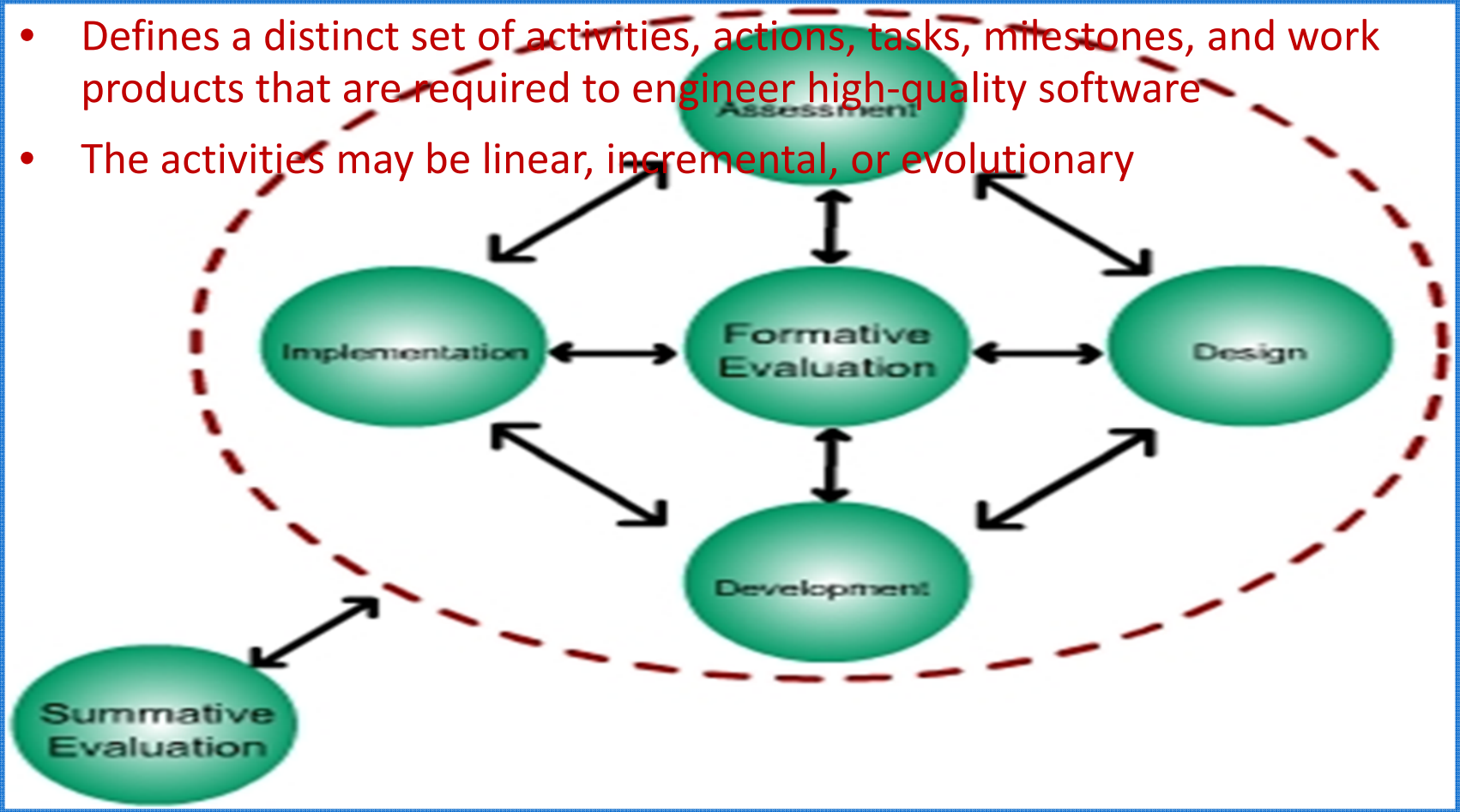
SRM UNIVERSITY
(Under section 3 of UGC Act 1956)

CHAPTER_3

SOFTWARE ENGINEERING (PROCESS MODELS)

Prescriptive Process Model

- Defines a distinct set of activities, actions, tasks, milestones, and work products that are required to engineer high-quality software
- The activities may be linear, incremental, or evolutionary



