

Measurement & Analysis of Multimedia Streaming

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CIS 510

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Type of Mechanism

◆ Server based

- Collect trace log at server
- Paper 1, Characterizing User Access to Videos on the World Wide Web

◆ Client based

- Collect trace log near a group of clients
- Paper 2, Measurement and Analysis of a Streaming-Media Workload

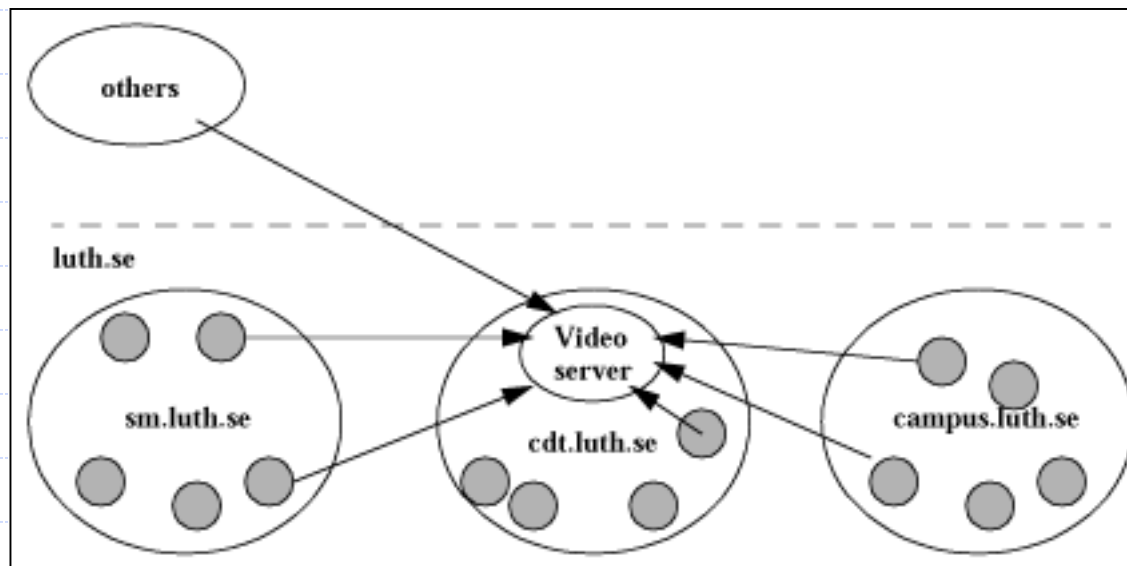
Paper 1: Motivation

- ◆ Know little about the user patterns
 - Temporal locality
 - Access frequency & preference
 - Partial access

- ◆ Can be used for performance improvement
 - Proxy caching, e.g....
 - Pre-fetching, e.g....

Methodology

- ◆ Trace in a high speed network for over 6 months
 - Avoid network factor
 - Focus on access patterns
- ◆ Extract data & analyze them



Methodology (2)

◆ Log format

- Ex: 02:01:33 salt.cdt.luth.se GET Movie1
03:10:11 aniara.cdt.luth.se STOP Movie2

◆ Log type & filtering

- Starting a video playback session (keep)
- Stopping a session (keep)
- Joining an in-progress session (keep)
- Retrieving HTML documents (eliminate)
- Retrieving images (eliminate)

File Characteristics

◆ Size

- Total 15.7 GB, most common 125 MB, mean size 121 MB

◆ Duration

- Range from 10 min to 2 hours, most common 90–100 min, mean length 75 min

◆ Bit Rate

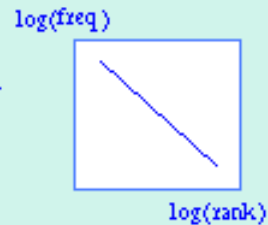
- Most common 150–250 Kb/s

Zipf's Law (Zipfian Distribution)

◆ Definition

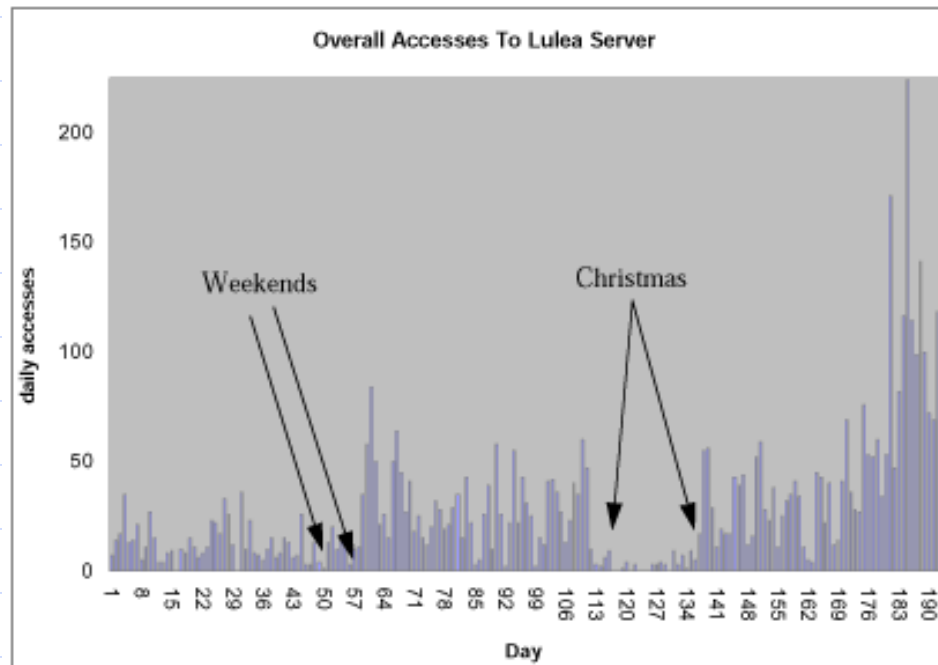
- Occurrence frequency of some event (P) is a power-law function of the rank (i), $P_i \sim 1/i^a$, with the exponent a close to 1

ZIPF'S LAW



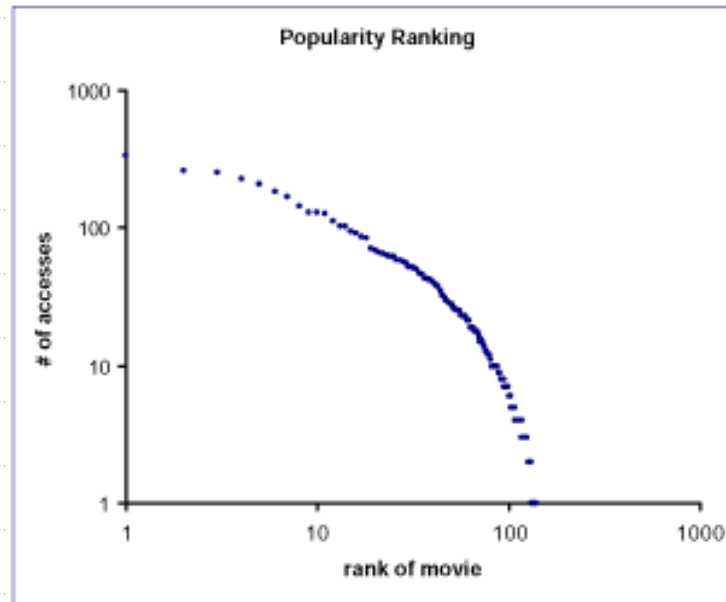
Trace Collection & Analysis

- ◆ Video access by day
 - Low during the weekend and holidays



Trace Collection & Analysis (2)

