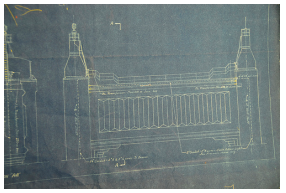
software development lifecycle (sdlc) models & agile methods

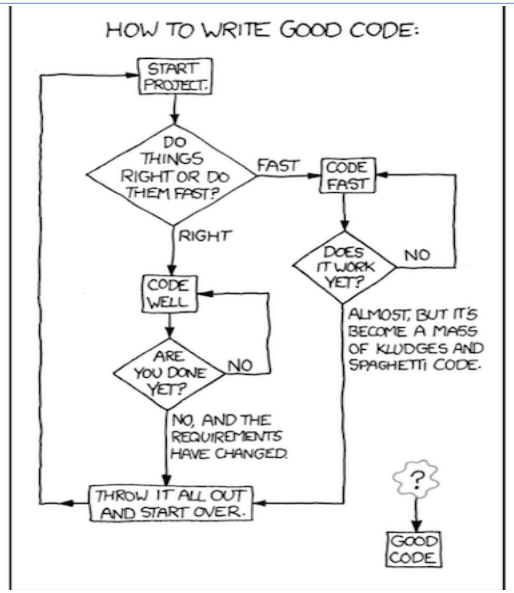
sdlc

how did that happen?



- by analogy with civil engineering, where you design first, then do construction
- in software, there is no "construction" it's *all* design
- used to be called coding

sdlc (2)



sdlc (3)

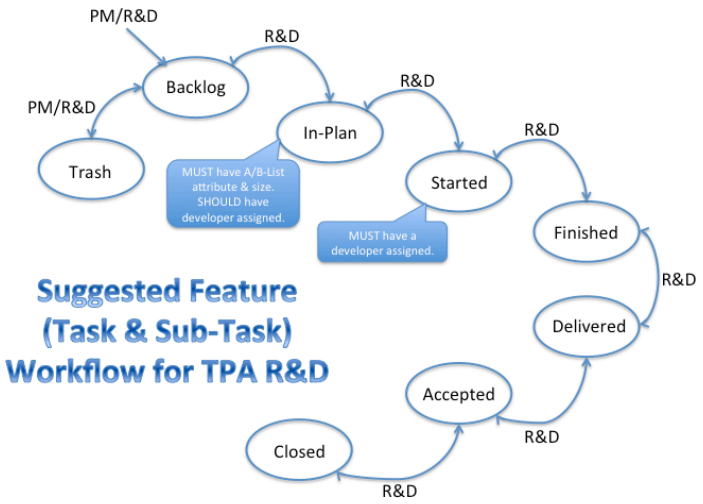
- what is a software development process?
- what is the lifecycle of a software project?

- will talk about "agile" later. first, we'll talk about "disciplined" or is it "traditional?" or is it "sturdy?" or is it "planned?" or is it…

sdlc (4)

- tend to talk about sdlc in terms of a dichotomy
  - "agile" vs. well…um…"not agile"
  - or, "planned" vs. "continuous"
  - others tend to (incorrectly) think that the deployment method implies the process
    - saas == agile
    - installed == traditional
- think more in terms applying the process on an individual feature, or an aggregate

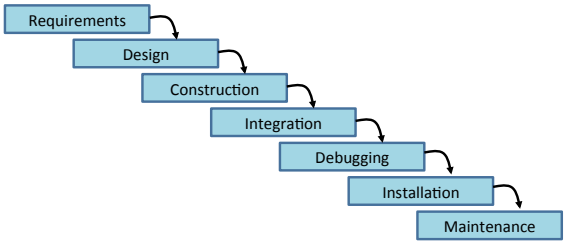
example feature workflow



goal of sdlc

- what's the goal of a good sdlc?
  - passes all the tests (external quality attributes)
  - good design/architecture (internal)
  - good user experience (quality in use)
  - process quality (can process help ensure product quality)

waterfall



- move from one phase to the next only when its preceding phase is completed and perfected.
- first mentioned by Royce in 1970 as an example of a flawed, non-working model for software development.
- US department of defence projects attempted to entrench this model by requiring their contractors to produce the waterfall deliverables and then to formally accept them to a certain schedule (US military standard DoD-2167)
  - there was a unwieldy process for going back and amending previous deliverables

