Software Development Lifecycles

CSE 403 Software Engineering

Autumn 2023

Today's Outline

- Quick recap
  - Software Engineering
  - Project Proposals

- Software development lifecycles (SDLC)
  - What and why are they needed
  - Recurring themes
  - Popular models and their tradeoffs

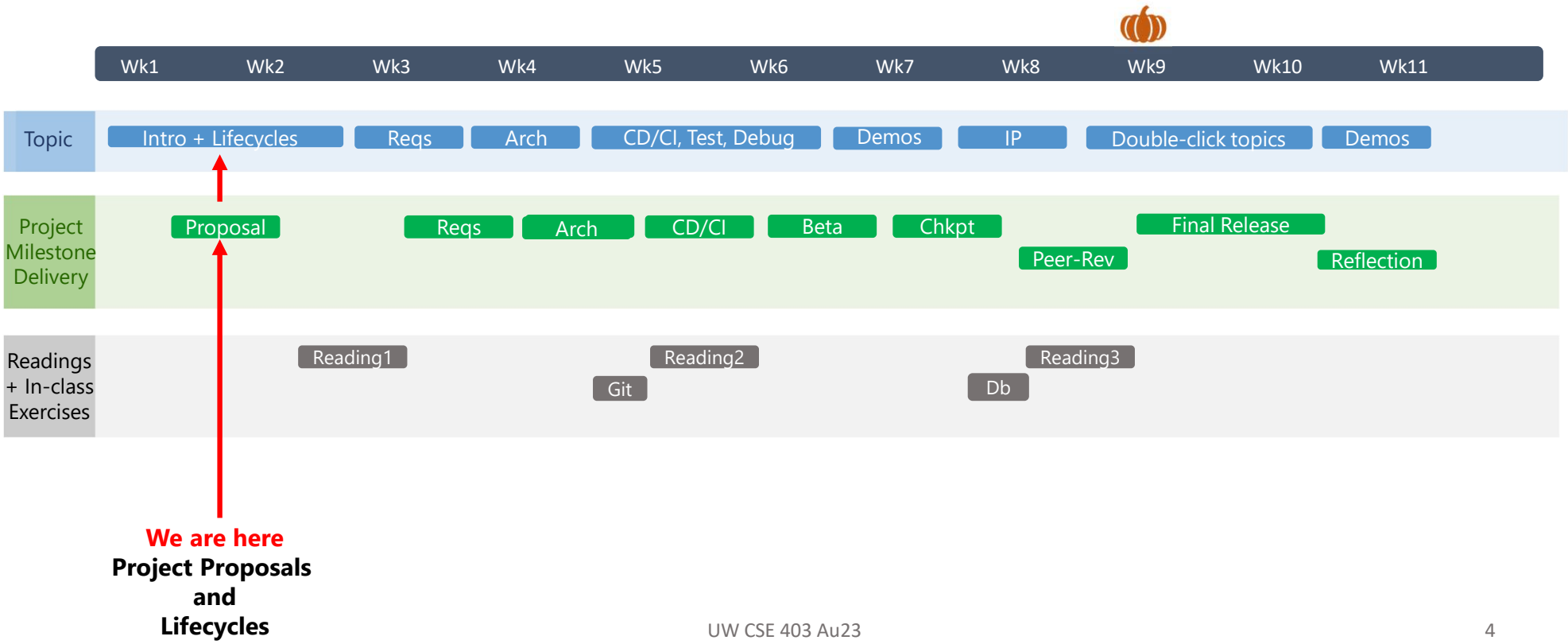
Software Engineering is …

"An **engineering discipline** concerned with all aspects of **software production** from the early stages of system specification [requirements] through to maintaining [evolving] the system after it has gone into use." — Ian Sommerville

Software Engineering tasks include:

- Requirements engineering
- Specification writing and documentation
- Architecture and design
- Programming
- Testing and debugging
- Deploying, operating, evaluating, refactoring and evolving
- Planning, teamwork and communication

CSE 403 Projects work as learning tools



Assignment 1 – Project Proposals

An elevator pitch is a brief, persuasive speech that you use to spark interest in a product, project or idea, or in yourself. An elevator pitch is short, about the time you spend in an elevator, hence the name.

https://asana.com/resources/elevator-pitch-examples

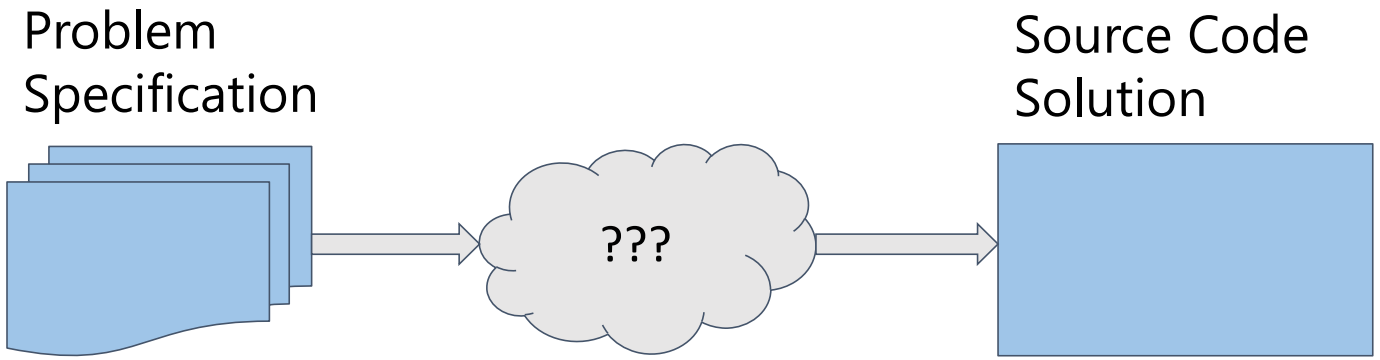
You have 2-3 minutes for your project pitch to the class - this is a good example of how it could flow

