OSGi™ Community Event 2010

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# Migration from Java EE Application Server to Server-side OSGi for Process Management and Event Handling

## Content

- Migration problem areas
- Requirements
- Migration solutions and patterns
- Lessions learned
- Wish list

# Motivation for migration

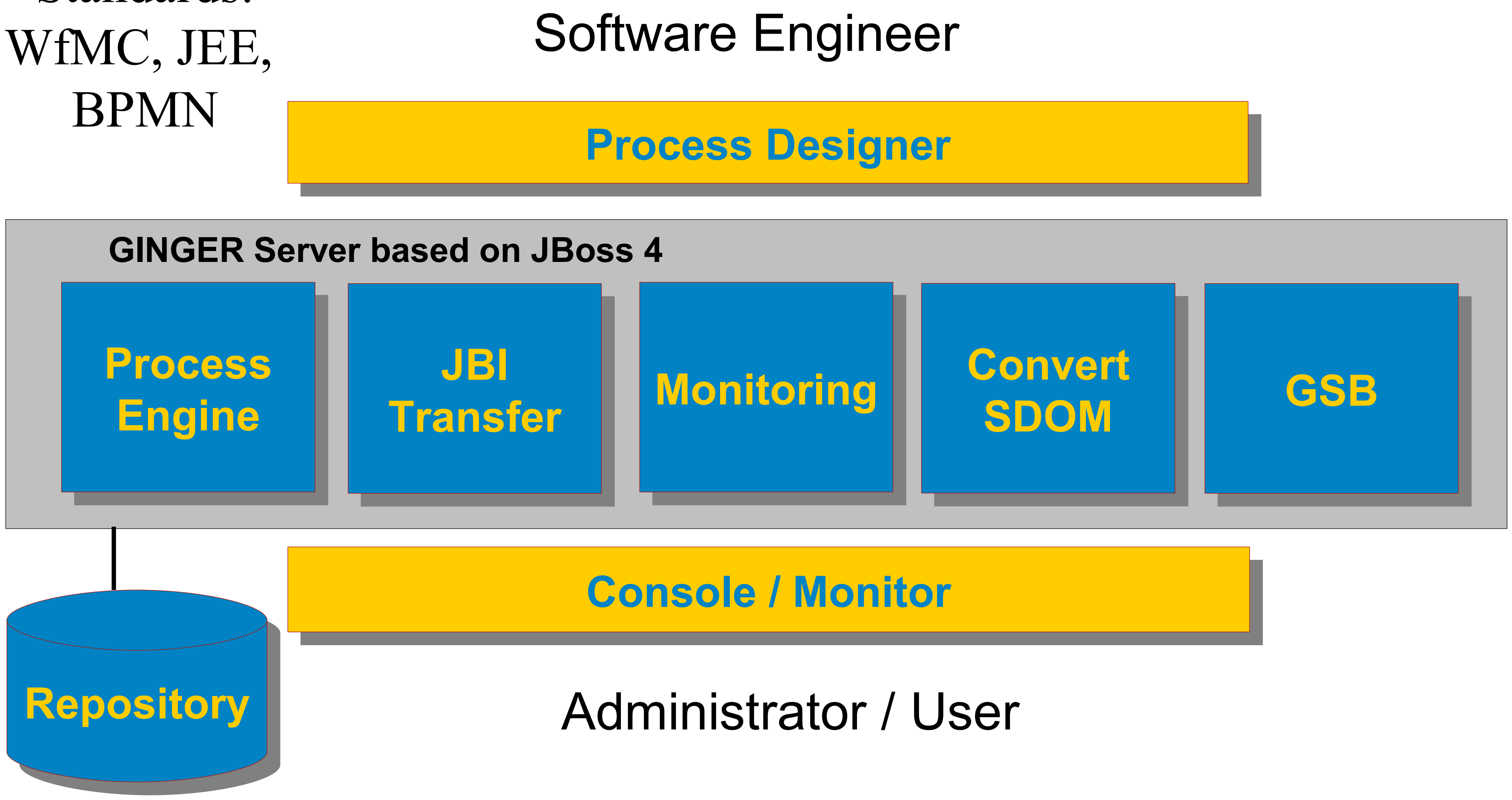
- Migrate from GINGER to Roots
  - Paradigm reduction: Process Management, Messaging, and Event Processing → Event Processing
  - Older components became hard to maintain, needed some re-engineering
  - CTO would like to have something new ☺

