

Open Connect Everywhere: A Glimpse at the Internet Ecosystem through the Lens of the Netflix CDN

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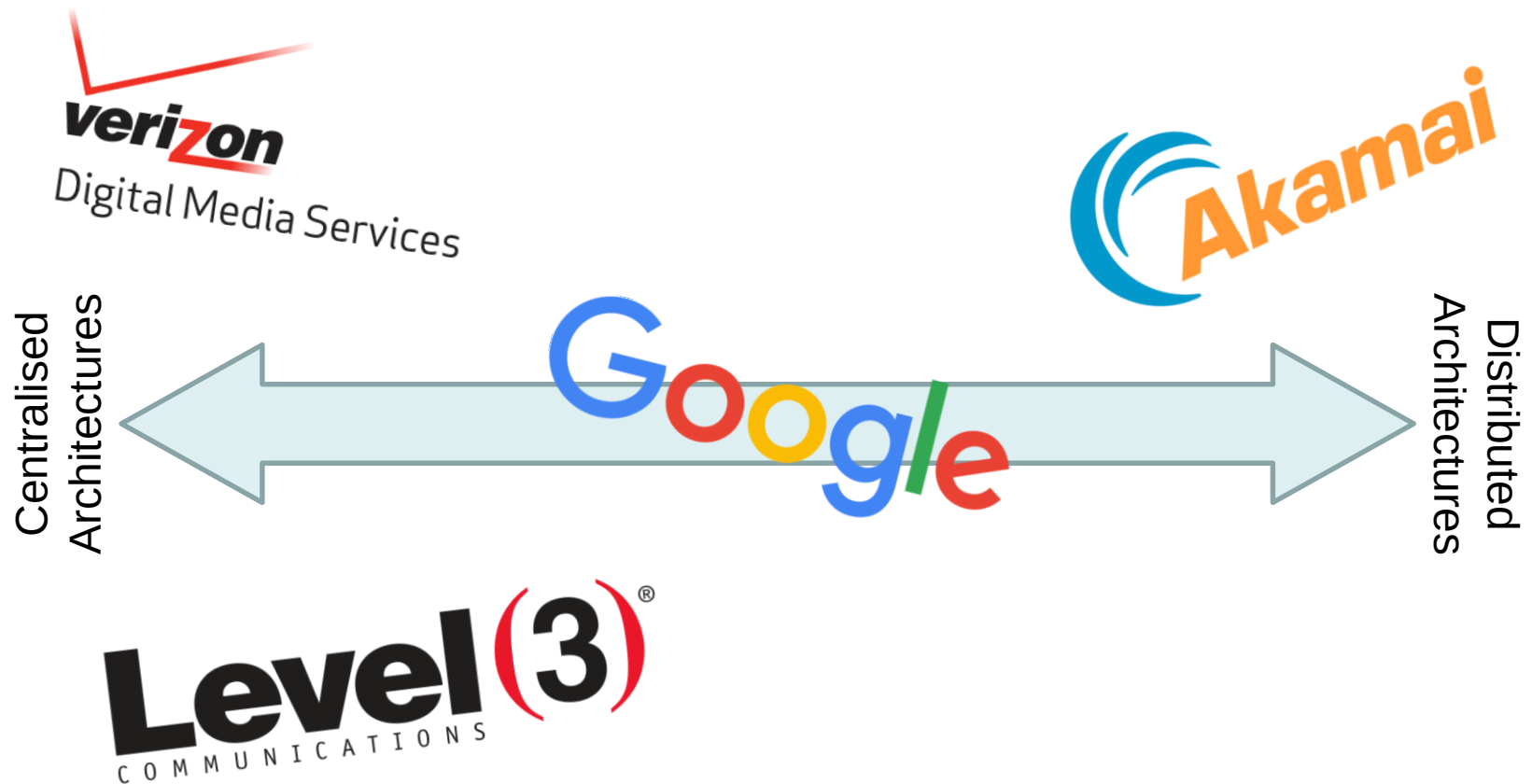
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World-Wide Content Availability



feature films and documentaries, a wide range of stand-up comedy specials and 30 original kids series -- available at the same time to members everywhere.

