

isban

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Building interoperable read-write Linked Data applications with the W3C Linked Data Platform and the LDP4j framework

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Building interoperable read-write Linked Data applications with the W3C Linked Data Platform and the LDP4j framework

HANDS-ON

Recipe for using LDP4j

1. Prepare dependencies
2. Create a Maven web-app project
3. Implement your business logic
4. Build the project
5. Deploy onto an servlet container
6. Enjoy!!!

Developing an application (I)

- **Prepare dependencies:**

- From the sources

```
> git clone https://github.com/ldp4j/ldp4j
> cd ldp4j
> mvn clean install
```

- Use Sonatype's OSS snapshot repository

```
<?xml version="1.0" encoding="UTF-8"?>
<settings
  xmlns="http://maven.apache.org/SETTINGS/1.0.0"  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation=
    "http://maven.apache.org/SETTINGS/1.0.0 http://maven.apache.org/xsd/settings-1.0.0.xsd">
  <!-- Other configuration here -->
  <profiles>
    <profile>
      <id>ldp4j</id>
      <activation><!-- Activation configuration here --></activation>
      <repositories>
        <repository>
          <id>sonatype-oss-public-snapshots</id>
          <url>https://oss.sonatype.org/content/groups/public/</url>
          <snapshots><enabled>true</enabled></snapshots>
          <releases><enabled>false</enabled></releases>
        </repository>
      </repositories>
    </profile>
  </profiles>
</settings>
```

Developing an application (II)

- Create a Maven web-app project:

```
<?xml version="1.0" encoding="UTF-8"?>
<project
  xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd"
  xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <!-- Module coordinates here -->
  <packaging>war</packaging>
  <properties>
    <ldp4j.version>1.0.0-SNAPSHOT</ldp4j.version>
    <!-- Other properties here -->
  </properties>
  <dependencies>
    <dependency>
      <groupId>org.ldp4j.framework</groupId>
      <artifactId>ldp4j-application-api</artifactId>
      <version>${ldp4j.version}</version>
    </dependency>
    <dependency>
      <groupId>org.ldp4j.framework</groupId>
      <artifactId>ldp4j-server-core</artifactId>
      <scope>runtime</scope>
      <version>${ldp4j.version}</version>
    </dependency>
    <!-- Other dependencies here -->
  </dependencies>
  <!-- Other build settings here -->
</project>
```

Developing an application (III)

- Implement your resource handlers...

```
package org.example;

import org.ldap4j.application.data.DataSet;
import org.ldap4j.application.ext.Deletable;
import org.ldap4j.application.ext.ResourceHandler;
import org.ldap4j.application.session.ResourceSnapshot;
import org.ldap4j.application.session.WriteSession;

public class MyDeletableResourceHandler implements ResourceHandler, Deletable {

    @Override
    public DataSet get(ResourceSnapshot resource)
        throws UnknownResourceException, ApplicationRuntimeException {
        // TODO Implement your data retrieval logic
        return null;
    }

    @Override
    public void delete(ResourceSnapshot resource, WriteSession session)
        throws UnknownResourceException, ApplicationRuntimeException {
        // TODO Implement your deletion logic
    }
}
```

Developing an application (IV)

- ... and container handlers:

```
package org.example;

import org.ldp4j.application.data.DataSet;
import org.ldp4j.application.ext.ContainerHandler;
import org.ldp4j.application.ext.ContentProcessingException;
import org.ldp4j.application.ext.Modifiable;
import org.ldp4j.application.session.ContainerSnapshot;
import org.ldp4j.application.session.ResourceSnapshot;
import org.ldp4j.application.session.WriteSession;

public class MyModifiableContainerHandler implements ContainerHandler, Modifiable {

    @Override
    public DataSet get(ResourceSnapshot resource) throws UnknownResourceException, ApplicationRuntimeException {
        // TODO Implement your data retrieval logic
        return null;
    }

    @Override
    public ResourceSnapshot create(ContainerSnapshot container, DataSet representation, WriteSession session)
        throws UnknownResourceException, UnsupportedContentException, ApplicationRuntimeException {
        // TODO Implement your creation logic here
        return null;
    }

    @Override
    public void update(ResourceSnapshot resource, DataSet content, WriteSession session)
        throws UnknownResourceException, UnsupportedContentException,
        InconsistentContentException, ApplicationRuntimeException {
        // TODO Implement your modification logic here
    }
}
```

Developing an application (V)

- Annotate the handlers:

```
package org.example;

...

import org.ldp4j.application.ext.annotations.Resource;

@Resource(
    id="resourceTemplateId"
)
public class MyDeletableResourceHandler implements ResourceHandler, Deletable {

...

}
```

```
package org.example;

...

import org.ldp4j.application.ext.annotations.BasicContainer;

@BasicContainer(
    id="containerTemplateId",
    memberHandler = MyDeletableResourceHandler.class
)
public class MyModifiableContainerHandler implements ContainerHandler, Modifiable {

...

}
```


Developing an application (VI)

- Implement your application class:

```
package org.example;

import org.ldp4j.application.data.Name;
import org.ldp4j.application.data.NamingScheme;
import org.ldp4j.application.ext.Application;
import org.ldp4j.application.ext.Configuration;
import org.ldp4j.application.session.WriteSession;
import org.ldp4j.application.setup.Bootstrap;
import org.ldp4j.application.setup.Environment;

public class MyApplication extends Application<Configuration> {
    @Override
    public void setup(Environment environment, Bootstrap<Configuration> bootstrap) throws ApplicationSetupException {
        MyModifiableContainerHandler containerHandler=new MyModifiableContainerHandler();
        MyDeletableResourceHandler resourceHandler=new MyDeletableResourceHandler();
        // TODO Your handler configuration logic here
        bootstrap.addHandler(resourceHandler);
        bootstrap.addHandler(containerHandler);

        Name<?> rootContainerName=NamingScheme.getDefault().name("containerName") ;

        environment.publishResource(rootContainerName, MyModifiableContainerHandler.class, "containerRootPath");
    }
    @Override
    public void initialize(WriteSession session) throws ApplicationInitializationException {
        // TODO Your handler initialization logic here
        // Remember, the session has to be updated to reflect the state of the data managed by the handlers
    }
    @Override
    public void shutdown() throws ApplicationShutdownException {
        // TODO Your shutdown logic here
    }
}
```

Developing an application (and VII)

