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Managing Installations and Provisioning of OSGi Applications

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About

- Member of the ASF
  - Current PMC Chair of Apache Sling
  - Apache Sling, Felix, ACE, Portals
  - (Incubator, Cocoon, Excalibur, Commons)
- RnD Team at Adobe Research Switzerland
- Article/Book Author, Conference Speaker
- Technical Reviewer
- JSR 286 Spec Group (Portlet API 2.0)

Agenda

- **1 Motivation**
- **2 Apache Sling Launchpad**
- **3 Apache Sling OSGi Installer**
- **4 Apache Sling Maven Launchpad Plugin**
- **5 Needful Things**
- **6 Summary**
- **7 The End…**

1 Motivation

Motivation I

- Modularity is key
  - Manage growing complexity
  - Support dynamic extensibility
- Embrace change – Embrace OSGi
  - Only a few concepts – easy to get started
  - Minor “overhead”
  - High coherence
- Loose Coupling
  - Modules and Services

Motivation II

- OSGi is everywhere!
- State of the Art solution for modularity in Java
- Ongoing and evolving development
  - Cloud, Enterprise etc.
- Modules are fine, but what about?
  - Assembling an application
  - Deployment
  - Provisioning
  - (Development)

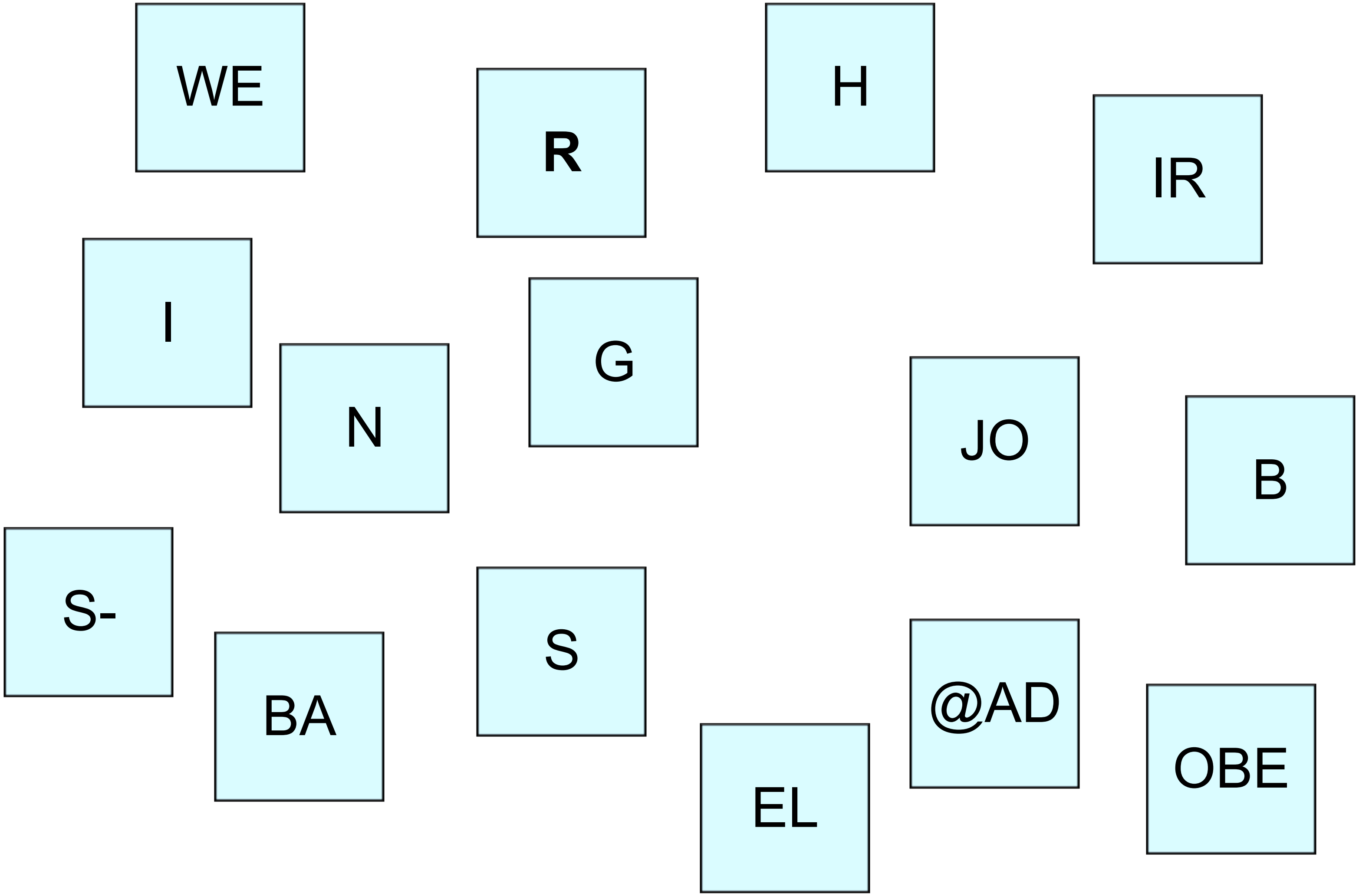
Apache Sling – Secret Facts

- Apache Sling provides ecosystem
- Launchpad
- Launchpad Maven Plugin
- Partial Bundle Lists
- OSGi Installer
- Installer Providers
- Installer Factories
- And more…

Neither tied to Sling nor to each other!

