

Advanced Computer Networks

Ankit Singla

ETH Zürich Spring 2017

Course staff



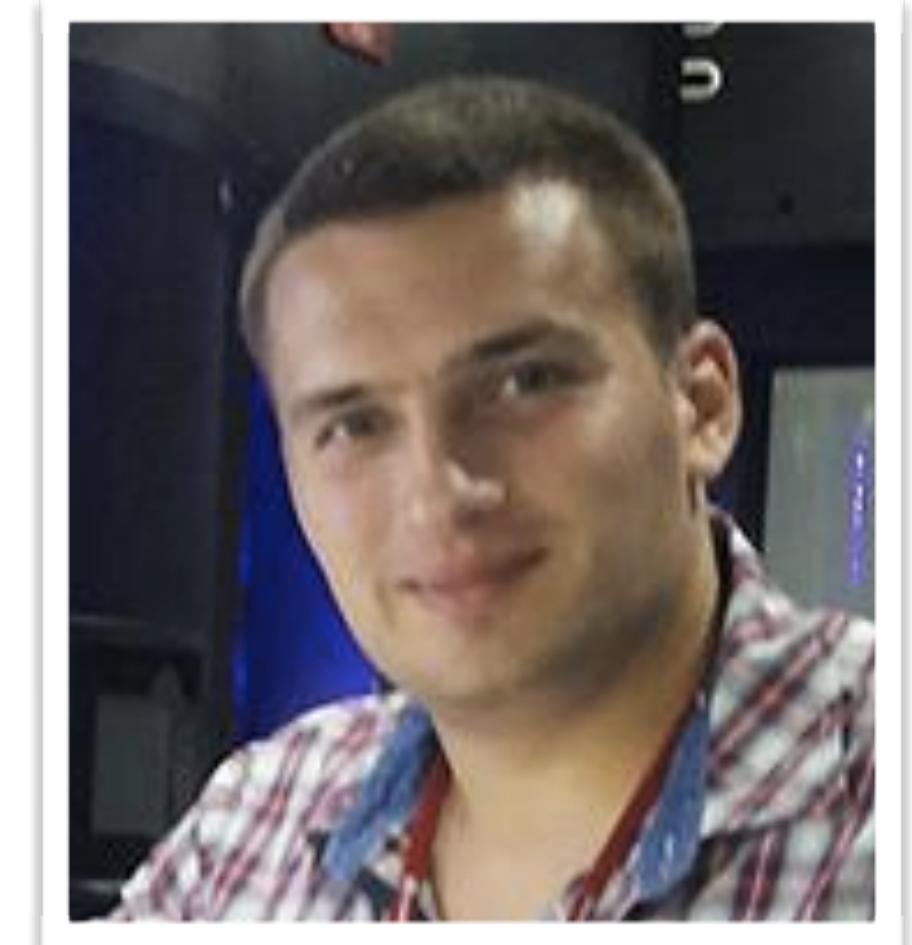
Ankit Singla



Patrick Stuedi



Debopam
Bhattacherjee



Vojislav Đukić

Reach us at <https://acn-eth.slack.com>. Use real names.

Every week ...

- Lecture and discussion around a focus topic
- Introduction to next week's topic
- Assigned readings on next week's topic
- Exercises and programming assignments

<https://www.systems.ethz.ch/courses/spring2017/acn>

What's this course about?

- State of the art in networking practice
- State of the art in networking research
- Preparing to advance beyond the state of the art

Why study networking?

For the love of ...

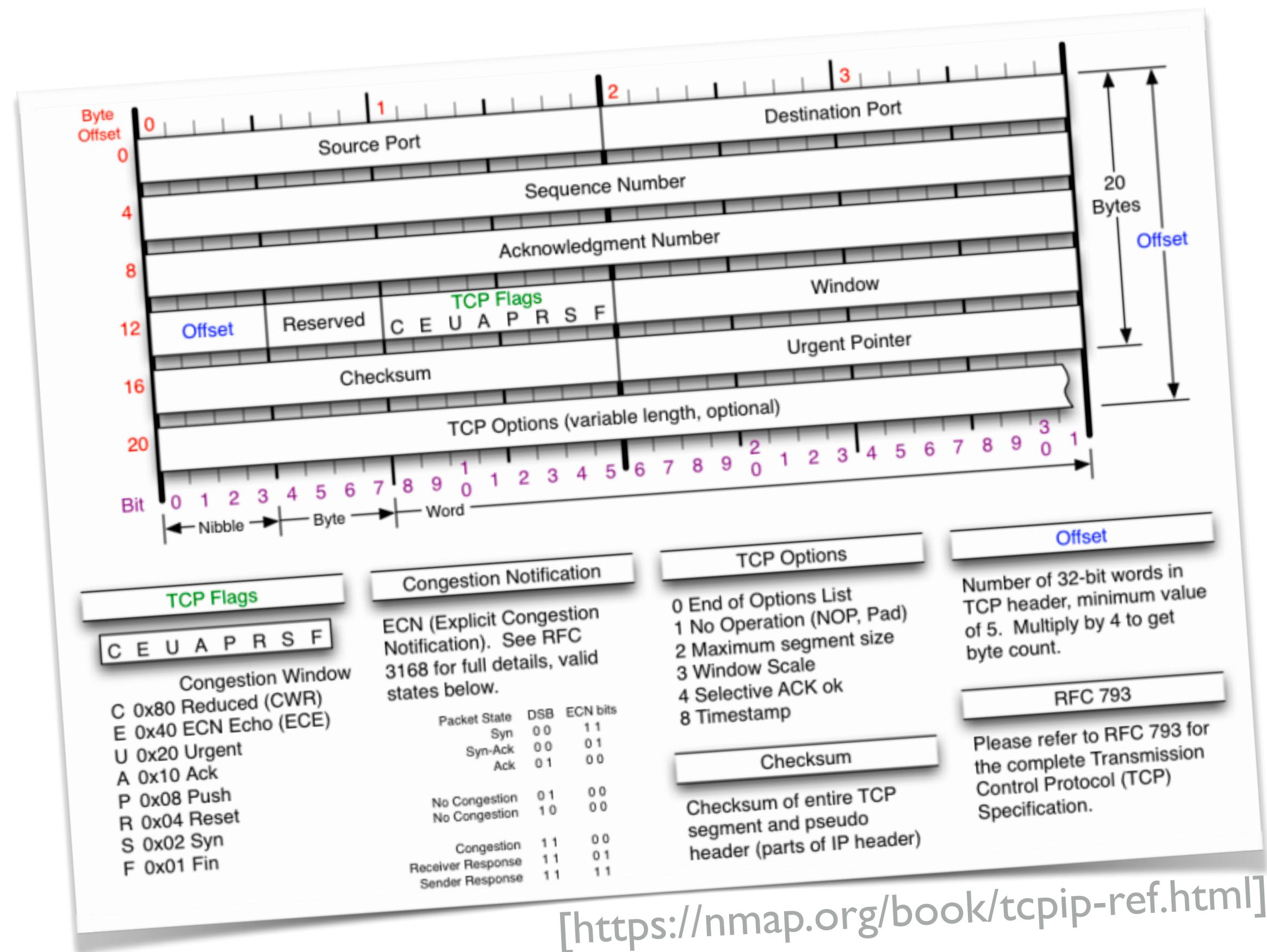
- ... acronyms?
 - BGP, OSPF, DNS, MAC, TCP, IP, WAN, DCTCP, ACL, AES, AP, SYN, ACK, LAN, CRC, HTTP, WWW, DoS, 4G, DHCP, ECN, RED, FIB, RIB, TLD, IETF, ICMP, IDS, IGMP, IS-IS, P2P, PHY, MTU, RTO, RDMA, WiFi, ...



[<http://appletoncreative.com/>]

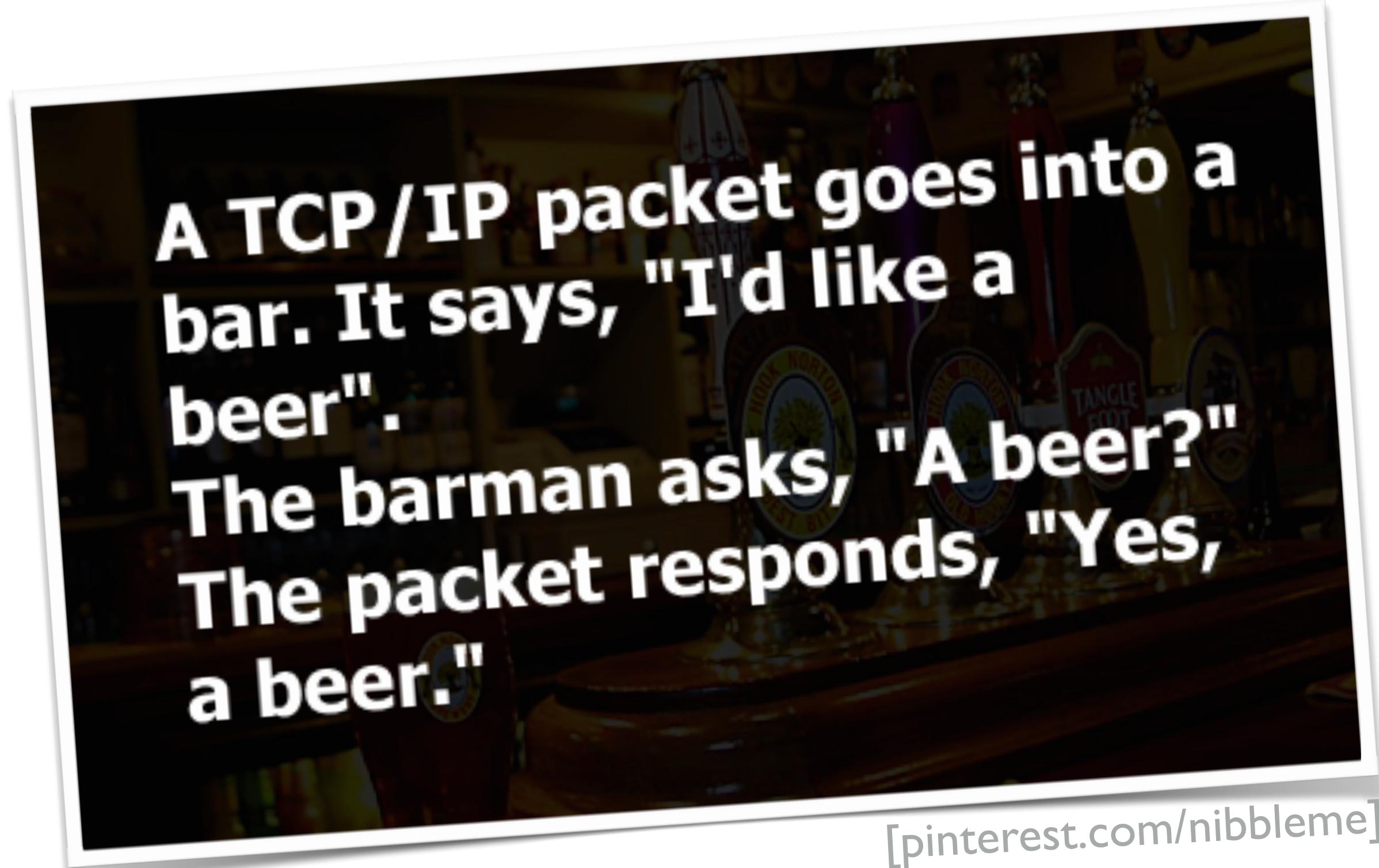
For the love of ...

