Agile Software Development

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Some Material from Mike Cohn and Mountain Goat Software

Outline

- A short talk about waste
- Intro to Agile Software Development
- Examples of Agile Development Processes
  - DSDM (overview)
  - eXtreme Programming (more detailed)
  - Scrum (in depth)

A short talk about waste

Lean Manufacturing

- Lean manufacturing is a production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination.
- Value = what the user is willing to pay for
- Derived mostly from the Toyota Production System (hence the term Toyotism is also prevalent) and identified as "Lean" only in the 1990s
- Economical motivations in adapting production to demand, high cost of land (storage), economies of scale to improve competitiveness

無駄

(muda - unnecessary)

無理

(muri – work that can be avoided)

斑

(mura – unevennes)

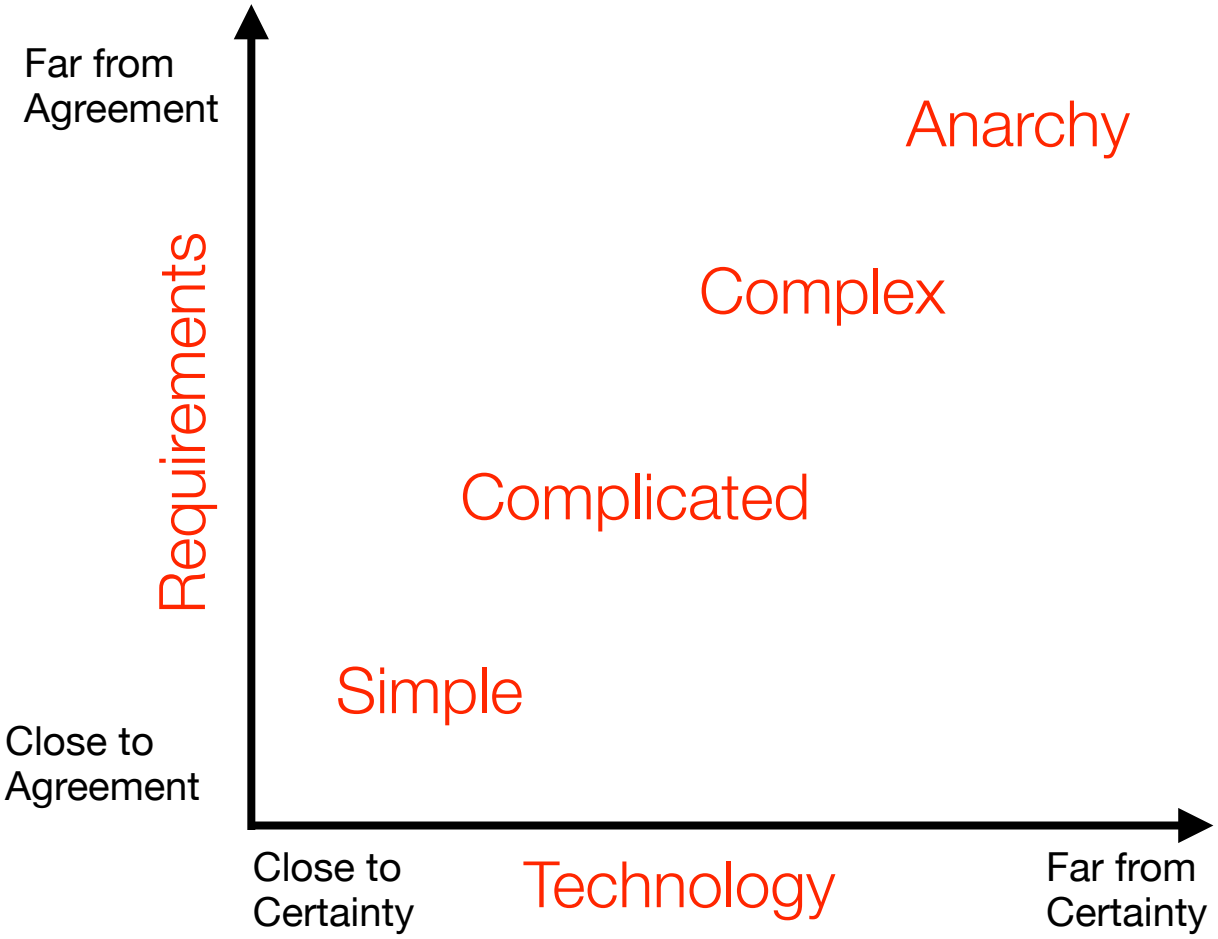
TIMWOOD – types of 無駄

- **Transportation:** moving products that is not actually required to perform the processing
- **Inventory:** all components, work in progress, and finished product not being processed
- **Motion:** people or equipment moving or walking more than is required to perform the processing
- **Waiting:** waiting for the next production step
- **Overproduction:** production ahead of demand
- **Over Processing:** resulting from poor tool or product design creating activity
- **Defects:** the effort involved in inspecting for and fixing defects

