

Agile Models



What is Agile Software Development?

- **Agile:** Easily moved, light, nimble, active software processes
- **How agility achieved?**
 - Fitting the process to the project
 - Avoidance of things that waste time

Agile Model

- To overcome the shortcomings of the waterfall model of development.
 - Proposed in mid-1990s
- The agile model was primarily designed:
 - To help projects to adapt to change requests
- In the agile model:
 - The requirements are decomposed into many small incremental parts that can be developed over one to four weeks each.

Ideology: 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

<http://www.agilemanifesto.org>

Agile Methodologies

- XP
- Scrum
- Unified process
- Crystal
- DSDM
- Lean

Agile Model: Principal Techniques

- **User stories:**
 - Simpler than use cases.
- **Metaphors:**
 - Based on user stories, developers propose a common vision of what is required.
- **Spike:**
 - Simple program to explore potential solutions.
- **Refactor:**
 - Restructure code without affecting behavior, improve efficiency, structure, etc.

- At a time, only one increment is planned, developed, deployed at the customer site.

Agile Model: Nitty Gritty

- **No long-term plans are made.**

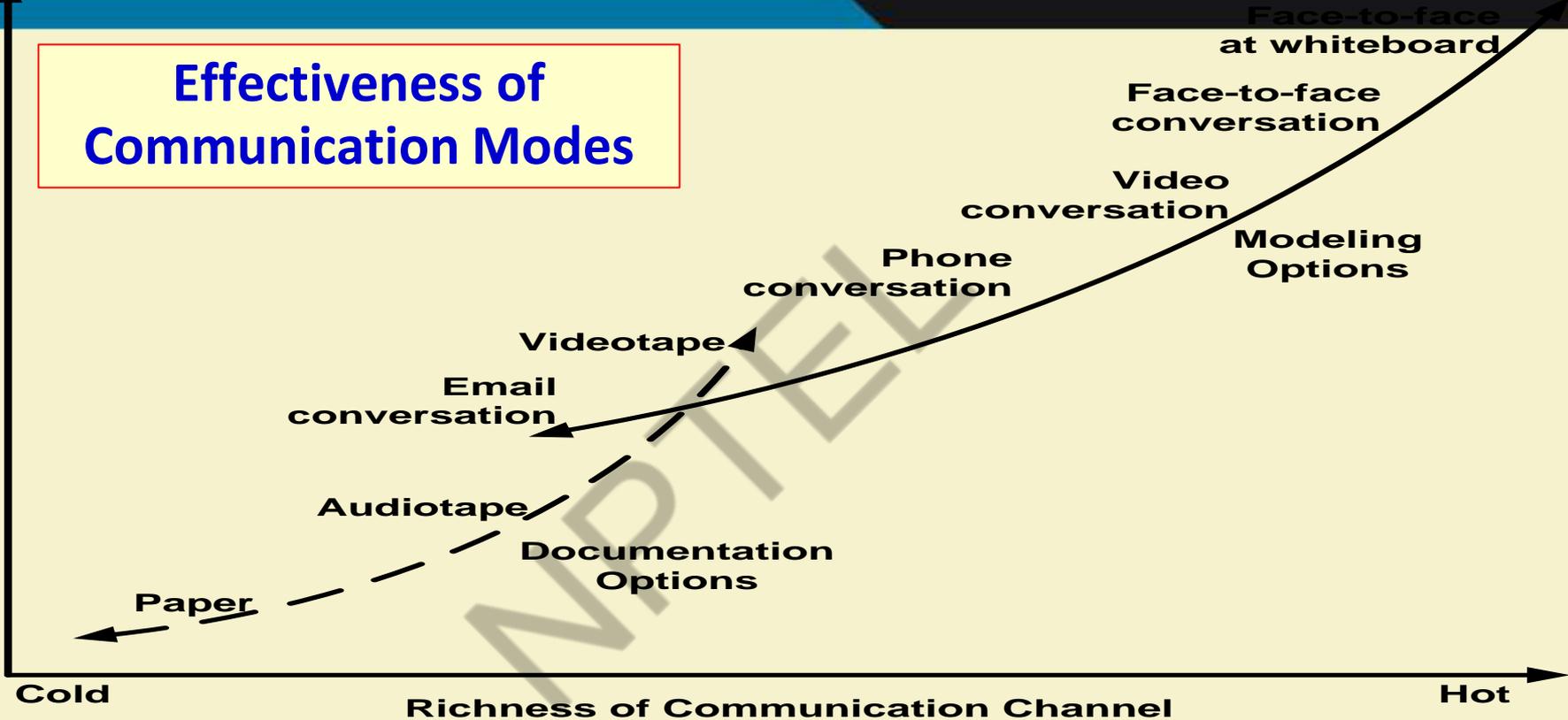
- An iteration may not add significant functionality,
 - But still a new release is invariably made at the end of each iteration
 - Delivered to the customer for regular use.

