

Semantic Sticky Note: RDF Metadata Access and Querying Using GT4 Java WS

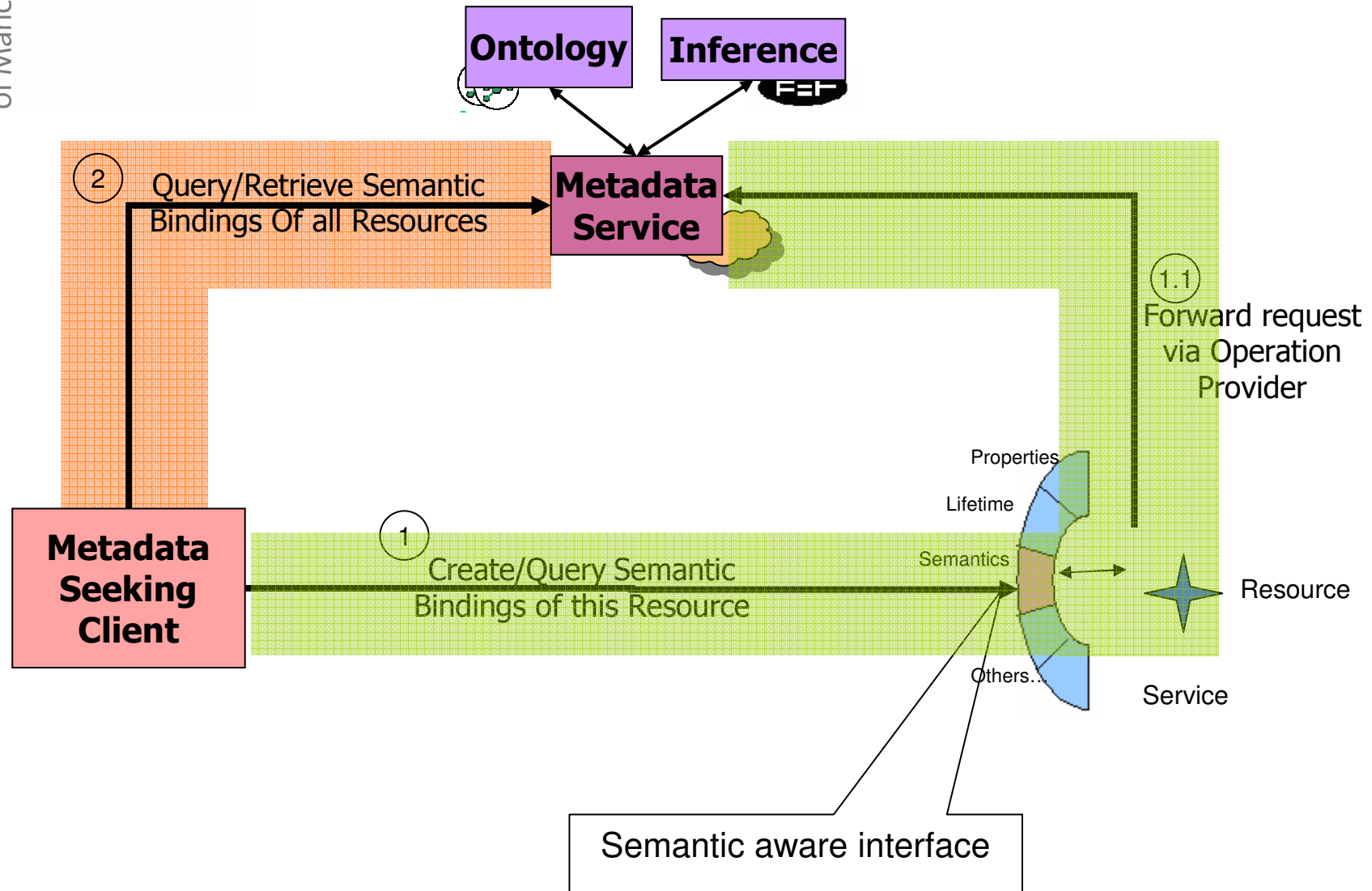
Pinar Alper, Oscar Corcho
University of Manchester



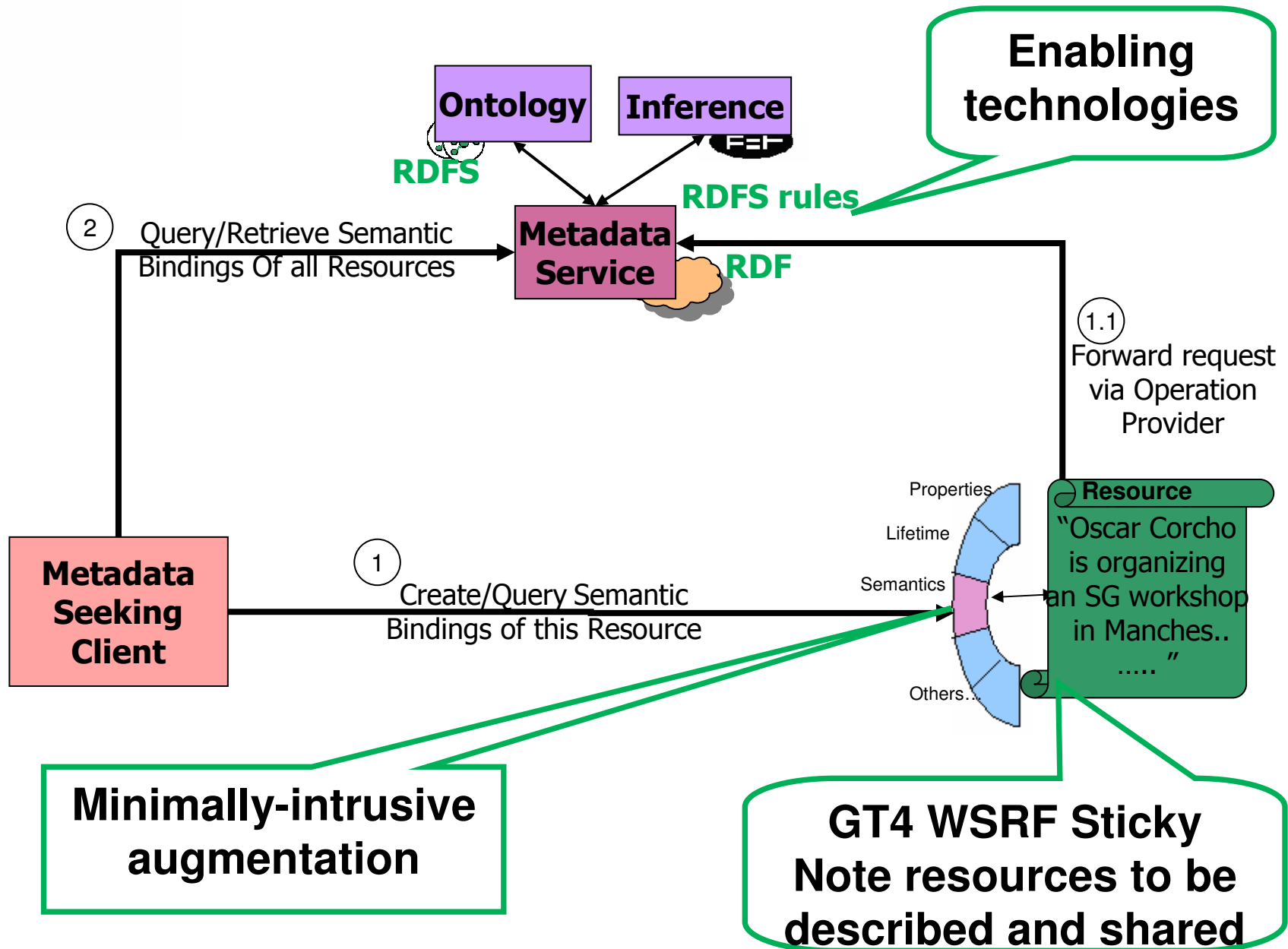
Tutorial Roadmap

- Objectives
- Hands-on: Build a Semantically-Aware Grid Service
 - Structure and materials
 - Exercises
 - **1.** Setup the Globus Container
 - **2.** Deploy Semantic Services and Operation Providers
 - **3.** Attach Semantic Bindings to a Sticky Note
 - **4.** Query Semantic Bindings of a Sticky Note
 - **5.** Make Inferences on the Semantic Bindings of a Sticky Note
 - 6. Query over a Set of Semantic Bindings (advanced)
 - 7. Use a Remote Semantic Binding Service (advanced)
 - Summary
- Conclusions

Tutorial Objective



Context & Technologies



Roadmap

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Structure

- Each chapter includes:
 - A discussion of the concepts
 - A discussion of implementation details
 - Hands-on exercises
 - A summary
- Assumptions
 - Familiarity with BAS GT4 Sticky Note Tutorial.
 - Tutorial for demonstrating basic WSRF operations

Tutorial Material

- In a browser window, please go to & bookmark:
 - <http://www.cs.man.ac.uk/~ocorcho/OntoGrid/ISSGC2007/>
- The material includes
 - Exercise notes - HTML
 - Demonstration code
 - A GT container distribution (currently version 4.0.3)
 - This slideset

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Ex1. Deploy the Globus Container.