Causes of Waste in Software Development

- Accurate estimation, effective planning, management and control, and deterministic delivery of quality software has always been subject of great debate
- Some of the causes include:
  - Immateriality: software is difficult to measure
  - Flexibility: “why don’t we add this nice feature?”
  - Complexity
  - New: maturity of engineering techniques

Software Development Complexity



Source: *Strategic Management and Organizational Dynamics* by Ralph Stacey in *Agile Software Development with Scrum* by Ken Schwaber and Mike Beedle.

Motivation for Agile (1/2)

- Traditional approaches to control complexity in software development rely on superimposing structure on development
- A natural trend from the Waterfall model that risks to end up in a bureaucratic structure

Motivation for Agile (2/2)

- **Agile Software Development:** A group of SW development methodologies based on similar principles:
  - A management process that encourages frequent inspection and adaptation
  - Team work, self organization, accountability
  - Rapid delivery of high-quality software
  - A business approach that aligns development with customer needs and company goals

The Agile Manifesto

Individuals and interactions	over	Process and tools
Working software	over	Comprehensive documentation
Customer collaboration	over	Contract negotiation
Responding to change	over	Following a plan

Source: www.agilemanifesto.org

Some Consequences

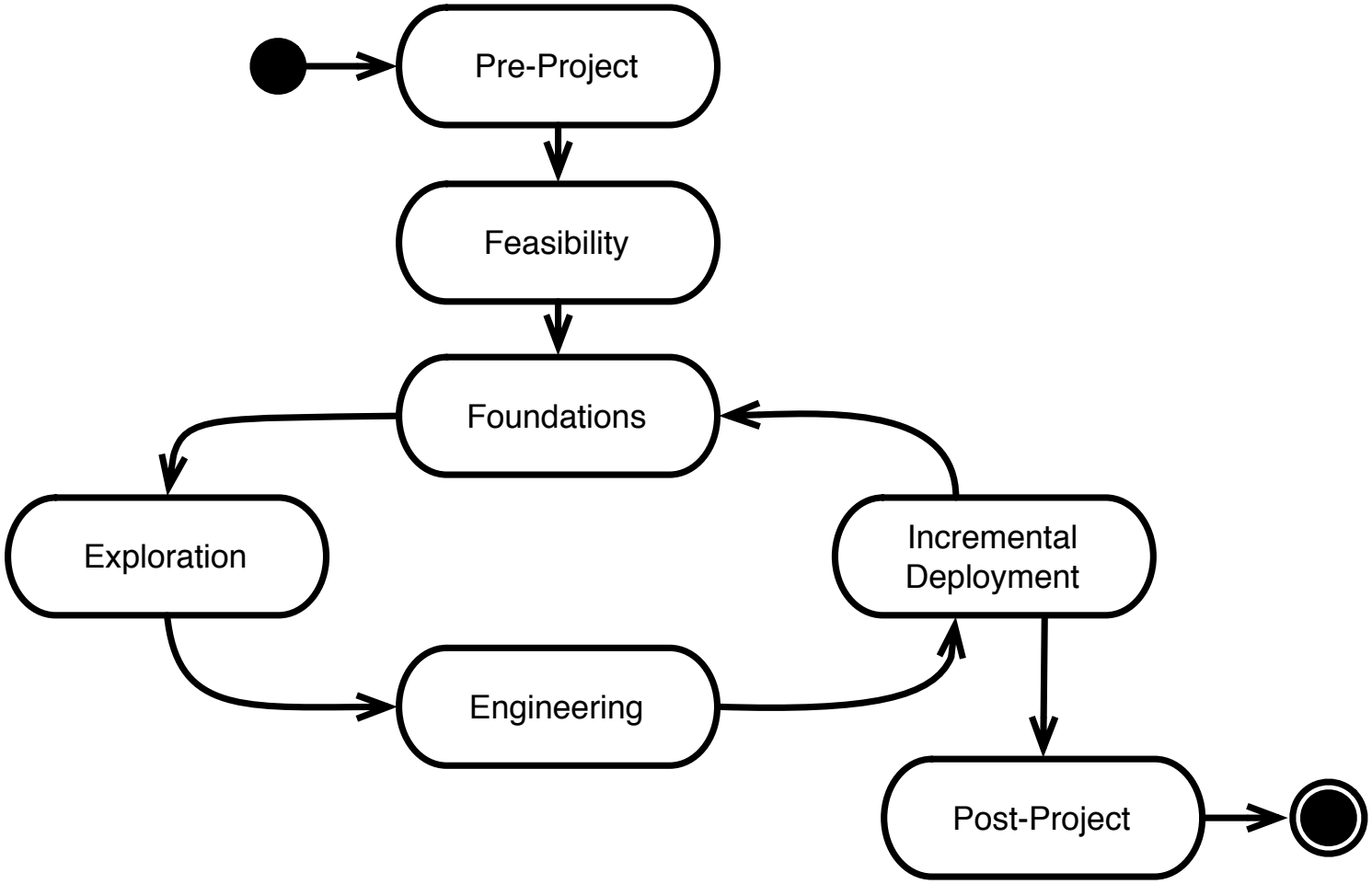
- Customer satisfaction
- Working software delivered frequently
- Working software is the principal measure of progress
- Late changes in requirements = no problem
- Close, daily cooperation
- Face2Face & Co-location
- Projects built around individuals
- Attention to technical excellence and good design
- Simplicity
- Adaptation

