

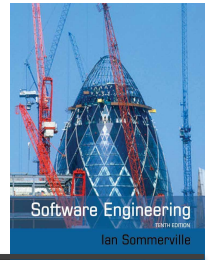
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# Application Development Process

Adapted by Michael Haaf from Ch 1-5  
of [“Software Engineering, 10th Edition”](#) by Ian Sommerville

# Topics covered

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- ✧ Application Development Process
- ✧ Agile methods
- ✧ Agile development techniques
- ✧ Agile project management
- ✧ Scaling agile methods

# Application Development Process

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- ✧ **Specification**, where the requirements and the con of the software that is to be produced are defined.
- ✧ **Development**, where the software is designed and programmed.
- ✧ **Validation**, where the software is checked to ensure that it meets requirements.
- ✧ **Evolution**, where the software is modified to reflect changing requirements.

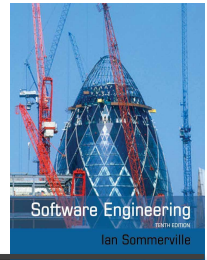
# Agile development

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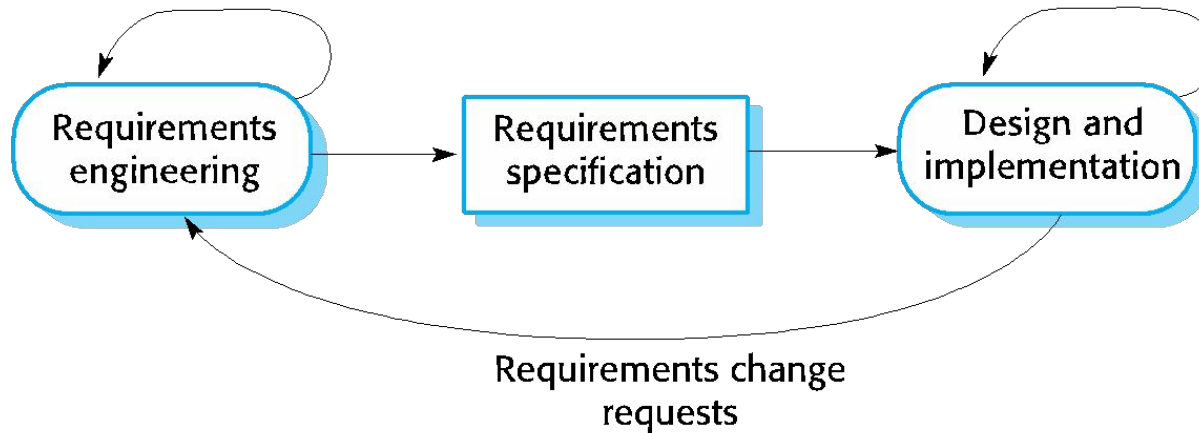


- ✧ The **specification, design** and **implementation** phases are interwoven (combined)
- ✧ The system is developed as a series of versions or increments
- ✧ Frequent delivery of new versions for evaluation
- ✧ Extensive tool support (e.g. automated testing tools) used to support development.
- ✧ Minimal documentation – focus on working code

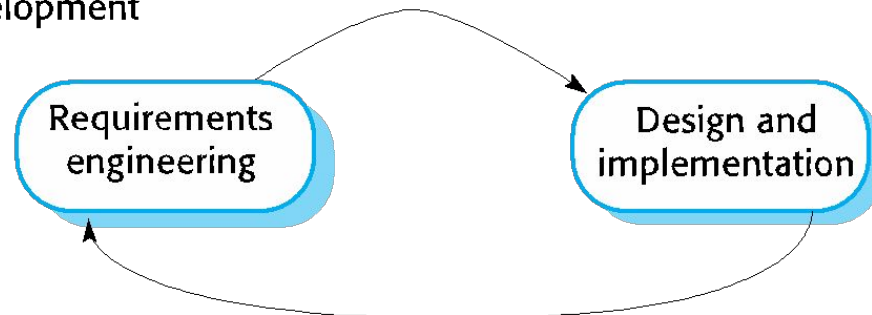
# Plan-driven and agile development



## Plan-based development

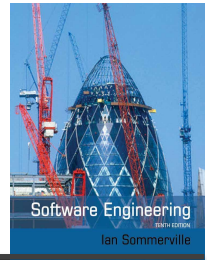


## Agile development



# Plan-driven and agile development

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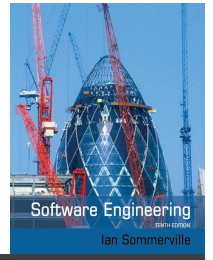


## ✧ Plan-driven development

- A plan-driven approach to software engineering is based around separate development stages with the outputs to be produced at each of these stages planned in advance.
- Iteration occurs within activities.