- Update the web application descriptor:

```
<?xml version="1.0" encoding="UTF-8"?>
<web-app
  metadata-complete="false"
  version="3.0"
  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">

  <display-name>My LDP4j Application</display-name>

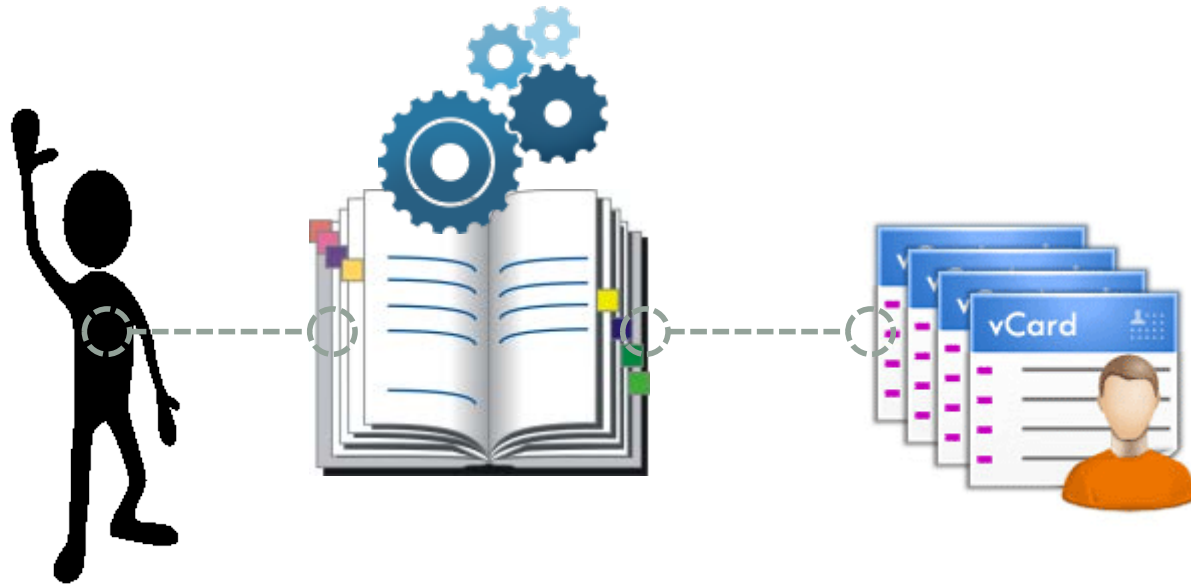
  <context-param>
    <param-name>ldp4jTargetApplication</param-name>
    <param-value>org.example.MyApplication</param-value>
  </context-param>

  <!-- Other configuration here -->

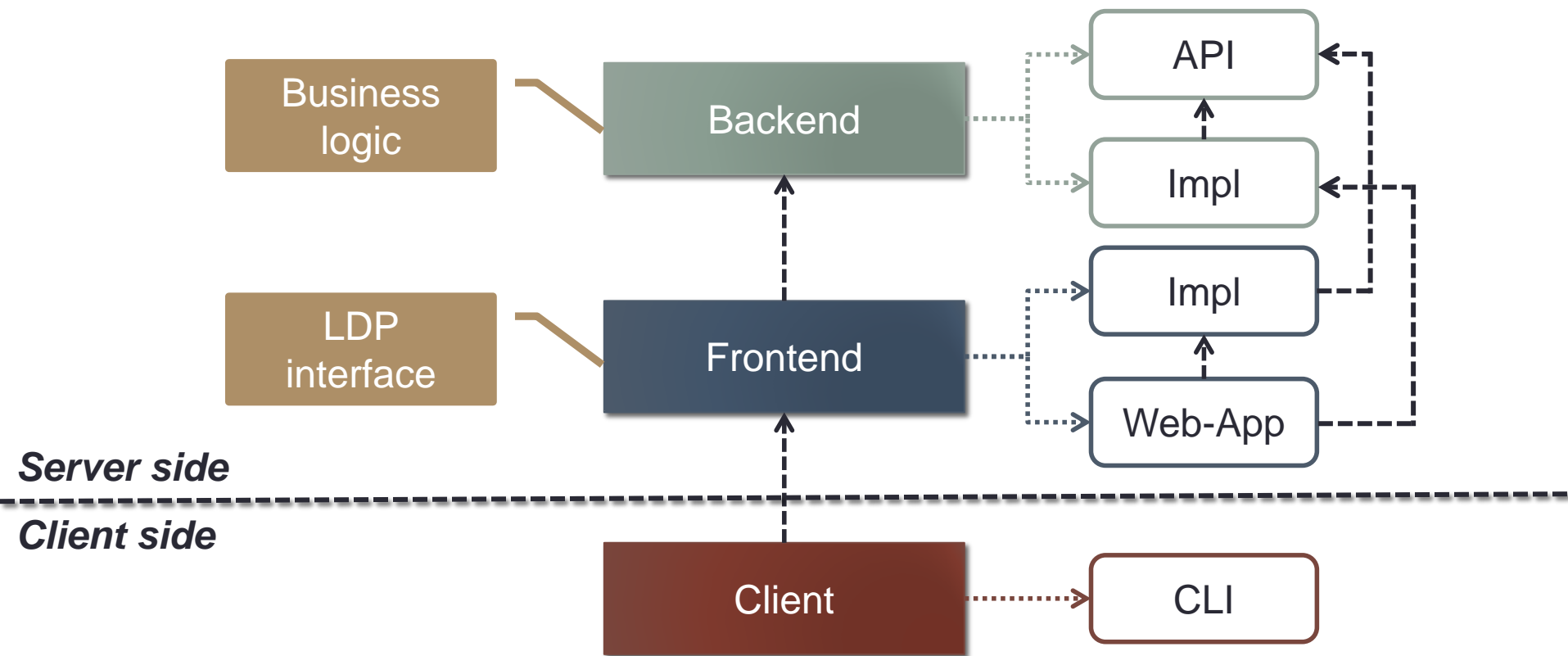
</web-app>
```

An example read-write Linked Data application with LDP4j

- **Contacts Application:** a multi-tenant address book application
 - Persons shall be able to register for a personal address book
 - Each address book will host the contacts that belong to the owner

