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Software Engineering

Topic 2

Software Process Model

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Acknowledgement

These slides have been adapted from Pressman, R.S. (2015). *Software Engineering : A Practioner's Approach. 8th ed*. McGraw-Hill Companies.Inc, Americas, New York. ISBN : 978 1 259 253157. Chapter 3 , 4, 5 and 6

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Learning Objectives

LO 1 : Describe the concepts of software process models and the opportunity for potential business project

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Contents

- Software Process Structure
- Process Models
- Agile Development
- Human Aspects of Software Engineering

SOFTWARE PROCESS STRUCTURE

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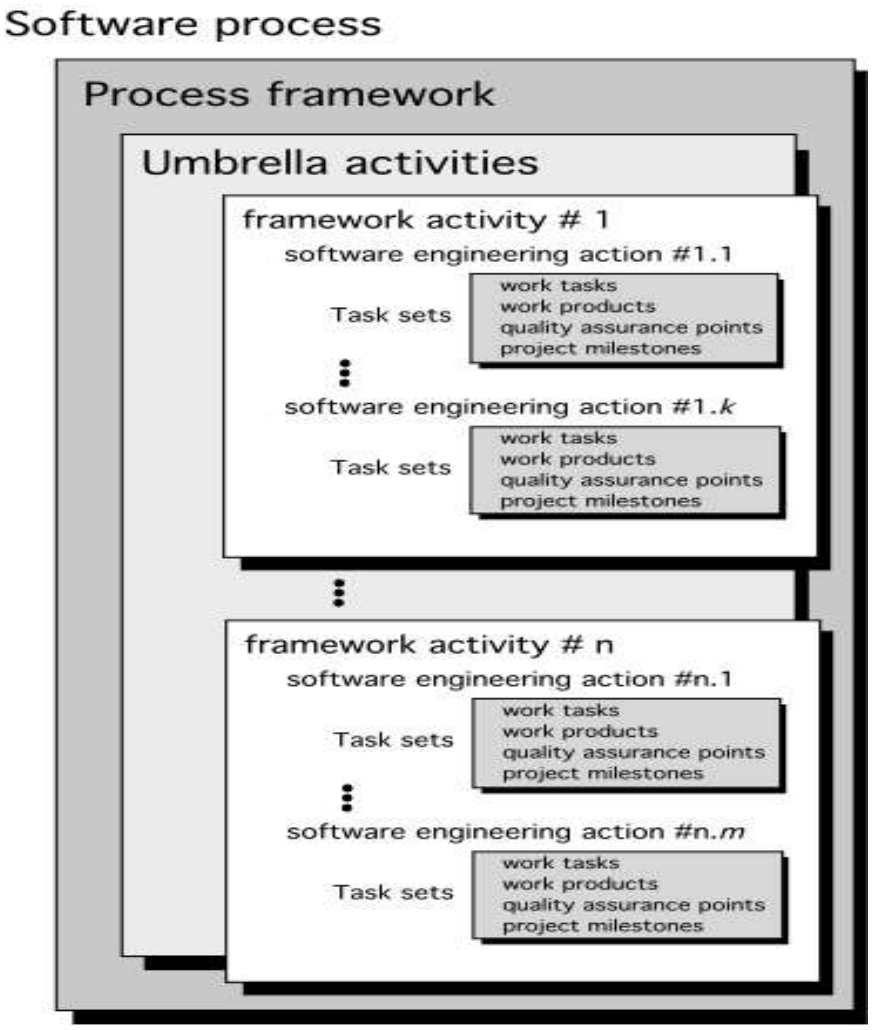
Software Process Structure

Software Process Framework



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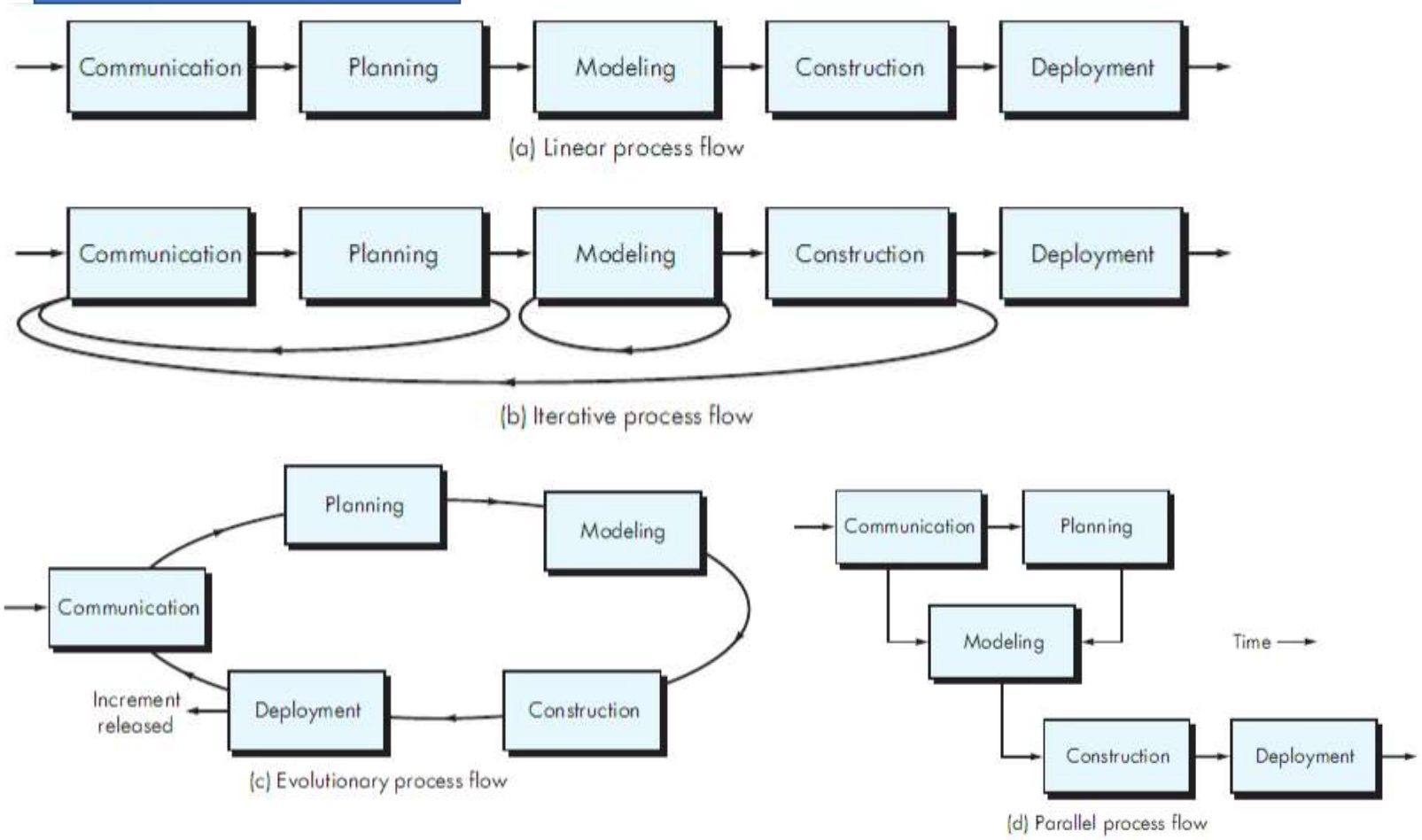
Software Process Structure

Process Flow



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Software Process Structure

Identifying a Task Set

- A task set defines the actual work to be done to accomplish the objectives of a software engineering action.
  - A list of the task to be accomplished
  - A list of the work products to be produced
  - A list of the quality assurance filters to be applied

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Software Process Structure

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* [Amb98]—a consistent method for describing problem solutions within the context of the software process.

