Enterprise Development

with …

APACHECON
EUROPE

CORINTHIA HOTEL
BUDAPEST, HUNGARY

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What needs to be done to run JEE like applications inside Karaf?

@anierbeck

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- OPS4j Pax Web Project Lead

- Senior IT Consultant @codecentric

- co-Author of Apache Karaf Cookbook

Agenda

- Enterprise Requirements
- OSGi with Karaf
- Enterprise Requirements on Karaf
- Specialties
- Http Service
- Cellar - or how to cluster Karaf
- Summary

Enterprise Requirements

Enterprise Java

Servlet 3	JSP	JAX-WS	JAX-RS	JASPIC	JSR-88
EJB 3.1	CDI	JAX-RPC	JAXB	JACC	JSR-77
JSF 2	JTA	JAXR	JMS	JCA	RMI
JPA 2	Bean Validation	SAAJ	JAAS	JavaMail	JNDI

OSGi with Karaf

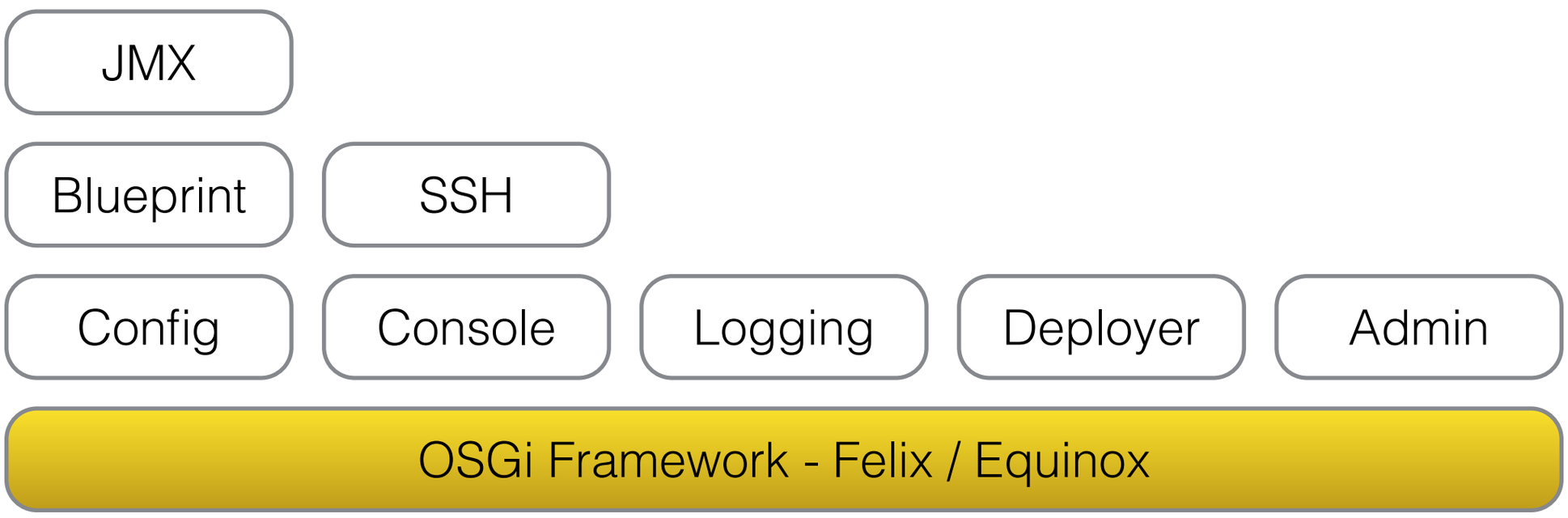
OSGi - a very brief introduction

- Modular
- OSGi Bundles:
  - High Cohesion (One classloader/bundle)
  - Low Coupling (Package Import/Export)
  - Versioning per bundle ([1.0,2,0))
- Service Registry

What is Karaf

- Container
  - OSGi Applications
- Ligthtweight
  - expandable to Full Enterprise support
- Covers all major needs
  - Logging
  - Deployment
  - Configuration

Karaf - Overview



Enterprise requirements on Karaf

Karaf

Servlet 3	JSP	JAX-WS	JAX-RS	JASPIC	JSR-88
EJB 3.1	CDI	JAX-RPC	JAXB	JACC	JSR-77
JSF 2	JTA	JAXR	JMS	JCA	RMI
JPA 2	Bean Validation	SAAJ	JAAS	JavaMail	JNDI

Enterprise - Pax Web

Servlet 3	JSP	JAX-WS	JAX-RS	JASPIC	JSR-88
EJB 3.1	CDI	JAX-RPC	JAXB	JACC	JSR-77

JSF 2	JTA	JAXR	JMS	JCA	RMI
JPA 2	Bean Validation	SAAJ	JAAS	JavaMail	JNDI

Enterprise - Pax CDI

Servlet 3	JSP	JAX-WS	JAX-RS	JASPIC	JSR-88
EJB 3.1	CDI	JAX-RPC	JAXB	JACC	JSR-77
JSF 2	JTA	JAXR	JMS	JCA	RMI
JPA 2	Bean Validation	SAAJ	JAAS	JavaMail	JNDI

Enterprise - Aries

Servlet 3	JSP	JAX-WS	JAX-RS	JASPIC	JSR-88
EJB 3.1	CDI	JAX-RPC	JAXB	JACC	JSR-77
JSF 2	JTA	JAXR	JMS	JCA	RMI
JPA 2	Bean Validation	SAAJ	JAAS	JavaMail	JNDI

Enterprise - Tomee aka OpenEJB

Servlet 3	JSP	JAX-WS	JAX-RS	JASPIC	JSR-88
EJB 3.1	CDI	JAX-RPC	JAXB	JACC	JSR-77
JSF 2	JTA	JAXR	JMS	JCA	RMI
JPA 2	Bean Validation	SAAJ	JAAS	JavaMail	JNDI

Enterprise - CXF

Servlet 3	JSP	JAX-WS	JAX-RS	JASPIC	JSR-88
EJB 3.1	CDI	JAX-RPC	JAXB	JACC	JSR-77
JSF 2	JTA	JAXR	JMS	JCA	RMI
JPA 2	Bean Validation	SAAJ	JAAS	JavaMail	JNDI

Enterprise - ActiveMQ

Servlet 3	JSP	JAX-WS	JAX-RS	JASPIC	JSR-88
EJB 3.1	CDI	JAX-RPC	JAXB	JACC	JSR-77
JSF 2	JTA	JAXR	JMS	JCA	RMI
JPA 2	Bean Validation	SAAJ	JAAS	JavaMail	JNDI

Enterprise - Cellar

Servlet 3	JSP	JAX-WS	JAX-RS	JASPIC	JSR-88
EJB 3.1	CDI	JAX-RPC	JAXB	JACC	JSR-77
JSF 2	JTA	JAXR	JMS	JCA	RMI
JPA 2	Bean Validation	SAAJ	JAAS	JavaMail	JNDI

Enterprise - Karaf with features

Servlet 3 | JSP | JAX-WS | JAX-RS | JASPIC | JSR-88

EJB 3.1 | CDI | JAX-RPC | JAXB | JACC | JSR-77

JSF 2 | JTA | JAXR | JMS | JCA | RMI

JPA 2 | Bean Validation | SAAJ | JAAS | JavaMail | JNDI

Specialties

JPA - Karaf

```
<persistence xmlns="http://java.sun.com/xml/ns/persistence"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://java.sun.com/xml/ns/persistence
      http://java.sun.com/xml/ns/persistence/persistence_2_0.xsd"
   version="2.0" >
   <persistence-unit name="cookbook" transaction-type="JTA">
         <provider>org.apache.openjpa.persistence.PersistenceProviderImpl</provider>
        <jta-data-source>
              osgi:service/javax.sql.DataSource/(osgi.jndi.service.name=jdbc/cookbook)
         </jta-data-source>
        <class>de.nierbeck.apachecon.persistence.entity.Book</class>
        <class>de.nierbeck.apachecon.persistence.entity.Recipe</class>
        <exclude-unlisted-classes>true</exclude-unlisted-classes>
        <properties>
              <property name="openjpa.Log" value="slf4j" />
              <property name="openjpa.RuntimeUnenhancedClasses" value="supported" />
              <property name="openjpa.jdbc.SynchronizeMappings" value="buildSchema"/>
         </properties>
   </persistence-unit>
</persistence>
```

JPA - Karaf

```
<persistence xmlns="http://java.sun.com/xml/ns/persistence"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://java.sun.com/xml/ns/persistence
      http://java.sun.com/xml/ns/persistence/persistence_2_0.xsd"
   version="2.0" >
   <persistence-unit name="cookbook" transaction-type="JTA">
         <provider>org.apache.openjpa.persistence.PersistenceProviderImpl</provider>
         <jta-data-source>
               osgi:service/javax.sql.DataSource/(osgi.jndi.service.name=jdbc/cookbook)
         </jta-data-source>
         <class>de.nierbeck.apachecon.persistence.entity.Book</class>
         <class>de.nierbeck.apachecon.persistence.entity.Recipe</class>
         <exclude-unlisted-classes>true</exclude-unlisted-classes>
         <properties>
               <property name="openjpa.Log" value="slf4j" />
               <property name="openjpa.RuntimeUnenhancedClasses" value="supported" />
               <property name="openjpa.jdbc.SynchronizeMappings" value="buildSchema"/>
         </properties>
   </persistence-unit>
</persistence>
```

To have this blueprint JNDI is needed

JTA - Karaf

```
<blueprint default-activation=„eager"
        xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xmlns:jpa="http://aries.apache.org/xmlns/jpa/v1.0.0"
        xmlns:tx="http://aries.apache.org/xmlns/transactions/v1.0.0"
        xsi:schemaLocation="http://www.osgi.org/xmlns/blueprint/v1.0.0
      http://www.osgi.org/xmlns/blueprint/v1.0.0/blueprint.xsd">

        <bean id="cookBookServiceImpl"
                class="de.nierbeck.apachecon.persistence.dao.CookBookServiceImpl">
                <jpa:context property="em" unitname="cookbook" />
                <tx:transaction method="*" value="Required" />
        </bean>

        <service id="cookBookService" ref="cookBookServiceImpl"
                interface="de.nierbeck.apachecon.persistence.api.CookBookService" />
</blueprint>
```

JTA - Karaf

```
<blueprint default-activation=„eager"
        xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xmlns:jpa="http://aries.apache.org/xmlns/jpa/v1.0.0"
        xmlns:tx="http://aries.apache.org/xmlns/transactions/v1.0
        xsi:schemaLocation="http://www.osgi.org/xmlns/blueprin
       http://www.osgi.org/xmlns/blueprint/v1.0.0/blueprint.xsd">

    <bean id="cookBookServiceImpl"
            class="de.nierbeck.apachecon.persistence.dao.CookBookServiceImpl">
            <jpa:context property="em" unitname="cookbook" />
            <tx:transaction method="*" value="Required" />
    </bean>

    <service id="cookBookService" ref="cookBookServiceImpl"
            interface="de.nierbeck.apachecon.persistence.api.CookBookService" />
</blueprint>
```

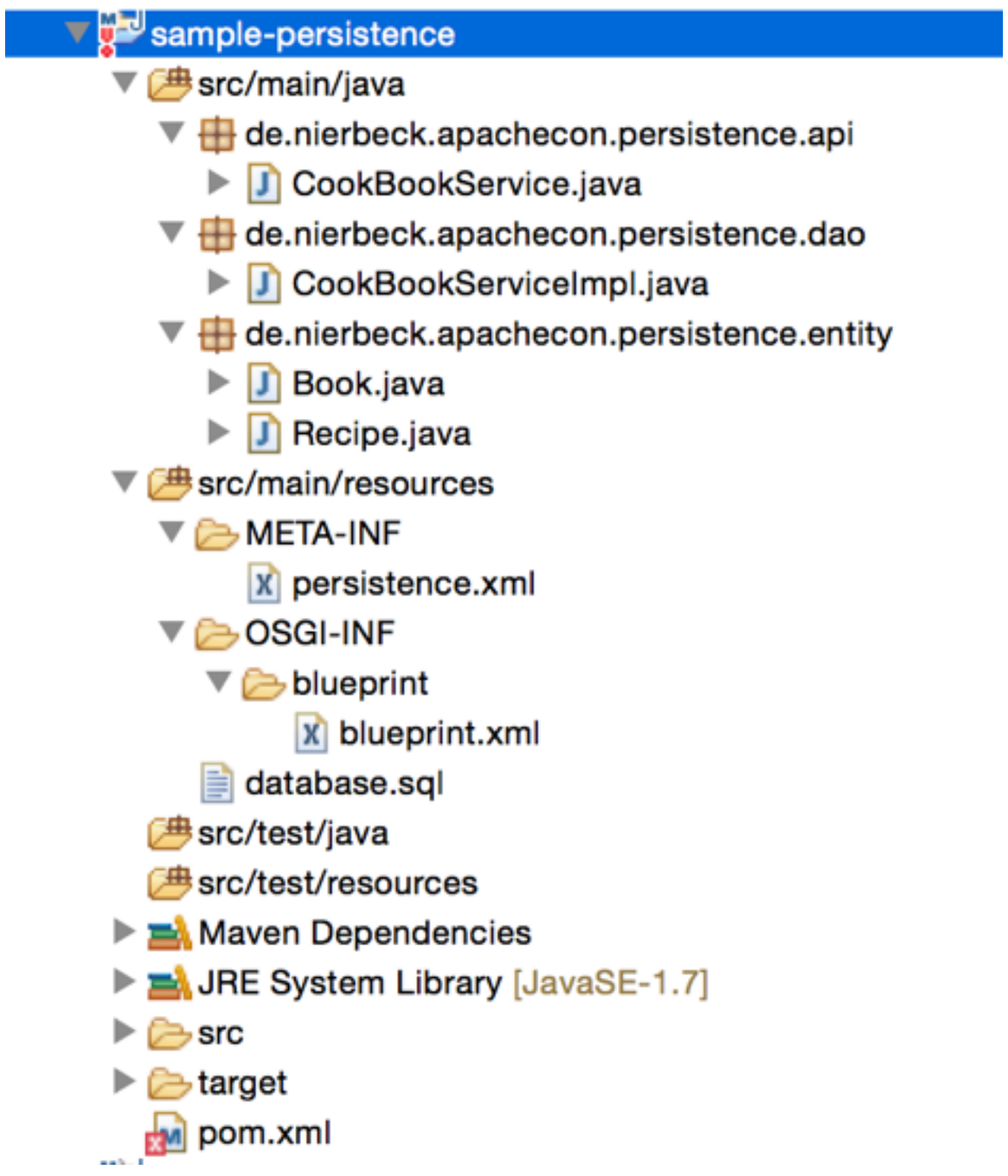
To have this blueprint JPA and JTA is needed

Client - Karaf

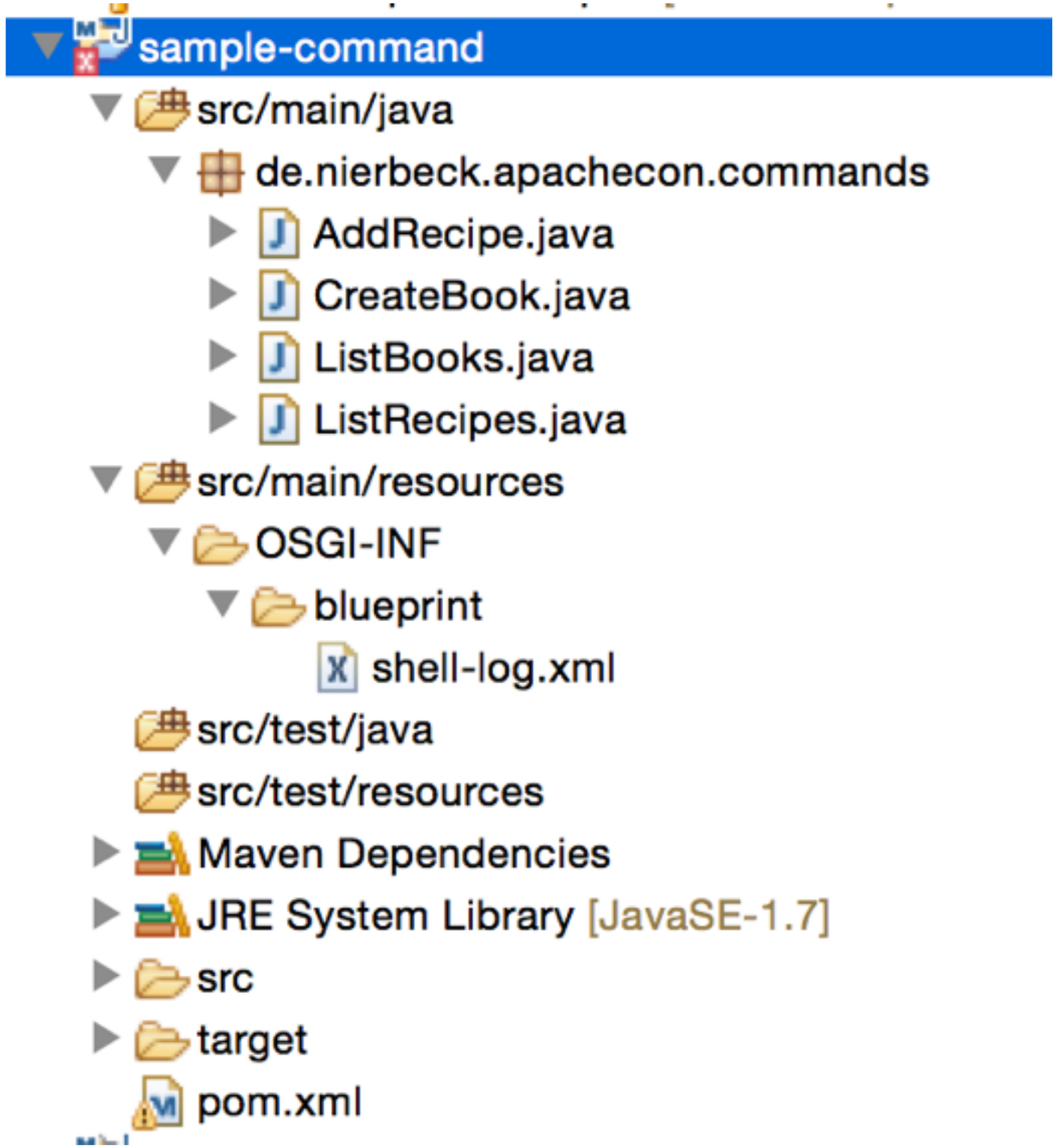
```
<?xml version="1.0" encoding="UTF-8"?>
<blueprint xmlns="http://www.osgi.org/xmlns/blueprint/v1.0.0"
   default-activation="lazy">

   <reference id="cookBookService"
      interface="de.nierbeck.apachecon.persistence.api.CookBookService" />

   <command-bundle xmlns="http://karaf.apache.org/xmlns/shell/v1.1.0">
        <command>
         <action class="de.nierbeck.apachecon.commands.CreateBook">
            <property name="bookService" ref="cookBookService" />
         </action>
      </command>
      ...

   </command-bundle>
</blueprint>
```

Demo

Persistence



Client


sample-command
src/main/java
de.nierbeck.apachecon.commands
AddRecipe.java
CreateBook.java
ListBooks.java
ListRecipes.java
src/main/resources
OSGI-INF
blueprint
shell-log.xml
src/test/java
src/test/resources
Maven Dependencies
JRE System Library [JavaSE-1.7]
src
target
pom.xml

Client Shell

```
149 | Active   |  80 | 0.8.0                | OPS4J Pax CDI Extender for Bean Bundles
150 | Active   |  80 | 0.8.0                | OPS4J Pax CDI Web Adapter
151 | Active   |  80 | 1.1                  | Apache Geronimo JSR-303 Bean Validation Spec API
152 | Active   |  80 | 3.18.0               | Apache XBean :: ASM 5 shaded (repackaged)
153 | Active   |  80 | 3.18.0               | Apache XBean :: Finder shaded (repackaged)
154 | Active   |  80 | 1.2.6                | SPI definition
155 | Active   |  80 | 1.2.6                | OpenWebBeans Core
156 | Active   |  80 | 1.2.6                | EL 2.2 plugin
157 | Active   |  80 | 0.8.0                | OPS4J Pax CDI OpenWebBeans Adapter
158 | Active   |  80 | 1.2.6                | Web plugin
159 | Active   |  80 | 0.8.0                | OPS4J Pax CDI Web OpenWebBeans Adapter
160 | Active   |  80 | 1.3.167              | H2 Database Engine
161 | Active   |  80 | 1.0.0.SNAPSHOT       | Enterprise Sample : Command
162 | Active   |  80 | 1.0.0.SNAPSHOT       | Enterprise Sample : Persistence
163 | Active   |  80 | 1.0.0.SNAPSHOT       | Enterprise Sample : WebView
164 | Resolved |  80 | 3.2.3                | hazelcast-wm, Hosts: 66
karaf@root()>
```

Client - Shell

```
karaf@root()> apachecon
apachecon                 apachecon:addrecipe     apachecon:createbook     apachecon:listbooks     apachecon:listrecipes
karaf@root()> apachecon:createbook --help
DESCRIPTION
        apachecon:CreateBook

        Create book

SYNTAX
        apachecon:CreateBook [options] name

ARGUMENTS
        name
                Name of CookBook

OPTIONS
        -i, --isbn
                The ISBN of the book
        --help
                Display this help message

karaf@root()>
```

Client Shell

```
karaf@root()> apachecon:createbook -i 978-1783985081 "Apache Karaf Cookbook"
Book created
karaf@root()>
```

Client - Shell

```
karaf@root()> apachecon:listbooks
ID   | Name                    | ISBN            | Recipes
-----------------------------------------------------------
101  | Apache Karaf Cookbook | 978-1783985081 | 0
1    | test                    |                 | 1
karaf@root()>
```

