Distributed Algorithms in the Cloud

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Distributed Systems

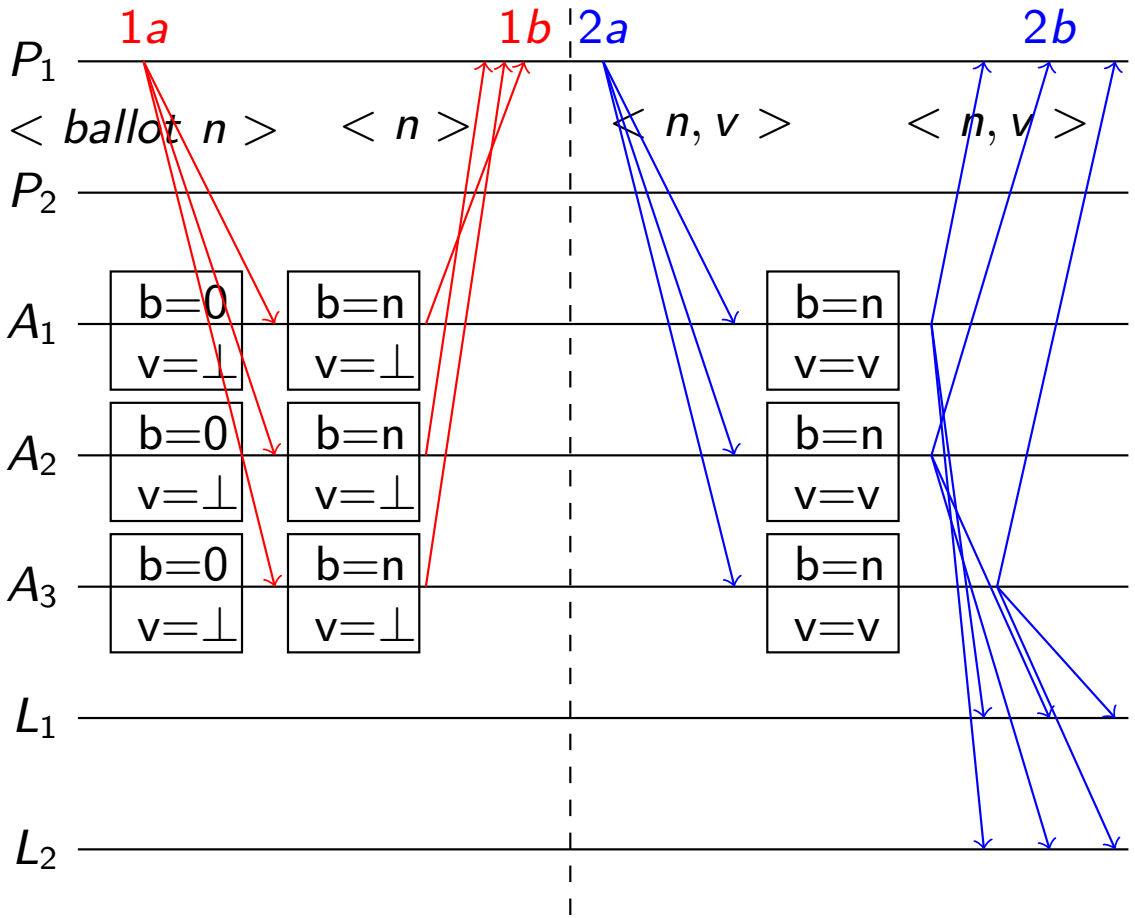
Problem

1. Scalability:
   - Size: Internet scale services
   - Location: Access latency
2. Fault-Tolerance

Solution

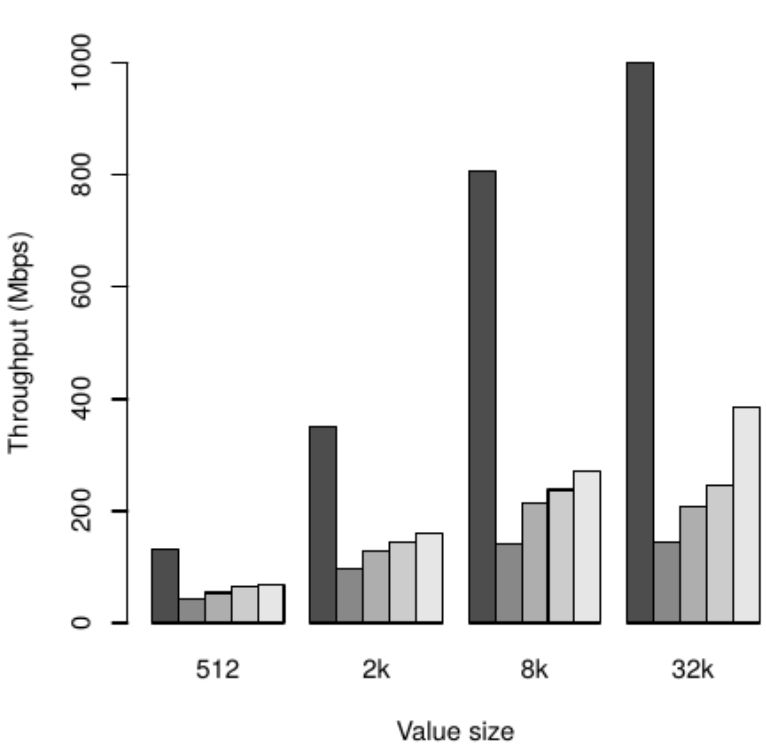
1. Distributed Data: Replication
2. Distributed Computing: Coordination

