Institute of Systems Science
National University of Singapore

MASTER OF TECHNOLOGY IN SOFTWARE ENGINEERING

Graduate Certificate Examination

Subject: *Architecting Scalable Systems*

Sample Examination Questions 2

SECTION A

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Question 1 *(Total: 19 Marks)*

Refer to the case study in **Appendix A** and answer the following questions:

a. One of the measures of success of a platform is how it grows its ecosystem by growing its reach with new types and numbers of customers and interactions. Two seeds that the current platform has are 'prescription of medicine' and 'equipment'. Amongst many others, some interactions are 'uploading prescription', 'ordering medicines/equipment' and 'tracking orders'.

With respect to the seeds and the interactions described above, explain one aspect of the architecture that is crucial to the success of the platform.

(2 Marks)

b. A platform consists of reusable or shared components, entities and services using which specific applications and services can be built.

i. Domain entities make up an essential part of the reusable assets of a platform. Analyze the descriptions of the significant use case flows in **Section 5** of the case study and using DDD approach identify the **domain objects and their relationships**. Capture them in a UML class diagram.

ii. Architecting services that can be shared across applications and exposed to be consumed by external application is an essential characteristics of a platform. Identify the recommended **shared services** for the platform described in the case study.

(9 Marks)

c. Platforms enable creation of business ecosystems and one such enabler is the services exposed to partners and other participating applications/services of the ecosystem.

i. From the list of shared services identified in Q1(b)(ii), list **two** services that you would expose as APIs to any two customers (producers/consumers) of your platform. State specific customers who would use each of these APIs. Justify your answer.

ii. Pick any one service to be exposed in Q1(c)(i) and design the service API at Level 3 maturity according to Richardson Maturity Model. The design should include the service URI, HTTP action, definition for the service input and output and explanation of the purpose for each of the service operations.

(6 Marks)

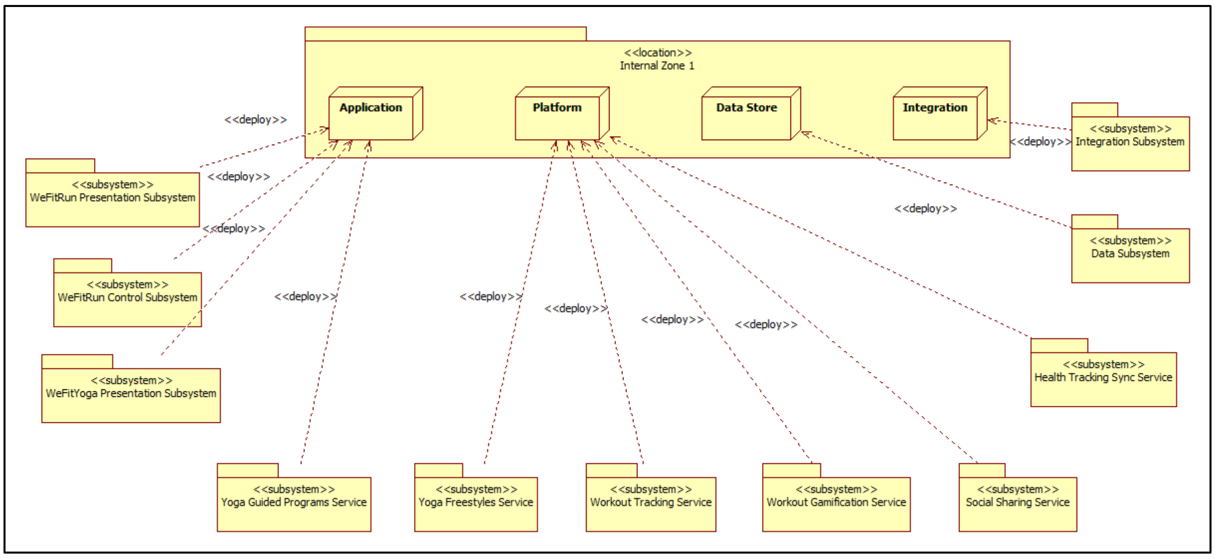
d. After the platform services are implemented, they would be deployed into production environment. Assuming that the reusable services identified in Q1(b)(ii) are to be deployed using containers. One architectural decision is that those services with high communication affinity (defined by the number and size of messages exchanged over time) should be considered to be collocated in the same container. Propose **two or more** services that are most suitable to share the same container. Justify your answer.

(2 Marks)

Question 2 *(Total: 15 Marks)*

Refer to the case study in **Appendix A** and answer the following questions:

a. Analyse the following logical detail deployment diagram (note: the functional components are not shown) for the **WeFitRun** and **WeFitYoga** systems and identify three **undesirable** architectural decisions. For each issue, propose the corrective action. Justify your answer.
Hint: You may draw a similar diagram to illustrate your corrective actions.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Internal Zone 1
Application
Platform
Data Store
Integration
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<<subsystem>> Yoga Freestyles Service
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<<subsystem>> Social Sharing Service
<<deploy>>

(6 Marks)

b. Based on the corrected logical detail deployment diagram (without showing the outline functional components) for the WeFitRun and WeFitYoga systems in Q2(a), craft a **physical detail deployment diagram** to illustrate Cloud deployment using some of the following AWS services. Explain at least **three significant architectural decisions** that lead to your physical architecture.

(9 Marks)

The following is a list of some AWS services/products that you could consider.

1. AWS API gateway: A fully managed service that makes it easy for developers to create, publish, maintain, monitor, and secure APIs at any scale.
2. AWS ElastiCache: fully managed Redis and Memcached. Seamlessly deploy, run, and scale popular open source compatible in-memory data stores.
3. EMR Hadoop: A cloud-native big data platform, allowing teams to process vast amounts of data quickly, and cost-effectively at scale.
4. AWS Lambda service: A serverless service that lets you run code without provisioning or managing servers. Useful to run and scale your code with high availability. You can set up your code to automatically trigger from other AWS services or call it directly from any web or mobile app.
5. AWS RDS: A Relational Database Service (Amazon RDS) that makes it easy to set up, operate, and scale a relational database in the cloud.
6. AWS Cognito: A service that lets you add user sign-up, sign-in, and access control to your web and mobile apps quickly and easily. Amazon Cognito scales

to millions of users and supports sign-in with social identity providers, such as Facebook, Google, and Amazon, and enterprise identity providers via SAML 2.0.

7. AWS Beanstalk: An easy-to-use service for deploying and scaling web applications and services developed with Java, .NET, PHP, Node.js, Python, Ruby, Go, and Docker on familiar servers such as Apache, Nginx, Passenger, and IIS.
8. AWS Redis: Stands for Remote Dictionary Server, is a fast, open-source, in-memory key-value data store for use as a database, cache, message broker, and queue. Redis is a popular choice for caching, session management, gaming, leaderboards, real-time analytics, geospatial, ride-hailing, chat/messaging, media streaming, and pub/sub apps.
9. AWS Dynamo: a key-value and document database that delivers single-digit millisecond performance at any scale.
10. AWS S3: An object storage service that offers industry-leading scalability, data availability, security, and performance.
11. AWS CloudFront: A fast content delivery network (CDN) service that securely delivers data, videos, applications, and APIs to customers globally with low latency, high transfer speeds, all within a developer-friendly environment.