Software Engineering

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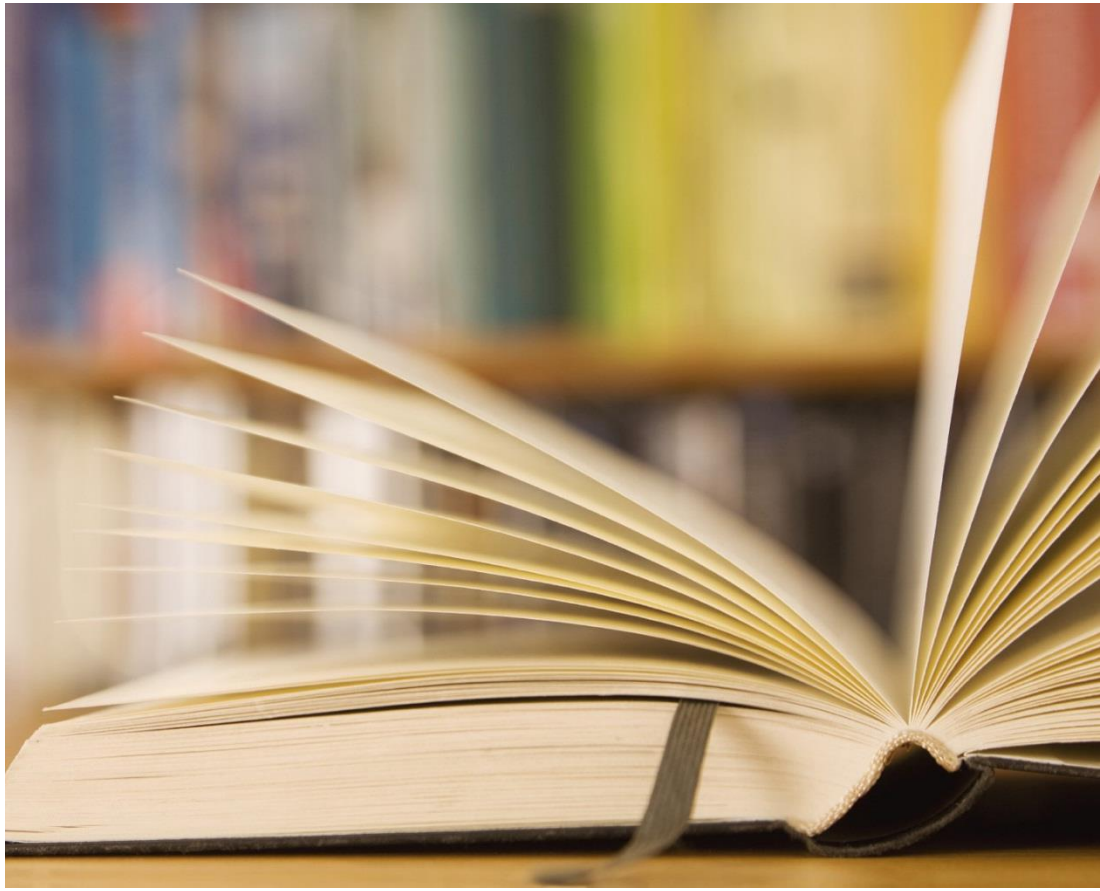


