



SS2019 – Component-based Software Engineering
Designing Component-Based Systems

Professor: Prof. Dr. Uwe Aßmann
Tutor: Dr.-Ing. Thomas Kühn

Task 1 Components

Components are the central elements of component-based systems. This task reiterates the terminology and the fundamental concept of components.

- a) Malcolm Douglas McIlroy was talking about *Components Off the Shelf* (COTS), already in 1969 [2]. What is the main idea of *COTS* and why would this be beneficial?
- b) What is a facet and what is a facet classification? Give an example.
- c) What is a component repository, a component market and a component trader?
- d) What are the key modeling elements of UML Components? What is the graphical notation? Provide an example.
- e) Why should big component-based systems be structured hierarchically?

Task 2 Cheesman/Daniels Process

The **Cheesman/Daniels process** [1] helps to identify UML-Components, by stepwise refinement, starting with a requirements specifications.

- a) What is a domain model and why is it necessary?
- b) What is a business component, according to Cheesman and Daniels?
- c) What should be visible from a component? How is that related to the *Information Hiding Principle* [3]?
- d) How is the *Cheesman/Daniels Process* related to technologies, such as CORBA, EJB, and Android?

Task 3 Factory Automation

This task will be used as a basis for the following exercises. You can either solve the task alone or form groups of up to five students.

Note: The solutions have to be presented in the next exercise.

You are supposed to develop a component-based management system for factory automation. The company you are developing the system for, provides customizable 3D-printing services. Customers must first have registered and must be approved. Afterwards, they can upload 3D-printing jobs. The company provides multiple different types of 3D printers and different types of finishing procedures. Depending on the concrete order of an individual customer, a process is generated (e.g., print, finish, paint). In such a process, multiple different machines (e.g., 3D printers, painting machines) are involved. The company also uses mobile robotic platforms to move parts between the individual machines. Furthermore, the machines are equipped with robot arms to move the parts between the machine and the mobile robot. The robots act autonomously, but receive their tasks from a central process management system. After the production process finished, the product is transported to a central store and shipped to the customer. The customer also receives an invoice. Invoices are managed by a central invoicing system.

- a) Design the application following the Cheesman/Daniels process. Create the required models, i.e., *Domain Model*, *Use-Case model*, *Business Type Model*, *Business Object Interface Model*, *Component Specification*, and *Component Architecture* (cf. lecture).
- b) Create **one** PDF Document containing your models in a readable format.

References

- [1] John Cheesman and John Daniels. *UML Components: a Simple Process for Specifying Component-Based Software*. Addison-Wesley, Longman, Amsterdam, 2001. ISBN 201-70851-5.
- [2] M Douglas McIlroy. Mass-produced software components. In J. M. Buxton, Peter Naur, and Brian Randell, editors, *Proceedings of the 1st International Conference on Software Engineering, Garmisch Pattenkirchen, Germany*, pages 88–98. NATO Science Committee, 1968.
- [3] David Lorge Parnas, Paul C Clements, and David M Weiss. The modular structure of complex systems. In *Proceedings of the 7th international conference on Software engineering*, pages 408–417. IEEE Press, 1984.