605.601 Foundations of Software Engineering
Fall 2020

Module 08: Process Models

Dr. Tushar K. Hazra

tkhazra@gmail.com

(443)540-2230

605.601 Foundations of Software Engineering
Course Module 08: Process Models

Topics for Discussion

- Process Models

Course Module 08: Process Models

- A Generic Process Model
  - Process framework
    - Umbrella activities
      - … Framework activity
        - … Software engineering action
        - … Software engineering action
      - … . . .
        - … Framework activity
          - … Software engineering action
          - … Software engineering action
        - … . . .

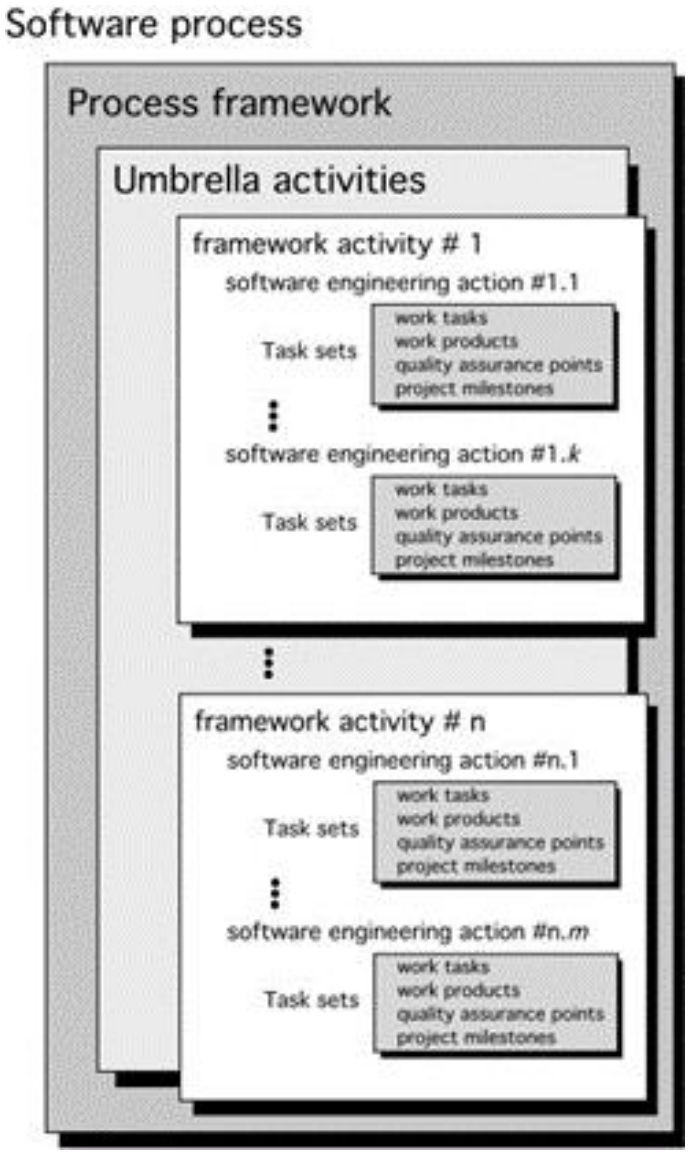
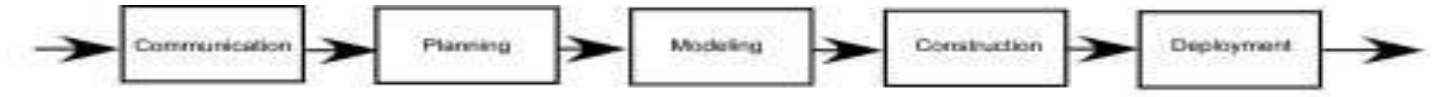


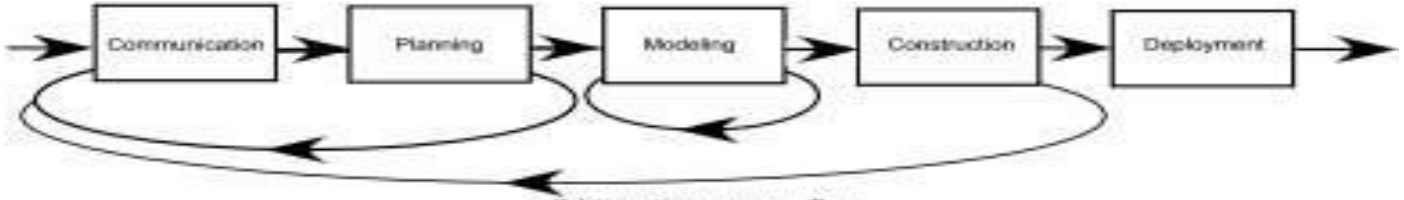
Image source: Pressman, R. (2010). *Software Engineering: A Practitioner's Approach*. McGraw-Hill, Inc., New York, NY, 7th edition