- ... headers and bit / byte offsets?



For the love of ...

- ... *terrible jokes?*



Why study networking?

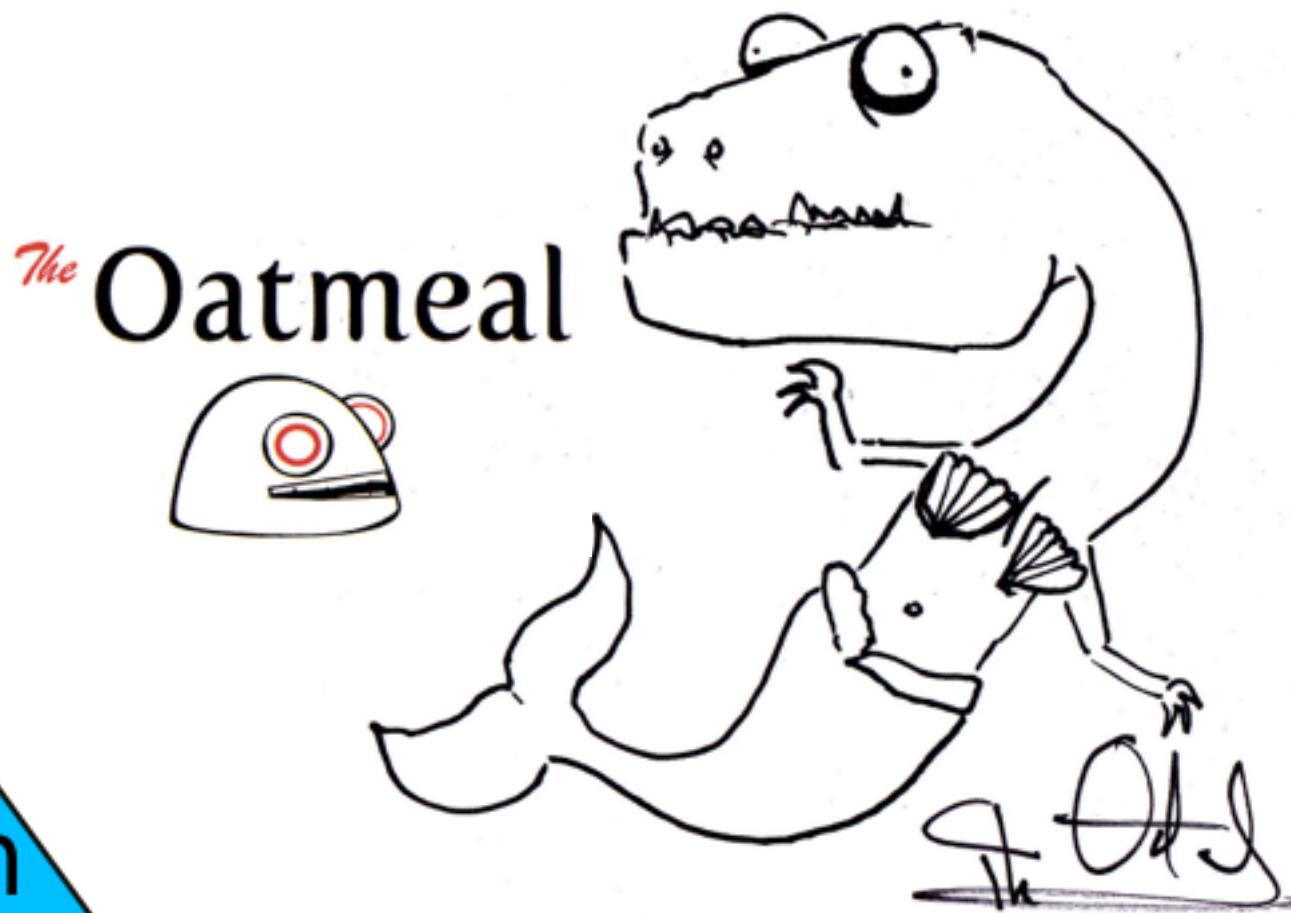
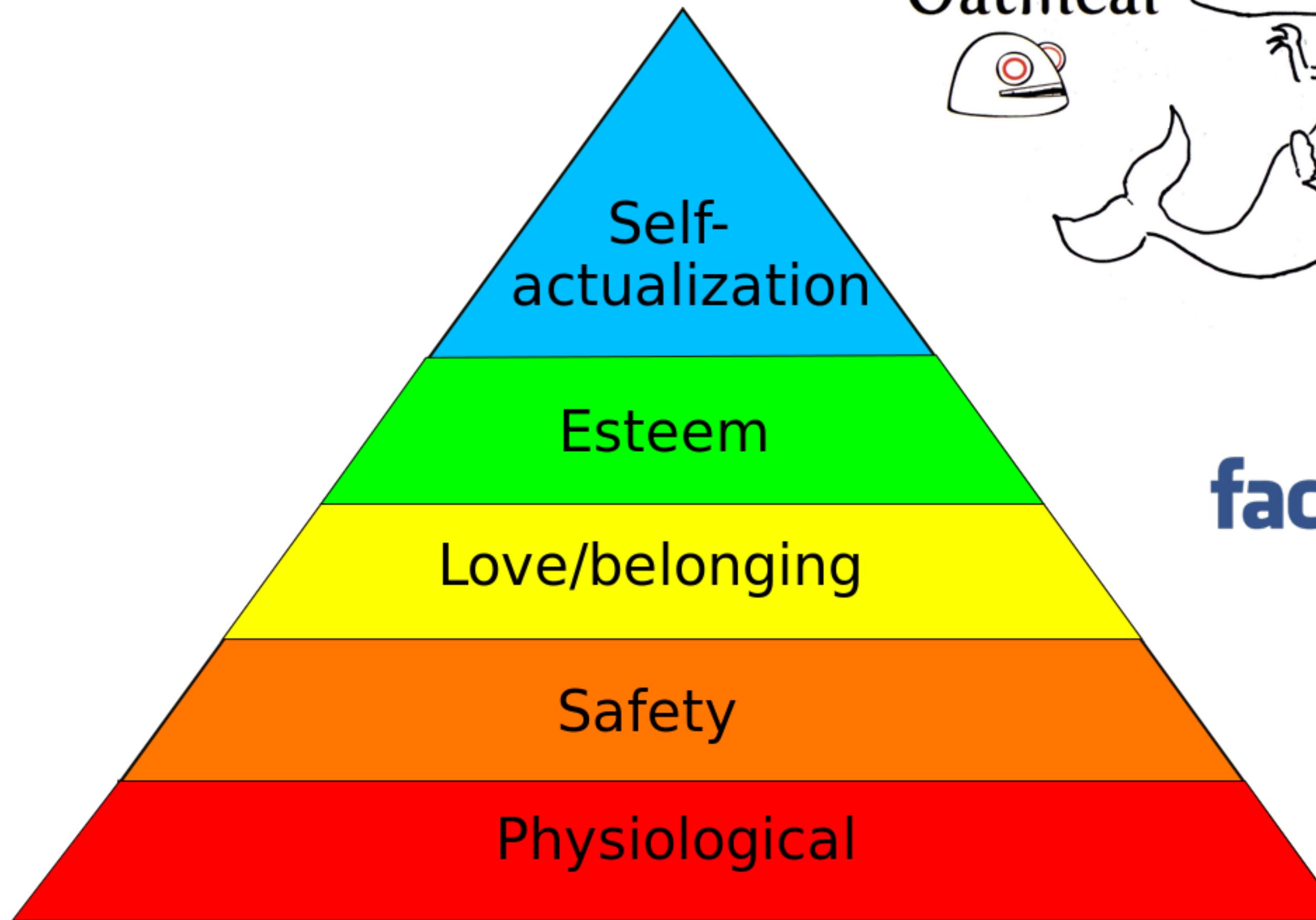
1. Printing press, 1430s
2. Electricity, late 19th century
3. Penicillin, 1928
4. Semiconductor electronics, 1950s
5. Optical lenses, 13th century
6. Paper, second century
7. Internal combustion engine, ~1860
8. Vaccination, 1796
9. **The Internet, 1960s**
10. Steam engine, 1712

The 50 Greatest Breakthroughs Since the Wheel

Why did it take so long to invent the wheelbarrow? Have we hit peak innovation? What our list reveals about imagination, optimism, and the nature of progress.



Everything depends on networking ...



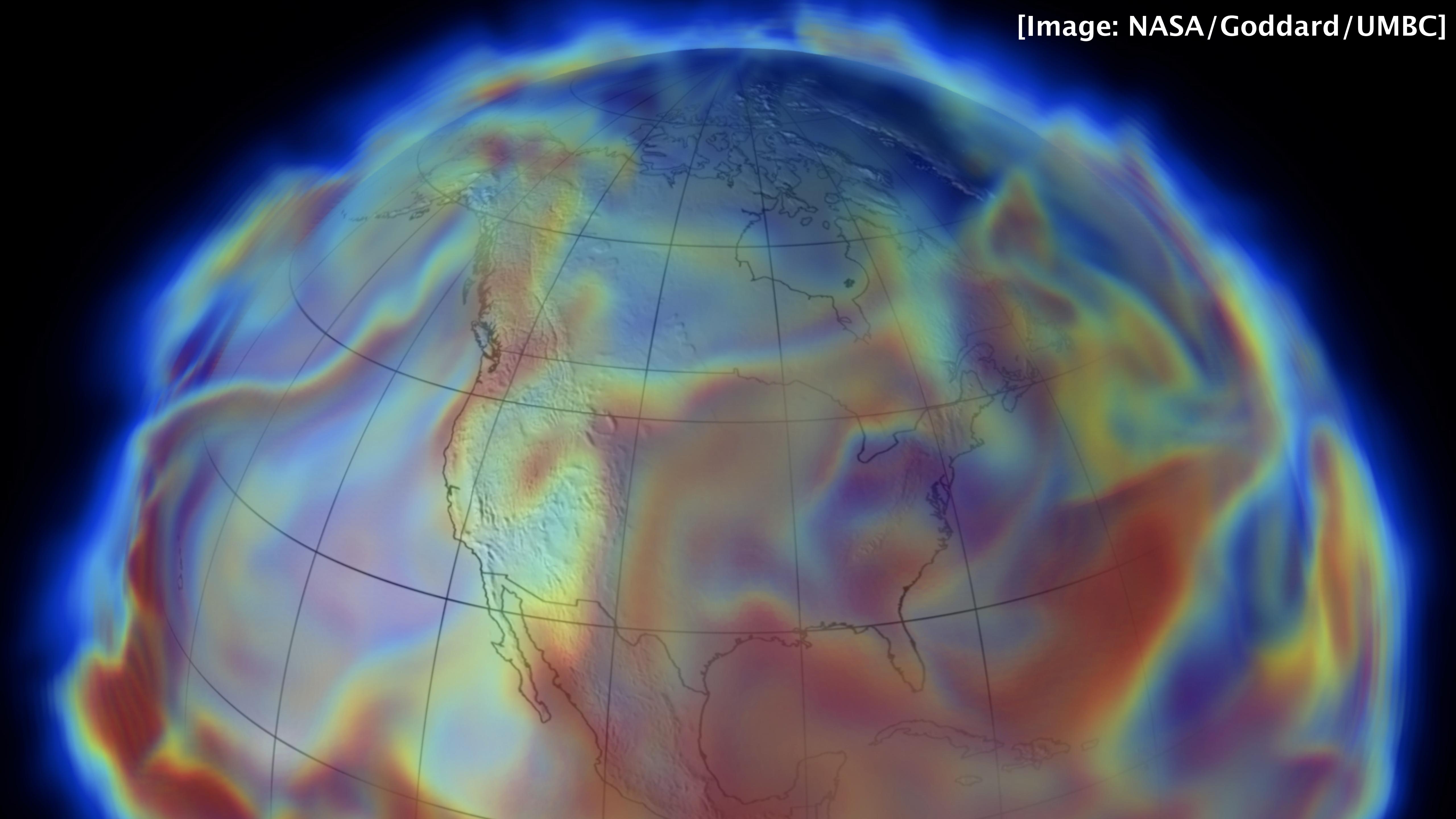
facebook.



