AmazingStore: Available, Low-cost Online Storage Service Using Cloudlets

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Motivation

- Online storage services are getting increasingly popular
  - Amazon’s S3, EMC’s Mozy …
  - Rely on data centers.

- Challenges
  - Threatened by the single point of failure.
    - Amazon suffers outages (3 times); Gmail is down (4 times) …
    - Social networks make downtime harder to hide.
  - Incur high hardware, network and cooling costs.

- P2P storage
  - Use idle resource of users to avoid costs
  - Provide low availability because of churn.
Motivation

- Best of both worlds
  - Stability of data center
  - Low cost of P2P

P2P Storage Layer
AmazingStore Design

- Combine data center and P2P storage system
AmazingStore Design

- During data center outage
  - Degrade to pure P2P storage
  - Peers closest to servers are assigned as new master nodes.
AmazingStore Design

- Determine replication degree at the peer layer
  - Threshold $c$ derived from hybrid availability model

\[
c = \frac{\log(1 - A) - \log(1 - \mu_S)}{\log(1 - \mu_p)}
\]
AmazingStore Design

- Maintain replication level at the peer side
  - Probabilistic failure detection
  - Group-level estimator of replica number

Possible situations

\[ \Pr(A \text{ and } B \text{ are transient}) = 0.36 \]
\[ \Pr(\text{one is transient, the other is permanent}) = 0.58 \]
\[ \Pr(A \text{ and } B \text{ are permanent}) = 0.06 \]

\[ \Pr(\text{permanent | offline 5 hours}) = 0.1 \]
\[ \Pr(\text{permanent | offline 25 hours}) = 0.6 \]
AmazingStore: Sharing & Storage

- Upload files important to you

Sharing Files locally with DHT

File Storage with guarantee

No guarantee

SLA: Availability guarantee

Upload files
Preliminary Measurements

- composed of users and data center containing PKU servers.

- As of early April. 2010
  - Registered users > 11,820
  - Daily peak of online users > 1000
  - Data objects > 52,055.

- Provides a target of two nines availability
  - The data center availability is only 0.932
  - maintain at least 6 replicas at peer side.
Availability Improvement

- Overall availability jumps from 93.22% to 99.13%
- Availability gained at peer side is 83.8%
Bandwidth offloading

- 90.38% requests were handled by the peer layer.
- Average download bandwidth is 2.1MB/sec
Discussion

- Edge-cached system cannot work alone.

![Graph showing only cached replicas](image-url)
Discussion

- AmazingStore works well with data recovery

**Cached replicas + Repaired replicas**

*Guarantee enough replicas*
Conclusion

- We advocate that data center and peers can complement well.
- We describe a deployed prototype called AmazingStore.
Questions?

Thank you!