Inf2-SEPP Lecture 23: Different Approaches to Agile Software Development

Cristina Adriana Alexandru

School of Informatics
University of Edinburgh

Last lecture

Plan-driven processes (up to the late ‘90s):

- The Waterfall Model
- The Spiral Model

This lecture

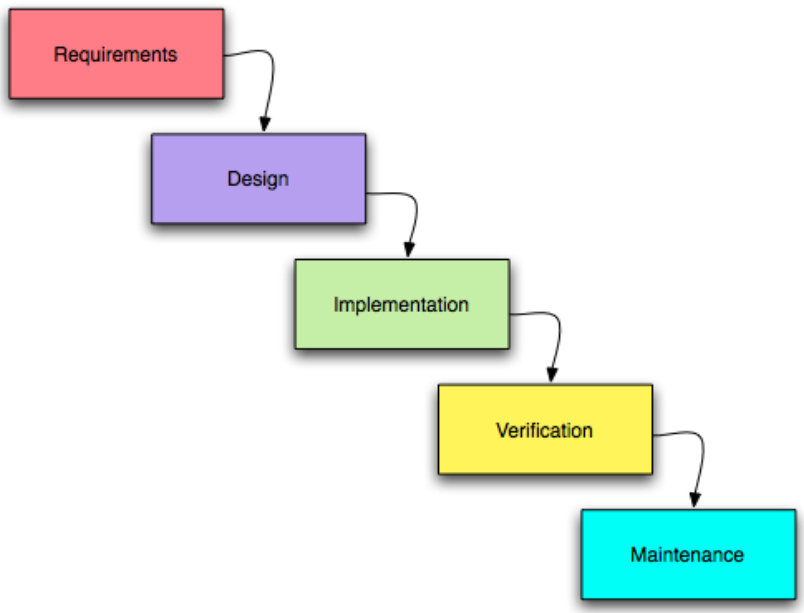
Different Approaches to Agile Software Development

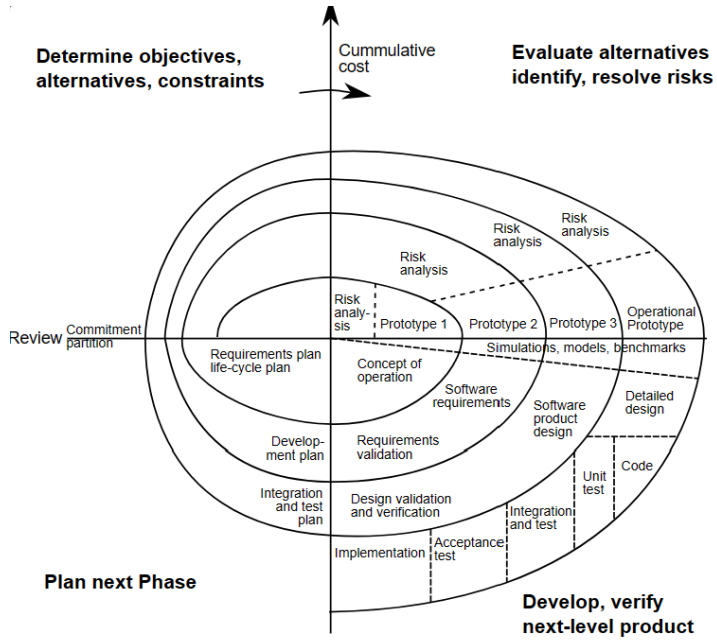
- Reminders
- Extreme Programming (XP)
  - Definition and values
  - Example risks and XP responses
  - XP classification of software development activities
  - XP practices
  - Can one mix and match XP practices?
  - Applicability of XP
- Scrum
  - Definition, values
  - The Scrum team
  - Scrum events
  - Applicability of Scrum

This lecture

- Kanban
  - Definition, theory
  - Kanban practices, including the Kanban Board
  - Kanban measures
  - Applicability of Kanban