## Why OSGi?

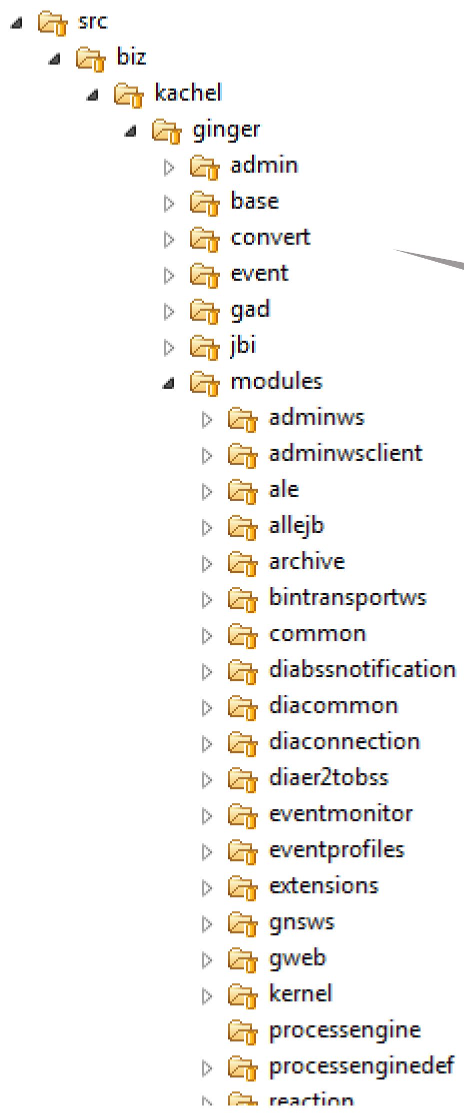
- Best support for:
  - Modularisation
  - Service-orientation
  - Component dependencies
- A lot of useful predefined services
- Open source implementations available

# Existing Product: GINGER

Standards: WfMC, JEE, BPMN



# Existing Software Structure


src
biz
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event
gad
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ale
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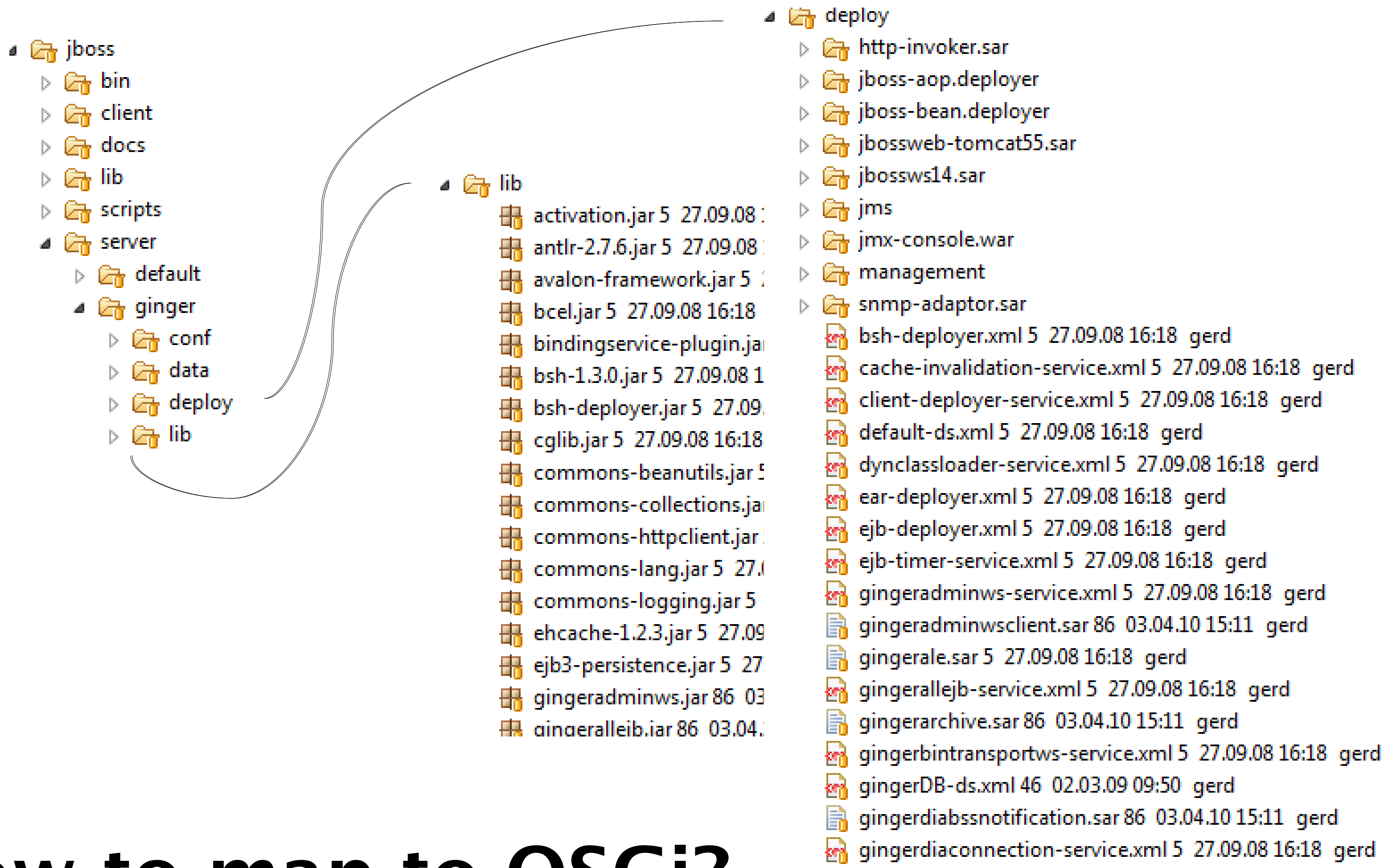
archive
bintransportws
common
diabssnotification
diacommon
diaconnection
diaer2tobss
eventmonitor
eventprofiles
extensions
gnsws
gweb
kernel
processengine
processenginedef
reaction