2 Apache Sling Launchpad

Old Fashioned: I Have a Bunch of JARs



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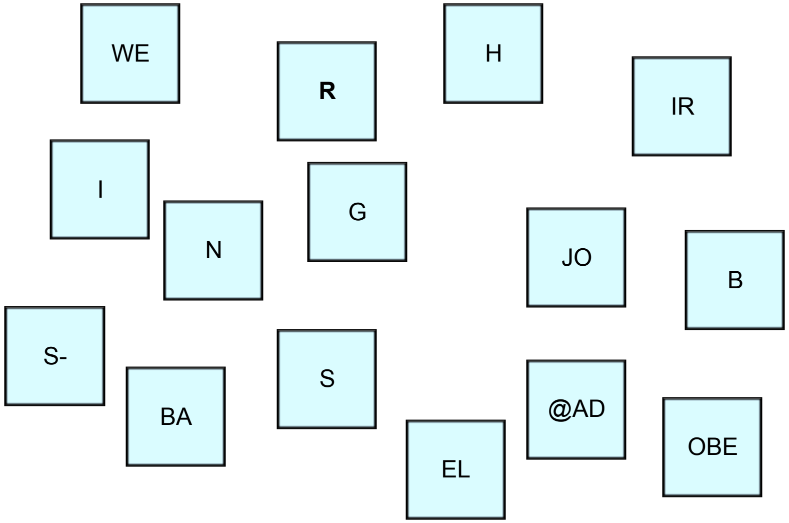
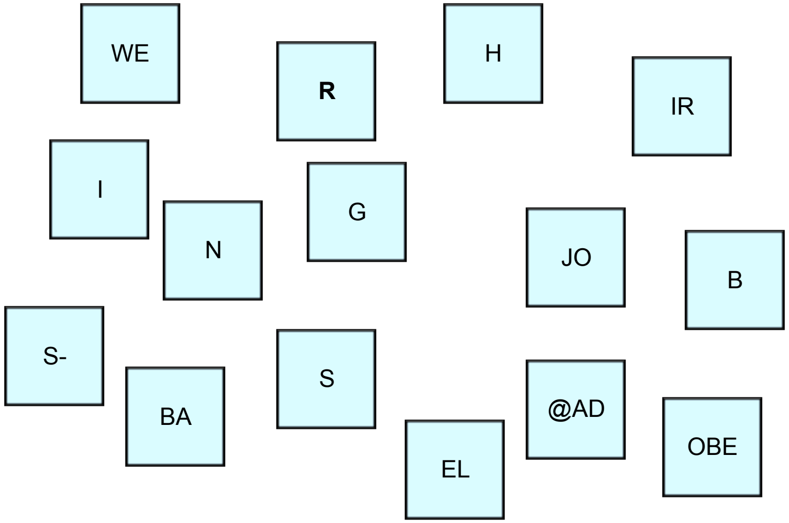
Standalone App or Webapp

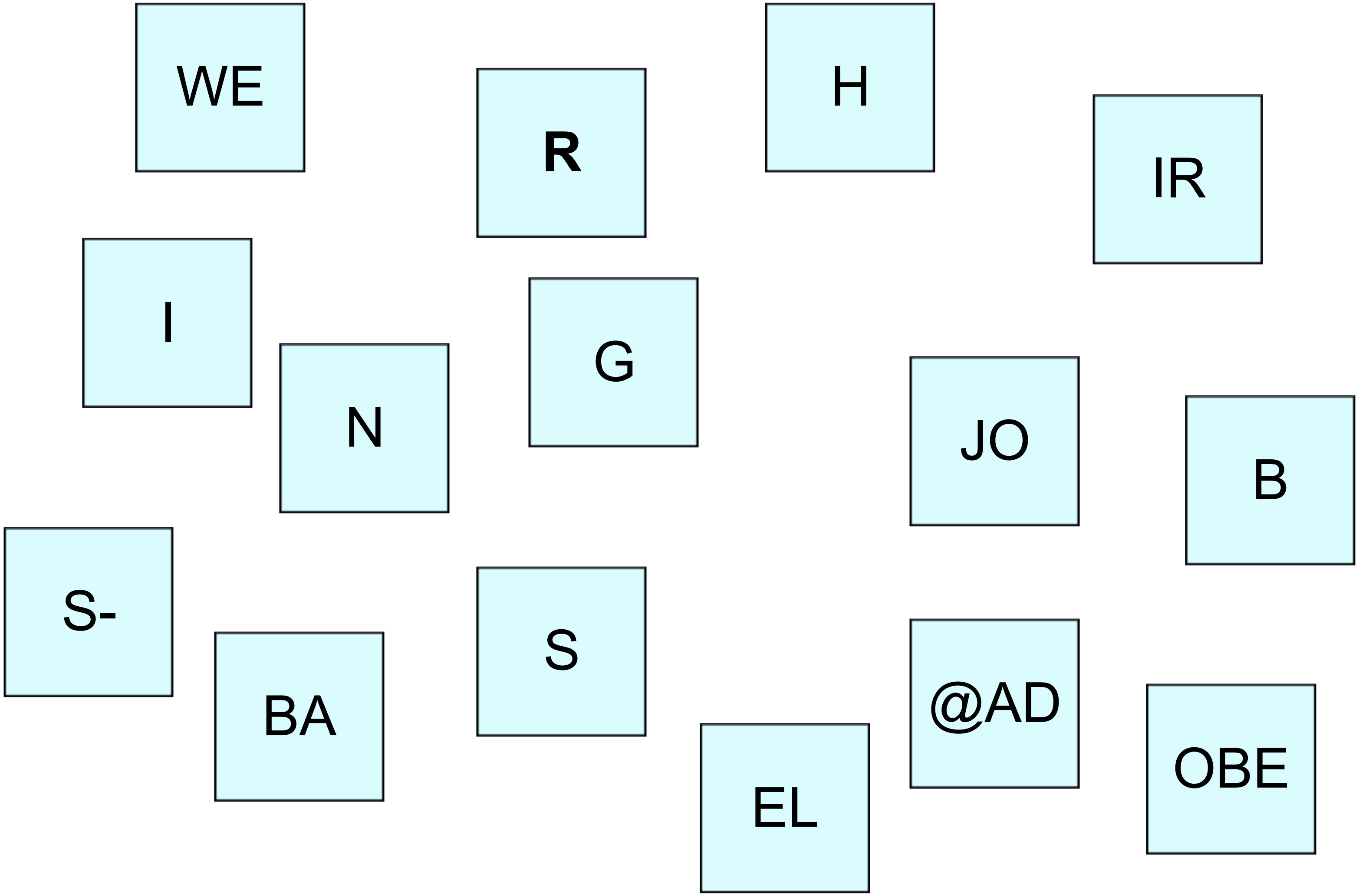
- Main class
- Classpath:



- Web application archive
- web-inf/lib:



I Have OSGi Bundles – and now?



