Measurements and Observations of IP Multicast Traffic

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Outline

- Introduction
- Environment and methodology
- Measurements
  - Aggregate
  - Audio conversations
  - Video conversations
- Analysis and random observations
- Conclusions

Introduction

IP Multicast

MBONE (Multicast Backbone): Virtual network for supporting Internet-wide multicasts

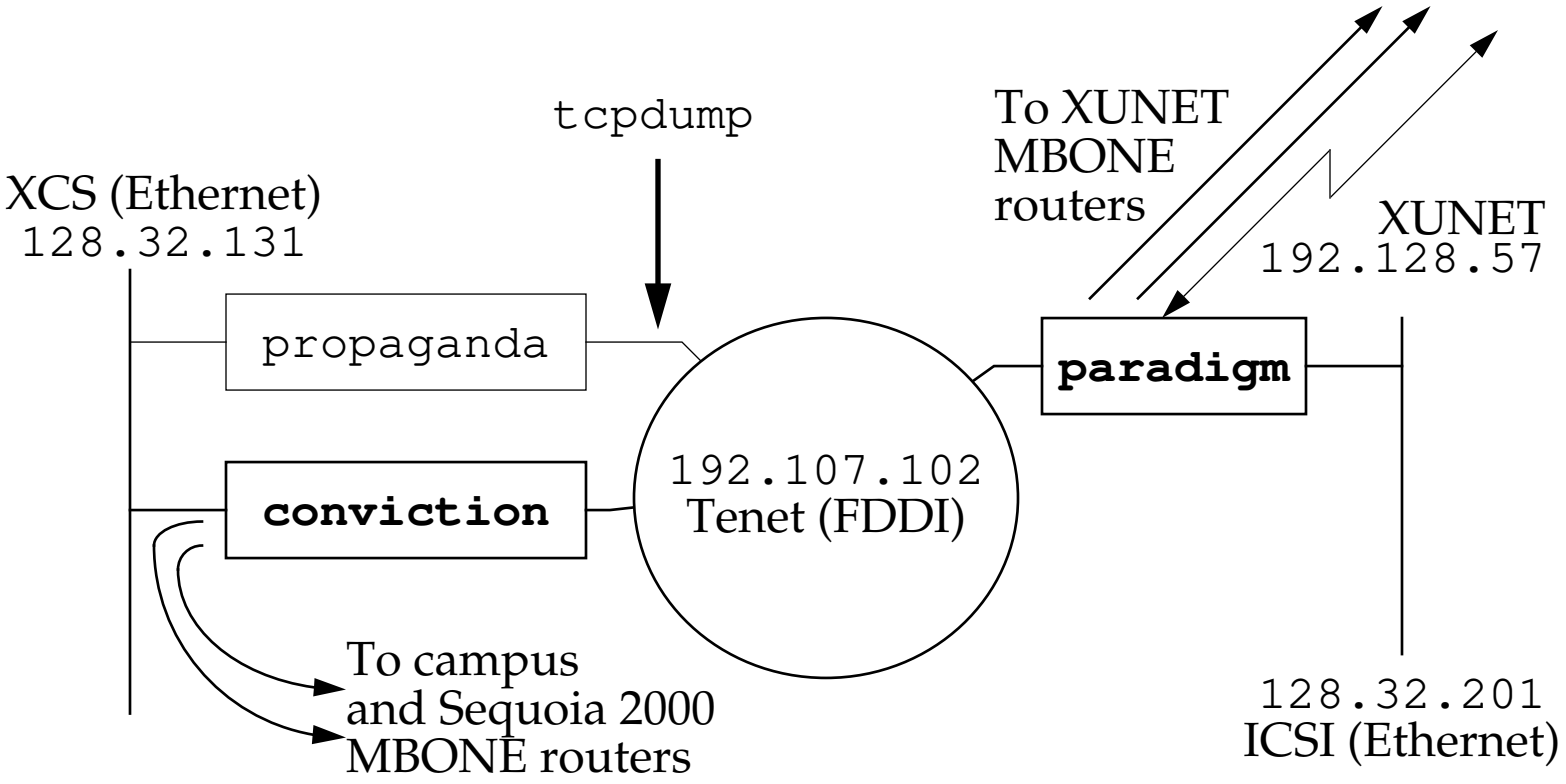
"Multimedia" tools

- Video (`nv, vic, ivs`)
- Audio (`vat, nevot`)
- Shared whiteboard (`wb`)
- Still image distribution (`imm`)

The first *widespread* multimedia applications

What can we learn about network traffic generated by *production use* multimedia applications?

