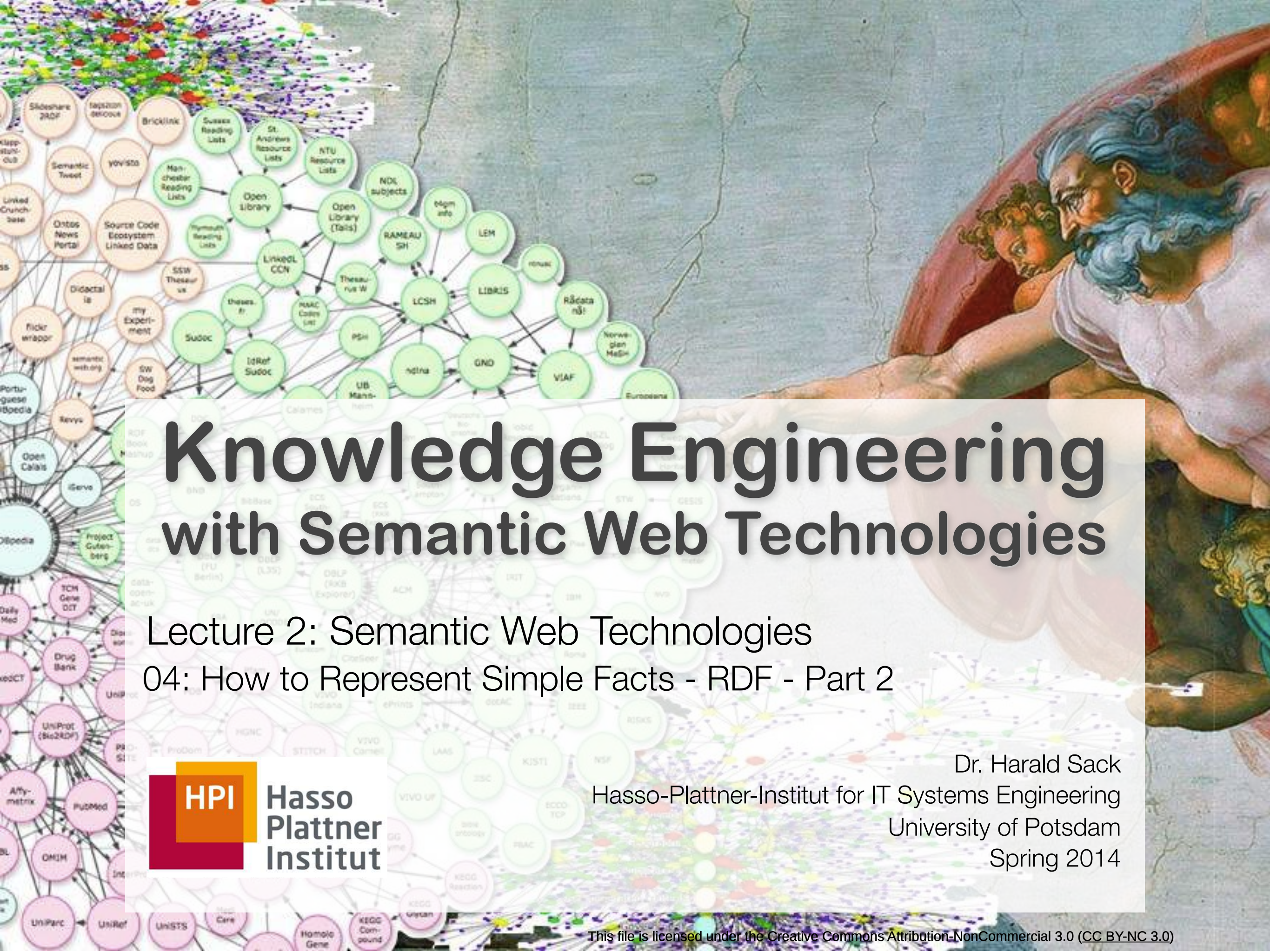




Knowledge Engineering with Semantic Web Technologies

Lecture 2: Semantic Web Technologies

04: How to Represent Simple Facts - RDF - Part 2



Dr. Harald Sack
Hasso-Plattner-Institut for IT Systems Engineering
University of Potsdam
Spring 2014



Lecture 2: Semantic Web Technologies - Part 1

Open HPI - Course: Knowledge Engineering with Semantic Web Technologies

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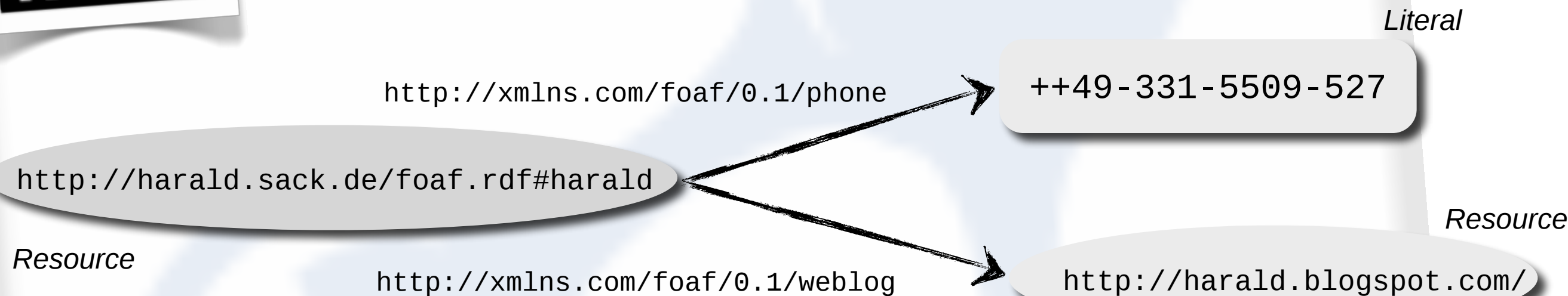
**Simple Facts in RDF
with Turtle**

04 How to Represent Simple Facts - RDF Pt.2

Open HPI - Course: Knowledge Engineering with Semantic Web Technologies
Lecture 2: Semantic Web Technologies Part I