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Software Process Structure

Process Pattern Types

- ***Stage*** *patterns*—defines a problem associated with a framework activity for the process.
- ***Task*** *patterns*—defines a problem associated with a software engineering action or work task and relevant to successful software engineering practice
- ***Phase*** *patterns*—define the sequence of framework activities that occur with the process, even when the overall flow of activities is iterative in nature

PROCESS MODEL

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Process 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?**

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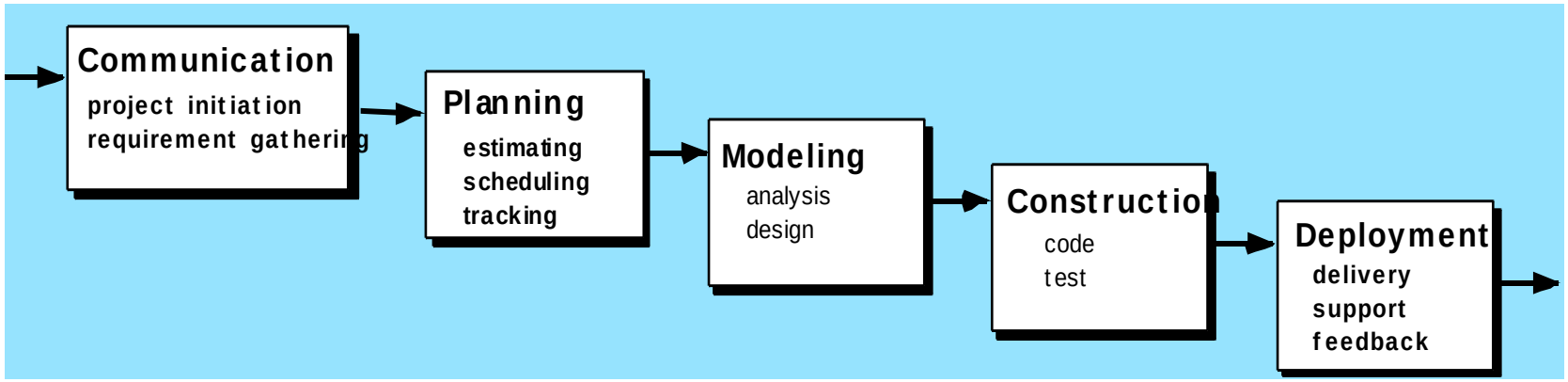
Process Models

The Waterfall Model



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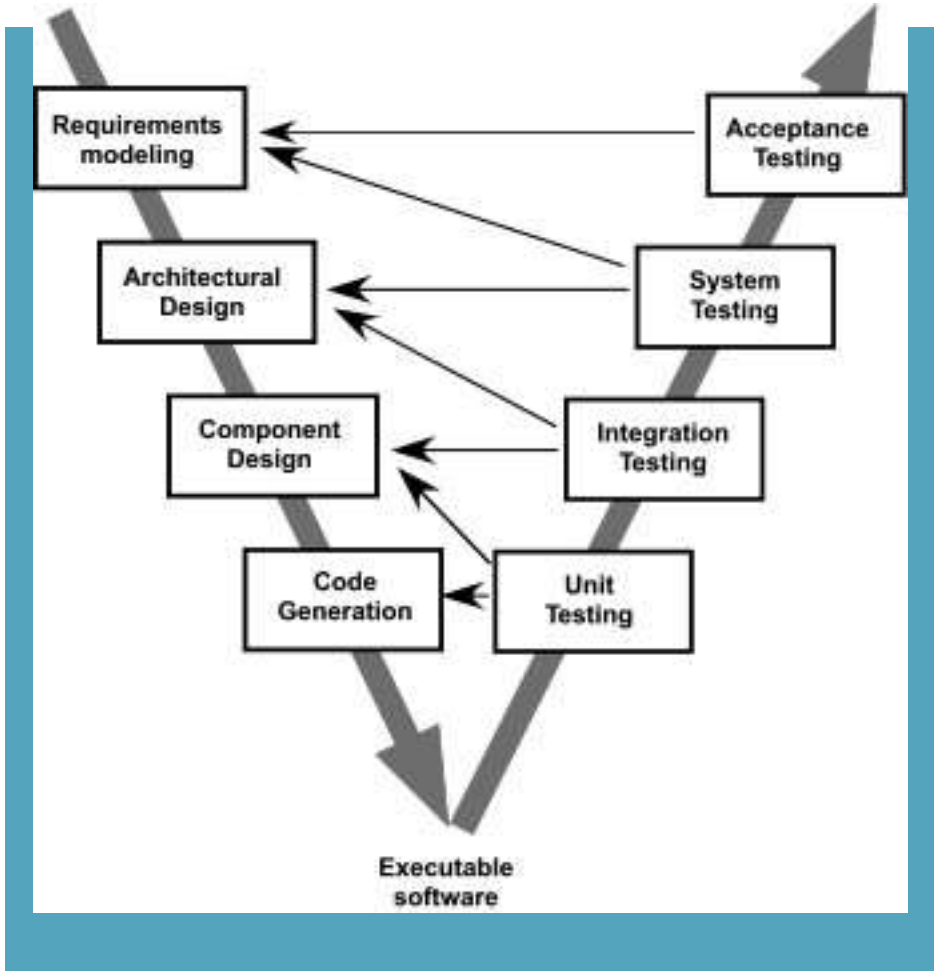
Process Models

