Improving RAFT When There Are Failures

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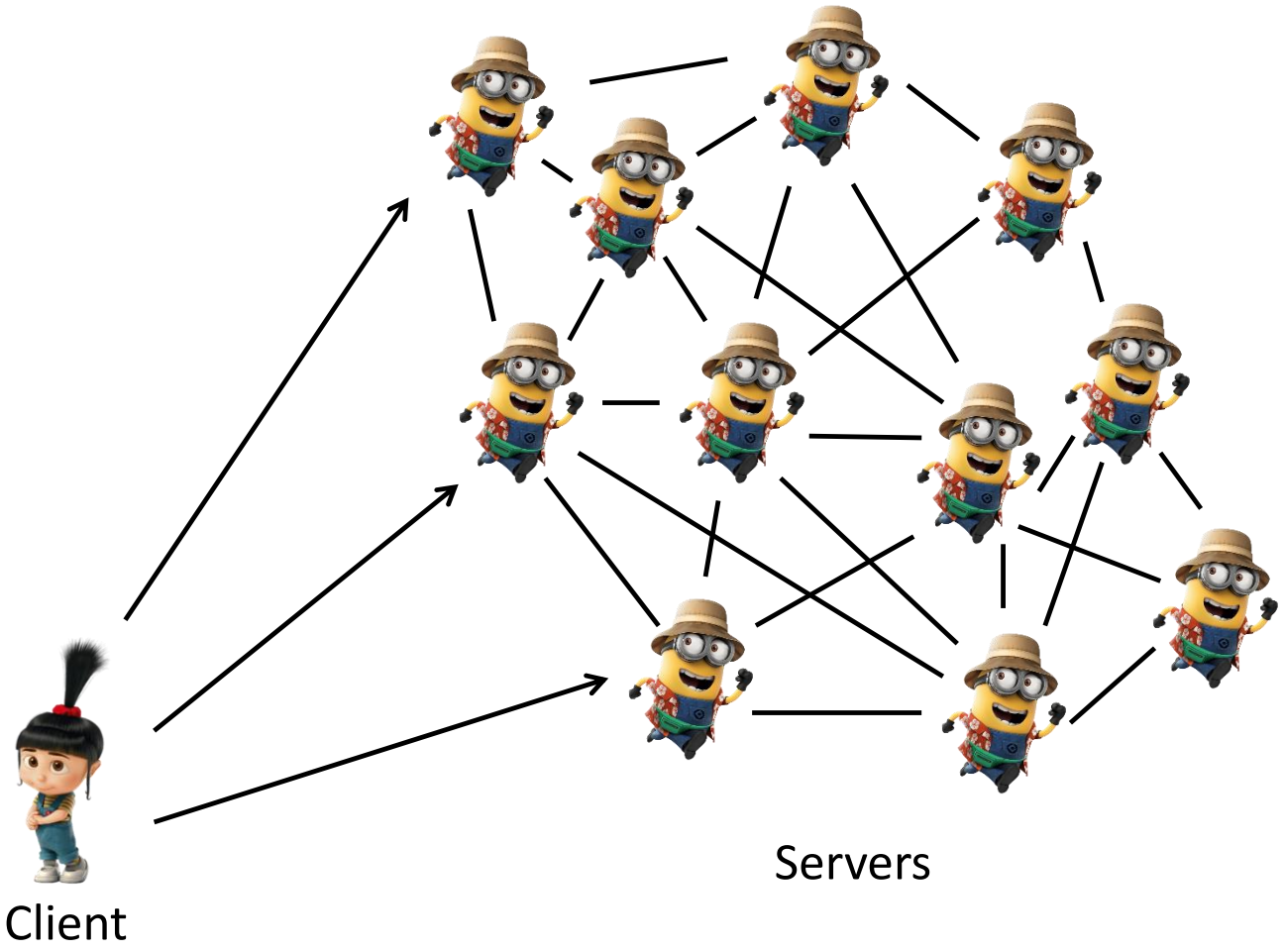
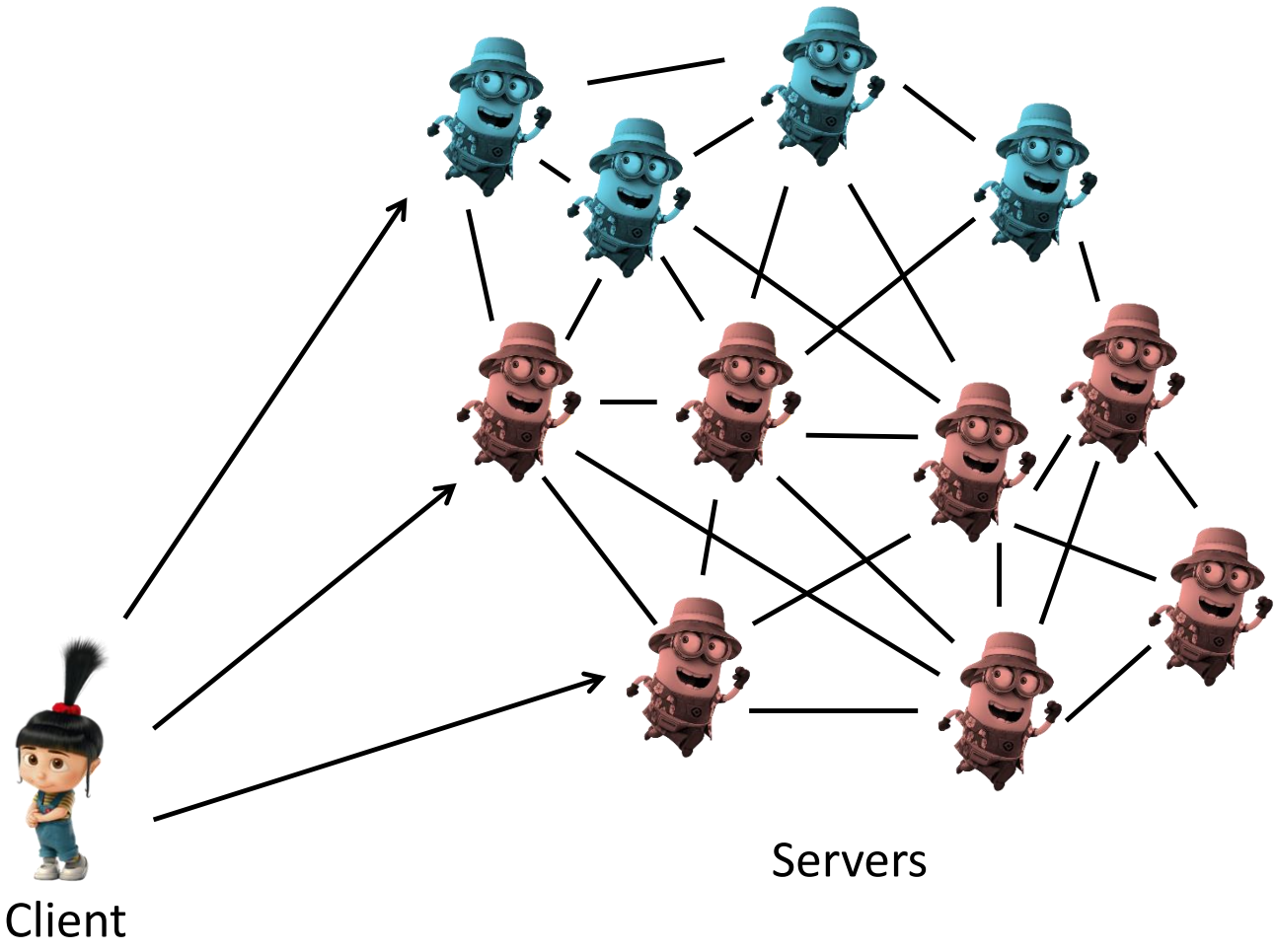
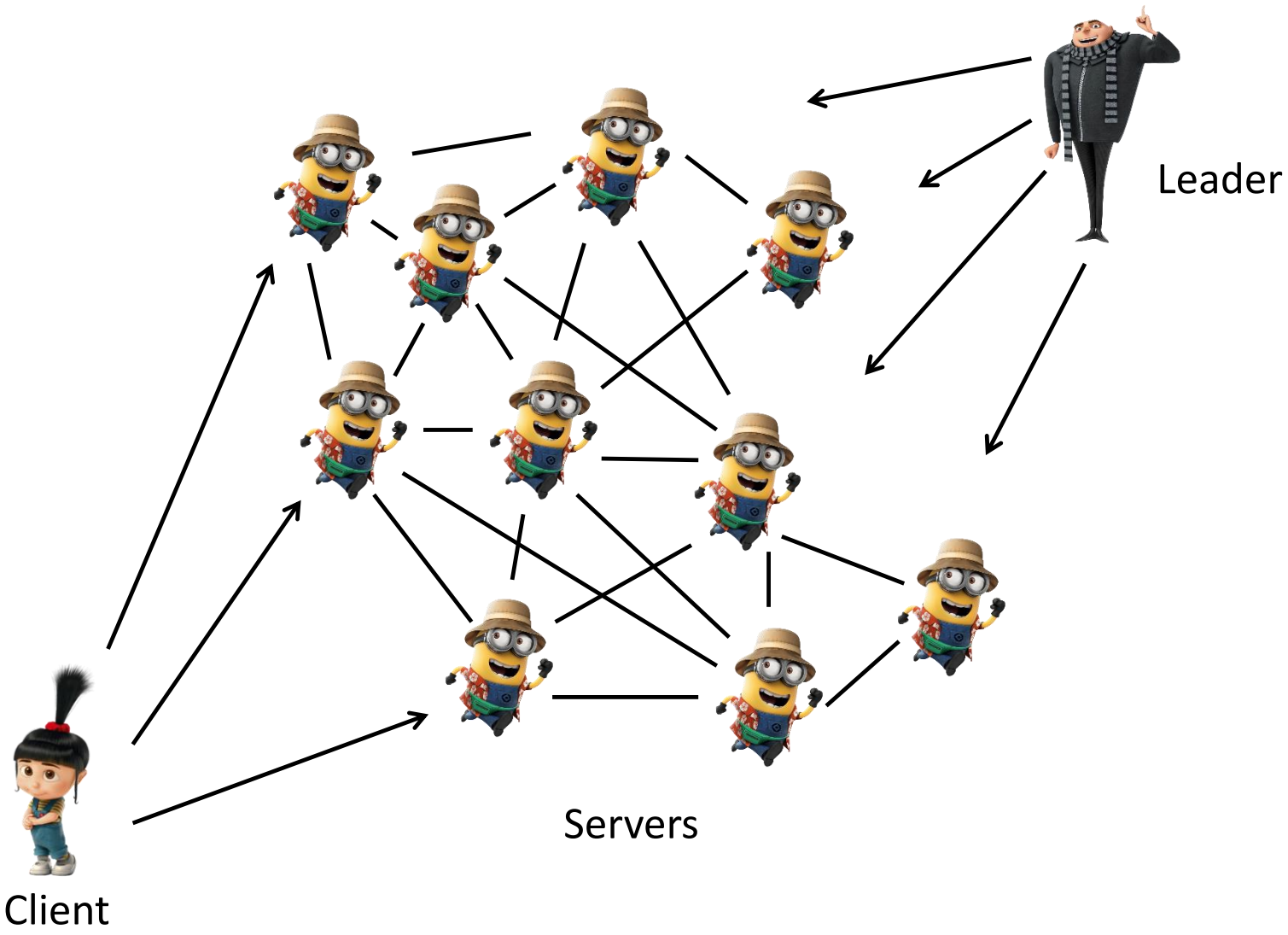
RAFT Protocol



