

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

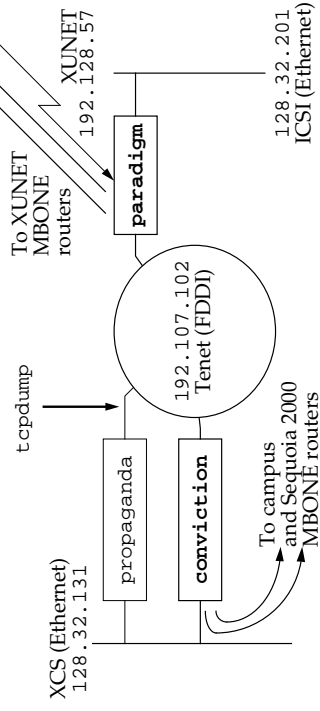
“Multimedia” tools

- Video (rv, 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?

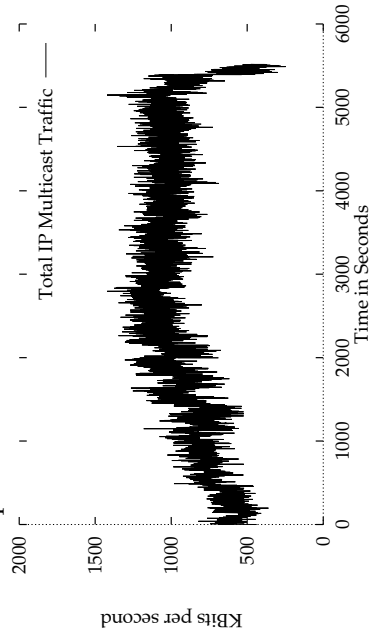
Environment and Methodology



Capture packet headers for off-line processing
sdsnoop: Session Directory Snoop

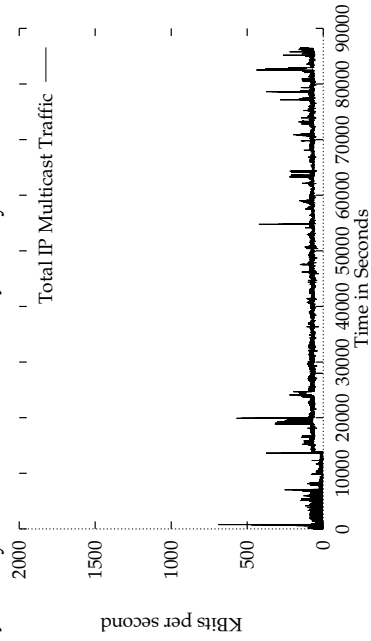
Aggregate IP Multicast Traffic

XUNET Video Conference
22 September 1993 11:34 AM to 1:06 PM PST



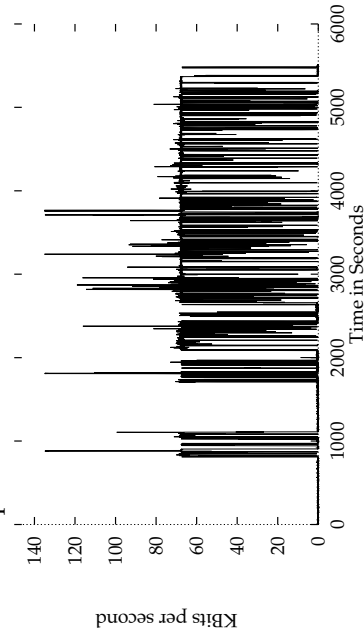
Aggregate IP Multicast Traffic

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



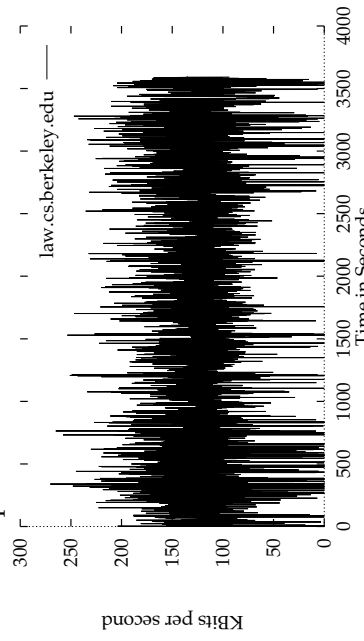
Audio Bitrate

XUNET Audio
22 September 1993 11:34 AM to 1:06 PM PST



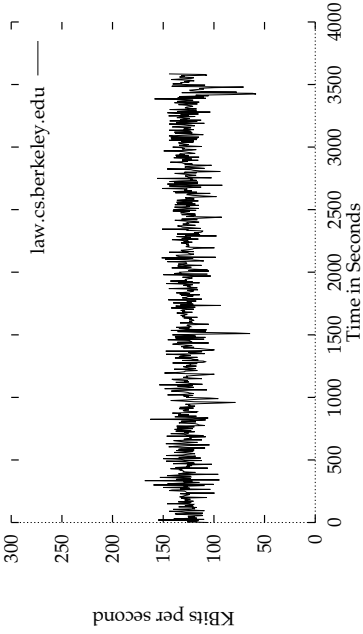
Video Bitrate (nv 128Kbps)