Course Module 08: Process Models

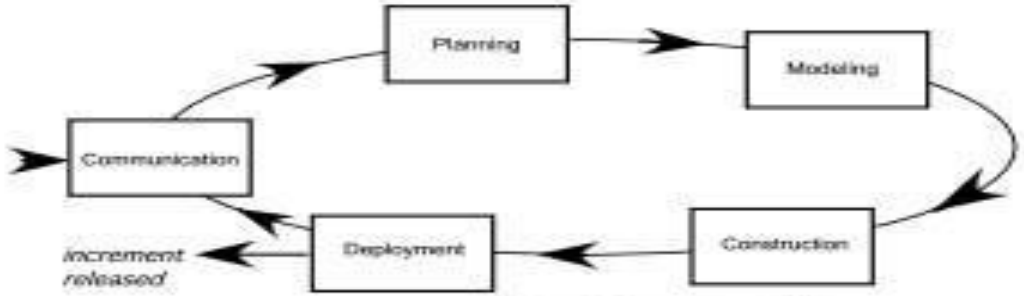
- Process Flow



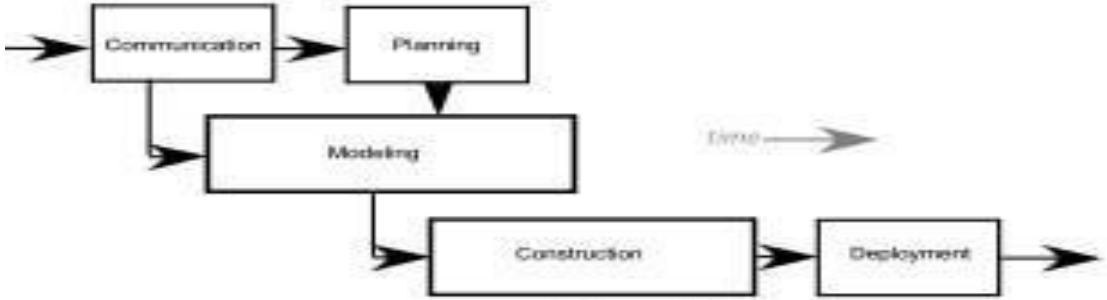
(a) linear process flow



(b) iterative process flow



(c) evolutionary process flow



(d) parallel process flow

Image source: Pressman, R. (2010). *Software Engineering: A Practitioner's Approach*. McGraw-Hill, Inc., New York, NY, 7th edition

Course Module 08: Process Models

Process Patterns

- A process pattern
  - describes a process-related problem that is encountered during software engineering work,
  - identifies the environment in which the problem has been encountered, and
  - suggests one or more proven solutions to the problem.

- Stated in more general terms, a process pattern provides you with a template (Ambler, 1998)—a consistent method for describing problem solutions within the context of the software process.

Course Module 08: Process Models

- Process Assessment and Improvement
  - Standard CMMI Assessment Method for Process Improvement (SCAMPI): provides a five step process assessment model that incorporates five phases: initiating, diagnosing, establishing, acting and learning.
  - CMM-Based Appraisal for Internal Process Improvement (CBA IPI): provides a diagnostic technique for assessing the relative maturity of a software organization; uses the SEI CMM as the basis for the assessment (Dunaway and Masters, 2001)

Course Module 08: Process Models

- Process Assessment and Improvement (Continued)
  - SPICE: The SPICE (ISO/IEC15504) standard defines a set of requirements for software process assessment. The intent of the standard is to assist organizations in developing an objective evaluation of the efficacy of any defined software process. (ISO, 2008)
  - ISO 9001:2000 for Software: a generic standard that applies to any organization that wants to improve the overall quality of the products, systems, or services that it provides. Therefore, the standard is directly applicable to software organizations and companies. (Anton and Anton, 2006)

Course Module 08: Process Models

- Prescriptive Models
  - Prescriptive process models advocate an orderly approach to software engineering.

- That leads to a few questions. . .
  - If prescriptive process models strive for structure and order, are they inappropriate for a software world that thrives on change?
  - Yet, if we reject traditional process models (and the order they imply) and replace them with something less structured, do we make it impossible to achieve coordination and coherence in software work?