In Software

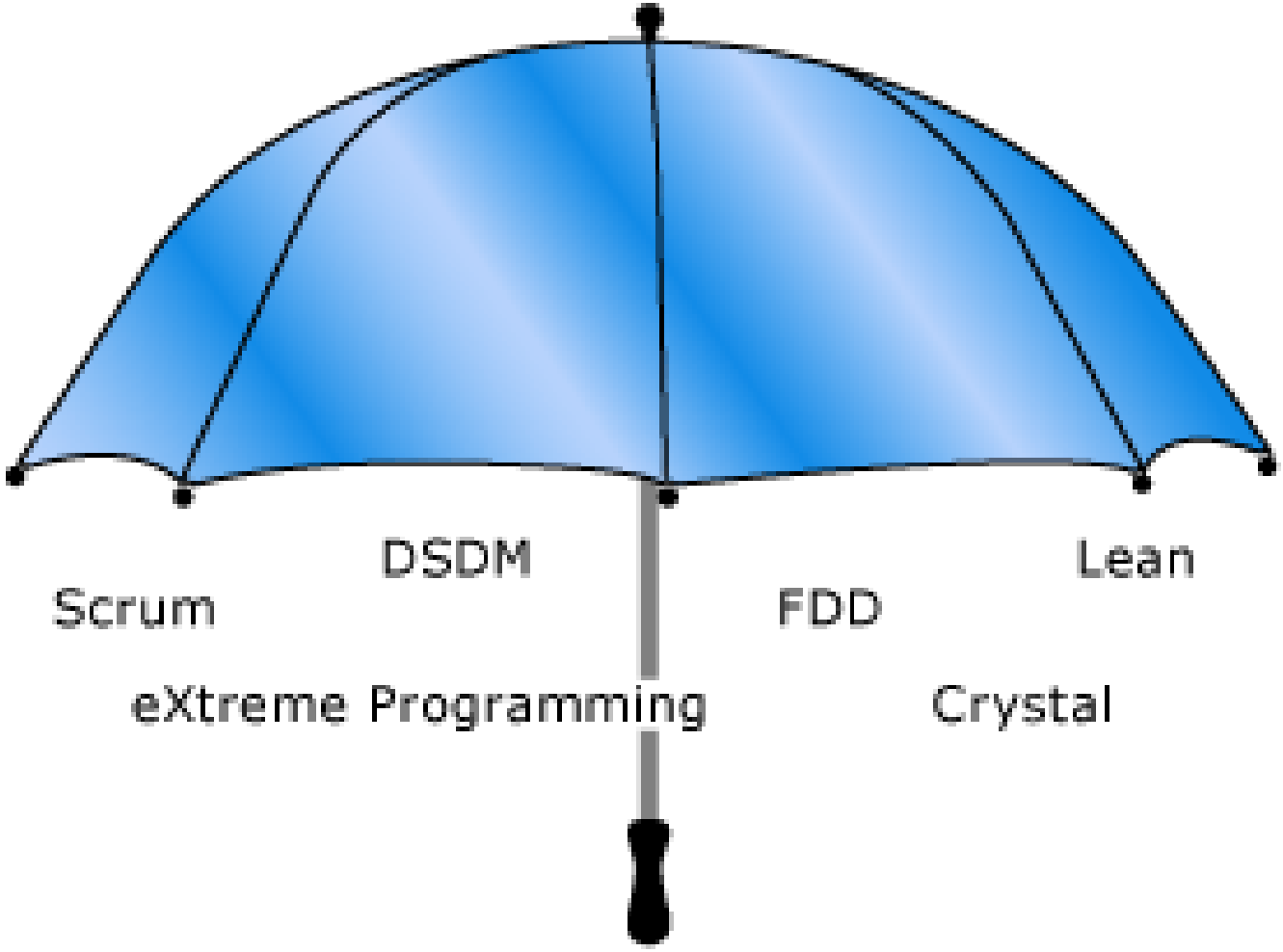
One thing is constant

that is

Change

What is Agile

What is Agile

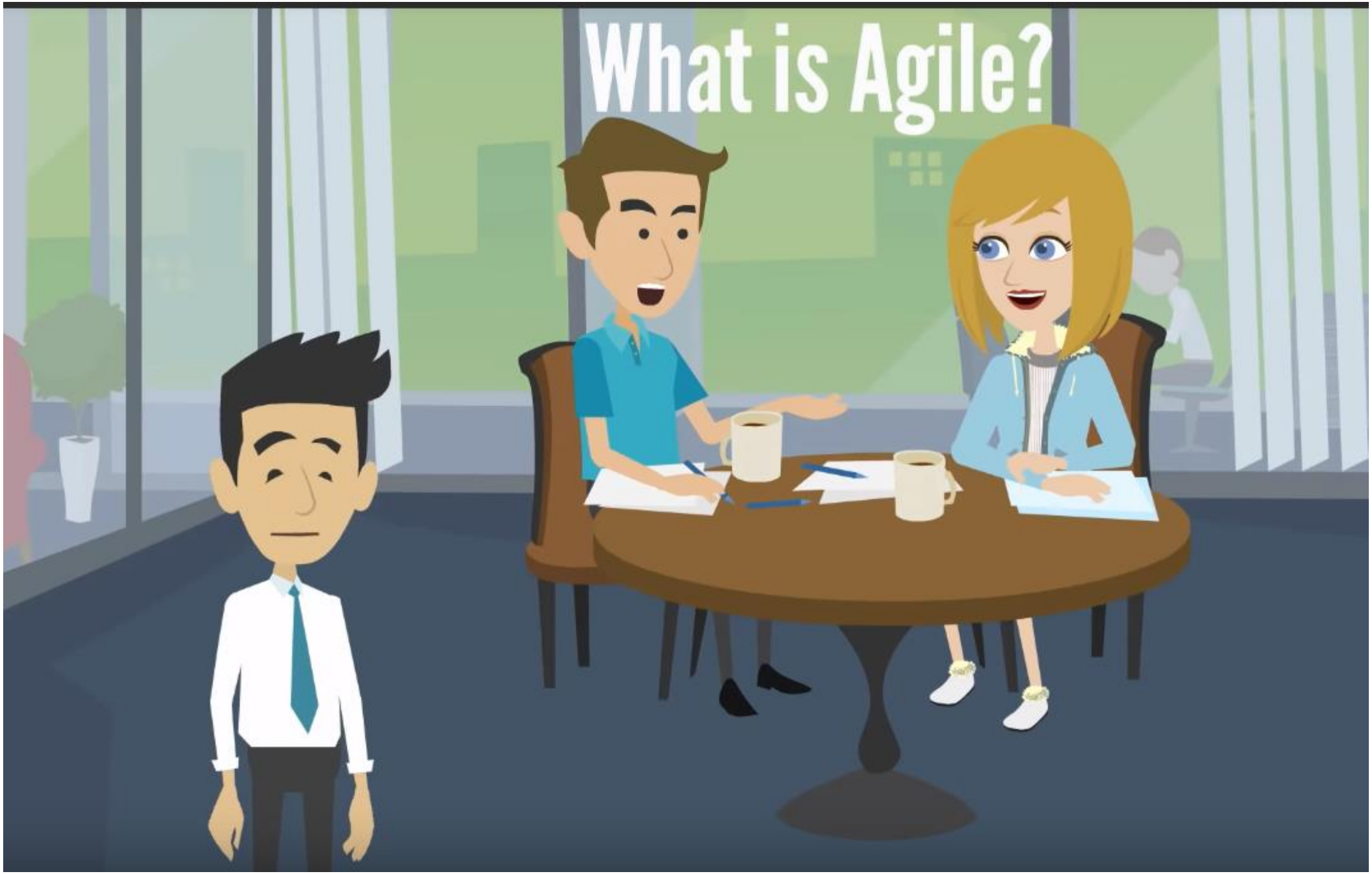


Agile Development

Rapid software development

- **Rapid development and delivery** is now often the **most important requirement** for software systems
  - Businesses operate in a fast-changing requirement and it is practically impossible to produce a set of stable software requirements
  - Software has to evolve quickly to reflect changing business needs.

- Plan-driven development is essential for some types of system but does not meet these business needs.
- Agile development methods emerged in the late 1990s whose aim was to radically reduce the delivery time for working software systems