## How to map to OSGi?

Components (jars)

Modules (JBoss MBean services)

# Existing Software Structure



```
jboss
  bin
  client
  docs
  lib
  scripts
  server
    default
    ginger
      conf
      data
      deploy
      lib
```

```
lib
  activation.jar 5  27.09.08
  antlr-2.7.6.jar 5  27.09.08
  avalon-framework.jar 5
  bcel.jar 5  27.09.08 16:18
  bindingservice-plugin.ja
  bsh-1.3.0.jar 5  27.09.08 1
  bsh-deployer.jar 5  27.09.
  cglib.jar 5  27.09.08 16:18
  commons-beanutils.jar
  commons-collections.ja
  commons-httpclient.jar
  commons-lang.jar 5  27.
  commons-logging.jar 5
  ehcache-1.2.3.jar 5  27.09
  ejb3-persistence.jar 5  27
  gingeradminws.jar 86  03
  gingeralleib.jar 86  03.04.
```

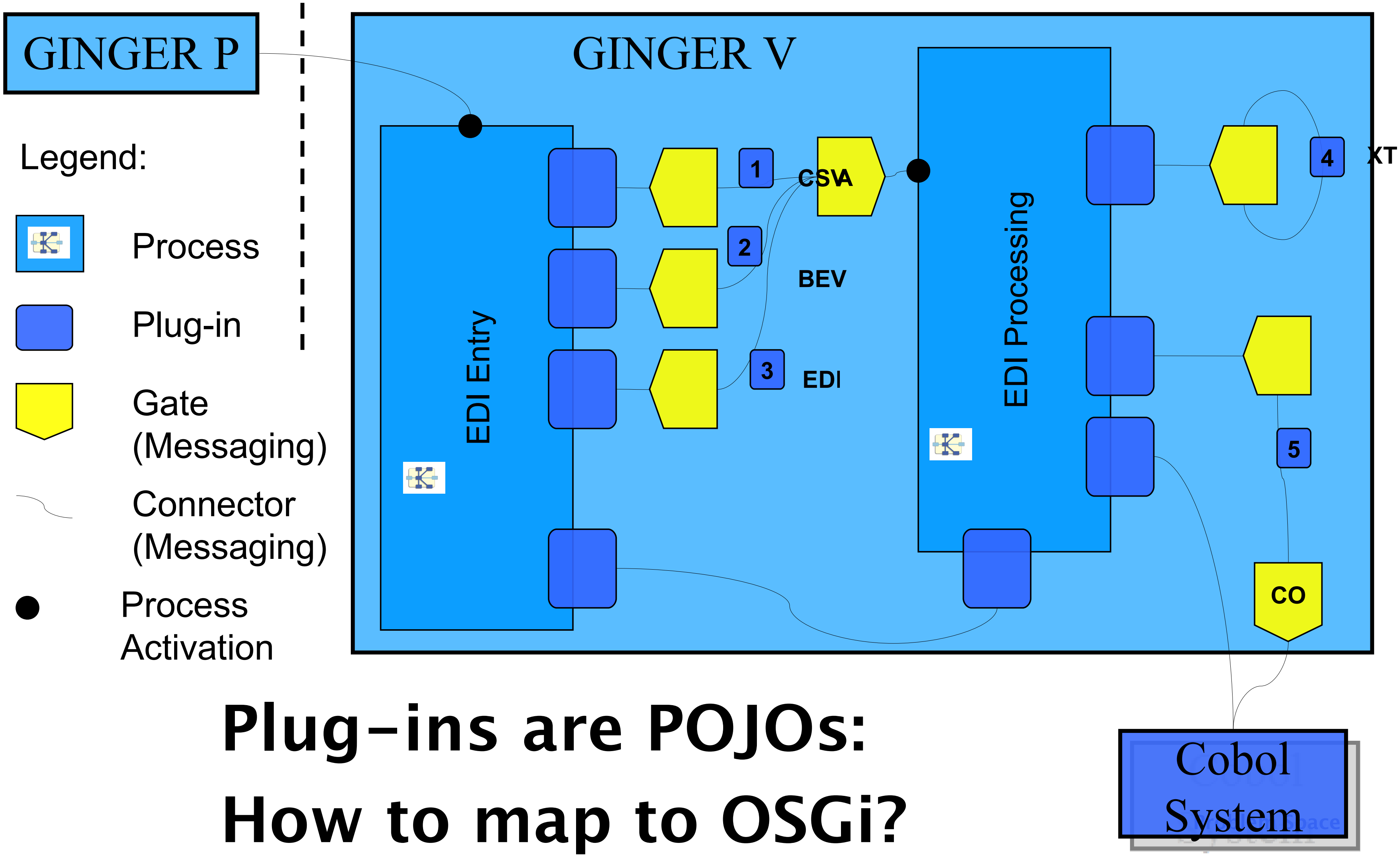
```
deploy
  http-invoker.sar
  jboss-aop.deployer
  jboss-bean.deployer
  jbossweb-tomcat55.sar
  jbossws14.sar
  jms
  jmx-console.war
  management
  snmp-adaptor.sar
  bsh-deployer.xml 5  27.09.08 16:18  gerd
  cache-invalidation-service.xml 5  27.09.08 16:18  gerd
  client-deployer-service.xml 5  27.09.08 16:18  gerd
  default-ds.xml 5  27.09.08 16:18  gerd
  dynclassloader-service.xml 5  27.09.08 16:18  gerd
  ear-deployer.xml 5  27.09.08 16:18  gerd
  ejb-deployer.xml 5  27.09.08 16:18  gerd
  ejb-timer-service.xml 5  27.09.08 16:18  gerd
  gingeradminws-service.xml 5  27.09.08 16:18  gerd
  gingeradminwsclient.sar 86  03.04.10 15:11  gerd
  gingerale.sar 5  27.09.08 16:18  gerd
  gingerallejb-service.xml 5  27.09.08 16:18  gerd
  gingerarchive.sar 86  03.04.10 15:11  gerd
  gingerbintransportws-service.xml 5  27.09.08 16:18  gerd
  gingerDB-ds.xml 46  02.03.09 09:50  gerd
  gingerdiabssnotification.sar 86  03.04.10 15:11  gerd
  gingerdiaconnection-service.xml 5  27.09.08 16:18  gerd
```