Resource Description Framework



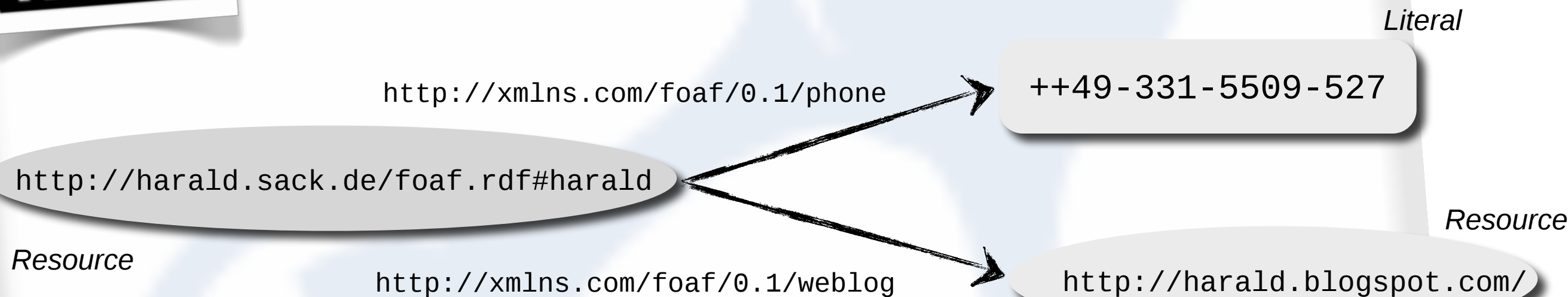
- **Turtle (Terse RDF Tripel Language) Notation**
- ...starting from N-Triples

```
<http://harald.sack.de/foaf.rdf#harald> <http://xmlns.com/foaf/0.1/phone> "+49-331-5509-527" .
```

```
<http://harald.sack.de/foaf.rdf#harald> <http://xmlns.com/foaf/0.1/weblog> <http://semweb2014.blogspot.com/> .
```



Resource Description Framework



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

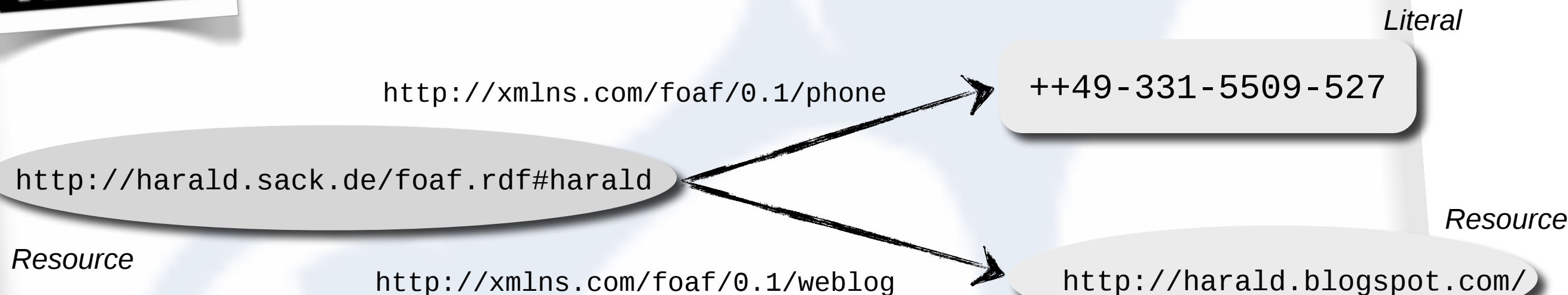
```
@base <http://harald.sack.de/foaf.rdf> .
```

```
<#harald> foaf:phone "++49-331-5509-527" .
```

```
<#harald> foaf:weblog <http://semweb2014.blogspot.com/> .
```



Resource Description Framework



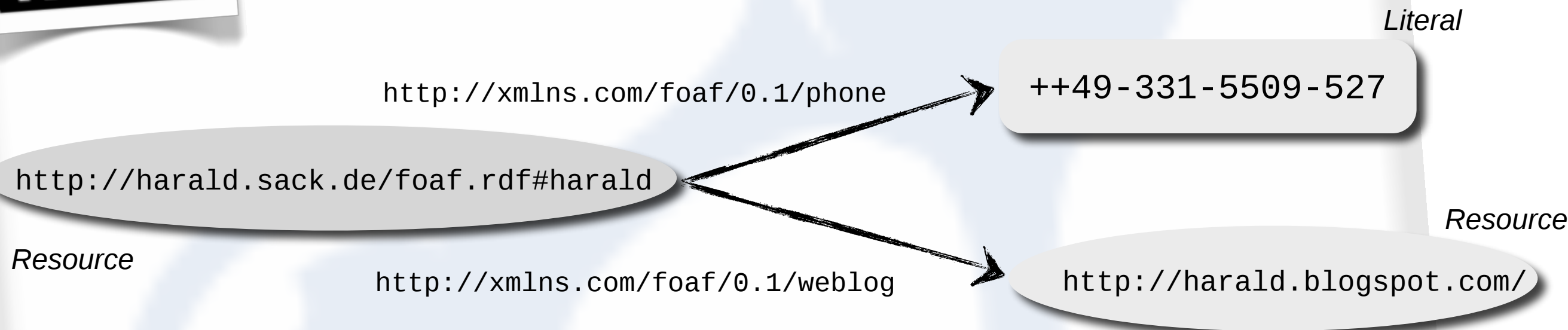
@prefix directive associates prefix-label with IRI

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .
@base <http://harald.sack.de/foaf.rdf> .

<#harald> foaf:phone "++49-331-5509-527" .
<#harald> foaf:weblog <http://semweb2014.blogspot.com/> .
```



Resource Description Framework



@prefix directive associates prefix-label with IRI

```
@prefix foaf: <http://xmlns.com/foaf/0.1/> .  
@base <http://harald.sack.de/foaf.rdf> .
```

```
<#harald> foaf:phone "++49-331-5509-527" .  
<#harald> foaf:weblog <http://semweb2014.blogspot.com/> .
```

usage of prefix label



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

`http://xmlns.com/foaf/0.1/phone`

`++49-331-5509-527`

Literal

`http://xmlns.com/foaf/0.1/weblog`

`http://harald.blogspot.com/`

Resource

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

```
@base <http://harald.sack.de/foaf.rdf> .
```

```
<#harald> foaf:phone "++49-331-5509-527" .
```

```
<#harald> foaf:weblog <http://semweb2014.blogspot.com/> .
```



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

`http://xmlns.com/foaf/0.1/phone`

`++49-331-5509-527`

Literal

`http://xmlns.com/foaf/0.1/weblog`

`http://harald.blogspot.com/`

Resource

@base directive provides IRI to complement all relative IRIs

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

`@base <http://harald.sack.de/foaf.rdf> .`

`<#harald> foaf:phone "++49-331-5509-527" .`

`<#harald> foaf:weblog <http://semweb2014.blogspot.com/> .`



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

`http://xmlns.com/foaf/0.1/phone`

`++49-331-5509-527`

Literal

`http://xmlns.com/foaf/0.1/weblog`

`http://harald.blogspot.com/`

Resource

@base directive provides IRI to complement all relative IRIs

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

`@base <http://harald.sack.de/foaf.rdf> .`

`<#harald> foaf:phone "++49-331-5509-527" .`

`<#harald> foaf:weblog <http://semweb2014.blogspot.com/> .`

example for relative IRI in RDF



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

`http://xmlns.com/foaf/0.1/phone`

`++49-331-5509-527`

Literal

`http://xmlns.com/foaf/0.1/weblog`

`http://harald.blogspot.com/`

Resource

file `http://harald.sack.de/foaf.rdf`

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

