Lecture 10: Internet Media Distribution Case Studies

Client-server, IP Multicast, YouTube, IPTV, P2P streaming

Some slides were built from Sanjay Rao's lecture from Purdue, Bruce Maggs's akamai talk, and the Imc07 presentation from M.Cha



Today's Schedule

- Motivation
- Ways to distribute video online
 - Client-server
 - IP Multicast
 - Content delivery networks
 - P2P media streaming design
- YouTube Study



Ways to Distribute Video

- Client-server
- IP multicast
- Content delivery networks (CDNs)
- Application end points (pure P2P)





Multicast Basic idea: the same data needs to reach multiple receivers avoid transmitting it once for each receiver particularly useful if access link has bandwidth limitations can be implemented at link, network and application layer e.g., mailing list as example IP-Multicast: Network-layer solution Routers responsible for multicasting

IP Multicast

- Network-layer solution
 - Routers responsible for multicasting
- Efficient bandwidth usage
- Requires per-group state in routers
 - Scalability concern
 - Violates end-to-end design principle
- Slow deployment
 - IP multicast is often disabled in routers
- Difficult to support higher layer functionality















Problems with the Centralized Approach

- Slow
 - content must traverse multiple backbones and long distances
- Unreliable
 - delivery may be prevented by congestion or backbone peering problems
- Not scalable
 - usage limited by bandwidth available at master site
- Inferior streaming quality

 packet loss, congestion, and narrow pipes degrade stream quality







Advantages of the Akamai Solution

- Fast
 - Content is served from locations near to end users
- Reliable
 - No single point of failure
 - Automatic fail-over

• Scalable

 Master site no longer requires massive available bandwidth

Ways to Distribute Videos

- Single server, single (or many) clients
 Not scalable
- IP multicast
 - Required uniform router hardware
- Content delivery networks (CDNs)
 - \$\$\$\$, serve small-size, highly popular data
- Application end points (pure/hybrid P2P)

P2P Applications

- Many P2P applications since the 1990s
 - File sharing
 - Napster, Gnutella, KaZaa, BitTorrent
 - Internet telephony
 - Skype
 - Internet television
 - PPLive, CoolStreaming, Joost

Why P2P?

- Every node is both a server and client – Easier to deploy applications at endpoints
 - No need to build and maintain expensive infrastructure
 - Potential for both performance improvement and additional robustness
 - Additional clients create additional servers for scalability

P2P Overview

- Application-layer approach
- Clients send contents to each other
- Use an Overlay Network!

Ways to Distribute Videos

- Single server, single (or many) clients
 Not scalable
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 - \$\$\$\$, serve small-size, highly popular data
- Application end points (pure/hybrid P2P)
 Unstable, popularity driven

Relationship between popularity and age

QUESTION 2: HOW DOES POPULARITY EVOLVE OVER TIME?

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Summary of Observations

- Server-created video content – Popular videos rule!
- User created video content
 Popular videos rule!
- Now Question: How to distribute these video contents?

Today's Learning

- IP media is popular!
- Ways to distribute video online, advantages and disadvantages
 - Client-server
 - IP Multicast
 - Content delivery networks
 - P2P media streaming design
- YouTube Study
 - 10% popular videos account for 80% total views P2P can help to distribute video better..