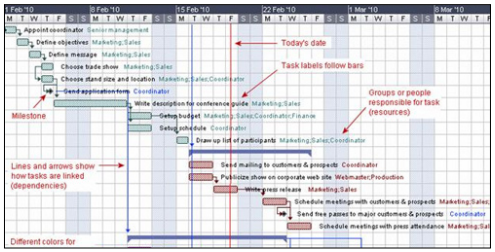
waterfall (2)

problems

- static view of requirements – ignores volatility
- lack of user involvement once specification is written
- unrealistic separation of specification from design
- doesn't easily accommodate prototyping, reuse, etc.

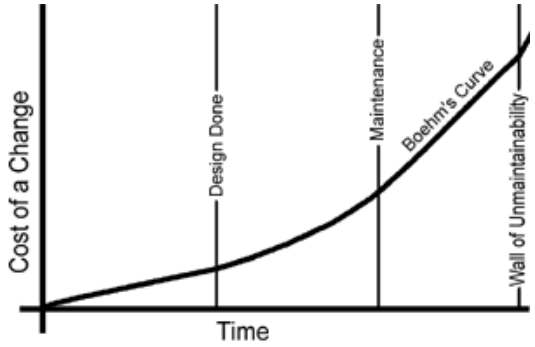
waterfall (3)

more problems



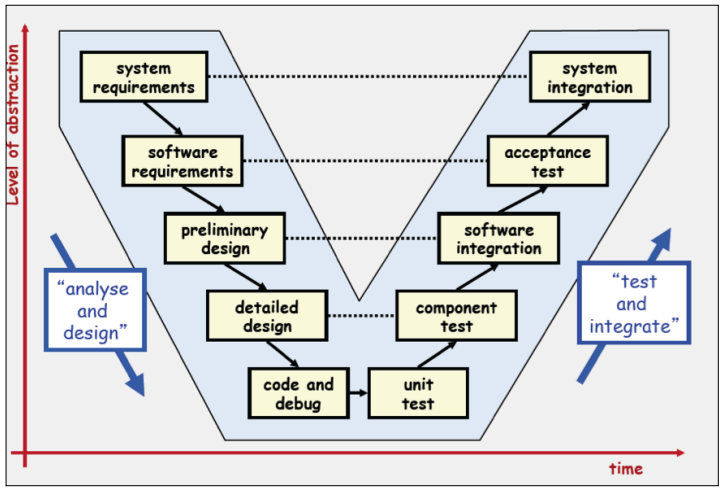
- often tracked with Gantt charts!
  - printed and taped up on the wall
  - out of date immediately
  - difficult to move tasks between developers
    - must assign all tasks before starting!
  - start writing in changes – disaster mess!

Bohem's cost of change

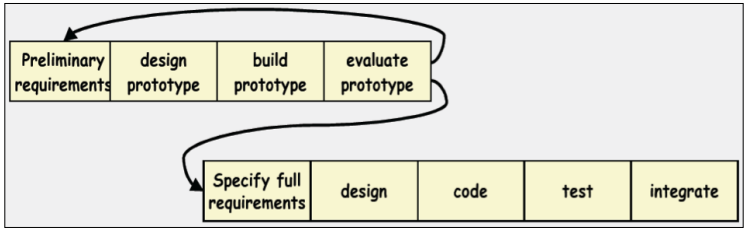


- *Software Engineering Economics* – Barry Boehm, 1981
  - data from waterfall-based projects in 1970s at IBM
  - acknowledged "architecture-breaker" flawed assumptions
  - small project – 1:4, large project – 1:100
  - also known as "software rot"