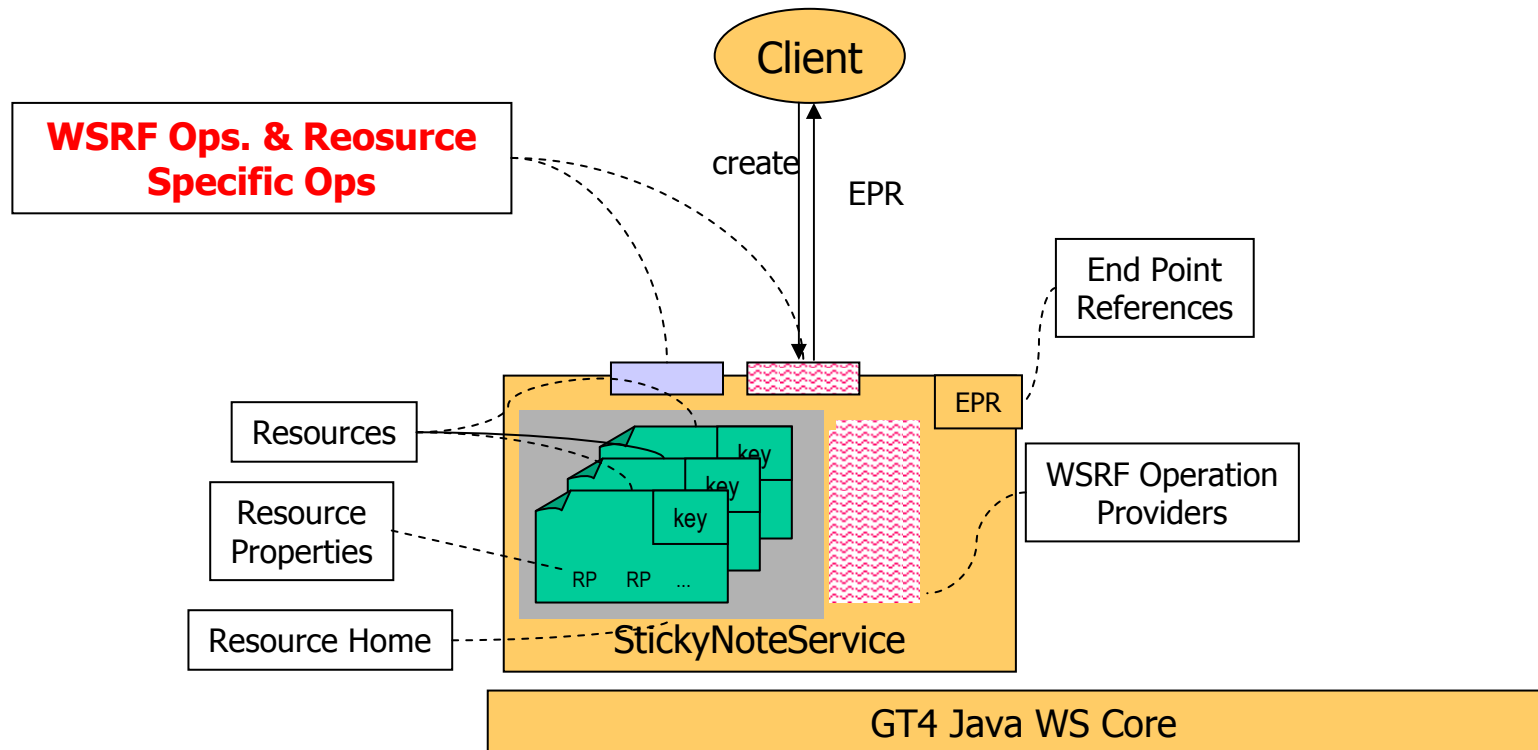
- In this exercise,
 - we will **download**:
 - The Globus Container
 - The source code for the Semantic Grid tutorial
 - Includes Basic Sticky Note source
 - ... and we will **setup** (set environment and run):
 - The Globus Container
 - The StickyNote Service

Hands-on Exercises

Student Notes, Chapter 1

Ex1 Review

- This is the setup obtained after setting up all the components in this exercise



Ex1 Base Sticky Note Capabilities

1. Run container.

2. Create a Sticky Note

```
$GLOBUS_LOCATION/bin/create-note -s http://local....
```

3. Write a message to a Sticky Note

```
$GLOBUS_LOCATION/bin/write-note -e note-123.epr  
HelloWorld
```

4. Read the message of a Sticky Note

```
$GLOBUS_LOCATION/bin/show-note -e note-123.epr
```

5. Destroy a Sticky Note

```
$GLOBUS_LOCATION/bin/wsrft-destroy -e note123.epr
```

Repeat show-note after this step....

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Ex2. Deploy Semantic Services & Operation Provider

In to the Globus Container we will **deploy**

– The **Semantic Services** suite:

- The SB Factory Service,
 - creating contextualized RDF graphs (i.e. Semantic Bindings)
- The SB Service,
 - WS-Resource representatives of Semantic Bindings
- The Metadata Query Service,
 - Global view over multiple Semantic Bindings

`exercise-install/SemanticBindingService/src/`

– **Semantics Operation Provider** , a proxy to the Semantic Binding Service. Could be augmented with any WSRF service and make it semantically aware.

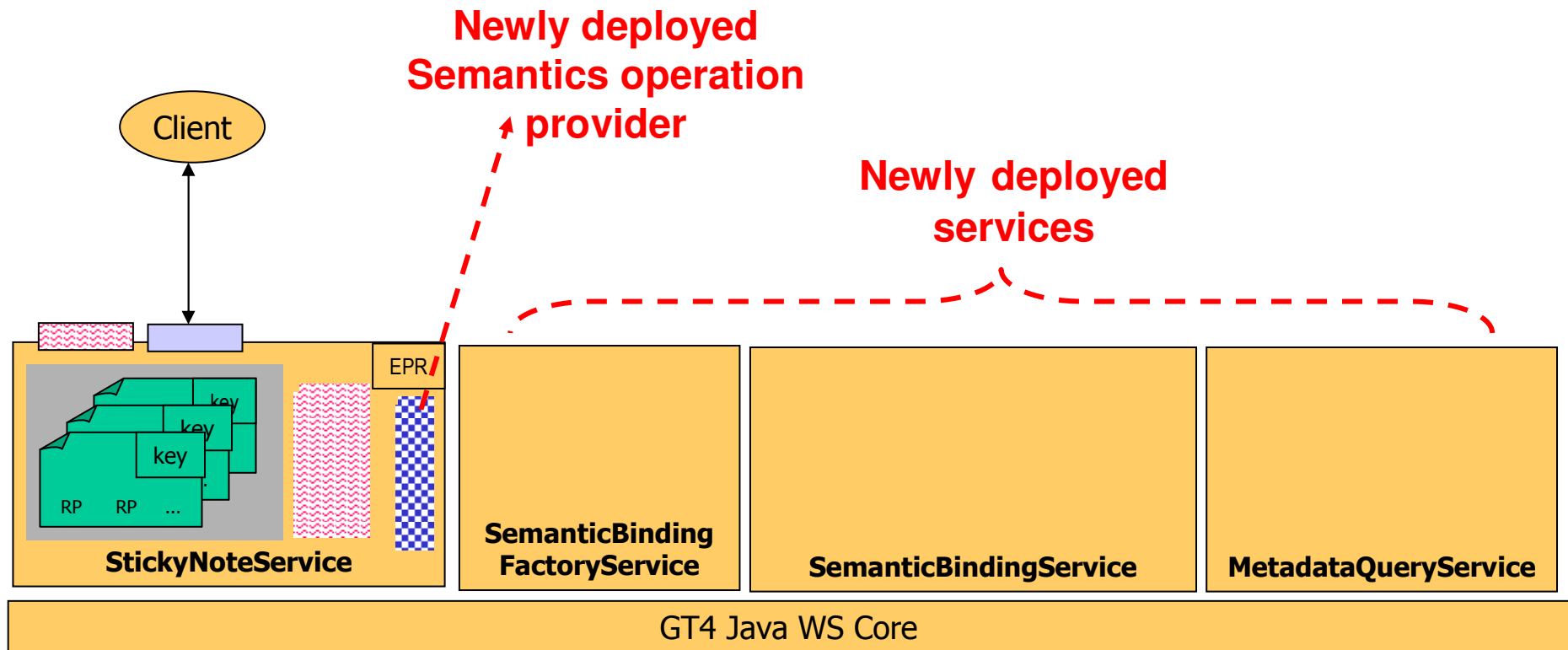
`exercise-install/SemanticsOperationProvider/src`

