Remote Mirroring over Low-bandwidth WAN with iSCSI

Ming Zhang (mingz at ele.uri.edu)

Adviser: Dr Qing(Ken) Yang
High Performance Computing Laboratory
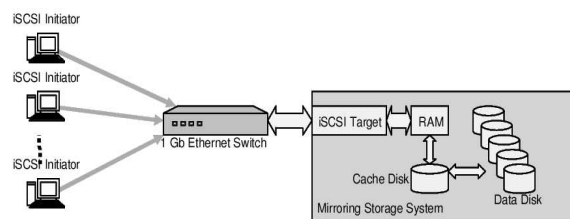University of Rhode Island

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Motivation

- Why remote mirroring?
  - Mouse (FAR); PC ($1,000); Storage ($10,000);
  - Data (priceless)
- Why remote mirroring on low-bandwidth WAN?
  - Cost: 40 Mbps ATM ($60,000/year in CA) *vs.* 3 Mbps Cable ($1,200/year in RI).
  - Data: 50 TB/year (40 Mbps) vs. 3.7 TB/year (3 Mbps) (assume the average throughput can only achieve 1/3 of maximum value).
- Why remote mirroring over iSCSI?
  - SCSI over **TCP/IP**;
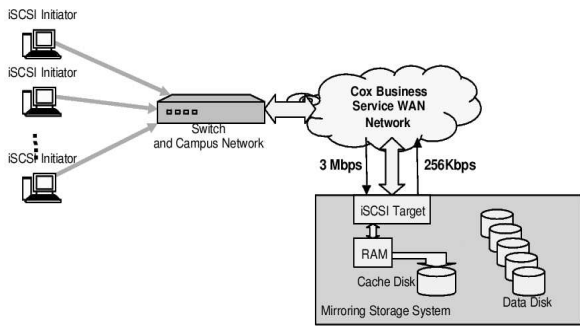 - Open Standard vs. proprietary techniques.

Experimental Methodology

- LAN and WAN
- iSCSI and DCD enhanced iSCSI
- Hardware configurations:
  - S-S, S-iL, S-iW, S-iDL, S-iDW
- Workloads:
  - PostMark, IoMeter
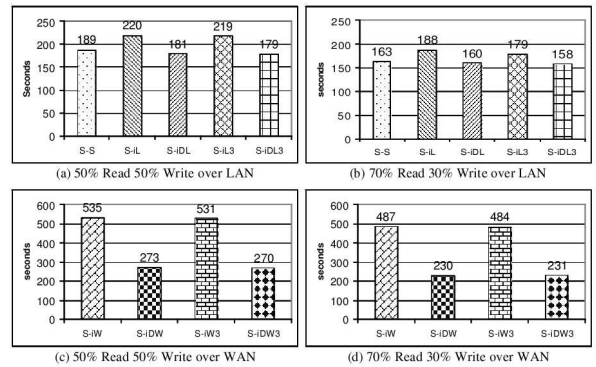 - Traces: Financial-1, Financial-2, TPC-C
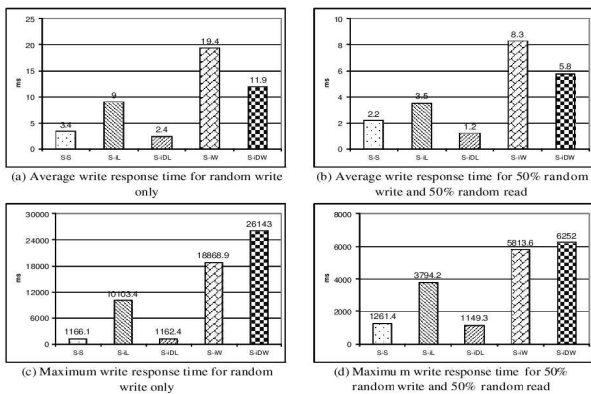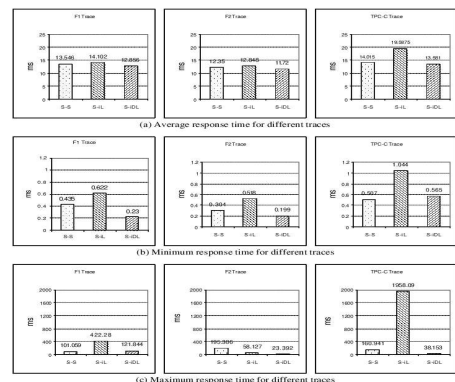

Environment Setting - LAN

Experiment Setting - WAN

PostMark Results

(a) 50% Read 50% Write over LAN

(b) 70% Read 30% Write over LAN

(c) 50% Read 50% Write over WAN

(d) 70% Read 30% Write over WAN

IoMeter Results

(a) Average write response time for random write only

(b) Average write response time for 50% random write and 50% random read

(c) Maximum write response time for random write only

(d) Maximum write response time for 50% random write and 50% random read

Trace Results (1)

(a) Average response time for different traces

(b) Minimum response time for different traces

(c) Maximum response time for different traces
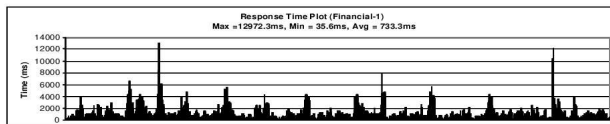
Trace Results (2)

- Response time plot of traces in WAN environment

Response Time Plot (Financial-1)
Max =12972.3ms, Min = 35.6ms, Avg = 733.3ms

(a) Financial-1

Response Time Plot (Financial-2)
Max = 5123.6ms, Min = 28.0ms, Avg = 405.3ms
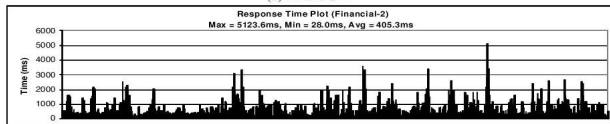
(b) Financial-2

Trace Results (3)

Response Time Plot (Financial-1)
Max = 6413.9ms, Min = 61.0ms, Avg = 379.5ms

(a)

Response Time Plot (Financial-2)
Max = 5435.8ms, Min = 46.5ms, Avg = 250.0ms

(b)

Response Time Plot (TPC-C)
Max = 9272.4ms, Min = 350.7ms, Avg = 2578.9ms
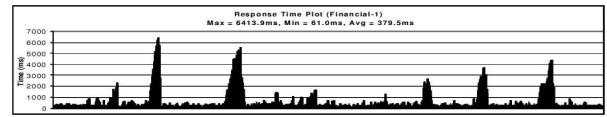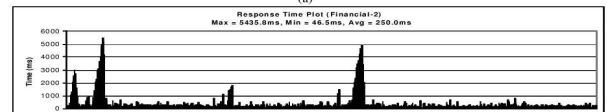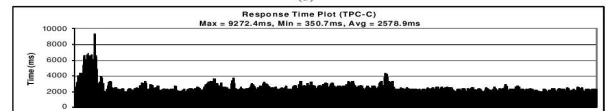
(c)

Conclusion

- Remote mirroring over low-bandwidth WAN with iSCSI is a cost-effective and feasible solution;
- Asynchronous mirroring is needed for low-bandwidth WAN.
- Aggressive caching at iSCSI target side can greatly improve the performance.