SOFTWARE ENGINEERING
(Week-2)

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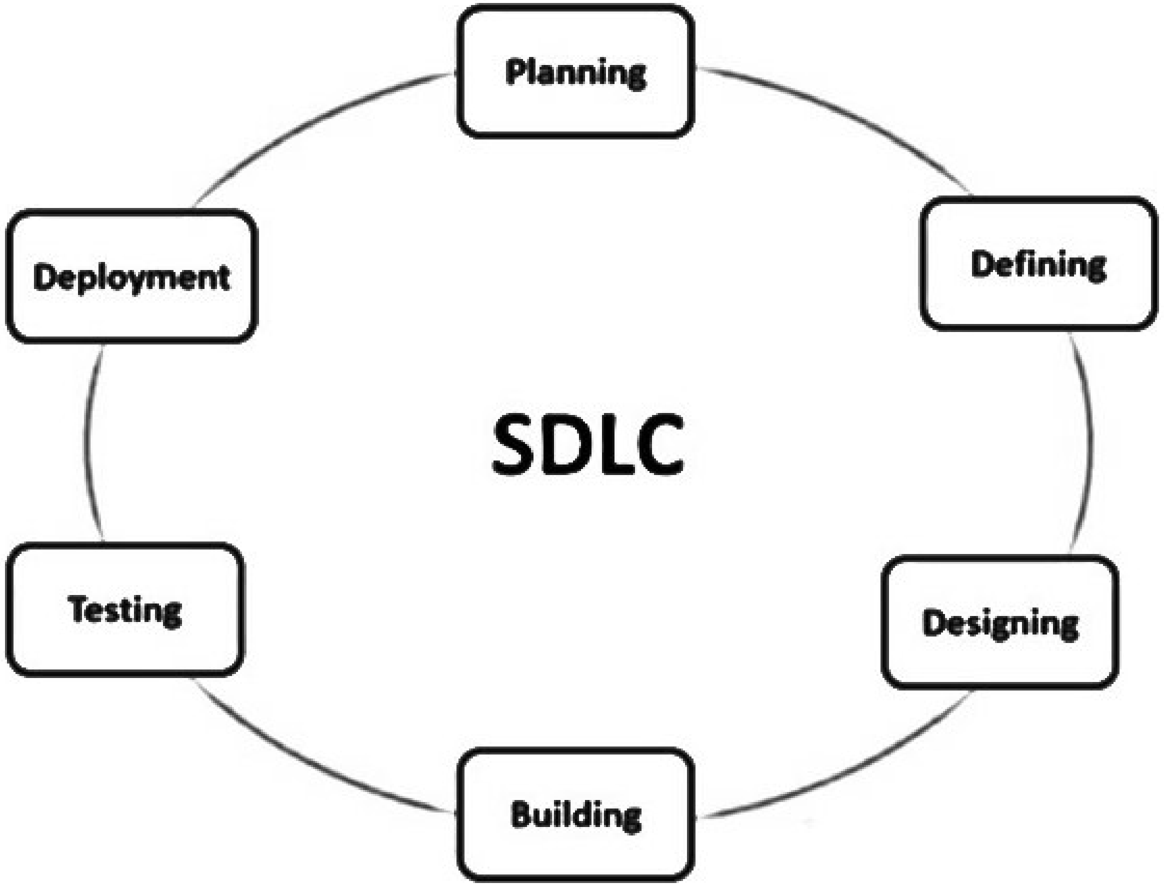
AGENDA OF WEEK # 2

- Software Development Process Models
- Agile Development

WHAT IS A SOFTWARE PROCESS?

- SP is a **set of activities** whose goal is the development or evolution of software.
- Fundamental activities in all software processes are:
  - **Specification** - what the system should do and its development constraints.
  - **Development** - production of the software system (design and implementation)
  - **Validation** - checking that the software is what the customer wants
  - **Evolution** - changing the software in response to changing demands

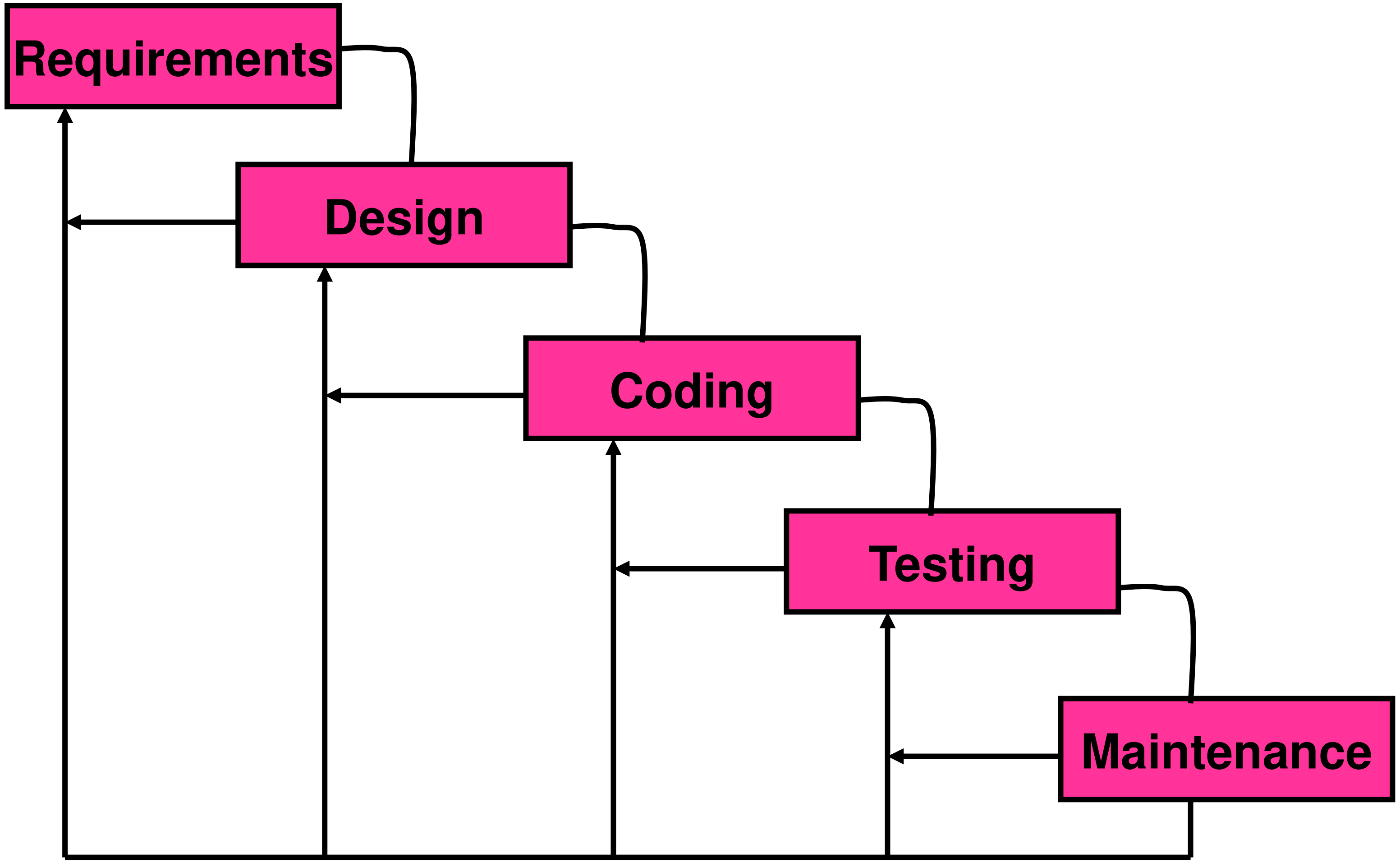
SOFTWARE DEVELOPMENT LIFE CYCLE



SOFTWARE PROCESS MODELS

1. **Waterfall model**
2. **V Model**
3. **Rapid prototyping model**
4. **Evolutionary s/w process Model**
   - **Incremental model**
   - **Spiral Model**
5. **Agile Development**
   1. **Extreme Programming**
   2. **Scrum**

WATERFALL PROCESS MODEL
AKA
LINEAR SEQUENTIAL MODEL



WATERFALL MODEL ADVANTAGES

- Simple and easy to understand and use
- Works well for smaller projects where requirements are very well understood.
- Clearly defined stages.
- Well understood milestones.
- Easy to arrange tasks.
- Process and results are well documented.

