TOPICS

The Nature and History of Software Development

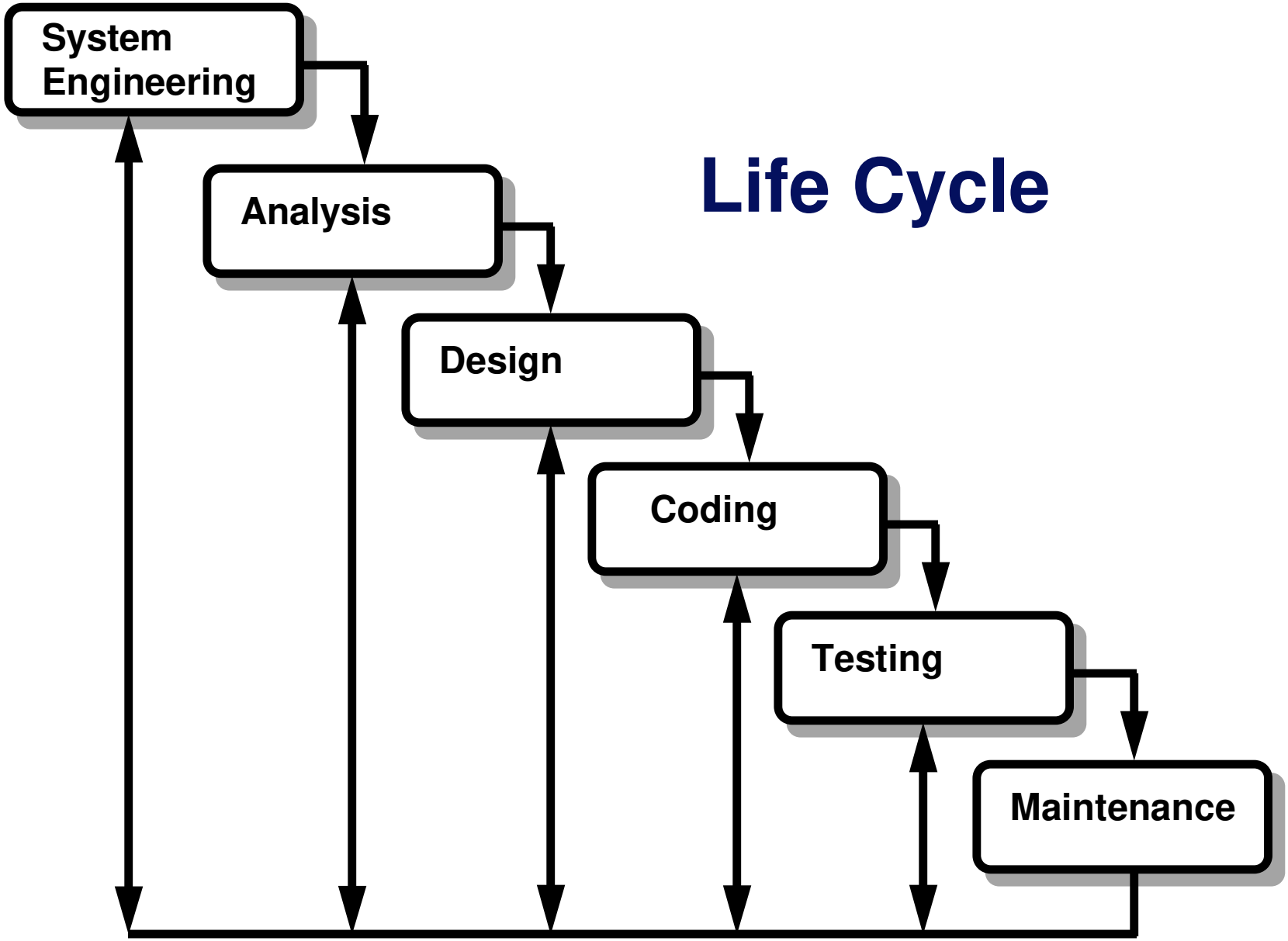
Problems with Software Development

Software Engineering Paradigms and Technology