Majority decisions in Paxos are...



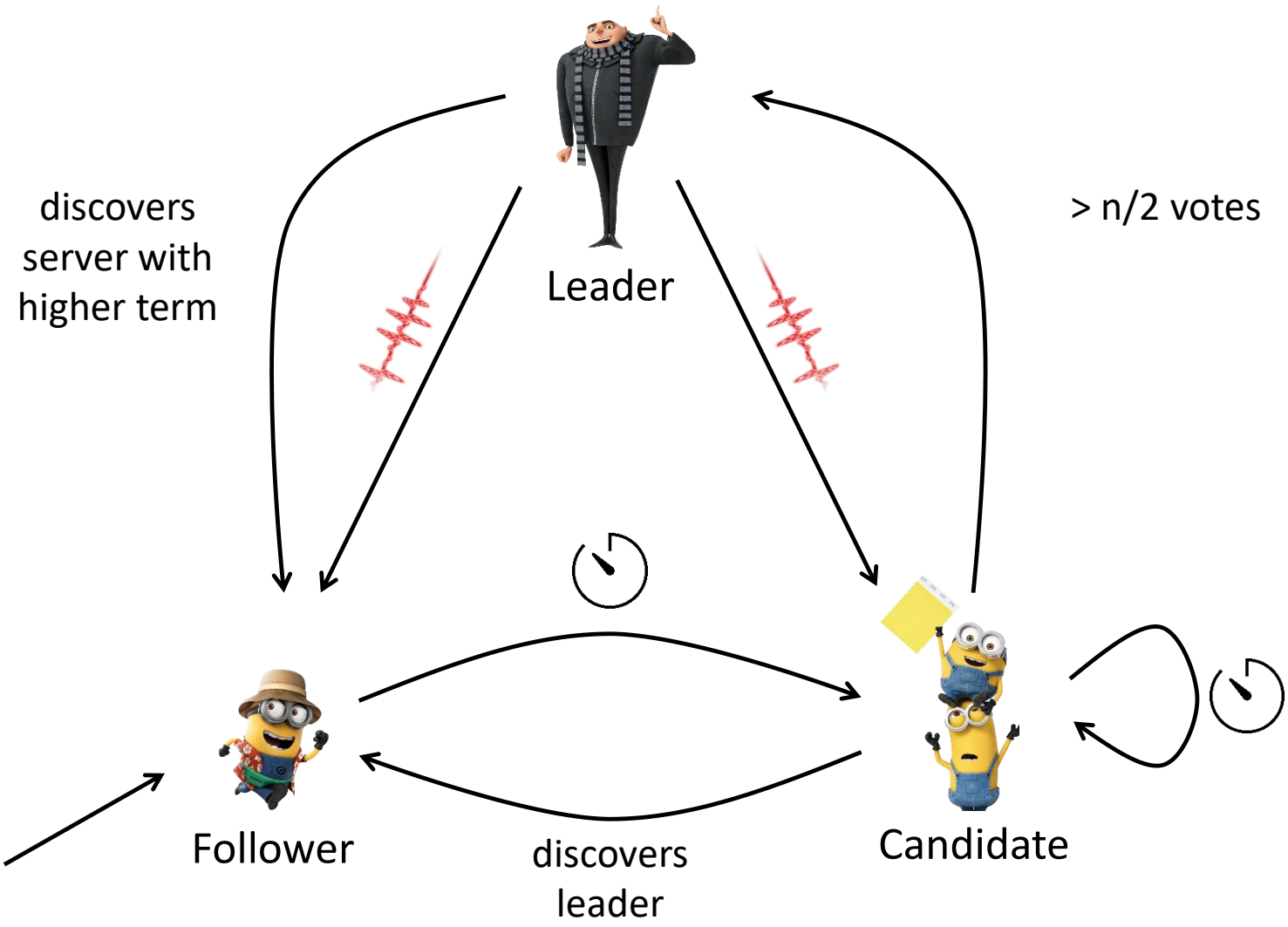
Majority decisions in Paxos are leader decisions in RAFT



