Methodologies: Extreme Programming and Scrum

Software Engineering I
Lecture 19

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Outline of the Lecture

- Examples of Methodologies
  - Extreme Programming
  - Scrum
  - Royce's Methodology (slide set L20 posted on SE portal)
    - Combines the unified process with hierarchical project management.

XP

- Extreme Programming is an example of an agile software methodology
  - Higher priority on *adaptability* (“empirical process control model”) than on *predictability* (“defined process control model”)
    - Change, in particular in the requirements, is normal during software development
    - Software developer must be able react to changing requirements at any point during the project (“polynesian navigation”)
- XP prescribes a set of day-to-day practices for managers and developers
  - These are accepted normal practices, but taken to the extreme. Hypothesis:
  - Better way to elicit client requirements
  - Better way to construct higher quality software.

History of XP

- Original cast
  - Kent Beck
  - Ward Cunningham (also created Wiki)
  - Ron Jeffries
- Application of XP in the Chrysler Comprehensive Compensation project (C3 Project) in 1995
- Lots of initial excitement but also resentment
  - Daimler actually shut down the C3 Project in 2000 and even banned XP for some time
  - See Additional References

XP Day-to-Day Practices ("Mantras")

- Rapid feedback
  - Confronting issues early results in more time for resolving issues. This applies both to client feedback and feedback from testing
- Simplicity
  - The design should focus on the current requirements
  - Simple designs are easier to understand and change than complex ones
- Incremental change
  - One change at the time instead of many concurrent changes
  - One change at the time should be integrated with the current baseline.

XP Mantras (continued)

- Embracing change
  - Change is inevitable and frequent in XP projects
  - Change is normal and not an exception that needs to be avoided
- Quality work
  - Focus on rapid projects where progress is demonstrated frequently
  - Each change should be implemented carefully and completely.

How much planning in XP?

- Planning is driven by requirements and their relative priorities
  - Requirements are elicited by writing stories with the client (called user stories)
  - User stories are high-level scenarios or use cases that encompass a set of coherent features
  - Developers decompose each user story in terms of development tasks that are needed to realize the features required by the story
  - Developers estimate the duration of each task in terms of days
  - If a task is planned for more than a couple of weeks, it is further decomposed into smaller tasks.

Team Organization in XP

- Production code is written in pairs (pair programming)
- Individual developers may write prototypes for experiments or proof of concepts, but not production code
- Moreover, pairs are rotated often to enable a better distribution of knowledge throughout the project.

How much planning in XP?

- Ideal weeks
  - Number of weeks estimated by a developer to implement the story if all work time was dedicated for this single purpose
- Fudge Factor
  - Factor to reflect overhead activities (meetings, holidays, sick days...)
  - Also takes into account uncertainties associated with planning
- Project velocity
  - Inverse of ideal weeks
    - i.e., how many ideal weeks can be accomplished in fixed time.

How much planning in XP?

- Stacks
  - The user stories are organized into stacks of related functionality
- Prioritization of stacks
  - The client prioritizes the stacks so that essential requirements can be addressed early and optional requirements last
- Release Plan
  - Specifies which story will be implemented for which release and when it will be deployed to the end user
- Schedule
  - Releases are scheduled frequently (e.g., every 1–2 months) to ensure rapid feedback from the end users.