## How to map to OSGi?

# Ginger/JBoss

- Ginger/JBoss are composed of functional components and modules (FCM)
- Problems to solve
  - Find functional substitutes in OSGi
  - Identify FCM to embed in OSGi
  - Identify FCM to port to OSGi
  - Identify new FCM to be implemented

# Existing Applications



**Plug-ins are POJOs:**

**How to map to OSGi?**

## Summary: Problem Areas

- Two kinds of software
  - Product
  - Applications of the product
- Two major problem areas
  - Mapping of software structure
  - Mapping of functional building blocks

## Requirements

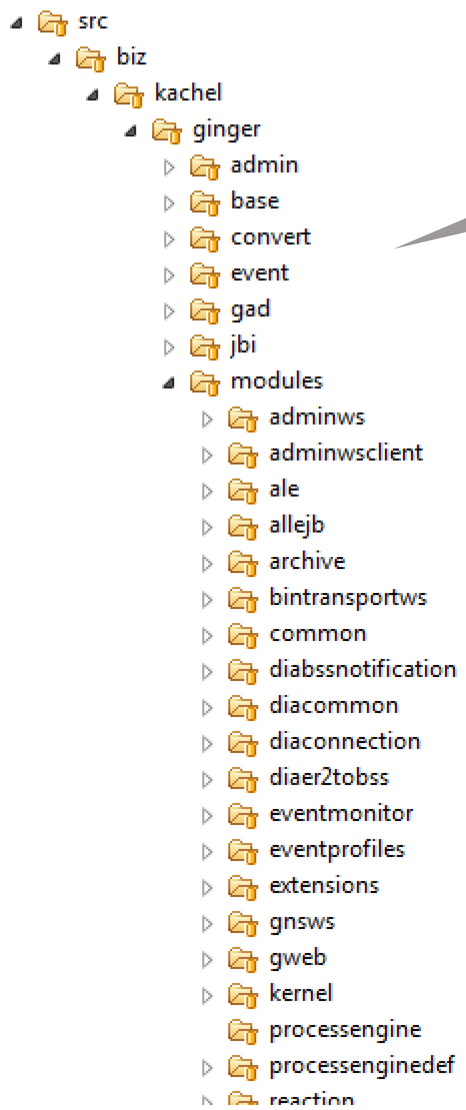
- Overall requirements
  - Minimum cost
    - Re-use as much as possible
    - Replace old components by OSGi technology
- Overall OSGi requirements
  - Use of Equinox (as starting point); today part of Eclipse RT
  - Use of declarative services

# Migration Solutions / Patterns

Derived from problem areas:

| | |
|---|---|
| Product Software Structure (PS) | Application Software Structure (AS) |
| Product Functionality (PF) | Application Functionality (AF) |

# Map Components to Bundles



```
src
  biz
    kachel
      ginger
        admin
        base
        convert
        event
        gad
        jbi
        modules
          adminws
          adminwsclient
          ale
          allejb
          archive
          bintransportws
          common
          diabssnotification
          diacommon
          diaconnection
          diaer2tobss
          eventmonitor
          eventprofiles
          extensions
          gnsws
          gweb
          kernel
          processengine
          processenginedef
          reaction
```

