CSCI910 – Software Requirements, Specifications and Formal Methods

Tutorial 1

Objectives

- Get familiar with the fundamental concepts of software development
- Get familiar with the fundamental concepts of software requirement

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Exercise 1:

Based on your own knowledge, discuss why different application types require specialized software engineering techniques to support their design and development.

Answer 1:
Different application types require the use of different development techniques for a number of reasons:

1. Costs and frequency of change. Some systems (such as embedded systems in consumer devices) are extremely expensive to change; others, must change frequently in response to changing requirements (e.g. business systems). Systems which are very expensive to change need extensive upfront analysis to ensure that the requirements are consistent and extensive validation to ensure that the system meets its specification. This is not cost effective for systems that change very rapidly.

2. The most important 'non-functional' requirements. Different systems have different priorities for non-functional requirements. For example, a real-time control system in an aircraft has safety as its principal priority; an interactive game has responsiveness and usability as its priority. The techniques used to achieve safety are not required for interactive gaming; the extensive UI design required for games is not needed in safety-critical control systems.

3. The software lifetime and delivery schedule. Some software systems have a relatively short lifetime (many web-based systems), others have a lifetime of tens of years (large command and control systems). Some systems have to be delivered quickly if they are to be useful. The techniques used to develop short-lifetime, rapid delivery systems (e.g. use of scripting languages, prototyping, etc.) are inappropriate for long-lifetime systems which require techniques that allow for long-term support such as design modelling.

Exercise 2:

Consider the integration and configuration process model shown in Figure “Reuse-oriented software engineering”. Explain why it is essential to repeat the requirements engineering activity in the process.

Answer 2:

You need to repeat the requirements engineering activity because it is essential to adapt the system requirements according to the capabilities of the system/components to be reused. These activities are:

1. An initial activity where you understand the function of the system and set out broad requirements for what the system should do. These should be expressed in sufficient detail that you can use them as a basis for deciding of a system/component satisfies some of the requirements and so can be reused.

2. Once systems/components have been selected, you need a more detailed requirements engineering activity to check that the features of the reused software meet the business needs and to identify changes and additions that are required.

Exercise 3:

Suggest why it is important to make a distinction between developing the user requirements and developing system requirements in the requirements engineering process.

Answer 3:

There is a fundamental difference between the user and the system requirements that mean they should be considered separately.

1. The user requirements are intended to describe the system’s functions and features from a user perspective and it is essential that users understand these requirements. They should be expressed in natural language and may not be expressed in great detail, to allow some implementation flexibility. The people involved in the process must be able to understand the user’s environment and application domain.

2. The system requirements are much more detailed than the user requirements and are intended to be a precise specification of the system that may be part of a system contract. They may also be used in situations where development is outsourced and the development team need a complete specification of what should be developed. The system requirements are developed after user requirements have been established.