Internet Broadcast Using End System Multicast

http://www.cs.cmu.edu/~ESM-streaming

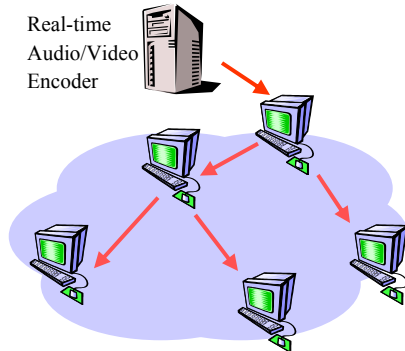## Overview of ESM

Real-time Audio/Video Encoder

Figure 1. End systems (viewers) self-organize into a high performance data distribution tree structure.

End System Multicast (ESM) allows for live audio and video content to be delivered over the Internet at a low cost to the broadcaster. It achieves this by harnessing the idle network resources of its viewers to help distribute the broadcast. The viewers automatically arrange themselves into a broadcast distribution tree. The tree continuously adapts to network dynamics, attempting to obtain the highest bandwidth and lowest latency.

Applications

Key Benefits of ESM

- No extra router support necessary
  - In contrast to IP multicast solutions
- No infrastructure servers necessary
  - In contrast to content delivery services
- Instantly deployable by end users
- No central performance bottleneck
  - Load shared across end systems
- Extremely cost-effective
- Better routing from broadcaster to viewer
- Adaptive to heterogeneity and dynamics in end system and Internet performance

Value-Added Features

Data Type	Priority	Bandwidth
Audio	High	15Kbps
LQ Video	↓	100Kbps
HQ Video	Low	300Kbps

Pittsburgh broadcast

415Kbps — Boston viewer

415Kbps
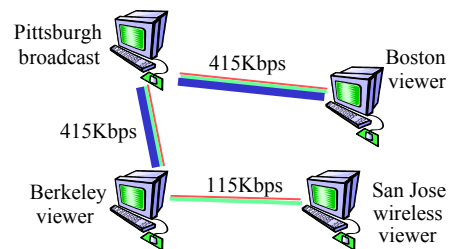
Berkeley viewer — 115Kbps — San Jose wireless viewer

Figure 2. High priority audio and LQ video are selectively sent to bandwidth constrained San Jose wireless viewer

- Prioritized audio and video transmission
  - Ensures high fidelity audio and clear video even when network congestion occurs
- Network-friendly TCP-based congestion control