Software Development: Theory and Exercises

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Outline

Part I

Theory
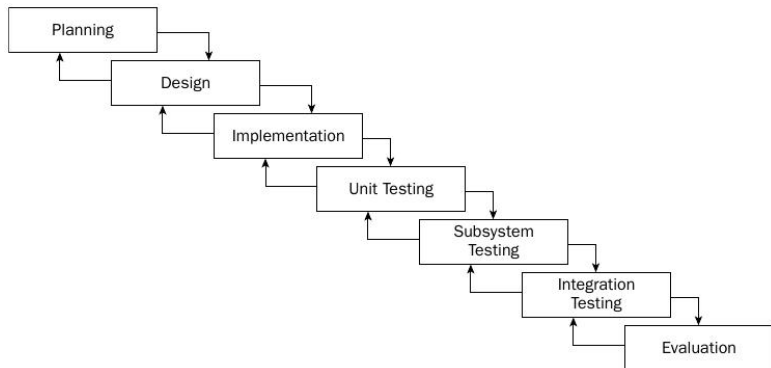
If you sit down and ...

... start a project, what do you do?

- ▶ what is the purpose of my software?
- ▶ what should it do?
- ▶ who is to use it?
- ▶ how long will it live?
- ▶ what should I do first?

In nuce ...

... you enter the **software development process**!
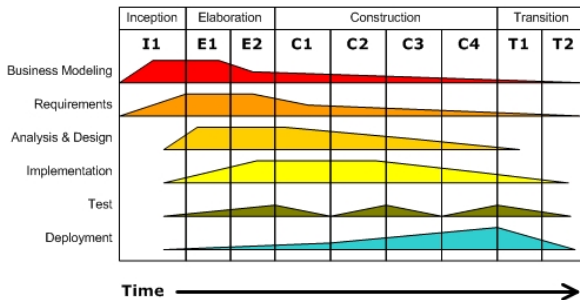
Waterfall Model, [3]

The Waterfall Model

- ▶ each step requires documentation
- ▶ one may reverse or forward only one interval
- ▶ very rigid process model

Rational Unified Process by IBM, [2]

Iterative Development
Business value is delivered incrementally in
time-boxed cross-discipline iterations.

The Rational Unified Process by IBM (RUP)

- developed at Rational (later bought by IBM)
- IBM sells adequate software to follow RUP
- first interative approach to software development

The Agile Manifesto, [1]

In 2001 ...

- ▶ 20 renowned computer scientists come together in Utah, USA
- ▶ goal: create lightweight and flexible software development process
- ▶ the agile movement was born

"We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

Individuals and interactions *over processes and tools*
Working software *over comprehensive documentation*
Customer collaboration *over contract negotiation*
Responding to change *over following a plan*

That is, while there is value in the items on the right, **we value the items on the left more**."

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- Continuous attention to technical excellence and **good design enhances agility**.
- **Simplicity**–the art of maximizing the amount of work not done–is essential.
- **The best architectures, requirements, and designs emerge from self-organizing teams**.
- **At regular intervals, the team reflects on how to become more effective**, then tunes and adjusts its behavior accordingly.

Summary

- software development techniques apply to teams working on projects
- some models are for fixed requirements
- some for ever changing requirements
- agile development has forged many techniques that are worthwhile to study for HEP

    - Pair Programming
    - Unit Testing (Test Driven Design)
    - Refactoring
    - Continuous Integration
    - ...

Part II

Exercises

Putting it all together

- ▶ The goal of this exercise is to obtain an almost complete UML description of the project.
- ▶ You are free to add features to or to choose your own project, if none on the list interests you.
- ▶ Please work in groups of $3 - 6$ people.
- ▶ Try to collect your thoughts in the end, so that your design can be presented to the group.

time

Let's reconvene here at 11.30 am to compare results!

Topics: Combination of Errors

Goal

Write a HistoHandler that extracts and displays systematic errors for a given histogram.