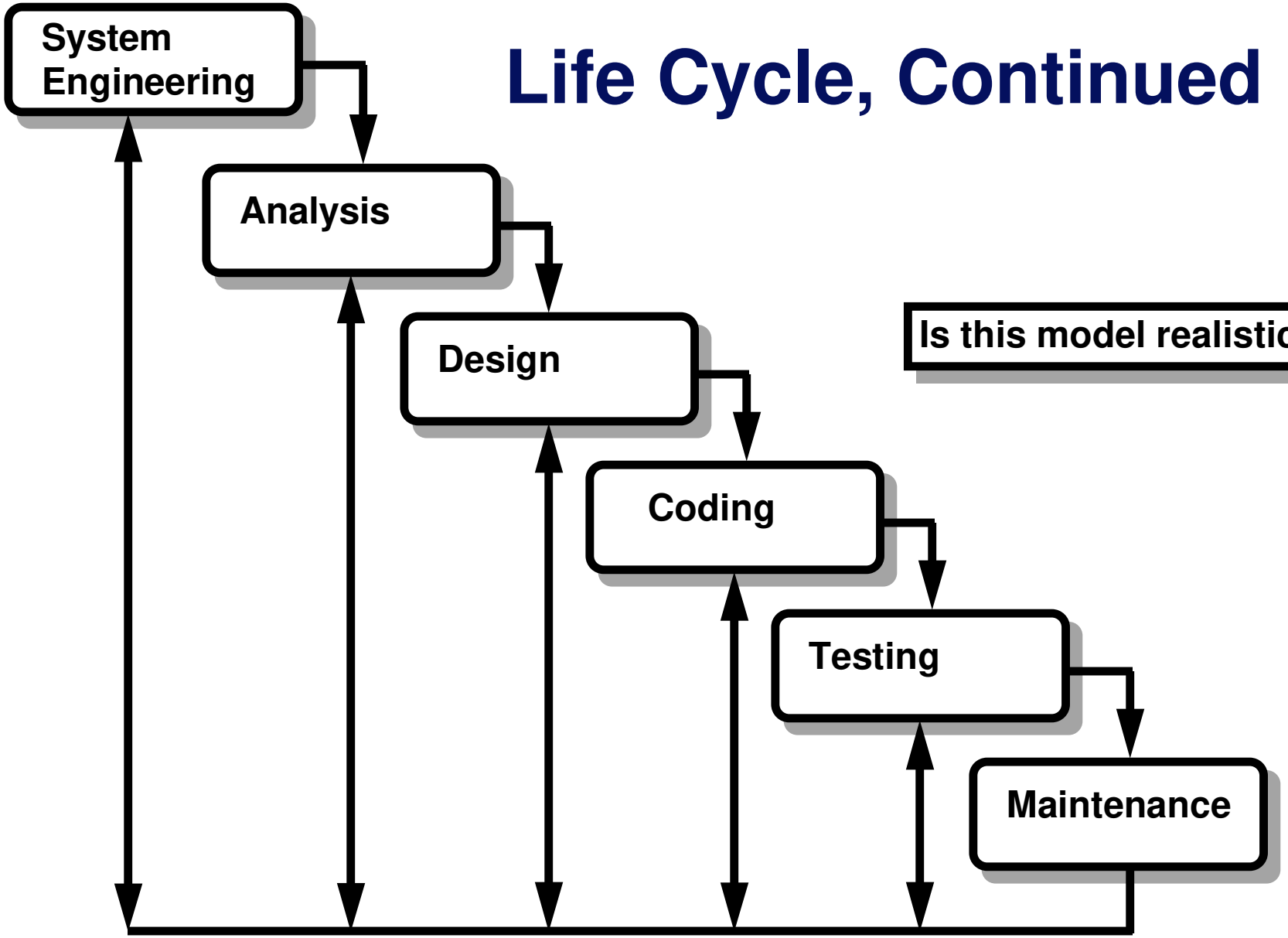
SOFTWARE ENGINEERING PARADIGMS

- Life Cycle
- Prototyping Model
- Spiral Model
- Fourth Generation Techniques
- Combining Paradigms
- Generic Paradigm