Course Module 08: Process Models

- The Waterfall Model

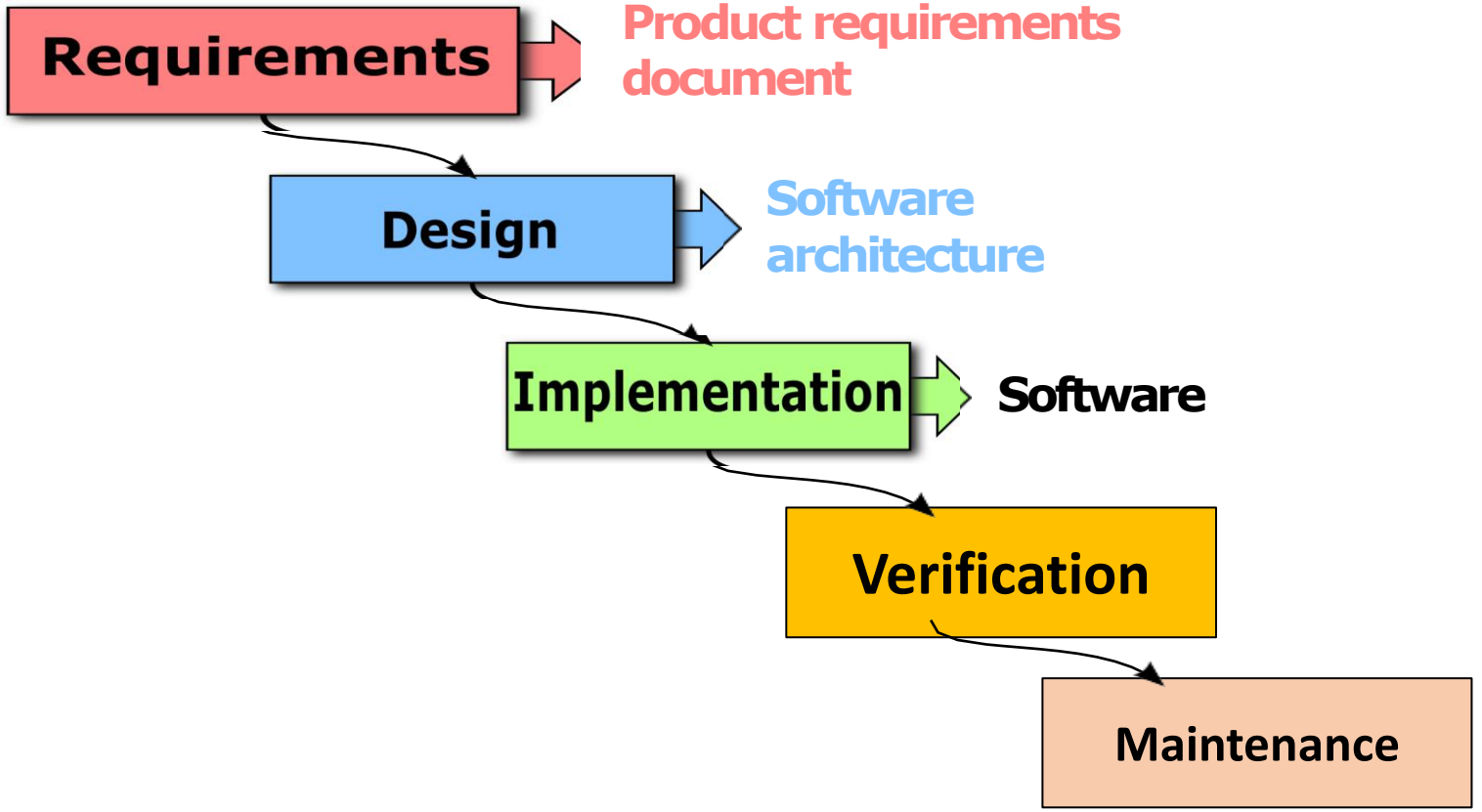


Image source: https://commons.wikimedia.org/wiki/File:Waterfall_model.svg

Course Module 08: Process Models

- The V-Model

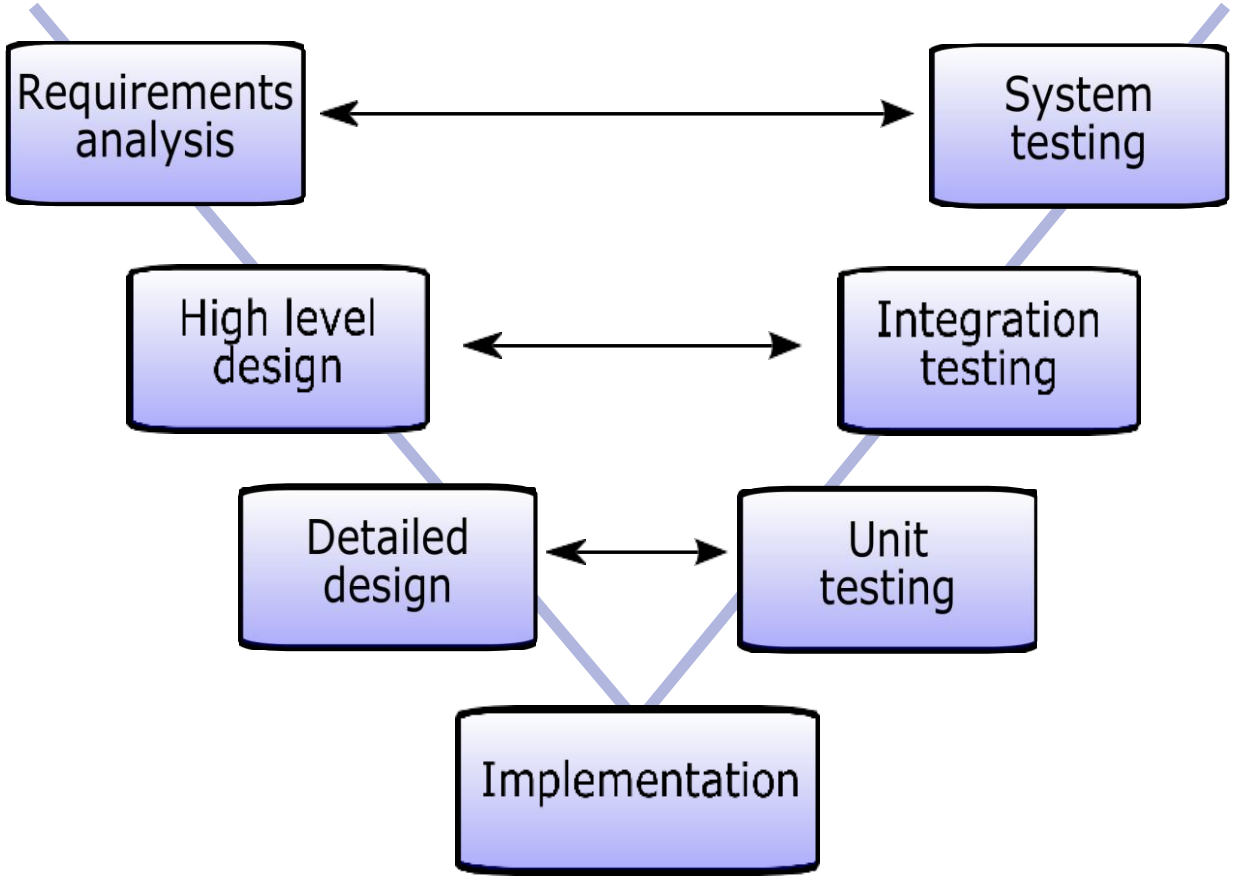


Image source: https://commons.wikimedia.org/wiki/File:V-model.svg

