Hands-on introduction to Object Teams

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Hands-on Introduction to Object Teams

- **With good connectivity:**
  - follow links from the EclipseCon program page

- **Else unpack these archives from USB to your hard disk**

  - `OTEclipseConTutorial.zip`
    - creates a directory `OTEclipseConTutorial/`
  - the Eclipse SDK for your platform
  - ✔ done with the USB stick
- **Within Eclipse (new empty workspace!) install OTDT:**

  - local repository: `OTEclipseConTutorial/otdt-updateSite`
  - select everything (two features) & install
- **Open tutorial data**

  - within OTDT import existing project
    - `OTEclipseConTutorial/StarterKit.zip`

  - slides are in `OTEclipseConTutorial/Slides.pdf`

Speaker Introduction (1/2)

GK SOFTWARE

SoftwareArchitect

Xtext

ProjectLead

???

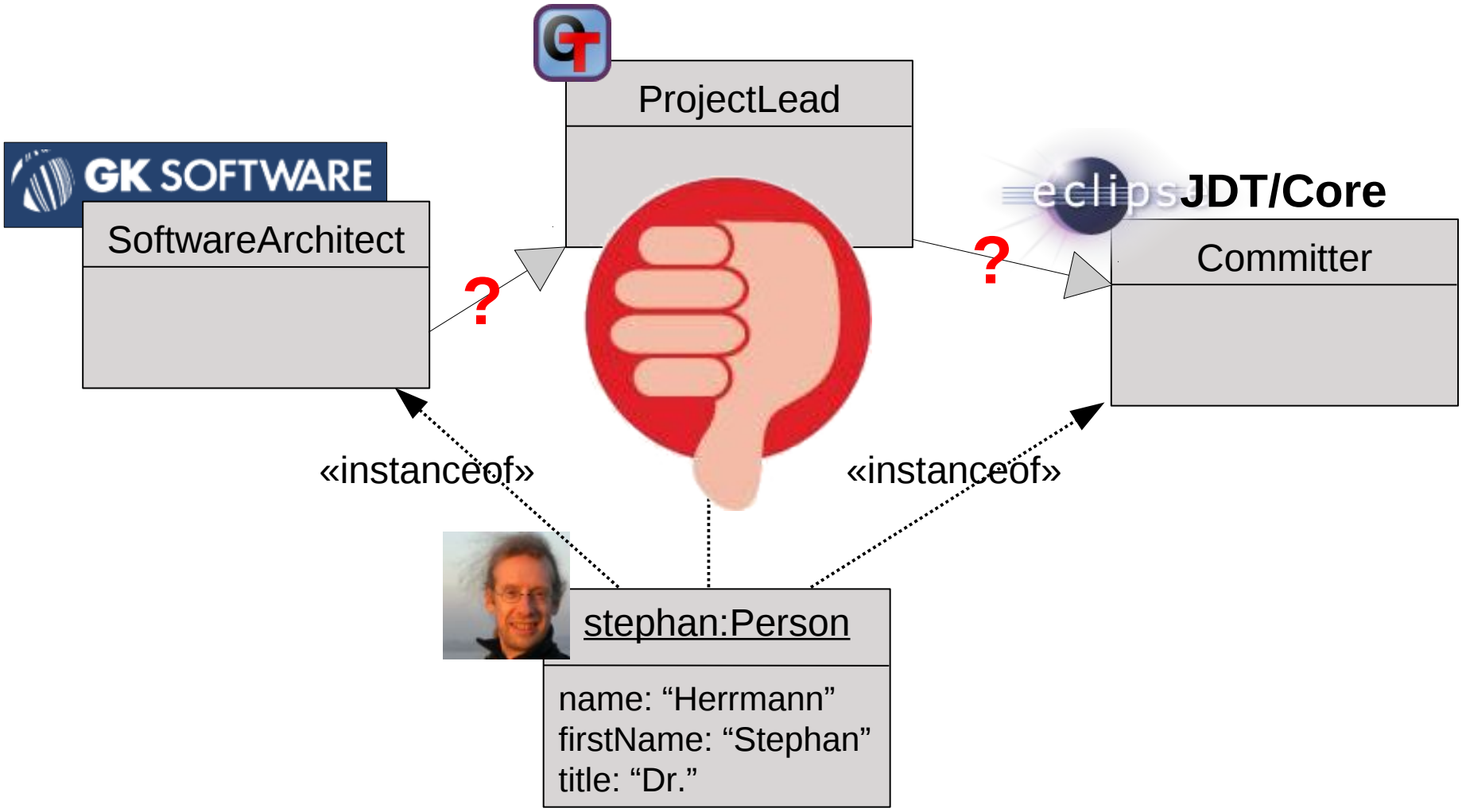
eclipse JDT/Core

Committer

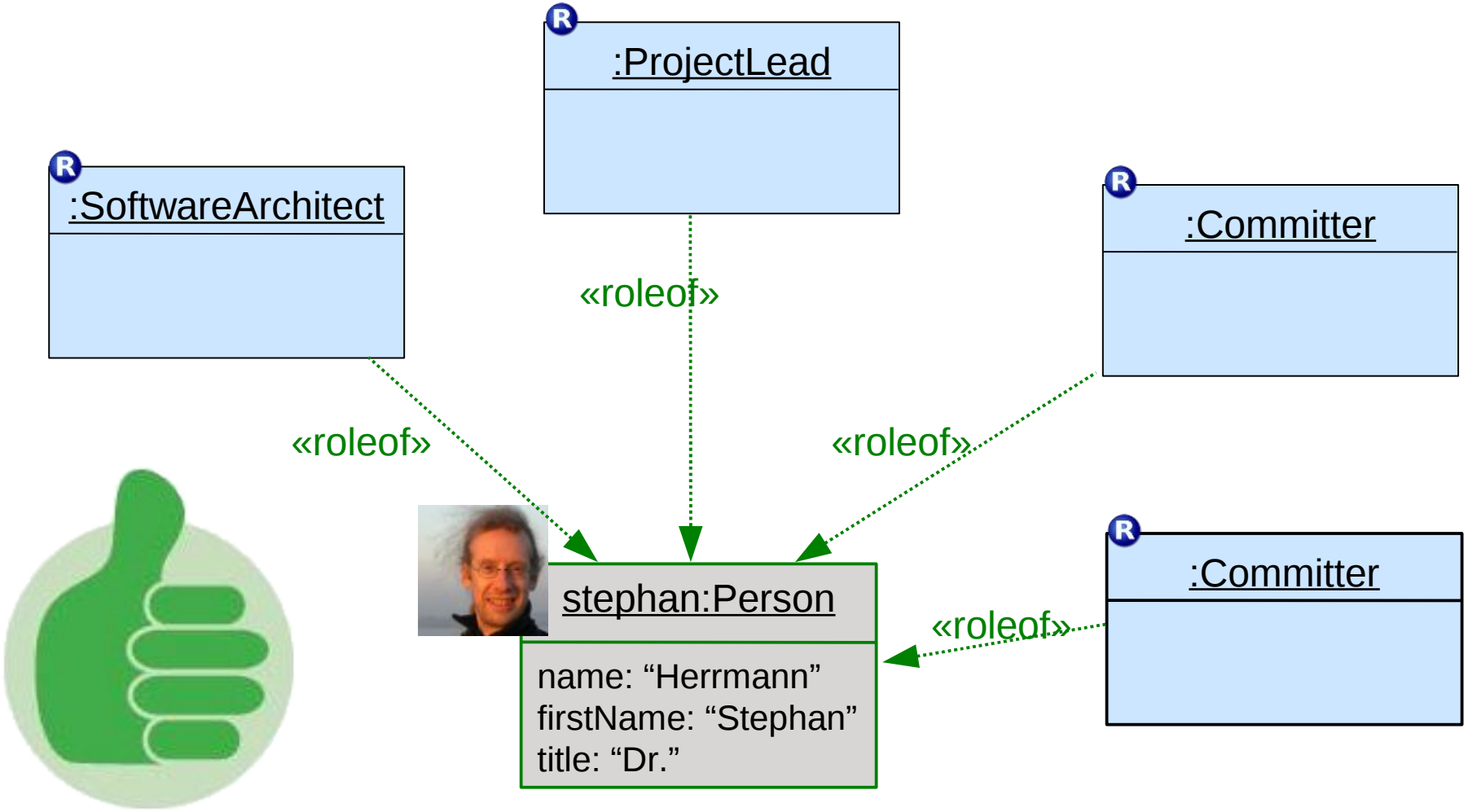
stephan:Person

name: “Herrmann”
firstName: “Stephan”
title: “Dr.”

Model Review



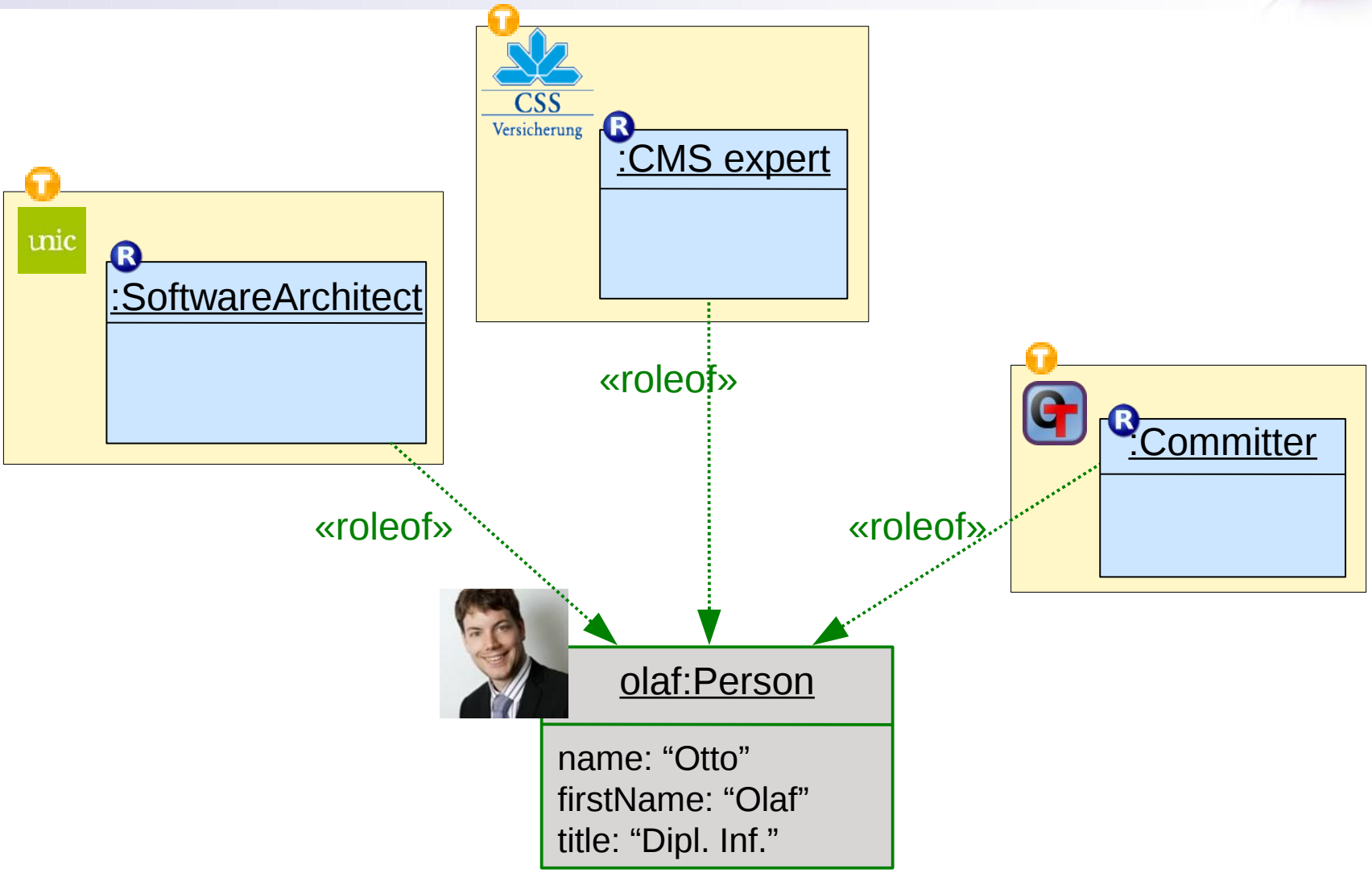
Not Classes – Roles!



