

17.03.2025 Week 5 exercises: Distributed Transactions

Exercise 1:

Describe the use of ACKs in 2PC. How does the 2PC with Presumed Aborts handles this situation?

Solution

ACKs are used so that the coordinator knows when to “forget” a transaction, namely remove it from the transaction table. In the 2PC with Presumed Aborts, if a transaction aborts the coordinator removes it from the transaction table without waiting for ACKs from the subordinates. If a transaction is not in the transaction table it is considered to be failed.

Exercise 2:

Imagine a scenario with N nodes. Explain how many messages does 2PC and 2PC with Presumed Aborts need in the following cases:

- A transaction commits normally
- One of the subordinates aborts the transaction

Solution

- $4N-4$ in both cases
- $4N-4$ in 2PC, $3N-3$ in 2PC with presumed aborts

Exercise 3:

Briefly describe what would happen in the following cases during the execution of 2PC:

- In a configuration with N nodes, $N-1$ reply yes to the prepare message, and 1 replies no.
- The coordinator fails after sending the prepare messages.
- A subordinate fails before receiving a prepare message.
- Assuming 2PC with Presumed Aborts: The coordinator aborts a transaction, but the abort message to a subordinate is lost.

Solution

- The transaction aborts.
- All the subordinates are blocked.
- There is a timeout in the coordinator waiting the failed subordinate and the transaction aborts.
- The coordinator removes the transaction from the transaction table. The subordinate that didn't receive the abort message, re-tries to send yes or no. The coordinator doesn't find the transaction in the transaction table and replies abort.