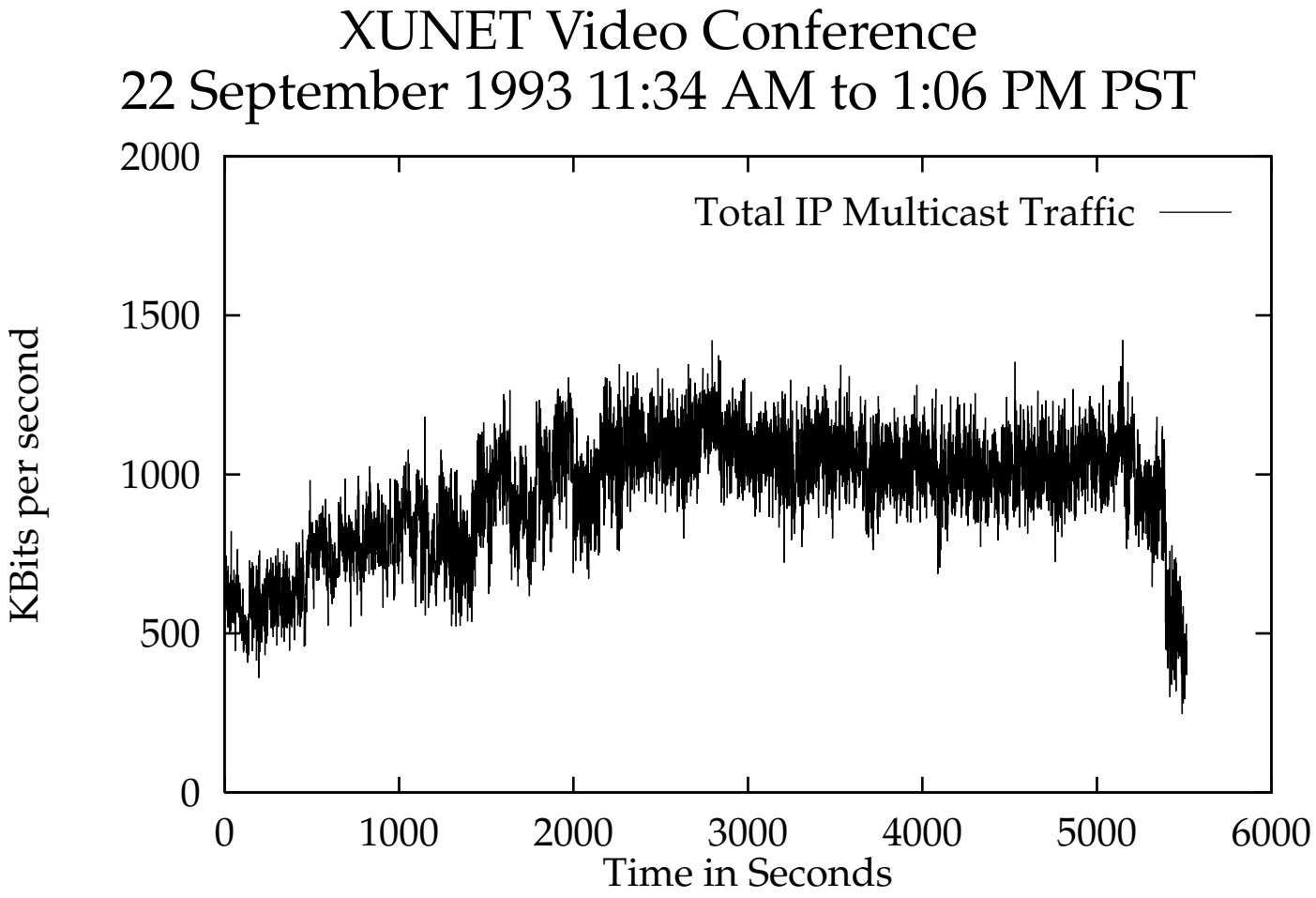
Environment and Methodology



Capture packet headers for off-line processing

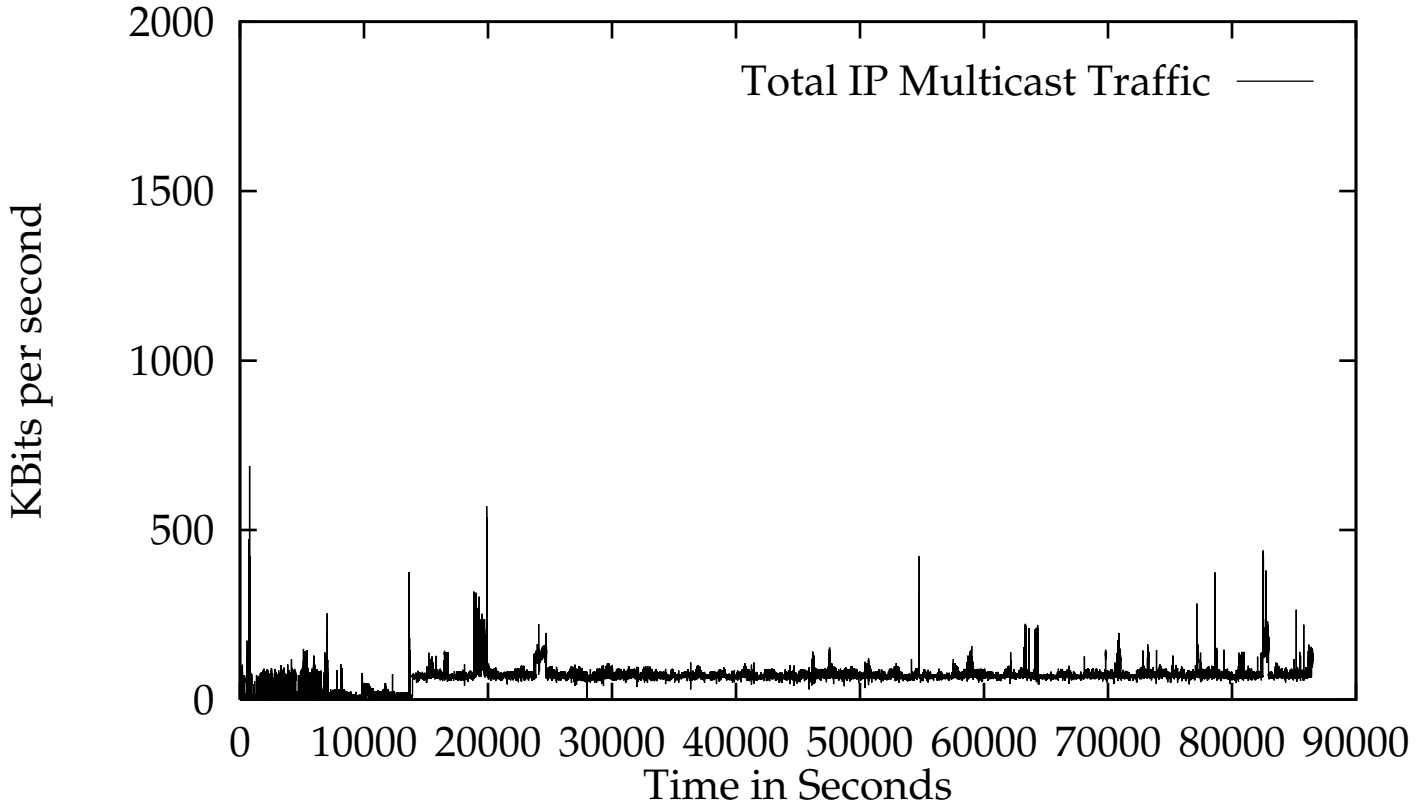