Methodology

- **Face-to-face communication favoured over written documents.**
- To facilitate face-to-face communication,
 - Development team to share a single office space.
 - Team size is deliberately kept small (5-9 people)
 - This makes the agile model most suited to the development of small projects.

Effectiveness of Communication Modes

Communication Effectiveness



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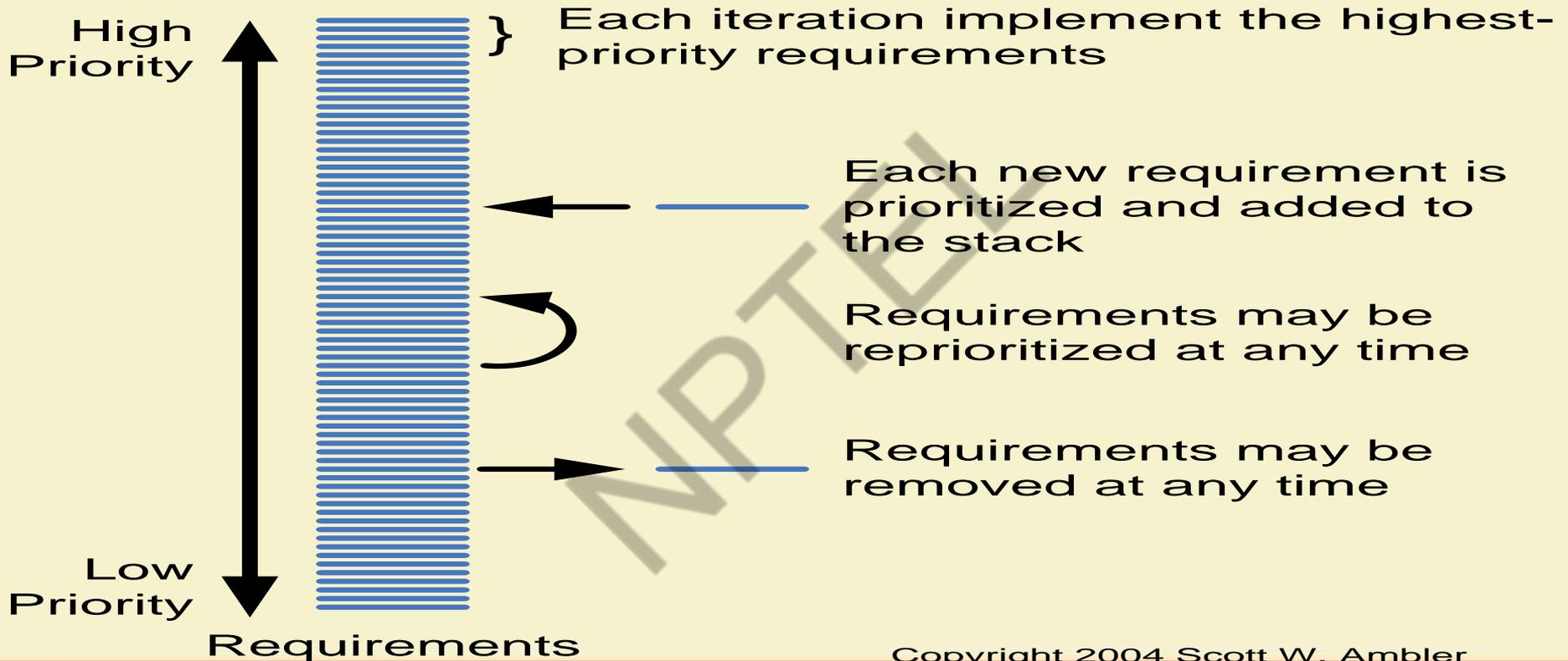
Agile Model: Principles

- The primary measure of progress:
 - **Incremental release of working software**
- Important principles behind agile model:
 - Frequent delivery of versions --- once every few weeks.
 - Requirements change requests are easily accommodated.
 - Close cooperation between customers and developers.
 - Face-to-face communication among team members.

Agile Documentation

- Travel light:
 - You need far less documentation than you think.
- Agile documents:
 - Are concise
 - Describe information that is less likely to change
 - Describe “good things to know”
 - Are sufficiently accurate, consistent, and detailed
- Valid reasons to document:
 - Project stakeholders require it
 - To define a contract model
 - To support communication with an external group
 - To think something through

Agile Software Requirements Management



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Adoption Detractors

- Sketchy definitions, make it possible to have
 - Inconsistent and diverse definitions
- High quality people skills required
- Short iterations inhibit long-term perspective
- Higher risks due to feature creep:
 - Harder to manage feature creep and customer expectations
 - Difficult to quantify cost, time, quality.

Agile Model Shortcomings

- Derives agility through developing tacit knowledge within the team, rather than any formal document:
 - Can be misinterpreted...
 - External review difficult to get...
 - When project is complete, and team disperses, maintenance becomes difficult...