Classes vs. Roles

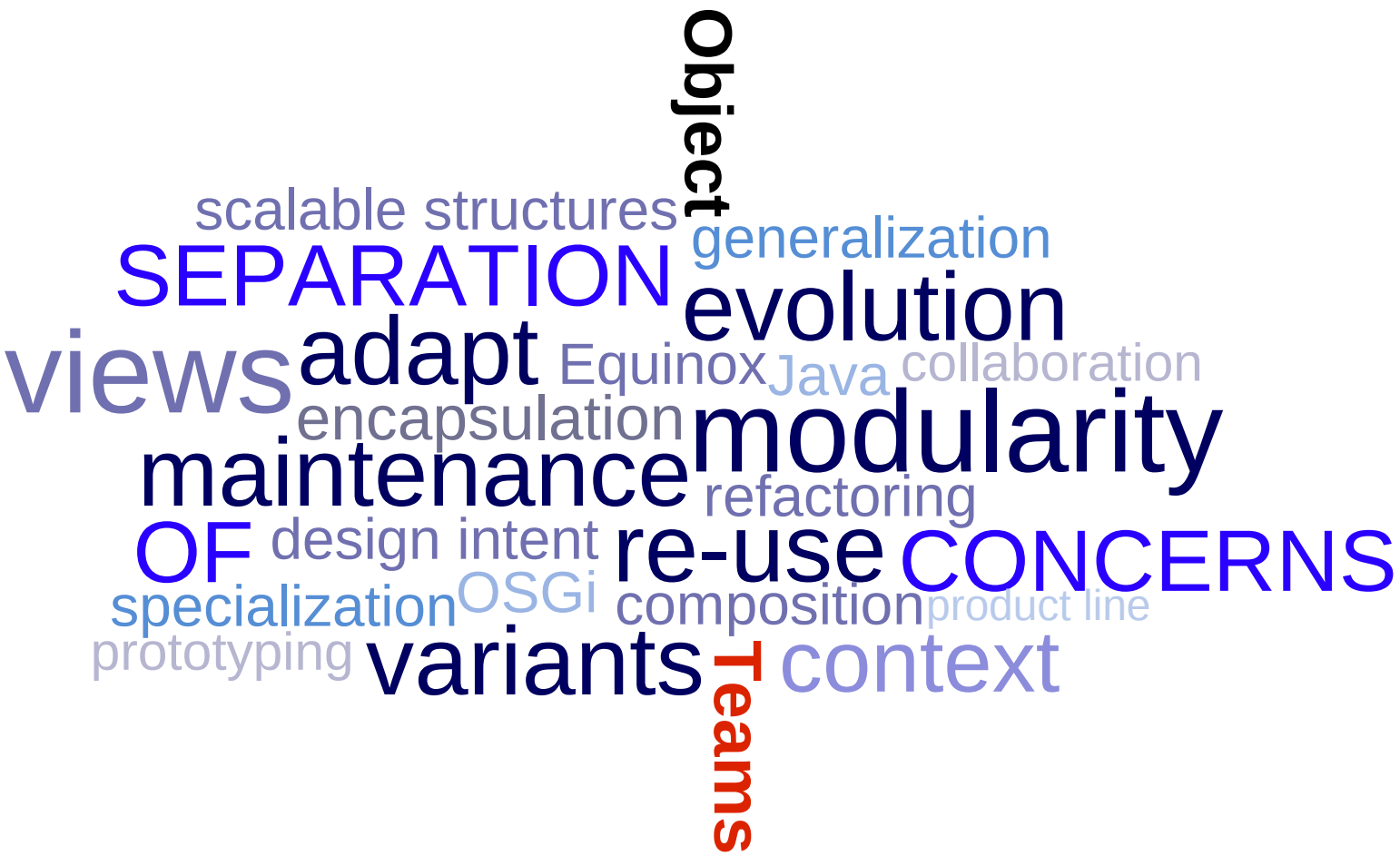
- **Roles are instances**
  - modeled by classes
- **«roleof» is an instance relation**
  - modeled by a **playedBy** relation
- **Roles are dynamic**
  - add at runtime
  - remove at runtime
- **Roles are independent**
  - object may have several roles ...
  - … even of the same type
    („I am 2 committers")

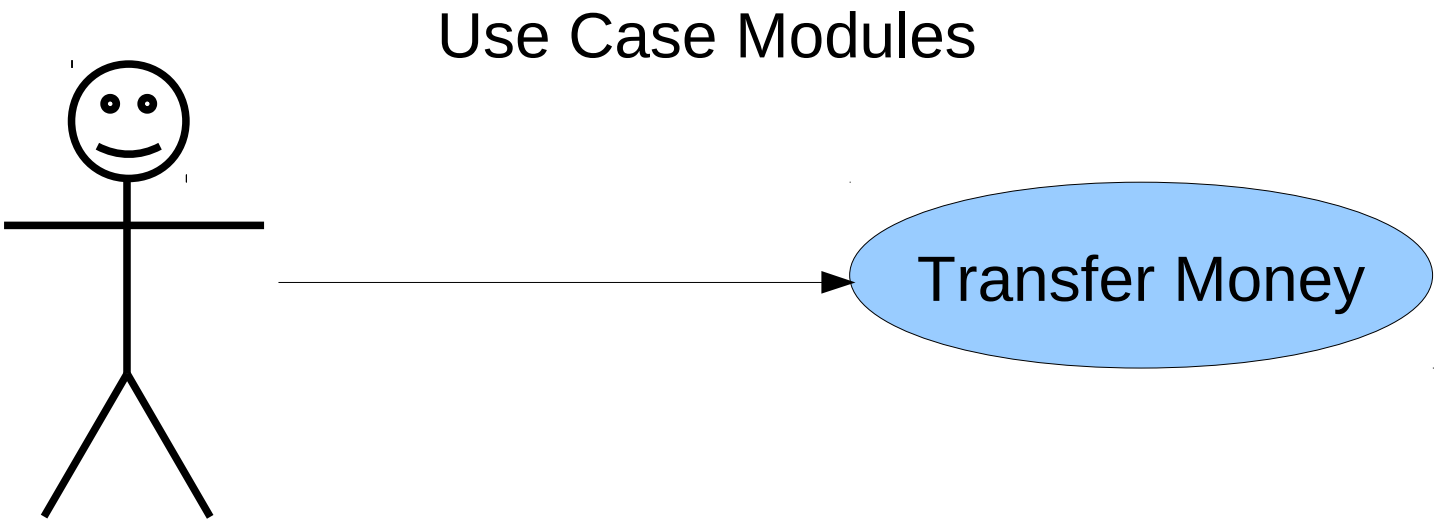
Speaker Introduction (2/2)