WATERFALL MODEL PROBLEMS

The drawback of the waterfall model is the difficulty of accommodating change after

the process is underway.

This makes it difficult to respond to changing customer requirements

- Therefore, this model is only appropriate when the requirements are well-understood.

Waterfall model describes a process of stepwise refinement

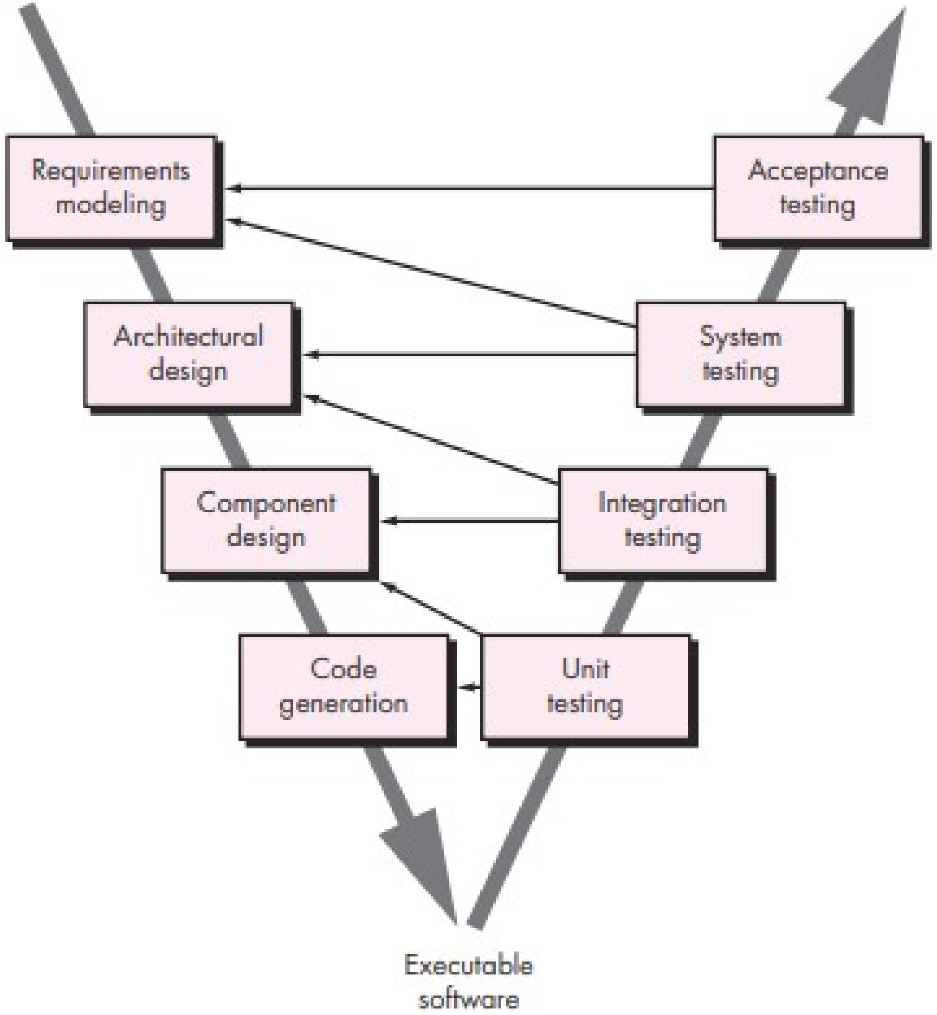
WATERFALL MODEL (PROBLEMS)

- Doesn't support iteration, so changes can cause confusion

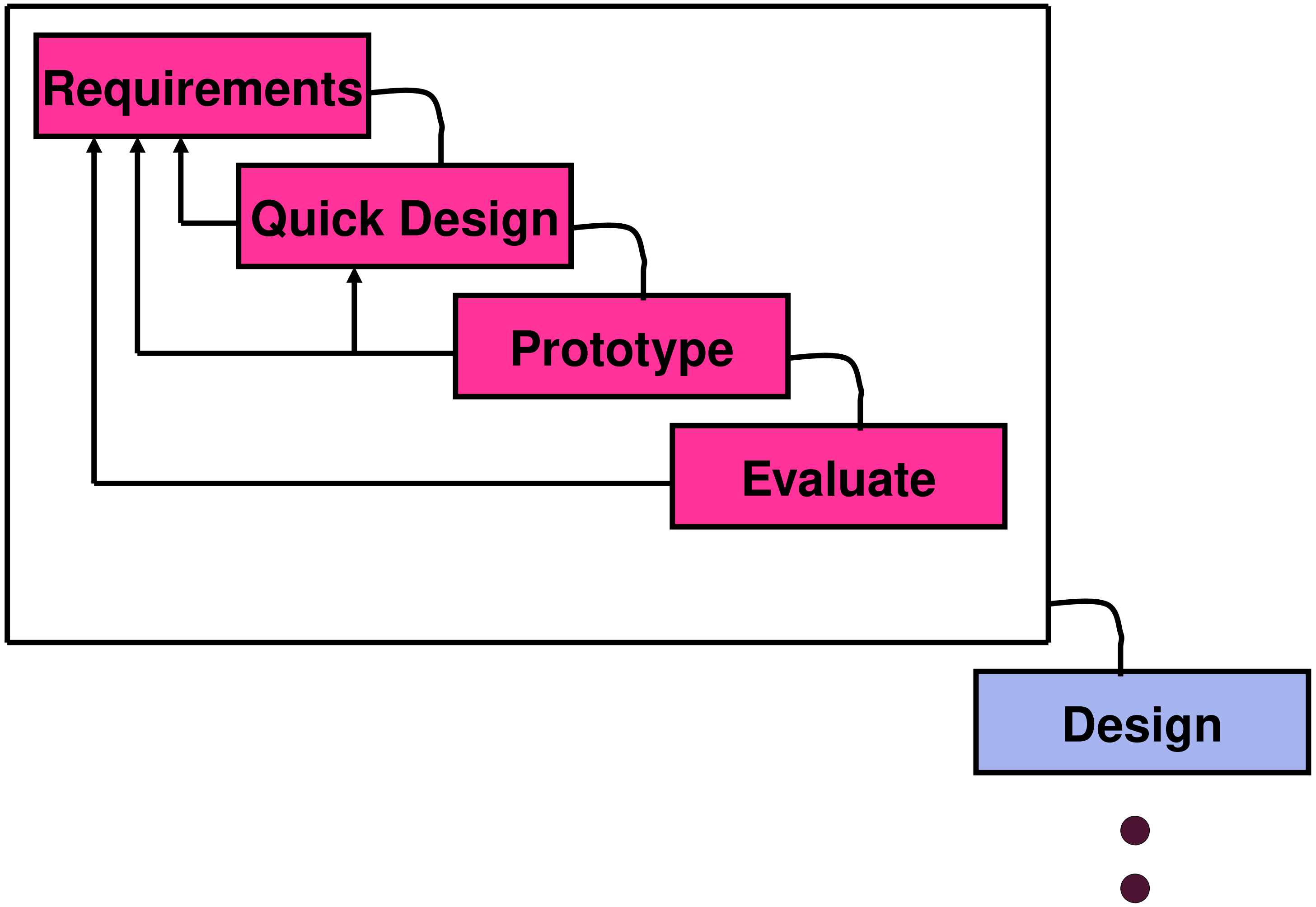
- Difficult for customers to state all requirements explicitly and up front

