

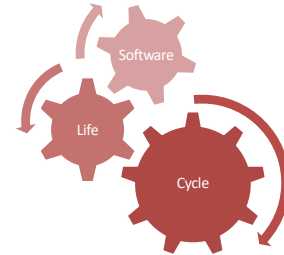
last time: Product idea proposal

- First assignment: **Due on Monday, Sep 19, 9PM**
<http://www.cs.umass.edu/~brun/class/2022Fall/CS320/productidea.pdf>
- Groups of 1 or 2
 - get into groups after class or use the Moodle class discussion forum
- Submit 4 slides:
- 3-minute presentations in class next week

Does everyone have a 1–2 person group?

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Software Development Lifecycle



thinking about the process

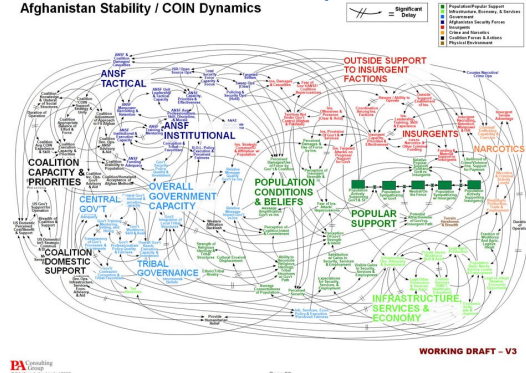
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How complex is software?

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What is complex?

Afghanistan Stability / COIN Dynamics



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How complex is software?

- Measures of complexity:
 - lines of code
 - number of classes
 - number of modules
 - module interconnections and dependencies
 - time to understand
 - # of authors
 - ... many more

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How complex is software?

- Measures of complexity:
 - **lines of code** Windows Server 2003: 50 MSLoC
 - **number of classes** Debian 5.0: 324 MSLoC
 - number of modules
 - module interconnections and dependencies
 - time to understand
 - # of authors
 - ... many more

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How big is 324 MSLoC?

- 50 lines/page \Rightarrow 6.5M pages
- 1K pages/ream \Rightarrow 6.5K reams
- 2 inches/ream \Rightarrow 13K inches
- 13K inches \approx taller than the Prudential
- 5 words/LoC @ 50 wpm \Rightarrow 32M min \approx 61 years

And we don't just want random words,
we want compiling code!

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Managing software development

- Requirements
- Design
- Implementation
- Testing
- Maintenance

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Outline

- Why do we need a lifecycle process?
- Lifecycle models and their tradeoffs
 - code-and-fix
 - waterfall
 - spiral
 - staged delivery
 - agile (scrum)
 - ... there are many others

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Ad-hoc development

- Creating software without any formal guidelines or process
- Advantage: easy to learn and use!
- Disadvantages?

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Ad-hoc development disadvantages

- Some important actions (testing, design) may go ignored
- Unclear when to start or stop each task
- Scales poorly to multiple people
- Hard to review or evaluate one's work

The later a problem is found in software,
the more costly it is to fix.

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What makes a lifecycle?

- Requirements
- Design
- Implementation
- Testing
- Maintenance

How do we combine them?

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Benefits of using a lifecycle

- provides a work structure
- forces thinking about the “big picture”
- helps prevent decisions that are individually on target but collectively misdirected
- assists management and progress control

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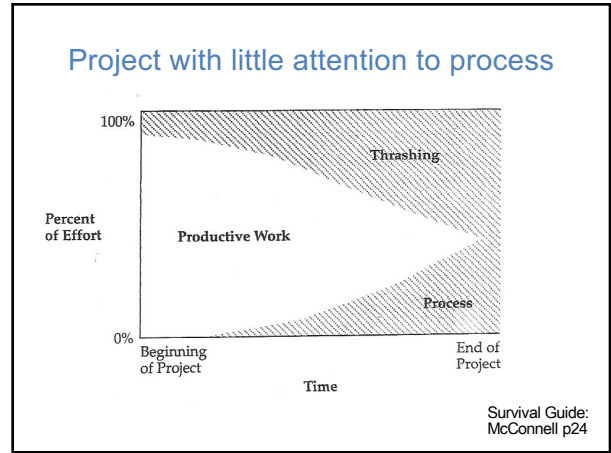
What are some drawbacks?

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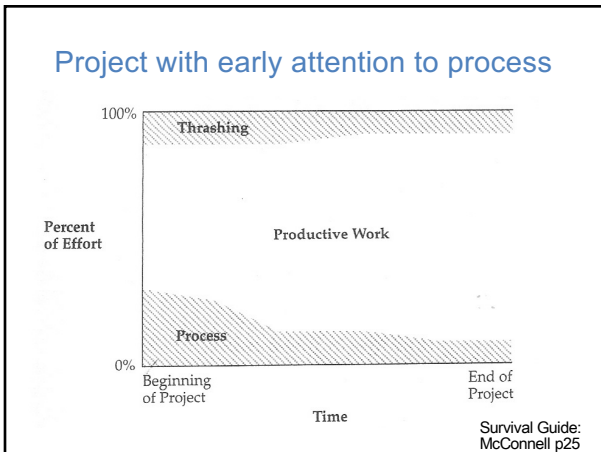
Are there analogies outside of SE?