- **OT/J** — since 2001
  - Java += roles, teams, bindings
- **Object Teams Development Tooling** — since 2003
  - Java Compiler += OT/J constructs
  - JDT for OT/J (code assist, ui, launch …)
- **OT/Equinox** — since 2006
  - Equinox += aspect bindings
- **Eclipse Object Teams Project** — since 2010
  - Indigo train += OTDT
  - Planning to graduate for Indigo

Why?

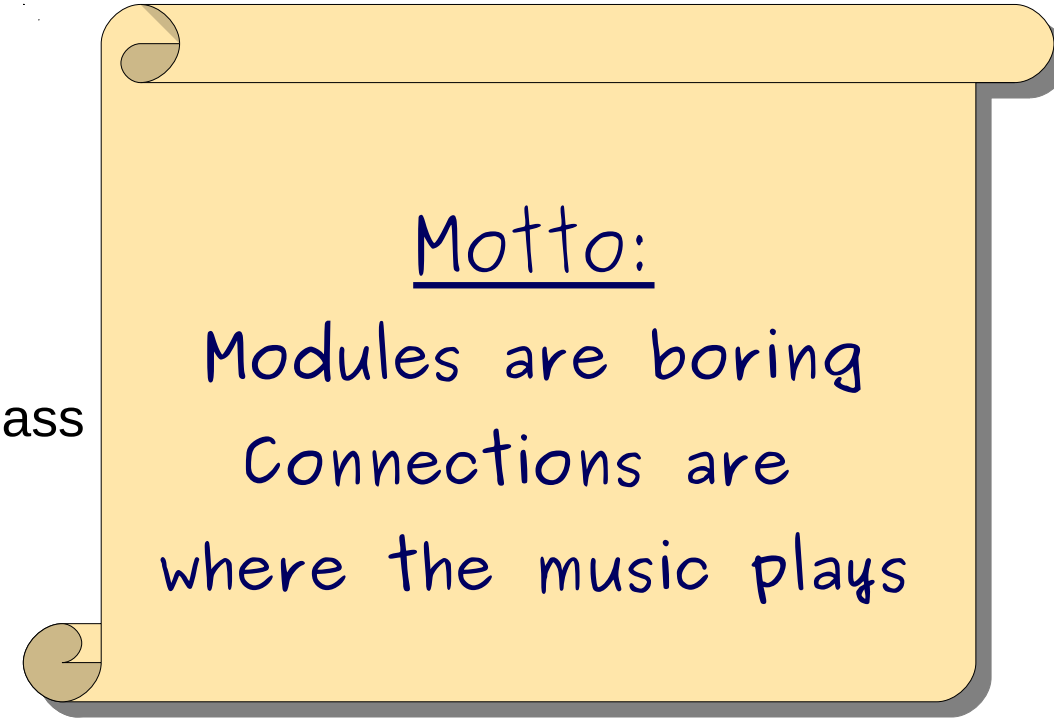

Object
scalable structures
generalization
SEPARATION
evolution
views
adapt
Equinox
Java
collaboration
encapsulation
modularity
maintenance
refactoring
OF
design intent
re-use
CONCERNS
specialization
OSGi
composition
product line
prototyping
variants
Teams
context


Use Case Modules
Transfer Money

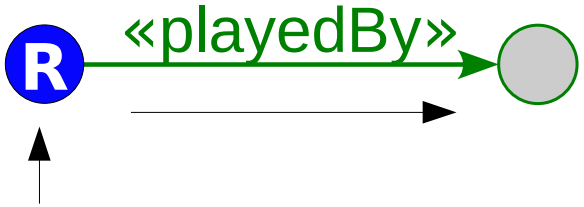
Lesson 1: Use Case Modules

- **Separation of layers**
  - domain layer: pretty dumb objects
  - use case layer: behavior implemented as roles

  for maximum re-use: make border permeable
- **Wiring of layers**
  - bind classes
  - bind instances
  - bind methods
- **Use case API**
  - entire use case is one class
  - instantiate and invoke

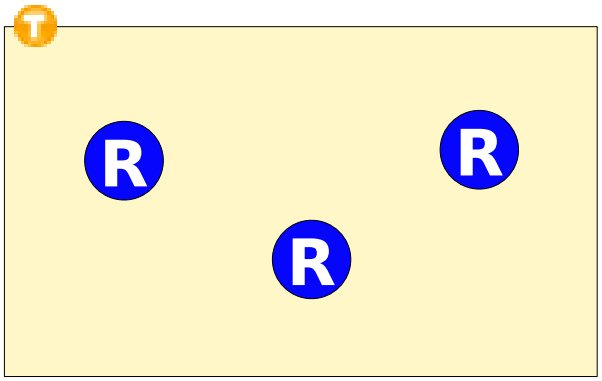


Use Case Modules: Concepts (1/2)



- **Split: behavior object → domain object**
  - **role** → base
- **Access to domain objects**
  - only via role (“gateway”)
  - access to base methods via “**callout**” method binding

Use Case Modules: Concepts (2/2)



- **Use case module**
  - **team** class & team instance
  - container for roles
- **Instantiate**
  - teams
  - roles inside a team instance
    - role instance needs a base instance
    - may invoke **base** constructor

Use case modules: Syntax

```
public class Person {
    private String name;
    public Person(String name) { this.name = name; }
    public String getName()    { return this.name; }
}
```


```
public team class Company {
    protected class Employee playedBy Person {
        private String officePhoneNo;
        String getName() -> String getName();
    }
    ...
}
```