Agile Model versus Iterative Waterfall Model

- The waterfall model steps through in a planned sequence:
 - Requirements-capture, analysis, design, coding, and testing .
- Progress is measured in terms of delivered artefacts:
 - Requirement specifications, design documents, test plans, code reviews, etc.
- In contrast agile model sequences:
 - Delivery of working versions of a product in several increments.

Agile Model versus Iterative Waterfall Model

- As regards to similarity:
 - We can say that Agile teams use the waterfall model on a small scale.

Agile versus RAD Model

- Agile model does not recommend developing prototypes:
 - Systematic development of each incremental feature is emphasized.
- In contrast:
 - RAD is based on designing quick-and-dirty prototypes, which are then refined into production quality code.

Agile versus exploratory programming

- Similarity:
 - Frequent re-evaluation of plans,
 - Emphasis on face-to-face communication,
 - Relatively sparse use of documents.
- Agile teams, however, do follow defined and disciplined processes and carry out rigorous designs:
 - This is in contrast to chaotic coding in exploratory programming.

Extreme Programming (XP)



Extreme Programming Model

- Extreme programming (XP) was proposed by Kent Beck in 1999.
- The methodology got its name from the fact that:
 - Recommends taking the best practices to extreme levels.
 - If something is good, why not do it all the time.

Taking Good Practices to Extreme

- **If code review is good:**
 - Always review --- **pair programming**
- **If testing is good:**
 - Continually write and execute test cases --- **test-driven development**
- **If incremental development is good:**
 - Come up with new increments every few days
- **If simplicity is good:**
 - Create the simplest design that will support only the currently required functionality.

Taking to Extreme

- **If design is good,**
 - everybody will design daily (refactoring)
- **If architecture is important,**
 - everybody will work at defining and refining the architecture (metaphor)
- **If integration testing is important,**
 - build and integrate test several times a day (continuous integration)

4 Values

- **Communication:**
 - Enhance communication among team members and with the customers.
- **Simplicity:**
 - Build something simple that will work today rather than something that takes time and yet never used
 - May not pay attention for tomorrow
- **Feedback:**
 - System staying out of users is trouble waiting to happen
- **Courage:**
 - Don't hesitate to discard code

Best Practices

- **Coding:**
 - without code it is not possible to have a working system.
 - Utmost attention needs to be placed on coding.
- **Testing:**
 - Testing is the primary means for developing a fault-free product.
- **Listening:**
 - Careful listening to the customers is essential to develop a good quality product.

Extreme Development Activities

- **XP Planning an increment**

- Begins by creating “user stories”
- Agile team assesses each story and assigns a cost
- Few stories are grouped into a deliverable increment
- Delivery date planned

- **XP Design**

- Follows the KIS principle
- Encourage the use of CRC cards
- For difficult design problems, suggests the creation of “spike solutions”—a design prototype
- Encourages “refactoring”—refinement of the internal program design

**Extreme
Program
Development
Activities**

- **XP Coding**
 - Recommends the construction of unit test cases *before* coding commences (test-driven development)
 - Encourages “pair programming”
- **XP Testing**
 - All unit tests are executed daily
 - “Acceptance tests” are defined by the customer and executed to assess customer visible functionalities

Full List of XP Practices

1. **Planning** – determine scope of the next release by combining business priorities and technical estimates
2. **Small releases** – put a simple system into production, then release new versions in very short cycles
3. **Metaphor** – all development is guided by a simple shared story of how the whole system works
4. **Simple design** – system is to be designed as simple as possible
5. **Testing** – programmers continuously write and execute unit tests

Full List of XP Practices

- 7. Refactoring** – programmers continuously restructure the system without changing its behavior to remove duplication and simplify
- 8. Pair-programming** -- all production code is written with two programmers at one machine
- 9. Collective ownership** – anyone can change any code anywhere in the system at any time.
- 10. Continuous integration** – integrate and build the system many times a day – every time a task is completed.

Full List of XP Practices

- 11. 40-hour week** – work no more than 40 hours a week as a rule
- 12. On-site customer** – a user is a part of the team and available full-time to answer questions
- 13. Coding standards** – programmers write all code in accordance with rules emphasizing communication through the code

Emphasizes Test-Driven Development (TDD)

- Based on user story develop test cases
- Implement a quick and dirty feature every couple of days:
 - **Get customer feedback**
 - **Alter if necessary**
 - **Refactor**
- Take up next feature

Project Characteristics that Suggest Suitability of Extreme Programming

- Projects involving new technology or research projects.
 - In this case, the requirements change rapidly and unforeseen technical problems need to be resolved.
- Small projects:
 - These are easily developed using extreme programming.

Practice Questions

- What are the stages of iterative waterfall model?
- What are the disadvantages of the iterative waterfall model?
- Why has agile model become so popular?
- What difficulties might be faced if no life cycle model is followed for a certain large project?