Input

- ▶ histos with central value
- ▶ histos with uncertainties
- ▶ recipe how to combine uncertainties

Output

- ▶ The result plot in which the statistical AND the total systematic error are displayed as error bars

Aside

- ▶ extraction of histo objects is done automatically for you!
- ▶ how to pass recipe to handler?
- ▶ maybe extend this design to have multiple outputs?

Topics: Calibration Data Interface

Goal

Write a CalibrationInterface that extracts and stores calibration constants for a given physical quantity in a file.

Input

- ▶ file with TH1/TF1/XML style data
- ▶ recipe what to retrieve from the file
- ▶ recipe what/how to calculate values from what was stored in file
- ▶ recipe how to invert retrieval

Output

- ▶ a calculated calibration constant
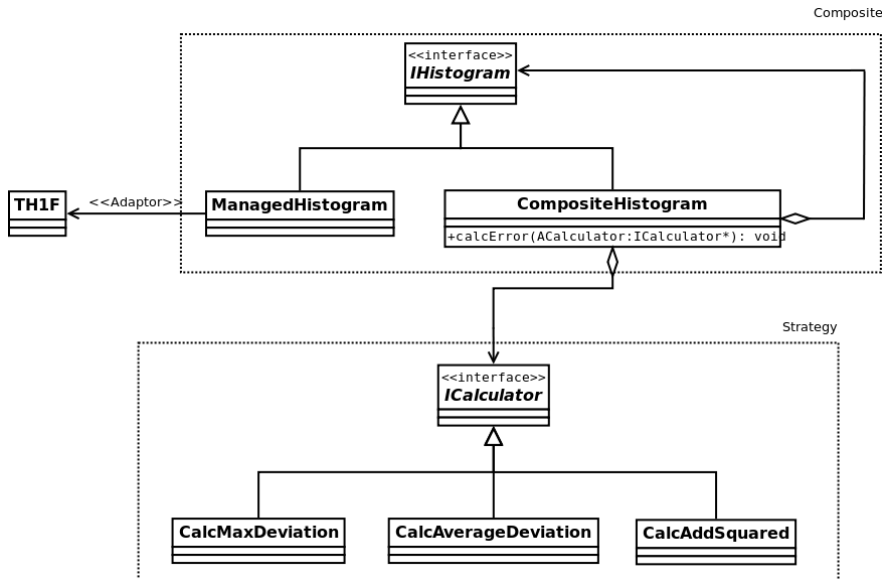- ▶ a file containing calibration constants

Aside

- ▶ try to imagine the difficult read/write calls to be handled by a service!
- ▶ don't invest time contemplating performance
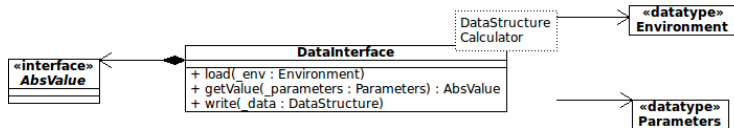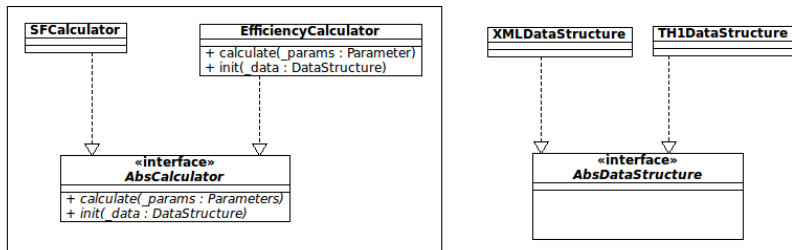- ▶ concentrate on how to represent the data and how to formulate recipes!

Part III

Possible Solutions

A Solution to "Calibration Data Interface"

A Solution to "Calibration Data Interface"

References

[1] Kent Beck et al.
Agile manifesto.
agilemanifesto.org.

[2] Ivar Jacobson, Grady Booch, and James Rumbaugh.
The Unified Software Development Process.
Addison-Wesley Professional, 1999.

[3] Nicholas Solter and Scott Kleper.
Professional C++ (Programmer to Programmer).
Wrox, 2005.