Praktikum — Software Engineering

Lecturer:	Prof. Oscar Nierstrasz Schützenmattstr. 14/103
Tel:	631.4618
Email:	Oscar.Nierstrasz@iam.unibe.ch
Assistants:	Nathanael Schaerli Roman Bertolami, Florian Brunner, Marc-Philippe Horvath, Michael Locher
WWW:	www.iam.unibe.ch/~scg/Teaching/PSE ☞ *Requirements* documents ☞ PSE *wiki* ☞ Entry point to *team pages* ☞ Pointers to *technical documentation*

Agenda

- Introduction to PSE (Prof. Nierstrasz)
- Client presentation (Fachschaft)
- Student presentations (max 20 seconds each!)
- Form teams (break)
- Schedule meetings

Overview

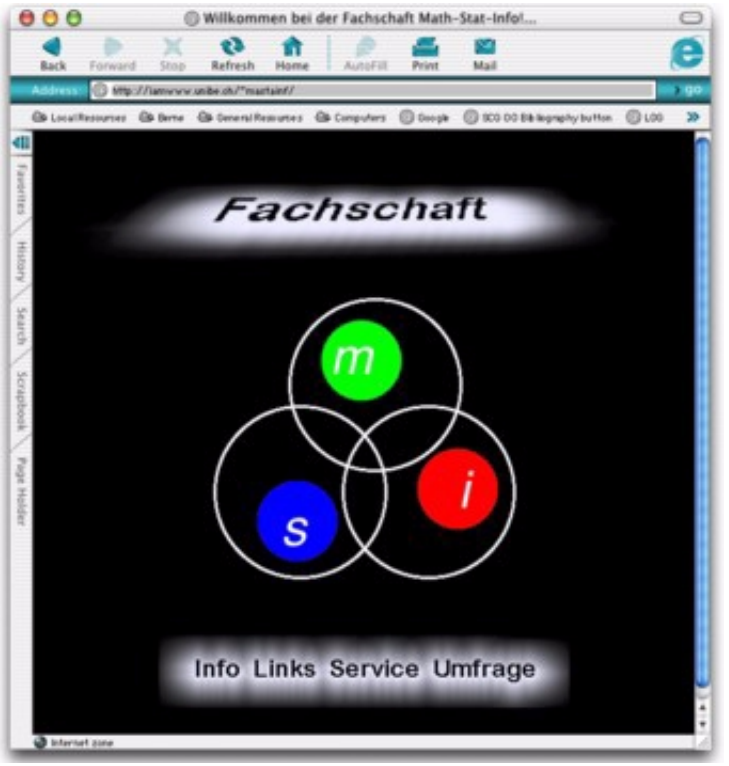
- Goals of this workshop
- Project overview
- Schedule — milestones, deliverables
- Analysis and Design documents: guidelines
- Prototyping — reducing risk
- Testing — coverage and regression tests
- Tools — UML, cvs, ANT, ...
- Teamwork — roles and responsibilities

Goals of this Workshop...

Methodological skills	*Practising* Responsibility-Driven Design
	Evaluating Implementation Strategies
	Planning and *Reporting*
	Prototyping
Practical skills	Working with *open* requirements (setting scope...)
	Developing a *complete product* (documentation, installation...)
	Teamwork (division of labour, planning, collaboration...)
Technical skills	JSP/TomCat, Zope ...
	UML
	Testing

The Customer

The Math-Stat-Info Fachschaft (www.iam.unibe.ch/~mastainf) provides various services to students of the Mathematics department of the University of Bern.



In an effort to modernize their services, they would like to offer the *Vorlesungsvorschau* on their web site, together with a set of operations that make the web version both attractive for students to use, and easy for the Fachschaft to maintain.