Http Service

with …

PaxWeb

HTTP Service

- Using an Activator:

```
final HttpContext httpContext = httpService
        .createDefaultHttpContext();
// register the BookServlet

// first wait for the DAO-Service
CookBookService cookBookService;
ServiceReference<CookBookService> serviceReference = bundleContext
        .getServiceReference(CookBookService.class);
cookBookService = bundleContext.getService(serviceReference);

//now create the servlet
ViewBookServlet viewBookServlet = new ViewBookServlet();

//set the DAO to the Servlet
viewBookServlet.setCookBookService(cookBookService);

final Dictionary<String, Object> initParams = new Hashtable<String, Object>();
try {
    httpService.registerServlet("/book", // alias
            viewBookServlet,
            initParams, httpContext);
```

Whiteboard

- Using the whiteboard approach via Activator

```
public void start(BundleContext bc) throws Exception {
   bundleContext = bc;

   // first wait for the DAO-Service
   CookBookService cookBookService;
   ServiceReference<CookBookService> serviceReference = bundleContext
         .getServiceReference(CookBookService.class);
   cookBookService = bundleContext.getService(serviceReference);

   // create new Servlet
   ViewBookServlet cookBookViewServlet = new ViewBookServlet();
   cookBookViewServlet.setCookBookService(cookBookService);

   registerServiced = bundleContext.registerService(Servlet.class,
         cookBookViewServlet, null);
}
```

Whiteboard

- Using the whiteboard approach via Blueprint

```
<blueprint default-activation="eager">

   <reference id="cookBookService"
      interface="de.nierbeck.apachecon.persistence.api.CookBookService" />

   <bean id="viewBookServlet"
class="de.nierbeck.apachecon.view.ViewBookServlet" >
      <property name="cookBookService" ref="cookBookService"/>
   </bean>

   <service id="servletService" interface="javax.servlet.Servlet"
ref="viewBookServlet" />
</blueprint>
```

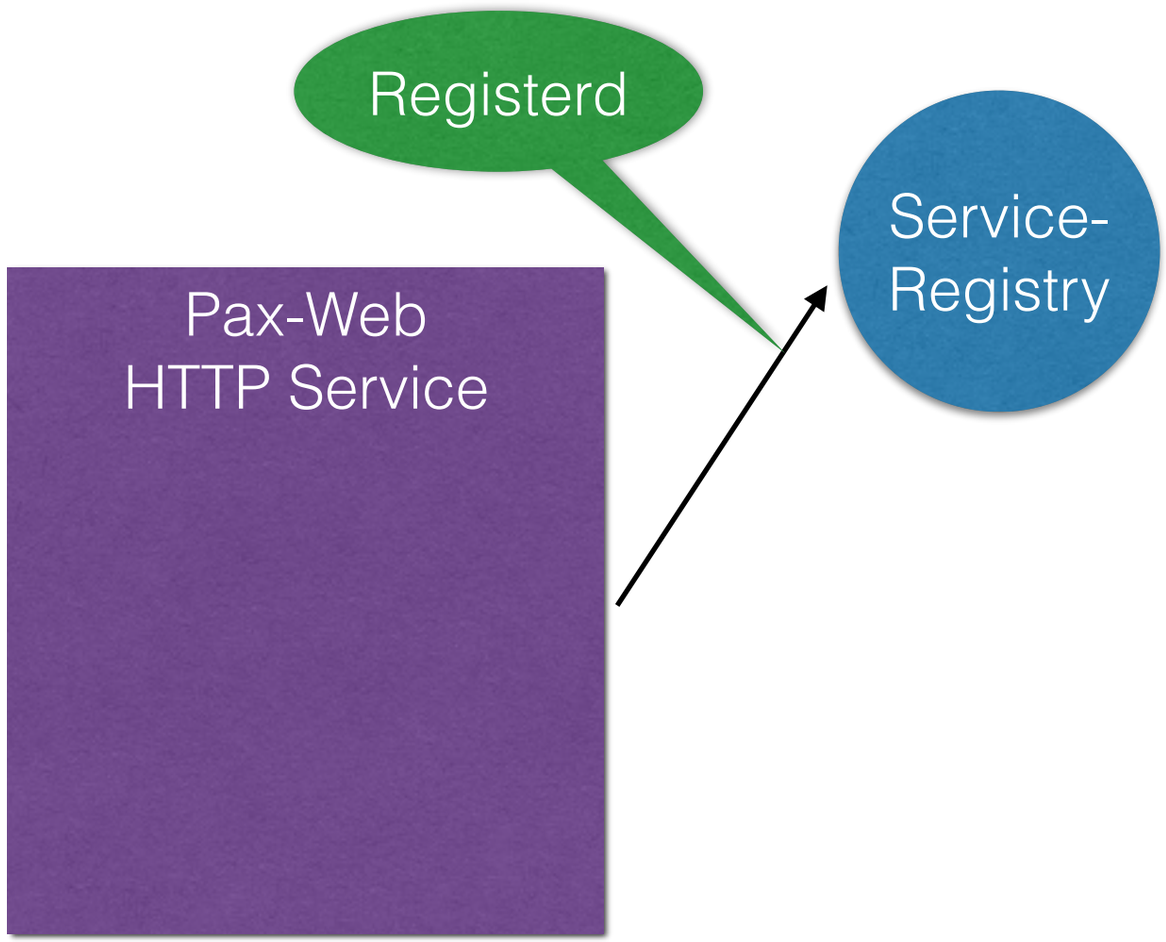
Servlet 3.0 - Just annotation

```
@WebServlet(urlPatterns = "/book")
public class ViewBookServlet extends HttpServlet {

    /**
     *
     */
    private static final long serialVersionUID = 1L;

    @Inject
    @OsgiService
    CookBookService cookBookService;

    @Override
    protected void doGet(HttpServletRequest req, HttpServletResponse resp)
            throws ServletException, IOException {
    ...
    }
}
```

LOST?