- ◆ Video access by Movie Title
 - Access is biased towards popular ones.
 - Not showing Zipf's distribution



Trace Collection & Analysis (3)

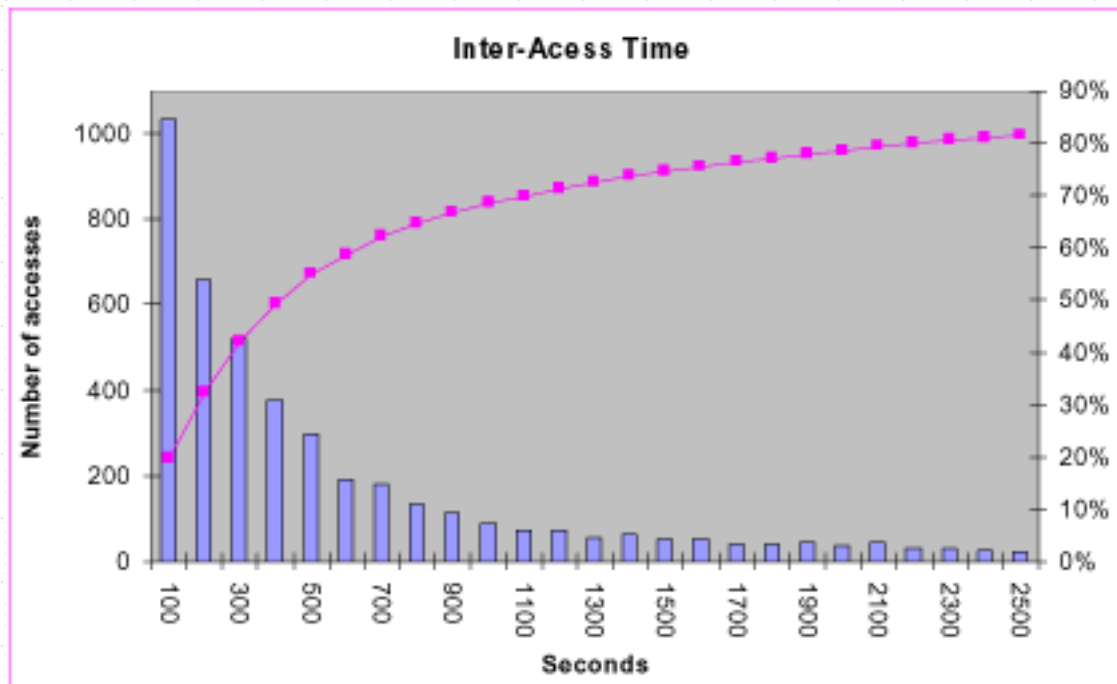
◆ Video Access by Machine

■ Spatial locality

- ◆ Few machines are responsible for most of the requests
- ◆ CDN server

Trace Collection & Analysis (4)

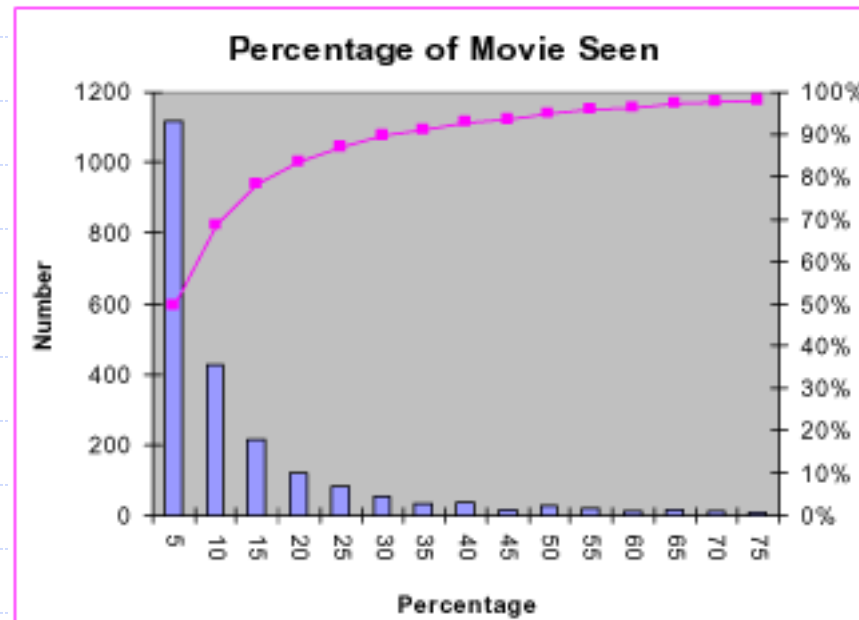
- ◆ Inter Access/Request Arrival Time
 - tend to arrive in a short time



Trace Collection & Analysis (5)