Architectural Decisions

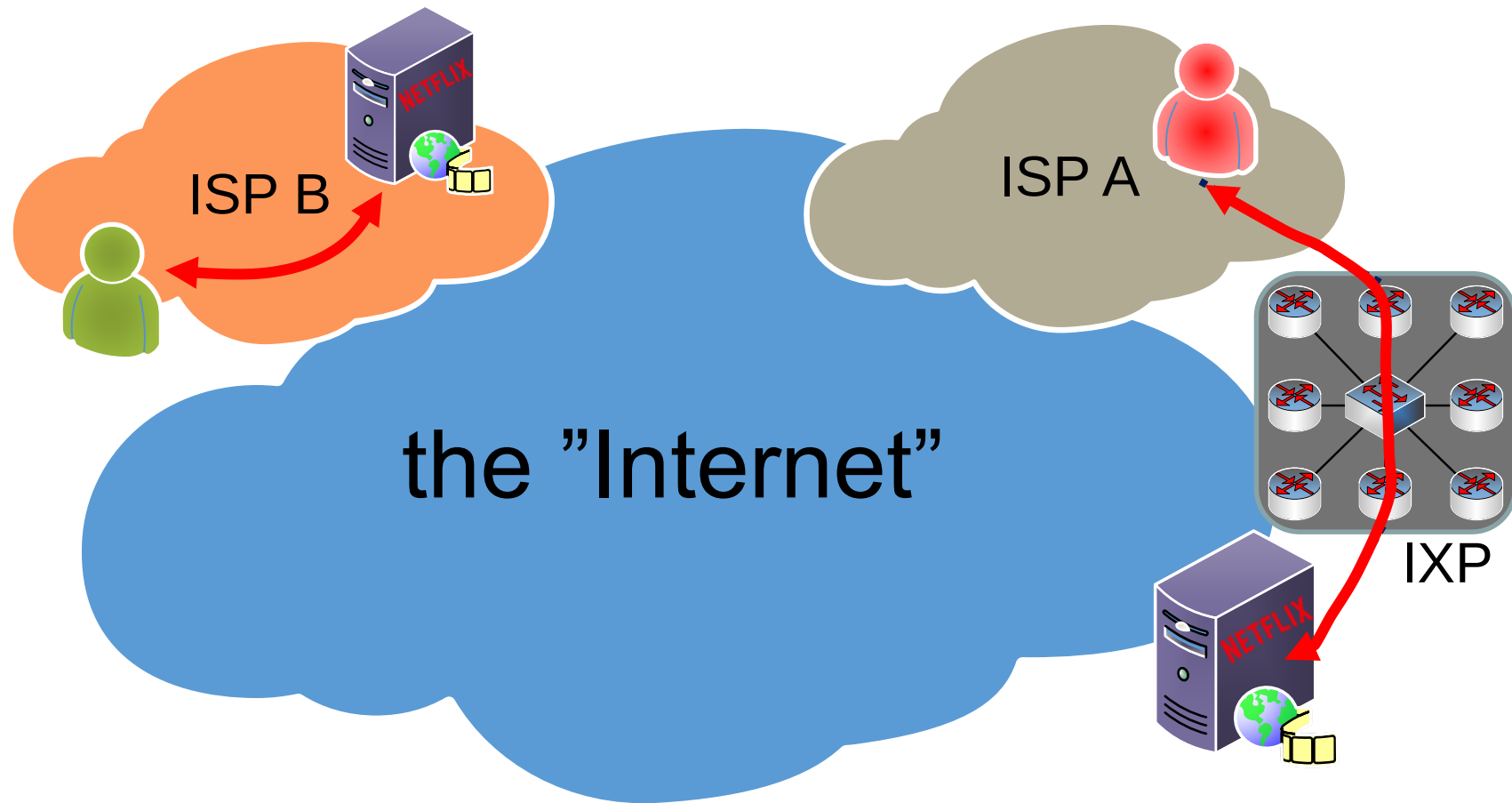


Netflix's Architecture

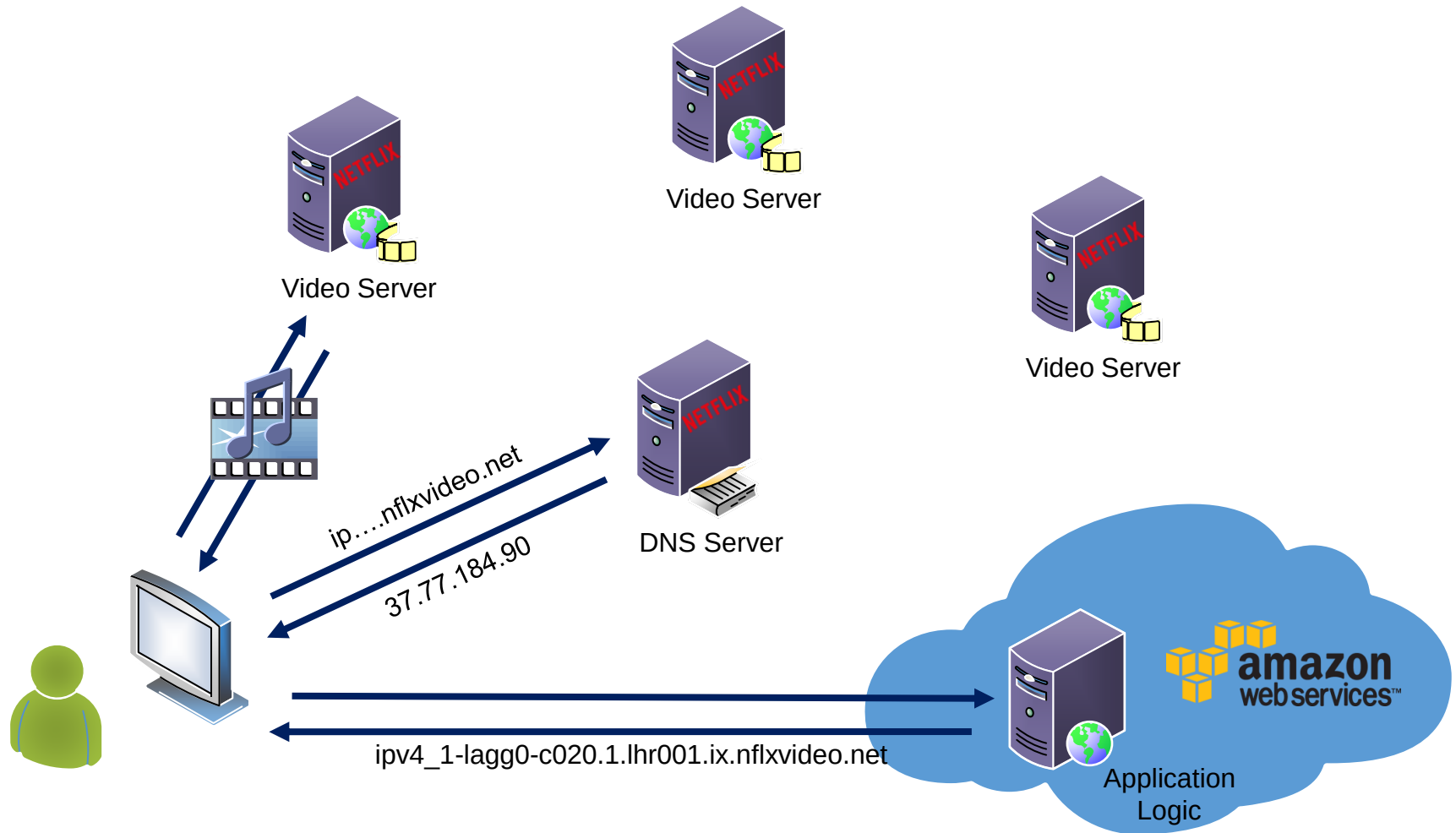
- Datacentre-free since January 2016
- Many services on Amazon Web Services
- Netflix deployed its own CDN: OpenConnect