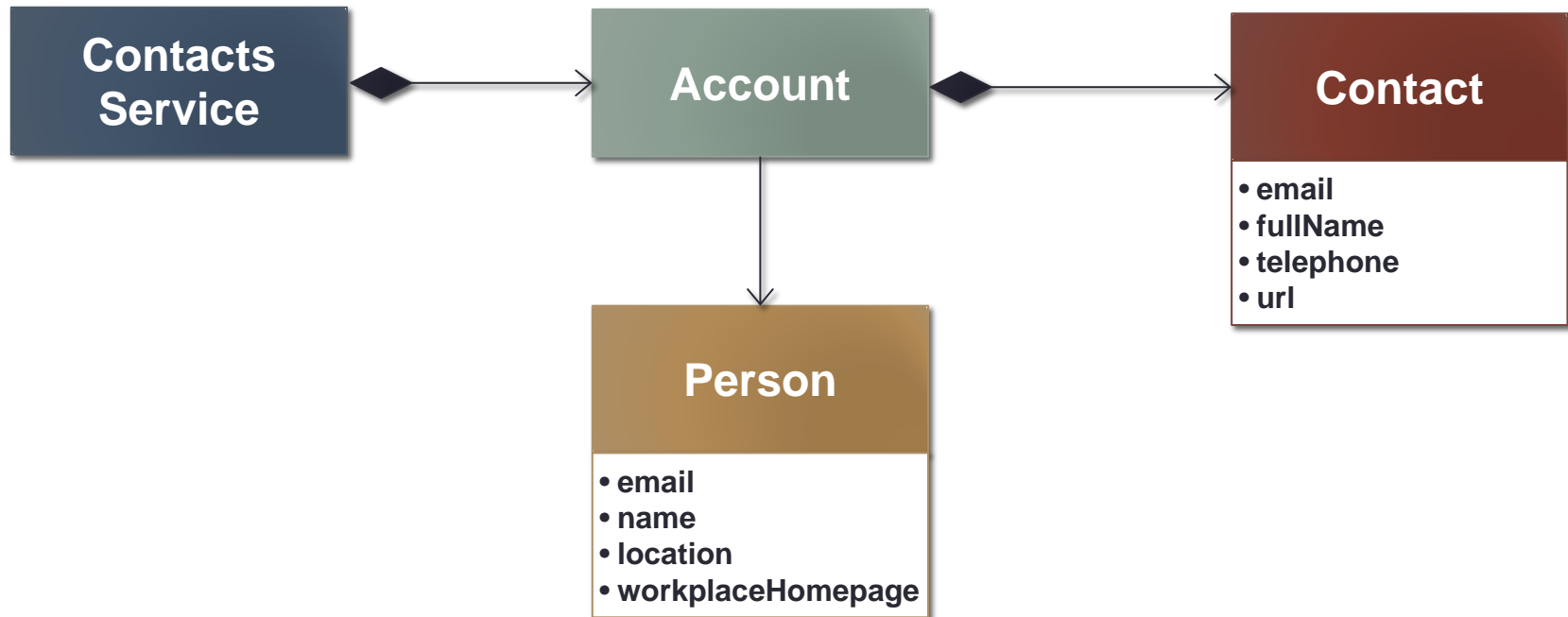


Architecture of the solution



Application component design

Domain model



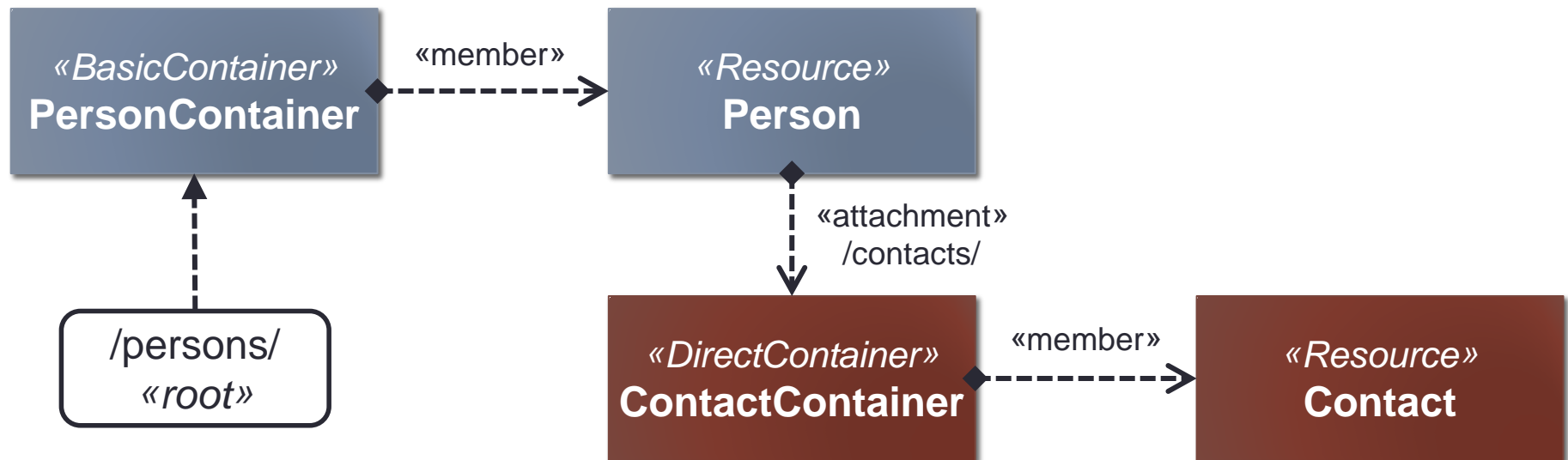
Application component design

Service API

- **ContactsService**
 - **getInstance**
 - **createPerson**
 - **getPerson**
 - **deletePerson**
 - **listPersons**
 - **addContactToPerson**
 - **getPersonContact**
 - **deletePersonContact**
 - **listPersonContacts**

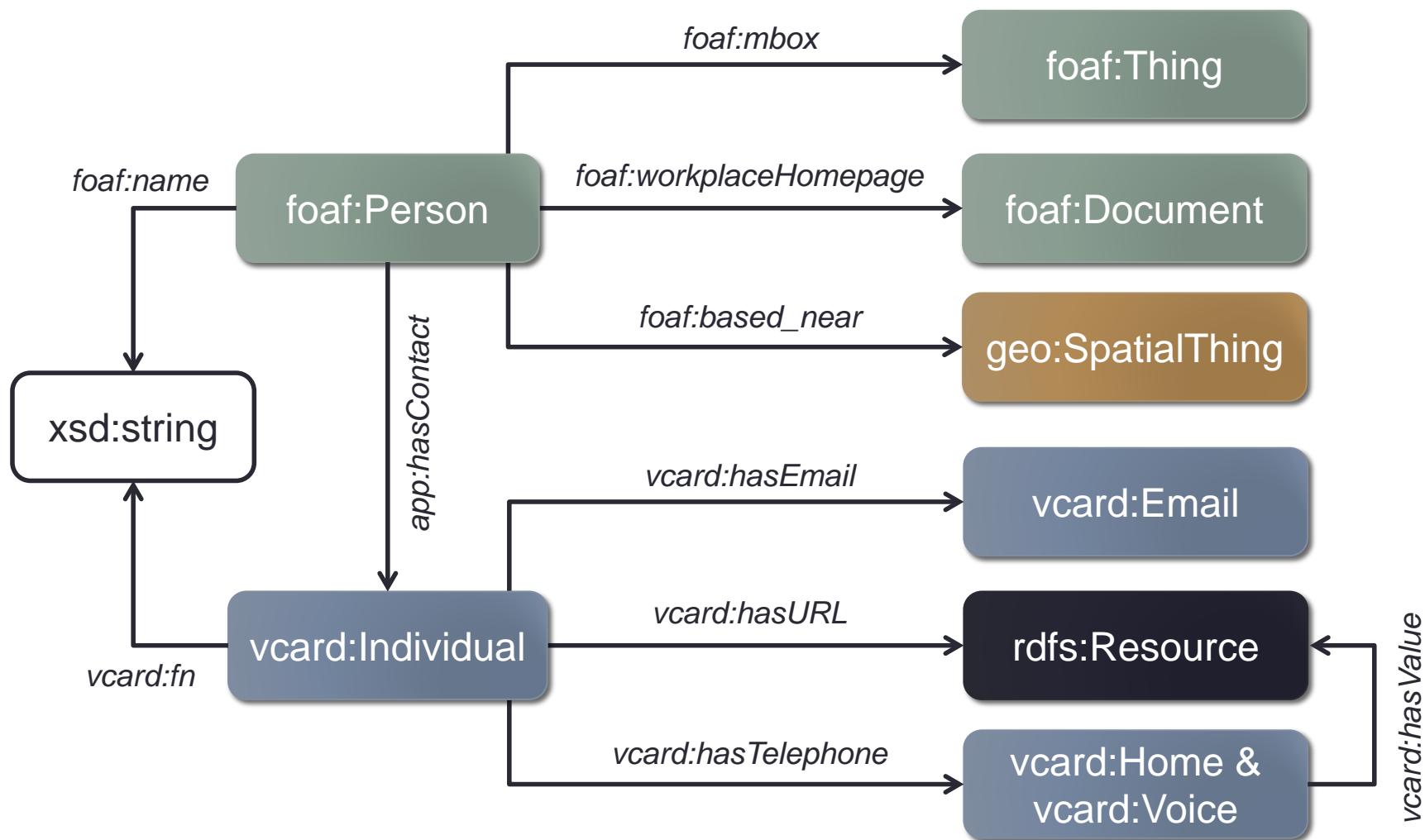
Frontend component design

LDP Organization



Frontend component design

Vocabulary



Frontend component design

Exposed API

- **Manage persons:**

- **POST** {base}/persons/ **[foaf:Person]**
- **GET** {base}/persons/{pid}/ **[foaf:Person]**
- **PUT** {base}/persons/{pid}/ **[foaf:Person]**
- **DELETE** {base}/persons/{pid}/

