Designing Adaptive Web Applications

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Information Systems

Outline

Motivations and Applications
Adaptive Web Application Design

- Information Access Applications
- Service Based Applications

Further Challenges

Outline

Motivations and Applications

Adaptive Web Application Design

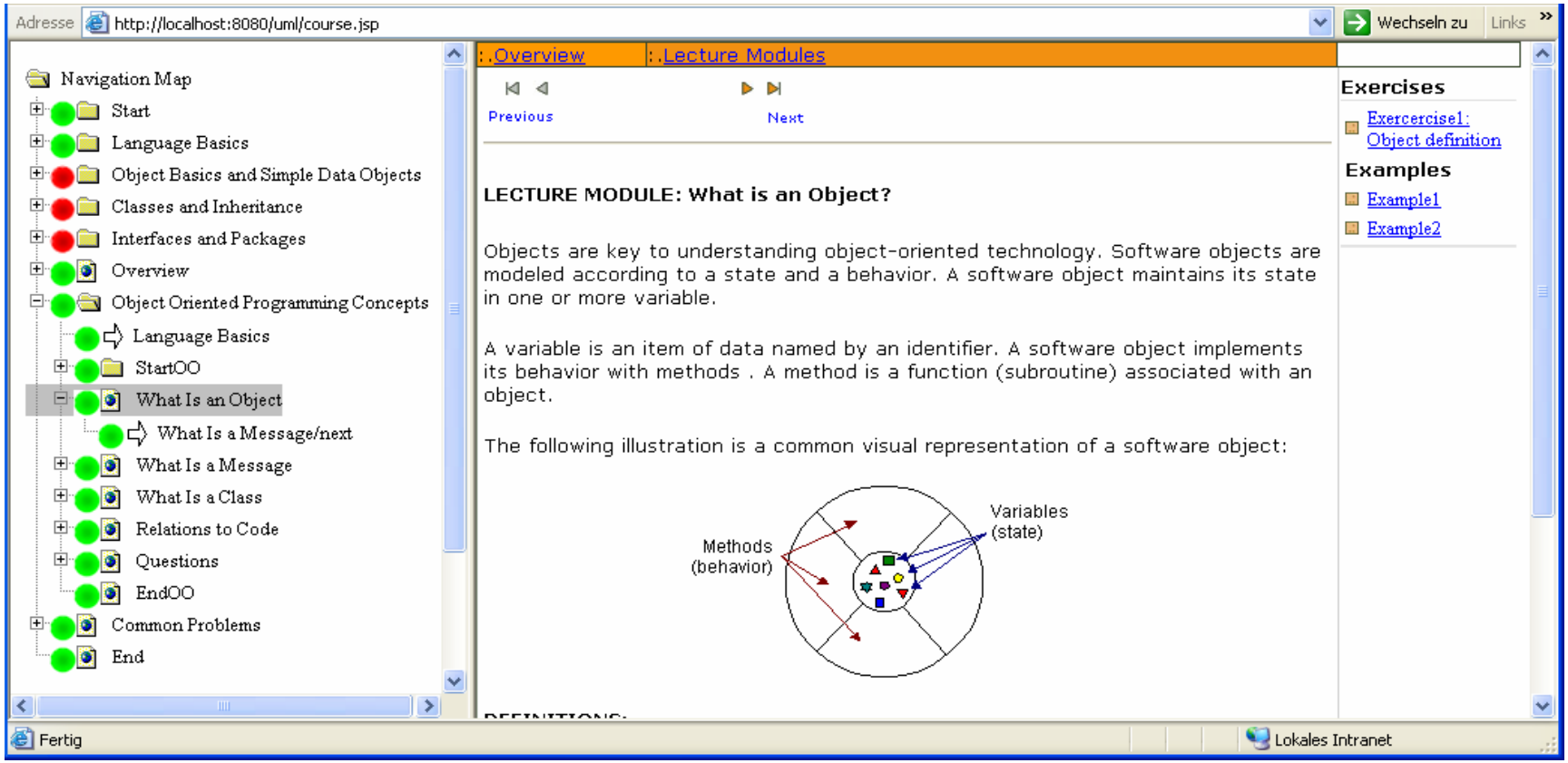
- Information Access Applications
- Service Based Applications

Further Challenges

Adaptation/Customization

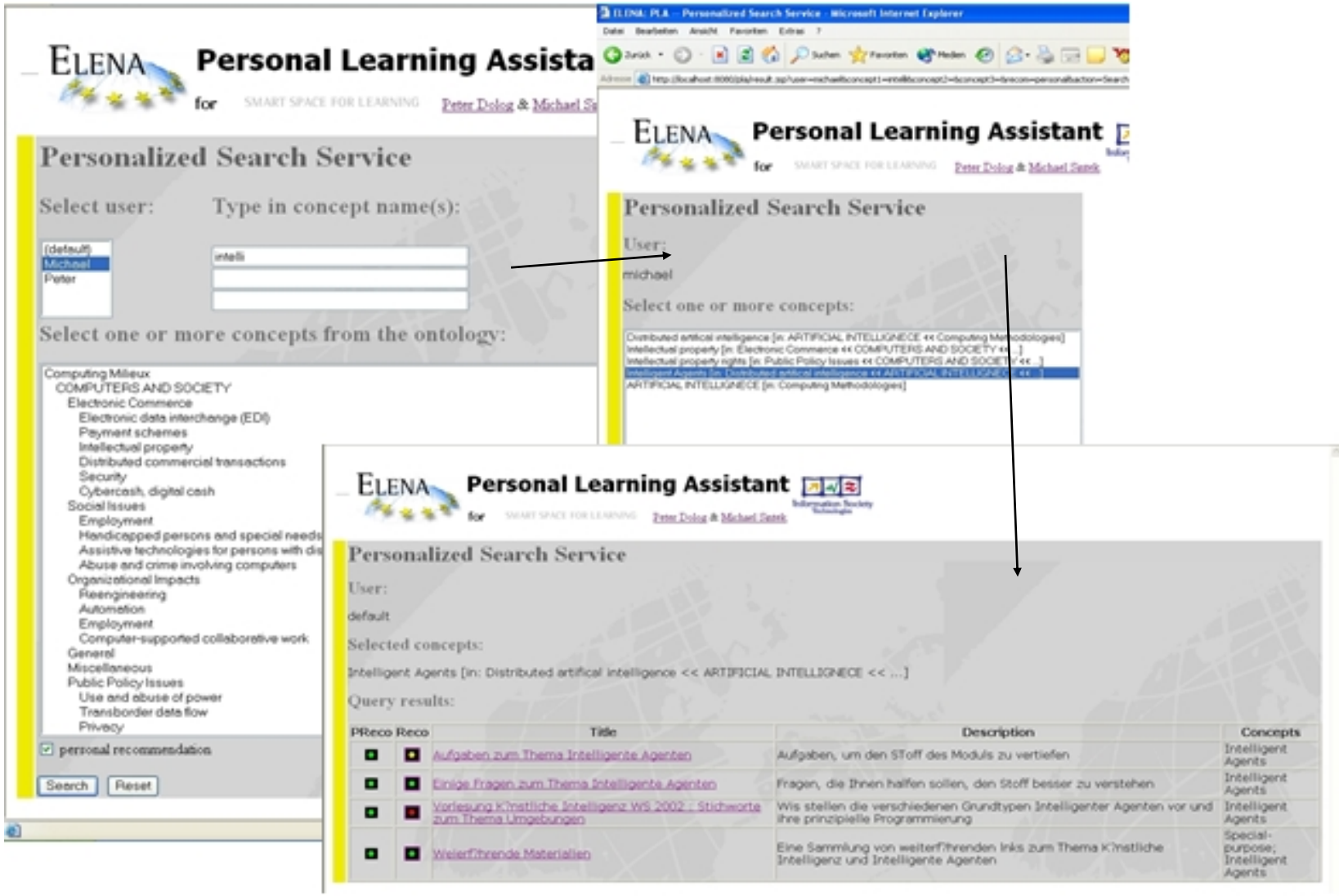
- Customization by humans (designers)
- Dynamic adaptation by a system itself
- Adaptation is about decision on which information resource or function variant to provide or recommend access to,
- We need a knowledge to decide about appropriate information or service configuration in a certain processing step (user or other):
  - Resource and information access environment
  - Application domain
  - User/Context
  - And their configuration – variants and their meaningful combinations for certain purposes

The UML-Guide

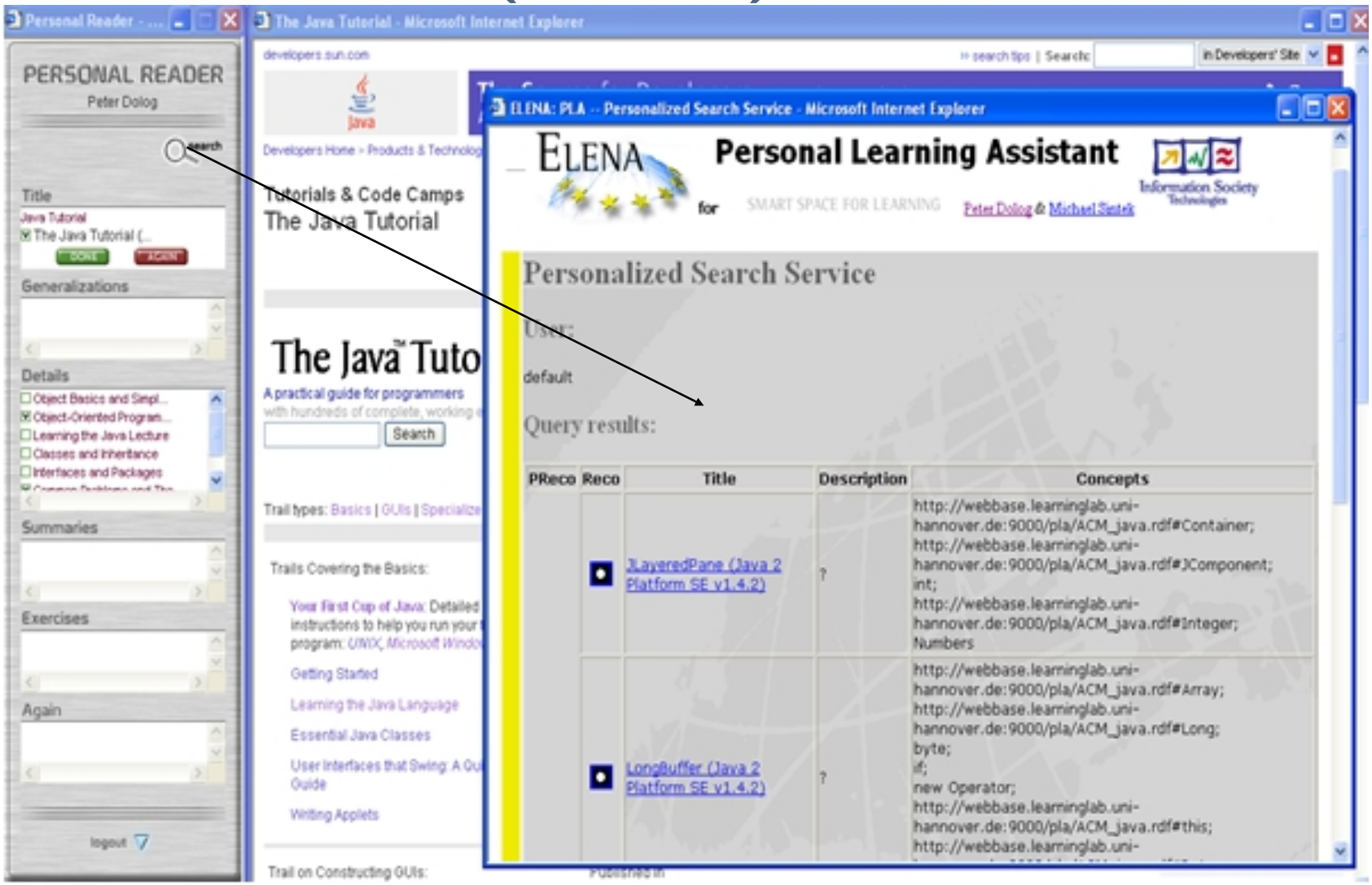


JWE2005

Personal Learning Assistant (WWW2004)



Personal Reader (AH2004)



http://www.hcd-online.com (ACMTOIT 2008)

Search results are currently collected. Next update in 2 seconds.