Netflix OpenConnect Delivery Options



Netflix Client Redirection



Exploiting the Naming Scheme



- DNS names of servers used by Netflix:
 - ipv4_1-lagg0-c020.1.**lhr**001.**ix**.nflxvideo.net
 - ipv4_1-cxl0-c045.1.**fra**001.**ix**.nflxvideo.net
 - ipv6_1-lagg0-c002.1.**lhr**005.**bt.isp**.nflxvideo.net



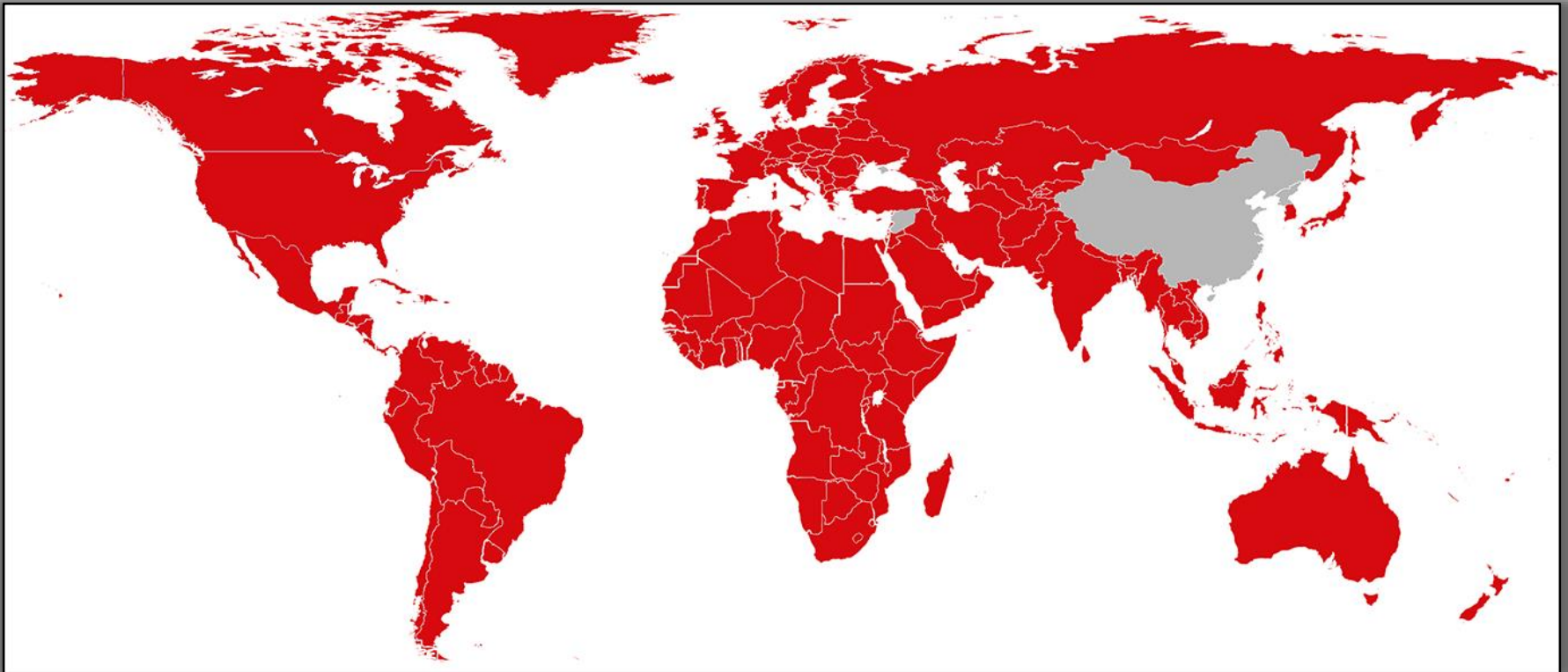
- Using a DNS crawler, we discovered
 - 4,777 servers
 - 243 locations
 - 48 countries
 - 123 ISPs