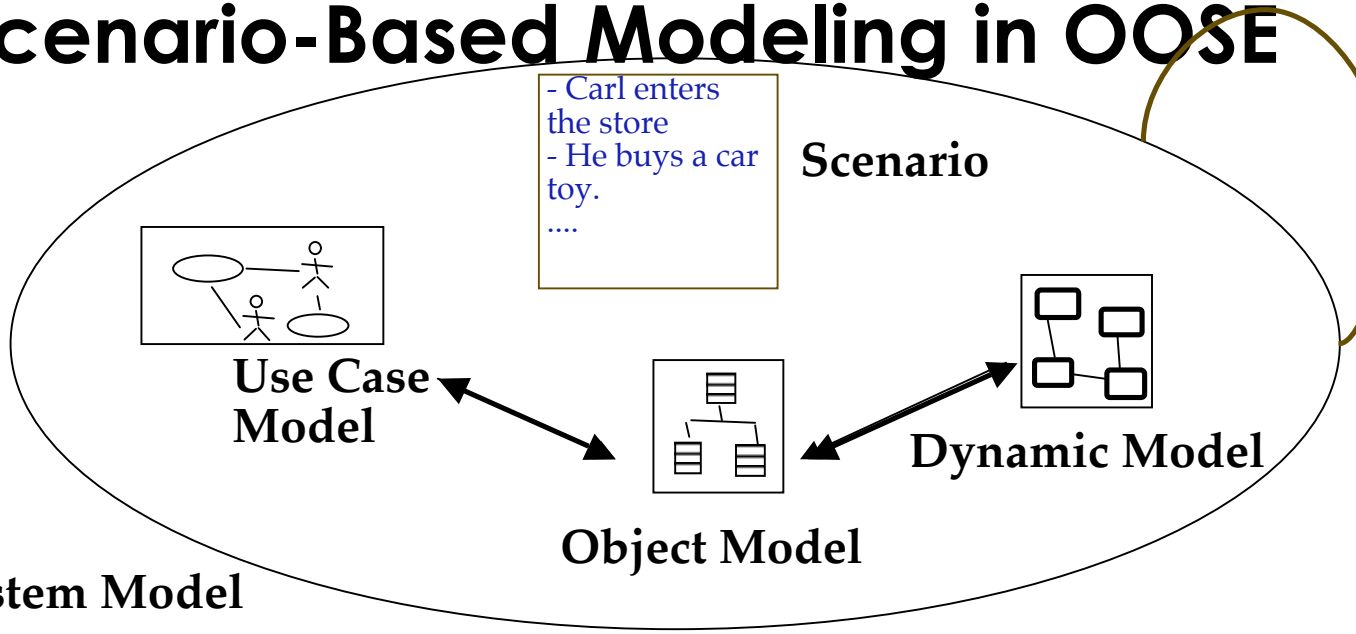
How much reuse in XP?

- Simple design
  - Developers are encouraged to select the most simple solution that addresses the user story being currently implemented
- No design reusability
  - The software architecture can be refined and discovered one story at the time, as the prototype evolves towards the complete system
- Focus on Refactoring
  - Design patterns might be introduced as a result of refactoring, when changes are actually implemented
  - Reuse discovery only during implementation.

How much modeling in XP?

- No explicit analysis/design models
  - Minimize the amount of documentation
  - Fewer deliverables reduce the duplication of issues
- Models are only communicated among participants
  - The client is the "walking specification"
- Source Code is the only external model
  - The system design is made visible in the source code by using descriptive naming schemes
- Refactoring is used to improve the source code
  - Coding standards are used to help developers communicate using only the source code.

Scenario-Based Modeling in OOSE



Analysis, System Design Object Design

are Model Transformations

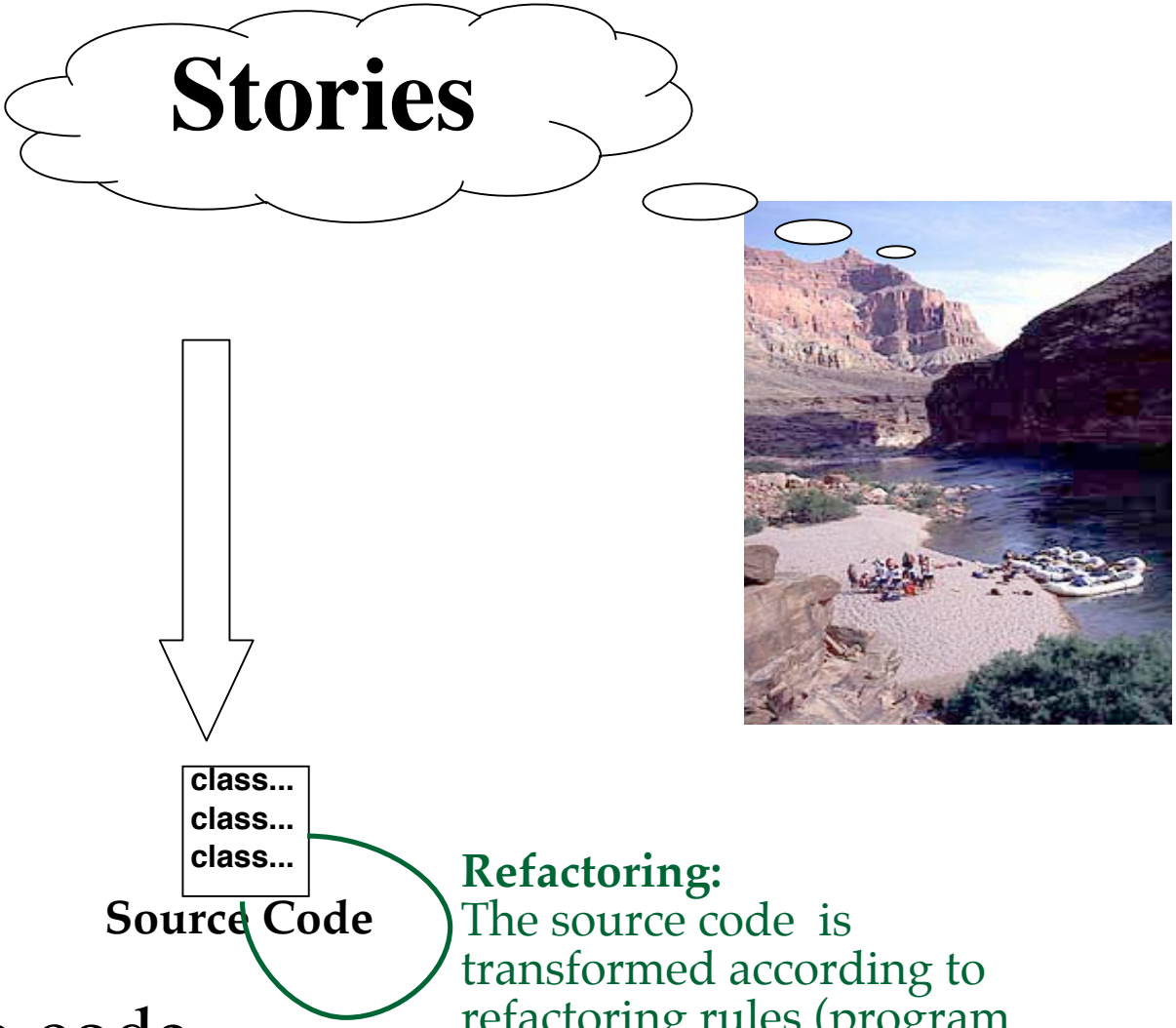
Reverse Engineering:
The system model is reconstructed from existing source code (legacy systems)