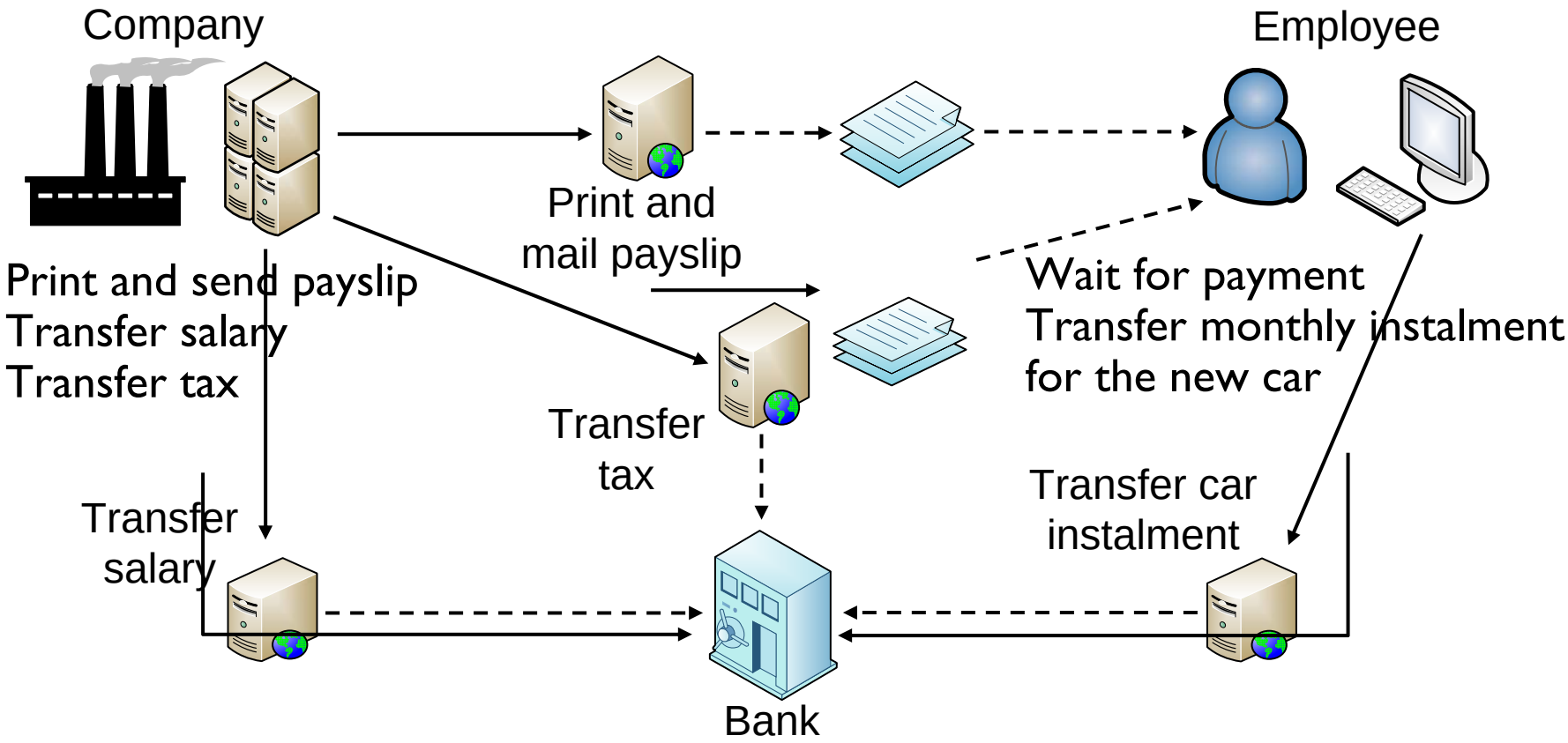
Currently used search-term(s): **economy**

Remote service status:

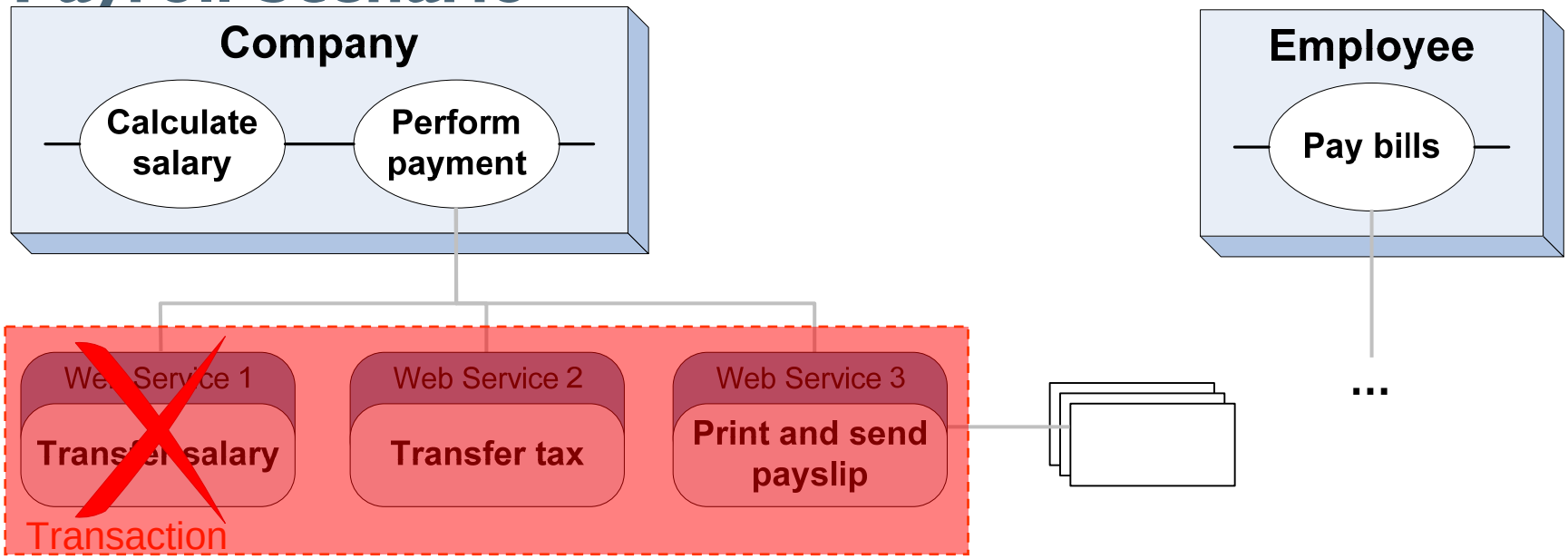
Executive Academy (WBZ): ✔
LASON: ⧗
Edutella: ✘
Seminarshop.com: ✔
CLIX: ⧗
ULI: ✘
Knowledgebay: ⧗
EduSource: ✔
Metzingen VHS-Kursdatenbank: ✔
Amazon: ✔
bfi-vienna: ⧗
EducaNext-UPM: ✘

Select	Relevance	Title / Description			
○	100. (1)	**Change-Management und Innovation** Die Zukunft (die sogenannte □Next Economy□) ist eine Innovations□Economy. Nur wer sich in Zukunft auf Ver□nderungen einstellt, wer hohe Innovationsraten verwirklichen kann, wird am Markt bestehen. Ein ...			
○	2.70 (2)	**The Experience Economy: Work Is Theatre & Every Business a Stage** Availability: Usually ships in 24 hours			
○	2.70 (3)	**Book of Common Prayer (1979, Personal Size Economy, Black)** Availability: Usually ships in 24 hours			
○	2.70 (4)	**Illicit : How Smugglers, Traffickers and Copycats are Hijacking the Global Economy** Availability: Usually ships in 24 hours	Yes	Amazon	English
○	2.70 (5)	**Basic Economics: A Citizens Guide to the Economy, Revised and Expanded** Availability: Usually ships in 24 hours	Yes	Amazon	English
○	2.70 (6)	**Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy** Availability: Usually ships in 24 hours	Yes	Amazon	English
○	2.70 (7)	**The Macro Economy Today with DiscoverEcon with Solman Videos** Availability: Usually ships in 2 to 5 weeks	Yes	Amazon	English
○	2.36 (8)	**The Travels of a T-Shirt in the Global Economy : An Economist Examines the Markets, Power, and Politics of World Trade** Availability: Usually ships in 24 hours	Yes	Amazon	English
○	2.02 (9)	**How We Compete : What Companies Around the World Are Doing to Make it in Today's Global Economy** Availability: Usually ships in 24 hours	Yes	Amazon	English
○	2.02 (10)	**The Wal-Mart Effect : How the World's Most Powerful Company Really Works--and How It's Transforming the American Economy** Availability: Usually ships in 24 hours	Yes	Amazon	English
○	1.88 (11)	**3043 Advanced Novell Network Administration NetWare 6.5** NetWare 6.x wurde speziell auf die Bed□rfnisse der heutigen Net Economy zugeschnitten. NetWare 6.x kann in bestehenden Netzwerken eingesetzt werden, um diese in ein einziges, alles umfassendes Netz - ...	Yes	Seminarshop.com	German
○	0.0 (12)	**China Reise Taijiquan Qi Gong** 21 Tage China Reise - Taijiquan / Qi Gong Unterricht an der Sportuniversit□t Peking, Rundreise zu faszinierenden St□tten der chinesischen Kultur	Yes	Seminarshop.com	German
○	0.0 (13)	**Szenario-Technik** Jeder Unternehmer, jede F□hrungskraft ist t□glich immer wieder neu mit der Frage konfrontiert□- Wie k□nnte mein Unternehmen/mein Bereich in ca. 1-3 Jahren aussehen?- Welche Anforderungen k□nnte der Ku ...	Yes	Seminarshop.com	German
○	0.0 (14)	**The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective Wisdom Shapes Business, Economies, Societies and Nations**	Yes	Amazon	English

Payroll Scenario (ICWE2007)



Payroll Scenario



A service fails due to an internal error.
The error can traditionally be compensated by aborting the complete transaction (all or nothing semantics).
Adaptation as replacement: a different service exists that can perform the same operations, so that the failed one can be replaced

General Problems to Deal with

What to Adapt
According to what to Adapt
How to adapt
How to Manage the Adaptation at a Product Level

Outline

Motivations and Applications

Web Application Design

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- Service Based Applications

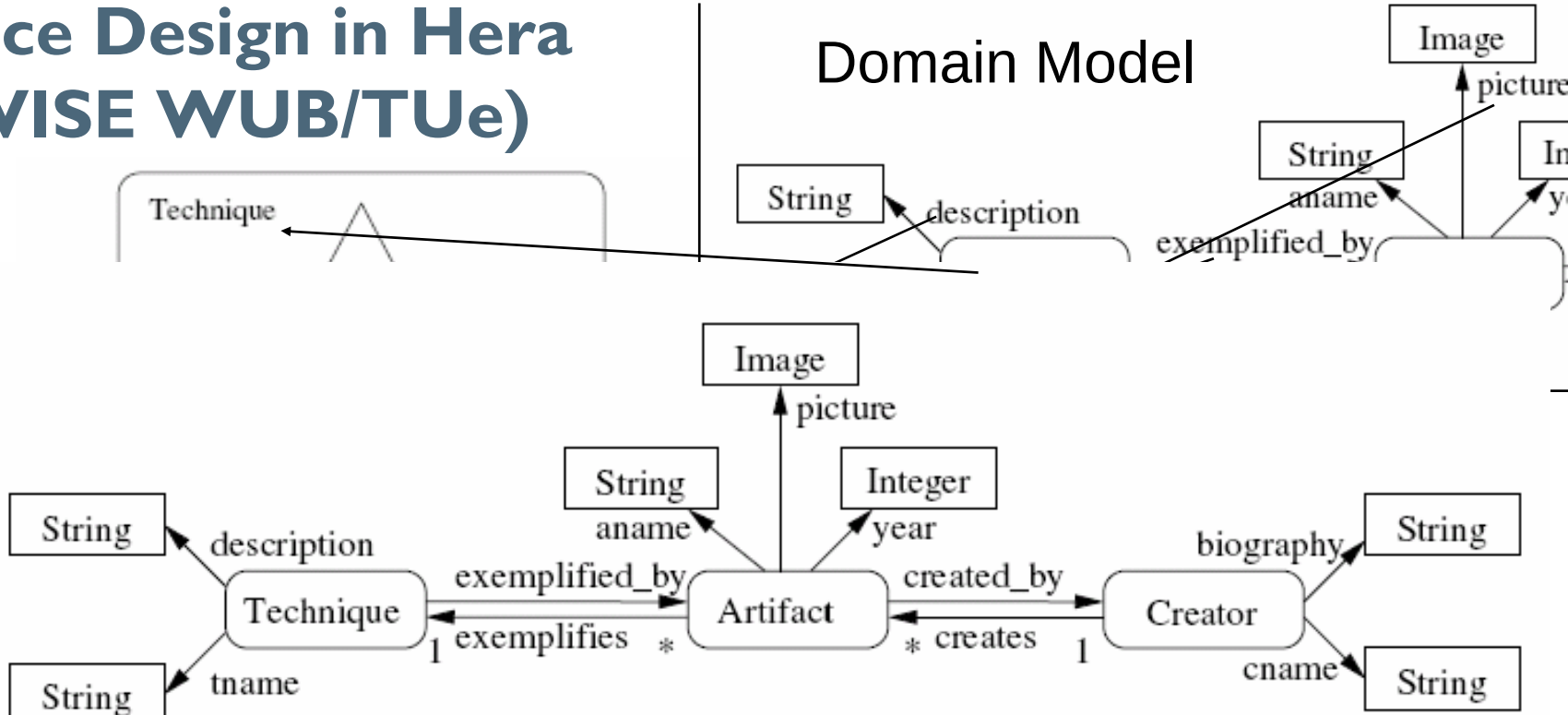
Further Challenges

Work Products of Web Application Design

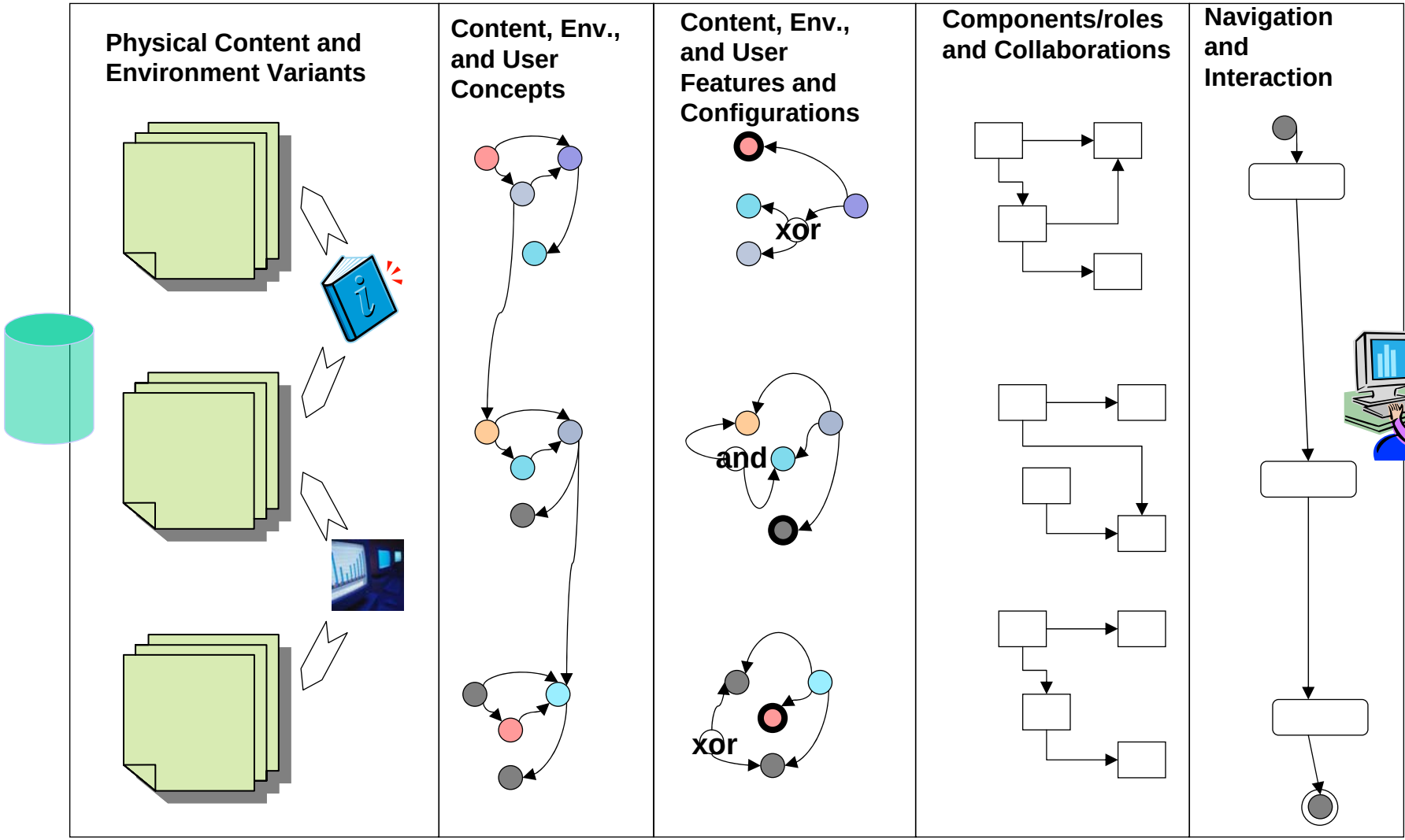
Content -> Application Domain
Navigation -> Information Context
Presentation -> Placement and Appearance

Slice Design in Hera (WISE WUB/TUe)

Domain Model



Layers of Abstraction



What Is a Class? - Microsoft Internet Explorer - [Offlinebetrieb]

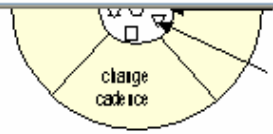
Datei Bearbeiten Ansicht Favoriten Extras ?