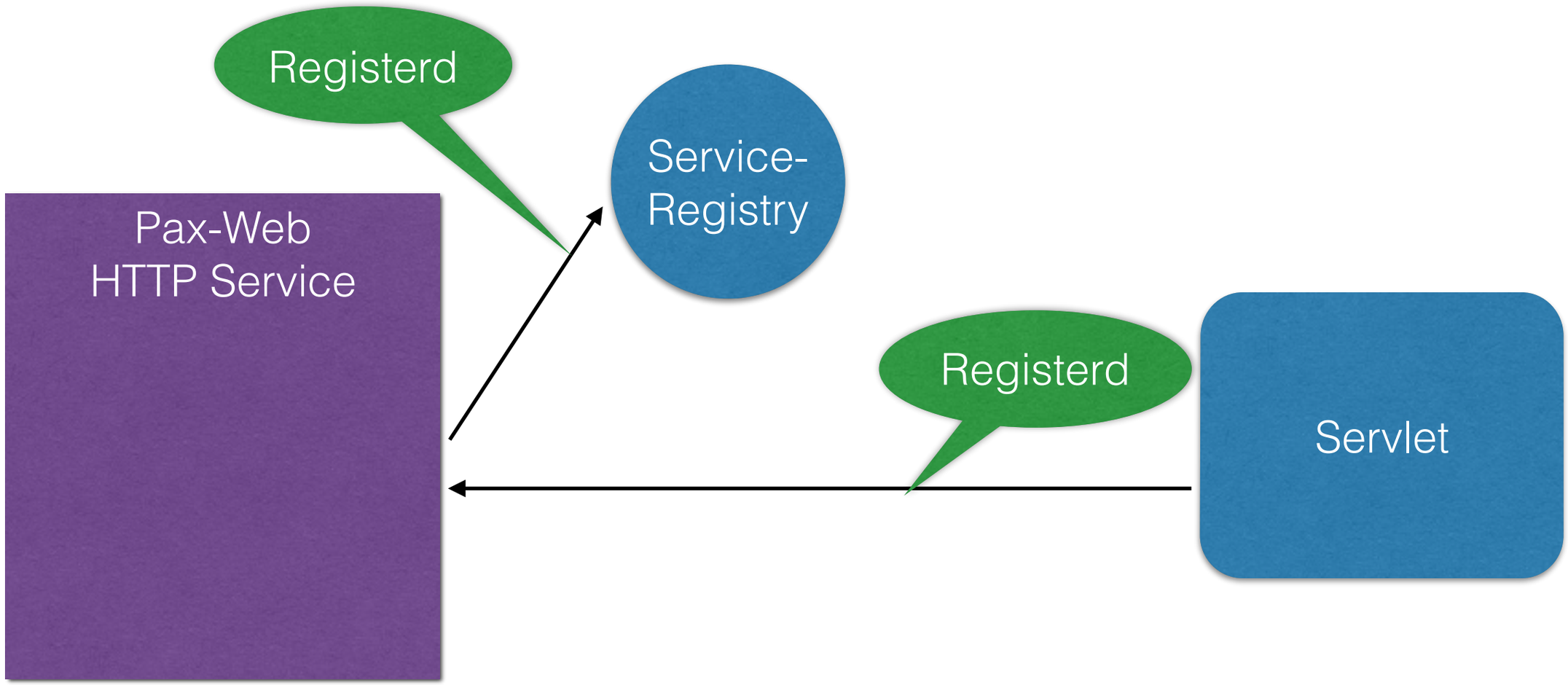
Registering - Servlet

Registering - Servlet



Servlet

Registering - Servlet



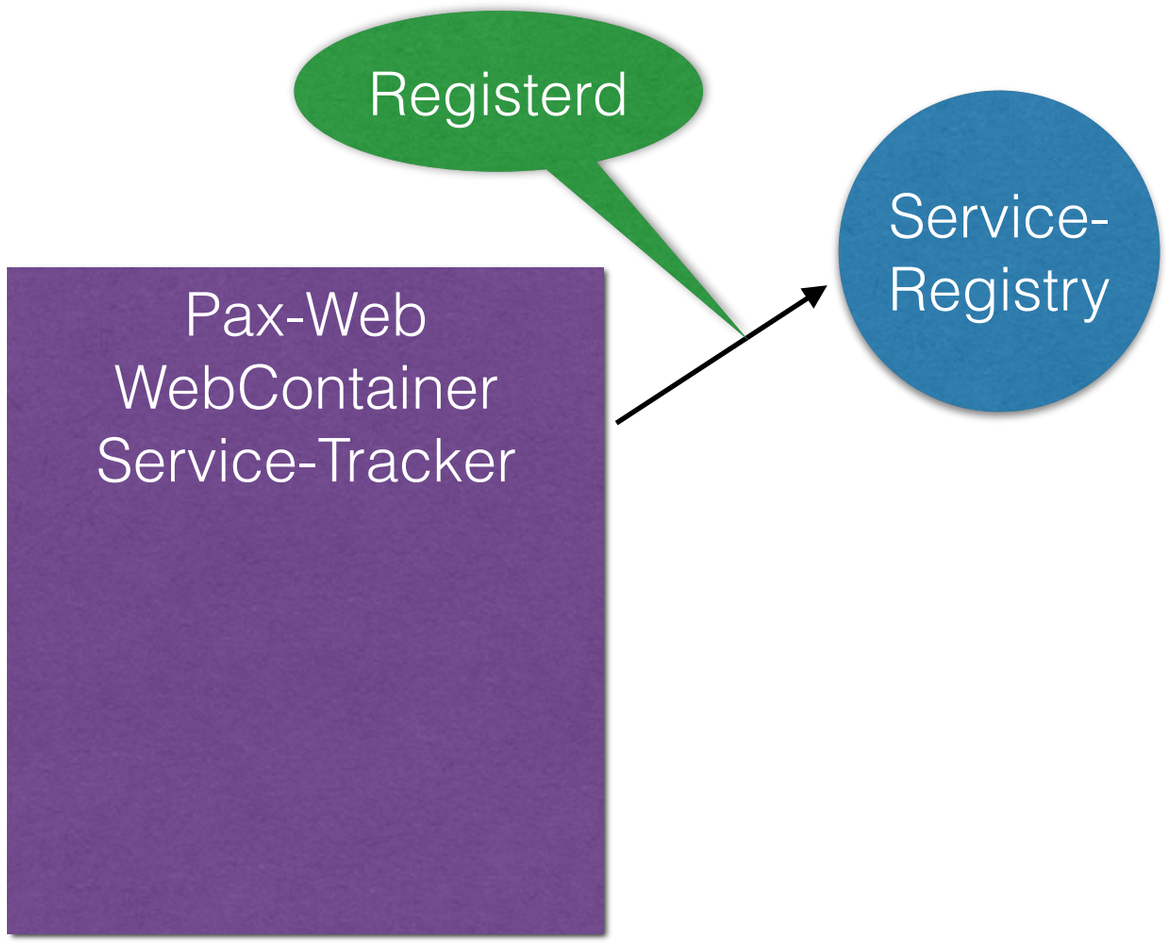
Registering - Whiteboard

Service-Registry

Pax-Web WebContainer Service-Tracker

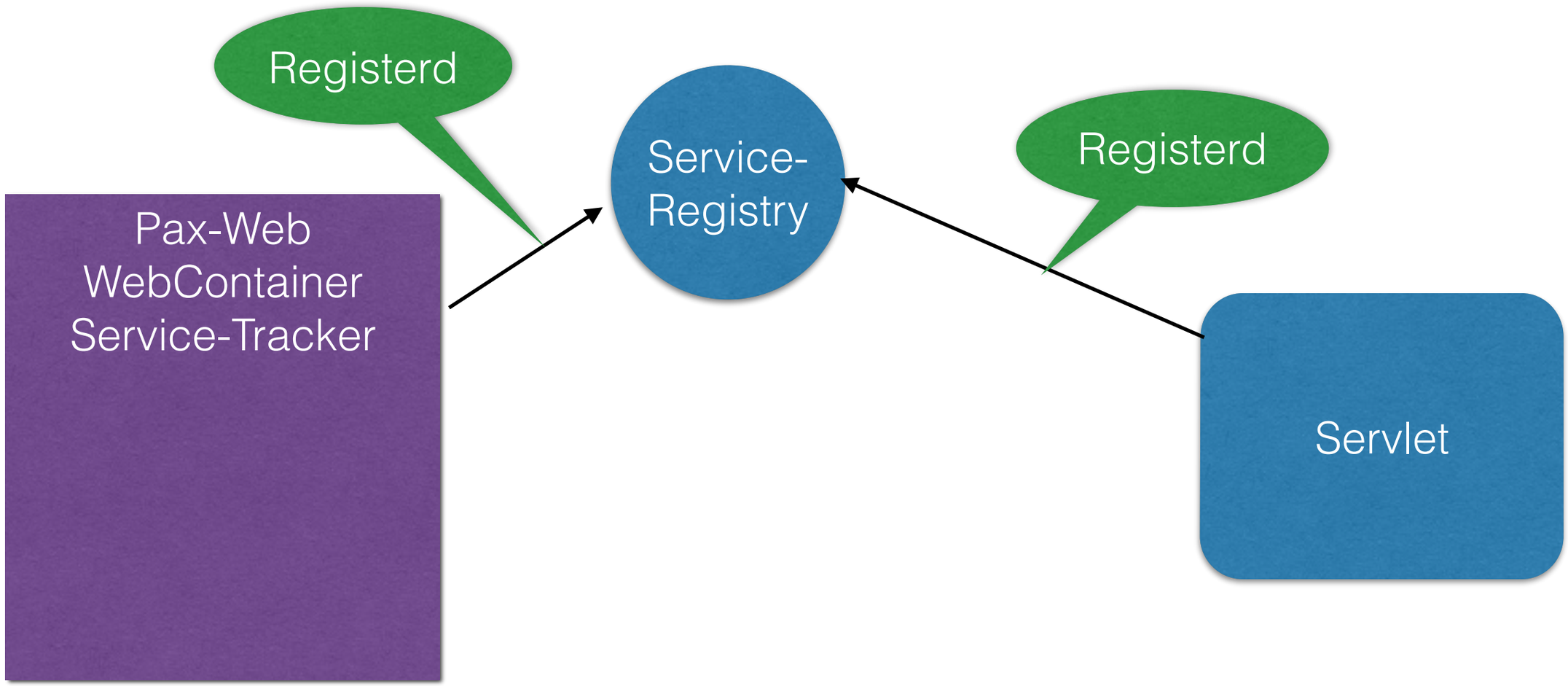
Servlet

Registering - Whiteboard

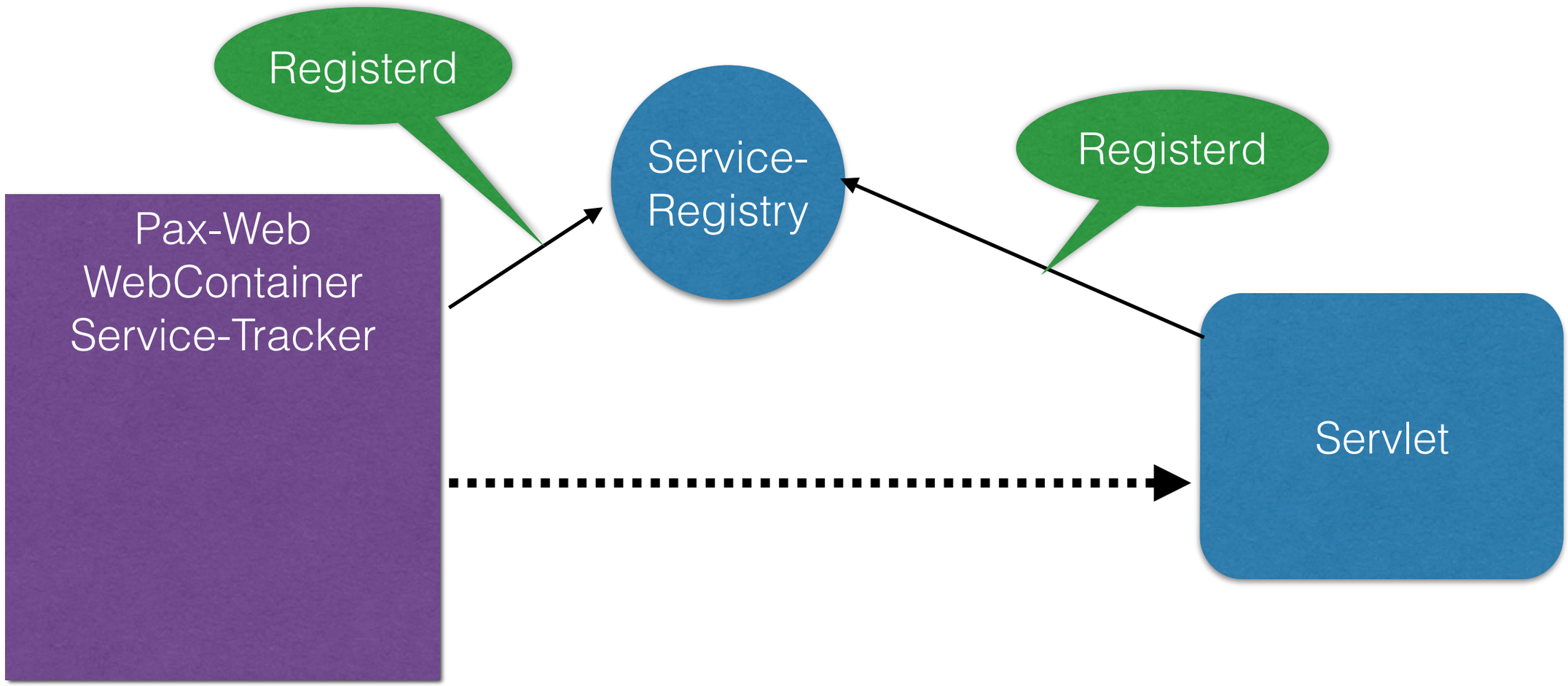


Servlet

Registering - Whiteboard



Registering - Whiteboard



Registering - WAR

Pax-Web
WebContainer

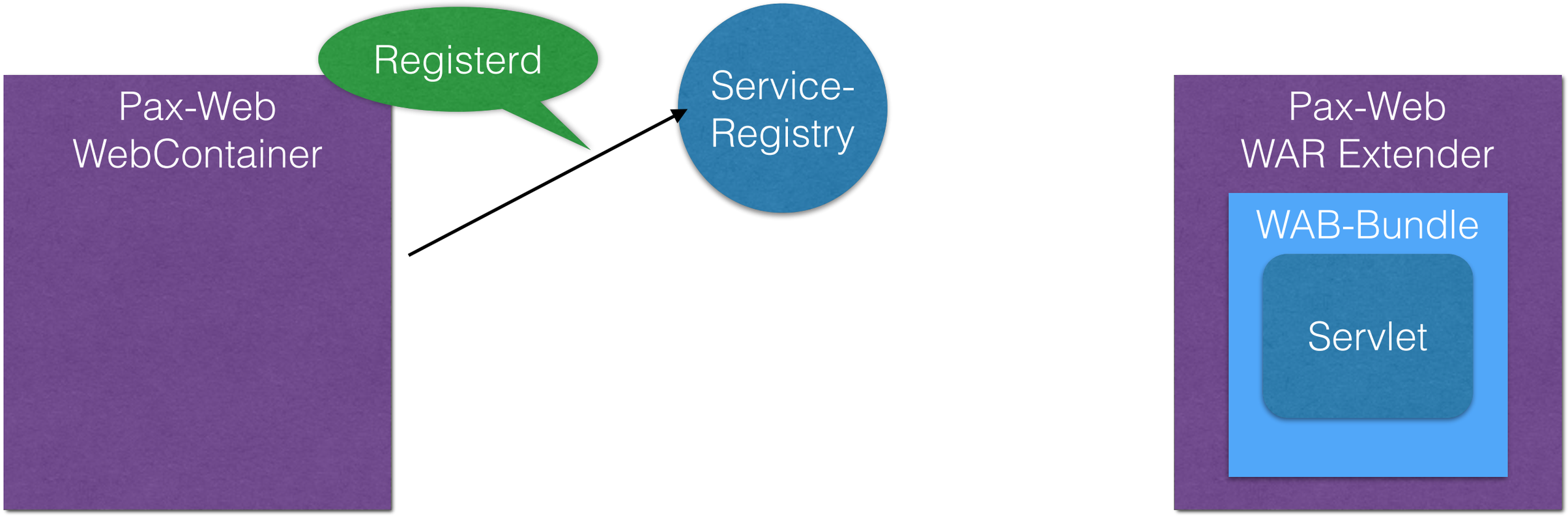
Service-
Registry

Pax-Web
WAR Extender

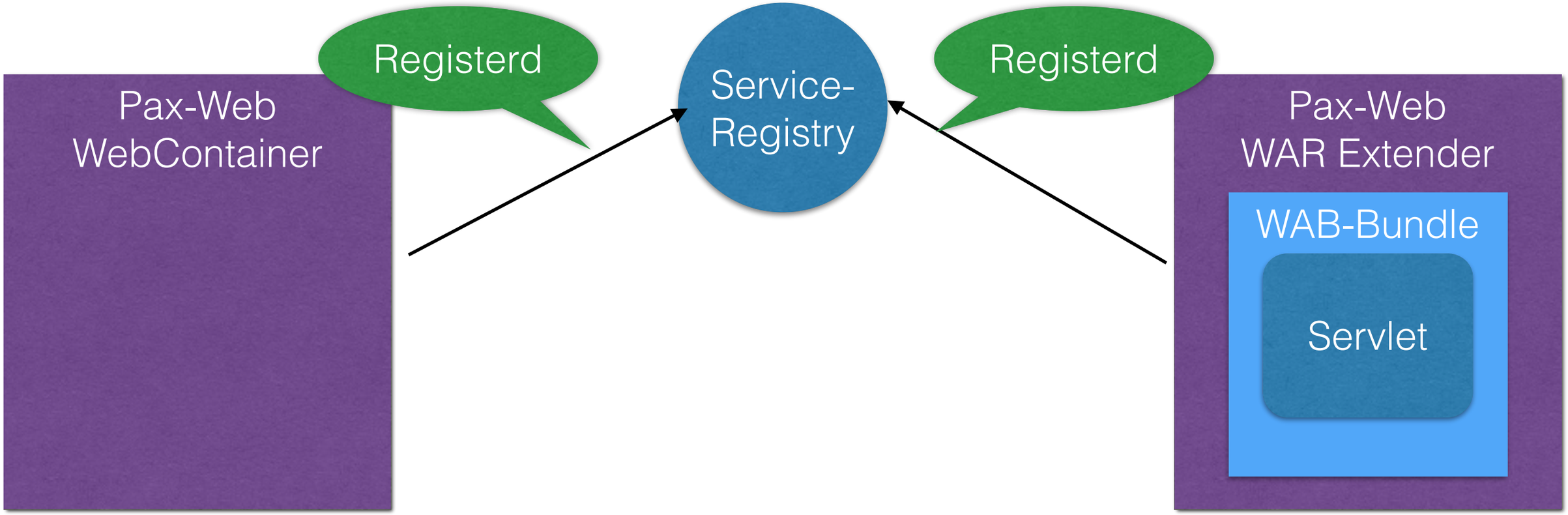
WAB-Bundle

Servlet

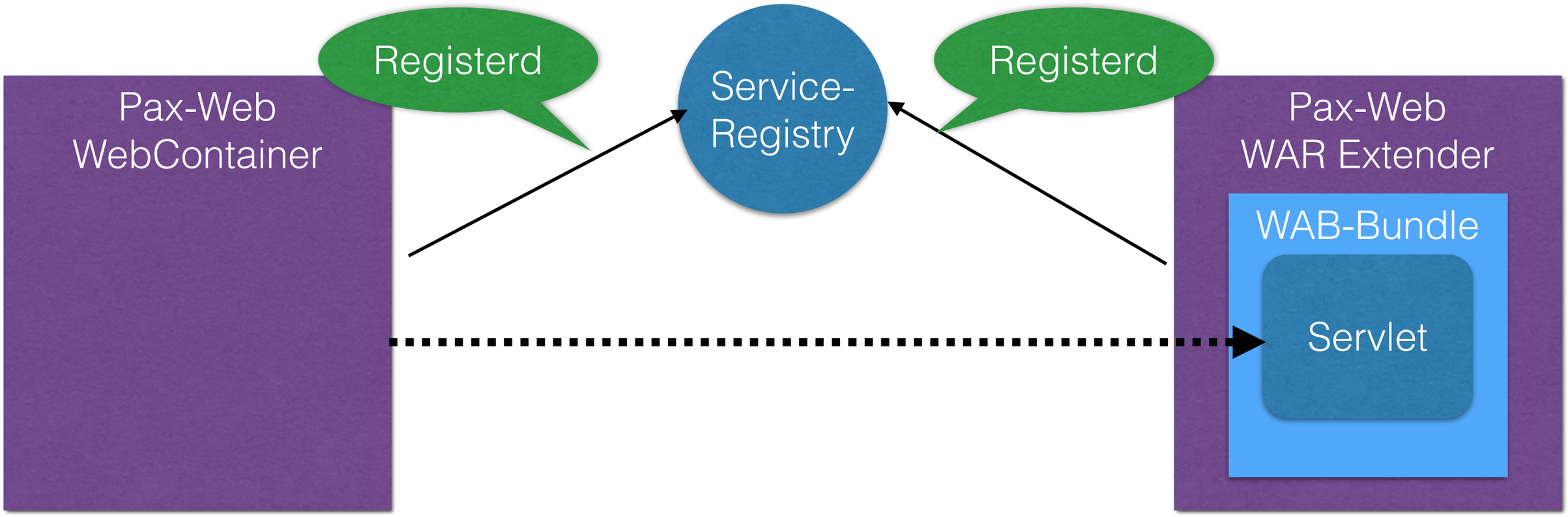
Registering - WAR



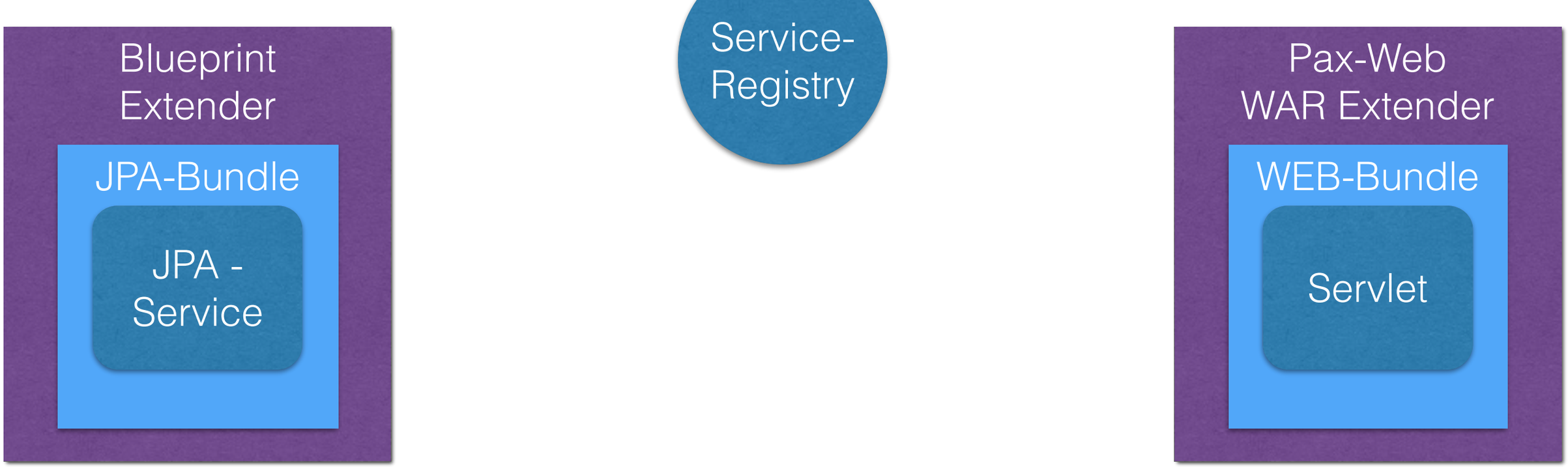
Registering - WAR