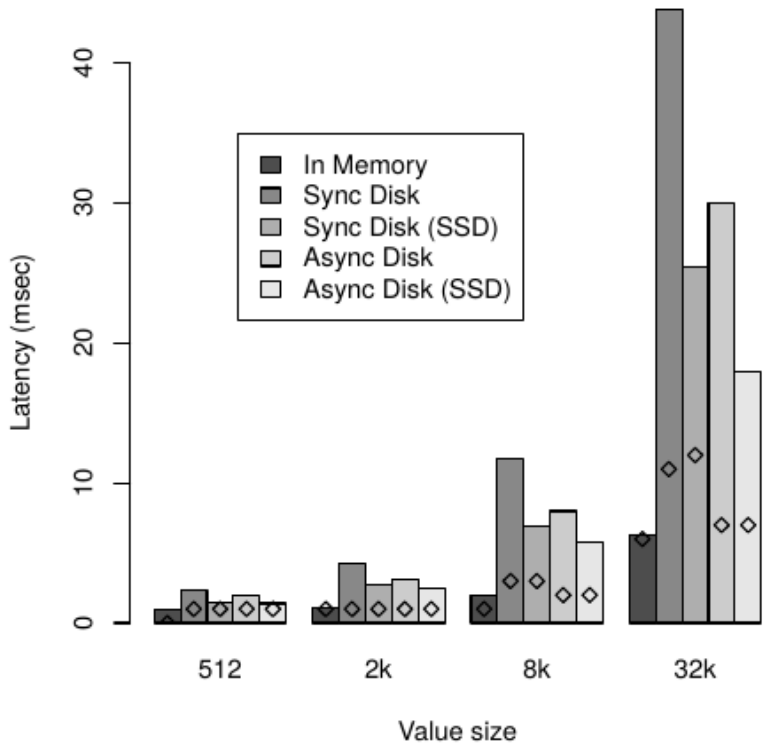
Example: Paxos