Your turn

Try pitching your project, or yourself, to your neighbor

Introduce yourself	
Present the problem	
Present your solution (This is your lucky day!)	
Share your value proposition	
Add a call to action	

Lifecycles: Here's the challenge



One solution: Code and fix

Specification (maybe)

Deliver (maybe)

SDLC: Code and fix

Pros:

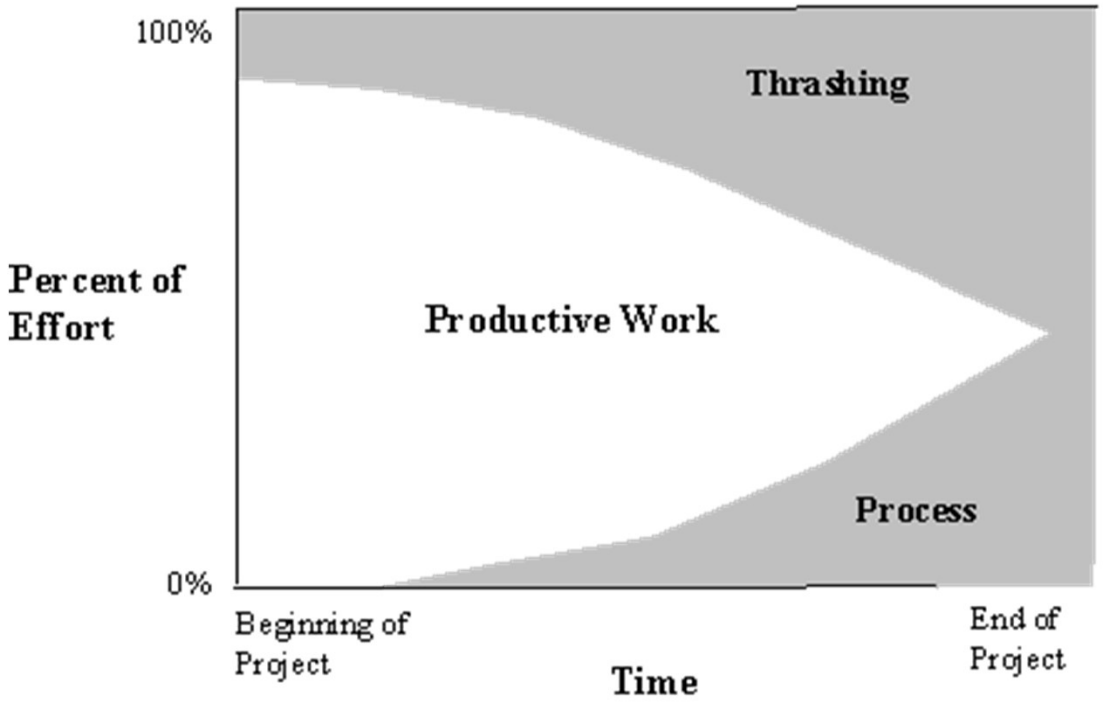
- Little or no overhead - just dive in and develop, and see progress quickly
- Applicable *sometimes* for small projects, short-lived prototypes, and/or small teams

Cons:

- <Over to you>

Let's look at data*

Project with little attention on SDLC process



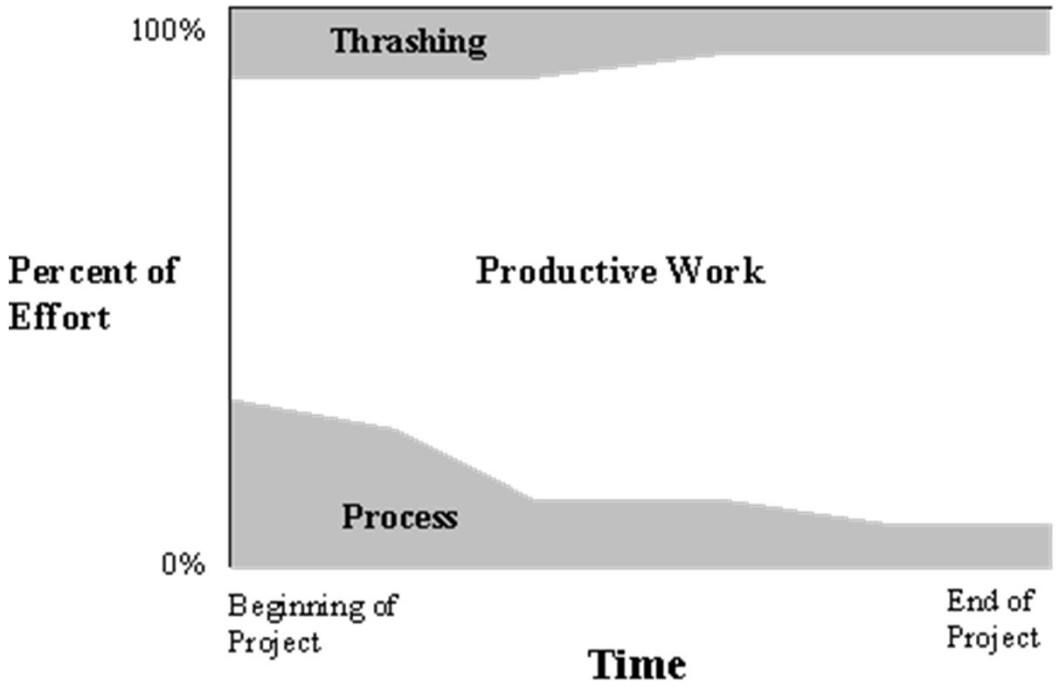
Thrashing = doing a lot of work but not making progress towards the goal