- **Manage contacts:**

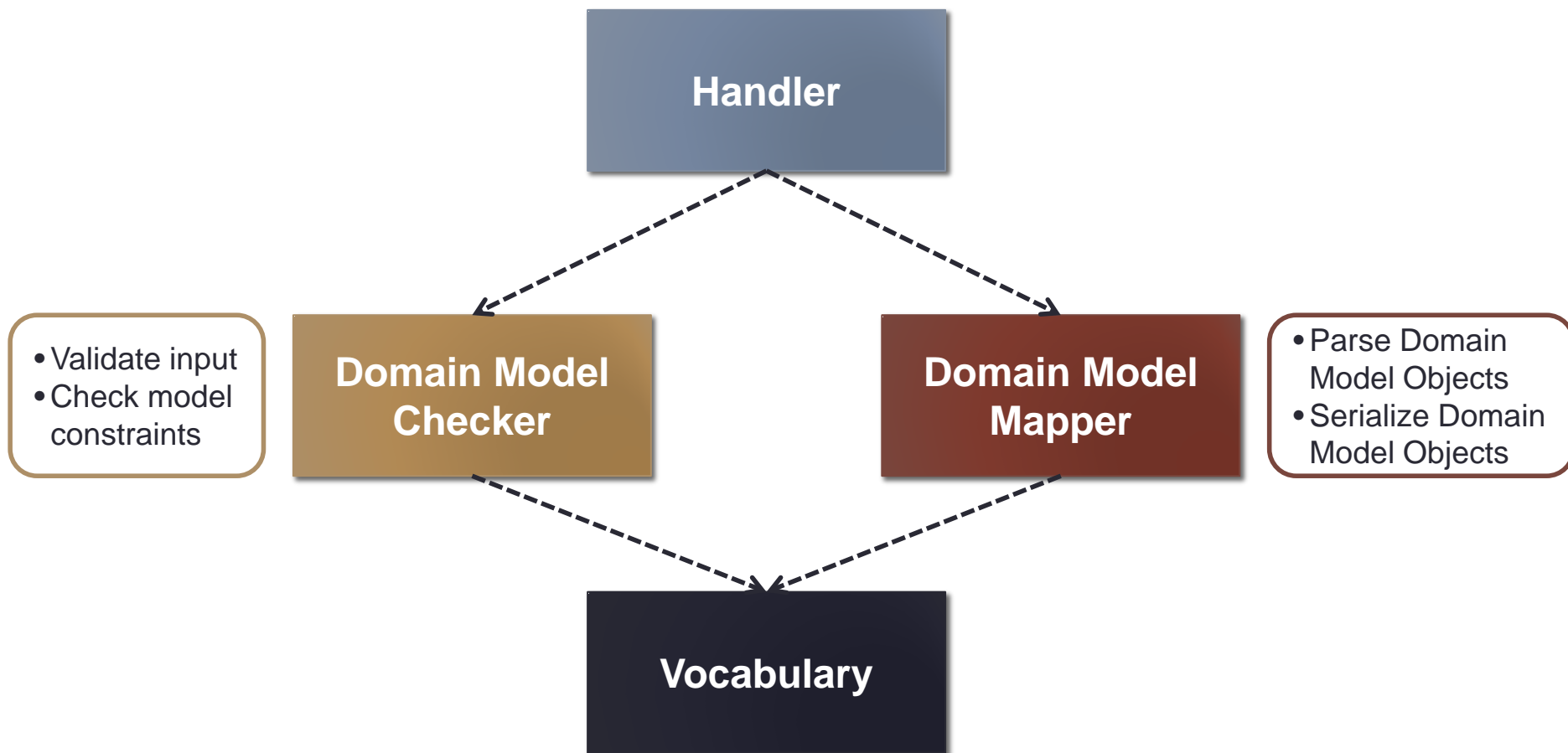
- **POST** {base}/persons/{pid}/contacts/ **[vcard:Individual]**
- **GET** {base}/persons/{pid}/contacts/{cid}/ **[vcard:Individual]**
- **PUT** {base}/persons/{pid}/contacts/{cid}/ **[vcard:Individual]**
- **DELETE** {base}/persons/{pid}/contacts/{cid}/

- **Other introspection operations:**

- **GET** {base}/persons/ **[ldp:BasicContainer]**
- **GET** {base}/persons/{pid}/contacts/ **[ldp:DirectContainer]**

Frontend component design

Separation of concerns



Client component design

- **CLI**
- **Shell for manipulating LDP resources**
 - *LDP commands*
 - retrieve-resource
 - modify-resource
 - create-resource
 - delete-resource
- **Local resource metadata and representation caching**
 - *Cache introspection commands:*
 - list-cached-representations
 - show-cached-representation

Person management (I)

PersonContainerHandler

- Annotated as **BasicContainer**, having as memberHandler **PersonHandler**.
- Implements **ContainerHandler**, thus supports retrieval and creation, **but nothing else**.
- **Get operation:**
 - As only one container is to exist ever, we don't need to track its state.
- **Creation operation:**
 - Parse person from input representation
 - If the parsed person is not valid,
 - Throw an **UnsupportedContentException**
 - Else
 - Request the creation of the person to the backend
 - Add a new member to the container related to the created person
 - Attach to the created member a resource for the ContactsHandler to be used for creating the contacts for the created person

Person management (II)

PersonHandler (I)

- Annotated as **Resource** and has attached a **ContactContainerHandler**.
- Implements **ResourceHandler**, **Modifiable** and **Deletable**.
- **Get operation:**
 - Find out the identity of the person associated to the target resource
 - If no person exists for the specified identity
 - Throw an **UnknownResourceException**
 - Else
 - Retrieve the person from the backend
 - Serialize the retrieved person
- **Update operation:**
 - Find out the identity of the person associated to the target resource
 - If no person exists for the specified identity
 - Throw an **UnknownResourceException**
 - Parse person from input representation
 - If the parsed person is not valid,
 - Throw an **UnsupportedContentException**
 - Else
 - If the parsed person does not satisfy the model constraints
 - Throw a **InconsistentContentException**
 - Else
 - Request the update of the person to the backend
 - Modify the resource associated to the person

Person management (III)

PersonHandler (II)

- Delete operation:
 - Find out the identity of the person associated to the target resource
 - If no person exists for the specified identity
 - Throw an **UnknownResourceException**
 - Else
 - Request the deletion of the person to the backend
 - Delete the resource associated to the person

Contact management (I)

ContactContainerHandler

- Annotated as **DirectContainer**, having as memberHandler **PersonHandler**.
- Implements **ContainerHandler**, thus supports retrieval and creation, **but nothing else**.
- **Get operation:**
 - As the only information relevant for the container are the members, and that's covered by LDP4j, we don't need to track its state.
- **Creation operation:**
 - Find out the identity of the person associated to the target resource
 - If no person exists for the specified identity
 - Throw an **UnknownResourceException**
 - Parse contact from input representation
 - If the parsed contact is not valid,
 - Throw an **UnsupportedContentException**
 - Else
 - Request the creation of the contact for the identified person to the backend
 - Add a new member to the container related to the person's contact container

Contact management (II)

ContactHandler (I)