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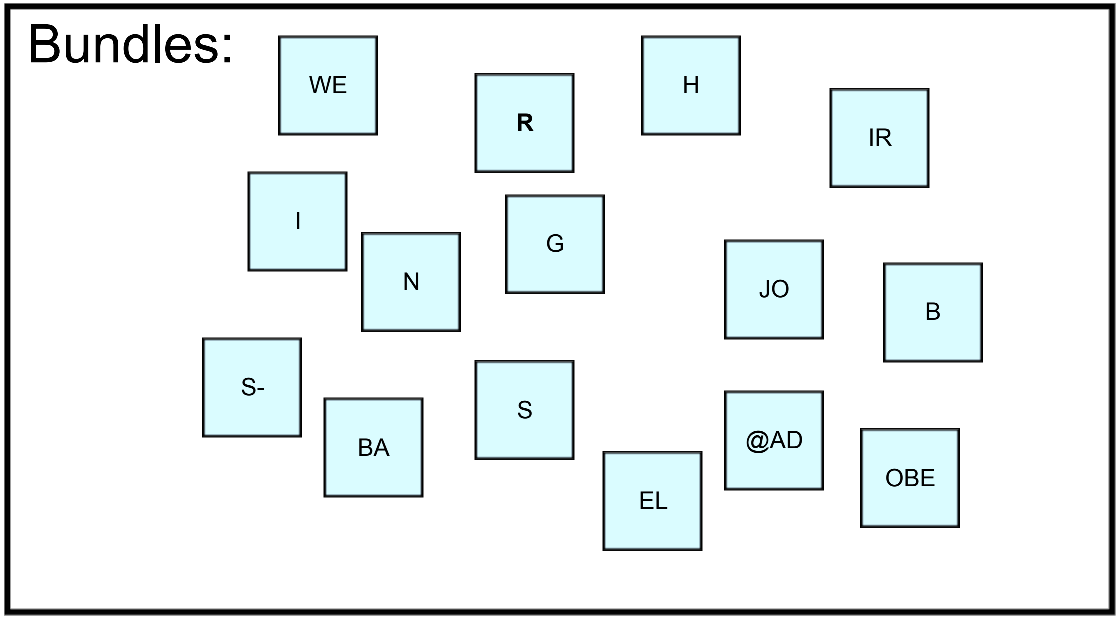
OSGi Standalone App or OSGi Webapp

- Main class starts OSGi framework and deploys bundles
- Classpath:
    - OSGi framework
    - Bootstrap code

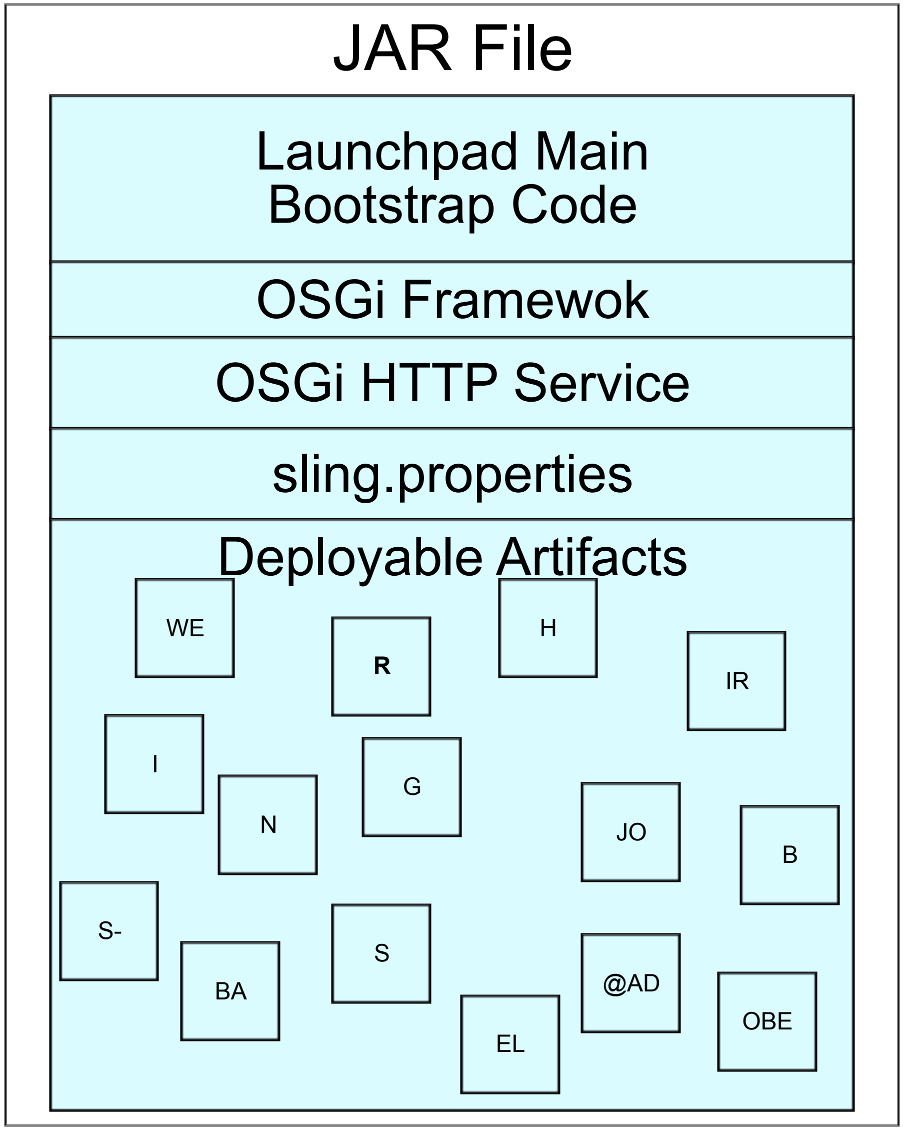
- Web application archive
- Servlet starts OSGi framework and deploys bundles
- web-inf/lib contains
    - OSGi framework
    - Bootstrap code



Apache Sling Launchpad

- Bootstrap code
- Launch an OSGi framework
  - Standalone jar with http service
  - As a web application with http bridge
- Includes Apache Felix
  - Handles framework updates
- Deploy packaged bundles
- Configurable
  - sling.properties
  - (system properties / servlet parameters)