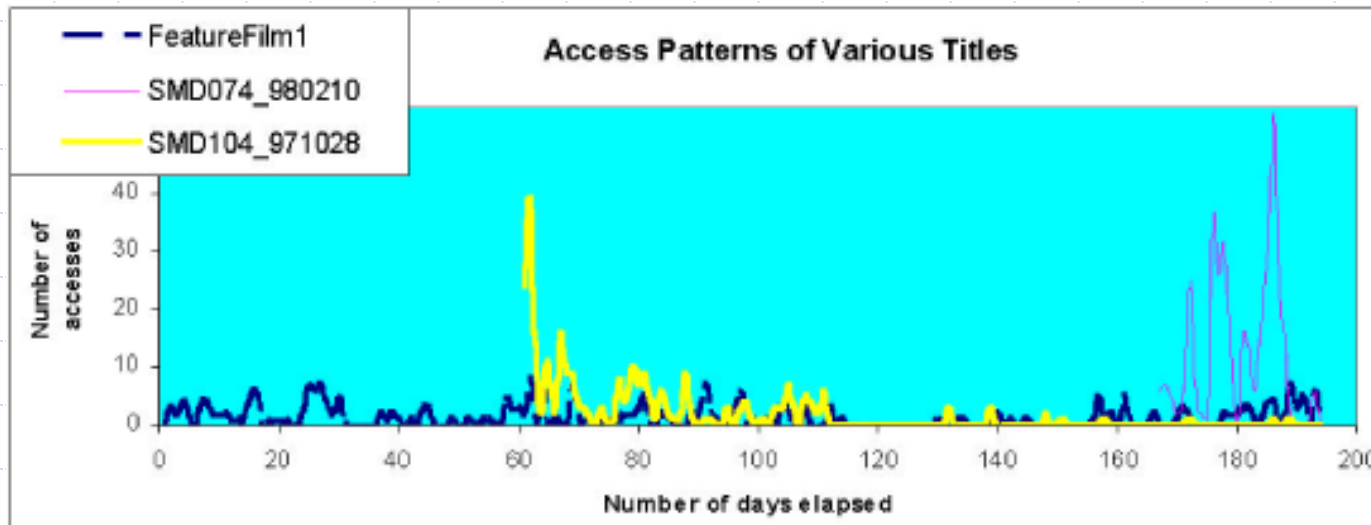
◆ Partial Access

- Tend to stop earlier
- Not the case for network congestion



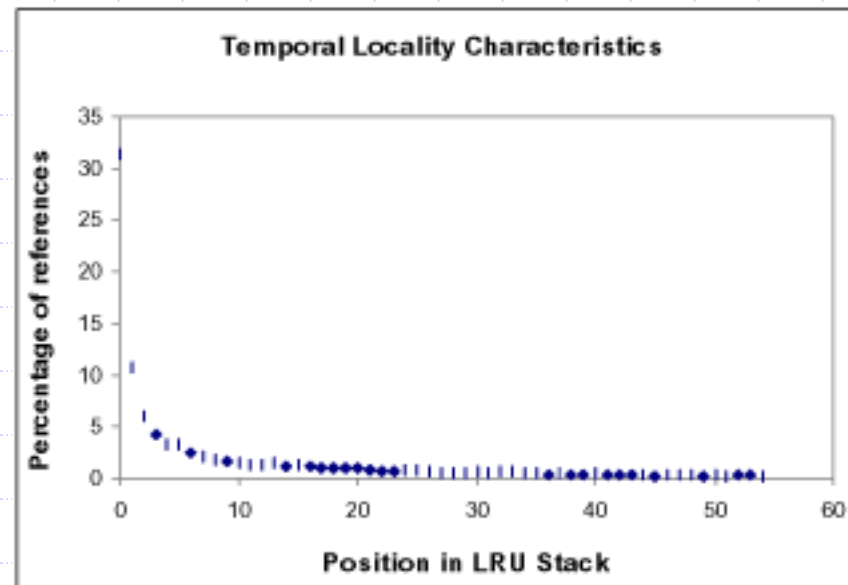
Trace Collection & Analysis (6)

- ◆ Behavior of different types
 - Different types, different behavior



Trace Collection & Analysis (7)

- ◆ Temporal Locality
 - Use LRU to measure



Findings & Contributions

- ◆ Partial access
- ◆ Temporal locality
- ◆ Spatial locality
- ◆ Difference of Access
 - category

Paper 2: Motivation

- ◆ Performance of optimizations is unclear
- ◆ Access pattern comparison with HTTP WWW
 - Bandwidth utilization
 - Server & object popularity
 - Object sharing
- ◆ Observation
 - Session duration & bit rate
 - Temporal locality
- ◆ Optimization policy
 - Proxy caching
 - Multicast delivery

Background Knowledge

◆ Stream control protocol

- Interactive control of stream, e.g. RTSP
- Typically rely on TCP

◆ Media packet protocol

- Data delivery & packet encapsulation, e.g. RTP

Background Knowledge (2)

◆ Encoding formats

- Stream digitization, e.g. MPEG-2

◆ Storage formats

- Stream storage mechanism, e.g. ASF

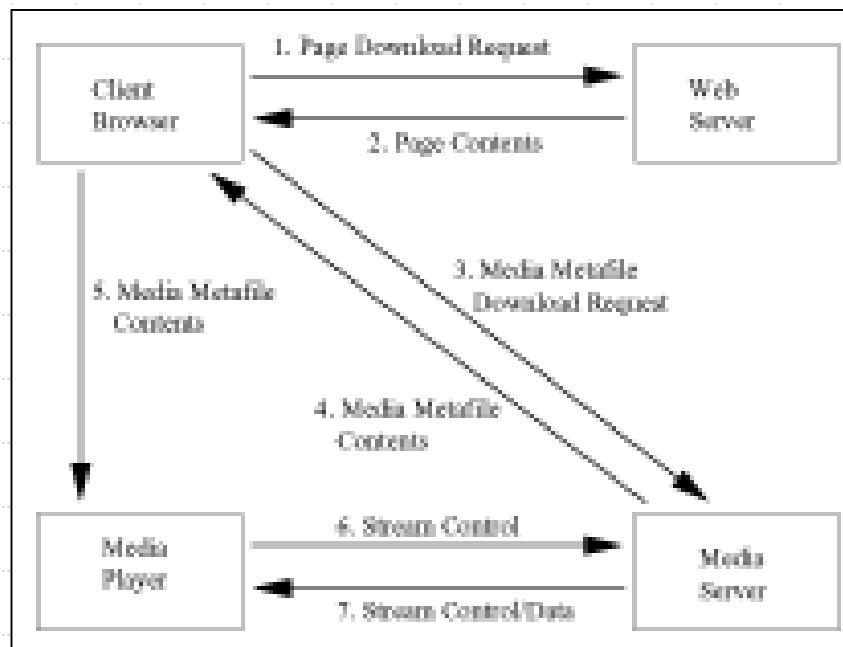
◆ Metafile formats

- Stream identification & attributes, e.g. ASX
 - ◆ Temporal & spatial attributes

Methodology

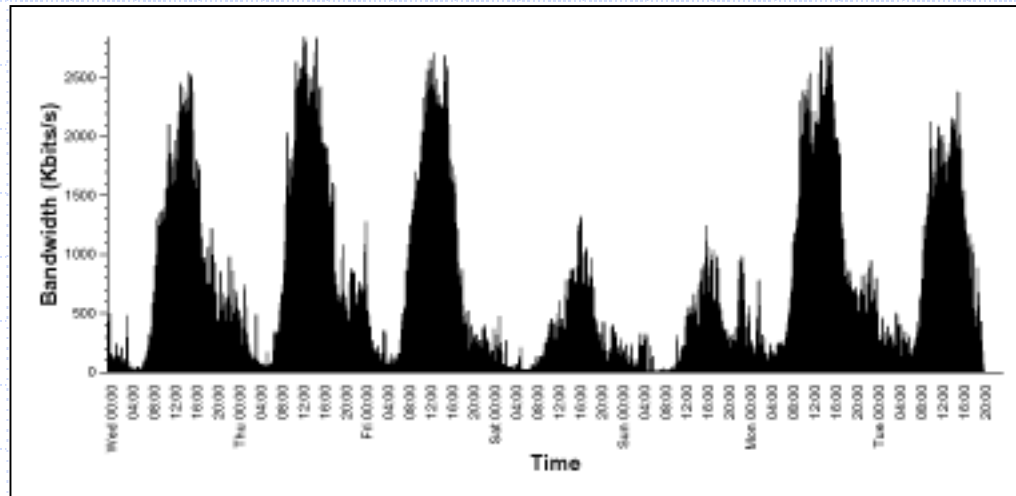
- ◆ Collect a continuous trace at the border routers
- ◆ monitor clients on campus accessing servers outside