Life Cycle

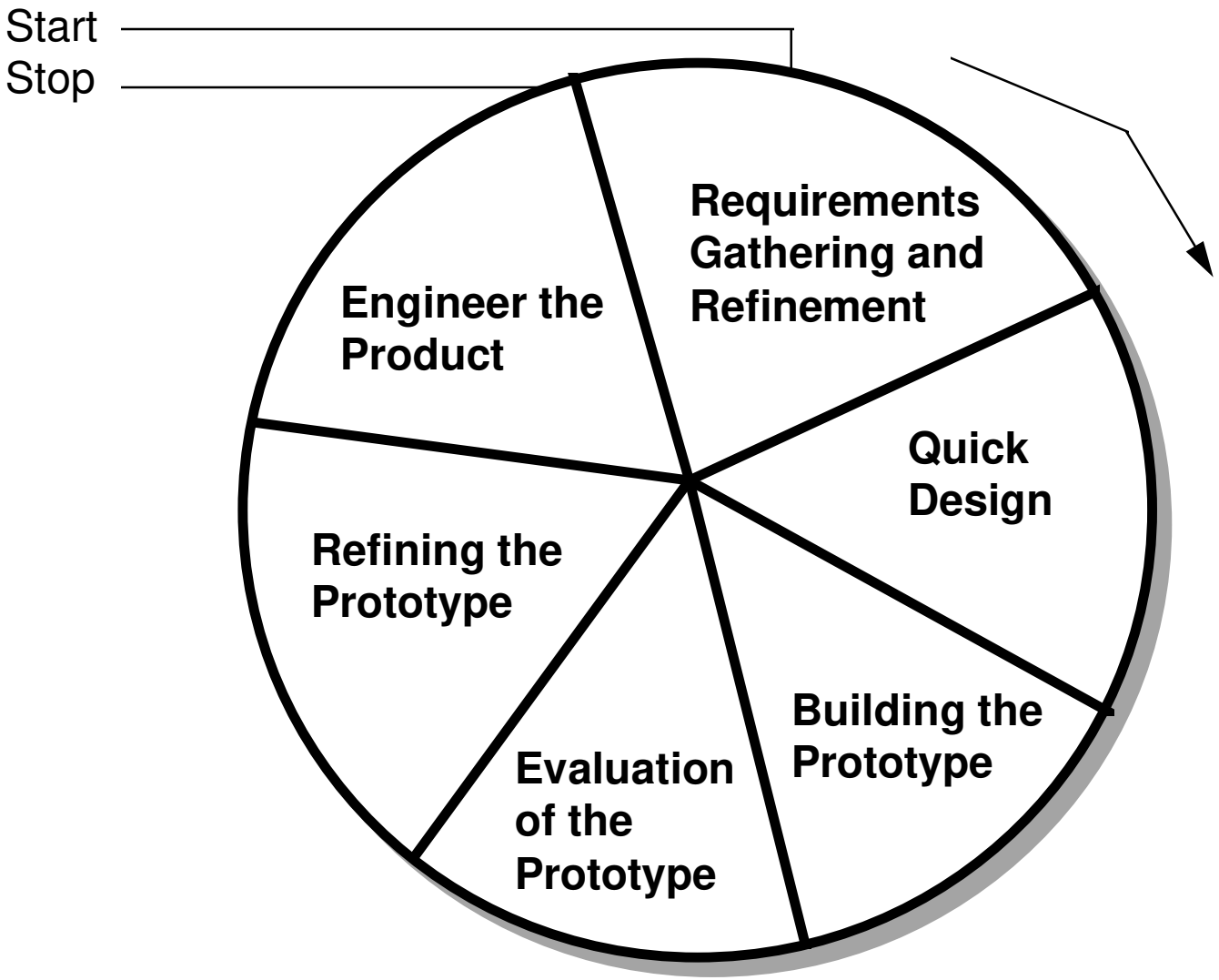

System Engineering
Analysis
Design
Coding
Testing
Maintenance

Life Cycle, Continued

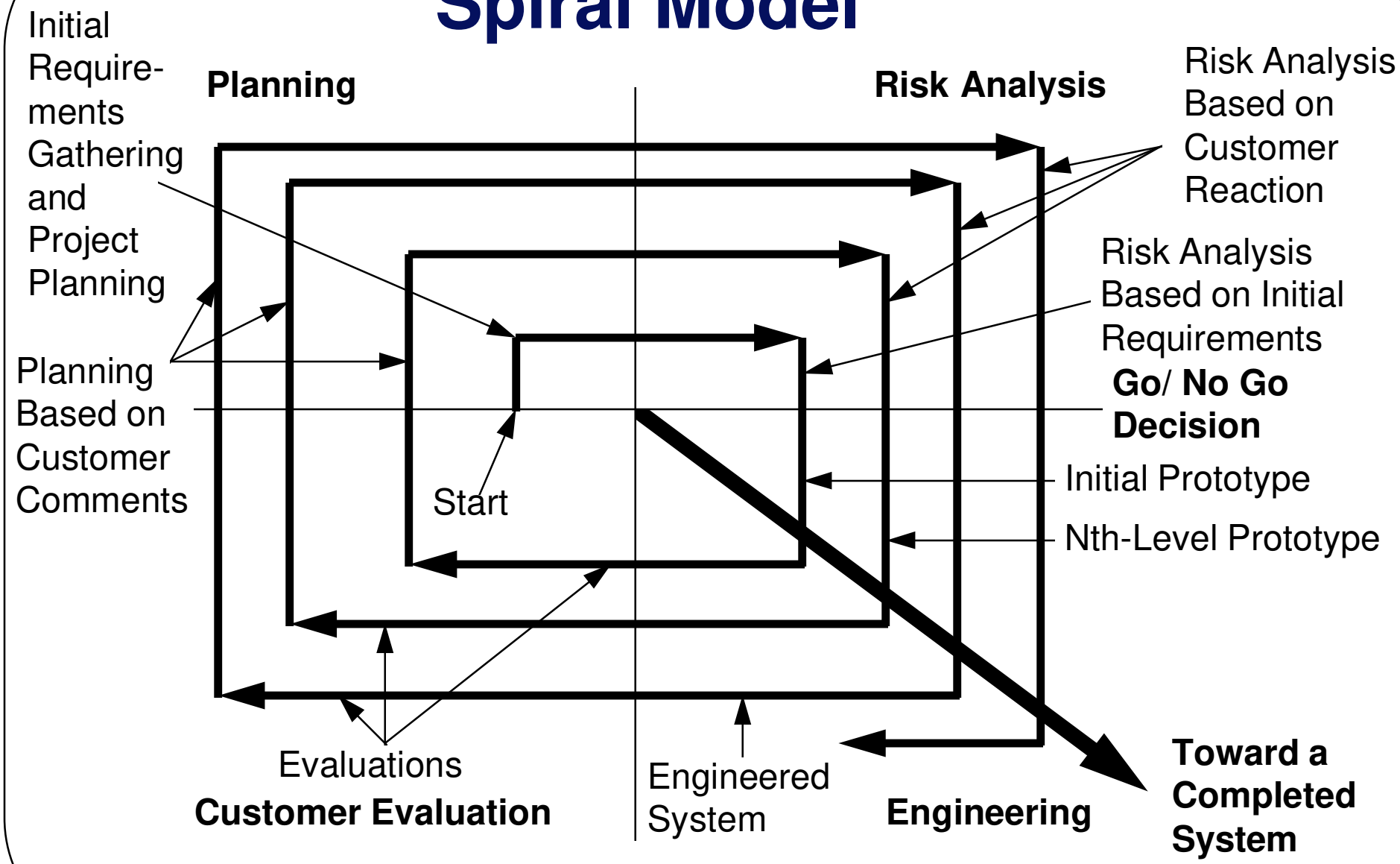


Is this model realistic?