DSDM

Dynamic System Development Method

- It starts from the experience of RAD (Rapid Application Development)
- Key considerations:
  - people are the key to project success
  - change is inevitable
  - no software is perfect the first time it is released
- Standardized and supported by a consortium

DSDM


Pre-Project
Feasibility
Foundations
Exploration
Incremental Deployment
Engineering
Post-Project

Extreme Programming

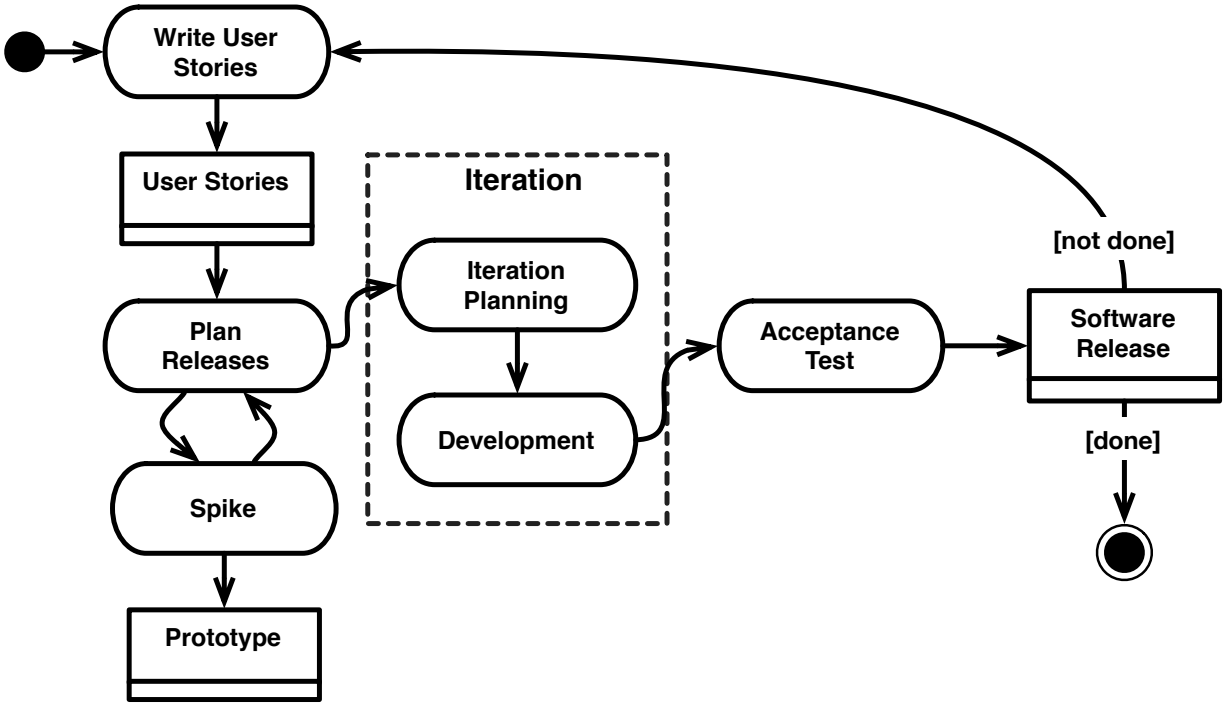
Extreme Programming

- XP takes proven practices to the extreme
  - If testing is good, let everybody test all the time
  - If code reviews are good, review all the time
  - If design is good, refactor all the time
  - If integration testing is good, integrate all the time
  - If simplicity is good, do the simplest thing that could possibly work
  - If short iterations are good, make them really, really short
- XP is based on:
  - values
  - practices
  - process

