



UNIVERSITY OF RUHUNA

Faculty of Engineering

End-Semester 8 Examination in Engineering: July 2022

Module Number: EE8217

Module Name: Software Architecture

[Three Hours]

[Answer all questions]

[First question carries 20 marks and rest of each carries 10 marks]

Q1 Answer the questions below based on the given scenario.

Assume that you are a software architect of a software company and your team is going to build a warehouse management system for a client.

The main business function of the warehouse is to store different types of goods and fulfil orders. The warehouse receives goods from different manufacturers and when the goods are received, the warehouse operator should add/update those items to the inventory and store those items in racks and bins (bins are small containers which can be used to store these items).

The warehouse currently uses a legacy system which was built around 20 years ago. A new system should replace this existing legacy system completely since it is outdated.

There is a modern web-based application already available for placing orders. The users can place the orders via this online ordering application. When placing an order via the online ordering system, the system should confirm the stock availability by contacting the warehouse management system.

Once an order is placed via the ordering system, the system should communicate with the warehouse management system to fulfill the order. When the warehouse management system receives the order details, the warehouse operator picks up the relevant items and creates a package which is ready to ship. When creating that package, a tracking number should be obtained from a third party logistics system. The warehouse is currently using the `Ship-Fast` Service as the logistics provider, and the new system should also use the same logistics provider. `Ship-Fast` has a REST API which can be used to obtain the tracking numbers.

Assume that the communication between the online ordering system and the warehouse management system occurs via REST APIs.

The warehouse operator should be able to access the warehouse management application using a mobile device, especially when fulfilling the orders, because the warehouse operator has to travel through the warehouse to find the relevant items

for a particular order.

Assume that you are going to create a separate back-end application using REST, a separate front-end application, and a separate mobile application to tackle the above requirement in the warehouse.

a) What is an API (Application Programming Interface)? Mention a scenario where APIs are used for **communication between services** in the above-mentioned software design.

[3 Marks]

b) Draw a context diagram for the above mentioned cloud based warehouse management system.

[3 Marks]

c) Draw a container diagram for the above mentioned cloud based warehouse management system. Clearly mention the technology stack for each container. Briefly explain the reasons behind selecting each technology.

[4 Marks]

d) Draw a component diagram for the back-end container of the above system.

[5 Marks]

e) Discuss the potential scalability related issues which could occur in such a system after the deployment and explain the suitable solutions.

[5 Marks]

Q2 a) Explain the "**Traditional View of a Component**" in component level design.

[3 Marks]

b) Briefly explain what is meant by "**Extensibility**" in a software component and how to achieve extensibility of a component.

[3 Marks]

c) Explain the "**Release Reuse Equivalency Principle (REP)**" in component level design with an example.

[4 Marks]

Q3 a) List down two (02) drawbacks of Pipe and Filter software architectural pattern.

[3 Marks]

b) Briefly explain the difference between Layered architectural style and N-Tier architectural style.

[2 Marks]

c) Mention two (02) properties of service in service-oriented architectural style.

[2 Marks]

- d) *'Scaling monolithic applications can often be a challenge'*.
Explain how microservices architecture can help to overcome the scaling challenge in monolithic applications.
[3 Marks]

Q4 a) Briefly explain the terms "System Architecture" and "Enterprise Architecture" in software designing.
[2 Marks]

b) Briefly explain the difference between a **framework** and a **design pattern** in software engineering.
[2 Marks]

c) Briefly explain a **common design mistake** in pattern based design and mention how to avoid such a mistake.
[3 Marks]

d) Explain how to use the concept of "**Abstraction**" in the software designing process.
[3 Marks]