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September 30, 2019

# Software life-cycle models

## CS-C3150 Software Engineering

"Rome wasn't built in a day, but they were laying bricks every hour." (John Heywood)

A software process is a set of related activities that leads to the production of a software system. Depending on the kind of software being developed there are different kinds of software processes. In this essay, we will try to have a peek at two popular software process models - the *waterfall model* and the *incremental model*. They are generic because they can be used to explain the different approaches to software development.(Sommerville, 2011)

## Waterfall model

The waterfall model is a sequential model where each fundamental stage is represented as a separate phase with each phase cascading into the next one in a linear fashion. This model basically produces one or more documents in each stage which are required to be approved only after which the next stage starts. The next stage should not essentially start until the previous one has been fully completed. In the case of hardware development, this is clearly necessary since the cost of production is high and improper planning can lead to a huge loss of resources. However, in the case of software development, these stages overlap and feed into each other. (Sommerville, 2011)

The advantage of using this model is that it is simple and easy to understand. Due to the rigidity, it is easy to control and manage. Since the model is sequential and linear, different phases don't overlap and there is a clean transfer of information at each step. All the goals are pre-defined which makes the milestones crystal clear for the team.

However, there are disadvantages too. Its sequential and linear characteristic inhibits flexibility and makes it very expensive to make unexpected changes. Since it is an internal process, it focuses very little on the end-user involvement with the process during development. The software is made available late for testing by the end-user which often makes debugging and changes expensive. All of this makes the model risky and uncertain.

This model can be used when the requirements and technology are well understood and fixed beforehand. It can be used when there are ample resources with the required expertise in hand. It is very effective to be used when developing large-scale systems that require extensive documentation and are safety-critical.

## Incremental model

Incremental model is a model in which the requirements are divided into different builds. The software is designed, implemented and tested incrementally in several builds. In the first build, the main working systems with a few basic features is built and delivered to the customer. Thereafter many successive versions of the software with added features are implemented until the desired system is realized. (Sommerville, 2011)

The main advantage of this model is that it delivers a working software very quickly and early. The flexible nature of the model makes it cheaper to make unexpected changes at any stage. This model involves the end-user during development which helps to add new features which weren't discussed earlier. It makes easier to test and debug in small iterations. The risk is involved is low since the risky pieces are identified and managed during each iteration.

However, there are disadvantages too. This model makes it harder to manage and control than the waterfall model. It needs a proper plan to integrate the components in the end. The complete definition of the software should be clear before the requirements can be broken down and built incrementally. It is less visible and the system tends to degrade as new features are added.

This model can be used when the product is needed to released in the market soon. It is useful when the major requirements are known but some details can evolve with time. It can be used when the required resources and skill set are not available.

A perfect practical example of the incremental model is Microsoft products such as Word, Excel, etc. Let's take Microsoft Word. Word was initially released in 1983 after which it has developed incrementally. Every version of Word is different and has different features. With every version, some new features are added and others are removed to increase productivity. (Larman et al., 2003)

## The RUP Model

The RUP model is a hybrid model which brings together the strengths of the waterfall model and incremental model and supports prototyping and delivery of software. There are four different phases in this model which are **inception, elaboration, construction,** and **transition**. In inception phase, the business cases for the system are established. The elaboration phase is the phase where the project starts to take shape, problem analysis is made and system architecture is laid. The main development of the components is implemented in the construction phase which is finally deployed in the transition phase. (Wikipedia, 2016)

The advantage of using this model is that it proactively resolves the risks of end-users evolving requirement. Development time is usually less because the same components are used again and again. The integration time required is less since the integration goes on throughout the life cycle.

The disadvantage of using this model is that the development process is too complex and disorganized. It cannot be used in building new software because the reuse of opponents won't be possible.

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