Lecture 03:
Software Lifecycle Models

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Resources
- "Rapid Development", Steve McConnell
  - Core reading: Ch. 7, 25
  - Be sure to examine the table on pages 156-157
  - Further reading: Ch. 21, 35, 36, 20

Outline
- Lifecycle – definition and stages
- Lifecycle models and their tradeoffs
  - "Code-and-fix"
  - Waterfall
  - Spiral
  - Evolutionary prototyping
  - Staged delivery
  - "Design-to-schedule"
- Main recurring themes

Software Lifecycle
- The stages that a product goes through in “life”
  - “from womb to tomb”
  - from the time it was first conceived as an idea to the time when it’s no longer used by any customer

Typical stages in software are:
- Requirements analysis/specification
- (High-level) architectural design
- Detailed design
- Coding & debugging
- Testing
- Maintenance

Software Lifecycle Models
- Different lifecycle models can be created by varying the order and frequency in which these stages occur.
  - "Code-and-fix"
  - Waterfall
  - Spiral
  - Evolutionary prototyping
  - Staged delivery
  - "Design-to-schedule"
  - etc.

Q: Which model is the right one to use?
A: It depends on the project circumstances and requirements.

What is the Value of a Model?
- Decomposing workflow
- Understanding and managing the process
- A management tool
Limitation of Models

- A model is just a model
  - It abstracts away some aspects and highlights others
- Artificial constraints
- Compromises with model are often necessary
  - (as with almost everything in SE)
- Risk of overemphasizing the process
  - The process is not the end in itself
  - Product delivery is

Dimensions for Evaluating Different Lifecycle Models

- Quality control
- Predictability
- Cost control
- Risk management
  - Including managing changes

Theme: Overall aim for good, fast, and cheap. But you can’t have all three at the same time.

How Do We Evaluate / Compare Different Lifecycle Models?

- What aspects might make sense to compare?

“Code-and-fix” Model

- No planning whatsoever
  - So there’s little or no management “overhead”
- Applicable for very small projects and short-lived prototypes
- Dangerous for long-term or high-risk projects
  - Unlikely to accommodate changes to specification without a major design overhaul

Q: Would you pick this model for your projects? Why?

“Code-and-fix” Model

- System Specification (maybe)
- Release (maybe)

Classic Waterfall Model

- Software Concept
- Requirements Analysis
- Architectural Design
- Detailed Design
- Coding and Debugging
- System Testing
Classic Waterfall Model

- Applicable to complex but well-explored tasks
  - ... where surprises are very few
  - Every detail must be known upfront, at the specification stage
  - Can’t move to the next stage until the current one is finished and verified
  - Swimming upstream is possible but costs dearly
  - No sense of progress until the very end
    - “so far so good”
    - Nothing to show to anxious customers (“we’re 90% done”)
    - Project burns cash, not knowing what comes back in return
  - Limited overhead from planning and management
  - May end up very far from the original goal

Q: Would you pick this model for your projects? Why?

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Spiral Model

- Breaks up the project into mini-projects based on risk levels
- Purpose: risk reduction
  - Great when charting new territories (with high risks)
  - Cost: more planning involved, more management involvement / oversight
  - Benefit: provides early indication of unforeseen problems
  - As costs increase, risks decrease!
    - Always addresses the biggest risk first

Q: Would you pick this model for your projects? Why?

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Staged Delivery Model

- Waterfall-like beginnings, then develop in short stages
  - Requires tight coordination with documentation, management, and marketing
  - Can ship at any time during implementation
  - From the outside (to customers) it looks like a successful delivery even if it is not the final goal the development team may have aimed for

Q: Would you pick this model for your projects? Why?

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Evolutionary Prototyping Model
Evolutionary Prototyping Model
- Produces steady signs of progress
- Useful when requirements are changing rapidly or customer is non-committing
- Requires close customer involvement
  - Not applicable if customers aren’t available on a short notice to give feedback
- May spell trouble if the developers are inexperienced
  - Feature creep, major design decisions, use of prototyping time, etc.
- **Q:** Would you pick this model for your projects? Why?

“Design-to-schedule” Model
- Useless when you absolutely need to ship by a certain (immovable) date
- Similar to the Staged Delivery model
  - But less flexible because of the fixed shipping date
- Requires careful prioritization of features and risks to address
- **Q:** Would you pick this model for your projects? Why?

Which Model to Use?
- The choice of a model depends on the project circumstances and requirements.
- A good choice of a model can result in a vastly more productive environment than a bad choice.
- A cocktail of models is frequently used in practice to get the best of all worlds.
  - But care must be applied – some models can’t intermix easily or at all.

Main Recurring Themes / Concerns
- Risk management / reduction
- Prioritization
  - Based on risks, schedule, etc.
- Customer involvement and feedback
- Visibility of progress