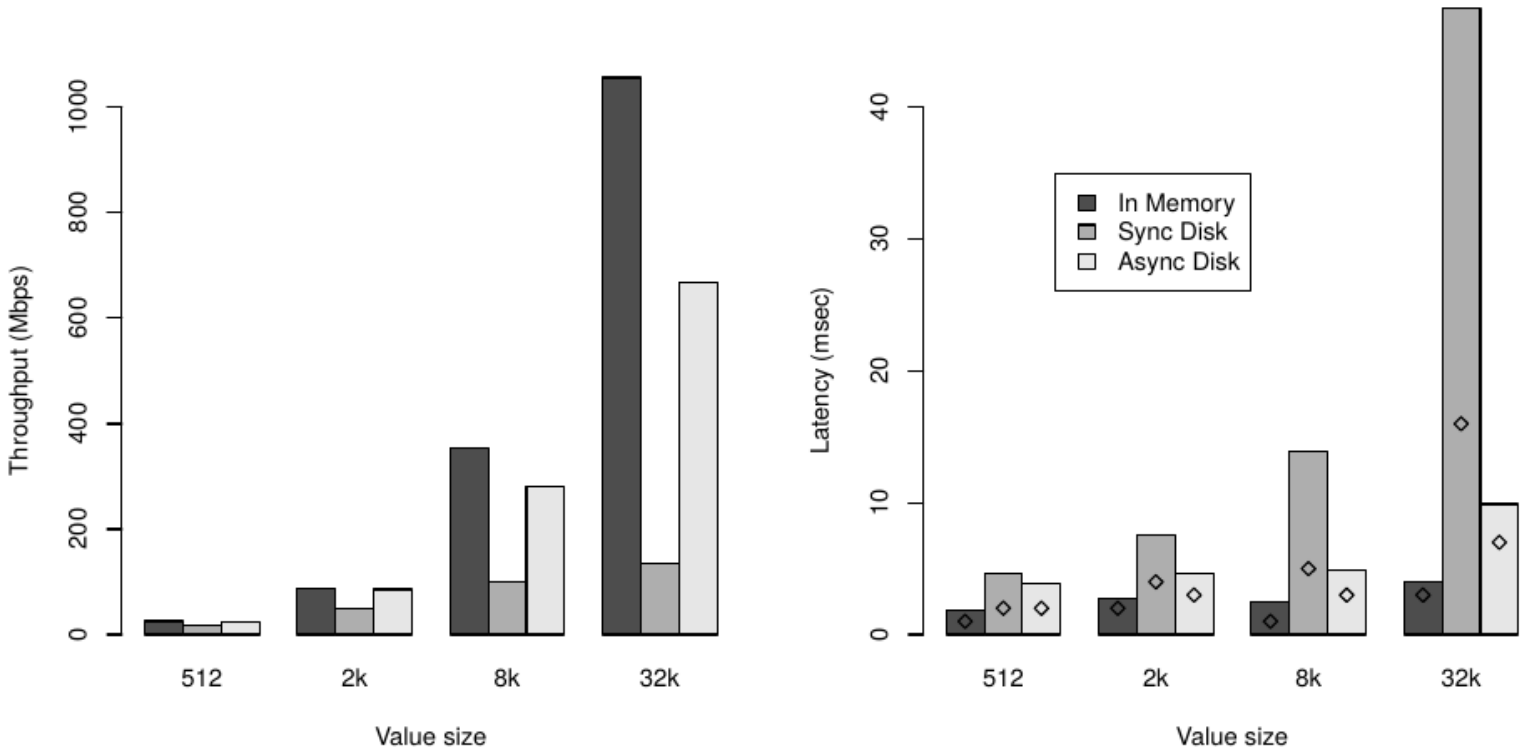
[Lamport. The part-time parliament. 1998.]

