The Rise and Rise of Content Distribution Networks

Geoff Huston

APNIC

WIE December 2017

Our Heritage

The Telephone Network:

- Connected handset to handset
- Intentionally transparent network
- Peer-to-peer service construct
- Network-centric architecture with minimal functionality in the edge devices

Computer Networks

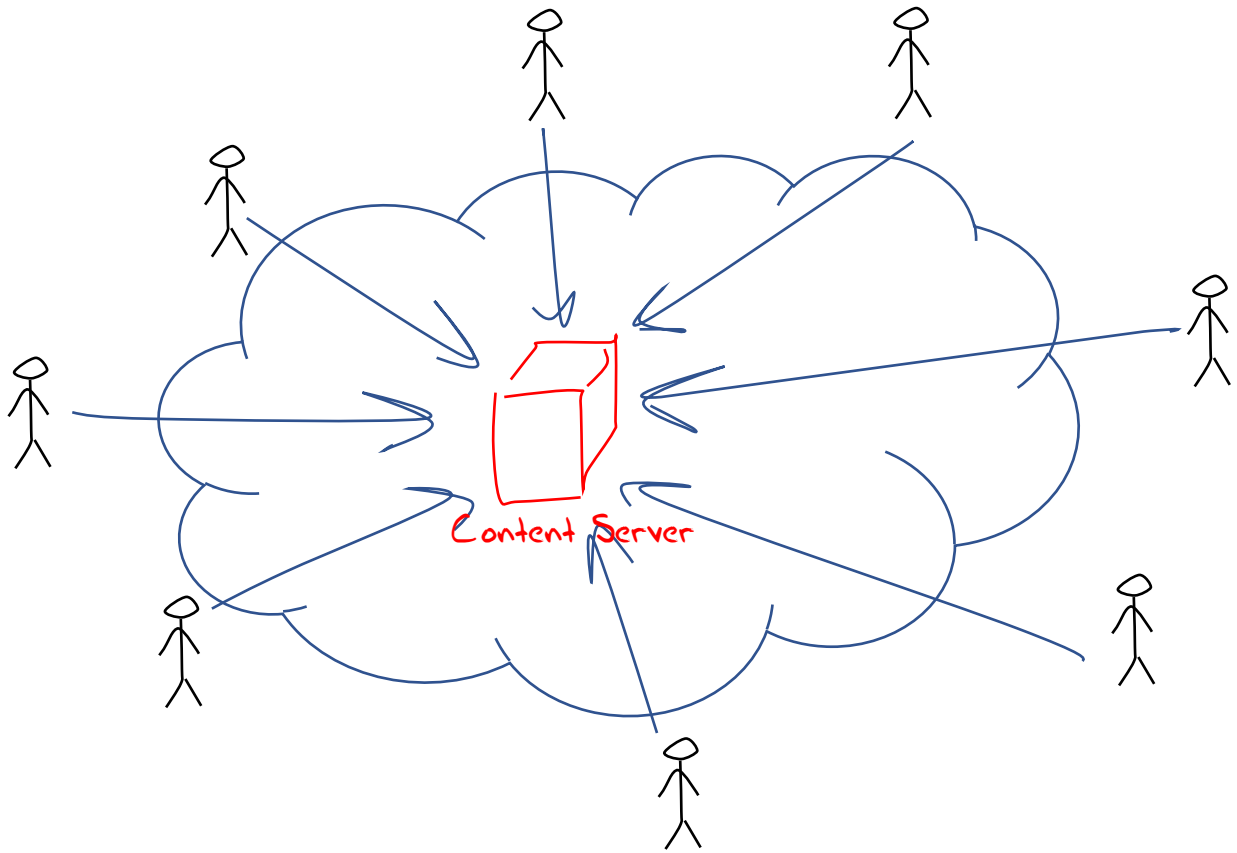
The original concept for computer networks was like the telephone network:

- The network was there to enable connected computers to exchange data
- All connected computers were able to initiate or receive “calls”
- A connected computer could not call ”the network” – the network was an invisible common substrate
- It made no difference if the network had active or passive internal elements