grubHub[®]
happy eating

Google

[Image: NASA/Goddard/UMBC]







BACKGROUND PAPER

Digital Dividends

**Exploring the Relationship
Between Broadband and
Economic Growth**

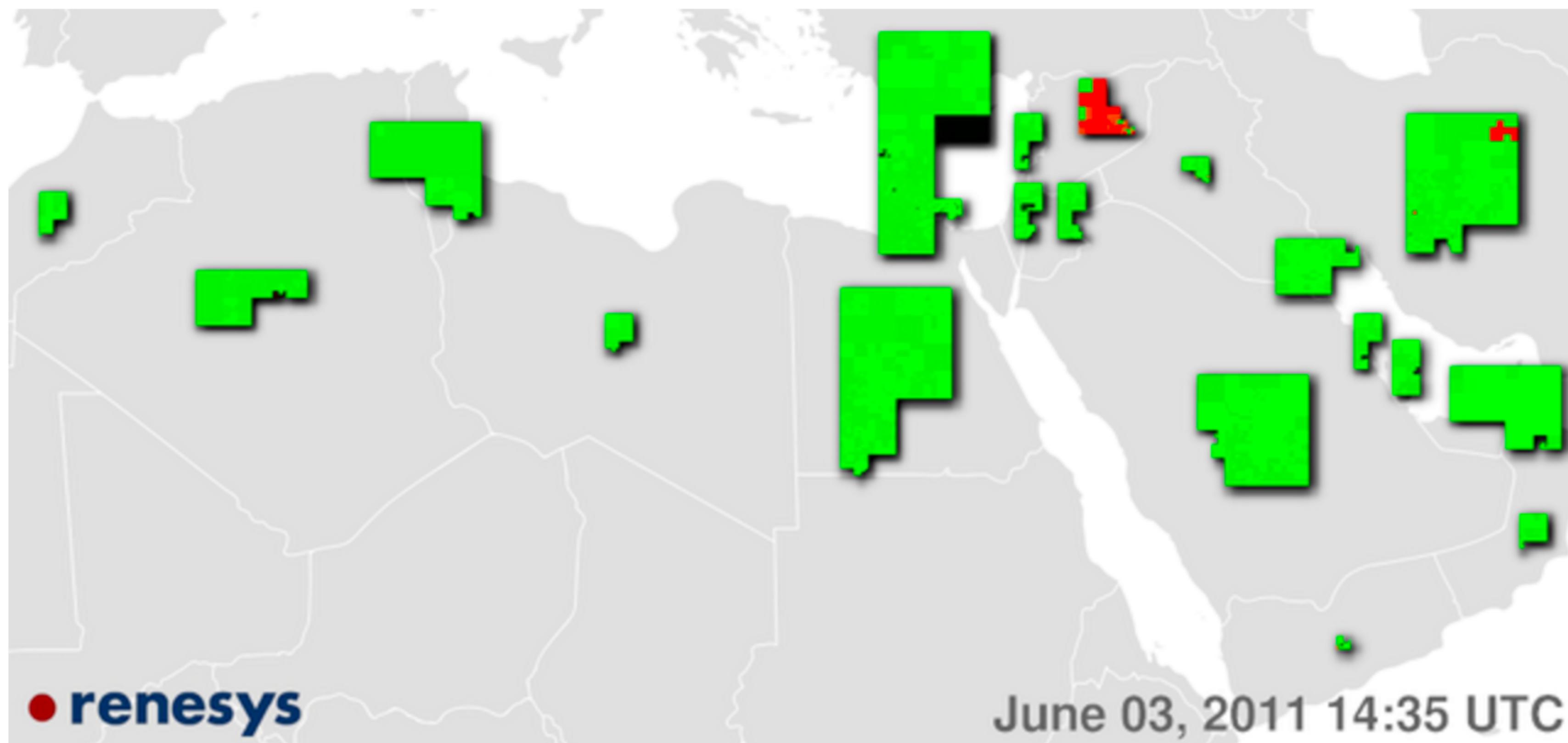
Michael Minges

ictData.org

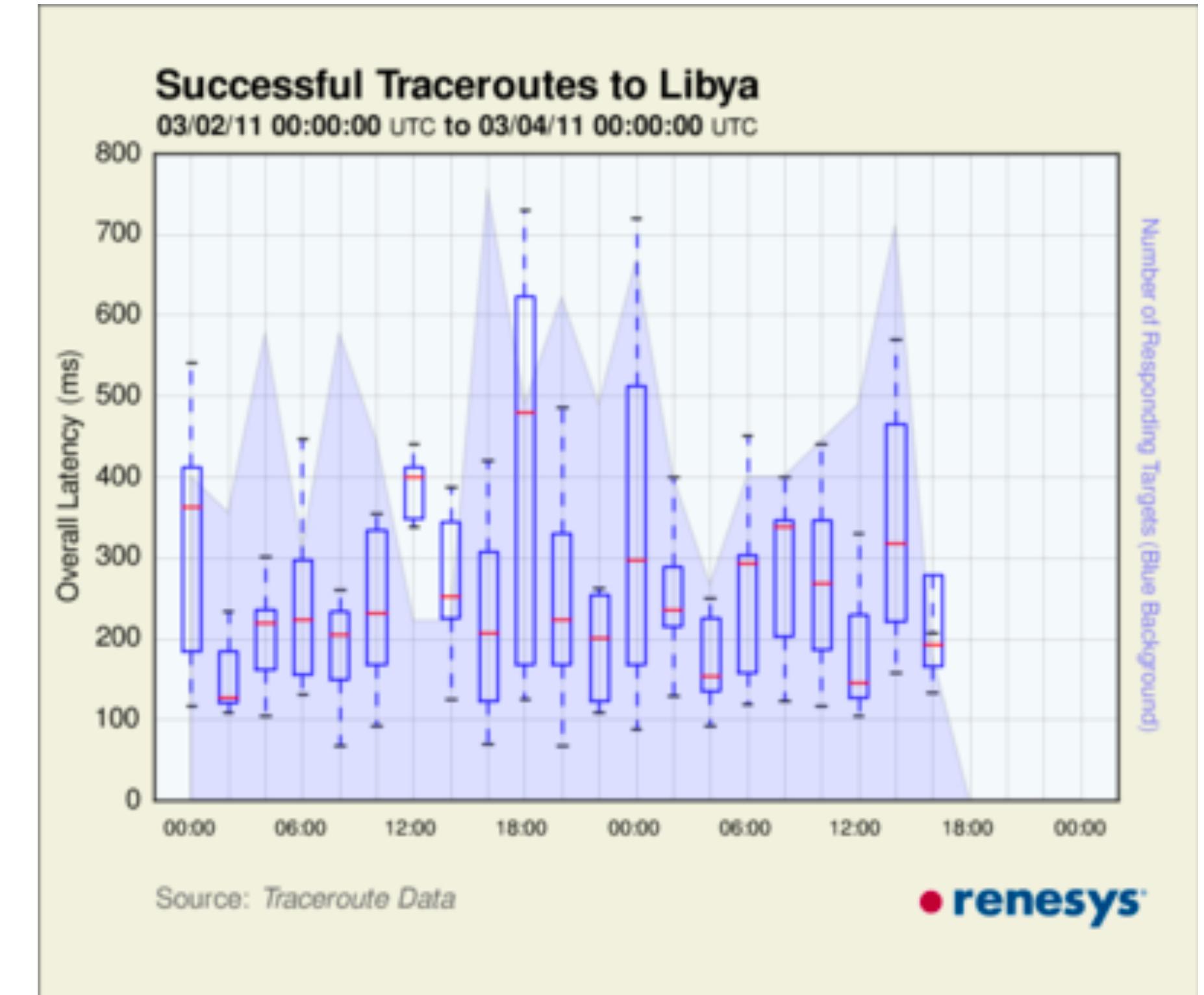
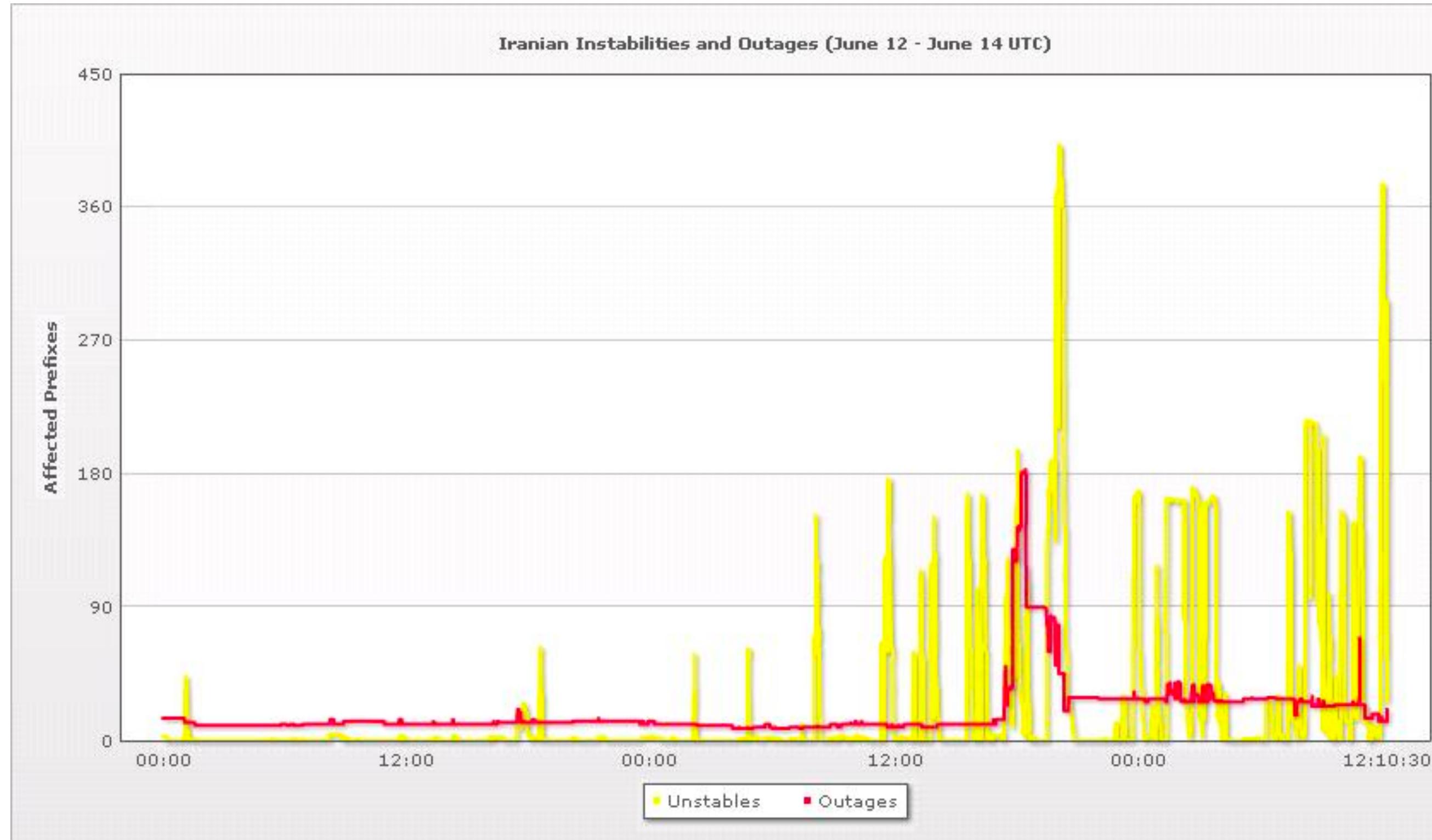