Zurück

Adresse http://java.sun.com/docs/books/tutorial/java/

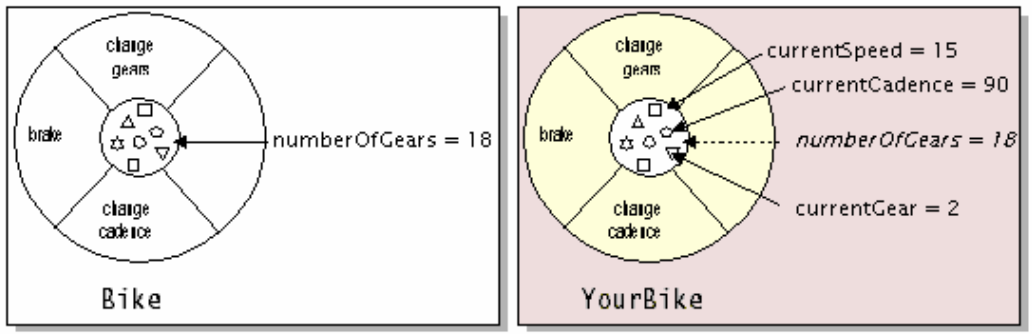
Application Domain Concepts:

- Class – the main goal,
- Class Variables,
- Class Methods



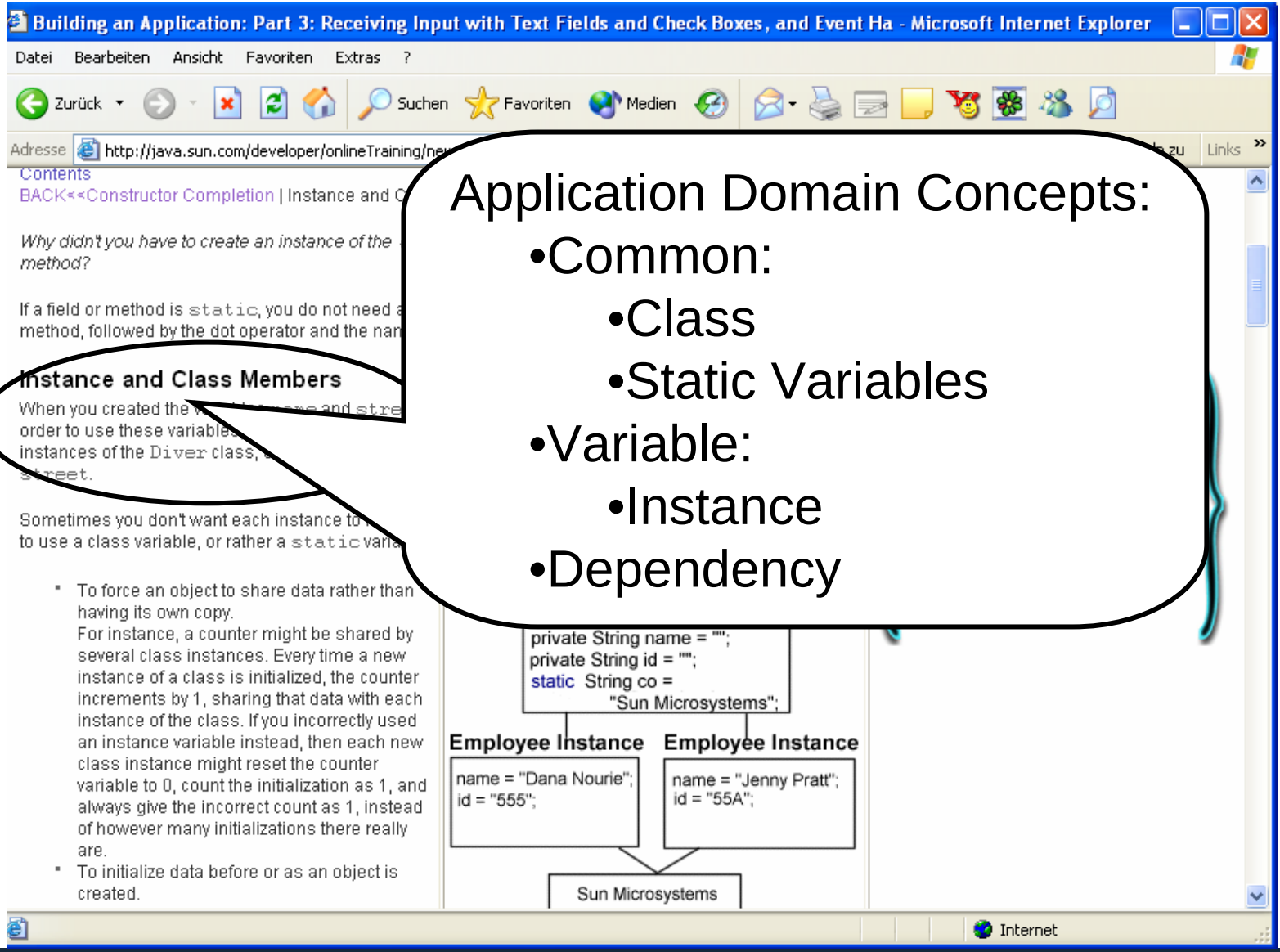
MyBike

In addition to instance variables, classes can define *class variables*. A class variable contains information that is shared by all instances of the class. For example, suppose that all instances had the same number of gears. In this case, defining an instance variable to hold the number of gears is inefficient; each instance would have its own copy of the variable, but the value would be the same for every instance. In such situations, you can define a class variable that contains the number of gears. All instances share this variable. If one object changes the variable, it changes for all other objects of that type. A class can also declare *class methods*. You can invoke a class method directly from the class, whereas you must invoke instance methods on a particular instance.



Class Instance of a Class

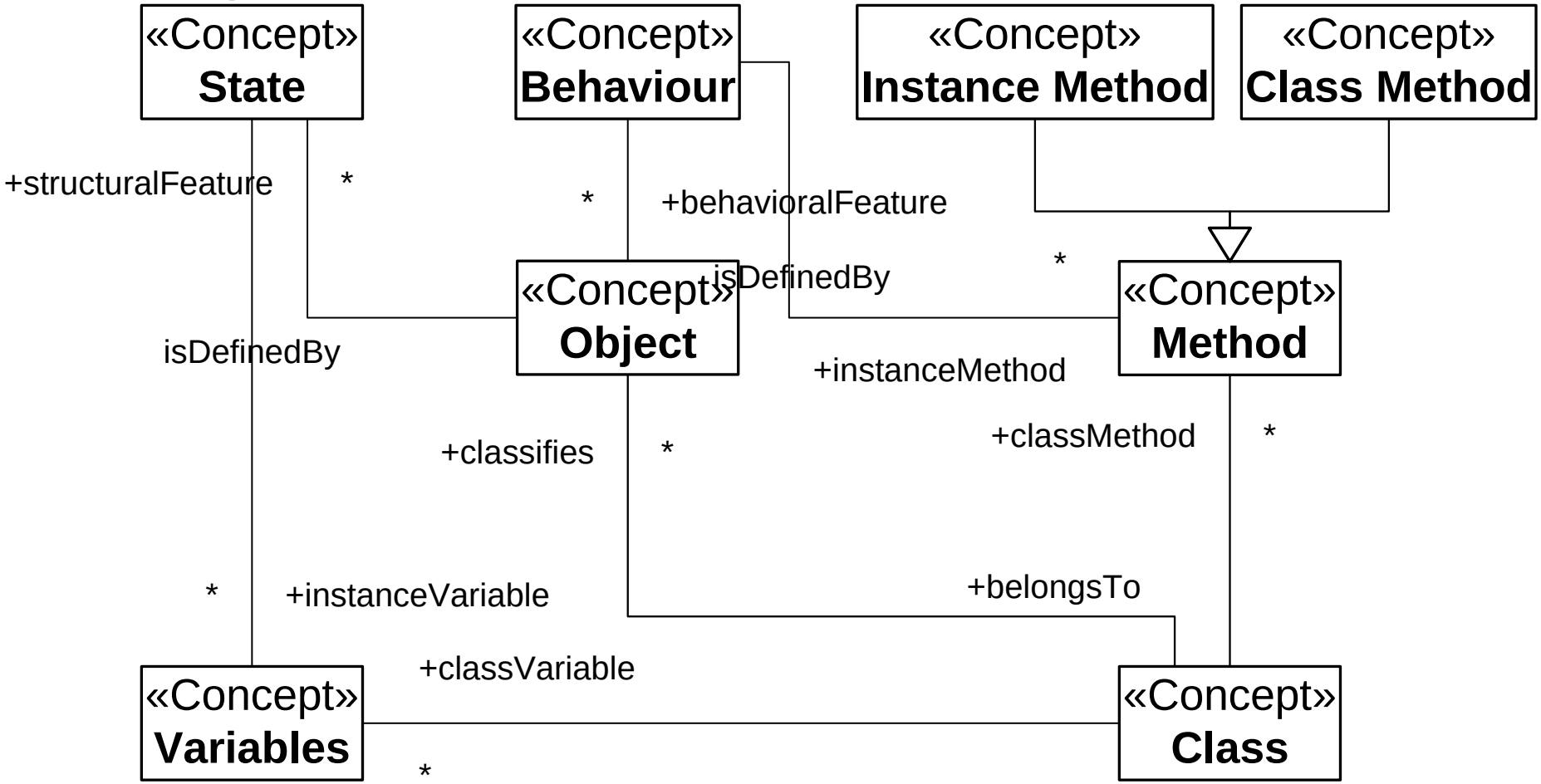
Fertig Internet



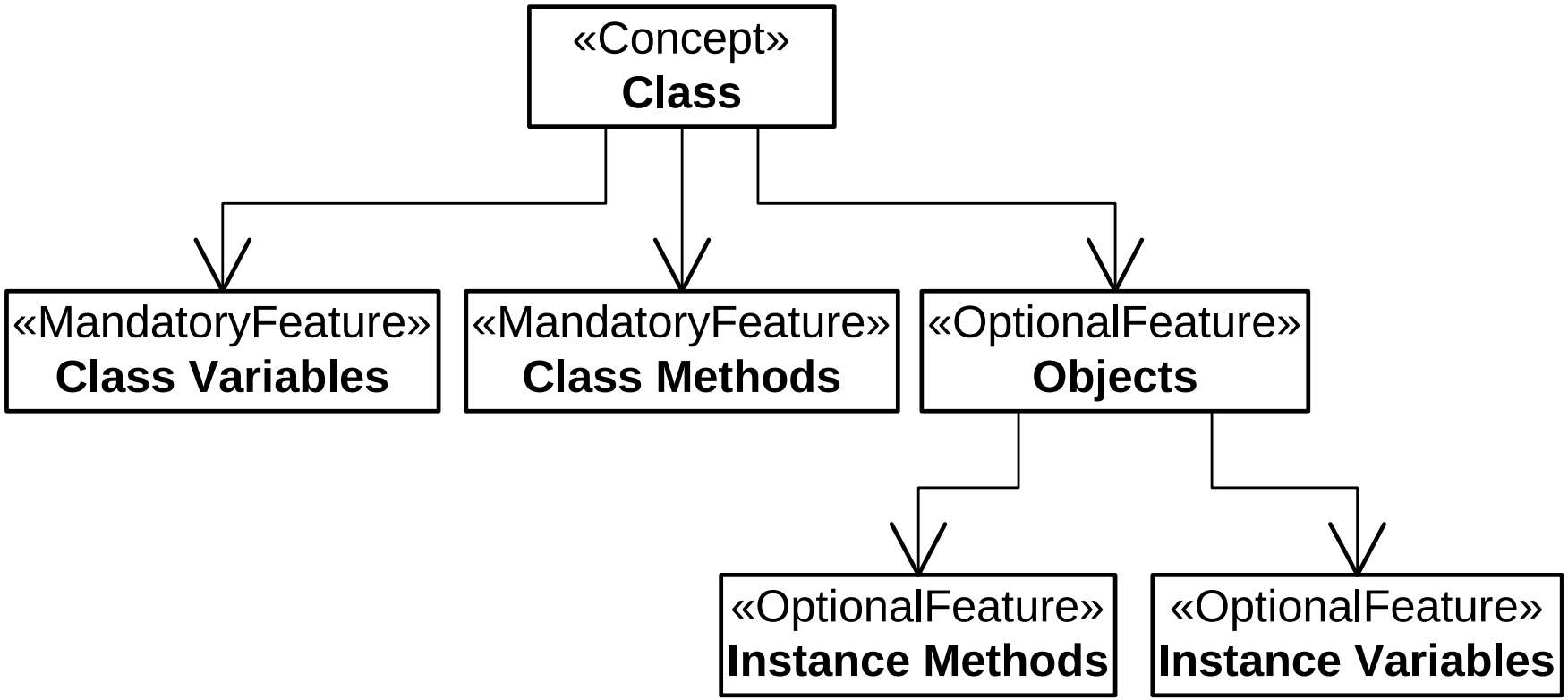
Application Domain Concepts:

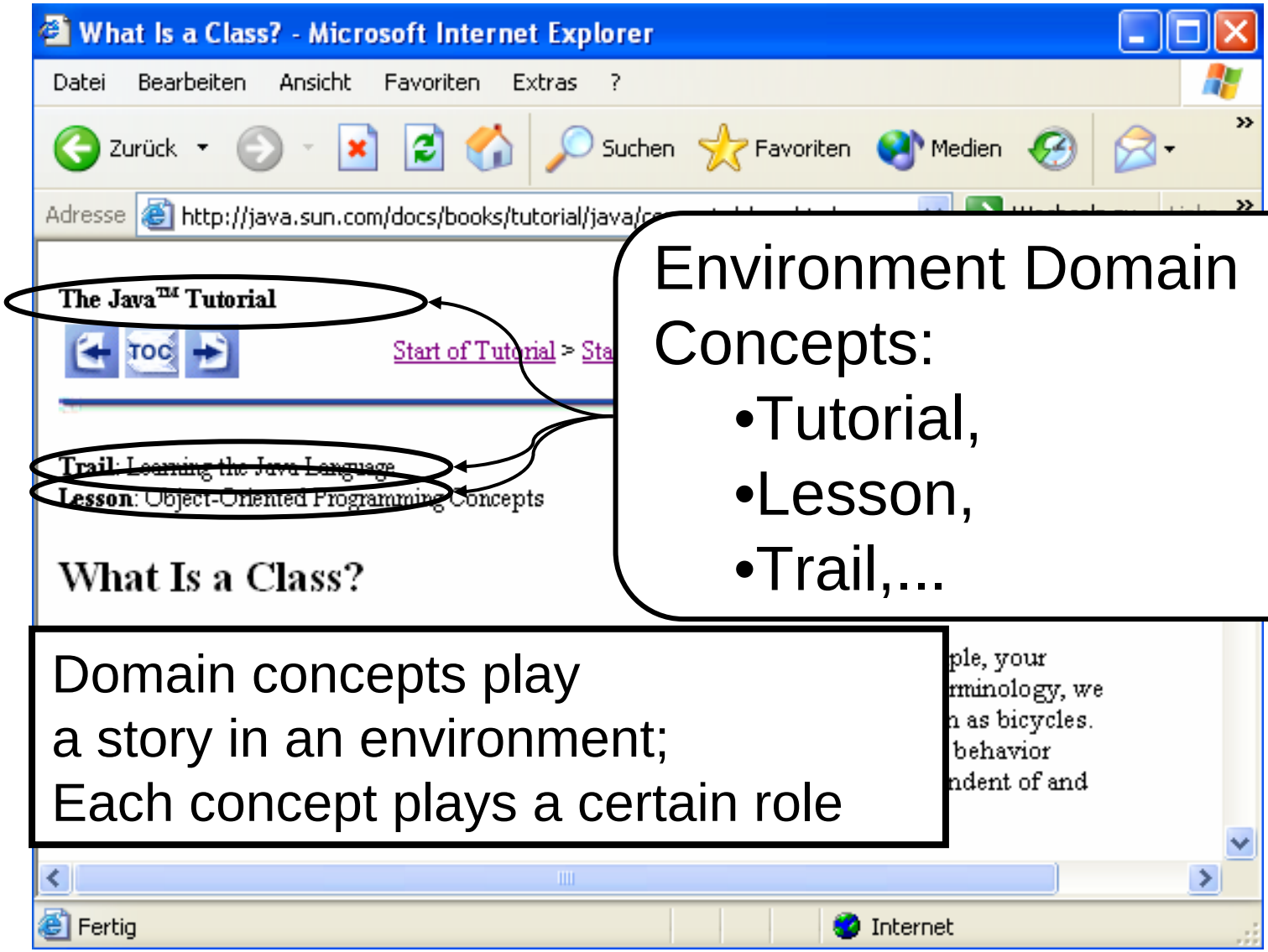
- Common:
  - Class
  - Static Variables
- Variable:
  - Instance
- Dependency

An Excerpt of Domain Conceptual Model for OOP/Java



An excerpt of *Class* feature model

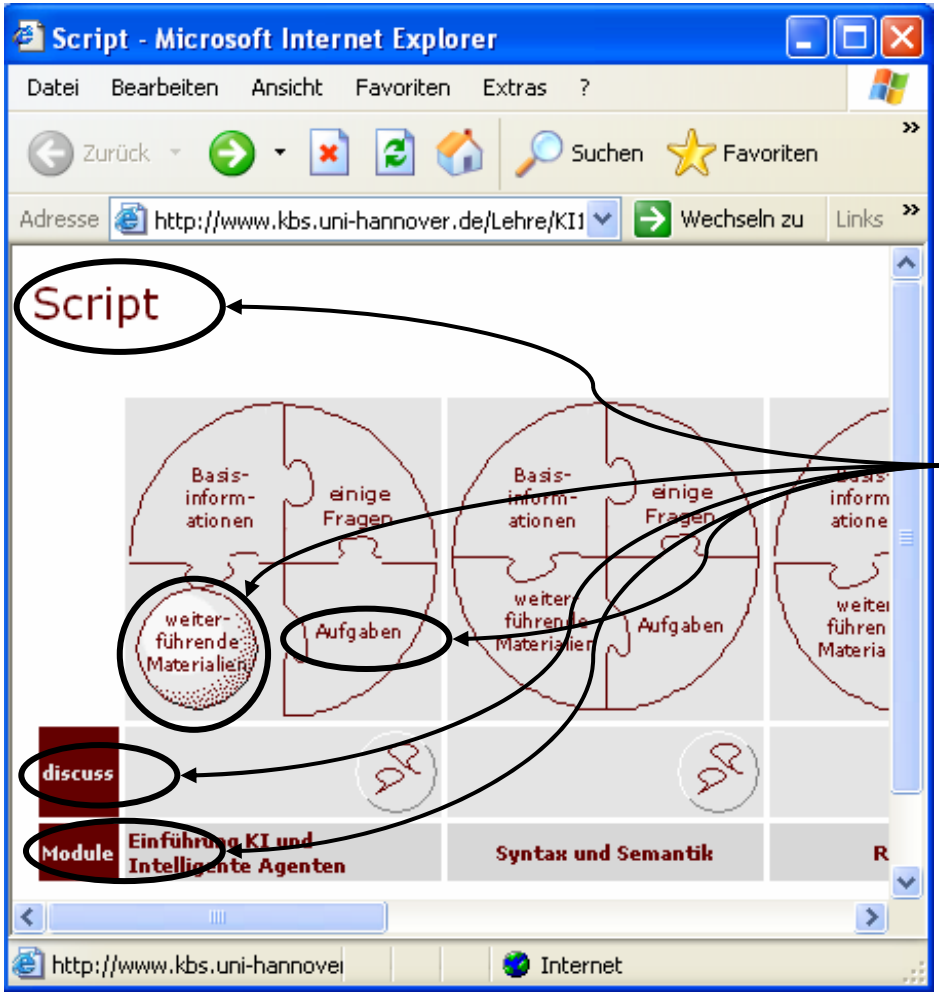


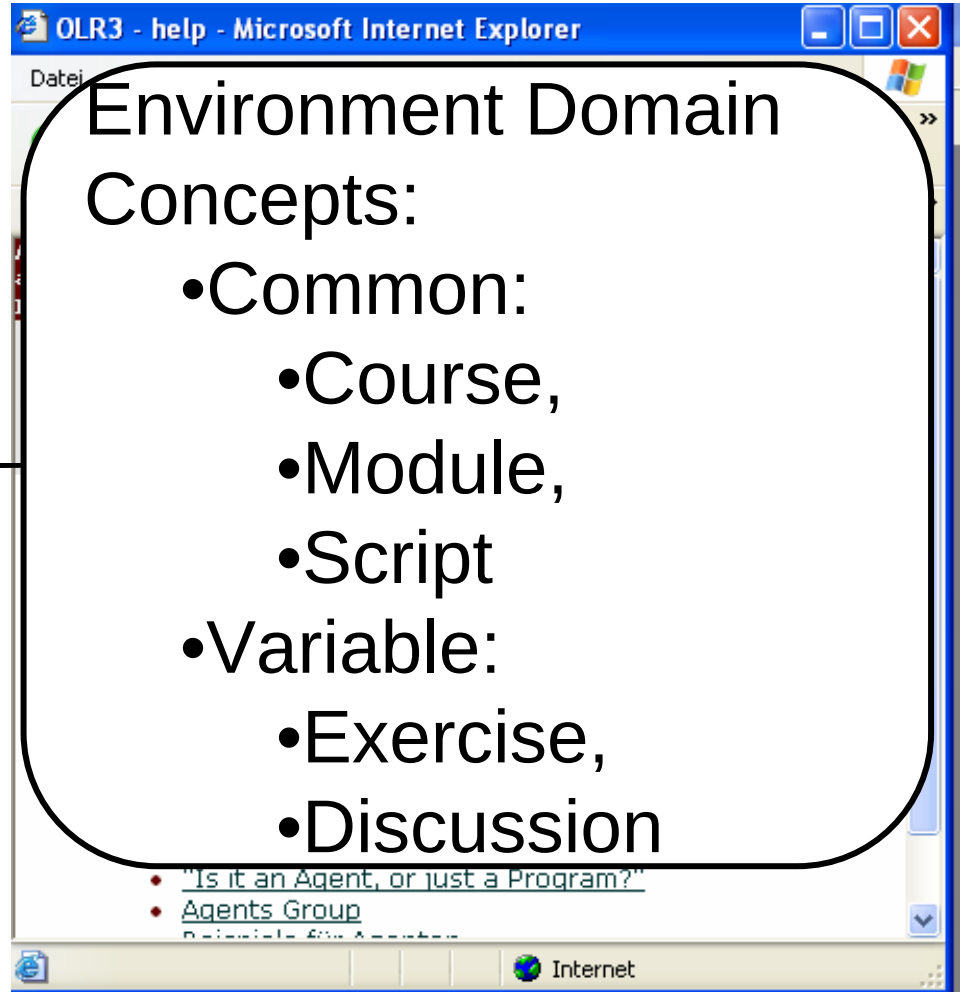


Environment Domain Concepts:

- Tutorial,
- Lesson,
- Trail,...

Domain concepts play a story in an environment; Each concept plays a certain role

