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Class Exercises
Module: Distributed Systems
Chapter 2: Architectures

Question 1: If a client and a server are placed far apart, we may see network latency dominating overall performance. How can we tackle this problem?

We can divide the client-side code into smaller parts that can run separately, or we can rearrange the client so that it can do other work after having sent a request to the server.

Question 2: What is a three-tiered client-server architecture?

A three-tiered client-server architecture consists of three logical layers, where each layer is, in principle, implemented at separate machine. The highest layer consists of a client user interface, the middle layer contains the actual application, and the the lowest layer implements the data that are being used.

Question 3: What is the difference between a vertical distribution and a horizontal distribution?

Vertical distribution refers to the distribution of the different layers in a multitiered architectures across multiple machines. In principle, each layer is implemented on a different machine. Horizontal distribution deals with the distribution of a single layer across multiple machines, such as distributing a single database.

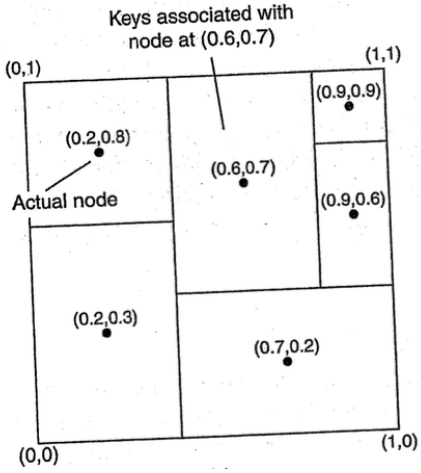
Question 4: In a structured overlay network, messages are routed according to the topology of the overlay. What is an important disadvantage of this approach?

The problem is that we are dealing only with logical paths. It may very well be the case that two nodes A and B which are neighbors in the overlay network are physically placed far apart. As a consequence, the logically short path between A and B may require routing a message along a very long path in the underlying physical network.

Question 5: Consider a chain of processes P1 , P2 , ..., P n implementing a multitiered client-server architecture. Process P_i is client of process P_{i+1}, and P_i will return a reply to P_{i-1} only after receiving a reply from P_{i+1} . What are the main problems with this organization when taking a look at the request-reply performance at process P_1?

Performance can be expected to be bad for large n. The problem is that each communication between two successive layers is, in principle, between two different machines. consequently, the performance between P1 and P2 may also be determined by n-2 request-replay interactions between the other layers. Another problem is that if one machine in the chain performs badly or is even temporarily unreachable, then this will immediately degrade the performance at the highest level.

Question 6: Considering that a node in CAN knows the coordinates of its immediate neighbors, a reasonable routing policy would be to forward a message to the closest node toward the destination. How good is this policy?



There are several possiblities, but if we want to follow the shortest path according to a Euclidean distance, we should follow the route (0.2,0.3) -> (0.6,0.7) -> (0.9,0.6), which has a distance of 0.882. The alternative route (0.2,0.3) -> (0.7,0.2) -> (0.9,0.6) has a distance of 0.957.

Question 7: What are the benefits of Microservices architecture compared to monolithic architecture?

Microservices are easier to deploy and understand, has independent components so that all the services can be deployed and updated independently, which gives more flexibility. Secondly, a bug in one microservice has an impact only on a particular service and does not influence the entire application. Also, it is much easier to add new features to a microservice application than a monolithic one, thus a better scalability

Question 8: Design yourself an e-commerce system using Microservices architecture.