Paxos made Live

n, $f < \frac{n-1}{2}$

$n = 2f+1$

Clients	Leader	Proposer	Acceptors	Replicas
8	0	0	0	0
8	0	0	0	0
	1	1	$2f+1$	$f+1$

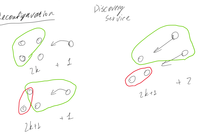
DC1	DC2	DC3	DC4
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

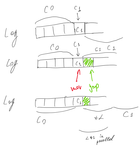
$f = 2$

$F = 1$

Empty log

Reconfiguration





RAFT

Leader election

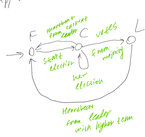
at most one leader in each (term) 0,1

Roles:
- Leader
- Candidate
- Follower

election timeout

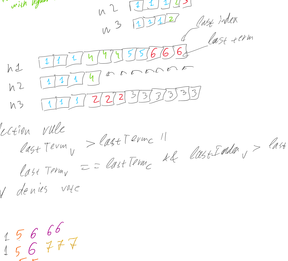
Election:
1) ++term
2) Become candidate
3) Request vote
   1. Majority votes
      - Become leader
      - Starts minor terms
   2. Heartbeat from valid leader
      - Become follower
   3. Timeout elapses
      - new election

Append Entries (command_batch)



Timeouts:
- timeout $\in [T, 2T]$
- $T \gg$ time of the round trip

log entry — (index, term, cmd)

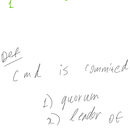


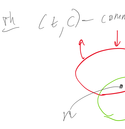
Election rule

if $lastTerm_v > lastTerm_c$ ||

$lastTerm_v == lastTerm_c$ && $lastIndex_v > lastIndex_c$:

v denies vote



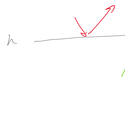


Def

Cmd is commited if

1) quorum
2) leader of t cmd with t

Th (t, i) — commited $\Rightarrow \forall t' \geq t$ (t, i) — in log of t' leader



$\forall t'' < t'$

(t, i) — in their logs

log n — prefix of log c

1) $lastTerm_c == lastTerm_n$, $len_n \leq len_c$

2) $\nexists\, t > lastTerm_c$ > $lastTerm_n \geq t$

KV

Get(k):

Read(k) → [n, v]

pick max n → v*

Set(k, v):

Read(k) → [(n, v)]

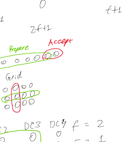
n' = max (n) + 1

write (k, n', v)

Get (k)

Read (k) → [(n, v)]

if (∃ n_i, n_j : $n_i \neq n_j$)

write (k, v*), where max n → v*

}