piChain

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piChain: When a Blockchain Meets Paxos
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Transaction
depth

parent

depth
New Transaction: Reaction Time

- quick
- medium
- slow

wait
wait

time
State Transitions

quick → medium → slow

seen: either deeper or by
Self-Healing

healthy
Self-Healing

$q > 1$

$q = 0$
$m > 1$

$q = 0$
$m = 0$

$\text{election}$

$q = 1$
$m > 0$

$q = 1$
$m = 0$

healthy

$q = 0$
$m = 1$
committed
Truncated Paxos

* and next propose

propose

ack

committed*

time
Normal Paxos

Round 1

1: Quick node $q$ sends “try $b_{new}$” to all nodes

2: On receiving a try message, all nodes:
3: \textbf{if} $b_{new}$ deeper than $b_{max}$ \textbf{then}
4: \hspace{1em} $b_{max} = b_{new}$
5: \hspace{1em} Answer $q$ with “ok $b_{prop}, b_{supp}$”
6: \textbf{end if}

Round 2

7: Node $q$: If majority responded with ok:
8: \hspace{1em} $b_{com} = b_{new}$
9: \textbf{if} some response included $b_{prop} \neq \bot$ \textbf{then}
10: \hspace{1em} $b_{com} = b_{prop}$ with deepest $b_{supp}$
11: \textbf{end if}
12: Node $q$ sends “propose $b_{com}, b_{new}$” to all nodes

13: On receiving a propose message, all nodes:
14: \textbf{if} $b_{new} = b_{max}$ \textbf{then}
15: \hspace{1em} $b_{prop} = b_{com}$
16: \hspace{1em} $b_{supp} = b_{new}$
17: \hspace{1em} Answer $q$ with “ack $b_{com}$”
18: \textbf{end if}

Round 3

19: Node $q$: If majority responded with ack:
20: Node $q$ sends “commit $b_{com}$” to all nodes

21: On receiving a commit message, all nodes:
22: Store $b_{com}$ in their list of committed blocks
A Typical Example

- **Existing transactions**
- **Transactions in blocks**
- **Committed transactions**
piChain vs. Raft

**similar** essentially same goals

**simple** e.g., no explicit leader election

**silent** no msg when no tx, no heartbeat

**scalable** $O(1)$ msgs per node per tx
Thank You!
Questions & Comments?

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