Forward Engineering:
Source code is generated from the system model (Ideal: „0 % manual coding“, Component-Based Software Engineering)

Refactoring:
The source code is transformed according to refactoring rules (program transformation)

Textual scenarios generate external models

Models in XP (Story-Based)



Stories

generate source code

How much process in XP?

- Iterative life cycle model with activities: planning, design, coding, testing and integration
  - Planning occurs at the beginning of each iteration
  - Design, coding, and testing are done incrementally
  - Source code is continuously integrated into the main branch, one contribution at the time
  - Unit tests for all integrated units; regression testing
- Constraints on these activities
  - Test first. Unit tests are written before units. They are written by the developer
  - When defects are discovered, a unit test is created to reproduce the defect
  - Refactor before extending the source code.

How much control?

- Reduced number of formal meetings
  - Daily stand up meeting for status communication
  - No discussions to keep the meeting short
- No inspections and no peer reviews
  - Pair programming is used instead
  - Production code is written in pairs, review during coding.
- Self-organizing system with a leader:
  - The Leader communicates the vision of the system
  - The leader does not plan, schedule or budget
  - The leader establishes an environment based on collaboration, shared information, and mutual trust
  - The leader ensures that a product is shipped.

Summary of the XP Methodology

Planning	Collocate the project with the client,write user stories with the client, frequent small releases (1-2 months), create schedule with release planning, kick off an iteration with iteration planning, create programmer pairs, allow rotation of pairs
Modeling	Select the simplest design that addresses the current story; Use a system metaphor to model difficult concepts; Use CRC cards for the initial object identification; Write code that adheres to standards; Refactor whenever possible
Process	Code unit test first, do not release before all unit tests pass, write a unit test for each uncovered bug, integrate one pair at the time
Control	Code is owned collectively. Adjust schedule, Rotate pairs, Daily status stand-up meeting, Run acceptance tests often and publish the results.

Methodologies: Extreme Programming and Scrum

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Scrum

- What is Scrum?
- History of Scrum
- Agile Alliance
- Agile Project Management
- Functionality of Scrum
- Components of Scrum
  - Scrum Roles
  - The Process
  - Scrum Artifacts
- Scaling Scrum
- Evolution of Scrum
- Conclusion

Introduction

- Classical software development methodologies have several disadvantages:
  - Huge effort during the planning phase
  - Poor requirements conversion in a rapid changing environment
  - Treatment of staff as a factor of production

- Agile Software Development Methodologies
  - Minimize risk → short iterations
  - Real-time communication (preferable face-to-face) → very little written documentation
  - www.agilealliance.org

Scrum

- Definition (Rugby): A Scrum is a way to restart the game after an interruption,
    - The forwards of each side come together in a tight formation and struggle to gain possession of the ball when it is tossed in among them
- Definition (Software Development): Scrum is an agile, lightweight process
    - To manage and control software and product development with rapidly changing requirements
    - Based on improved communication and maximizing cooperation.