Project Characteristics

Several characteristics of "real" projects:

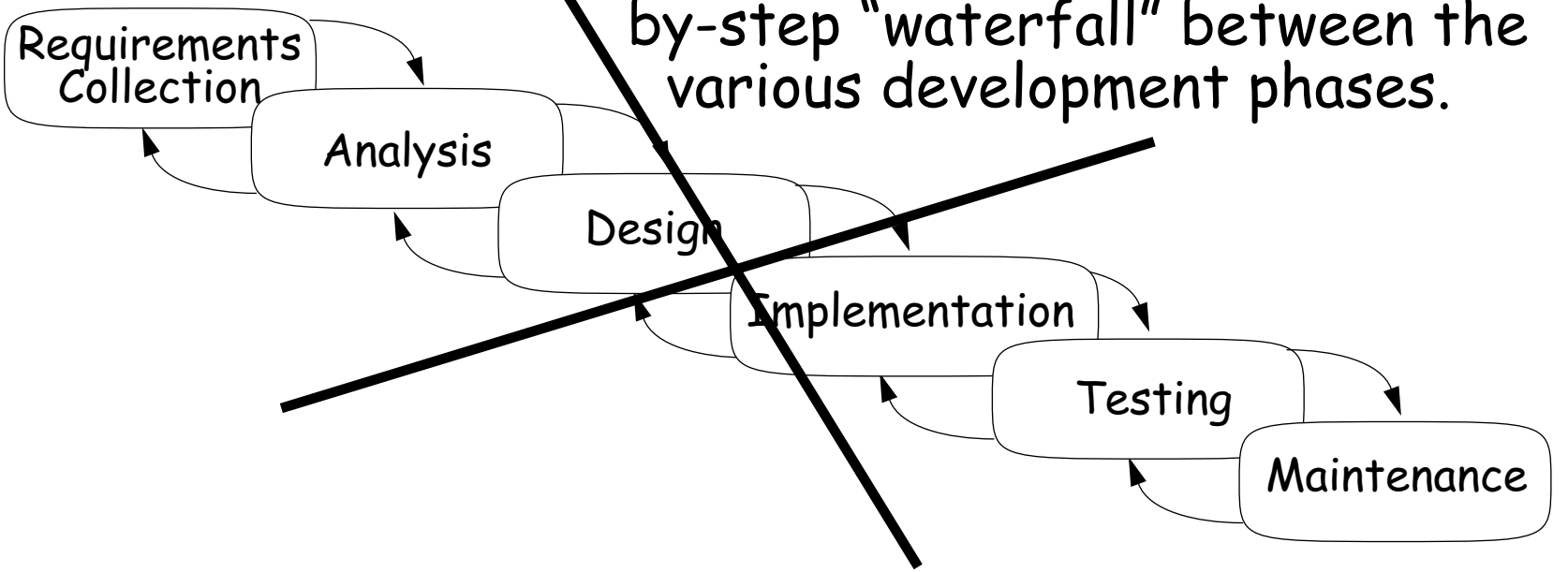
- *Open-ended* requirements
- Large *user base*
- Solution to be built using *standard* software packages
- Project *lifetime* extends beyond the end of the course!

Non-issues:

- Requirements collection, done by the client
- Communication: customer has IT expertise
- No integration with existing applications or legacy software

The Classical Software Lifecycle

The classical software lifecycle models the software development as a step-by-step "waterfall" between the various development phases.

