National College of Ireland

Higher Diploma in Computing

(HDSDEV_SEPBL_YR2)

Distributed Systems

Terminal-Based Assignment Assessment (TABA) – 2023-24

Wednesday 10th January, 09:00 am to Sunday 14th January, 23:55 pm

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Marks Breakdown: The Terminal Assignment Based Assessments is worth 40% of your overall mark for the module

Duration: The students will have to answer questions (1, 2, 3, 4) and question (a) or (b) from question 5.

All submissions will be electronically screened for evidence of academic misconduct (plagiarism and collusion). The assessment should be submitted via a Turnitin link.

Attachments: None

Presentation of Code: Your code should be presented as follows. You should include screenshots of all the inputs and outputs of your services. You should also include screenshots of all your code in your IDE(whichever IDE you are using Eclipse, NetBeans IntelliJ).

1. By using the MQTT protocol implement using JavaScript, the Publisher – Subscriber parts of the following application. Your application simulates a smart agriculture environment, where sensors emit different data about the farm. There are two types of clients (programs):

one client (program) that publishes messages every second about the field conditions, such as soil/moisture (e.g., 40%) and soil/temperature (e.g., 25°C),

and another client (program) that publishes messages about the equipment every half second, like sprinkler/harvester equipment status (e.g., ON) and sprinkler/harvester equipment location (e.g., GPS coordinates)

a. Implement two publishers, one for each client, and demonstrate the sending of messages on the respective topics and subtopics. Use a loop that periodically emits values/readings either randomly or from a list **[10 marks]**

You should also develop and run different subscribers (hint - copy and change the class name andsubscribe method in each case) that listens for messages on the following topics and subtopics

b. Strictly messages related to soil temperature **[5 marks]**
c. Any messages that are related to the farm field (including its subtopics) **[5 marks]**
d. Messages that are related to the equipment for both sprinkler and harvester **[5 marks]**
e. Finally, show and explain how you can facilitate disconnected clients. **[5 marks]**

[30 marks in total]

Must include the screenshot of the code and output.

2. Conceptually demonstrate a simple client-server application/scenario with an implementation technology of your choice. Your solution should mention and depict the relations and interactions among the following components: client-part, server-part, middleware and registry. In this scenario, what is the use of middleware and registry?

[20 marks in total]

Explain using any technology of your choice.

3. Discuss the challenges and advantages of adopting a microservices architecture in distributed systems. How does the use of microservices impact issues such as data consistency, fault tolerance, and system complexity? **[15 marks in total]**

4. Discuss mitigation strategies for the following Fallacies of Distributed Computing.

a. The Network is Reliable **[5 marks in total]**

b. Latency is zero. **[5 marks in total]**

c. Bandwidth is infinite. **[5 marks in total]**

5. a) Explain the different styles of RPC methods in gRPC. Explain using proto files and provide practical applications of each style. **[20 Marks]**

(OR)

5. b) Investigate and report how cloud-based systems (select one of Amazon WS, Microsoft Azure, Google Cloud Platform, etc) balance the trade-offs of the PACELC theorem, and what approaches they take to guarantee Consistency, Availability and Partition Tolerance.

[20 Marks]