Chapter Five

Business Process Engineering

Outline

- Definitions
- Phases of Software Development Life Cycle
- SDLC Models (Software Development Process Models)

Definitions

- A process is a specific ordering of work activities across time and space, with a beginning, an end, and clearly identified inputs and outputs: a structure for action.
- A business process is a group of logically related tasks that use the firm's resources to provide customer-oriented results in support of organization's objectives.

A business process is the DNA of a company.

Definitions Cont.…

- Business process Engineering focuses (in our case) on automating business processes with software processes and on assisting the analysis, design, implementation, control, maintenance, and optimization of software development process to ensure success.
- Also called
  - Business process Re-engineering
  - Business process Re-design (to reduce cost and add more value)

Definitions Cont.…

- Software engineering is an important and critical discipline concerned with cost effective software development.
- It is based on a systematic approach that uses appropriate tools and techniques, operates under specific constraints and most importantly follows a process.
- Read about triple constraint (project management, an umbrella activity)

The IEEE definition Software Engineering:

1) The application of a systematic, disciplined, quantifiable **approach** to the development, operation, and maintenance of software; that is, the application of engineering to software.

2) The study of approaches as in 1)

A Layered Technology

Software Engineering

Roger S. Pressman

What is CASE (Computer-Aided Software Engineering)

- Software systems which are intended to provide automated support for software process activities
- Upper-CASE
  - Tools to support the early process activities of requirements and design, and planning
- Lower-CASE
  - Tools to support later activities such as programming, debugging and testing

Software (System) development process

- Software System development process contains **fundamental** activities or phases.
- These phases are: Requirements engineering (As-Is), followed by System Design (To-Be), Implementation, Verification and Validation, and finally Maintenance.