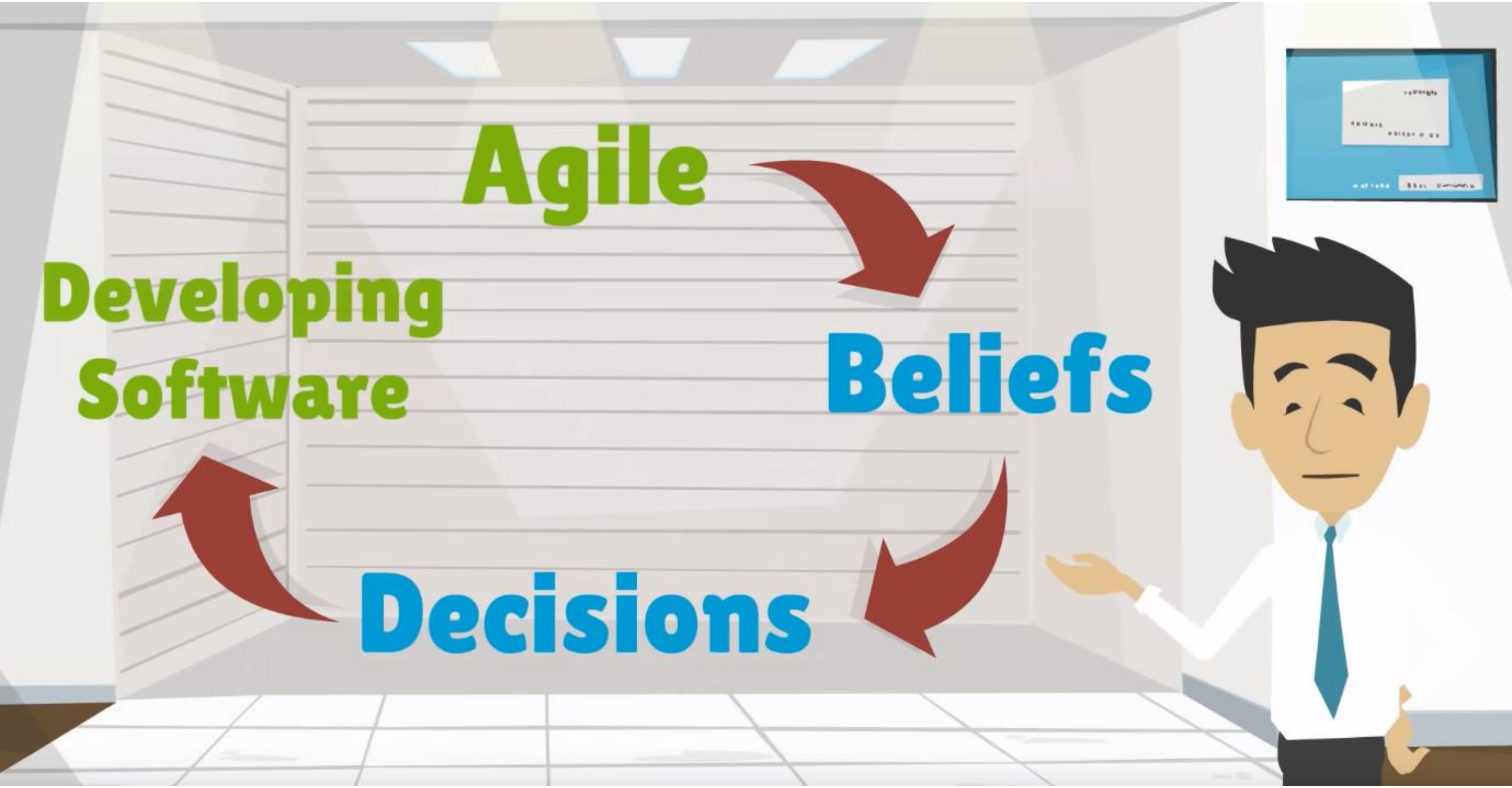

What is Agile?

Agile is not a:

- ~~Methodology~~
- ~~Specific Way Of Developing Software~~
- ~~Framework or Process~~

Agile is a set of Values and Principles


Standup


Agile
Developing
Software
Beliefs
Decisions

What agile is , it is surprisingly flexible

Agile doesn’t make decisions for you

Instead it gives a foundation for teams to make decisions that result in better software development

Value more than

- Individuals and Interactions
- Working software
- Customer collaboration
- Responding to change

- Processes and tools
- Comprehensive documentation
- Contract negotiation
- Following a plan

12 Principles of Agile

they're about
giving you
the ability to make
a good decision

12 Principles of Agile

Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.

12 Principles of Agile

Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.

12 Principles of Agile

Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.

4

12 Principles of Agile

Business people and developers must work together daily throughout the project.

12 Principles of Agile

Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.

6

12 Principles of Agile

The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.

7

12 Principles of Agile

Working software is the primary measure of progress.

12 Principles of Agile

Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.

9

12 Principles of Agile

Continuous attention to technical excellence and good design enhances agility.

10

12 Principles of Agile

Simplicity –the art of maximizing the amount of work not done– is essential.

11

12 Principles of Agile

The best architectures, requirements, and designs emerge from self-organizing teams.

12

12 Principles of Agile

At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.


Manifesto for Agile Software Development
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.

Principles behind the Agile Manifesto

We follow these 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(control) 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.

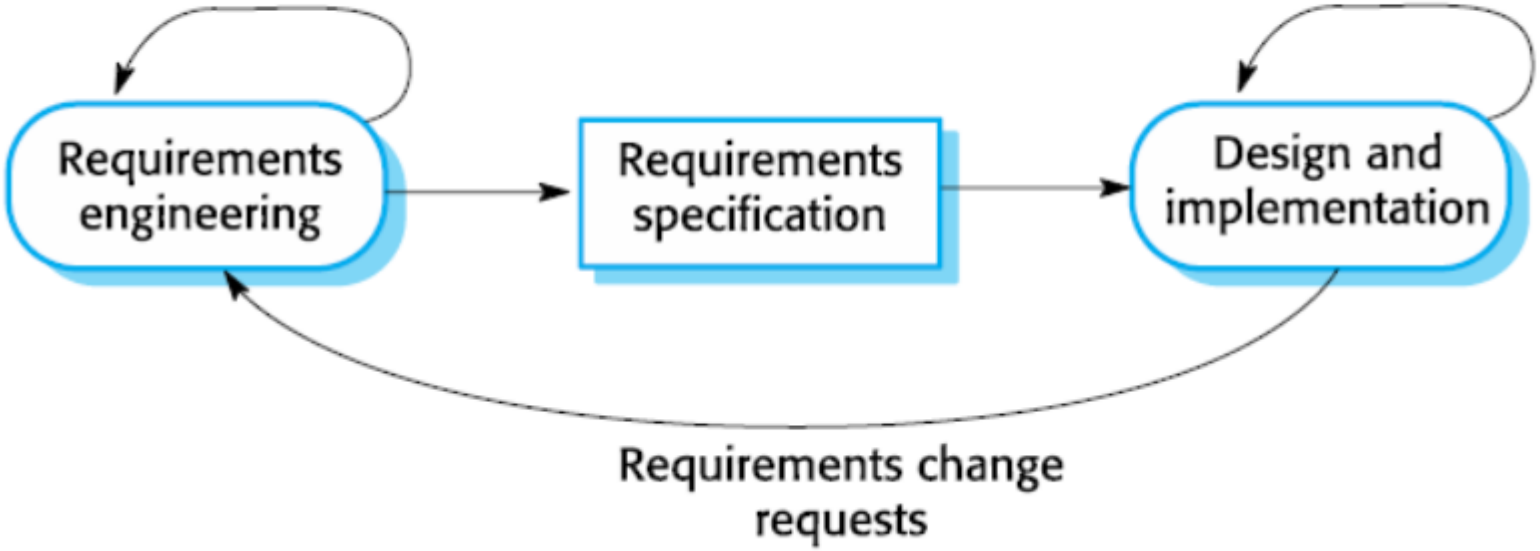
Principles behind the Agile Manifesto

- 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.