Course Module 08: Process Models

- The Incremental Model

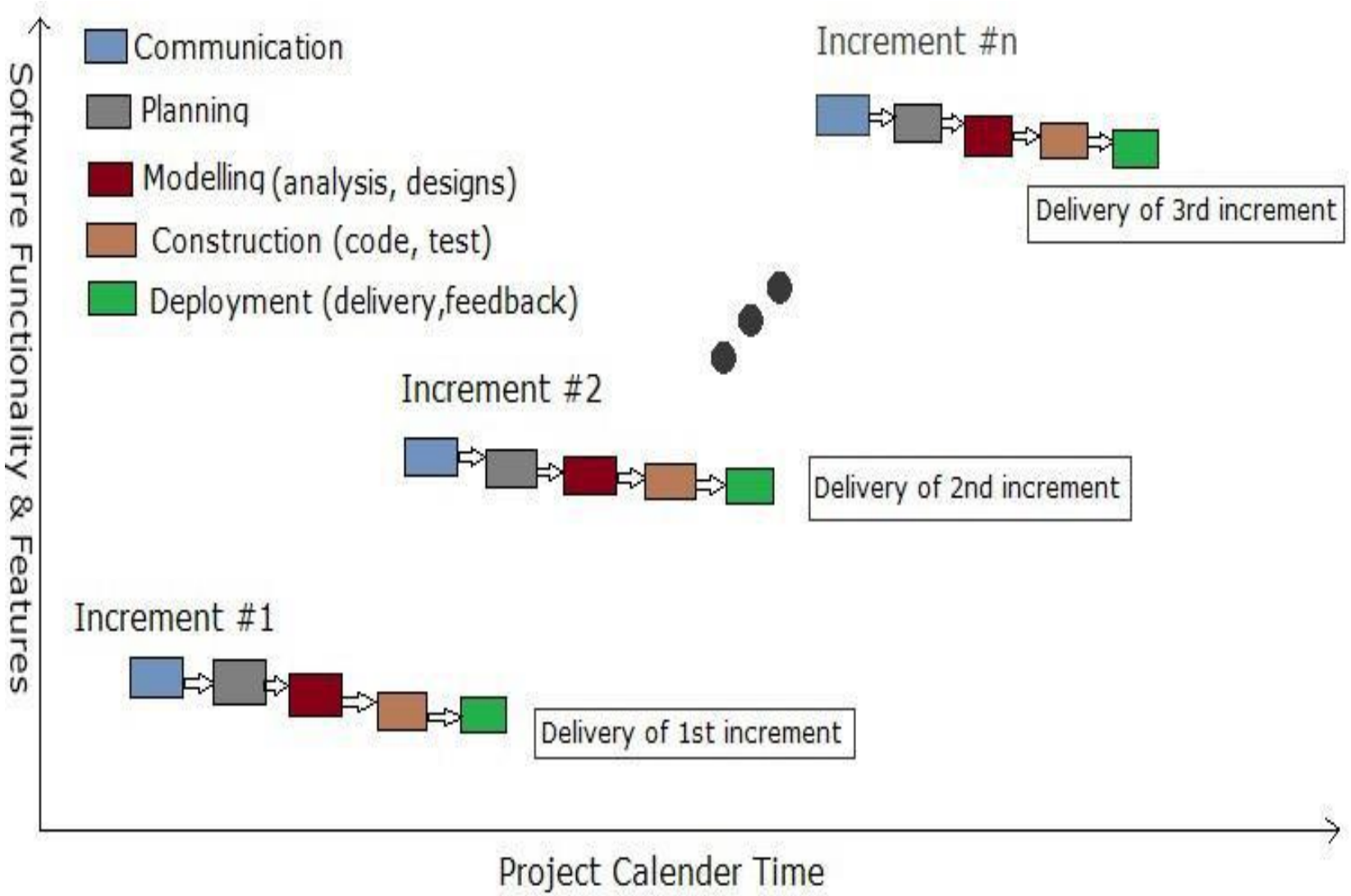


Image source: https://commons.wikimedia.org/wiki/File:Incremental_Model.jpg

Course Module 08: Process Models

- Prototyping

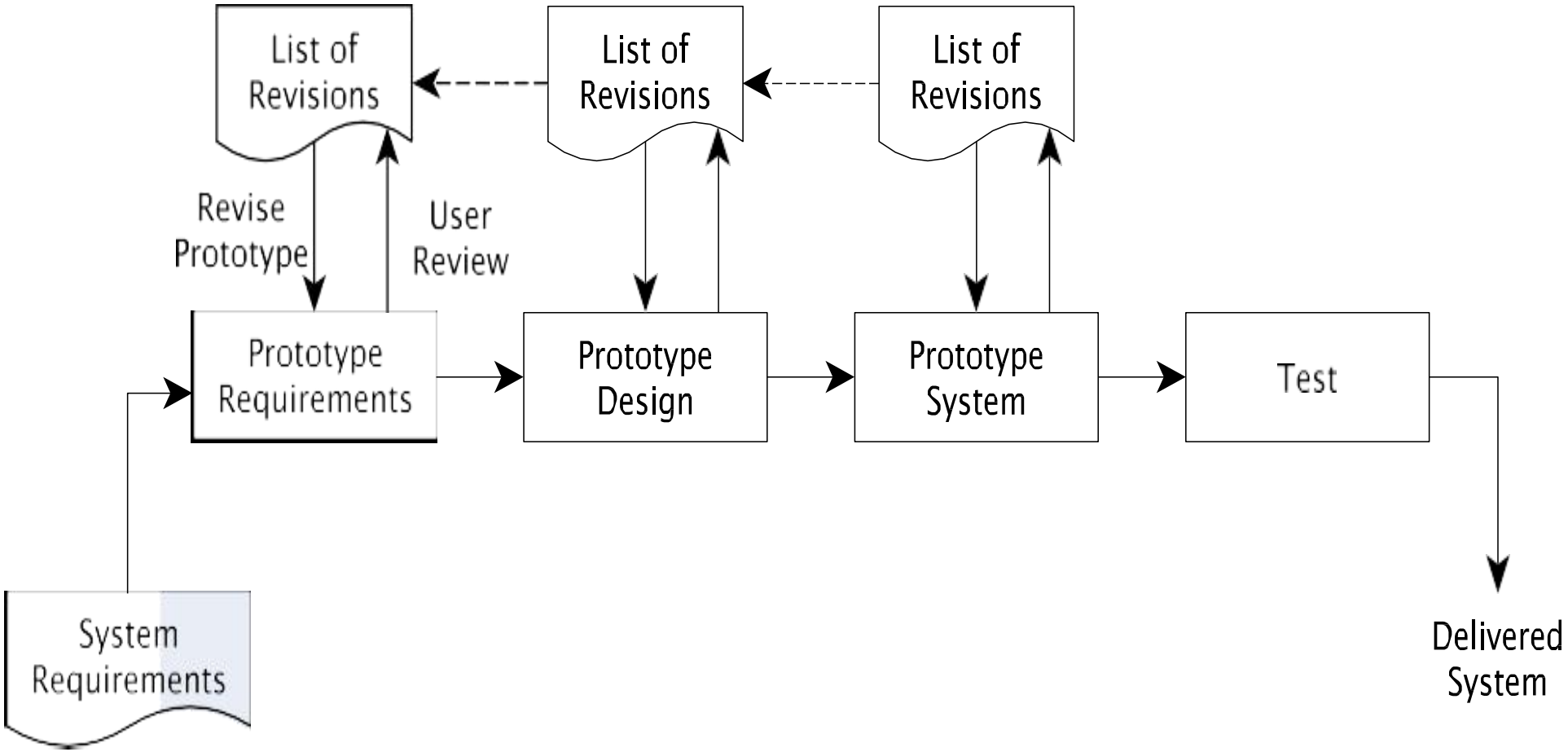