Hands-on Exercises

Student Notes, Chapter 2

Ex2 Review

- This is the setup obtained after completing this exercise

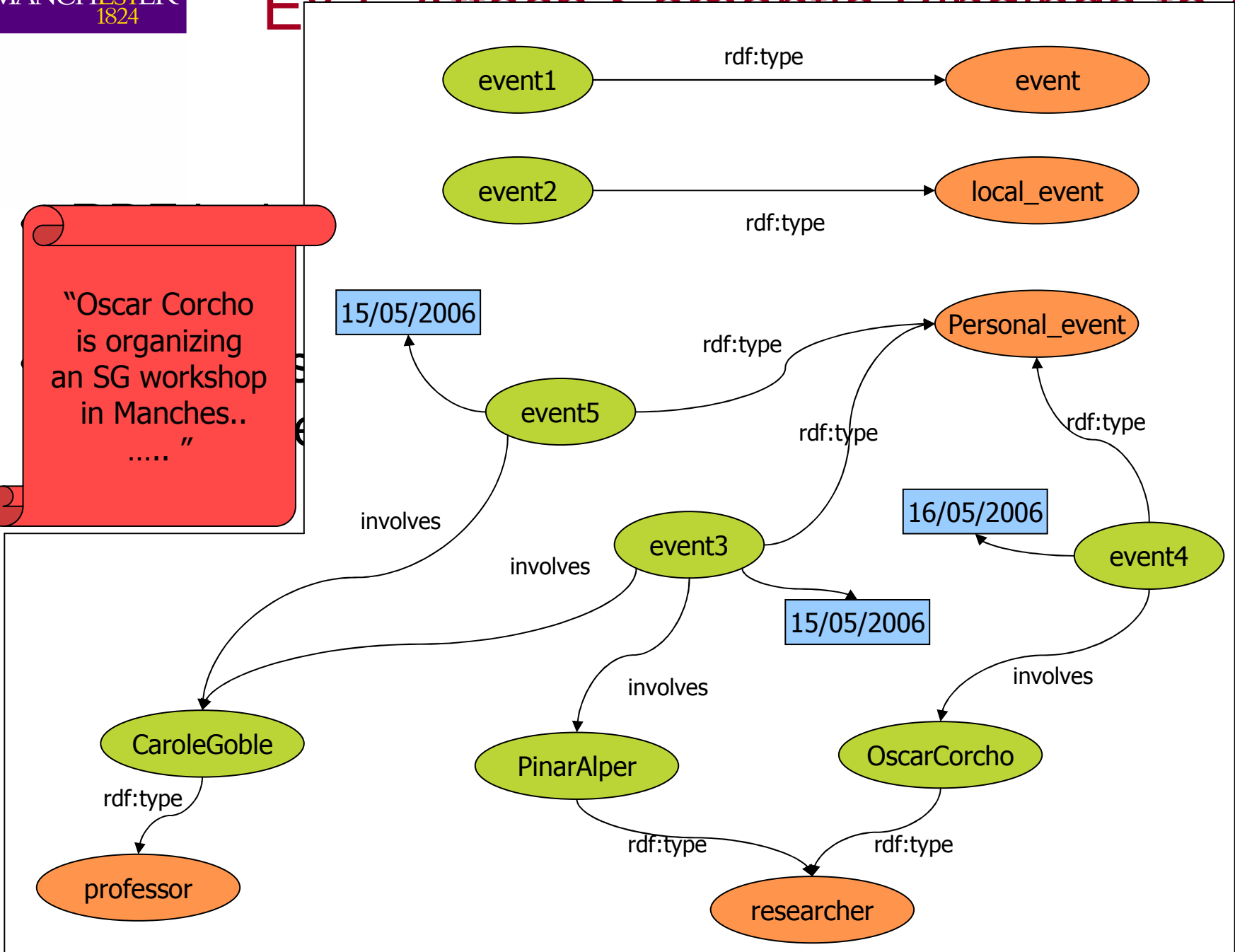


Roadmap

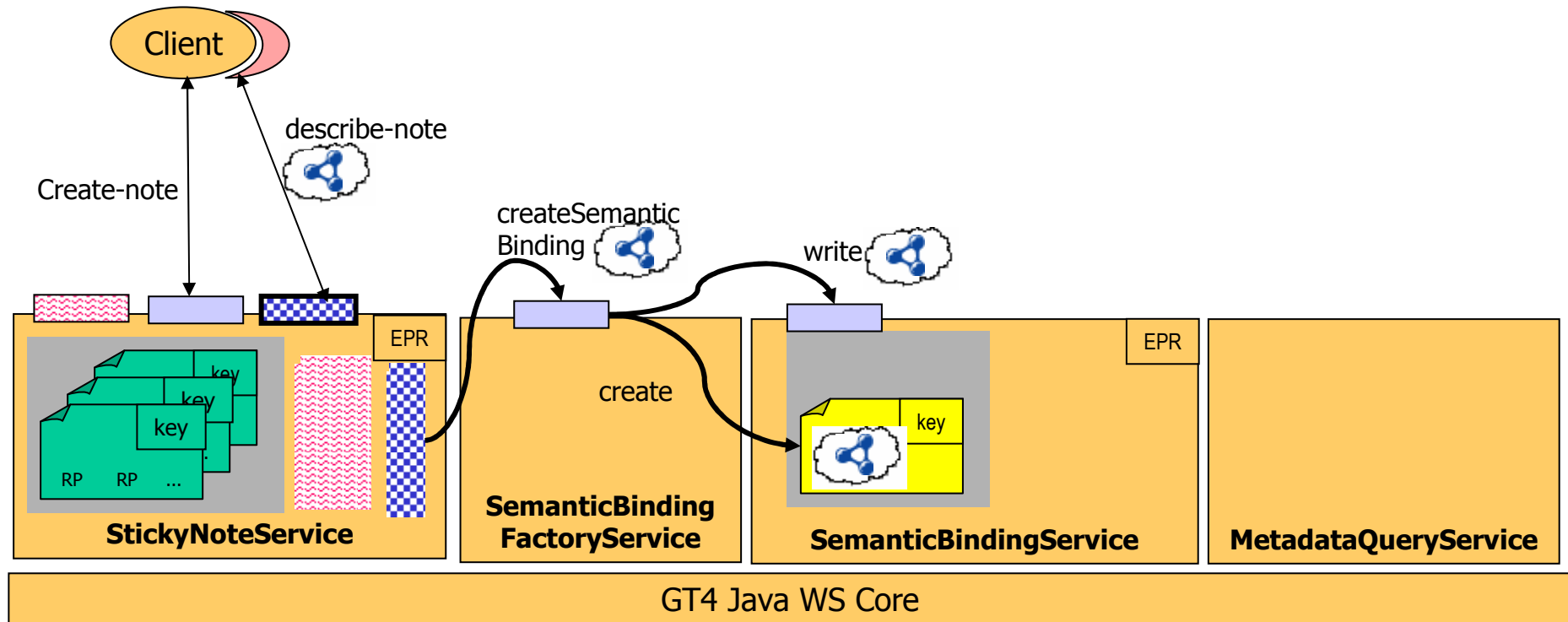
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Ex2 Attack Semantic Databases to a

"Oscar Corcho is organizing an SG workshop in Manches..
....."