Suggest Suitable Life Cycle Model

- A software for an academic institution to automate its:
 - Course registration and grading
 - Fee collection
 - Staff salary
 - Purchase and store inventory
- The software would be developed by tailoring a similar software that was developed for another educational institution:
 - 70% reuse
 - 10% new code and 20% modification

Practice Questions

- Which types of risks can be better handled using the spiral model compared to the prototyping model?
- Which type of process model is suitable for the following projects:
 - A customization software
 - A payroll software for contract employees that would be add on to an existing payroll software

Practice Questions

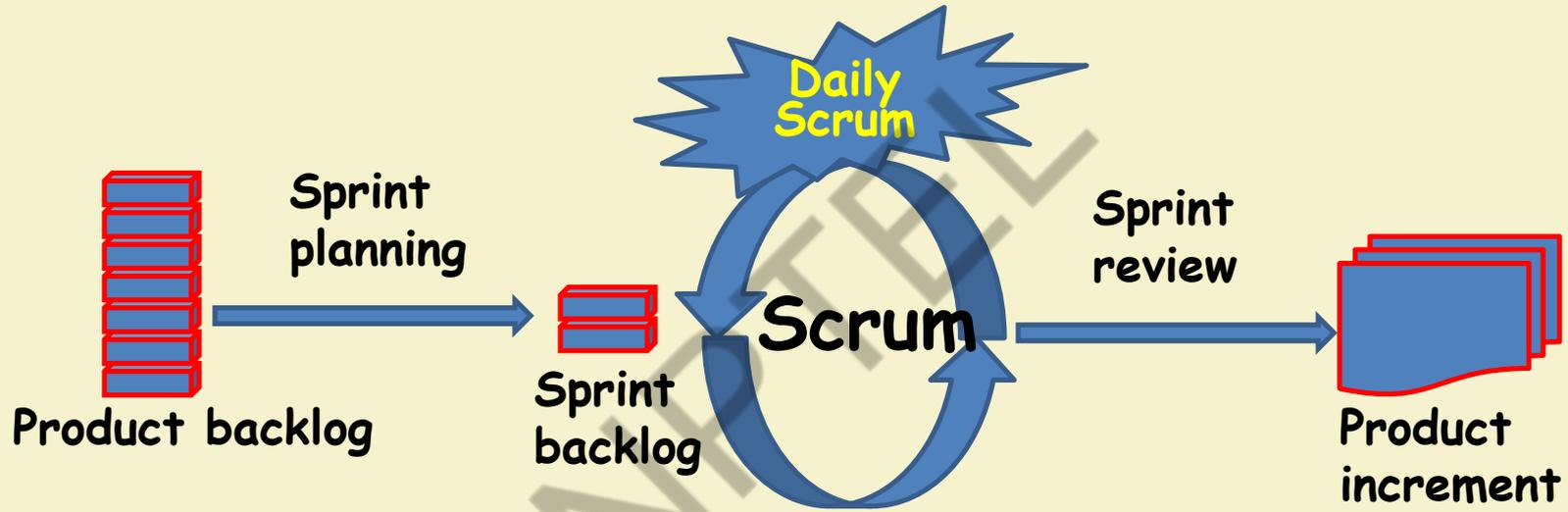
- Which lifecycle model would you select for the following project which has been awarded to us by a mobile phone vendor:
 - A new mobile operating system by upgrading the existing operating system
 - Needs to work well efficiently with 4G systems
 - Power usage minimization
 - Directly upload backup data on a cloud infrastructure maintained by the mobile phone vendor

Scrum



Scrum: Characteristics

- One of the agile processes
- Self-organizing teams
- Product development progresses in a series of month-long **sprints**
- Requirements are listed in a **product backlog**



Sprint

- Scrum projects progress in a series of “sprints”
 - Analogous to XP iterations or time boxes
 - Target duration is one month
- **Software increment is designed, coded, and tested during a sprint**
- **No changes entertained during a sprint**

Sprint

- Fundamental process flow of Scrum
- A month-long iteration, during which an incremental product functionality completed
- NO outside influence can interfere with the Scrum team during the Sprint
- Each day begins with the Daily Scrum Meeting

Scrum Framework

- **Roles** : Product Owner, ScrumMaster, Team
- **Ceremonies** : Sprint Planning, Sprint Review, Sprint Retrospective, and Daily Scrum Meeting
- **Artifacts** : Product Backlog, Sprint Backlog, and Burndown Chart

Key Roles and Responsibilities in Scrum Process

- **Product Owner**
 - Acts on behalf of customers to represent their interests.
- **Development Team**
 - Team of five to nine people with cross-functional skill sets.
- **Scrum Master (aka Project Manager)**
 - Facilitates scrum process and resolves impediments and acts as a buffer between the team and outside interference.