Clients and Servers

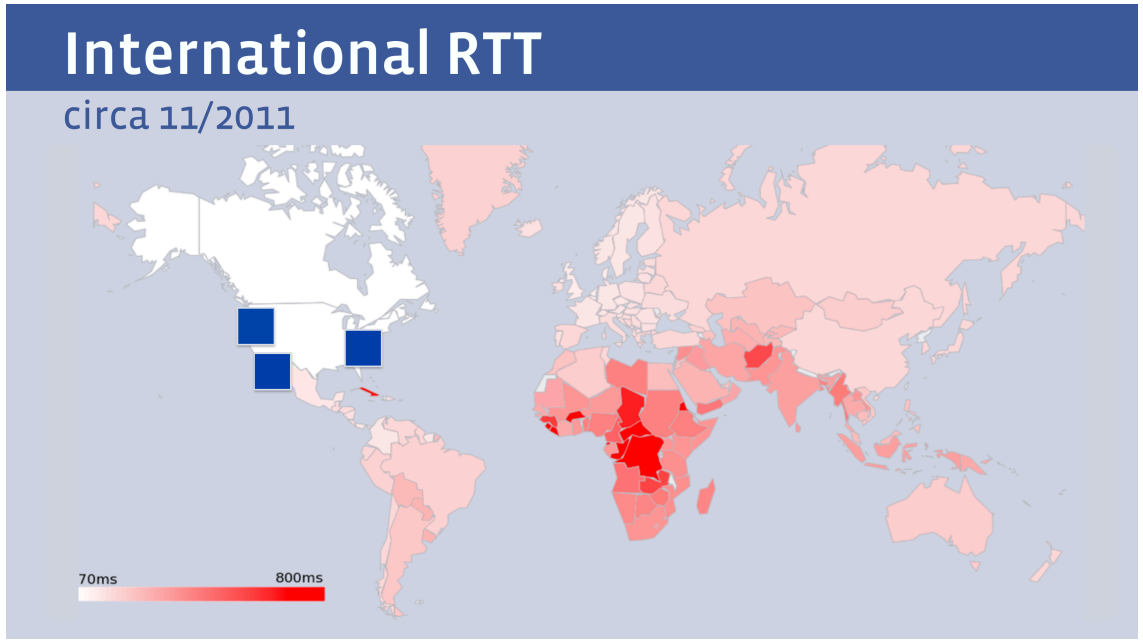
- The rise of the web-based content publishing model was accompanied by the creation of specialised server computers that published data, and specialised client-side devices who could only retrieve published data
- The rise of NATs enforced this role segmentation in the network
  - And, coincidentally removed any sense of urgency associated with the transition to IPv6

Content Server



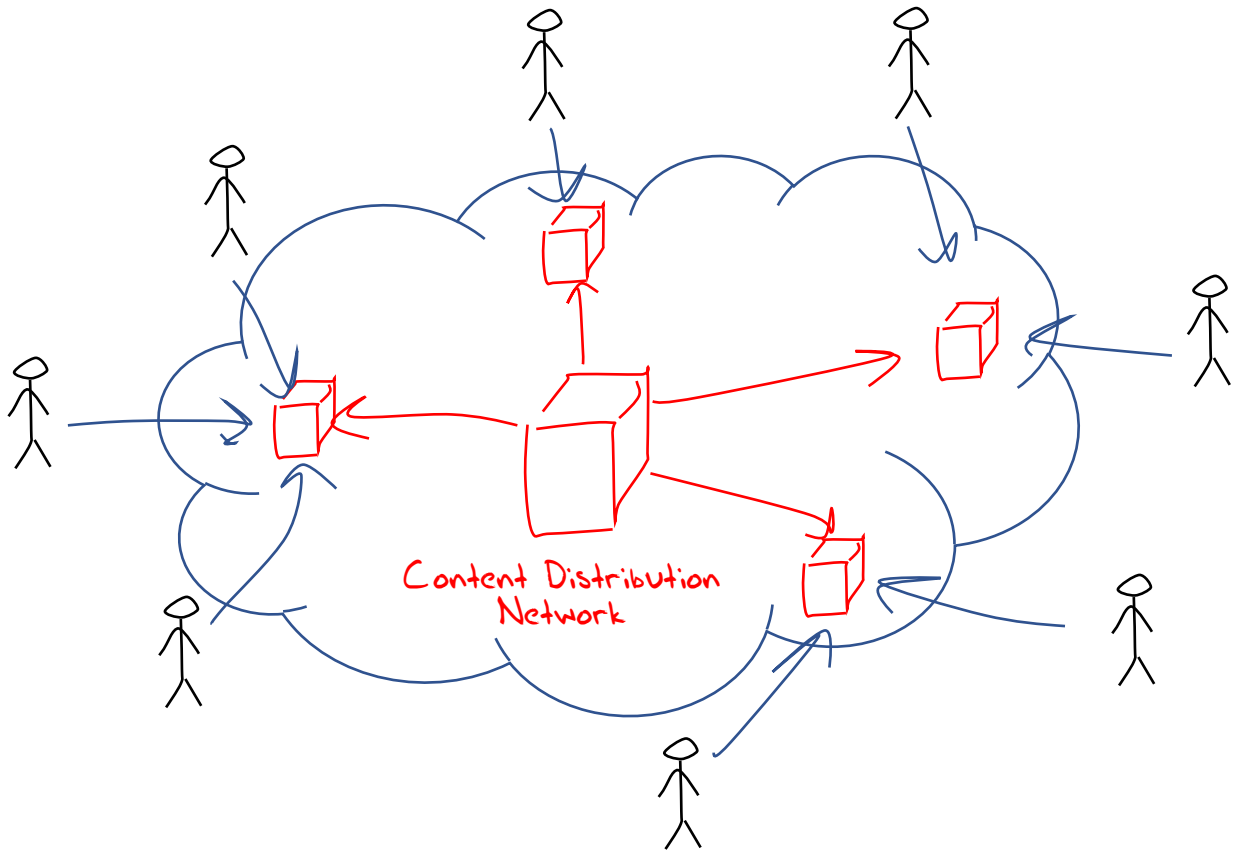
The Tyranny of Distance

But not all clients enjoy the same experience from a single service portal



Facebook presentation at NANOG 68

Content Distribution



Let them eat data!