The V-Model



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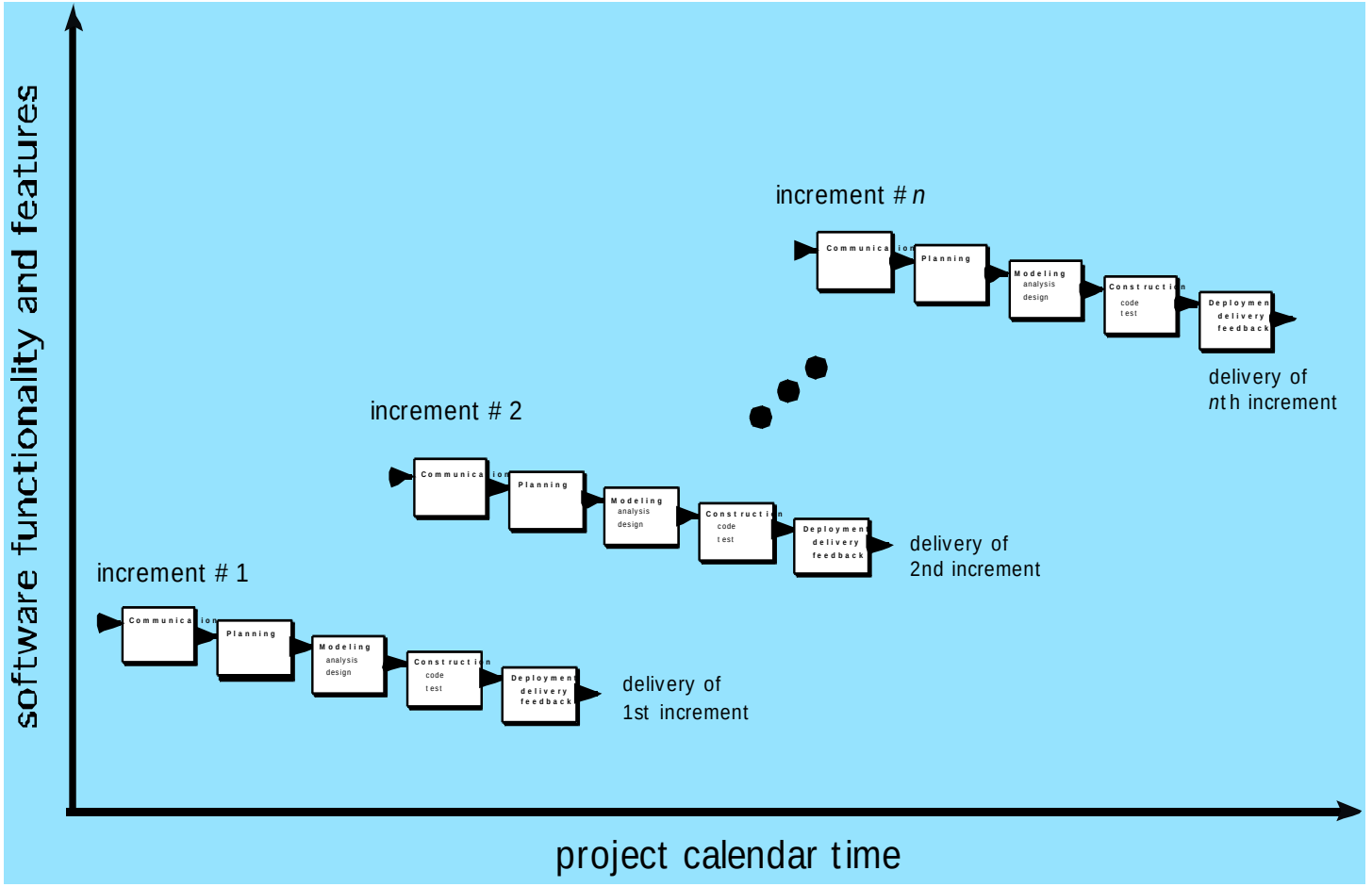
Process Models

The Incremental-Model



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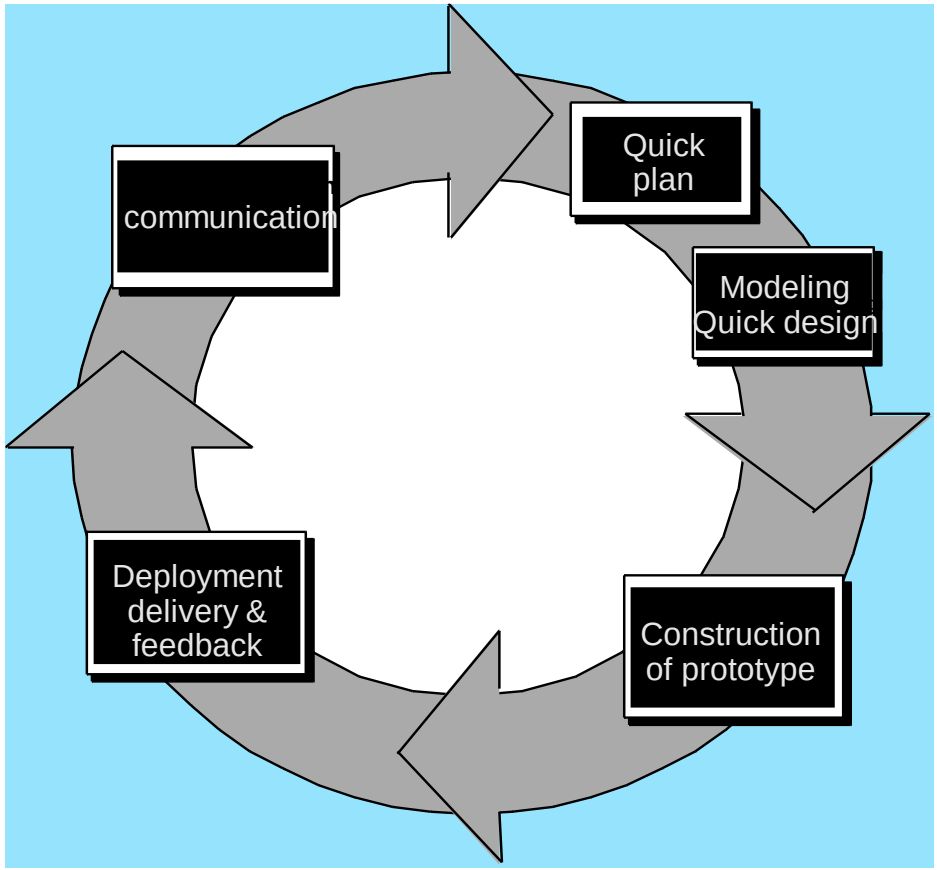
Process Models