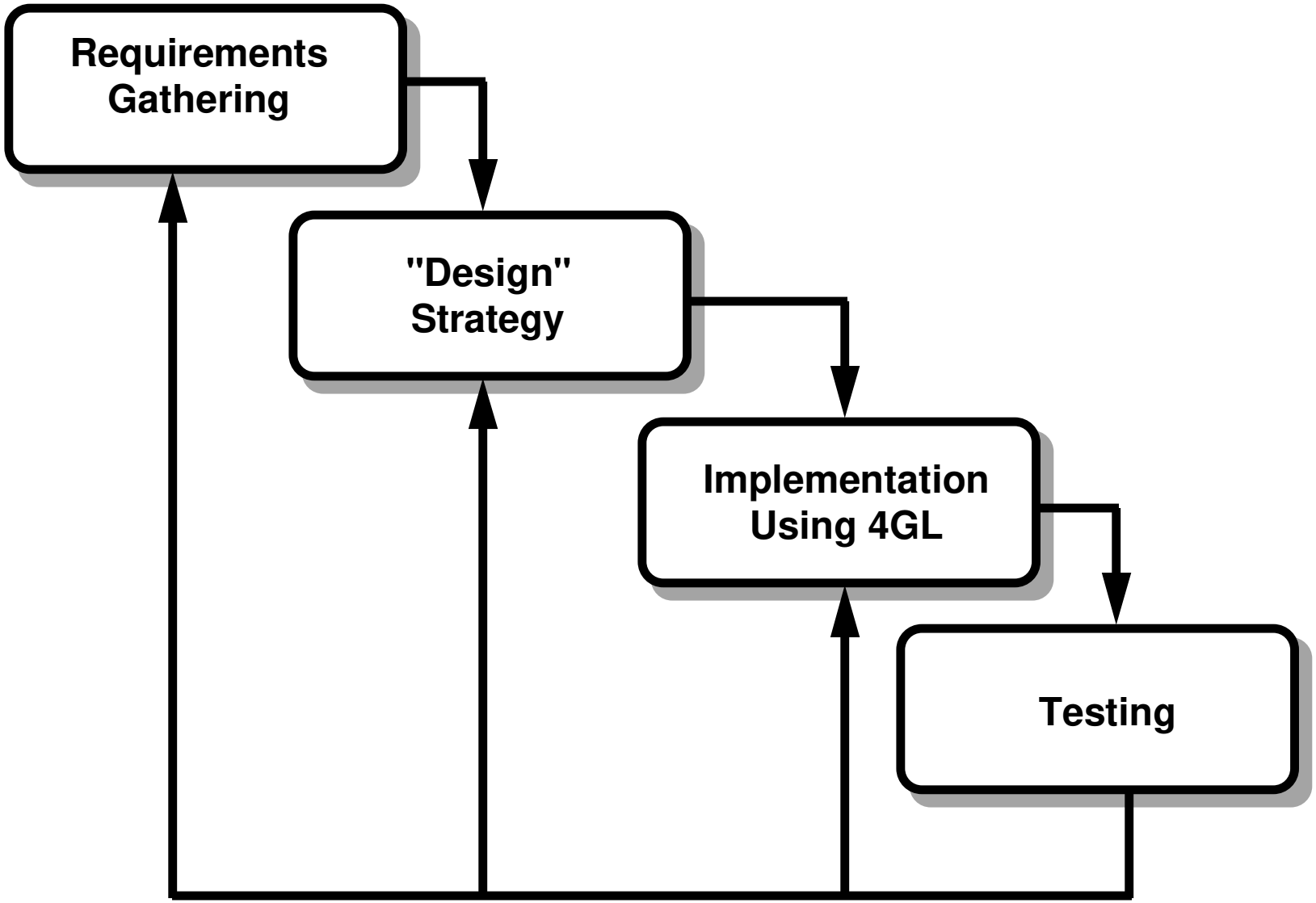
Prototyping Model



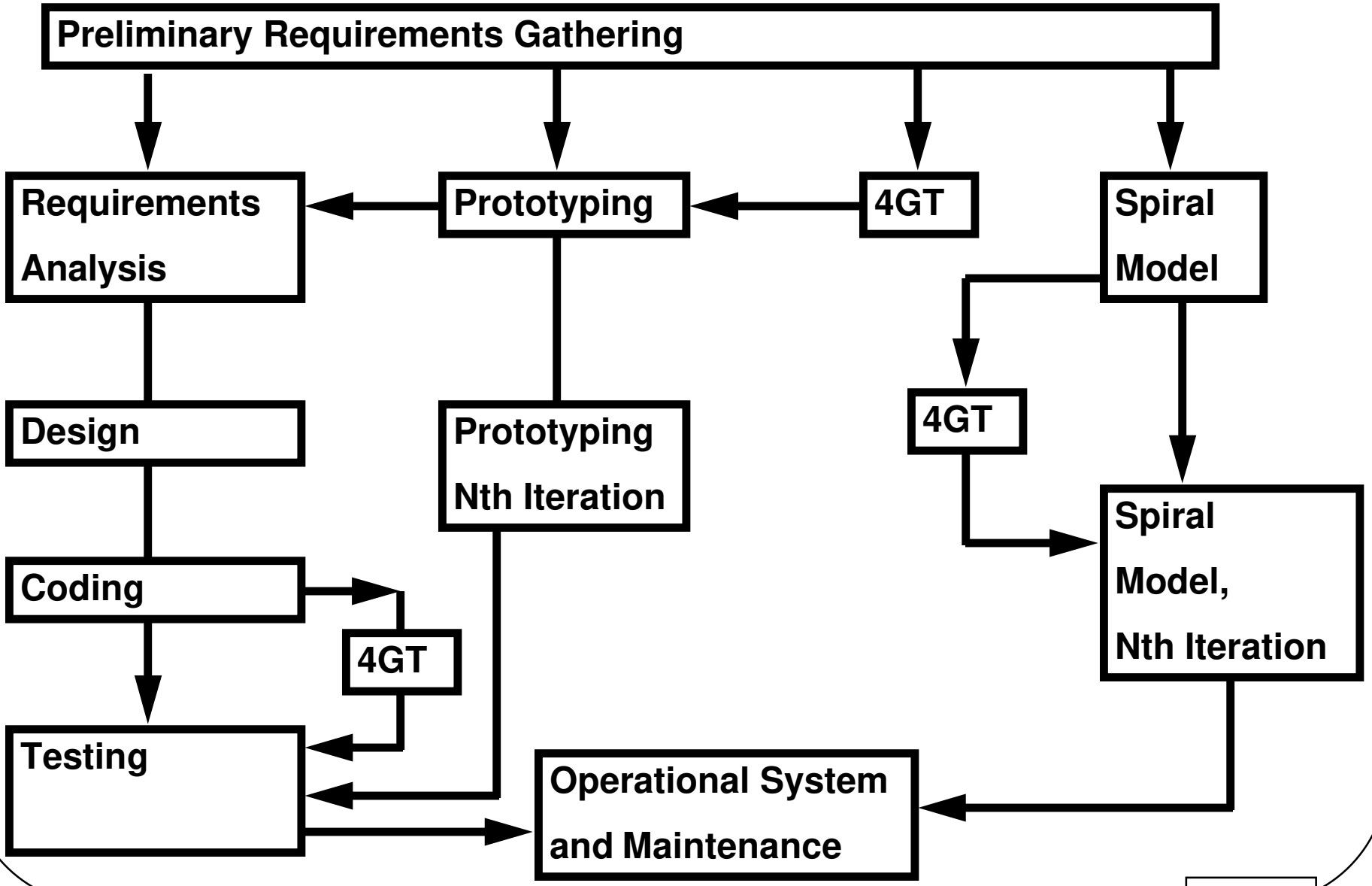
Spiral Model



Fourth Generation Techniques



Combining Paradigms



Generic Paradigm

1. DEFINITION PHASE
- System Analysis
- Software Project Planning
- Requirements Analysis

2. DEVELOPMENT PHASE
- Software Design
- Coding
- Software Testing

3. MAINTENANCE PHASE
- Correction
- Adaptation
- Enhancement

SOFTWARE ENGINEERING TECHNOLOGY

- What is Software Engineering?
- Software Engineering Capability and Its Measurement
- Ada Technology

What Is Software Engineering?

Methods

- Analysis
- Design
- Coding
- Testing
- Maintenance

Procedures

- Project Management
- Software Quality Assurance
- Software Configuration Management
- Measurement
- Tracking
- Innovative Technology Insertion

Computer-Aided Software Engineering **(CASE)**

- Tools which support the ***Methods*** and ***Procedures***

Software Engineering Capability and Its Measurement

- The maturity of an organization's software engineering capability can be measured in terms of the degree to which the outcome of the process by which software is developed can be predicted.
  - Predict the amount of time required to develop a software artifact
  - Predict the resources (number of people, amount of disk space, *etc.*) required to develop a software artifact
  - Predict the cost of developing a software artifact
- The *process* and the *technology* go hand in hand.
- One method of measurement is the *Capability Maturity Model for Software* developed by the Software Engineering Institute.