```
<#harald> foaf:phone "++49-331-5509-527" .
```

```
<#harald> foaf:weblog <http://semweb2014.blogspot.com/> .
```



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

`http://xmlns.com/foaf/0.1/phone`

`++49-331-5509-527`

Literal

`http://xmlns.com/foaf/0.1/weblog`

`http://harald.blogspot.com/`

Resource

file `http://harald.sack.de/foaf.rdf`

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

```
<#harald> foaf:phone "++49-331-5509-527" .
```

```
<#harald> foaf:weblog <http://semweb2014.blogspot.com/> .
```

if there is no @base directive, relative URIs/IRIs will be complemented by the document's own URI/IRI



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

`http://xmlns.com/foaf/0.1/phone`

`++49-331-5509-527`

Literal

`http://xmlns.com/foaf/0.1/weblog`

`http://harald.blogspot.com/`

Resource

`file http://harald.sack.de/foaf.rdf`

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

```
<#harald> foaf:phone "++49-331-5509-527" .
```

```
<#harald> foaf:weblog <http://semweb2014.blogspot.com/> .
```

if there is no @base directive, relative URIs/IRIs will be complemented by the document's own URI/IRI



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

`http://xmlns.com/foaf/0.1/phone`

`++49-331-5509-527`

Literal

`http://xmlns.com/foaf/0.1/weblog`

`http://harald.blogspot.com/`

Resource

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

```
@base <http://harald.sack.de/foaf.rdf> .
```

```
<#harald> foaf:phone "++49-331-5509-527" ;
```

```
foaf:weblog <http://semweb2014.blogspot.com/> .
```



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

`http://xmlns.com/foaf/0.1/phone`

`++49-331-5509-527`

Literal

`http://xmlns.com/foaf/0.1/weblog`

`http://harald.blogspot.com/`

Resource

semicolon indicates that subsequent
triples have the same subject
(**predicate list**)

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

`@base <http://harald.sack.de/foaf.rdf> .`

`<#harald> foaf:phone "++49-331-5509-527";`
`foaf:weblog <http://semweb2014.blogspot.com/> .`



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

`http://xmlns.com/foaf/0.1/phone`

`++49-331-5509-527`

Literal

`http://xmlns.com/foaf/0.1/weblog`

`http://harald.blogspot.com/`

Resource

semicolon indicates that subsequent triples have the same subject
(**predicate list**)

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

@base <http://harald.sack.de/foaf.rdf> .

<#harald> foaf:phone "++49-331-5509-527";
foaf:weblog <http://semweb2014.blogspot.com/> .

subject of subsequent triples can be left out



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

`foaf:weblog`

`http://semweb2014.blogspot.com/`

`foaf:weblog`

`http://semweb2013.blogspot.com/`

`foaf:weblog`

`http://semweb2012.blogspot.com/`

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

```
<#harald> foaf:weblog <http://semweb2014.blogspot.com/> ,  
                  <http://semweb2013.blogspot.com/> ,  
                  <http://semweb2012.blogspot.com/> .
```

file `http://harald.sack.de/foaf.rdf`



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

`foaf:weblog`

`http://semweb2014.blogspot.com/`

`foaf:weblog`

`http://semweb2013.blogspot.com/`

`foaf:weblog`

`http://semweb2012.blogspot.com/`

comma indicates that subsequent triples have same subject and property (**object list**)

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

```
<#harald> foaf:weblog <http://semweb2014.blogspot.com/> ,  
                <http://semweb2013.blogspot.com/> ,  
                <http://semweb2012.blogspot.com/> .
```

file `http://harald.sack.de/foaf.rdf`



Resource Description Framework

`http://harald.sack.de/foaf.rdf#harald`

Resource

foaf:weblog

`http://semweb2014.blogspot.com/`

foaf:weblog

`http://semweb2013.blogspot.com/`

foaf:weblog

`http://semweb2012.blogspot.com/`

comma indicates that subsequent triples have same subject and property (**object list**)

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

```
<#harald> foaf:weblog <http://semweb2014.blogspot.com/> ,  
                <http://semweb2013.blogspot.com/> ,  
                <http://semweb2012.blogspot.com/> .
```

file `http://harald.sack.de/foaf.rdf`

subject and property of subsequent triples are the same



Resource Description Framework

`http://hpi-web.de/Lecture#name`

Knowledge
Engineering

`http://hpi-web.de/Spring14#KE`

`http://hpi-web.de/Lecture#hours`

4

- **Typed Literals**

```
@prefix lec: <http://hpi-web.de/Lecture#> .
```

```
<http://hpi.web.de/Spring14#KE>
```

```
lec:name "Knowledge Engineering"^^<http://www.w3c.org/2001/XMLSchema#string> ;
```

```
lec:hours "4"^^<http://www.w3c.org/2001/XMLSchema#integer> .
```



Resource Description Framework

`http://hpi-web.de/Lecture#name`

Knowledge
Engineering

`http://hpi-web.de/Spring14#KE`

`http://hpi-web.de/Lecture#hours`

4

- **Typed Literals**