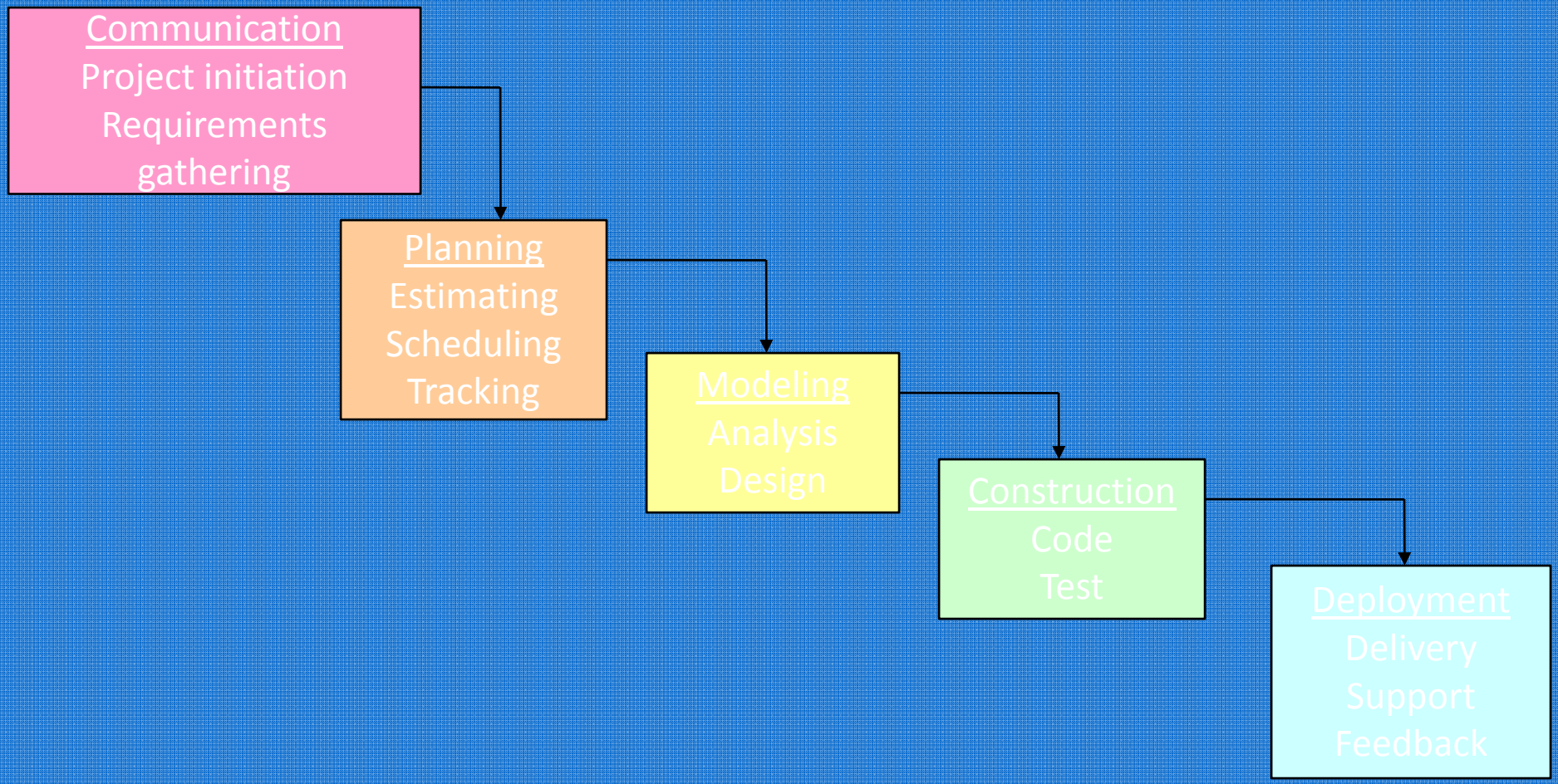
Prescriptive Models

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?

Waterfall Model (Diagram)