Image adapted from [Pfleeger and Atlee, 2006]

Course Module 08: Process Models

- The Spiral

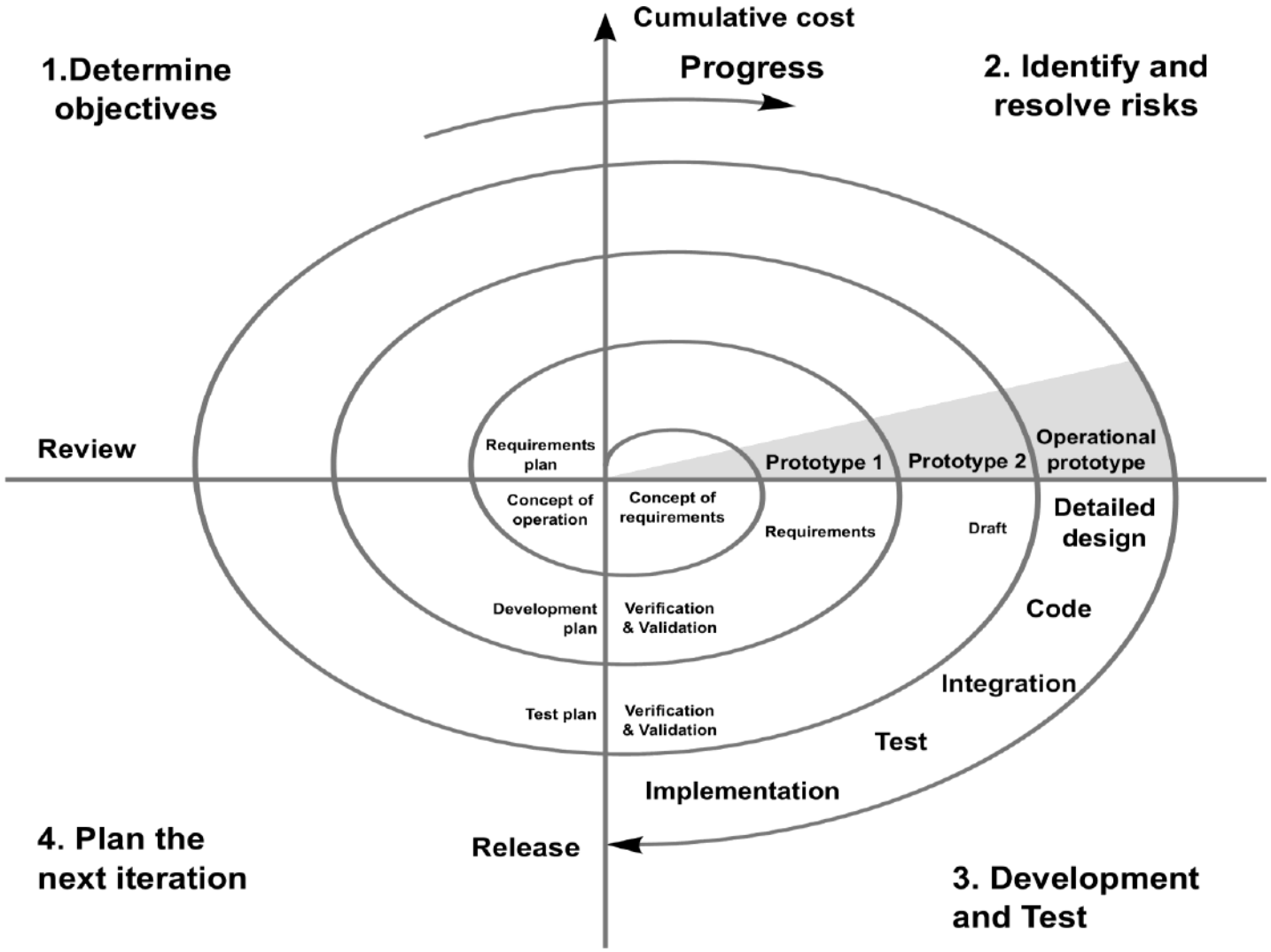


Image source: https://commons.wikimedia.org/wiki/File:Spiral_model_(Boehm,_1988).svg

Course Module 08: Process Models

The 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. (Beck et al.)