```
@prefix lec: <http://hpi-web.de/Lecture#> .
```

```
<http://hpi.v  
lec:na  
lec:h
```

```
@prefix lv: <http://hpi-web.de/Lecture#> .
```

```
<http://hpi.web.de/Spring14#KE> lec:name "Semantic Web Technologies" ;  
lec:hours 4 .
```



Resource Description Framework

Multi Valued Relations and Blank Nodes

- Example:
 - A lecture takes place twice a week in two different rooms
 - How to model this in RDF?

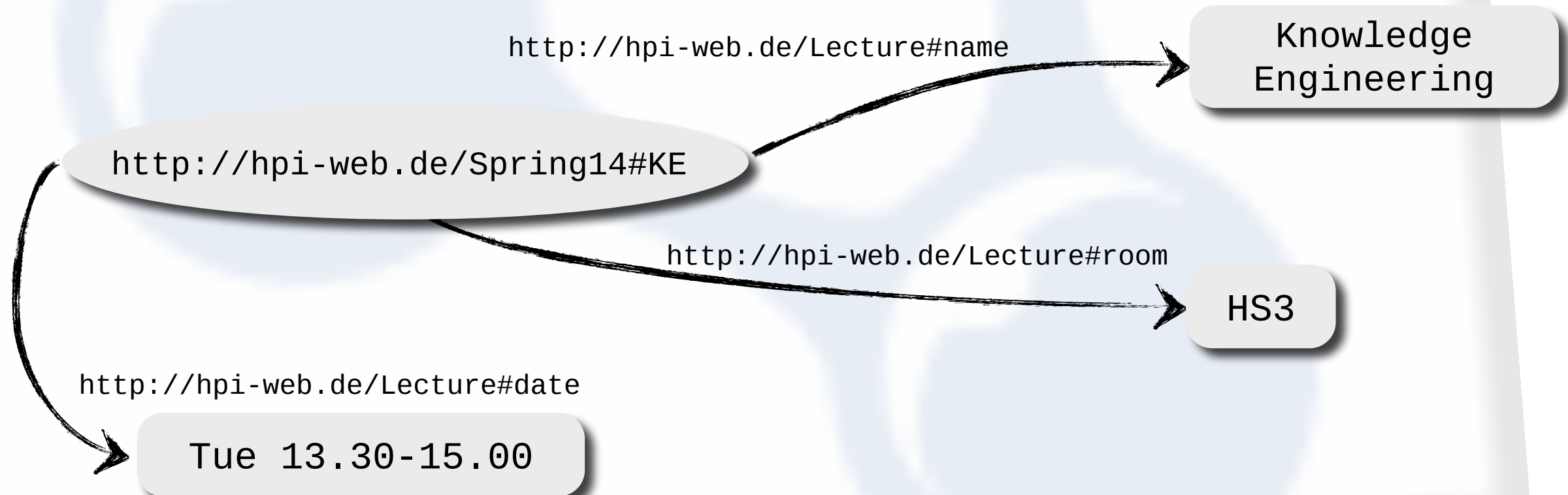




Resource Description Framework

Multi Valued Relations and Blank Nodes

- Example:
 - A lecture takes place twice a week in two different rooms