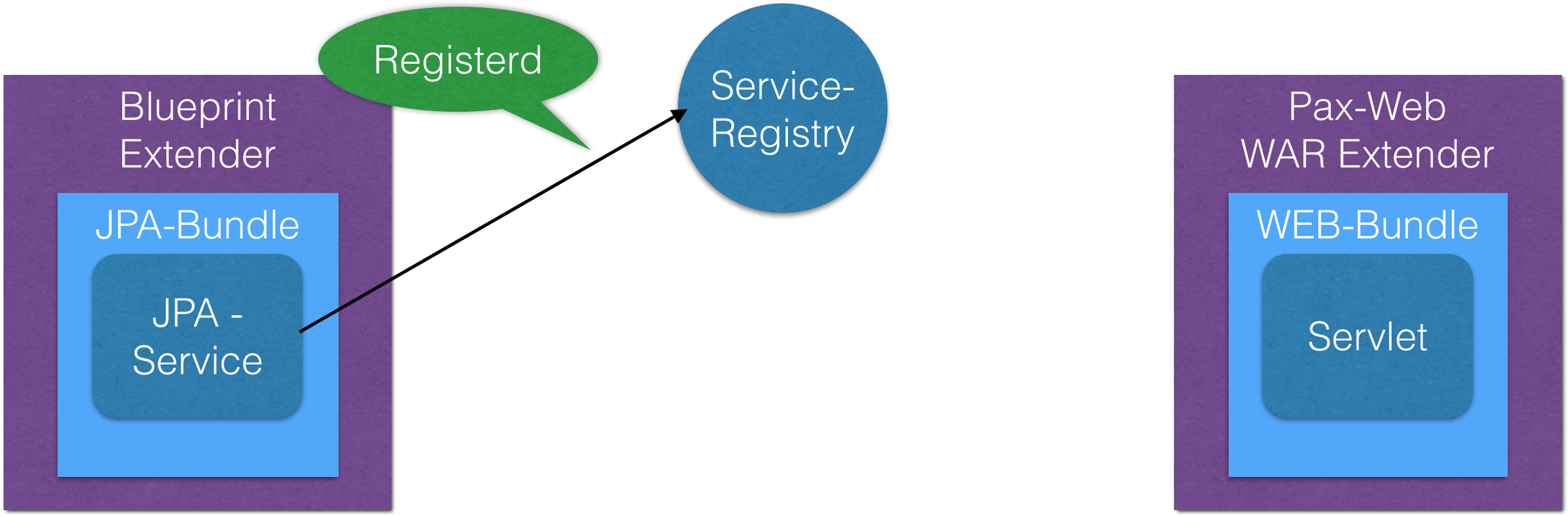
Registering - WAR



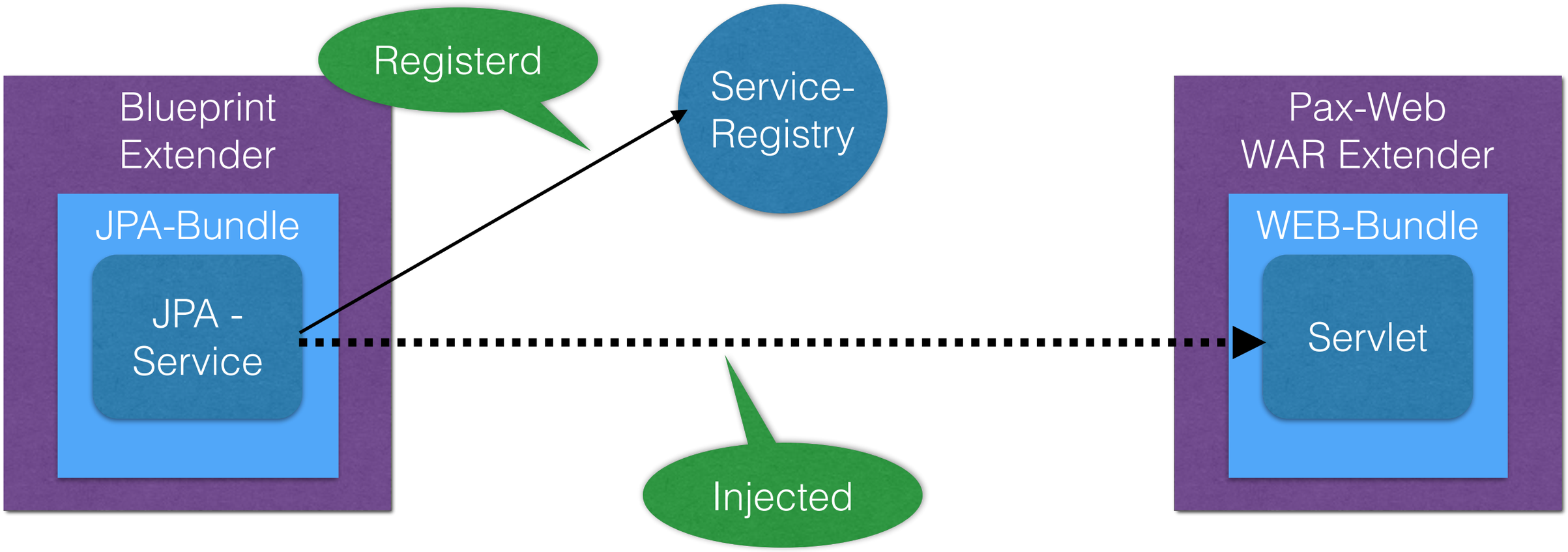
Servlet + JPA / Service



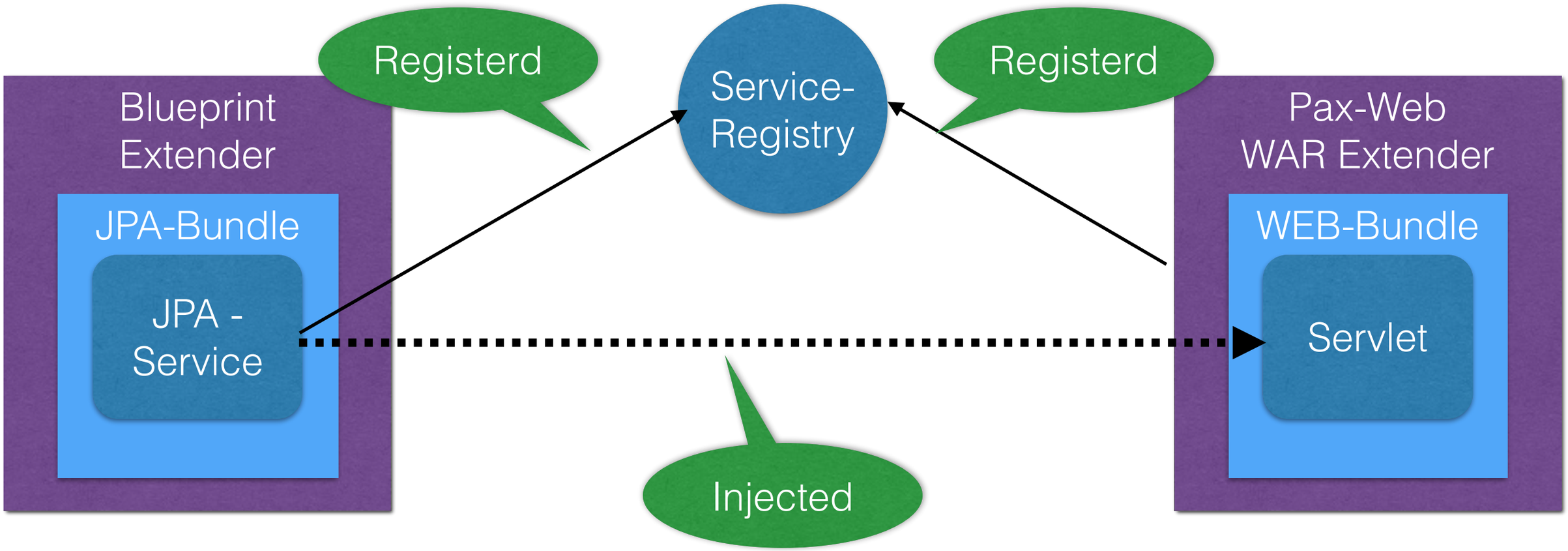
Servlet + JPA / Service



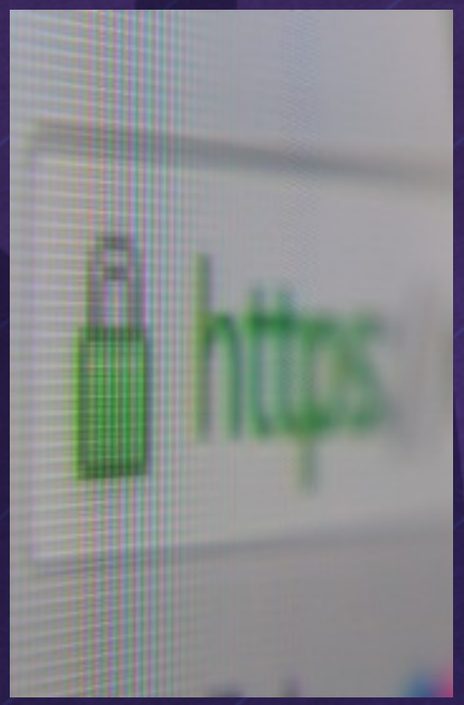
Servlet + JPA / Service



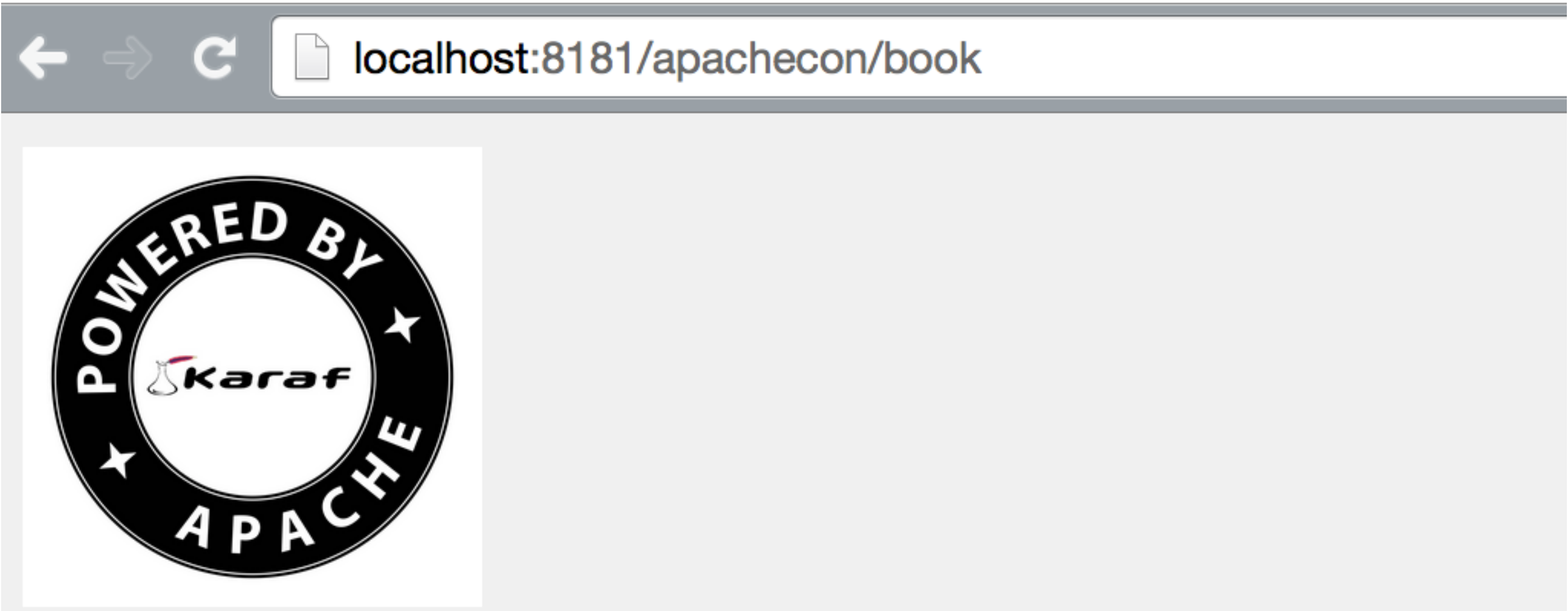
Servlet + JPA / Service



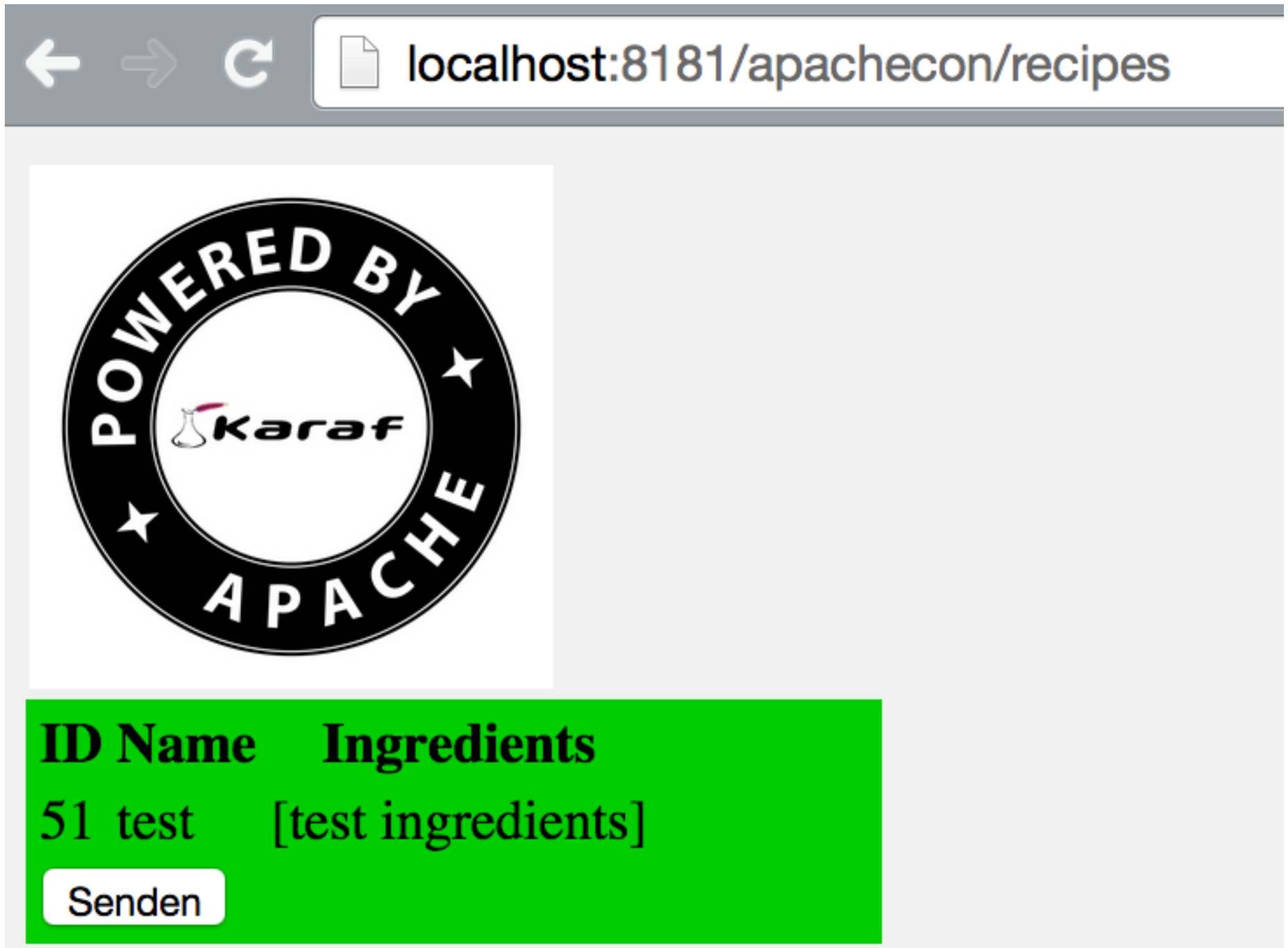
Demo



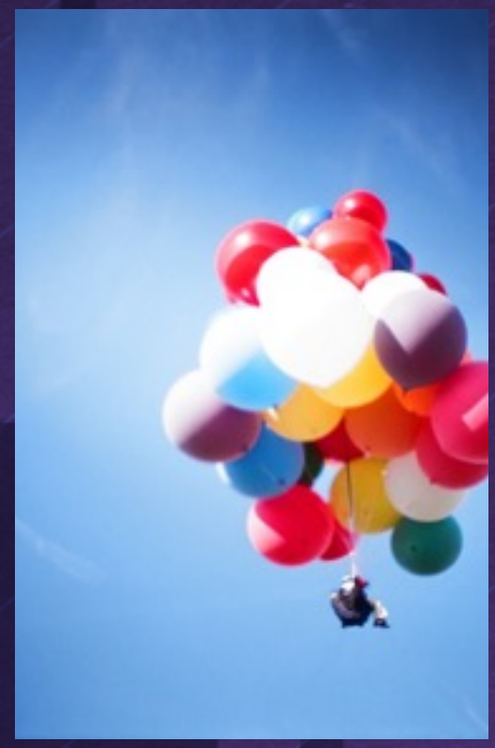
View


localhost:8181/apachecon/book
POWERED BY
karaf
APACHE
Select ID Name ISBN
101 Apache Karaf Cookbook 978-1783985081
1 test null
Senden

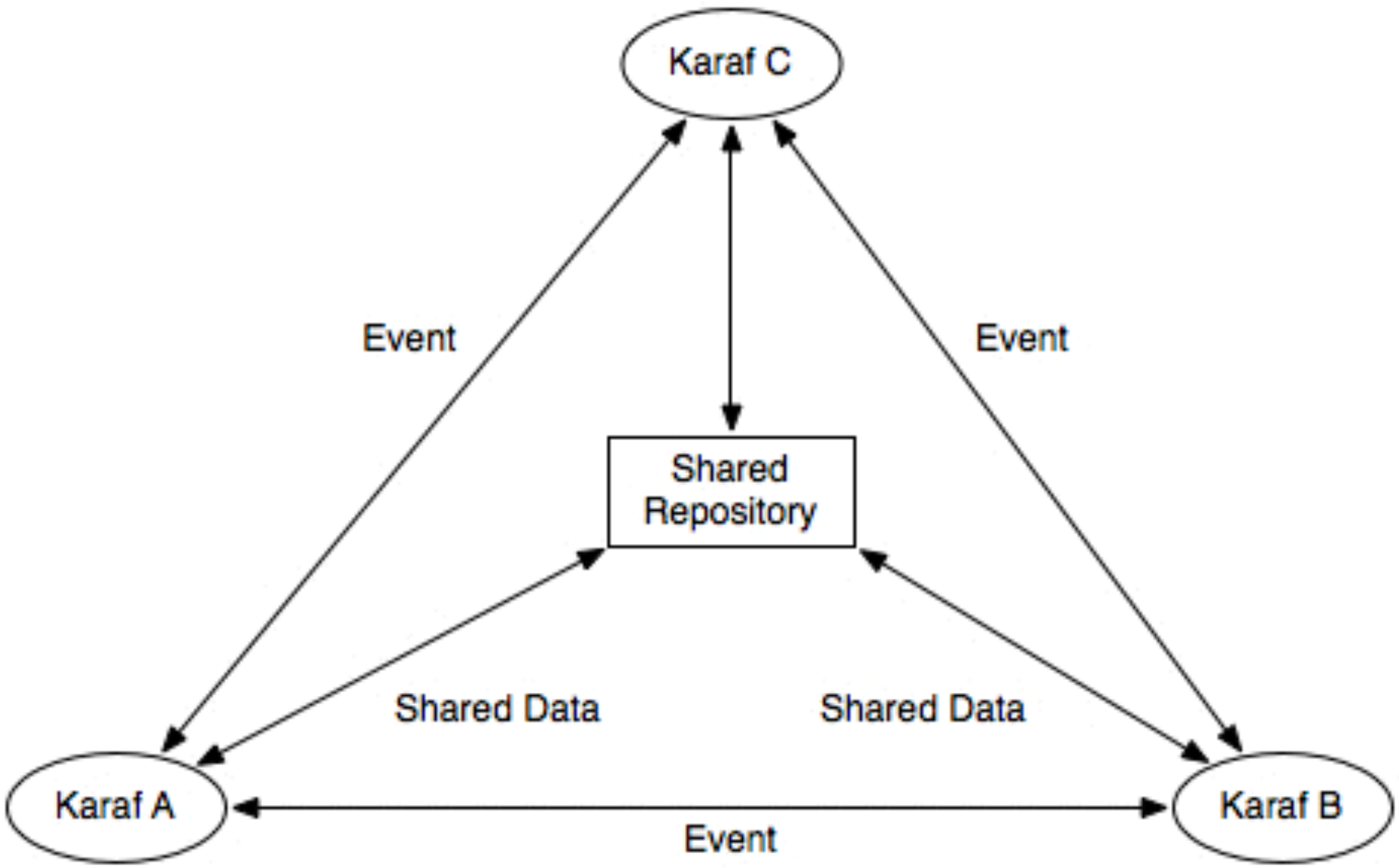
View


localhost:8181/apachecon/recipes
POWERED BY
karaf
APACHE
ID Name Ingredients
51 test [test ingredients]
Senden