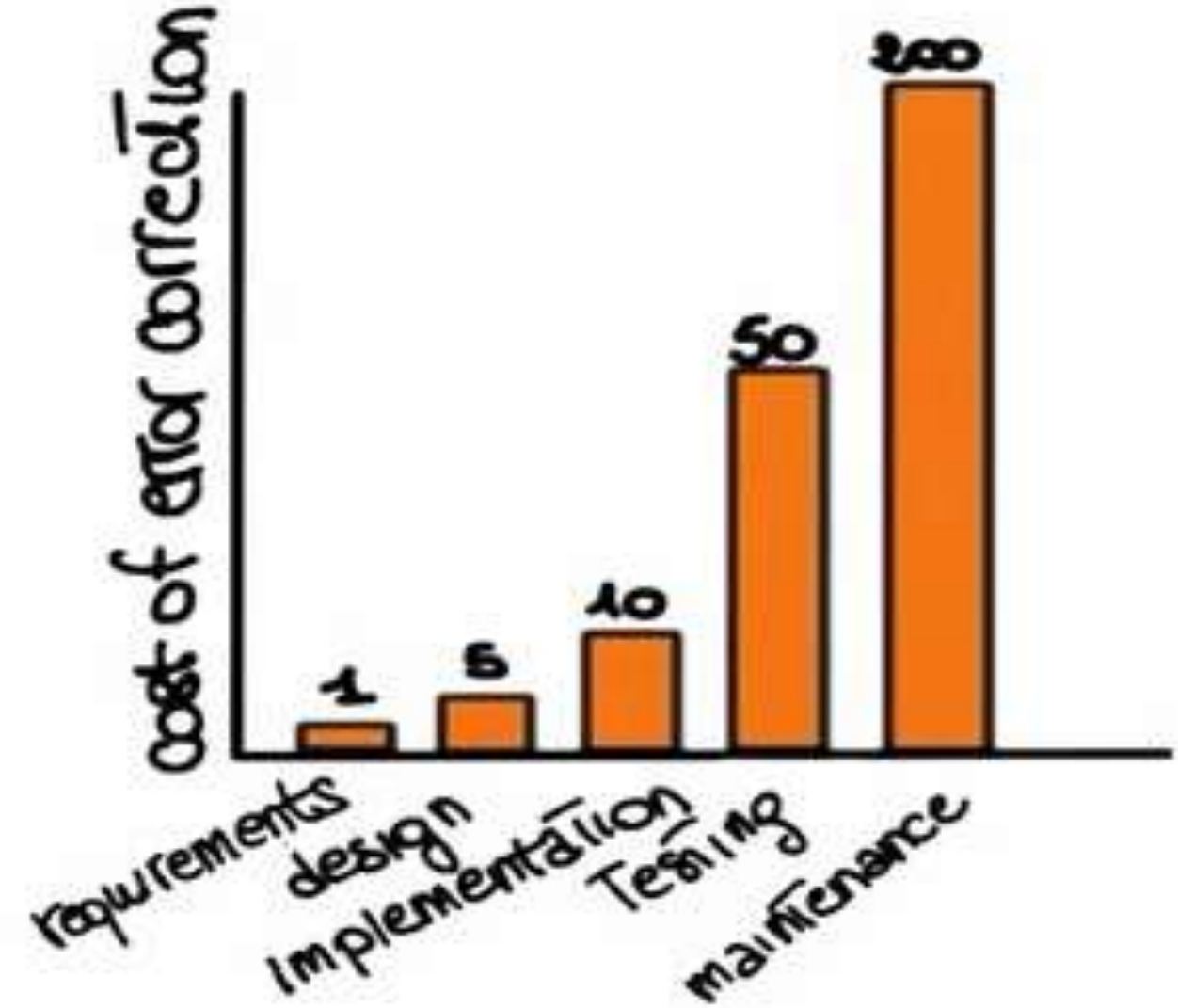
Professor Barry Boehm

Software (System) development process phases: SDLC phases