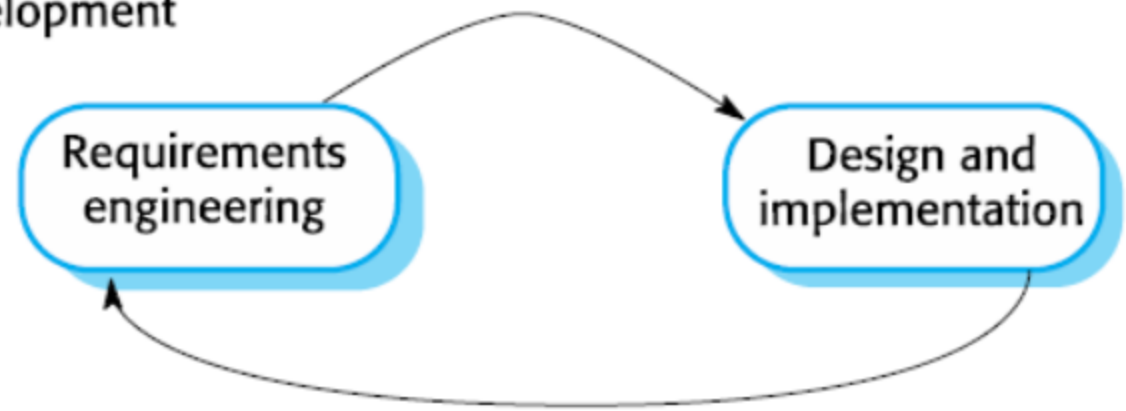
Principles behind the Agile Manifesto

- **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.

Plan-based development



Agile development



What is “Agility”?

- Effective (rapid and adaptive) **response to change**
- Effective communication among all stakeholders
- Drawing the **customer onto the team**
- Organizing a team so that it is in control of the work performed

Yielding …

- Rapid, incremental delivery of software

An Agile Process

- Is driven by customer descriptions of what is required (scenarios)
- Recognizes that plans are short-lived
- Develops software iteratively with a heavy emphasis on construction activities
- Delivers multiple ‘software increments’
- Adapts as changes occur

Principles of agile methods

Principle	Description
Customer involvement	The customer should be closely involved throughout the development process. Their role is provide and prioritise new system requirements and to evaluate the iterations of the system.
Incremental delivery	The software is developed in increments with the customer specifying the requirements to be included in each increment.
People not process	The skills of the development team should be recognised and exploited. The team should be left to develop their own ways of working without prescriptive processes.
Embrace change	Expect the system requirements to change and design the system so that it can accommodate these changes.
Maintain simplicity	Focus on simplicity in both the software being developed and in the development process used. Wherever possible, actively work to eliminate complexity from the system.

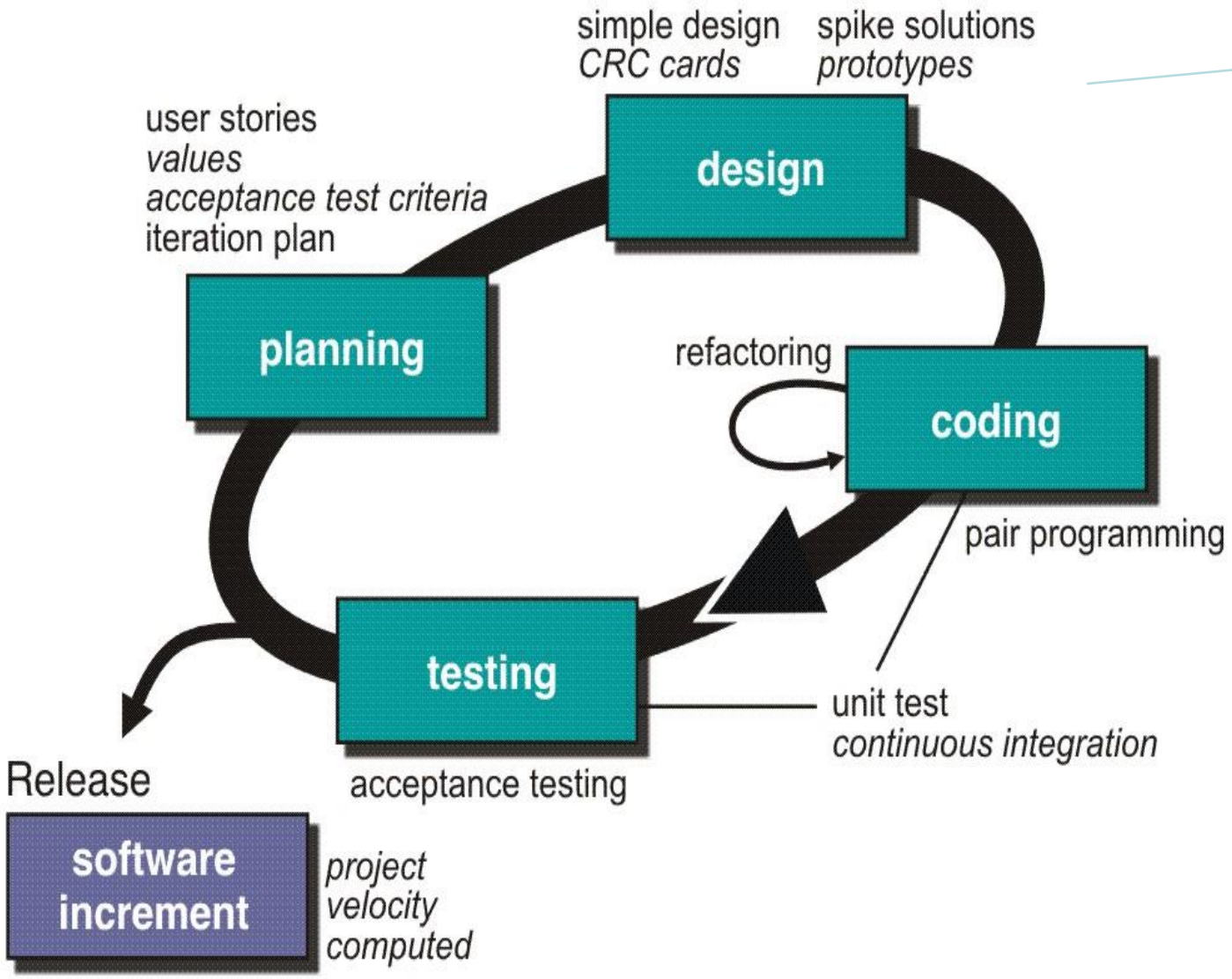
Agile process models

- Extreme Programming (XP)
- Scrum
- Adaptive Software Development
- Dynamic System Development Method (DSDM)
- Crystal
- Feature Driven Development
- Agile Modeling (AM)