Increasing Process Maturity

Optimizing - Process refined constantly

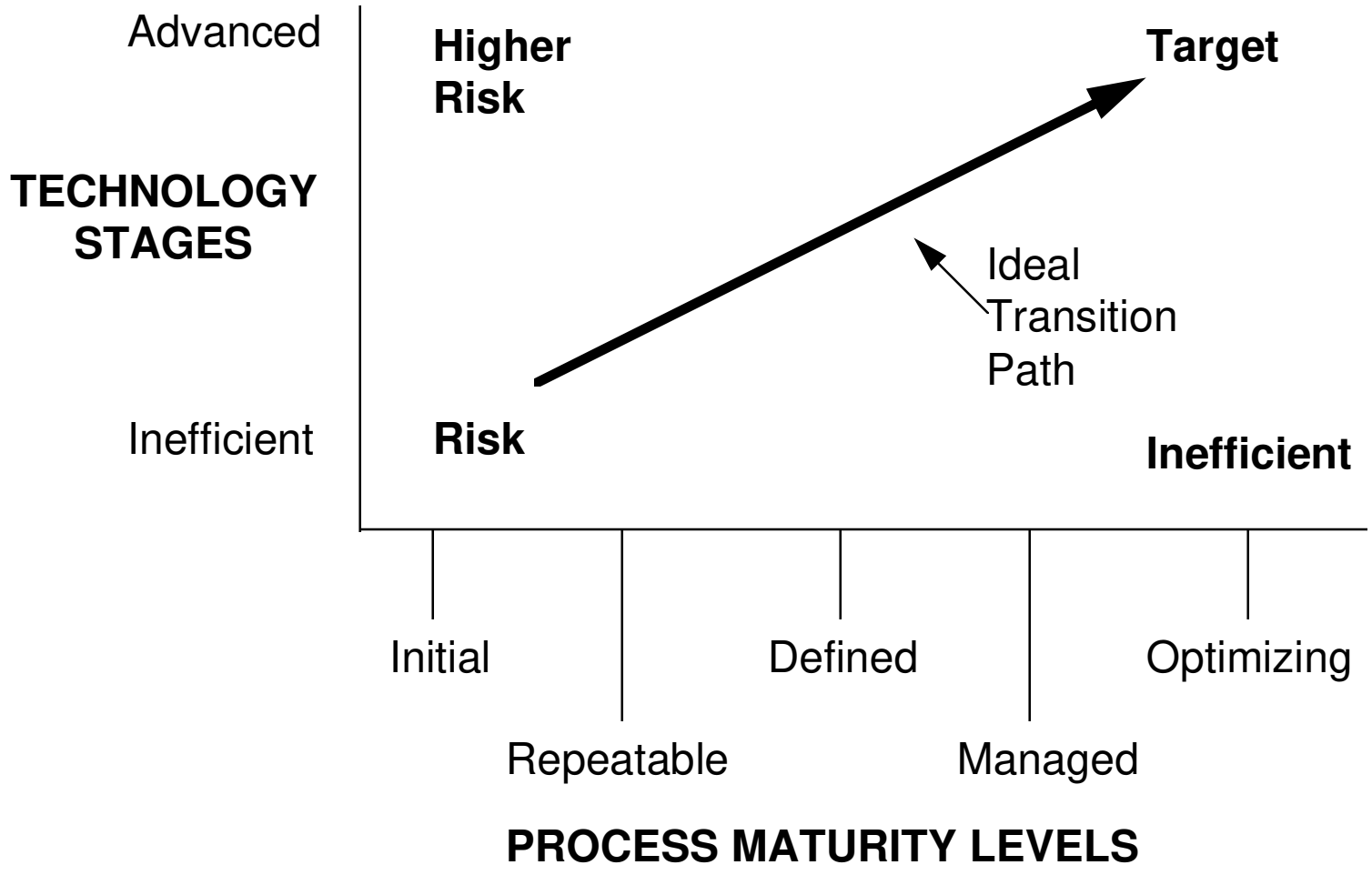
Managed - Process measured/controlled

Defined - Process institutionalized