HUGE impact on society

Starting at 3:35 UTC today (6:35am local time), approximately two-thirds of all Syrian networks became unreachable from the global Internet. Over the course of roughly half an hour, the routes to 40 of 59 networks were withdrawn from the global routing table.



HUGE impact on society



~~HUGE~~ impact on society

YUUUGE



Donald J. Trump

@realDonaldTrump

Follow

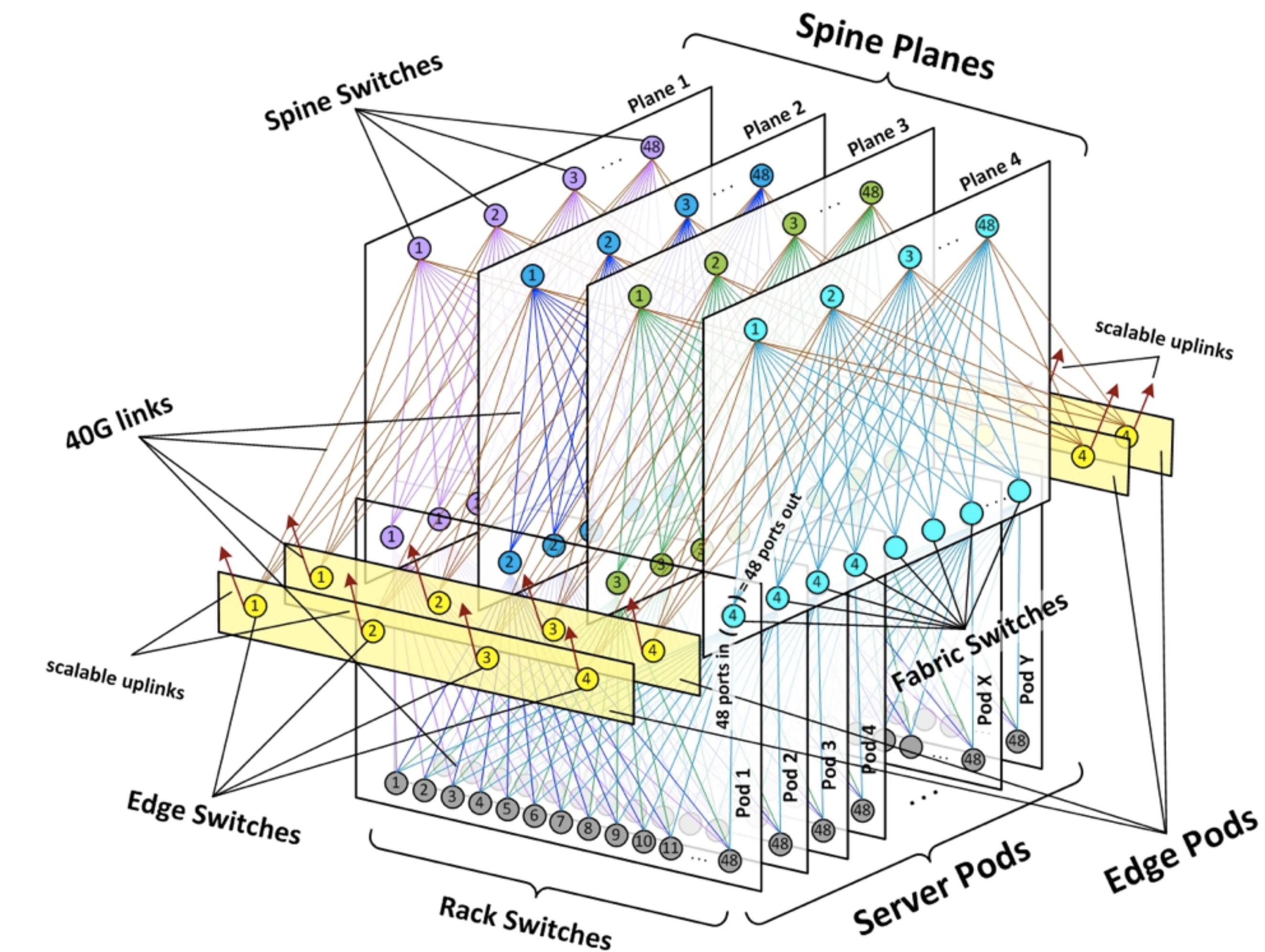
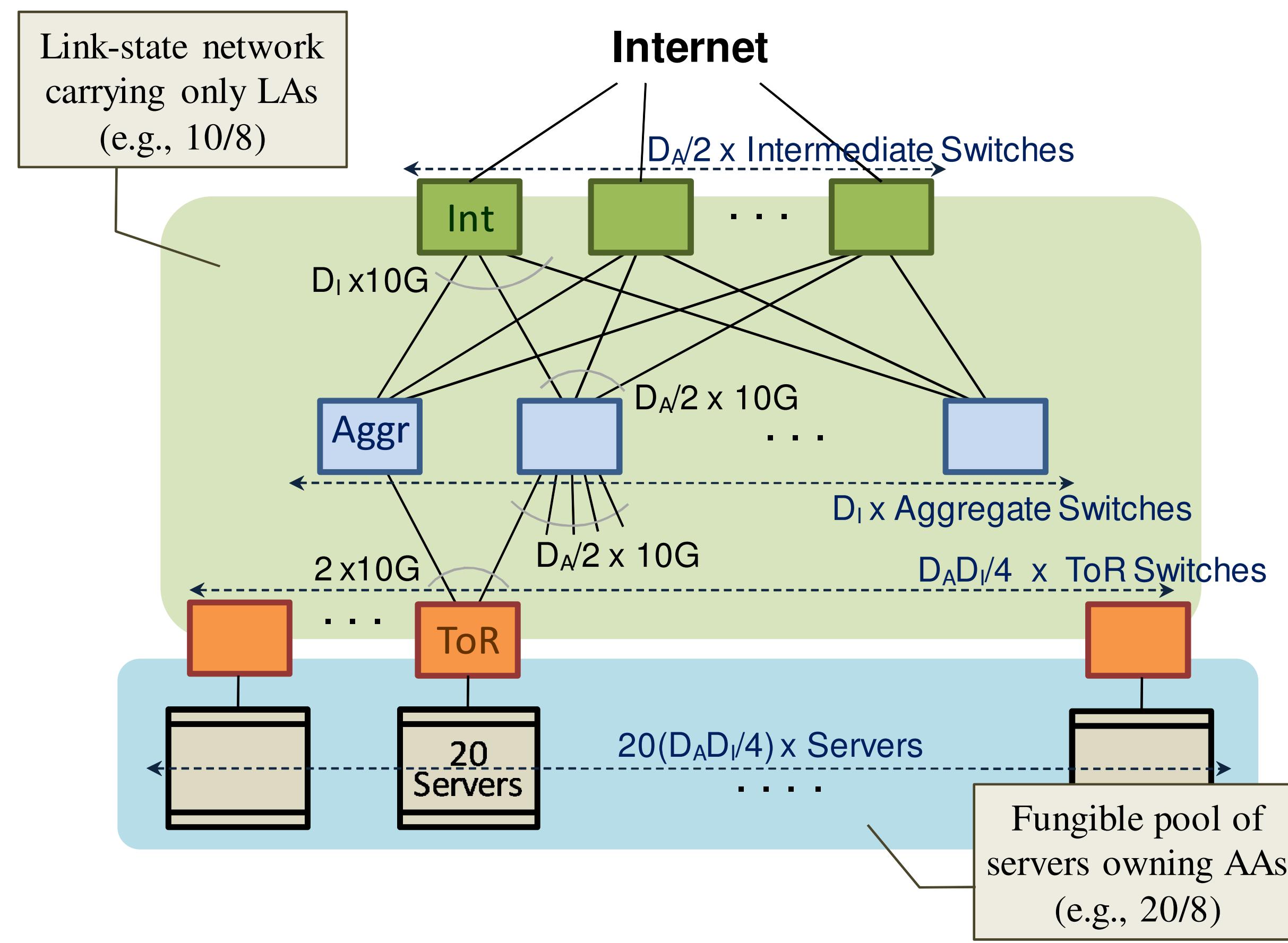
This election is a total sham and a travesty. We are not a democracy!

