ETH
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Distributed Computing

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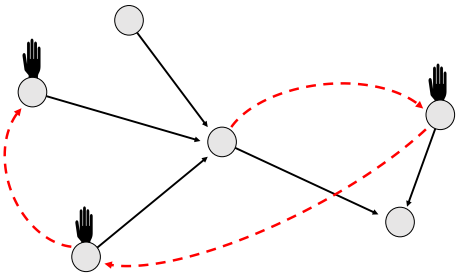
Implementing a Fault-Tolerant Distributed Ordering Protocol

State machine replication (SMR) is a popular technique in distributed computing used to increase the fault-tolerance of a system: To mitigate the effect of a faulty node, SMR replicates computation on several machines and outputs the result computed by a majority. An essential ingredient for SMR is *ordering* because the machines need to execute the transactions in the same order. It is important that the ordering mechanism is *fault-tolerant*, so continues to work even in the presence of faulty nodes.

Many popular fault-tolerant distributed ordering protocols, such as PBFT or Bitcoin's Blockchain, have a central ordering component. That is, at any time there is a single node doing the ordering work.



The Arrow distributed ordering protocol [1] orders incoming transactions in a completely decentralized fashion. Instead of one central node doing the ordering, many distant nodes do part of the ordering. However, the classic Arrow protocol is not fault-tolerant. If a single node or edge fails, the entire ordering mechanism breaks.

We have developed extensions to the Arrow protocol that are to make the ordering fault-tolerant. In this thesis, it will be your task to implement these algorithms to analyze their complexity and practicality.

Requirements: Knowledge in a programming language of choice, distributed systems, and graph algorithms.

We will have weekly meetings to address questions, discuss progress and think about future ideas.

Contact

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References

[1] Michael J Demmer and Maurice P Herlihy. The arrow distributed directory protocol. In *Distributed Computing: 12th International Symposium, DISC'98 Andros, Greece, September 24–26, 1998 Proceedings 12*, pages 119–133. Springer, 1998.