RAFT Protocol: four sub-problems

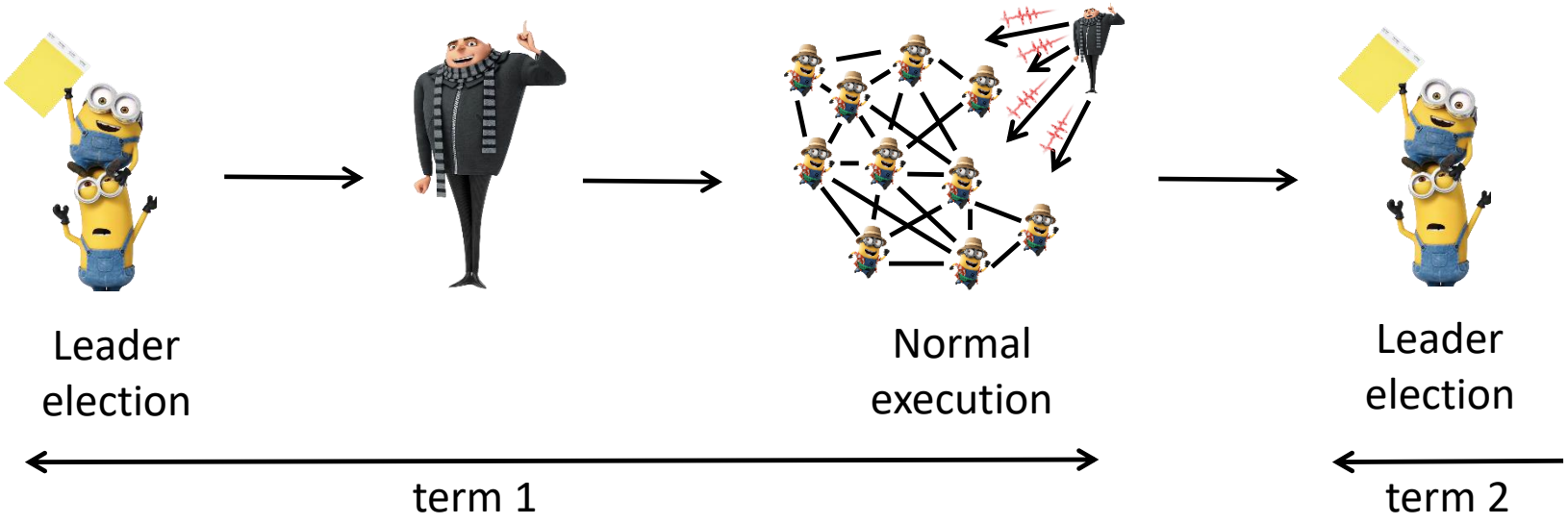
- Leader Election
- Terms
- Log Replication
- Consistency