- Requires customer patience because a working version of the program doesn't occur until the final phase

V MODEL


Requirements modeling
Acceptance testing
Architectural design
System testing
Component design
Integration testing
Code generation
Unit testing
Executable software

RAPID PROTOTYPING PROCESS MODEL



Requirements

Quick Design

Prototype

Evaluate

Design

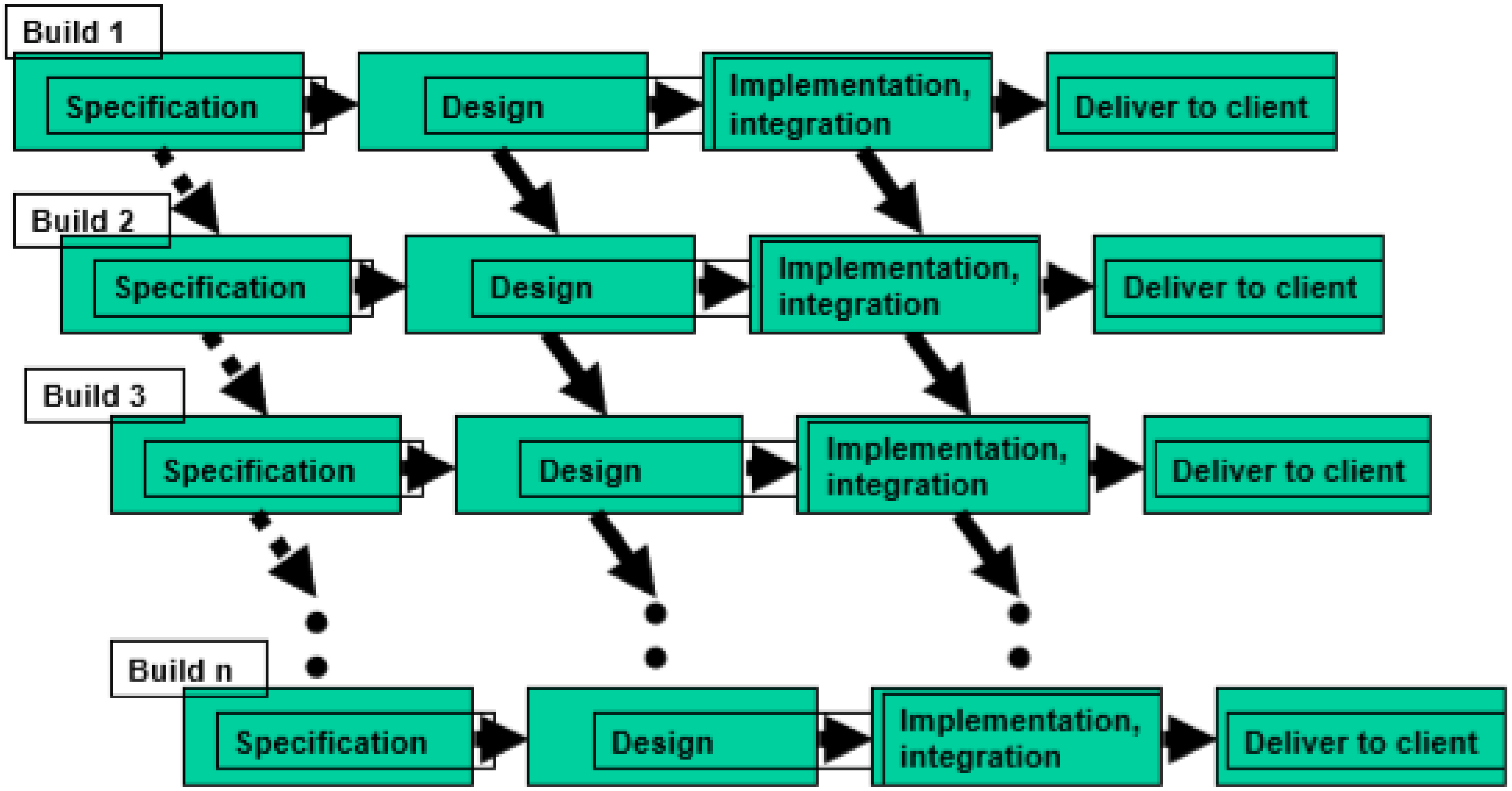
RAPID PROTOTYPING MODEL

- The Rapid Prototyping Model is used to overcome issues related to understanding and capturing of user requirements.

Evolutionary s/w process Model

1. Incremental model
2. Spiral Model

INCREMENTAL OR ITERATIVE PROCESS MODEL



INCREMENTAL OR ITERATIVE PROCESS MODEL

- Rather than deliver the system as a single delivery, **the development and delivery is broken down into increments** with each increment delivering part of the required functionality.

- **Once the development of an increment is started, the requirements are frozen** though requirements for later increments can continue to evolve.

INCREMENTAL OR ITERATIVE DEVELOPMENT ADVANTAGES

- **Customer value** can be delivered with each increment so system functionality is available earlier.

- **Early increments** act as a prototype to help elicit requirements for later increments.