- Annotated as **Resource**.
- Implements **ResourceHandler**, **Modifiable** and **Deletable**.
- **Get operation:**
 - Find out the identity of the contact associated to the target resource
 - If no contact exists for the specified identity
 - Throw an **UnknownResourceException**
 - Else
 - Retrieve the contact from the backend
 - Serialize the retrieved contact
- **Update operation:**
 - Find out the identity of the contact associated to the target resource
 - If no contact exists for the specified identity
 - Throw an **UnknownResourceException**
 - Parse contact from input representation
 - If the parsed contact is not valid,
 - Throw an **UnsupportedContentException**
 - Else
 - If the parsed contact does not satisfy the model constraints
 - Throw a **InconsistentContentException**
 - Else
 - Request the update of the contact to the backend
 - Modify the resource associated to the contact

Contact management (III)

ContactHandler (II)

- Delete operation:
 - Find out the identity of the contact associated to the target resource
 - If no contact exists for the specified identity
 - Throw an **UnknownResourceException**
 - Else
 - Request the deletion of the contact to the backend
 - Delete the resource associated to the contact

Putting it all together

ContactsApplication

- Extend the **Application** class
- During the application setup:
 - Setup the backend service
 - Instantiate and configure the handlers
 - Register the handlers
 - Publish a PersonContainerHandler root resource
- Initialization and shutdown
 - As no state is tracked there is no need to do any thing else

Mapping concerns

- **Identity:**

- *Persons*: identified by their emails
 - Contacts container: person email
- *Contacts*: identified by the email of the owner and the email of the contact

- **Transformation:**

- *Person*: Managed individual
 - email: External individual
 - name: Literal
 - workplaceHomepage: External individual
 - location: External individual
- *Contact*: Managed individual
 - email: External individual
 - fullName: Literal
 - url: External individual
 - telephone: Local individual
 - number: Literal

Validation & constraints concerns

- Typing is required for principal entities
 - Persons
 - Contacts
 - Telephones
- All properties are mandatory
- Emails are write-once, read-many
 - Set when the resource is created (POST)
 - Cannot be modified when the resource is updated (PUT)

Playing with the Contacts Application

- Get and build the sources:

```
> git clone https://github.com/ldp4j/eswc2015-tutorial/  
[...]  
> cd eswc2015-tutorial  
> mvn clean install  
[...]
```

- Execute the application Frontend¹:

```
> cd frontend/dist/  
> cd eswc2015-tutorial  
> mvn tomcat7:run-war-only  
[...]
```

- Open your browser's REST client add-on and point it to
 - <http://localhost/contacts/ldp4j/api/persons/>
- Or use the application Client:

```
> cd client/  
> target/client/bin/ContactsClient.sh  
[...]
```

[1] By default the container starts on port **80**. However it can be changed to any other by starting the container using **-Dfrontend.http.port=«desired-port»**

Checking the application status

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/
```

```
Retrieving resource...
```

```
Resource retrieved:
```

```
- Content-Type   : text/turtle
- Entity Tag     : "persons/"
- Last Modified  : Sat, 30 May 2015 18:27:47 GMT
- Links:
  + type : http://www.w3.org/ns/ldp#BasicResource
  + type : http://www.w3.org/ns/ldp#Resource
- Content:
@prefix ldp: <http://www.w3.org/ns/ldp#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@base <http://localhost/contacts/ldp4j/api/persons/> .

<>

    rdf:type ldp:Container, ldp:RDFSSource, ldp:Resource .
```

```
Representation persisted to d:\iStack\workspaces\eclipse\luna\default\eswc2015-
tutorial\client\.cache\http_localhost_contacts_ldp4j_api_persons_.dat
```

Creating a person... (I)

- Craft a person description
(e.g., *src/main/resources/persons/mesteban.ttl*)

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
```

```
<> a foaf:Person;  
  foaf:name "Miguel Esteban Gutierrez";  
  foaf:mbox <mailto:mesteban@fi.upm.es>;  
  foaf:based_near <http://es.dbpedia.org/resource/Getafe>;  
  foaf:workplaceHomepage <http://www.centeropenmiddleware.com/> .
```

Creating a person... (II)

Request the creation...

```
contacts> create-resource -e src/main/resources/persons/mesteban.ttl \  
http://localhost/contacts/ldp4j/api/persons/
```

Creating resource...

- Content-Type: text/turtle
- Content:

[...]

@prefix foaf: <http://xmlns.com/foaf/0.1/> .

<> a foaf:Person;

foaf:name "Miguel Esteban Gutierrez";

foaf:mbox <mailto:mesteban@fi.upm.es>;

foaf:based_near <http://es.dbpedia.org/resource/Getafe>;

foaf:workplaceHomepage <http://www.centeropenmiddleware.com/> .

Resource created:

- New resource available at <http://localhost/contacts/ldp4j/api/persons/1/>

Target resource status:

- Entity Tag : "cb04ca0c-004b-47fd-906a-fcda43fa7fc1"

- Last Modified : Sat, 30 May 2015 18:37:01 GMT

- Links:

- + type : <http://www.w3.org/ns/ldp#BasicContainer>

- + type : <http://www.w3.org/ns/ldp#Resource>

Creating a person... (III)

... check the created person resource...

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/1/
```

Retrieving resource...

Resource retrieved:

- Content-Type : text/turtle
- Entity Tag : "e244be45-9c74-49a7-b2ae-57da222f086d"
- Last Modified : Sat, 30 May 2015 18:29:33 GMT
- Links:
 - + type : http://www.w3.org/ns/ldp#Resource
- Content:

@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@base <http://localhost/contacts/ldp4j/api/persons/1/> .

<>

```
    rdf:type ldp:RDFSsource, ldp:Resource, <http://xmlns.com/foaf/0.1/Person> ;
    <http://www.ldap4j.org/ns/application#hasAttachment> <contacts/> ;
    <http://xmlns.com/foaf/0.1/based_near> <http://es.dbpedia.org/resource/Getafe> ;
    <http://xmlns.com/foaf/0.1/mbox> <mailto:mesteban@fi.upm.es> ;
    <http://xmlns.com/foaf/0.1/name> "Miguel Esteban Gutierrez" ;
    <http://xmlns.com/foaf/0.1/workplaceHomepage>
```

```
<http://www.centeropenmiddleware.com/> .
```

Representation persisted to d:\iStack\workspaces\eclipse\luna\default\eswc2015-tutorial\client\.cache\http_localhost_contacts_ldp4j_api_persons_1_.dat

Creating a person... (III)

... check the created contacts resource...

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/1/contacts/
```

Retrieving resource...

Resource retrieved:

- Content-Type : text/turtle
- Entity Tag : "44419594-68d9-4858-99c3-40a33509da4f"
- Last Modified : Sat, 30 May 2015 18:29:33 GMT

- Links:

- + type : http://www.w3.org/ns/ldp#DirectResource
- + type : http://www.w3.org/ns/ldp#Resource

- Content:

@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@base <http://localhost/contacts/ldp4j/api/persons/1/contacts/> .

<>

```
    rdf:type ldp:Container, ldp:DirectContainer, ldp:RDFSsource, ldp:Resource ;
    ldp:hasMemberRelation <http://www.ldp4j.org/ns/application#hasContact> ;
    ldp:insertedContentRelation ldp:MemberSubject ;
    ldp:membershipResource <..> .
```

Representation persisted to d:\iStack\workspaces\eclipse\luna\default\eswc2015-tutorial\client\.cache\http_localhost_contacts_ldp4j_api_persons_1_contacts.dat

Creating a person... (IV)

... and the application status.