XP values

- **Communication:** open and honest
- **Feedback:** honest and rapid (close the look quickly to make feedback effective)
- **Simplicity:** K.I.S.S.
- **Courage:** take the right decisions, even if they are difficult (if it can't be done, say it!)

XP Process



- Planning
- Management
- Design
- Coding
- Testing

XP Planning

- User stories are written
- Release planning creates the release schedule
- Make frequent small releases
- The project is divided into iterations
- Iteration planning starts each iteration

XP Management

- Give the team a dedicated open work space
- Set a sustainable pace
- A stand up meeting starts each day
- The Project Velocity is measured
- Move people around
- Fix XP when it breaks

XP Design

- Simplicity
- Choose a system metaphor
- Use CRC cards for design sessions
- Create spike solutions to reduce risk
- No functionality is added early
- Refactor whenever and wherever possible

XP Coding

- The customer is always available
- Code must be written to agreed standards
- Code the unit test first
- All production code is pair programmed
- Only one pair integrates code at a time
- Integrate often
- Set up a dedicated integration computer
- Use collective ownership

XP Testing

- All code must have unit tests
- All code must pass all unit tests before it can be released
- When a bug is found tests are created
- Acceptance tests are run often and the score is published

Pair Programming

- Two programmers work on the same screen/keyboard (the Driver and the Navigator)
- Some considerations:
  - About 15% less output than 2 solo programmers
  - Continuous code review: better design, fewer defects
  - Confidence to add to or change the system
  - Discipline to always test and refactor
  - Teach each other how the system works (reduced staffing risks)
  - Learn from partner's knowledge and experience (enhances technical skills)

Simple design

- Do the simplest thing that could possibly work
- Passes all the tests
- No duplicate code
- States every intention
- Fewest possible classes and methods

Refactoring

- Design becomes everybody's daily business
- Continuously improve quality of the code
- Unit Tests and Pair Programming give courage
- Consequences:
  - Fast development speed
  - Code becomes easy to change

Why XP works

- Light-weight: discipline without bureaucracy
- Under stress, people do what is easiest
- All XP practices have short-term benefits as well as long-term benefits
- Development as a Conversation
- The code is the documentation
- XP is fun

XP Criticism

- Too many changes = higher costs
- “Scope creep” beyond what is agreed at the beginning of the project
- Requirements continuously updated
- No “Big Design” upfront
- Customer representative = single point of failure
- Generates stress
- Risk of non-technical representative dictating technical choices

Scrum

Scrum Approach

A team approach in which all players move together towards the same goal, setting the rhythm and adapating to change similar to what happens in rugby

Scrum Principles

- **Built-in instability:** broad goals and general strategic directions
- **Self-organizing project teams**
- **Overlapping development phases**
- **Multilearning**, so that the team can learn both from internal and external sources and adapt quickly to changing conditions and environments.
- **Subtle control:** steer the project without interfering too much (e.g., selecting the right people for the job, creating an open environment, tolerating and anticipating mistakes).
- **Organizational transfer of learning:** by ensuring that the know-how acquired in a project is transferred and reused in other projects.

Scrum has been used by:

- Microsoft
- Yahoo
- Google
- Electronic Arts
- IBM
- Lockheed Martin
- Philips
- Turner Broadcasting
- Oce
- Siemens
- Nokia
- Capital One
- Nielsen Media
- First American Real Estate
- BMC Software
- Ipswitch
- John Deere
- Lexis Nexis
- Intuit
- Sabre
- Salesforce.com
- Time Warner
- BBC

source

Scrum has been used for:

- Commercial software
- In-house development
- Contract development
- Fixed-price projects
- Financial applications
- ISO 9001-certified applications
- Embedded systems
- 24x7 systems with 99.999% uptime requirements
- the Joint Strike Fighter
- Video game development
- FDA-approved, life-critical systems
- Satellite-control software
- Websites
- Handheld software
- Mobile phones
- Network switching applications
- ISV applications
- Some of the largest applications in use

source

The Scrum Roles

Scrum Roles in One Slide

- Scrum Master
  - Facilitator, ensures Scrum is applied and the team can operate and work
  - Shields team from external interferences
- Product owner
  - Defines the features of the product, decides priorities, accepts or rejects work
- Team
  - Self organized, ideally full-time, small (5-9)

