Faculty of Computers & Information
Distributed Systems
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Problem Sheet 1

1) Draw **one possible example of a two-tiered and a three-tiered architecture**. **Explain briefly** the placement of components in both architectures.

2) Briefly describe the difference between **a fault** and **a failure** that may occur in a distributed system.

3) Describe briefly the purpose of each of the following servers shown in the distributed system shown in Figure 1: **DNS server**, **Proxy server on the client side** and **Proxy server on the server side**.

Web:

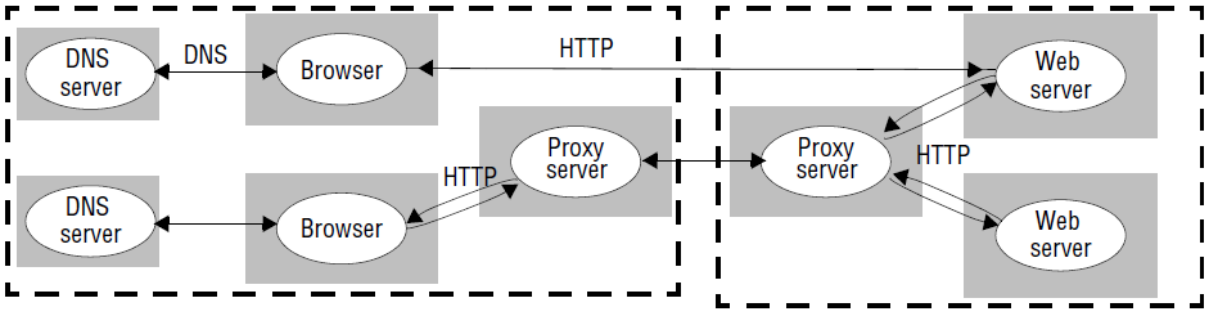

Figure 1

4) The development of distributed systems may need building a **model** for the system being tested and evaluated. What is the purpose of building this model? **Explain briefly**.

5) Compare between the **client-server architectural model** and the **peer-to-peer architectural model** in terms of the following five characteristics: **Put your answers in a table form**.

   a- system description
   b- system availability
   c- fault tolerance
   d- system scalability
   e- complexity of system maintenance

6) **Figure 2** shows two setups for a distributed system composed of a widely spread sensor network. In setup (a), each sensor has **NO** data storage unit associated with it with the whole data should be stored at the operator's site. In setup (b), the data storage is the responsibility of each sensor with **NO** data stored at all at the operator's site. Compare between the two setups using the following criteria. **Place your comments in a table form as shown below**.

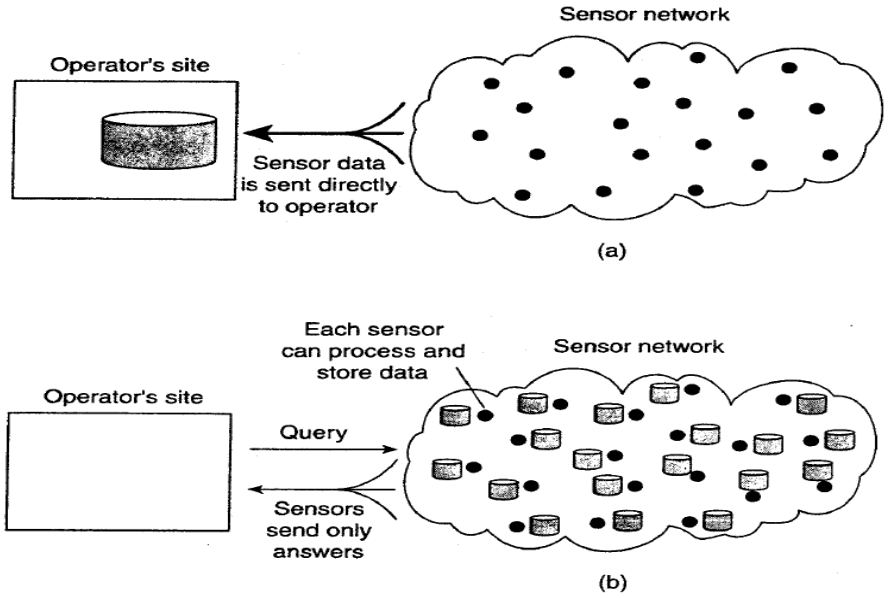

Figure 2: Two Different System Setups for a Sensor Network

Criteria	**System Setup (a)**	**System Setup (b)**
Availability		
Maintainability from the point of view of the operator		
Failure handling and bottlenecks		
Message communication overhead on the network		
Response time of the system when a user queries the operator's site to get information from a specific sensor		
Which system setup is more suitable for real-time access to sensor data? Explain why?		
Which system setup consumes more power in the sensors? Explain why?		

7) In client- server architectural model, a **performance bottleneck problem** may arise due to server overloading to fulfil client requests at peak times. Propose **two design modifications** or **extensions** to the system to resolve this problem. Comment on the **limitations** or **obstacles** that may face each proposed design extension when implemented.