## ✧ Agile development

- Specification, design, implementation and testing are inter-leaved and the outputs from the development process are decided through a process of negotiation during the software development process.



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# Agile methods

# Agile methods



- ✧ Dissatisfaction with the overheads involved in software design methods of the 1980s and 1990s led to the creation of agile methods. These methods:
  - Focus on the code rather than the design
  - Are based on an iterative approach to software development
  - Are intended to deliver working software quickly and evolve this quickly to meet changing requirements.
- ✧ The aim of agile methods is to reduce overheads in the software process (e.g. by limiting documentation) and to be able to respond quickly to changing requirements without excessive rework.

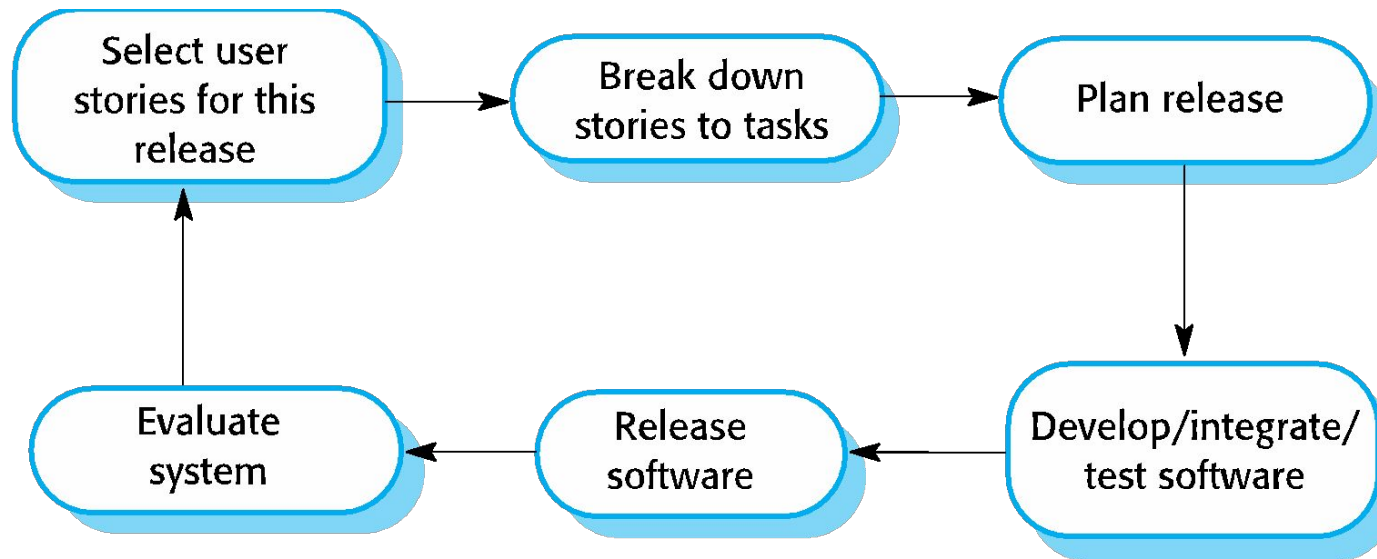


# Extreme programming



- ✧ A very influential agile method, developed in the late 1990s, that introduced a range of agile development techniques.
- ✧ 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.