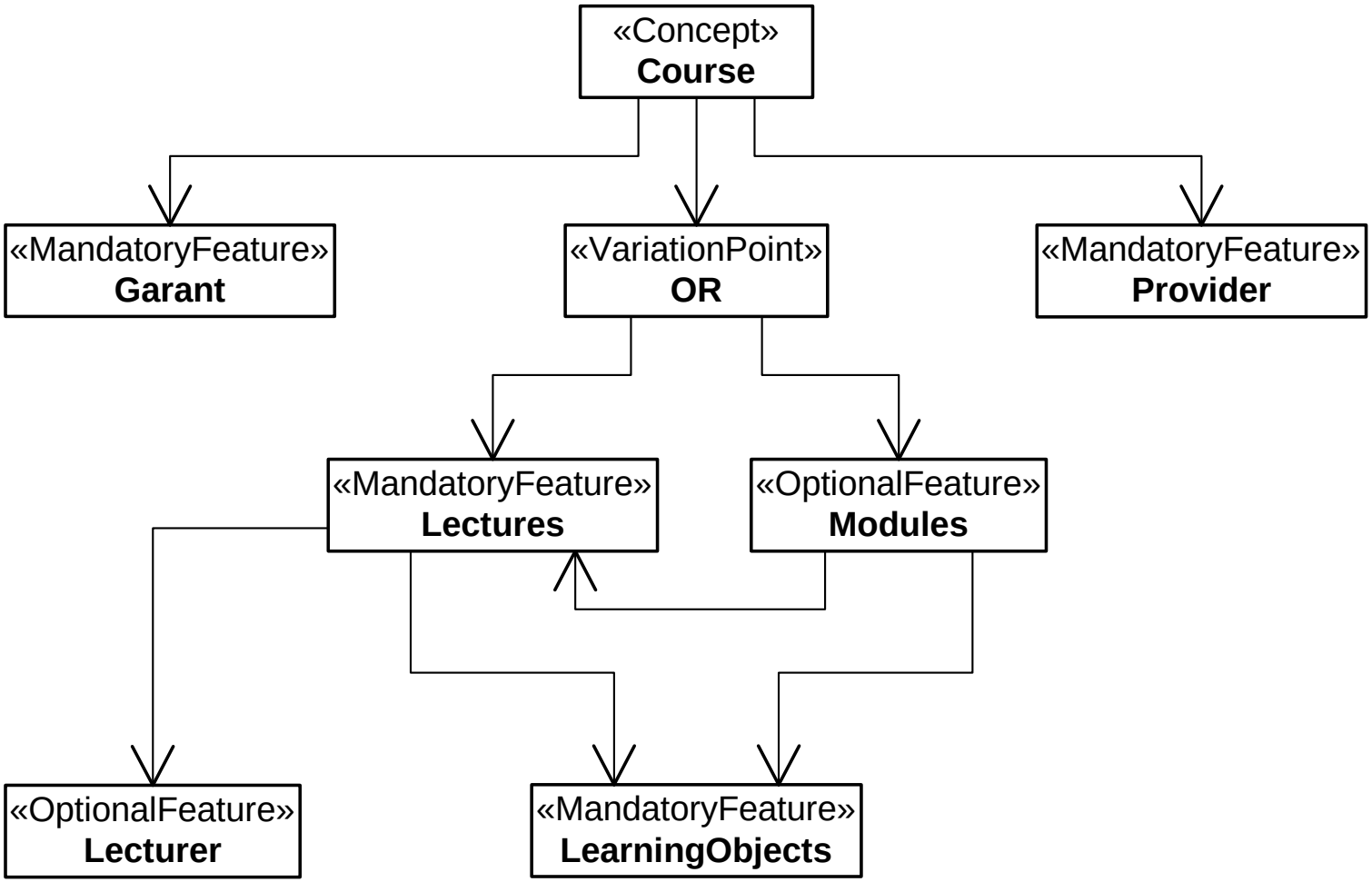




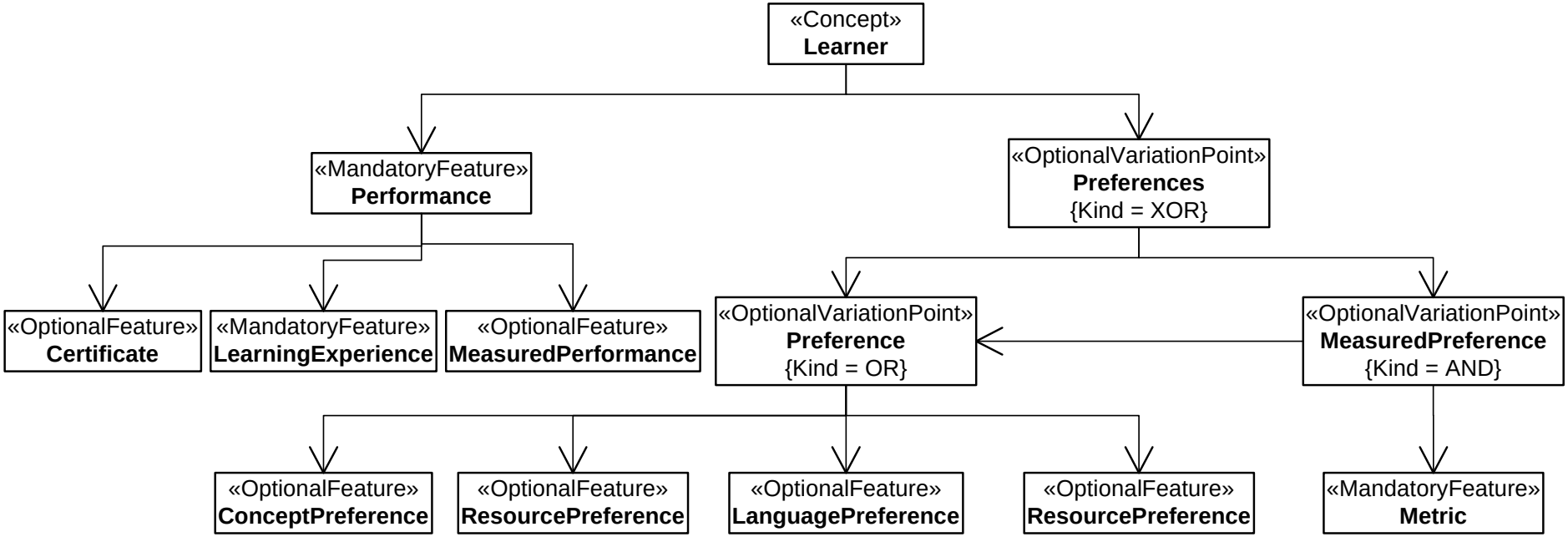
Environment Domain Concepts:

- Common:
  - Course,
  - Module,
  - Script
- Variable:
  - Exercise,
  - Discussion

An Excerpt of Course Feature Model

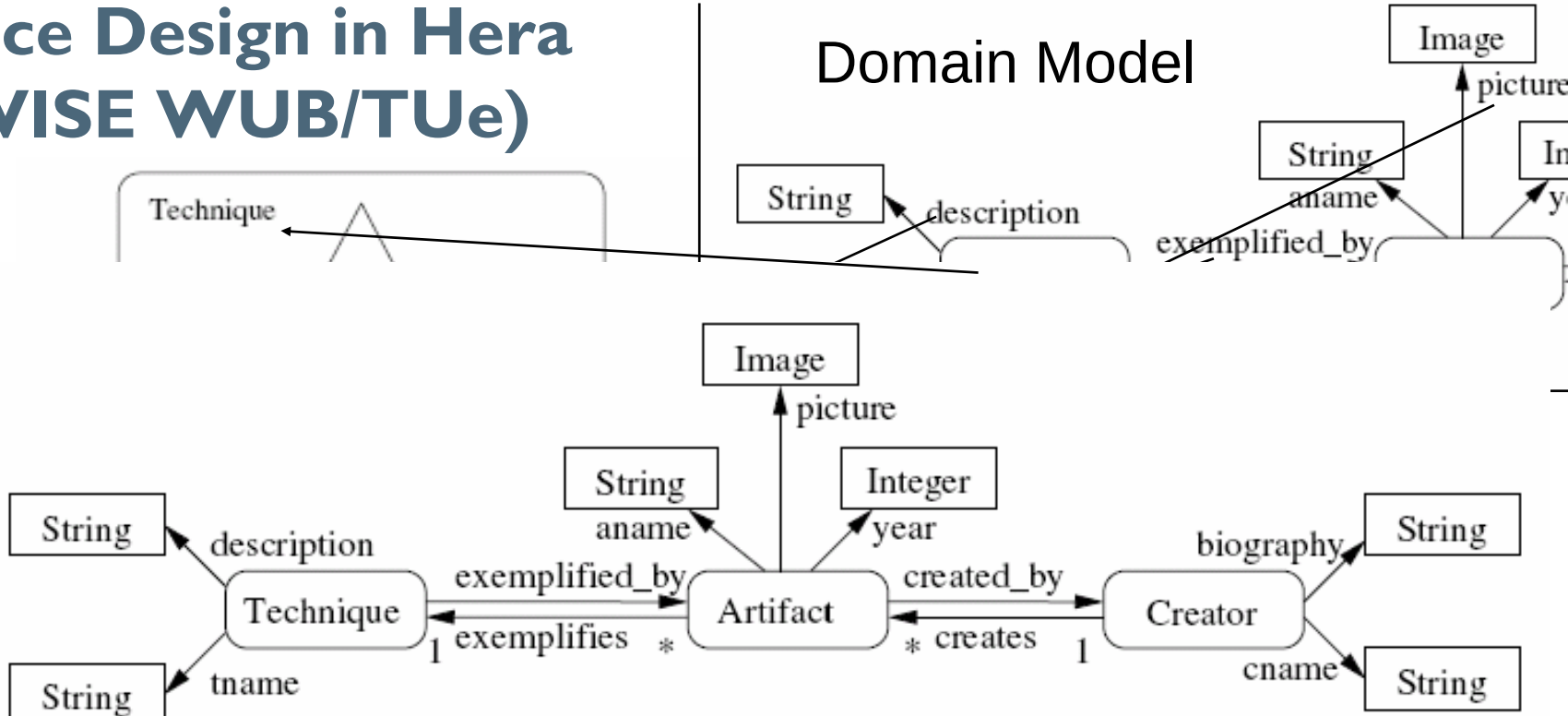


User Feature Model



Slice Design in Hera (WISE WUB/TUe)

Domain Model



Variability at Run-Time

Variability at the design time – subgraph of the feature model

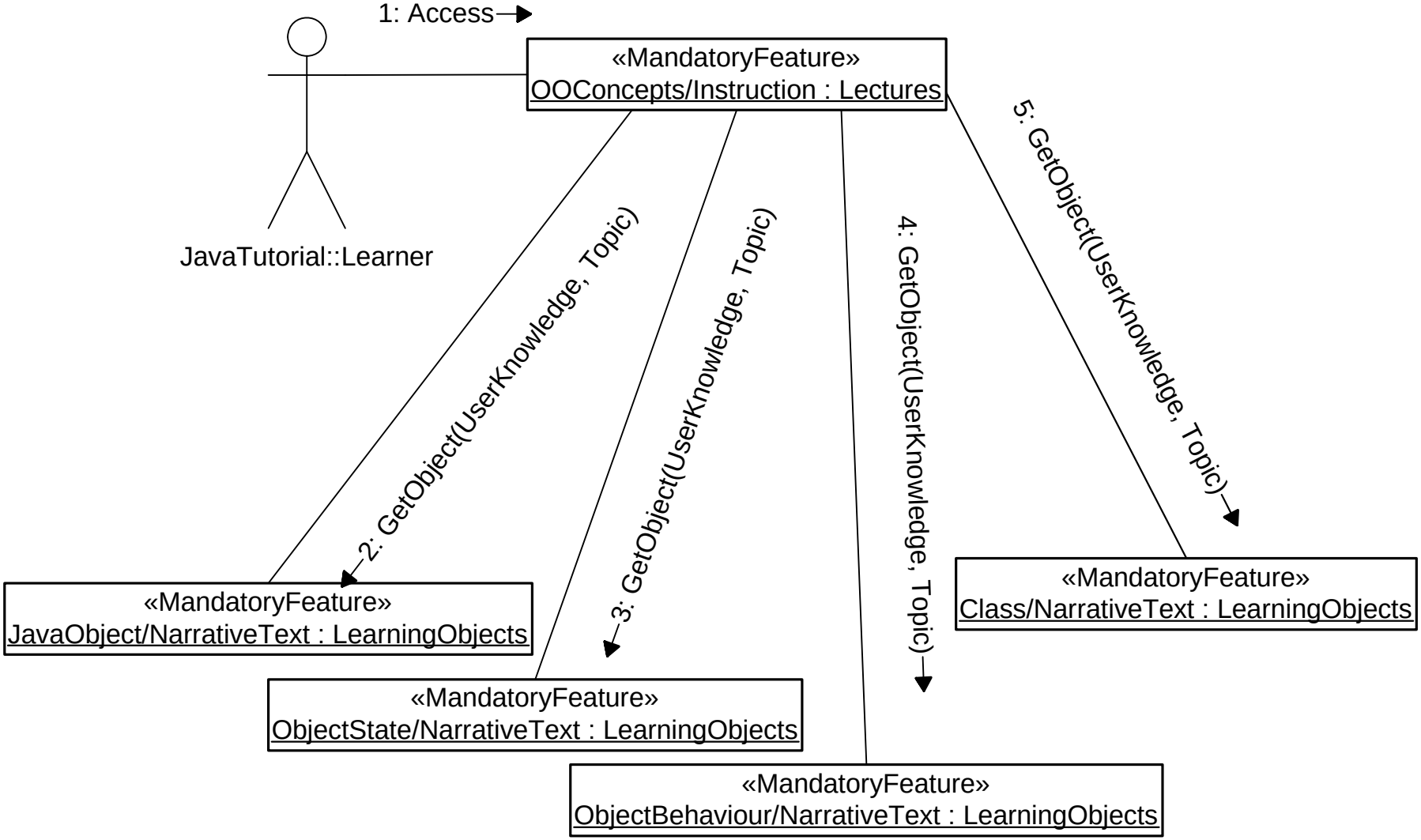
Run-Time – selecting target information according to features which are evolving dynamically (e.g. a user profile)

Such selection contributes to the evolution of the user profile as well

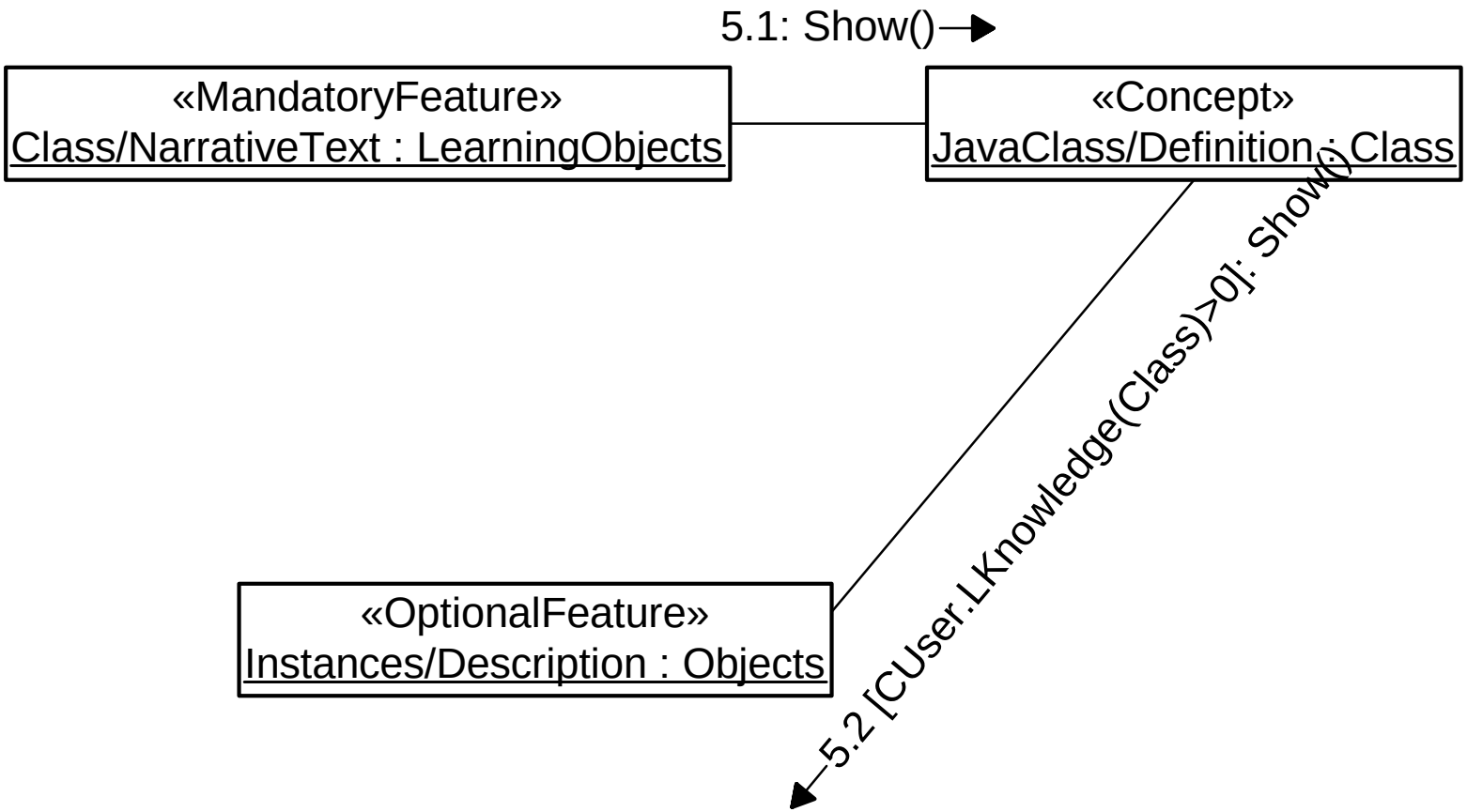
Path through information can be altered according to the profile as well

Static structure model is not enough => behavioural models, e.g. State diagrams which provide a user interaction and reactivity point of view to the specifications