The Scrum Master

- Represents management to the project
- Responsible for enacting Scrum values and practices
- Removes impediments
- Ensure that the team is fully functional and productive
- Enable close cooperation across all roles and functions
- Shield the team from external interferences

source

Product owner

- Define the features of the product
- Decide on release date and content
- Be responsible for the profitability of the product (ROI)
- Prioritize features according to market value
- Adjust features and priority every iteration, as needed
- Accept or reject work results

source

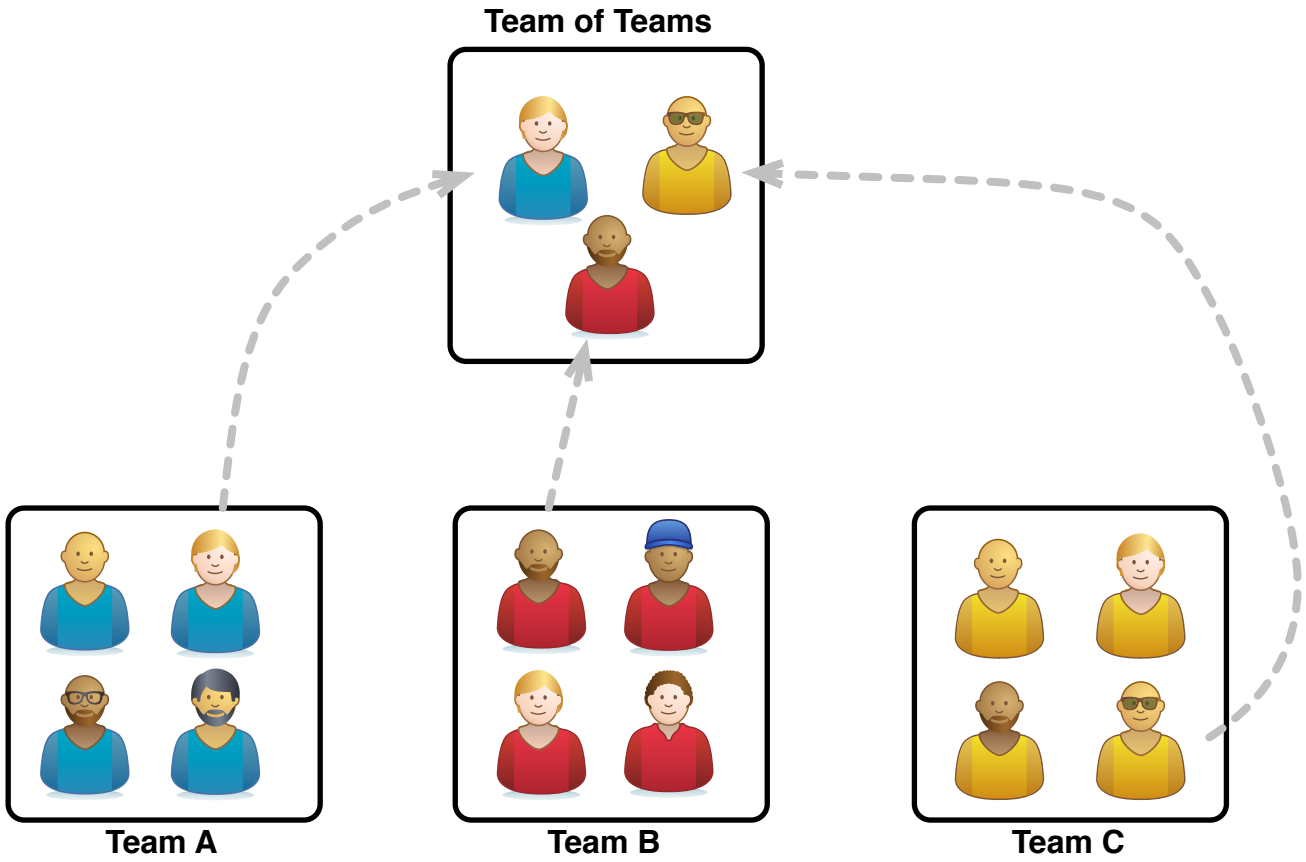
The team

- Typically 5-9 people
- Cross-functional:
  - Programmers, testers, user experience designers, etc.
- Members should be full-time
  - May be exceptions (e.g., database administrator)
- Teams are self-organizing
  - Ideally, no titles but rarely a possibility
- Membership should change only between sprints