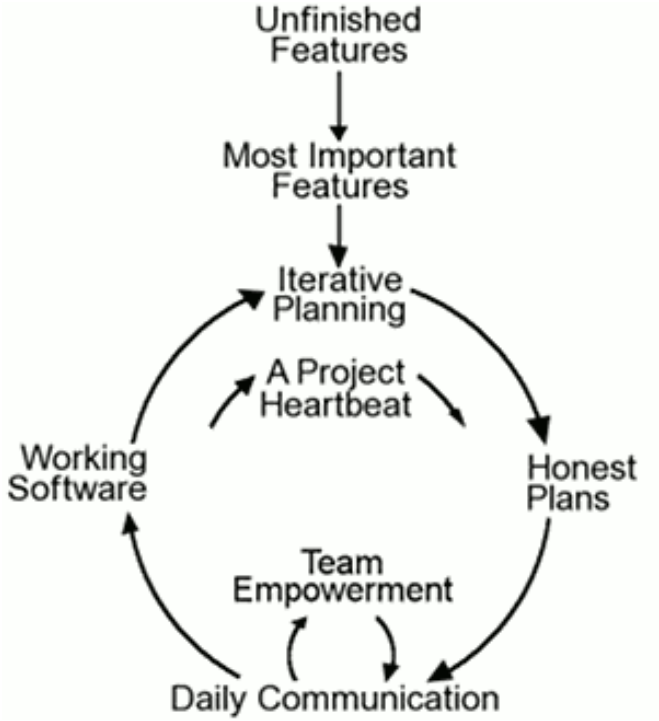
Reminder: Plan-driven Waterfall and Spiral Models





What the spiral model was reaching towards was that software development has to be *agile*: able to react quickly to change.

Reminder: Agile



IMPORTANT! By "customer" we will always mean initiator of requirements (even business person from development company!) in following slides.

Extreme Programming

Extreme Programming (XP) is

"a humanistic discipline of software development, based on values of communication, simplicity, feedback and courage"

People: Kent Beck, Ward Cunningham, Ron Jeffries, Martin Fowler, Erich Gamma...

More info: `www.extremeprogramming.org`,
Beck "Extreme Programming Explained: Embrace Change"

Example risks and the XP responses

- Schedule slips:
  Short iterations give frequent feedback; features prioritised
- Project cancelled after many slips:
  Customer chooses smallest release with biggest value
- Release has so many defects that it is never used:
  Tests written with both unit-level and customer perspectives
- System degrades after release:
  Frequent rerunning of tests maintains quality
- Business misunderstood:
  Customer representative embedded in development team
- System rich in unimportant features
  Only highest priority tasks addressed
- Staff turnover:
  Programmers estimate task times; new programmers nurtured

XP classification of software development activities

- Coding
  Central. Includes understanding, communicating, learning
- Testing
  Embodying requirements, assessing quality, driving coding
- Listening
  Understanding the customer, communicating efficiently
- Designing
  Creating structure, organising system logic

XP Practices

The Planning Game
On-site customer
Small releases
Metaphor
Continuous integration
Simple design
Testing
Refactoring
Pair programming
Collective ownership
Coding standards
40-hour week

The Planning Game

Goal: Plan the next release, maximising value & controlling development costs and risk

Pieces: user story cards

Players:

- Customer understands scope, priority, business needs for releases: sorts cards by priority.
- Developers estimate risk and effort: sorts cards by risk, split cards if more than 2-4 weeks.

Phases: Exploration, Commitment, Steer

On-site customer

A customer

> someone capable of making the business's decisions in the planning game

sits with the development team always ready to

- clarify,
- write functional tests,
- make small-scale priority and scope decisions.

Customer maybe does their normal work when not needed to interact with the development team.

Small releases

Release as frequently as is possible whilst still adding some business value in each release.

This ensures

- that you get feedback as soon as possible
- lets the customer have the most essential functionality asap.