sdsnoop: Session Directory Snoop

Aggregate IP Multicast Traffic

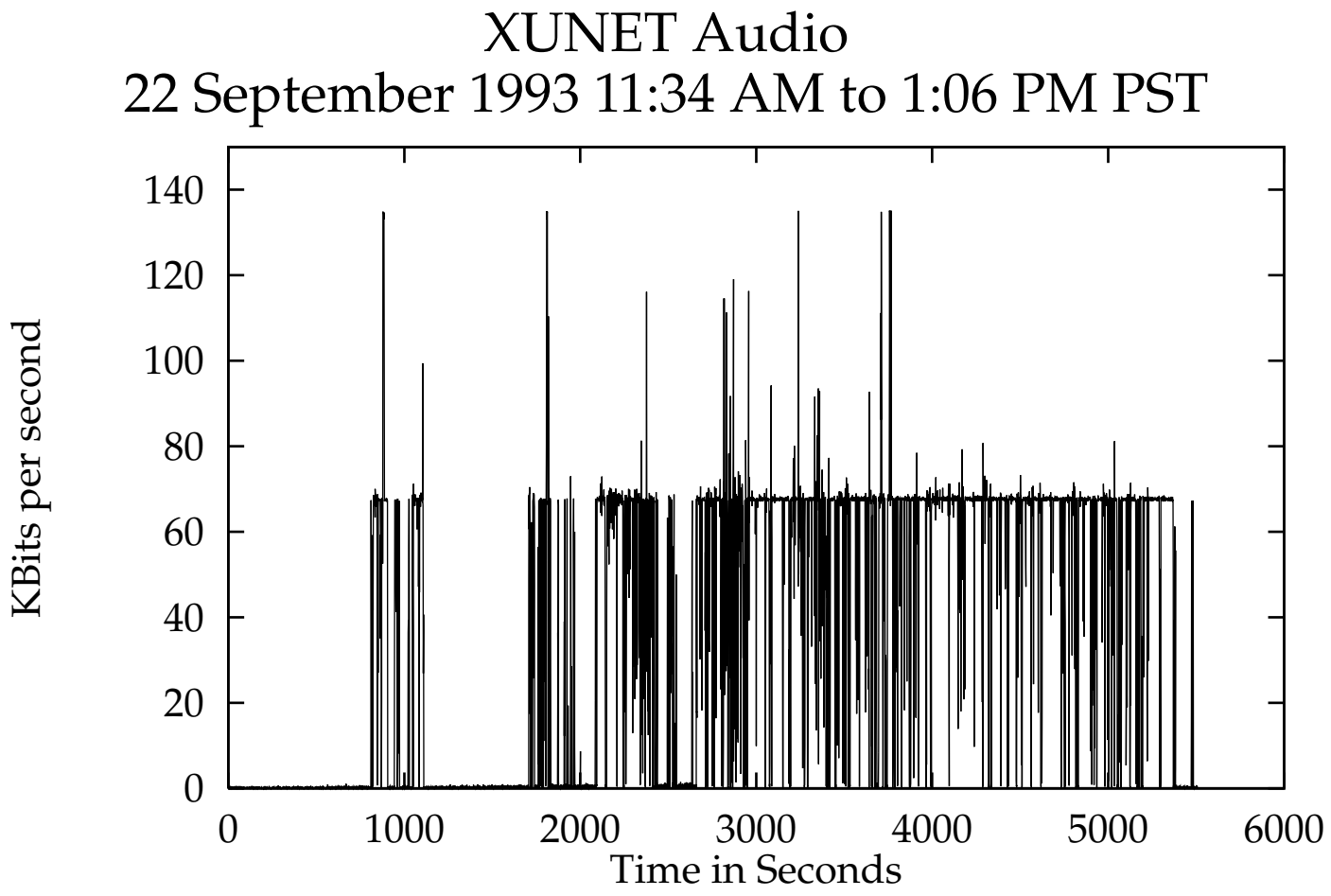


Aggregate IP Multicast Traffic