Research Group Cluster

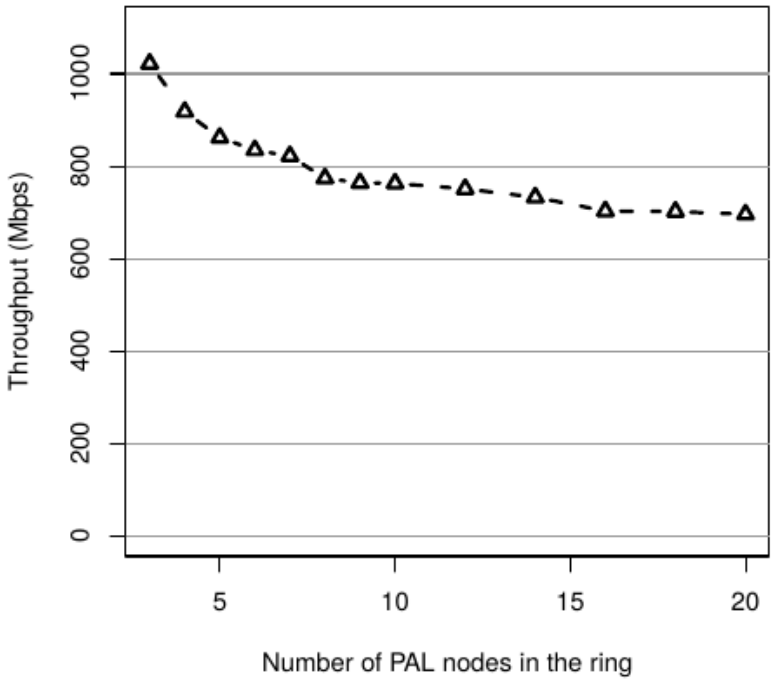


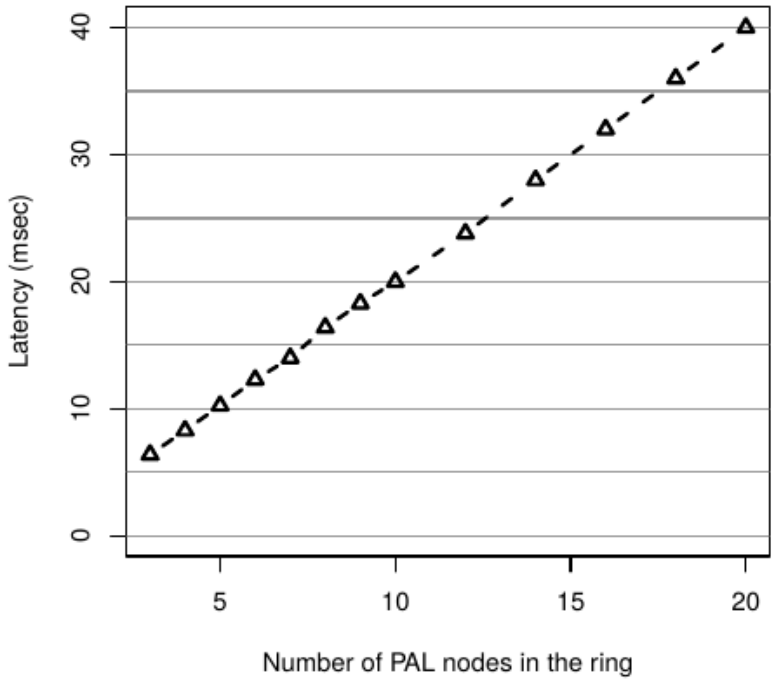


SWITCHengines



Scale-out


Throughput (Mbps)
0
200
400
600
800
1000
5
10
15
20
Number of PAL nodes in the ring


