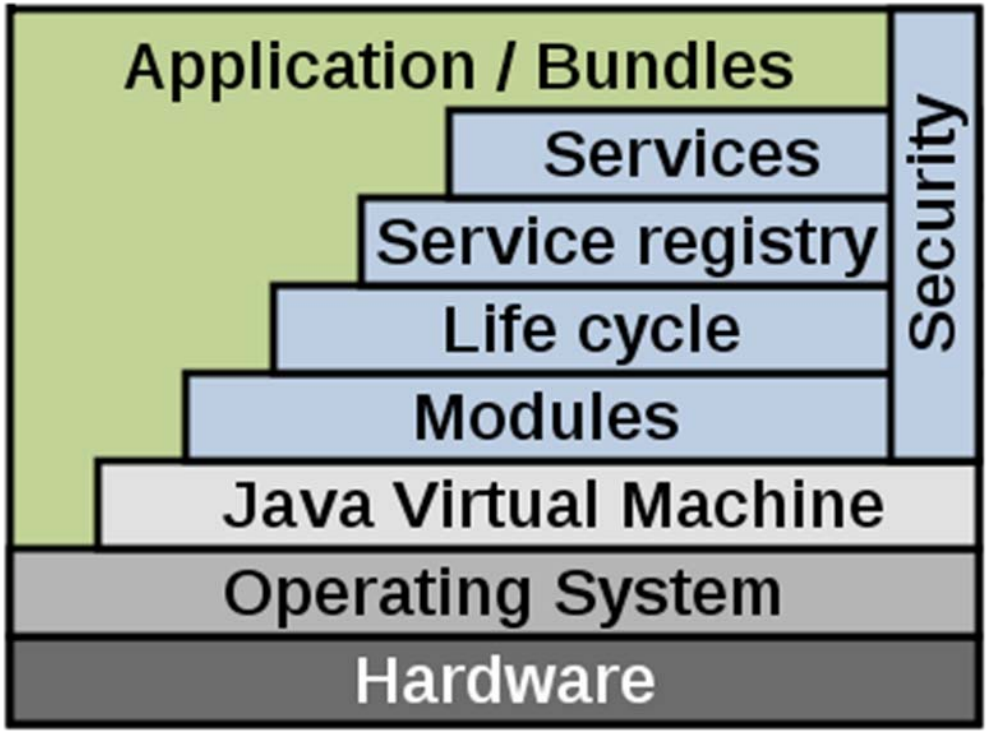
mBedded Server

Hello World, mBedded Server
mBedded Server Status: Started
Used Memory: 2655656 Bytes
Start Time: 15150 ms

Source:
http://www.prosyst.com/news/prosyst_cisco.html
http://www.adon-line.de/kunden/prosystBlog/?p=24

OSGi Framework Layers: Which main concepts are in the box?

- Modules = Define the **concept of bundles** that can share packages and services in a controlled manner
- Life cycle = Defines the **life cycle management** („hot-swapping“) for bundles
- Service registry and services = Provide a **publish-find-bind model** for bundles
- Security = Limits bundle functionality to **pre-defined capabilities**



Source:
http://en.wikipedia.org/wiki/File:Osgi_framework.svg

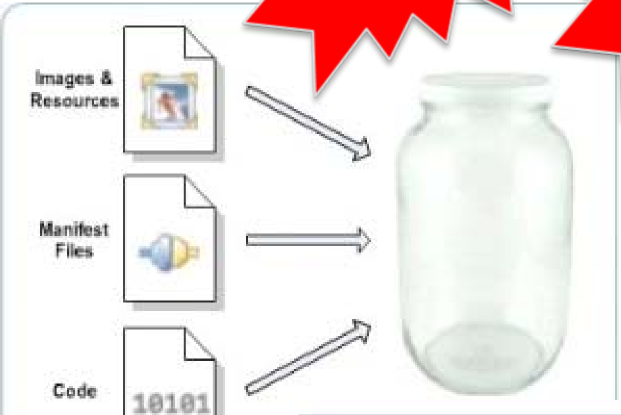
OSGi Bundle concept: What is a bundle?