Use case modules: Syntax

```
public class Person {
    private String nam
    public Person(Stri                    name = name; }
    public String getN                    n this.name; }
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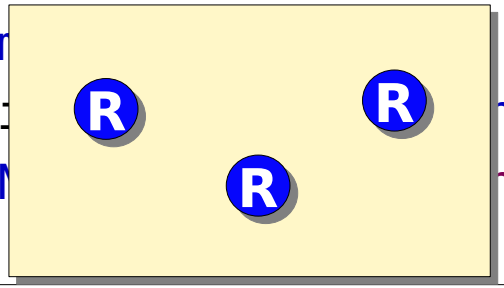
```



```
public team class Company {
    protected class Employee playedBy Person {
        private String officePhoneNo;
        String getName() -> String getName();
    }
    ...
}
```

Use case modules: Syntax

```
public class Person {
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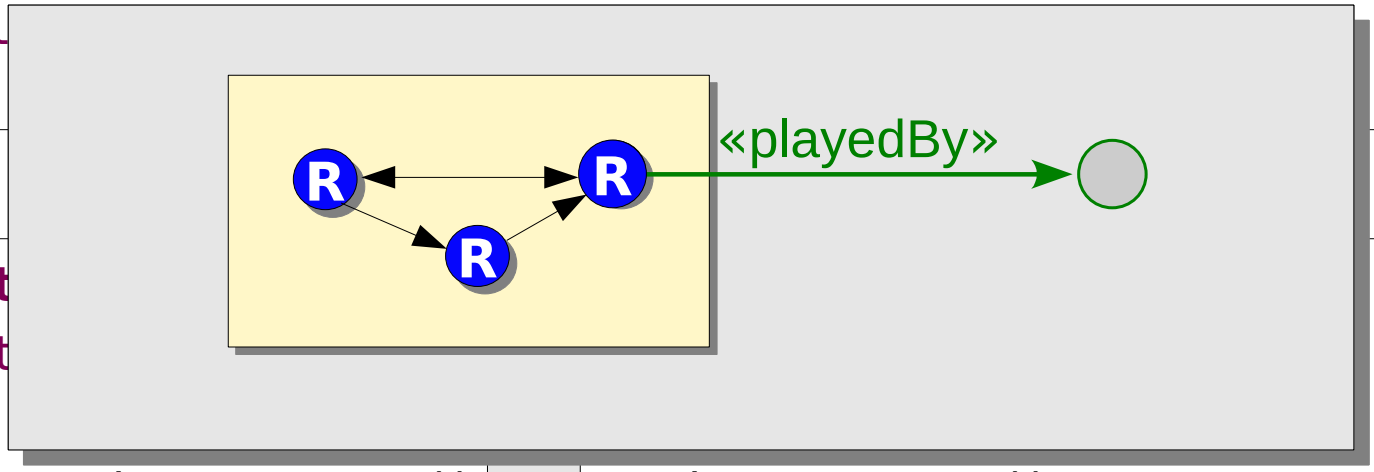



```
public t
    prot

        String getName() -> String getName();
    }
    ...
}
```

Code-along Lesson 1.1

- Create team “Company”
- Create role “Employee”
- Create callout to “getName()”

Obtaining and wiring instances

- Explicit role creation
- Implicit role creation

Obtaining and wiring instances

- **Explicit role creation**
  - requires a base instance
    - e.g. by passing an existing base as argument
- **Implicit role creation**

Obtaining and wiring instances

- **Explicit role creation**
- **Implicit role creation**
  - already have a **team instance** and a **base instance**
  - team and outside use this base as a shared handle
    - do you know “Olaf”?
      - *“Ah, that funny guy!”* *(Person)*
      - *“Oh, he's our best software architect!”* *(Employee)*
  - team translates the base to an appropriate role: “**lifting**”
  - translation may **create** a role (on-demand)
  - when to lift?
    - rule-of-thumb: lifting affects all **data flows ...**
      - entering a team instance
      - involving a base instance
      - for which a bound role class exists

Use Case API

- **Team class as a façade to hidden roles**
  - new syntax "**declared lifting**"

```
void hire(Person as Employee emp, …)
```

  - partial information sharing
    - ouside (client): pass base instance,
cannot see roles
    - inside (team): treat as a role,
should mention base only after playedBy
  - inverse: **lowering**
    - team trying to pass a role to the outside
    - the outside will only see the base instance

Code-along Lesson 1.2

- Create API methods in “Company”
  - Method “hire(Person)”
  - Method “getBusinessCard(Person)”

Exercise 1.1: Money transfer between accounts

- Given a pretty dumb base class `world.Account`
- Write a use case module (**team**) for the transfer
  - distinct **role classes** for the participating objects
    - access base members using **callout**
  - implement this use case in a non-static team method:

    "if amount can be withdrawn from the source,
    let the sink accept this amount"
    - handle insufficient funds inside the source account
    - optional: add simple checkPoint/rollBack capability to source account
- Implement API as required by `TransferTest`:
  - provide methods for invoking the transfer from the outside
    - clients cannot see role types, but still invoke role behavior
    - client will provide Accounts as arguments
- Hint: to make roles printable declare (overriding callout):

```
toString => toString;
```

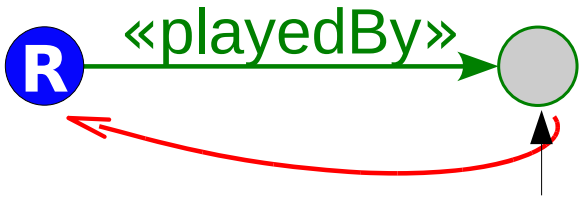
Exercise 1.2: Generalization

- **Support loading a pre-paid phone, too**
  - generalize: extract a role interface `IMoneySink`
    - use the interface where appropriate
  - create a new role class bound to PrepaidPhone
  - uncomment statements for testing the new case

Exercise 1: Summary

- **Roles** are context specific views
  - bound to base class using playedBy
  - base properties are exposed using “callout”
  - more properties can be added as needed
- **Teams** define context for interacting roles
  - team = container & façade
  - data flows into/out off team: “lifting” / “lowering”
- Post-hoc generalization
  - roles can abstract about unrelated base classes
    - unbound super role (interface)
    - more specific roles bind to individual base classes

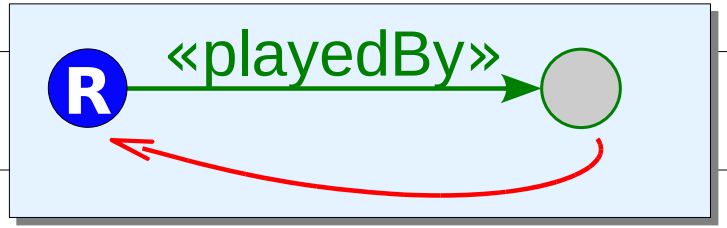
Lesson 2: Adapting Existing Behavior (1/2)



- **A role may intercept calls to its base**
  - "**callin**" method binding
  - inverse to callout
  - three flavors: before, after, replace
- **No pre-planning**
  - neither base object nor its caller need to know

Adaptation: Syntax