"Just an ordinary day"
20 January 1994 09:45 AM to 21 January 1994 09:47 AM PST

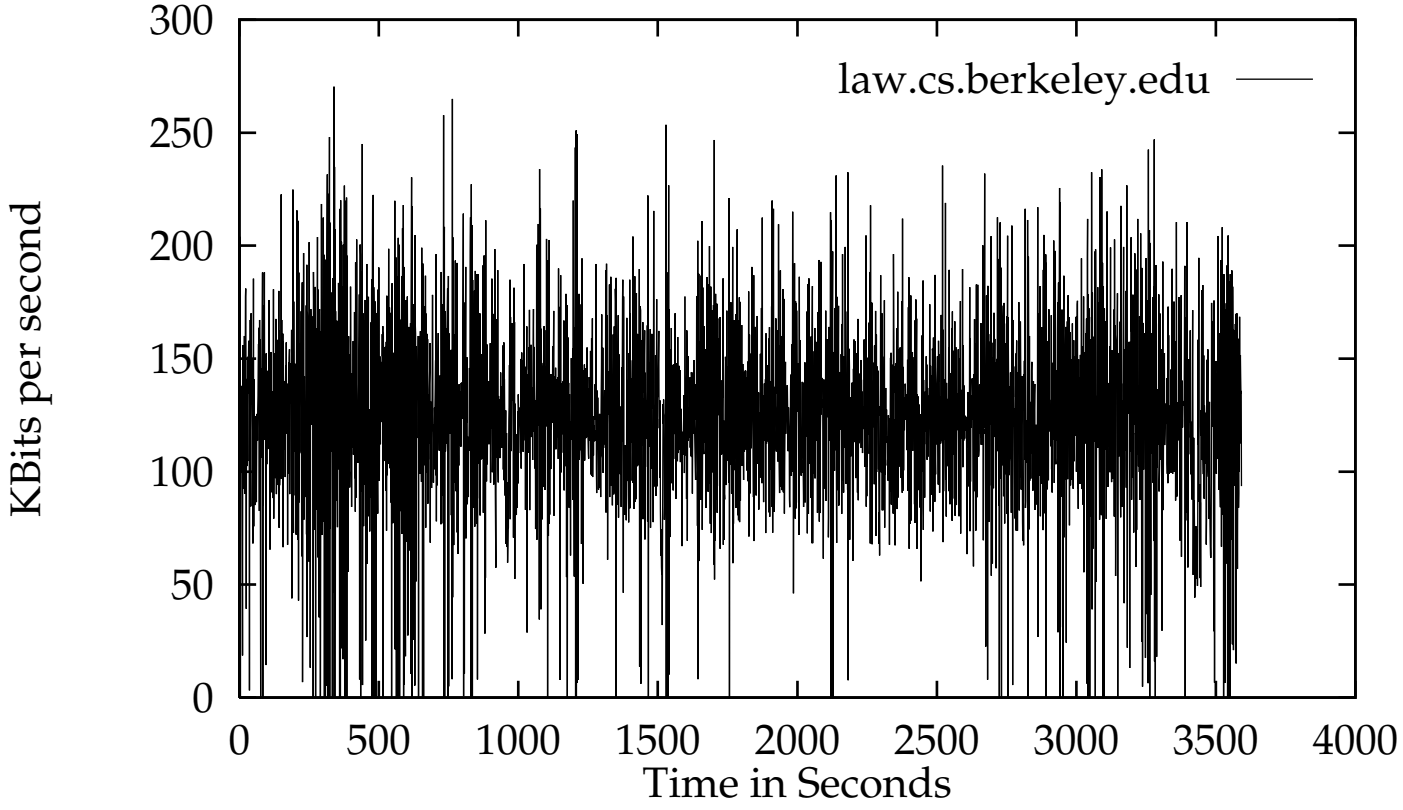


Audio Bitrate