Latency (msec)
0
10
20
30
40
5
10
15
20
Number of PAL nodes in the ring

Conclusions

pros

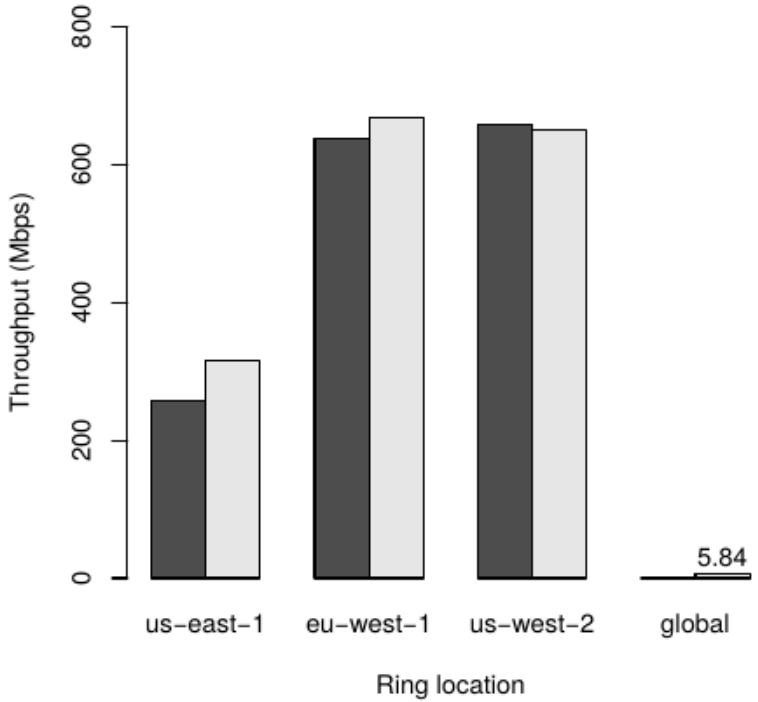
- Cloud performance is very good!
  - Scale-out tests
  - Local cluster alternative (near “deadline” experiments)
  - Usually geo-distributed

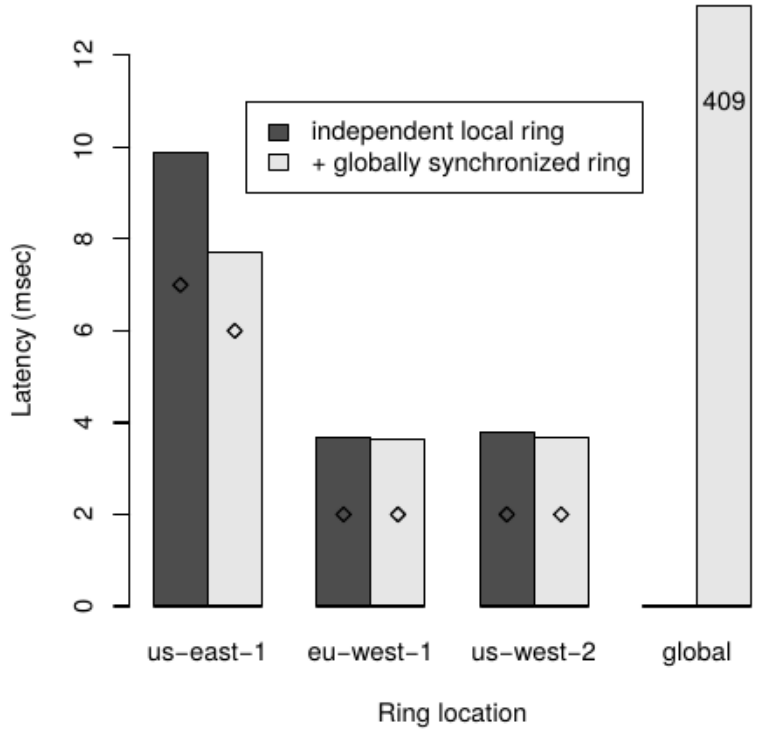
cons

- Shared resources (hard to reproduce or isolate performance problems)
- Deployment sometimes hard

github.com/sambenz/URingPaxos

Amazon EC2


Throughput (Mbps)
0
200
400
600
800
5.84
us−east−1
eu−west−1
us−west−2
global
Ring location


Latency (msec)
0
2
4
6
8
10
12
independent local ring
+ globally synchronized ring
409
us−east−1
eu−west−1
us−west−2
global
Ring location