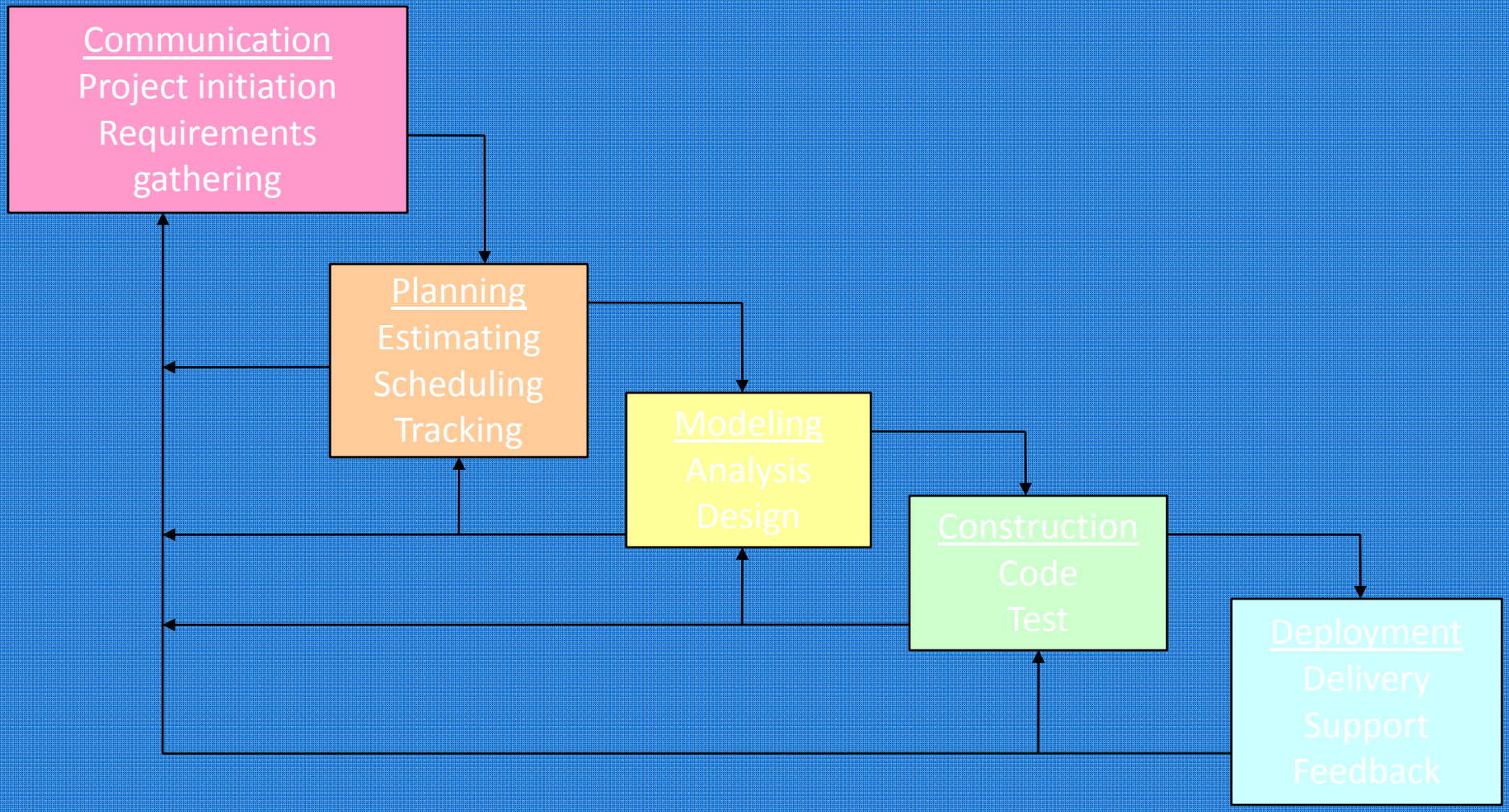
Waterfall Model (Description)

- Oldest software lifecycle model and best understood by upper management
- Used when requirements are well understood and risk is low
- Work flow is in a linear (i.e., sequential) fashion
- Used often with well-defined adaptations or enhancements to current software