Product Owner

- Defines the features of the product
- Decides on release date and content
- Prioritizes new features
- Adjusts features and priority every iteration, as needed
- Accepts or rejects work results.

The Scrum Master

- Represents management
- Removes impediments
- Ensures that the team is fully functional and productive
- Shield the team from external interferences

Scrum Team

- Typically 5-10 people
- Cross-functional
 - QA, Programmers, UI Designers, etc.
- Teams are self-organizing
- Membership can change only between sprints

Ceremonies

- Sprint Planning Meeting
- Daily Scrum
- Sprint Review Meeting

Sprint Planning

- Goal is to produce Sprint Backlog
- Product owner works with the Team to negotiate what Backlog Items the Team will work on in order to meet Release Goals
- Scrum Master ensures Team agrees to realistic goals

- Daily
- 15-minutes
- Stand-up meeting
- Not for problem solving
- Three questions:
 1. What did you do yesterday
 2. What will you do today?
 3. What obstacles are in your way?

Daily Scrum

Daily Scrum

- Is NOT a problem solving session
- Is NOT a way to collect information about WHO is behind the schedule
- Is a meeting in which team members make informal commitments to each other and to the Scrum Master
- Is a good way for a Scrum Master to track the progress of the Team

- Team presents what it accomplished during the sprint
- Typically takes the form of a demo of new features
- Informal
 - 2-hour prep time rule
- Participants
 - Customers
 - Management
 - Product Owner
 - Other teammates

Sprint Review Meeting

Product Backlog

- A list of all desired work on the project
 - Usually a combination of
 - **story-based work** (“allow user to search and replace”)
 - **task-based work** (“improve exception handling”)
- List is prioritized by the Product Owner.

Product Backlog

- Requirements for a system, expressed as a prioritized list of Backlog Items
 - **Managed and owned by Product Owner**
 - **Spreadsheet (typically)**

	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

Sample Product Backlog

Sprint Backlog

- A subset of Product Backlog Items, which define the work for a Sprint
 - Created by Team members
 - Each Item has its own status
 - Updated daily

Sprint Backlog during the Sprint

- Changes occur:
 - Team adds new tasks whenever they need to in order to meet the Sprint Goal
 - Team can remove unnecessary tasks
 - But: Sprint Backlog is only updated by the team
- Estimates are updated whenever there's new information