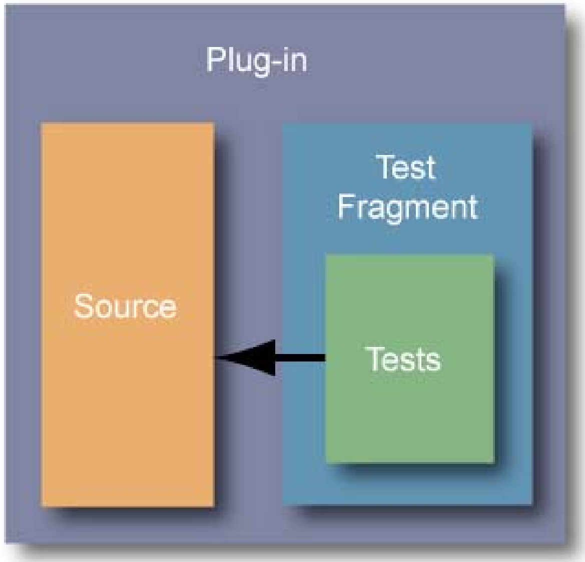
Which version is it?

How do I start the app?

- You guessed it: It‘s a jar.
- Container for applications, services or libraries.

- But it can do more:
- Can be **loaded, resolved and unloaded** at Framework runtime.
- **Defines its own imports and exports** (which are later resolved by the framework)
- **Can have a version** (which is obeyed by other importing bundles)
- **Can be a fragment** of another bundle (so it can also see the non-public methods of the host bundle or provide additional resources to it)

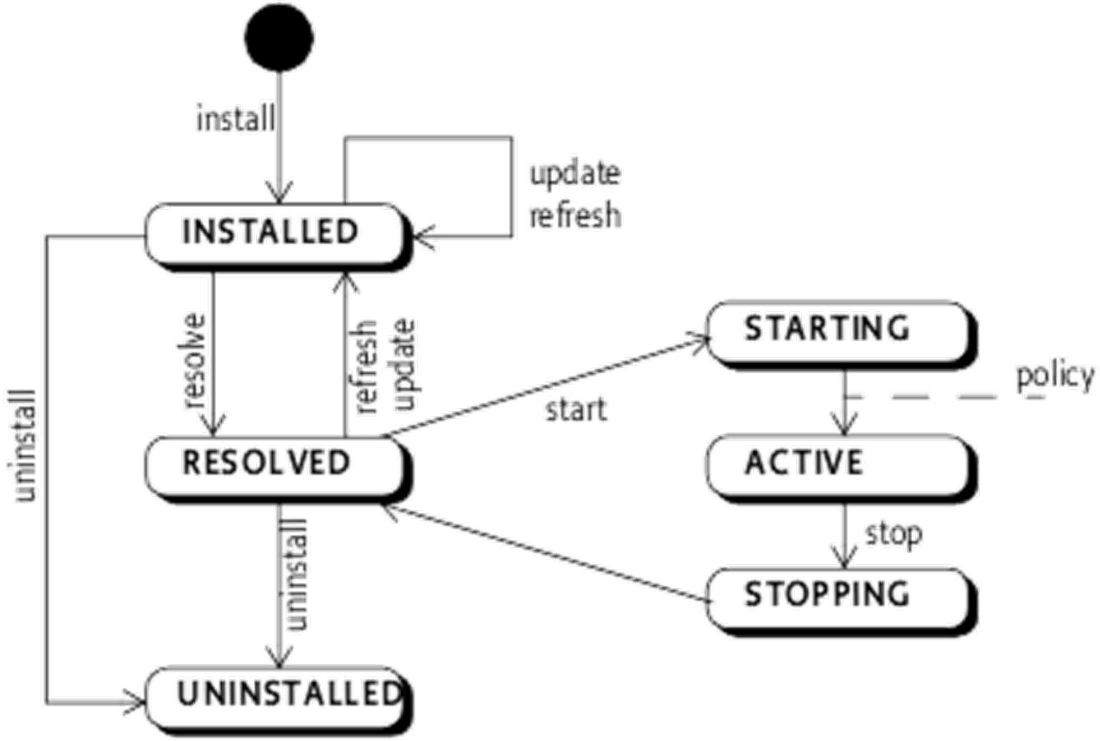




Sources:
http://eclipsesource.com/blogs/2009/01/20/tip-eclipse-bundleshape/
http://rcpquickstart.com/2007/06/20/unit-testing-plug-ins-with-fragments/

OSGi Bundle Life cycle

- **Dynamic handling** of bundles at runtime
- **Resolving of dependencies** before start
- Check of **security policies** before activation