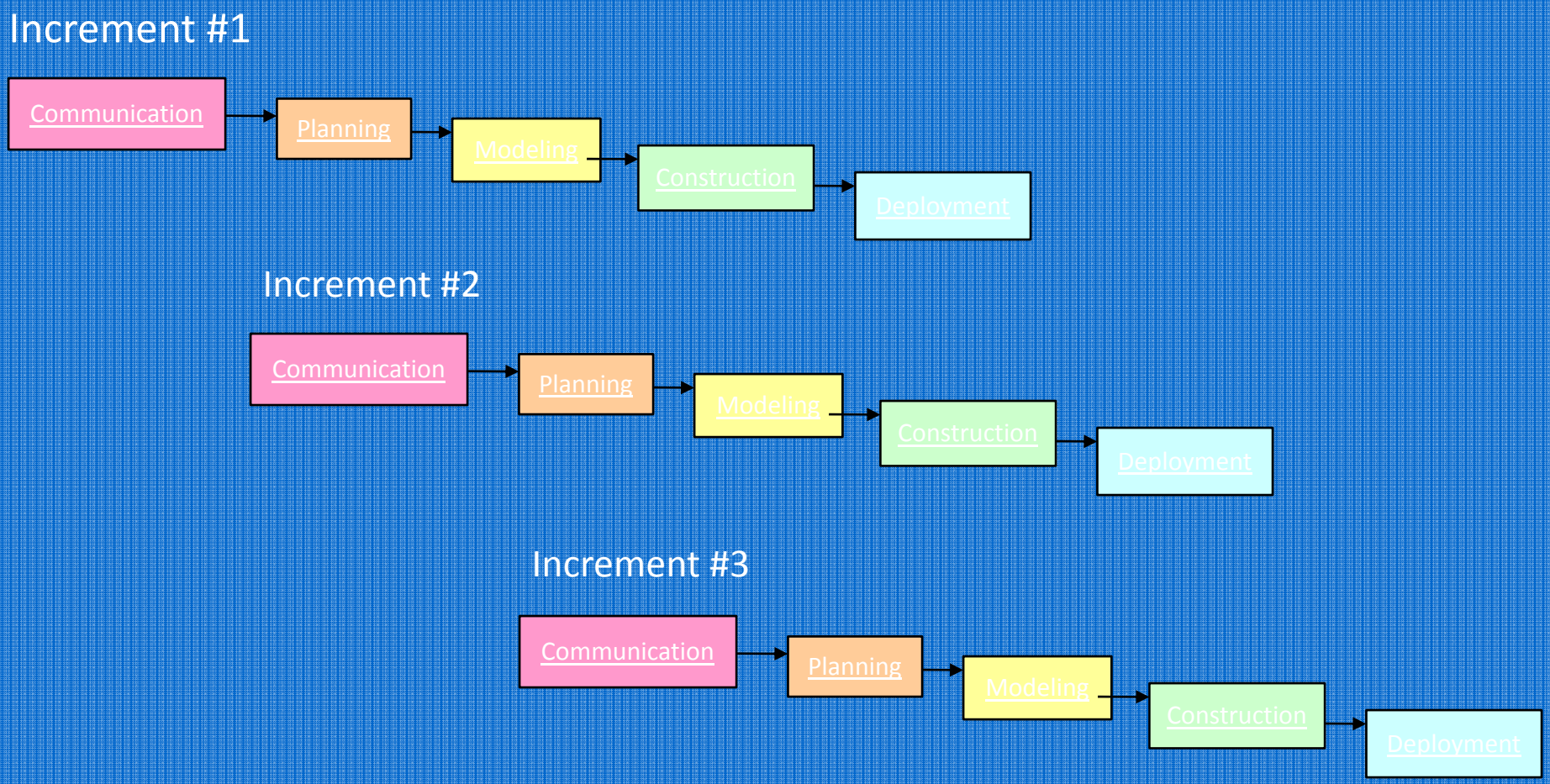
Waterfall Model (Problems)

- 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
- Problems can be somewhat alleviated in the model through the addition of feedback loops (see the next slide)

Waterfall Model with Feedback (Diagram)