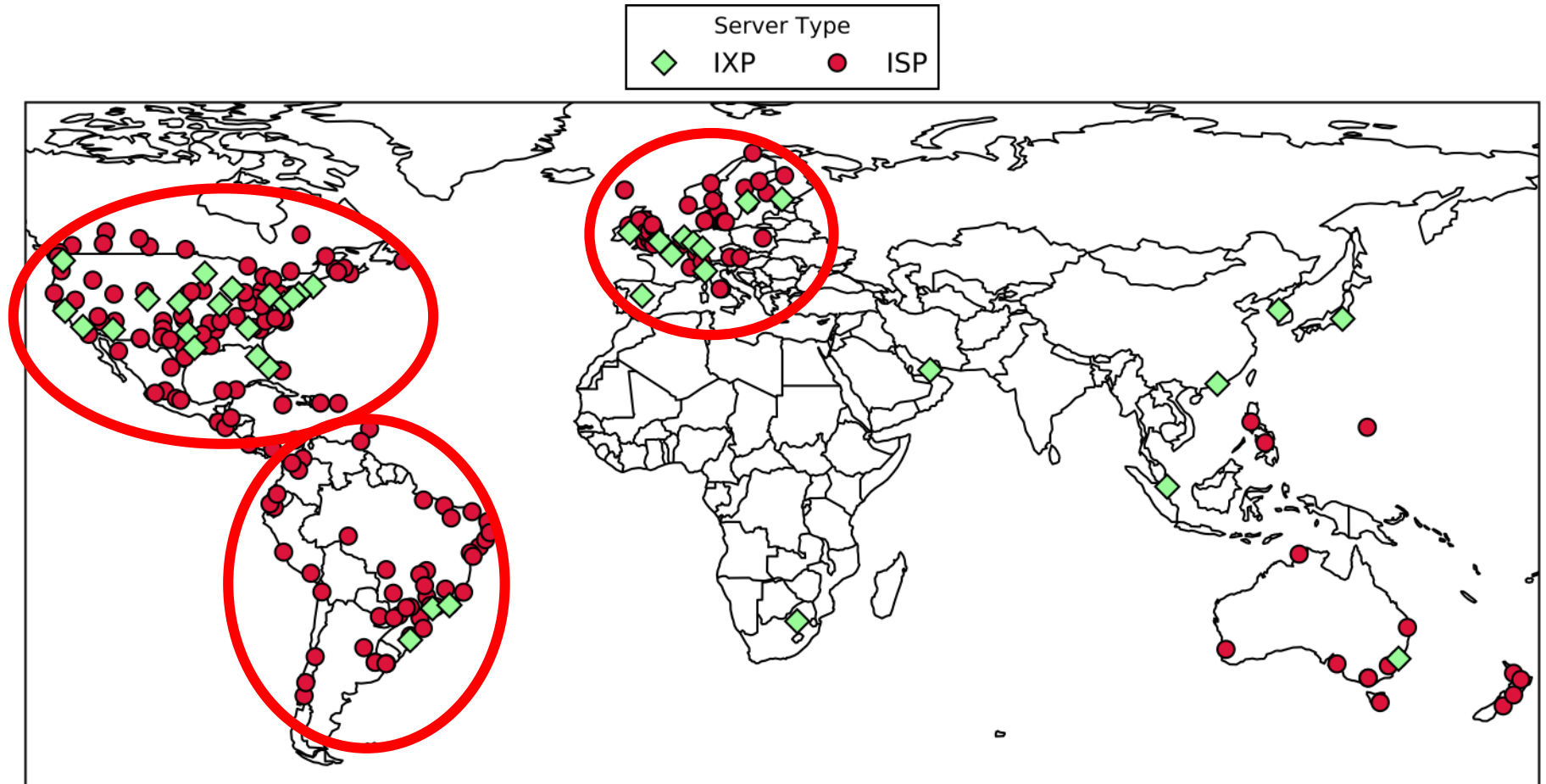
Traffic: Exploiting IPID

- IPID
 - Field of the IPv4 header
 - Originally used for fragmentation
 - Can be incremented arbitrarily, though often incrementally [RFC6864]
- All Netflix caches run FreeBSD 10
- Checked that consistent values of the IPID field returned
- 1 sample per server every 30 mins to reduce overhead