OSGi Standalone App or OSGi Webapp with Launchpad



JAR File

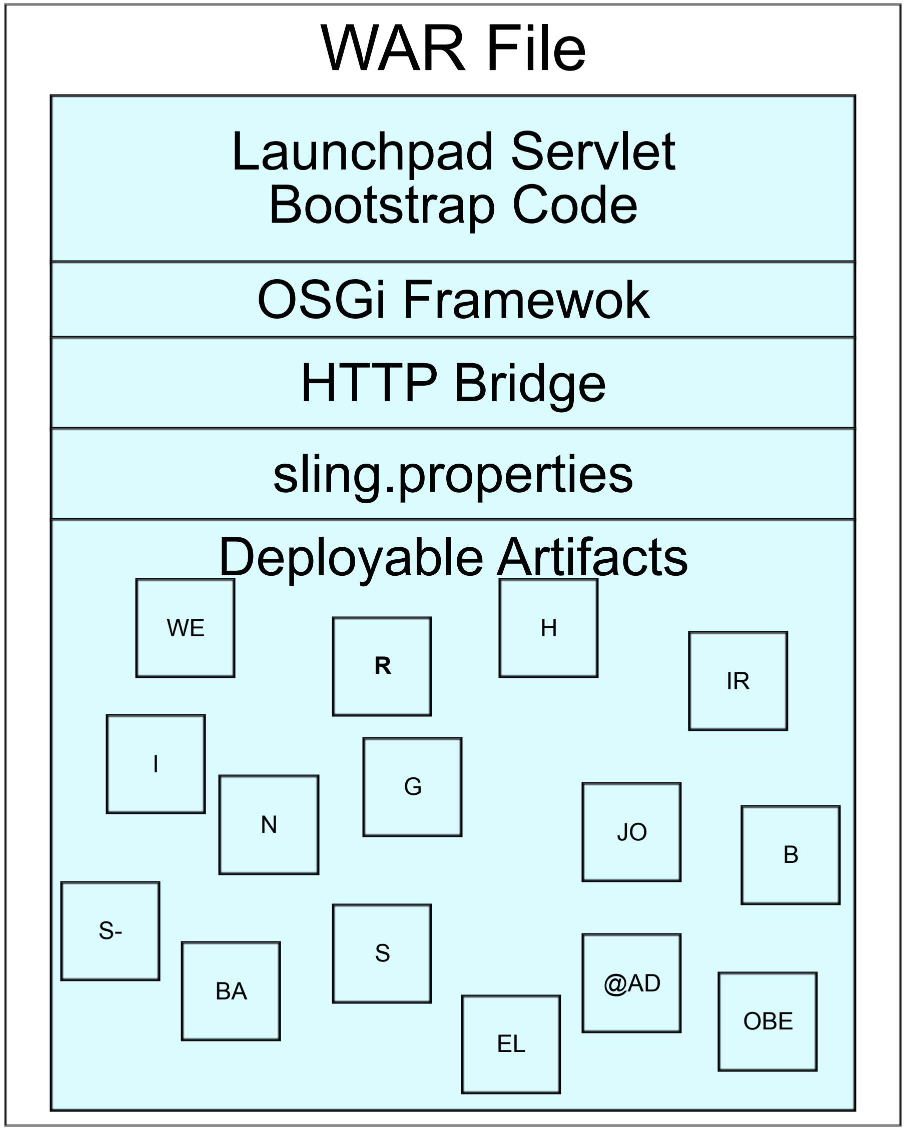
Launchpad Main
Bootstrap Code

OSGi Framewok

OSGi HTTP Service

sling.properties

Deployable Artifacts



WAR File

Launchpad Servlet
Bootstrap Code

OSGi Framewok

HTTP Bridge

sling.properties

Deployable Artifacts

Apache Sling Properties

- Central configuration file
- OSGi framework configuration
  - System packages
  - Framework Start level
- Bootstrap logging
- Configurations which should be there before the configuration admin is available

Packaged Artifacts

- Bootstrap bundles
  - Directly installed by the Sling Launchpad
  - E.g. logging, Apache Sling OSGi installer etc.
- Start levels can be used
- Advice: only bootstrapping bundles!
- Optional Bootstrap command file
  - Uninstalling bundles for upgrades

Example Sling Launchpad JAR

Created by the launchpad maven plugin:

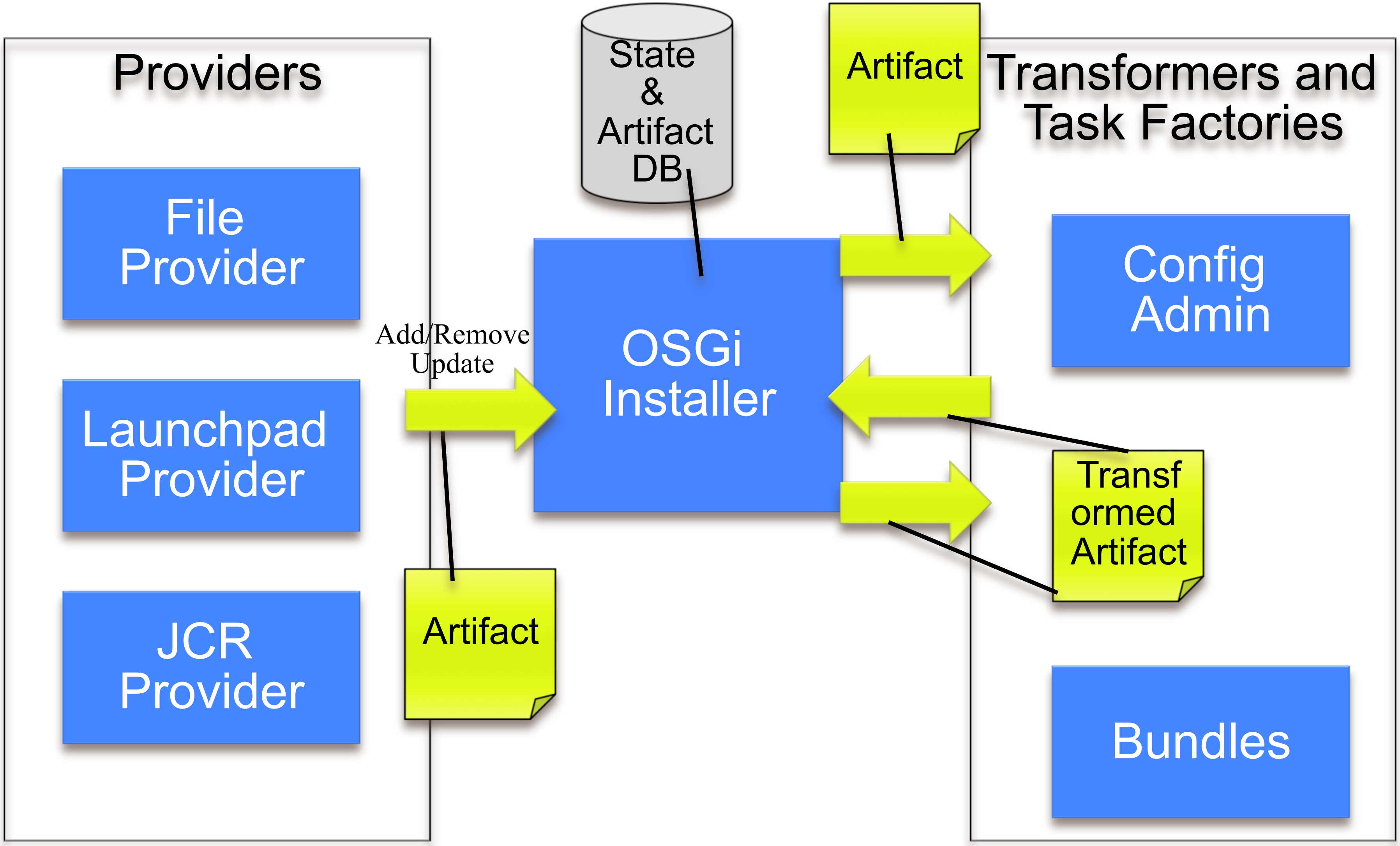
```
> jar tf launchpad-sample.jar
…
org/apache/sling/launchpad/app/Main.class
org/apache/sling/launchpad/base/shared/Launcher.class
resources/bundles/1/org.apache.sling.commons.log-3.0.0.jar
resources/bundles/1/slf4j-api-1.6.4.jar
resources/bundles/1/org.apache.sling.installer.core-3.4.0.jar
resources/org.apache.sling.launchpad.base.jar
…
```

3 Apache Sling OSGi Installer

Apache Sling OSGi Installer

- Bundled service for
  - Install
  - Update
  - Uninstall
- Of
  - Bundles
  - Configurations
  - Custom artifacts

Apache Sling OSGi Installer



Installer Providers

- Just provide artifacts or inform about removal
- Don’t need knowledge about artifacts
- Simple trackers

Apache Sling Installer File Provider

- Service for monitoring directories in the file system
  - Configurable through sling.properties (and system properties)
- Informs the OSGi Installer about
  - Add
  - Update
  - Delete
- Of artifacts
- Like Apache Felix FileInstall but delegates work!

Apache Sling Installer JCR Provider

- Support for Java Content Repository (Apache Jackrabbit)
- Service for monitoring nodes in the JCR
  - Configurable through Config Admin
- Informs the OSGi Installer about
  - Add
  - Update
  - Delete
- Of artifacts

Transformers

- Transformers inspect artifacts
- Detect artifact type
  - Bundle, configuration etc.
- Might transform artifact
- Provide unique id
  - Symbolic name + version
  - Configuration PID