Leader Election



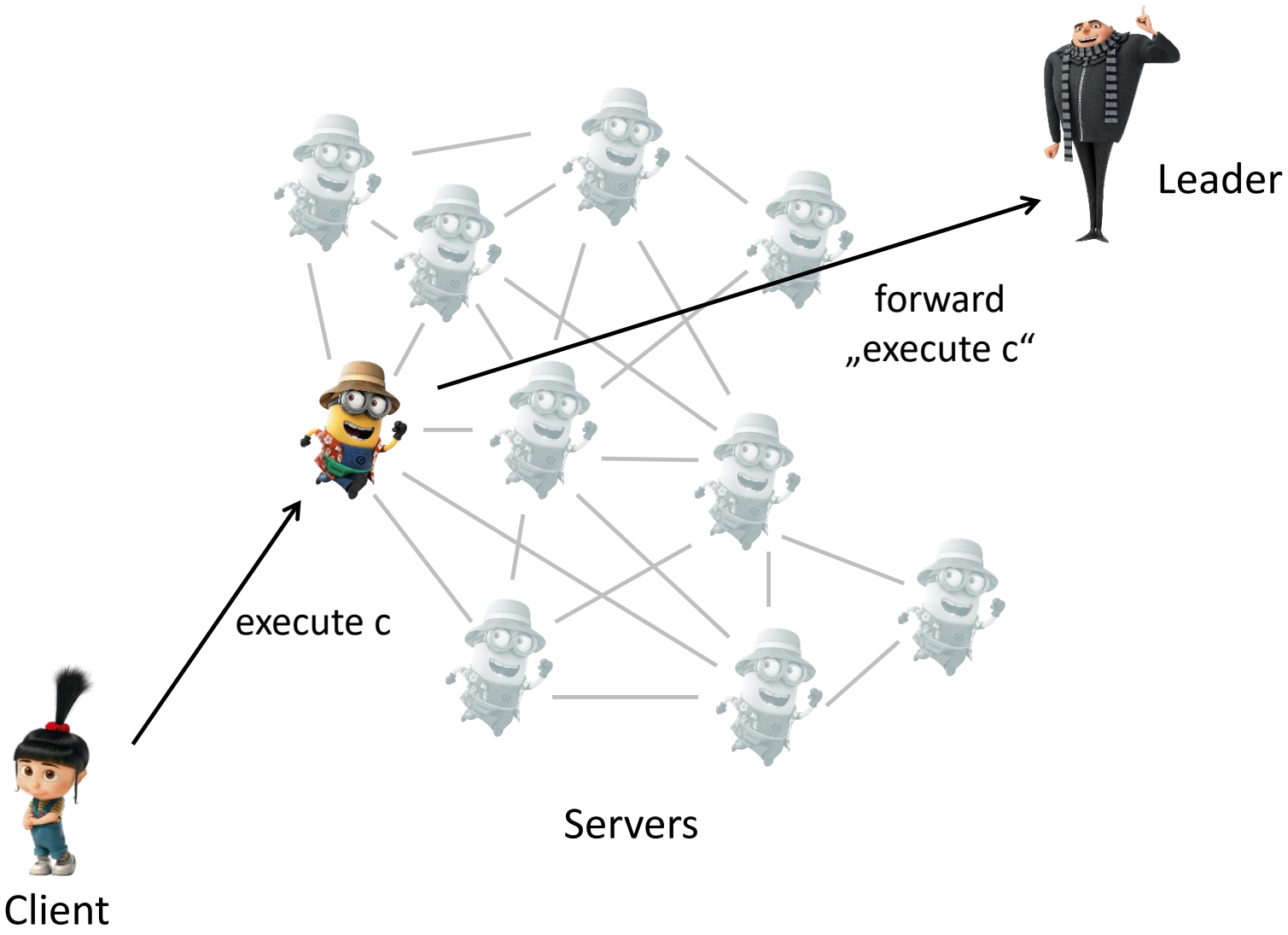
Terms

- Time from a leader election until the next leader election takes place

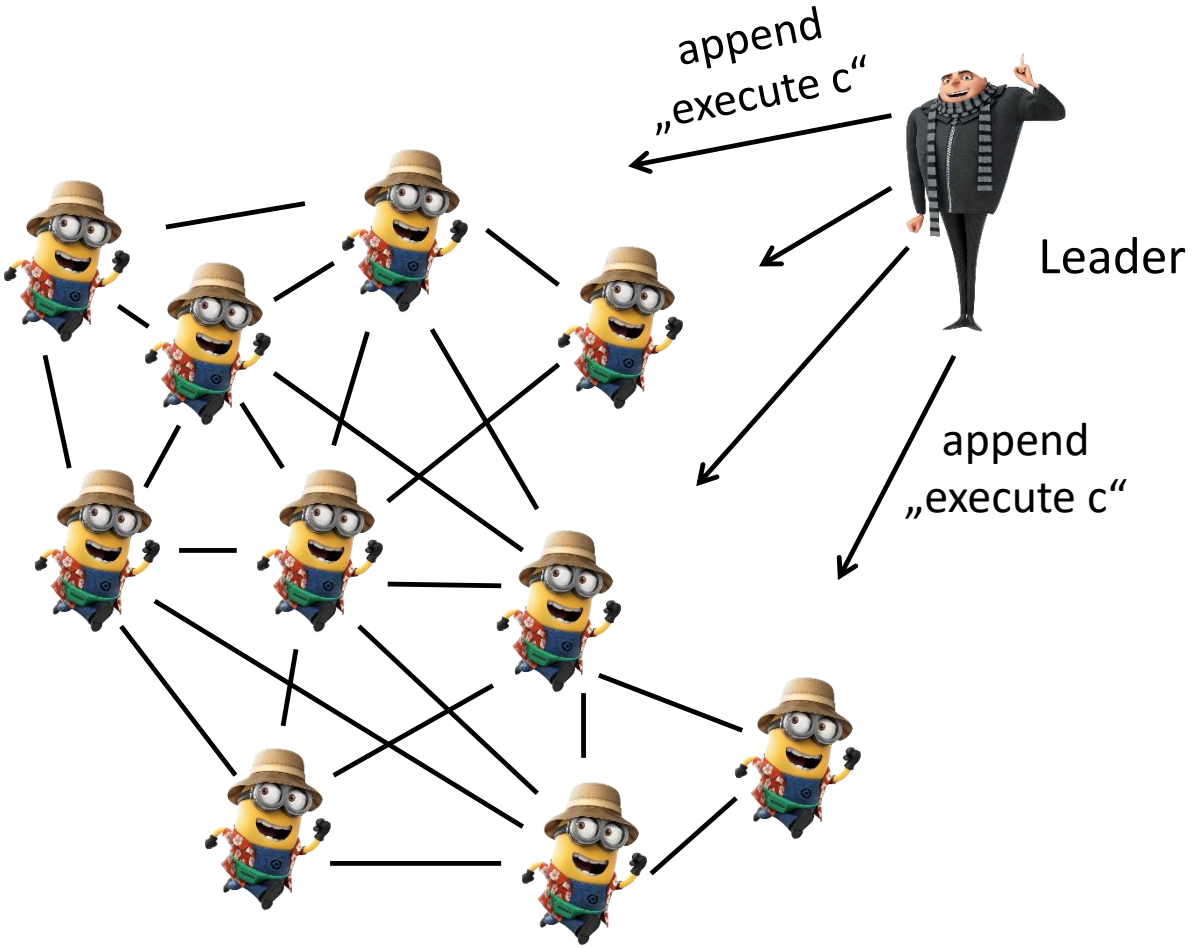


- A node increases its term when
  - it times out
  - it receives a message with a higher term