Metaphor

- About an easily-communicated overarching view of system. E.g. *Desktop*
- Encompasses concept of software architecture.
- Provides a sense of cohesion
- Often suggests a consistent vocabulary

Continuous integration

Code is integrated, debugged and tested in full system build at most a few hours or one day after being written.

- Maintains a working system at all times
- Responsibility for integration failures easy to trace
- If integration difficult, maybe new feature was not understood well, so integration should be abandoned

Simple design

Motto: *do the simplest thing that could possibly work*. Don't design for tomorrow: you might not need it.

Testing

Any program feature without an automated test simply doesn't exist.

Test everything that could break.

Programmers write unit tests

- use a good automated testing framework (e.g. JUnit) to minimise the effort of writing running and checking tests.

Customers (with developer help) write functional tests.

Refactoring

Refactoring is especially vital for XP because of the way it dives almost straight into coding.

Later redesign is essential.

A maxim for not getting buried in refactoring is "Three strikes and you refactor". Consider removing code duplication:

1. The first time you need some piece of code you just write it.
2. The second time, you are annoyed but probably duplicate it anyway.
3. The third time, you refactor and use the shared code.

i.e. do refactorings that you *know* are beneficial

Pair programming

All production code is written by two people at one machine. You pair with different people on the team and take each role at different times.

> *There are two roles in each pair. The one with the keyboard and the mouse, is coding. The other partner is thinking more strategically about:*
>
> - *Is this whole approach going to work?*
> - *What are some other test cases that might not work yet?*
> - *Is there some way to simplify the whole system so the current problem just disappears?*

Collective ownership

i.e. you don't have "your modules" which no-one else is allowed to touch.

If anybody sees a way to improve the design of the whole system they don't need anyone else's permission to go ahead and make all the necessary changes.

Of course a good configuration management tool is vital.

Coding standards

The whole team adheres to a single set of conventions about how code is written (in order to make pair programming and collective ownership work).

Sustainable pace

aka **40 hour week**, but this means not 60, rather than not 35!

People need to be fresh, creative, careful and confident to work effectively in the way XP prescribes.

There might be a week coming up to deadlines when people had to work more than this, but there shouldn't be two consecutive such weeks.

Mix and match?

Can you use just some of the XP practices?