Course Module 08: Process Models

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

Course Module 08: Process Models

- Agility and the Cost of Change

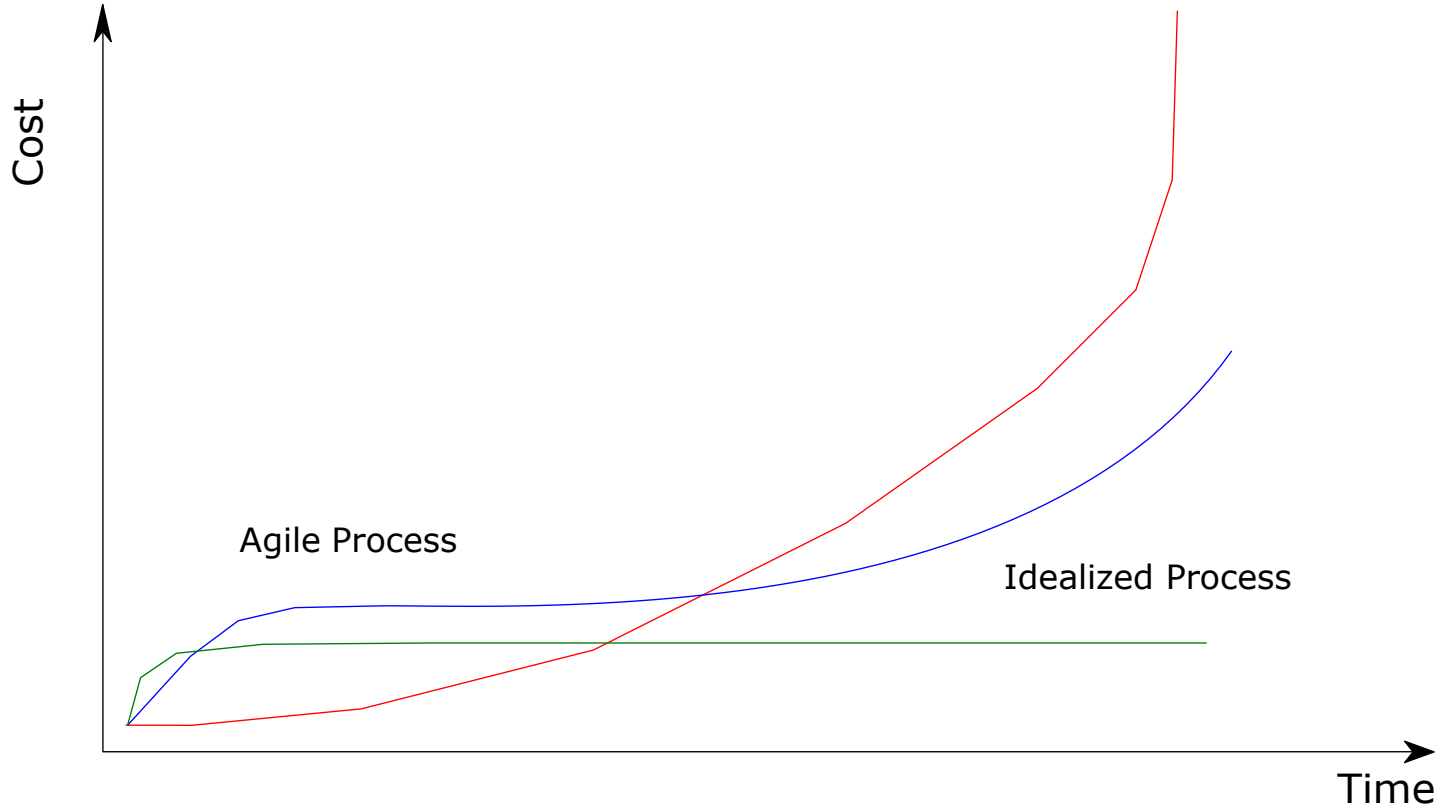


Image adapted from [Pressman, 2010]

Course Module 08: Process Models

- 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

- Agile Principles I
  1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
  2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
  3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
  4. Business people and developers must work together daily throughout the project.
  5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.

Course Module 08: Process Models

- Agile Principles II
  6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
  7. Working software is the primary measure of progress.
  8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
  9. Continuous attention to technical excellence and good design enhances agility.
  10. Simplicity—the art of maximizing the amount of work not done—is essential.
  11. The best architectures, requirements, and designs emerge from self-organizing teams.

Course Module 08: Process Models

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

Human Factors

- The process molds to the needs of the people and team, not the other way around
- Key traits must exist among the people on an agile team and the team itself:
  - Competence
  - Common focus
  - Collaboration
  - Decision-making ability
  - Fuzzy problem-solving ability
  - Mutual trust and respect
  - Self-organization

Extreme Programming (XP)

- The most widely used agile process, originally proposed by Kent Beck
- 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 (continued)

- 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—an iterative refinement of the internal program design

Extreme Programming (continued)

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

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

- Extreme Programmin (continued)

Image source: https://commons.wikimedia.org/wiki/File:Xp-loop_with_time_frames.jpg

Course Module 08: Process Models

Scrum: Originally proposed by Schwaber and Beedle

- Distinguishing features
  - Development work is partitioned into packets
  - Testing and documentation are on-going as the product is constructed
  - Work occurs in sprints and is derived from a backlog of existing requirements
  - Meetings are very short and sometimes conducted without chairs
  - Demos are delivered to the customer with the time-box allocated