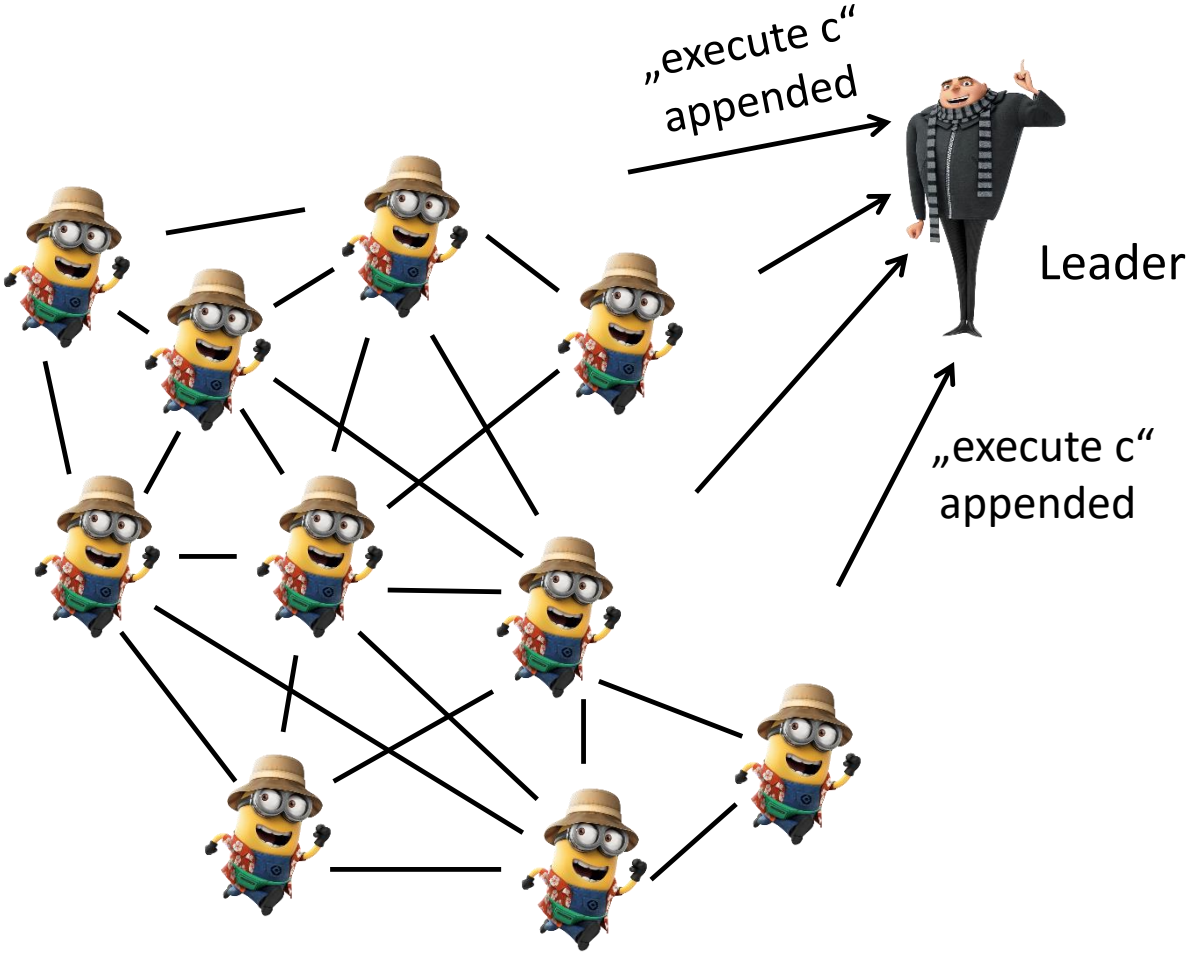
Log Replication



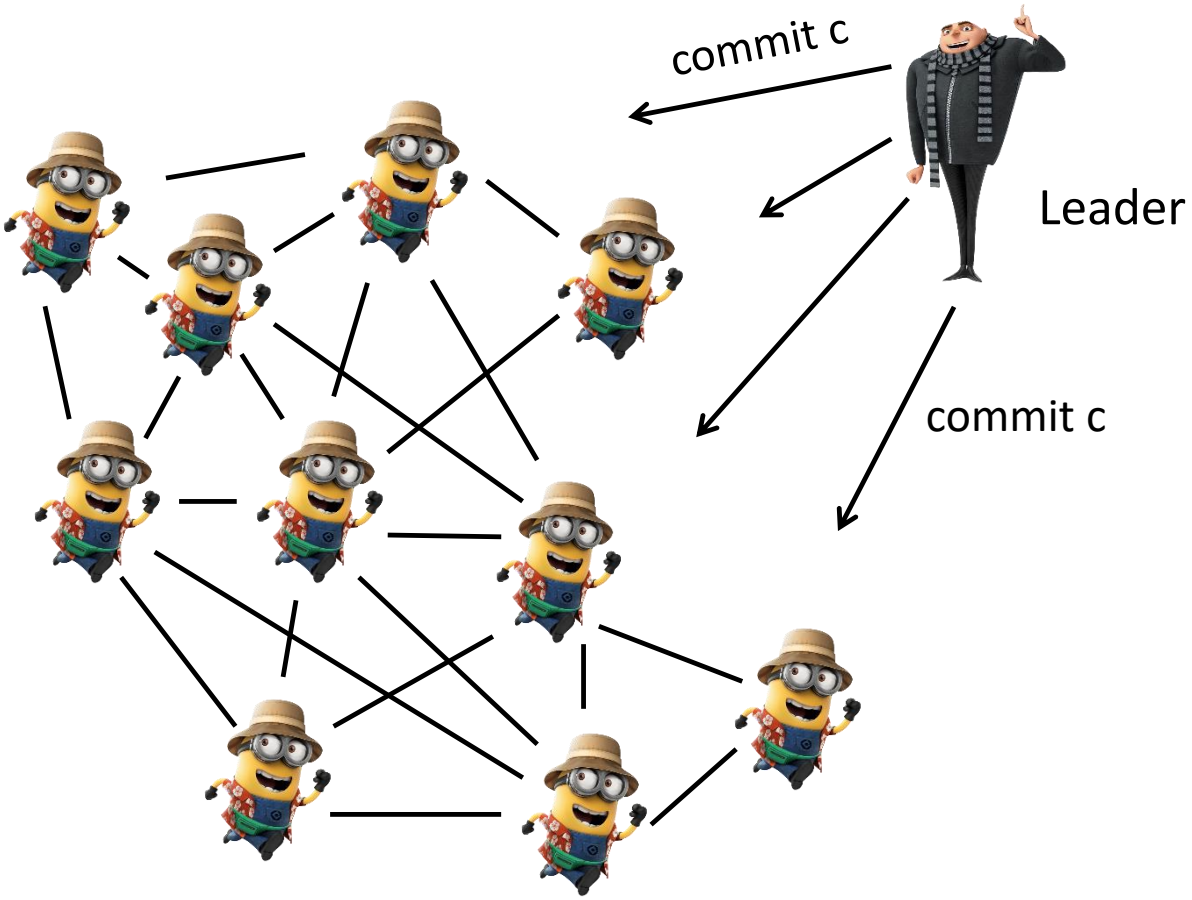
Log Replication



Log Replication



Log Replication

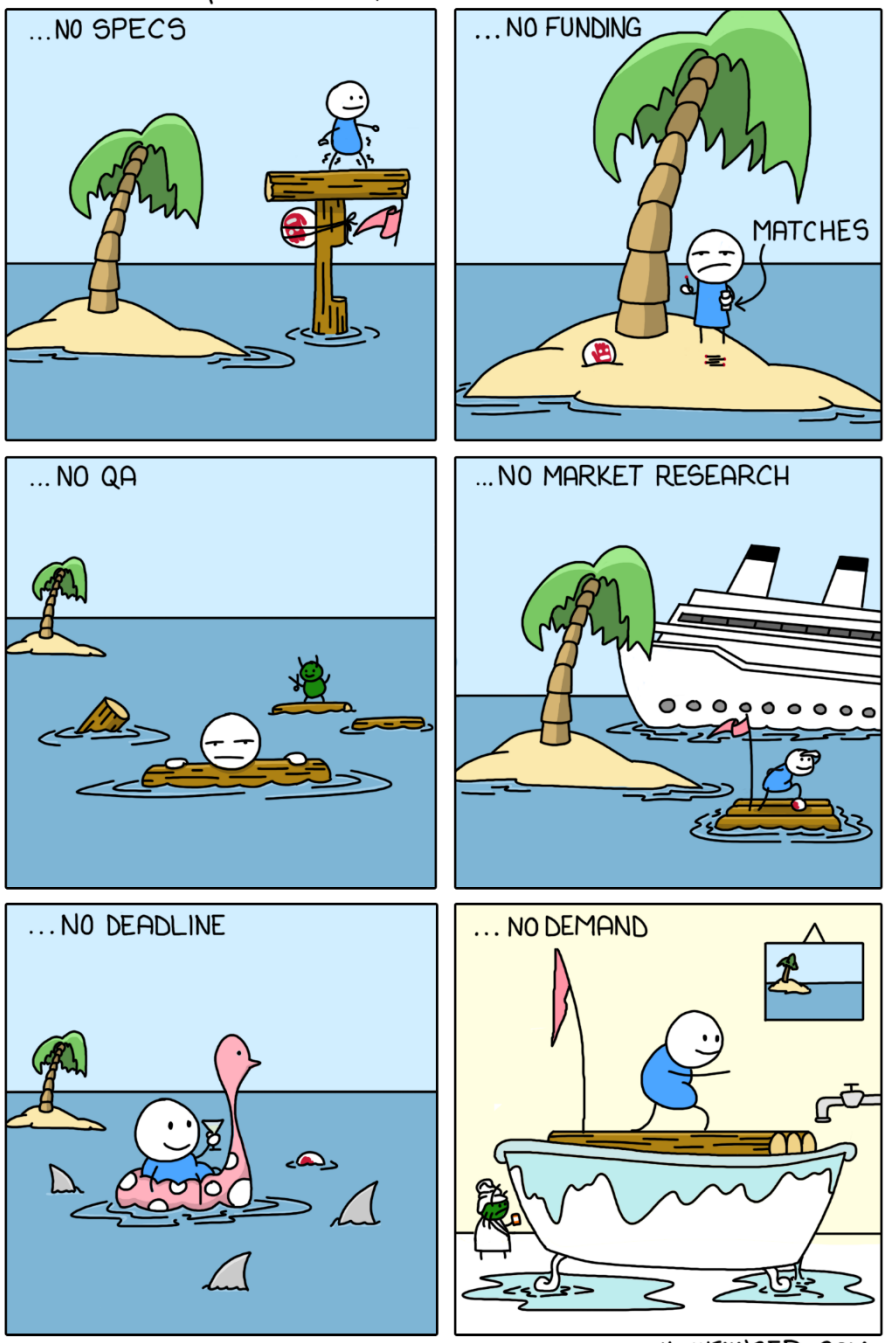


Client

Consistency

- followers only vote for candidates that are consistent with all their committed log entries
- only candidates with all committed log entries have a chance to win an election

