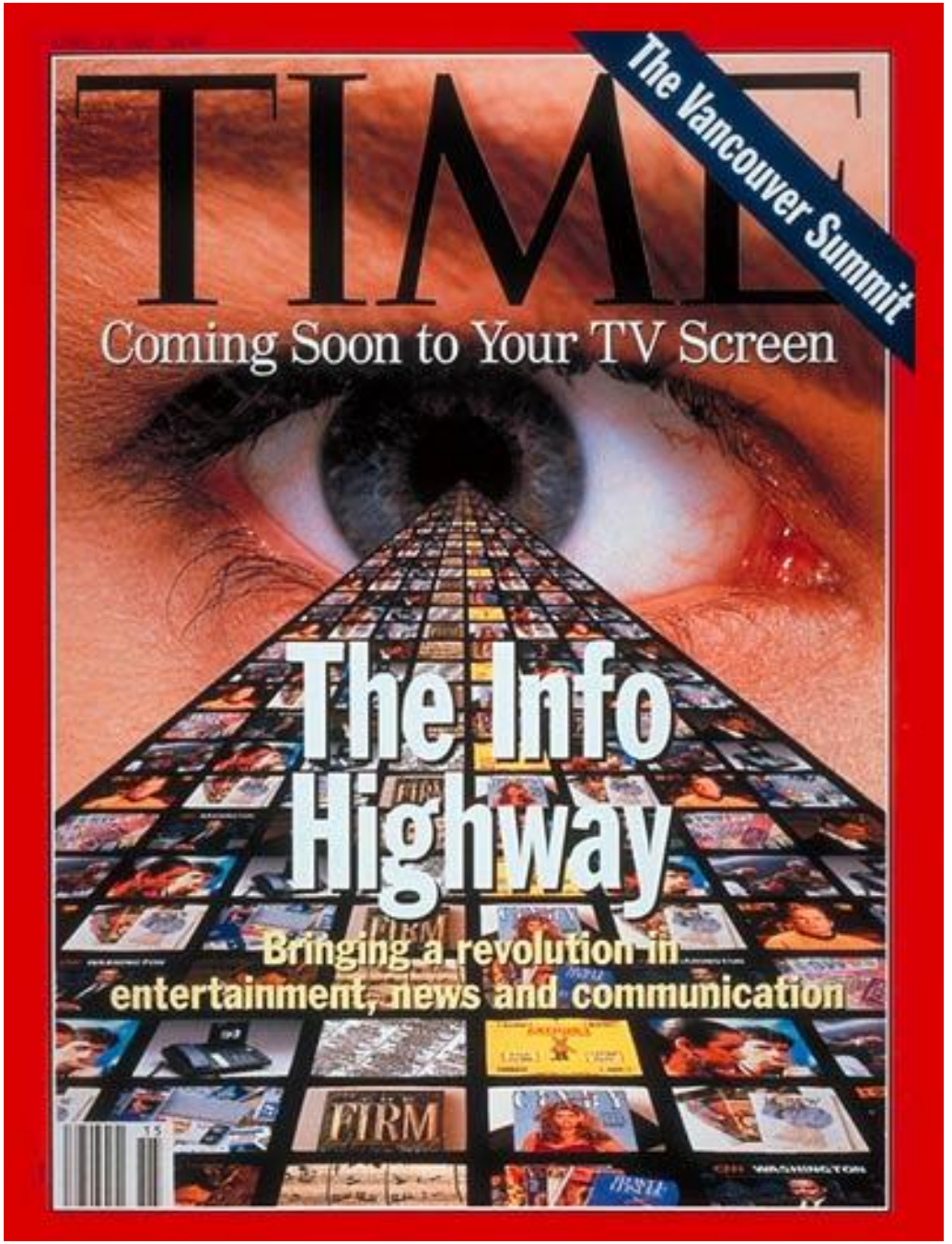
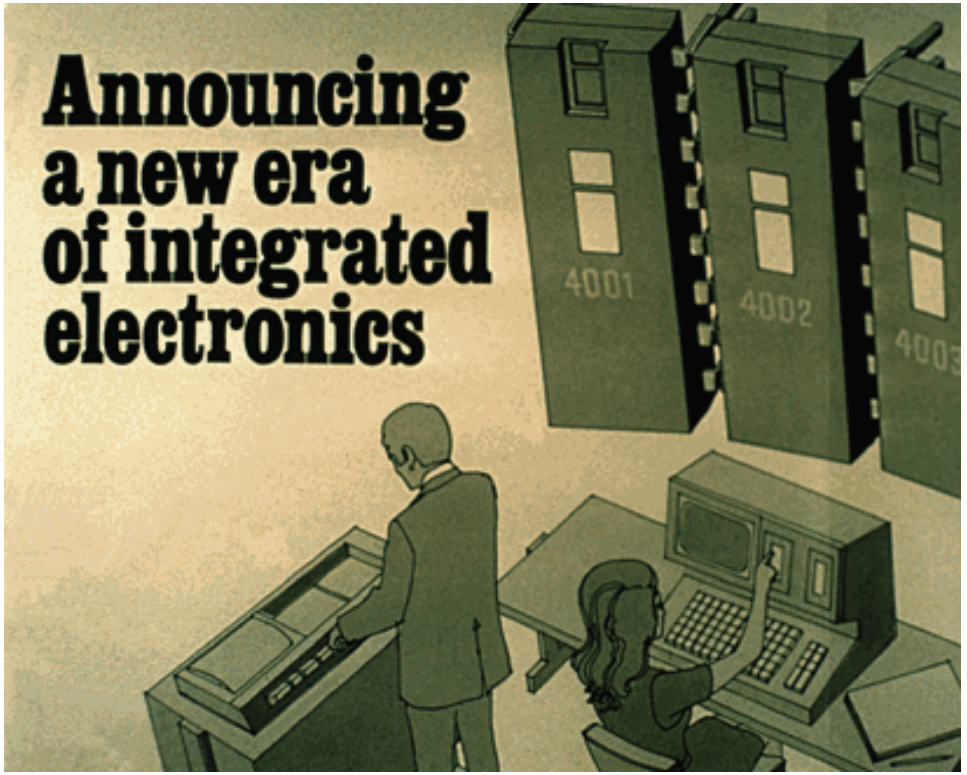
The Internet Shouldn't Work: Networking 101