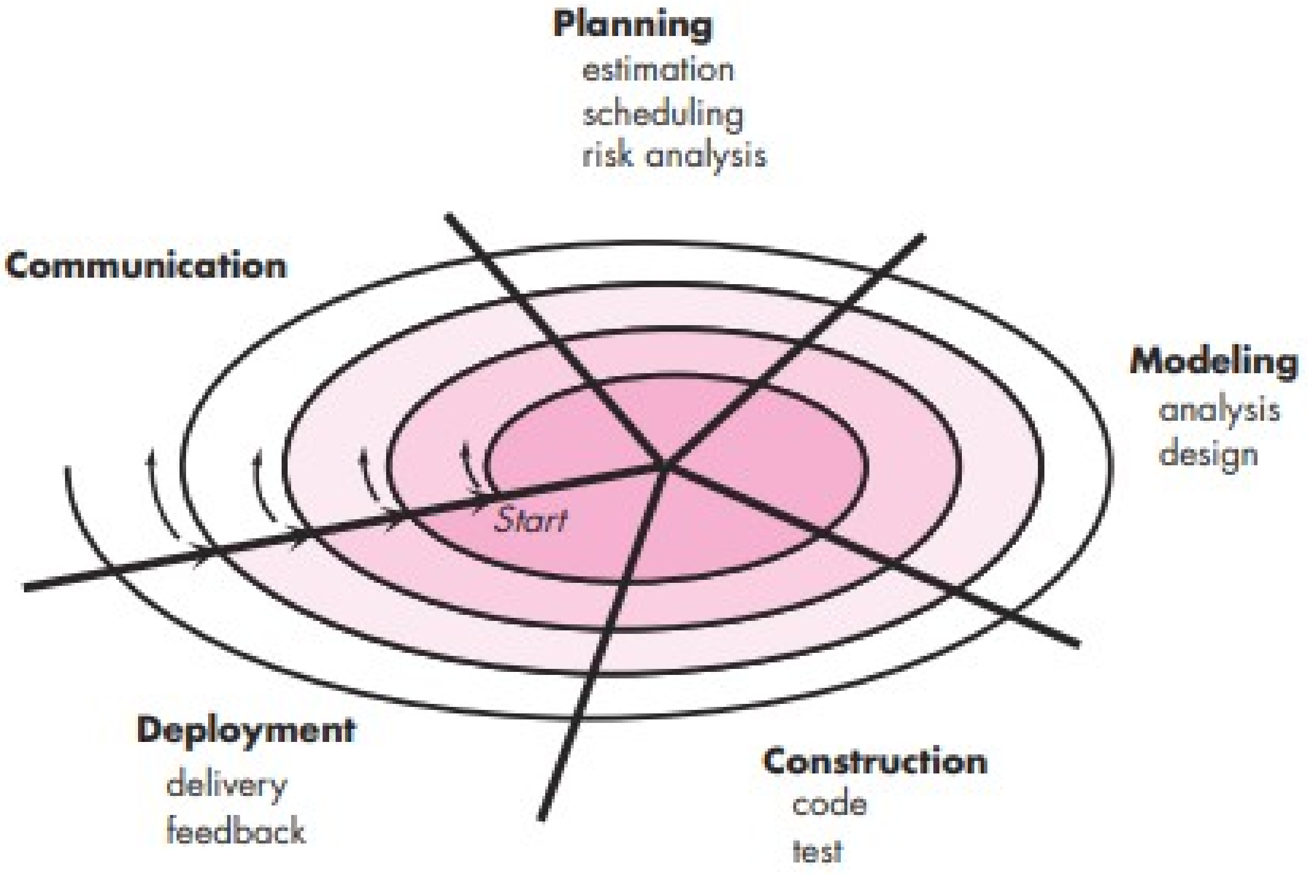
- Lower risk of overall project failure.

SPIRAL PROCESS MODEL

- The spiral model, originally proposed by Boehm is an evolutionary software process model that couples the iterative nature of prototyping with the controlled and systematic aspects of the linear sequential model.

- Using the spiral model, software is developed in a series of incremental releases.

SPIRAL PROCESS MODEL



SPIRAL MODEL(DESCRIPTION)

- Follows an evolutionary approach
- Used when requirements are not well understood and risks are high
- Operates as a risk-driven model…a go/no-go decision occurs after each complete spiral in order to react to risk determinations
- Requires considerable expertise in risk assessment
- Serves as a realistic model for large-scale software development

GENERAL WEAKNESSES OF EVOLUTIONARY PROCESS MODELS

1) Prototyping poses a problem to project planning because of the uncertain number of iterations required to construct the product

2) Evolutionary software processes do not establish the maximum speed of the evolution
   - If too fast, the process will fall into chaos
   - If too slow, productivity could be affected

AGILE DEVELOPMENT

COMMON FEARS FOR DEVELOPERS

- The project will produce the wrong product.
- The project will produce a product of inferior quality.
- The project will be late.
- We’ll have to work 80 hour weeks.

WHAT IS “AGILITY”?

- Effective (rapid and adaptive) response to change
- Effective communication among all stakeholders

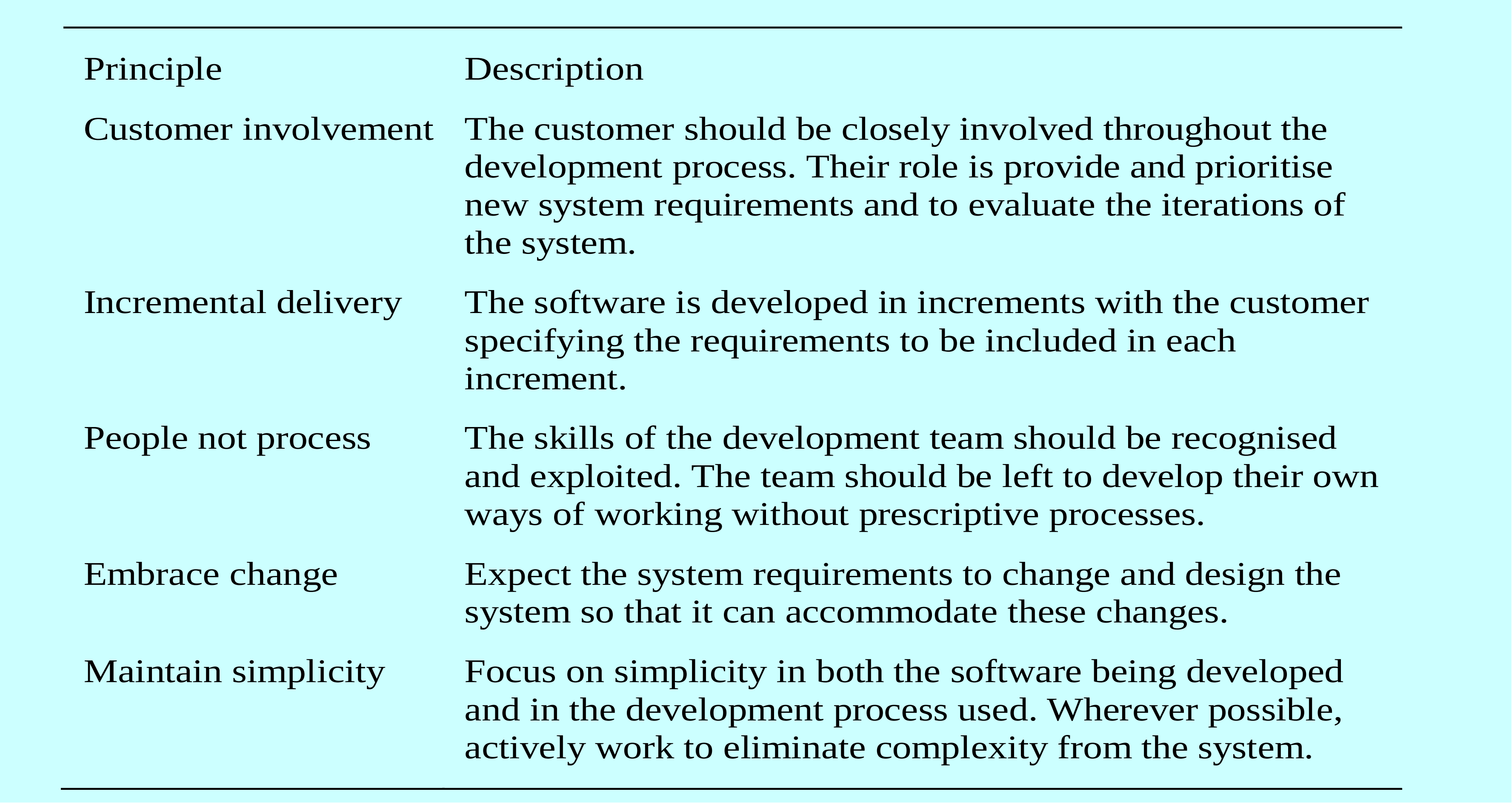
Yielding …

- Rapid, incremental delivery of software

AN AGILE PROCESS

- Is driven by customer descriptions of what is required (scenarios)
- 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.