BUILDING (A RAFT) WITH



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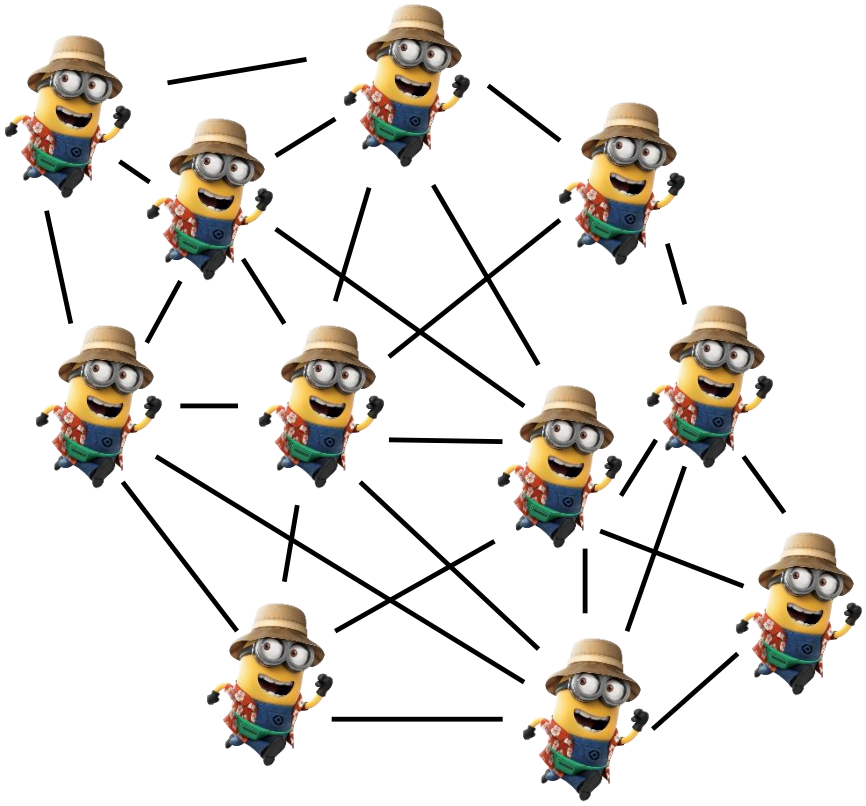
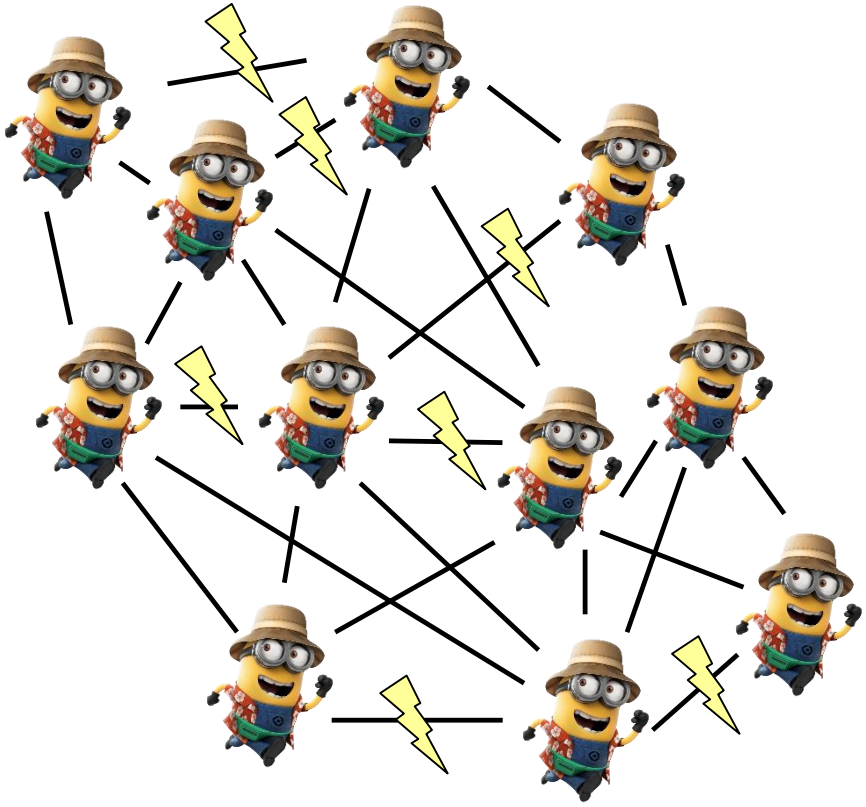
We did (almost) all of this...

- We followed the instructions from Diego Ongaro and John Ousterhout, **“In Search of an Understandable Consensus Algorithm”**
- all server processes are independent **threads** and let them
- Communication runs via **sockets**
- For each **socket listener** we generated a new thread that constantly performs a blocking socket-read
- Implemented in Python 3.6, since it provides a threading library with a fair **distributed scheduling** in terms of CPU allocation
- ZeroMQ as library for **asynchronous messaging**

What about failures?