source

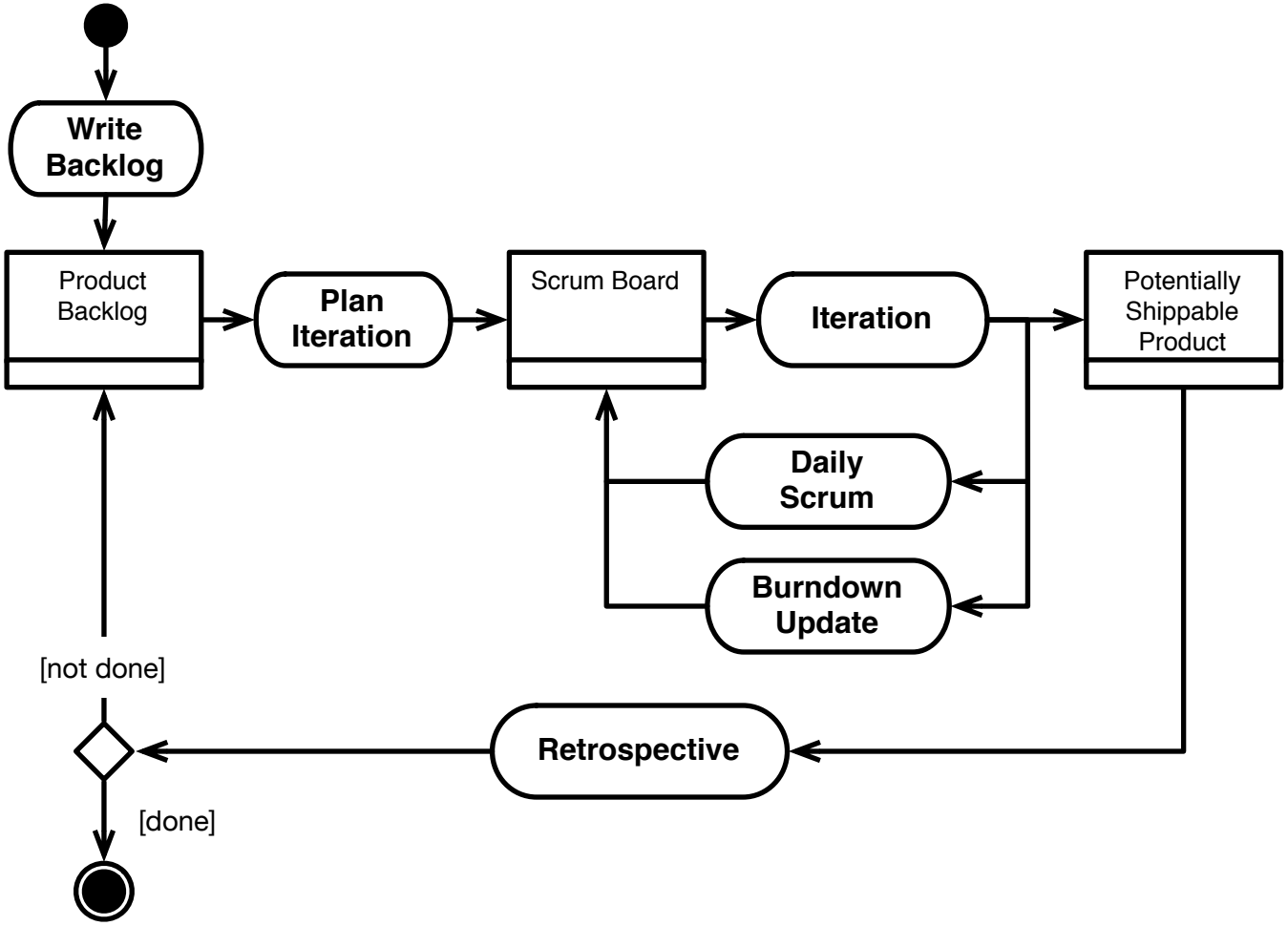
Team of Teams

- For large projects teams of teams can be organized:



The Scrum Process

The Scrum Process



The Product Backlog

User Stories

- The three Cs:
  - **Cards:** traditionally on note cards with annotations
  - **Conversation:** details behind the story come out during conversation with the product owner
  - **Confirmation:** details take the form acceptance tests confirm the story was understood right and coded correctly