Imagine recoding something again and again and it's still not right for purpose

The Power of Process | Steve McConnell

Let's look at data*

Project with early attention to SDLC process



The Power of Process | Steve McConnell

Is a more structured SDLC necessary?

It's used to establish an order – provide a model - in which software project events occur from project conception to project delivery

- It forces us to think of the "big picture" and follow steps so that we reach it without glaring deficiencies
- Without it we may make decisions that are individually on target but collectively misdirected
- It allows us to organize and coordinate our work as a team
- It allows us to track progress and risks, and adjust as necessary

Recurring themes in SDLCs

A SDLC defines how to produce software through a series of stages

Goals of each stage

- Define a clear set of actions to perform
- Produce tangible (trackable) items
- Allow for work revision
- Plan actions to perform in the next stage

– Key question –
how to combine the stages, in what order, and why

Common stages

- Requirements
- Design
- Implementation
- Testing
- Release
- Maintenance

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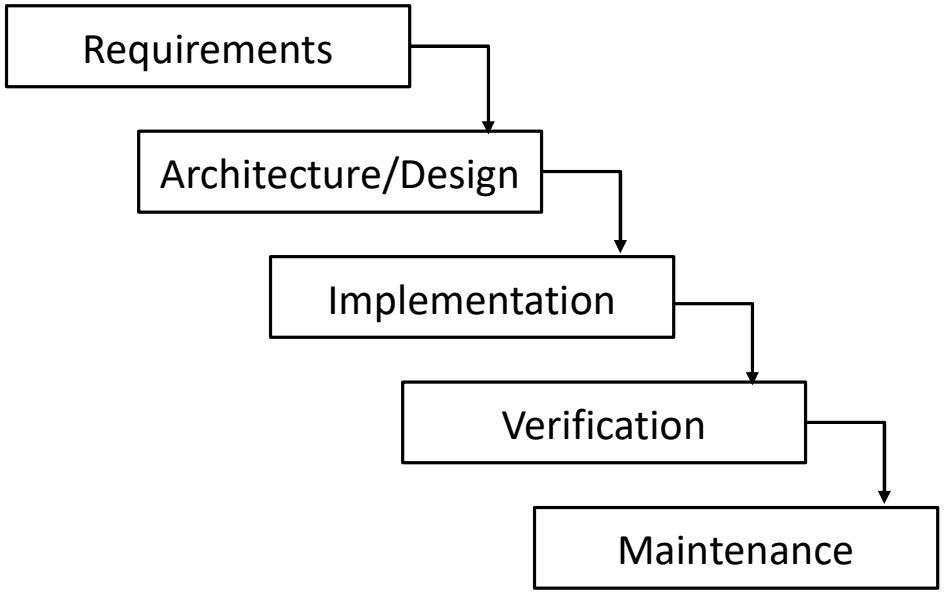
  - What and why are they needed
  - Recurring themes
  - **Popular models and their tradeoffs**
    - Waterfall model
    - Evolutionary prototyping
    - Spiral model
    - Staged delivery
    - Agile (XP, Scrum)

We are here!

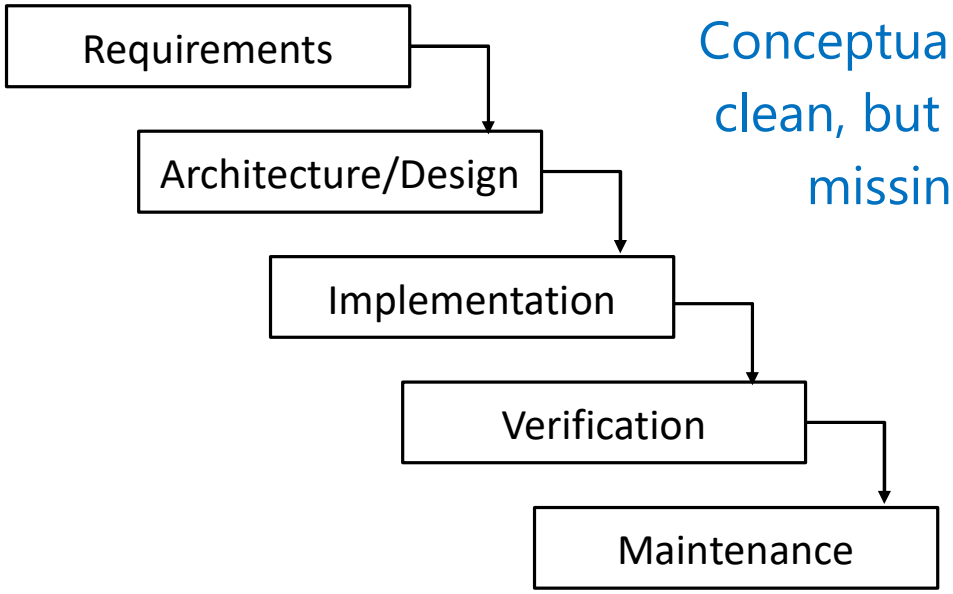
All have the same goal – deliver high quality software, on time, meeting the customers needs