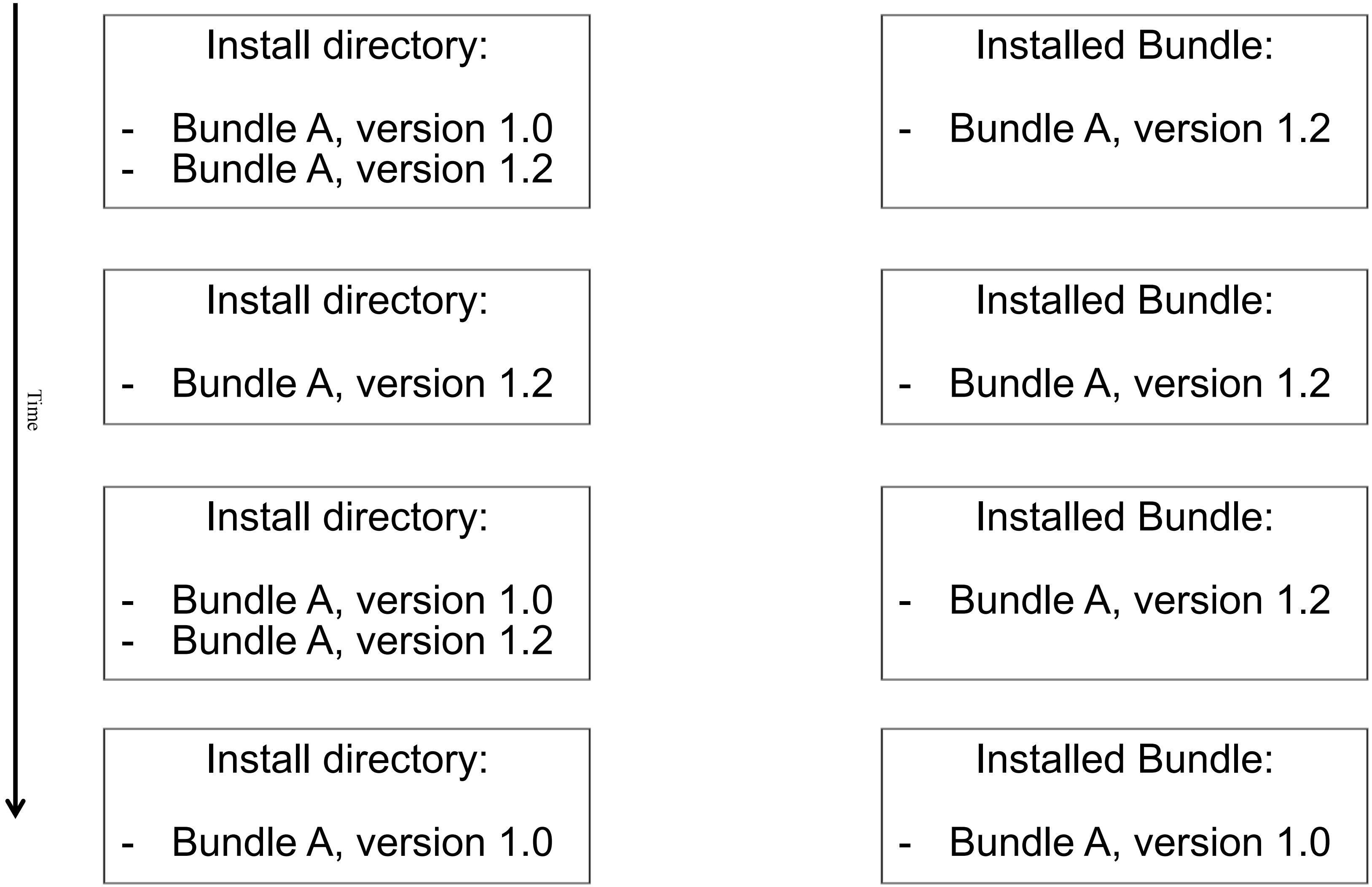
Installer Task Factories

- Register for artifact types
- Get transformed artifacts or removal event
- Perform their task
- OSGi Installer manages retry and failure
- A task might add another task
  - Like bundle refresh after all installs etc.

Advantages of the OSGi Installer Family

- Pluggable and highly customizable
  - New artifact types: transformer + task factory
  - New artifact sources: provider
- Retry mechanism in the OSGi core
- State management in the OSGi core

Example I – Always Install Highest Version



Install directory:

- Bundle A, version 1.0
- Bundle A, version 1.2

Installed Bundle:

- Bundle A, version 1.2

Install directory:

- Bundle A, version 1.2

Installed Bundle:

- Bundle A, version 1.2

Install directory:

- Bundle A, version 1.0
- Bundle A, version 1.2

Installed Bundle:

- Bundle A, version 1.2

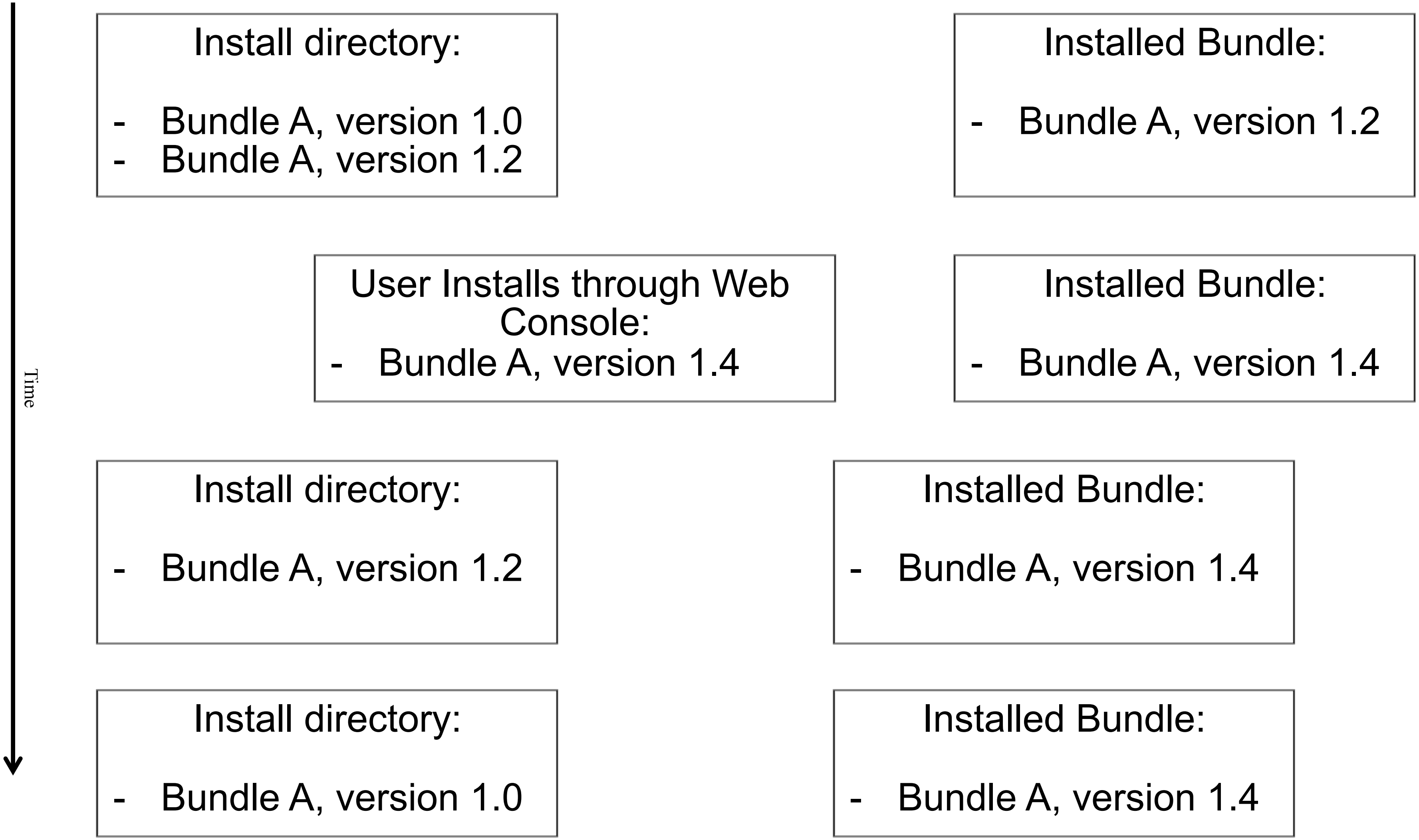
Install directory:

- Bundle A, version 1.0

Installed Bundle:

- Bundle A, version 1.0

Example II – State Management



Time

Install directory:

- Bundle A, version 1.0
- Bundle A, version 1.2

Installed Bundle:

- Bundle A, version 1.2

User Installs through Web Console:

- Bundle A, version 1.4

Installed Bundle:

- Bundle A, version 1.4

Install directory:

- Bundle A, version 1.2

Installed Bundle:

- Bundle A, version 1.4

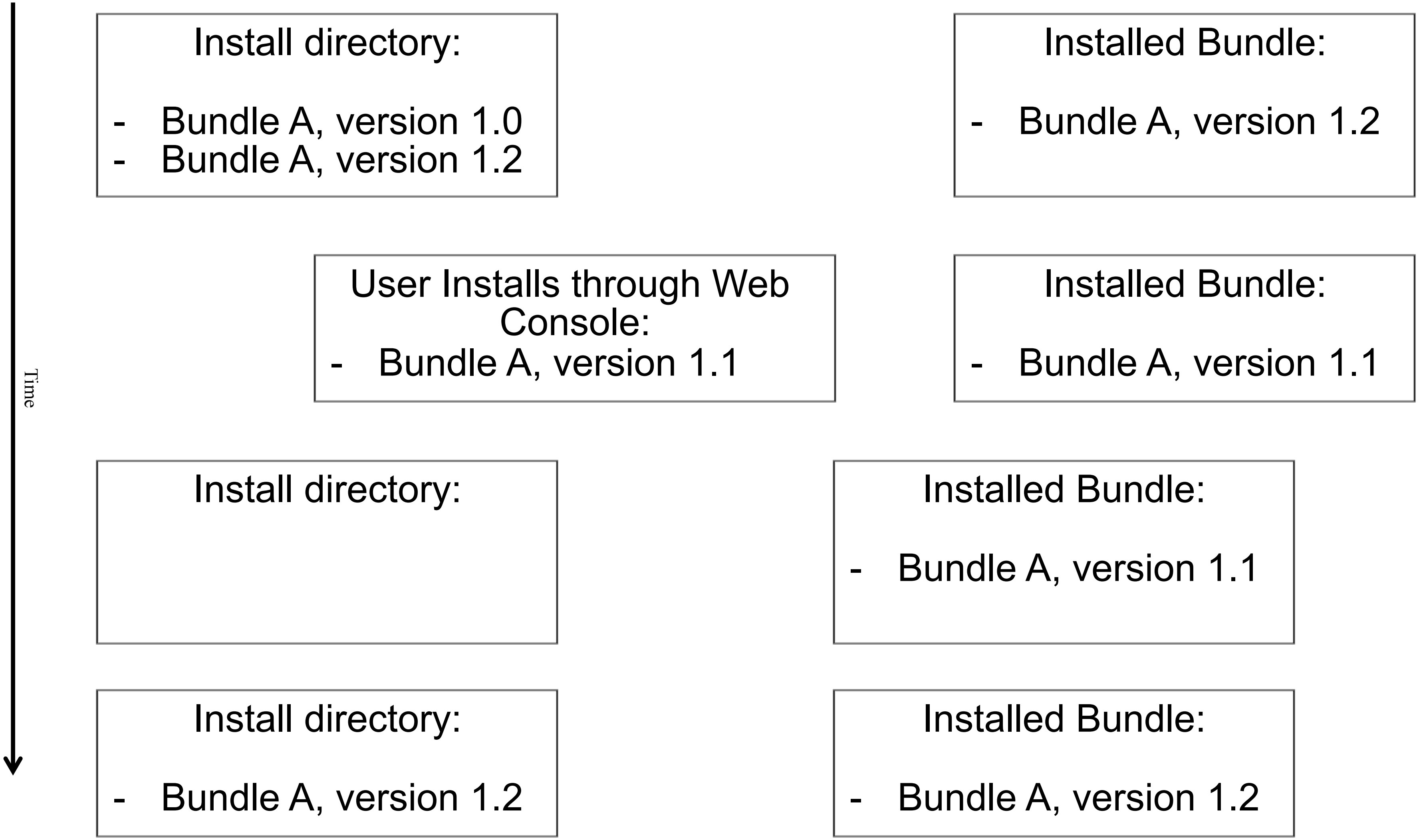
Install directory:

- Bundle A, version 1.0

Installed Bundle:

- Bundle A, version 1.4

Example III – State Management + Highest Version



Time

Install directory:

- Bundle A, version 1.0
- Bundle A, version 1.2

Installed Bundle:

- Bundle A, version 1.2

User Installs through Web Console:

- Bundle A, version 1.1

Installed Bundle:

- Bundle A, version 1.1

Install directory:

Installed Bundle:

- Bundle A, version 1.1

Install directory:

- Bundle A, version 1.2

Installed Bundle:

- Bundle A, version 1.2

Change Notification

- Many different tools for managing bundles and configurations
  - OSGi Installer, shell, web console etc.
- OSGi Installer checks for changes from other sources
  - When getting changes from a provider
- Supports write back of ”external” changes:
  - Currently configurations only
  - Provider might support write back of changes
    - File and JCR provider do!

Apache Sling OSGi Installer

- Central mechanism for handling
  - Install
  - Update
  - Delete
- No dependencies except OSGi framework
- Triggered by various providers
- Highly customizable through transformers and task factories

Apache Sling Installer Launchpad Provider

- Informs the OSGi Installer about
  - Artifacts bundled with the launchpad
- Scans predefined directories inside launchpad
- Supports start level
- Very handy for provisioning in combination with the Maven Launchpad Plugin

4 Apache Sling Maven Launchpad Plugin

Contents of a Deliverable

- A deliverable / distribution consists of
  - Apache Sling Launchpad
  - OSGi framework
  - Bootstrap bundles
  - Infrastructure bundles
  - Application bundles
  - Configurations
  - (Custom artifacts)

Apache Sling Maven Launchpad Plugin

- Creates two artifacts for a Maven project
  - Standalone jar
  - Web application
- Use Apache Sling Launchpad Base Module
  - Launchpad Code
  - OSGi framework
  - Predefined sling.properties