History of Scrum

- 1995:
  - Jeff Sutherland and Ken Schwaber analyse common software development processes
    - Conclusion: not suitable for empirical, unpredictable and non-repeatable processes
  - Proposal of Scrum
  - Enhancement of Scrum by Mike Beedle
    - Combination of Scrum with Extreme Programming
- 1996: Introduction of Scrum at OOPSLA
- 2001: Publication "Agile Software Development with Scrum" by Ken Schwaber & Mike Beedle
- Founders are also members in the Agile Alliance.

Manifesto for Agile Software Development

- http://www.agilemanifesto.org/
- Individuals and interactions over processes and tools
- Working software over comprehensive documentation
- Customer collaboration over contract negotiation
- Responding to change over following a plan.

Methodology Issues

- Methodologies provide guidance, general principles and strategies for selecting methods and tools in a given project environment
- Key questions for which methodologies provide guidance:
  - How much involvement of the customer?
  - How much planning?
  - How much reuse?
  - How much modeling before coding?
  - How much process?
  - How much control and monitoring?

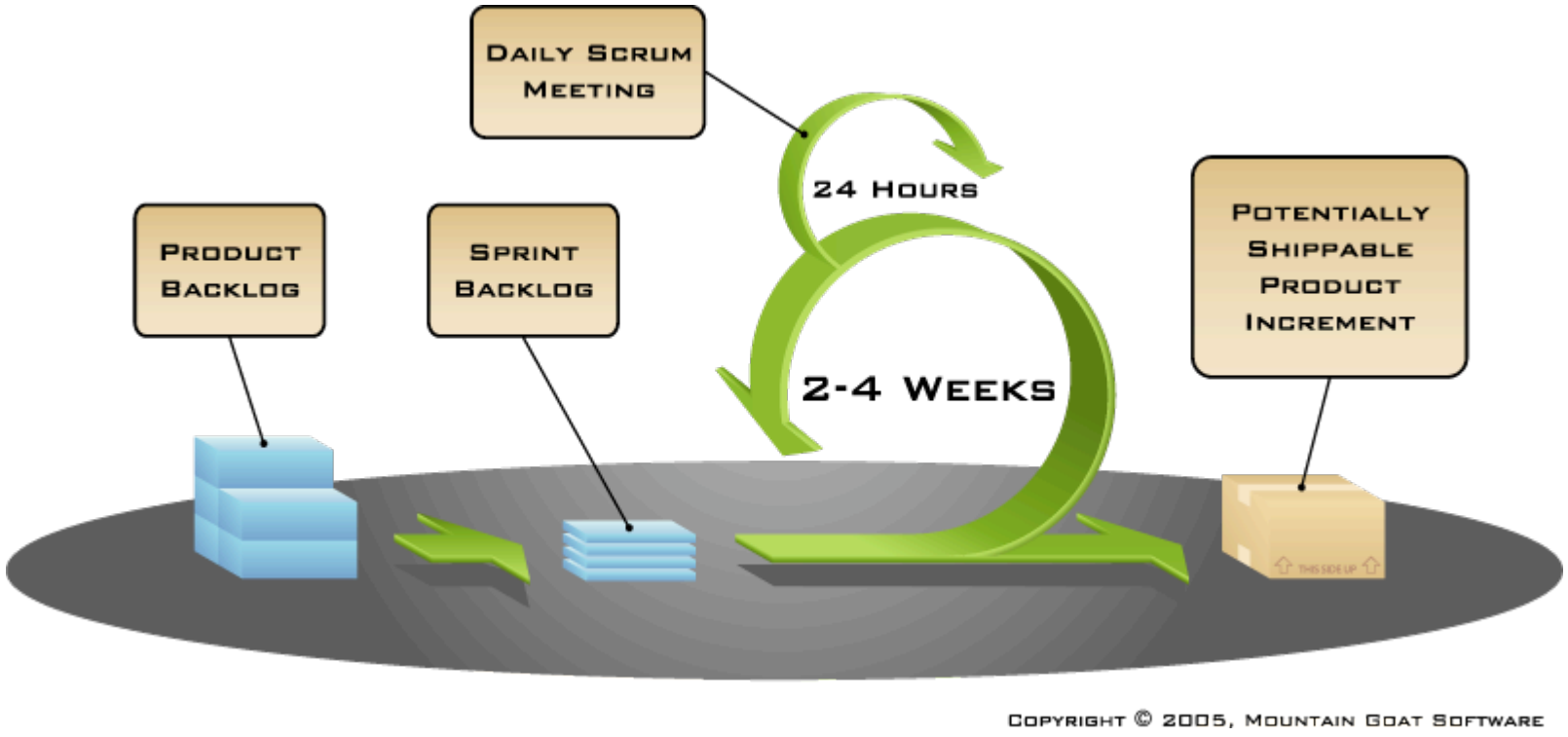
Scrum as Methodology

- Involvement of the customer
  - Onsite customer
- Planning
  - Checklists and incremental daily plans
- Reuse
  - Checklists from previous projects
- Modeling
  - Models may or may not be used
- Process
  - Iterative, incremental process
- Control and Monitoring
  - Daily meetings.

Components of Scrum

- Scrum Roles
  - Scrum Master, Scrum Team, Product Owner
- Process
  - Sprint Planning Meeting
  - Kickoff Meeting
  - Sprint (~~ Iteration in a Unified Process)
  - Daily Scrum Meeting
  - Sprint Review Meeting
- Scrum Artifacts
  - Product Backlog, Sprint Backlog
  - Burndown Charts

Overview of Scrum



Scrum Master

- Represents management to the project
- Typically filled by a project manager or team leader
- Responsible for enacting scrum values and practices
- Main job is to remove impediments.

The Scrum Team

- Typically 5-6 people
- Cross-functional (QA, Programmers, UI Designers, etc.)
- Members should be full-time
- Team is self-organizing
- Membership can change only between sprints

Product Owner

- Knows what needs to be build and in what sequence this should be done
- Typically a product manager

Scrum Process Activities

- Project-Kickoff Meeting
- Sprint Planning Meeting
- Sprint
- Daily Scrum Meeting
- Sprint Review Meeting