RTSP overview



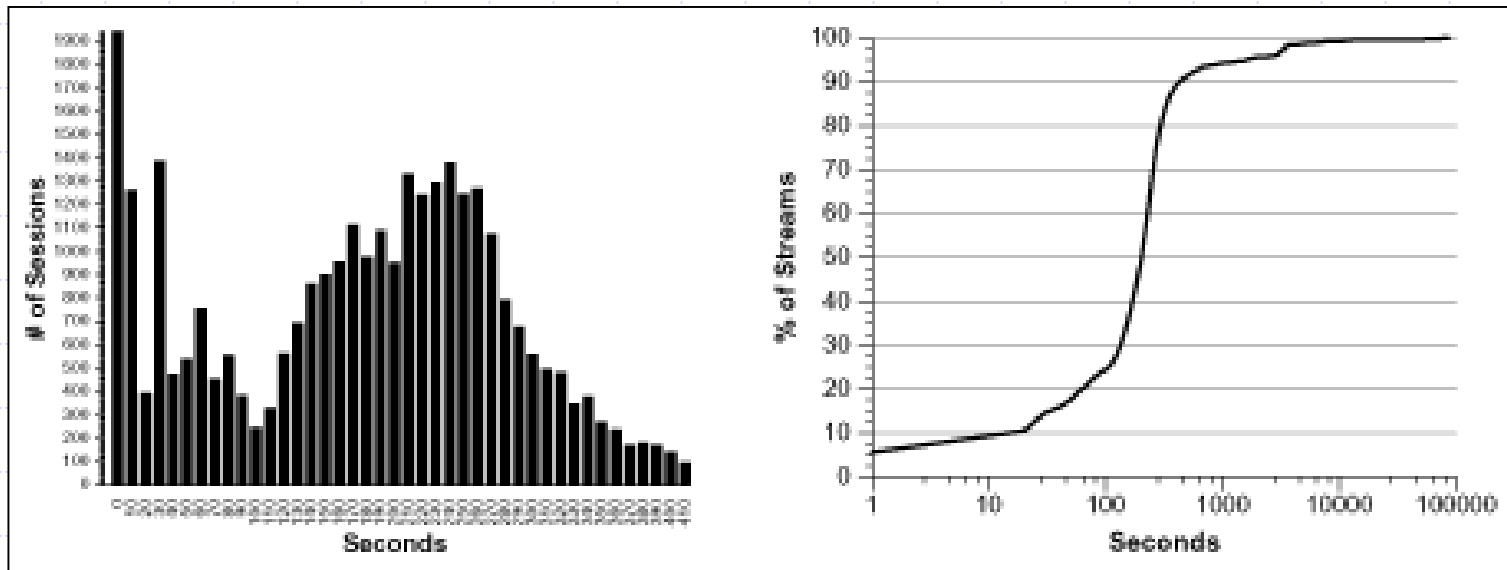
Trace Collection & Analysis

- ◆ Diurnal cycles
- ◆ Low bit rate
 - Server encoding



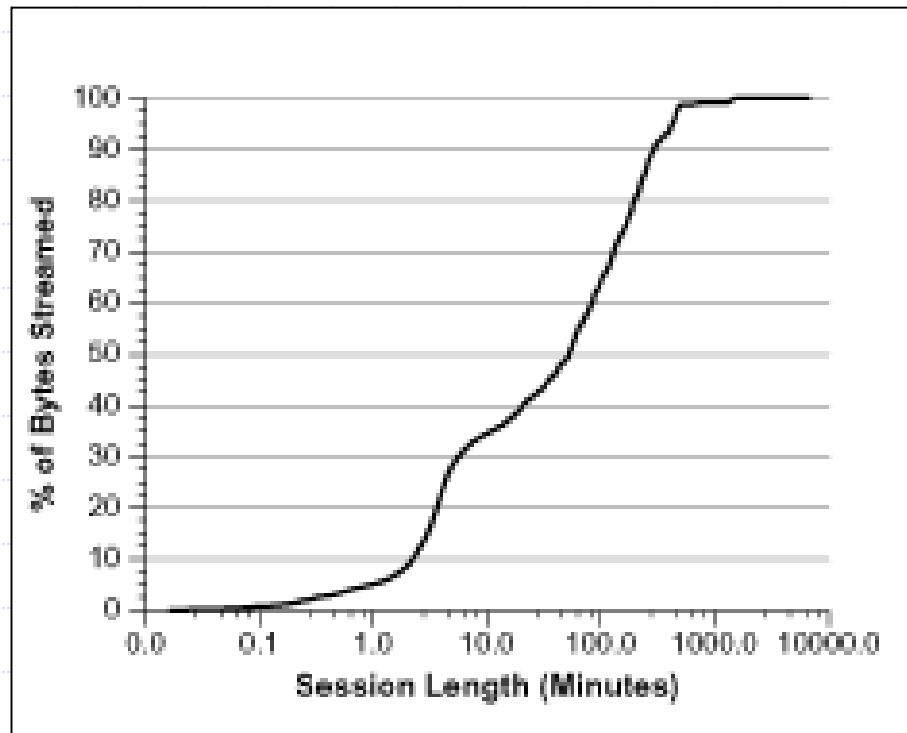
Trace Collection & Analysis (2)

- ◆ Advertised stream length
 - From the metafiles
 - Short streams are preferred



