

521290S Distributed Systems

Intermediate exam extra #1

02.03.2020

Each question is worth 2.0 points.
You must answer in English.

Always justify your answers! As a rule of thumb, a correct answer without justification fetches only 50% of maximum points.

Good luck!

0. Please estimate the amount of self-study (in hours) that you have invested in this extra intermediate exam, thank you.

1. Basics

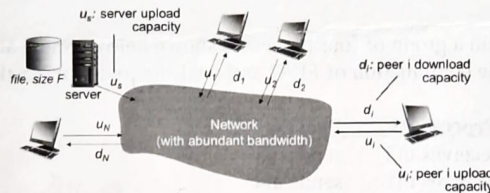
Describe briefly different techniques for scaling up a distributed system.

2. Architectures

Describe briefly different architectural styles of distributed systems and give a practical example of each style.

Consider an unstructured overlay network of N nodes in which each node randomly chooses c neighbours. Let's compare the performance of client-server and P2P architectures in the distribution of a file of size F from one server to N clients/peers in the network below, where server/client/peer upload/download capacity is a limited resource whereas the network has abundant bandwidth. Let d_{min} denote the minimum client download rate.

- (a) Determine minimum time it takes to distribute F to N clients using C-S approach.
- (b) Determine minimum time it takes to distribute F to N peers using P2P approach.



3. Processes

Essay (maximum length half page in legible handwriting and complete sentences): Code migration.

4. Communication

- (a) How could you guarantee a maximum end-to-end delay when a collection of computers is organized in a (logical or physical) ring?
- (b) How could you guarantee a minimum end-to-end delay when a collection of computers is organized in a (logical or physical) ring?

5. Naming

Explain how DNS can be used to implement a home-based approach to locating mobile hosts.

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Intermediate exam extra #2

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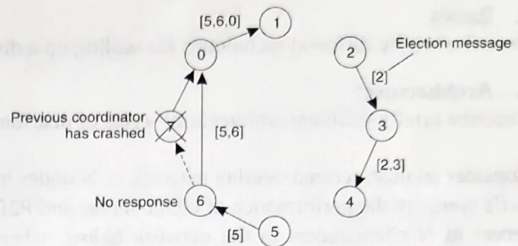
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1. Coordination

In the right figure, the coordinator (7) has crashed and two ELECTION messages are circulating simultaneously. While it does no harm to have two of them, it would be more elegant if one could be killed off. Design a simple algorithm for doing this without affecting the operation of the basic election algorithm.



2. Consistency and Replication

Discuss briefly the advantages and disadvantages of replication as a scaling technique.

3. Fault tolerance

Consider the communication within a group of four processes shown below. Show and justify all permissible delivery orders of messages for the combination of FIFO and total-ordered multicasting?

Process P1	Process P2	Process P3	Process P4
sends m1	receives m1	receives m3	sends m3
sends m2	receives m3	receives m1	sends m4
	receives m2	receives m4	sends m5
	receives m4	receives m5	
	receives m5	receives m2	

4. Edge Computing

Assuming you are hired to design a smart traffic light system with edge computing. What are potential design goals for this system? Please illustrate your design with a diagram to meet your goals.

5. Google

Show the architecture of Bigtable in form of a diagram and explain briefly the role of each component.