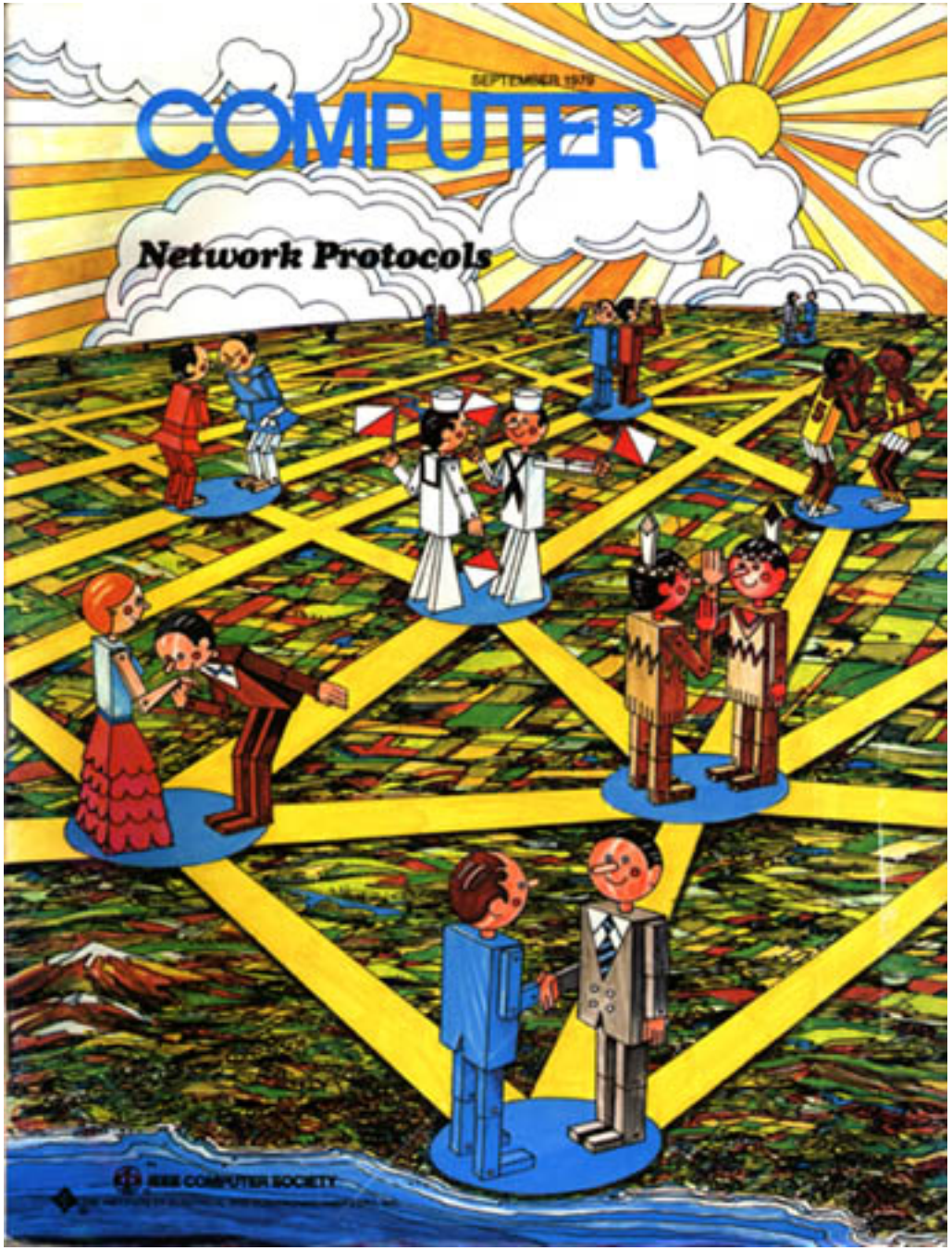
Roadmap

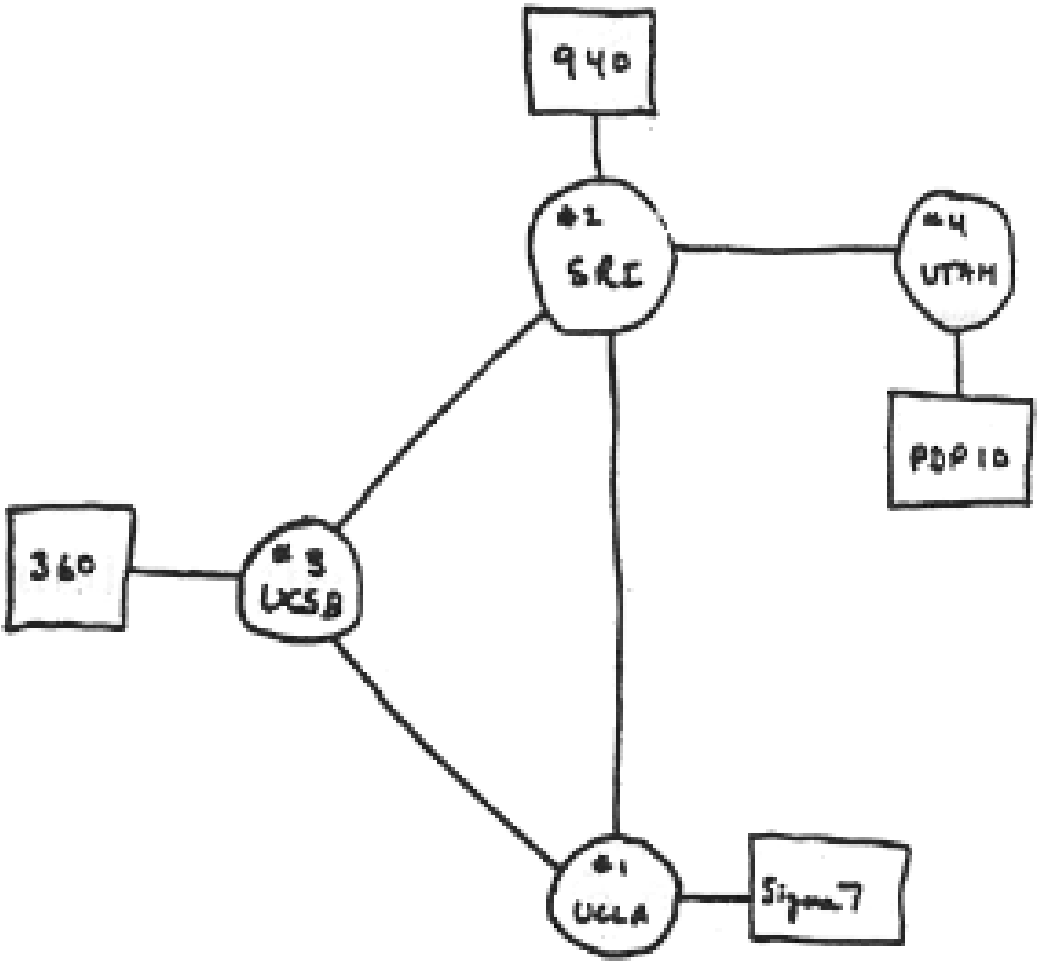
- History
- Governance and protocols
- Putting it all together: what happens when you browse the web
- Current events: networking in the news
- Demos, interspersed
- Q & A