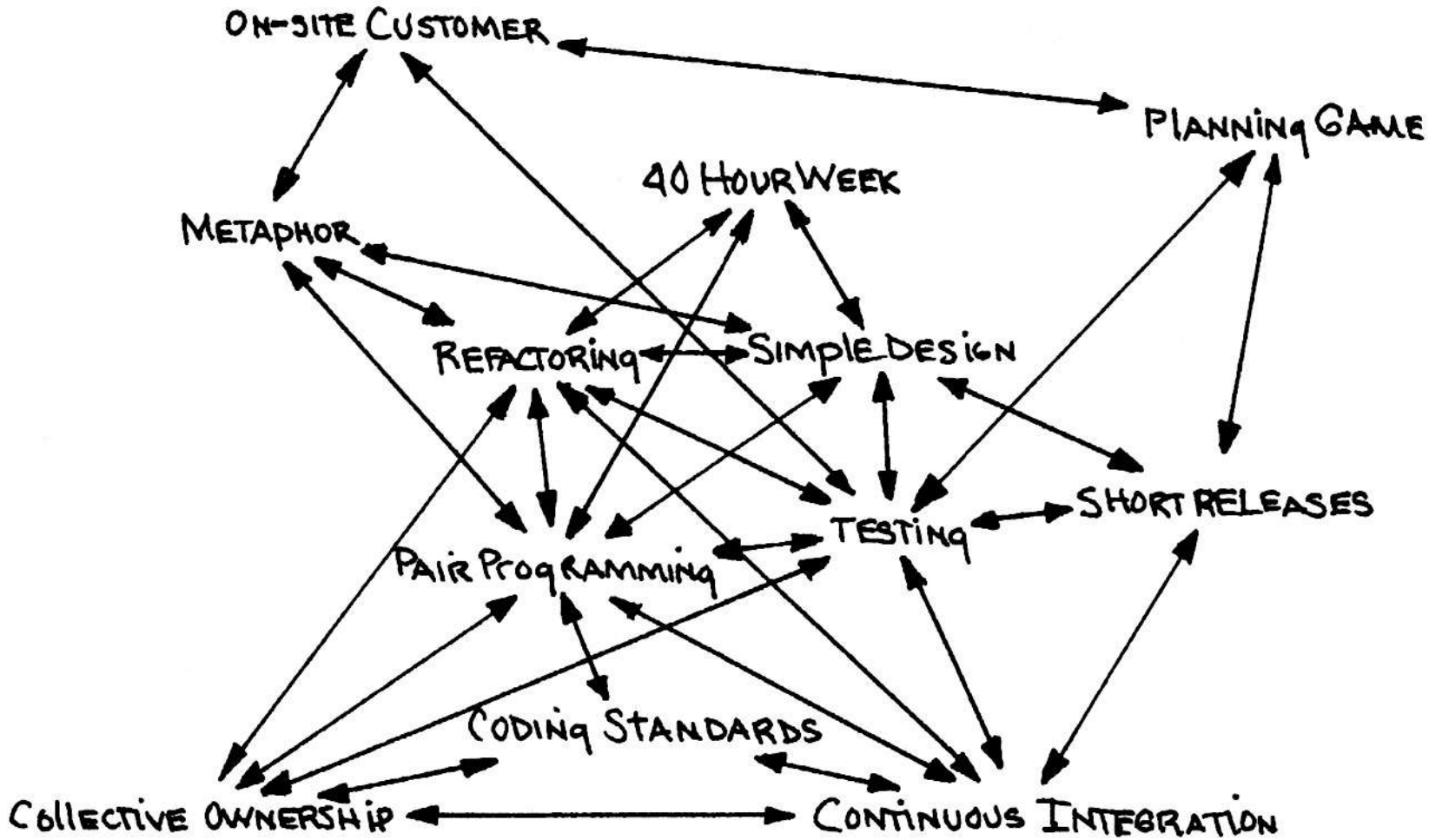
Maybe... but they are *very* interrelated, so it's dangerous.

If you do collective ownership but not coding standards
    the code will end up a mess;

If you do simple design but not refactoring
    you'll get stuck!

XP practices support each other in many ways . . .

How XP practices support each other



From *Extreme Programming explained: embrace change* by Kent Beck.

Where is XP applicable?

The scope of situations in which XP is appropriate is somewhat controversial.

Two examples:

- there are documented cases where it has worked well for development in-house of custom software for a given organisation (e.g. Chrysler).
- A decade ago it seemed clear that it wouldn't work for Microsoft: big releases were an essential part of the business; even the frequency of updates they did used to annoy people. Now we have automated updates to OSs, and Microsoft is a Gold Sponsor of an Agile conference

XP does need: team in one place, customer on site, etc.

Scrum

Scrum is *"a framework within which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value"*

People: first mentioned by Hirotaka Takeuchi and Ikujiro Nonaka in a paper introducing a new approach to commercial product development, developed into the final Scrum by Ken Schwaber and Jeff Sutherland (signees of the Agile Manifesto) since the 90s, with first publication in 1995.

More info: The Scrum Guide, published and revised 6 times by Schwaber and Sutherland:
`https://scrumguides.org/index.html`

Scrum values

- Commitment to achieve team goals
- Courage: doing the right thing, tackling problems
- Focus on work and goals of the team
- Openness about work and its challenges
- Respect towards members of the team as capable, independent people

The Scrum Team

Is:

- Self-organising: chooses how to do the work, is not told how.
- Cross-functional: have the needed competencies without need of help from outside the team.

Team members:

- Product Owner
- Development Team
- Scrum Master

The Product Owner (PO)

One person responsible for maximising the value of the team's work through the management of the Product Backlog (ordered list of requirements for the software).