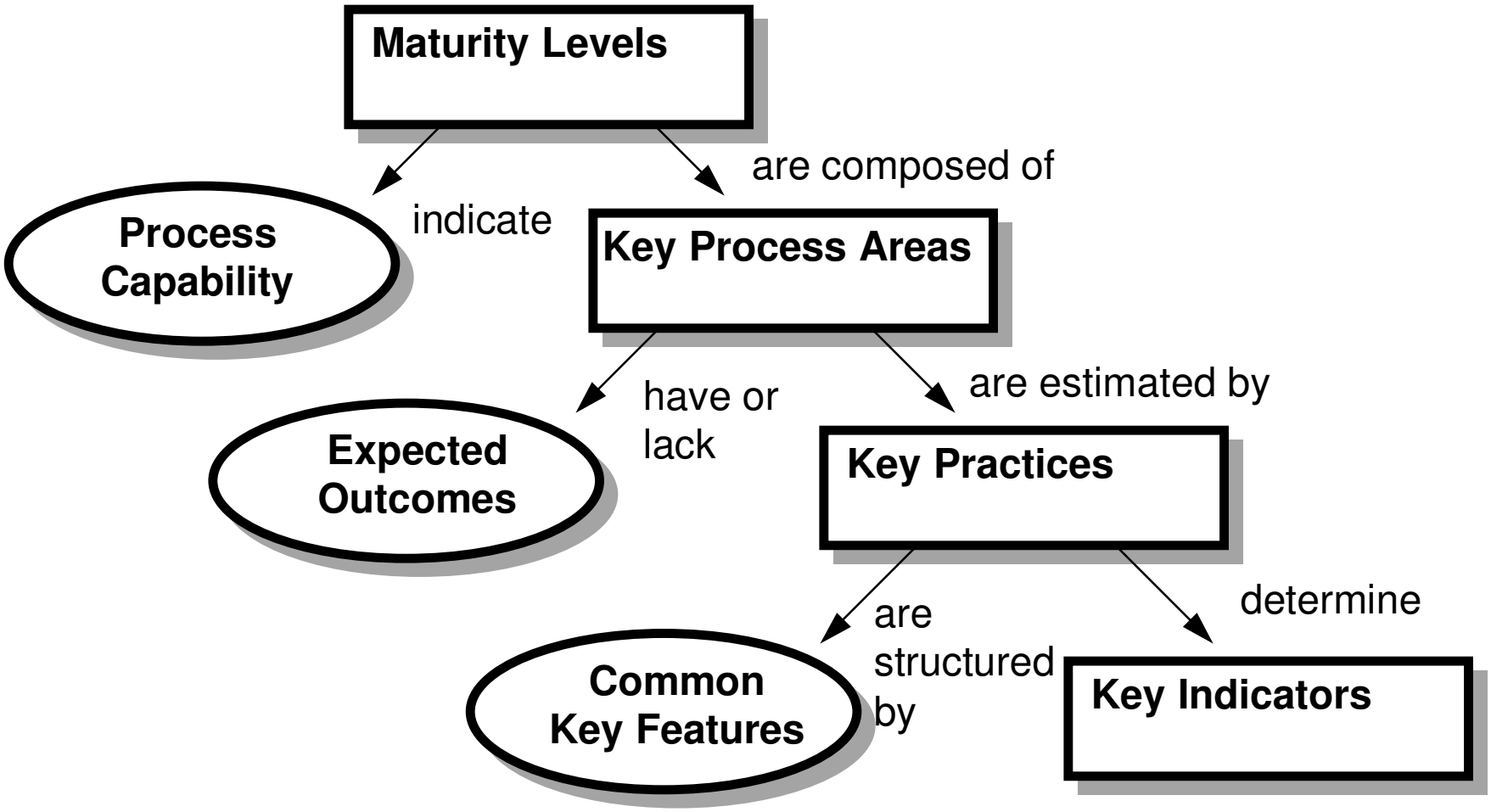
Repeatable - Costs, Schedules managed

Initial - Ad hoc; unpredictable

Process Maturity and Technology



Maturity Keys



Key Process Areas by Level
Level 2 (Repeatable)