# The Extreme Programming release cycle



# Extreme programming practices (a)



Principle or practice	Description
Incremental planning	Requirements are recorded on story cards and the stories to be included in a release are determined by the time available and their relative priority. The developers break these stories into development 'Tasks'. See Figures 3.5 and 3.6.
Small releases	The minimal useful set of functionality that provides business value is developed first. Releases of the system are frequent and incrementally add functionality to the first release.
Simple design	Enough design is carried out to meet the current requirements and no more.
Test-first development	An automated unit test framework is used to write tests for a new piece of functionality before that functionality itself is implemented.
Refactoring	All developers are expected to refactor the code continuously as soon as possible code improvements are found. This keeps the code simple and maintainable.

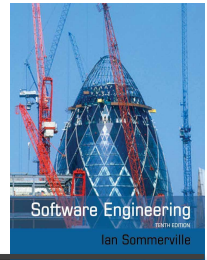
# Extreme programming practices (b)



Pair programming	Developers work in pairs, checking each other's work and providing the support to always do a good job.
Collective ownership	The pairs of developers work on all areas of the system, so that no islands of expertise develop and all the developers take responsibility for all of the code. Anyone can change anything.
Continuous integration	As soon as the work on a task is complete, it is integrated into the whole system. After any such integration, all the unit tests in the system must pass.
Sustainable pace	Large amounts of overtime are not considered acceptable as the net effect is often to reduce code quality and medium term productivity

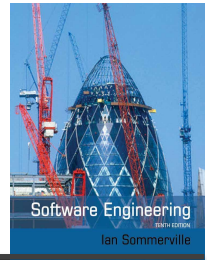
# XP and agile principles

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- ✧ Incremental development is supported through small, frequent system releases.
- ✧ 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.

# Influential XP practices



- ✧ Extreme programming has a technical focus and is not easy to integrate with management practice in most organizations.
- ✧ Consequently, while agile development uses practices from XP, the method as originally defined is not widely used.
- ✧ Key practices
  - User stories for specification
  - Refactoring
  - Test-first development
  - Pair programming

# User stories for requirements

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- ✧ In XP, a customer or user is part of the XP team and is responsible for making decisions on requirements.
- ✧ User requirements are expressed as user stories or scenarios.
- ✧ 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.

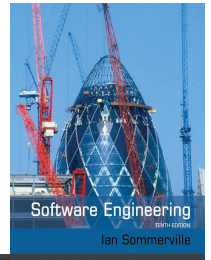
# Refactoring



- ✧ 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.
- ✧ XP, however, maintains that this is not worthwhile as changes cannot be reliably anticipated.
- ✧ Rather, it proposes constant code improvement (refactoring) to make changes easier when they have to be implemented.



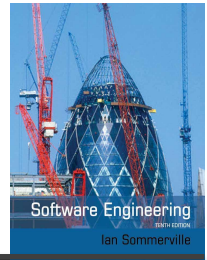
# Refactoring



- ✧ Programming team look for possible software improvements and make these improvements even where there is no immediate need for them.
- ✧ This improves the understandability of the software and so reduces the need for documentation.
- ✧ Changes are easier to make because the code is well-structured and clear.
- ✧ However, some changes requires architecture refactoring and this is much more expensive.

# Examples of refactoring

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- ✧ Re-organization of a class hierarchy to remove duplicate code.
- ✧ Tidying up and renaming attributes and methods to make them easier to understand.
- ✧ The replacement of inline code with calls to methods that have been included in a program library.

# Pair programming



- ✧ Pair programming involves programmers working in pairs, developing code together.
- ✧ 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 improving the system code.

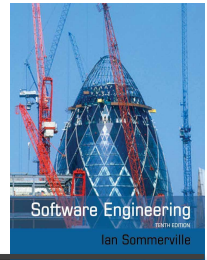
# Pair programming



- ✧ In pair programming, programmers sit together at the same computer to develop the software.
- ✧ Pairs are created dynamically so that all team members work with each other during the development process.
- ✧ The sharing of knowledge that happens during pair programming is very important as it reduces the overall risks to a project when team members leave.
- ✧ Pair programming is not necessarily inefficient and there is some evidence that suggests that a pair working together is more efficient than 2 programmers working separately.

