Chapter 7
Multimedia Networking: CDNs

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Content distribution networks

- **challenge**: how to stream content (selected from millions of videos) to hundreds of thousands of simultaneous users?

- **option 1**: single, large “mega-server”
  - single point of failure
  - point of network congestion
  - long path to distant clients
  - multiple copies of video sent over outgoing link

....quite simply: this solution *doesn’t scale*
Content distribution networks

- **challenge**: how to stream content (selected from millions of videos) to hundreds of thousands of simultaneous users?

- **option 2**: store/serve multiple copies of videos at multiple geographically distributed sites (CDN)
  - **enter deep**: push CDN servers deep into many access networks
    - close to users
    - used by Akamai, 1700 locations
  - **bring home**: smaller number (10’s) of larger clusters in POPs near (but not within) access networks
    - used by Limelight
CDN: “simple” content access scenario

Bob (client) requests video http://netcinema.com/6Y7B23V
- video stored in CDN at http://KingCDN.com/NetC6y&B23V


2. resolve http://netcinema.com/6Y7B23V via Bob’s local DNS

3. netcinema’s authoritative DNS returns URL http://KingCDN.com/NetC6y&B23V

4&5. Resolve http://KingCDN.com/NetC6y&B23 via KingCDN’s authoritative DNS, which returns IP address of KIngCDN server with video

6. request video from KINGCDN server, streamed via HTTP
CDN cluster selection strategy

- **challenge:** how does CDN DNS select “good” CDN node to stream to client
  - pick CDN node geographically closest to client
  - pick CDN node with shortest delay (or min # hops) to client (CDN nodes periodically ping access ISPs, reporting results to CDN DNS)
  - IP anycast

- **alternative:** let **client** decide - give client a list of several CDN servers
  - client pings servers, picks “best”
  - Netflix approach
Case study: Netflix

- 30% downstream US traffic in 2011
- owns very little infrastructure, uses 3rd party services:
  - own registration, payment servers
  - Amazon (3rd party) cloud services:
    - Netflix uploads studio master to Amazon cloud
    - create multiple version of movie (different endodings) in cloud
    - upload versions from cloud to CDNs
    - Cloud hosts Netflix web pages for user browsing
  - **three** 3rd party CDNs host/stream Netflix content: Akamai, Limeligh, Level-3
Case study: Netflix

1. Bob manages Netflix account

2. Bob browses Netflix video

3. Manifest file returned for requested video

4. DASH streaming

Netflix registration, accounting servers

Amazon cloud

upload copies of multiple versions of video to CDNs

Akamai CDN

Limelight CDN

Level-3 CDN