Course Module 08 Process Models

Scrum Framework

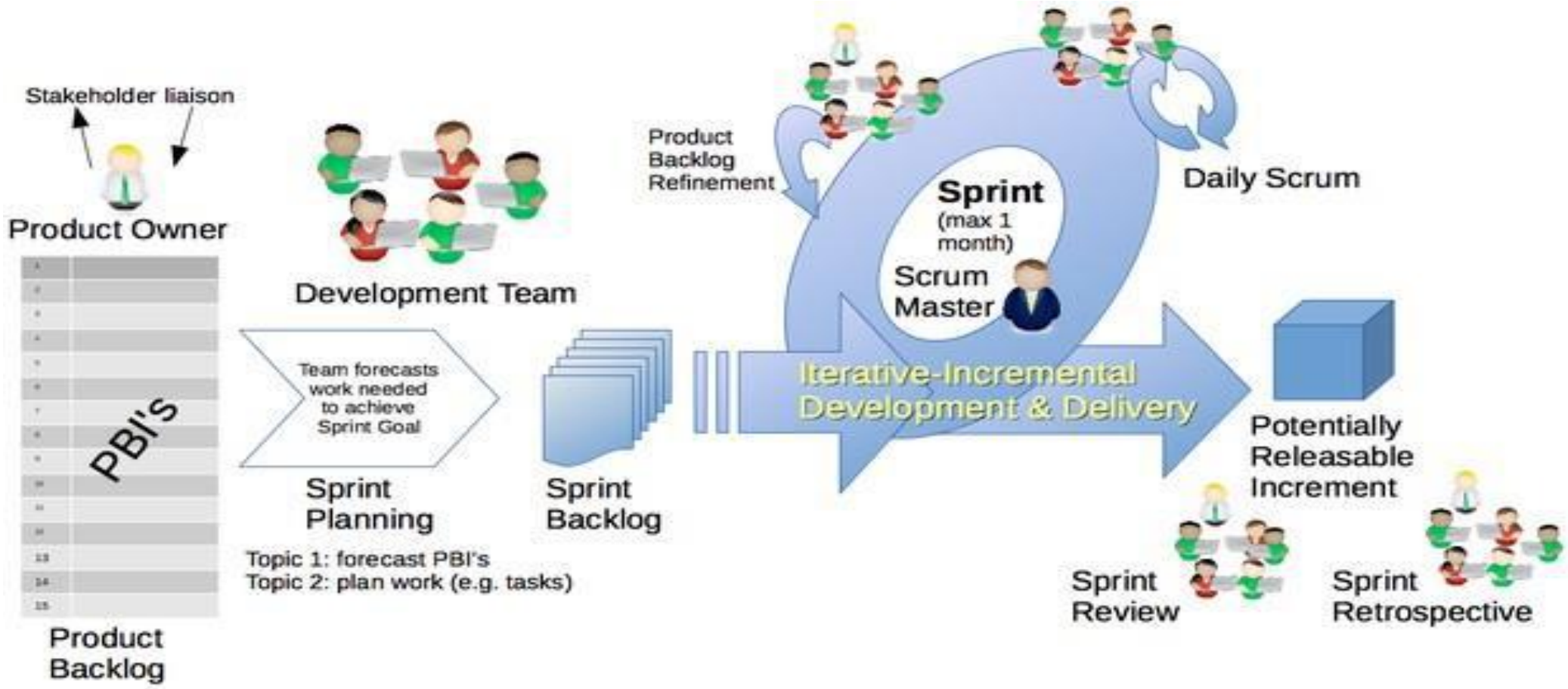


Image source: https://commons.wikimedia.org/wiki/File:Scrum_Framework.png

Course Module 08: Process Models

- Scrum Process

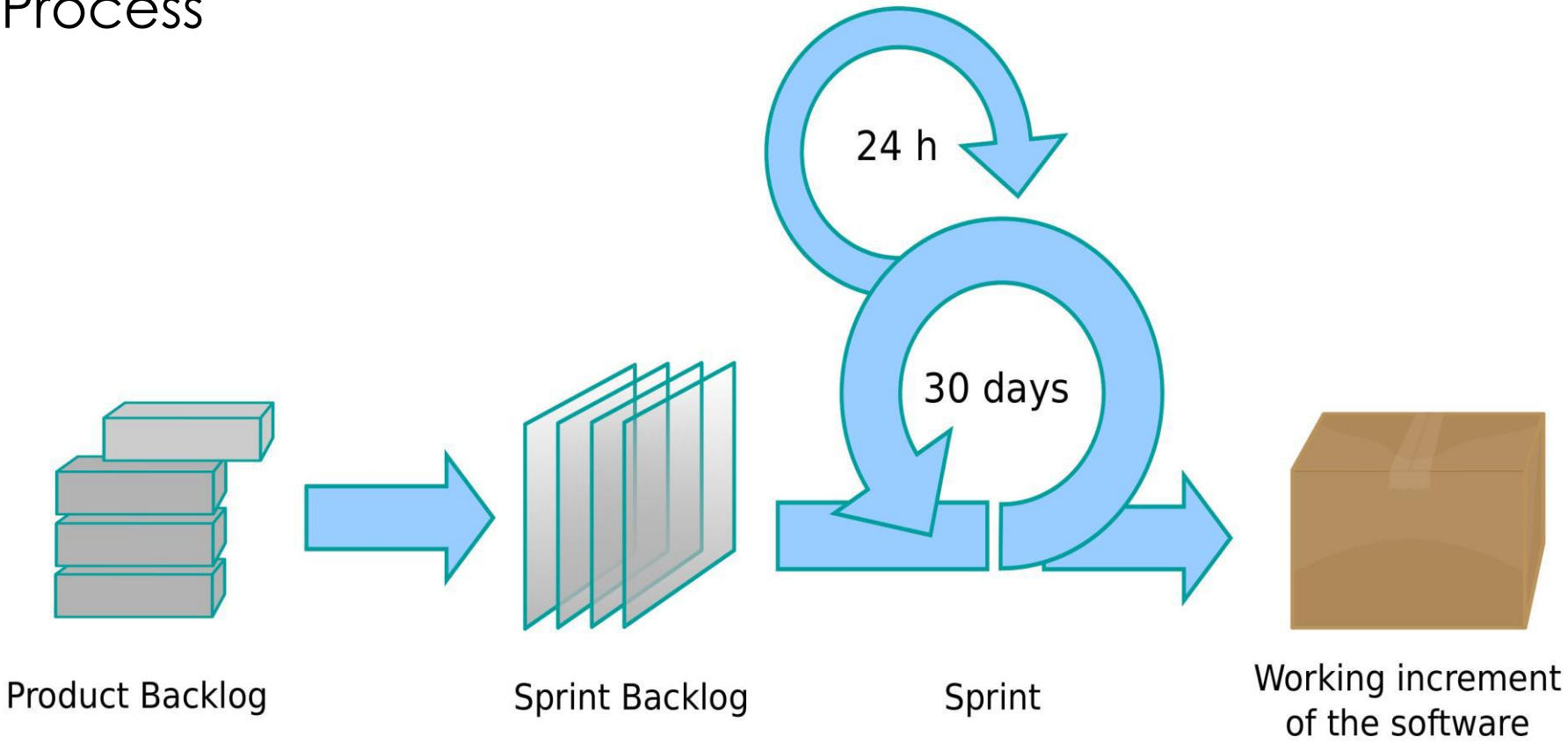


Image source: https://commons.wikimedia.org/wiki/File:Scrum_process.svg

Course Module 08: Process Models

- Measuring Agile

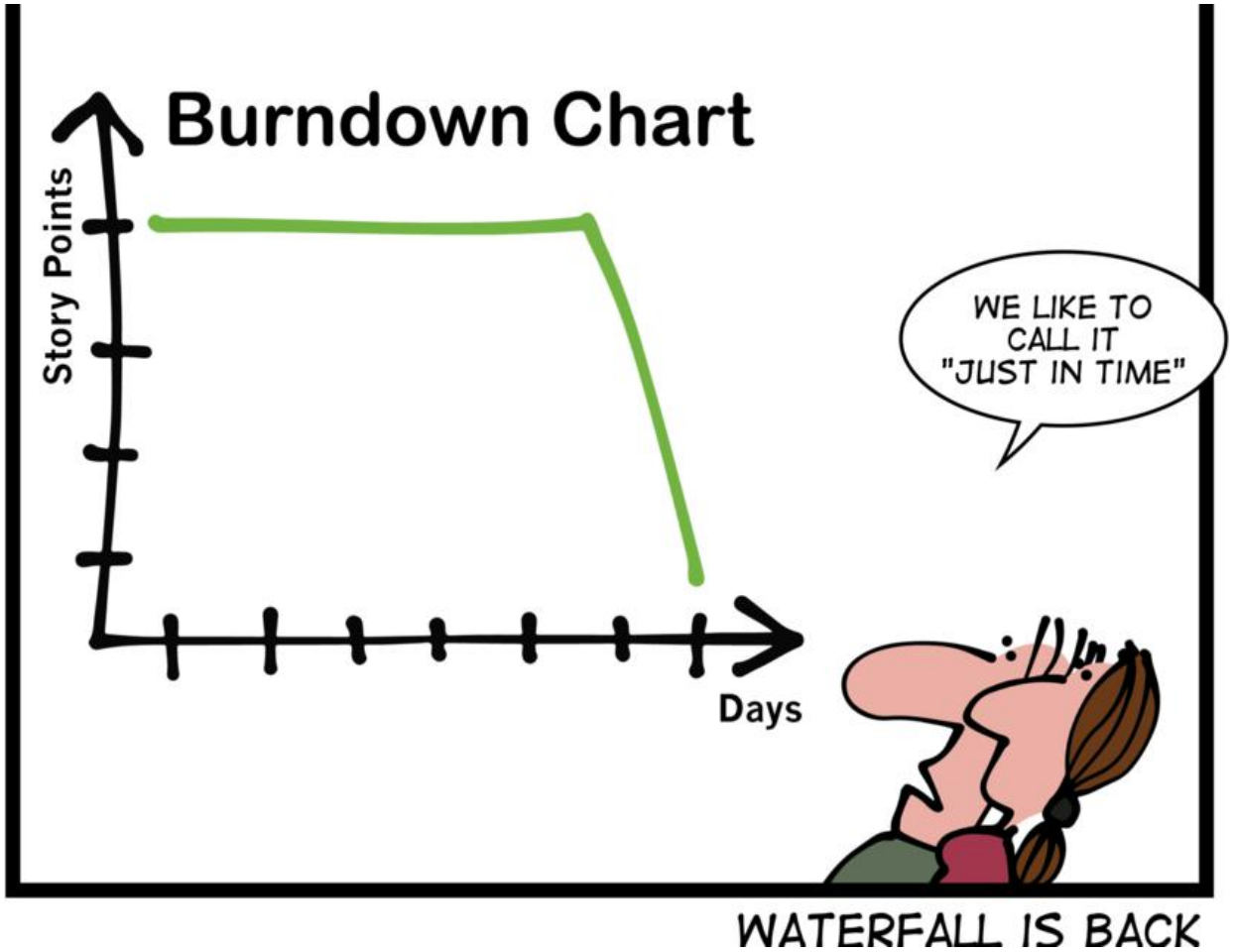


Image source: http://geek-and-poke.com/geekandpoke/2015/7/5/the-new-waterfall

Course Module 08: Process Models

How "agile" is an organization?

- Agile is not an excuse to ignore formal software project management
- Embracing agile or buzzwords?
  - Joe Little, "The Nokia Test," Agile & Business (blog), 2 December 2007. Online: http://agileconsortium.blogspot.com/2007/12/nokia-test.html
  - Karlskrona test: http://mayberg.se/learning/karlskrona-test
  - Kelly Waters, "How Agile Are You? (Take This 42 Point Test)," All About Agile (blog), 21 January 2008. Online: http://www.allaboutagile.com/how-agile-are-you-take-this-42-point-test/