SDLC: Waterfall model



- Top-down approach
- Sequential, non-overlapping activities and steps
- Each step is signed off on and then frozen
- Most steps result in a final document

SDLC: Waterfall model



Conceptually very clean, but what's missing?

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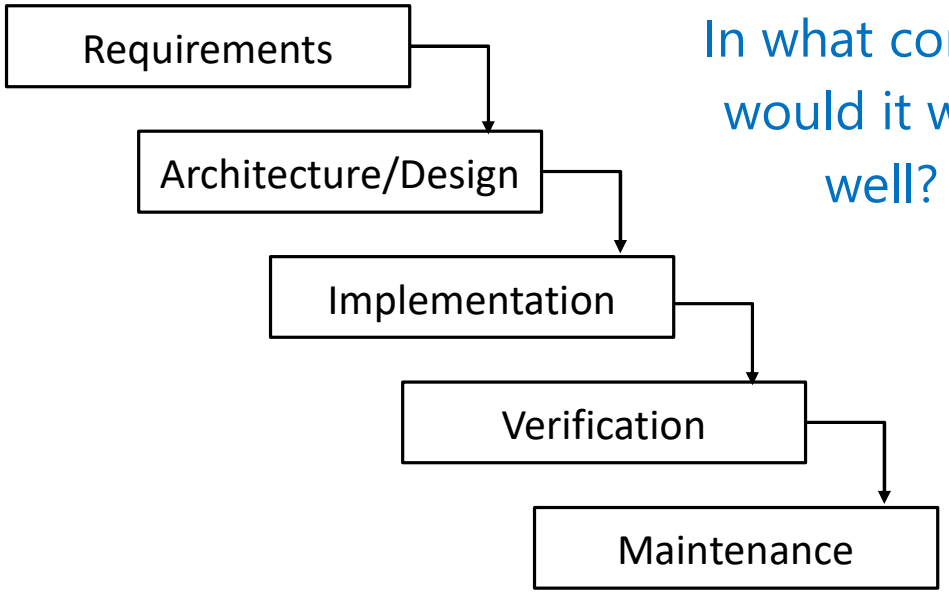
SDLC: Waterfall model



In what context would it work well?

- Top-down approach
- Sequential, non-overlapping activities and steps
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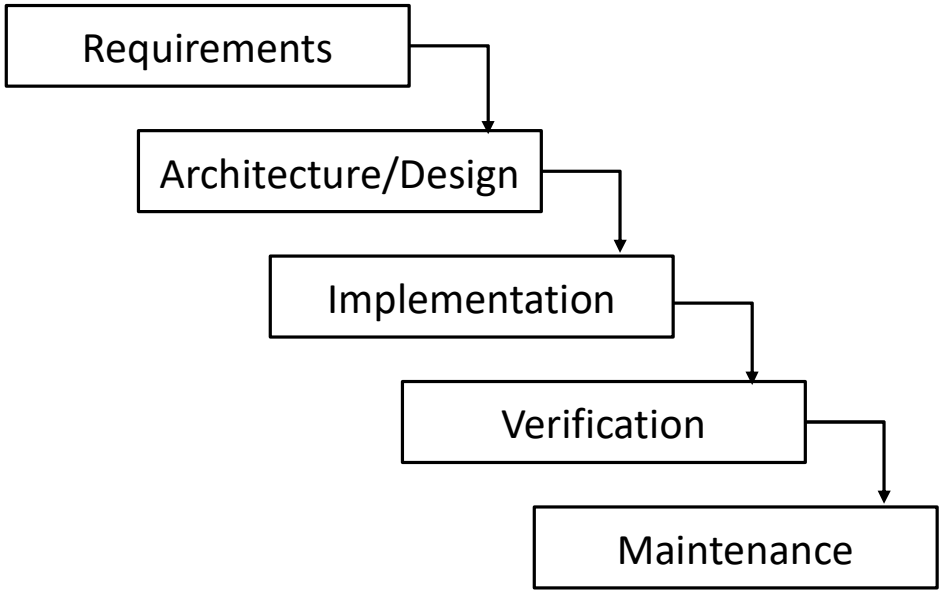
Likely parts of their SDLC is waterfall-like due to the upfront and regulated requirements