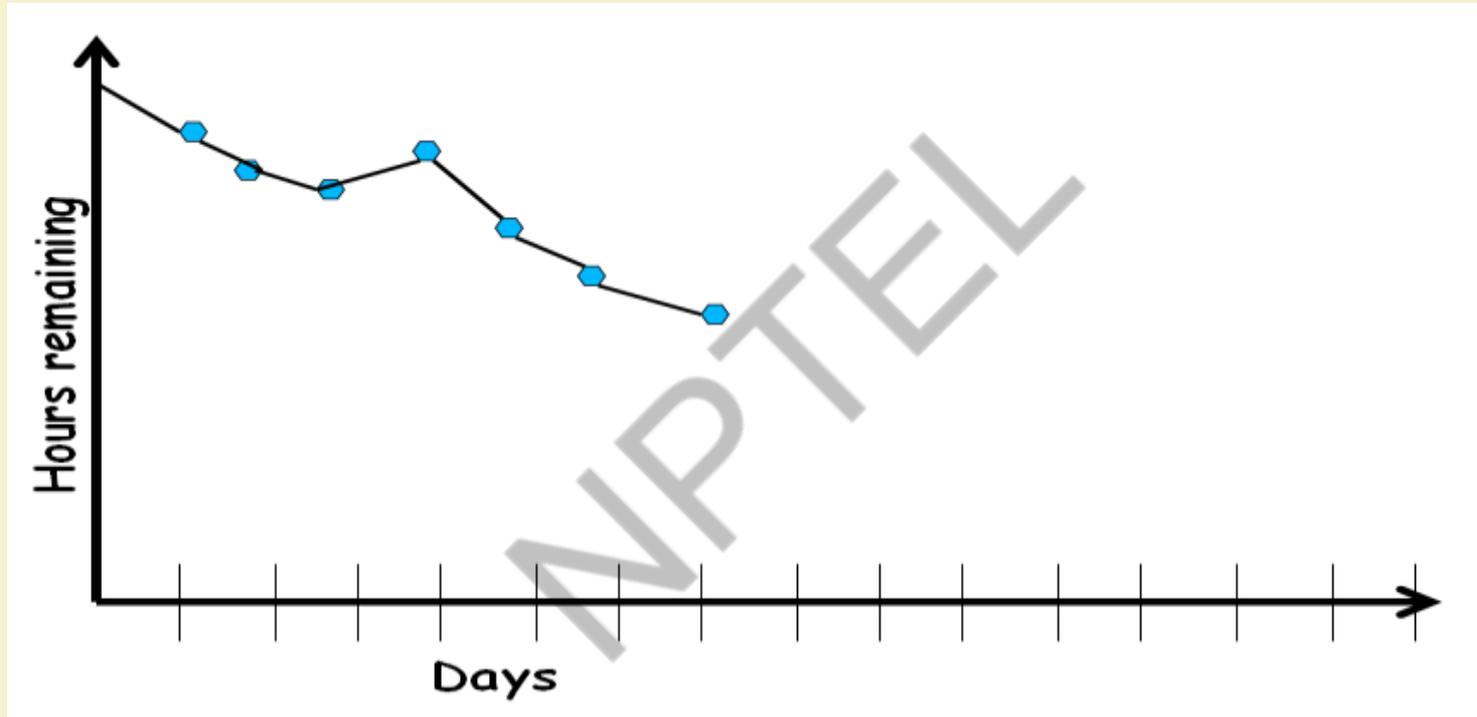
Burn down Charts

- Are used to represent “work done”.
- Are remarkably simple but effective Information disseminators
- Three Types:
 - **Sprint Burn down Chart (progress of the Sprint)**
 - **Release Burn down Chart (progress of release)**
 - **Product Burn down chart (progress of the Product)**

Sprint Burn down Chart

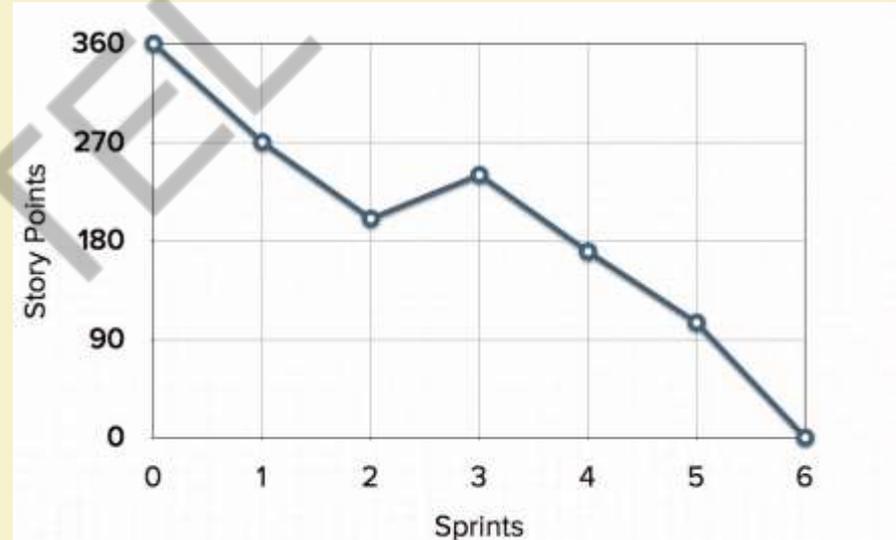
- Depicts the total Sprint Backlog hours remaining per day
- Shows the estimated amount of time to complete
- Ideally should burn down to zero to the end of the Sprint
- Usually is not a straight line

Sprint Burndown Chart



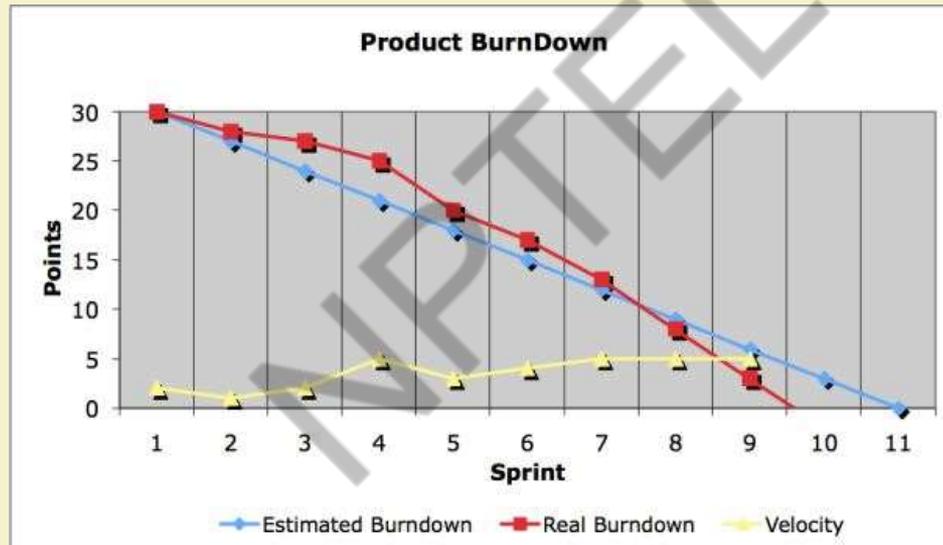
Release Burndown Chart

- Will the next release be done on right time?
- How many more sprints?
- X-axis: sprints
- Y-axis: amount of story points remaining



Product Burndown Chart

- Is a “big picture” view of project’s progress (all the releases)



Scalability of Scrum

- A typical Scrum team is 6-10 people
- Jeff Sutherland proposed and experimented with up to over 800 people
- "Scrum of Scrums" also called "Meta-Scrum"

Requirements Analysis and Specification

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What are Requirements?