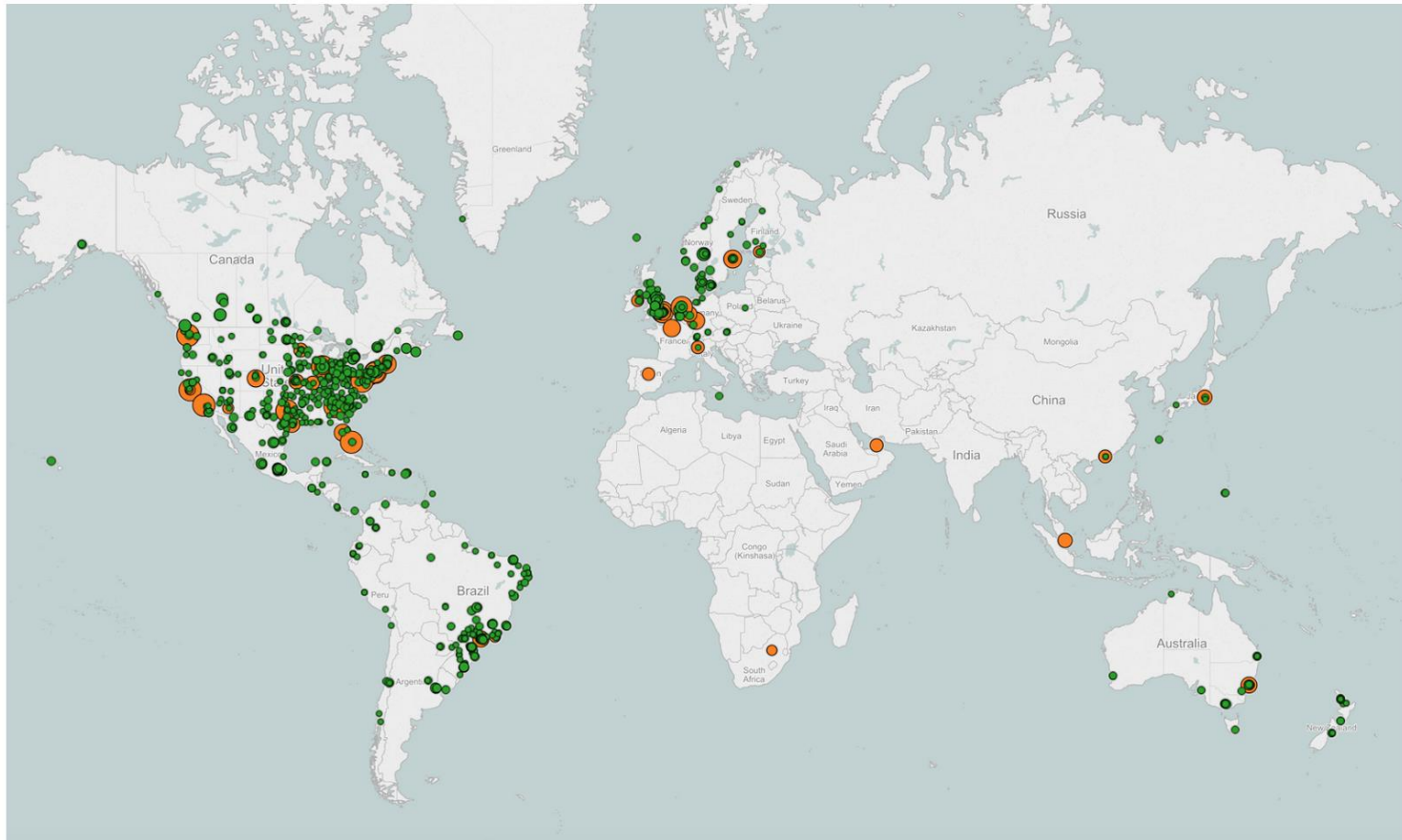
World-Wide Content Availability



Global Netflix deployment (locations)



