LECTURE

Software Process Models

Plan-driven Process Models

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Based on Slides from

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Plan-driven Process Models

- Waterfall Model
- Prototype Model
- Spiral Model
- V Model
- …. And more

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"Good people with a good process will outperform good people with no process every time.

-**Grady Booch**

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Waterfall Model

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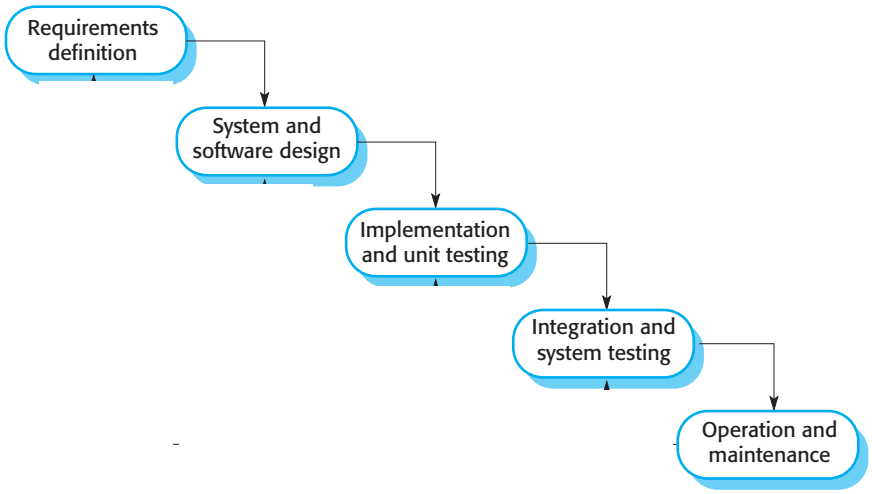
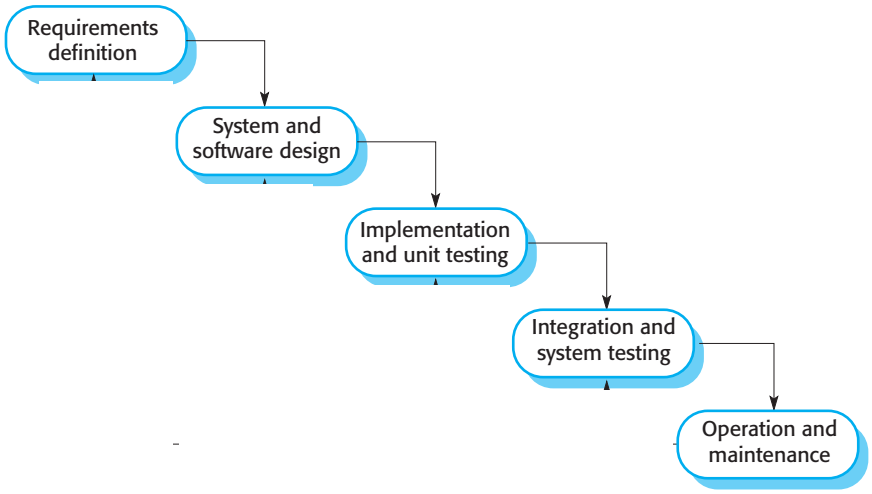
Waterfall Model

- A sequential, plan-driven process that requires planning and scheduling of all activities before starting the project.
  - It follows a linear and rigid approach, where each phase must be completed before the next one begins.
- This model is characterized by distinct phases of specification, development, testing, and maintenance.

Waterfall Model



Waterfall Model



Waterfall Model – Advantages

- Clear and well-defined requirements
  - The structured approach makes it easier to manage and understand the project's progress.
- Documentation is a key focus, ensuring that all project requirements and processes are well-documented.

Waterfall Model – Limitations

- Lack of flexibility to accommodate changes during the development phases
- Customer feedback is not incorporated until the end stage, leading to potential misalignment with the customer expectations

Waterfall Model

Waterfall Model

- When should be used
  - Large scale projects
  - Safety critical applications
  - Stability is important priority over money and time
  - Requirements are constant
  - High degree of oversight and/or accountability
  - Small projects ?