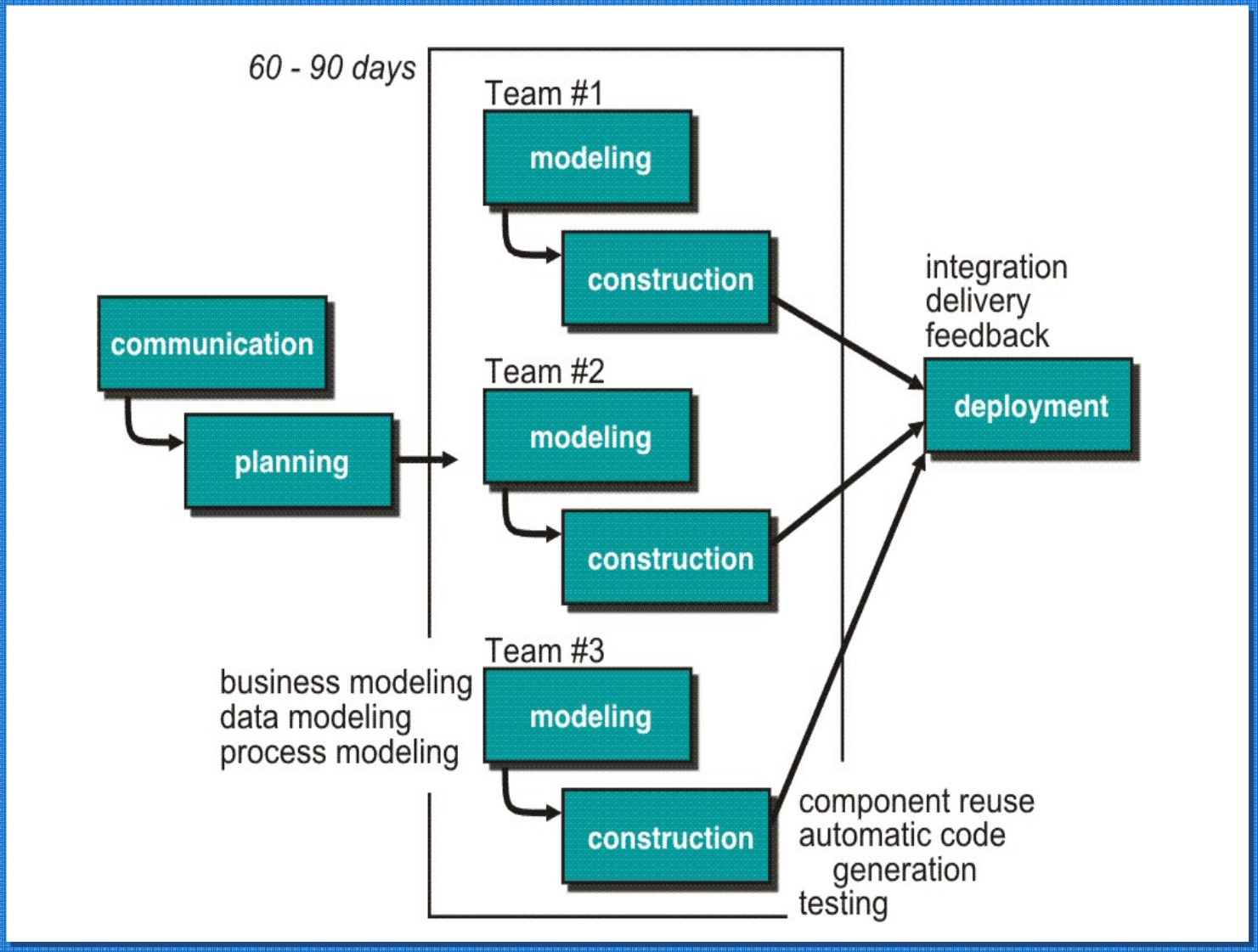
Incremental Model (Diagram)