History


Announcing
a new era
of integrated
electronics
4001
4002
4003


COMPUTER
Network Protocols



THE ARPA NETWORK

DEC 1969

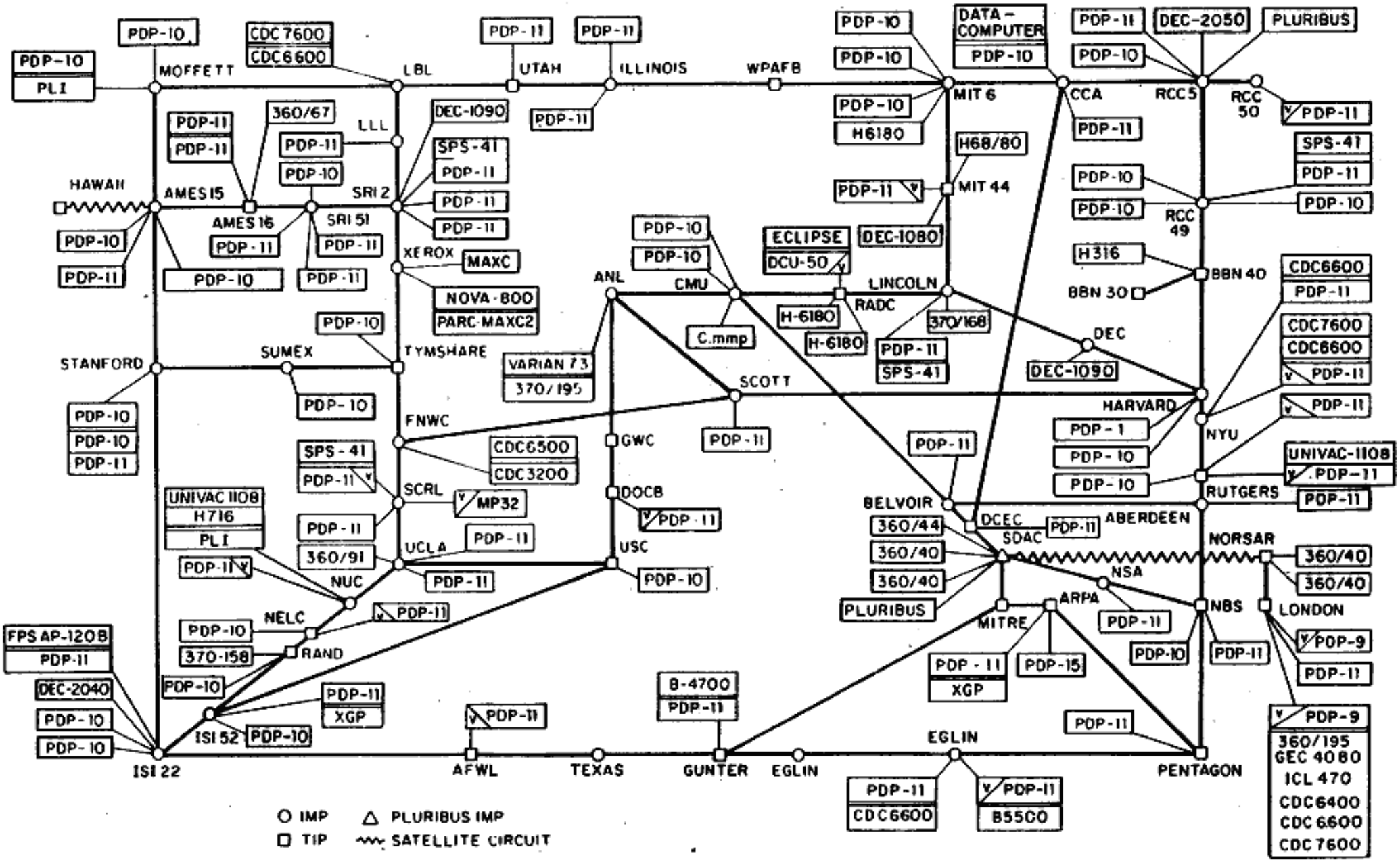
4 NODES

- UCLA
- Stanford Research Institute's Augmentation Research Center
- UC Santa Barbara
- University of Utah's Computer Science Department

The Design Philosophy of the DARPA Internet Protocols, David C. Clark

- ``Develop an effective technique for multiplexed utilization of existing interconnected networks"
- Robust
- Support for many communication services
- Support for heterogeneous networks
- Distributed management of resources
- Cost effective
- Low effort for host connection
- Accountability of resources