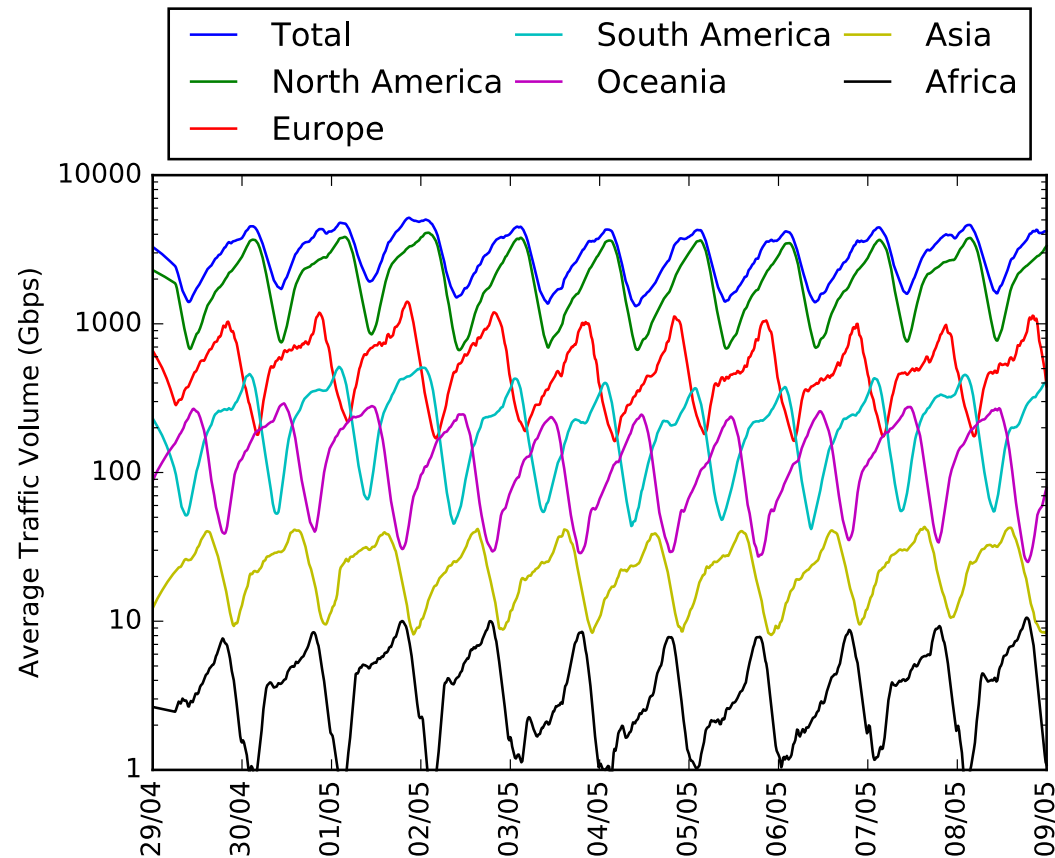
Deployment according to Netflix



■ ISP Locations ■ Internet Exchange Point (circles are sized by volume)