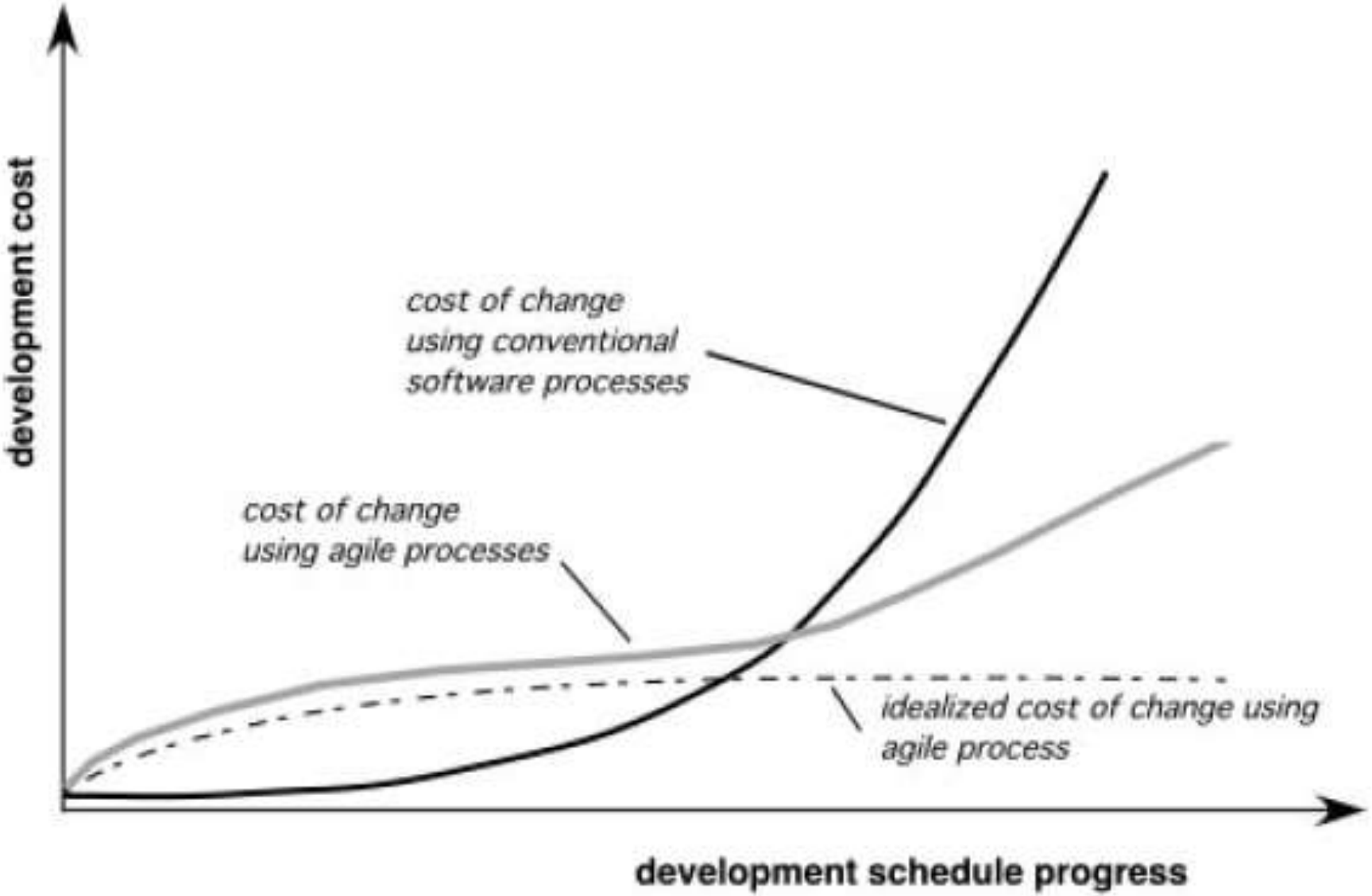
1) Requirements Engineering: is the process of establishing the needs of stakeholders that are to be solved by software.