ARPANET LOGICAL MAP, MARCH 1977

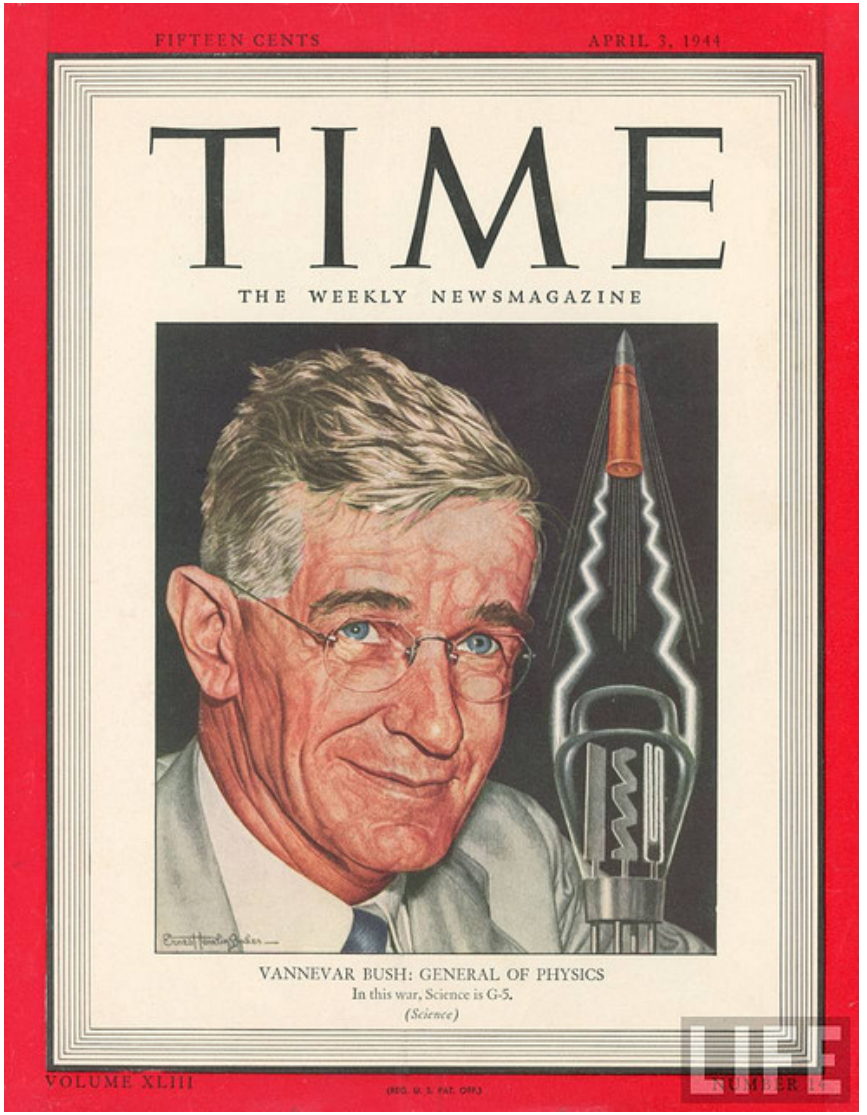


(PLEASE NOTE THAT WHILE THIS MAP SHOWS THE HOST POPULATION OF THE NETWORK ACCORDING TO THE BEST INFORMATION OBTAINABLE, NO CLAIM CAN BE MADE FOR ITS ACCURACY)

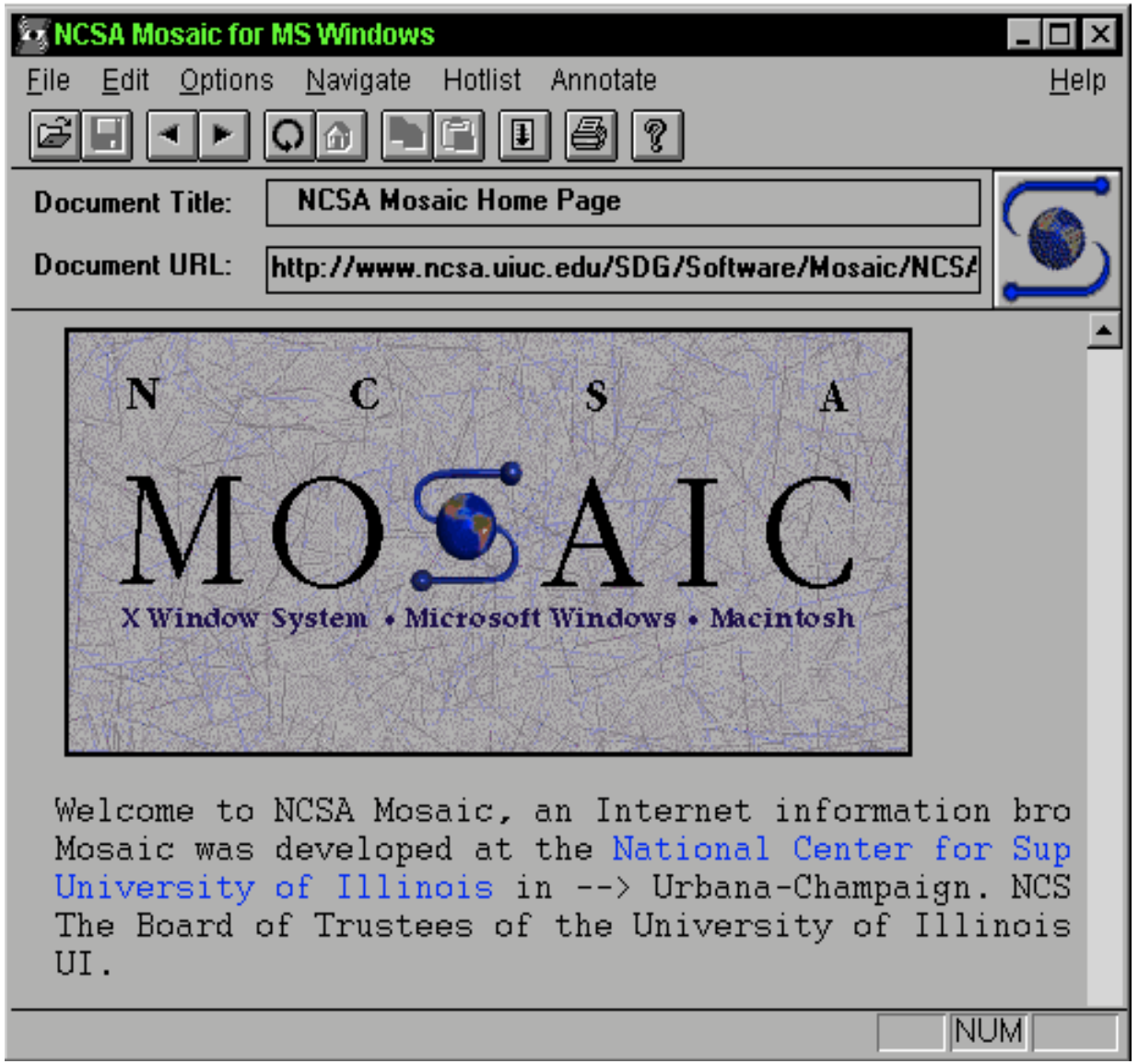
NAMES SHOWN ARE IMP NAMES, NOT (NECESSARILY) HOST NAMES

