

Component-Based Software Engineering (CBSE) Announcements

Prof. Dr. Uwe Aßmann
Technische Universität Dresden
Institut für Software- und Multimediatechnik
<http://st.inf.tu-dresden.de>
12-0.1, 29.03.12



CBSE, © Prof. Uwe Aßmann

1

Elements of the Course

- ▶ Lecturing
 - Do not miss one, they should give you a short and concise overview of the material
- ▶ Reading
 - Slides on “Obligatory Literature” require you to read papers from the web
 - TU Dresden has subscription to ACM Digital Library and IEEE Explorer
 - Slides on “Secondary Literature” contain useful but optional literature
- ▶ Exercise with Florian Heidenreich and Sebastian Richly
 - Exercise sheets
 - Handed out every week, with some breaks
 - You have one week to solve them on your own
 - After that, solutions will be explained in the Exercise



Prof. U. Aßmann, CBSE

2

Reading Along the Lectures

- ▶ Unfortunately, the course is not covered by any book
 - About 60% is covered by the blue book “Invasive Software Composition”
 - Most of the rest on classical component systems by Szyperski in the book “Component Software. Beyond object-oriented computing. Addison-Wesley.”
- ▶ You have to read several research papers, available on the internet
 - Marked by “Obligatory Literature”
- ▶ Secondary Literature is non-mandatory, but interesting reading. Can be done during the course
- ▶ Other Literature is not to be read, but also interesting.

Obligatory Literature

- ▶ During the course, read the following papers, if possible, in sequential order.
- ▶ Every week, read about 1 paper (3-4h work)
- ▶ Course web site



Prof. U. Aßmann, CBSE

3



Prof. U. Aßmann, CBSE

4



Obligatory Literature

- ▶ [ISC] U. Aßmann. Invasive Software Composition. Springer, 2003.
- ▶ C. Szyperski. Component software. Beyond object-oriented computing. Addison-Wesley. Bestseller on classical component systems.

Papers

- ▶ [McIlroy68] D. McIlroy. Mass-produced Software Components. 1st NATO Conference on Software Engineering.
- ▶ [Dami95] Laurent Dami. [Functions, Records and Compatibility in the Lambda N Calculus](#) in Chapter 6 of "Object-oriented Software Composition". <http://scg.unibe.ch/archive/oosc/PDF/Dami95aLambdaN.pdf>
- ▶ CORBA. Communications of the ACM, Oct. 1998. All articles. Overview on CORBA 3.0.
- ▶ Others will be announced.



Recommended Literature

- ▶ [GOF, Gamma] E. Gamma, R. Helm, R. Johnson, J. Vlissides: Design Patterns. Addison-Wesley 1995. Standard book belonging to the shelf of every software engineer.
 - The book is called GOF (Gang of Four), due to the 4 authors
- ▶ Alternatively to GOF can be read: [Remark: If you have already studied GOF intensively, do not read these]
 - A. Tesanovic. What is a pattern? Paper in Design Pattern seminar, IDA, 2001. Available at home page.
 - On Composite, Visitor: T. Panas. Design Patterns, A Quick Introduction. Paper in Design Pattern seminar, IDA, 2001. Available at home page.
 - P. Pop. Creational Patterns. Paper in Design Pattern seminar, IDA, 2001. Available at home page.



Recommended Literature

- ▶ Oscar Nierstrasz, Dennis Tsichritzis. Object-oriented Software Composition. Web book. <http://scg.unibe.ch/archive/oosc/download.html>
- ▶ I. Forman, S. Danforth. Meta-objects in SOM-C++. Very good book on meta object protocols and meta object composition.
- ▶ Journal Software - Tools and Techniques. Special Edition on Componentware, 1998. Springer. Good overviews.
- ▶ R. Orfali, D. Harkey: Client/Server programming with Java and Corba. Wiley&Sons. Easy to read.
- ▶ CORBA. Communications of the ACM, Oct. 1998. All Articles.



Less Important

- ▶ K. Czarnecki, U. Eisenecker. Generative programming . Addison-Wesley 2000. Good overview on aspects, but not on components
- ▶ F. Griffel. Componentware. dpunkt-Verlag. In German. A lot of material.



Please, Please Be Aware – There Will Be Pain!

- ▶ This course is not like a standard course
- ▶ It treats rather advanced material, the concept of graybox engineering
- ▶ No single book exists on all of that at all
 - ISC covers about 60%
 - Please, collaborate!
 - Read the articles
 - Ask questions!
 - Do the exercise sheets
- ▶ The exam can only be done if you have visited all lectures and solved all exercise sheets
- ▶ Learn continuously! One week before the exam is too late!
- ▶ Be aware: you have not yet seen larger systems
 - Middle-size systems start over 100KLOC



Component-based Software Contents and Goals



The Positive Side

- ▶ If you follow carefully, you will discover an exciting world of graybox composition, a new way to *extend* software
- ▶ The gain is worthwhile the pain!



Course Contents

- ▶ **Part I: Basics**
 - History and overview: Criteria for composition
 - Basics: Reflection and metaprogramming, Meta-object protocols (MOP), Metadata,
 - Finding components with faceted metadata and protocol conformance
- ▶ **Part IIa: Classical component systems (Simple black-box composition systems)**
 - Business components
 - Classical component systems: Development Process, Problems
 - Enterprise Java Beans (EJB)
 - Quality-controlled composition systems (QCS)
- ▶ **Part IIb: Architecture systems and languages (Advanced black-box composition systems)**
 - Corba
 - Web services
 - Architecture Systems
- ▶ **Part III: Gray-box composition systems (Invasive composition)**
 - Calculi for component systems
 - Composition Filters
 - Generic Programming (BETA)
 - View-based programming: Hyperspace programming
 - Aspect-oriented software development: AOSD and AOP
 - Invasive software composition
- ▶ **Part IV: Applications of composition systems**
 - ▶ Universal Composition
 - ▶ Invasive Model Composition
 - ▶ Transconsistent document composition
 - ▶ Staged composition





Basics

- Introduction
- Metamodelling
- Component repositories

Black-box composition systems

- UML Business components
- Transparency problems and Connectors
- Corba
- EJB
- ArchJava
- Web services
- Contract checking in SPEEDS HRC

Grey-box composition systems

- Composition filters
- Generic programming
- View-based programming
- Aspect-oriented programming
- Invasive Software Composition

Applications of Composition Programs

- Transconsistent composition
- Staged composition
- Software Ecosystems



Component-Based Software Goals



Main Goals

- ▶ Understand the concept of a *component model*
 - ▶ Frameworks and product lines work with various different component models
 - Variability, extensibility, and glueing are three central goals
 - There are other central concepts for component models than classes and objects
- Understand *composition systems*
 - Understand grey-box, fragment-based composition
 - why it introduces new forms of static extensibility
 - why other static component models are special cases of it
- ▶ Understand different times of composition
 - ▶ dynamic composition
- ▶ Understand components as collections of standardized role types
- ▶ Understand connectors as role models plus protocol



The Hypothesis of Composition

- ▶ There are only two basic kinds of compositions
 - static composition (can be modeled as fragment-based invasive compositions)
 - dynamic composition (use assignment and extension of runtime values)
- ▶ There are only some basic operations, on code or on data
 - Variability with *bind* operator
 - Extensibility with *extend* operator
 - *Glue* with glue code operators
 - *Select* to select fragments from a fragment universe
- ▶ There are additional composition operations:
 - copy, rename, unbind
 - distribute (with crosscut graph)





The End

