Chapter 4: Selection of an appropriate project approach

NET481: Project Management

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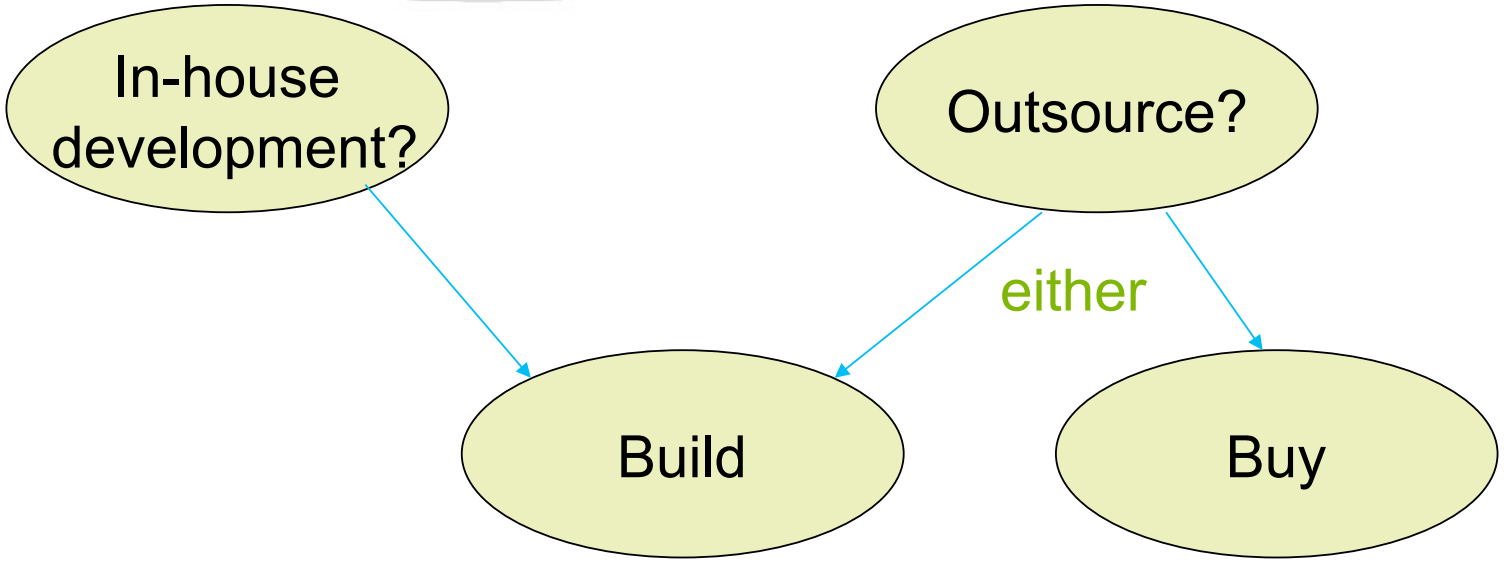
Outline of lecture

- Building OR buying software
- Taking account of the characteristics of the project
- Process models
  - Waterfall
  - Prototyping and iterative approaches
  - Incremental delivery
- Agile approaches

Selection of project approaches

- This lecture concerned with choosing the right approach to a particular project: variously called *technical planning*, *project analysis*, *methods engineering* and *methods tailoring*
- In-house: means that the developers and the users of the software are in the same organization.
  - often the methods to be used dictated by organizational standards
- Suppliers: : means that the developers and the users of the software are in the different organization.
  - need for tailoring as different customers have different needs

Build or buy?