- A Requirement is:
 - **A capability or condition required from the system.**
- What is involved in requirements analysis and specification?
 - **Determine what is expected by the client from the system. (Gather and Analyze)**
 - **Document those in a form that is clear to the client as well as to the development team members. (Document)**

Understanding and specifying requirements

- **For toy problems:** understanding and specifying requirements is rather easy...
- **For industry-standard problems:** Probably the hardest, most problematic and error prone among development tasks...
- The task of requirements specification :
 - **Input:** User needs that are hopefully fully understood by the users.
 - **Output:** Precise statement of what the software will do.

Requirements for Products

- When a company plans to develop a generic product:
 - Who gives the requirements?
- **The sales personnel!**

Activities in Requirements Analysis and Specification

Requirements Gathering



Requirements Analysis



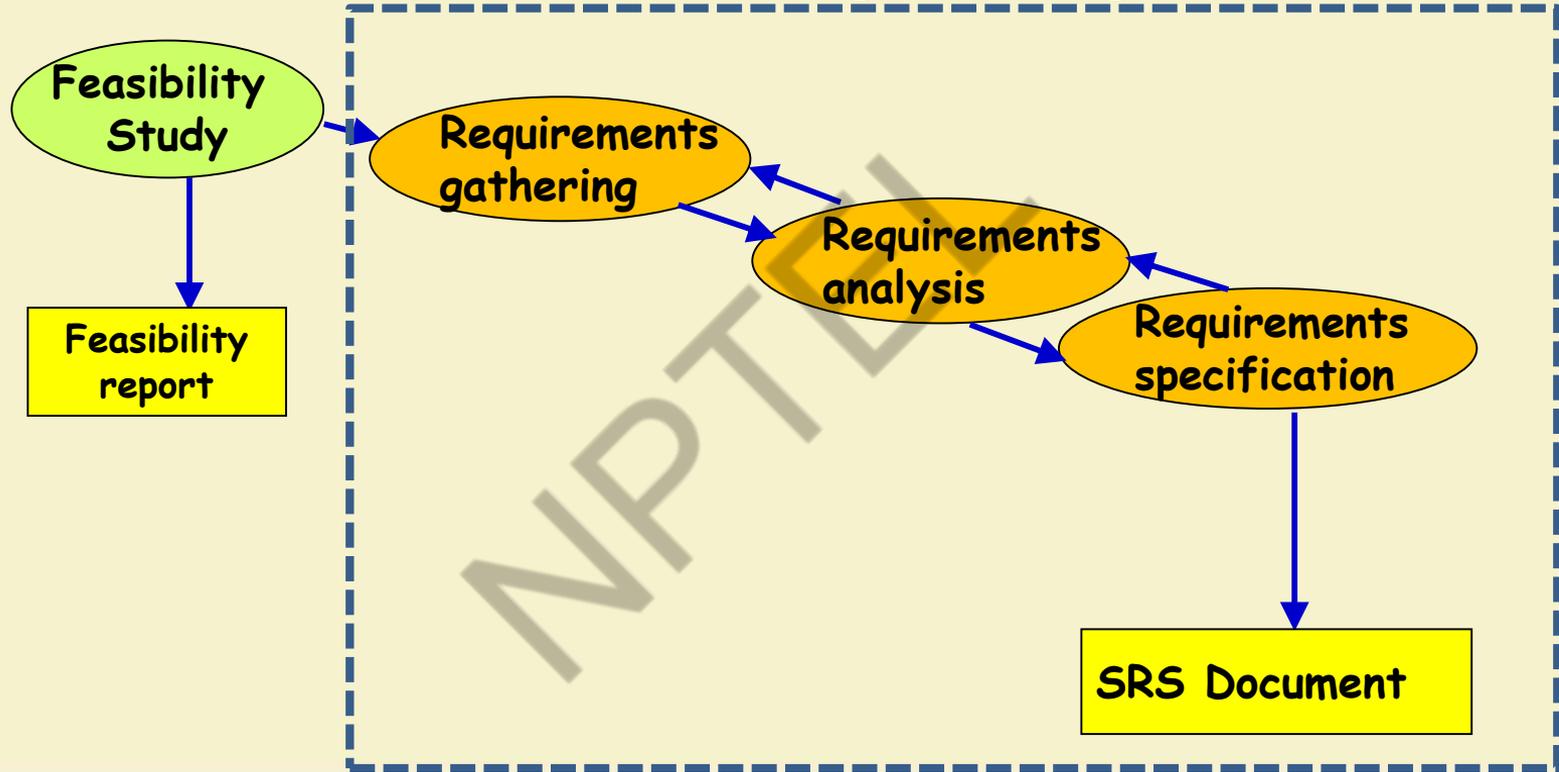
Requirements Specification



SRS Document



Requirements Engineering Process



Requirements Analysis and Specification

- Requirements Gathering:
 - Fully understand the user requirements.
- Requirements Analysis:
 - Remove inconsistencies, anomalies, etc. from requirements.
- Requirements Specification:
 - Document requirements properly in an SRS document.