Components (jars)

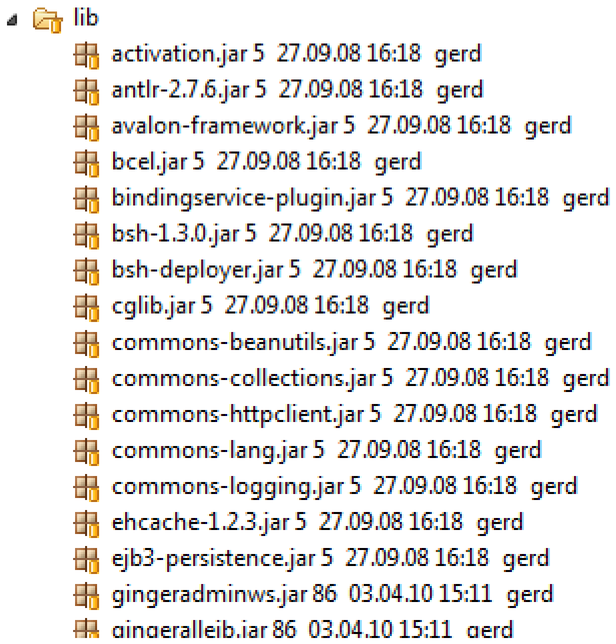
Mappings:

- Intuitive: Component → OSGi Bundle
- One to one: for good software designs

| | |
|---|---|
| PS | AS |
| PF | AF |

Migration Solutions

# Bad Software Designs



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lib
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    antlr-2.7.6.jar 5  27.09.08 16:18  gerd
    avalon-framework.jar 5  27.09.08 16:18  gerd
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    bsh-1.3.0.jar 5  27.09.08 16:18  gerd
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    cglib.jar 5  27.09.08 16:18  gerd
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    commons-collections.jar 5  27.09.08 16:18  gerd
    commons-httpclient.jar 5  27.09.08 16:18  gerd
    commons-lang.jar 5  27.09.08 16:18  gerd
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    ehcache-1.2.3.jar 5  27.09.08 16:18  gerd
    ejb3-persistence.jar 5  27.09.08 16:18  gerd
    gingeradminws.jar 86  03.04.10 15:11  gerd
    gingeralleib.jar 86  03.04.10 15:11  gerd
```

- JBoss flat class loading allows mud, e.g. dependency cycles
- OSGi forces good hierarchical software designs

→ re-engineering of components to hierachical design

| | |
|---|---|
| PS | AS |
| PF | AF |

Migration Solutions

# Bundle Design

- Old components were collections of packages
- Now, benefit from bundles:
  - Activator
  - Bundle respectively package dependencies
  - Hide internals, export packages to be used by other bundles:
    - Some adaptions required on component packages
    - Optional: add used libraries locally to bundle

| | |
|---|---|
| PS | AS |
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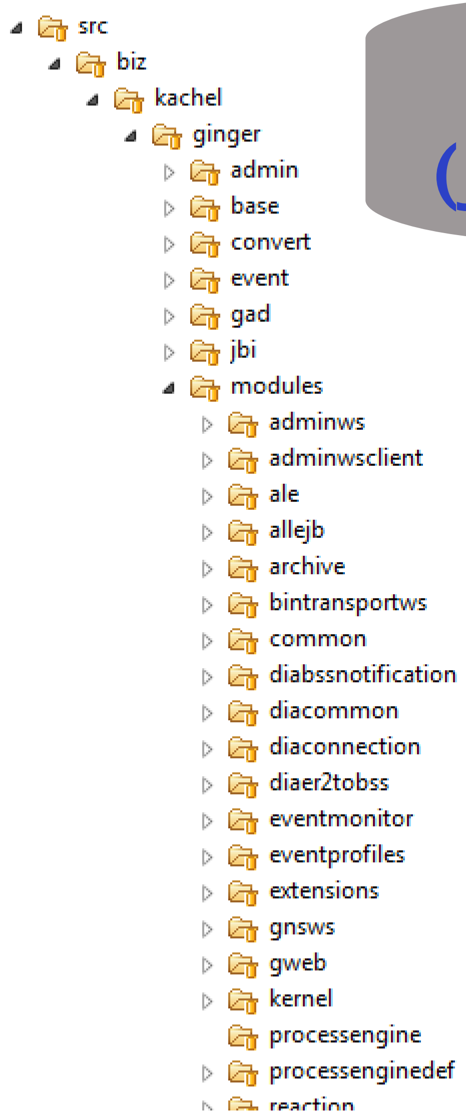
Migration Solutions

# Map Modules to Bundles