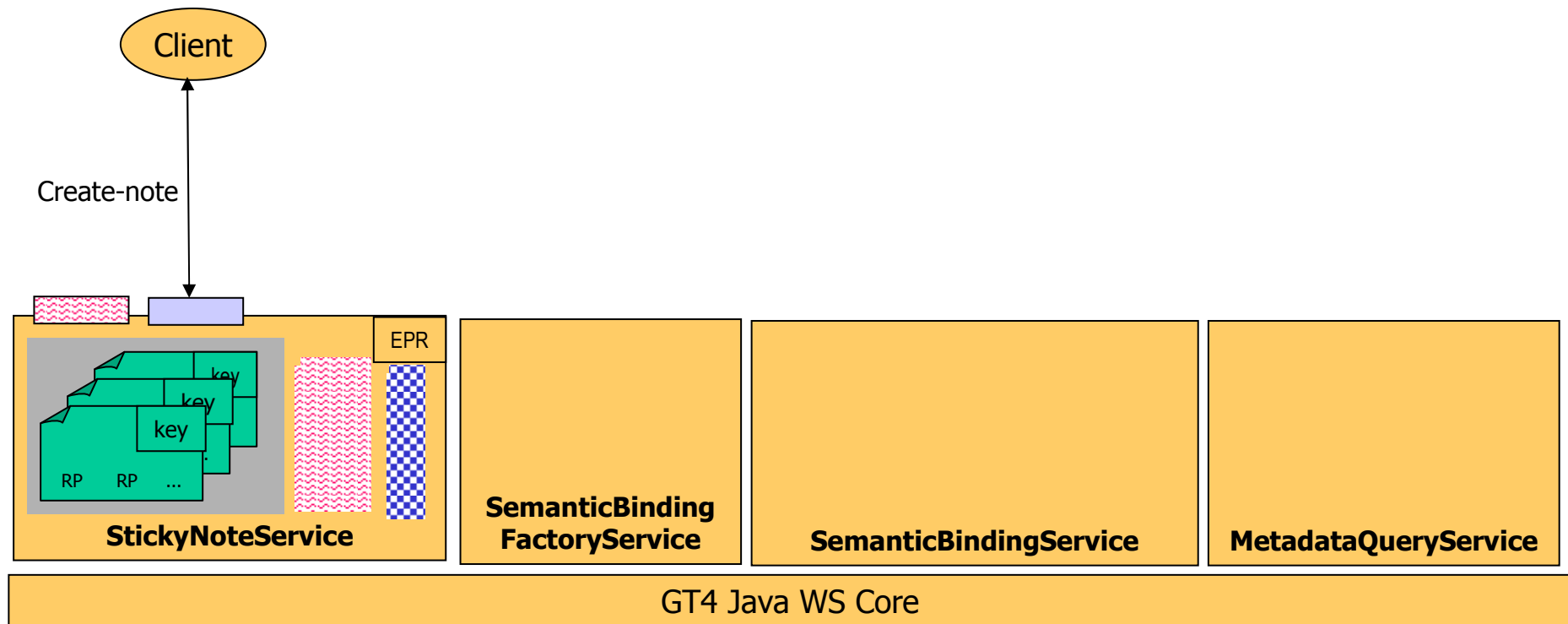


Ex3. System Operation



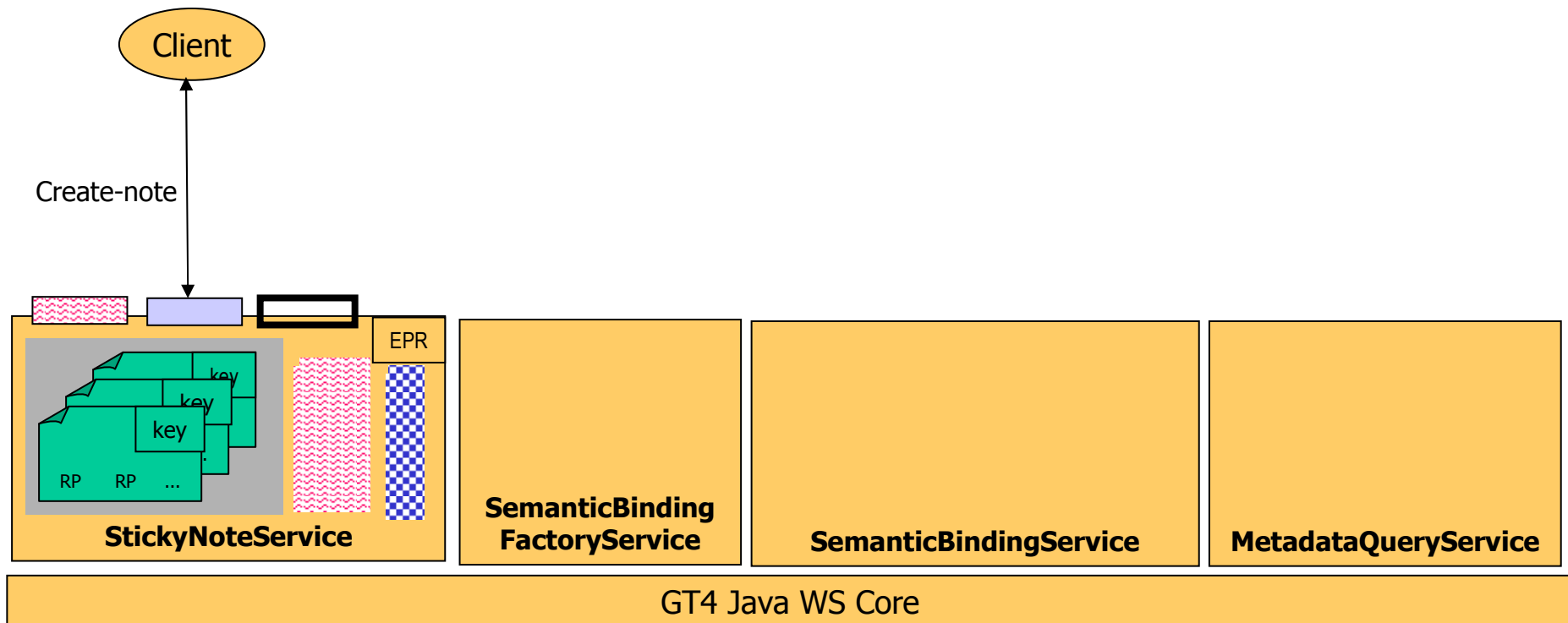
Ex3. Adding a new operation

- This was the setup after completing exercise 2



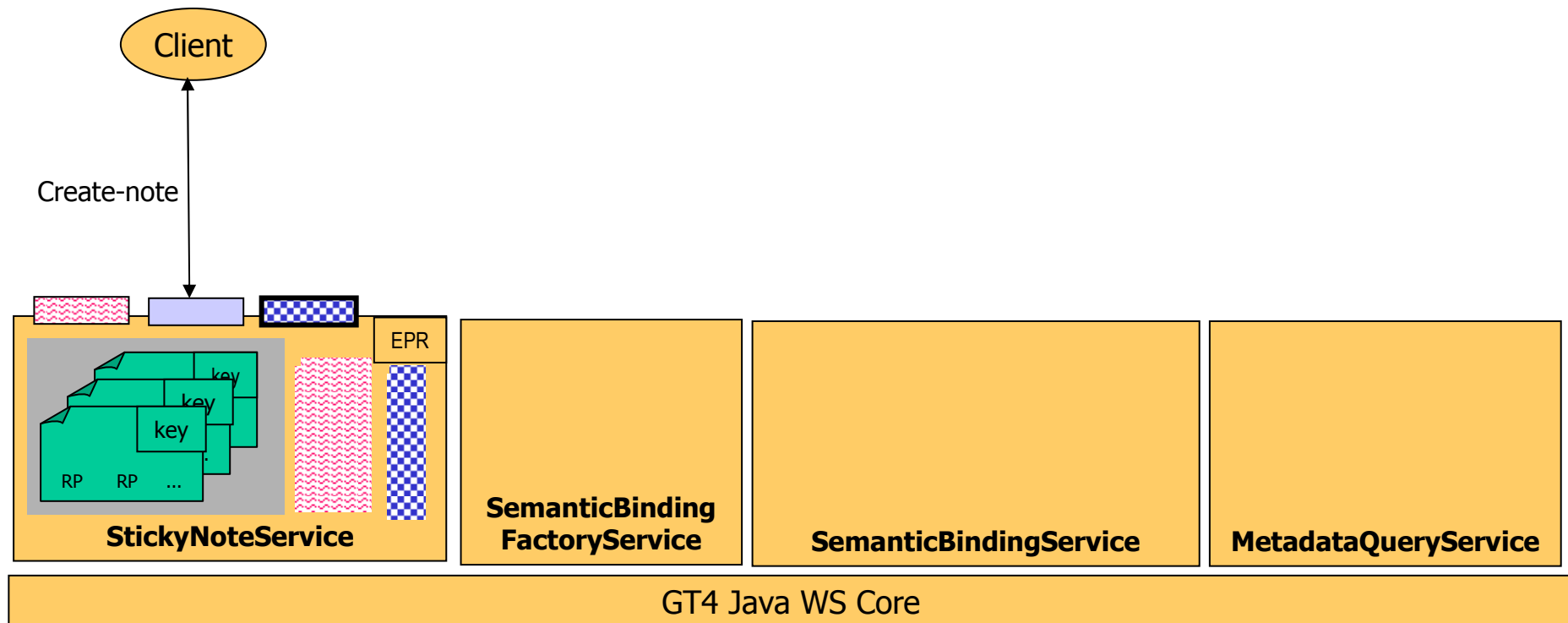
Ex3. Adding a new operation

- Add **writeSemanticBinding** operation to the Sticky Note service. (uncomment WSDL file)
 - Input: Semantic Binding content as RDF