Evolutionary Models: Prototyping



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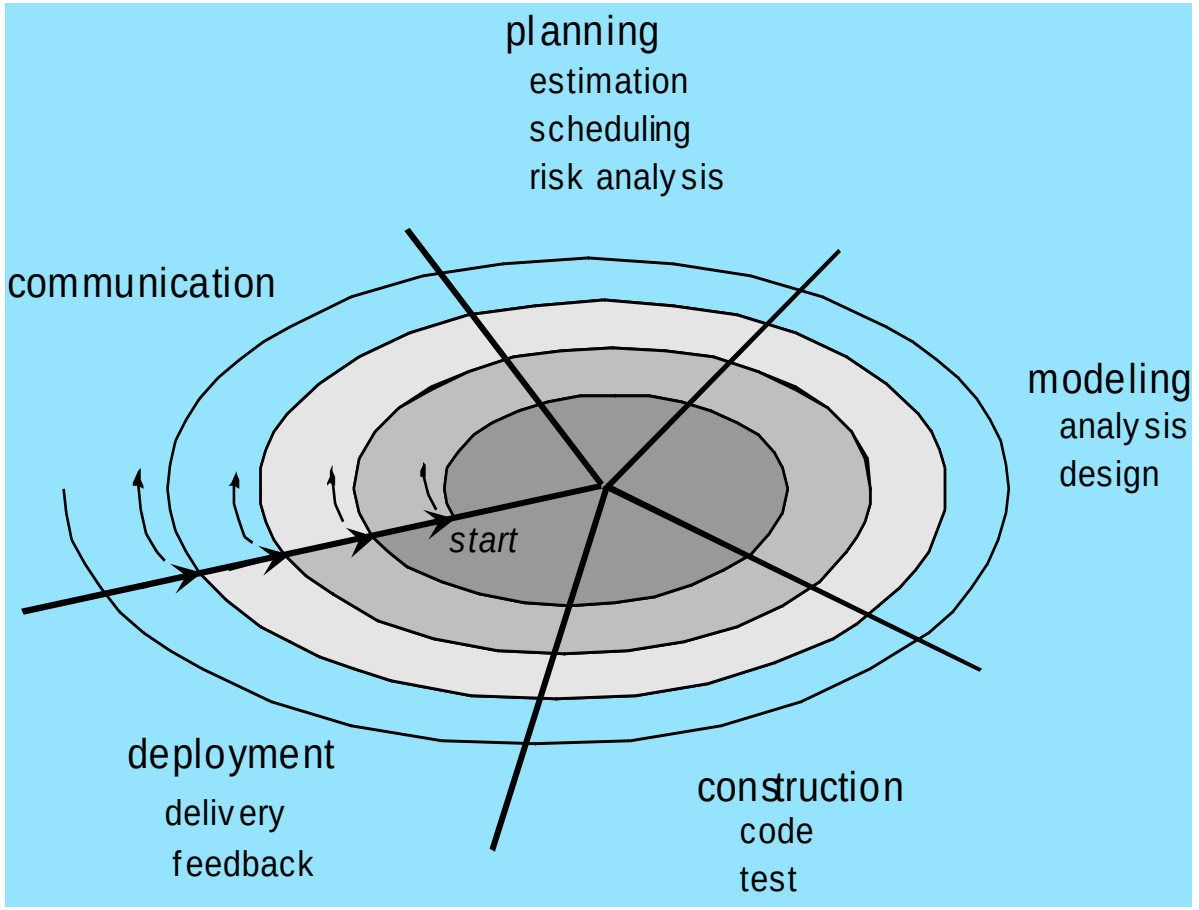
Process Models

Evolutionary Models: The Spiral



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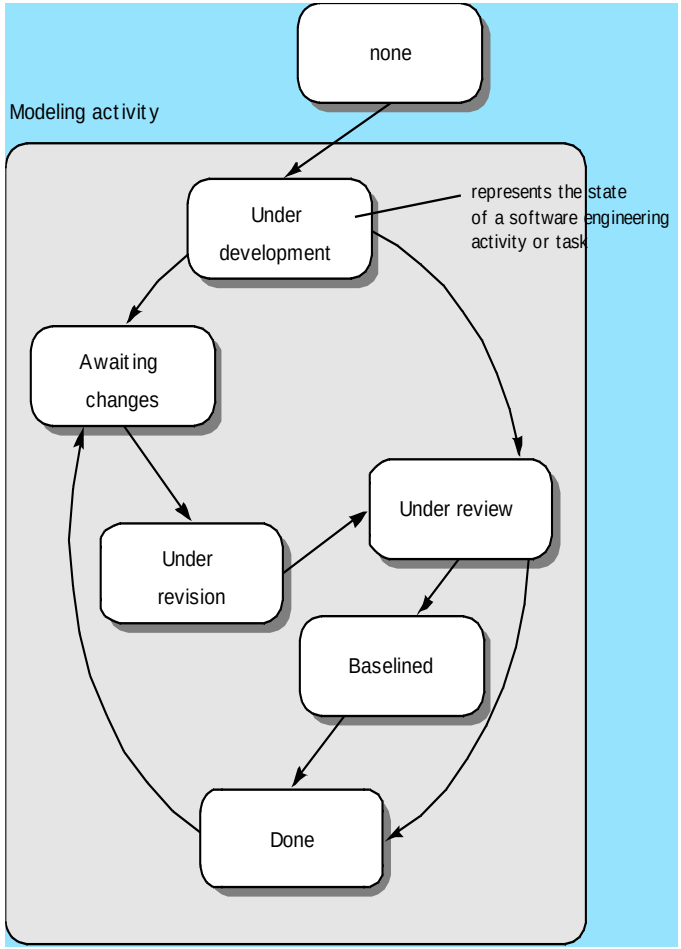
Process Models

Evolutionary Models: Concurrent



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Specialized Process Models

- Component based development—the process to apply when reuse is a development objective
- Formal methods—emphasizes the mathematical specification of requirements
- AOSD—provides a process and methodological approach for defining, specifying, designing, and constructing *aspects*
- Unified Process—a "use-case driven, architecture-centric, iterative and incremental" software process closely aligned with the Unified Modeling Language (UML)