Responsibility details:

- Clearly expressing items in the Product Backlog
- Maintaining visibility, transparency, clarity of Product Backlog
- Ensuring the team's understanding of the Product Backlog
- Ordering items
- Optimizing the value of the work of the team

This work can be delegated to the Development Team, but PO accountable.

The Development Team

Should be small: 3-9 members

Responsible for producing a potentially releasable increment of the software which is considered ''Done".

No titles, no sub-teams, all equally accountable.

The Scrum Master

Servant-leader to the Scrum team.

Promotes and supports Scrum as defined in the Scrum Guide e.g. by coaching, reviewing the use of Scrum practices, facilitating Scrum events including making sure they are held, purpose is understood, they keep to time.

Facilitates helpful interactions between those outside the Scrum team and the Scrum team.

The Sprint

Time-boxed constant duration event of maximum one month during which a new increment is developed up to the point of ''Done".

Scrum consists of a succession of sprints.

Each sprint has a Sprint Goal and a Sprint Backlog (subset of Product Backlog containing items to be addressed in sprint)

Container for all other Scrum events:

- Sprint Planning
- Daily Scrums
- Sprint Review
- Sprint Retrospective

Sprint Planning

Time boxed (maximum 8 hours per one month sprint) event deciding on the work to be performed in the Sprint:

- What the sprint can deliver, in terms of:
  - The Sprint Goal- based on objectives put forward by the PO and discussion by the whole team.
  - The items from the Product Backlog that would achieve the Sprint Goal- brought up by the PO but the decision of the Development Team.
- A plan of the work (usually split into units of maximum 1 day each)- discussed by the Development Team, with PO potentially proposing trade-offs.

Items + plans moved to Sprint Backlog document.

Daily Scrums

Daily time-boxed 15-minute event held in same place at the same time, during which Development Team plans next 24 hours.

Aims: inspecting progress with Sprint Backlog towards Sprint Goal.

Organised and structred by the Development Team. Scrum Master teaches importance of meeting, ensures it is held.

One possible structure: each person stating:

1. Progress towards the goal in the last 24 hours
2. Plans for the next 24 hours
3. Potential impediments

Daily Scrums

Advantages:

- Improves communication
- Reduces need for other meetings
- Identifies impediments and who can help (separate longer meetings).
- Promotes quick decision making
- Improves level of knowledge of the Development Team

Sprint Review

Time-boxed (maximum 4-hour for one month long sprint) informal event held at end of sprint.

Attended by Scrum team and stakeholders invited by PO

Aims:

- Inspecting increment (what was ''Done" and what not, what went well, problems, solutions)
- Potentially adapting Product Backlog in view of progress
- Collaborating on ways forward to optimize value
- Gathering feedback from stakeholders

Outcome: revised Product Backlog, probable items in it for the next sprint.

Sprint Retrospective

Time-boxed (maximum 3-hour meeting for one month long sprint) event held after Sprint Review and before next Sprint Planning.

Aims:

- Review last sprint with regards to people, relationships, process and tools
- Identify and order what went well and potential improvements
- Create a plan for carrying out improvements and potentially adapting definition of ''Done" for next sprint

Apart from normal responsibilities, the Scrum Master acts as a peer team member, keeps meeting positive and productive.

Applicability of Scrum

Scum is currenty the most popular and widely used agile framework.

Companies using Scrum: Google, Apple, Facebook, Amazon, IBM, Intel, Netflix, Adobe, ING, Vodafone

Reported benefits according to the Scrum Alliance (`https://resources.scrumalliance.org/Article/quick-guide-things-scrum`):

- Better reactivity to change
- Better alignment business- IT
- Faster time to market

Scrum also used in research, sales, marketing and advanced technologies.

Kanban

Kanban is "a strategy for optimizing the flow of value through a process that uses a visual, pull-based system" (Kanban Guide)

People: Taiichi Ohno and W. Edwards Deming from Toyota and the Toyota Production System; Then David J. Anderson from Microsoft made it applicable to any company that needs organisation, since 2004.