```
public class Person {
    private String phoneNo;
    public String getPhoneNo()    { return this.phoneNo; }
}
```

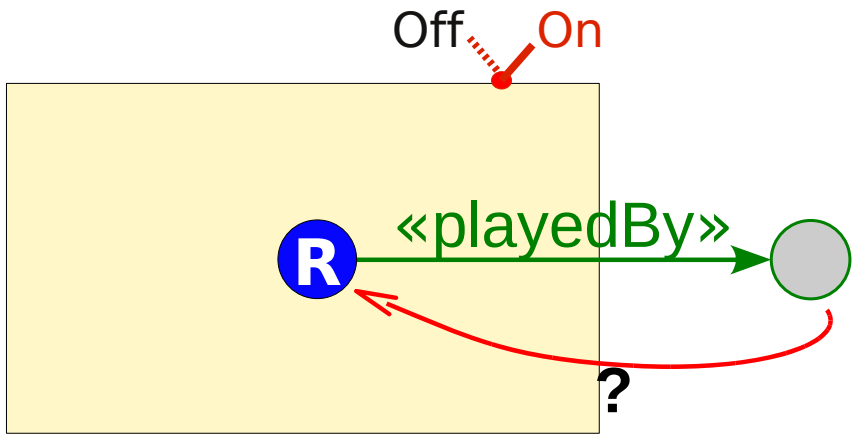