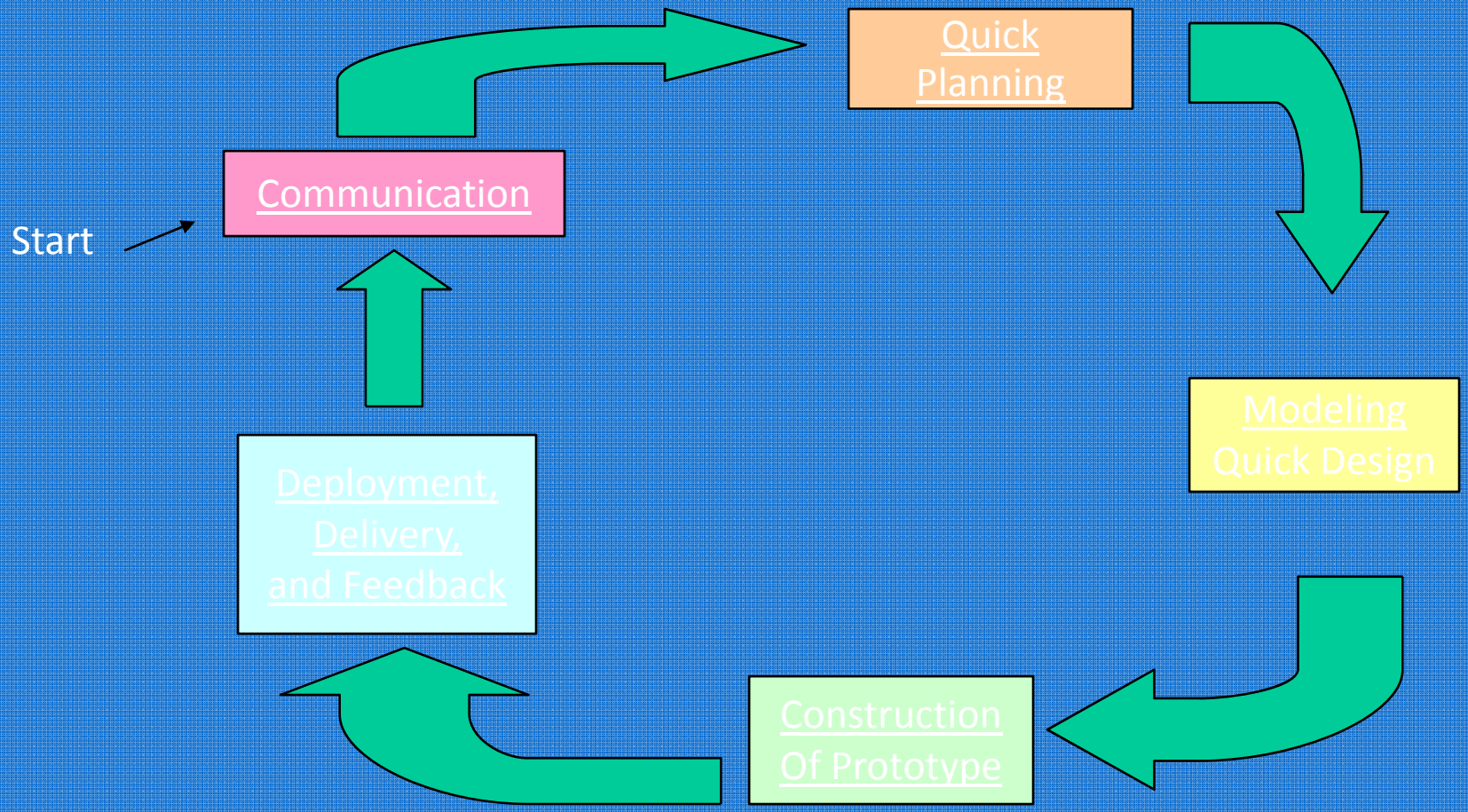
Incremental Model (Description)