Collaboration Models



Collaboration Models



State Diagrams: Adaptive Navigation

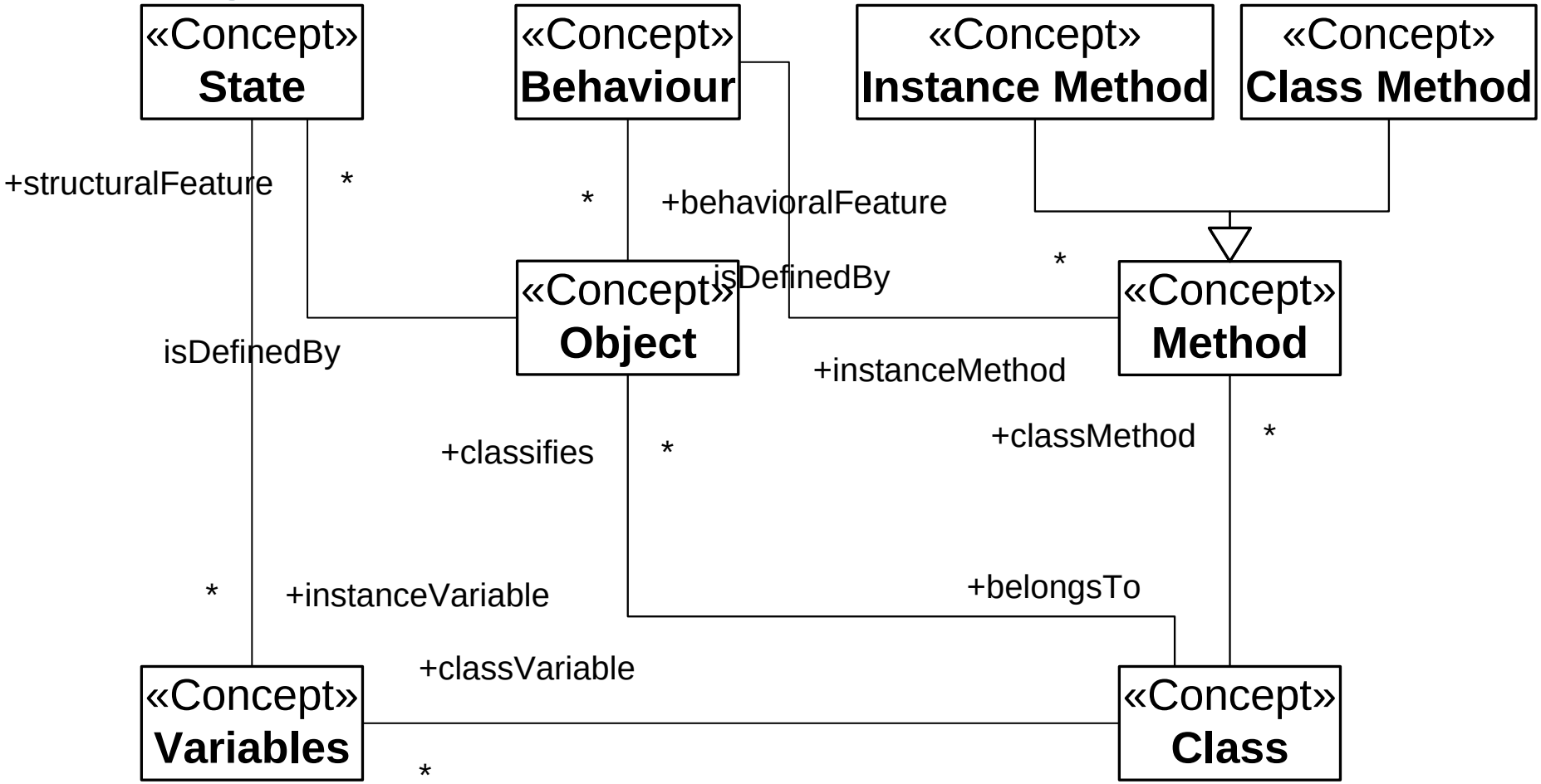
State Diagram as a model of a trail through an information space (states are hypertext nodes, transitions are possible links)

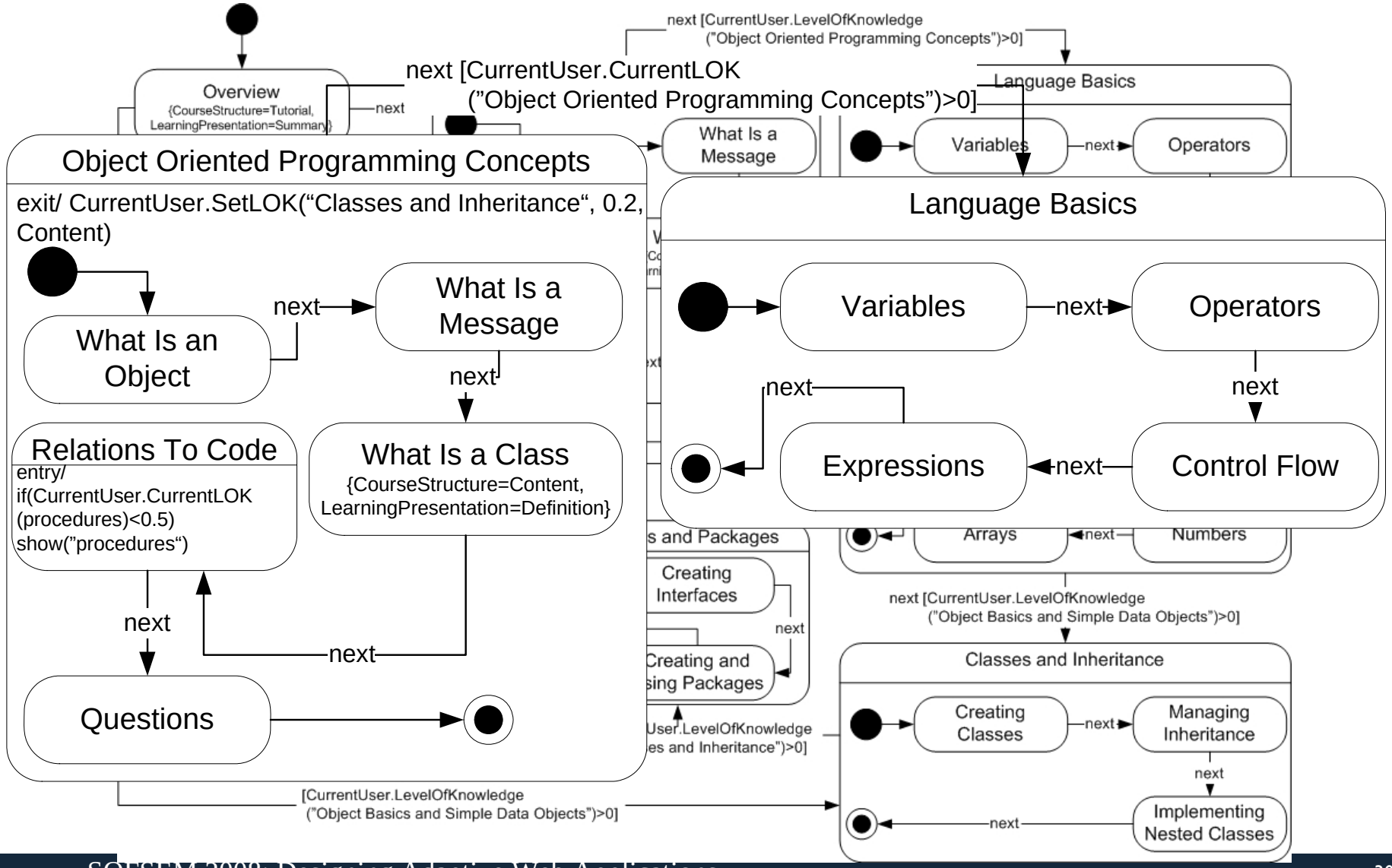
Event-Condition-Action on states and transitions for constraints on possible links and nodes

User model features in conditions

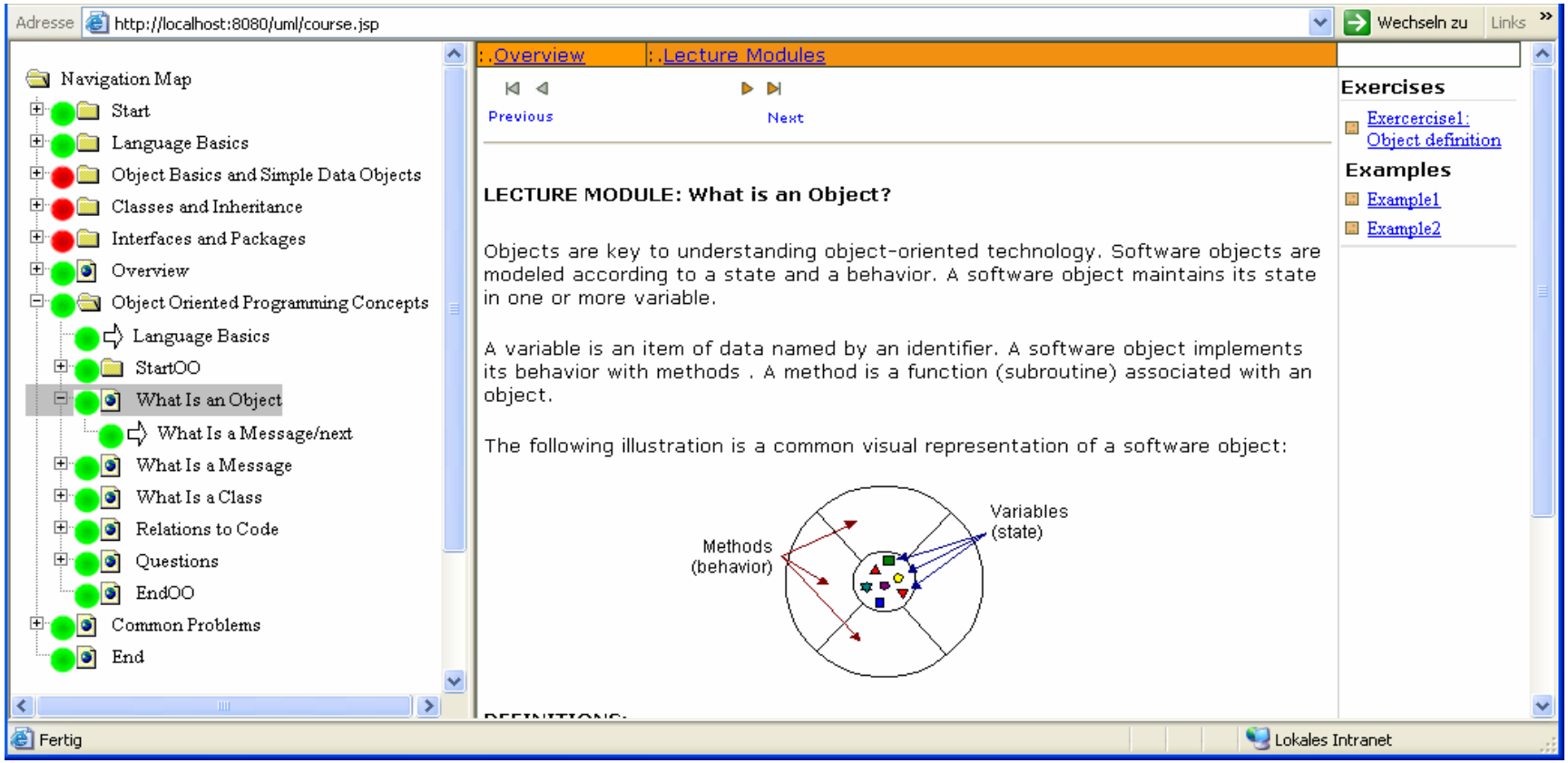
Actions for user model run-time updates and additional computations needed for rendering or processing

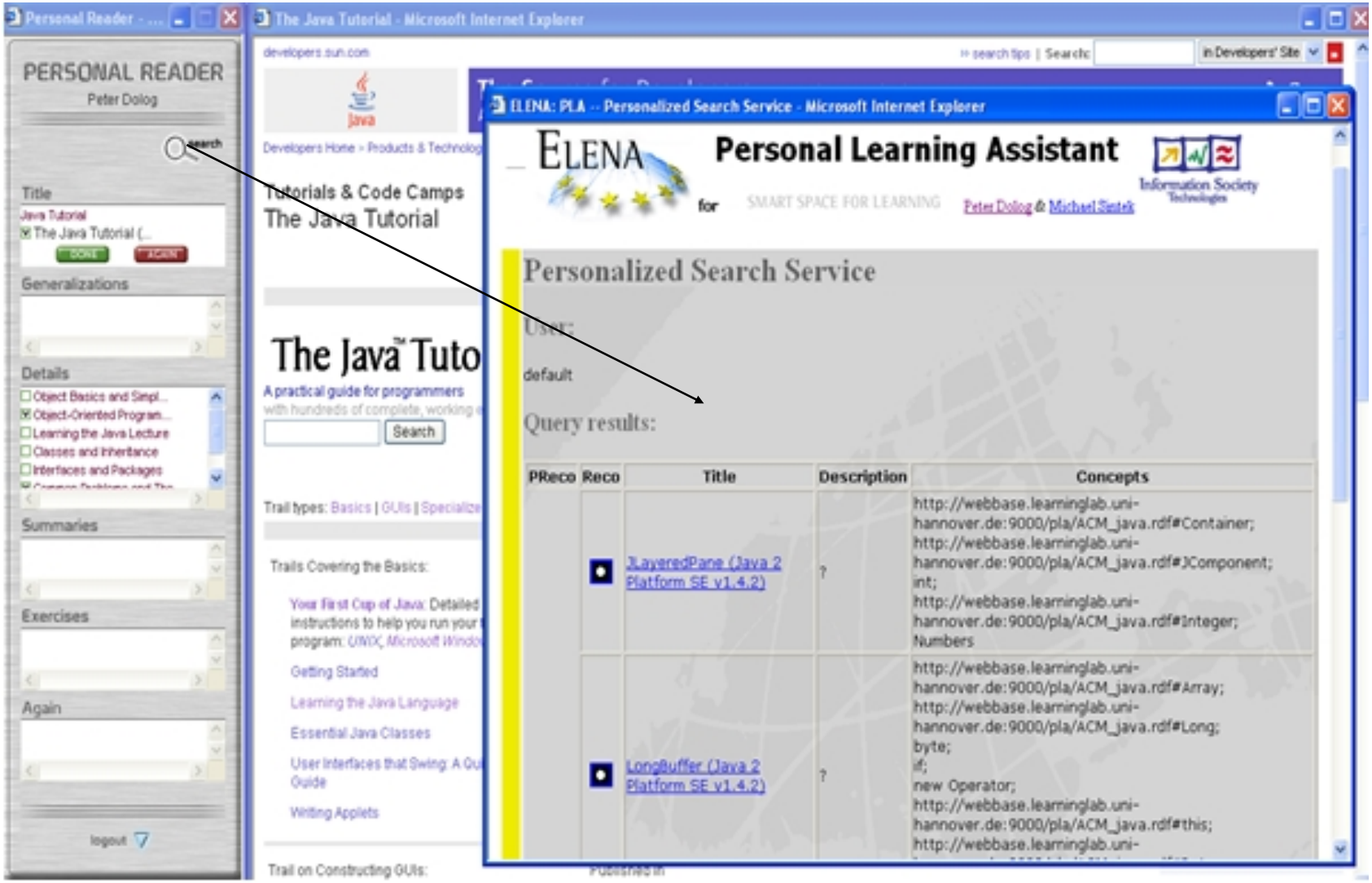
An Excerpt of Domain Conceptual Model for OOP/Java