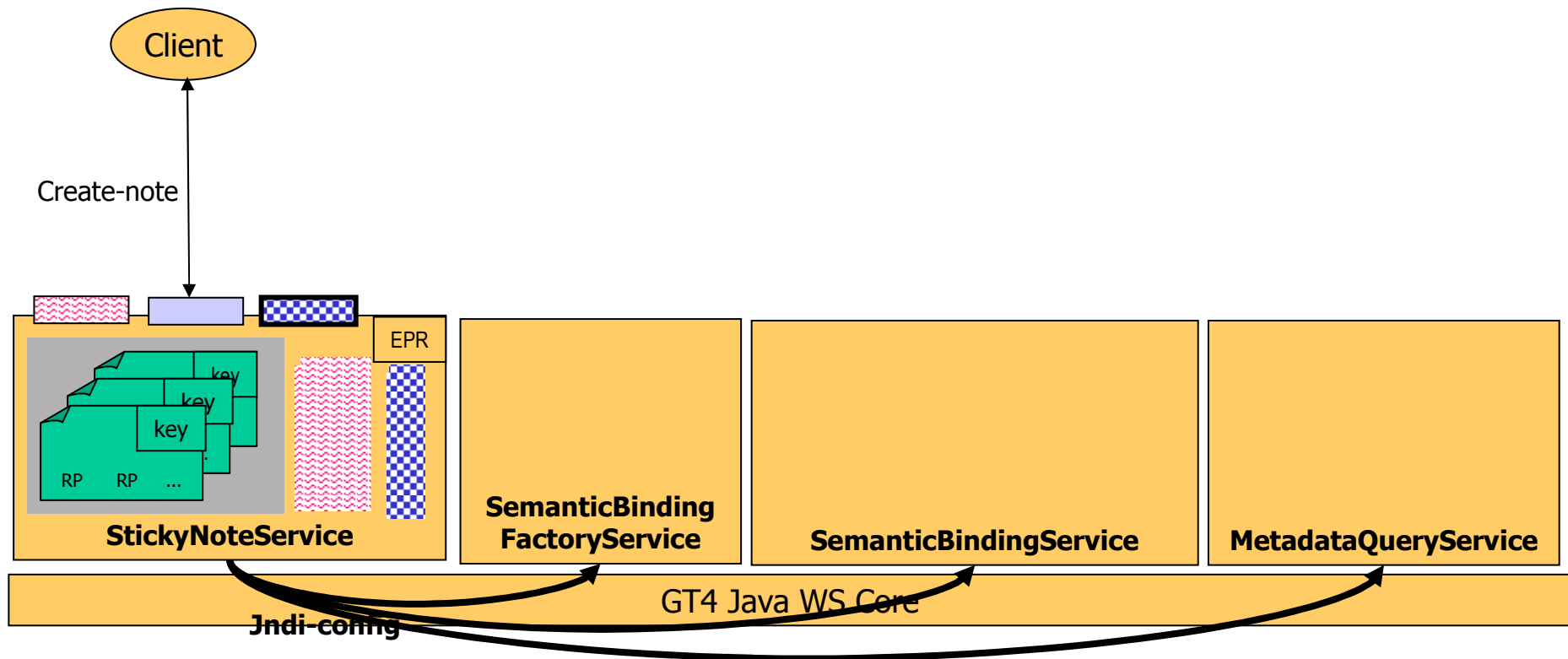
Ex3. Adding a new operation

- Provide implementation for the new operation via the Semantics Operation Provider. (uncomment wsdd file)



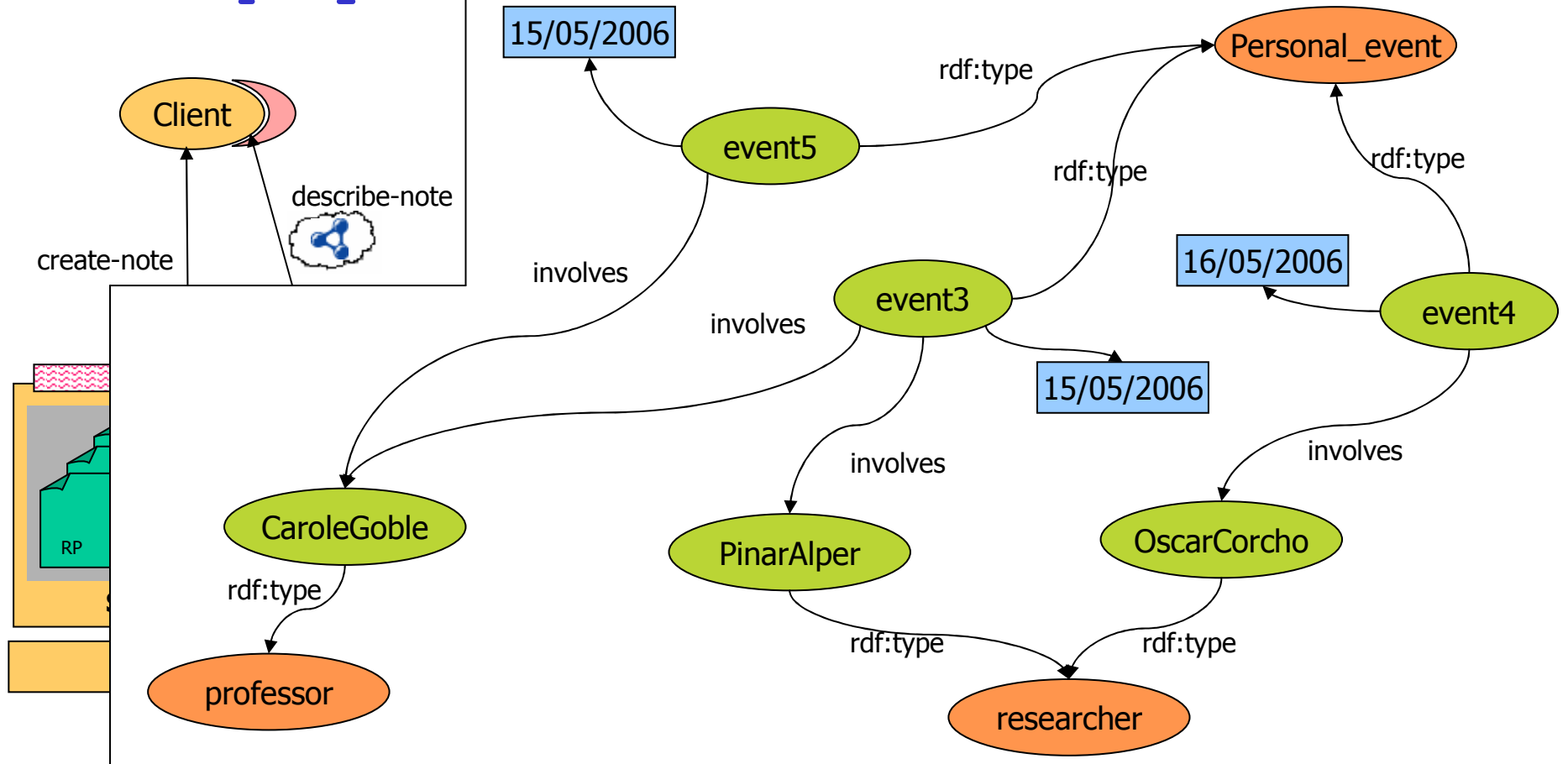
Ex3. Adding a new operation

- Add JNDI configuration parameters to StickyNote to specify location of Semantic Services. (uncomment jndi xml file, caution to port numbers!!)