Source:
http://www.jboss.org/feeds/view/jbossosgi

Recap – Best practices for Java Projects

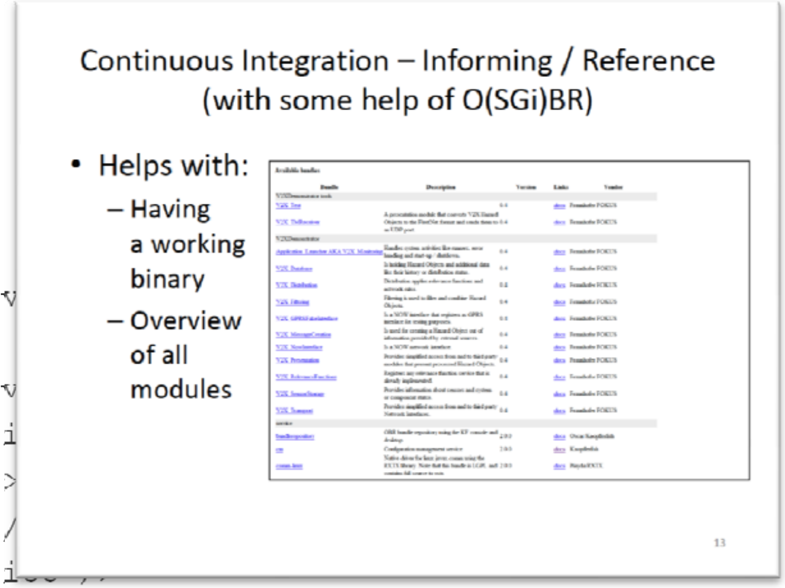
Which jars do I need?

Where do I find your module?

- Resolving dependencies though a respository
- RFC-0112 Bundle Repository (OBR)

```
<bundle>
  <bundle-name>serialportdevice</bundle-name>
  <bundle-version>2.0.0</bundle-version>
…
  <export-package package="org.knopflerfish.serv
  <import-package package="javax.comm"/>
  <import-package package="org.knopflerfish.serv
  <!-- skip import org.knopflerfish.service.seri
  <import-package package="org.osgi.framework"/>
  <import-package package="org.osgi.service.cm"/
  <import-package package="org.osgi.service.devi
  <bundle-filesize>7107</bundle-filesize>
 </bundle>
```

- (extracted from MANIFEST.MF)



Continuous Integration – Informing / Reference (with some help of O(SGi)BR)

- Helps with:
  - Having a working binary
  - Overview of all modules

Available bundles

Bundle	Description	Version	Links	Vendor
V2XDemonstrator tools				
V2X Test		0.4	docs	Fraunhofer FOKUS
V2X TxReceiver	A presentation module that converts V2X Hazard Objects to the FleetNet format and sends them to an UDP port	0.4	docs	Fraunhofer FOKUS
V2XDemonstrator				
Application Launcher AKA V2X Monitoring	Handles system activities like timers, error handling and start-up / shutdown.	0.4	docs	Fraunhofer FOKUS
V2X Database	Is holding Hazard Objects and additional data like their history or distribution status.	0.4	docs	Fraunhofer FOKUS
V2X Distribution	Distribution applies relevance functions and network rules.	0.2	docs	Fraunhofer FOKUS
V2X Filtering	Filtering is used to filter and combine Hazard Objects.	0.4	docs	Fraunhofer FOKUS
V2X GPRSFakeInterface	Is a NOW interface that registers as GPRS interface for testing purposes.	0.1	docs	Fraunhofer FOKUS
V2X MessageCreation	Is used for creating a Hazard Object out of information provided by external sources.	0.4	docs	Fraunhofer FOKUS
V2X NowInterface	Is a NOW network interface.	0.4	docs	Fraunhofer FOKUS
V2X Presentation	Provides simplified access from and to third party modules that present processed Hazard Objects.	0.4	docs	Fraunhofer FOKUS
V2X RelevanceFunctions	Registers any relevance function service that is already implemented.	0.4	docs	Fraunhofer FOKUS
V2X SensorStatus	Provides information about sensors and system or component status.	0.4	docs	Fraunhofer FOKUS
V2X Transport	Provides simplified access from and to third party Network Interfaces.	0.4	docs	Fraunhofer FOKUS
service				
bundlerepository	OBR bundle repository using the KF console and desktop.	2.0.0	docs	Oscar Knopflerfish
cm	Configuration management service	2.0.0	docs	Knopflerfish
comm-linux	Native driver for linux javax.comm using the RXTX library. Note that this bundle is LGPL and contains full source to rxtx.	2.0.0	docs	[illegible]