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/
```

```
Retrieving resource...
```

```
Resource retrieved:
```

```
- Content-Type   : text/turtle
- Entity Tag     : "f8a759fb-c78f-476f-9e27-f5a88e000473"
- Last Modified  : Sat, 30 May 2015 18:29:33 GMT
- Links:
  + type : http://www.w3.org/ns/ldp#BasicResource
  + type : http://www.w3.org/ns/ldp#Resource
- Content:
@prefix ldp: <http://www.w3.org/ns/ldp#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@base <http://localhost/contacts/ldp4j/api/persons/> .

<>

    rdf:type ldp:Container, ldp:RDFSSource, ldp:Resource ;
    ldp:contains <1/> .
```

```
Representation persisted to d:\iStack\workspaces\eclipse\luna\default\eswc2015-
tutorial\client\.cache\http_localhost_contacts_ldp4j_api_persons_.dat
```

... adding a contact... (I)

- Craft a contact description
(e.g., *src/main/resources/contacts/corky.ttl*)

```
@prefix vcard: <http://www.w3.org/2006/vcard/ns#> .
```

```
<> a vcard:Individual ;  
    vcard:hasURL <http://example.com> ;  
    vcard:hasEmail <mailto:corky@example.com> ;  
    vcard:fn "Corky Crystal" ;  
    vcard:hasTelephone [  
        a vcard:Home, vcard:Voice;  
        vcard:hasValue <tel:+61755555555>  
    ] .
```

... adding a contact... (II)

Requesting the creation...

```
contacts> create-resource -e src/main/resources/contacts/corky.ttl \  
http://localhost/contacts/ldp4j/api/persons/1/contacts/
```

Creating resource...

- Content-Type: text/turtle

- Content:

[...]

```
<> a vcard:Individual ;  
    vcard:hasURL <http://example.com> ;  
    vcard:hasEmail <mailto:corky@example.com> ;  
    vcard:fn "Corky Crystal" ;  
    vcard:hasTelephone [  
        a vcard:Home, vcard:Voice;  
        vcard:hasValue <tel:+6175555555>  
    ] .Resource created:
```

- New resource available at <http://localhost/contacts/ldp4j/api/persons/1/contacts/1/>

Target resource status:

- Entity Tag : "523ab17b-c631-45e7-84b0-b6e58c5918d9"

- Last Modified : Sat, 30 May 2015 18:39:05 GMT

- Links:

+ type : <http://www.w3.org/ns/ldp#DirectContainer>

+ type : <http://www.w3.org/ns/ldp#Resource>

... adding a contact... (III)

... check the created contact resource...

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/1/contacts/1/
```

Retrieving resource...

Resource retrieved:

- Content-Type : text/turtle
- Entity Tag : "e244be45-9c74-49a7-b2ae-57da222f086d"
- Last Modified : Sat, 30 May 2015 18:39:05 GMT
- Links:
 - + type : http://www.w3.org/ns/ldp#Resource
- Content:

@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@base <http://localhost/contacts/ldp4j/api/persons/1/contacts/1/> .

<>

```
rdf:type <http://www.w3.org/2006/vcard/ns#Individual>, ldp:RDFSource, ldp:Resource ;
<http://www.w3.org/2006/vcard/ns#fn> "Corky Crystal" ;
<http://www.w3.org/2006/vcard/ns#hasEmail> <mailto:corky@example.com> ;
<http://www.w3.org/2006/vcard/ns#hasTelephone> [
  # FOLDED: _:mailto:corky@example.com.telephone
  rdf:type <http://www.w3.org/2006/vcard/ns#Home>,
    <http://www.w3.org/2006/vcard/ns#Voice> ;
  <http://www.w3.org/2006/vcard/ns#hasValue> <tel:+61755555555>
] ;
<http://www.w3.org/2006/vcard/ns#hasURL> <http://example.com> .
```

Representation persisted to d:\iStack\workspaces\eclipse\luna\default\eswc2015-tutorial\client\.cache\http_localhost_contacts_ldp4j_api_persons_1_contacts_1.dat

... adding a contact... (IV)

... the person's contacts container resource...

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/1/contacts/
```

Retrieving resource...

Resource retrieved:

- Content-Type : text/turtle
- Entity Tag : "8e8a86ab-171e-435a-a7ae-1909333537ae"
- Last Modified : Sat, 30 May 2015 18:39:05 GMT
- Links:

- + type : http://www.w3.org/ns/ldp#DirectResource

- + type : http://www.w3.org/ns/ldp#Resource

- Content:

@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@base <http://localhost/contacts/ldp4j/api/persons/1/contacts/> .

<..>

<http://www.ldap4j.org/ns/application#hasContact> <1/> .

<>

rdf:type ldp:Container, ldp:DirectContainer, ldp:RDFSsource, ldp:Resource ;
ldp:contains <1/> ;

ldp:hasMemberRelation <http://www.ldap4j.org/ns/application#hasContact> ;

ldp:insertedContentRelation ldp:MemberSubject ;

ldp:membershipResource <..> .

Representation persisted to d:\iStack\workspaces\eclipse\luna\default\eswc2015-tutorial\client\.cache\http_localhost_contacts_ldap4j_api_persons_1_contacts.dat

... adding a contact... (V)

... and the person resource.

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/1/
```

Retrieving resource...

Resource retrieved:

- Content-Type : text/turtle
- Entity Tag : "adaffbba-eb36-4118-8f63-8da178c0e12d"
- Last Modified : Sat, 30 May 2015 18:39:05 GMT

- Links:

+ type : <http://www.w3.org/ns/ldp#Resource>

- Content:

@prefix ldp: <<http://www.w3.org/ns/ldp#>> .

@prefix rdf: <<http://www.w3.org/1999/02/22-rdf-syntax-ns#>> .

@base <<http://localhost/contacts/ldp4j/api/persons/1/>> .

<>

```
    rdf:type ldp:RDFSsource, ldp:Resource, <http://xmlns.com/foaf/0.1/Person> ;
    <http://www.ldap4j.org/ns/application#hasAttachment> <contacts/> ;
    <http://www.ldap4j.org/ns/application#hasContact> <contacts/1/> ;
    <http://xmlns.com/foaf/0.1/based\_near> <http://es.dbpedia.org/resource/Getafe> ;
    <http://xmlns.com/foaf/0.1/mbox> <mailto:mesteban@fi.upm.es> ;
    <http://xmlns.com/foaf/0.1/name> "Miguel Esteban Gutierrez" ;
    <http://xmlns.com/foaf/0.1/workplaceHomepage>
```

<<http://www.centeropenmiddleware.com/>> .

Representation persisted to d:\iStack\workspaces\eclipse\luna\default\eswc2015-tutorial\client\.cache\http_localhost_contacts_ldp4j_api_persons_1.dat

Updating the person... (I)

- Craft the new person description starting from the representation retrieved from the server:

```
@prefix ldp: <http://www.w3.org/ns/ldp#> .
```

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

```
@base <http://localhost/contacts/ldp4j/api/persons/1/> .
```

```
<>
```

```
  rdf:type ldp:RDFSSource, ldp:Resource, <http://xmlns.com/foaf/0.1/Person> ;  
  <http://www.ldap4j.org/ns/application#hasAttachment> <contacts/> ;  
  <http://www.ldap4j.org/ns/application#hasContact> <contacts/1/> ;  
  <http://xmlns.com/foaf/0.1/based_near> <http://es.dbpedia.org/resource/Alcorcón> ;  
  <http://xmlns.com/foaf/0.1/mbox> <mailto:mesteban@fi.upm.es> ;  
  <http://xmlns.com/foaf/0.1/name> "Miguel Esteban Gutierrez" ;  
  <http://xmlns.com/foaf/0.1/workplaceHomepage> <http://www.centeropenmiddleware.com/>
```

```
.
```

Updating the person... (II)

Request the modification

```
contacts> modify-resource http://localhost/contacts/ldp4j/api/persons/1/
```

Modifying resource...