   Why is this phase so important? In general the cost of correcting an error depends on the number of subsequent decisions that are based on it. Therefore, error made in understanding requirements have the potential for greater cost because many design and other following phase decisions depend on RE results.

Cost of late correction



Agility and the Cost of Change



Requirements Engineering Cont…

- Also called requirements analysis and specification
- How can we collect the right requirements? Traditional requirements engineering does so through a set of steps: The first step is Elicitation which is the collection of requirements from stakeholders and other sources and can be done in a variety of ways (methods) [through questionnaire survey, interview, brainstorming, prototype, document analysis, work place observation, and so on]

Requirements Engineering Cont…

- The second step is requirements analysis which involves the study and deeper understanding of the collected requirements.
- Structuring (modeling) of system requirements is also part of this activity.
- The third one is the specification of requirements in which the collected requirements are suitably represented organized and saved so that they can be shared (**SRS**).
- They can be validated and delivered (as **SRS**).
- Requirements management may account to changes to requirements during the life time of the project.

System Design

- It is the phase where the description of the **internal structure** and **organization of the system** are produced and this description will serve as the basis for the **construction** of the actual system.
- Design activities normally consist of architectural design, abstract specification, interface design, component or subsystem design, persistent data management, and so on.
- These activities result in a set of design products which describe various characteristics of the system.

Implementation

- Here what we do is basically realizing the design of the system that we just created and create an actual software system.
- There are four fundamental principles or pillars that can affect the way software is constructed.
- The first is the reduction of complexity (Usability).
- The second is the anticipation of diversity (Agility).
- The third pillar is the structuring for validation (Testability).
- Finally it is important that the SW conforms to standards (Interoperability and other issues).

Verification and Validation

- After we have built the system, here is the phase where we check that the software system meets its specification and fulfills its intended purpose.
- Validation is the activity that answers the question, did we build the right system?
- Verification answers a different question, did we build the system right? Did we build the system that actually implement the specification that we defined?
- Verification can be performed at the unit level, integration level, and finally the system as a whole.

Verification and Validation Cont.

- Thus, in verification, we want to make sure that the different modules talk to each other in the right way.
- During system testing, we test the system as a **whole** and want to make sure all the system, all the different pieces of the system work together in the right way. This is also the level at which we apply validation and some other testing techniques like stress testing or robustness testing and so on.

Maintenance

- Software development effort normally result in the delivery of a software product that satisfies the user requirements. However, when the software is in operation many things can happen.
- The environment might change (there might be new libraries, new operating systems) in which our software system has to operate.
- There may be feature request that the users might want to do something different with the product that we gave them.
- Or users might have problems with the software and may file **bug report**.