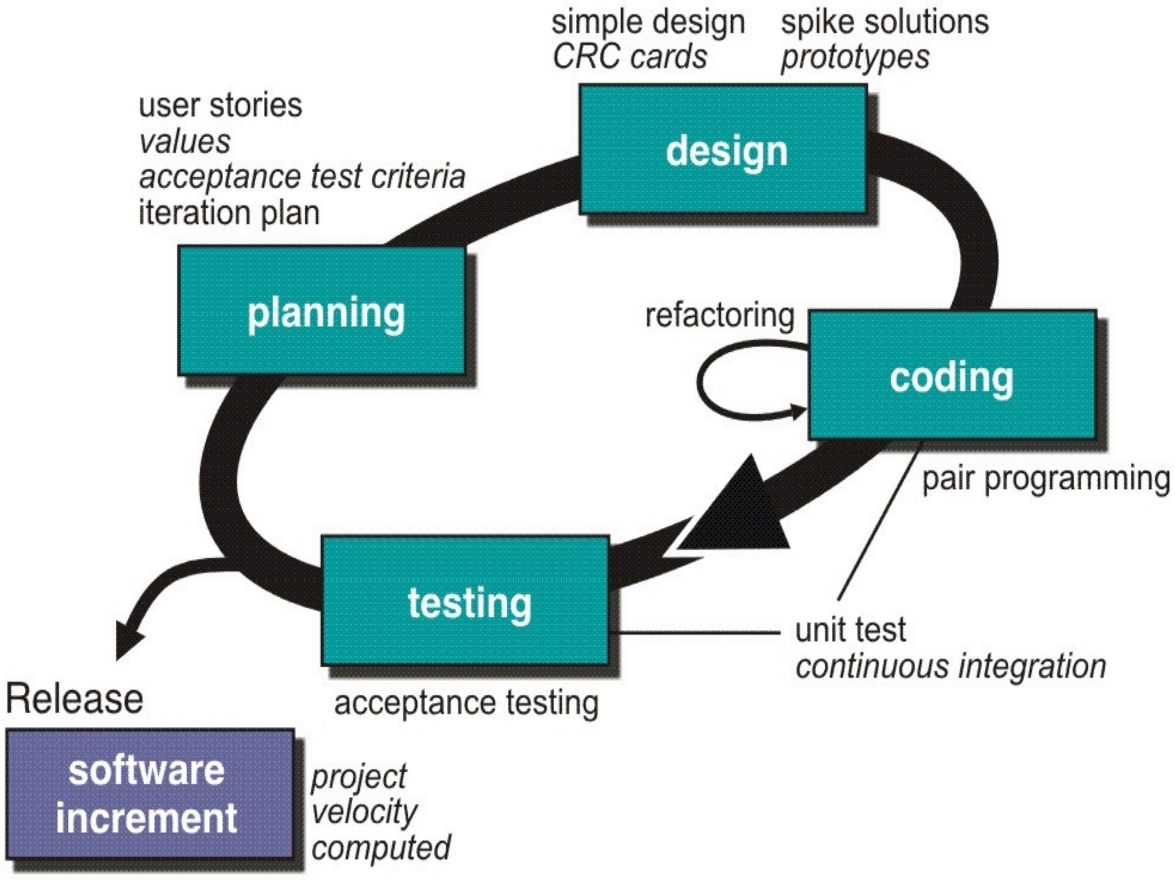
AGILE PROCESS MODELS

- 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.

EXTREME PROGRAMMING (XP)



EXTREME PROGRAMMING (XP)

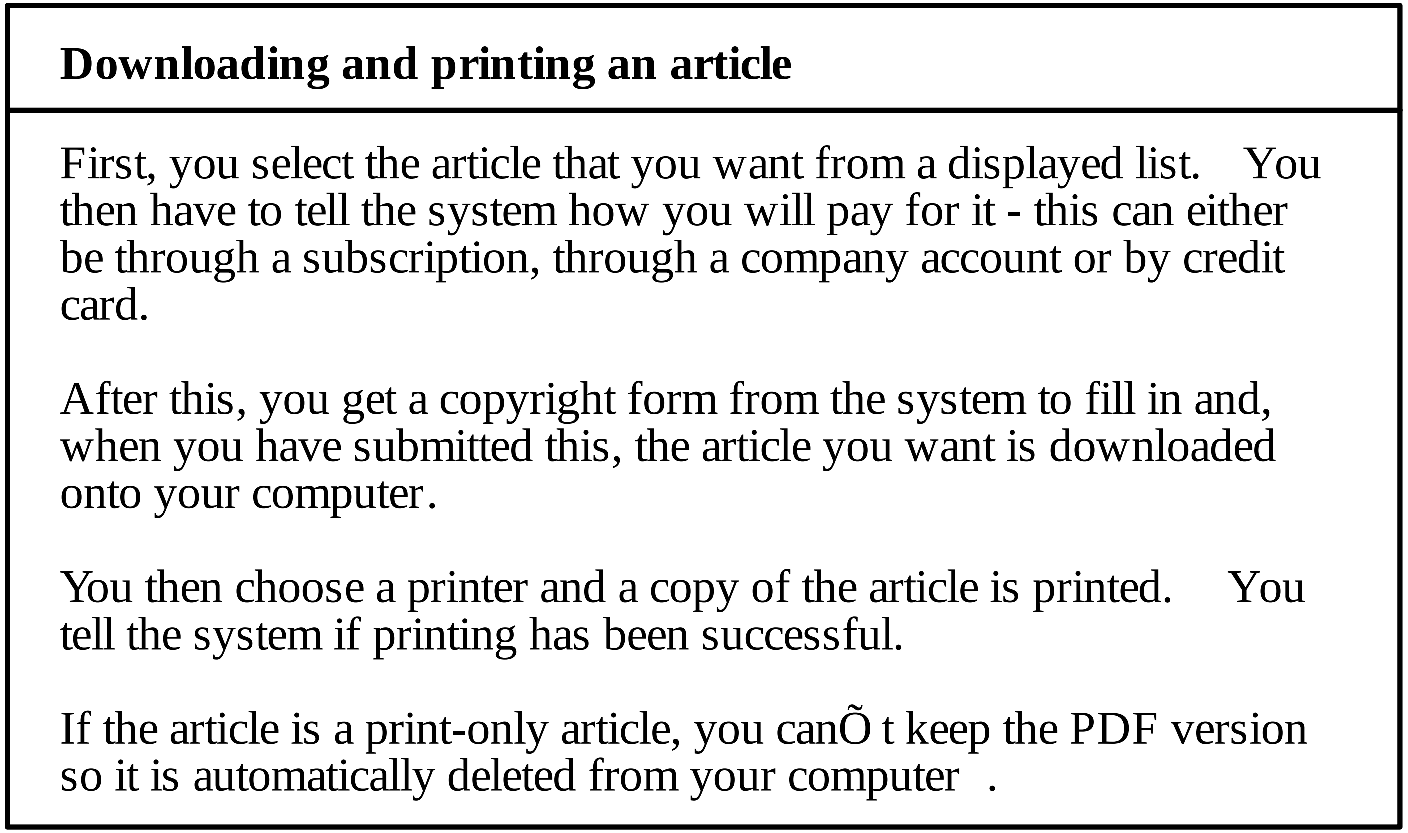
XP Planning

- 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

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 canÕ t keep the PDF version so it is automatically deleted from your computer .

EXTREME PROGRAMMING (XP)

XP Design

- Follows the KIS (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

EXTREME PROGRAMMING (XP)

CRC Cards:

Class-responsibility-collaboration (CRC) cards are a tool used in the design of object-oriented software.

