

Tentamen i kursen
Distribuerade System- TDDD25
2015-03-19, kl. 14-18

Hjälpmedel:

Engelsk ordbok.

Supporting material:

English dictionary.

Poänggränser:

Maximal poäng är 40.
För godkänt krävs sammanlagt
21 poäng.

Points:

Maximum points: 40.
In order to pass the exam you need a
total of minimum 21 points.

Jourhavande lärare:

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Good luck !!!

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Du kan skriva på svenska eller engelska!

1. What means transparency in a distributed system? We have defined seven aspects of transparency. Enumerate and explain at least five of them.

(3p)

2. We have introduced three fault models. Which are they? Describe each of them.

(2p)

3. Publish-Subscribe systems:

a) Draw a figure in which you illustrate the three players (publishers, subscribers, and notification service) and their interaction.

b) Explain the filtering function and illustrate by an example.

(3p)

4. BitTorrent and Napster:

a) Explain how each of them works; illustrate by a figure indicating the successive steps performed for access.

b) Compare the two.

(3p)

5. Consider a system of four processes P_1, P_2, P_3, P_4 . Consider the events a in P_1 , b in P_2 , c in P_3 , and d in P_4 .

a) Let us consider a case such that the Lamport's logical clock timestamps associated to the events are the following:

$$C(a) = 1; C(b) = 3; C(c) = 2; C(d) = 2;$$

What can you say regarding the happened before relation between events a, b, c, d (consider each pair of events) ?

b) Let us consider a case such that the vector clock timestamps associated to the events are the following:

$$C^V(a) = (2,0,0,1); C^V(b) = (2,3,1,1); C^V(c) = (3,2,2,1); C^V(d) = (2,3,1,2);$$

What can you say regarding the happened before relation between events a, b, c, d (consider each pair of events)?

(3p)

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6. We have introduced a theorem saying that a cut is consistent “if and only if no two cut events are causally related”. Illustrate the theorem with two examples (one showing a consistent cut and the other an inconsistent one). Use figures! Show how the theorem applies.

(3p)

7. Remote Method Invocation: trace the way of a request and of the reply from the client to a remote server and back. Illustrate with a figure.

(3p)

8. What is the basic idea behind the token based distributed mutual exclusion algorithm by Ricart-Agrawala (the second algorithm)? Consider how mutual exclusion is guaranteed and how the token is passed after a process has left the critical section. How many messages are passed in order a process to get permission to a critical section? Compare to the first algorithm by Ricart-Agrawala (which is not using a token).

(3p)

9. The Byzantine Generals Problem: show how agreement is not or is possible for three and for four participants respectively, in the case one of the generals (not the commander) is a traitor (illustrate the exchange of messages with figures).

(3p)

10. Consider a bully election with 6 processes, P_1, \dots, P_6 . P_6 , the current coordinator, fails and P_3 starts the election. Illustrate the sequence of messages exchanged (use figures).

(3p)

11.
 - a. Define total and causal ordering of requests. Illustrate by an example.
 - b. How can total ordering be implemented using a central sequencer?
 - c. Consider total ordering based on distributed agreement (no central sequencer); consider one front end and several replica managers.

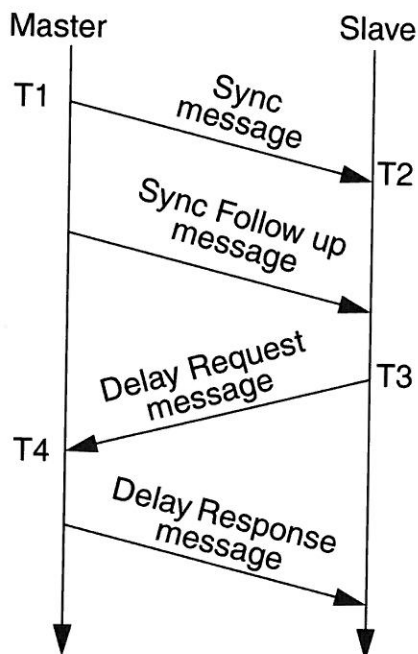
In this case, the replica managers, after receiving a request, send back to the front end a *cuid*. What does the front end send back to the replica managers after receiving the *cuid* from each replica manager? How does the front end calculate the value it sends back?
 - d. What happens if a replica manager crashes before sending to the front end the *cuid* for a request it received?

(3p)

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12. What is the basic idea with voting protocols for updating replicated data? How do they work? Consider a set of 12 replica managers. Define two voting protocols. One for a situation when the number of writes is relatively large compared to that of reads, and the other for the reverse situation. Give examples of read and write quorums (use figures). (3p)

13. What does it mean by external and internal synchronization of physical clocks? What does it mean by centralised and distributed synchronisation algorithms? (2p)



14. The figure shows the message exchange performed for clock synchronisation in the Precision Time Protocol (PTP).
a) What is the role of the "Sync Follow up message"? Why is it needed?
b) What information is the "Delay Response message" carrying?
c) Once the values T1, T2, T3, T4 are known, how is the clock update performed?

(3p)