

ICS 121 Topic 13:  
**Process and Environments**

Software Lifecycle Models  
 Process Evaluation Models  
 Software Engineering Environments  
 CASE: Computer-Aided Software Engineering

### Software Lifecycle Models, *repeat*

- Over time different lifecycle models were developed, *e.g.*,
  - from build-and-fix model
  - to stagewise development
  - to waterfall model
  - to spiral model
  - others
    - prototyping model
    - incremental model
    - ...
- Different lifecycle models decompose software engineering activities in different ways

**No "right" or "wrong" lifecycle model**

### Build and Fix Approach, *repeat*

– Build entire product; deliver to client who requires changes; change until client feels software can be used productively

### Stagewise Development

– Software developed in successive stages (lifecycle phases)

### Waterfall Model [Royce,1970], *repeat*

– Includes feedback confined between successive phase to minimize impact

### Test Development

– Develop test plans in conjunction with each lifecycle phase



### Capability Maturity Model, *continued*

- Five maturity levels
  - 1. initial – ad hoc process
  - 2. repeatable process – basic project management
  - 3. defined process – process modeling and definition
  - 4. managed process – process measurement
  - 5. optimizing process – process control and dynamic improvement
- to aid in maturation, the SEI has a series of questionnaires and conducts process assessments that highlight current shortcomings

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### ISO 9000

- Further attempt to improve software quality based on International Standards Organization (ISO)
- ISO 9000 = series of five related standards
  - within ISO 9000 standard series ISO 9000-3 focuses on software and software development
- Basic features:
  - stress on documenting the process in both words and pictures
  - requires management commitment to quality
  - requires intensive training of workers
  - emphasizes measurement
- Adopted by over 60 countries (e.g., USA, Japan, European Union, ...)
- Company needs to be certified that its process complies with the ISO 9000 standard

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### Software Engineering Environments

- An integrated collection of tools
  - Comprehensive
  - Open and Extensible
  - Flexible
  - Efficient
- Synergistic integration is the essence of an environment
  - Internal integration around internal objects
  - External integration around external tool usage and processes
- An experimental test bed for ideas, prototypes

**CAD/CAM for software development**

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### Environment Characteristics

- Broad in scope
  - Covers all lifecycle phases
    - requirements, specification, design, implementation, testing, debugging, maintenance, configuration management
  - Supports all personnel
    - technical (developers, reviewers, testers)
    - managers (visibility)
    - clerical
  - Supports office automation
    - mail
    - document preparation

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### Environment Characteristics

- User Friendly
  - Highly interactive
    - user has control
  - Graphics oriented
    - uses windows, icons
    - creates visual models
    - animates development
- Flexible/Extensible
  - Addition of new tools
  - Addition of new object types
  - Addition of new functionality
  - Addition of new methodologies
  - Addition of new processes

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### Environment Focus

- Function-Centered
  - how, not what or why
    - Interlisp, Unix, Mentor
- Object-Centered / Relation-Centered
  - what, not why or coordination
    - Stoneman, Odin, PCTE, PMDB
- Process-Centered
  - flexible, extensible, programmable
  - roles of personnel delineated
    - Arcadia, Eureka Software Factory

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### Environment Capabilities

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- Description
  - software artifacts
  - relations between artifacts
  - graphical as well as textual
  - interactive manipulation
  - versions of artifacts
- Analysis
  - quality
  - pre-implementation: completeness, consistency, performance prediction
  - post-implementation: syntactic and semantic checking, verification and validation, performance monitoring
  - modification analysis / change propagation

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### Environment Capabilities

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- Project Management
  - progress monitoring
  - resource allocation
  - standards and practices
  - access and modification control
  - documentation
- Technical Assistance
  - knowledge of software development
  - monitor modifications, discover inconsistencies
  - tutor user and guide process
  - adapt to individual style

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### CASE: Computer-Aided Software Engineering

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- Commercially available environments that assist in most steps of development
  - drudge work that bores developers and then gets slighted
    - document organization
    - diagram drawing and maintenance
    - change management
    - version control and configuration management
    - metrics
- A CASE tool assists in one aspect of development
  - upper CASE assists in early life-cycle phases
  - lower CASE assists in later phases
  - generator technology supports rapid prototyping
- A CASE environment is a collection of tools that together support one or more phases of software development
  - not much of a process focus

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### [Process-Centered] Environment Infrastructure

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- Process Specification and Interpretation
  - procedural, non-procedural
  - pro-active, re-active
- Object Management
  - types, relations, triggers, tool invocation
- Interoperability Mechanisms
  - event-based integration
- User Interface Management
  - non-preemptive, direct manipulation
- Measurement and Evaluation
  - low overhead, flexible collection
  - feedback and improvement

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### Something to think about: ICS 121 Environment

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- What tools would be useful for you in the following lifecycle phases?
  - requirements
  - design
  - formal specification
  - implementation
  - integration
  - test

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