Extreme Programming (XP)

- Perhaps the **best-known and most widely** used agile method.
- Extreme Programming (XP) takes an ‘extreme’ approach to iterative development.
  - New versions may be built several times per day;
  - Increments are delivered to customers every 2 weeks;
  - All tests must be run for every build and the build is only accepted if tests run successfully.
- XP Values
  - Communication
  - Simplicity
  - Feedback
  - Courage
  - Respect

Extreme Programming (XP)



http://www.extremeprogramming.org/rules/spike.html

Extreme Programming (XP)

- XP Planning
  - Begins with the creation of **user stories**
  - Agile team assesses each story and assigns a **cost**
  - Stories are grouped to for a **deliverable increment**
  - A **commitment** is made on delivery date
  - After the first increment **project velocity** is used to help define subsequent delivery dates for other increments

Extreme Programming (XP)

- XP Design
  - Follows the (keep it simple) principle
  - Encourage the use of CRC (class-responsibility-cards) cards
  - For difficult design problems, suggests the creation of spike solutions — a design prototype
  - Encourages refactoring — an iterative refinement of the internal program design

- XP Coding
  - Recommends the construction of a unit test for a story *before* coding commences
  - Encourages pair programming

Extreme Programming (XP)

- XP Testing
  - All unit tests are executed daily
  - Acceptance tests are defined by the customer and executed to assess customer visible functionality

XP and agile principles

- Incremental development is supported through small, frequent system releases.
- Customer involvement means full-time customer engagement with the team.
- People not process through pair programming, collective ownership and a process that avoids long working hours.
- Change supported through regular system releases.
- Maintaining simplicity through constant refactoring of code.

Customer involvement

- Customer involvement is a key part of XP where the customer is part of the development team.

- **The role of the customer is:**

  – To help **develop stories** that define the requirements

  – To help **prioritize the features** to be implemented in each release

  – To help **develop acceptance tests** which assess whether or not the system meets its requirements.

Requirements scenarios

- In XP, user requirements are expressed as scenarios or user stories.
- These are written on cards and the development team break them down into implementation tasks. These tasks are the basis of schedule and cost estimates.
- The customer chooses the stories for inclusion in the next release based on their priorities and the schedule estimates.

Story card for document downloading

Downloading and printing an article

First, you select the article that you want from a displayed list. You then have to tell the system how you will pay for it - this can either be through a subscription, through a company account or by credit card.

After this, you get a copyright form from the system to fill in and, when you have submitted this, the article you want is downloaded onto your computer.

You then choose a printer and a copy of the article is printed. You tell the system if printing has been successful.

If the article is a print-only article, you can't keep the PDF version so it is automatically deleted from your computer.

XP and change

- Conventional wisdom in software engineering is to design for change. It is worth spending time and effort anticipating changes as this reduces costs later in the life cycle.

- It proposes constant code improvement (refactoring) to make changes easier when they have to be implemented.

Refactoring

- Refactoring is the process of code improvement where code is re-organised and rewritten to make it more efficient, easier to understand, etc.

- Refactoring is required because frequent releases mean that code is developed incrementally and therefore tends to become messy.

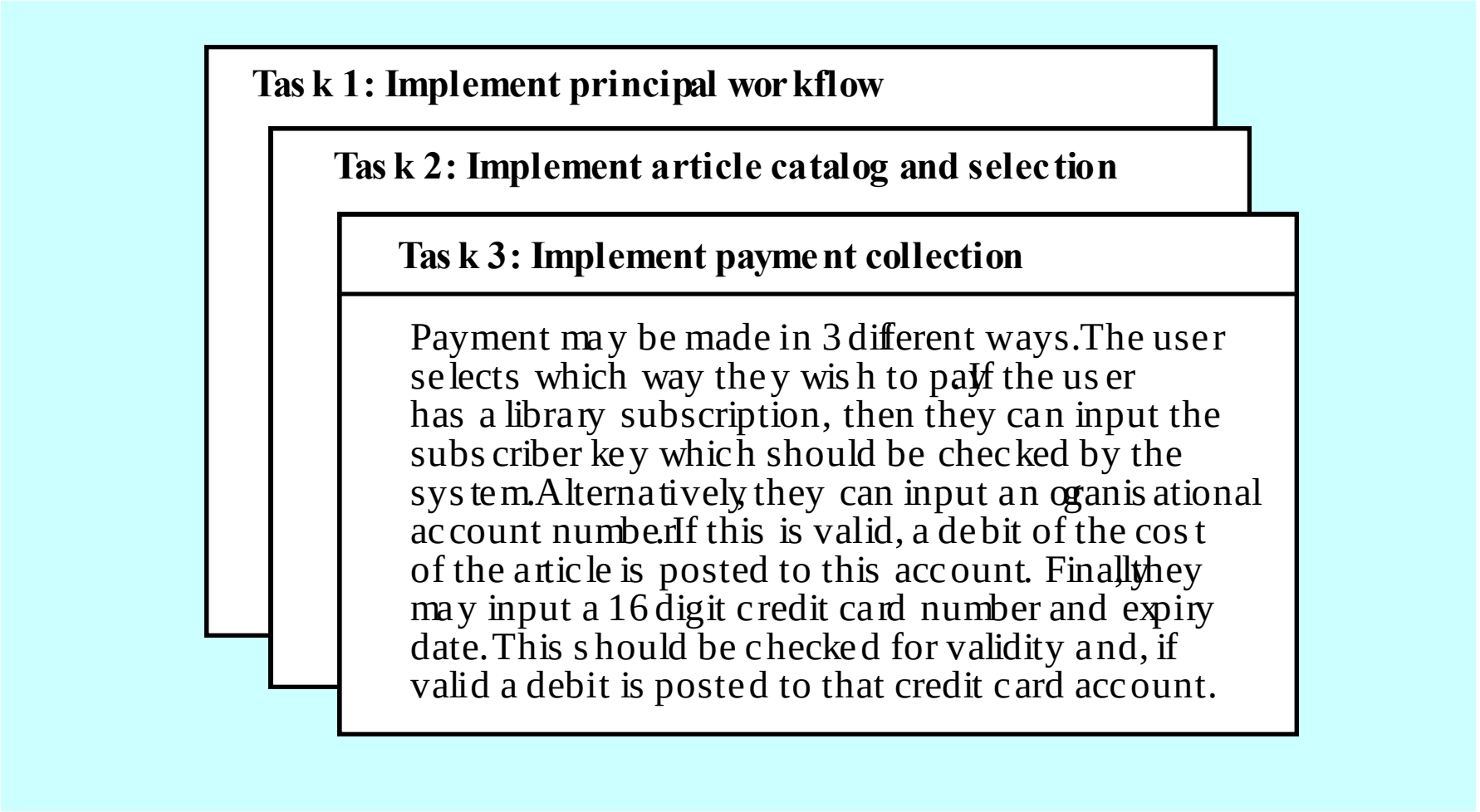
- Refactoring should not change the functionality of the system.