In-House

Developing a new IT application in-house:

- Time is needed to develop the software
- Would often require the recruitment of new technical staff to do the job
- Usually, the new staff won't be needed after the project is completed
- Sometimes due to the novelty of the project there may be lack of executives to lead the effort

Outsourcing

Contracting the project out to an external IT development company (outsourcing):

- Time is needed to develop the software
- The conducting company will have technical and project expertise not readily available to the client
- The client would still do management effort to establish and manage the contracts

Some advantages of off-the-shelf (OTS) software

- Cheaper as supplier can spread development costs over a large number of customers
- Software already exists
  - Can be trialled by potential customer
  - No delay while software being developed
- Where there have been existing users, bugs are likely to have been found and eradicated

Some possible disadvantages of off-the-shelf

- Customer will have same application as everyone else: no competitive advantage, *but* competitive advantage may come from the *way* application is used
- Customer may need to change the way they work in order to fit in with OTS application
- Customer does not own the code and cannot change it
- Danger of over-reliance on a single supplier

Steps of Project Analysis

- Identify project as either objective driven or product driven.
- Analyze other project characteristics by asking:–
  - Will we implement a data-oriented or a process oriented system?
  - Will the software to be produced be a general tool or application specific?
  - Are there specific tools available for implementing the particular type of application?
    - E.g.: – does it involve concurrent processing?
    - Is the system knowledge-based?
    - Will the system to be produced makes heavy use of computer graphics?

Steps of Project Analysis (cont'd)

- Is the system to be created safety critical?
- Is the system designed to carry out predefined services or to be engaging and entertaining?
- What is the nature of the hardware/software environment in which the system will operate?

Steps of Project Analysis (cont'd)

- Identify high-level project risks.
- The more uncertainty in the project the more the risk that the project will be unsuccessful.
- Recognizing the area of uncertainty allows taking steps towards reducing its uncertainty.
- Uncertainty can be associated with the products, processes, or resources of a project.

Steps of Project Analysis (cont'd)

- **Product uncertainty:**
  - How well are the requirements understood.
  - The users themselves could be uncertain about what the system is to do.
- **Process uncertainty:**
  - For the project under consideration, the organization will use an approach or an application building-tool that it never used before.
- **Resource uncertainty:**
  - The main area of resource uncertainty is the availability of the staff with the right ability and experience.

General approach

- Look at risks and uncertainties e.g.
  - are requirement well understood?
  - are technologies to be used well understood?
- Look at the type of application being built e.g.
  - information system? embedded system?
  - criticality? differences between target and development environments?
- Clients' own requirements
  - need to use a particular method

Structure versus speed of delivery

Structured approach

- Also called 'heavyweight' approaches
- Step-by-step methods where each step and intermediate product is carefully defined
- Emphasis on getting quality right first time
- Example: use of UML (Unified Modelling Language)
- Future vision: Model-Driven Architecture (MDA). UML supplemented with Object Constraint Language, press the button and application code generated from the UML/OCL model