Maintenance Cont.

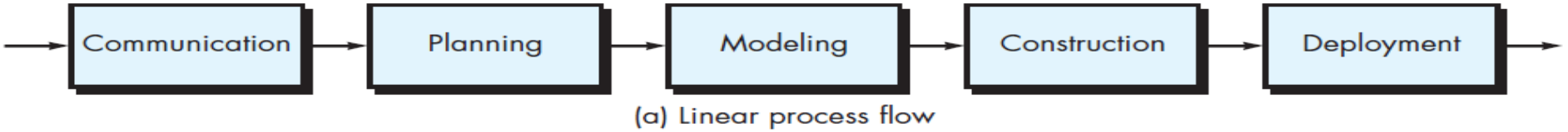
- Software maintenance is the activity that sustains the software product as it evolves throughout its lifecycle.
- Development organizations should perform three kinds of maintenance activities:
  - Corrective maintenance to eliminate problems with the code (bug).
  - Perfective maintenance to accommodate feature requests (and in some cases just to improve the software for example to make it more efficient, refactoring).
  - Adaptive maintenance to take care of environment changes.

Maintenance Cont.

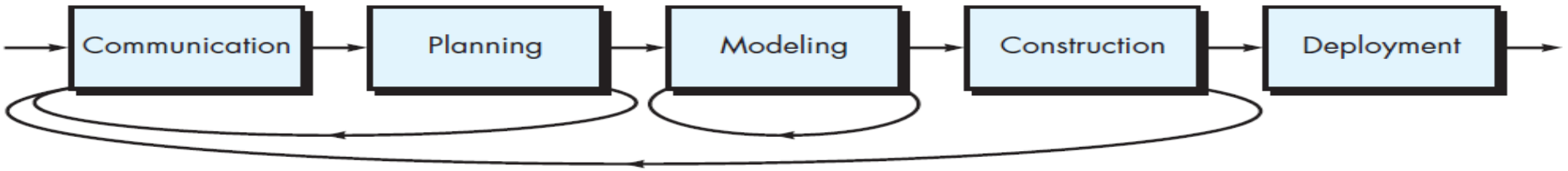
- And after these activities have been performed, the software developer will produce a new version of the application and will release it and the cycle will continue throughout the lifetime of the software.
- That is why maintenance is a fundamental activity and very expensive one.
- One of the reasons, in addition to the reasons in the previous slide, why maintenance is expensive is regression testing. Regression testing is the activity of retesting software after it has been modified.

Process/Methodology

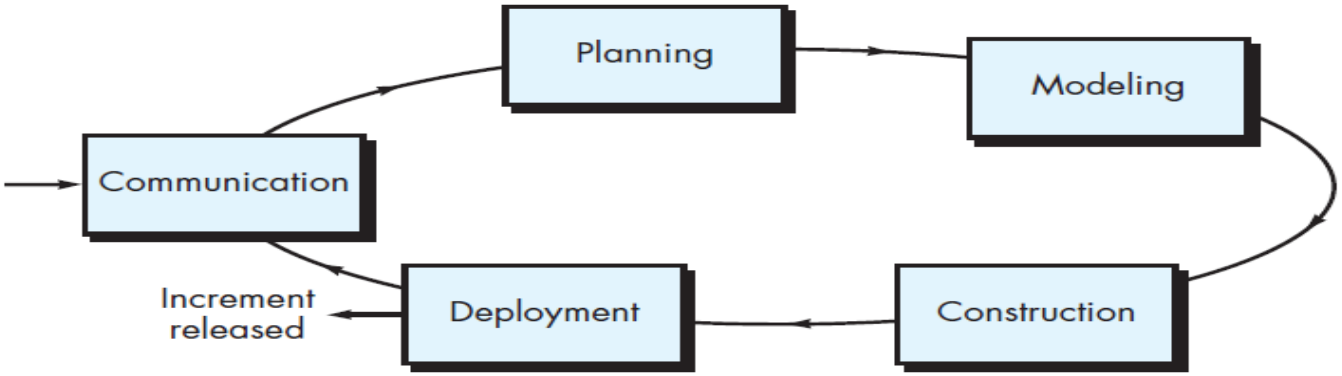
Analysis	Design	Implementation & Integration	Maintenance	Retirement
Documenting				
Testing				
Artifacts				
▪ Documents ▪ Models ▪ Mock-ups	▪ Documents ▪ Models ▪ Components ▪ Mock-ups	▪ Documents ▪ Models ▪ Source code ▪ Components ▪ Databases ▪ Unit tests ▪ Test data ▪ …	▪ Documents ▪ Models ▪ Source code ▪ Components ▪ Databases ▪ Unit tests ▪ Test data ▪ …	▪ Documents
Interactions/ Collaborations				
▪ Wikis ▪ Chats, Emails, Forums ▪ CVS ▪ Specialized tools	▪ Wikis ▪ Chats, Emails, Forums ▪ CVS ▪ Specialized tools	▪ Wikis ▪ Chats, Emails, Forums ▪ CVS ▪ Specialized tools	▪ Wikis ▪ Chats, Emails, Forums ▪ CVS ▪ Bug reports ▪ Execution logs	
Participants				
▪ Domain experts ▪ End-users ▪ System analysts	▪ Analysts ▪ Designers ▪ Domain experts	▪ Developers ▪ Designers ▪ Domain experts (testing) ▪ End-users (testing)	▪ Maintainers ▪ End-users ▪ Domain experts (testing)	▪ Maintainers