Project-Kickoff Meeting

- A collaborative meeting in the beginning of the project
  - Participants: Product Owner, Scrum Master
  - Takes 8 hours and consists of 2 parts ("before lunch and after lunch")
- Goal: Create the Product Backlog

Sprint Planning Meeting

- A collaborative meeting in the beginning of each Sprint
  - Participants: Product Owner, Scrum Master and Scrum Team
- Takes 8 hours and consists of 2 parts (“before lunch and after lunch”)
- Goal: Create the Sprint Backlog

Sprint

- A month-long iteration, during which is incremented a product functionality
- No outside influence can interference with the Scrum team during the Sprint
- Each day in a Sprint begins with the Daily Scrum Meeting

Daily Scrum Meeting

- Is a short (15 minutes long) meeting, which is held every day before the Team starts working
- Participants:
  - Scrum Master (which is the chairman), Scrum Team
- Every Team member should answer on 3 questions

Questions for each Scrum Team Member

1. Status:

   What did I do since the last Scrum meeting?
2. Issues:

   What is stopping me getting on with the work?
3. Action items:

   What am I doing until the next Scrum meeting?

Summary

- XP and Scrum are agile software development methodologies with focus on
  - Empirical process control model
  - Changing requirements are the norm
  - Controlling conflicting interests and needs
- Very simple processes with clearly defined rules
- Self-organizing teams, where each team member carries a lot of responsibility
- No extensive documentation
  - Possibility for “undisciplined hacking”.

Additional References

- Seminar SS 2007: Agile Techniques in Software Development
  - http://wwwbruegge.in.tum.de/twiki/bin/view/Lehrstuhl/AgilePMSoSe2007
- Books
  - Kent Beck, *Extreme Programming Explained: Embrace Change*
  - Kent Beck and Martin Fowler, *Planning Extreme Programming*
  - Martin Fowler *Refactoring: Improving the Design of Existing Code*
  - Ken Auer and Roy Miller, *Extreme Programming Applied: Playing To Win*
  - *Ron Jeffries, A. Anderson, C.Hendrickson* Extreme Programming Installed
  - Jim Smith, *Agile Project Management*
  - Mary & Tom Poppendieck, *Lean Software Development: An Agile Toolkit*
  - Mike Cohn, *Agile estimating and planning*
  - Craig Larman, *Agile & iterative development: A manager's guide*
  - Jim Highsmith, *Agile Software Development Ecosystems*
  - Mike Cohn, *User stories applied for agile software development.*

Thank you very much!