The World Wide Web

1945, Vannevar Bush's Memex



Early 90s, Tim Berners-Lee, WWW, HTML, web browsers



The Internet today

Top 10 sites according to Alexa

1. Google
2. Facebook
3. YouTube
4. Yahoo!
5. Baidu
6. Wikipedia
7. Windows Live
8. Blogspot
9. Twitter
10. Amazon

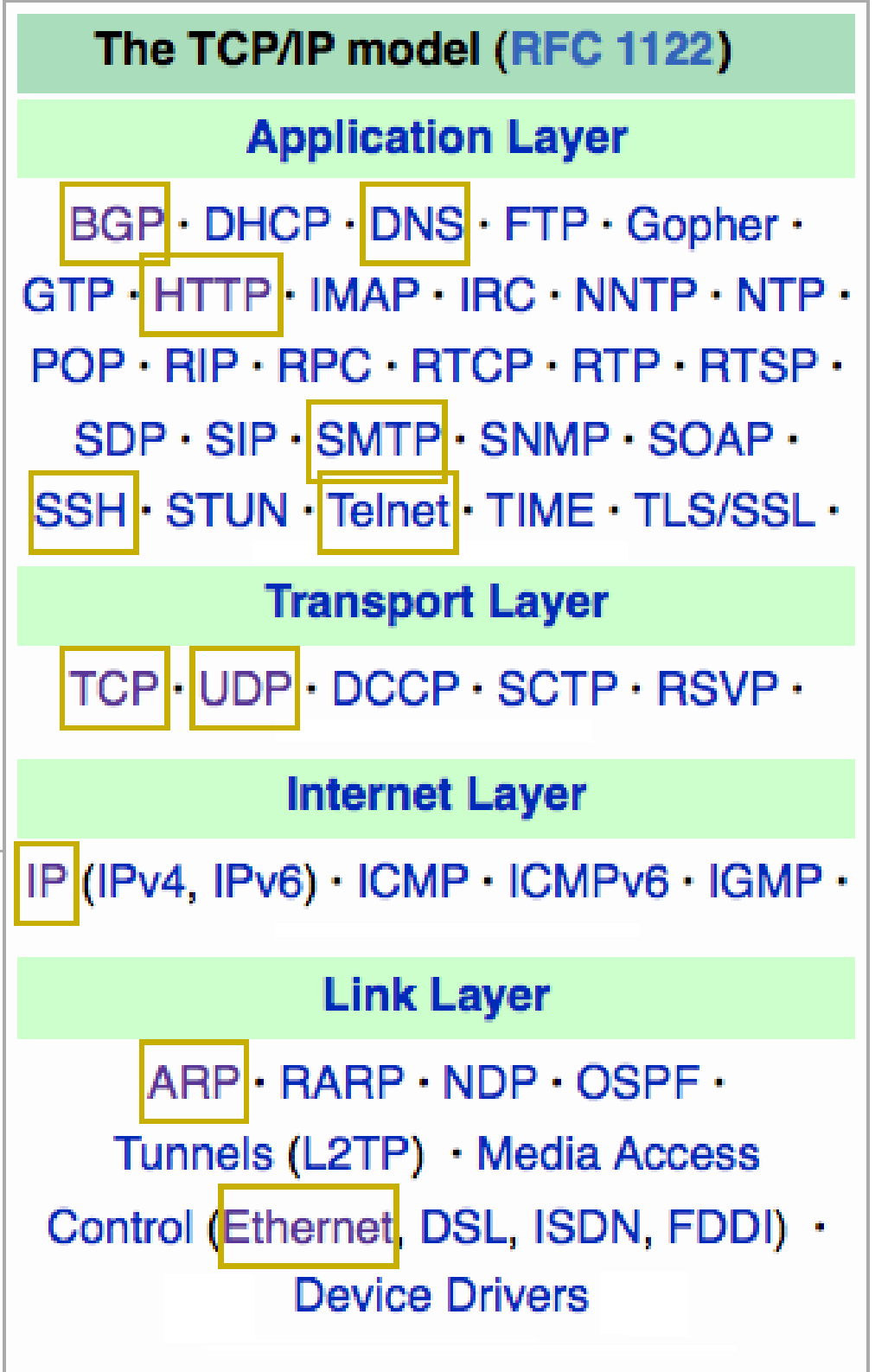
You type google.com into your browser bar and hit enter.

What happens?

Names and Hierarchies

- IP addresses
  - IPv4, 32-bit addresses => 2^32 (4,294,967,296) addresses
- Hostnames
- Domain Name Service (DNS)

DNS translates IP addresses to hostnames



Protocols

- HTTP
- TCP
- IP
- Ethernet

Application Layer: HTTP

Hypertext Transfer Protocol

Clients use HTTP to request resources from servers

`telnet` demo!