The rise of the Content Distribution Network

- Replicate content caches close to large user populations
- The challenge of delivering many replicant service requests over high delay network paths is replaced by the task of updating a set of local caches by the content distribution system and then serving user service requests over the access network
- Reduced service latency, increased service resilience, happy customers!

Role Reversal

Service portals are increasingly located adjacent to users

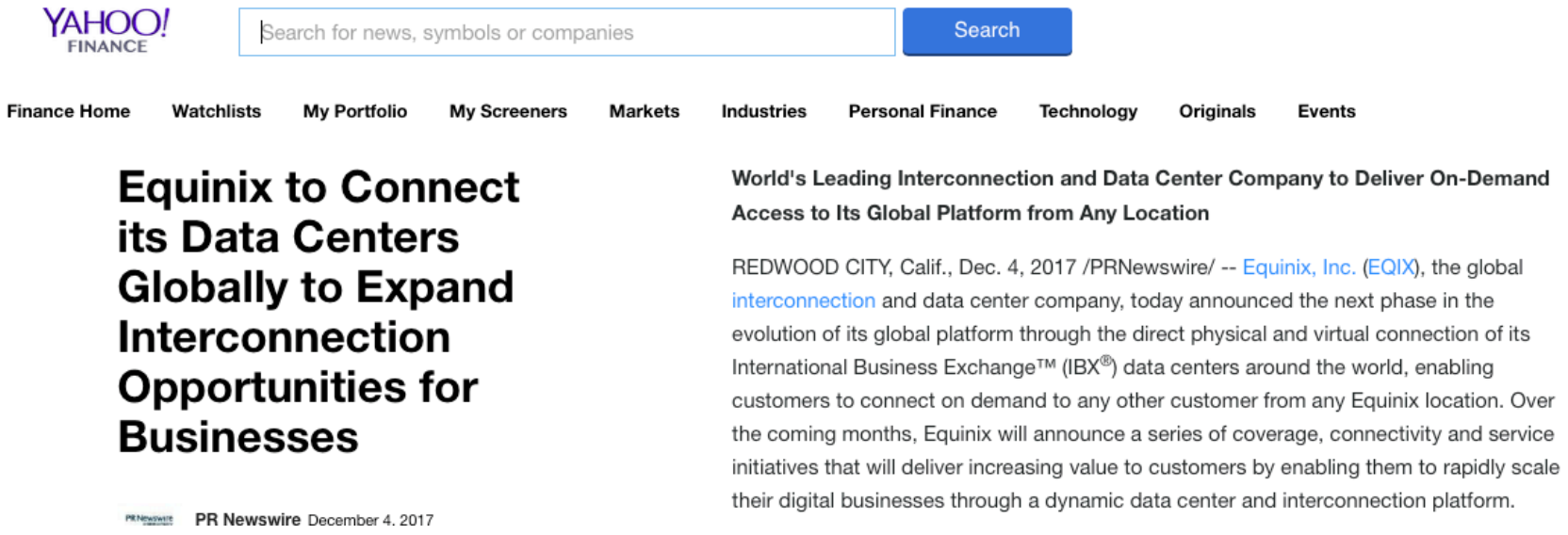
And that means changes to the network:

- Public Networks no longer carry users' traffic to/from service portals via ISP carriage services
- Instead, Private Networks carry content to service portals via CDN services

This shift has some profound implications for the Internet

Does Transit have a Future?

We see the CDN systems reserve a carriage resource through dedicated bandwidth / wavelength / cable purchase and effectively bypass the open IP carriage infrastructure



Does Transit have a Future?

- If users don't send packets to users any more…
- If content is now delivered via CDNs to users via discrete service cones…
- If there is no universal service obligation for content…
- If there is no visible definition of the "Internet Route Set" ('default') any more…
- If there is no economically viable demand for transit any more…

Then why do we still need Transit Service providers?

Exactly where are we?

- We started this journey building a telephone network for computers to communicate between each other
- But now one-way content distribution lies at the core of today's Internet
- This content distribution role is an enterprise service framework rather than a public carriage service
- The internal parts of the carriage network are now being privatized and removed from public regulatory scrutiny
- What's left is just the last mile

Last Mile Futures

- Can independent last mile access networks survive as independent entities in this environment?
  - Like the experience with transit markets will they fall victim to the pressure from the cashed up service provider sector and their CDNs?
  - If access networks come to rely on imposing tolls on content providers, then at what point will the folk paying the these tolls assert proprietorial control over this last mile asset?
- Is this something that markets will resolve, or will we see this as a more insidious form of market failure?

Fin!