Structure versus speed of delivery

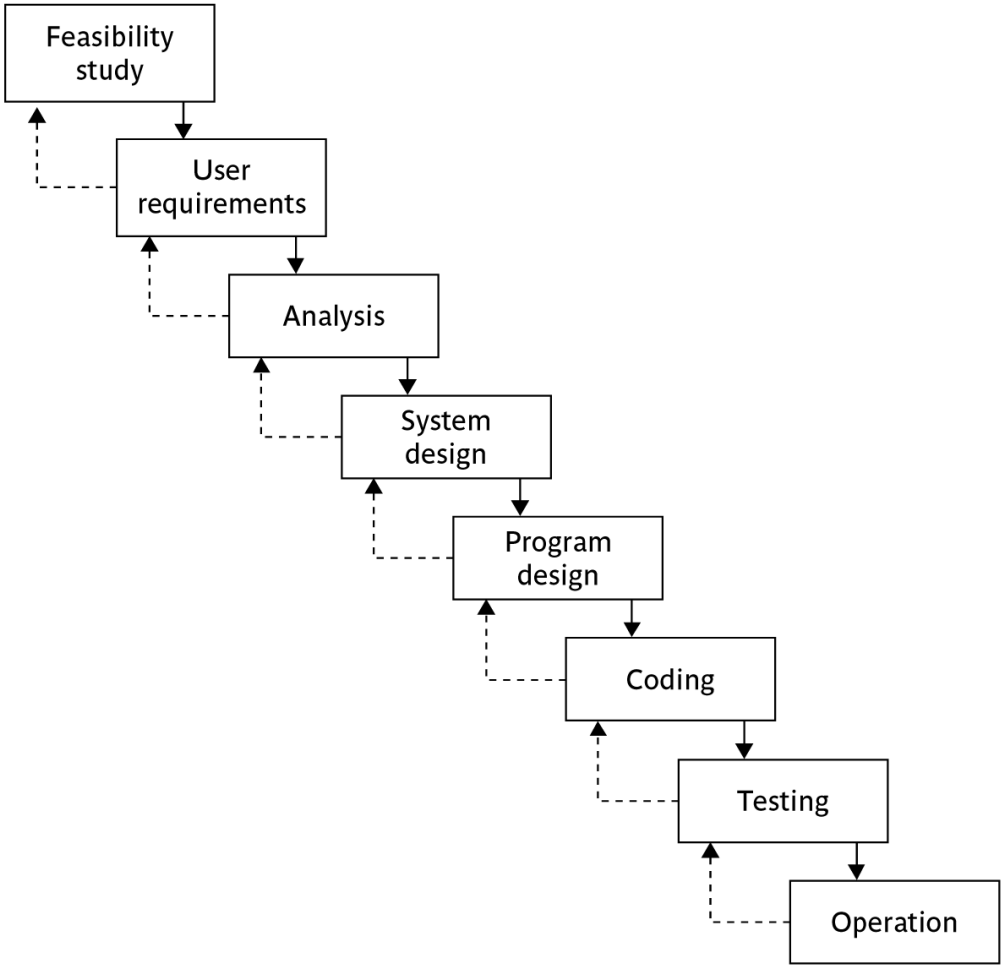
Agile methods

- Emphasis on speed of delivery rather than documentation
- RAD Rapid application development emphasized use of quickly developed prototypes
- JAD Joint application development. Requirements are identified and agreed in intensive workshops with users

Software Process Models

- Waterfall Model.
- V-process Model.
- Spiral Model.
- Software prototyping.
- Phased Development Model.
  - incremental development model.
  - iterative development model.

Waterfall


Feasibility study
User requirements
Analysis
System design
Program design
Coding
Testing
Operation

