# Chapter 7 Multimedia ~~Networking: CDNs~~

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Thanks and enjoy! JFK/KWR
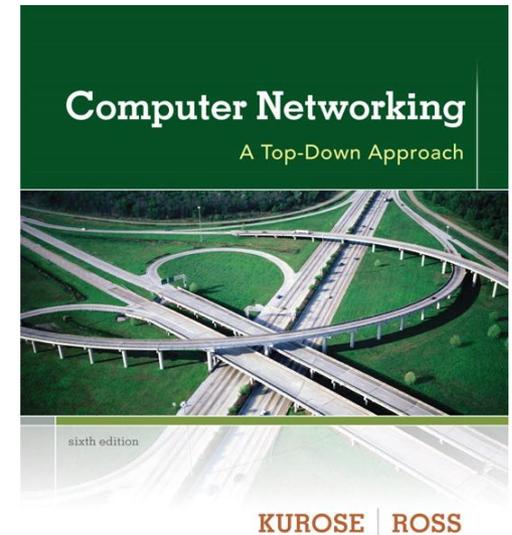
Computer Networking: A Top Down Approach
6th edition
Jim Kurose, Keith Ross
Addison-Wesley
March 2012

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

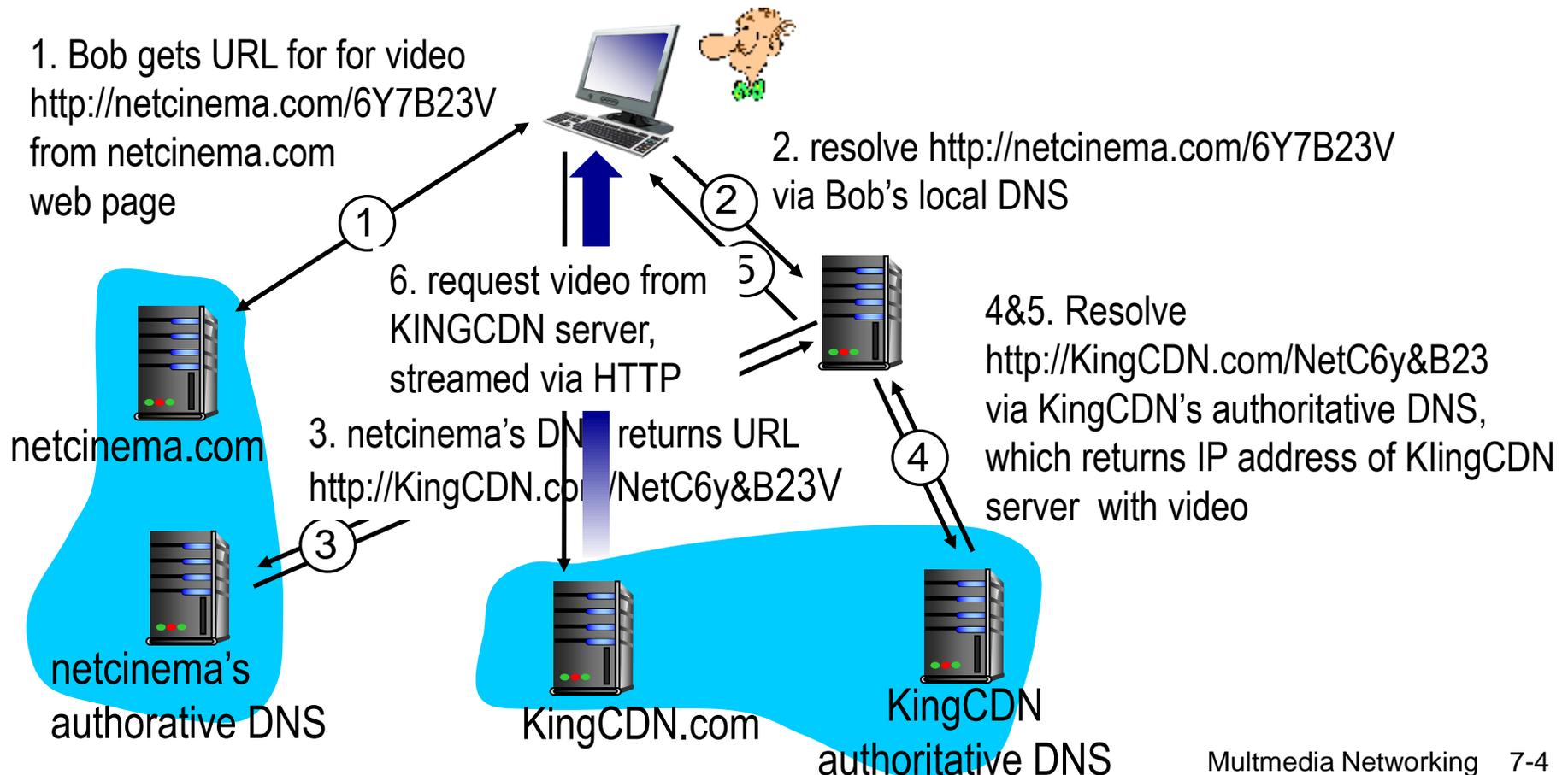….quite simply: this solution *doesn't scale*

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

1. Bob gets URL for for video
http://netcinema.com/6Y7B23V
from netcinema.com
web page

①

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

⑤

⑥

6. request video from
KINGCDN server,
streamed via HTTP

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

netcinema.com

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

③

④

netcinema's
authorative DNS

KingCDN.com

KingCDN
authoritative DNS

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, Limelight, Level-3

Case study: Netflix

Netflix registration, accounting servers

1. Bob manages Netflix account

2. Bob browses Netflix video

3. Manifest file returned for requested video

Amazon cloud

upload copies of multiple versions of video to CDNs

Akamai CDN

Limelight CDN

Level-3 CDN

4. DASH streaming