- Used when requirements are well understood
- Multiple independent deliveries are identified
- Work flow is in a linear (i.e., sequential) fashion within an increment and is staggered between increments
- Iterative in nature; focuses on an operational product with each increment
- Provides a needed set of functionality sooner while delivering optional components later
- Useful also when staffing is too short for a full-scale development

Incremental Models: RAD Model



Prototyping Model (Diagram)



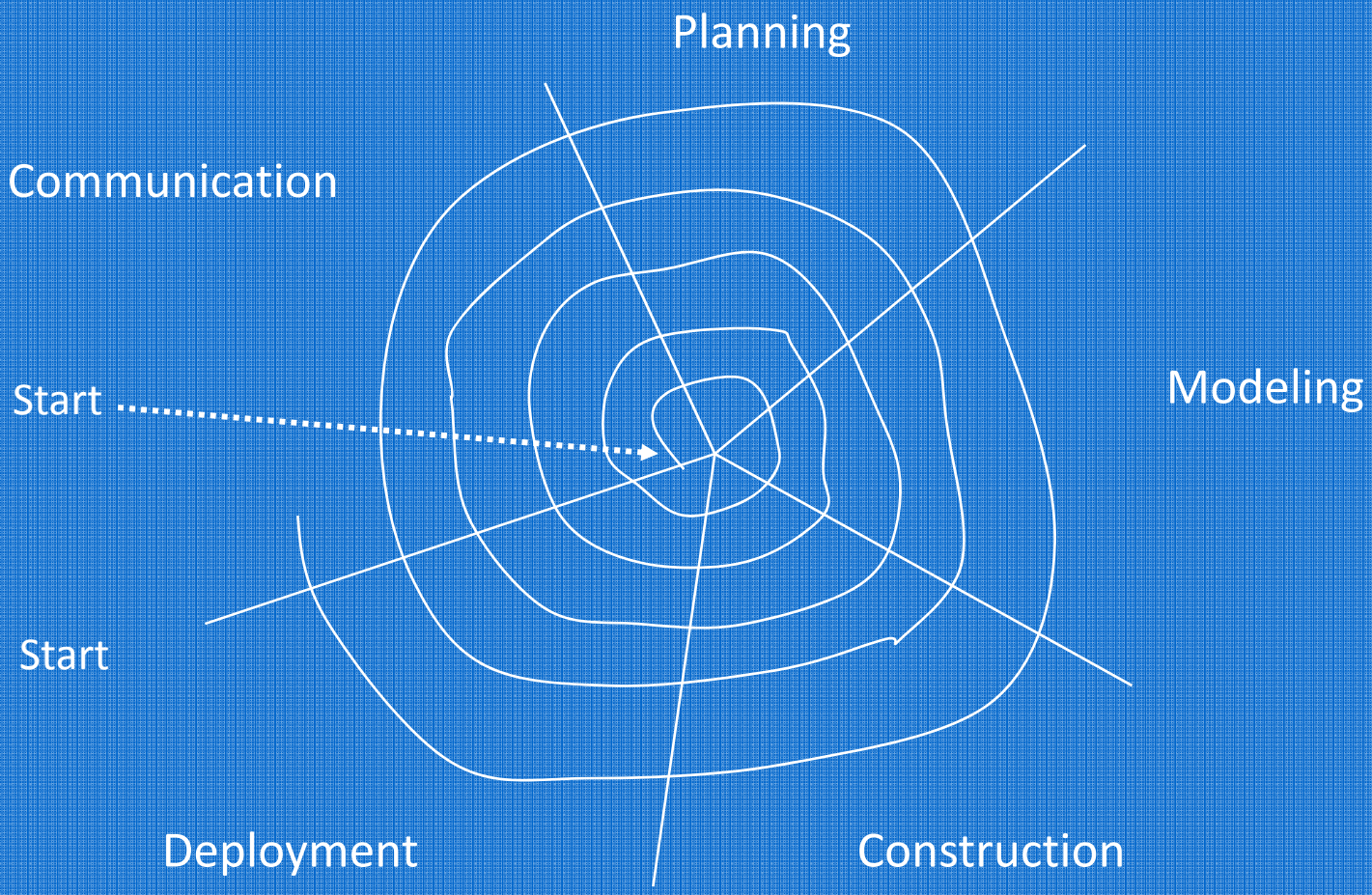
Prototyping Model (Description)