5:33 AM - 7 Nov 2012

↪ 45,771 ❤ 27,638

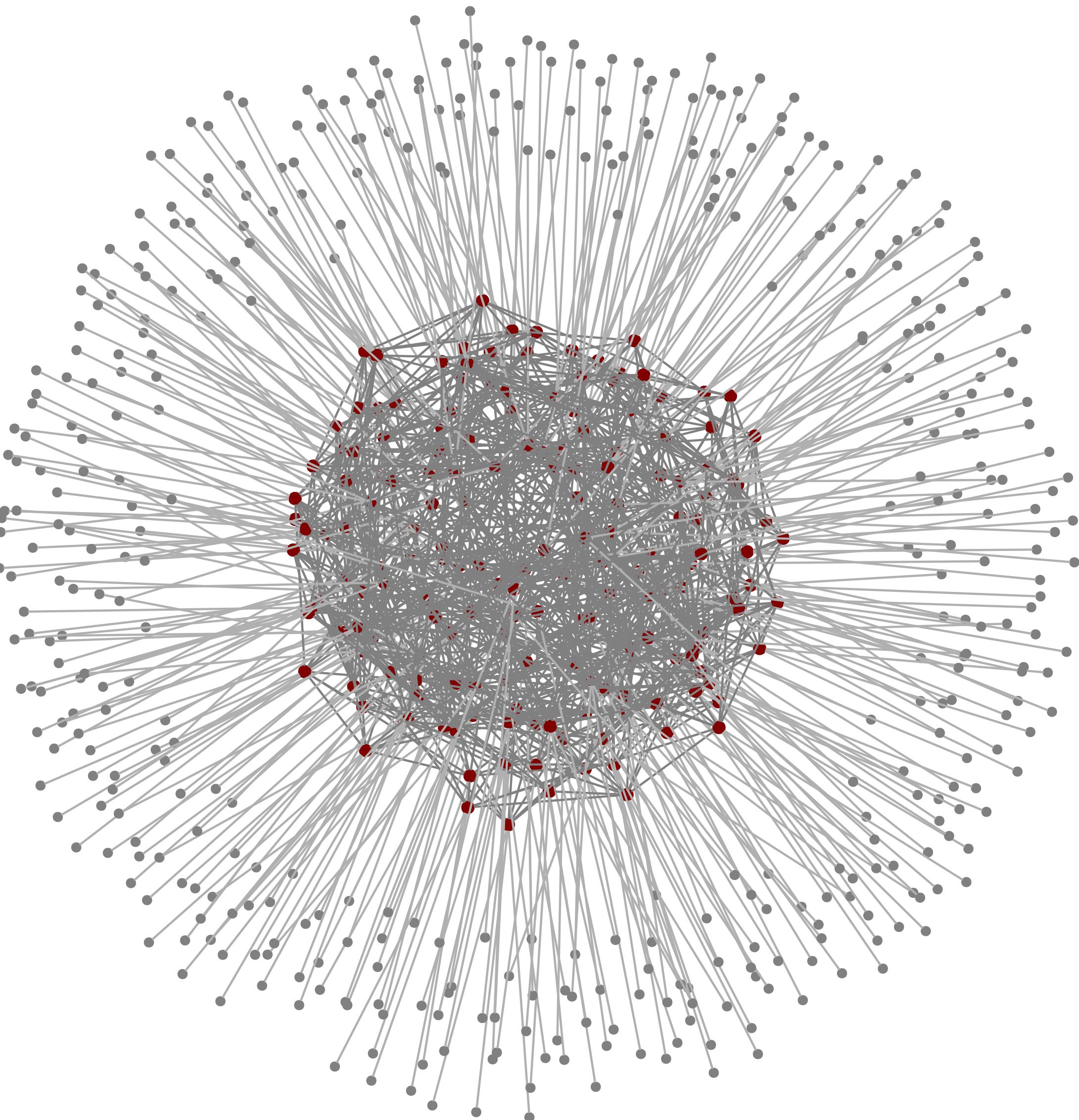
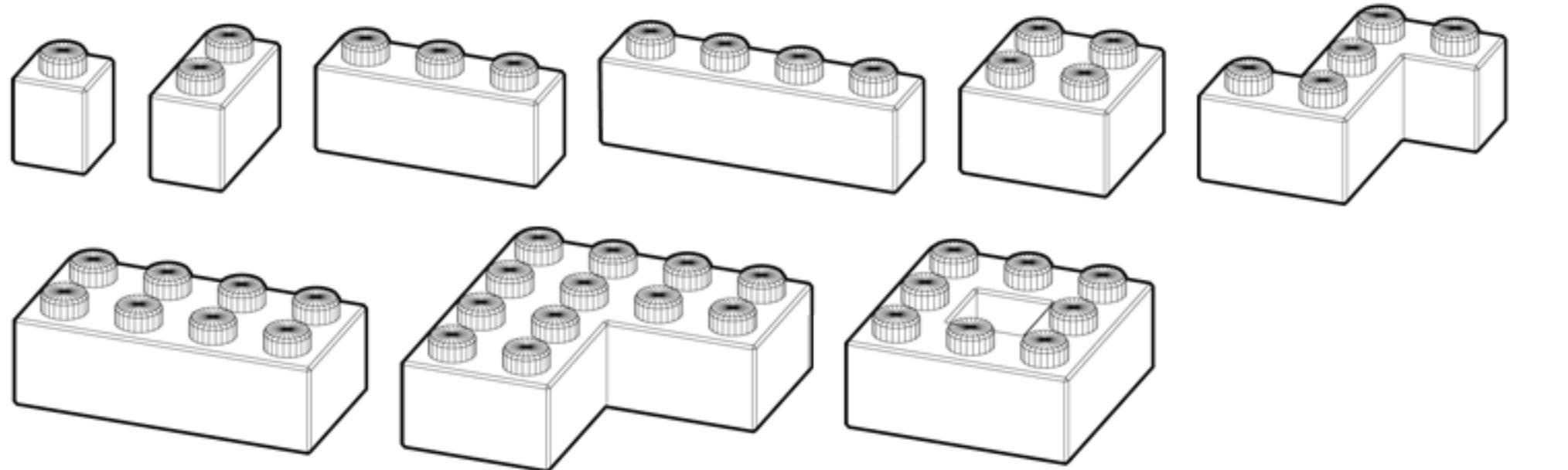
Maybe we should stop now?

How to build networks best?



How to build networks best?

Heterogeneity? Traffic skew?