(a) Linear process flow

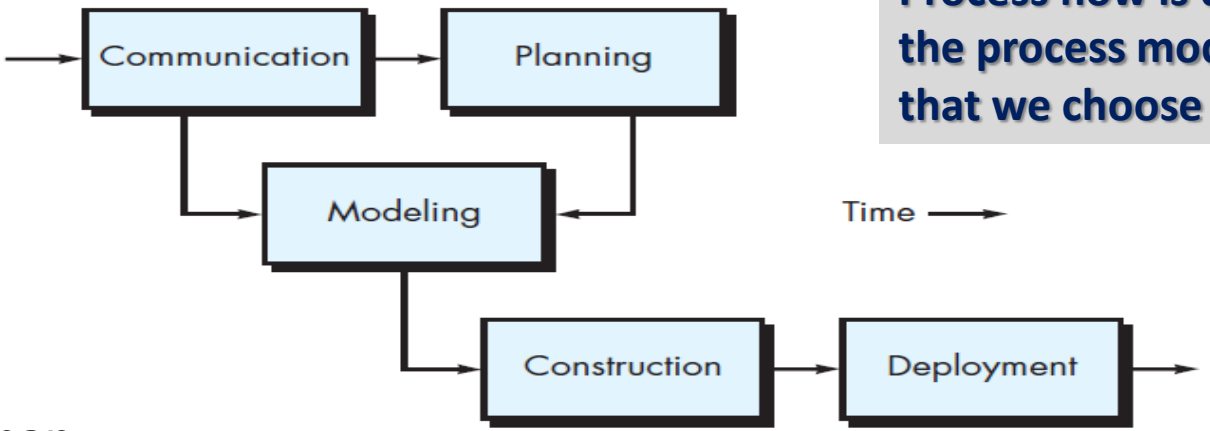


(b) Iterative process flow



(c) Evolutionary process flow

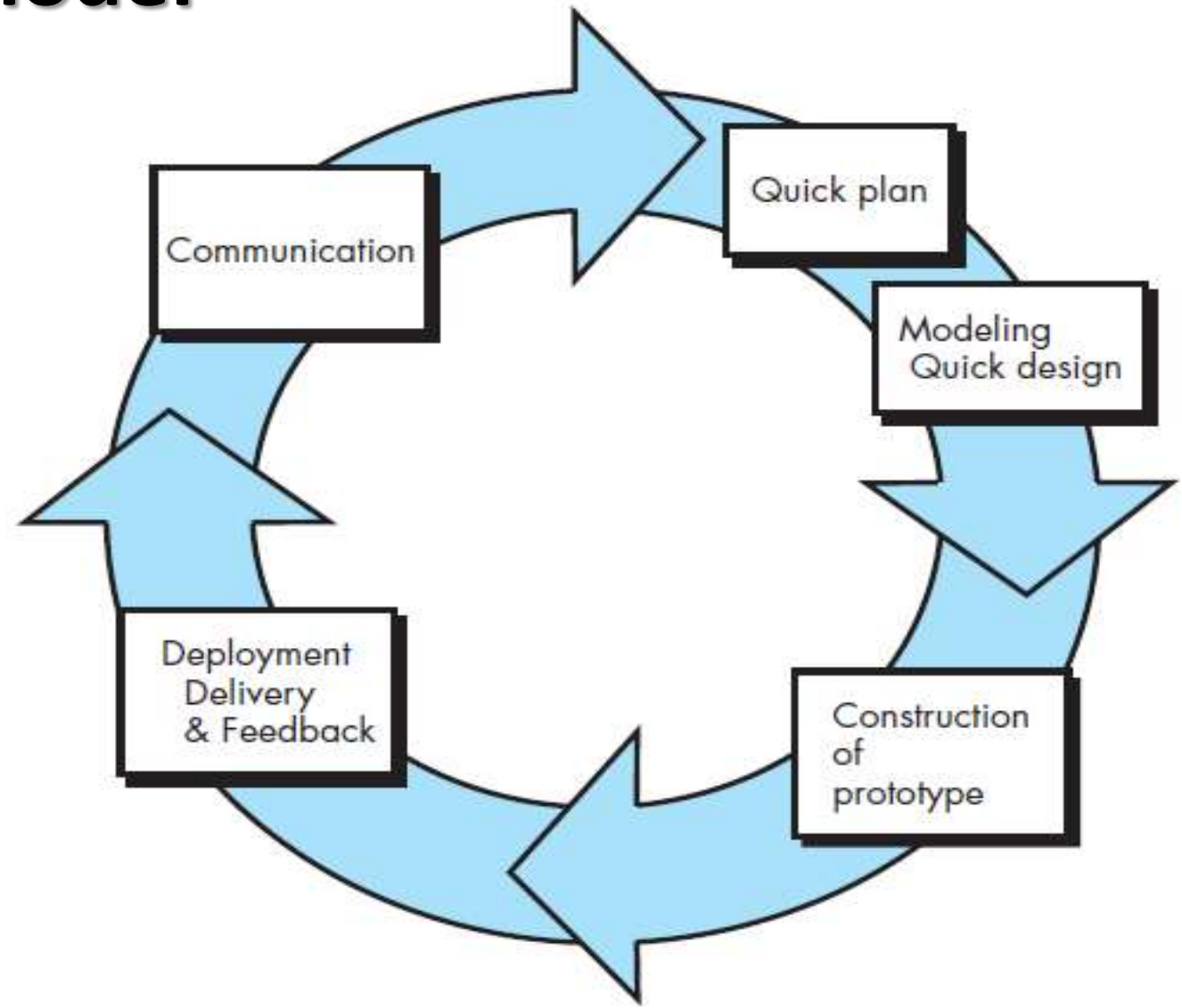
Process flow is determined by the process model or framework that we choose for development



(d) Parallel process flow

Roger S. Pressman

The Prototyping Paradigm or model



Assignment:

1. Make a research on SDLC process models and write your findings. Specify the advantages and disadvantages of each model. Identify and list artifacts produced in phases of each model, and describe entry and exit criteria. You should include the open source model in your discussion.
2. Make a thorough investigation about software CASE tools and write your findings.

- Work in groups of three students.
- Due date : On or before Saturday Jan 4, 2019, in printed copy.

What is a software process?

- A set of activities whose goal is the development or evolution of software
- Generic activities in all software processes are:
  - Specification - what the system should do and its development constraints
  - Development - production of the software system
  - Validation - checking that the software is what the customer wants
  - Evolution - changing the software in response to changing demands

What are software engineering methods?

- Structured approaches to software development which include system models, notations, rules, design advice and process guidance
- Model descriptions
  - Descriptions of graphical models which should be produced
- Rules
  - Constraints applied to system models
- Recommendations
  - Advice on good design practice
- Process guidance
  - What activities to follow