- Follows an evolutionary and iterative approach
- Used when requirements are not well understood
- Serves as a mechanism for identifying software requirements
- Focuses on those aspects of the software that are visible to the customer/user
- Feedback is used to refine the prototype

Prototyping Model (Potential Problems)

- The customer sees a "working version" of the software, wants to stop all development and then buy the prototype after a "few fixes" are made
- Developers often make implementation compromises to get the software running quickly (e.g., language choice, user interface, operating system choice, inefficient algorithms)
- Lesson learned
  - Define the rules up front on the final disposition of the prototype before it is built
  - In most circumstances, plan to discard the prototype and engineer the actual production software with a goal toward quality

Spiral Model (Diagram)



Spiral Model (Description)

- Invented by Dr. Barry Boehm in 1988 while working at TRW
- Follows an evolutionary approach
- Used when requirements are not well understood and risks are high
- Inner spirals focus on identifying software requirements and project risks; may also incorporate prototyping
- Outer spirals take on a classical waterfall approach after requirements have been defined, but permit iterative growth of the software
- 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

The Unified Process

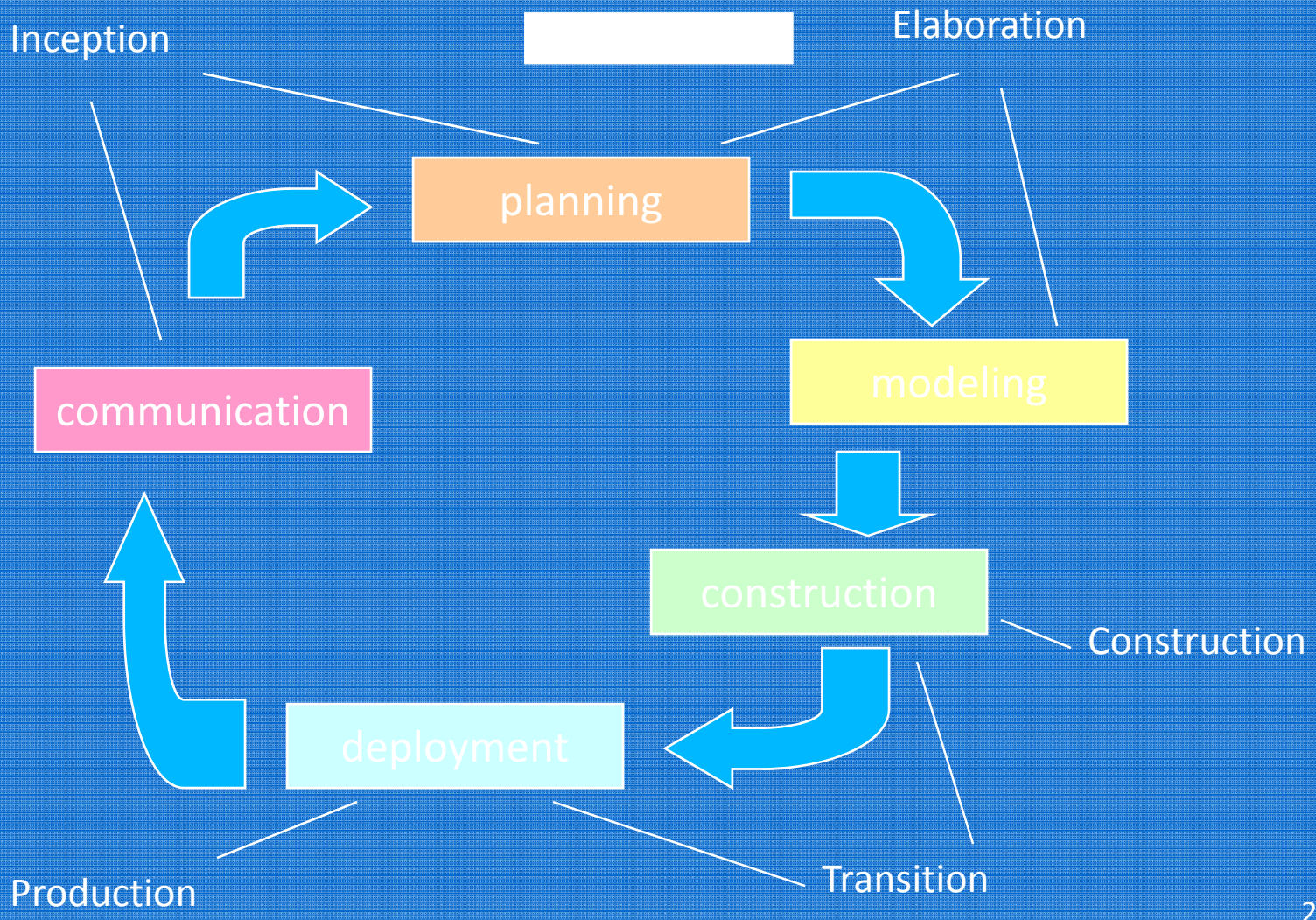
Background

- Birthed during the late 1980's and early 1990s when object-oriented languages were gaining wide-spread use
- Many object-oriented analysis and design methods were proposed; three top authors were Grady Booch, Ivar Jacobson, and James Rumbaugh
- They eventually worked together on a unified method, called the Unified Modeling Language (UML)
  - UML is a robust notation for the modeling and development of object-oriented systems
  - UML became an industry standard in 1997
  - However, UML does not provide the process framework, only the necessary technology for object-oriented development

Background (continued)

- Booch, Jacobson, and Rumbaugh later developed the unified process, which is a framework for object-oriented software engineering using UML
  - Draws on the best features and characteristics of conventional software process models
  - Emphasizes the important role of software architecture
  - Consists of a process flow that is iterative and incremental, thereby providing an evolutionary feel
- Consists of five phases: inception, elaboration, construction, transition, and production

Phases of the Unified Process



Inception Phase

- Encompasses both customer communication and planning activities of the generic process
- Business requirements for the software are identified
- A rough architecture for the system is proposed
- A plan is created for an incremental, iterative development
- Fundamental business requirements are described through preliminary use cases
  - A use case describes a sequence of actions that are performed by a user

Elaboration Phase

- Encompasses both the planning and modeling activities of the generic process
- Refines and expands the preliminary use cases
- Expands the architectural representation to include five views
  - Use-case model
  - Analysis model
  - Design model
  - Implementation model
  - Deployment model
- Often results in an executable architectural baseline that represents a first cut executable system
- The baseline demonstrates the viability of the architecture but does not provide all features and functions required to use the system

Construction Phase

- Encompasses the construction activity of the generic process
- Uses the architectural model from the elaboration phase as input
- Develops or acquires the software components that make each use-case operational
- Analysis and design models from the previous phase are completed to reflect the final version of the increment
- Use cases are used to derive a set of acceptance tests that are executed prior to the next phase

Transition Phase

- Encompasses the last part of the construction activity and the first part of the deployment activity of the generic process
- Software is given to end users for beta testing and user feedback reports on defects and necessary changes
- The software teams create necessary support documentation (user manuals, trouble-shooting guides, installation procedures)
- At the conclusion of this phase, the software increment becomes a usable software release

Production Phase

- Encompasses the last part of the deployment activity of the generic process
- On-going use of the software is monitored
- Support for the operating environment (infrastructure) is provided
- Defect reports and requests for changes are submitted and evaluated

Unified Process Work Products

- Work products are produced in each of the first four phases of the unified process
- In this course, we will concentrate on the analysis model and the design model work products
- Analysis model includes
  - Scenario-based model, class-based model, and behavioral model
- Design model includes
  - Component-level design, interface design, architectural design, and data/class design