Reliability

10:50am – 12:10pm
Tuesday, 10/9

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Web Services Are Important

Services Need to Be Reliable!
Web Services Are Huge

2.5 B – content items shared
2.7 B – “likes”
300 M – photos uploaded
105 TB – data scanned
500 TB – new data ingested

Service Is Distributed
Failure Happens

• Causes
  – Software bugs, misconfiguration, etc.
  – Hardware, power cut, natural disasters, etc.

• Scope
  – Single machine, rack, datacenter, etc.
Failure Is Inevitable
Failure Is Inevitable
System Reliability

• How well does a system tolerate failures
  – How effective?
  – How efficient?
  – Minimizing user impact? “Maelstrom”
  – Etc.

“Fuzzylog”, “SAUCR”
State Machine Replication – replicas like a single copy

- Multiple copies (replicas)
- Same input
- Same order
SMR Protocols

Op_A → A ~ G → Paxos → A ~ G → Op_C

Op_B
SMR Protocols

Op_A, Op_C, Op_B

A ~ G

Op_A, Op_C, Op_B

A ~ G

Op_A, Op_C, Op_B

Majority Wins

Op_A, Op_C, Op_B

A ~ G
SMR Protocols

“The FuzzyLog: A Partially Ordered Shared Log”

• How do they solve the problem of expensive total ordering in shared log approach?
“Fault-Tolerance, Fast and Slow: Exploiting Failure Asynchrony in Distributed Systems”

- Memory storing states
  - Fast, but less durable

- Disk storing states
  - Durable, but slow

Sweet spot?
“Maelstrom: Mitigating Datacenter-level Disasters by Draining Interdependent Traffic Safely and Efficiently”

• How does Facebook serve user requests when an entire datacenter is down?

• How do they test/evolve the failure recovery subsystem?
“Taming Performance Variability”

• Performance reliability of hardware
  – How does service providers control the variability of devices provided for users?
  – How do users cope with hardware variability when running experiments?
Conclusion

• Reliable web services are important!
  – Good user experience & revenue

• Reliable web services are challenging!
  – Large scale & failures everywhere

• Solution: state machine replication

• Talks in reliability session
  – More efficient protocols
  – How Facebook deals with DC disasters
Thank you!
Service Is Distributed

Web Clients

Storage Servers

stateless

stateful

A ~ G

Q ~ Z
Failure Is Inevitable
Failure Is Inevitable

• “the probability of seemingly strange behavior can be made very small. However, the distributed nature of the system dictates that this probability can never be zero.”

System Reliability

• How well does a system tolerate failures
  – How effective/efficient are the mechanisms
  – How fast is the recovery
  – How well do they avoid impact on users
  – Etc.
SMR Protocols

Op_A, Op_C, Op_B

A ~ P ~ B

Primary-backup
SMR Protocols

Writes:
$Op_A, Op_C, Op_B$

A ~ C

H

Chain replication

A ~ G

T

G

Reads