C1011 – Software Architecture

Assignment 2

(25 Points)

You are responsible to design a software architecture for the following system. You should use the Attribute Driven Design (ADD) method and document the final architecture in multiple views. In this assignment, three to four students need to form a group to collectively complete the assignment. The score of each student on Assignment 2 will be determined with the group performance by considering individual contribution to the work.

DEADLINE: 11:59pm on (Friday) January 15, 2016

System Overview

The system is required to capture images using a camera on a probe. The source of the image could be from visible light or from another frequency in the electromagnetic spectrum. To supplement the images, sensor readings provide additional information, such as the distance of the camera to the object being imaged. To make the images, the system has to acquire raw data and convert it into sensor readings and images suitable for viewing.

The user of the system may wish to take a single image, a series of images at different time intervals or to create a motion picture. The user may wish to keep the camera stationary or move it to take images from different angles. Each of these options is an example of an "acquisition mode". The system has a set of built-in acquisition modes. The system also allows user to define new acquisition modes.

When the acquisition is under way, the user is able to monitor it by inspecting the raw data as well as the raw image. After the raw images are acquired, the user can perform a number of processing operations to enhance the images for viewing. The user then can transfer them to a remote imaging system for remote viewing or processing.

The system must be designed to be extensible, maintainable and portable. It needs to be flexible enough to accommodate certain expected changes in terms of both functional requirements and non-functional requirements. The physical characteristics of the probe and camera may change as new models are introduced. The way users interact with the system is likely to change as they become more sophisticated in using the system and want more efficient ways of using it. Over time, built-in acquisition modes will evolve. The product needs to remain compatible with new and evolving standards for file formats and communication between workstations.

System Features

The system provides a range of image acquisition and processing operations on 2 dimensional images, data storage for the images and network access to the images. The key marketing features of the system are the following:

- Easy to operate

- A comprehensive catalogue of built-in acquisition modes

- The throughput of the image acquisition is 100 percent higher than previous products

- Image display can be as fast as maximum hardware speed

- At runtime, users can make trade-off between acquisition speed and image quality

- Easy to upgrade to new platforms

- Capability to connect to remote viewing and image processing work stations

Factors

The following example factors that will affect your architecture design have been identified.   *You can assume more factors as part of this assignment, but explicitly state your additional assumptions.* Your architecture needs to accommodate these factors.

Organizational Factors

- Building is mildly preferred over buying.

- Time-to-market is short and is not negotiable. Rough estimation of effort required for redesign and re-implementation suggests that it will take longer than 2 years.

- There is a preference for meeting the schedule over some features.

- Delivery of features is negotiable.

- There is only one developer who has experience with multi-threading programming.

Technical Factors

- The processor speed is likely to change very frequently.

- Probe hardware is expected to change every three years.

- OS features will change every two years.

- This is currently no standard for the format used in the probe.

- Image processing algorithms are quite mature. Improvements will be minor.

- Image format standards are likely to change every three years.

Product Factors

- Budget for commercial off-the-shelf (COTS) components is flexible. Both the price and licensing fees of COTS components must be considered.

- New image processing algorithms can be added on a regular basis.

- New image types can be added.

- Requirements for user level acquisition control are stable.

- There is no flexibility in budget.

Assignment Deliverables

A single PDF file should be submitted per group. Your report should be in TWELEEVE pages (A4 size) or shorter and include the following deliverables:

- A report on how you have followed the Attribute Driven Design method (10 points). You have to perform at least two iterations when designing the architecture. This part includes two components:

  o A list of all non-functional requirements in the format of scenarios that you have identified or assumed.

  o A list of all the architecturally significant requirements (ASRs), design concerns, and architectural patterns/tactics you chose every time when you performed Step 3 (choose an ASR) and 4.2/4.3 (choose architectural patterns/tactics) of the ADD method. This should include all intermediary candidates that might not have been included in the final architecture. A *brief* explanation of the choice should be provided.

- Final software architecture documentation (10 points):

  o Views and cross-views following the template in Chapter 9 (1st Edition) or Chapter 18 (2nd Edition) [1]. There should be at least two views and one cross-view. The "rationale" part can not be omitted. For more information, see [2].

  o You are encouraged to use suitable UML diagrams. Please refer to Chapter 9.6. For more information, see [3]. However, you may instead choose to use other alternative modeling language notations that you feel more comfortable with.

- Individual remark should be completed by each student (about half page each) in a group (5 points), and contains two components:

  o A description of your personal experiences using the ADD method.

  o A summary of your own contribution to the group work and report.

Notes:

1. You can compile and submit your report in either Chinese or English, but not a mix. You are not necessarily 100% correct in language when using English. However, you should make sure you convey everything in a clear and understandable manner.

2. When you require more information on requirements or affecting factors to make a design decision, you should make an assumption, document it and then make your design decision.

3. There is no minimum length requirement for this assignment, but it should not exceed TWELEVE pages. Be concise and to the point.

4. You will be assessed based on your ability to apply the design method and document the design rather than the absolute correctness of you design.

[1] Software Architecture in Practice, 1st Edition or 2nd Edition (1st Edition ebook available on Internet, and a couple of copies available in the school's library)

[2] Documenting Software Architectures: Views and Beyond, 1st or 2nd Edition (a few copies of the 1st Edition available in the school's library)

[3] UML Distilled: A Brief Guide to the Standard Object Modeling Language, 2nd Edition (some ebook available on Internet)