SDLC: Waterfall pros and cons



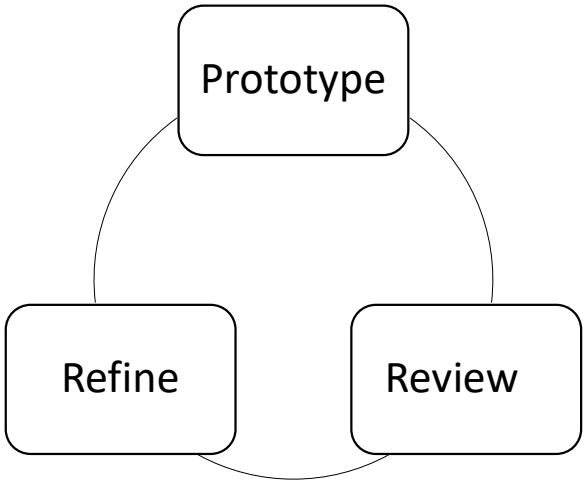
Pros:

- Simple to understand
- Promotes common dialogue
- Highly regulated deliverables

Cons:

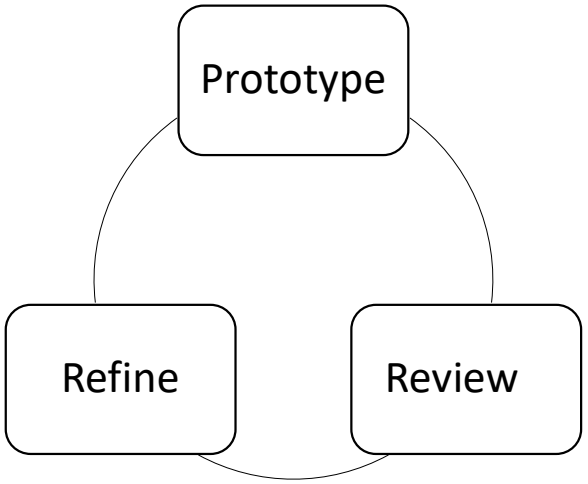
- Hard to do all the planning upfront
- Inflexible – changes are expensive
- Test and integration come late – fixes are expensive
- Final product may not match the customer's needs

SDLC: Prototyping



- Problem domain or requirements not well defined or understood
- Create small implementations of requirements that are least understood
- Requirements are “explored” before the product is fully developed
- Developers (and customers) gain experience when developing the product
- Prototype can evolve to the real product or can serve to be a learning tool only

SDLC: Prototyping



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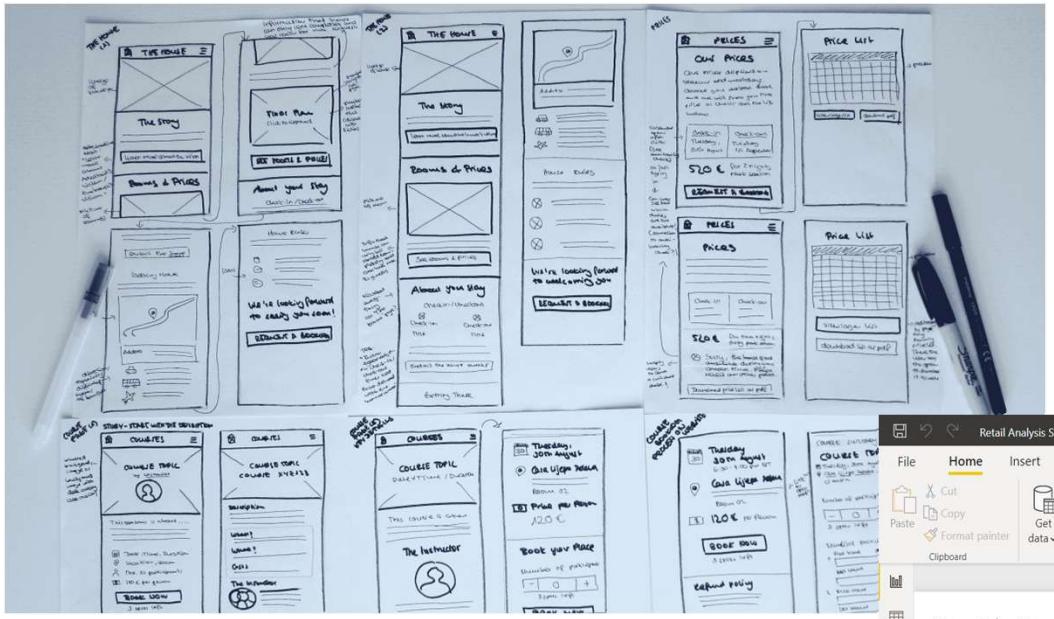
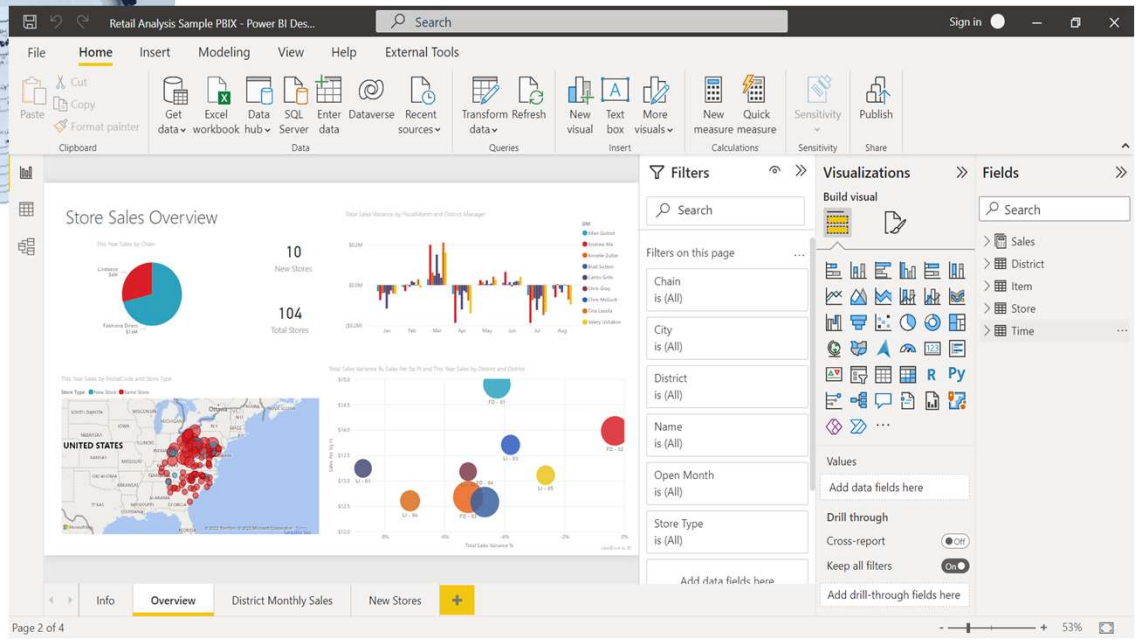
UI prototyping is popular