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



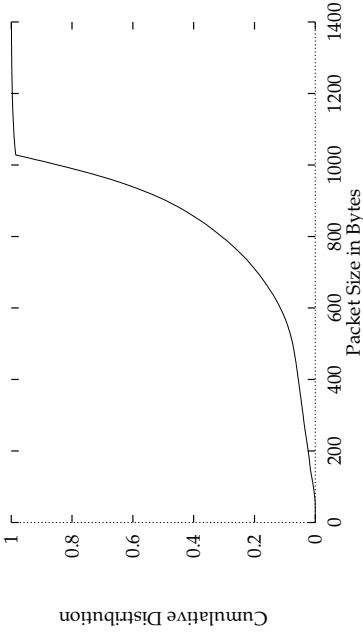
Video (nv) Bitrate

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



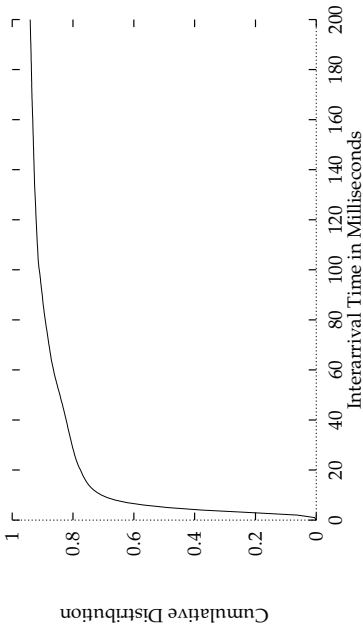
Video (nv) Packet Sizes

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22 September 1993 11:34 AM to 1:06 PM PST



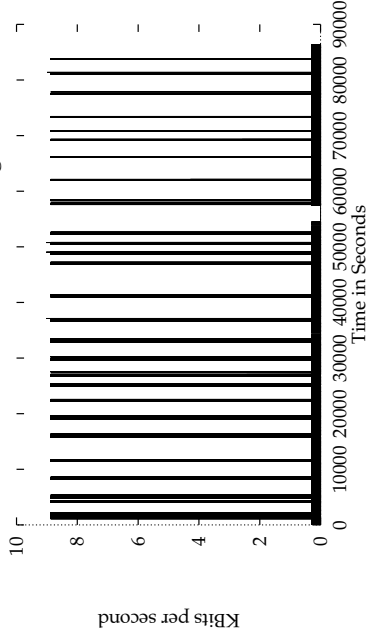
Video (nv) Packet Interarrival Time

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22 September 1993 11:34 AM to 1:06 PM PST



Still Image Distribution (imm)

GOES-7 (Visual Satellite Images)



The solution to "casual Internet usage?"

Traffic Analysis

20 January 1994 Trace Cross 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 (iimm and mmm): 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