AGILE DEVELOPMENT

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Agile Development

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

Source: agilemanifesto.org

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Agile Development

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**

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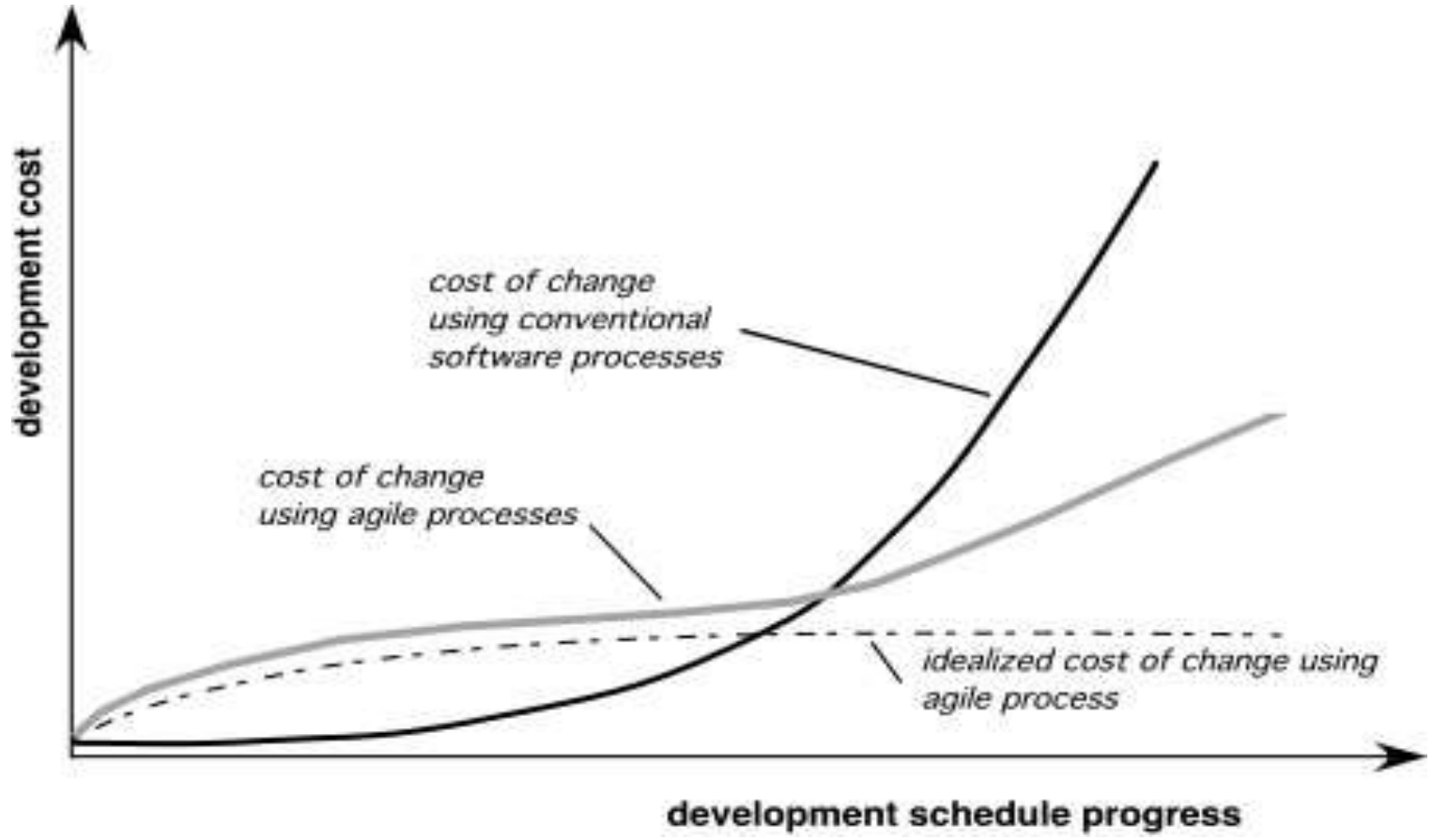
Agile Development

Agility and the Cost of Change



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Agile Development

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**

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Agile Development

Extreme Programming (XP)

- **XP Design**
  - **Follows the KIS principle**
  - **Encourage the use of CRC cards (see Chapter 8)**
  - **For difficult design problems, suggests the creation of "spike solutions"—a design prototype**
  - **Encourages "refactoring"—an iterative refinement of the internal program design**
- **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**

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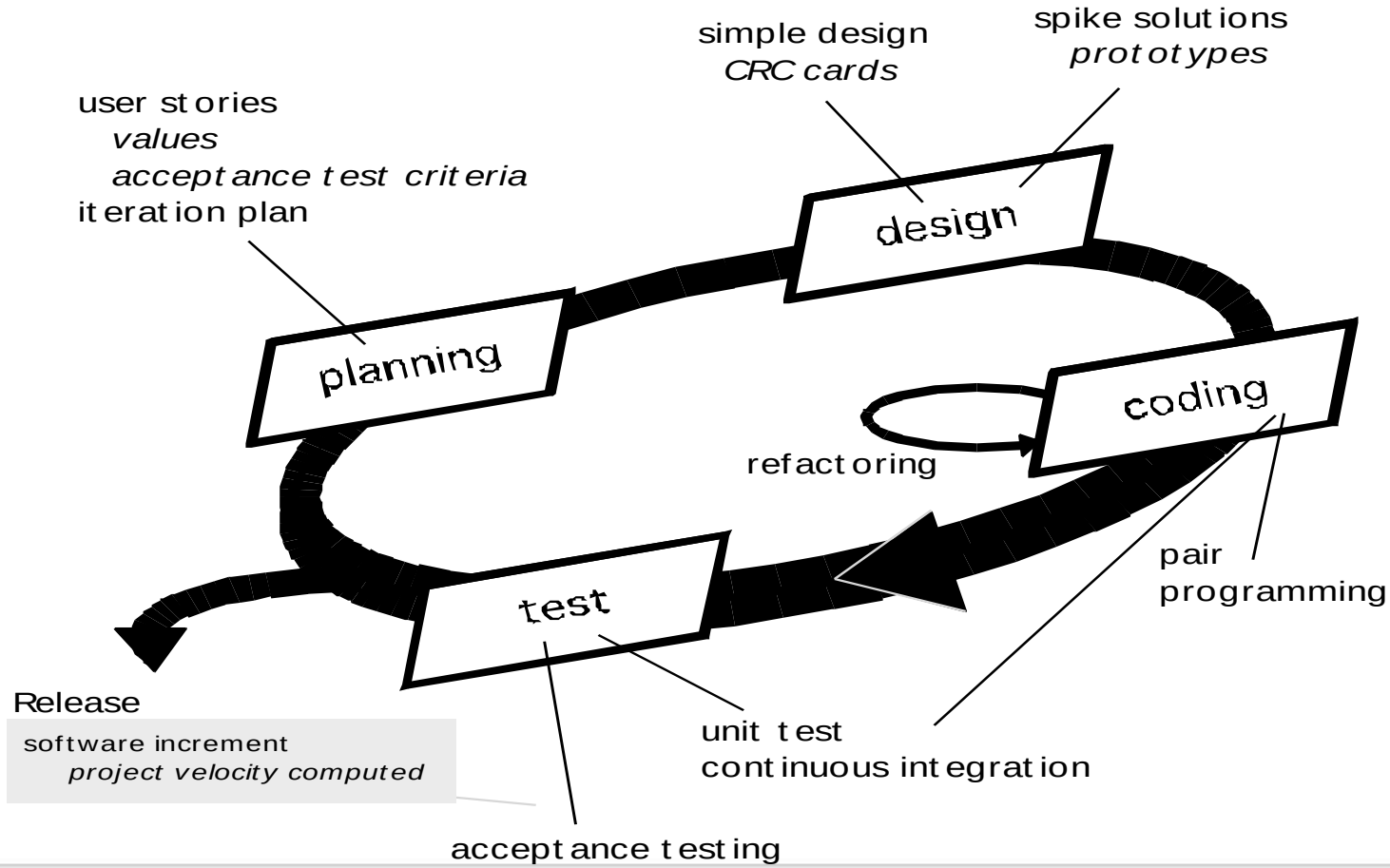
Agile Development