Ex3. Client for Attaching an SB

- Extend the added op
- DescribeN
- deploy fi

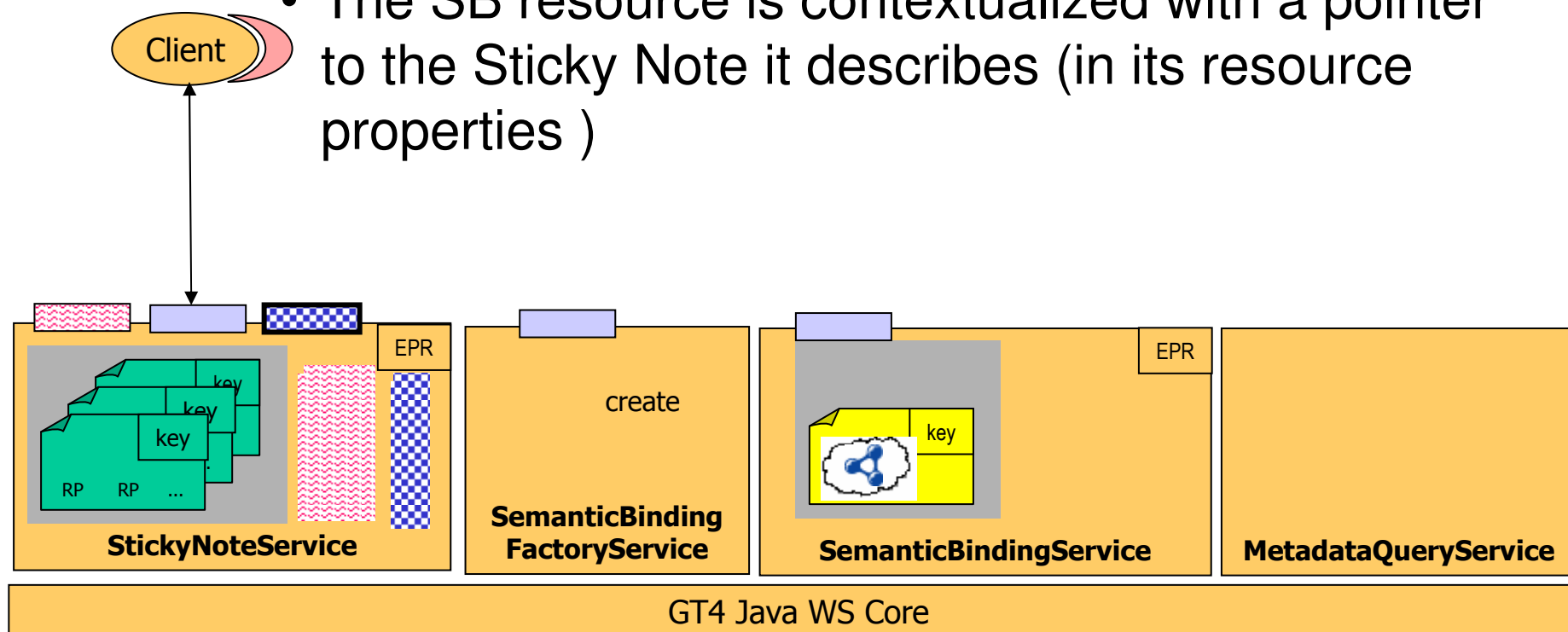


Hands-on Exercises

Student Notes, Chapter 3

Ex3 Review

- This is the setup obtained after completing this exercise
 - Now we have a SB resource that contains
 - The RDF content machine processable representation of the note content
 - The SB resource is contextualized with a pointer to the Sticky Note it describes (in its resource properties)



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Ex4. Query SBs of a Sticky Note

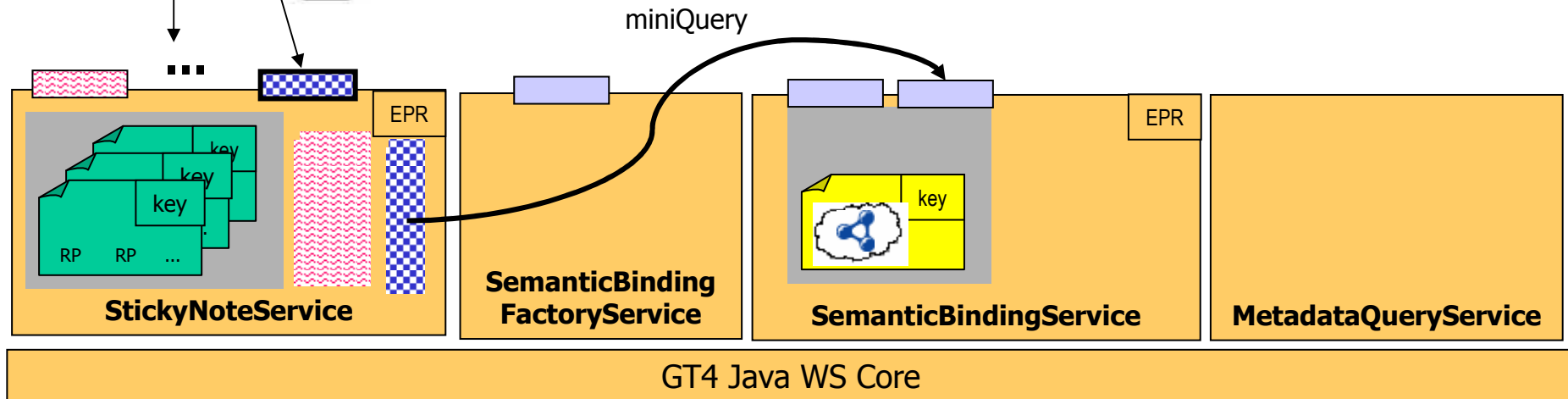
- RDF Metadata can be queried through a variety of languages.
 - Sparql, Serql, RDQL, RQL...
 - Languages allow desired graph patterns to be expressed.
 - Execution results are variable bindings for nodes in the specified pattern
- In this exercise we'll do querying of RDF based metadata

Ex4. Querying a Semantic Binding

Query 1: `SELECT N
FROM {N} rdf:type {sti:Event}
USING NAMESPACE sti=<http://www.ontogrid.net/StickyNote#>`

Query 2: `SELECT N
FROM {N} rdf:type {sti:Event}; sti:involves {sti:OscarCorcho}
USING NAMESPACE sti=<http://www.ontogrid.net/StickyNote#>`

Query 3: `SELECT N
FROM {N} rdf:type {sti:Event}; sti:involves {M} rdf:type {sti:Professor}
USING NAMESPACE sti=<http://www.ontogrid.net/StickyNote#>`



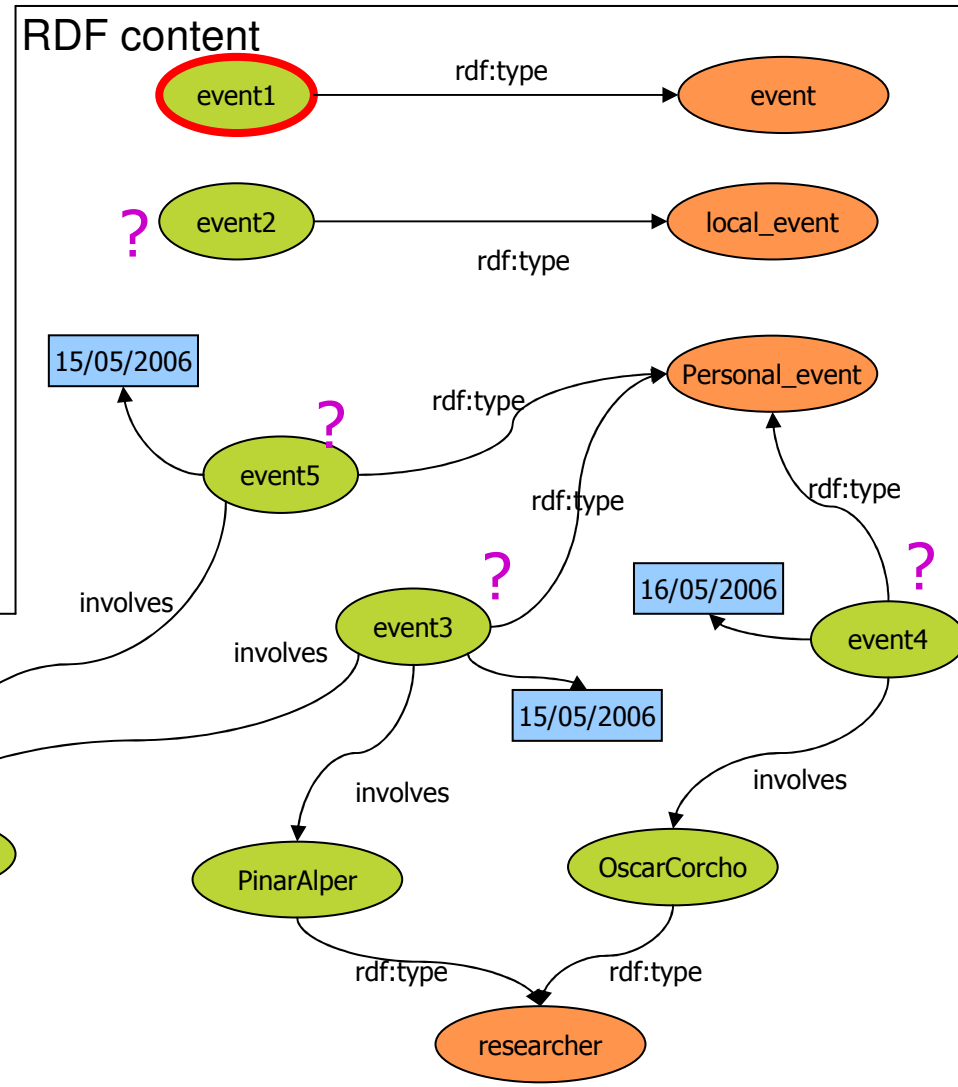
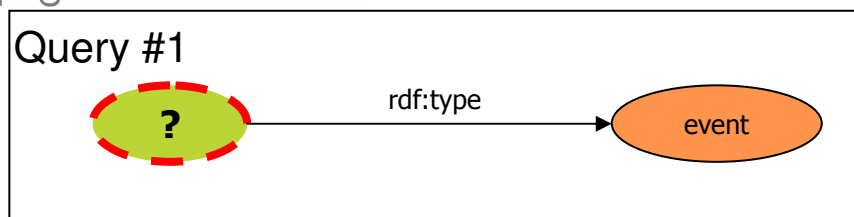
Ex4. Query SBs of a Sticky Note

- In this exercise we will add a **querySemanticBinding** operation to the Sticky Note Service (`uncomment wsdl file`)
 - Input: SeRQL query to be executed over the Semantic Binding attached to a Sticky note.
 - Output: an XML-formatted resultset
- We will extend the client to invoke the newly added operation. (`Uncomment QueryNote source code and post-deploy file`)
- NOTE: `wsdd` and `jndi` config not necessary. Already done in exercise 3.