Consider the process of building the Prudential

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Let's talk about some lifecycle models

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Code-and-fix model



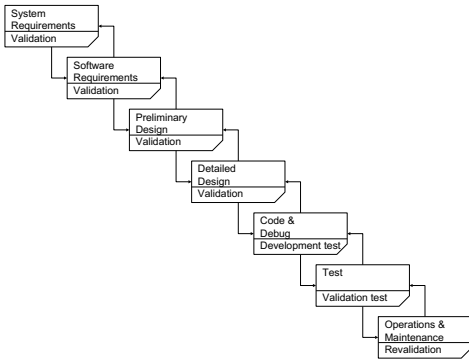
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Code-and-fix model

- Advantages
 - Low overhead
 - Applicable to small, short-lived projects
- Dangers
 - No way to assess progress and manage risks
 - Hard to accommodate changes
 - Unclear what and when will be delivered
 - Hard to assess quality

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Waterfall model



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Waterfall model advantages

- Works well for well-understood projects
 - tackles all planning upfront
 - no midstream changes leads to efficient software development process
- Supports experienced teams
 - Orderly, easy-to-follow sequential model
 - Reviews help determine readiness to advance

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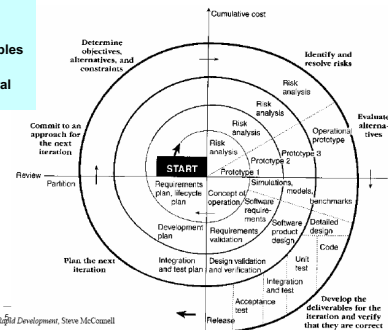
Waterfall model limitations

- Difficult to do all planning upfront
- No sense of progress until the end
- Integration occurs at the very end
 - Defies the “integrate early and often” rule
 - Without feedback, solutions are inflexible
 - Final product may not match customer’s needs
- Phase reviews are massive affairs
 - It takes a lot of inertia and \$ to make changes

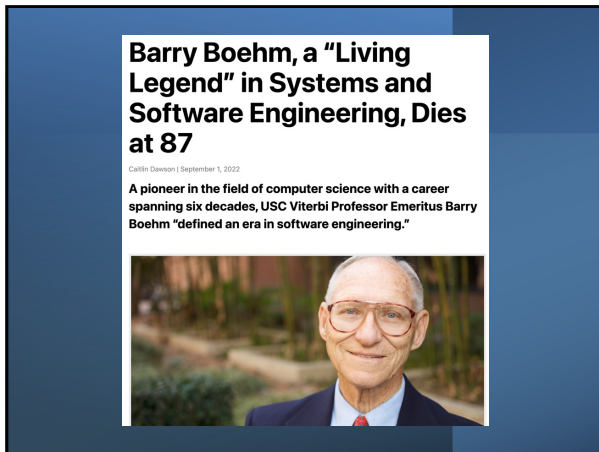
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Spiral model

Determine objectives
Identify and resolve risks
Evaluate alternatives
Develop and verify deliverables
Plan next spiral
Commit (or not) to next spiral



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Spiral model

- Oriented towards phased reduction of risk
- Take on the big risks early
 - are we building the right product?
 - do we have customers for this product?
 - is it possible to use existing technology?
 - tomorrow's technology?
- Progresses carefully toward a result

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Spiral model advantages

- Especially appropriate at the beginning of the project, allowing requirement fluidity
- Provides early indication of unforeseen problems
- Allows for change
- As costs increase, risks decrease!

Addresses the biggest risk first

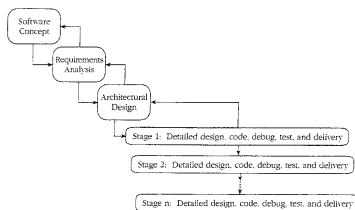
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Spiral model disadvantages

- A lot of planning and management
- Requires customer and contract flexibility
- Developers must be able to assess risk

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Staged delivery model



first, waterfall-like
then, short release cycles: plan, design, execute, test, release
with delivery possible at the end of any cycle

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Staged delivery model advantages

- Can ship at the end of any release cycle
- Intermediate deliveries show progress, satisfy customers, and lead to feedback
- Problems are visible early (e.g., integration)
- Facilitates shorter, more predictable release cycles

Very practical, widely used and successful

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Staged delivery model disadvantages

- Requires tight coordination with documentation, management, marketing
- Product must be decomposable
- Extra releases cause overhead

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What's the best model?

Consider

- The task at hand
- Risk management
- Quality / cost control
- Predictability
- Visibility of progress
- Customer involvement and feedback

Aim for good, fast, and cheap.
But you can't have all three at the same time.

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