More info: The Kanban Guide: `https://kanbanguides.org/`

Kanban Theory

Kanban uses flow theory.

Flow= "movement of potential value through a system" (The Kanban Guide)

Strategy: optimise value by optimising flow, finding the right balance between:

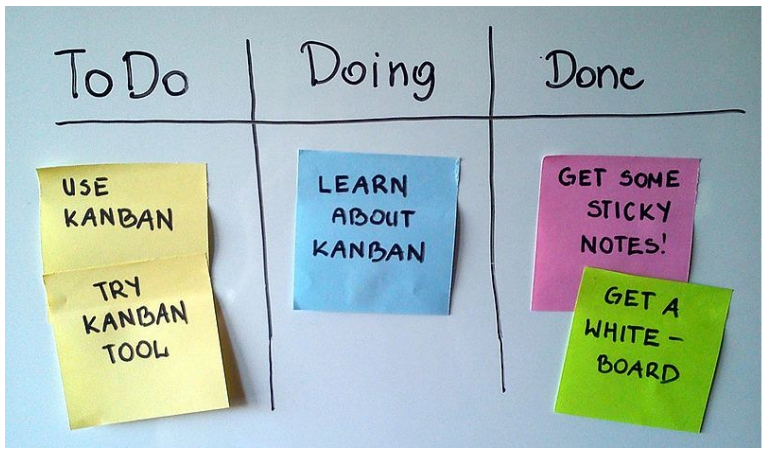
- Effectiveness: delivering what customers want when they want it
- Efficiency: allocating resources optimally to produce value
- Predictability: ability to forecast value delivery accurately in the presence of uncertainty

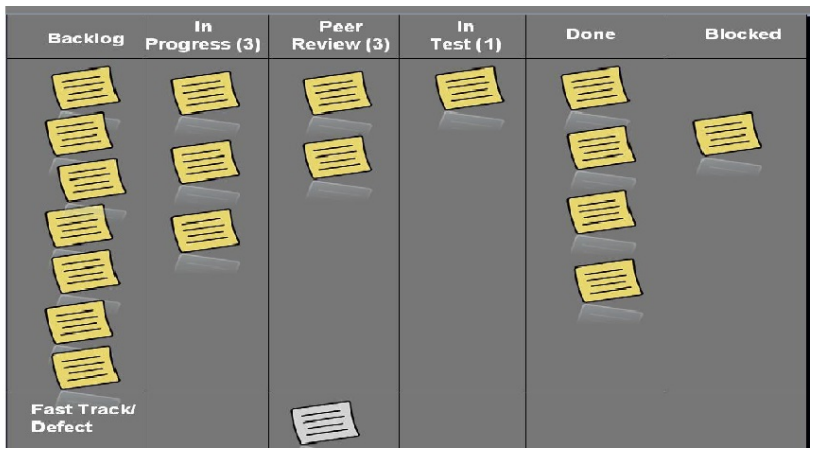
Kanban Practices

- Visualising the workflow
- Limiting work in progress (WIP) (sometimes considered part of the next practice)
- Actively managing items in the workflow
- Improving the workflow

Visualising the workflow

Use a Kanban Board (physical or digital) to visualise and keep workflow transparent amongst team members. Make the invisible visible.