```
public team class Company {
    protected class Employee playedBy Person {
        private String officePhoneNo;
        String getPhoneNo() <- replace String getPhoneNo();
        callin String getPhoneNo() {
            return officePhoneNo;
        }
    }
}
```

Code-along Lesson 2.1

- **Create callin method & binding in “Company”**
  - **Person should answer his/her officePhoneNo.**

Lesson 2: Adapting Existing Behavior (2/2)

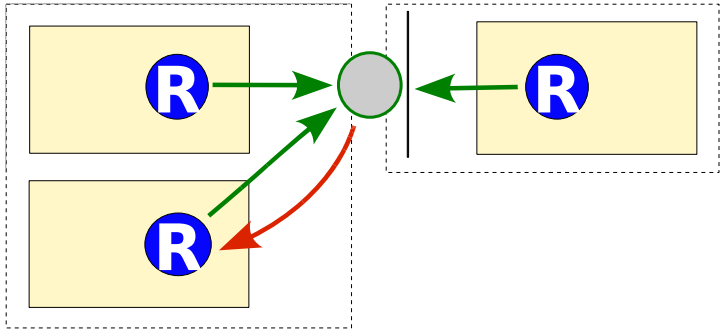


- **Enablement at different levels**
  - main switch: **team activation**
    - methods activate / deactivate of class `org.objectteams.Team`
    - block construct "`within`"
    - global / per thread
  - fine tuning: **guard predicates**
    - per role class
    - per callin binding

Code-along Lesson 2.2

- **Try different ways to activate “Company”**
  - **methods activate/deactivate**
  - **`within`**

Exercise 2: Transaction

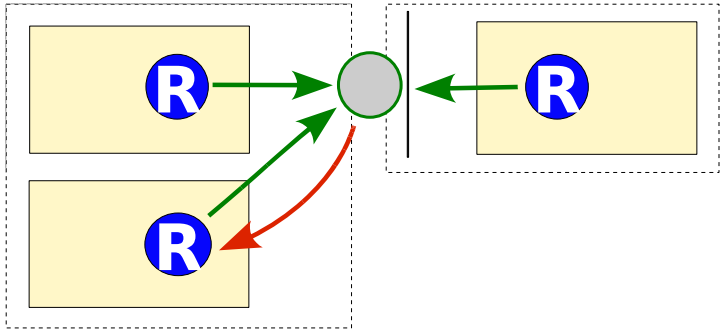


- **Transfer and Talk are concurrently modifying Phone**
  - Implement a transaction that synchronizes talk().
  - The transaction synchronizes access to its participants while it is active.
    The participants are only modifiable by the current thread.
    Other threads are blocked until the transaction is deactivated.
- **Hints**
  - Use the provided TransferTest for TDD
  - A java.util.concurrent.ReentrantLock() is a great tool for thread-exclusive locking

Exercise 2: Cheat sheet

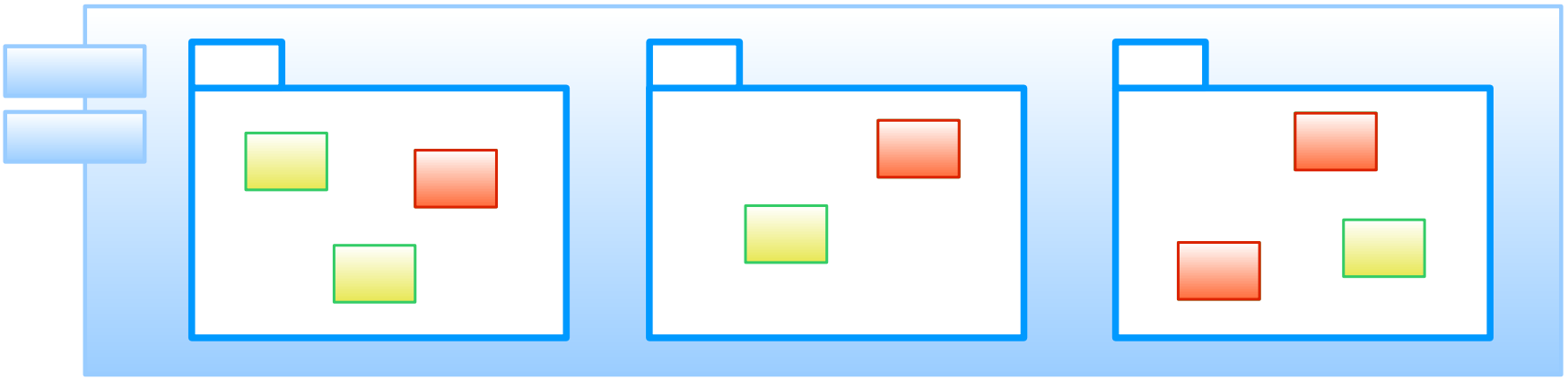
- **Calling bindings**
  - roleMethod <- [before | after | replace] baseMethod
- **Team Activation**
  - activate(): Activates a Team for the current thread
  - activate(Thread): Activates a team for the given thread, activate(Team.ALL_THREADS) activates it for all.
- **Advanced tips:**
  - A guard predicate of the form
    protected class MyRole … base when(hasRole(base)) {…
    can be used to prevent automatic role creation.
  - A team method of the form (BaseType as RoleType identifier) creates a role instance in the team.
  - within(Team) { … } activates a team for its scope and the current thread.

Exercise 2: Summary



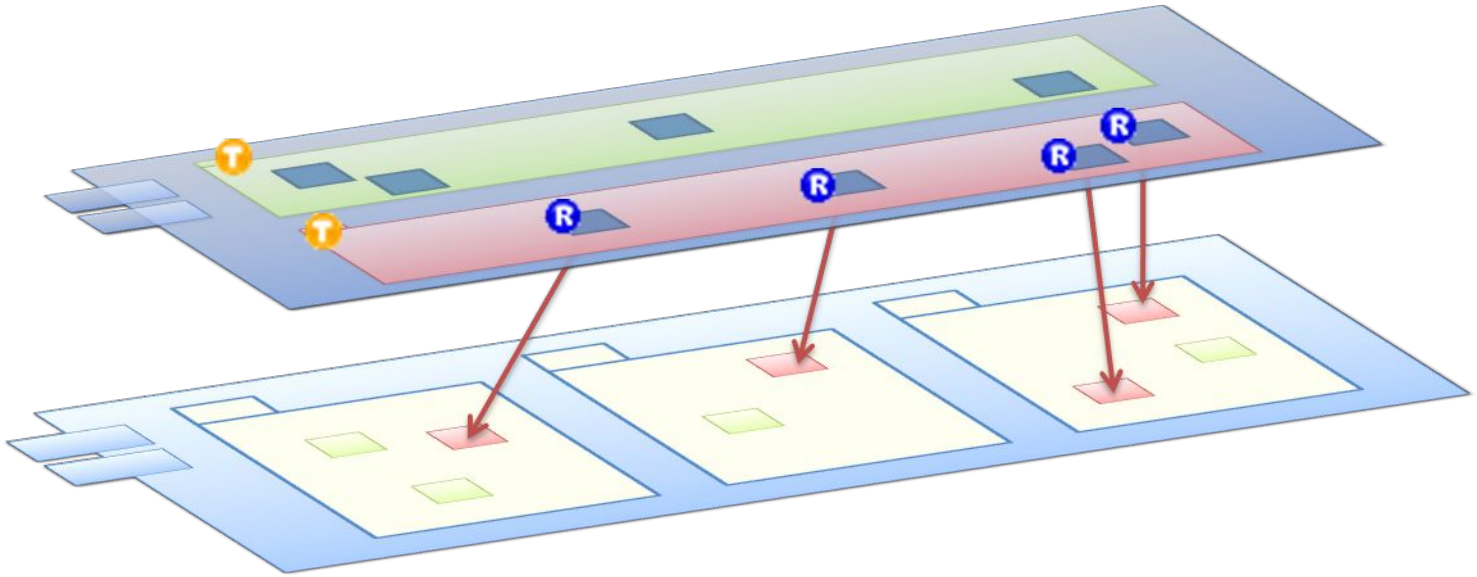
- **Achievements:**
  - Factored out the pervasive synchronization aspect
    - No changes in base and transfer
    - Entire synchronization context reified in team
  - Synchronization on demand
- **Used techniques:**
  - Callin bindings
  - Guard predicates
  - Team activation

The dilemma of SW evolution



- **For implementing & integrating a new feature**
  - need to modify many existing classes & their structure
- **For comprehensibility, maintainability**
  - need to keep changes well localized

Solution: add another Dimension