Overview
{CourseStructure=Tutorial, LearningPresentation=Summary}
next
next [CurrentUser.CurrentLOK ("Object Oriented Programming Concepts")>0]
next [CurrentUser.LevelOfKnowledge ("Object Oriented Programming Concepts")>0]
Object Oriented Programming Concepts
exit/ CurrentUser.SetLOK("Classes and Inheritance", 0.2, Content)
What Is an Object
next
What Is a Message
next
Relations To Code
entry/
if(CurrentUser.CurrentLOK (procedures)<0.5)
show("procedures")
What Is a Class
{CourseStructure=Content, LearningPresentation=Definition}
next
next
Questions
What Is a Message
Language Basics
Variables
next
Operators
Language Basics
Variables
next
Operators
next
next
Expressions
next
Control Flow
Arrays
next
Numbers
next [CurrentUser.LevelOfKnowledge ("Object Basics and Simple Data Objects")>0]
s and Packages
Creating Interfaces
next
Creating and sing Packages
User.LevelOfKnowledge es and Inheritance")>0]
Classes and Inheritance
Creating Classes
next
Managing Inheritance
next
Implementing Nested Classes
next
[CurrentUser.LevelOfKnowledge ("Object Basics and Simple Data Objects")>0]

The UML-Guide




Personal Reader - ...
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Peter Dolog
search
Title
Java Tutorial
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DONE
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Generalizations
Details
Object Basics and Simpl...
Object-Oriented Program...
Learning the Java Lecture
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Interfaces and Packages
Summaries
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developers.sun.com
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program: UNIX, Microsoft Windo
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Essential Java Classes
User Interfaces that Swing: A Gu
Guide
Writing Applets
Trail on Constructing GUIs:
ELENA: PLA -- Personalized Search Service - Microsoft Internet Explorer
ELENA
Personal Learning Assistant
for
SMART SPACE FOR LEARNING
Peter Dolog & Michael Sintek
Information Society Technologies
Personalized Search Service
User:
default
Query results:
PReco
Reco
Title
Description
Concepts
JLayeredPane (Java 2 Platform SE v1.4.2)
?
http://webbase.learninglab.uni-hannover.de:9000/pla/ACM_java.rdf#Container;
http://webbase.learninglab.uni-hannover.de:9000/pla/ACM_java.rdf#JComponent;
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byte;
if;
new Operator;
http://webbase.learninglab.uni-hannover.de:9000/pla/ACM_java.rdf#this;
http://webbase.learninglab.uni-

Advantages

- Designer
  - Separation of domains with possibility to connect them adaptively
  - State diagrams and collaboration models reflect user interaction better
  - Semiautomatic generation
- Application
  - Models used for search, provision, and integration purposes
- Process
  - Separation can contribute to easier distribution of work

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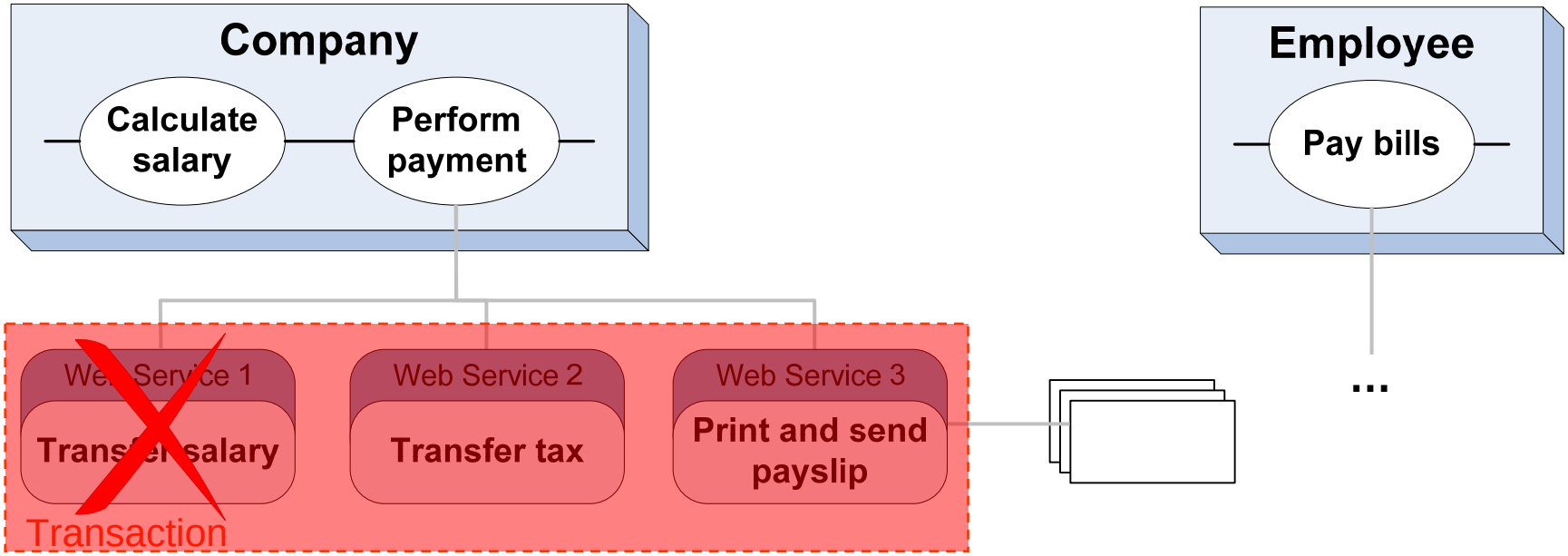
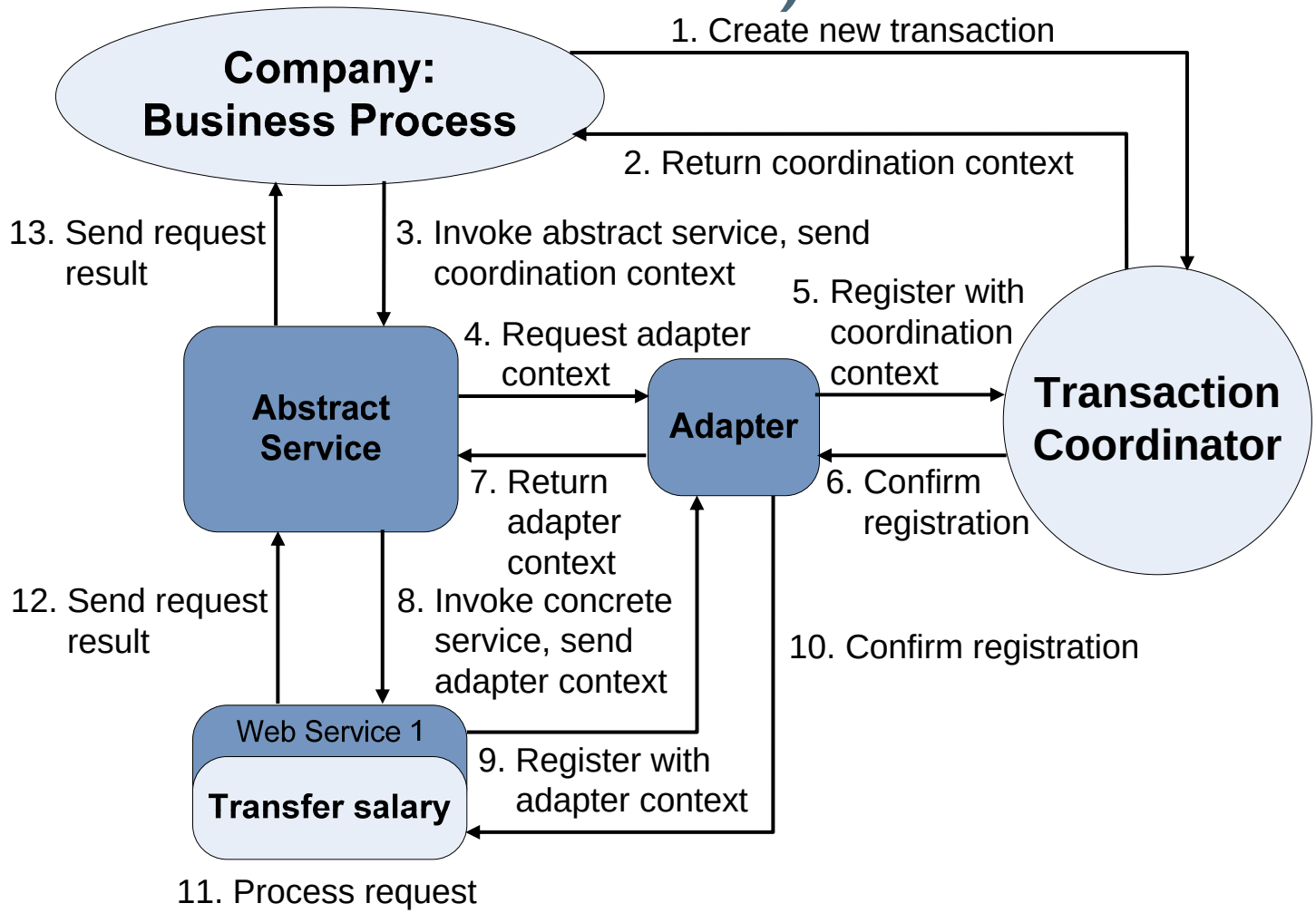
Further Challenges

Payroll Scenario

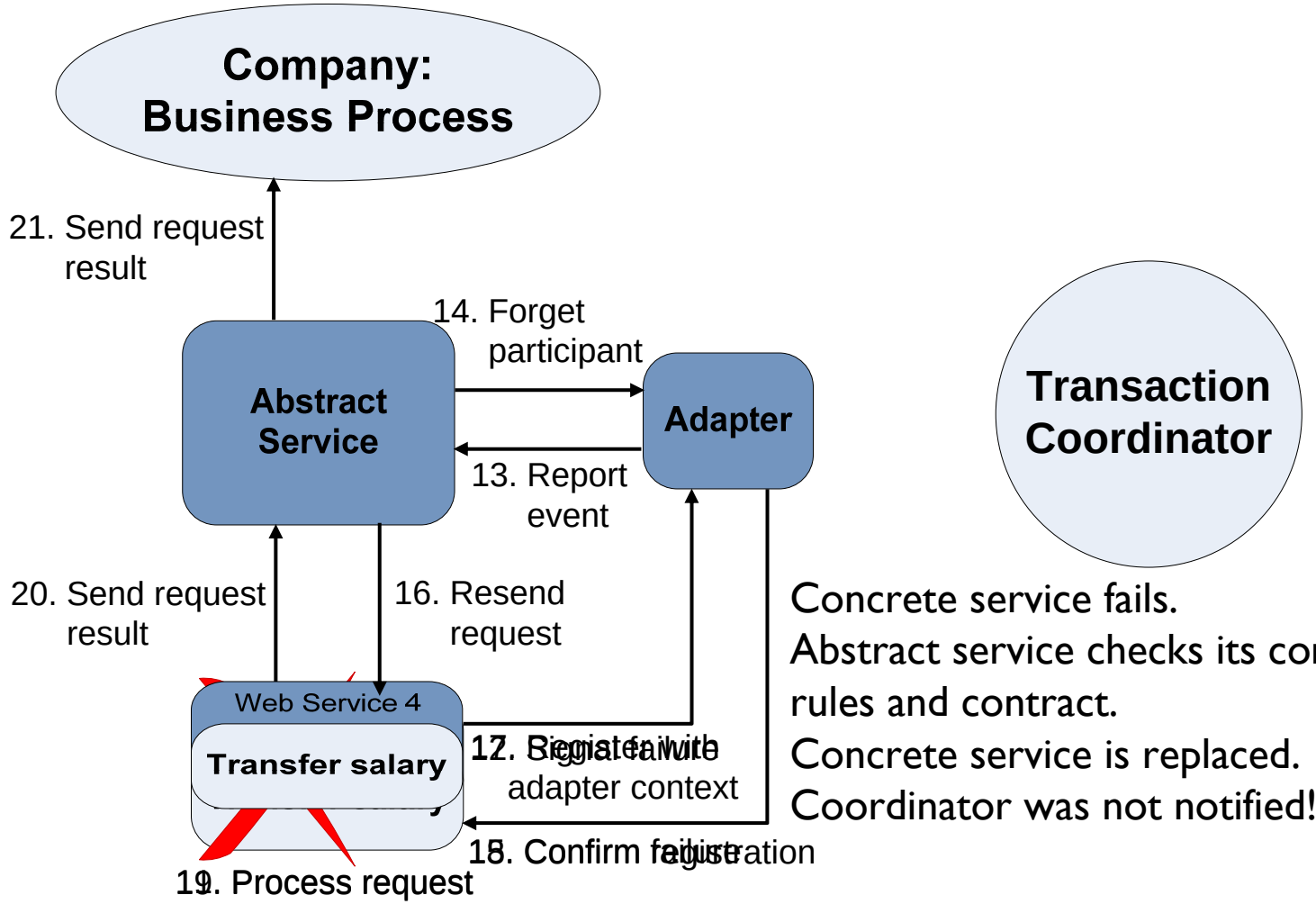


A service fails due to an internal error.
The error can only be compensated by aborting the complete transaction.
Why should the transaction be aborted, if a different service exists that can perform the same operations?