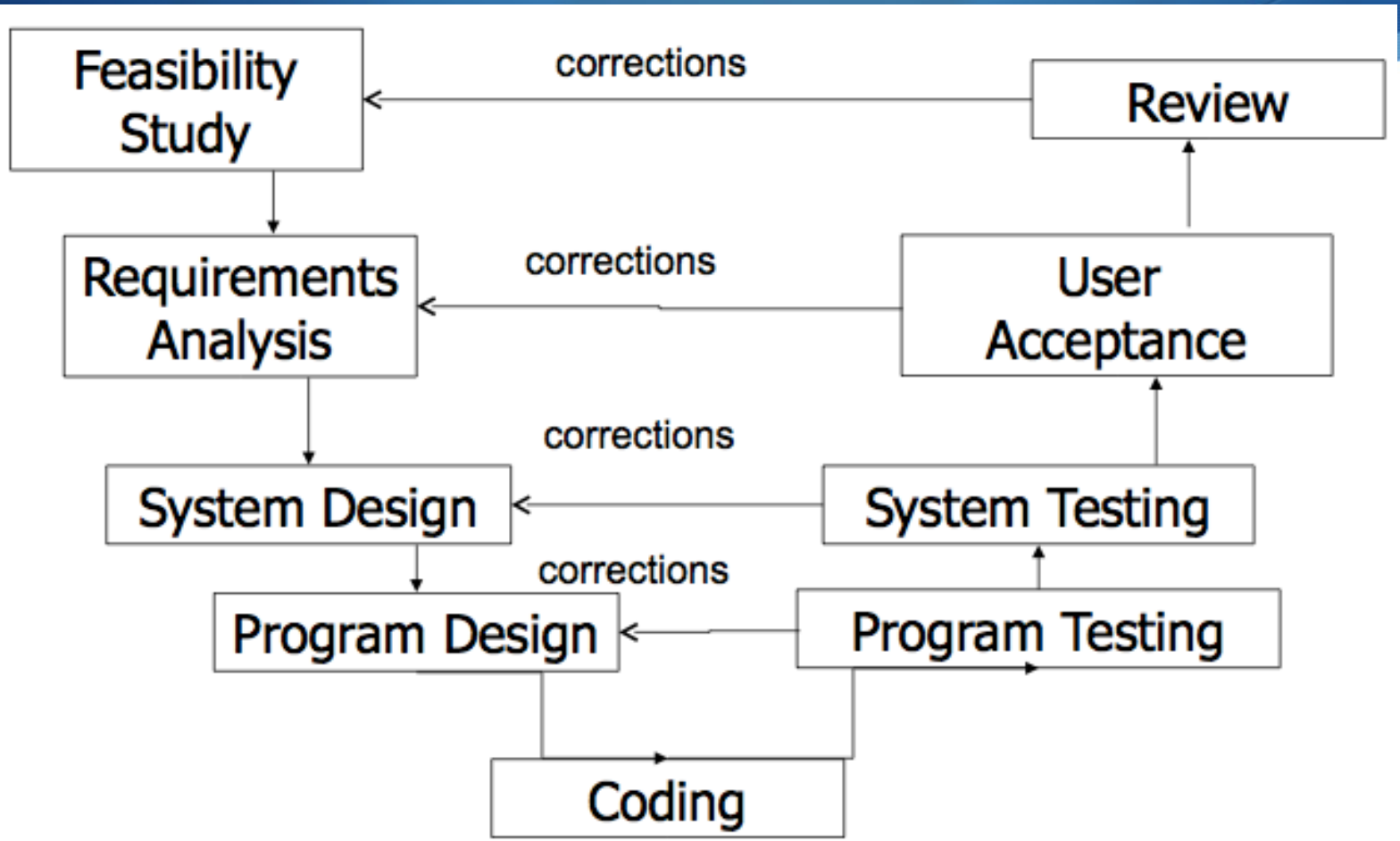
Waterfall

- Classical model of system development.
- Called one-shot or once-through model.
- limited scope of iteration. Is this a strength or a limitation??
  - This is a strength for the WF-model.
  - Because it is suitable for some projects especially for large projects, we want to avoid reworking tasks that are thought to be completed.
  - Reworking tasks could result in late delivery.
- Suitable for systems with well defined requirements.
- Not suitable for systems of high uncertainty

V-process Model

- An extension of the waterfall model.
- V-process model expands the activity box “testing” in the waterfall model.
- Each step has a matching validation process.
- Validation process can cause a Loop back to the corresponding stage and reworking the following steps in case of discrepancy.