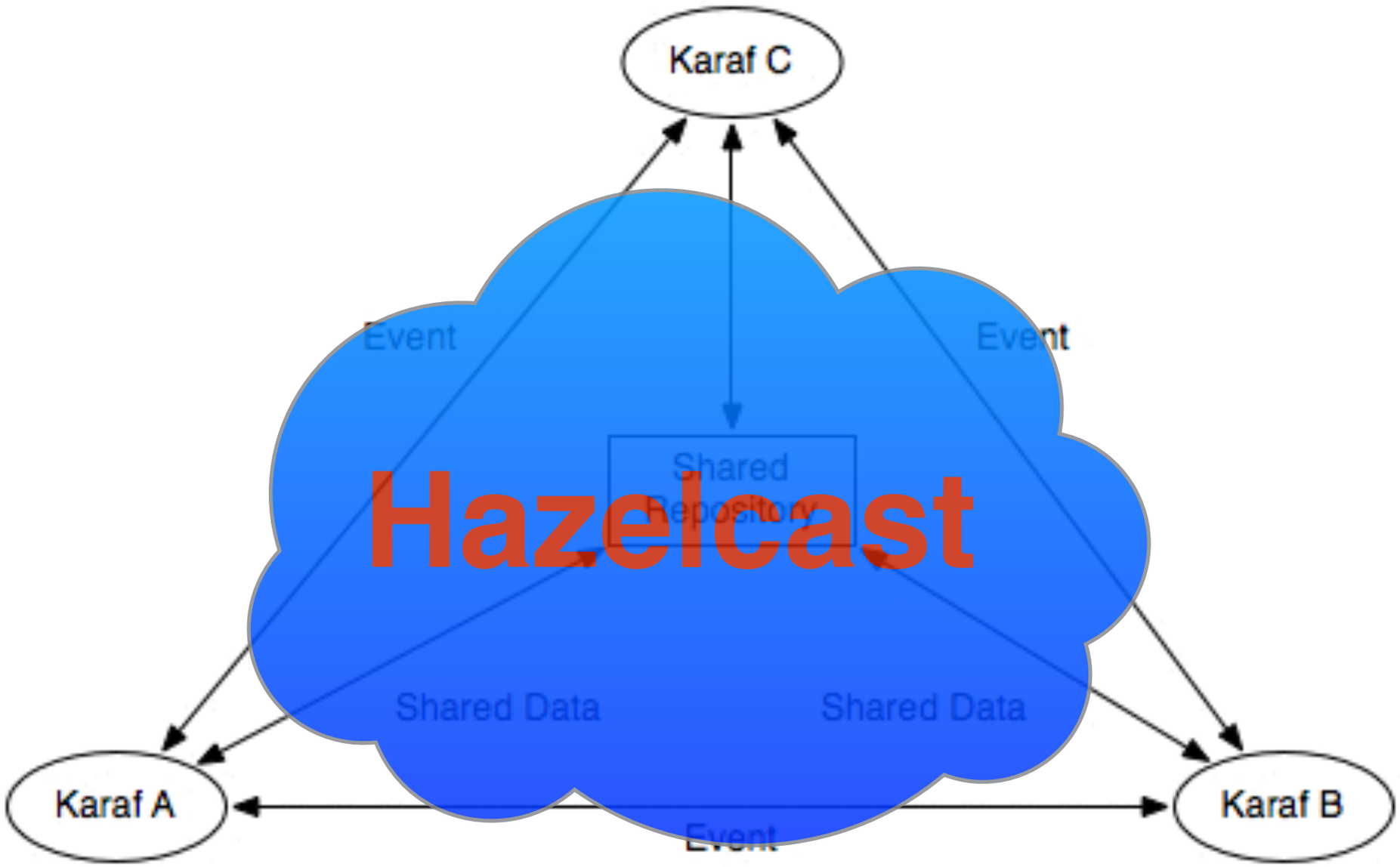
Cluster
provided by Apache Karaf Cellar



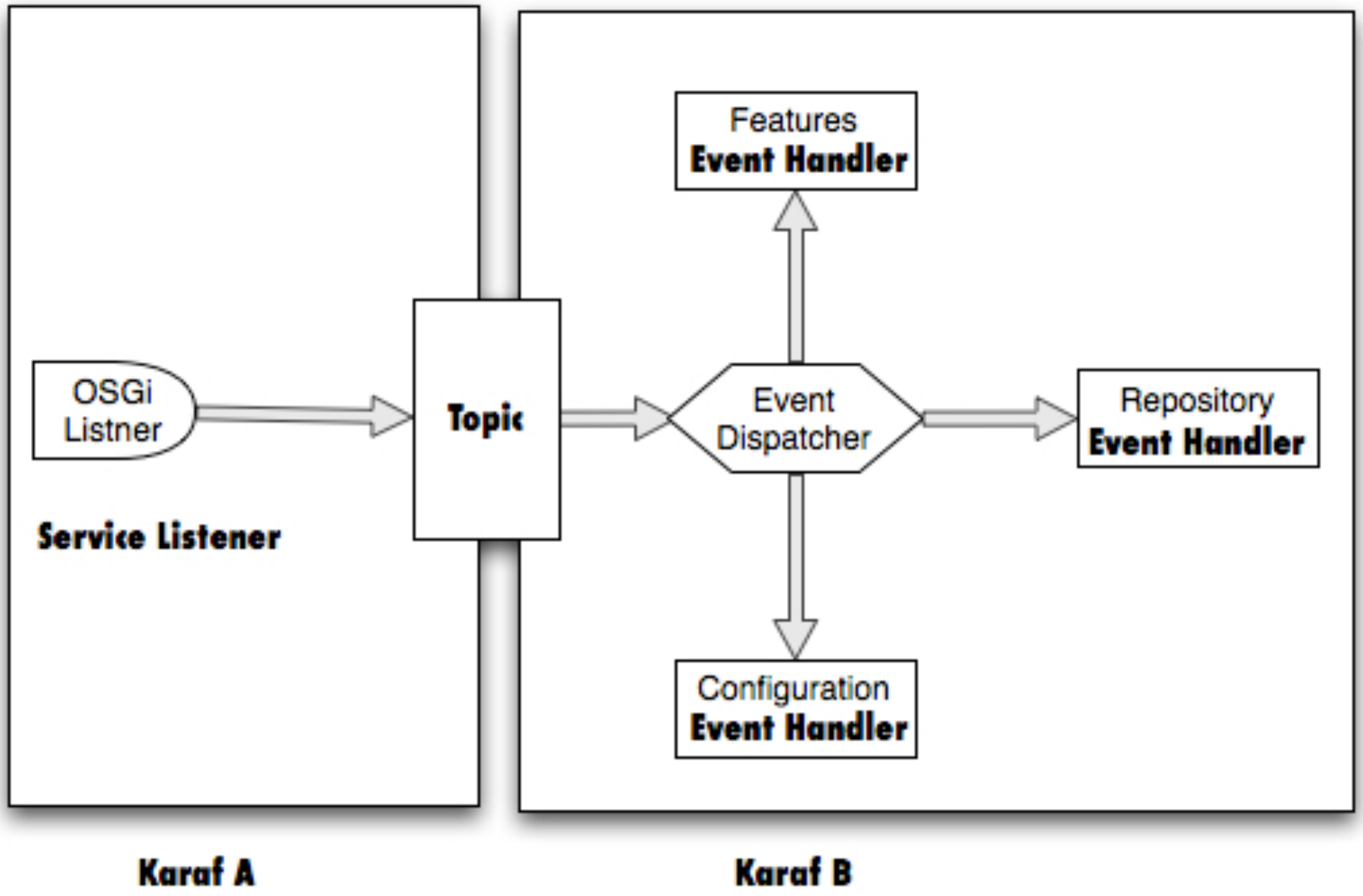
Cellar - Cluster Communication



Cellar - Cluster Communication



Cellar - Events



Cellar - Distributing Bundles

Node A

Node B

Node C

Maven Repository

Hazelcast

Cellar - Distributing Bundles

osgi:install mvn:groupId/artifactId/version

Node A

Node B

Node C

Maven Repository

Hazelcast

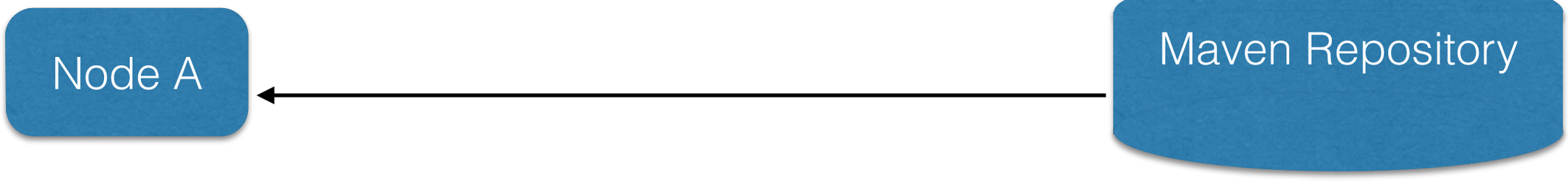
Cellar - Distributing Bundles

Node B

Hazelcast

Node C

Cellar - Distributing Bundles

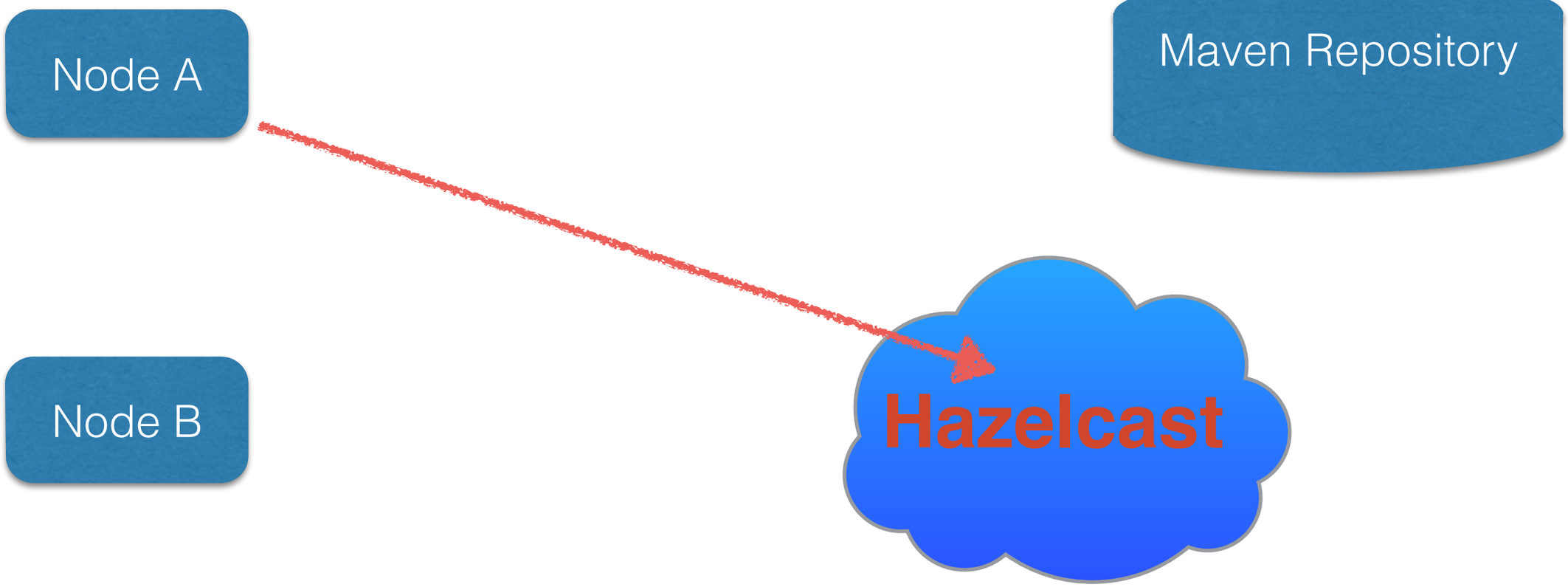


Node B

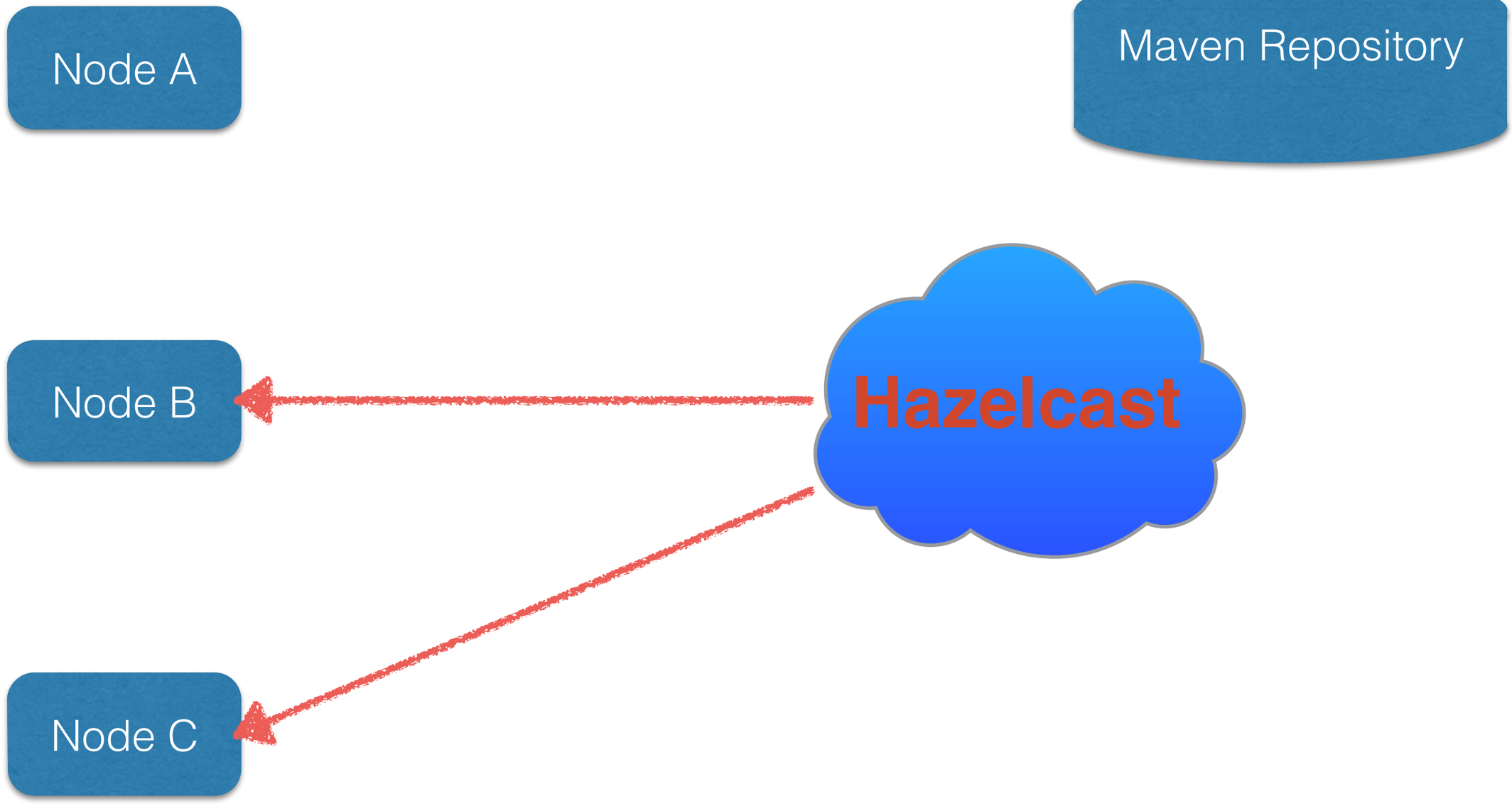
Hazelcast

Node C