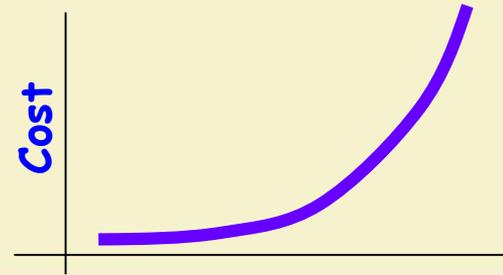
- **Good SRS reduces development cost:**

- Req. errors are expensive to fix later
- Req. changes cost a lot (typically 40% of requirements change later)
- Good SRS can minimize changes and errors
- **Substantial savings --- effort spent during req. saves multiple times that effort**

Need for SRS...

- **An Example:**

- Cost of fixing errors in req. , design , coding , acceptance testing and operation increases exponentially



What are the Uses of an SRS Document?

- Establishes the basis for agreement between the customers and the suppliers
- Forms the starting point for development.
- Provide a basis for estimating costs and schedules.
- Provide a basis for validation and verification.
- Provide a basis for user manual preparation.
- Serves as a basis for later enhancements.

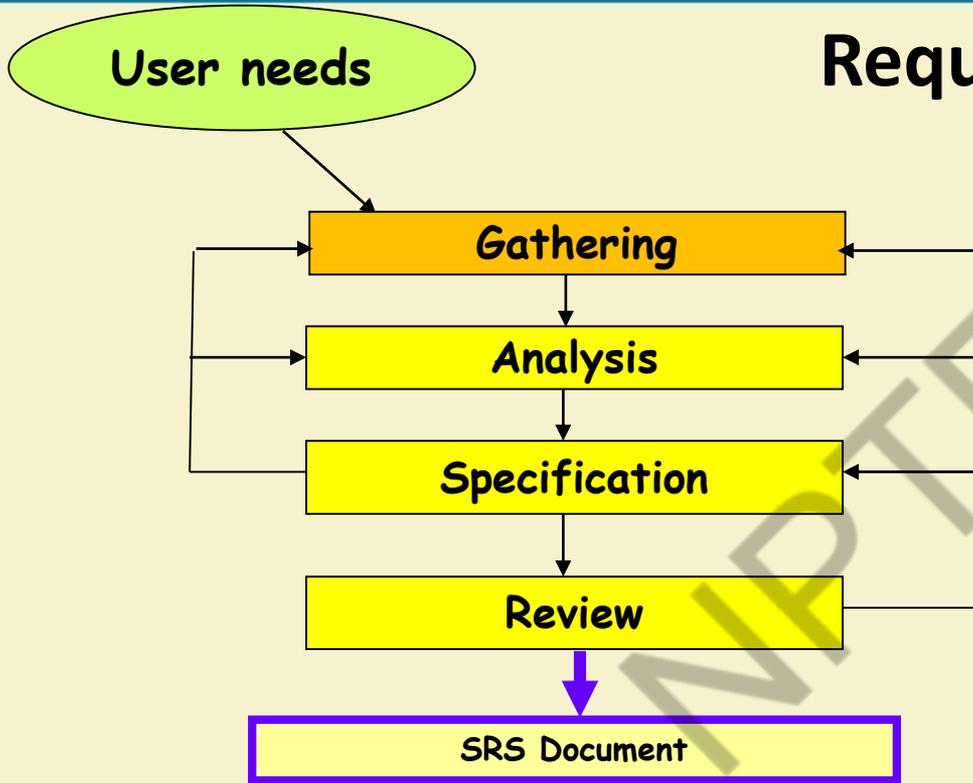
Forms A Basis for User Manual

- The SRS serves as the basis for writing User Manual for the software:
 - **User Manual: Describes the functionality from the perspective of a user --- An important document for users.**
 - Typically also describes how to carry out the required tasks with examples.

SRS Document: Stakeholders

- SRS intended for a diverse audience:
 - Customers and users use it for validation, contract, ...
 - Systems (requirements) analysts
 - Developers, programmers to implement the system
 - Testers use it to check whether requirements have been met
 - Project Managers to measure and control the project
- Different levels of detail and formality is needed for each audience
- Different templates for requirements specifications used by companies:
 - Often variations of **IEEE 830**

Requirement process..



- Specification and review may lead to further gathering and analysis.

Thank You!!