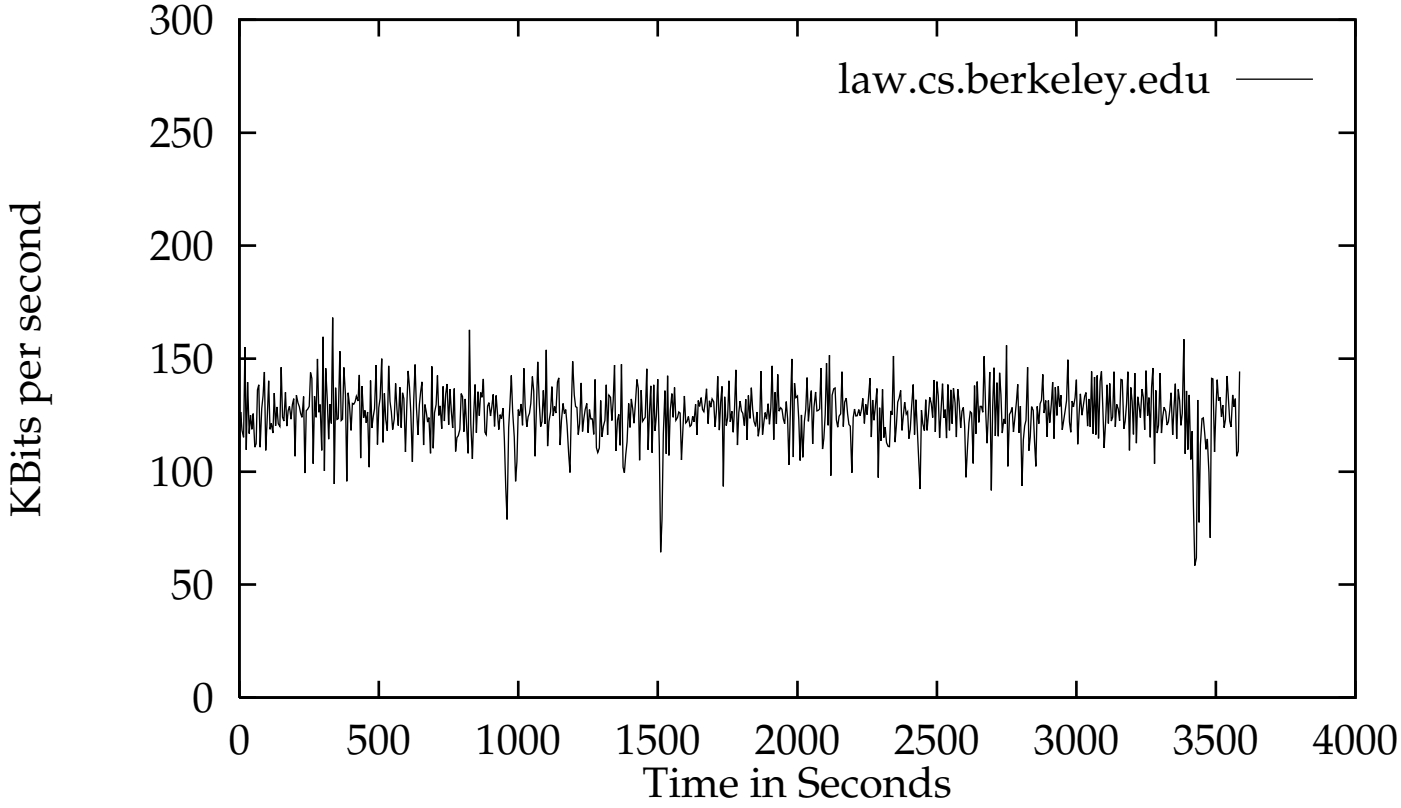
Video Bitrate (nv 128Kbps)

law.CS.Berkeley.EDU to XUNET Video (one-second samples)
22 September 1993 11:34 AM to 1:06 PM PST