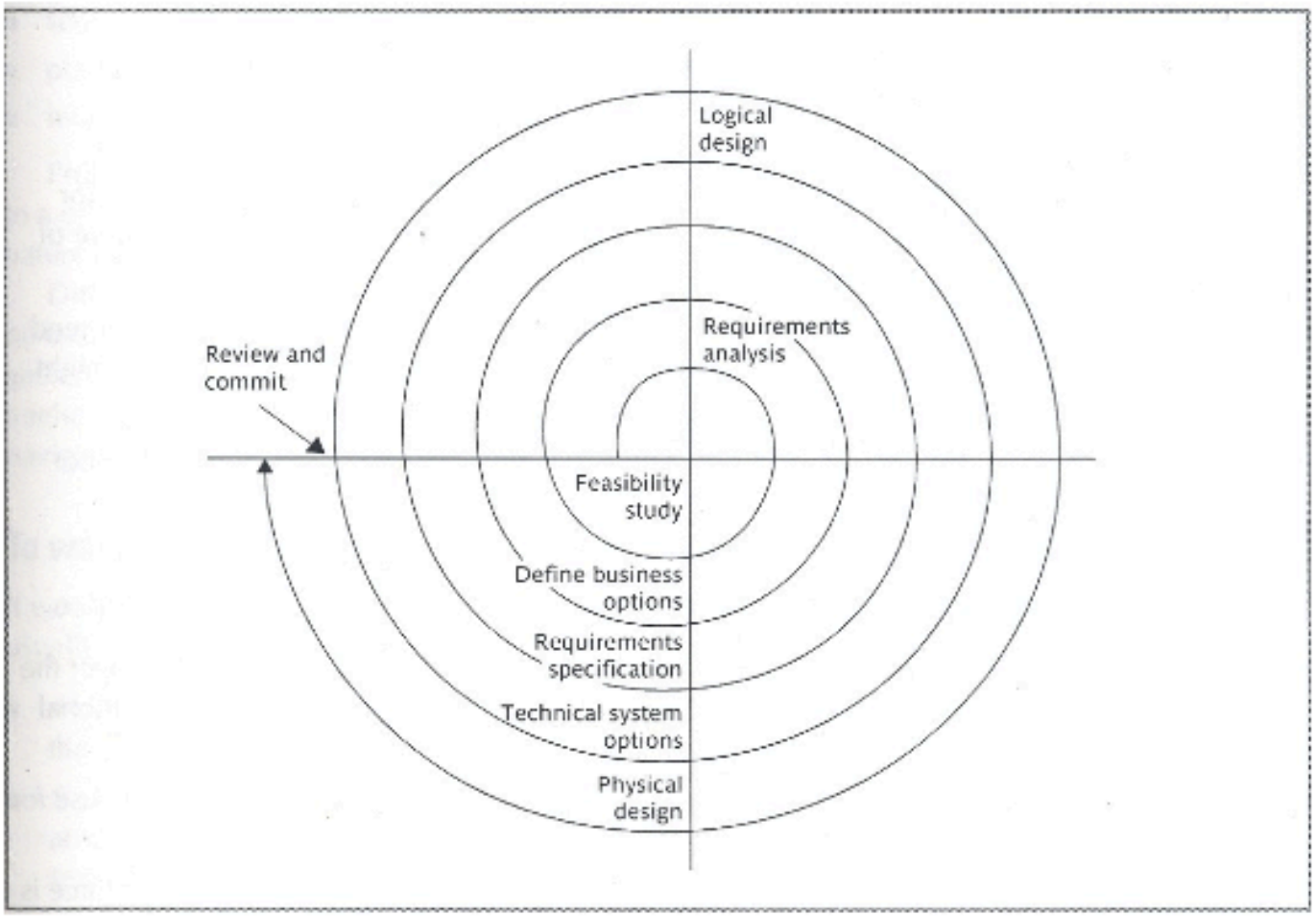
V-process Model (cont'd)



Spiral Model

- A greater level of detail is considered at each stage of the project.
- Represented as a loop or a spiral where the system is considered in more detail.
- This means **greater confidence** about the probability of success.
- Each sweep is terminated by an evaluation before the next iteration is embarked upon.

Spiral Model (cont'd)