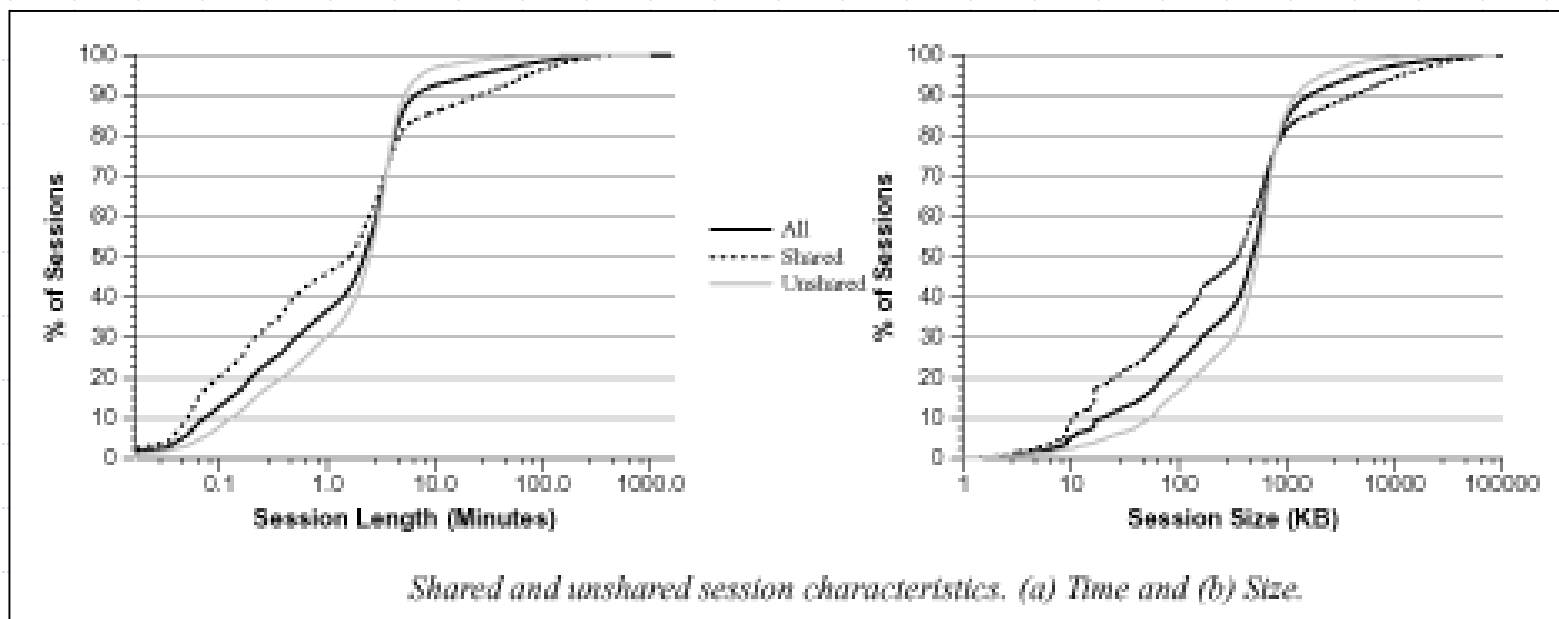
Trace Collection & Analysis (3)

◆ Duration/length vs. bytes transferred



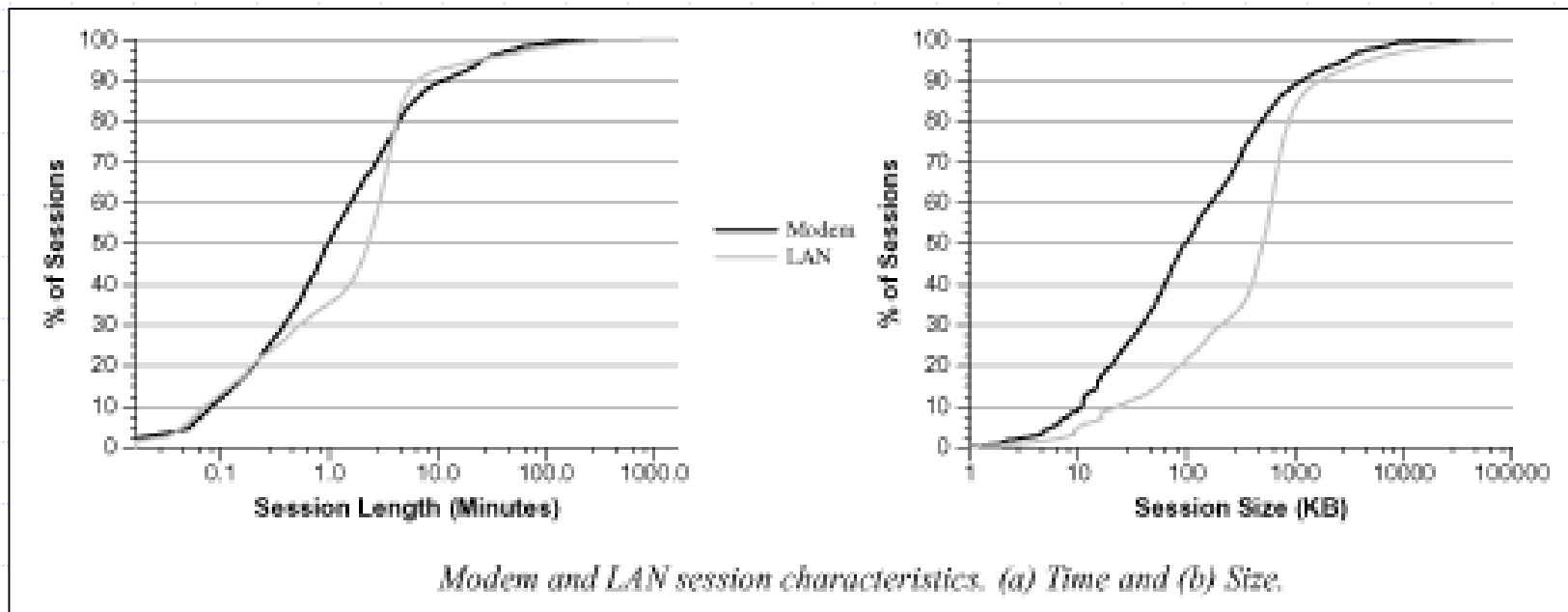
Trace Collection & Analysis (4)

◆ Shared accessing vs. unshared accessing



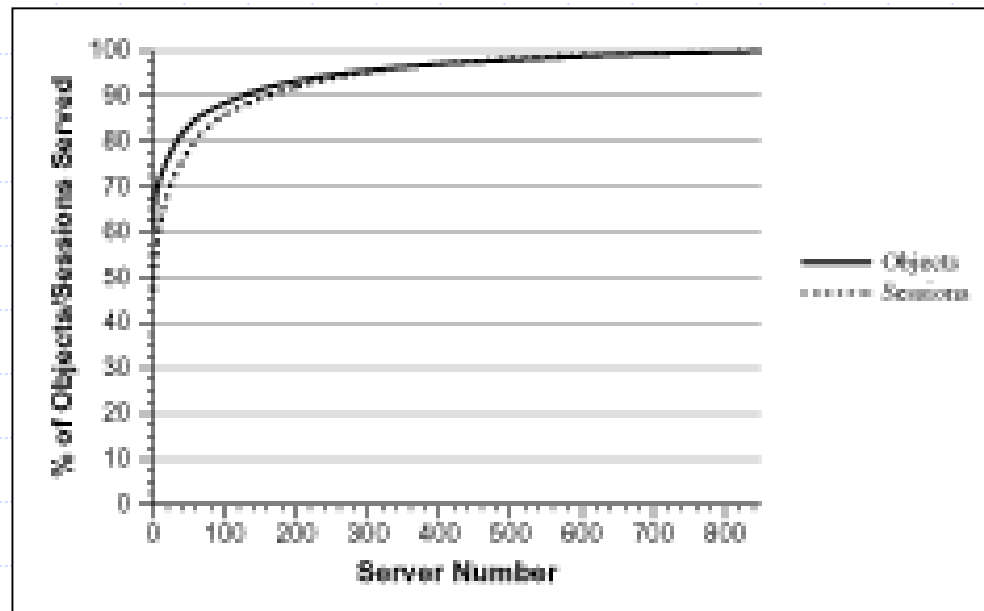
Trace Collection & Analysis (5)