Prototype Model

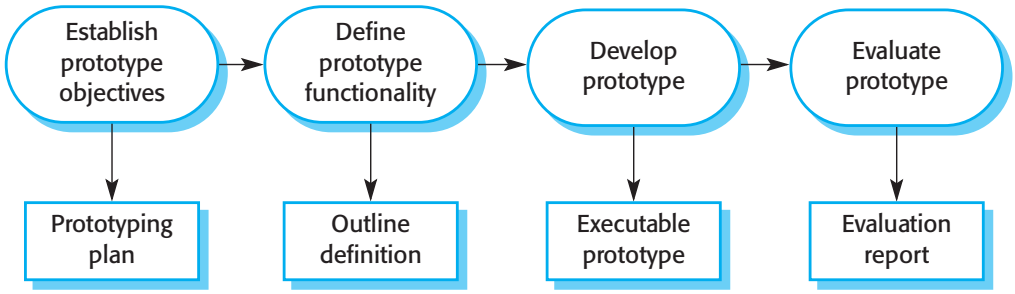
Prototype Model

- The Prototype model involves the creation of a working model of the system early in the development process.
  - Allows for user feedback and involvement
- The model is particularly useful when the requirements are not well understood or are subject to change.

Prototype Model

- Throw-away prototype
  - Learn and Discard
- Evolutionary prototype
  - Build then improve continuously
- Incremental prototype
  - Complete piece by piece
- Extreme prototype
  - Test the risky bit first

Prototype Model



Prototype Model – Advantages

- Early and continuous user involvement
  - leads to a product that better meets user needs and expectations.
- Provides a clear understanding of user requirements
  - helps in refining the system design.
- Identifies design flaws and issues early in the development process
  - reduced rework in later stages.

Prototype Model – Limitations

- The focus on quick development of prototypes may lead to insufficient attention to documentation and long-term maintainability.
- The iterative nature of the model can lead to scope creep and project delays if not managed effectively.

Prototype Model

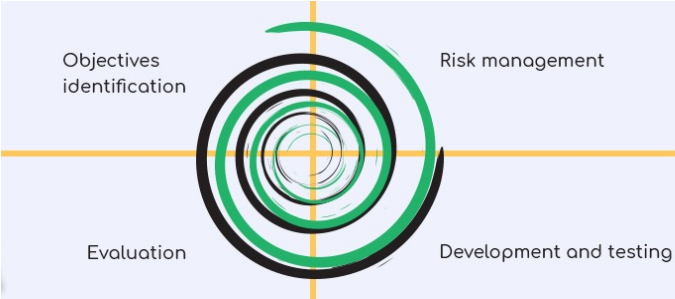
Spiral Model

Spiral Model – Meta Model

- The Spiral model is a risk-driven model that combines elements of the Waterfall and Iterative and Incremental models.
  - It is more flexible than the Waterfall model and allows for iterations and risk analysis at each phase
  - The model involves a series of incremental releases, with each release adding more functionality.

Spiral Model

- Objectives determination and identify alternative solutions
- Identify and resolve Risks
- Develop next version of the product
- Review and plan for the next phase



Spiral Model – Advantages

- Incorporates risk analysis and management throughout the development process
  - Flexibility to accommodate changes and address issues identified in earlier iterations.
- Highly customized product based on customer feedback and evolving requirements.