- Automated testing simplifies refactoring as you can see if the changed code still runs the tests successfully.

Testing in XP

- Test-first development.
- Incremental test development from scenarios.
- **User involvement** in test development and validation.
- **Automated test harnesses** are used to run all component tests each time that a new release is built.

Task cards for document downloading



Test case description

Test 4: Test credit card validity

Input:
A string representing the credit card number and two integers representing the month and year when the card expires

Tests:
Check that all bytes in the string are digits
Check that the month lies between 1 and 12 and the year is greater than or equal to the current year
Using the first 4 digits of the credit card number, check that the card issuer is valid by looking up the card issuer table. Check credit card validity by submitting the card number and expiry date infomation to the card issuer

Output:
OK or error message indicating that the card is invalid

Test-first development

- Writing tests before code clarifies the requirements to be implemented.
- Tests are written as programs rather than data so that they can be executed automatically. The test includes a check that it has executed correctly.
- All previous and new tests are automatically run when new functionality is added. Thus checking that the new functionality has not introduced errors.

Pair programming

- In XP, programmers work in pairs, sitting together to develop code.
- This helps develop common ownership of code and spreads knowledge across the team.
- It serves as an informal review process as each line of code is looked at by more than 1 person.
- It encourages refactoring as the whole team can benefit from this.
- Measurements suggest that development productivity with pair programming is similar to that of two people working independently.

Problems with XP

- Customer involvement
  - This is perhaps the most difficult problem. It may be difficult or impossible to find a customer who can represent all stakeholders and who can be taken off their normal work to become part of the XP team. For generic products, there is no ‘customer’ - the marketing team may not be typical of real customers.
- Architectural design
  - The incremental style of development can mean that inappropriate architectural decisions are made at an early stage of the process.
  - Problems with these may not become clear until many features have been implemented and refactoring the architecture is very expensive.

- **Test complacency**
  - It is easy for a team to believe that because it has many tests, the system is properly tested.
  - Because of the automated testing approach, there is a tendency to develop tests that are easy to automate rather than tests that are ‘good’ tests.

Key points

- Extreme programming includes practices such as systematic testing, continuous improvement and customer involvement.
- Customers are involved in developing requirements which are expressed as simple scenarios.
- The approach to testing in XP is a particular strength where executable tests are developed before the code is written.
- Key problems with XP include difficulties of getting representative customers and problems of architectural design.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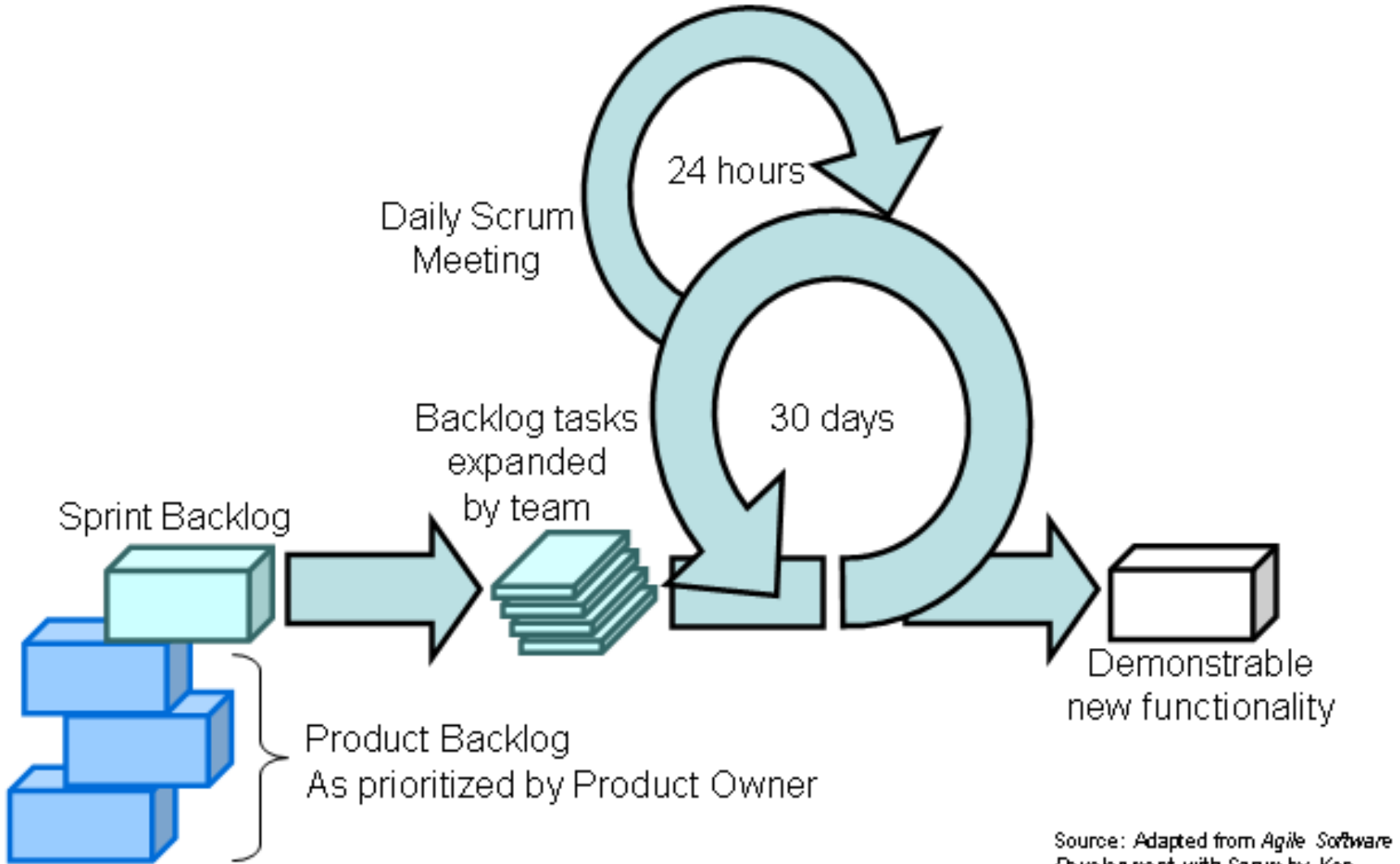
SPORT 2000