◆ LAN session vs. Modem session



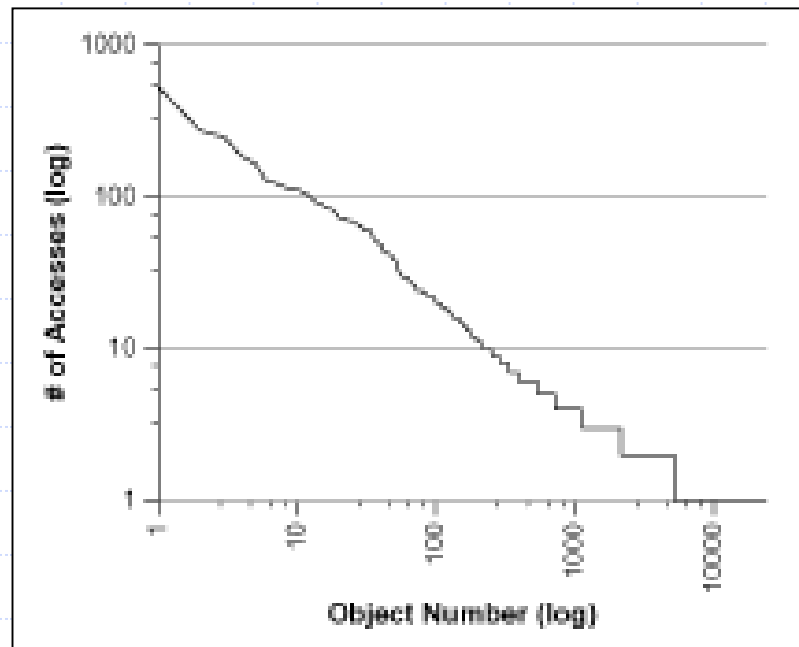
Trace Collection & Analysis (6)

◆ Server Popularity



Trace Collection & Analysis (7)

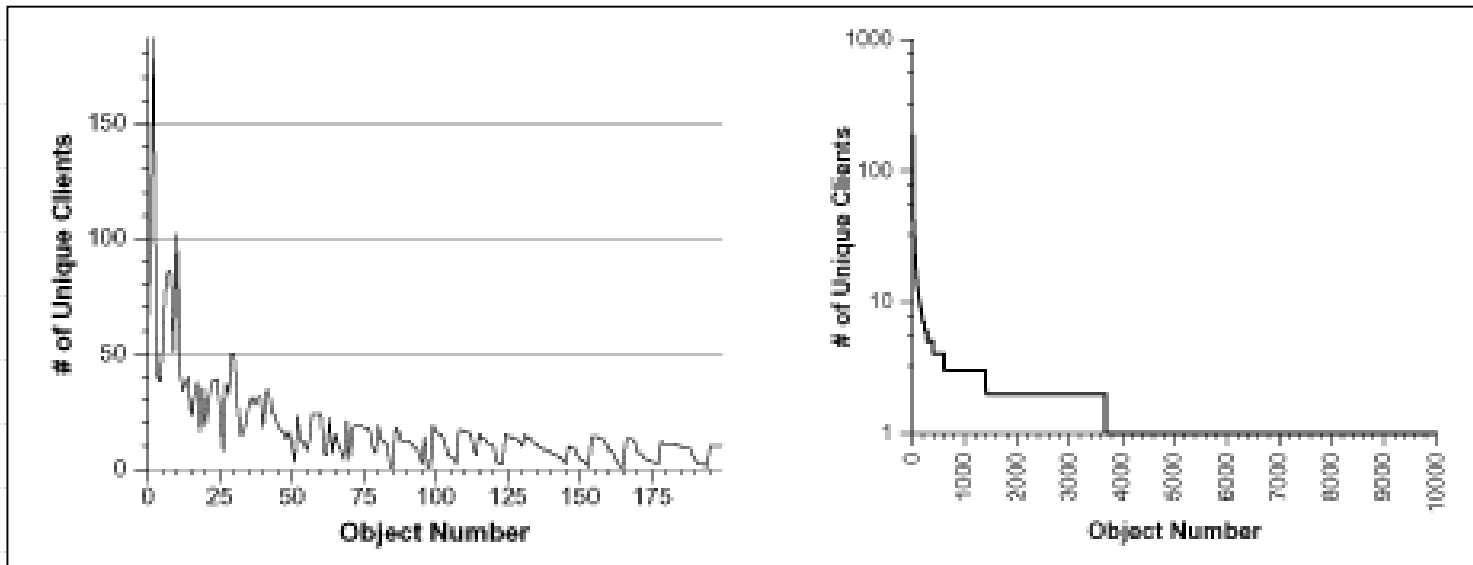
- ◆ Object Popularity
 - Zipf-like graph



Trace Collection & Analysis (8)