```
◢ src
  ◢ biz
    ◢ kachel
      ◢ ginger
        ▷ admin
        ▷ base
        ▷ convert
        ▷ event
        ▷ gad
        ▷ jbi
        ◢ modules
          ▷ adminws
          ▷ adminwsclient
          ▷ ale
          ▷ allejb
          ▷ archive
          ▷ bintransportws
          ▷ common
          ▷ diabssnotification
          ▷ diacommon
          ▷ diaconnection
          ▷ diaer2tobss
          ▷ eventmonitor
          ▷ eventprofiles
          ▷ extensions
          ▷ gnsws
          ▷ gweb
          ▷ kernel
            processengine
          ▷ processenginedef
          ▷ reaction
```

**Modules**
**(JBoss MBean services)**

Mappings:

- Module → Bundle
- Modules: good software designs area
- Bundle design same as for components
- Add-ons required for services

| | |
|---|---|
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| PF | AF |

Migration Solutions

## Map MBean Services to Services

- <server>
-     <mbean code="biz.kachel.ginger.modules.diaconnection.**gmodule.**
-                     DiamantConnection" name="biz.kachel.ginger:service=DiamantConnection">

        <!-- configuration attributes (and methods) -->
-         <attribute name="MasterDatabase">sasystem</attribute>
          …
-         <depends>biz.kachel.ginger:service=system</depends>
-     </mbean>
- </server>

Map one to one to Declarative Services in OSGi

## Details on Service Mapping

- MBean service description
  - → component service description
- MBean attributes
  - → service properties
- MBean methods
  - → to be provided as service interface
- MBean dependencies
  - → referenced services

## Special Features on Modules

- Modules with MBeans

  → Bundles with Component Services
- GModule = Ginger Module:
  - Wrapper for dependency injection
    - JBoss MBean Services
    - Spring Beans
    - Direct GModule implementation

  → Allows set of modules to be deployed as one bundle

## Module Groups

Common for porting using a dependency injection framework (DIF):

- Keep set or sub-set of modules as one bundle
- Import DIF or include DIF libraries into bundle
- Start DIF on your bundle within bundle activator
- Export packages as externally required
- Provide services as externally required

That is great for porting to keep efforts low!

| | |
|---|---|
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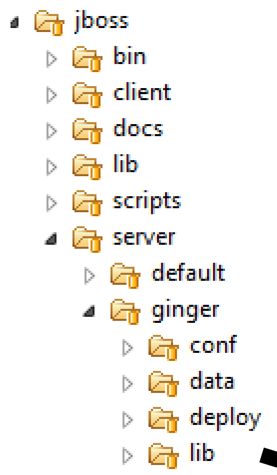
# Third Party Software



JEE services: find OSGi-like equivalents, see below

jars: wrap into bundles

| | |
|---|---|
| PS | AS |
| PF | AF |

Migration Solutions

## Summary: Product Structure

- Mapping of components, modules, and jars to bundles
- Mapping of MBeans to declarative services
- Bundle benefits support a good software design

# Application Software Structure

- Migration mappings are the same as for the product structure
- In addition, mapping is desired for application code
  - Provided by POJOs

| | |
|---|---|
| PS | AS |
| PF | AF |

Migration Solutions

# POJOs from Messaging

```
<InputGate Name=„BDProcessTrigger" Type="FILE">
        <FileInfo Format="Text">
            <Path>..\List\BaseDataImport</Path>
            <File>BaseDataStart.txt</File>
        </FileInfo>
        <PlugIns>
            <Class Name="biz.kachel.fair.BaseDataTransportPlugIns">
                <Method Name="readVTLs"/>
            </Class>
            <Class Name="biz.kachel.fair.ApplicationLog">
                <Method Name="work" Configuration="xml"/>
            </Class>
        </PlugIns>
</InputGate>
```

| | |
|---|---|
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# POJOs from Process Engine