EXTREME PROGRAMMING (XP)

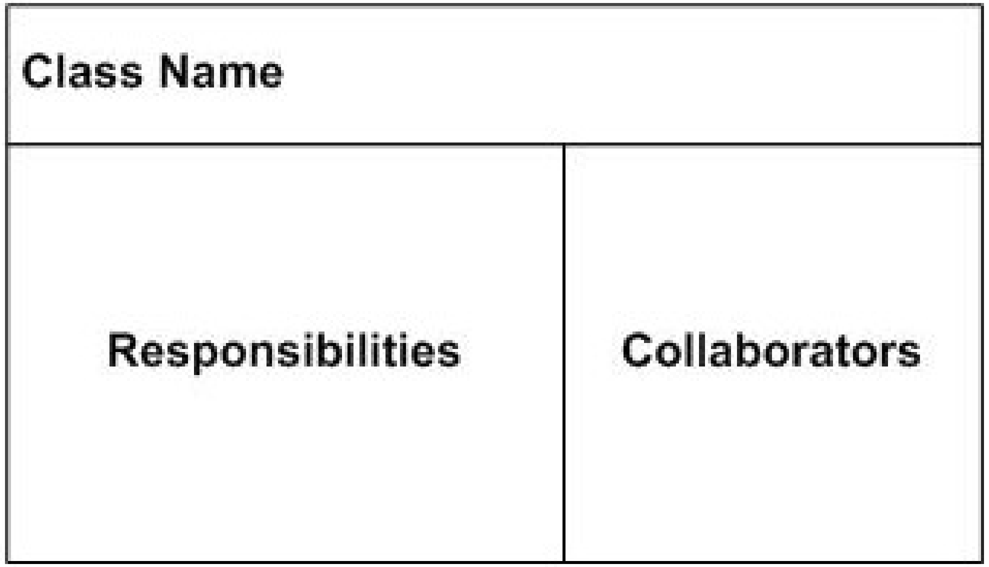
CRC Cards:

The card is partitioned into three areas:

I. On top of the card, the class name
II. On the left, the responsibilities of the class
III. On the right, collaborators (other classes) with which this class interacts to fulfill its responsibilities.

EXTREME PROGRAMMING (XP)

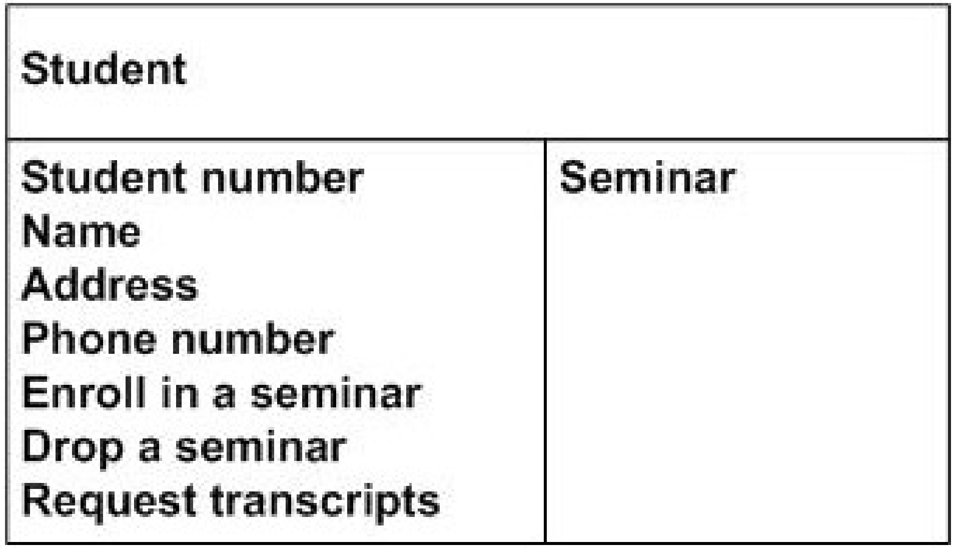
CRC



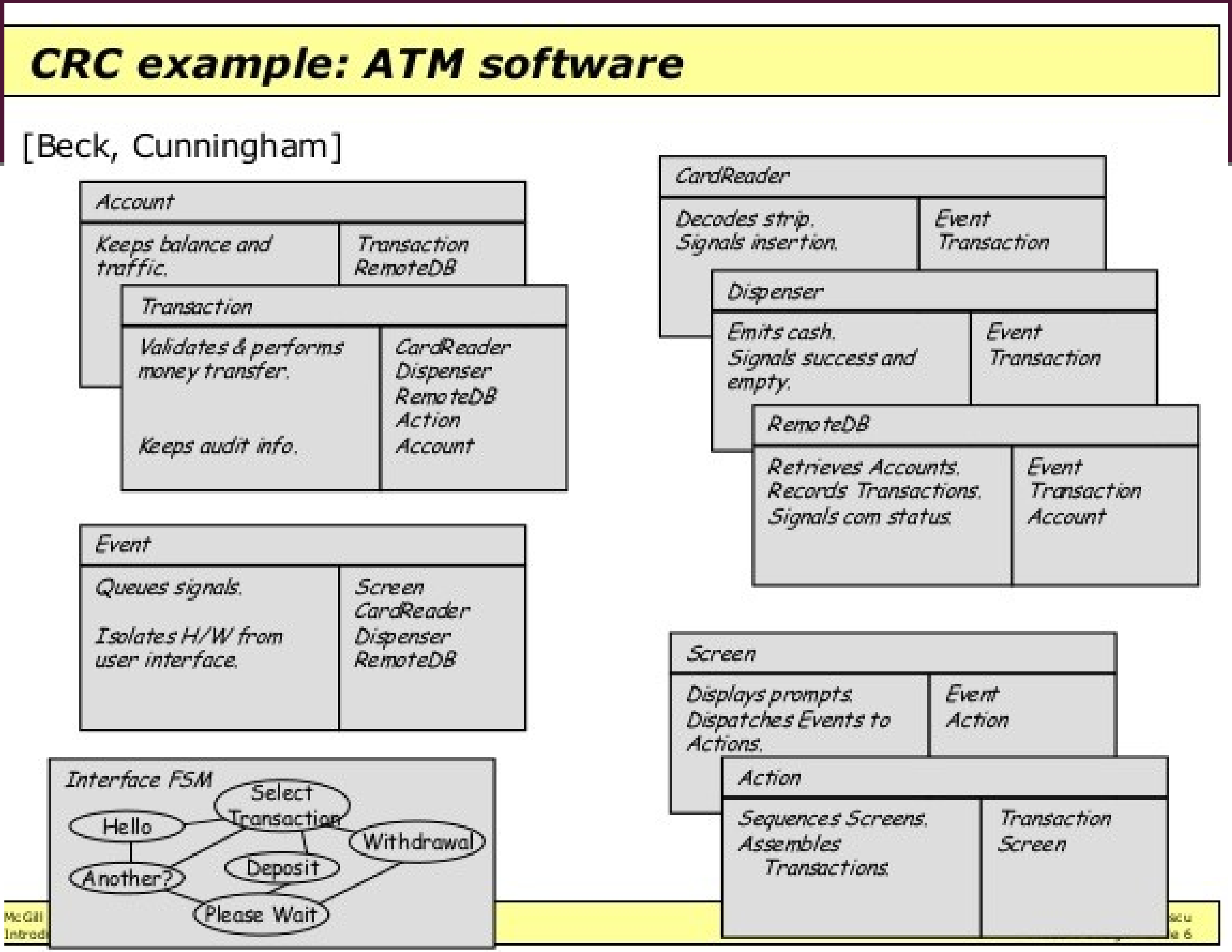
Class Name	
Responsibilities	Collaborators

EXTREME PROGRAMMING (XP)