Scrum

- Emphasizes use of a set of software patterns
  - Backlog
  - Sprints
  - Scrum meetings

Scrum



Source: Adapted from *Agile Software Development with Scrum* by Ken Schwaber and Mike Beedle.

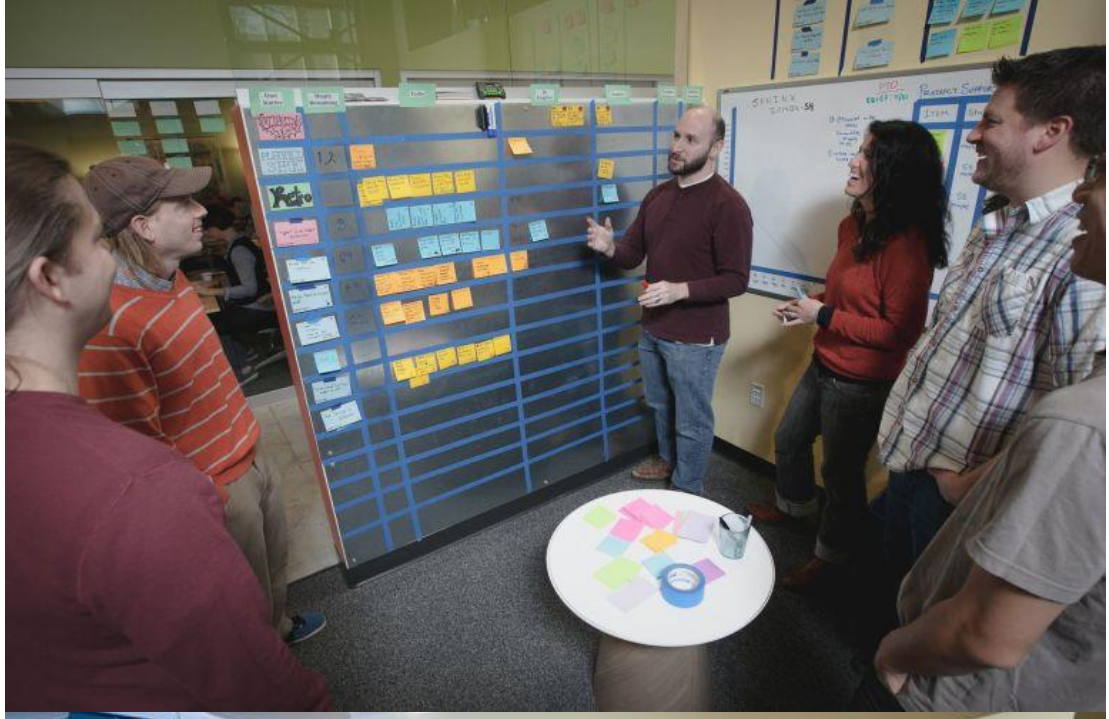
Scrum’s Roles

- The Product Owner(Project Sponsor, Decides features, release date, prioritization)
- The Scrum Master (-Typically a Project Manager or Team Leader
  -Responsible for endorsing Scrum values and practices
  -Remove weaknesses / politics, keeps everyone productive)
- The Team
- Everyone else is not part of Scrum

Scrum’s Practices

- The Sprint Planning Meeting
- The Sprint
- The Sprint Review Meeting
- The Daily Scrum

- *Everything else is not part of Scrum*



The Sprint Planning Meeting

- **Product Owner** describes **highest priority** features to the Team.

- **Team** decides what the can **commit** to **delivering** in the Sprint.

The Sprint Review Meeting

- **Time boxed** to **one hour** of prep and **four hours** of meeting.
- Team demonstrates product increment to product owner’s satisfaction.
- Informality is encouraged. PowerPoint is discouraged.

The Daily Scrum

- **Time** boxed to **fifteen minutes!**
- **The Team and the Scrum Master only.**
- What have you **accomplished** since yesterday?
- Are your Sprint Backlog **estimates accurate**?
- What are you working on today?
- Is there anything **blocking** you?

The Sprint Retrospective

- Time boxed to **three hours**.
- Team, Scrum Master, and (optionally) Product Owner review the **last Sprint**
- What went well?
- What can be improved?

- Actionable items are presented to the Product Owner for prioritization as non-functional requirements.

Scrum’s Artefacts

- The Product Backlog
- The Sprint Backlog
- The Sprint Burndown Chart
- The Product Increment
- Everything else is not part of Scrum