v-model

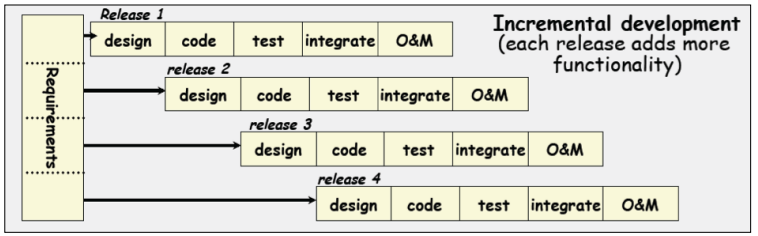


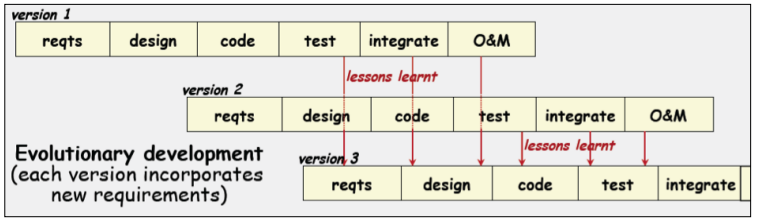
rapid prototyping



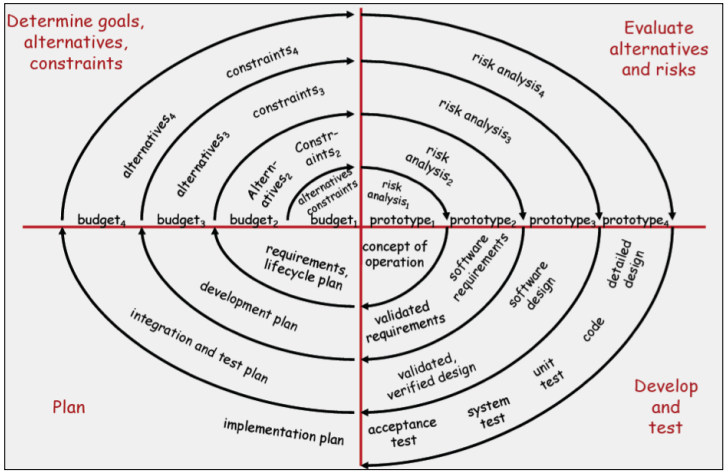
- prototyping used for:
  - understanding requirements for the user interface
  - determining feasibility of a proposed design
- problems:
  - users treat the prototype as the solution (or boss thinks it's done!)
  - prototype is only a partial specification

phased lifecycles



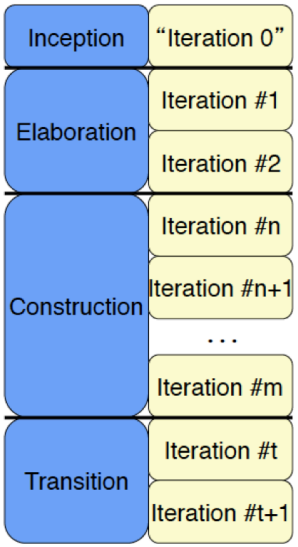


spiral model

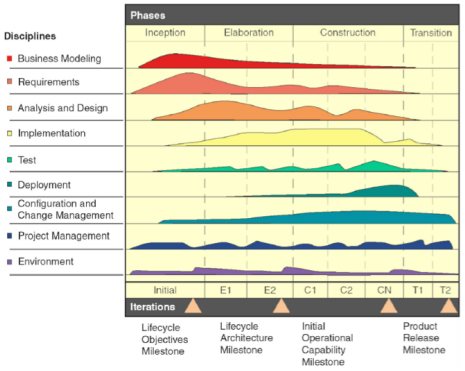


rational unified process

- inception
  - establish scope
  - build business case
  - stakeholder buy-in
- elaboration
  - identify & manage risks
  - work out architecture
  - focus on high risk items
- construction
  - iterate & build operational version
  - develop docs & training material
- transition
  - fine-tune
  - resolve config, install & usability issues



rational unified process (2)



- framework created by Rational, acquired by IBM in 2003
- four phases:
  - inception: business planning, requirements gather
  - elaboration: mitigate risks, use cases, dev. plan, architecture, prototypes
  - construction: development, unit tests, QA
  - transition: user acceptance testing, training

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agile methods

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agile

- refers to a group of software development methodologies created as a reaction against the heavily regulated, regimented, micro-managed use of the waterfall model ("pure waterfall").
- developed in the mid-1990's as "lightweight methods". most popular ones to survive are:
  - scrum – 1995
  - extreme programming (XP) - 1996
- "agile" term was first used in 2001.