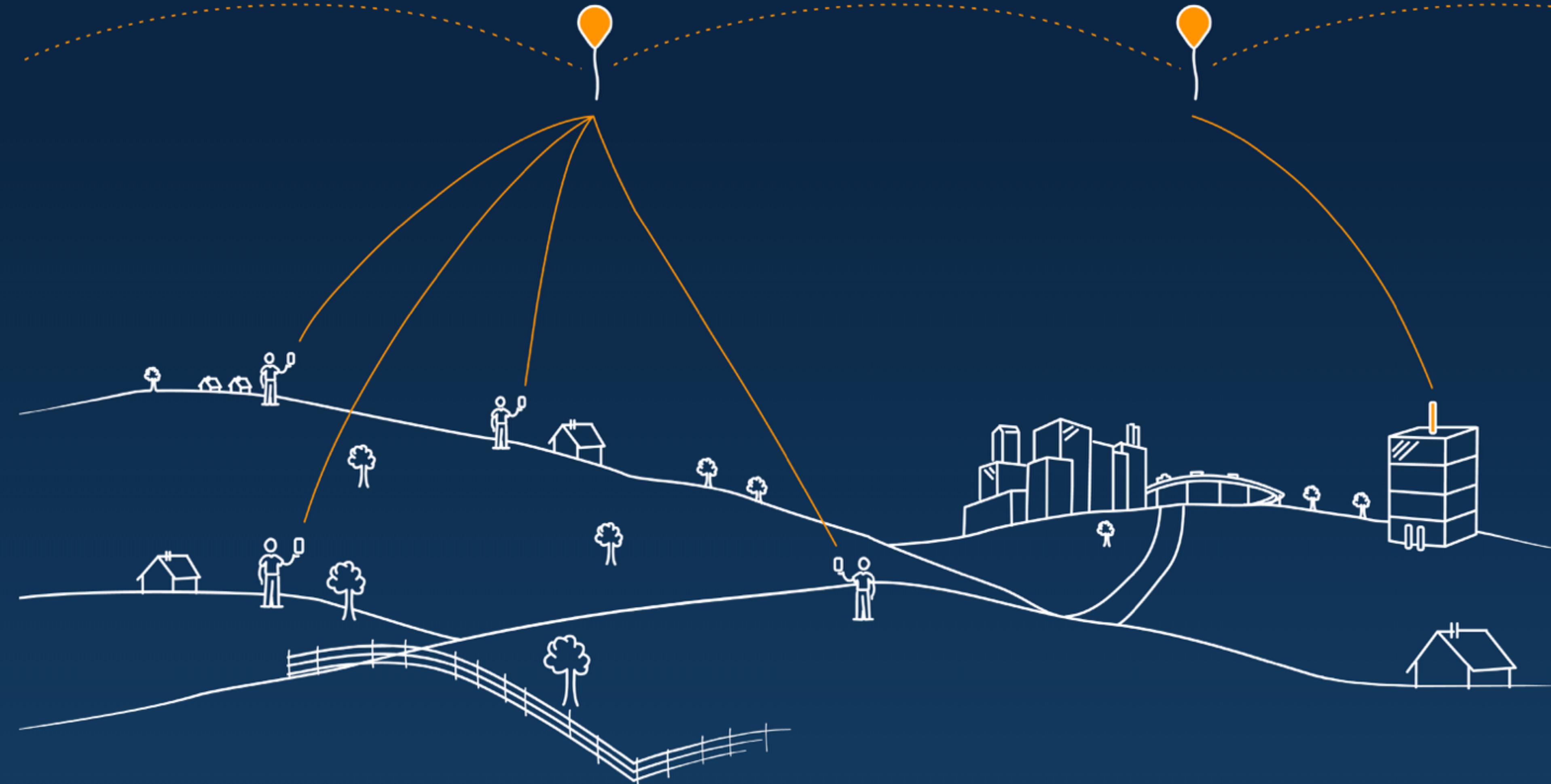




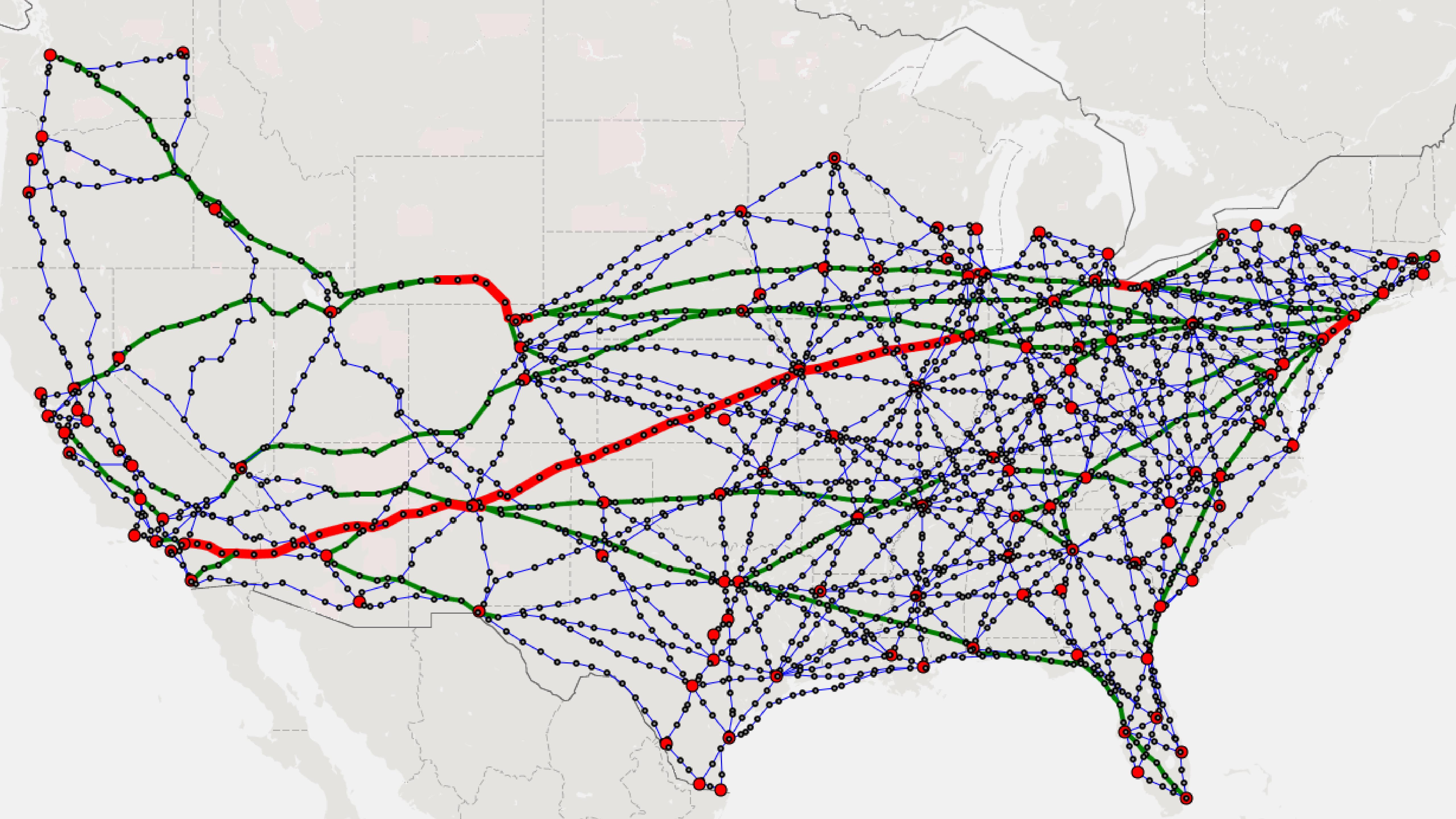




Titan Aerospace







How do we manage networks best?

Operator error the root cause of Microsoft Azure failure

Cliff Saran
Managing Editor

20 Nov 2014 17:10

[Twitter](#) [G+](#) [in](#) [Email](#)

Operator error was the root cause of the catastrophic failure of Microsoft's Azure cloud computing platform on 19 November 2014

Telia engineer error to blame for massive net outage

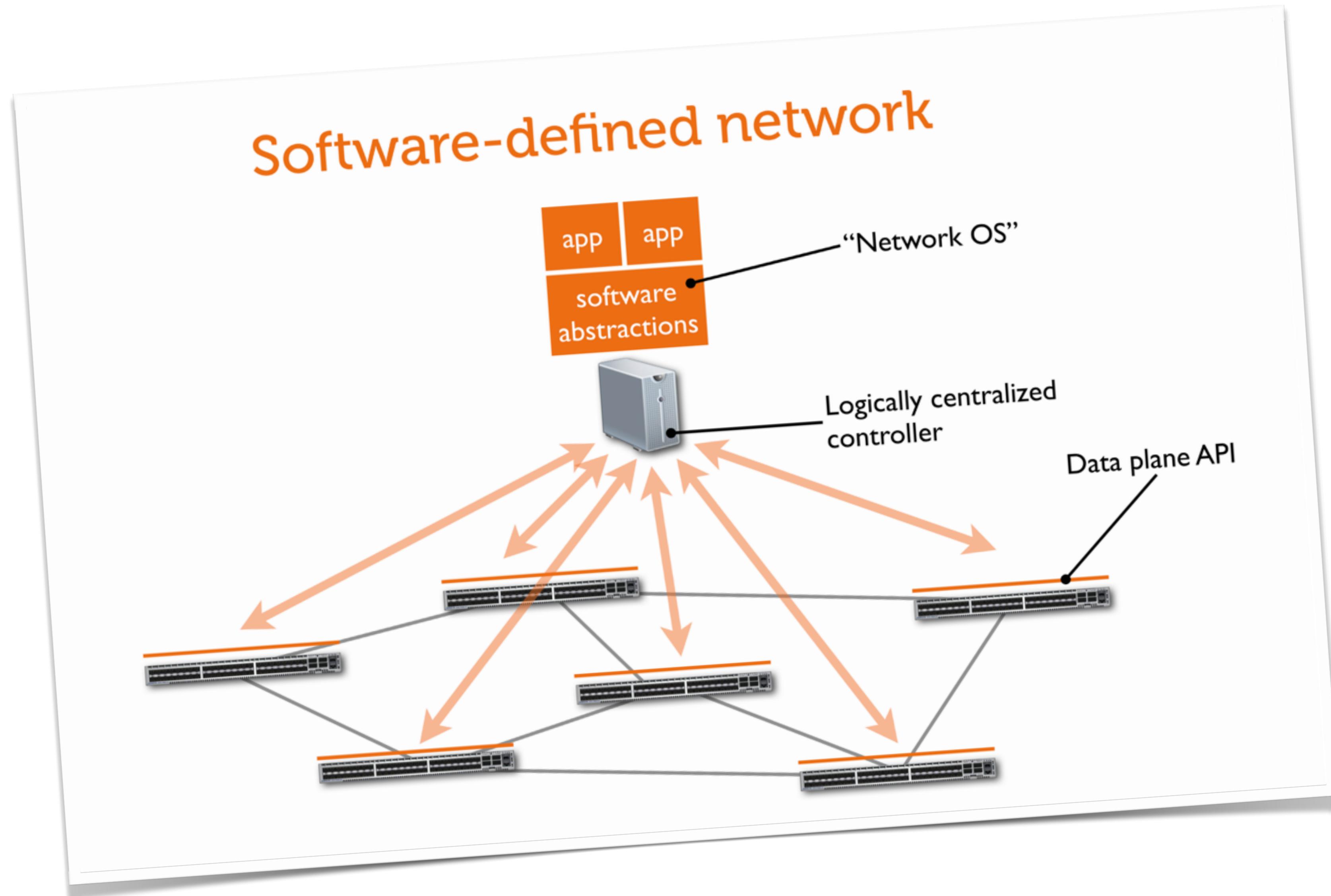
Lesson 1: Don't confuse Europe with Hong Kong



20 Jun 2016 at 20:27, Kieren McCarthy

[Reddit](#) [Twitter](#) [Facebook](#) [LinkedIn](#)

How do we manage networks best?



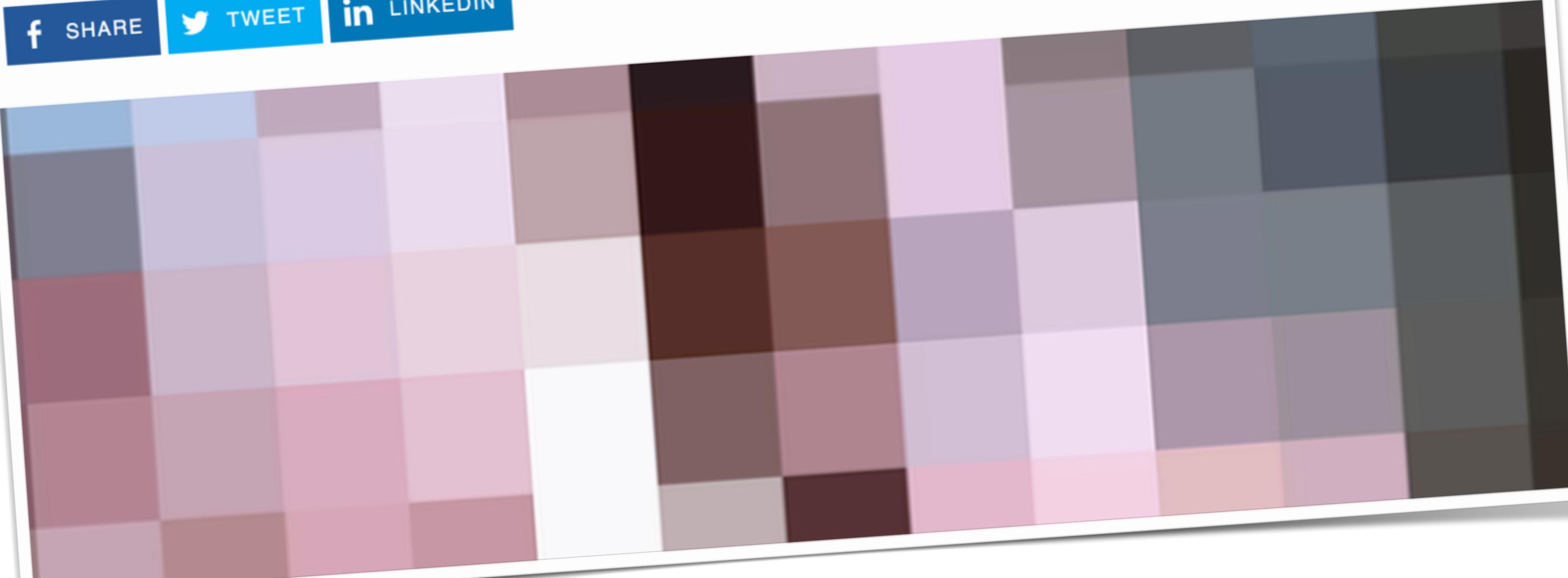
How do we manage networks best?