- If-Match : "e244be45-9c74-49a7-b2ae-57da222f086d"

- Content-Type: text/turtle

- Content:

@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@base <http://localhost/contacts/ldp4j/api/persons/1/> .

<>

```
rdf:type ldp:RDFSsource, ldp:Resource, <http://xmlns.com/foaf/0.1/Person> ;
<http://www.ldap4j.org/ns/application#hasAttachment> <contacts/> ;
<http://www.ldap4j.org/ns/application#hasContact> <contacts/1/> ;
<http://xmlns.com/foaf/0.1/based_near> <http://es.dbpedia.org/resource/Alcorcón> ;
<http://xmlns.com/foaf/0.1/mbox> <mailto:mesteban@fi.upm.es> ;
<http://xmlns.com/foaf/0.1/name> "Miguel Esteban Gutierrez" ;
<http://xmlns.com/foaf/0.1/workplaceHomepage> <http://www.centeropenmiddleware.com/> .
```

Resource modified:

- Entity Tag : "adaffbbba-eb36-4118-8f63-8da178c0e12d"

- Last Modified : Sat, 30 May 2015 18:43:12 GMT

- Links:

+ type : http://www.w3.org/ns/ldp#Resource

... and updating the contact... (I)

- Craft the new contact description starting from the representation retrieved from the server:

```
@prefix ldp: <http://www.w3.org/ns/ldp#> .
```

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

```
@base <http://localhost/contacts/ldp4j/api/persons/1/contacts/1/> .
```

```
<>
```

```
  rdf:type <http://www.w3.org/2006/vcard/ns#Individual>, ldp:RDFSsource, ldp:Resource ;  
  <http://www.w3.org/2006/vcard/ns#fn> "Corky Crystal" ;  
  <http://www.w3.org/2006/vcard/ns#hasEmail> <mailto:corky@example.com> ;  
  <http://www.w3.org/2006/vcard/ns#hasTelephone> [  
    # FOLDED: _:mailto:corky@example.com.telephone  
    rdf:type <http://www.w3.org/2006/vcard/ns#Home>,  
             <http://www.w3.org/2006/vcard/ns#Voice> ;  
    <http://www.w3.org/2006/vcard/ns#hasValue> <tel:+61755555555>  
  ] ;  
  <http://www.w3.org/2006/vcard/ns#hasURL> <http://www.example.com> .
```

... and updating the contact... (II)

Request the modification

```
contacts> modify-resource http://localhost/contacts/ldp4j/api/persons/1/contacts/1/
```

Modifying resource...

- If-Match : "e244be45-9c74-49a7-b2ae-57da222f086d"

- Content-Type: text/turtle

- Content:

@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@base <http://localhost/contacts/ldp4j/api/persons/1/contacts/1/> .

<>

```
rdf:type <http://www.w3.org/2006/vcard/ns#Individual>, ldp:RDFSsource, ldp:Resource ;
<http://www.w3.org/2006/vcard/ns#fn> "Corky Crystal" ;
<http://www.w3.org/2006/vcard/ns#hasEmail> <mailto:corky@example.com> ;
<http://www.w3.org/2006/vcard/ns#hasTelephone> [
  # FOLDED: _:mailto:corky@example.com.telephone
  rdf:type <http://www.w3.org/2006/vcard/ns#Home>,
    <http://www.w3.org/2006/vcard/ns#Voice> ;
  <http://www.w3.org/2006/vcard/ns#hasValue> <tel:+61755555555>
] ;
<http://www.w3.org/2006/vcard/ns#hasURL> <http://www.example.com> .
```

Resource modified:

- Entity Tag : "5c27e1c2-248b-44d6-b0e6-10a232c23231"

- Last Modified : Sat, 30 May 2015 18:46:28 GMT

- Links:

+ type : http://www.w3.org/ns/ldp#Resource

Breaking the rules... (I)

- Modify the person's email...

```
@prefix ldp: <http://www.w3.org/ns/ldp#> .
```

```
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .
```

```
@base <http://localhost/contacts/ldp4j/api/persons/1/> .
```

```
<>
```

```
  rdf:type ldp:RDFSSource, ldp:Resource, <http://xmlns.com/foaf/0.1/Person> ;  
  <http://www.ldap4j.org/ns/application#hasAttachment> <contacts/> ;  
  <http://www.ldap4j.org/ns/application#hasContact> <contacts/1/> ;  
  <http://xmlns.com/foaf/0.1/based_near> <http://es.dbpedia.org/resource/Alcorcón> ;  
  <http://xmlns.com/foaf/0.1/mbox> <mailto:miguel.esteban@centeropenmiddleware.com> ;  
  <http://xmlns.com/foaf/0.1/name> "Miguel Esteban Gutierrez" ;  
  <http://xmlns.com/foaf/0.1/workplaceHomepage> <http://www.centeropenmiddleware.com/>
```

```
.
```

Breaking the rules... (II)

Request the modification and...

```
contacts> modify-resource http://localhost/contacts/ldp4j/api/persons/1/
```

Modifying resource...

- If-Match : "adaffbba-eb36-4118-8f63-8da178c0e12d"

- Content-Type: text/turtle

- Content:

@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@base <http://localhost/contacts/ldp4j/api/persons/1/> .

<>

```
  rdf:type ldp:RDFSsource, ldp:Resource, <http://xmlns.com/foaf/0.1/Person> ;
  <http://www.ldap4j.org/ns/application#hasAttachment> <contacts/> ;
  <http://www.ldap4j.org/ns/application#hasContact> <contacts/1/> ;
  <http://xmlns.com/foaf/0.1/based_near> <http://es.dbpedia.org/resource/Alcorcón> ;
  <http://xmlns.com/foaf/0.1/mbox> <mailto:miguel.esteban@centeropenmiddleware.com> ;
  <http://xmlns.com/foaf/0.1/name> "Miguel Esteban Gutierrez" ;
  <http://xmlns.com/foaf/0.1/workplaceHomepage> <http://www.centeropenmiddleware.com/> .
```

Could not modify resource

- Server response: Specified values for application-managed properties are not consistent with the actual resource state Person email cannot be modified

- Constraint report [http://localhost/contacts/ldp4j/api/persons/1/?ldp:constrainedBy=a69cafd2-0259-45a7-9f65-8885ac779beb]:

[...]