 - How to model this in RDF?

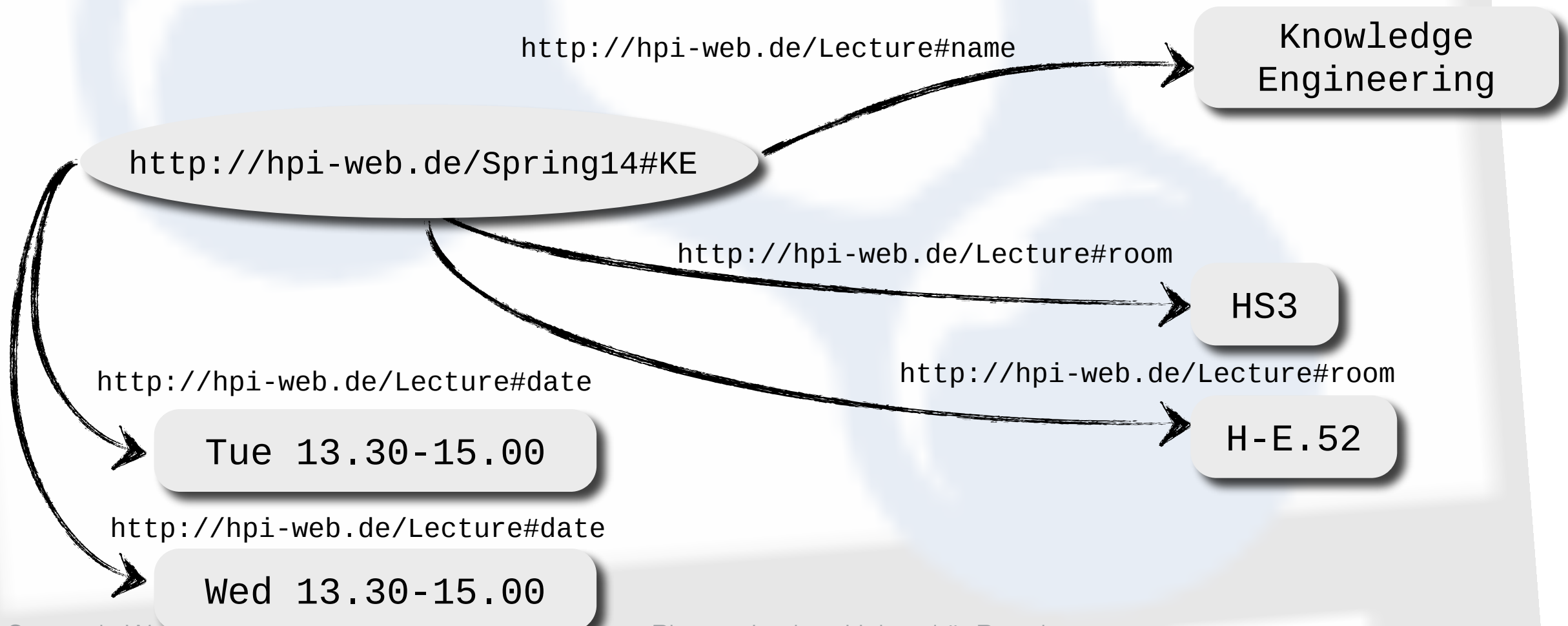




Resource Description Framework

Multi Valued Relations and Blank Nodes

- Example:
 - A lecture takes place twice a week in two different rooms
 - How to model this in RDF?

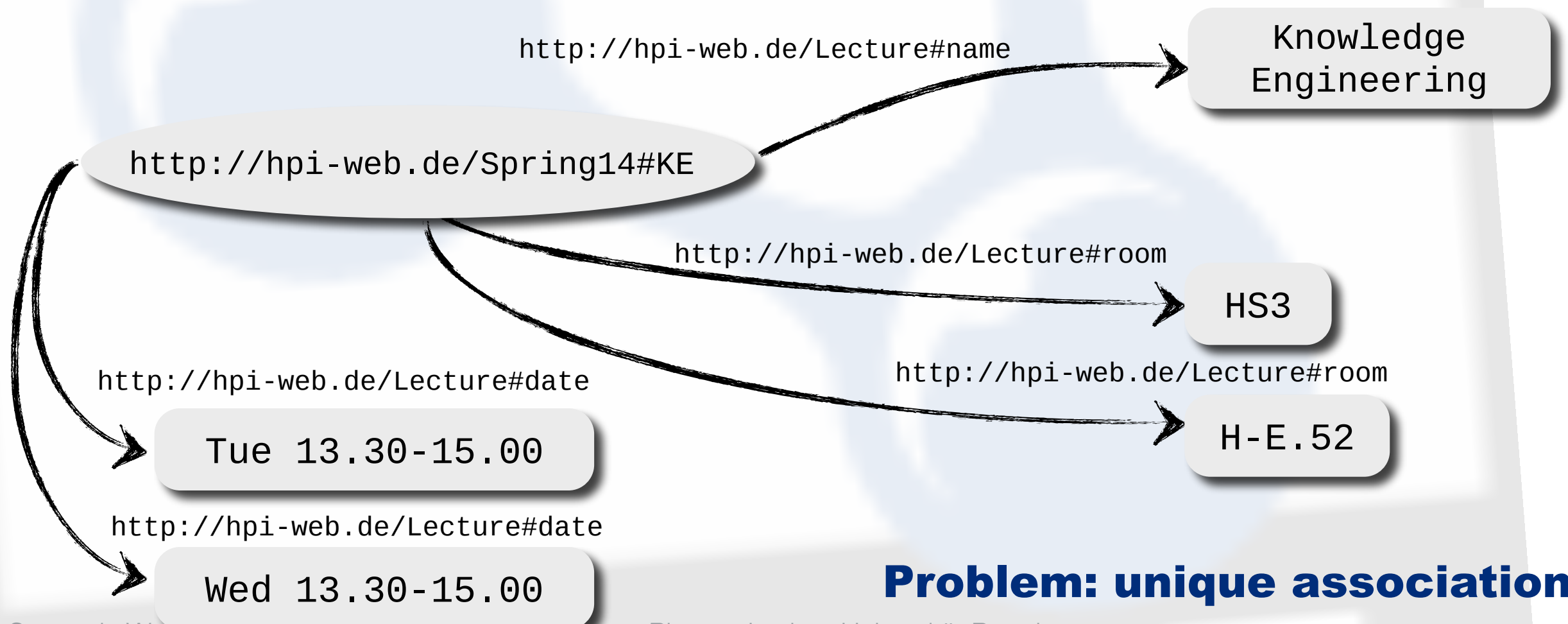




Resource Description Framework

Multi Valued Relations and Blank Nodes

- Example:
 - A lecture takes place twice a week in two different rooms
 - How to model this in RDF?

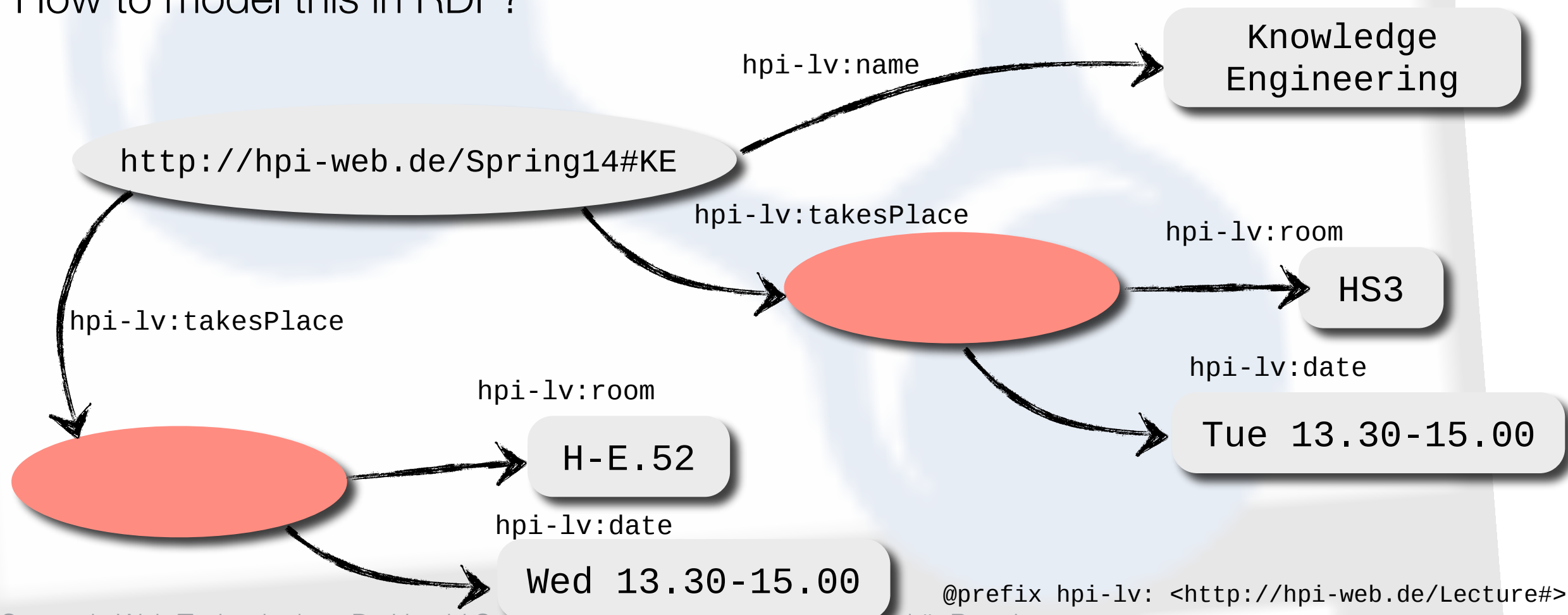




Resource Description Framework

Multi Valued Relations and Blank Nodes

- Example:
 - A lecture takes place twice a week in two different rooms
 - How to model this in RDF?

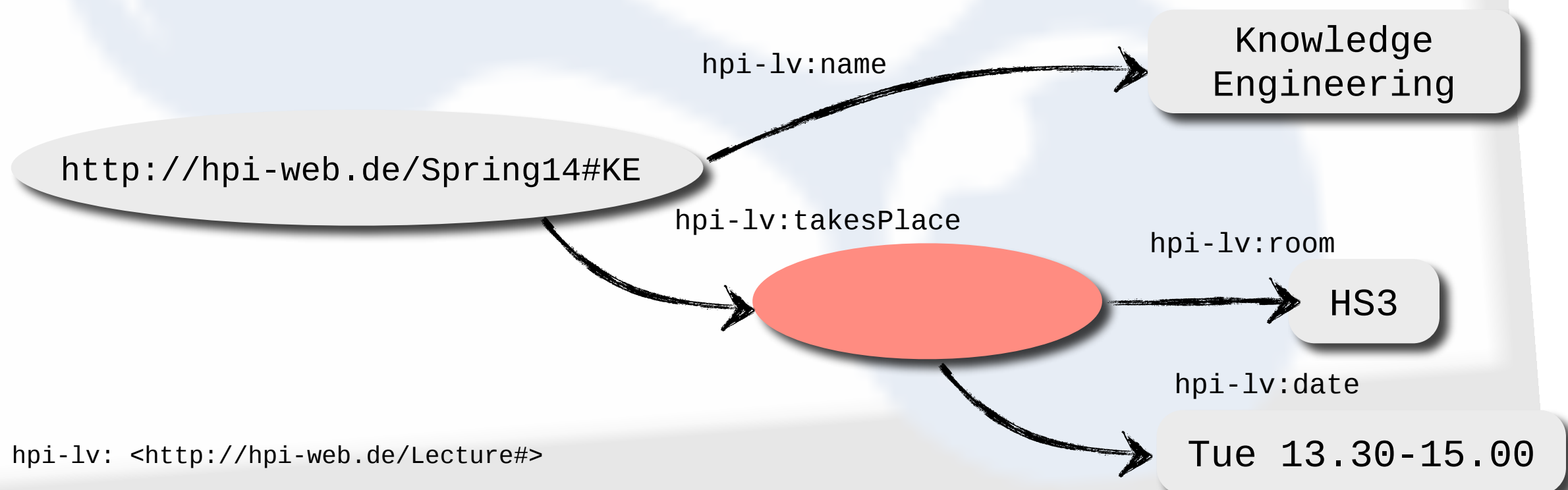




Resource Description Framework

Blank Nodes

- Blank Nodes (Bnodes) can be introduced to represent multi valued relationships
- Blank Nodes can be introduced for resources that don't need a name (auxiliary nodes)

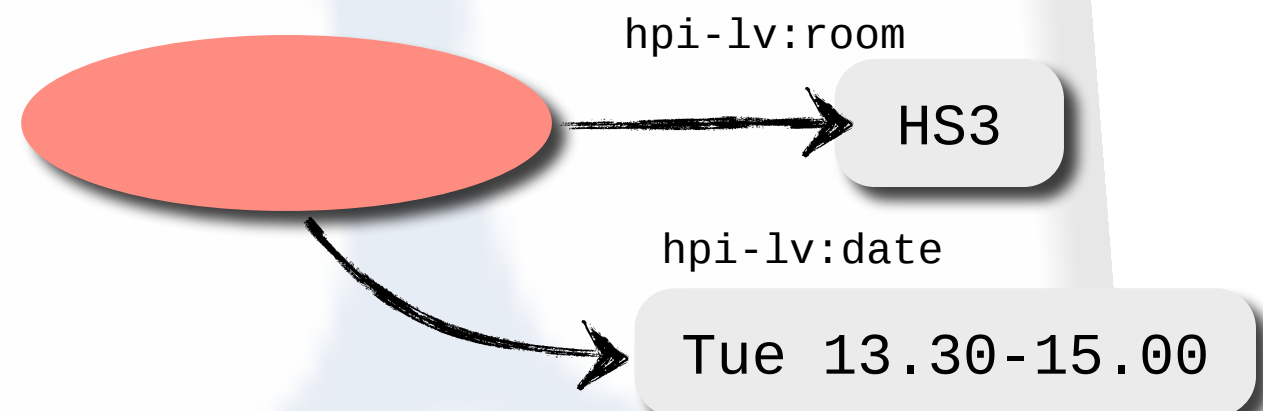


@prefix hpi-lv: <http://hpi-web.de/Lecture#>



Resource Description Framework

Anonymous Blank Nodes



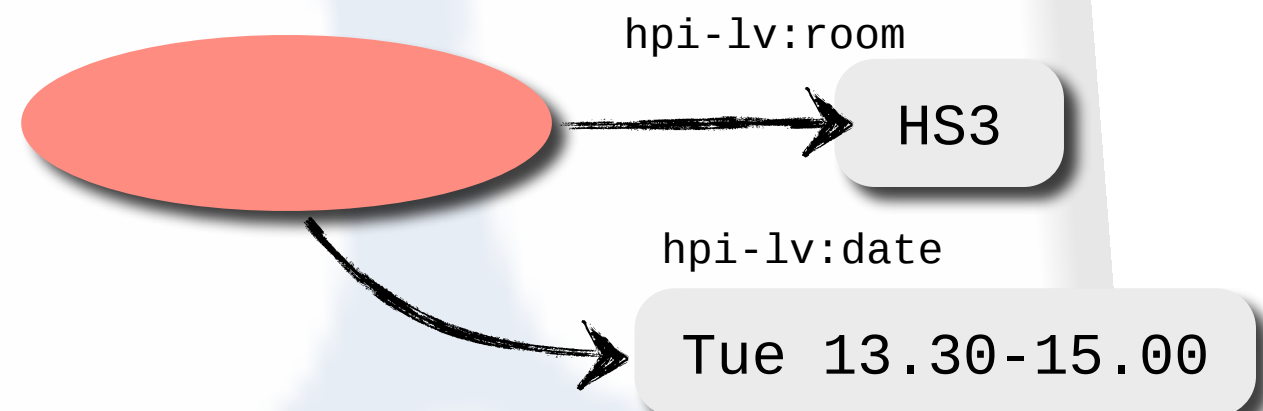
```
@prefix hpi-lv: <http://hpi-web.de/Lecture#> .
```