- **Requirements Management**
- **Software Project Planning**
- Software Project Tracking and Oversight
- Software Subcontract Management
- Software Quality Assurance
- Software Configuration Management

Key Process Areas by Level
Level 2 (Repeatable), Continued

- Requirements Management
- Software Project Planning
- **Software Project Tracking and Oversight**
- **Software Subcontract Management**
- Software Quality Assurance
- Software Configuration Management

Key Process Areas by Level
Level 2 (Repeatable), Continued

- Requirements Management
- Software Project Planning
- Software Project Tracking and Oversight
- Software Subcontract Management
- **Software Quality Assurance**
- **Software Configuration Management**

Key Process Areas by Level
Level 3 (Defined)

- **Organization Process Focus**
- **Organization Process Definition**
- Training Program
- Integrated Software Management
- Software Product Engineering
- Intergroup Coordination
- Peer Reviews

Key Process Areas by Level
Level 3 (Defined), Continued

- Organization Process Focus
- Organization Process Definition
- **Training Program**
- **Integrated Software Management**
- Software Product Engineering
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Key Process Areas by Level
Level 3 (Defined), Continued

- Organization Process Focus
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Key Process Areas by Level
Level 3 (Defined), Continued

- Organization Process Focus
- Organization Process Definition
- Training Program
- Integrated Software Management
- Software Product Engineering
- Intergroup Coordination
- **Peer Reviews**

Key Process Areas by Level
Level 4 (Managed)

- Process Measurement and Analysis
- Quality Management

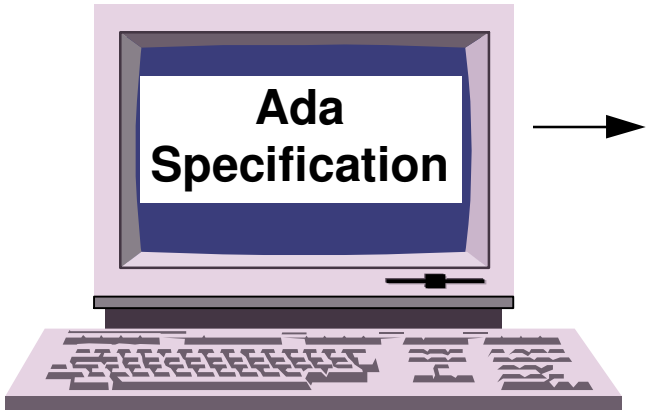
Key Process Areas by Level
Level 5 (Optimizing)

- Defect Prevention
- Technology Innovation
- Process Change Management

Ada Technology

- *Ada* is a computer programming language specifically designed to support software engineering.
- Some of Ada's features include:
  - All of the normal constructs for looping, branching, flow control, and subprogram construction
  - Support for enumeration types, integers, floating point, fixed point, characters, strings, arrays, records, and user-defined data types
  - Support for algorithm templates (called generics) which allow algorithms to be expressed without concern for the kind of data on which the algorithm is applied
  - Support for interrupts and concurrent processing
  - Support for low-level control, such as memory allocation
- Ada is a *design* language as well as a *programming* language.
- Ada is designed to be read by Ada programmers and non-programmers.

Ada Technology, Continued




```
with System;

package Sensor is

   type Device is private;

   -- Abstract concept of a sensor

   procedure Define (S : in out Device;

      Where : in System.Address);

   -- Associate a sensor with memory

   function Read(S : in Device)

         return Integer;

   -- Return sensed value

private

   -- details omitted

end Sensor;
```

Ada Technology, Continued

- From the software engineering perspective, Ada helps by acting as something much more than a programming language; Ada can be used as a common language for communicating:
  - Some aspects of the requirements
  - Some aspects of the design
  - All aspects of the code
- In particular, by using Ada as a *design language*, code is simply realized as a complete, detailed elaboration of a design.
- For large, multi-person teams, Ada can be used as an exact, precise way to communicate requirements and design information -- often in a form which may be syntactically checked by a compiler. Ada is much better than conventional English in this regard.