

Royal Military College of Canada Electrical and Computer Engineering

Rule of Thumb

- To estimate the amount of time required for a given project:
 - Estimate the time it would take you to do the task.
 - Double it
 - Go to the next highest time unit
- For example, if you think you could do the task in 2 hours, estimate 4 days

Outline

- Definitions
- Project Life Cycle
- Documentation
- Engineering Process and Models
- Tasks and Deliverables

Definitions

System	a group of independent but interrelated elements that make a product
Life-Cycle	a series of phases describing the evolution of a system
Engineering Activity	the tasks undertaken by engineers to develop a system (what)
Engineering Process	a systematic sequence of engineering activities that is followed to develop a system or product (how)

Project Life Cycle

Life Cycle Phases

- Requirements
- Conceptualization
- Implementation
- Testing
- Deployment
- Operation
- Maintenance
- Disposal

Your projects

Requirements

- Stage at which we define what the system should do
- Statement of Requirements
 - analysis
 - survey of previous similar systems
 - interview with the future users
 - acquire required expertise
- Example: "... ability to send messages containing text and attachments electronically from one computer to another"

Conceptualization

- Stage at which we describe how the system can satisfy requirements
- Preliminary design
 - breakdown functionality in subsystems/modules
- Detailed design
 - schematic
 - computer modeling
 - simulation
 - verification

Implementation

- Stage at which we build the product
- Manufacturing and/or Coding
- Assembly and/or Integration

Testing

- Stage at which we verify the system satisfies the requirements
- Verification Testing
 - unit testing
 - integration testing
 - sub-systems testing
 - acceptance testing

Documentation

Documentation

• More that simply commenting code

• Common problems:

Treated as necessary evil; after thought; inconsistent

//increment counter

counter = counter + 1;

 Contract obligation; large, unreadable document; obscure format

Documentation

- Good documentation is built considering
- Audience
 - who are the readers
 - what must the reader know
- Purpose
 - what should the reader learn
- Actual use
 - reference, complete, maintainable

- For your projects, you will naturally want to dive into your problem and just start developing solutions
- Poses a few problems:
 - Does not scale well
 - Does not facilitate efficient collaboration
 - Difficulty in communicating with stakeholders
- You must frame your approach in terms of a deliberate and coherent **engineering process**

- Systematic way to go about development
- An engineering process describes how engineering activities are tied together in order to make a system evolve throughout its life cycle
- Activities are grouped together to form project phases and to provide a workflow
- Abstractions

Traditional Engineering Process

Process = phases + milestones = groups of activities + work products (deliverables)



Engineering Process Models

- Waterfall
- Incremental Waterfall
- Evolutionary
- Others: Spiral, RUP, XP, Agile, TQM, many variations, combinations, etc

Which will you use?

Waterfall Model



Strengths of Waterfall

- Encourages periodic review
- Each phase results in document
 - helps clarify decisions, provides an audit trail, serves as concrete milestone
- Formal transition from each phase
 - results in a progressive "setting" of the product; reduces unnecessary changes

Weaknesses of Waterfall

- Hard to get requirements right at start
- Momentum tends to inhibit rework
- Can work well in small projects

- requirements generally better understood

Incremental Waterfall Model



Incremental Model

- Building in small increments to provide some immediate functionality
- Deliver core product, then build on subsequent releases
- Requirements must still be fully defined
- Could be employed during conceptualisation and/or implementation



Evolutionary Model

- Rapidly develop simple models of system
 - get rapid feedback & clarify requirements
 - reduce uncertainty about design aspects (risk reduction)
- Some deliverables have no capability
 - often required to solve specific problems
 - requires significant effort and discipline

Spiral Development Model



Tasks and Deliverables

Tasks and Deliverables

- Your deliverables align with the Life Cycle
 - Requirements
 - DID-03 Statement of Requirement
 - Conceptualization
 - DID-04 Preliminary Design Specification
 - DID-05 Design Review
 - DID-06 Schedule
 - DID-07 Detailed Design
 - Implementation/Testing
 - DID-08 Final Project Presentation
 - DID-09 Final Project Demonstration

Tasks and Deliverables

- Which engineering process will you use to achieve these tasks?
- This should be answered in your Preliminary Design Specification
- Suggested to start with waterfall method, but should be adapted to suit your project

Review/Revue

What is the goal of the engineering process?

- ensure a logical flow of activities
- ensure specific deliverables are created
- ensure successful completion of project
- Name & describe some types of processes
- Waterfall, Incremental, Evolutionary

Life-Cycle Phases

- Requirements
- Conceptualization
- Implementation
- Testing
- Deployment
- Operation
- Maintenance
- Disposal

Your projects



How the customer explained it



How the Project Leader understood it



How the Analyst designed it

EEE/GEF 455/457



How the Programmer wrote it





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Questions?