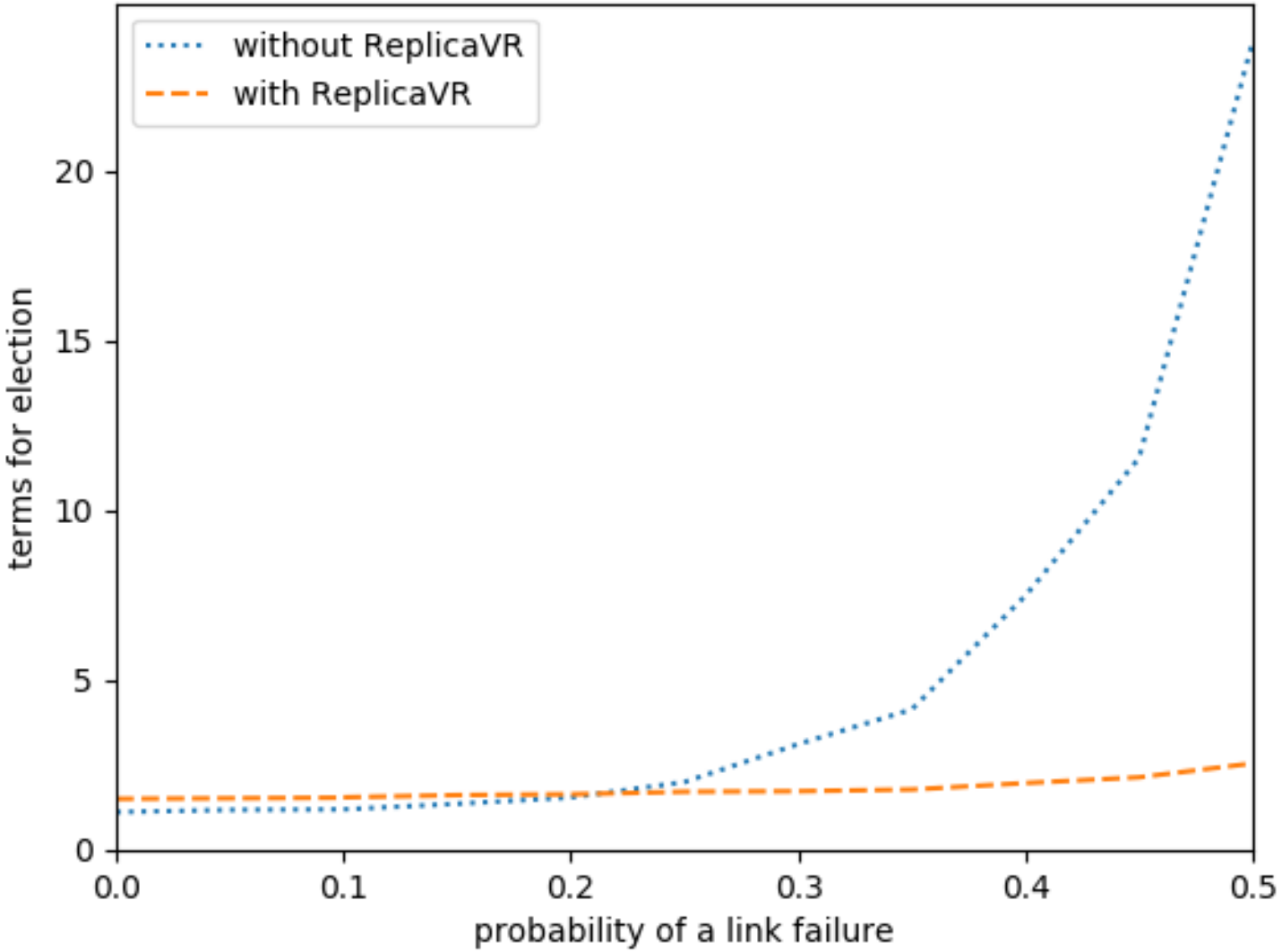
Link Failures



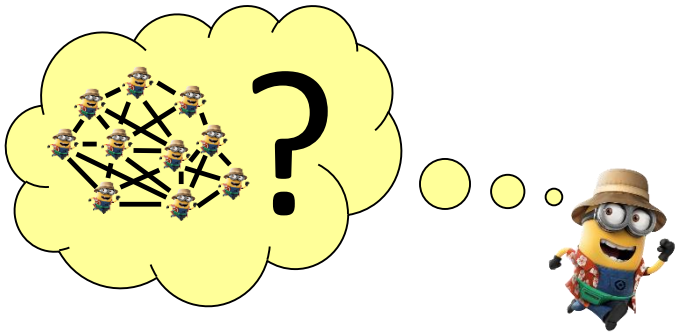
Link Failures: Policies

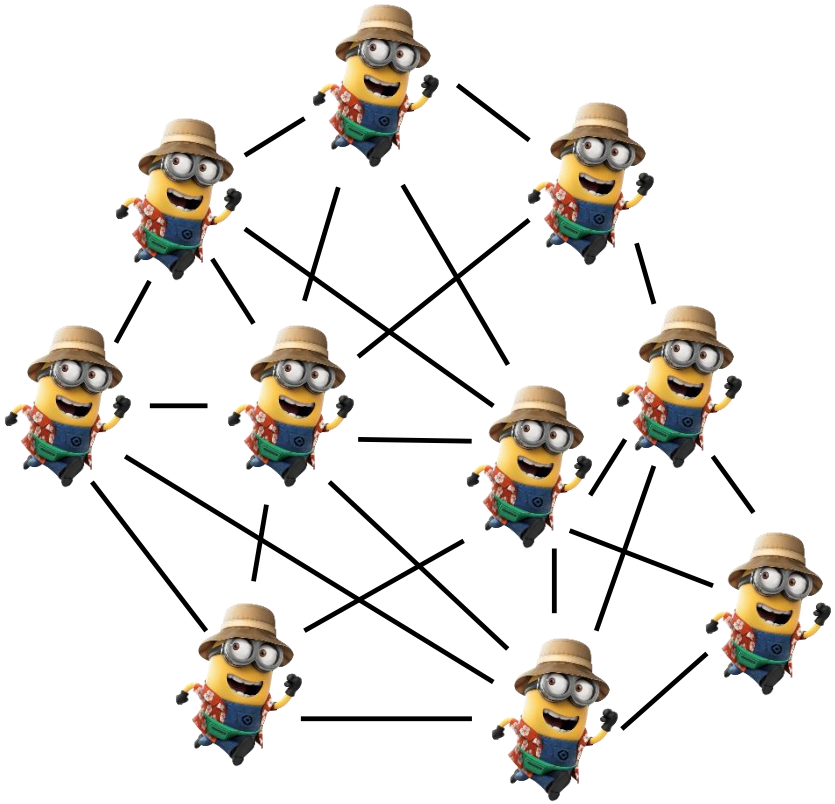
- send the RequestVote and the corresponding reply messages several times
- number of times a message is sent is equal to number of terms since the last leader was active