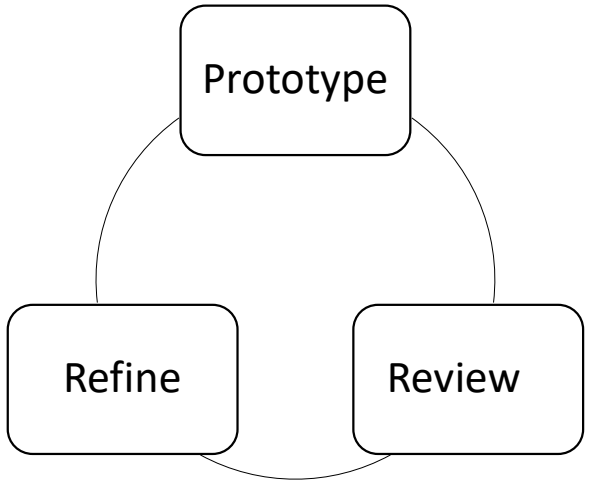


https://internetdevels.com/blog/what-is-website-prototype-how-build-website-prototype



https://learn.microsoft.com/en-us/power-bi/fundamentals/desktop-what-is-desktop

SDLC: Prototyping pros and cons



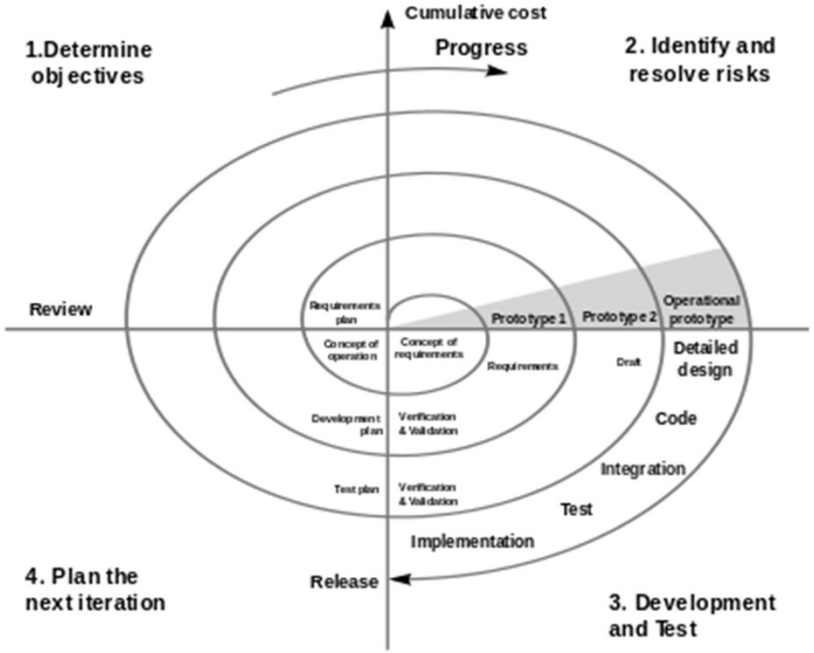
Pros:

- Client involvement and early feedback
- Improves requirements and specifications
- Reduces risk of developing the "wrong" product

Cons:

- Time/cost for developing may be high
- Hard to commit what will be delivered and when
- May end up evolving a poor choice (limit thinking holistically)