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Prototyping Model

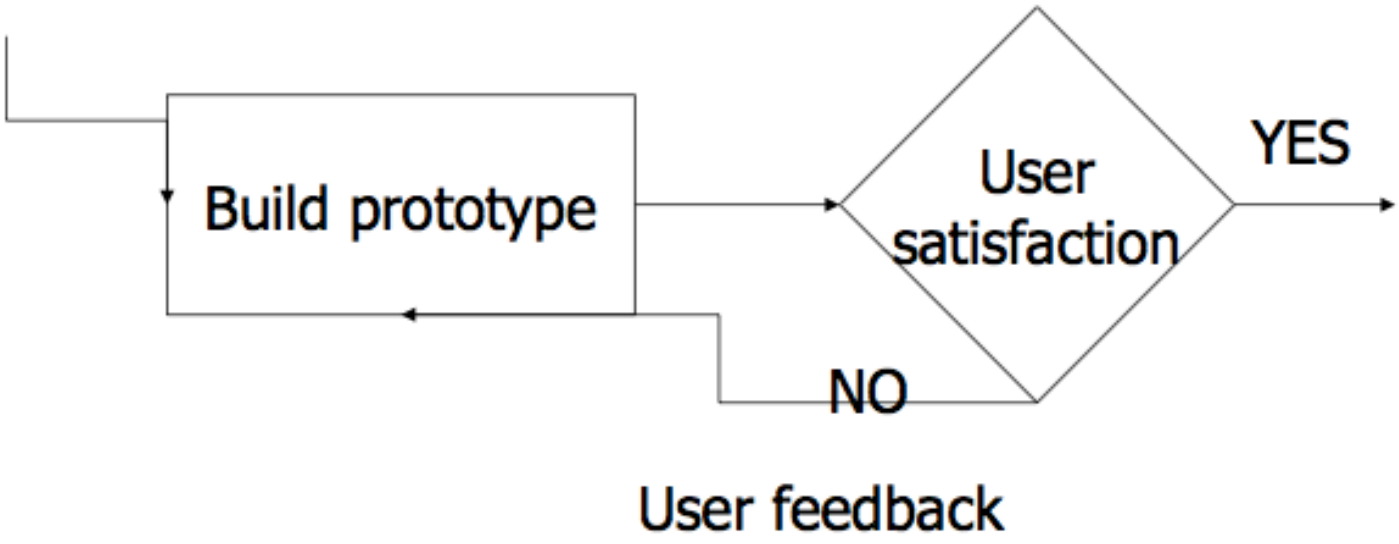
- **Prototype** is a working model of one or more aspects of the projected system.
- **Goal**
  - Gain knowledge
  - reduce risk and uncertainty
  - verify a design or implementation approach

The prototype is constructed and tested, quickly and inexpensively to test assumptions.

Classification of a Prototype

- **Throw-away**
  - Tests out some ideas.
  - Discarded when the true development of the operational system is started.
  - The prototype could be developed using a different SW and HW environment than those that will be used for the final system.
- **Example: user interface**
  - **Prototype :**use a desktop application builder to produce an acceptable user interface.
  - **Final system:** use a procedural programming language.

Prototyping Model



Benefits of Prototyping

- Learning by doing.
- Improved communication.
- Improved user involvement.
- Clarification of partially-known requirements.
- Demonstration of the consistency and completeness of a specification

Benefits of Prototyping (cont'd)

- Reduced need for documentation.
- Reduced maintenance costs.
- Feature constraint.

Drawbacks of Prototyping

- Users sometimes misunderstand the role of the prototype.
- Lack of project standards possible.
- Lack of control.
- Additional expense.
- Machine efficiency.
- Close proximity of developers.

Prototypes at Different Stages

- Different projects will have uncertainties at different stages.
- Thus, prototypes can be used at different stages.

Examples:

At the requirements gathering stage: to pin down requirements that seem blurred and shifting.

At the design stage: to test out the user's ability to navigate through a sequence of input screens.

To what extent is the prototyping done?

- **The prototyping usually simulates only some aspects of the target application, thus there might be:**
  - **Mock-ups**
    - e.g. Copies of input screens shown to the users on a terminal.
    - They cant actually be used.
  - **Simulated interaction**
    - A user can type in a request to see a record in a database and an example of a result is shown.
    - There is no real access is made to the database.