As a **Client of the Hotel** I want to **cancel a reservation**

As a <role> I want to achieve <goal> (so that <reason>)

source

What Makes a Good Story

Independent	to simplify estimation
Negotiable	stories are not contracts; leave space for negotiation
Valuable	to the customer
Estimatable	they are the basis for planning
Sized Appropriately	break them into smaller ones, if necessary
Testable	

source

Some Advantages

- Easy to comprehend and manage
- Right size for planning (btw, similar approach to FP)
- Encourage iterative development
- They support opportunistic development (top-down and bottom-up approaches)
- Stories support participatory design
- Verifiable

The Product backlog

- The Product Backlog is a list of user stories, possibly annotated with additional information, such as:
  - Initiator
  - Priority
  - Cost
  - Owner
  - How to demo/test
  - …

Sprint Planning

Sprints

- Scrum projects make progress in a series of “sprints” lasting between 2 and 4 weeks
- Emphasis on rhythm
- Product backlog items are allocated and developed during a sprint
- Once items are allocated, during a sprint no changes are possible
- Plan sprint durations around how long you can commit to keeping change out of the sprint

Sprint Planning

- Goal: collaboratively decide what stories end up in the sprint
- Activities involved
  - **Prioritize:** decide what the sprint will focus on (short narrative) and select stories accordingly
  - Break users stories into **tasks**
  - **Estimate** using planning poker (Delphi)
- Constraint: put all (and only) the stories the team can commit to

As a **Client of the Hotel** I want to **cancel a reservation**

Implement Reservation Class

Add view for cancelation

...

Estimating

- **Effort:**
  - simpler for people accustomed to traditional software development practices
- **Story points:**
  - abstract dimensionless measurements
  - provide a relative ordering of user stories
  - allows to compute velocity (how fast the team implements story points) and, therefore, to the number of story points allocatable in a sprint
  - defines an “algebra” of story points (10 story points require the same time as two 5 story points user stories)

source

Planning Poker® - an example

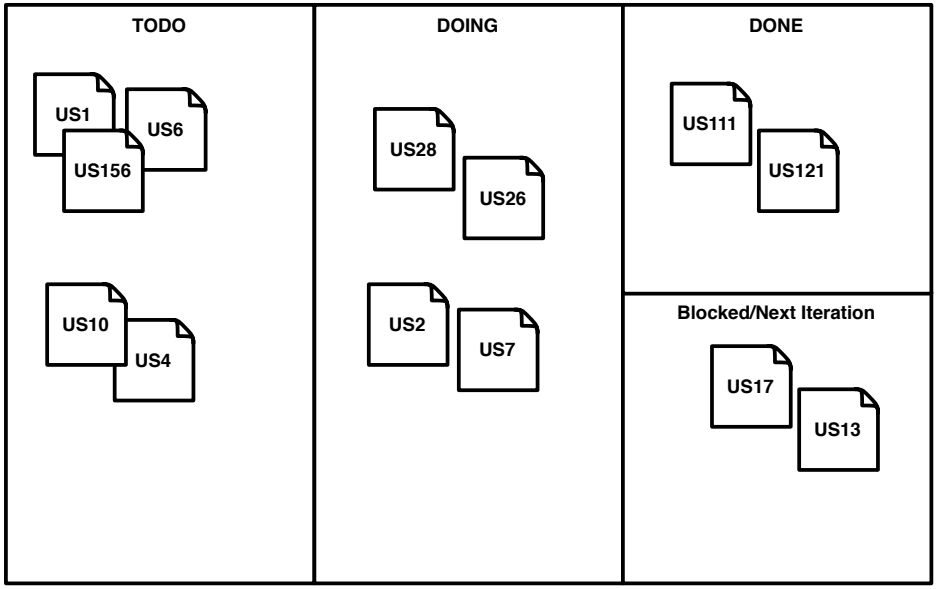
Estimator	Round 1	Round 2
Susan	3	5
Vadim	8	5
Ann	2	5
Chris	5	8

http://store.mountaingoatsoftware.com/products/planning-poker-cards

Running the Sprint and Tracking

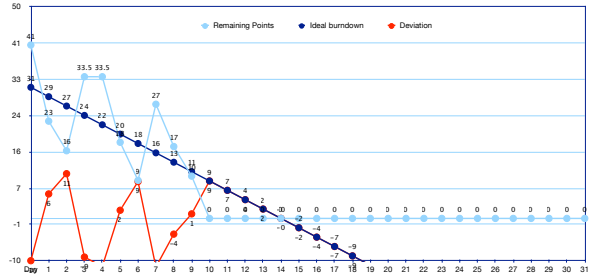
Scrum Tracking

- Two main goals:
  - Keep track of the work (todo, doing, done, blocked)
  - Measure the team “velocity” (sprints of fixed length means velocity is the important measure)