See you again in the Summer

Einführung in die Softwaretechnik I

Agile Modeling with Design Patterns

Knowledge Management in Software Engineering

Offshore Software Testing

Product Line Requirements Engineering

Agile Project Management

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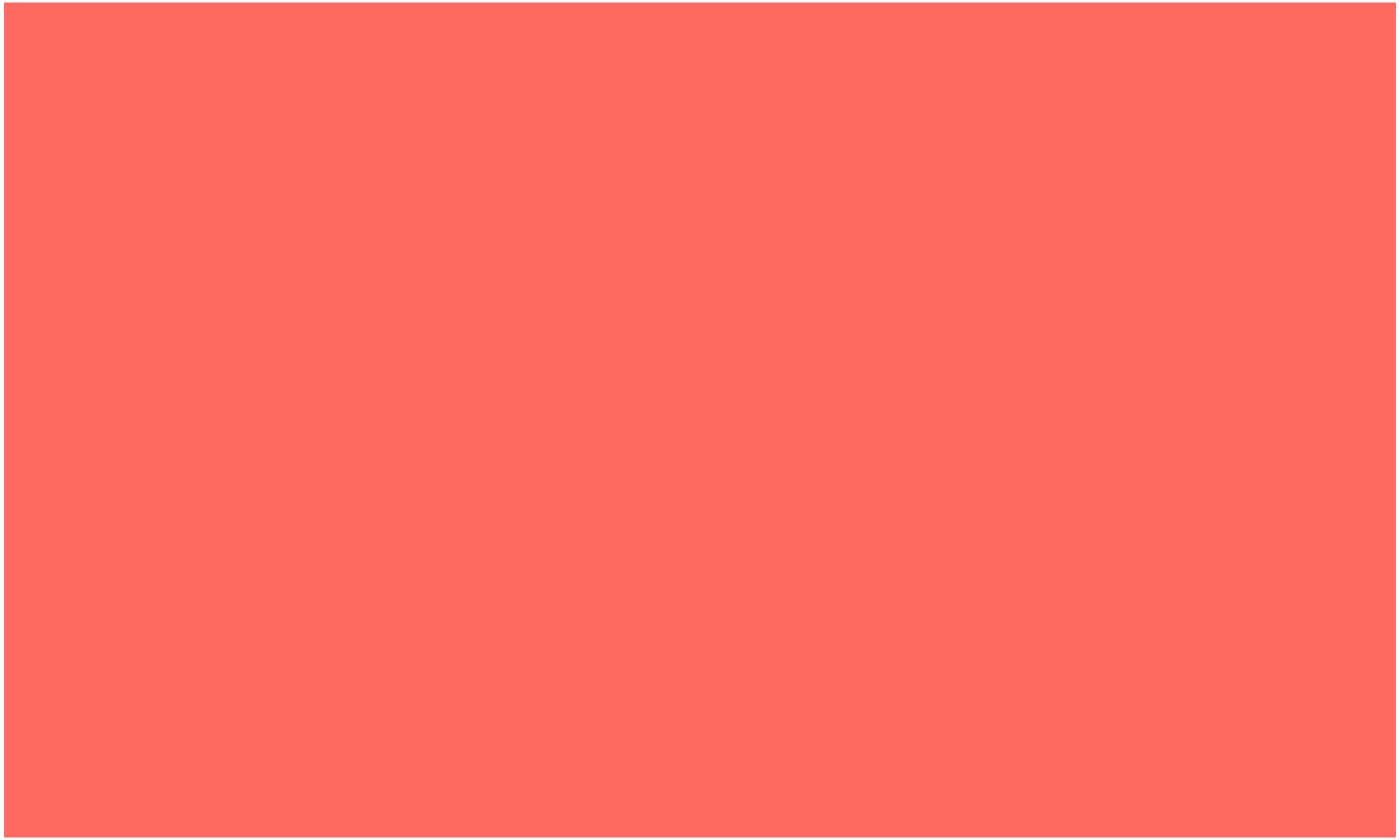
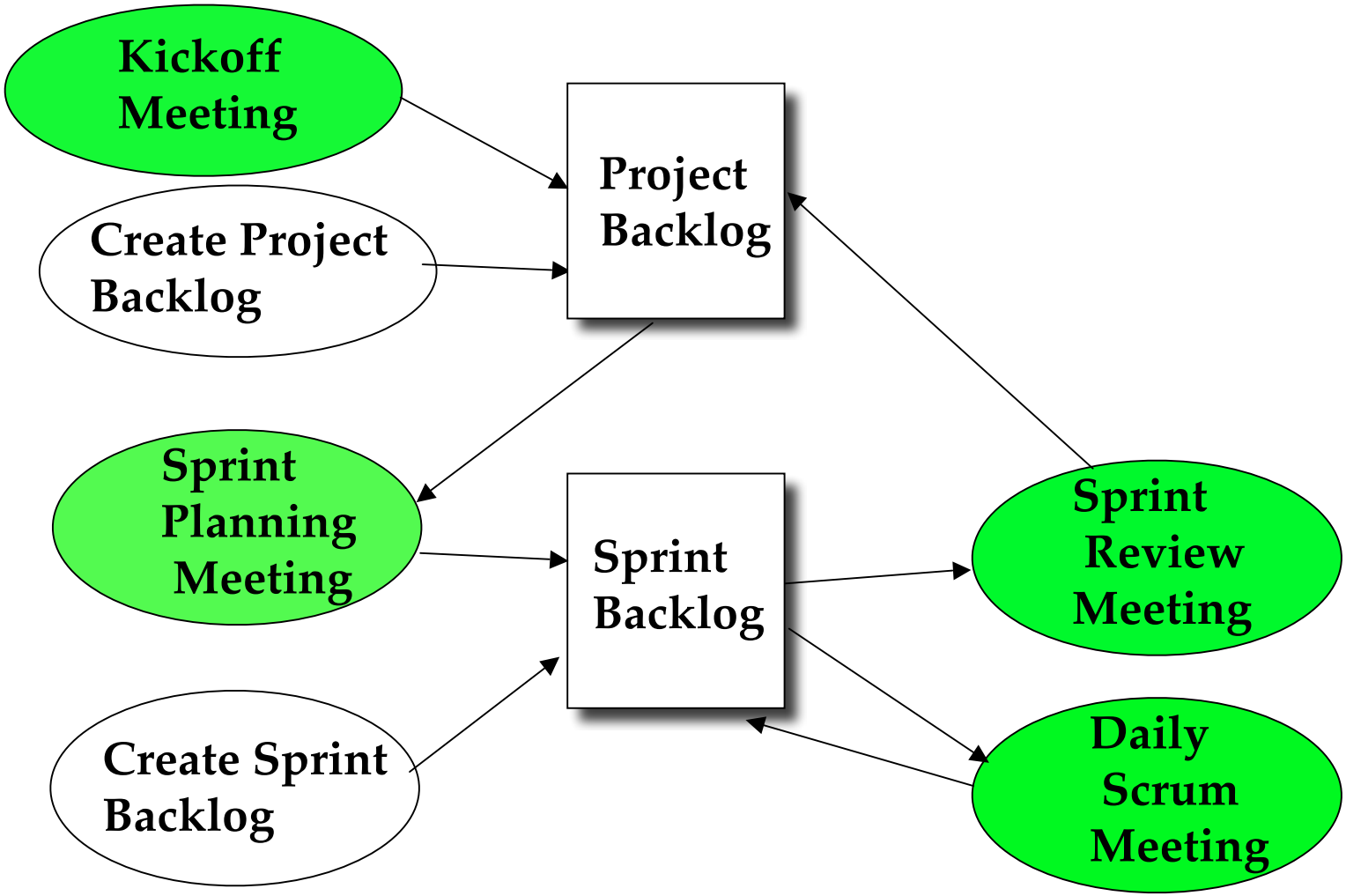
Backup and Additional Slides