Extreme Programming (XP)



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Agile Development

Adaptive Software Development

- **Originally proposed by Jim Highsmith**
- **ASD — distinguishing features**
  - **Mission-driven planning**
  - **Component-based focus**
  - **Uses “time-boxing”**
  - **Explicit consideration of risks**
  - **Emphasizes collaboration for requirements gathering**
  - **Emphasizes “learning” throughout the process**

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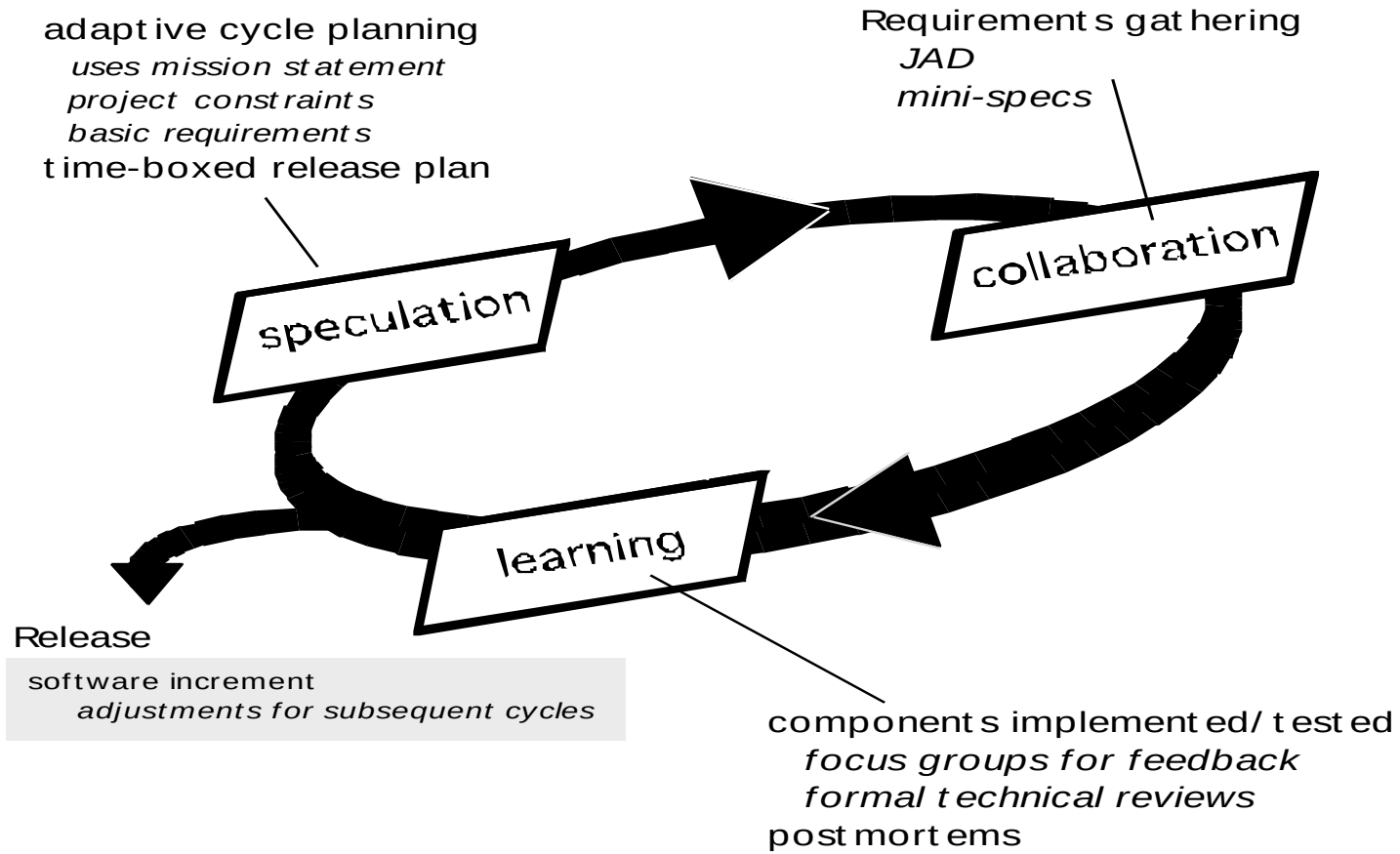
Agile Development

Adaptive Software Development



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Agile Development

Dynamic Systems Development Method

- **Promoted by the DSDM Consortium (www.dsdm.org)**
- **DSDM—distinguishing features**
  - **Similar in most respects to XP and/or ASD**
  - **Nine guiding principles**
    - **Active user involvement is imperative.**
    - **DSDM teams must be empowered to make decisions.**
    - **The focus is on frequent delivery of products.**
    - **Fitness for business purpose is the essential criterion for acceptance of deliverables.**
    - **Iterative and incremental development is necessary to converge on an accurate business solution.**
    - **All changes during development are reversible.**
    - **Requirements are baselined at a high level**
    - **Testing is integrated throughout the life-cycle.**