Sprint Detail

Sprint Number	1
Duration	14
Allocated Points	31
Ideal Average Point Burndown	2.2142857142857



TASK ID	RESP.	TASK	Actual Points	Day 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	1	Migration of events data in production database	10	2	2	2	2	1	1	1	1	1																						
2	1	Table ordering through javascript/Ajax	5	5	0	0	0	0	0	0	0	0																						
3	1	Views with pending admissions	3	3	3	3	3	3	0	0	0	0																						
4	1	Views with pending renewals	3	3	3	3	3	3	0	0	0	0																						
5	1	Views with inactive members	3	3	3	3	3	3	0	0	0	0																						
6	1	Export data to CSV for merge printing	3	3	3	1	1	1	1	1	1	1																						
7	1	"Approximated" bit on dates related to events (only	2	2	2	2	2	2	2	2	2	2																						
8	1	Management of interest bits	1	1	1	1	1	1	1	1	0	0																						
9	1	Management of remarks field	1	1	1	1	1	1	1	1	0	0																						
10	1	User Interface/Layout	2			2	0	0	0	0	0	0																						
11	1	Table paging	5			5	5	0	0	0	0	0																						
12	1	Fix problem with search and locale/	3			3	3	3	3	3	3	3																						
13	1	Make search box standard on all tables				7.5	7.5	0	0	0	0	0																						
14	1	Application title					2	0	0	0	0	0																						
15	5	Authentication - with roles and multiple users								15	7	0																						
16	5	Distinguish actions from links								3	3	3																						
		Remaining Days	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	-16	-17
		Remaining Points	41	23	16	33.5	33.5	18	9	27	17	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Ideal burndown	31	28.78	26.5	24.3	22.1	19.9	17.7	15.5	13.2	11.0	8.85	6.64	4.42	2.21	-0.0	-2.2	-4.4	-6.6	-8.8	-11.(	-13.(	-15.(	-17.(	-19.(	-22.	-24.	-26.(	-28.(	-31	-33.(	-35.(	-37.(
		Deviation	-10	5.783	10.5	-9.1	-11.	1.92	8.71	-1.(	-3.7(	1.07	8.85	6.64	4.42	2.21	-0.0	-2.2	-4.4	-6.6	-8.8	-11.(	-13.(	-15.(	-17.(	-19.(	-22.	-24.	-26.(	-28.(	-31	-33.(	-35.(	-37.(

Adapting/Computing Speed

- What if:
  - Speed is **higher** than expected: add stories
  - Speed is **lower** than expected: remove stories
- Speed is estimated according to historical data
- Velocity tends to converge after a few sprints
- Initial estimation is a guess or uses effort

Adapting/Computing Speed

- Between sprints, it is possible to accommodate for changes in effort, by inserting effort in the estimation:

$$\text{efficiency}_i = \frac{\text{actual velocity}_i}{\text{actual effort}_i}$$

$$\text{est. velocity}_{(i+1)} = \text{efficiency}_i \times \text{effort}_{(i+1)}$$

Managing the Scrum Process

The Daily Scrum

- A daily 15-minutes stand-up meeting for the whole team (including product owner)
- Everyone is invited (but only to listening)
- Emphasizes commitment
- Answer to three questions:
  - What did you do yesterday?
  - What will you do today?
  - What is blocking your work? (impediments)
- Impediments become the responsibility of the Scrum Master

The Sprint Review

- Each sprint ends with a demoable product (potentially shippable product): a piece of software, a mockup, a manual, …
- The Sprint Review has the goal of demoing the output of the sprint
- Everyone participates
- Informal if focuses on demos (rather than slides)

The Sprint Retrospective

- After every sprint the team takes a look at what is and is not working
- Not very long: 15–30 minutes
- Whole team participates
- One approach is start-stop-continue:
  - What we need to start doing
  - What we should stop doing
  - What we should continue doing

Software Development Practices

- According to Cohn SCRUM entails the adoption of some practices typical of Agile processes such as
  - Pair programming
  - Test-first approach
  - Automated testing and integration
  - Refactoring
- ... they are not necessary, but make SCRUM really effective