Lists, Activities and Meetings in Scrum



Scrum Artifacts

- Product Backlog
- Sprint Backlog
- Burn down Charts

Product Backlog

- Requirements for a system, expressed as a prioritized list of todo Items
  - Managed and owned by a Product Owner
  - Contained in a spreadsheet (typically)
- Usually created during the Project Kickoff Meeting
- Can be changed and re-prioritized before each Sprint.

Sprint Backlog

- A subset of Product Backlog Items, which defines the work to be done in a Sprint
- Is created ONLY by Team members
- Each item has it's own status
- Should be updated every day

- No more then 300 tasks in the list
- If a task requires more than 16 hours, it should be broken down
- Team can add or subtract items from the list
  - Product owner is not allowed to do it.

Daily Scrum Meeting

- Not a problem solving session
- Also not a way to collect information about who is behind the schedule

- It is a meeting in which team members make commitments to each other and to the Scrum Master
- Is a good way for a Scrum Master to track the progress of the team.

Sprint Review Meeting

- Is held at the end of each Sprint
- Business functionality which was created during the Sprint is demonstrated to the Product Owner
- Informal, should not distract Team members of doing their work

Measuring Progress in Scrum

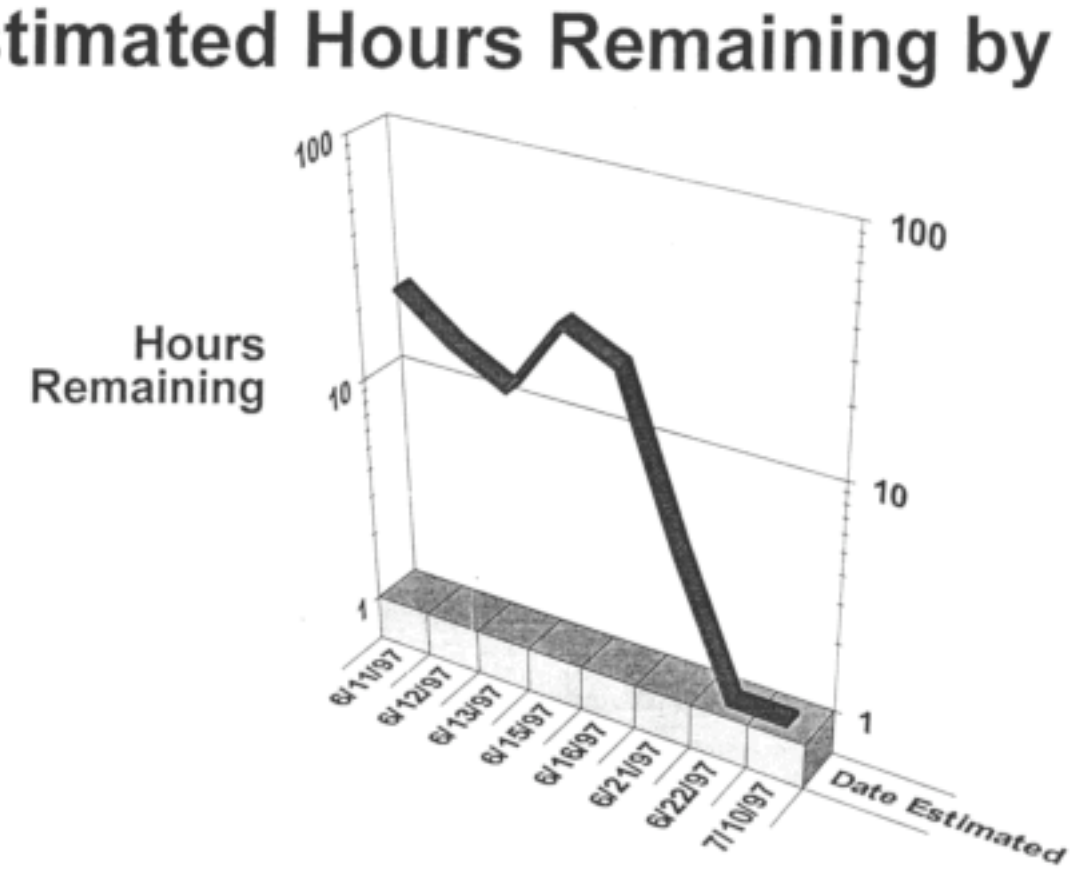
- Project Manager is mostly concerned about
  - Sprint progress: How is the team doing toward meeting their Sprint goal
  - Release progress: Will the release be on time with the quality and functionality desired?
  - Product progress: how is the product filling out compared to what's needed?
- 3 Types of Charts (good information radiators)
  - Sprint Burn down Chart (progress of the sprint)
  - Release Burn down Chart (progress of release)
  - Product Burn down chart (progress of the product)

Estimation of Product Backlog Items

- Establishes team's velocity (how much effort a Team can handle in one Sprint)
- Units of complexity
  - Size-category: L, M, S ("T-Shirt size")
  - Story points
  - Work days/work hours
- Methods of estimation:
  - Expert Review
  - Creating a Work Breakdown Structure (WBS)

Burn down Charts

- X-Axis: time (usually in days)
- Y-Axis: remaining effort



Burn down Charts are good Information Radiators

- Two characteristics are key for a good information radiator
  - The information changes over time
    - This makes it worth a person's while to look at the display...
  - It takes very little energy to view the display."

Sprint Burn down Chart

- Depicts the total Sprint Backlog hours remaining per day
- Shows the estimated amount of time to release
- Ideally should burn down to zero to the end of the Sprint
- Actually is not a straight line
- Can bump UP

Release Burn down Chart

- Will the release be done on right time?
- X-axis: sprints
- Y-axis: amount of hours remaining
- The estimated work remaining can also burn up

Alternative Release Burn down Chart

- Consists of bars (one for each sprint)
- Values on the Y-axis: positive AND negative
- Is more informative then a simple chart

Product Burn down Chart

- The “big picture” view of project’s progress
  - Burn down Chart containing all the releases.