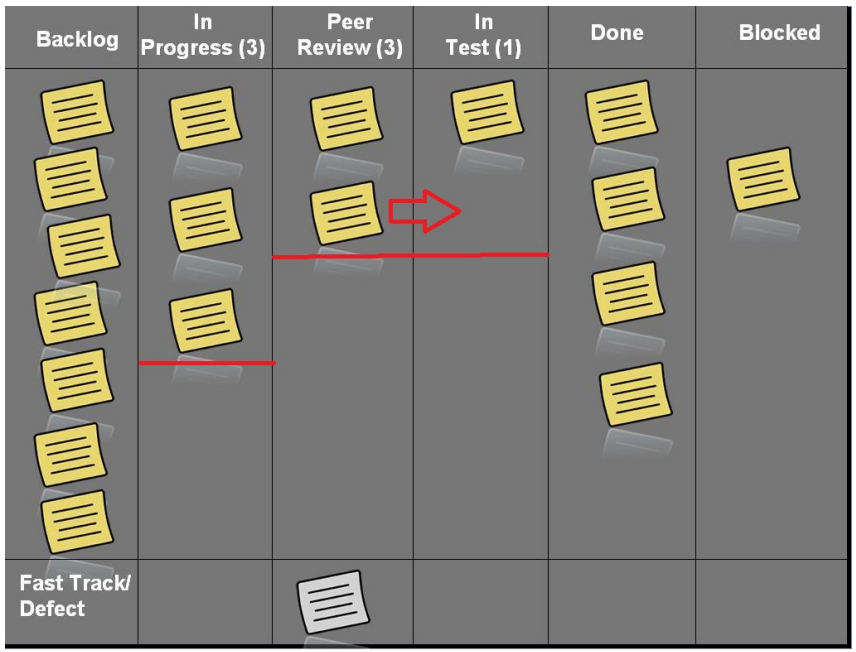
Useful tools for Kanban boards are Jira and Trello (see reading for tutorials)

Limit work in progress (WIP)

WIP= "any work items between a started point and a finished point" (the Kanban Guide), i.e. started but not finished. Also used to indicate their number.

Little's Law: The more things (WIP) you work on at the same time (on average), the longer it will take (on average). Thus, can lower WIP in single column, several grouped columns, or whole board.

Side effect: creates pull system, improves collective focus, commitment, and collaboration



Actively managing items in the workflow

Limiting WIP helps achieve flow, but not sufficient. Additional management could include:

- Avoiding work items piling up in part of the workflow
- Ensuring work items pulled at about same rate with leaving the workflow
- Ensuring work items do not age unnecessarily (using the service level expectation (SLE): forecast of duration of work item flowing from start to finish).
- Responding quickly to unblock blocked work.

Improving the workflow

Continuously improve workflow towards better balance effectiveness- efficiency- predictability.

Alterations should be just-in-time as context dictates, and not waiting for formal meetings.

Useful: the use of measures (see next slide) and visualisations.

Kanban Measures

Four mandatory flow measures:

- WIP
- Throughput: The number of work items finished per unit of time
- Work Item Age: Time elapsed between start of work item and current time.
- Cycle Time: Time elapsed between start-finish of work item.

Can help reach shared understanding of Kanban system's health and performance.

Useful to use charts to represent them, and use them to inform the Kanban practices.

Applicability of Kanban

Companies using Kanban or Kanban tools: HP, Spotify, Pixar Studios, Zara, Pirelli.

Kanban is often used to enhance Scrum. See "The Kanban Guide for Scrum Teams" from reading.

Also used in finance, marketing, healthcare.

Reading

On XP:

Essential : Browse through this useful tutorial on Extreme Programming: `http://www.extremeprogramming.org/`

Recommended : Sommerville ESP Chapter 2 Section 2.2

On Scrum:

Essential : The Scrum Guide: download from `https://scrumguides.org/index.html`

Recommended : Sommerville ESP Chapter 2 Section 2.3

On Kanban:

Essential : This YouTube video and related videos are a great introduction to Kanban: `https://www.youtube.com/watch?v=iVaFVa7HYj4`

Essential : The Kanban Guide: download from `https://kanbanguides.org/`

Reading

Essential : "Revisiting the Principles and General Practices of the Kanban Method" by David J Anderson: `https://djaa.com/revisiting-the-principles-and-general-practices`

Recommended : Kanban Guide for Scrum Teams: download from `https://www.scrum.org/resources/kanban-guide-scrum-teams`

Recommended : This YouTube JIRA tutorial for Kanban boards: `https://www.youtube.com/watch?v=mT9wIFztYeA`

Recommended : This YouTube Trello tutorial for Kanban boards: `https://www.youtube.com/watch?v=U_73PkR3XlI`