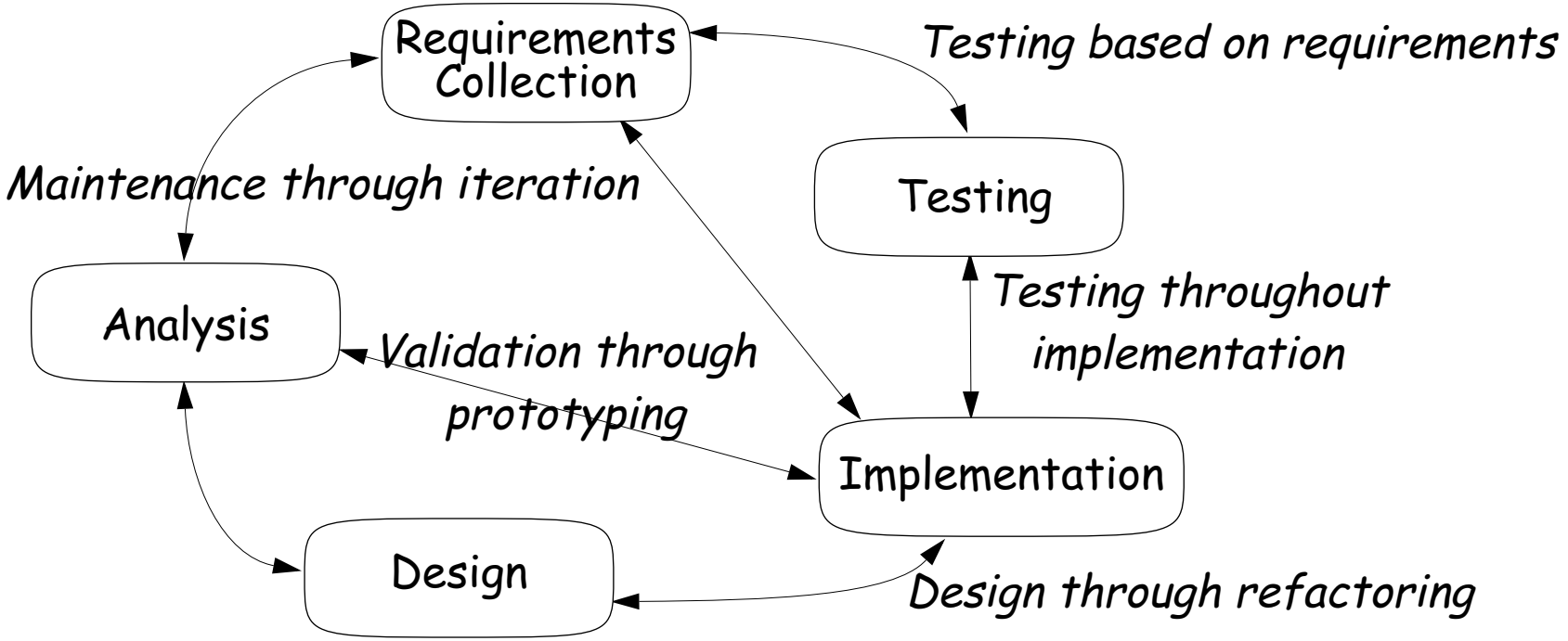


The waterfall model is unrealistic for many reasons, especially:

- requirements must be "frozen" too early in the life-cycle
- requirements are validated too late

Iterative Development

In practice, development is always iterative, and *all* software phases progress in parallel.



Preliminary Schedule

		Meeting / Deliverable	Homework/Consultation
1	2001 03-27	Introduction; Presentation of client and project; Team forming	Study project descriptions & software documentation; prepare risk analysis & workplan; prepare interview questions
2	04-03	Presentation of Risk Analysis Deliver workplan v1	Implementation and testing...
3	04-10	To be defined ...	
4	04-17	End of first iteration: DEMO	Revise workplan for second iteration ...
5	04-24	Planning Game for second iteration	
6	05-01	Deliver workplan v2	Implementation and testing ...
7	05-08	To be defined ...	
8	05-15	End of second iteration: DEMO	Revise workplan for third iteration

		Meeting / Deliverable	Homework/Consultation
9	05-22	Planning Game for third iteration	Product revision ...
10	05-29	To be defined ...	Review test cases (other team) (planned)
11	06-05	Present test case review (planned)	Product revision ...
12	06-12	End of third iteration: Final DEMO, at client site	Review final product (other team); finalize architecture documentation
13	06-19	Deliver full architecture documentation	Revise final product
14	06-26	Deliver revised final product; Feedback and Testat	

This schedule will be revised as the workshop progresses...

Evaluation

Every Team must:

- provide deliverables of *acceptable quality*
  - deliverables will be *reviewed* by the client or another team
  - unacceptable deliverables must be revised

Every Team Member must:

- *assume responsibility* for and present at least one deliverable
- *contribute "fairly"* to the team effort

Deliverables

Group web pages

- each group will have a *group account* for development
- all deliverables (documentation, demos and source code) must be accessible from the *group's web page*
- keep deliverables *up-to-date* as the project progresses
  - ☞ each version and revision of a deliverable must be accessible
- every deliverable will be *reviewed* by another team
  - ☞ write documentation and code to be read by others!

Log your activities

Keep *minutes* of all meetings

- Date & time; participants
- Decisions and actions *with deadlines*

***Estimate cost* of each task**

- Iteratively improve your estimates
  - —"We'll need about 8 CRC cards, so we'll probably need 80 minutes"

***Log* all effort**

- Use simple metrics
  - —"I spent 80 minutes debugging 15 short methods"
  - —"We spent 120 minutes filling out 12 CRC cards"

Weekly status reports must be logged on the web site!