REPORT \ US & WORLD \

Iran's porn censorship broke browsers as far away as Hong Kong

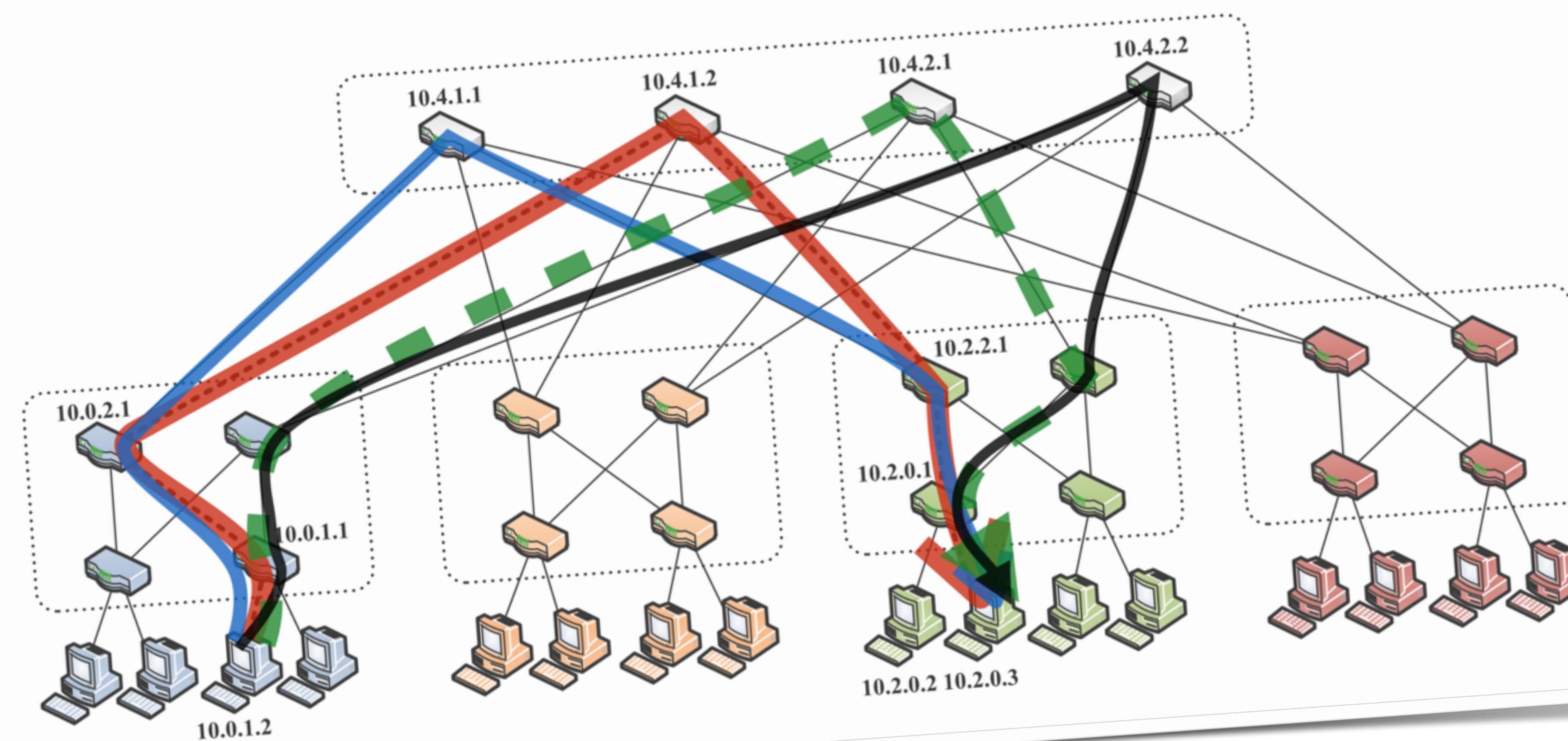
by Russell Brandom | @russellbrandom | Jan 7, 2017, 12:00pm EST

[f SHARE](#) [t TWEET](#) [in LINKEDIN](#)



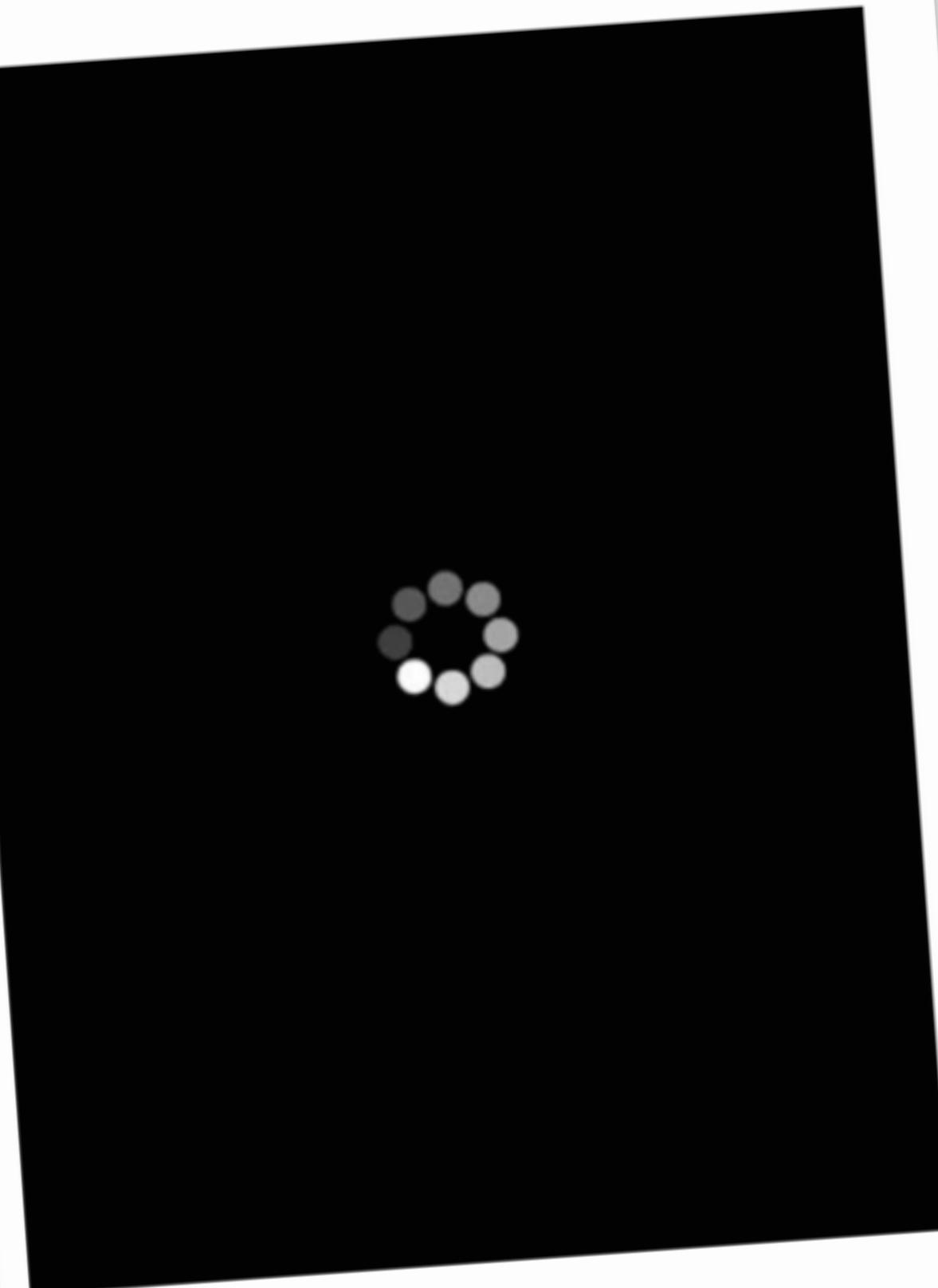
How do we use networks best?

Routing and traffic engineering



How do we use networks best?

Video quality vs. buffering



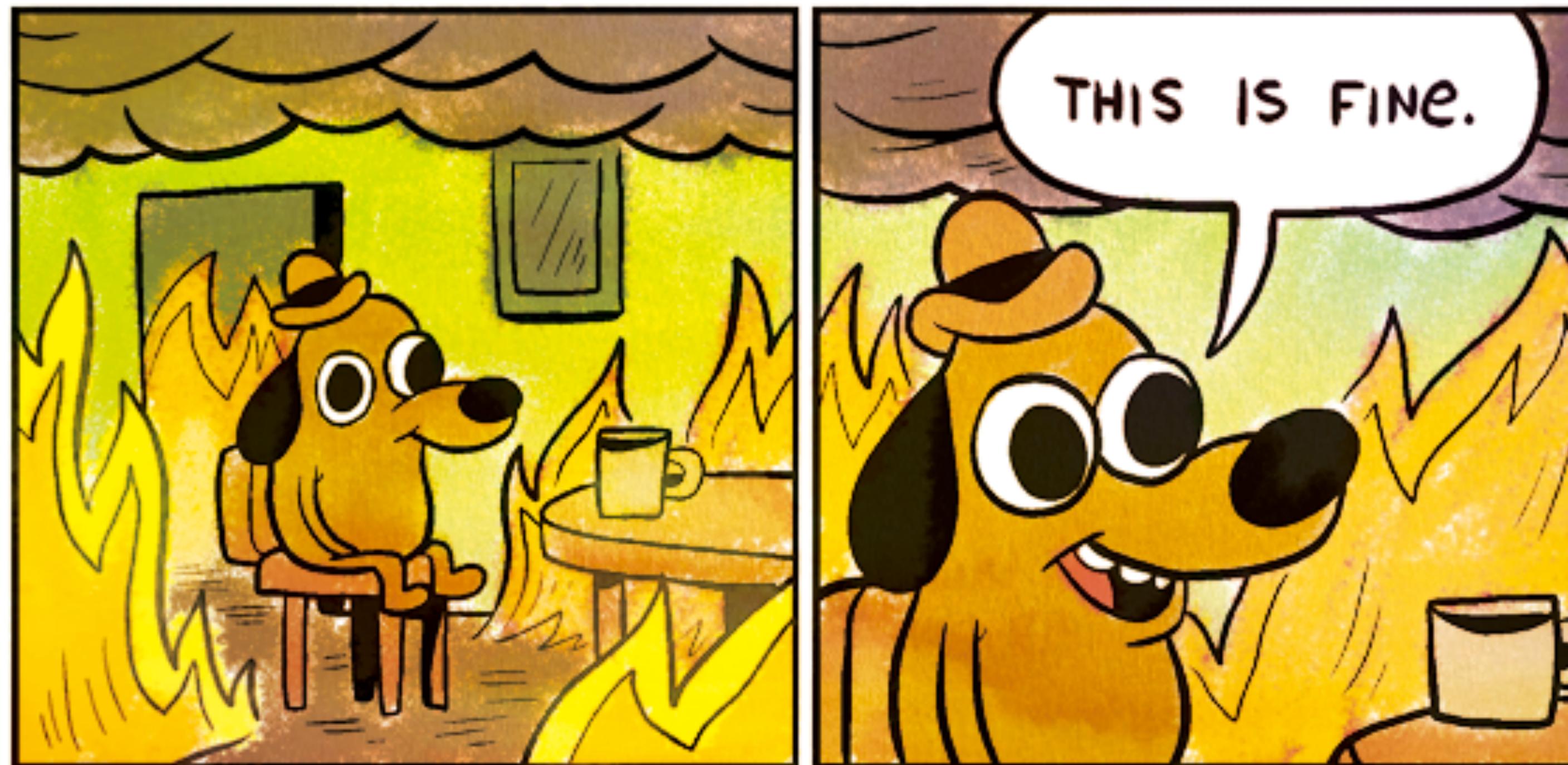
(c) copyright 2008, Blender Foundation / www.bigbuckbunny.org, CC-BY-3.0