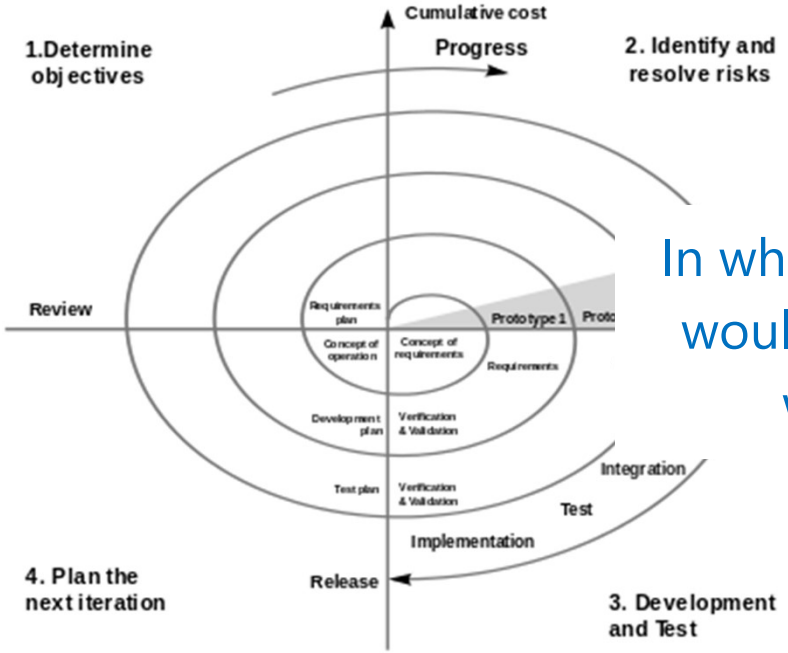
SDLC: Spiral Model



- Incremental/iterative model (combines waterfall and prototyping)
- Iterations called spirals
- Repeat these activities:
  - Determine objectives (reqs)
  - Risk analysis
  - Develop and test
  - Plan
- Phased reduction of risks (address high risks early)

Boehm, *Spiral Development: Experience, Principles,and Refinements*

SDLC: Spiral Model



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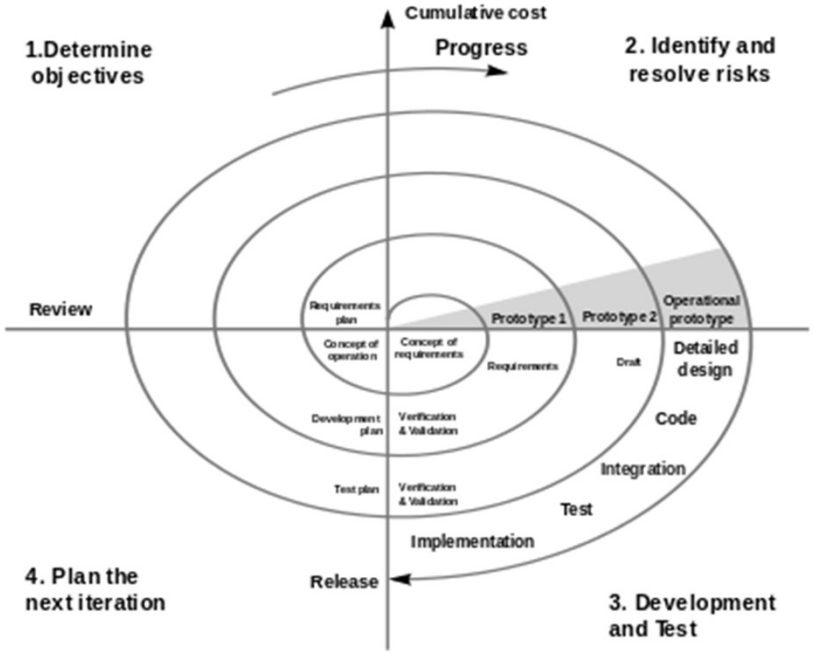
SDLC: Spiral Model pros and cons



Pros:

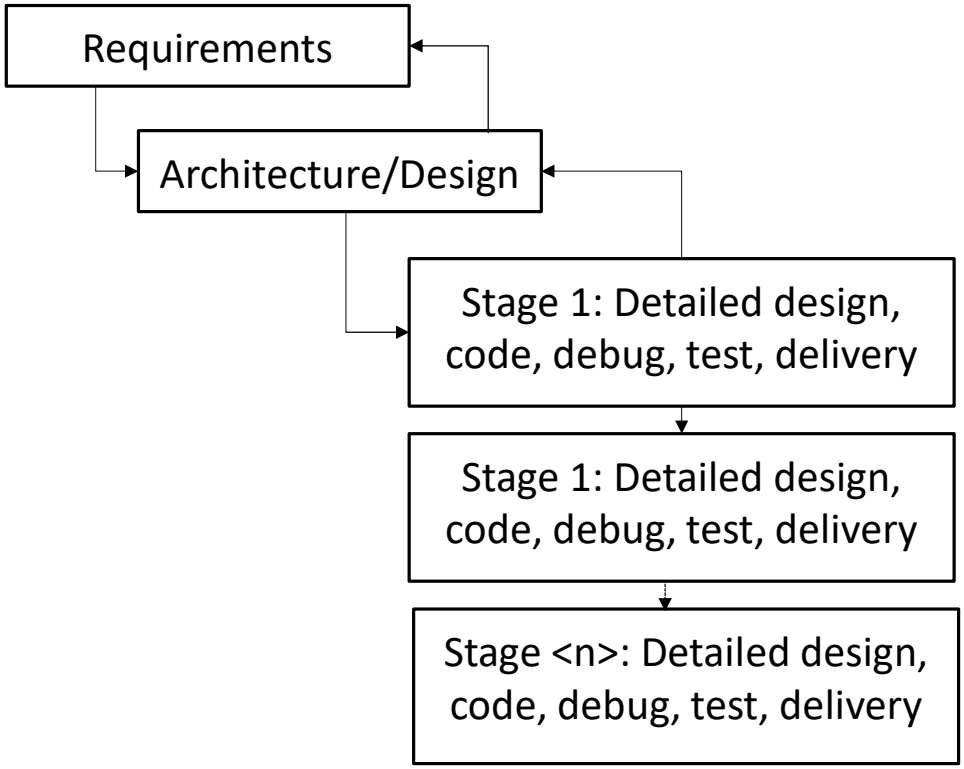
- Early indication of unforeseen problems
- Allows for changes
- The risk reduces as costs increase