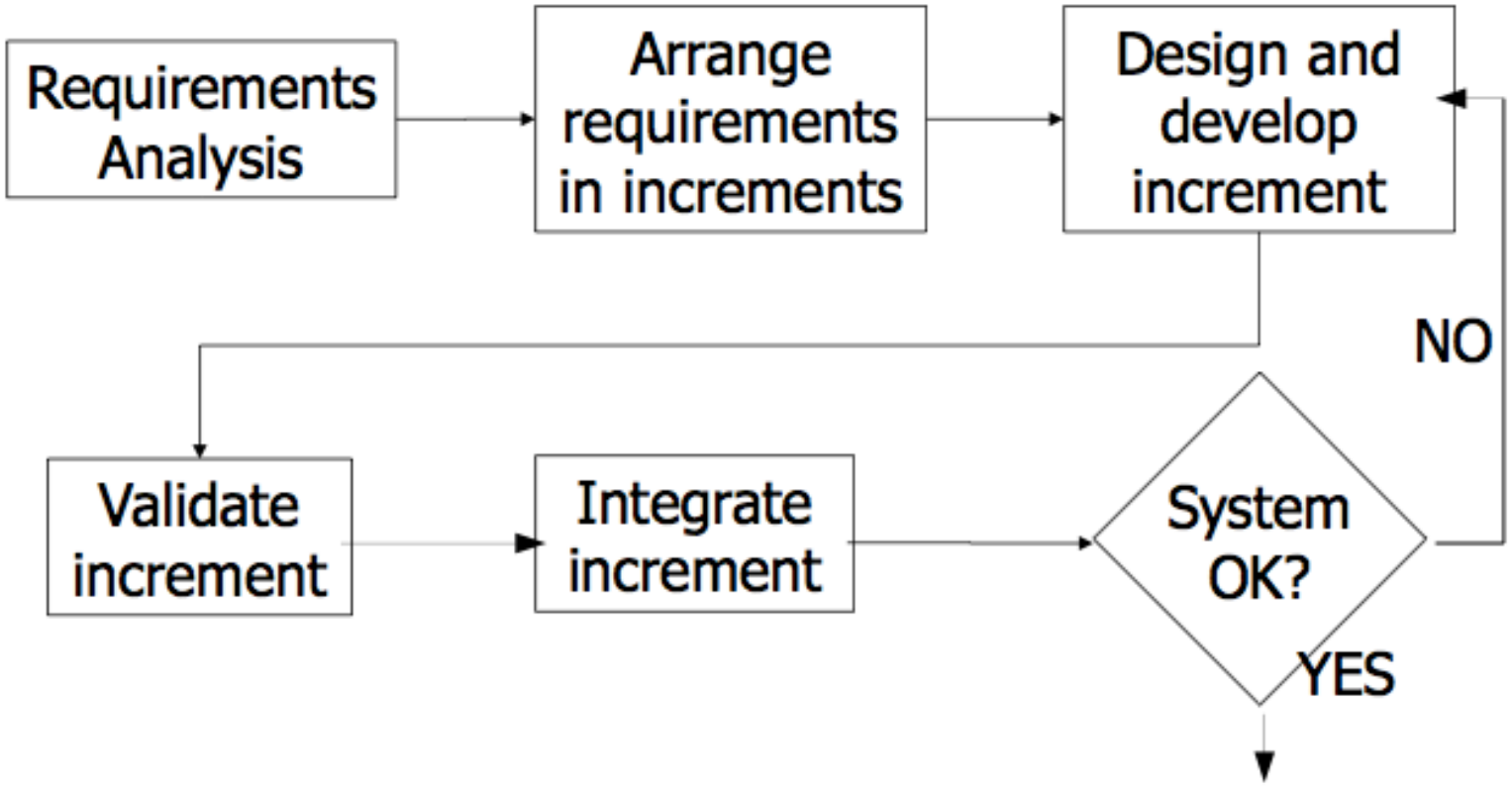
Forms of Prototypes

- **Partial working model**
  - **Vertical:** only some features are fully prototyped
  - **Horizontal:** all featured are prototyped but not in detail.

Incremental Model

- Break the system into small components.
- Implement and deliver small components in sequence.
- Every delivered component provides extra functionality to the user.

