Distributed Algorithms in the Cloud

Samuel Benz

Università della Svizzera Italiana

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

![Graph showing throughput and latency for different value sizes. The x-axis represents value sizes (512, 2k, 8k, 32k), and the y-axis shows throughput (left) and latency (right). The graphs compare In Memory, Sync Disk, and Async Disk performance.]
Scale-out

![Graph showing throughput and latency vs number of PAL nodes in the ring.](image)
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
Amazon EC2

![Graph showing throughput and latency for Amazon EC2 regions.]

- Throughput (Mbps) for regions:
  - us-east-1
  - eu-west-1
  - us-west-2
  - Global

- Latency (msec) for regions:
  - us-east-1
  - eu-west-1
  - us-west-2
  - Global

Legend:
- **Black** = independent local ring
- **Gray** = + globally synchronized ring

- Throughput ranges from 0 to 800 Mbps.
- Latency ranges from 0 to 12 milliseconds.

Global throughput is 5.84 Mbps.

Global latency is 409 milliseconds.