Cons:

- More complex to run
- Requires proper risk assessment
- Requires more planning and experienced management

Boehm, *Spiral Development: Experience, Principles,and Refinements*

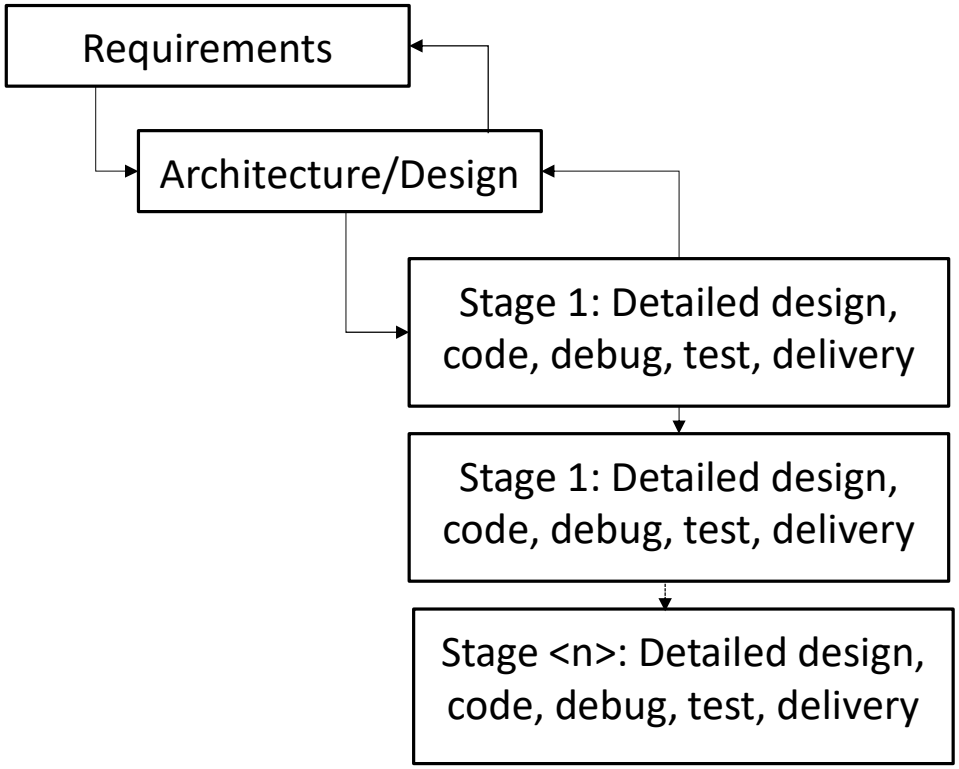
SDLC: Lots of variants  - Staged Delivery



- Combines waterfall, spiral, scrum
- Waterfall-like planning upfront then spiral/scrum-like short release cycles
- Pros: ?
- Cons: ?

McConnell: https://stevemcconnell.com/

SDLC: Staged Delivery pros and cons



- Pros:
  - Can ship at the end of any release cycle
  - Intermediate deliveries show progress, satisfy customers, and lead to feedback
  - Problems are visible early
- Cons:
  - Requires tight coordination
  - Product must be decomposable
  - Extra releases cause overhead

Thoughts on which SDLC to use?

CONTACTS

ACES Representatives

Jim Lujan
Los Alamos National Laboratory

Jim Laros
Sandia National Laboratories

Crossroads Request for Proposal (RFP) No. 511017

All proposals are due by 2:30 p.m. Mountain Time on Monda

Interested parties are invited to submit a proposal for one (1) of the Crossroads supercomputer system. The subcontract m in support of the New Mexico Alliance for Computing at Extre composed of the following NNSA High Performance Computir

- Los Alamos National Laboratory (LANL)
- Sandia National Laboratories (SNL)

Interested parties are advised to monitor this website for pot amendments and other Crossroads RFP information updates. Administrator may notify interested parties of updated Cross via e-mail; however, there is no obligation to do so.

It is the responsibility of all interested parties to monitor this Crossroads RFP information.

Interested parties must submit in writing all communication r RFP (questions, comments, etc.) to the Contract Administrato

Crossroads RFP Components

- RFP Invitation Letter (pdf)
- RFP Instructions to Offerors (pdf)
- RFP Offerors Proposal Letter (pdf)

Crossroads 2021 Technical Requirements Document

LA-UR-18-25993
SAND2018-7366 O

Crossroads 2021: Technical Requirements

Stay tuned for more!

- Truly, there is no end, but we'll move to the more recent SDLC next week
- Questions on the traditional models?