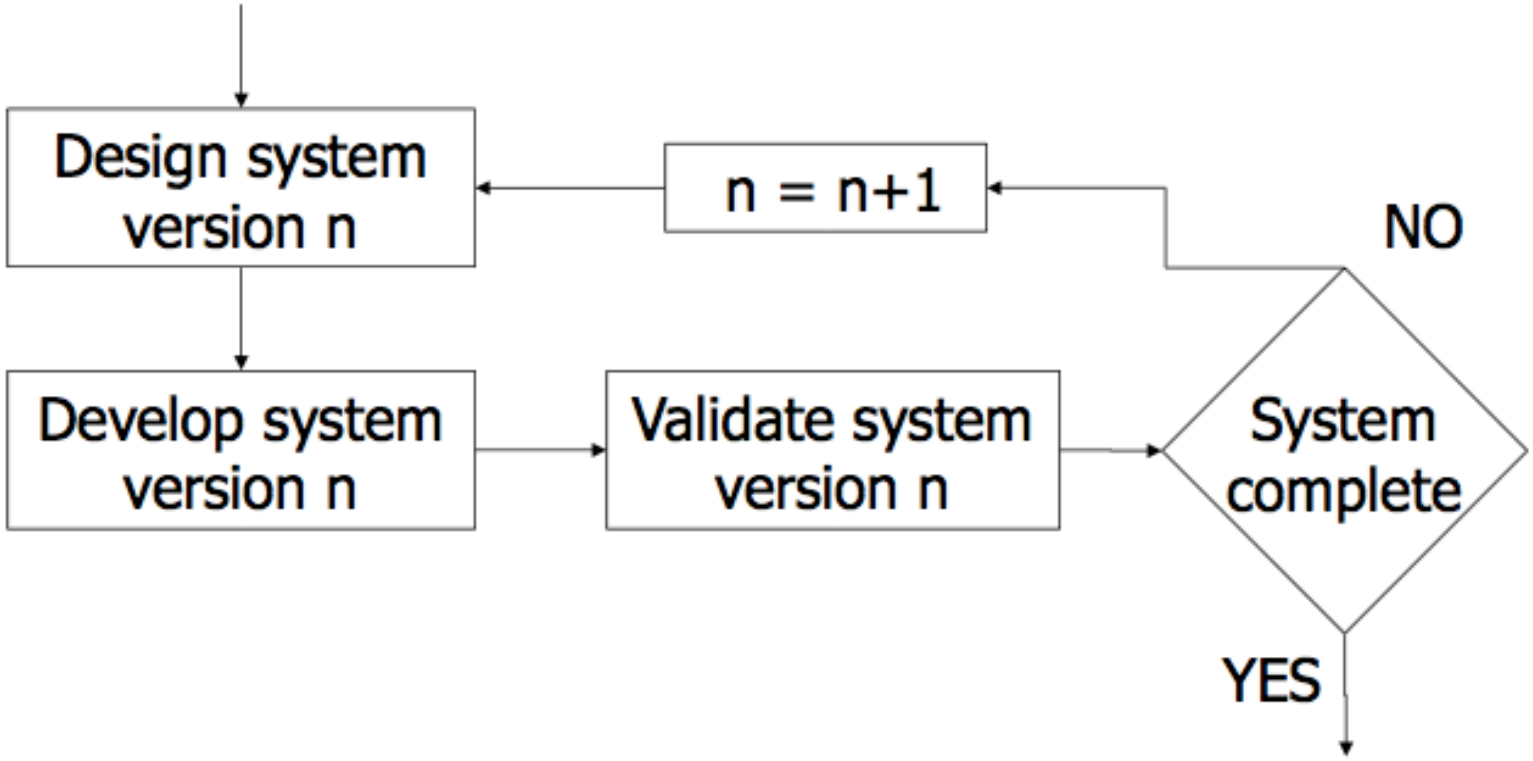
Incremental Model (cont'd)



Iterative Model

- Deliver full system in the beginning.
- Enhance existing functionality in new releases.

Iterative Model



Combined Incremental and Iterative Model

- **Every new release includes:**
  - extra functionality.
  - enhancement of existing functionality.

Popularly used in software industry.