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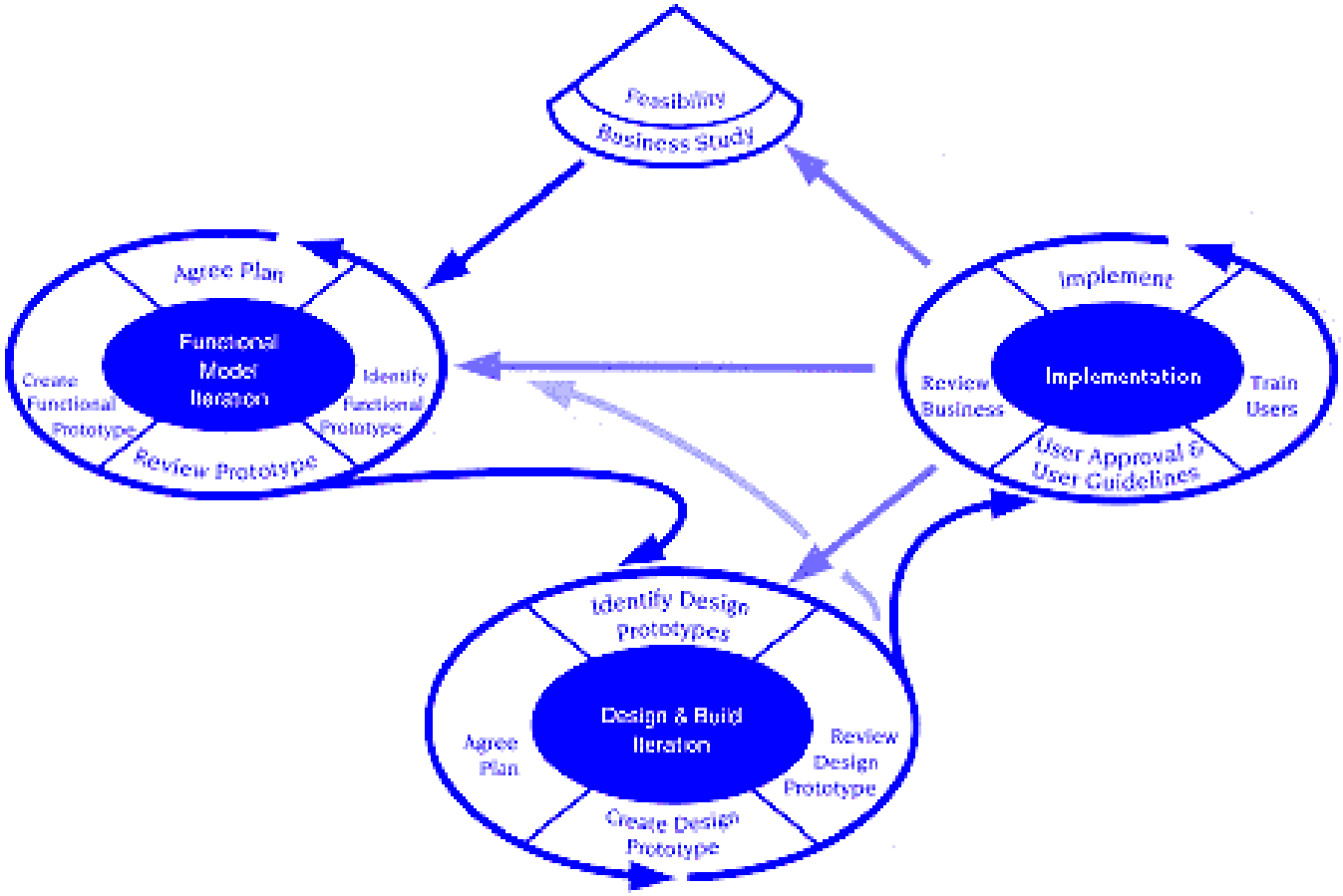
Dynamic Systems Development Method



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Agile Development

Scrum

- **Originally proposed by Schwaber and Beedle**
- **Scrum—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**

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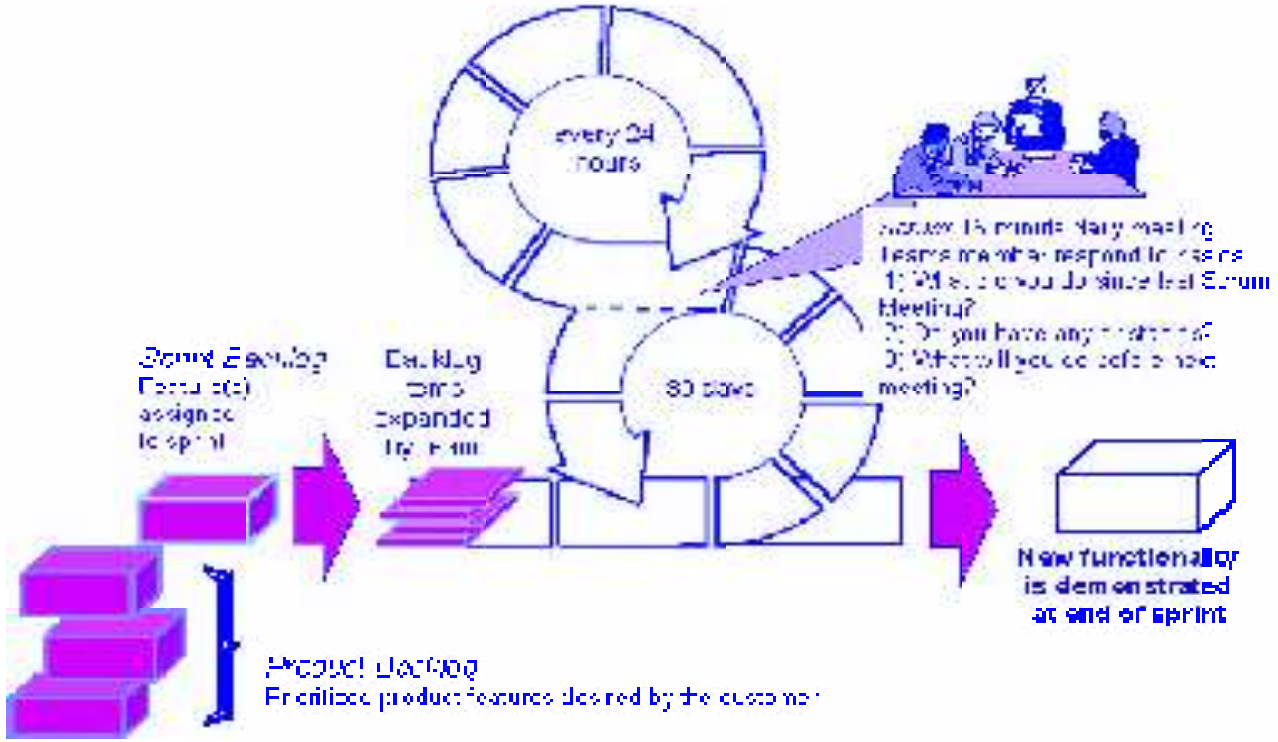
Agile Development

Scrum



Scrum Process Flow (used with permission)

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Agile Development

Crystal

- **Proposed by Cockburn and Highsmith**
- **Crystal—distinguishing features**
  - **Actually a family of process models that allow "maneuverability" based on problem characteristics**
  - **Face-to-face communication is emphasized**
  - **Suggests the use of "reflection workshops" to review the work habits of the team**

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Agile Development

Feature Driven Development

- **Originally proposed by Peter Coad et al**
- **FDD—distinguishing features**
  - **Emphasis is on defining "features"**
    - **a *feature* "is a client-valued function that can be implemented in two weeks or less."**
  - **Uses a feature template**
    - **<action> the <result> <by | for | of | to> a(n) <object>**
  - **A features list is created and "plan by feature" is conducted**
  - **Design and construction merge in FDD**