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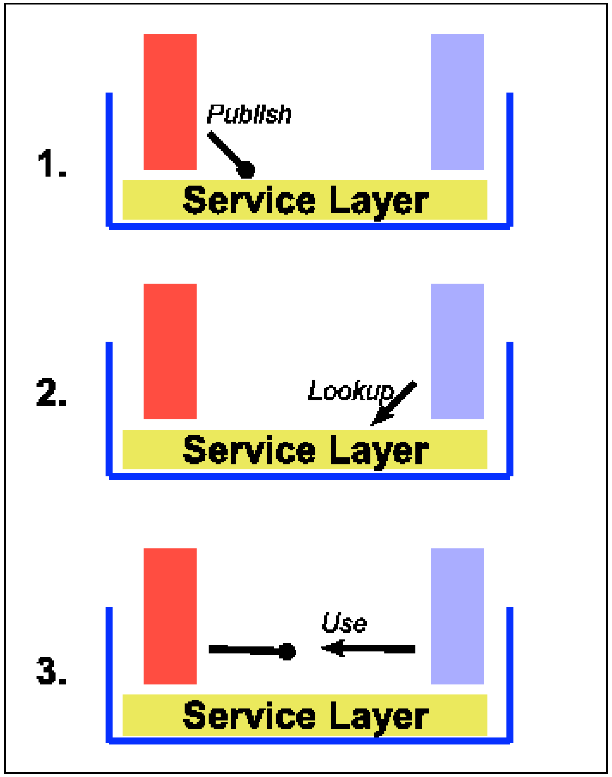
See also:
http://www.osgi.org/Download/File?url=/download/rfc-0112_BundleRepository.pdf

OSGi Features: Service Registry & the publish-find-bind model

- Publish: context.registerService(MyService.class.getName(), new MyServiceImpl(), props1);
- Find: context.getServiceReference(MyService.class.getName()); (or iterate over all bundles and all services)
- Bind: context.getService(reference); (and use!)

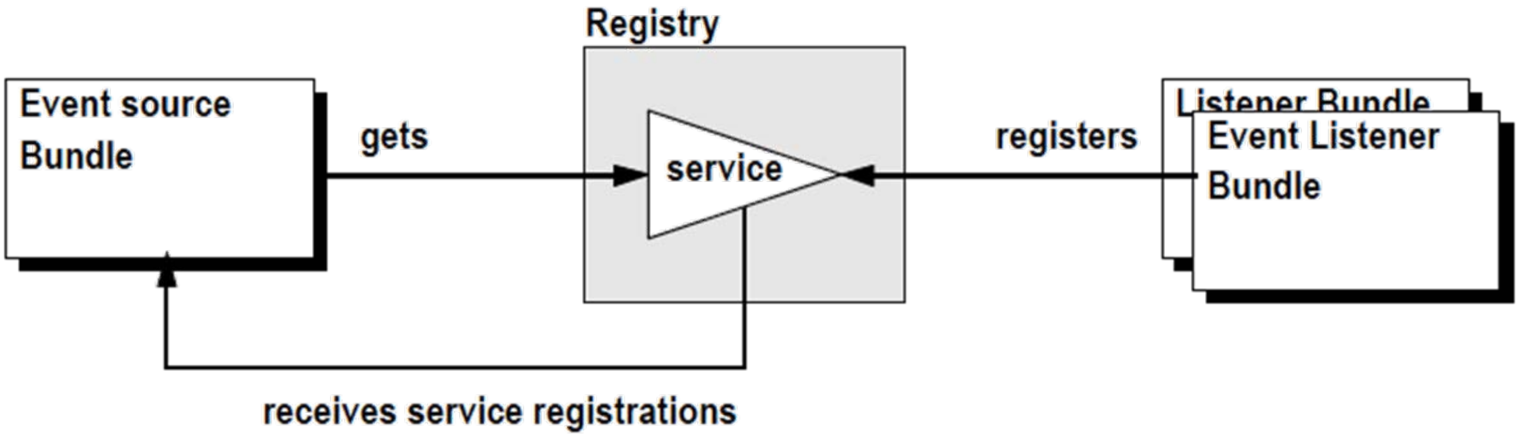


Source:
http://sfelix.gforge.inria.fr/osgi-security/osgi.html

OSGi Features: Whiteboard pattern / Inversion of control

Which order do I have to start the modules in?