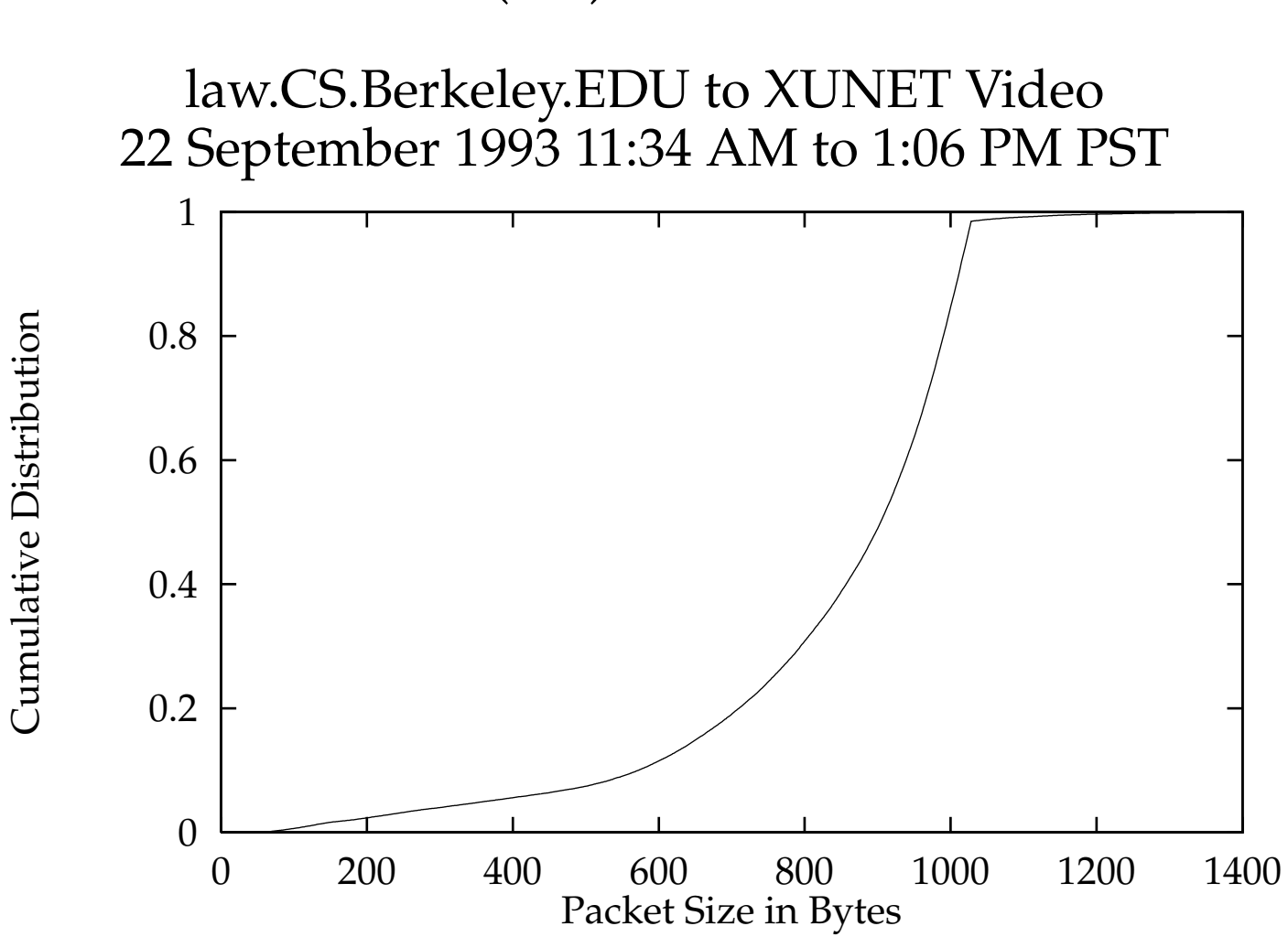


Video (nv) Bitrate

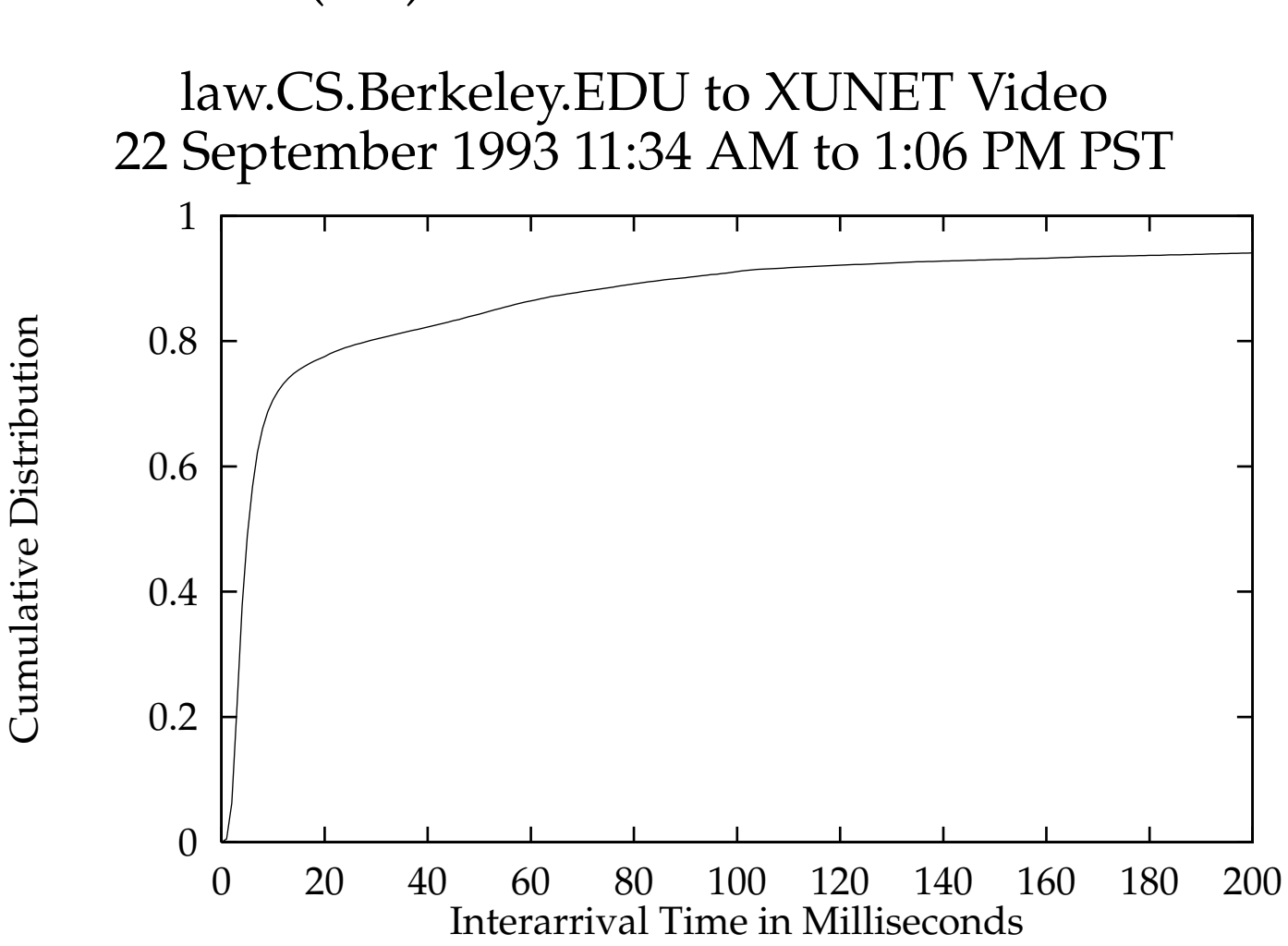
law.CS.Berkeley.EDU to XUNET Video (five second samples)
22 September 1993 11:34 AM to 1:06 PM PST