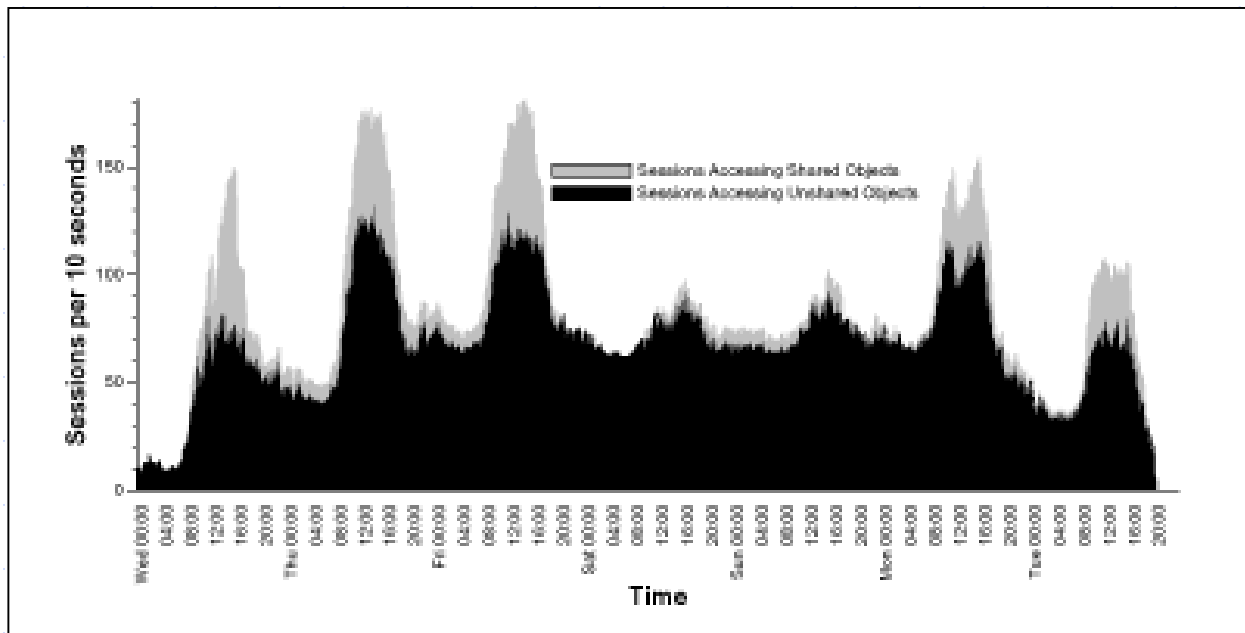
◆ Object sharing

- Popular ones are accessed more
- Concentrating on few objects



Trace Collection & Analysis (9)

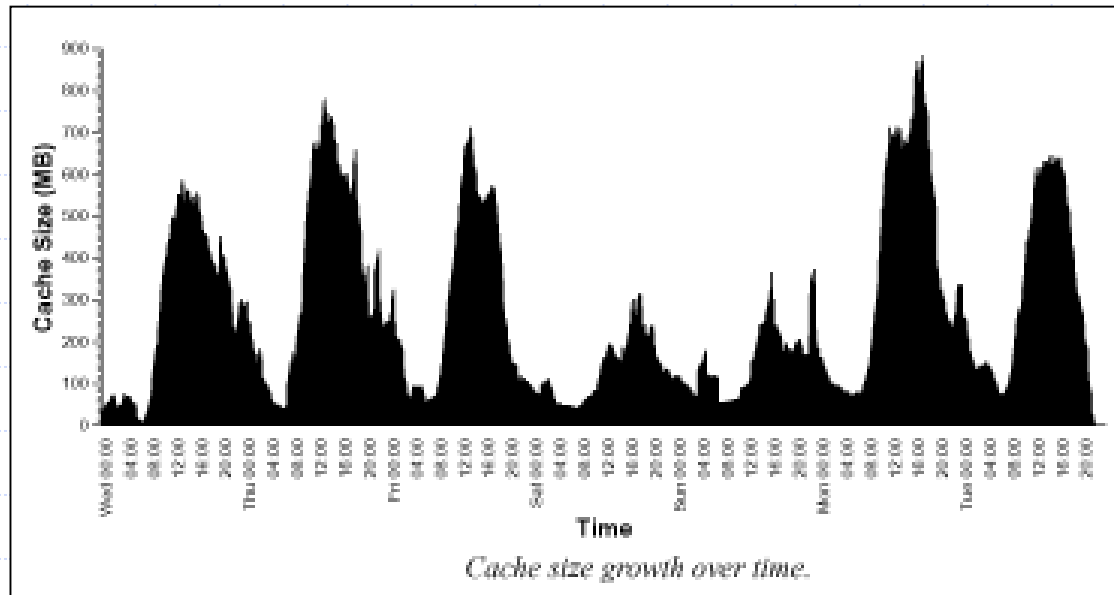
- ◆ Temporal locality exists
 - Higher during the peak



Trace Collection & Analysis (10)