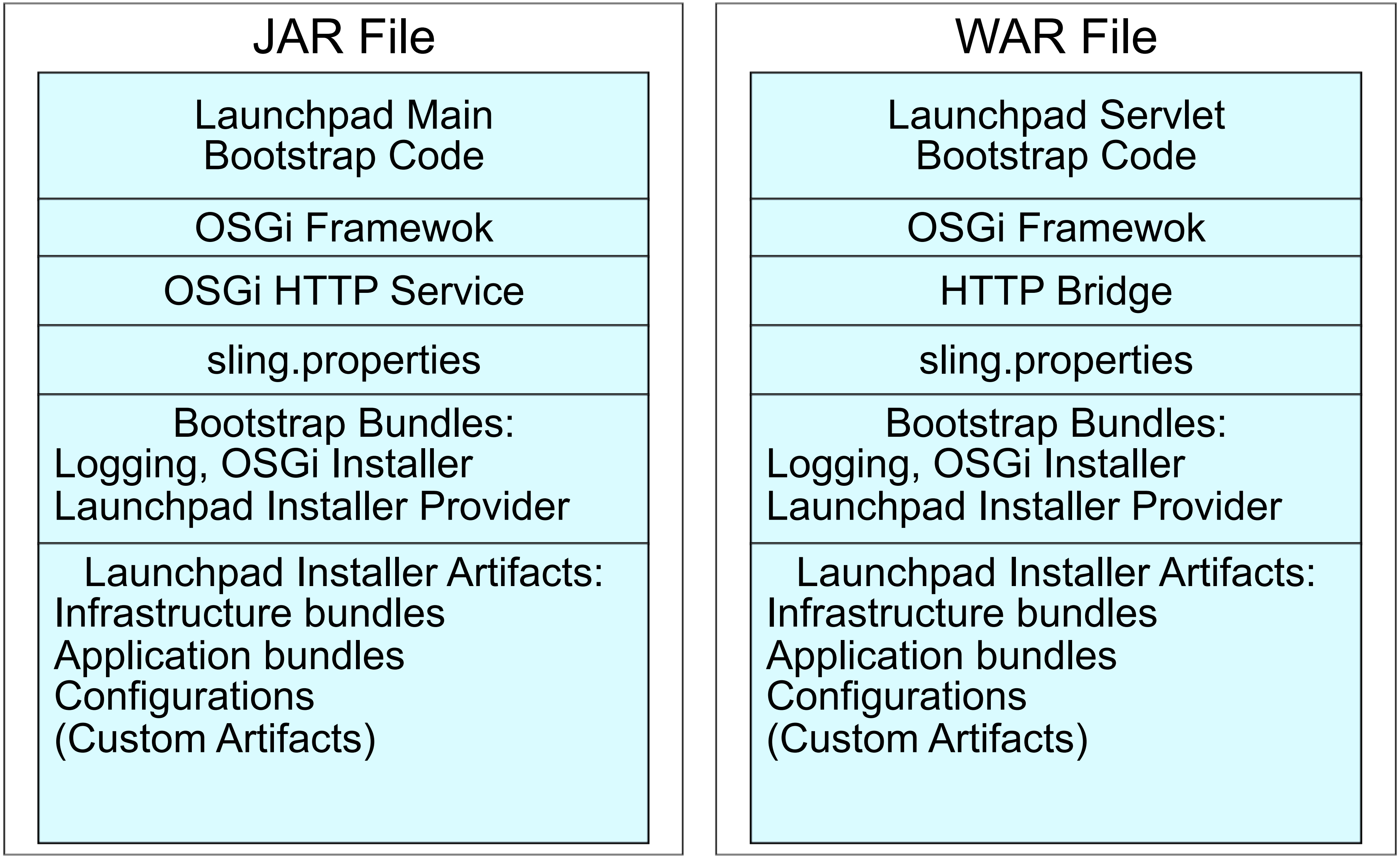
Bundle List

- XML Configuration for the Maven plugin
- Contains list of bundles with their start levels
  - “boot” : bootstrap bundles handled by Launchpad
  - N : Bundle with start level N handled by OSGi installer and Launchpad Provider
  - 0 : Bundle with default framework start level
- Bundle list can contain other artifact types!

Bundle List Example

```
<?xml version="1.0"?>
<bundles>
    <startLevel level="boot">
        <bundle>
            <groupId>org.apache.sling</groupId>
            <artifactId>org.apache.sling.commons.log</artifactId>
            <version>2.1.2</version>
        </bundle>

    …

    <startLevel level="9">
        <bundle>
            <groupId>org.apache.felix</groupId>
            <artifactId>org.apache.felix.eventadmin</artifactId>
            <version>1.3.2</version>
        </bundle>

    …

    <startLevel level="0">
        <bundle>
            <groupId>org.some.company</groupId>
            <artifactId>a.strange.artifact</artifactId>
            <version>1.2.0</version>
            <type>zip</zip>
        </bundle>
```

OSGi Standalone App or OSGi Webapp with Launchpad



JAR File	WAR File
Launchpad Main Bootstrap Code	Launchpad Servlet Bootstrap Code
OSGi Framewok	OSGi Framewok
OSGi HTTP Service	HTTP Bridge
sling.properties	sling.properties
Bootstrap Bundles: Logging, OSGi Installer Launchpad Installer Provider	Bootstrap Bundles: Logging, OSGi Installer Launchpad Installer Provider
Launchpad Installer Artifacts: Infrastructure bundles Application bundles Configurations (Custom Artifacts)	Launchpad Installer Artifacts: Infrastructure bundles Application bundles Configurations (Custom Artifacts)

Partial Bundle List aka Feature List

- Maven artifact for
  - A bundle list
  - Configurations
  - Additional sling.properties
  - Additional bootstrap commands
- Final deliverable can aggregate partial bundle lists

Apache Sling Maven Launchpad Plugin

- Configurated with
  - Launchpad base artifact
  - Bundle list (+ partial bundle lists)
  - OSGi configurations
  - Additional sling.properties
    - Common, standalone, webapp
  - Bootstrap command file
    - Common, standalone, webapp
- Creates the deliverable

5 Needful Things

Apache Sling Settings Service

- Unique instance id : Sling ID
  - Created on first installation
- Run mode support
  - Can be used for different setups like
    - Prod, dev, test etc.
  - Supported by the OSGi installer providers
- Sling home directory
  - If something needs to be stored outside bundle data

Launchpad Features

- Startup mode detection
  - First install, restart, update
- Start level handling for install/restart
  - Start level is increased one by one
  - Waits for OSGi installer to finish on each level
- Reports startup progress

6 Summary

Apache Sling OSGi Installer + Launchpad

- Creating a distribution is easy
  - Standalone jar files
  - Web application
- Bootstrap bundles get packaged into launchpad
  - Including OSGi installer and friends
- Leveraging JCR Installer (or others)
- Maven Launchpad Plugin
  - Define your deliverable as a package list
- OSGi Installer can be used without Launchpad
- Launchpad does not need OSGi Installer

The End...