Transport Layer:
TCP

Transmission Control Protocol

TCP reliably delivers data across the internet

Internet Layer:
IP

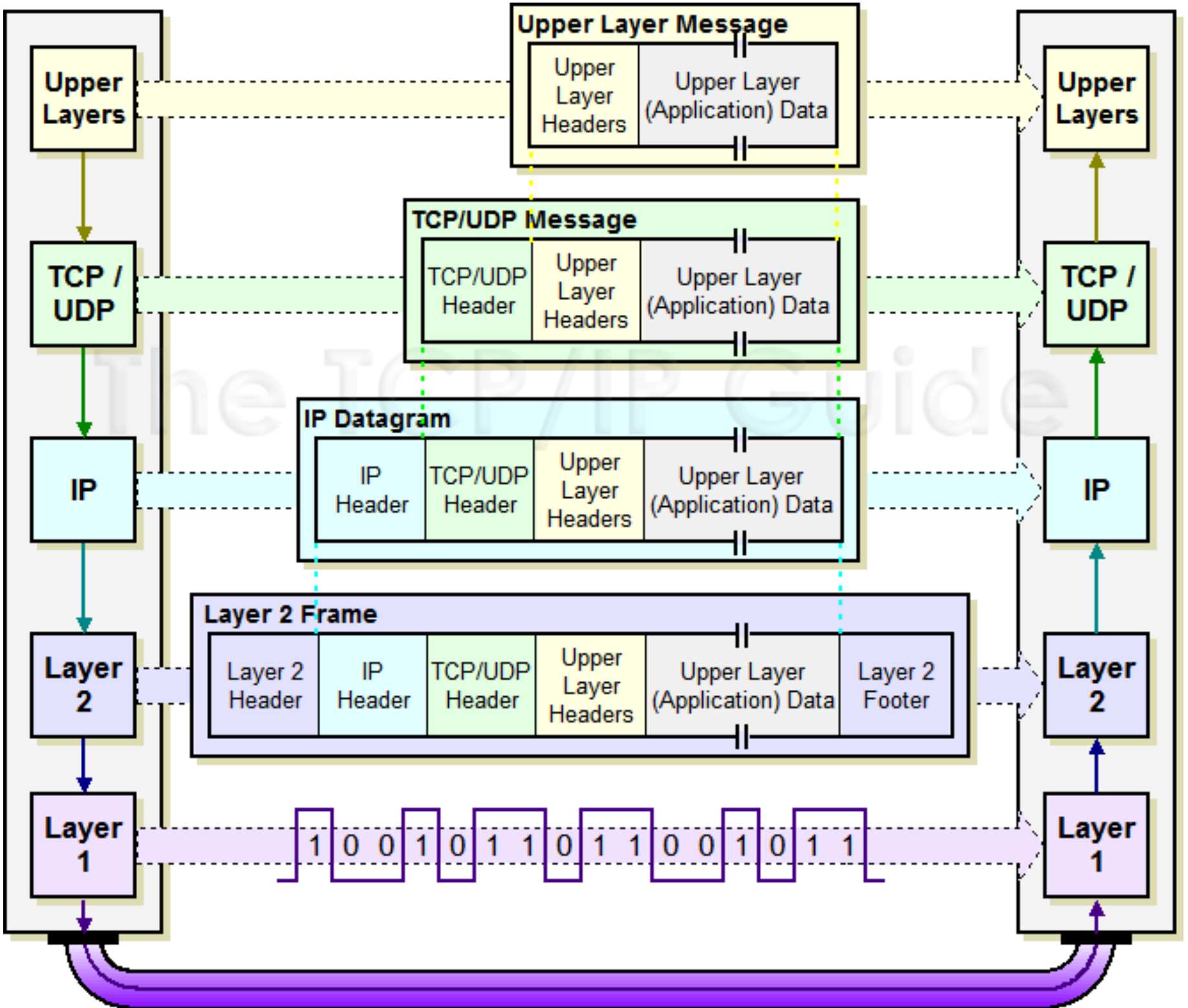
Internet Protocol

IP handles addressing and routing

`traceroute` demo!

You type google.com into your browser bar and hit enter.

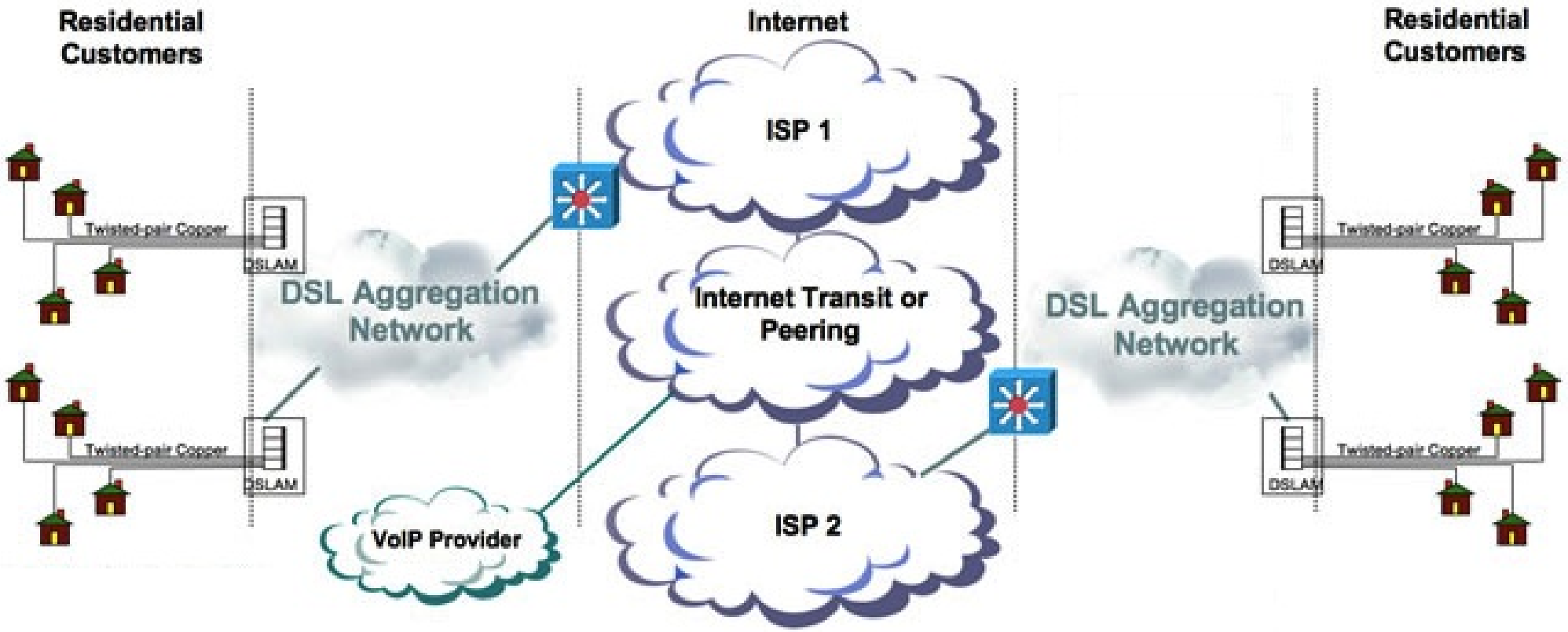
What happens?


Upper Layer Message
Upper Layer Headers
Upper Layer (Application) Data
TCP/UDP Message
TCP/UDP Header
Upper Layer Headers
Upper Layer (Application) Data
IP Datagram
IP Header
TCP/UDP Header
Upper Layer Headers
Upper Layer (Application) Data
Layer 2 Frame
Layer 2 Header
IP Header
TCP/UDP Header
Upper Layer Headers
Upper Layer (Application) Data
Layer 2 Footer
Upper Layers
TCP / UDP
IP
Layer 2
Layer 1
1 0 0 1 0 1 1 0 1 1 0 0 1 0 1 1
Upper Layers
TCP / UDP
IP
Layer 2
Layer 1