Hands-on Exercises

Student Notes, Chapter 4

- We executed queries over SBS
- As is querying



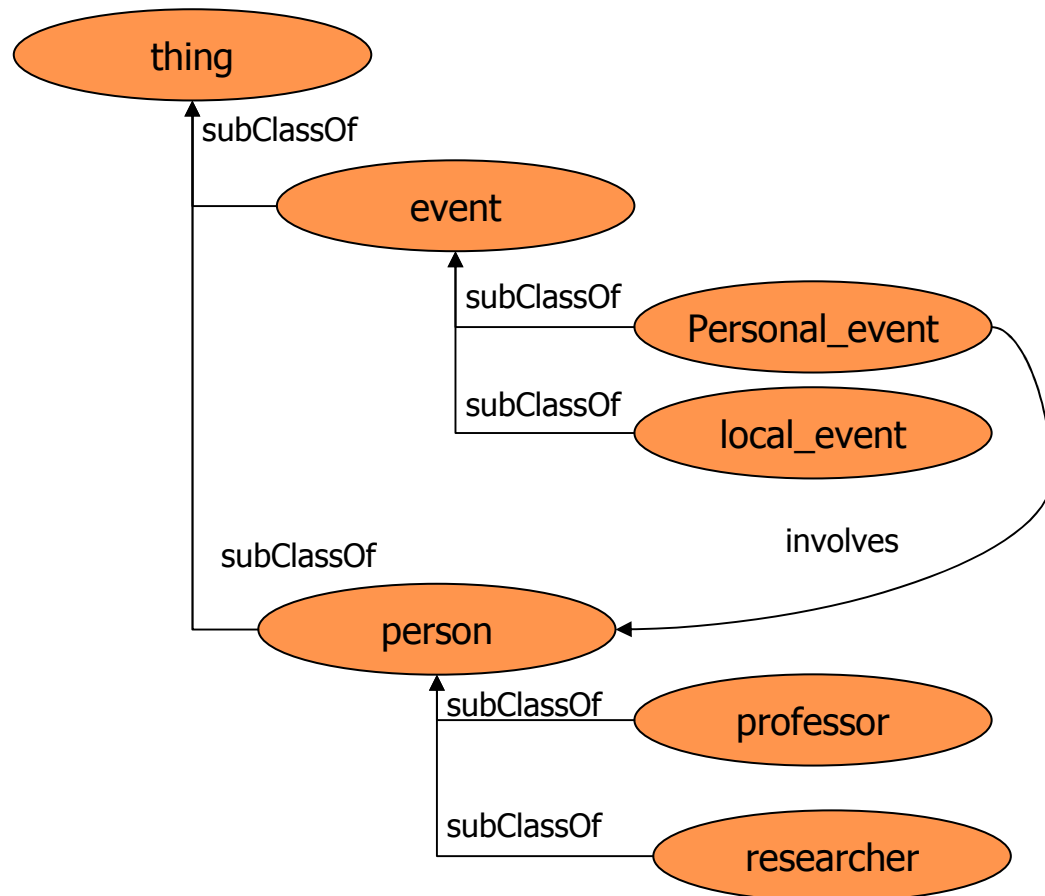
- Relationships between terms missing
- Represent our model of the world in a simple ontology
- Exploit relations during querying

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Ex5. Query SBs with Inferences

- RDF S
language
- RDFS
differen
 - Term
des
 - R
- In this
exploiting
ontology



Ex5. Query SBs with Inferences

- In this exercise:
 - Setup a second Globus Container. (set environment vars)
 - We will introduce the Sticky note RDFS ontology as a new repository to the WS-DAIONT ontology service (**uncomment `RDFSRepository.rdf` file**)
 - Deploy the WS-DAIOnt service on to the new Globus container (set environment vars)
 - Ignore any error messages in the DAIONT container related to Logging
- cntd

Ex5. Query SBs with Inferences

- We will add a **querySemanticBindingInference** operation to the Sticky Note Service (**uncomment wsdl file**)
 - Inputs:
 - SeRQL query to be executed over the Semantic Binding attached to a Sticky note.
 - The RDFS based knowledge model to be taken into account during querying
 - Output:
 - an XML-formatted resultset of variable bindings
- We will extend the client to invoke the newly added operation. (**Uncomment QueryNoteInference source code and post-deploy file**)
- NOTE:
 - **wsdd and jndi** config not necessary. Already done in Chapter 3.

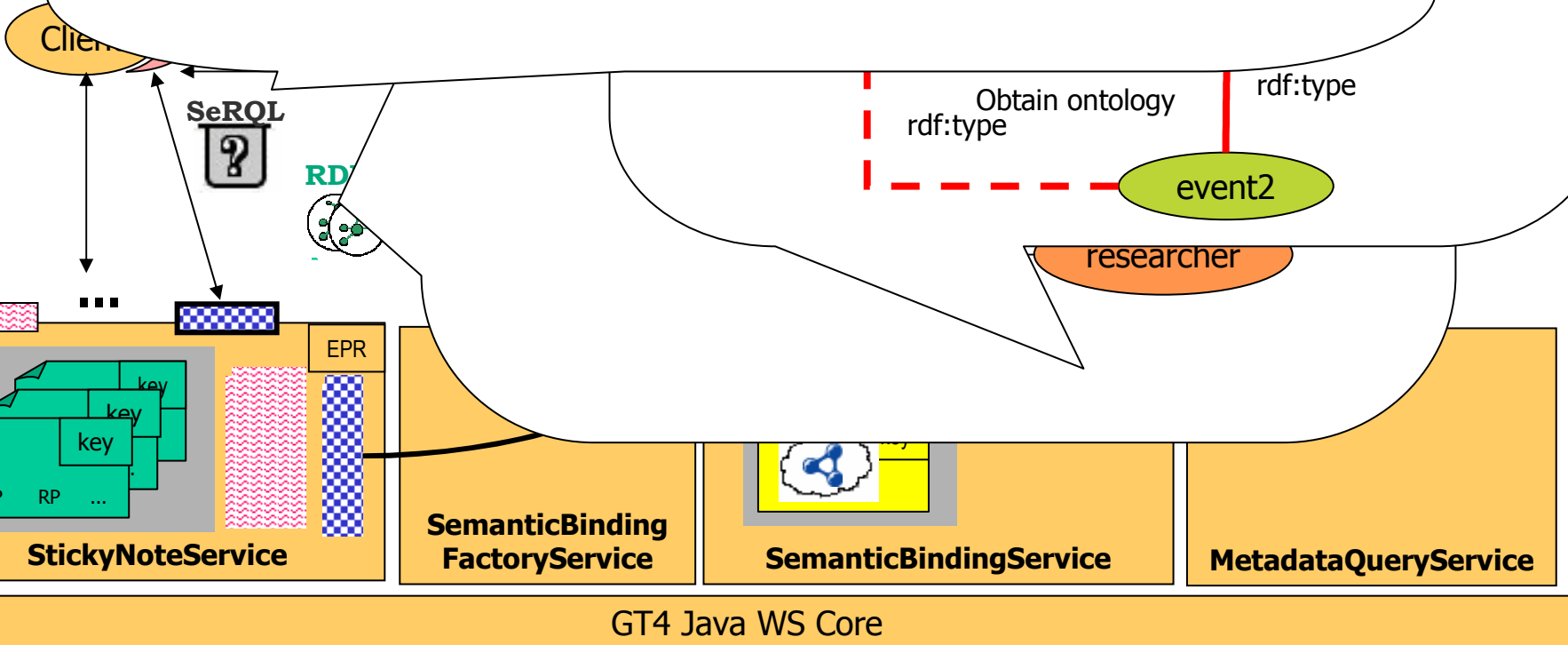
RDF Semantics says:

- Create a StickyNote

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Query 2: `SELECT N
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Query 3: `SELECT N
FROM {N} rdf:type {sti:Event}; sti:involves {M} rdf:type {sti:Professor}
USING NAMESPACE sti=<http://www.ontogrid.net/StickyNote#>`



Hands-on Exercises

Student Notes, Chapter 5

Ex5 Review

- We executed queries over the Semantic Binding attached to a Sticky Note via the StickyNote.
- The query execution took into account not only the asserted but also the **inferred** statements.
- So far, we've interrogated one single sticky note
- How about queries across the semantic bindings of several sticky notes?