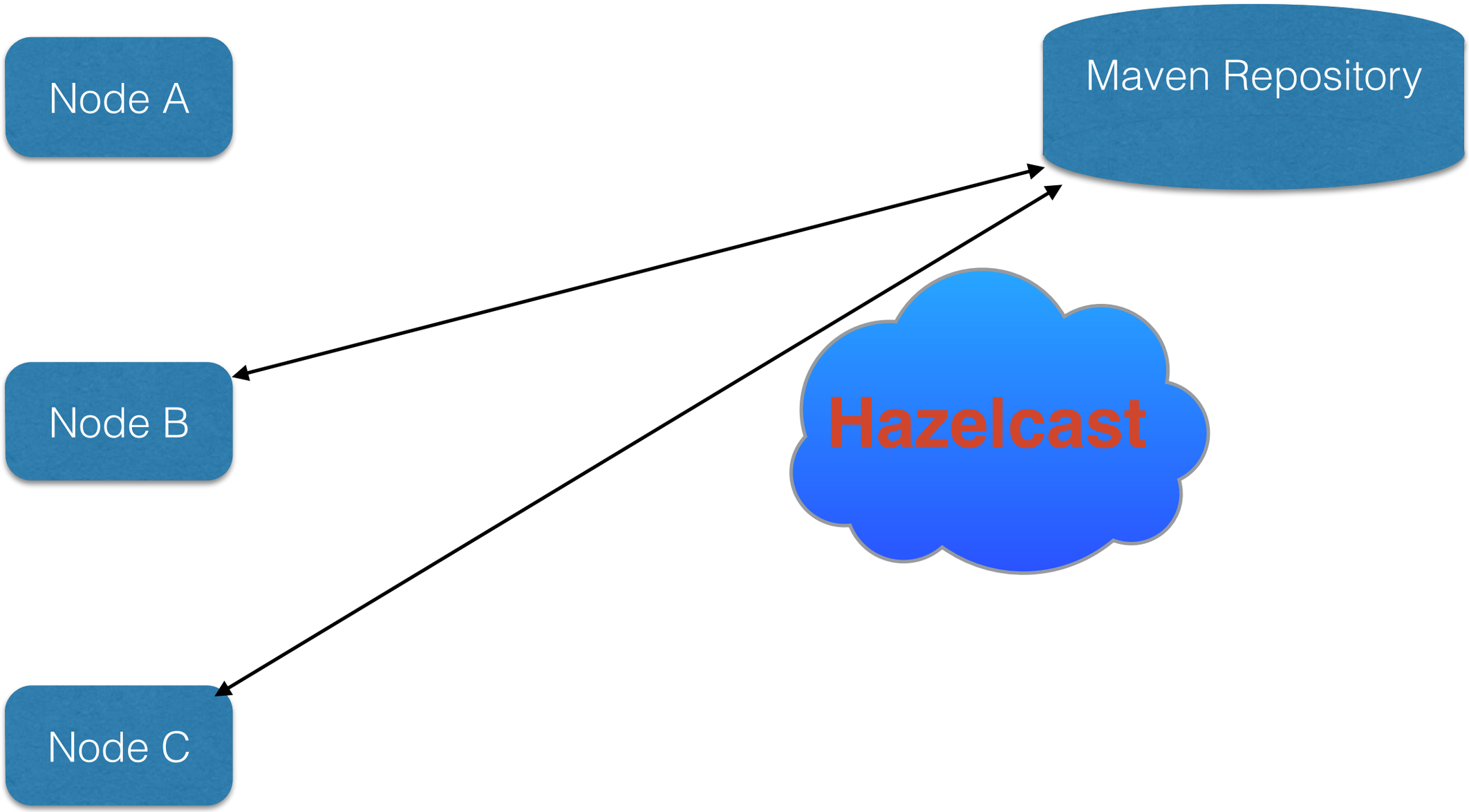
Cellar - Distributing Bundles



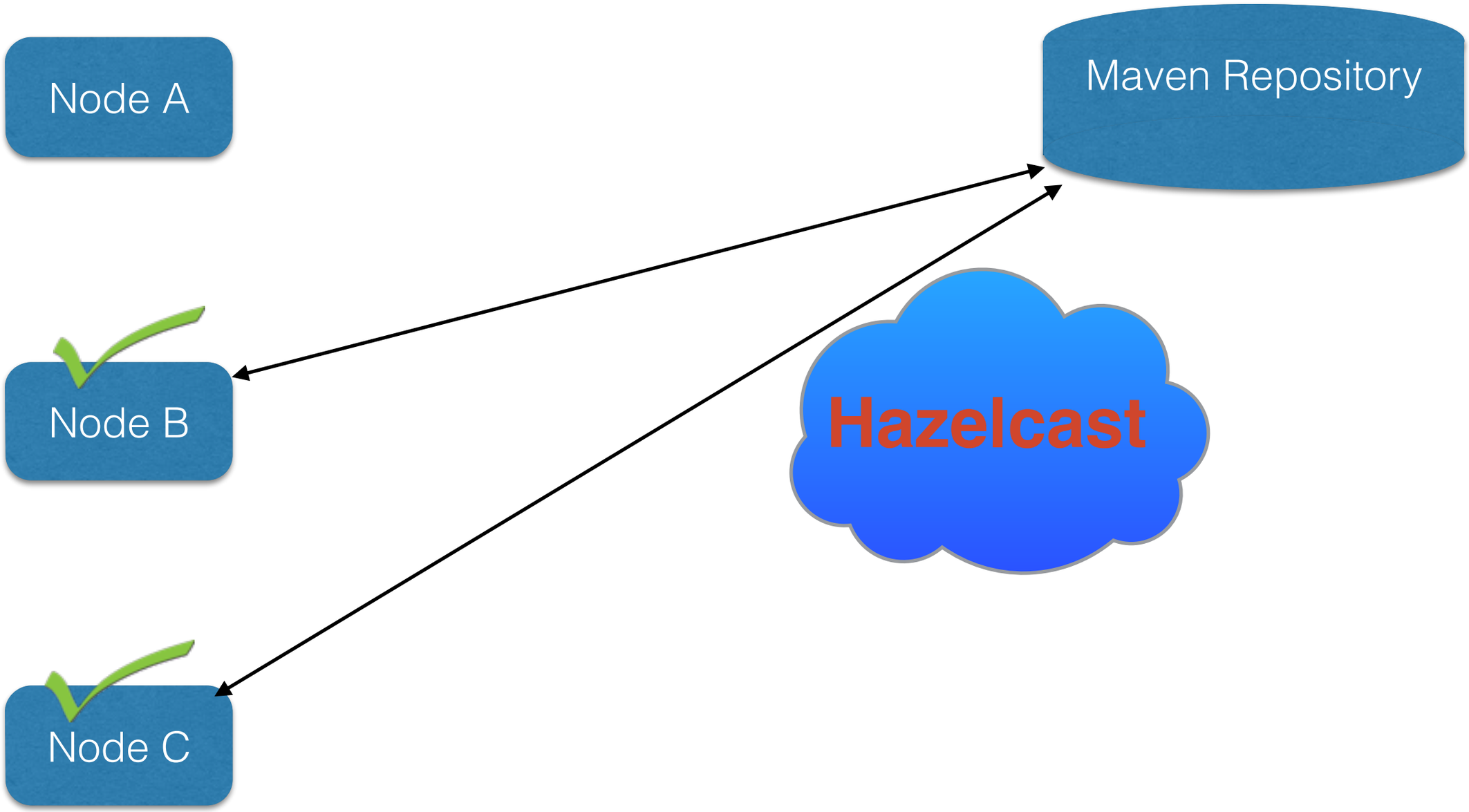
Cellar - Distributing Bundles



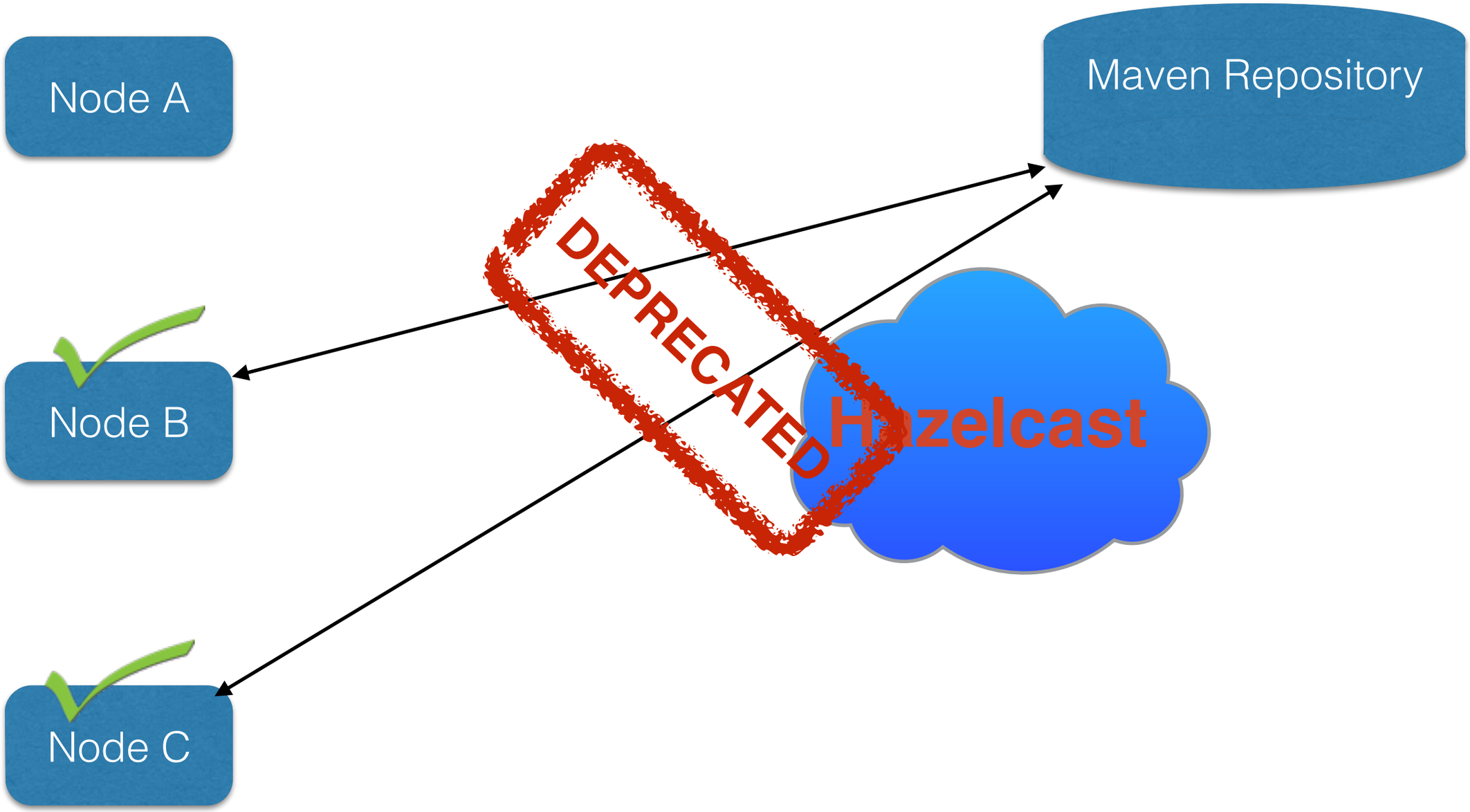
Cellar - Distributing Bundles



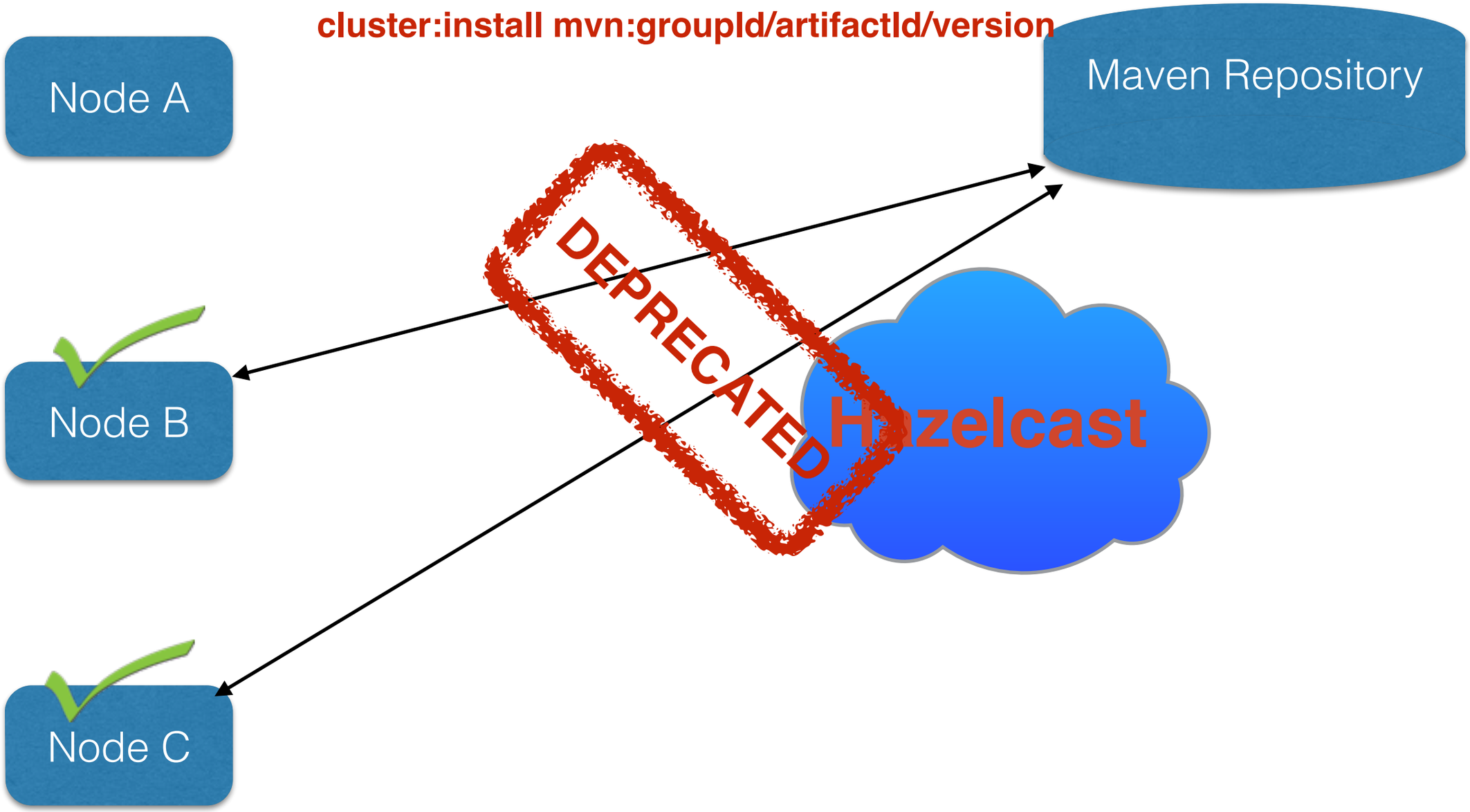
Cellar - Distributing Bundles



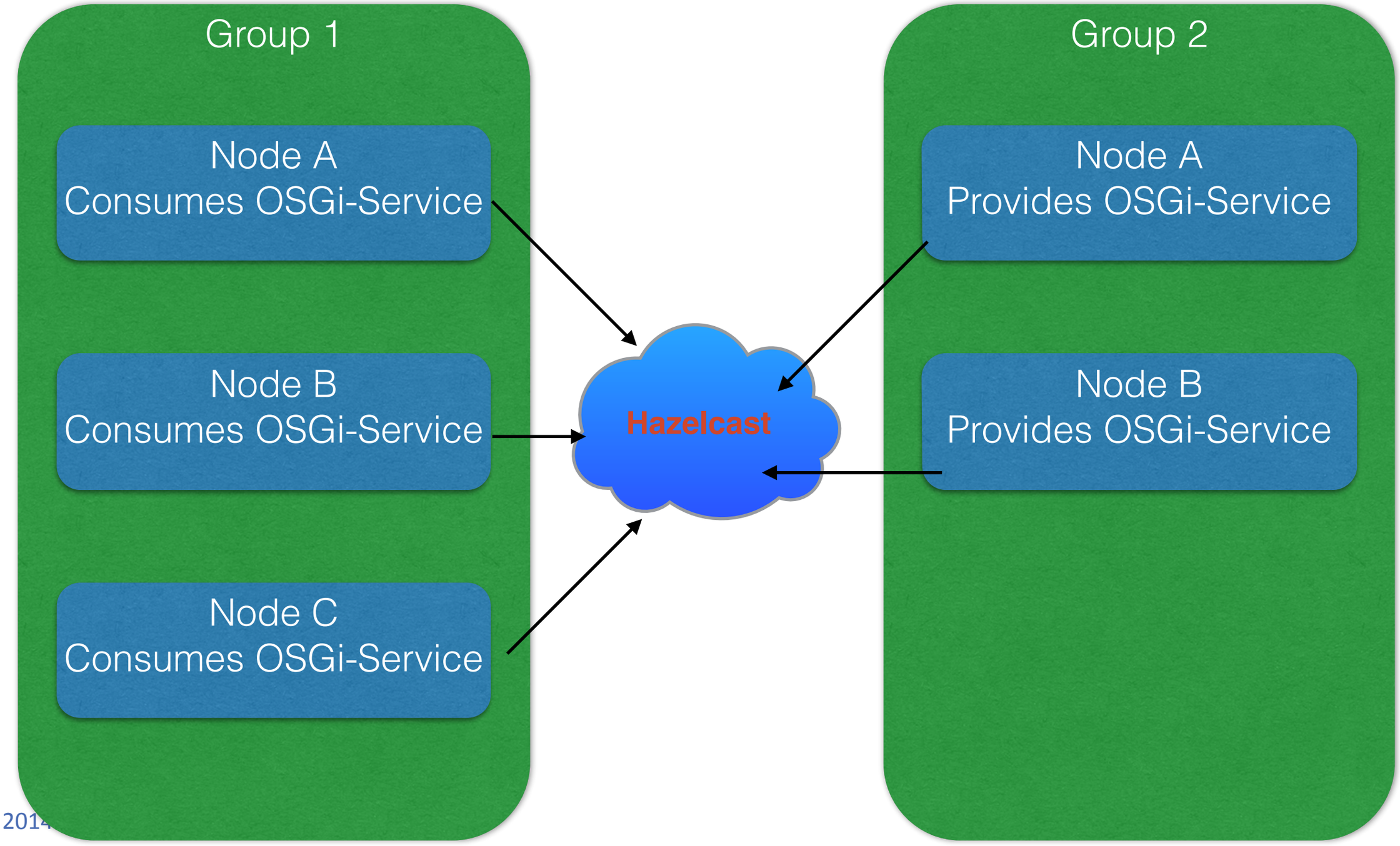
Cellar - Distributing Bundles



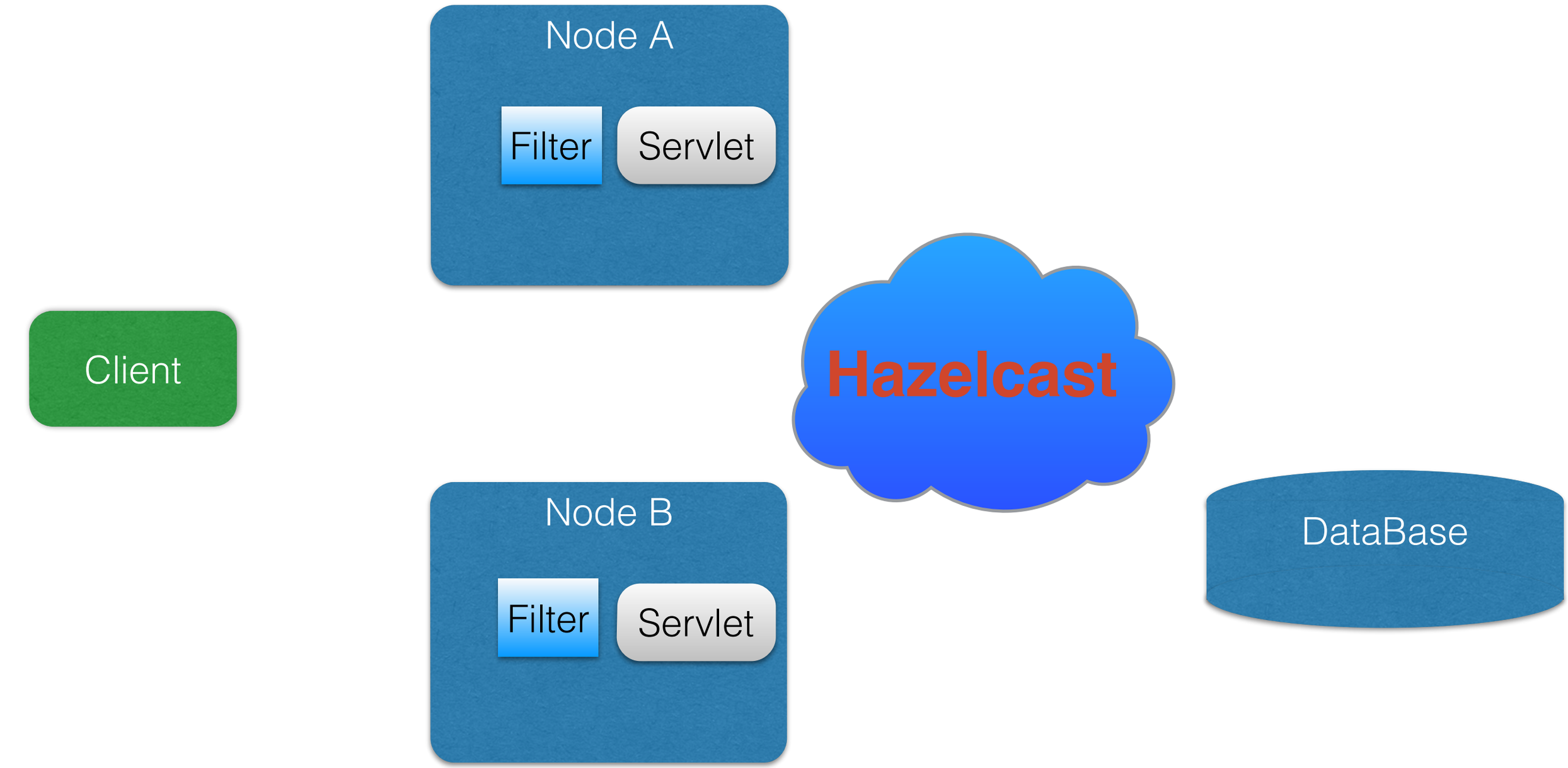
Cellar - Distributing Bundles



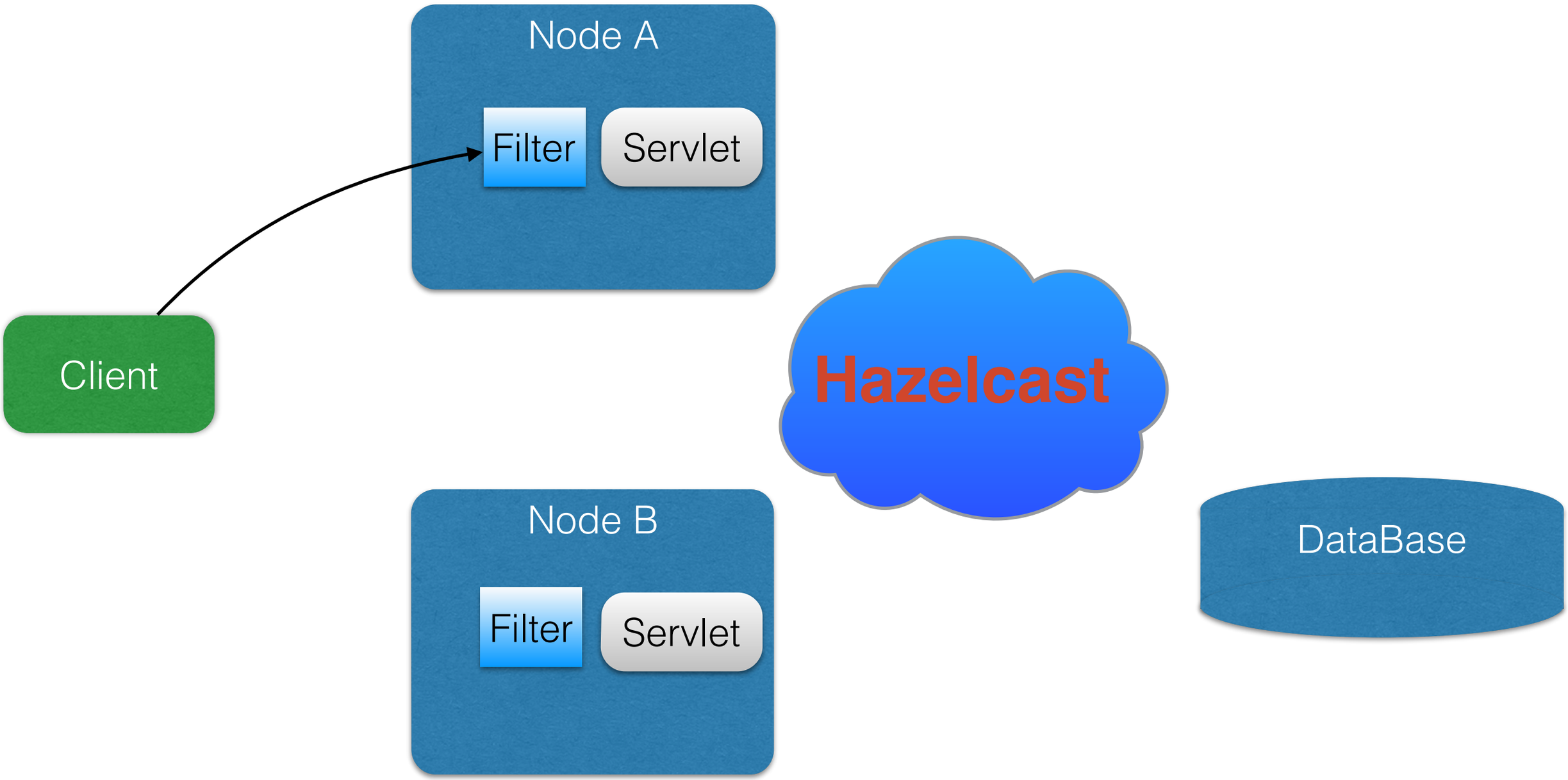
Cellar - RMI


Group 1
Node A
Consumes OSGi-Service
Node B
Consumes OSGi-Service
Node C
Consumes OSGi-Service
Hazelcast
Group 2
Node A
Provides OSGi-Service
Node B
Provides OSGi-Service