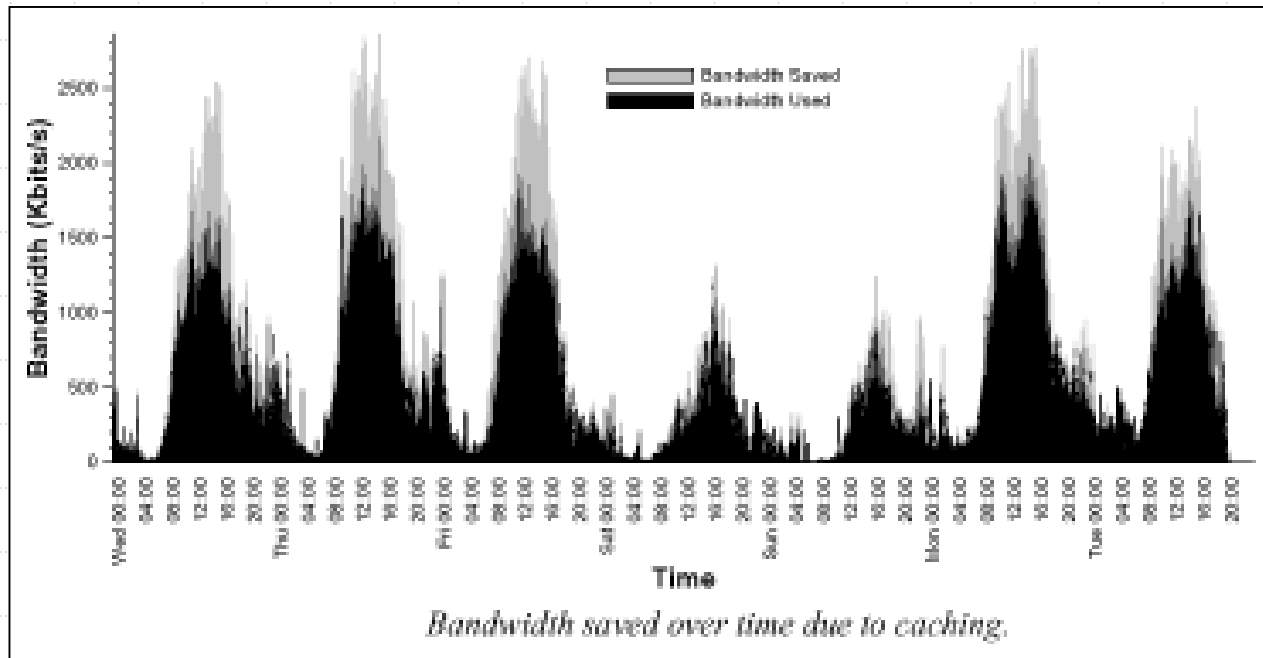
◆ Caching

- Use simulator
- Caches retrieved objects
- Unlimited capacity

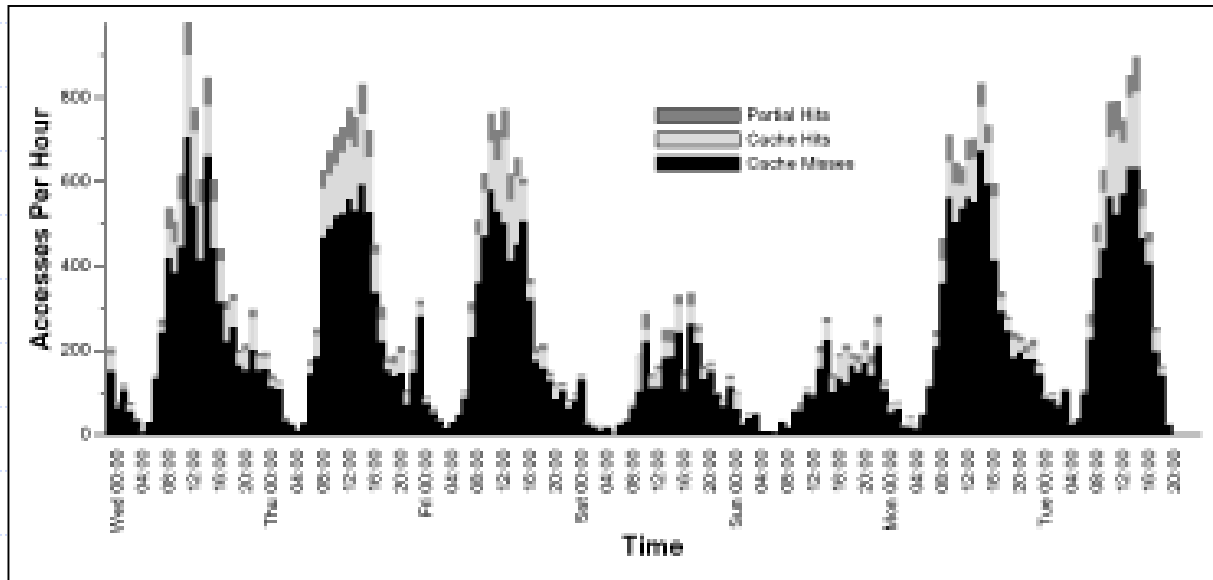


Trace Collection & Analysis (11)

- ◆ Caching (conti)
 - Save more during the peak



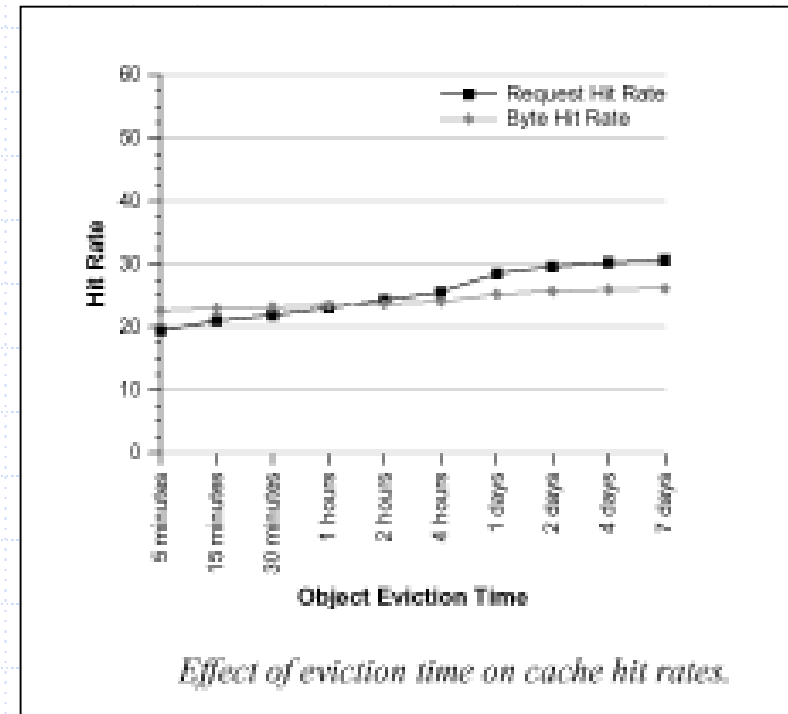
Trace Collection & Analysis (12)



Trace Collection & Analysis (13)

◆ Caching

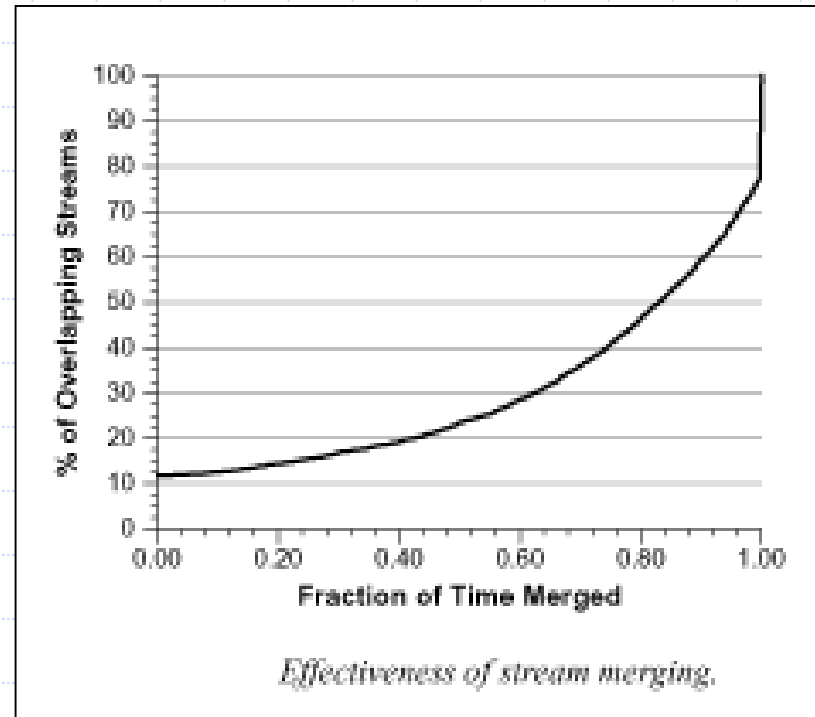
- Imply temporal locality
- Traditional parameter is sufficient



Trace Collection & Analysis (14)

◆ Stream Merging

- BW overhead
- Require more buffer
- Imply multicast



Findings & Contributions

- ◆ Performance enhancement observation
- ◆ Session characteristics
 - Shared/unshared, modem/LAN, server & object popularity
- ◆ Follow Zipf' law
- ◆ Not more benefit from long time caching
- ◆ Temporal locality
 - Multicast and merging
- ◆ Effectiveness of multicast