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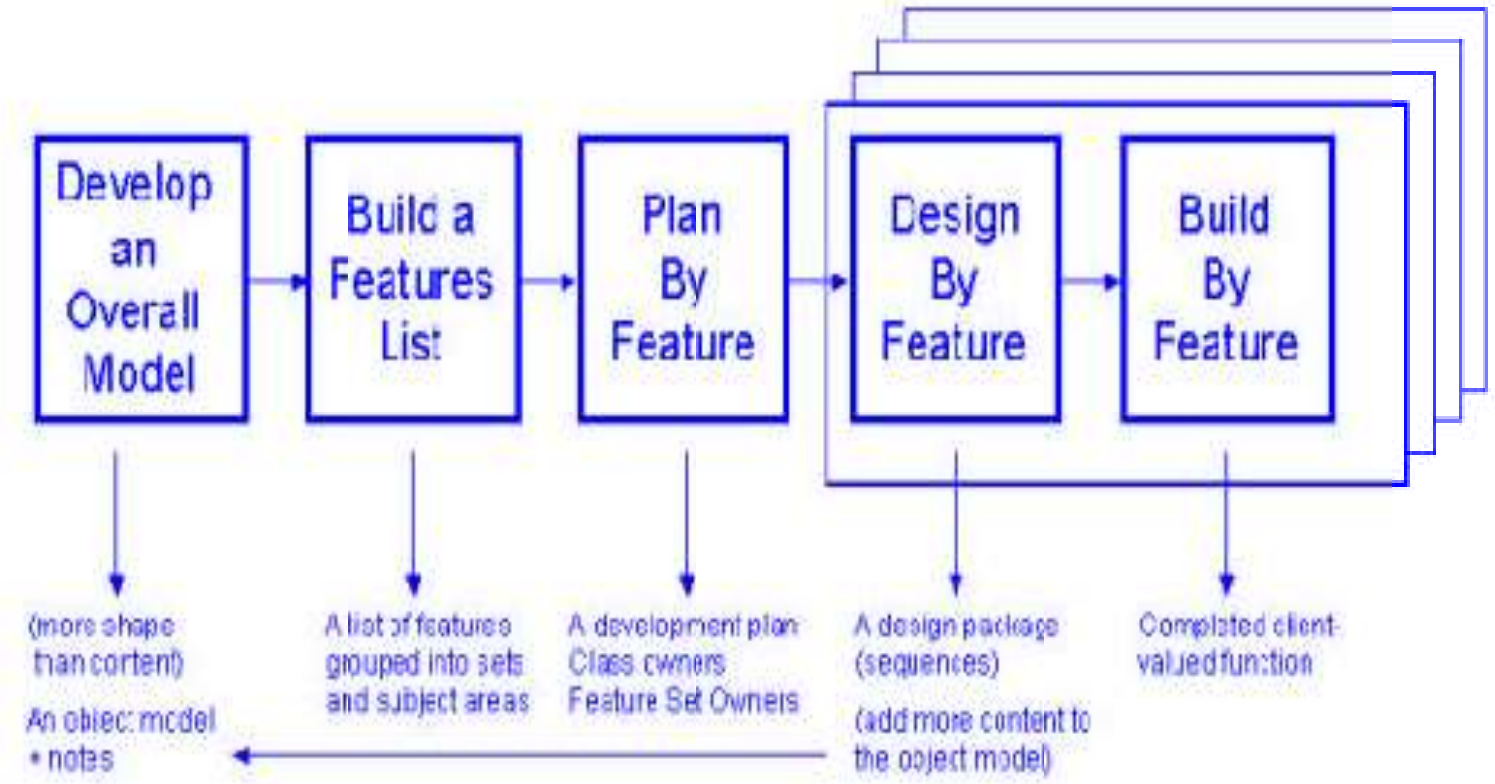
Agile Development

Feature Driven Development



Reprinted with permission of Peter Coad

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Agile Development

Agile Modeling

- **Originally proposed by Scott Ambler**
- **Suggests a set of agile modeling principles**
  - **Model with a purpose**
  - **Use multiple models**
  - **Travel light**
  - **Content is more important than representation**
  - **Know the models and the tools you use to create them**
  - **Adapt locally**

HUMAN ASPECT OF SOFTWARE ENGINEERING

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Human Aspects of Software Engineering

Characteristics of Software Engineer

Erdogmus [erd09] identifies seven traits that are present when an individual software engineer exhibits "superprofesional" behavior.

An effective software engineer :

- **has a sense of individual responsibility**
- **has an acute awareness**
- **is brutally honest**
- **exhibits resilience under prerssure**
- **has a heightened sense of fairness**
- **exhibits attention to detail**
- **is pragmatic**

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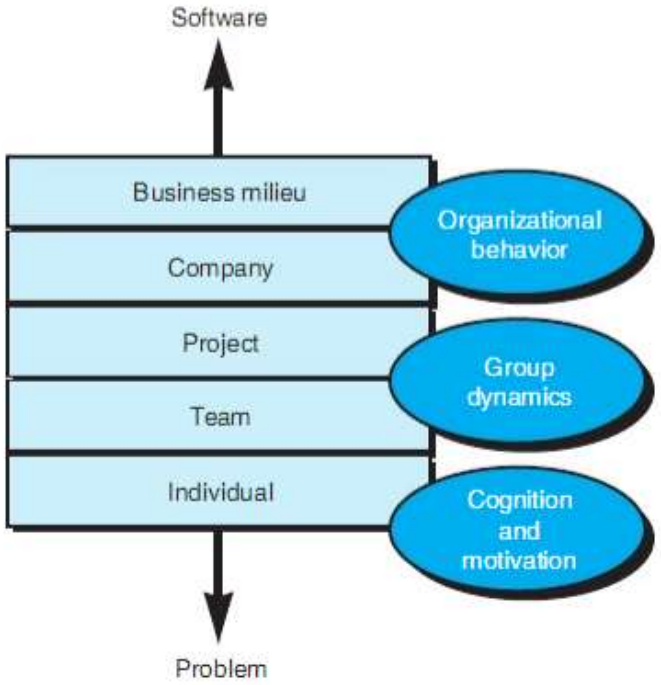
Human Aspects of Software Engineering

The Psychology of Software Engineering

In a seminal paper on the psychology of software engineering, Bill curtis and Dave Walz [Cur90] suggest a layered behavioral model for software development.



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Human Aspects of Software Engineering

- An effective team should foster a sense of trust
- Software engineers on the team should trust the skills and competence of their peers and their managers.
- The team should encourage a sense of improvement by periodically reflecting on its approach to software engineering and looking for ways to improve their work

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Team Structure

Human Aspects of Software Engineering

Constantine [Con93] suggests four "organizational paradigms" for software engineering teams

1. **A closed paradigm; a team along a traditional hierarchy of authority**
2. **A random paradigm; a team loosely and depends on individual initiative of the team members**
3. **An open paradigm; a team in a manner that achieves some of the controls associated with the closed paradigm but also much of the innovation that occurs when using the random paradigm**
4. **A synchronous paradigm; relies on the natural compartmentalization of a problem and organizes team members to work on pieces of the problem with little active communication amonjg themselves**

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Q & A

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Thank You