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agile manifesto

http://agilemanifesto.org/

we are uncovering better ways of developing software by doing it and helping others do it. through this work we have come to value:

individuals and interactions over processes and tools
working software over comprehensive documentation
customer collaboration over contract negotiation
responding to change over following a plan

that is, while there is value in the items on the right, we value the items on the left more

12 agile principles

- our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
- welcome changing requirements, even late in development. agile processes harness change for the customer's competitive advantage.
- deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
- business people and developers must work together daily throughout the project.

12 agile principles (2)

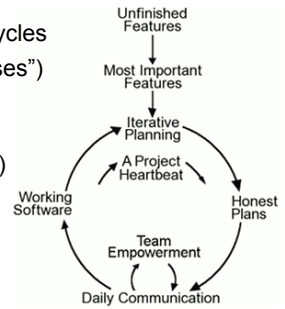
- build projects around motivated individuals. give them the environment and support they need, and trust them to get the job done.
- the most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
- working software is the primary measure of progress.
- agile processes promote sustainable development. the sponsors, developers, and users should be able to maintain a constant pace indefinitely.

12 agile principles (3)

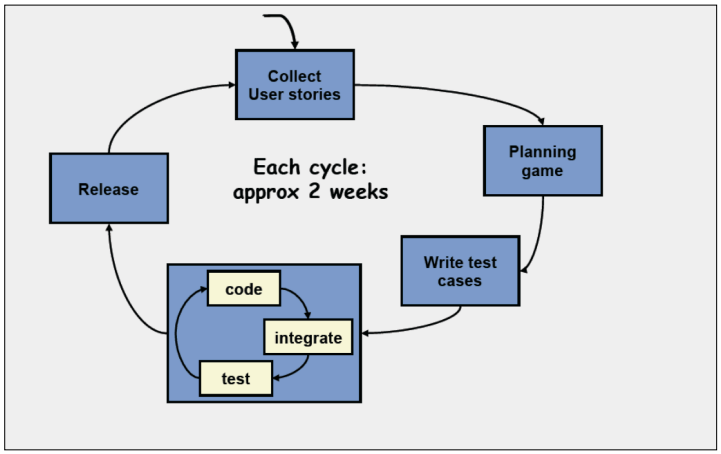
- continuous attention to technical excellence and good design enhances agility.
- simplicity – the art of maximizing the amount of work not done – is essential.
- the best architectures, requirements, and designs emerge from self-organizing teams.
- at regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

eXtreme Programming (XP)

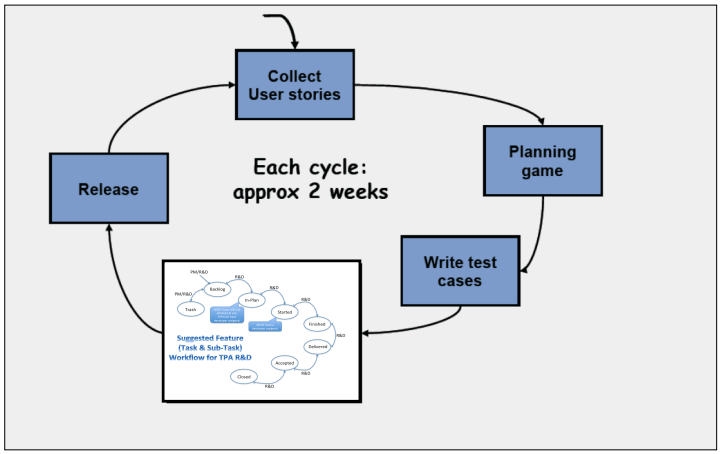
- XP = eXtreme Programming (Beck 1999)
- frequent “releases” in short development cycles
- manage by features (“user story” / “use cases”)
  - release planning / iteration planning
- continuous integration
- pair programming (continuous code review)
- unit testing of all code
- avoiding programming of features until they are actually needed
- simplicity and clarity in code
- frequent communication (customers and coders)
- expecting changes in the customer's requirements as time passes and the problem is better understood
- coding standard
- collective code ownership
- sustainable pace