```
[ ] hpi-lv:date "Tue 13.30-15.00";  
    hpi-lv:room "HS3" .
```



Resource Description Framework

Anonymous Blank Nodes



```
@prefix hpi-lv: <http://hpi-web.de/Lecture#> .
```

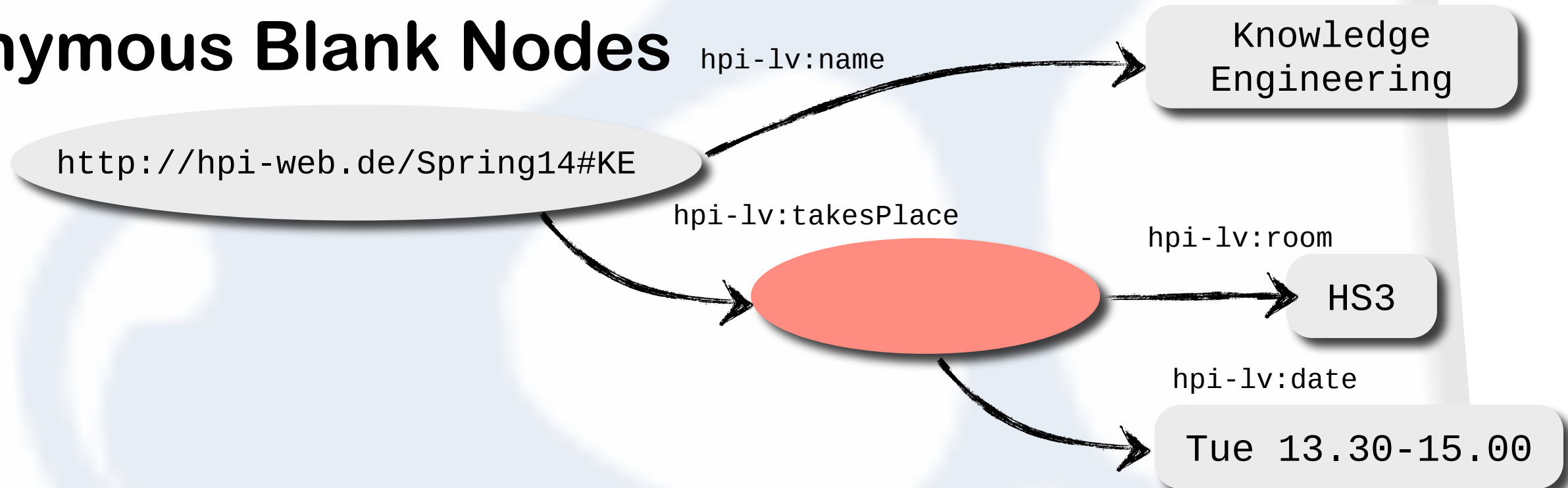
```
[ ] hpi-lv:date "Tue 13.30-15.00";  
    hpi-lv:room "HS3" .
```

anonymous blank node



Resource Description Framework

Anonymous Blank Nodes



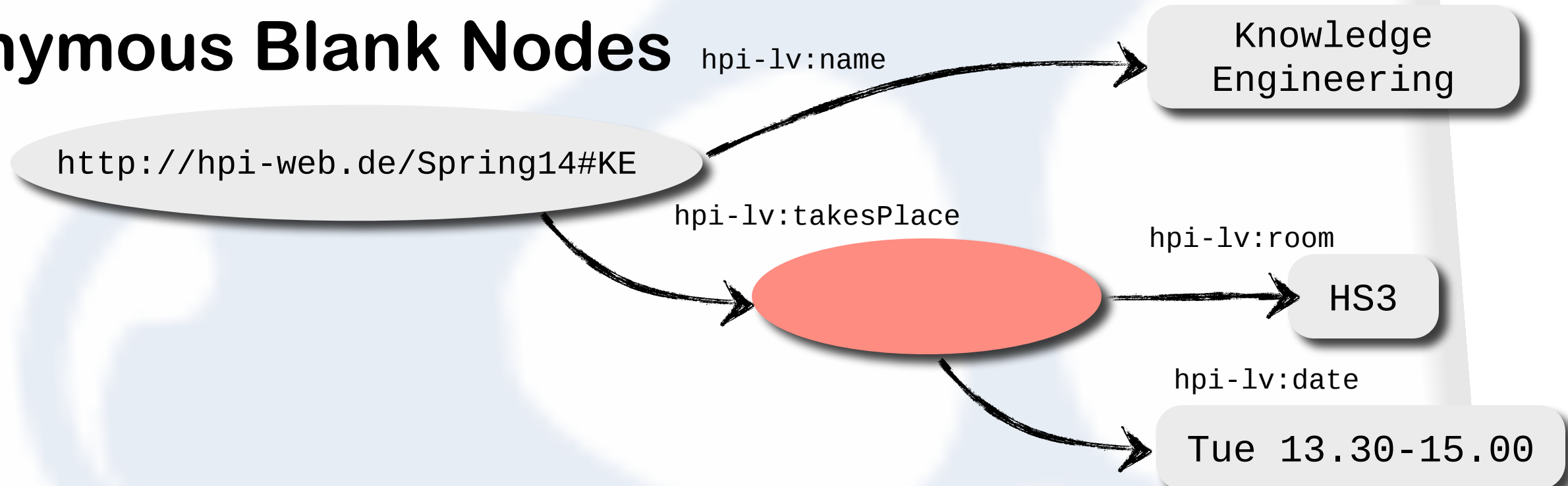
@prefix hpi-lv: <http://hpi-web.de/Lecture#>.

```
<http://hpi-web.de/Spring14#KE> hpi-lv:name "Knowledge Engineering";  
                                hpi-lv:takesPlace [  
                                    hpi-lv:date "Tue 13.30-15.00";  
                                    hpi-lv:room "HS3" ] .
```



Resource Description Framework

Anonymous Blank Nodes



@prefix hpi-lv: <http://hpi-web.de/Lecture#>.