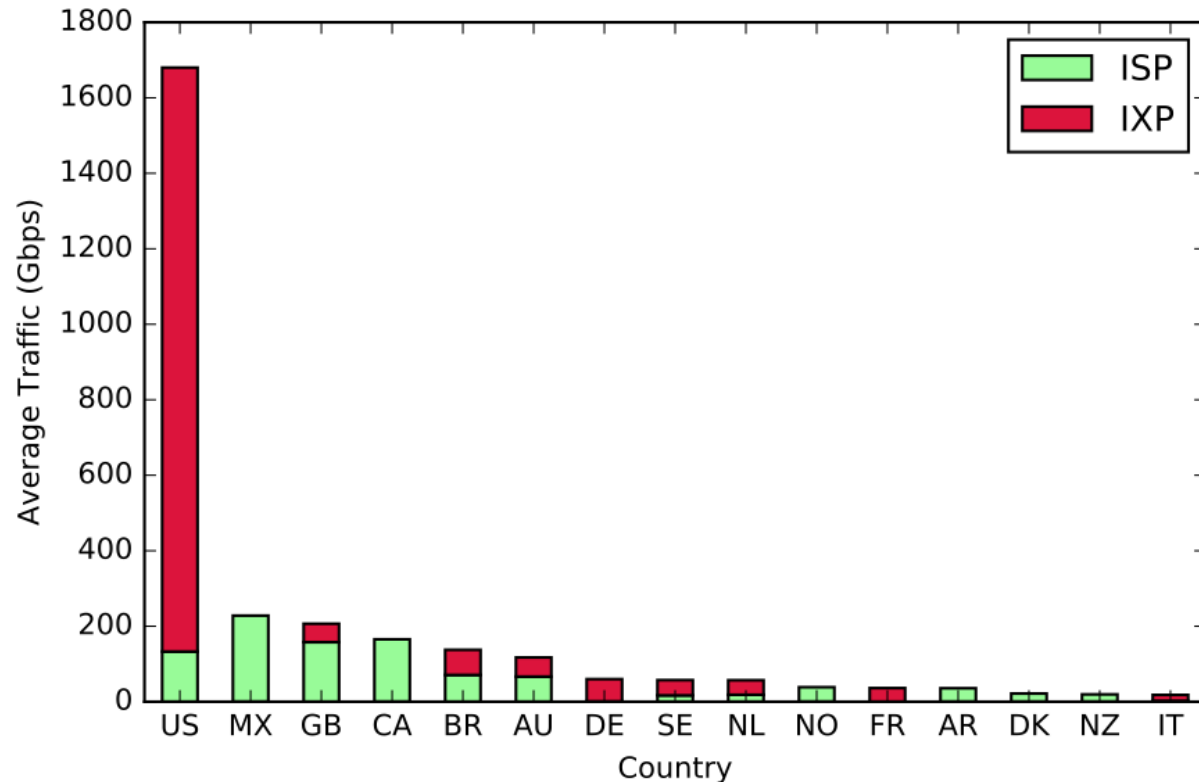
Estimated global traffic pattern

- North America dominates
- Followed by Europe (UK mostly)
- Central/South America unexpectedly third (Mexico and Brazil)



Traffic per country

- Total traffic:
 - Expected:
 - USA
 - Canada
 - GB
 - Australia
 - Interesting:
 - Mexico
 - Brazil



Lessons Learned

- First ever mapping of Netflix's OpenConnect CDN
 - Physical server distribution
 - Virtual expansion
 - Traffic estimation
- Exposing Netflix' overall server placement strategy
- Different markets require region-specific deployments
 - Differences between the local Internet Ecosystems
- Full paper at arXiv and ResearchGate
 - <http://tiny.cc/netflix-maps>