Breaking the rules... (III)

... see the failure

```
@prefix sh: <http://www.w3.org/ns/shacl#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .

@base <http://localhost/contacts/ldp4j/api/persons/1/> .

<>
    ldp4j:entityTag "\"adaffbba-eb36-4118-8f63-8da178c0e12d\"" ;
    ldp4j:lastModified "2015-05-30T18:43:12.819+02:00"^^xsd:dateTime ;
    ldp:constrainedBy <?ldp:constrainedBy=a69cafd2-0259-45a7-9f65-8885ac779beb> ;
    sh:nodeShape _:s0 .

<?ldp:constrainedBy=a69cafd2-0259-45a7-9f65-8885ac779beb>
    rdf:type ldp4j:ConstraintReport ;
    ldp4j:failureDate "2015-05-30T18:49:01.822+02:00"^^xsd:dateTime ;
    ldp4j:failureId "a69cafd2-0259-45a7-9f65-8885ac779beb" ;
    ldp4j:failureRequest [
[...]]
    ] ;
    ldp4j:hasShape _:s0 .
```

Breaking the rules... (IV)

... see the failure

```
[...]
_:s0 # Referenced 2 times by resources: <>,
# <?ldp:constrainedBy=a69cafd2-0259-45a7-9f65-8885ac779beb>
rdf:type sh:Shape ;
rdfs:comment "Person resource shape" ;
rdfs:label "PersonShape" ;
sh:property [ # FOLDED: _:s0_pc0
  rdf:type sh:PropertyConstraint ;
  sh:hasValue <mailto:mesteban@fi.upm.es> ;
  sh:predicate <http://xmlns.com/foaf/0.1/mbox> ;
  sh:ValueType <http://xmlns.com/foaf/0.1/Thing>
] , [ # FOLDED: _:s0_pc1
  rdf:type sh:PropertyConstraint ;
  sh:datatype xsd:string ;
  sh:maxCount "1"^^xsd:integer ;
  sh:minCount "1"^^xsd:integer ;
  sh:predicate <http://xmlns.com/foaf/0.1/name>
] , [ # FOLDED: _:s0_pc2
  rdf:type sh:PropertyConstraint ;
  sh:maxCount "1"^^xsd:integer ;
  sh:minCount "1"^^xsd:integer ;
  sh:predicate <http://xmlns.com/foaf/0.1/based_near> ;
  sh:ValueType <http://www.w3.org/2003/01/geo/wgs84_pos#SpatialThing>
] , [ # FOLDED: _:s0_pc3
  rdf:type sh:PropertyConstraint ;
  sh:maxCount "1"^^xsd:integer ;
  sh:minCount "1"^^xsd:integer ;
  sh:predicate <http://xmlns.com/foaf/0.1/workplaceHomepage> ;
  sh:ValueType <http://xmlns.com/foaf/0.1/Document>
] .
```


Deleting the contact... (I)

Request the deletion and check the resource...

```
contacts> delete-resource http://localhost/contacts/ldp4j/api/persons/1/contacts/1/
```

```
Deleting resource...
```

```
- If-Match: "5c27e1c2-248b-44d6-b0e6-10a232c23231"
```

```
Resource deleted
```

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/1/contacts/1/
```

```
Retrieving resource...
```

```
Cannot retrieve resource
```

```
- Server response: Endpoint at http://localhost/contacts/ldp4j/api/persons/1/contacts/1/ is  
gone. Last activity on Sat, 30 May 2015 18:46:28 GMT
```

```
- Resource has been already deleted
```

Deleting the contact... (II)

... the person's contacts container resource...

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/1/contacts/
```

Retrieving resource...

Resource retrieved:

- Content-Type : text/turtle
- Entity Tag : "a65d3ed5-19bc-4e4a-90e7-af9ffab40df5"
- Last Modified : Sat, 30 May 2015 18:51:01 GMT
- Links:
 - + type : http://www.w3.org/ns/ldp#DirectResource
 - + type : http://www.w3.org/ns/ldp#Resource
- Content:

@prefix ldp: <http://www.w3.org/ns/ldp#> .

@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

@base <http://localhost/contacts/ldp4j/api/persons/1/contacts/> .

<>

```
    rdf:type ldp:Container, ldp:DirectContainer, ldp:RDFSource, ldp:Resource ;
    ldp:hasMemberRelation <http://www.ldap4j.org/ns/application#hasContact> ;
    ldp:insertedContentRelation ldp:MemberSubject ;
    ldp:membershipResource <...> .
```

Representation persisted to d:\iStack\workspaces\eclipse\luna\default\eswc2015-tutorial\client\.cache\http_localhost_contacts_ldp4j_api_persons_1_contacts_.dat

Deleting the contact... (III)

... and the person resource.

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/1/
```

Retrieving resource...

Resource retrieved:

- Content-Type : text/turtle
- Entity Tag : "7d56b23c-9cb4-4742-9ae0-8d5e980e279a"
- Last Modified : Sat, 30 May 2015 18:51:01 GMT

- Links:

+ type : <http://www.w3.org/ns/ldp#Resource>

- Content:

@prefix ldp: <<http://www.w3.org/ns/ldp#>> .

@prefix rdf: <<http://www.w3.org/1999/02/22-rdf-syntax-ns#>> .

@base <<http://localhost/contacts/ldp4j/api/persons/1/>> .

<>

```
    rdf:type ldp:RDFSsource, ldp:Resource, <http://xmlns.com/foaf/0.1/Person> ;
    <http://www.ldap4j.org/ns/application#hasAttachment> <contacts/> ;
    <http://xmlns.com/foaf/0.1/based\_near> <http://es.dbpedia.org/resource/Getafe> ;
    <http://xmlns.com/foaf/0.1/mbox> <mailto:mesteban@fi.upm.es> ;
    <http://xmlns.com/foaf/0.1/name> "Miguel Esteban Gutierrez" ;
    <http://xmlns.com/foaf/0.1/workplaceHomepage>
```

<<http://www.centeropenmiddleware.com/>> .

Representation persisted to d:\iStack\workspaces\eclipse\luna\default\eswc2015-tutorial\client\.cache\http_localhost_contacts_ldp4j_api_persons_1.dat

Deleting the person... (I)

Request the deletion and check the resource...

```
contacts> delete-resource http://localhost/contacts/ldp4j/api/persons/1/
```

```
Deleting resource...
```

```
- If-Match: "7d56b23c-9cb4-4742-9ae0-8d5e980e279a"
```

```
Resource deleted
```

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/1/
```

```
Retrieving resource...
```

```
Cannot retrieve resource
```

```
- Server response: Endpoint at http://localhost/contacts/ldp4j/api/persons/1/ is gone. Last  
activity on Sat, 30 May 2015 18:51:01 GMT
```

```
- Resource has been already deleted
```

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/1/contacts/
```

```
Retrieving resource...
```

```
Cannot retrieve resource
```

```
- Server response: Endpoint at http://localhost/contacts/ldp4j/api/persons/1/contacts/ is  
gone. Last activity on Sat, 30 May 2015 18:51:01 GMT
```

```
- Resource has been already deleted
```

Deleting the person... (II)

... and the application status

```
contacts> retrieve-resource http://localhost/contacts/ldp4j/api/persons/
```

```
Retrieving resource...
```

```
Resource retrieved:
```

```
- Content-Type   : text/turtle
- Entity Tag     : "7d56b23c-9cb4-4742-9ae0-8d5e980e279a"
- Last Modified  : Sat, 30 May 2015 18:56:44 GMT
- Links:
  + type : http://www.w3.org/ns/ldp#BasicResource
  + type : http://www.w3.org/ns/ldp#Resource
- Content:
@prefix ldp: <http://www.w3.org/ns/ldp#> .
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#> .

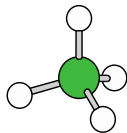
@base <http://localhost/contacts/ldp4j/api/persons/> .

<>

    rdf:type ldp:Container, ldp:RDFSSource, ldp:Resource .
```

```
Representation persisted to d:\iStack\workspaces\eclipse\luna\default\eswc2015-
tutorial\client\.cache\http_localhost_contacts_ldp4j_api_persons_.dat
```

Questions?



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