```
<Application Id="clearSubCatalog_APP" Name="clearSubCatalog">
    <FormalParameters>
        <FormalParameter Id="CatalogSubName_FP" Mode="IN">
            <DataType>
                <BasicType Type="STRING"/>
            </DataType>
        </FormalParameter>
             ...
    </FormalParameters>
        <ExtendedAttributes>
            <ExtendedAttribute Name="Toolname"
Value="clearSubCatalog"/>
            <ExtendedAttribute Name="Tooltype"
             Value="biz.kachel.fair.backbone.PlugInFurninetExport"/>
            <ExtendedAttribute Name="ExecutionFrame" Value="server"/>
        </ExtendedAttributes>
</Application>
```

| | |
|---|---|
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Migration Solutions

## Common POJO Mapping

- Ginger/JBoss with messaging (MSG) and process engine (PE):
  - One class loader
  - Object instances are created via JAVA reflection API
- Roots/OSGi:
  - Bundle class loading
  - Such modules as MSG and PE are provided as bundle
  - POJO is part of application bundle
  - Problem:
    - MSG or PE are not aware of application code bundles

| | |
|---|---|
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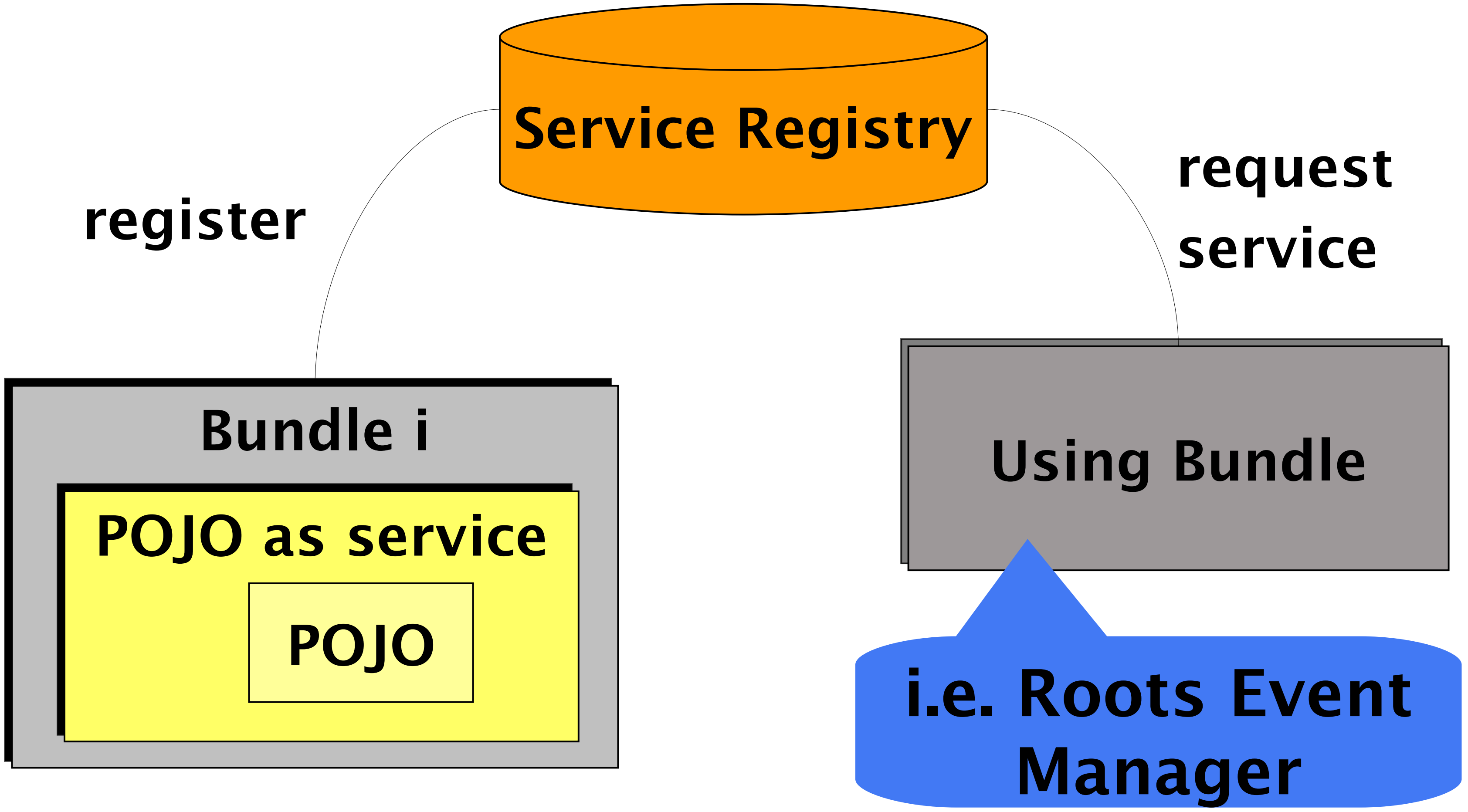
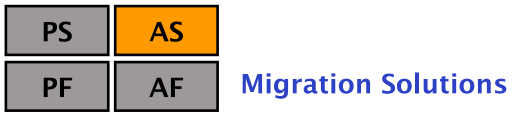
Migration Solutions

# Common POJO Solution





# Summary: Application Structure

- Mapping of POJOs
  - Provide POJO as service, service factory, or service providing POJO factory
  - Alternative:
    - fragments (limited)
    - not part of specification, e.g. Extensions

## Product Functionality

- JBoss:
  - Look for substitute
- Ginger to Roots
  - Migrated according to software structure mappings
  - Look for substitutes

# JBoss Substitutes

| JBoss | Roots (OSGi, Eclipse RT) |
|---|---|
| Tomcat | HTTP Service, Jetty |
| WebService | Remote Services, Riena |
| Hibernate | Hibernate |
| EJB | – |
| log4j | Roots Logging, Events (DB-Track) |

| PS | AS |
|---|---|
| PF | AF |

## GINGER Substitutes

| GINGER | Roots (OSGi, Eclipse RT) |
|---|---|
| Core | OSGi Core, Compendium partially |
| Process Engine | Event Manager |
| Messaging | Event Manager |
| Event Engine, Monitoring | Event Manager, Event Admin |
| UPnP | UPnP Device Service |