XP alternate

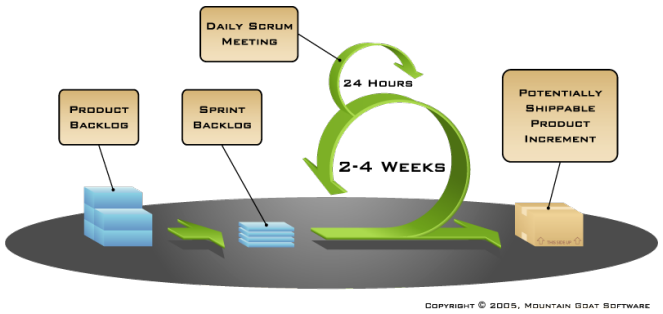


XP alternate (2)



scrum

- scrum (Schwaber & Beedle 2001)
- product owner, team, scrum master
- "sprints" 2-4 weeks
- "stories" are described and sized in "units" or "points"
- team commits to number of "points" they can do in next sprint
- product owner picks stories accordingly
- product owner tests stories and gives feedback after each sprint



scrum fable

- in 2011 this fable was removed from the scrum process
  - pigs (committed): project owner, scrum master, development team
  - chickens (involved): customers, executive management
  - rooster: struts around offering unrequested, uninformed & unhelpful opinions
  - analogy is breakfast – bacon & eggs

"Agile" vs "Sturdy"

Iterative	Planned
Small increments	Analysis before design
Adaptive planning	Prescriptive planning
Embrace change	Control change
Innovation and exploration	High ceremony
Trendy	Traditional
Highly fluid	Upfront design / architecture
Feedback driven	Negotiated requirements
Individuals and Interactions	Processes and Tools
Human communication	Documentation
Small teams	Large teams

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personal experience

- feature-driven development is not in question.
  - almost nobody believes in pure waterfall
  - written reqs/specs/design for *entire* release ≈ waterfall
  - written requirements/spec/design per feature when necessary ≠ waterfall
    - advocated where necessary in agile
- continuous integration, keeping the code in good shape at all times & automated architectural regression testing? **yes!**
- full unit tests? **usually impractical**
- pair programming? **sometimes, maybe**
- frequent communications? **yes!**
  - involving stakeholders? **yes (if they will attend!)**
- simple design with constant re-factoring? **yes, mostly**
  - but too extreme to *never* design for the future.

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personal experience (2)

- commit only to next sprint? **not practical**
- use of "points" as opposed to a time unit? **no**
  - everyone outside of development will not trust it
- coding standards and collective code ownership? **yes**
- eliminate final test phase? **not practical**
  - reduce it with code/test iterations within the coding phase
- use working software as the primary measure of progress? **yes, for the most part**
  - for big-bang releases, I advocate:
    - feature demos during the development process.
    - independent function testing during the coding phase.
    - reflect on release plan when a feature is done by above def'n.
    - relentlessly plan and manage to dcut (= feature complete)

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personal experience (3)

- welcome changing requirements? **can't avoid**
  - but within a planning framework. cannot welcome all changes without considering the impact on the end-dates.
- sustainable development? **yes**
  - but unrealistic without careful planning
- the best architectures, requirements, and designs
  emerge from self-organizing teams? **not convinced**
- beware: it's easy to proudly claim agile but actually be doing cowboy development!

which process is the best?

- all processes have their pros and cons, but only in the context of a given project.
  - does continuous deployment make sense for the next version of microsoft office?
  - what process is best for an x-ray machine?
  - space shuttle avionics – hal/s developed specifically for shuttle
    - completely independently developed primary and backup systems!
  - curiosity rover software, installed in flight! and then upgraded on mars!
- again, depends on the nature of the project

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summary

- do these things, and you are doing well!