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Ex6. Query over a Set of SBs

- In this exercise we will use the **query** operation available in the metadata service
 - Input: a SeRQL query to be executed over a the set of Semantic Bindings.
 - Output: an XML-formatted resultset of variable bindings
- Extend the client to invoke the **query** operation of the Metadata Service.
(Uncomment `QueryAllNotes` source code and post-deploy file)

Hands-on Exercises

Student Notes, Chapter 6

- We executed queries over a set of SBs attached to a set of Sticky Notes
- We used the Metada Service to perform this operation
 - Provides a global view of RDF content of all SB WS-Resources hosted by an SB service

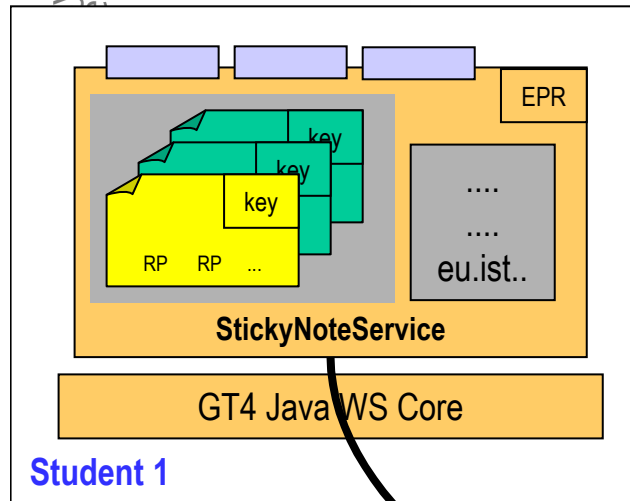
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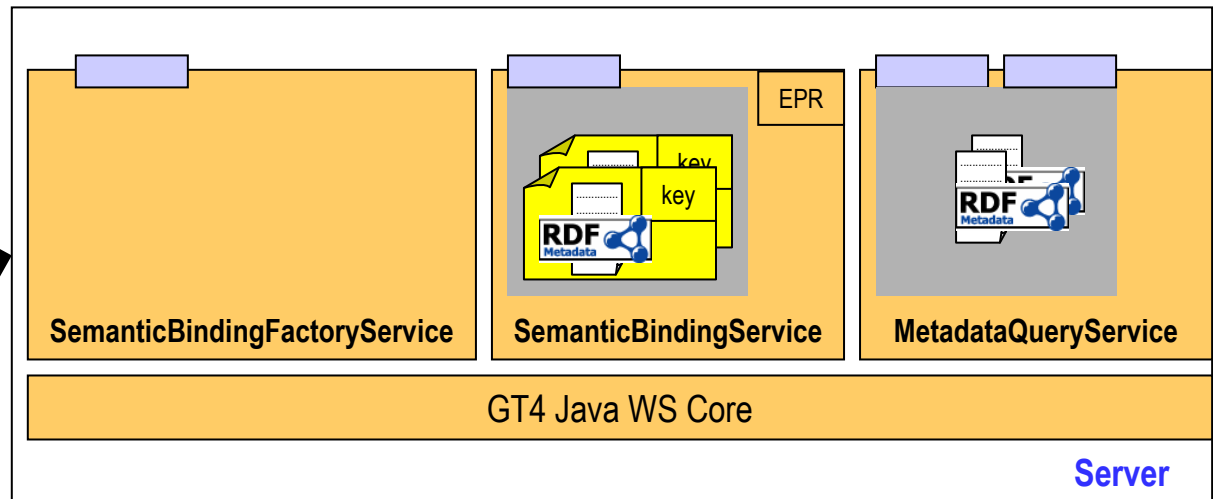
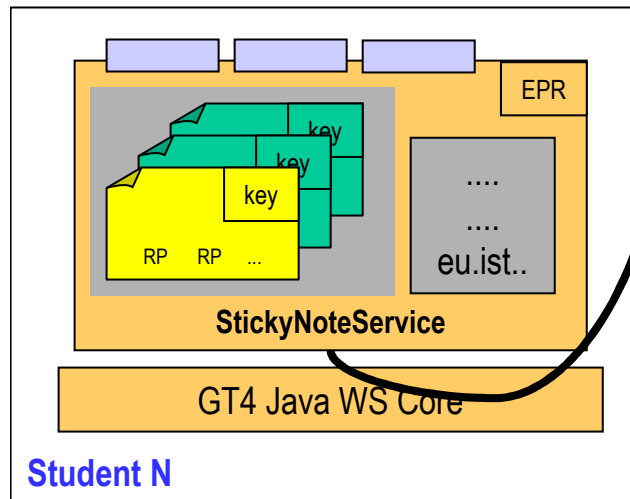
Ex7. Use a Remote SB Service

- In this exercise we will repeat the previous exercise using a common Semantic Binding Factory Service, Semantic Binding Service and Metadata Query Service
- Every student will create its own sticky notes and will attach Semantic Bindings to them
 - The content of the Semantic Bindings will be different types of events where a student specifies that he/she wants to meet other students on a specific date.
 - Every student can be identified by the following URI:
<http://www.ontogrid.net/StickyNote#NameSurname>
 - Make queries to see whom you have to meet in the following days, and which types of events you have to attend to
- How do we do it?
 - Change the configuration settings at the JNDI configuration parameters to specify where the Semantic Services are available
 - <<URLs of the Semantic Services>>

Ex7. Use a Remote SB Service



...



Hands-on Exercises

Student Notes, Chapter 7

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Summary

- Storing and querying Semantic Bindings
 - SBs are first class citizens
 - SBs can be managed as any other Grid resource.
- Minimally-intrusive extension mechanisms for augmenting existing service with metadata capabilities
 - Metadata Operation Provider.
- Knowledge Models and inference rules allow for inferring new information
 - If RDFS model is not used for querying, then the results are the same as what it could be obtained using a traditional database.

Ideas for Further Work

- Points for improvement:
 - Lifetime management of Semantic Bindings (avoiding staleness)
 - Allowing for both resource provider and 3rd party annotations.
 - Show how the use of different RDFS models has an influence on the results obtained for a query.
- Feedback or even contributions are wellcomed.

Further Reading

- **Semantic-OGSA**
 - *An overview of S-OGSA: a Reference Semantic Grid Architecture.* Oscar Corcho et. al. *Journal of Web Semantics* 4(2):102-115. June 2006
- **WS-DAIOnt-RDF(S)**
 - *WS-DAIOnt-RDF(S): Ontology Access Provisioning in Grids.* Miguel Esteban Gutiérrez, Asunción Gómez-Pérez, Oscar Corcho, Oscar Muñoz. *Grid 2007.* September 2007.
- **Websites**
 - <http://www.semanticgrid.org/>
 - <http://www.ontogrid.eu/>
- **OntoGrid CVS:**
 - Connection type: pserver
 - user: ontogrid
 - password: not needed
 - Host: rpc262.cs.man.ac.uk
 - Port: 2401
 - Repository path: /local/ontogrid/cvsroot
 - module: prototype

Credits

- The SG tutorial is based on the **BAS GT4 Sticky Note Tutorial**, developed by ***Rachana Ananthakrishnan, Charles Bacon, Lisa Childers, Ben Clifford, Jarek Gawor and Joe Insley (Globus Alliance)***
- We also thank people who tested the SG tutorial and helped improve it a lot.
 - ***Ted Wen***
 - ***Borja Sotomayor***
 - ***Paolo Missier***
 - ***Rafael González-Cabero***
 - ***Miguel Esteban Gutiérrez***
 - ***David Buján Carballal***
 - ***Cristina Vicente Torres***
- Work funded by the EC, OntoGrid and RSSGRID projects
- Questions regarding this tutorial should be directed to
 - ***Oscar (dot) Corcho (at) manchester (dot) ac (dot) uk***
 - ***penpecip (at) cs (dot) man (dot) ac (dot) uk***