| Convert | Convert |
| GSB | Remote Services, Riena |

| | |
|---|---|
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| PF | AF |

Migration Solutions

## Port to Event Processing

- Ginger Messaging and Process Engine are substituted by Roots Event Processing (Event Manager)
- In addition: migrate messaging gates to pro-active or re-active event processors

| | |
|---|---|
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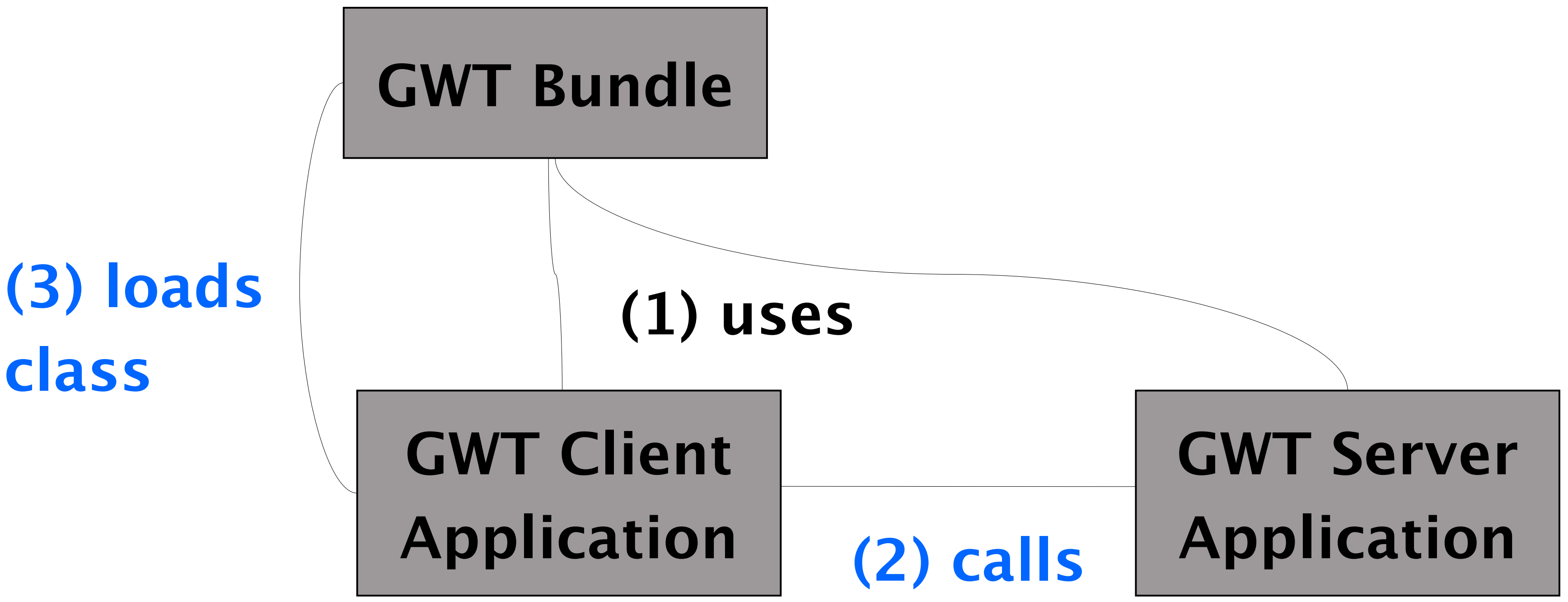
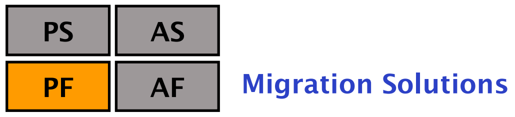
## Google Web Toolkit Migration



Solve class loading problem!

→ Equinox Budy Class loading



## Summary: Product Functionality

- Used main JBoss and main Ginger components are directly substituted by OSGi and Eclipse RT components
- Direct porting according to migration rules
- Concept shot to event processing

## Application Functionality

- Map messaging models and processes to event processes
- Map POJOs to services
- Add some glue if necessary

| | |
|---|---|
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## Lessions Learned

- Drawbacks
- Benefits
- Patterns
- Costs

## Drawbacks

- Need invest in learning curve: about 4 weeks per person
- Non modularised designs are costly to migrate
- Bundles and services require implementation overhead: about 15 to 30 min per part

## Benefits and Patterns

- Benefits
  - OSGi specification and implementation provides rich functionality
  - Add-ons by plattform, e.g. Eclipse RT
  - Reduced software size
  - OSGi forces stronger design rules (good designs)
  - Fine grained modularisation
- Migration patterns
  - As shown above: components, modules, POJOs

## Migrations Costs

- Learning curve: about 1 month per person
- GINGER core to one bundle: 1 person day (pd)
- GINGER module to bundle: about 1 pd
- Substitutes, new bundles, adaptions, test: 65 pd
- Total effort: about 110 pd (Ginger total development effort is about 2000 pd)

## Wish List

- Declarative services via annotations
- Open implementation by specifications, e.g. call back or persistence layer for User Admin Service or Preferences Service
- Extend Event Admin features:
  - Open event property behaviour, e.g. event persistence
  - Open event processing modells