- Yes, this can also be done without OSGi.
- Makes use of the frameworks service registry
- Pros
  - Event Source is **not registered** with the listeners
  - Listeners and Sources can be **plugged dynamically** – management is done by the framework (service registry)
  - **Central visibility** (easier debugging)

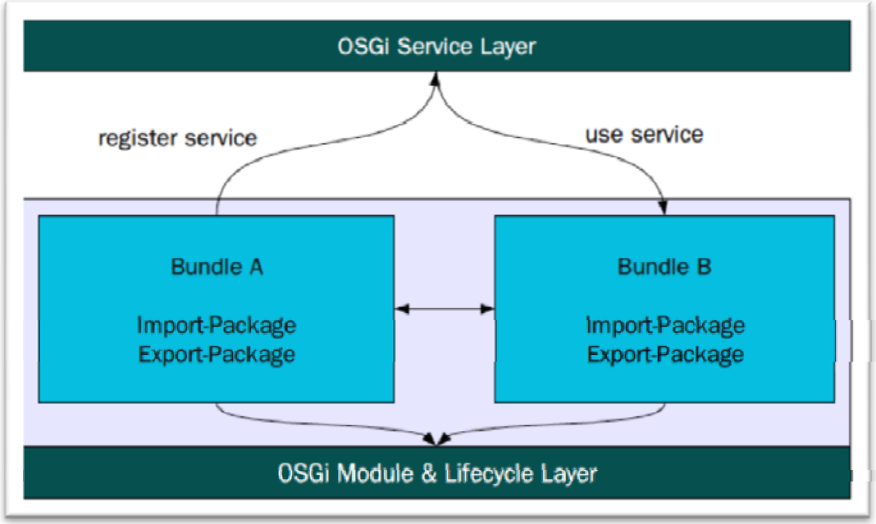


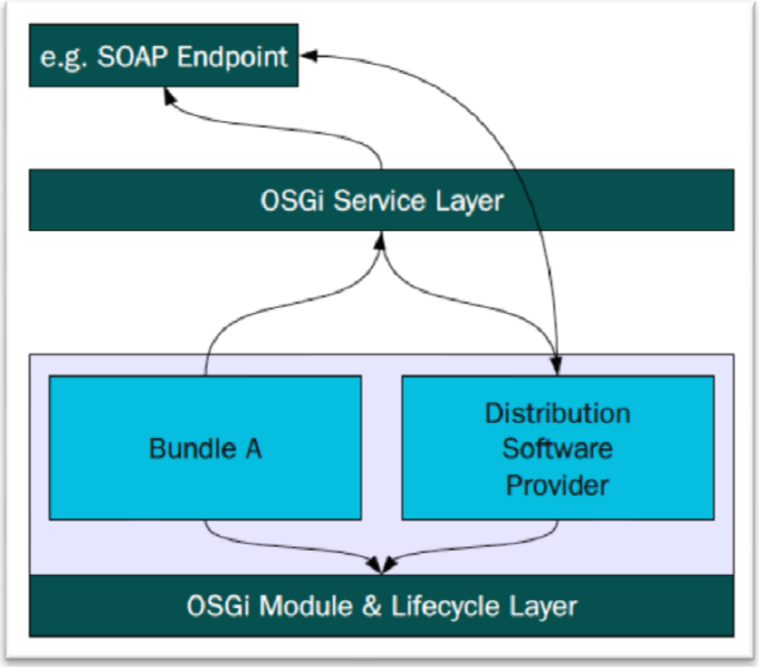
Source:
http://www.osgi.org/wiki/uploads/Links/whiteboard.pdf

OSGi Features: Distributed OSGi

How do we deal with a distributed platform?

- coming in R4.2
- DSP handles discovery, remote calls and creation of an proxy object





See also:
http://cxf.apache.org/distributed-osgi.html and
http://www.osgi.org/download/osgi-4.2-early-draft3.pdf

OSGi Security

- AdminPermission – Administrative tasks e.g. life cycle tasks
- PackagePermission – Restricts / grants imports and exports
- ServicePermission – Restricts / grants registration of services

```
grant {
   permission java.io.FilePermission
"${user.home}${file.separator}.oscar${file.separator}-", "read, write, delete";
   permission org.osgi.framework.PackagePermission "*", "EXPORT";
 };
```

OSGi: Further reading

- Read the specs…
- http://www.osgi.org/Release4/Download

OSGi Service Platform
Core Specification
The OSGi Alliance

Release 4, Version 4.1
April 2007

OSGi Service Platform
Service Compendium
The OSGi Alliance

Release 4, Version 4.1
April 2007

Can you answer those questions now?

- Where is the latest version of your module?
- How can I compile, install and use your module?
- Which dependencies does this module have?
- Which module is providing which interface / service / package?

Thank you for your attention!

Any questions?