`wireshark` Demo

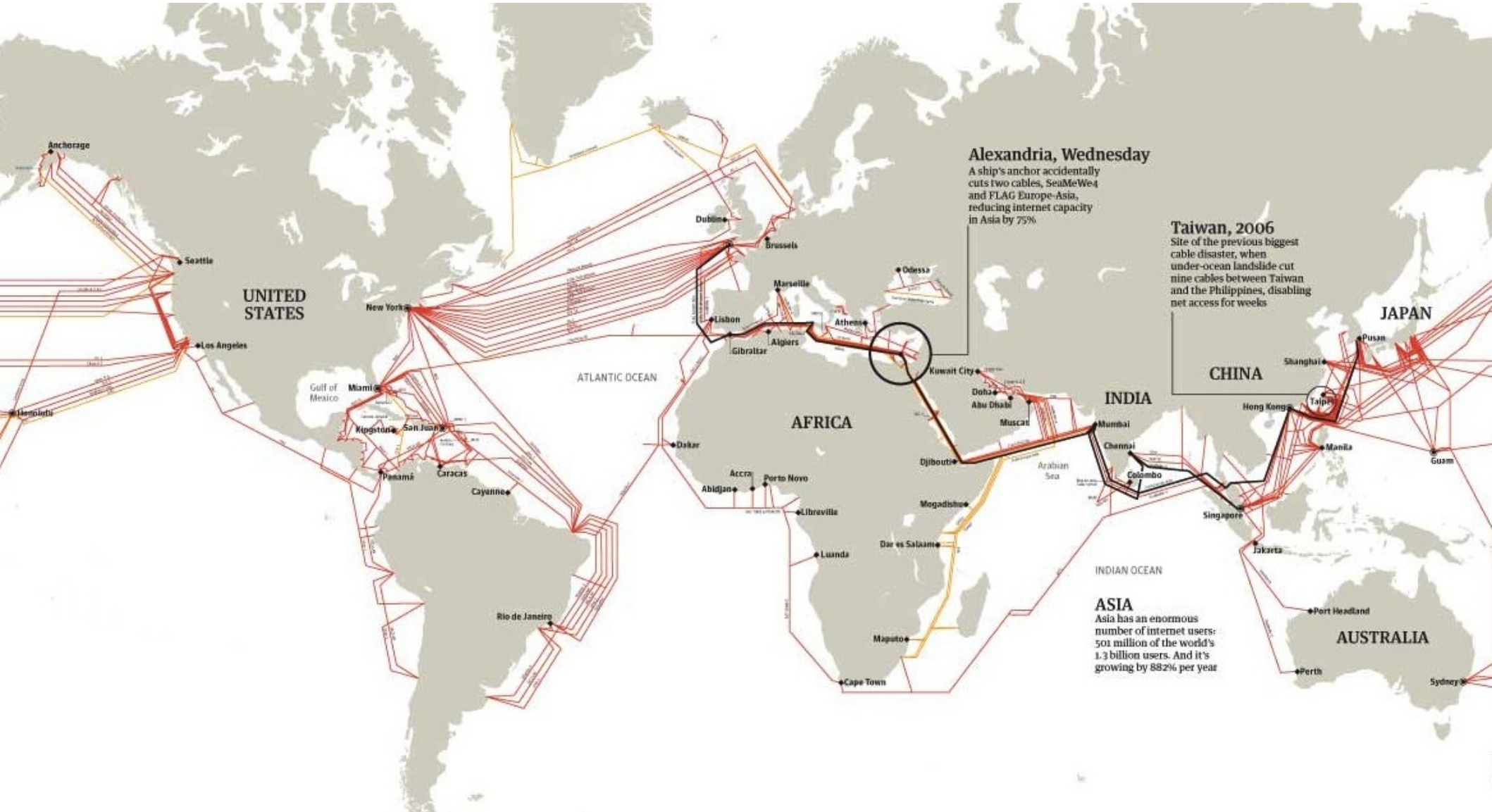
Governance

Internet Service Providers (ISPs)



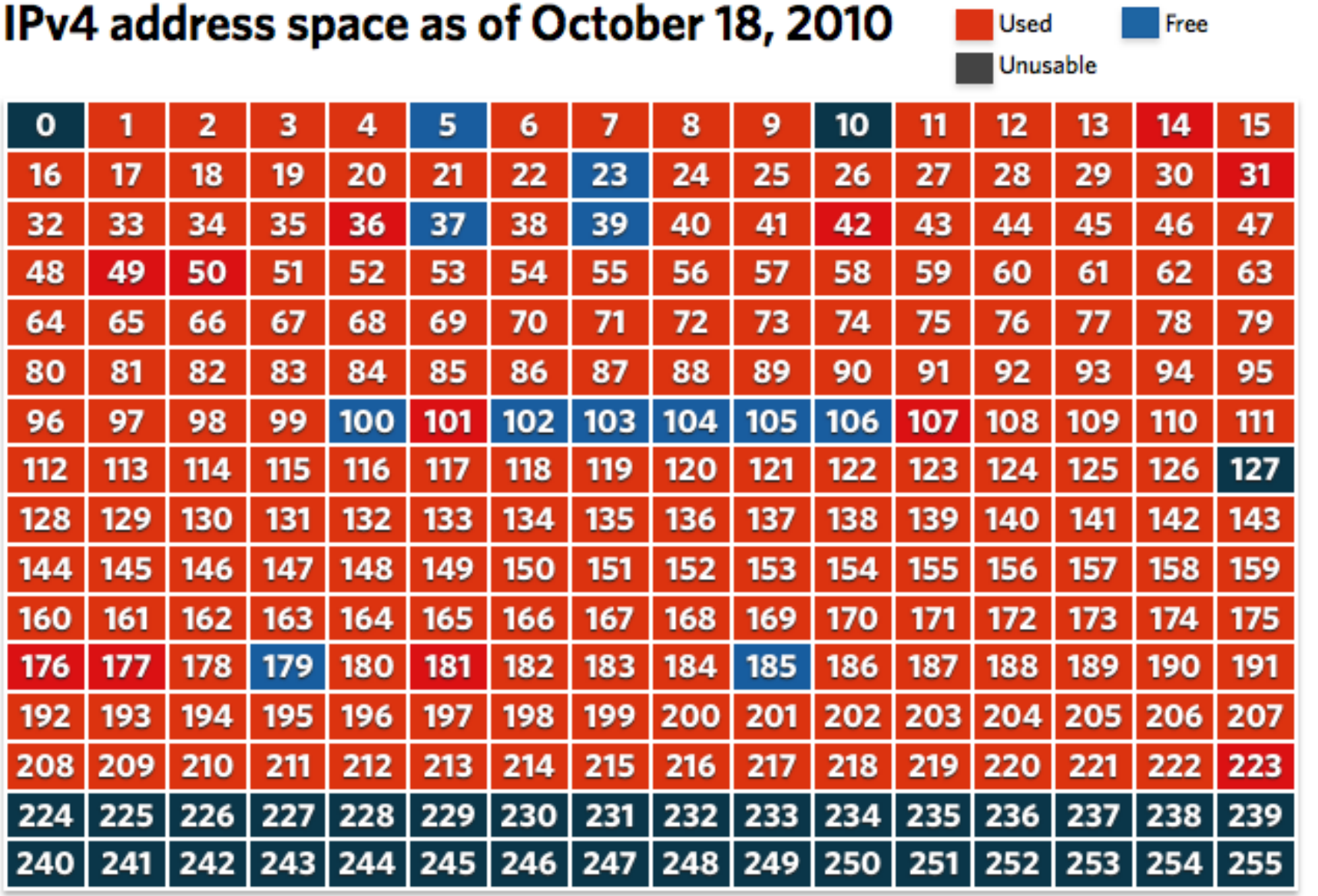
Autonomous System (AS), BGP

“Never underestimate a Southern gentleman with a backhoe and a shotgun.”



