* Distributed System (DS) - Assignment Number - 1.

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★ Explain what is middleware and its need in distributed system.

→ Middleware is a software layer situated between applications and operating systems. Middleware is typically used in distributed systems where it simplifies software development by doing following :

- Hides the intricacies of distributed applications.
- Hides the heterogeneity of hardware, operating systems and protocols.
- Provides uniform and high-level interfaces to make interoperable, reusable and portable applications.
- Provides a set of common services that minimizes duplication of efforts and enhances collaboration between applications.

Middleware may have multiple roles, but the most common one is usually handling communication between components of the system. At a high level, its analogous to postal system - you can send [almost] anything through the mail by packing and addressing it in a standard manner. The carrier makes no assumptions about the contents, on the assumption that the receiver knows what they represent.

★ Explain what is scalability in distributed system? What are the challenges to design scalable distributed system.

→ • A system is said to be scalable if it can handle the addition of user and resources without suffering a noticeable loss of performance or increase in administrative complexity.

• The ability to accommodate any growth in the future be it expected or not. Distributed system architectures achieve scalability through employing more than one host. Distributed systems can be scalable because additional computers can be added in order to host additional components.

1. In size: Dealing with large numbers of machines, users, tasks.
2. In location: Dealing with geometric distribution and mobility.
3. In administration: Addressing data passing through different regions of ownership.

• The design of scalable distributed systems presents the following challenges:

1. Controlling the cost of resources:
   Controlling the cost of physical resources i.e. servers and users.
2. Controlling the performance loss:
   DNS hierarchic structures scale better than linear structures and save time for access structured data.

3. Preventing software resources running out : Internet 32 bit addresses run out soon. 128 bits one give extra space in messages.

4. Avoiding performance bottlenecks : DNS name table was kept in a single master file partitioning between servers.