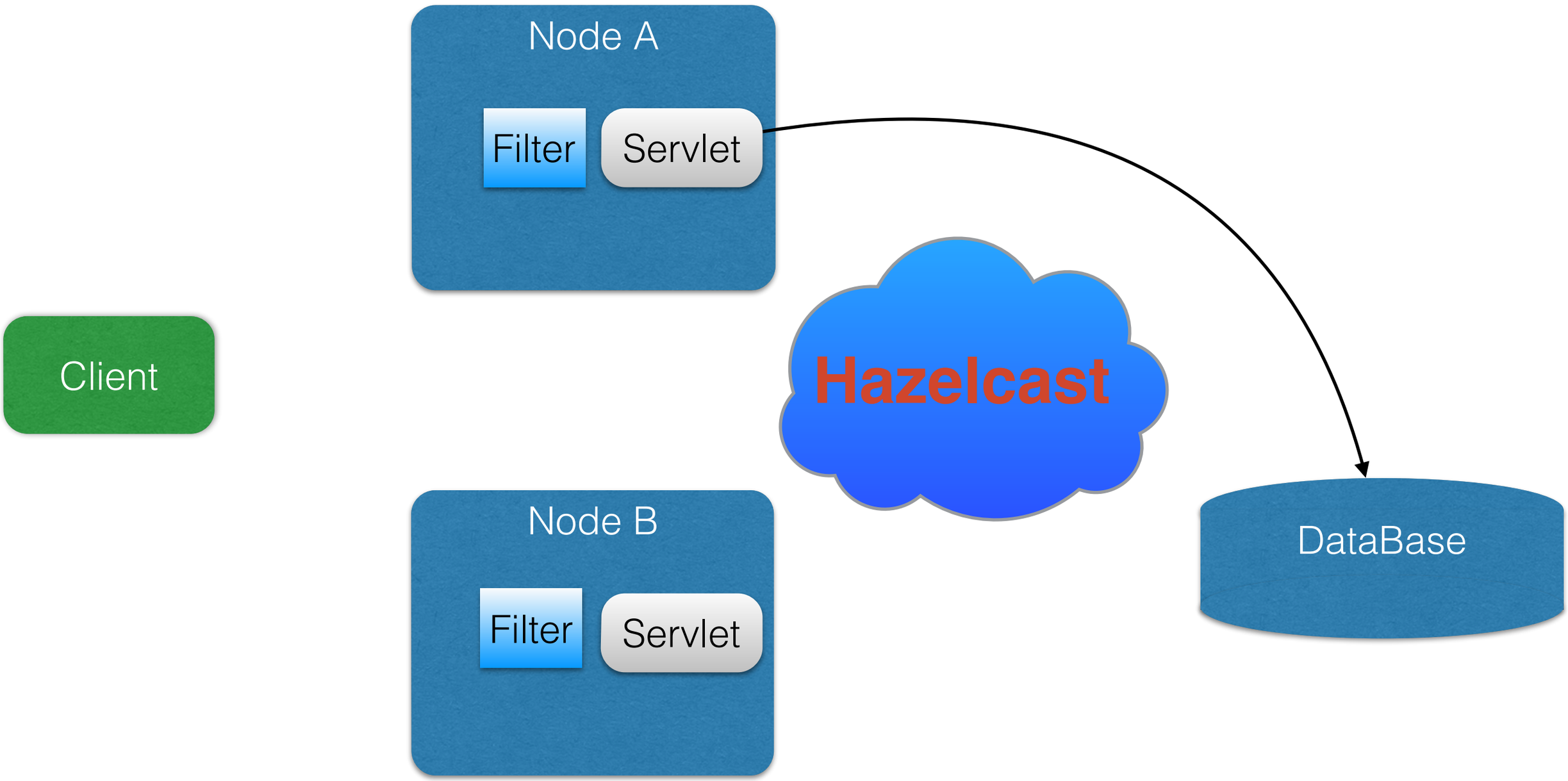
Cellar - Web session failover



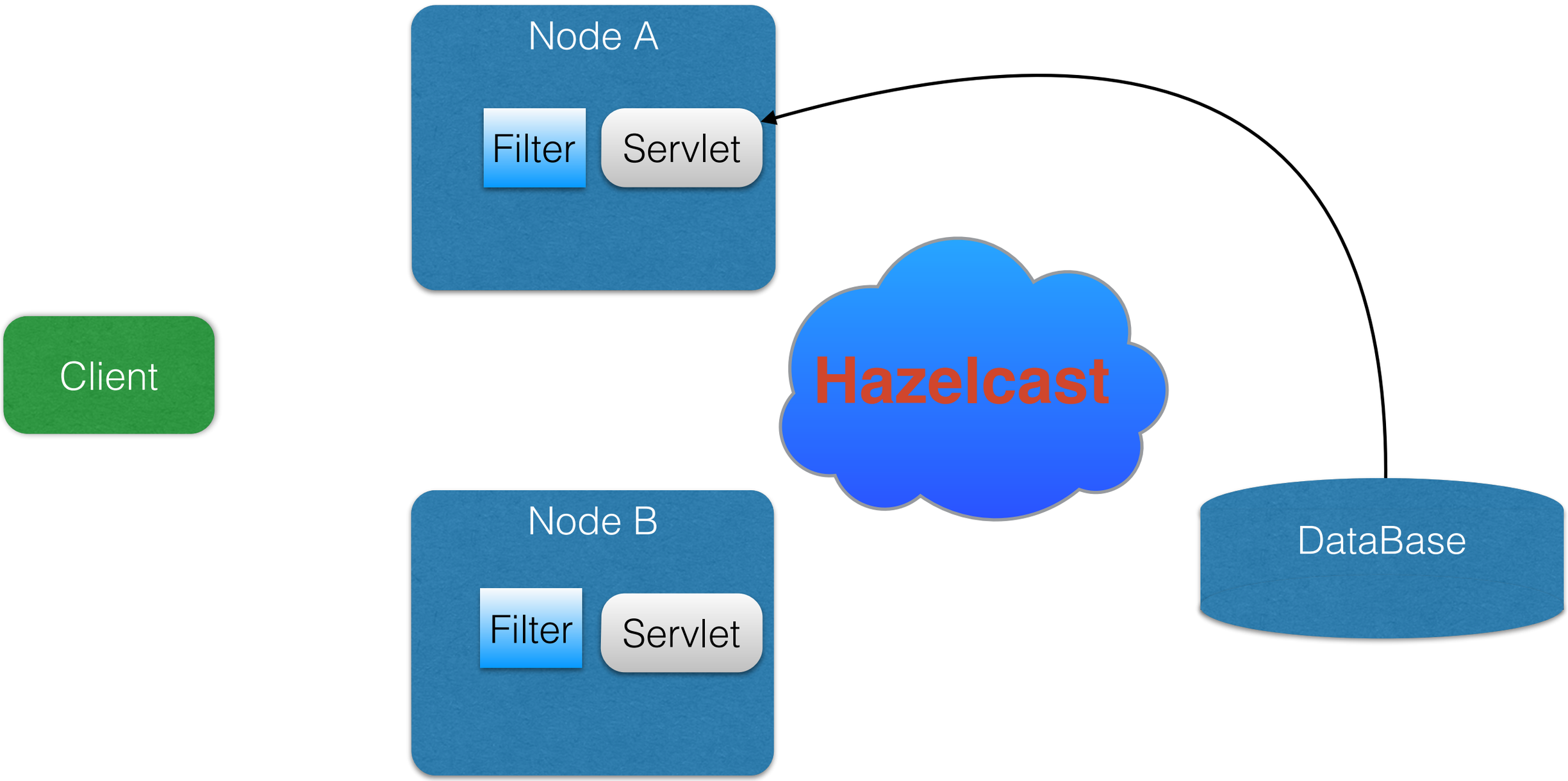
Cellar - Web session failover



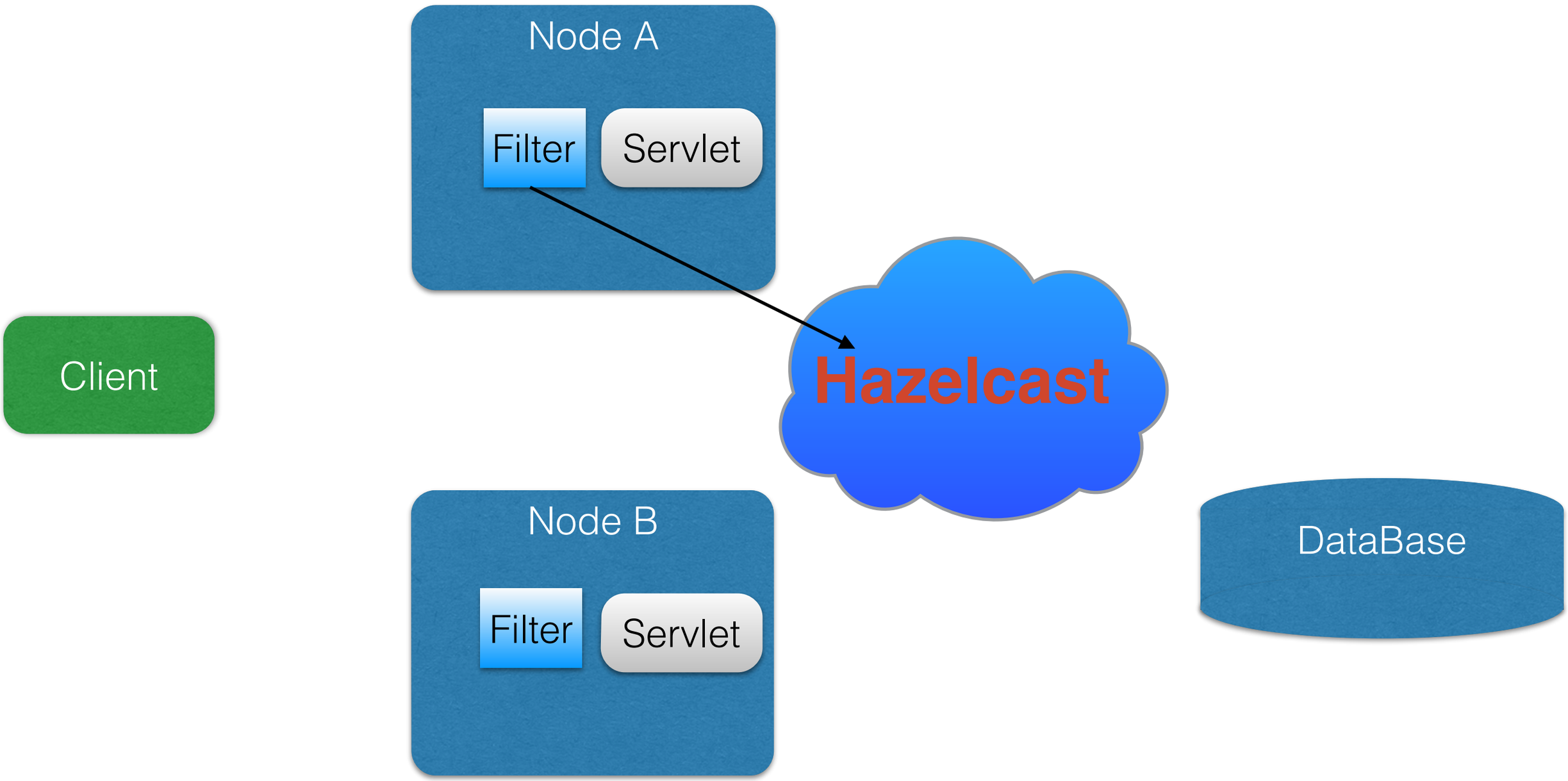
Cellar - Web session failover



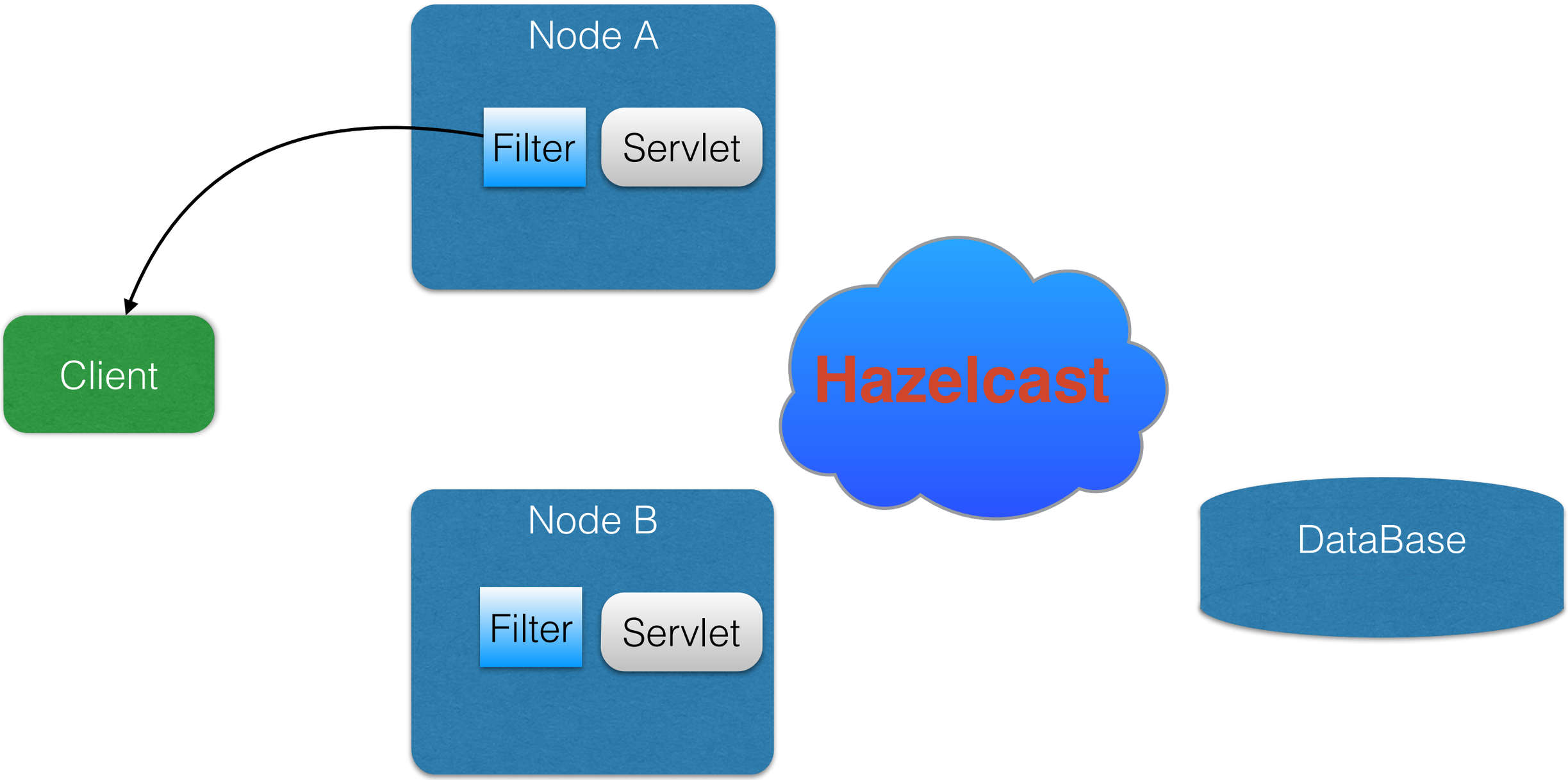
Cellar - Web session failover



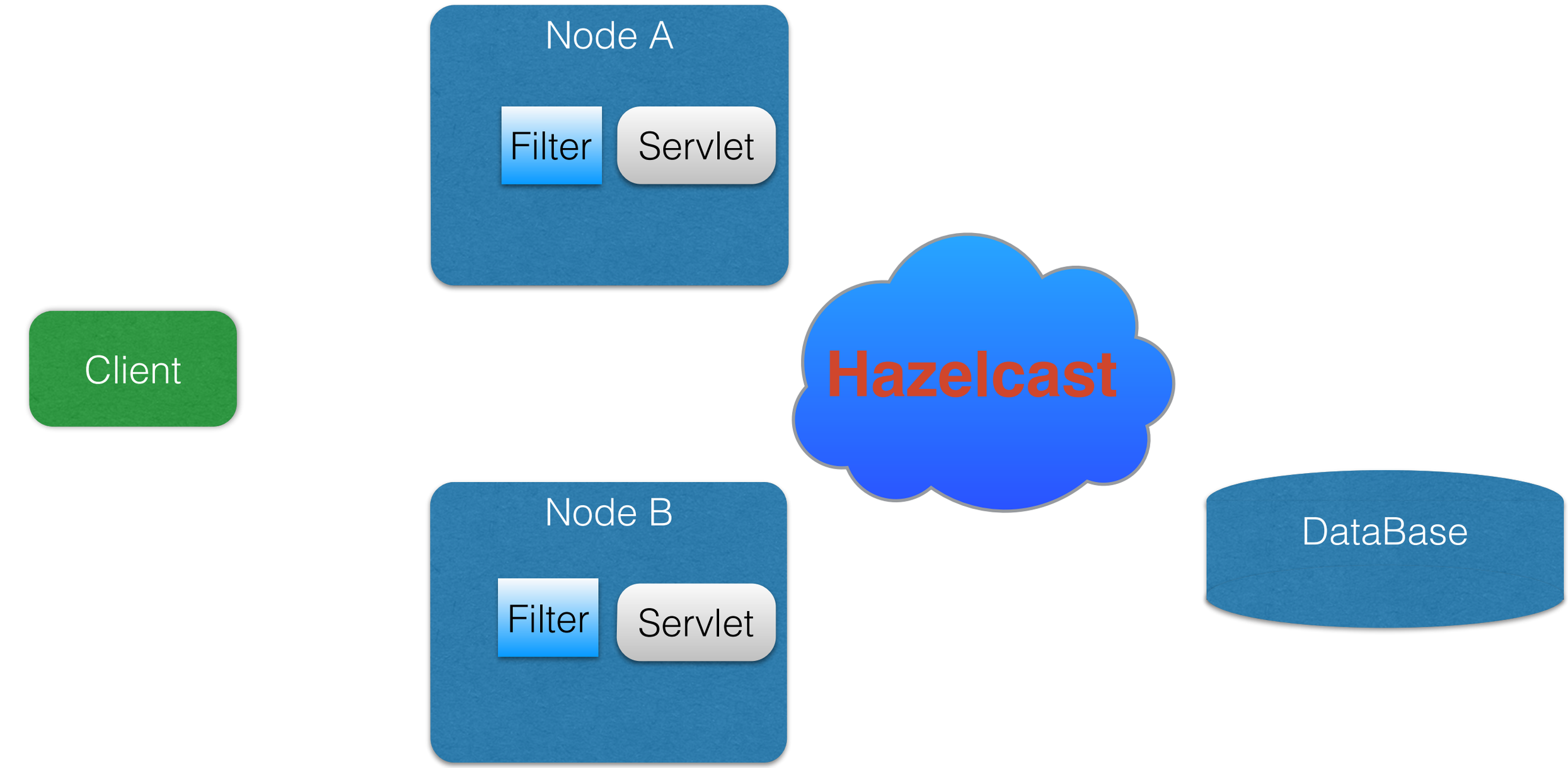
Cellar - Web session failover



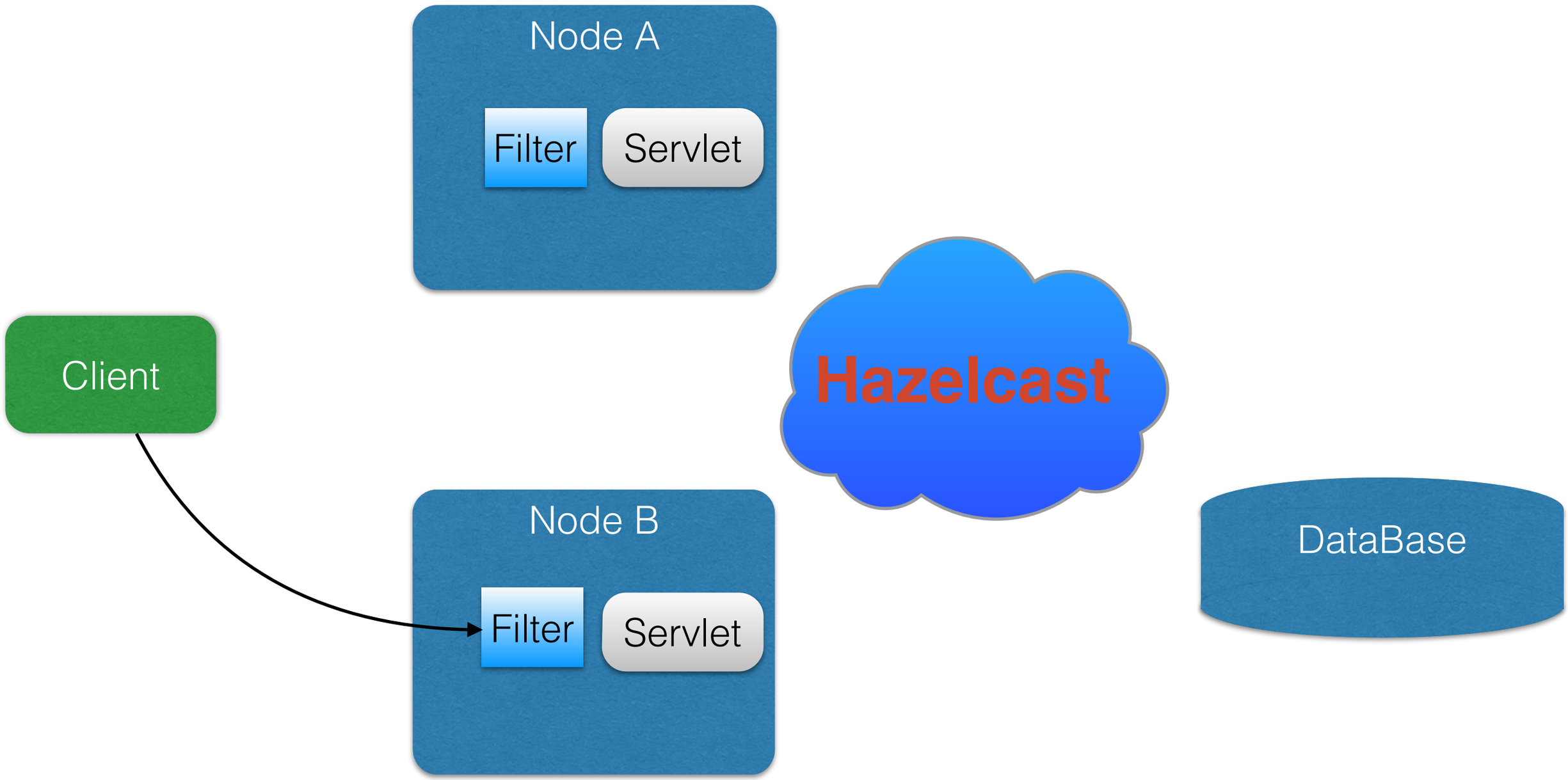
Cellar - Web session failover



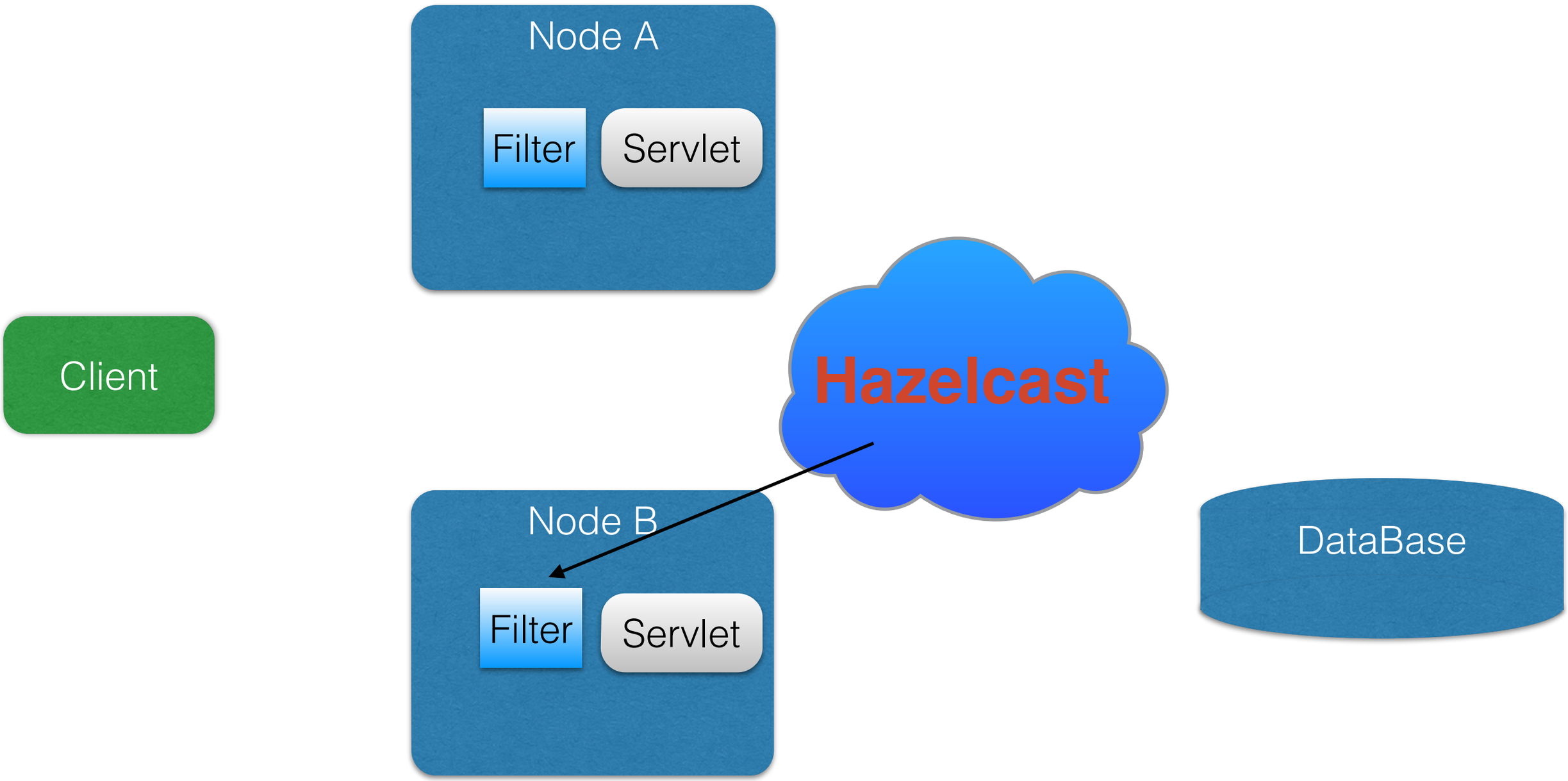
Cellar - Web session failover



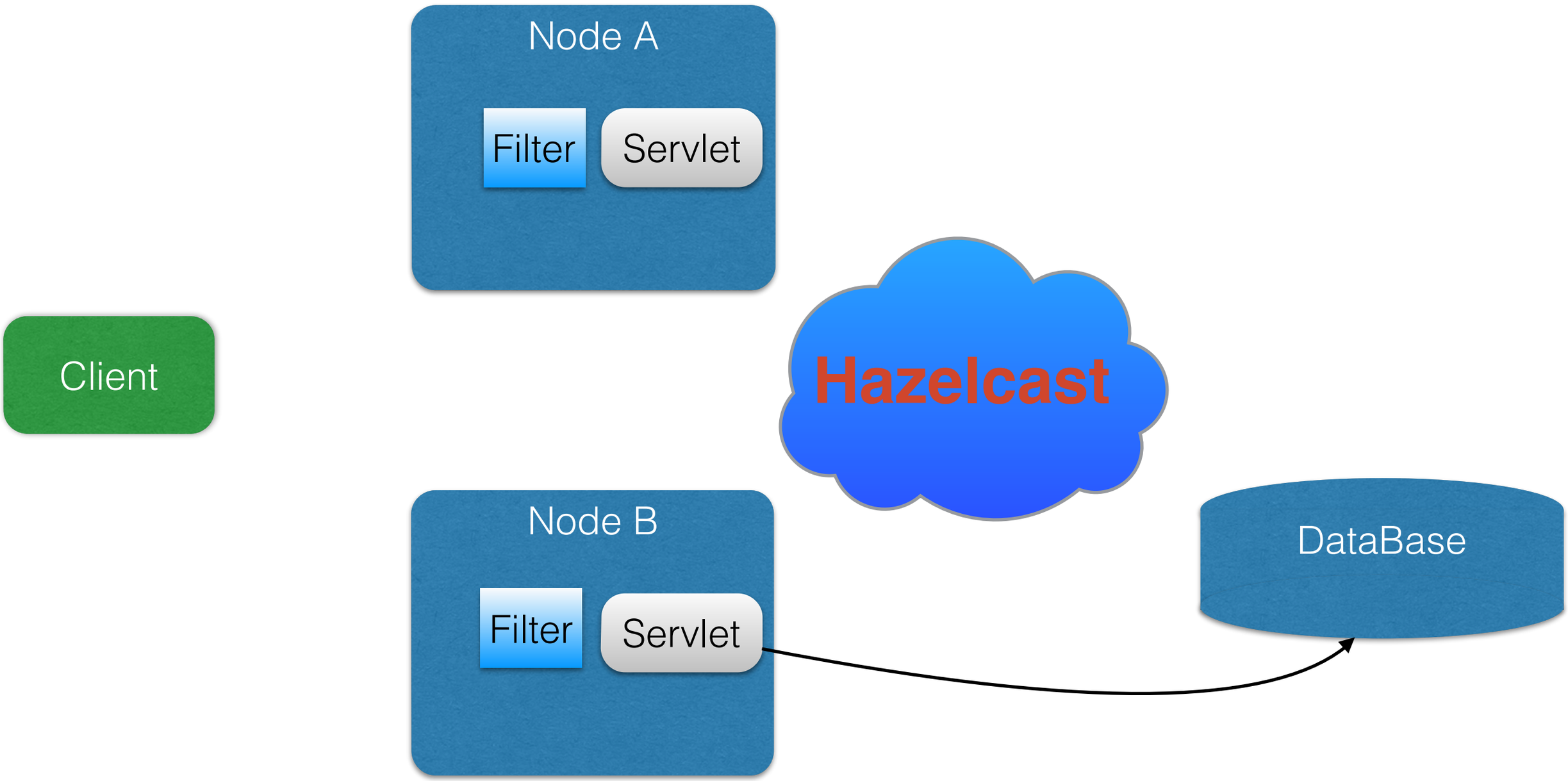
Cellar - Web session failover



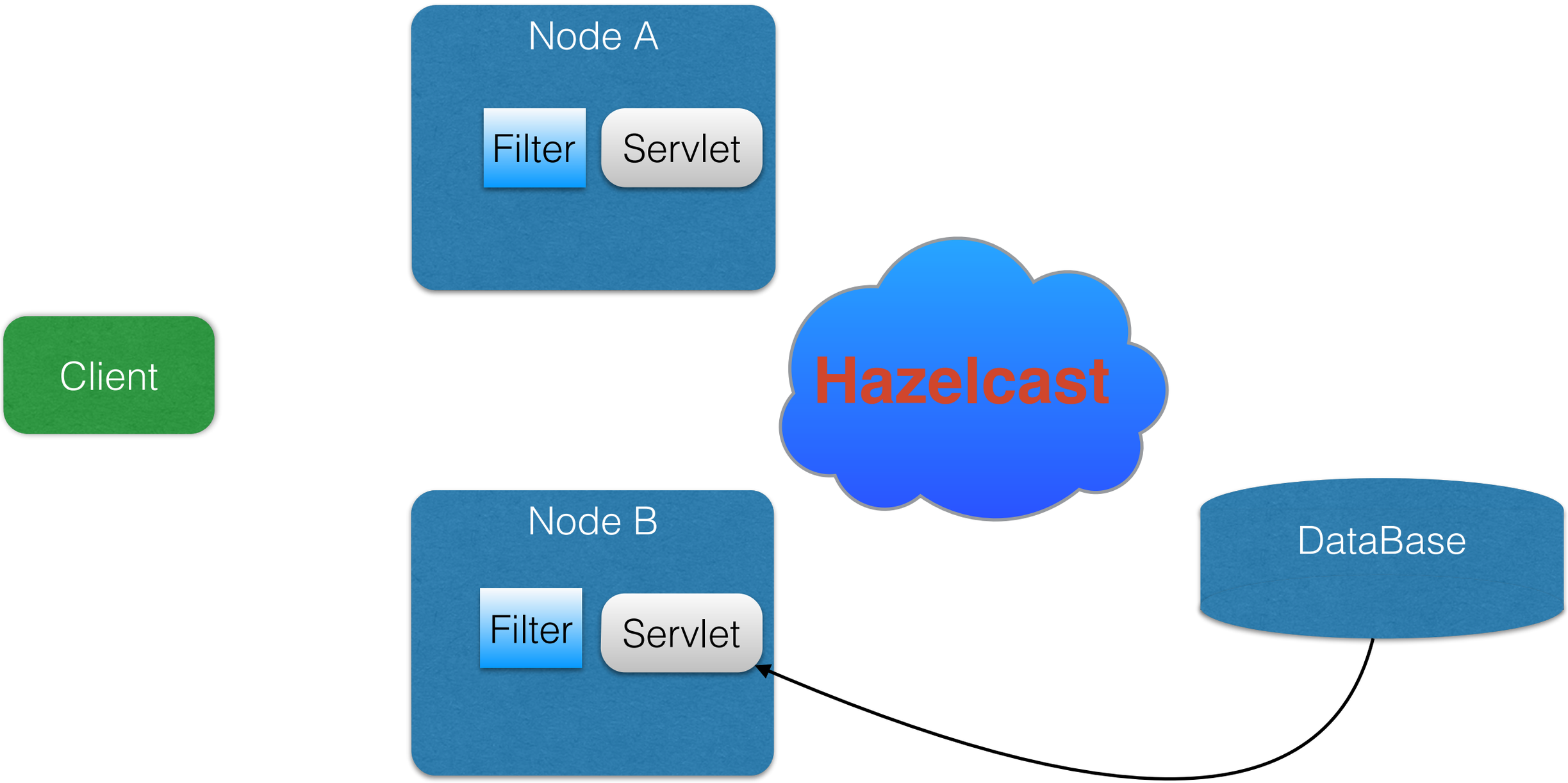
Cellar - Web session failover



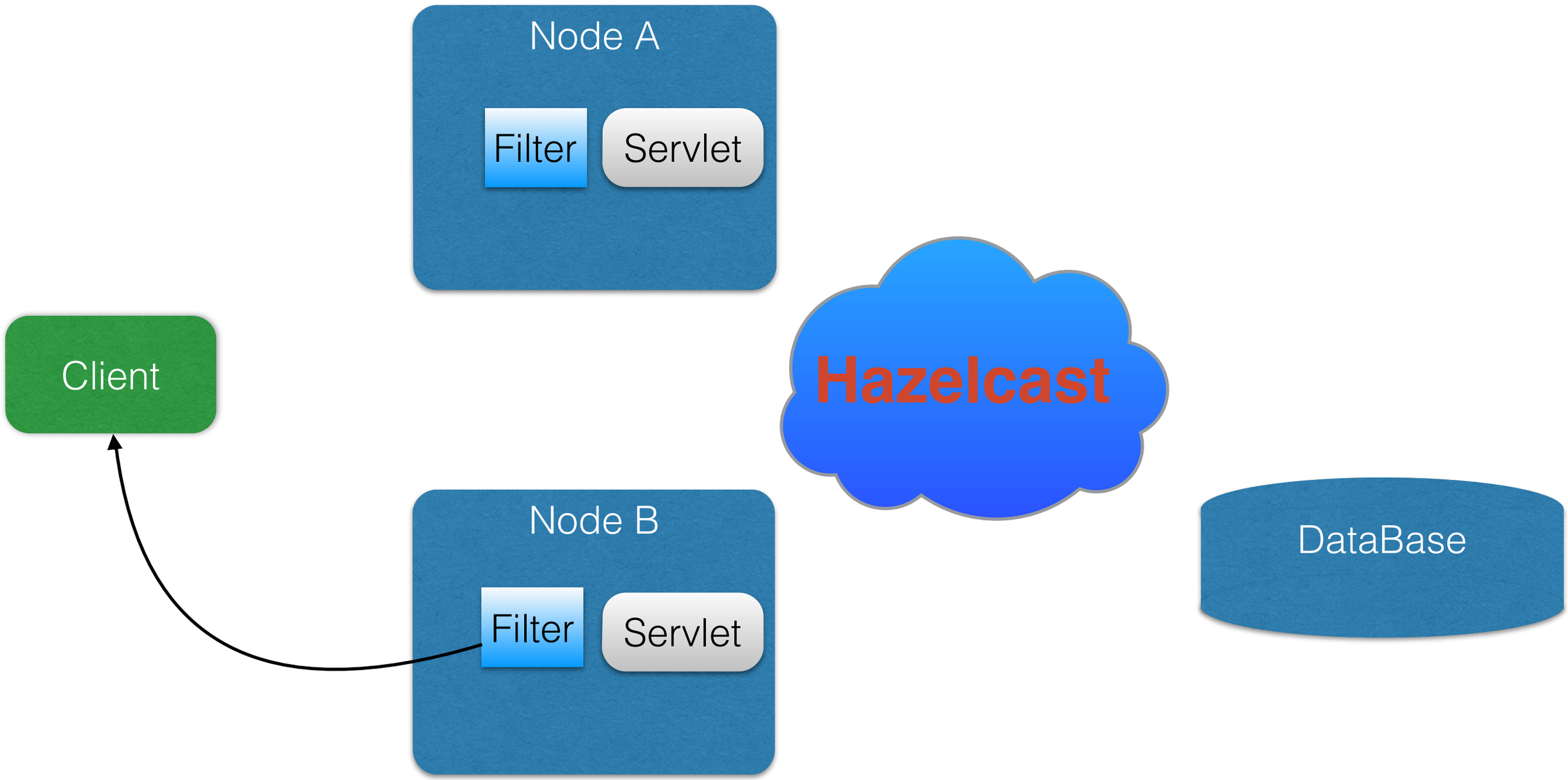
Cellar - Web session failover



Cellar - Web session failover



Cellar - Web session failover



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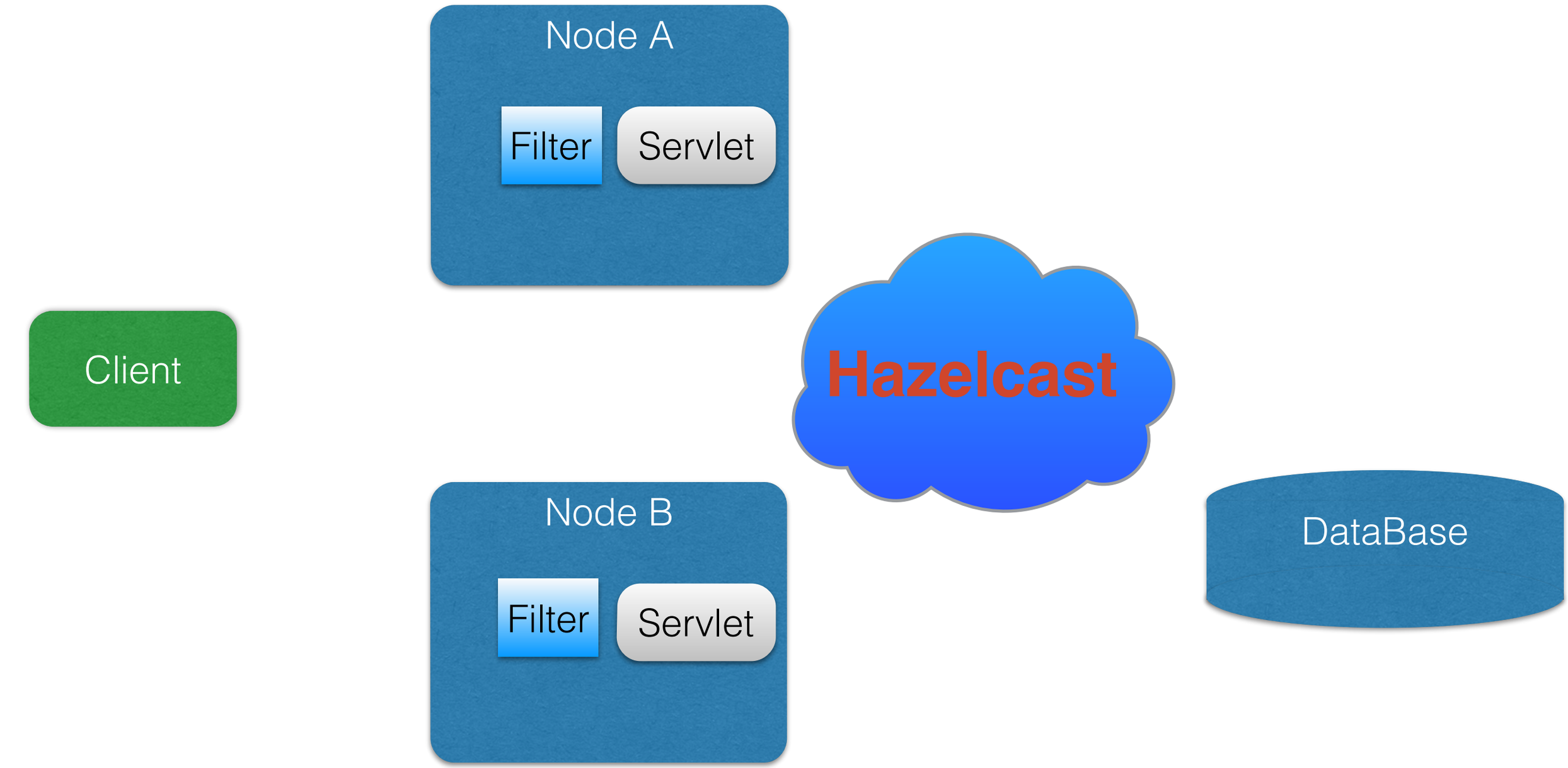
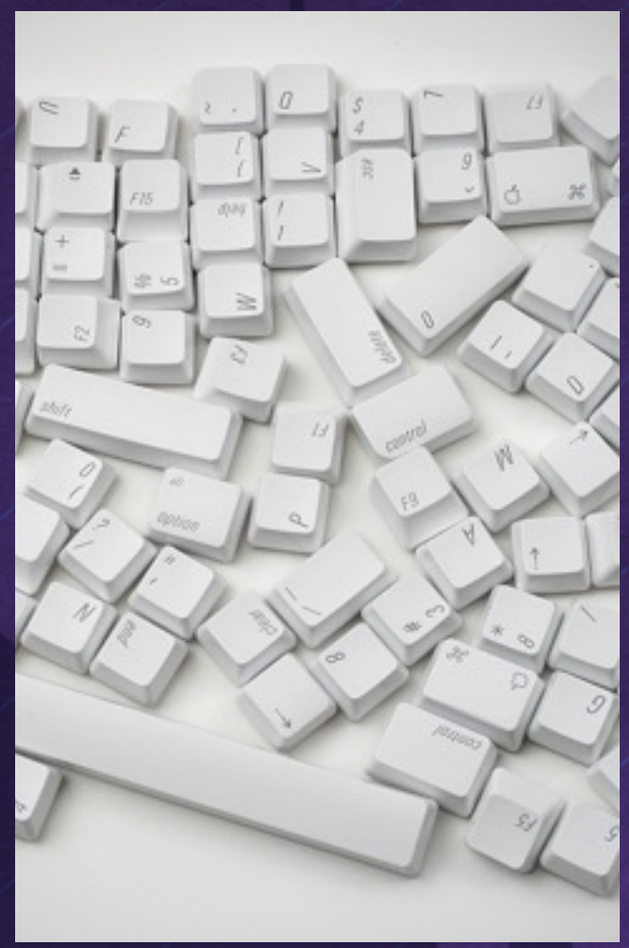
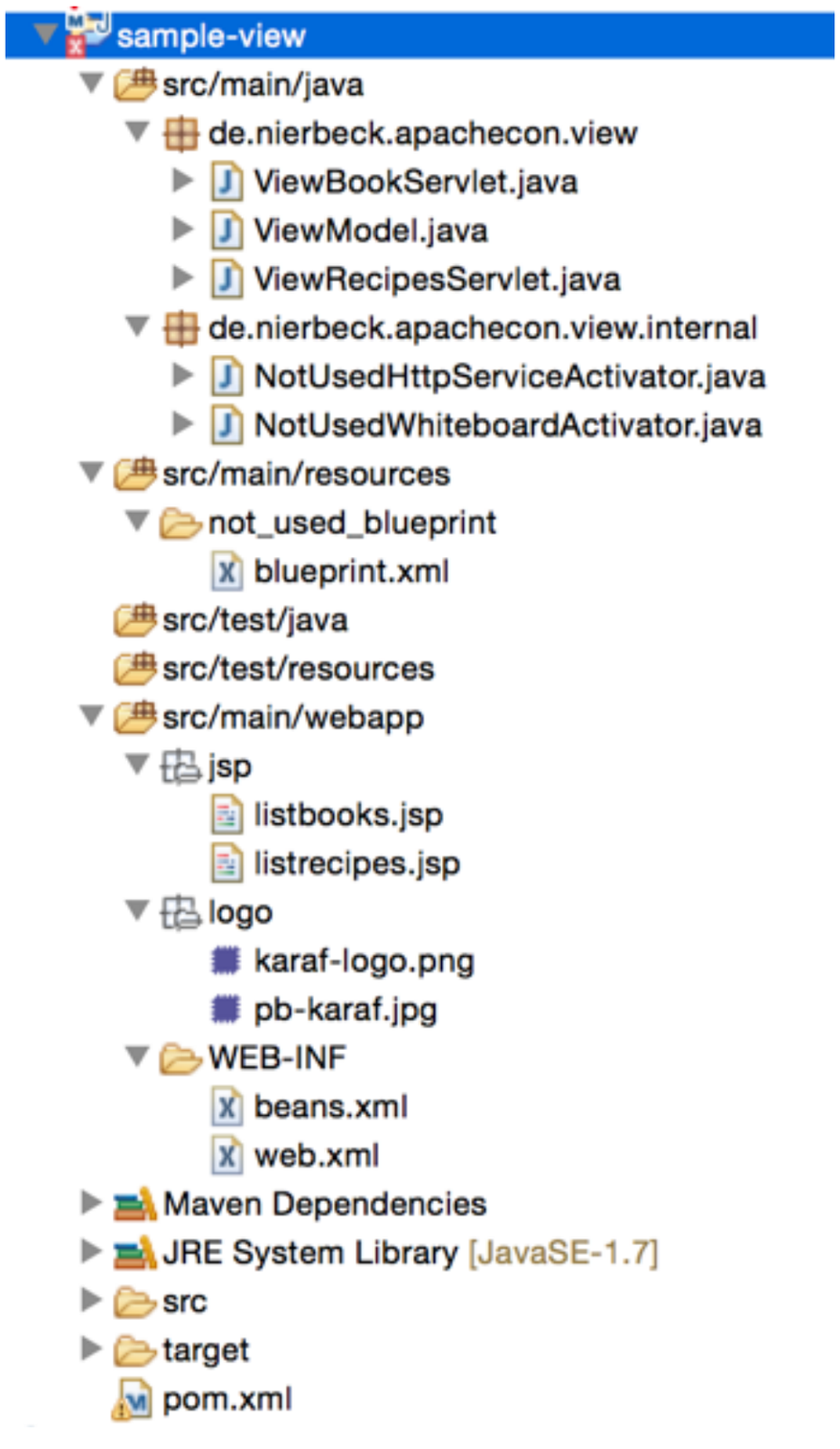


Cluster - Demo



Presentation Layer



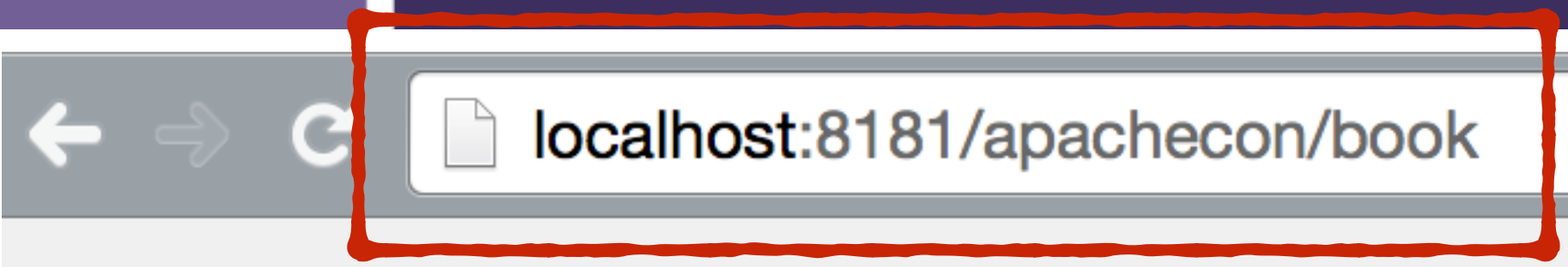
web.xml - Hazelcast

- Hazelcast for Session Replication

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app xmlns="http://java.sun.com/xml/ns/javaee" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
      xsi:schemaLocation="http://java.sun.com/xml/ns/javaee http://java.sun.com/xml/ns/javaee/web-app_3_0.xsd"
      version="3.0">

      <filter>
            <filter-name>hazelcast-filter</filter-name>
            <filter-class>com.hazelcast.web.WebFilter</filter-class>
          <!--
              Name of the distributed map storing
              your web session objects
          -->
            <init-param>
                  <param-name>map-name</param-name>
                  <param-value>my-sessions</param-value>
            </init-param>
            <init-param>
