The Spiral Model and Risks

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Basic Seminar on Software Engineering
Hebrew University
2009
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- Director of DARPA Information Science and Technology Office 1989-1992
- Fellow of ACM, IEEE
- COCOMO cost model, Spiral model, ...
The Basic Force

- Code-driven development
  - “Code-and-fix” approach
  - No design leads to poor code and frustrated clients
- Document-driven development
  - Waterfall model
  - Requirement for fully developed documents unrealistic
- Risk-driven development
  - Support iterative development
  - Decide how to proceed by reducing risk of failure
The Spiral Model

- Several rounds development: System concept, Requirements, design

- In each round, mitigate risks
  - Define objectives of part you are doing
  - Map alternatives for implementation
  - Recognize constraints on these alternatives
  - Use prototyping, analysis, etc. to gain necessary knowledge and reduce risk
  - Plan the next step

- At the end, perform sequence of coding, testing, and integration
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What you actually do depends on the biggest remaining risk
Using the Spiral

- Start with hypothesis that something can be done
- Round 1: concept and lifecycle plan
- Round 2: top level requirements
- Additional rounds: preliminary design, detailed design
- May go back and redo previous round if needed
- If the evaluation at some stage shows that it won't work then stop
Risks

- Developing software is fraught with uncertainty
- Uncertainty implies risk
- This needs to be quantified: 
  \[ \text{RiskExposure} = \text{Probability} \times \text{Loss} \]
- Can be used to chose between alternatives: select the one where the expected loss is smaller
Risk Management

Risk management
  ├ assessment
  │   └ identification
  │       └ analysis
  │           └ prioritization
  └ control
      └ planning
          └ resolution
              └ monitoring
Milestones

- In waterfall model there are many milestones
  - This is too rigid and sequential
- But there are three really important ones:
  - Life-cycle objectives
  - Life-cycle architecture
  - Initial operational capability

(these foreshadow the unified process)
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Make sure we know what we want to do, and that it can be done
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Make sure we know what we want, and that it can be done
Elaborate on how things will be built
Prepare for the transition to the client in terms of site and training
Milestones

- Milestones are not (necessarily) documents!
  - Not a fully specified spec or architecture, but a framework that will evolve
  - For example, important interfaces must be specified precisely, but user interfaces can be a prototype
  - Articulation of feasibility and rationale are important
  - Agreement of stakeholders is crucial
Conceptual Development with Time

- Spiral model (1988): in an example round 0 is about deciding that the project is worth doing
- Risk management (1991): one of the risks is that the project is plain wrong
- Anchoring (1996): the first anchor point is agreement among stakeholders that the project can and should be done