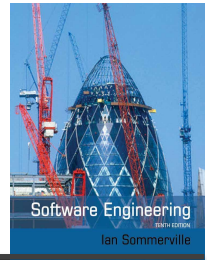
# Test-first development

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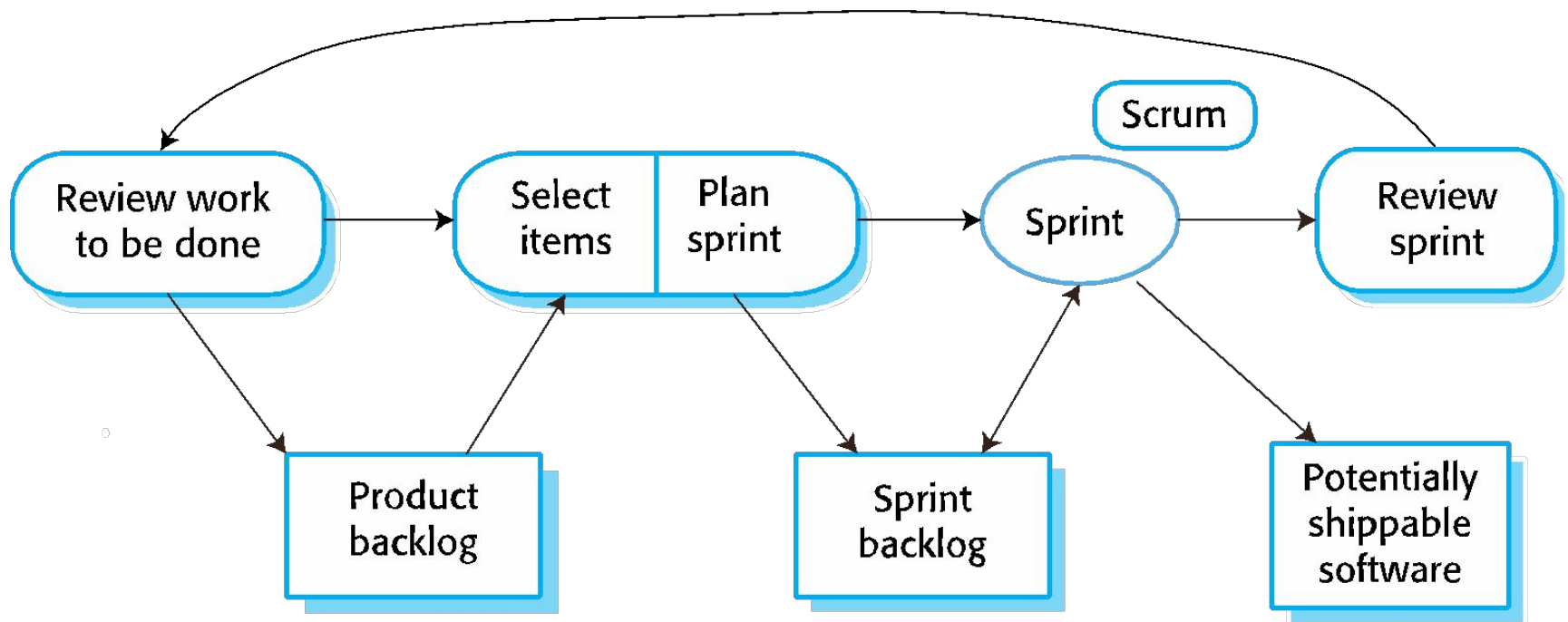
- ✧ Testing is central to XP and XP has developed an approach where the program is tested after every change has been made.
- ✧ XP testing features:
  - Test-first development.
  - Incremental test development from scenarios.
  - User involvement in test development and validation.
  - Automated test harnesses are used to run all component tests each time that a new release is built.

# Test-driven 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.
  - Usually relies on a testing framework such as Junit.
- ✧ All previous and new tests are run automatically when new functionality is added, thus checking that the new functionality has not introduced errors.

# Scrum sprint cycle



# Scrum benefits

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- ✧ The product is broken down into a set of manageable and understandable chunks.
- ✧ Unstable requirements do not hold up progress.
- ✧ The whole team have visibility of everything and consequently team communication is improved.
- ✧ Customers see on-time delivery of increments and gain feedback on how the product works.
- ✧ Trust between customers and developers is established and a positive culture is created in which everyone expects the project to succeed.