                  <param-name>sticky-session</param-name>
                  <param-value>false</param-value>
            </init-param>
      </filter>
      <filter-mapping>
            <filter-name>hazelcast-filter</filter-name>
            <url-pattern>/*</url-pattern>
            <dispatcher>FORWARD</dispatcher>
            <dispatcher>INCLUDE</dispatcher>
            <dispatcher>REQUEST</dispatcher>
      </filter-mapping>
      <listener>
            <listener-class>com.hazelcast.web.SessionListener</listener-class>
      </listener>
</web-app>
```

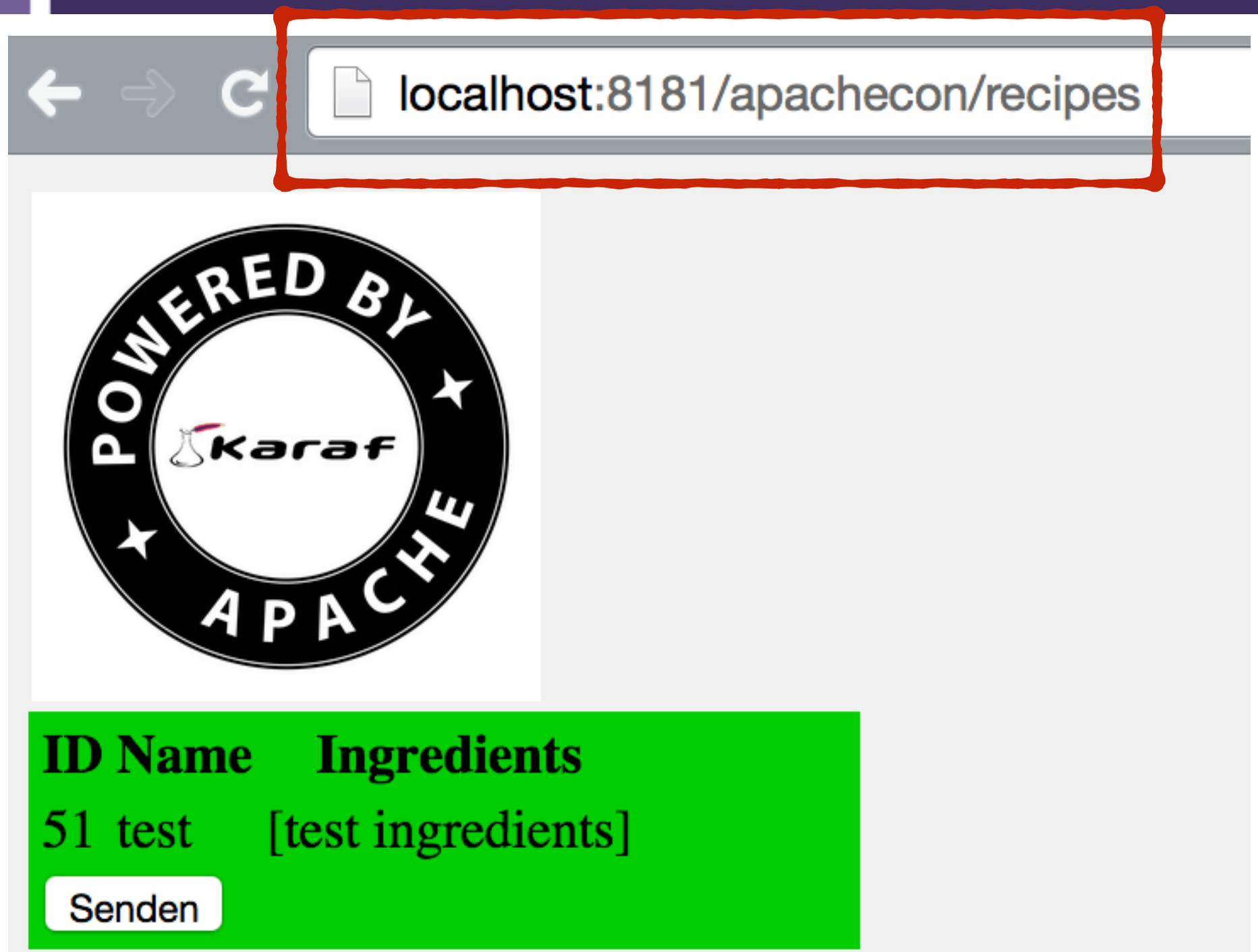
View



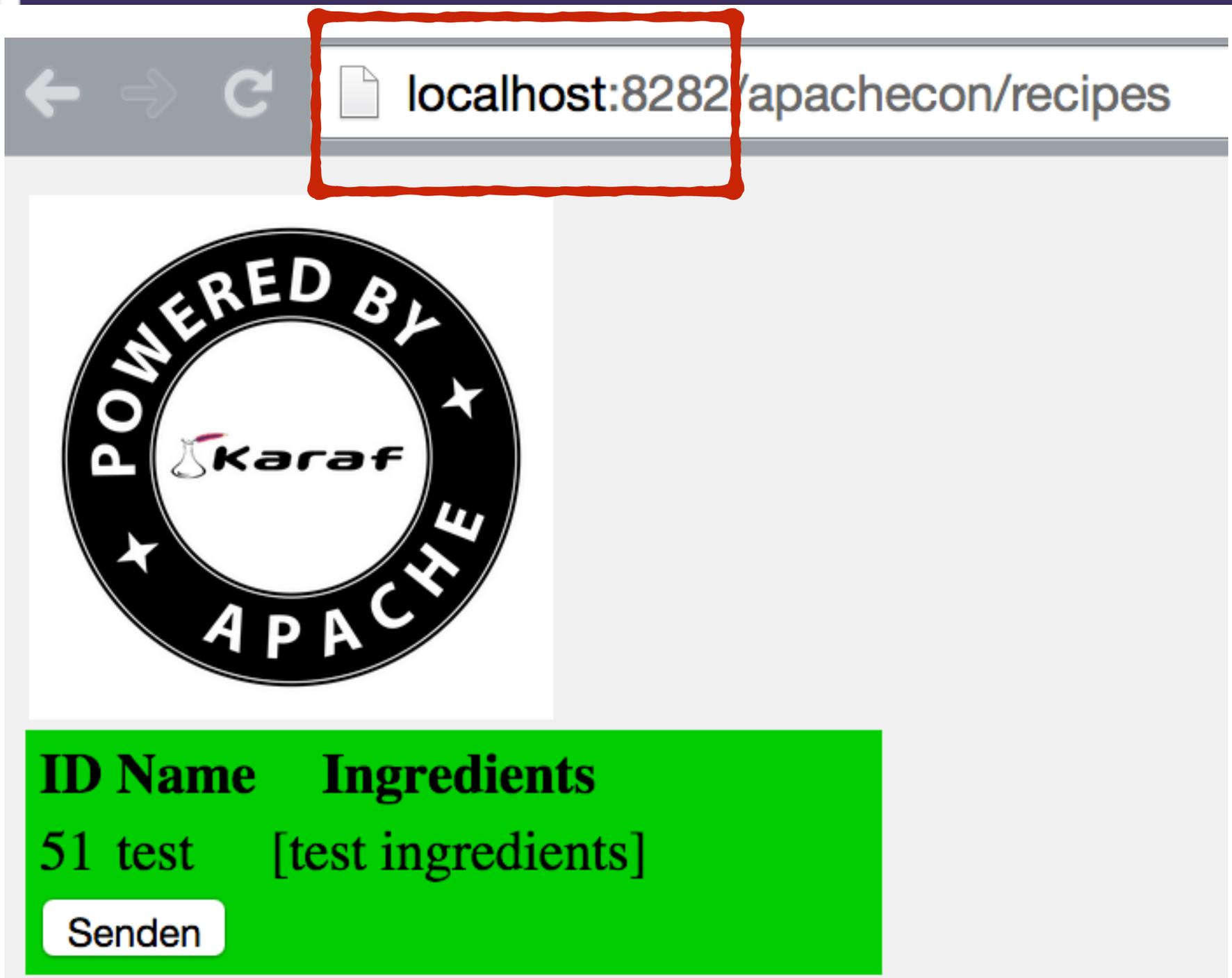
Select	ID	Name	ISBN
☐	101	Apache Karaf Cookbook	978-1783985081
☐	1	test	null

Senden

View


localhost:8181/apachecon/recipes
POWERED BY
karaf
APACHE
ID Name Ingredients
51 test [test ingredients]
Senden

View


localhost:8282/apachecon/recipes
POWERED BY
karaf
APACHE
ID Name Ingredients
51 test [test ingredients]
Senden

SUMMARY

Enterprise - Karaf

Servlet 3

JSP

JAX-WS

JAX-RS

EJB 3.1

CDI

JAX-RPC

JAXB

JSF 2

JTA

JAXR

JMS

JPA 2

JNDI

SAAJ

JAAS

RMI

JEE with Karaf?

- Adoptions needed? **YES**
  - Minor on Persistence - **JNDI lookup**
  - Minor on transaction - **Blueprint JTA**
    - Wiring of Services:
      - Use Blueprint
      - Use Servlet 3.0 with CDI - **@OsgiService**
- Session Replication throughout cluster, it's still standard Hazelcast

Resources

- @anierbeck
- notitzblog.nierbeck.de
- https://github.com/ANierbeck/karaf-enterprise-sample
- www.codecentric.de
- karaf.apache.org
- https://ops4j1.jira.com/wiki/display/paxweb/Pax+Web
- #karaf at irc.codehaus.org
- https://www.packtpub.com/application-development/apache-karaf-cookbook
- Pictures, mainly from flickr

THANKS FOR LISTENING

Thanks to the Apache
Community

Questions

Thanks