Current events

IPv4 address exhaustion

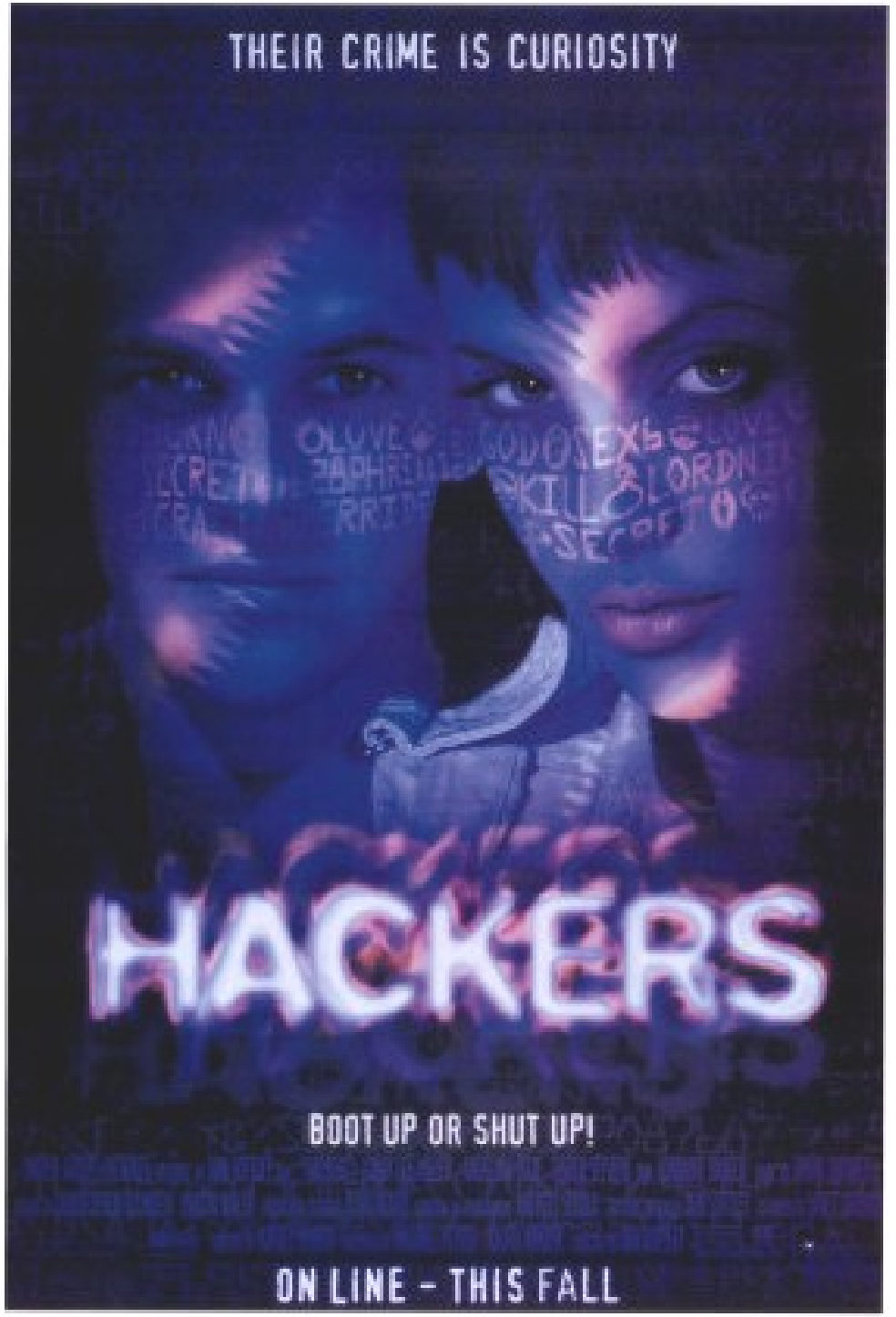


IANA released its remaining blocks on 2/3/2011

IPv4:
2^32 = 4.3 billion addresses

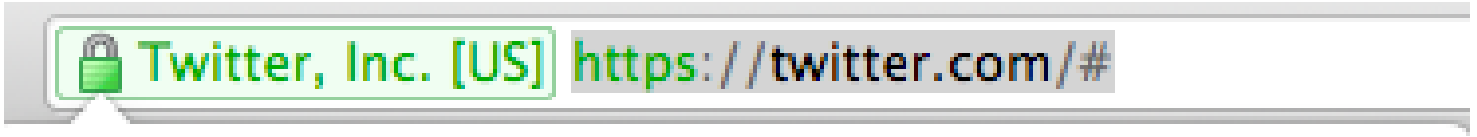
IPv6:
2^128 =
340282366920938463463374607431
768211456 addresses

“4.8×1028 addresses for each of the seven billion people alive in 2011”



Privacy

- Coffee shop wireless
- **HTTPS**



Twitter, Inc. (twitter.com)

The identity of Twitter, Inc. at San Francisco, California US has been verified by VeriSign Class 3 Extended Validation SSL CA.

Certificate Information

Your connection to twitter.com is encrypted with 128-bit encryption.

The connection uses TLS 1.0.

The connection is encrypted using RC4_128, with SHA1 for message authentication and RSA as the key exchange mechanism.

The connection is not compressed.

Site information

You first visited this site on Dec 31, 2011.

What do these mean?

Net neutrality, Internet Censorship

- Oppressive regimes
- Great Firewall of China
- **Tor**
- Stop Online Piracy Act (SOPA) and Protect IP Act (PIPA)

Q & A


YOUTUBE
TWITTER
SEA OF OPINIONS
SEA OF MEMES
TROLL BAY
SEA OF PROTOCOL CONFUSION
SKYPE
AIM
BLOGS
GG