Link Failures: Evaluation



Isolation



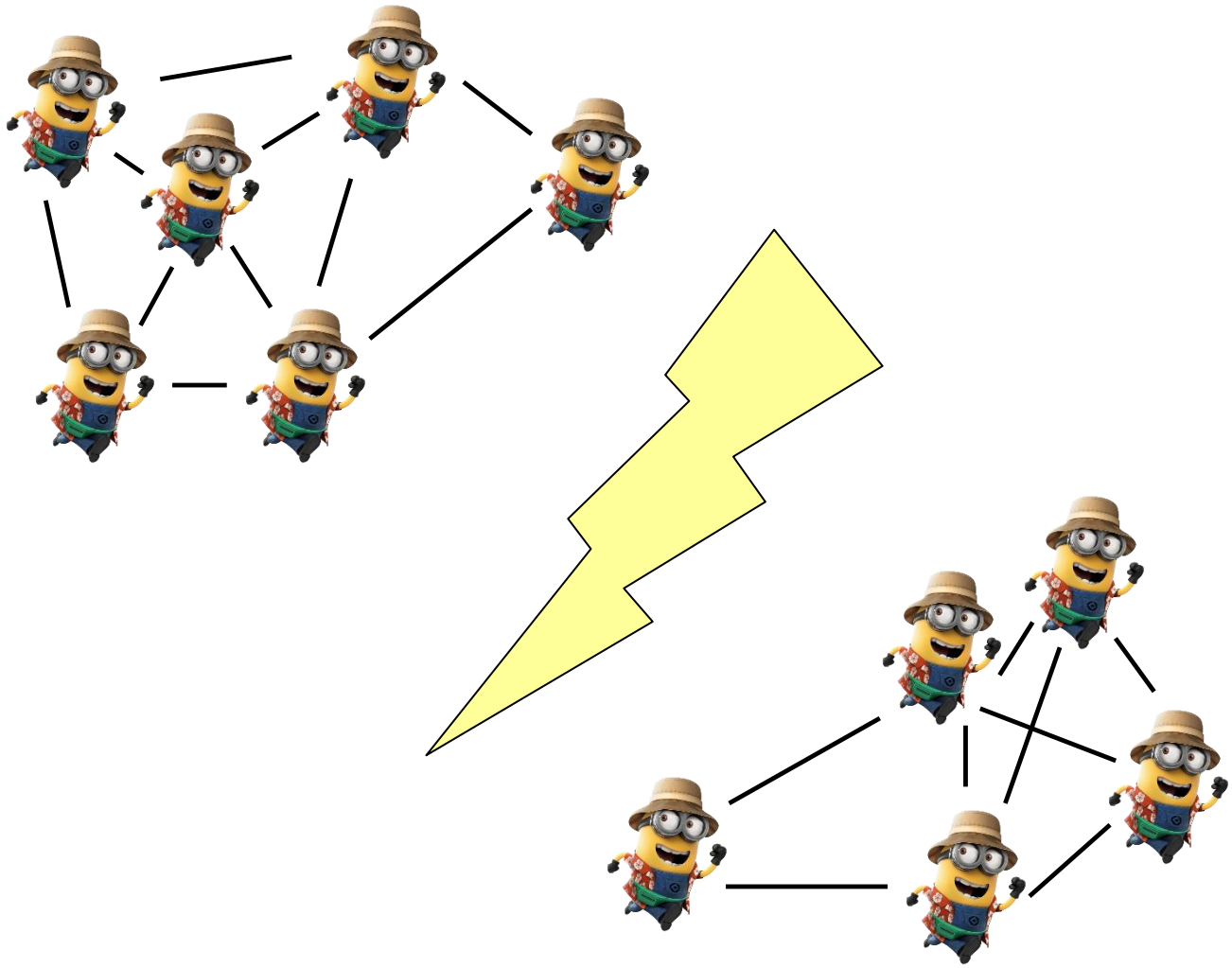


Isolation: Policies

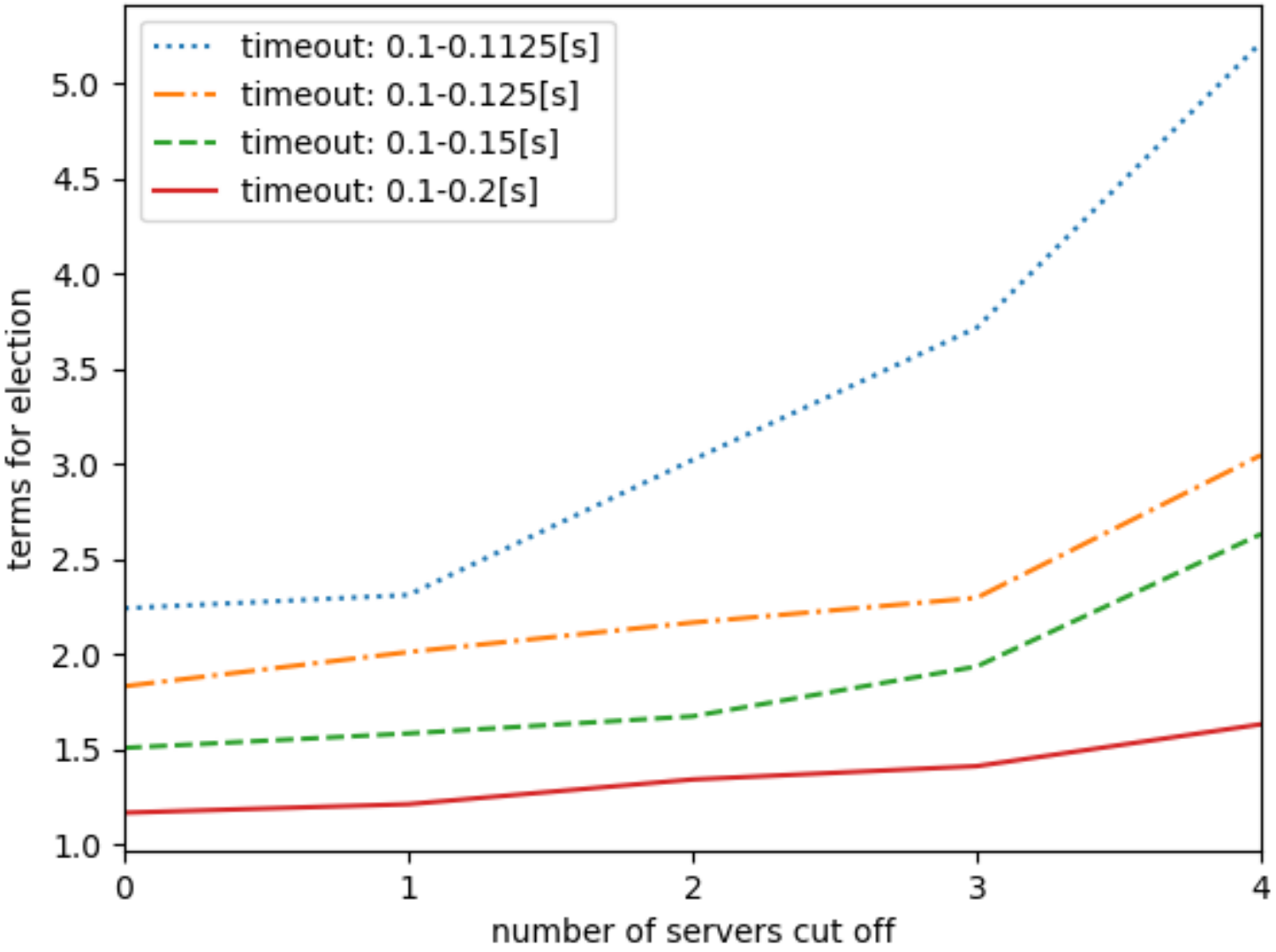
- Isolated server is a **leader**
  - **Commit Timeout**: timer for the leader when no more log entries have been committed within a certain time interval.

- Isolated server is a **candidate**
  - Each RequestVote has to contain the LastLeaderTerm
  - The server checks if its own LastLeaderTerm is higher
  - If this is true, the follower proceeds with the RequestVote as normal

Partition



Partition: Timeout Length

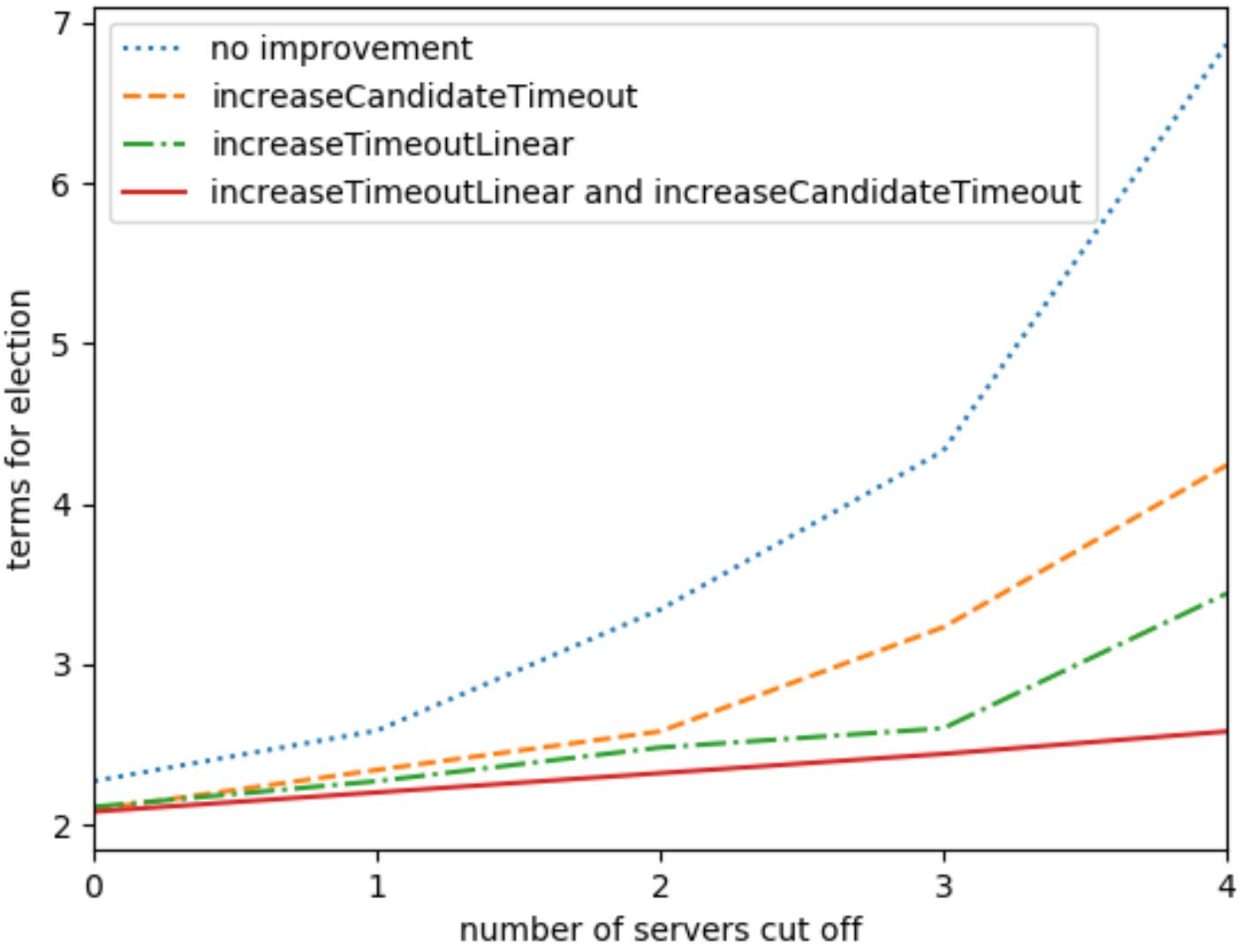


Partition: Timeout Policies

- increaseTimeoutLinear: Increase the timeout linearly, the more split votes happen

- increaseCandidateTimeout: Adjust the timeout according to the ratio between positive and negative votes

Partition: Comparison



Conclusion

- Link failures, Isolation, Partition
- Additional timers
- Small number of simulated servers
- Different interval policies may become relevant

Thank You!