Sri Lanka Institute of Information Technology

B. Sc. Special Honours Degree
in
Information Technology

Final Examination
Year 3, Semester I (2017)

SE3030 – Software Architecture

Duration: 2 Hours

May/June 2017

Instructions to Candidates:
- ❖ This paper contains **Three** questions. **Answer All** Questions.
- ❖ Marks for each question are given in the paper.
- ❖ Total Marks: 100.
- ❖ This paper contains **6** pages with the Cover Page.
- ❖ Reading Time 15 minutes

Question 1   (40 marks)

Given below is a Case Study. for Guwan Airline. Read the. case study and answer the following. You can use your own experiences when answering this question.

Guwan Airline is a domestic airline in Sri Lanka which has been operating for the past decade. Due to the success of its operations it has managed to earn reputation among local and foreign tourists who have flown with Guwan.

The management of Guwan airline is planning to expand its operations worldwide. Recently it has managed to lease 10 new Aircrafts and established partnerships with other airlines. The management also secured contracts with 4 international airports in China, Korea, Japan and Israel for direct flight operations. While it has a long term goal of operating flights to many worldwide destinations as possible via its own fleet, in the initial phase it would consider partnering with other airlines to take its passengers to the destinations where Guwan will not directly operate.

As a domestic airline Guwan has its own Airline software system for Flight Scheduling, Passenger Booking, Financial Reporting and Staff Management developed and operated by its own IT Department. Although the Software is in existence, currently the Customers don't directly interact with the system, rather the phone operator at Guwan use the system to enter data on passenger's behalf. The management realizes the current software and / or the process is not suitable when it operates internationally.

Guwan has evaluated how other competitor airlines implemented software system to handle their needs and below is an outline of their findings.

Online booking of flights for the international customers (Passengers) is one of the compelling features in the other airlines and Guwan wishes if its software system had the same capability. Online Payments, Seat Selection, Meal Plan, etc… are features provided by the other systems. Guwan's Sales team also realizes that many of the airlines have their own Loyalty Programs give better offers to regular customers and by doing so the airline retains customers. In the modern day most of the airlines facilitates Online Check-In for passengers and its convenient for the passenger to avoid long queues at the check-in desk at the airport as well as the airline's ground staff has less work to do at the airport thanks to customer initiated check-in. A number of airlines have also introduced Mobile Applications that feature passenger check-in and some airlines are connected to KIOSK terminals at airports for passenger self check-in.

After considering multiple factors and evaluating several third party software solutions, management of Guwan has decided to develop its own software with Free and Open Source Technologies.

Since the sales landscape changes heavily when operated internationally Guwan's management is opening up sales & booking channels via Ticket Booking Agents as an additional option. Further to attract the customers it plans to offer various discounts and

promotions for holiday seasons. The Booking Agents will be able to make the flight reservations and offer tickets to the discounted prices.

While signing new agreements with its new destinations, Airport Authorities have informed the management it too need data from the Airline software for Security and Safety reasons such as Passenger Screening. Although the data is required from the airline system the authorized personal will be accessing the data through their own systems, so no direct login access needs to be provided to authorities. In an event of an unscheduled flight alterations, such as a considerable delay due to bad weather conditions the Authorities will be contacting the Ground Crew to make suitable Flight Alterations.

The Flight Crew too will benefit with the new Software System. As the new Aircrafts are much larger and can accommodate more passengers in multiple seating classes the traditional paper based seating plan (printout) will be abandoned and a new iPad based system is proposed to be introduced for the Crew. In addition to obtaining the Passenger List & Seating Arrangements the iPad application will have the Meal Plan and Special Requests (Kids, Accessibility, etc…) for passengers.

a) Identify **4 main stakeholders** in this case study.

(4 marks)

b) **Draw** the Architecture Business Cycle with all the relevant details.

(4 marks)

c) Identify **2 key Quality Attributes** each from below categories in this Case Study and **justify** why they are important in this context.

   i)   Runtime Qualities

(2 marks)

   ii) Design Qualities

(2 marks)

   iii) User Qualities

(2 marks)

d) In reference to the identified Quality Attributes in part (c) **select 2 attributes** and explain what **Trade-Offs** should be made to improve them with proper **justification**.

(6 marks)

e) Suggest a suitable **tactic** for implementing **2 of the identified Quality Attributes** in part (c) with proper **justification**.

(6 marks)

f) Write concrete Quality Attribute Scenarios for the **2 User Qualities** identified in part (c).

(6 marks)

g) From the **System Maintenance perspective,** how would you Architect to support below activities? Explain with **justification** for each item separately.

   i) Disaster Management

(2 marks)

   ii) Data Portability

(2 marks)

   iii) Ability of upgrading components without shutting down the system as a whole

(2 marks)

   iii) Increased System usage during peak seasons

(2 marks)

Question 2   (30 Marks)

a) Explain the **role** of a Software Architect.

(3 marks)

b) Differentiate Architectural Structure and View.

(5 marks)

c) How does **Microkernel Architecture** work? Explain your answer with a Diagram.

(5 marks)

d) Explain the relationship between **Quality Attributes** and **Tactics.**

(5 marks)

e) Explain below Architecture Validation methods.

   i) ATAM

(2 marks)

   ii) SAAM

(2 marks)

   iii) ARID

(2 marks)

f) **Performance** is critical for any Software System, what are the **tactics** that would generally apply to improve performance?

(6 marks)

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Question 3   (30 Marks)

a) A software development team plans to build a web site with multiple web pages. While analysing their requirement they have realized all the web pages have a similar layout; a top navigation bar for drop down menus, a bottom footer for contact information and a right side floating area for web advertising.

For this scenario how would you advice the **presentation tier** to be designed? What are the design patterns/strategies to be used? Explain your answer with a diagram.

(6 marks)

b) At the prototype stage a software system plan to use an inexpensive simple File based data store, if the prototype is approved they plan to migrate to a commercial RDBMS. However, in the long term the data layer might be replaced with a Web Service based integration instead of having its own data store.
For this scenario how would you advice the **data/integration tier** to be designed? What are the design patterns/strategies to be used? Explain your answer with a diagram.

(6 marks)

c) An existing Software System has separate Service Components/Packages and its decoupled with the Presentation Tier. A new third party system integration is proposed to the external system which plans to utilize some of its service components. The development team is tasked to design/develop an interface that would **combine** the needed services/functions in to one component that will be accessed by the external system.

For this scenario how would you advice the new **third party interface** to be designed? What are the design patterns/strategies to be used? Explain your answer with a diagram.

(6 marks)

d) A University has Undergraduate and Post Graduate Students who gets enrolled in to various subjects at the beginning of the academic year. A Student cannot register as an Undergraduate and a Post Graduate at the same time. While there are many specialized separate subjects for Undergraduate and Post Graduate students, there are a few subjects that the University offers for any Student to be enrolled (e.g. Effective Communication Skills).

TOGAF Architecture Development Method describes developing Information Systems Architecture.

i) For the above scenario how would you develop **Data Architecture**? State your assumptions clearly.

(6 marks)

ii) **Draw** the Data Architecture diagrams and explain.

(6 marks)

End of the Question Paper