Workplans

Planning and Cost Estimation

- use *conventional tools!* (e.g., Gantt charts)
- prepare a *workplan* with delivery times and costs for each deliverable
- break down each task into *subtasks* whose *cost* you can estimate
- detailed cost estimates must be made by the team member who accepts *responsibility* for it
- *revise* and *refine* your plan as the project progresses
- keep precise logs of how much time you *actually spend* on every subtask
  - ☞ gradually try to *improve* your estimates!

NB: goal is to improve your estimates, not to evaluate productivity!

Requirements Collection and Analysis

Requirements Specification

- Clients provides requirements specification in the form of *Use Cases*.
- Requirements will be examined and probably refined during the planning games.
- Clients keeps *up-to-date* use-cases

or

- Teams keep up-to-date uses cases

Risk Assessment

A *risk* is something may *delay* the project or *increase its cost*.

- Identify the *risks* and trade-offs
  - what *open* questions must be answered before you can start implementing a solution? (what *prototyping* is needed?)
- Identify *priorities*
  - what are the minimal requirements for a *first product?*

Prototyping

Prototyping is an essential activity carried out during all phases of the software process.

Requirements validation

- Prototype a user interface as *early* as possible to validate your requirements specification.

Evaluating design decisions

- Prototype parts of your design to evaluate *feasibility* and *usability* of technical alternatives.
  - ☞ prototype to reduce risks!

Iterative development

- Integrate parts as early as possible to *always have a running prototype* of the target application that can be tested and demoed.

Architecture

- Choose a *simple* architecture that can cope with all known requirements
  - ☞ what are the principal parts of the system and how do they communicate?
- Architecture will be heavily influenced by the *framework* that is used
- Develop *prototypes* to test the architecture

Design

- Iteratively apply *responsibility-driven design*
- *Evaluate* technical alternatives and *document* design decisions
  - *keep it simple*; add complexity only when necessary
  - prototype when trade-offs are unclear
- *Refactor* the design as the implementation evolves

Testing

Coverage

- Design tests that will exercise *all required/implemented functionality*
  - ☞ every time you add a feature, write a test for that feature!

- Check that *all possible execution paths* are tested
  - ☞ Apply both black-box and white-box testing

Testing

Regression

- *Automate* testing so that all tests can be carried out after any system change

- Set up tests so they can run in either
  - "*verbose*" mode (i.e., logging every interesting event), or in
  - "*silent*" mode (i.e., only reporting when and where tests have failed)

Tools

Use (at least) the following tools (or equivalent ones)!

UML	Use UML to *document* all your models (esp. requirements specification and design).
cvs	Use *version control* for all text documents (i.e., both source code and documentation).
ANT	Use ANT to *automate compilation*, installation, testing and cleanup.
javadoc	Automate *generation of HTML documentation* from source code.

Many other tools are available — use them!

Teamwork

Break down and distribute work incrementally

- always *estimate cost* when you accept a task
- check and *revise workplans* and estimates as work progresses

Use the team to your advantage

- use *role-playing* with CRC cards to elaborate the design
- *distribute responsibilities* according to *skills*
- someone else should *test* your code
- all code and documentation should be *reviewed* by someone else

Program in pairs

- *code review* as you program to increase quality

Roles and Responsibilities

Roles may be *fixed* or *floating*, but must always be assigned to some team member.

Sample roles and responsibilities

- Project Administrator
- Chief programmer/architect
- Backup programmer
- Tester/test case developer
- Toolsmith
- Component librarian
- Documentation editor

The *team* is responsible for all the deliverables.
Individuals assume responsibilities for specific subtasks.

Supporting roles

Customer

- answer questions about requirements ☞ *use the wiki!*
- accept/reject requirements specs
- evaluate prototypes, final system

System support

- system administration
- maintain installation of required software
- (limited) help for technical problems ☞ *use the wiki!*

Consultants

- meet regularly (at least twice weekly) with their teams
- oversee quality of work; give advice
- tool support; crisis detection; trouble-shooting

Forming Teams

1. Identify your skills: *strong and weak points*
   - ☞ What skills would complement your own?

2. Round table: *20 seconds to present yourself*
   - ☞ What do you have to offer; who are you looking for?

3. Form teams of five: *look for suitable partners*
   - ☞ Seek complementary skills that cover responsibilities

4. Prepare your strategy and tactics:
   - ☞ What questions do you need to ask of the client?
   - ☞ What interactions do you anticipate with other teams?