Extended Transaction Coordination Structure (ICWE2007/ACMTWEB 2008)

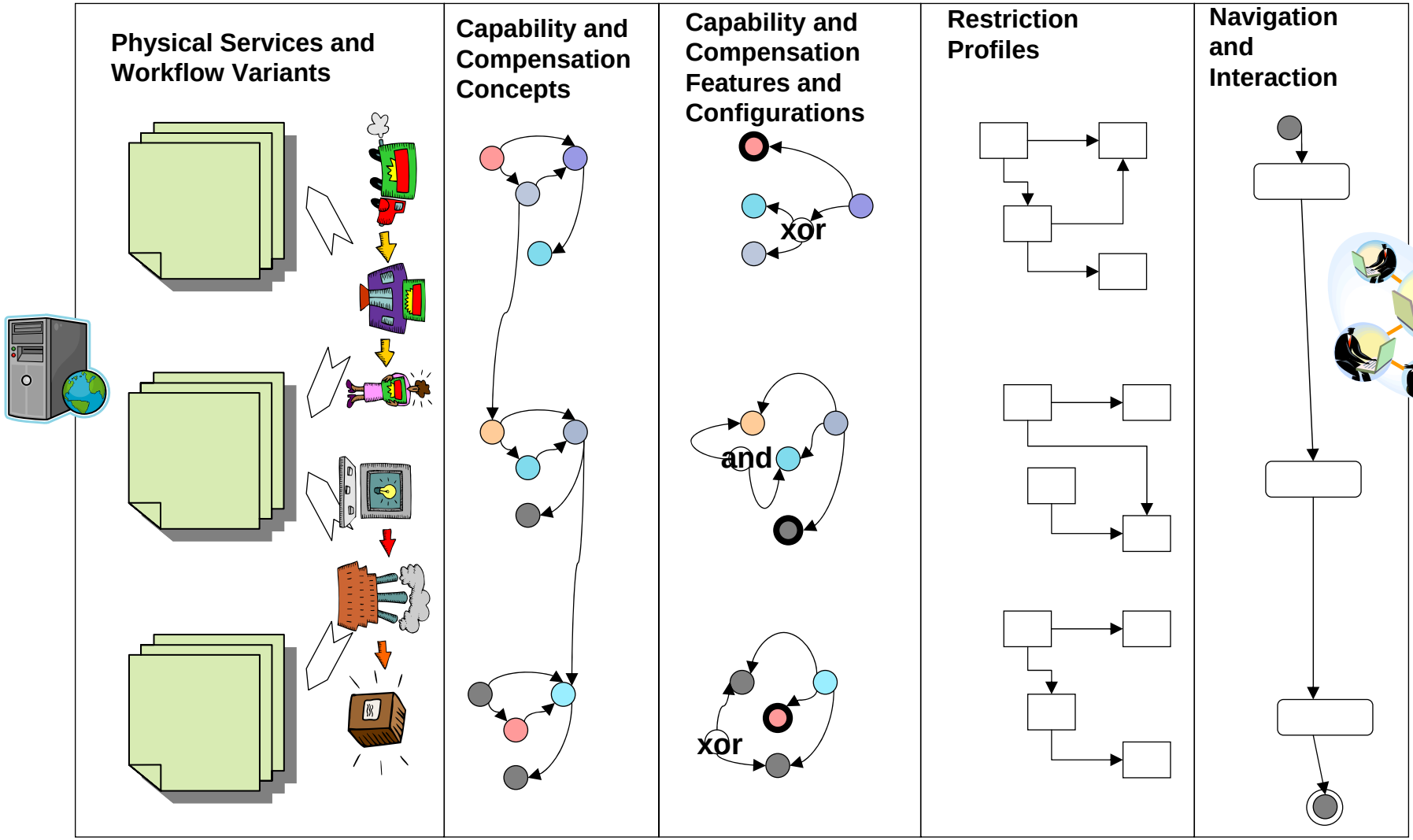


Internal Compensation Handling – Replacement

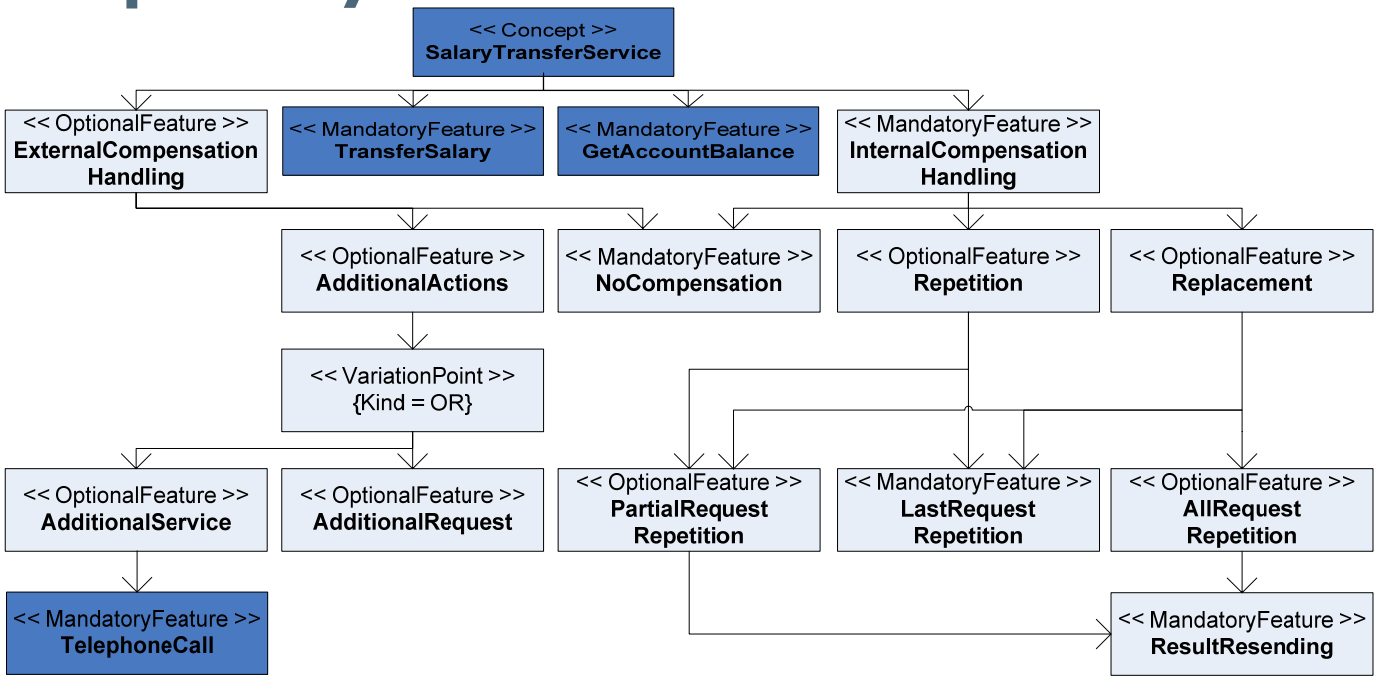


Concrete service fails.
Abstract service checks its compensation rules and contract.
Concrete service is replaced.
Coordinator was not notified!

Layers of Abstraction Revisited



Example: Capability Feature Model



Consists of:

- *functionality feature model*
- *compensation feature model*

The compensation feature model can contain custom features.

Requirements and Restrictions Feature Models

Similarly, client requirements for functionality and compansations can be stated in feature models

Matchmaking with capability profile creates restriction profile

Restriction profile specifies a compensation strategy for abstract service

Outline

Motivations and Applications

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Further Challenges

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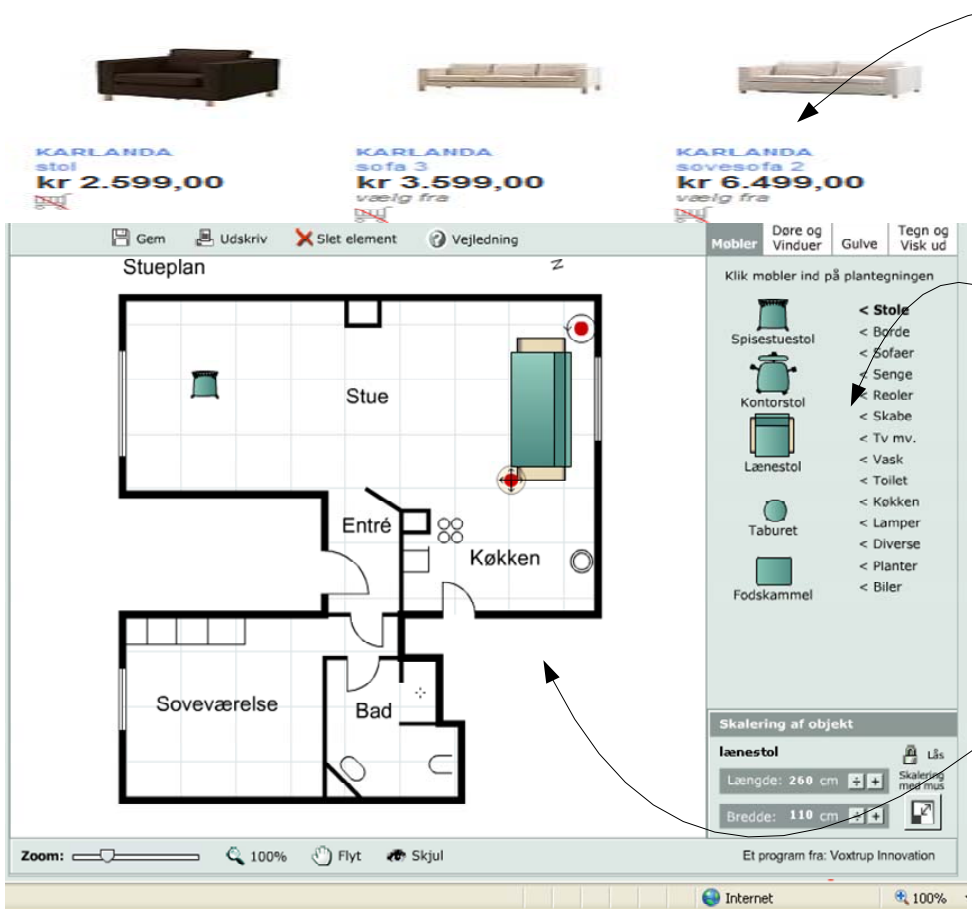
Rich Internet Applications

Appartment Room Arrangements



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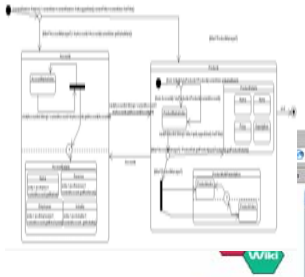
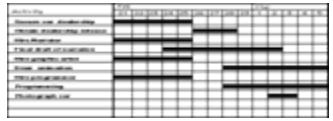
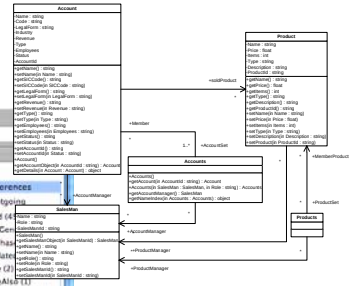
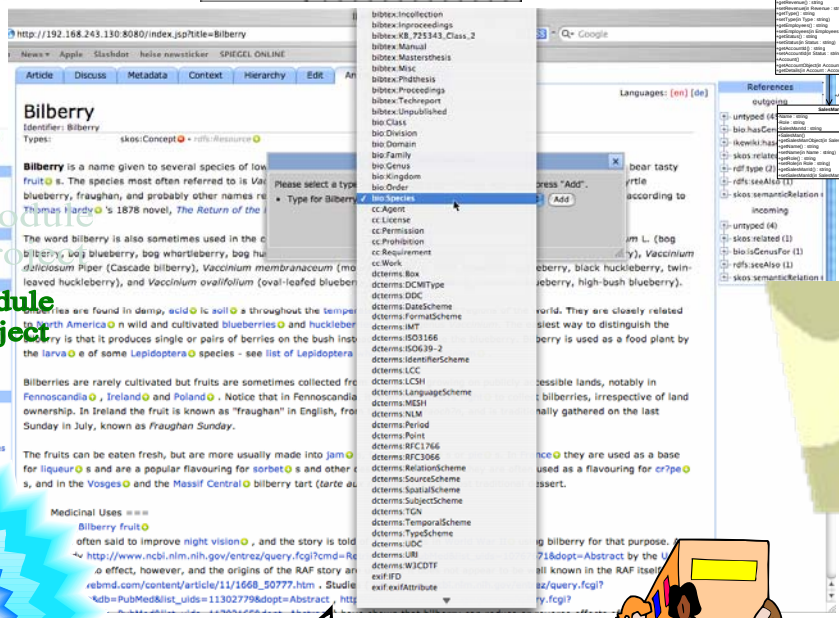
Social Web Applications

FP7/ICT STREP Kiwi Knowledge in a Wiki









Lines of Code
Number of Defects per Module
Number of Defects per Project
Unresolved Issues
Changes in Processes
...

AALBORG UNIVERSITY

Composition Models

Workflows vs. Middleware

Compensations and adaptations can be specified at the design level in workflows

Copensations and adaptations can be encoded in an intelligent middleware

How to combine them

How to compose them

How to ensure consistency

…

References

- P. Dolog, B. Simon, T. Klobucar, W. Nejdl: Personalizing Access to Learning Networks. ACM TOIT 8(2), January 2008
- S. Ceri, P. Dolog, M. Matera, W. Nejdl: Adding Client Side Adaptation to the Conceptual Design of eLearning Applications. JWE 4(1), 2005
- M. Schäfer, P. Dolog, W. Nejdl: An Environment for Flexible Advanced Compensations of Web Service Transactions. To appear in ACM TWEB, Special Issue on SOA.
- P. Dolog, W. Nejdl: Using UML and XMI for generating adaptive navigation sequences in web-based systems. UML 2003.
- P. Dolog, W. Nejdl: Using UML-based feature models and UML collaboration diagrams to information modelling for web-based applications. UML 2004.
- P. Dolog, J. Stage: Designing interaction spaces for rich internet applications with uml. ICWE 2007.
- P. Dolog, N. Henze, M. Sintek, W. Nejdl: Personalization in distributed e-learning environments. WWW2004
- P. Dolog, N. Henze, M. Sintek, W. Nejdl: The personal reader: Personalizing and enriching learning resource using semantic web technologies. AH2004.
- P. Dolog. Engineering Adaptive Web Applications. Doctoral Dissertation, Leibniz Universität Hannover. March 2006 (summa cum laude)

Thanks!!! Questions?

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