```
<http://hpi-web.de/Spring14#KE> hpi-lv:name "Knowledge Engineering";  
hpi-lv:takesPlace [  
  hpi-lv:date "Tue 13.30-15.00";  
  hpi-lv:room "HS3" ] .
```

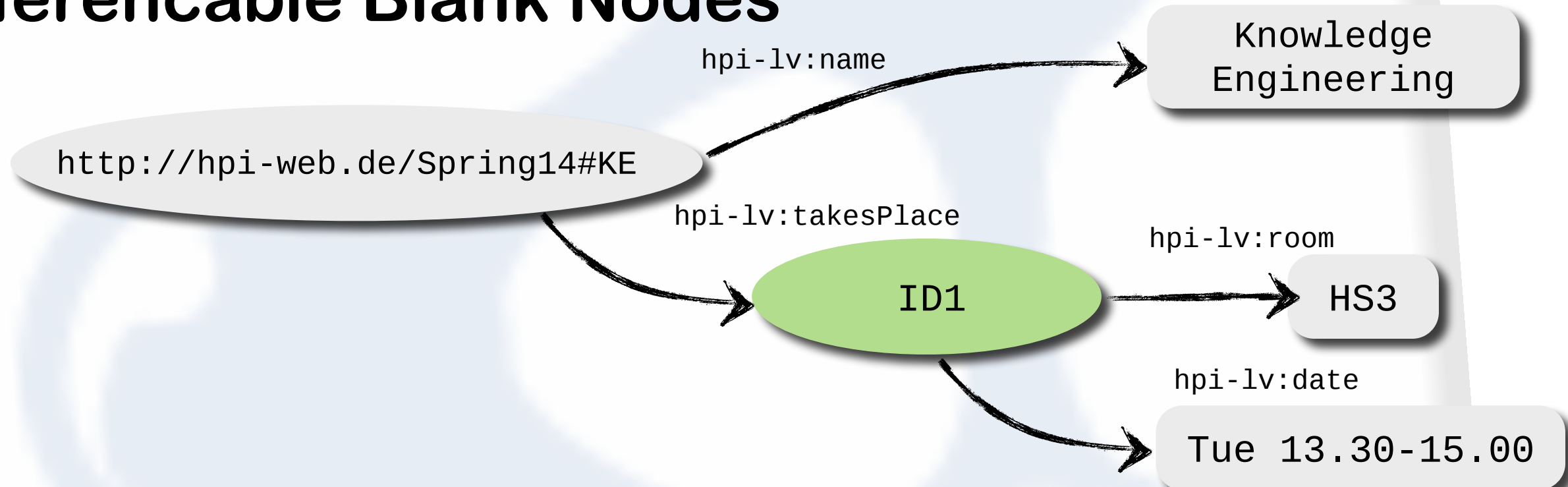
nested anonymous blank node



Resource Description Framework

16

Dereferencable Blank Nodes



@prefix hpi-lv: <http://hpi-web.de/Lecture#>.

<http://hpi-web.de/Spring14#KE> hpi-lv:name "Knowledge Engineering";
hpi-lv:takesPlace **_:ID1** .

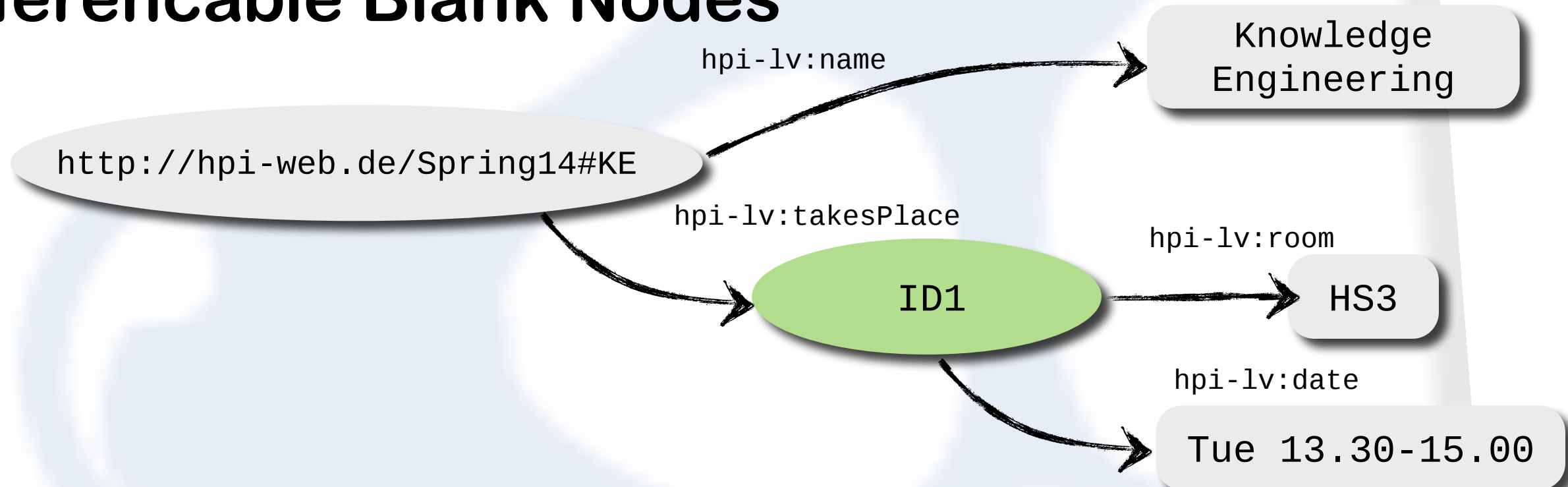
_:ID1 hpi-lv:date "Tue 13.30-15.00";
hpi-lv:room "HS3" .



Resource Description Framework

16

Dereferencable Blank Nodes



@prefix hpi-lv: <http://hpi-web.de/Lecture#>.

<http://hpi-web.de/Spring14#KE> hpi-lv:name "Knowledge Engineering";
hpi-lv:takesPlace **_:ID1** .

_:ID1 hpi-lv:date "Tue 13.30-15.00";
hpi-lv:room "HS3" .

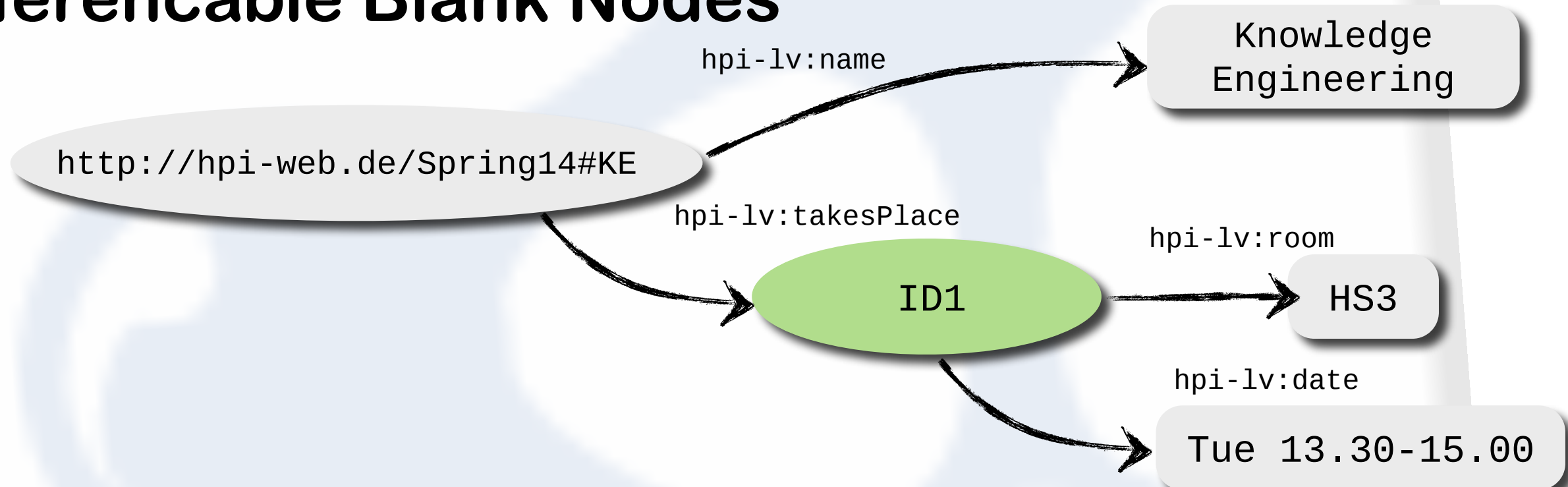
dereferencable blank node



Resource Description Framework

16

Dereferencable Blank Nodes



@prefix hpi-lv: <http://hpi-web.de/Lecture#>.

<http://hpi-web.de/Spring14#KE> hpi-lv:name "Knowledge Engineering";
hpi-lv:takesPlace **_:ID1** .

_:ID1 hpi-lv:date "Tue 13.30-15.00";
hpi-lv:room "HS3" .

dereferencable blank node

Lists in RDF

05 How to Represent Facts? - RDF (3)

Open HPI - Course: Knowledge Engineering with Semantic Web Technologies
Lecture 2: Semantic Web Technologies Part I