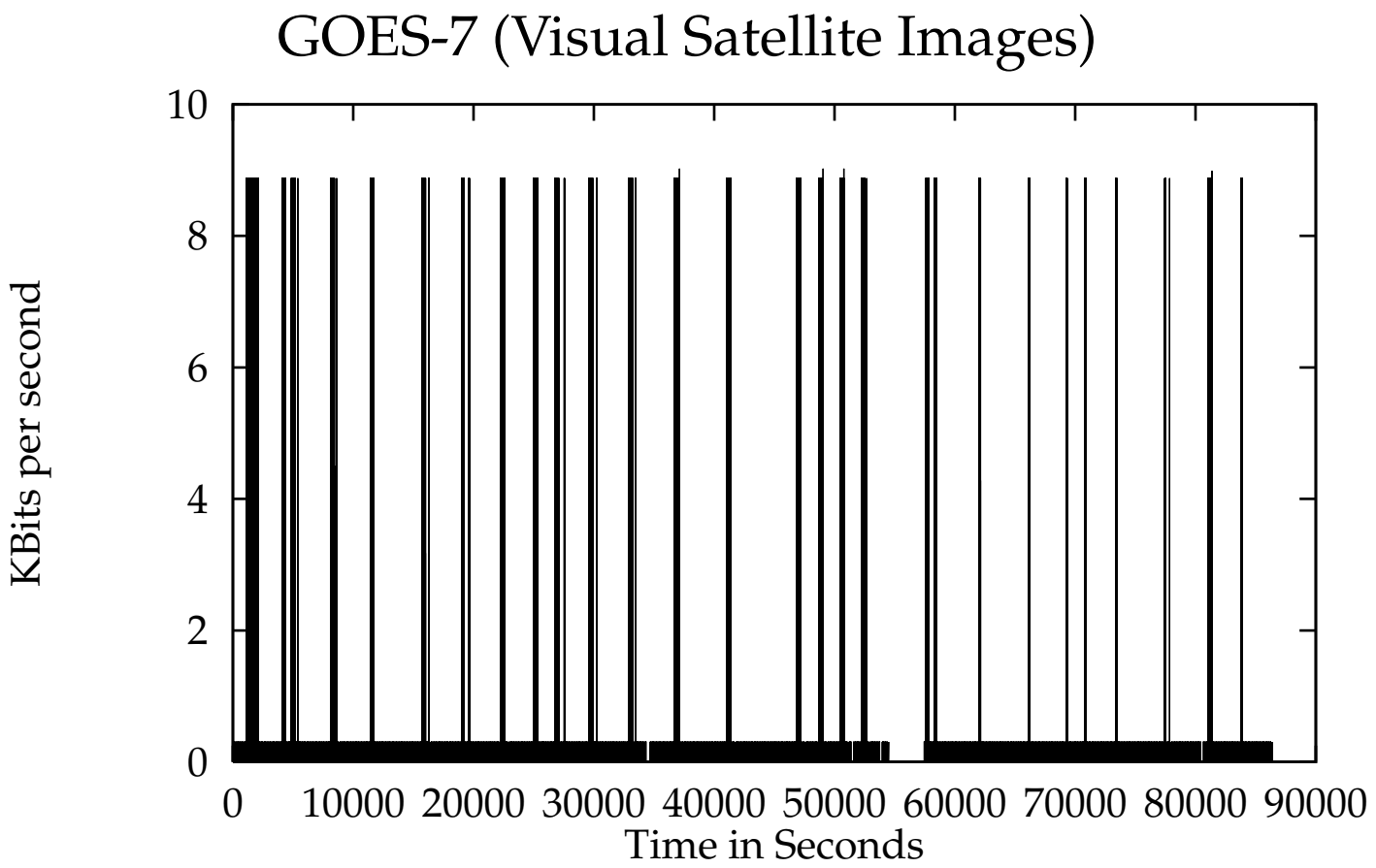
Video (nv) Packet Sizes



Video (nv) Packet Interarrival Time



Still Image Distribution (imm)



The solution to “casual Internet usage?”

Traffic Analysis

20 January 1994 Trace Gross Characteristics

- 299 traffic sources
- 65 destinations
- 1,005 conversations
- 722,901,051 total bytes
- 2,239,382 total packets

No special events this day...why so many destination addresses?

Traffic Breakdown

723 MB total (all sessions)

585 MB (81.0% percent of total) from a locally-advertised “radio session”, adjusted totals exclude this session

24 advertised sessions

100 MB (72.6% of adjusted total)

Still Images (`imm` and `mnm`): 46 MB

Audio (`vat`): 42 MB

Video (`nv`): 11 MB

7 unadvertised but known sessions

8 MB (5.5% of adjusted total)

33 unknown sessions

30 MB (21.8% of adjusted total)

Funny User Behavior

What's happening here?

- Traffic patterns suggest `vat`
- No `sd` advertisements suggests testing, experimentation
- Improper scope control (most sources in Europe, why should we see their traffic in California?)

Suggestions

- We need real multicast tree pruning!
- Users need education!

Hosts unreachable from ANSNET backbone

Conclusions

- Aggregate traffic
  - IP Multicast traffic still highly variable
  - Dependent on special events and outside factors
  - Difficult to construct a “typical” workload
  - Trends?
- Audio conferencing traffic
  - “Floor control” needed
- Video conferencing traffic
- User behavior
  - Better protection in network (true multicast tree pruning)
  - User education