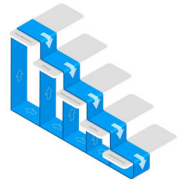


## The Waterfall Methodology

ISQA 8210

## The Waterfall Methodology

- Definition
- History
- Waterfall Phases
- Structured Systems Development
- Object-Oriented Systems Development
- The Waterfall Methodology Assessed



## The Waterfall Methodology

The waterfall methodology is a project management approach that emphasizes a linear progression from beginning to end of a project.

This methodology, often used by engineers, is front-loaded to rely on careful planning, detailed documentation, and consecutive execution.

Workfront.com

## The Waterfall Methodology

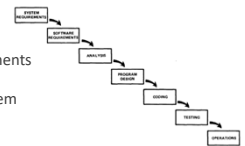
- Proposed by Winston W. Royce in 1970

- Pros:

- Tracks progress easily due to clear stages
- Easily identifiable milestones & deliverables

- Cons:

- Inflexible when requirements change
- Design and coding may uncover requirements inconsistencies
- Some problems not discovered until system testing



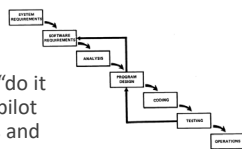
Royce, 1970

## The Waterfall Methodology

- Royce never intended for this to be a once-and-done, single pass approach for systems development!

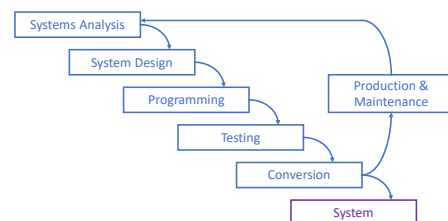
“... the implementation described above is risky and invites failure.”

- Royce goes on to recommend to “do it twice” by building a throw-away pilot model first to explore novel ideas and unknown factors



Royce, 1970

## The Waterfall Methodology



## Systems Planning & Analysis

- IS Planning
  - Feasibility study:
    - Technical, Economic, Operational
- Systems Analysis
  - Determines system requirements
  - Identifies who needs what information, and when, where, and how the information is needed



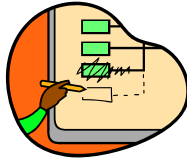
## System Design & Construction

- Systems Design: end user needs drive design!
  - Logical Design – WHAT?
  - Physical Design – HOW?
- Programming
- Testing / Certification
  - Unit Testing
  - System Testing
  - Acceptance Testing



## Implementation / Conversion

- Conversion Plan
  - Conversion schedule
  - End user training
- Parallel strategy
- Direct cutover
- Pilot study
- Phased approach



## Maintenance & System Review

- Production / Maintenance
- System Review
  - Post-Implementation audit

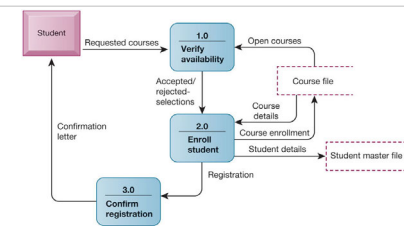


## Structured Systems Development

- Well-established method for building large information systems
  - Carefully separated techniques and development steps
  - Method starts at high level of abstraction, then fills in the details
  - Data design is separate from processes design
    - Ease of design for large, complex systems
    - Interdependencies might result in re-work



## Structured Systems Development



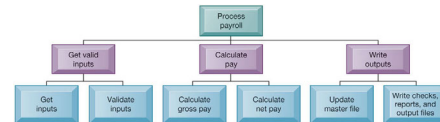
Data Flow Diagramming is a systems analysis technique which shows interactions among processes and data stores

## Structured Systems Development



Entity-Relationship Diagrams are used to design the system data requirements

## Structured Systems Development



Structure Charts are used by system designers to determine high-level abstract processes as well as more detailed sub-processes

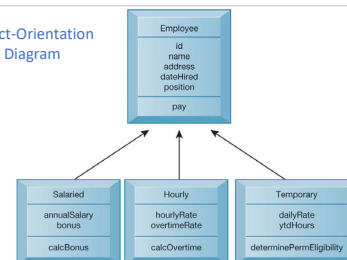
## Object-Oriented Systems Development

- Methodology used for building complex systems
  - Emphasizes flexibility, modularity, and reusability in software development
  - System is composed of objects, which contain processes and data
  - Each object can receive messages, process data, and send messages to other objects
  - Objects are organized in class hierarchies

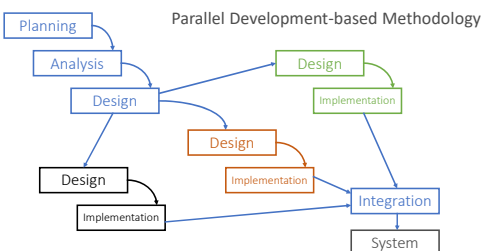


## Object-Oriented Systems Development

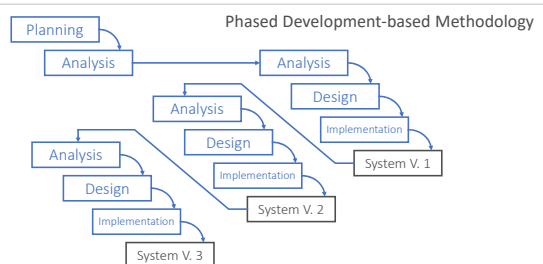
Object-Oriented Class Diagram



## The Waterfall Methodology - Variations



## The Waterfall Methodology - Variations



## The Waterfall Methodology Assessed

- The Waterfall Model is still useful
  - When requirements are clear and unlikely to change
  - When the application is not big or complicated
  - When the project is short and specific
  - When the development environment is stable
  - When developers are well trained and available
  - When the tools and techniques used are stable

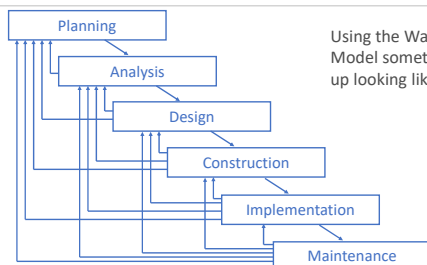
## The Waterfall Methodology Assessed

- The Waterfall Model is not entirely realistic
  - Software development is rarely a calm and orderly procession through the phases

The SDLC "works very well when we are automating the activities of clerks and accountants. It doesn't work nearly as well, if at all, when building systems for knowledge workers - people at help desks, experts trying to solve problems, or executives trying to lead their company into the Fortune 100."

- Larry Runge, 1991

## The Waterfall Methodology Assessed



Using the Waterfall Model sometimes ends up looking like this...

## The Waterfall Methodology Assessed

- Drawbacks of the Waterfall approach
  - Requirements can easily be misinterpreted, reducing system utility
    - Clients often don't know exactly what they want at the front end, resulting in requests for changes and new features later on
  - Defined requirements upfront decrease room for creativity, flexibility, or improvement as part of the process
  - When requirements change, updates can require costly rework
  - Waterfall requires a lot of documentation effort
  - When one phase in the process is delayed, all other phases are delayed too!
  - Ill-suited for projects that are large and complex

## The Waterfall Methodology

- The Waterfall methodology was an attempt in the early days of information systems to bring an engineering approach to systems development
- Waterfall is now one of several development approaches available to organizations

Q: In your estimation, what percentage of the projects completed within your organization in the past 12 months has used the following types of approaches?



Note: Numbers may not sum to 100% due to rounding

Project Management Institute  
Global management survey, 2017

## Waterfall Projects are Common!

- The Waterfall method is used widely in business projects today, but it is rarely called "Waterfall Methodology"