CRC Cards



Student	
Student number Name Address Phone number Enroll in a seminar Drop a seminar Request transcripts	Seminar



CRC example: ATM software

[Beck, Cunningham]

Account	
Keeps balance and traffic.	Transaction RemoteDB

Transaction	
Validates & performs money transfer. Keeps audit info.	CardReader Dispenser RemoteDB Action Account

Event	
Queues signals. Isolates H/W from user interface.	Screen CardReader Dispenser RemoteDB

CardReader	
Decodes strip. Signals insertion.	Event Transaction

Dispenser	
Emits cash. Signals success and empty.	Event Transaction

RemoteDB	
Retrieves Accounts. Records Transactions. Signals com status.	Event Transaction Account

Screen	
Displays prompts. Dispatches Events to Actions.	Event Action

Action	
Sequences Screens. Assembles Transactions.	Transaction Screen

Interface FSM

EXTREME PROGRAMMING (XP)

XP Coding

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

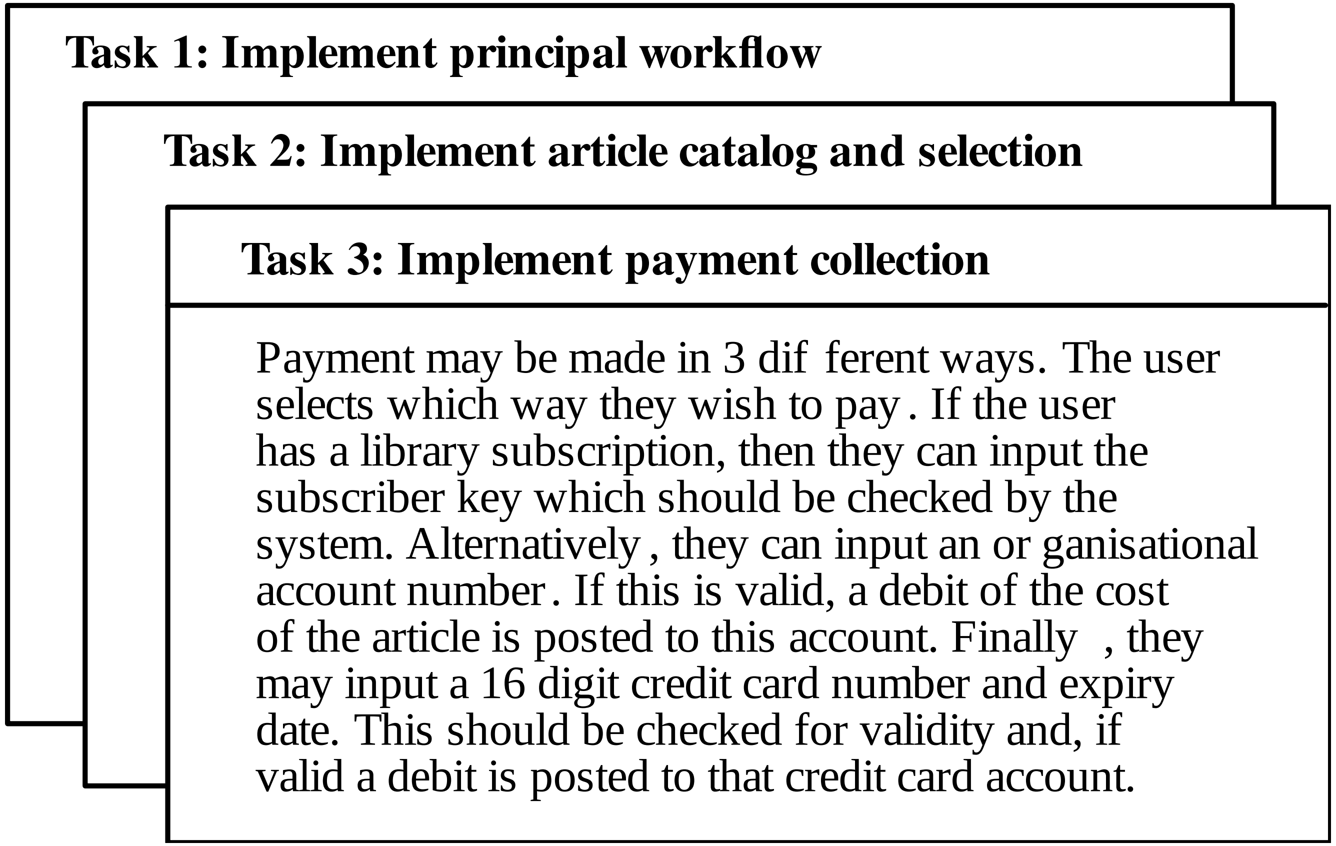
XP Testing

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

TESTING IN XP

- Test-first development.
- Incremental test development from scenarios.
- User involvement in test development and validation.

TASK CARDS FOR DOCUMENT DOWNLOADING



Task 1: Implement principal workflow

Task 2: Implement article catalog and selection

Task 3: Implement payment collection

Payment may be made in 3 different ways. The user selects which way they wish to pay. If the user has a library subscription, then they can input the subscriber key which should be checked by the system. Alternatively, they can input an organisational account number. If this is valid, a debit of the cost of the article is posted to this account. Finally, they may input a 16 digit credit card number and expiry date. This should be checked for validity and, if valid a debit is posted to that credit card account.