- Zoom out off the base plane
- Define suitable structure using teams & roles
- Create connections using playedBy, callout & callin

Lesson 3: Superimpose Structure

- **Find employees living in the same city for ride sharing**
  - needs relation `City →* Person`
    - this relation is missing from the model
    - this relation *may* be unwanted in the domain layer
  - consider possible solution Relation Manager
    - may be considered an anti-pattern
    - want information right in the objects operating on it
  - relation is a must, but we cannot pay for it

Code-along Lesson 3

- **Find employees living in the same city for ride sharing**
  - **Forget about** `City →* Person`
    - **instead add a new role** `HomeTown playedBy City` **and ...**
  - **Add missing relation** `HomeTown →* Employee`
    - **add collection** `commuters` **in role** `HomeTown`
    - **maintain collection during hiring of people**
      - using inverse relation `livesIn`: `Person → City`
  - **Find ride sharing**
    - **iterate all known** `HomeTowns`
      - using API `ITeam.getAllRoles(Class<?> roleClass)`
    - **iterate all registered commuters**

Lesson 3: Summary

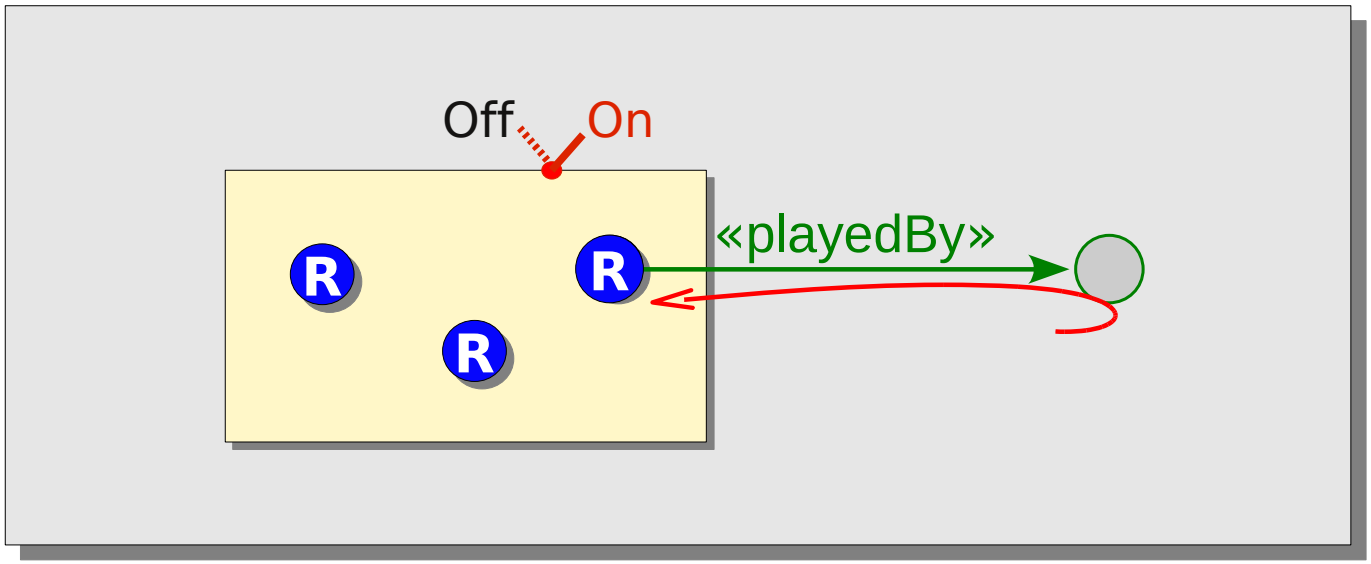
- **Not just classes: structure, too.**
  - views on existing **relations**: “callout”
    - getLivesIn(): Employee → HomeTown, view on Person → City
  - add new **relation**
    - commuters: HomeTown → Employee, derived from getLivesIn()
- **Team is a view of a base model**
  - role → base class & object
  - callout → base method / field
  - inheritance
  - relations
  - All:
    - selectively expose existing
    - adjust
    - and add more

Bonus Exercise

- **Implement the following demo-mode for the JDT**
  - When creating a Java project let the user select:
    - ☑ `Project is for demo purpose only`
  - When creating a class in a Demo project
    - insert class name as “`Foo1`”, “`Foo2`” …
- **Hints into the JDT/UI and JDT/Core (incomplete)**
  - `org.eclipse.jdt.ui.wizards.NewJavaProjectWizardPageOne.NameGroup`
  - `org.eclipse.jdt.core.IJavaProject`
  - `org.eclipse.jdt.ui.wizards.NewTypeWizardPage`
- **Configuration hints**

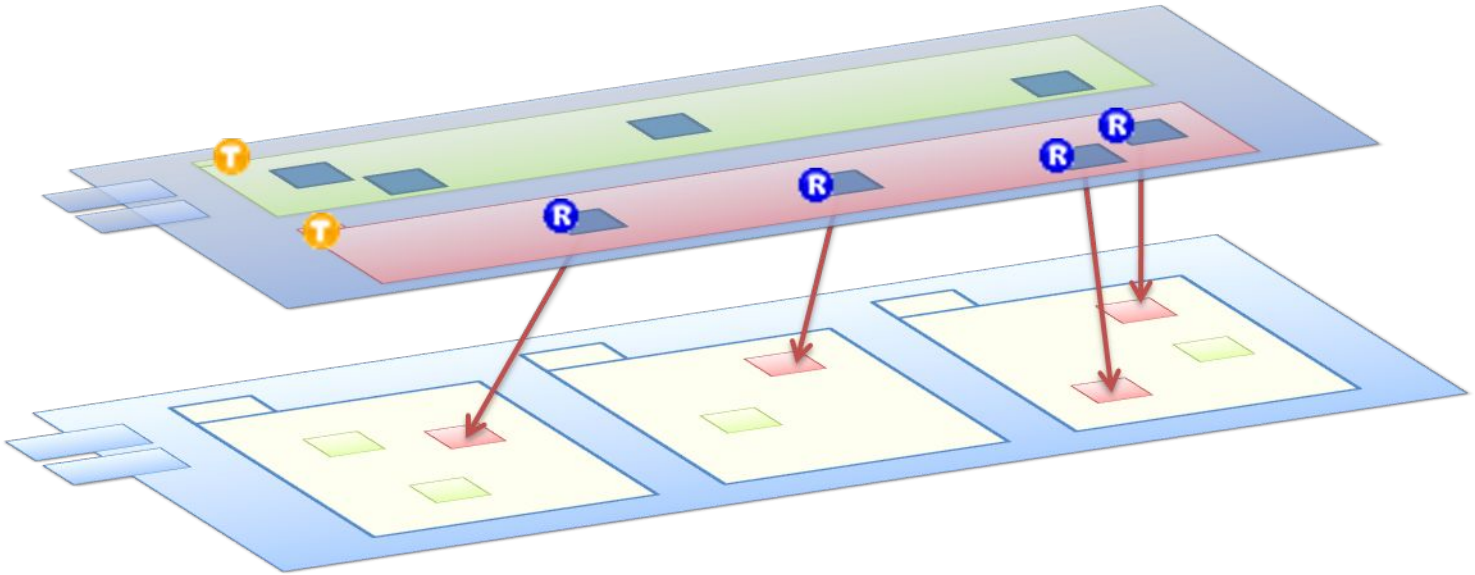
  cf. http://wiki.eclipse.org/Object_Teams_Quick-Start#OT.2FEquinox_Hello_World_Example
  - new Object Teams Plug-in Project
  - dependencies: `org.eclipse.jdt.ui` & `org.eclipse.jdt.core`
  - extension: `org.eclipse.objectteams.otequinox.aspectBinding`
    - one extension for each affected base plug-in
    - don't forget “activation”

Summary I



- Questions?

Summary II



- More questions?

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http://www.eclipse.org/newsportal/thread.php?group=eclipse.objectteams