Spiral Model – Limitations

- Complex and time-consuming
- Costly, especially if the project involves frequent changes and iterations.
- Requires a high level of expertise to effectively manage the risk analysis

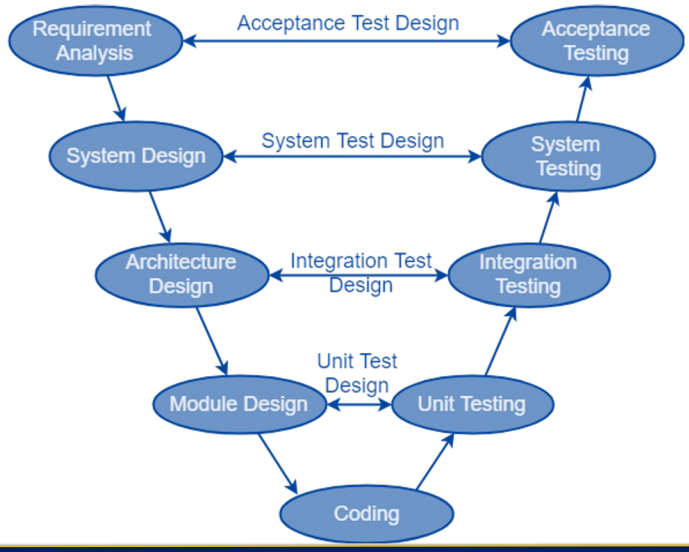
Spiral Model

V Model

V-model

- An extension of the Waterfall model and emphasizes the verification and validation of each phase.
  - The model highlights the relationship between each development phase and its associated testing phase.
- It involves the creation of a verification and validation plan for each phase of the development process.

V Model



V-Model – Advantages

- Clear and well-defined verification and validation processes ensure high-quality deliverables.
- Early identification and resolution of defects due to the parallel development and testing phases.

V-Model – Limitations

- Lack of flexibility to accommodate changes and evolving requirements during the development process.
  - May not be suitable for projects with a high degree of uncertainty and rapidly changing requirements.
- Testing activities are heavily front-loaded, leading to potential delays in the development process.

V-Model

V Model

- Sequential
- No feedback form customer
- No prototype
- Good for test-centric applications
- Rigid model, each phase has specific deliverables
- Proactive bug tracking

When to use?

- Waterfall
  - Large-scale projects
  - Small project
  - Requirements are fixed
  - Product definition is stable
  - Ample resources are available
- Prototype
  - Ambiguous requirements
  - Customer feedback is important
  - Unclear business needs
  - Long-term project

When to use?

- Spiral
  - Ambiguous requirements
  - Unclear business needs
  - Complex requirements and constant evaluation
  - Risk assessment
  - Long-term project
- V Model
  - Test driven development
  - Military or defense systems
  - Clear requirements

Use Cases for Plan-Driven Models

- Safety critical applications
- Stability is important priority over money and time
- Requirements are constant, but can be vague
- High degree of oversight and/or accountability

Software Process Models - Summary

- **Waterfall**: A sequential approach, where each fundamental activity of a process represented as a separate phase, arranged in linear order.
- **Prototyping**: A version of a system or part developed quickly to check the customer's requirements or feasibility of some design decisions. In prototyping, the client is involved throughout the development process.
- **Incremental Development:** developing an initial implementation, exposing this to user feedback, and evolving it through several versions until an acceptable system has been developed.

Software Process Models – Summary

- **Spiral:** a risk-driven where the process is represented as spiral rather than a sequence of activities. Best features from the waterfall and prototyping models, and introduces a new component; risk-assessment. Each loop represents a phase.
- **V Model:** Test driven development model aims to develop a system that is validated and verified in each of the software process activity

Suitable Process Model?

- A complex real-time system whose requirements can be relatively easily identified and are stable
- An order processing system with a web-site for a local business. Requirements are vague but stable (i.e. unlikely to change in the near future)
- A payroll system for the company. Requirements of the system are well defined.

Suitable Process Model

A human life is at stake and a system failure could result in fatalities.

Desired system needs to have a lot of interaction with the end users to get the clarity on requirements.

Projects with an extremely high degree of oversight and/or accountability such as those in the sectors of banking, healthcare and control systems for nuclear facilities

New product line (Significant changes are expected, involves research and exploration)

Suitable Process Model

- A system to track the position of trains to maximize the utilization of rail-tracks and monitor the same. System should be tested enough to avoid placing human lives on the line.

Thank you!