How Program Size Affects Construction

Stefan Ast
Motivation

• The bigger a software development project is the more planning and organization work is needed
  • 10x larger project usually needs 30x the effort
  • Only 25% of this increase is construction work
  • Rest is planning, architecture and testing work
  • 10x larger project usually has 15x more errors

• To handle this extra effort formal methods are used
Content

• Project Size
  • Communication
  • Errors
  • Productivity
  • Coding vs. other Activities

• Formal Methods
• Agile Methods
• Key Points
Project Size

- Small projects usually use casual and instinctive methods
- Large projects usually use formal and carefully planned methods
- It is important to find the right balance of casual and formal methods that fits the project size
Project Size

• Project size can be determined by
  • Team size
  • Lines of code
  • Quality/Complexity

• Simple program is a smaller project than a well documented and tested software system.
Project Size

• Kinds of software
  • Simple program
  • Software product
  • Software system
  • System product
Communication

- As project size increases, communication becomes more difficult

Errors

- As project size increases there is a
  - smaller amount of construction errors
  - greater amount of design and requirement errors

Productivity

• On big projects productivity is lower than on small projects.

Productivity

• But all other things being equal productivity can also be influenced by
  • the kind of software
  • personnel quality
  • programming language
  • product complexity,
  • ...
Coding vs. other Activities

• Larger projects need more architecture, integration and system testing work

Coding vs. other Activities

• Construction work scales up proportionately
  • Detailed design
  • Coding
  • Debugging
  • Unit testing

• Other activities scale up faster
  • Communication
  • Documentation
  • Management
  • Interface design
  • System testing
  • …

Formal Methods

• Large projects need formal methods
  • Very complex systems
  • Safety-critical systems
  • Systems which have to be highly reliable

• They focus on
  • defined requirements
  • standardized process management
  • thorough documentation (detailed plans, activities, workflow, roles and responsibilities)
Formal Methods

• Preconditions of formal methods
  • Requirements have to be stable
  • Environment has to be predictable

• Example
  • Waterfall model (sequential design process)
    • Progress flows steadily downwards through different phases

• Advantages
  • personnel can be moved quickly
  • loss of key personnel can be absorbed
Formal Methods

• Disadvantages
  • Innovation might be blocked
  • Additional effort is needed for managing and controlling
  • the focus can shift from the product to the process

• This can lead to spending more time writing documents than producing software.
Agile Methods

• Therefore agile methods have been developed
  • Fulfilling user expectations is more important than well-written code and documentation.
• They focus on
  • flexibility and speed
  • self-organizing teams
  • Close relationship with users/customers
  • programming as a craft and not as an industrial process.
• no delivery of the entire product at once (several iteration cycles)
Agile Methods

• Agile methods are used when there are
  • smaller teams
  • more volatile requirements and environments
  • close relationship with customers and users

• Requirements
  • Highly motivated team members who have to be willing
to work closely with other programmers

• Example
  • Scrum
    • Agile method framework with 30 day work intervals and daily
15 min Scrum meetings
Key Points

• As project size increase communication gets more difficult and has to be formalized in documents
• All other things equal a large project will have
  • more errors
  • lower productivity
• As project size increases construction activities become less predominant
• Scaling up agile methods works better than scaling down formal methods.
• Most effective to find the right balance of methods
Thanks!