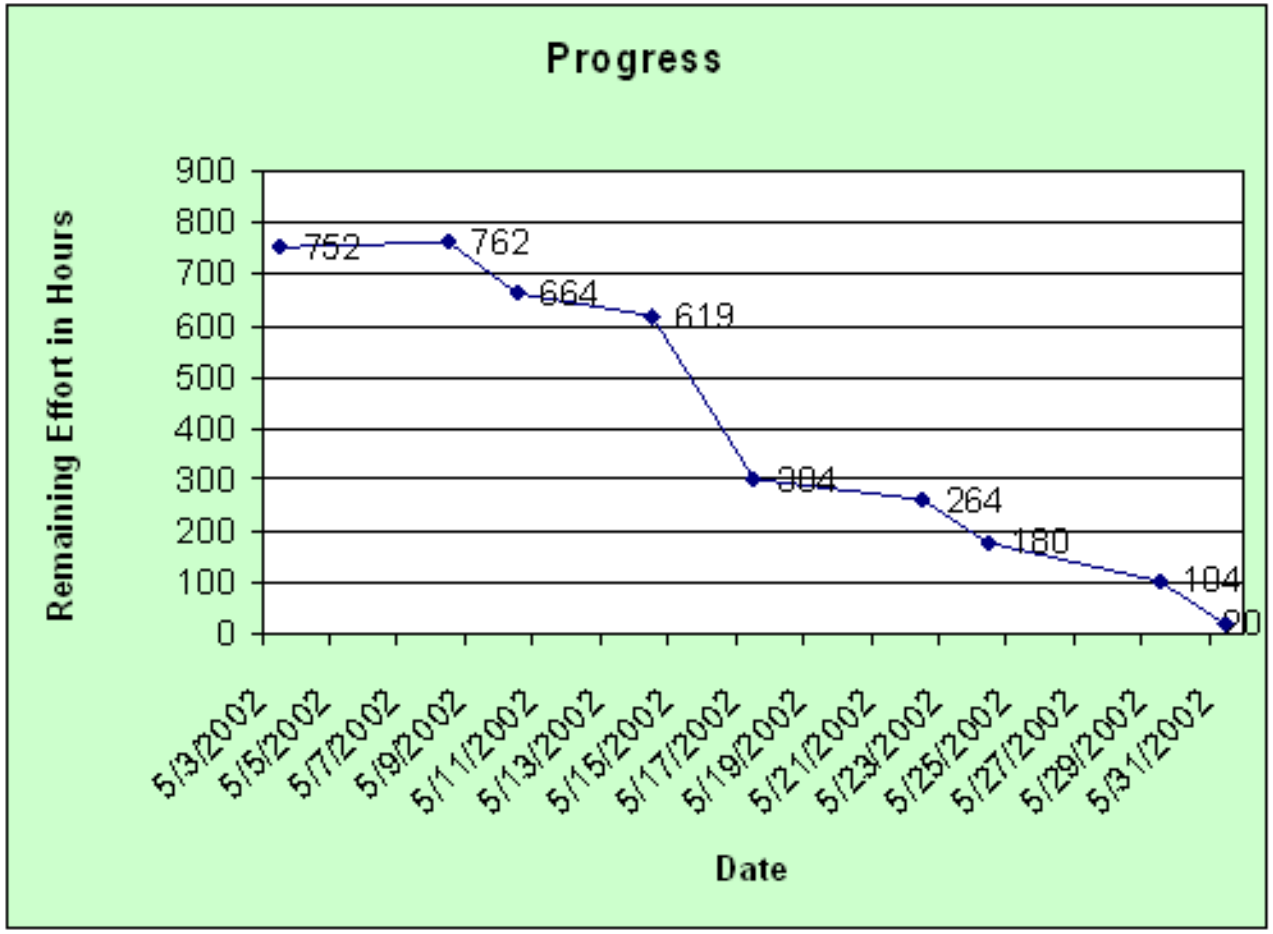
The Product Backlog

	Item #	Description	Est	By
Very High				
	1	**Finish database versioning**	16	KH
	2	**Get rid of unneeded shared Java in database**	8	KH
	-	**Add licensing**	-	-
	3	Concurrent user licensing	16	TG
	4	Demo / Eval licensing	16	TG
		Analysis Manager		
	5	File formats we support are out of date	160	TG
	6	Round-trip Analyses	250	MC
High				
	-	**Enforce unique names**	-	-
	7	In main application	24	KH
	8	In import	24	AM
	-	**Admin Program**	-	-
	9	Delete users	4	JM
	-	**Analysis Manager**	-	-
	10	When items are removed from an analysis, they should show up again in the pick list in lower 1/2 of the analysis tab	8	TG
	-	**Query**	-	-
	11	Support for wildcards when searching	16	T&A
	12	Sorting of number attributes to handle negative numbers	16	T&A
	13	Horizontal scrolling	12	T&A
	-	**Population Genetics**	-	-
	14	Frequency Manager	400	T&M
	15	Query Tool	400	T&M
	16	Additional Editors (which ones)	240	T&M
	17	Study Variable Manager	240	T&M
	18	Haplotypes	320	T&M
	19	**Add icons for v1.1 or 2.0**	-	-
	-	**Pedigree Manager**	-	-
	20	Validate Derived kindred	4	KH
Medium				
	-	**Explorer**	-	-
	21	Launch tab synchronization (only show queries/analyses for logged in users)	8	T&A
	22	Delete settings (?)	4	T&A

The Sprint Backlog

		Days Left in Sprint	15	13	10	8	
Who	Description		7/22/2002	7/24/2002	7/26/2002	7/31/2002	
		Total Estimated Hours:	**554**	**458**	**362**	**270**	**0**
-	**User's Guide**		-	-	-	-	-
SM	Start on Study Variable chapter first draft		16	16	16	16	
SM	Import chapter first draft		40	24	6	6	
SM	Export chapter first draft		24	24	24	6	
	Misc. Small Bugs						
JM	Fix connection leak		40				
JM	Delete queries		8	8			
JM	Delete analysis		8	8			
TG	Fix tear-off messaging bug		8	8			
JM	View pedigree for kindred column in a result set		2	2	2	2	
AM	Derived kindred validation		8				
	Environment						
TG	Install CVS		16	16			
TBD	Move code into CVS		40	40	40	40	
TBD	Move to JDK 1.4		8	8	8	8	
	Database						
KH	Killing Oracle sessions		8	8	8	8	
KH	Finish 2.206 database patch		8	2			
KH	Make a 2.207 database patch		8	8	8	8	
KH	Figure out why 461 indexes are created		4				

The Sprint Burndown Chart



The Product Increment

- Delivers **measurable value**
- “Potentially Shippable”: the process can be halted after every Sprint and there will be *some* value
- Must be a product, **no matter how incomplete**

Some reasons to avoid Scrum

- Your current software development produces acceptable results
- Your project cannot be **decomposed** into good, increment-able requirements **(“big ball of mud”)**
- Your engineering practices embrace heavy, up-front design, the construction of baroque frameworks, and throw-it-over-the-wall attitudes towards QA.
- Nobody can agree on ‘done-ness’
- Your management practices embrace ‘do it now and forget what I told you to do yesterday’.