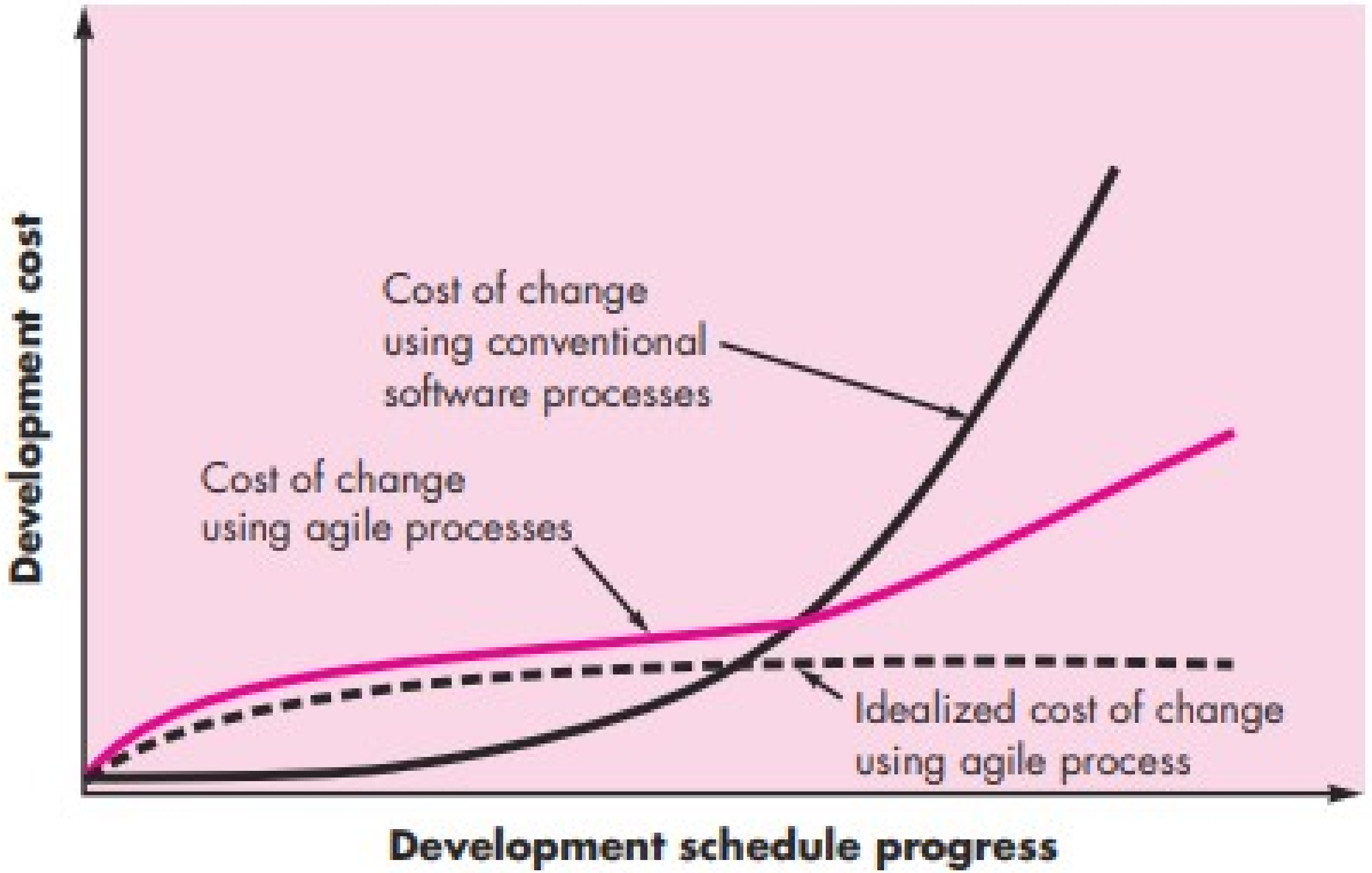
TEST CASE DESCRIPTION

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 information to the card issuer **Output:** OK or error message indicating that the card is invalid

SIGNIFICANCE OF 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.

COST OF CHANGE IN AGILE

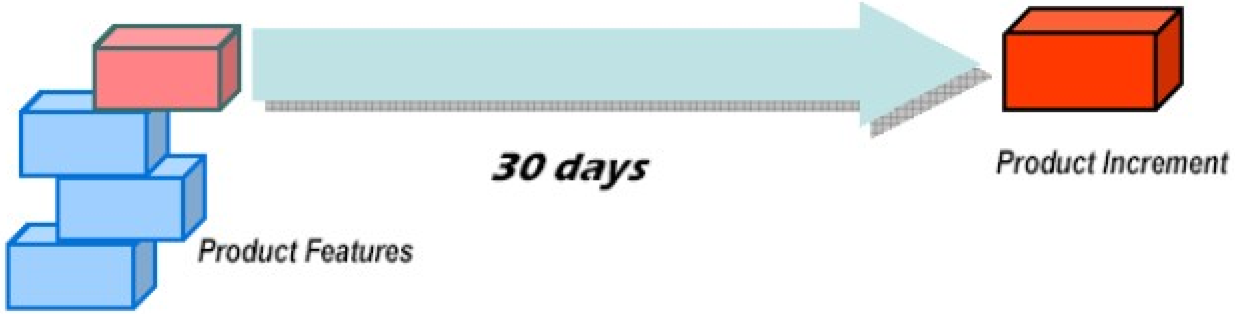


SCRUM

- Scrum is an Agile framework for completing complex projects.
- Scrum originally was formalized for software development projects, but it works well for any complex, innovative scope of work.
- Scrum is a team-based approach, to iteratively, incrementally develop systems and products.
- when requirements are rapidly changing .

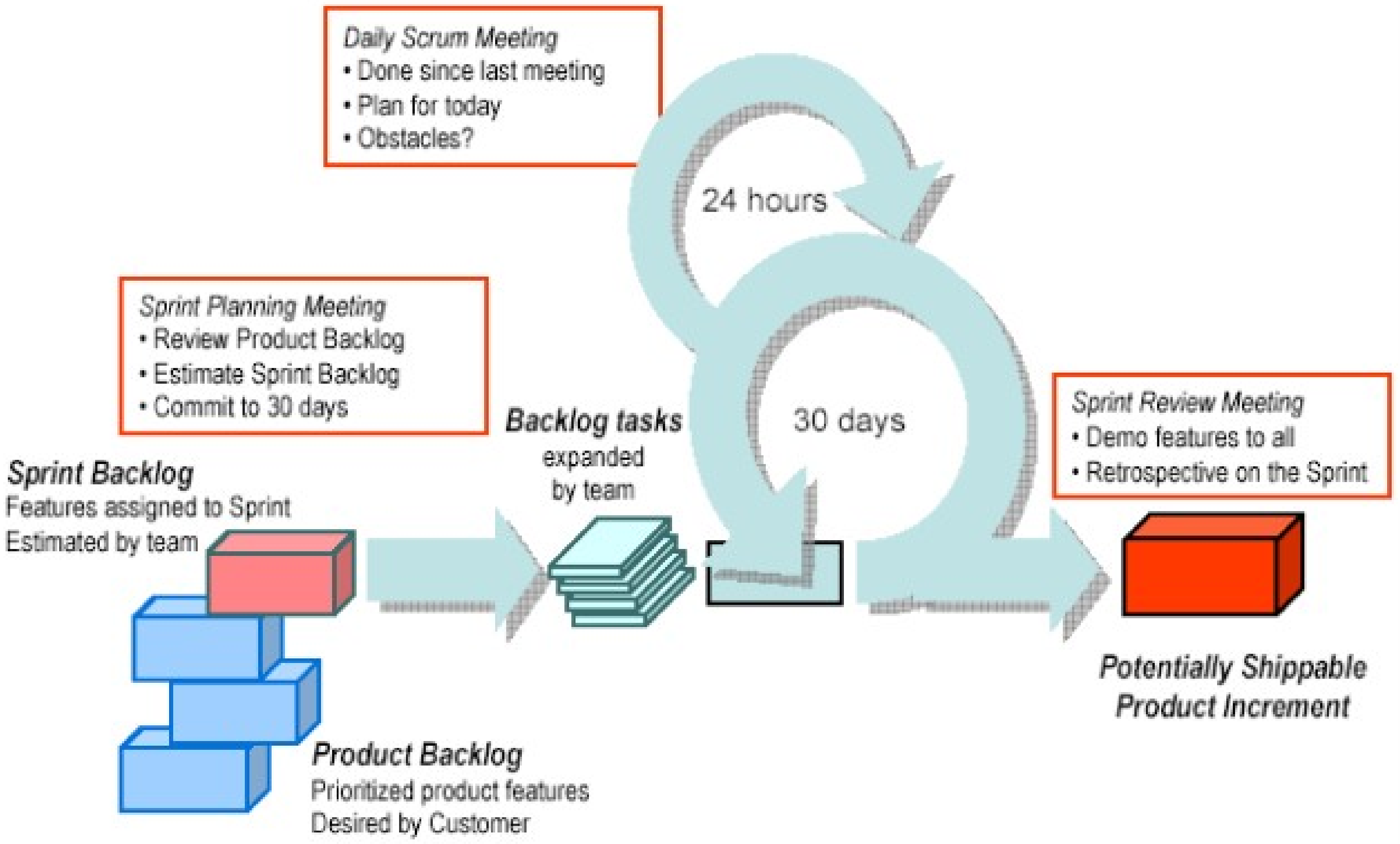
HOW DOES SCRUM WORK?

- Small teams (< 10 people)
- A series of Sprints (1-4 wee



Scrum Working

HOW DOES SCRUM WORK?



How Scrum work

HAVE A GOO DAY!