**Networking is a
very hot space!**





... with a lot of problems



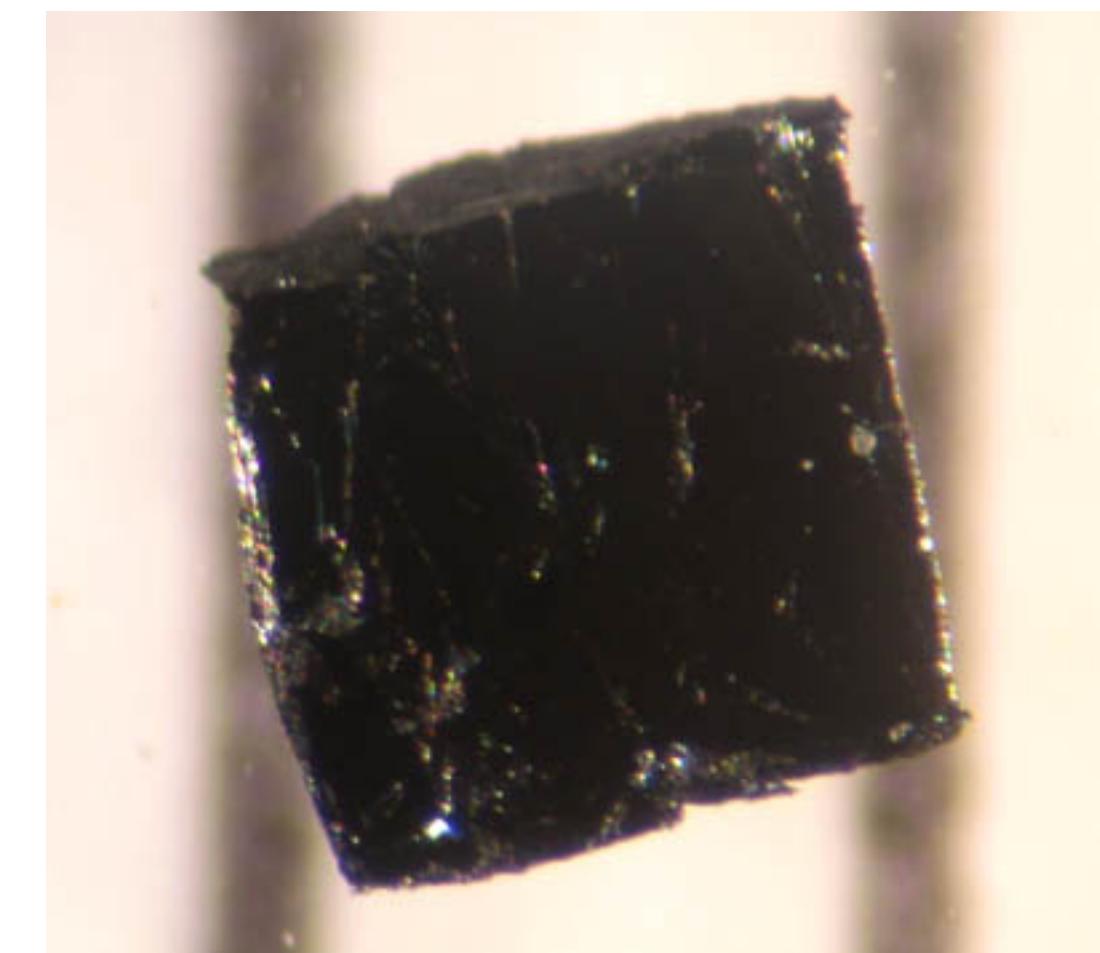
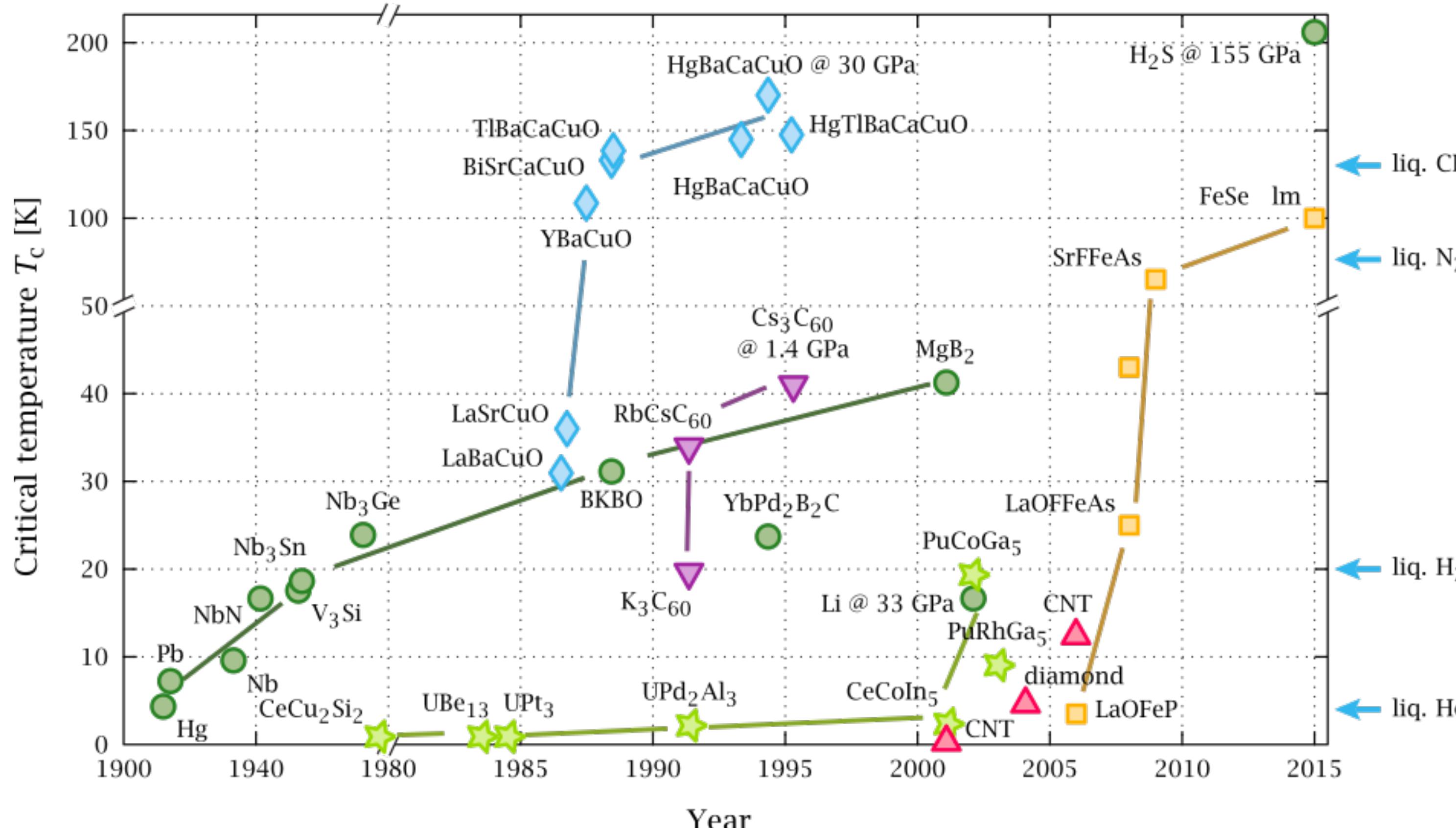
KC Green (<http://gunshowcomic.com/648>)

Networking's a very hot space!



What are the BIGGEST
problems?

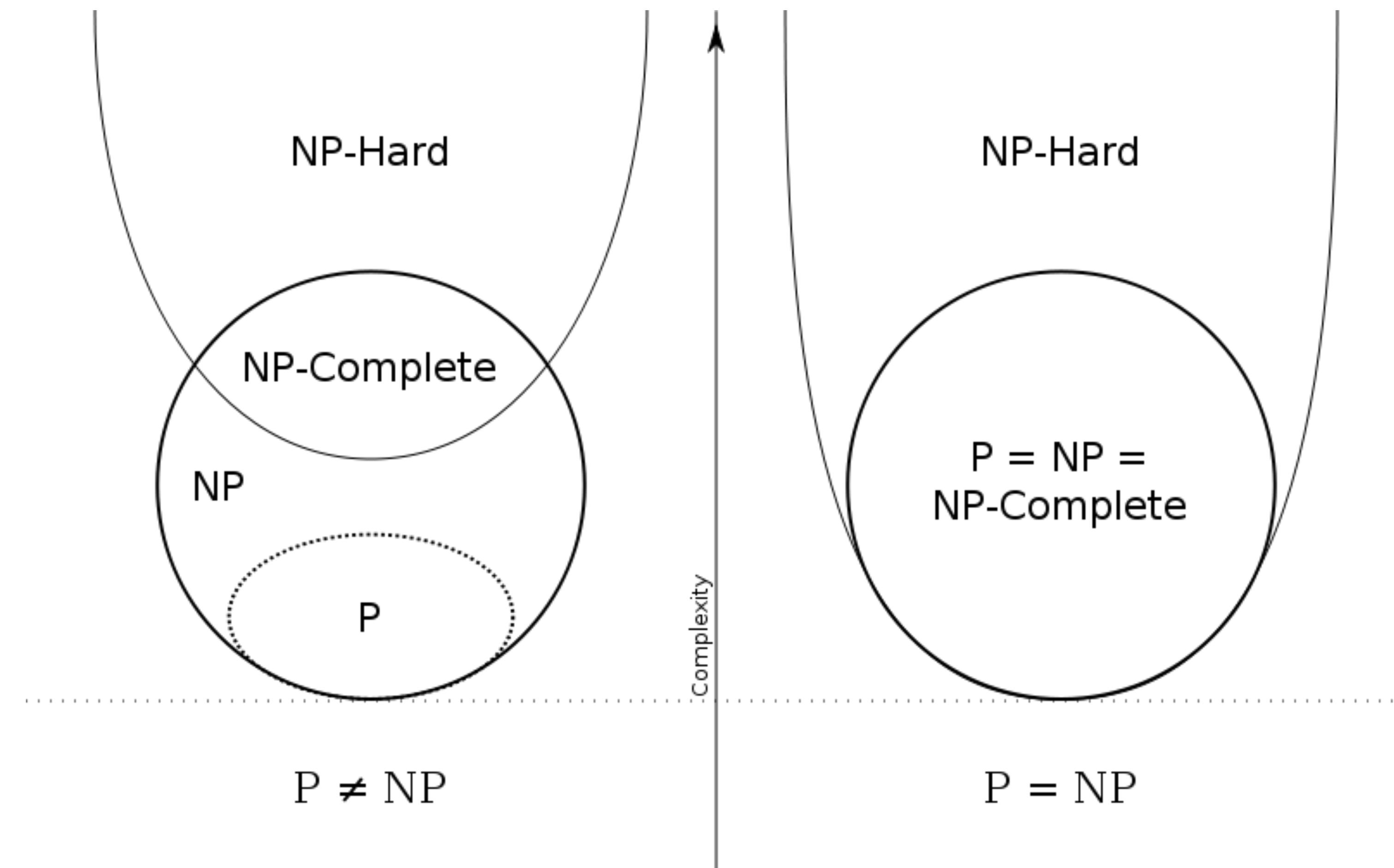
Physicists have superconductivity ...



[James Slezak via Wikimedia]

[Pia Jensen Ray. Figure 2.4 in Master's thesis, "Structural investigation of La(2-x)Sr(x)CuO(4+y) - Following staging as a function of temperature". Niels Bohr Institute, Faculty of Science, University of Copenhagen. Copenhagen, Denmark, November 2015. DOI:10.6084/m9.figshare.2075680.v2]

CS theorists have $P \stackrel{?}{=} NP$

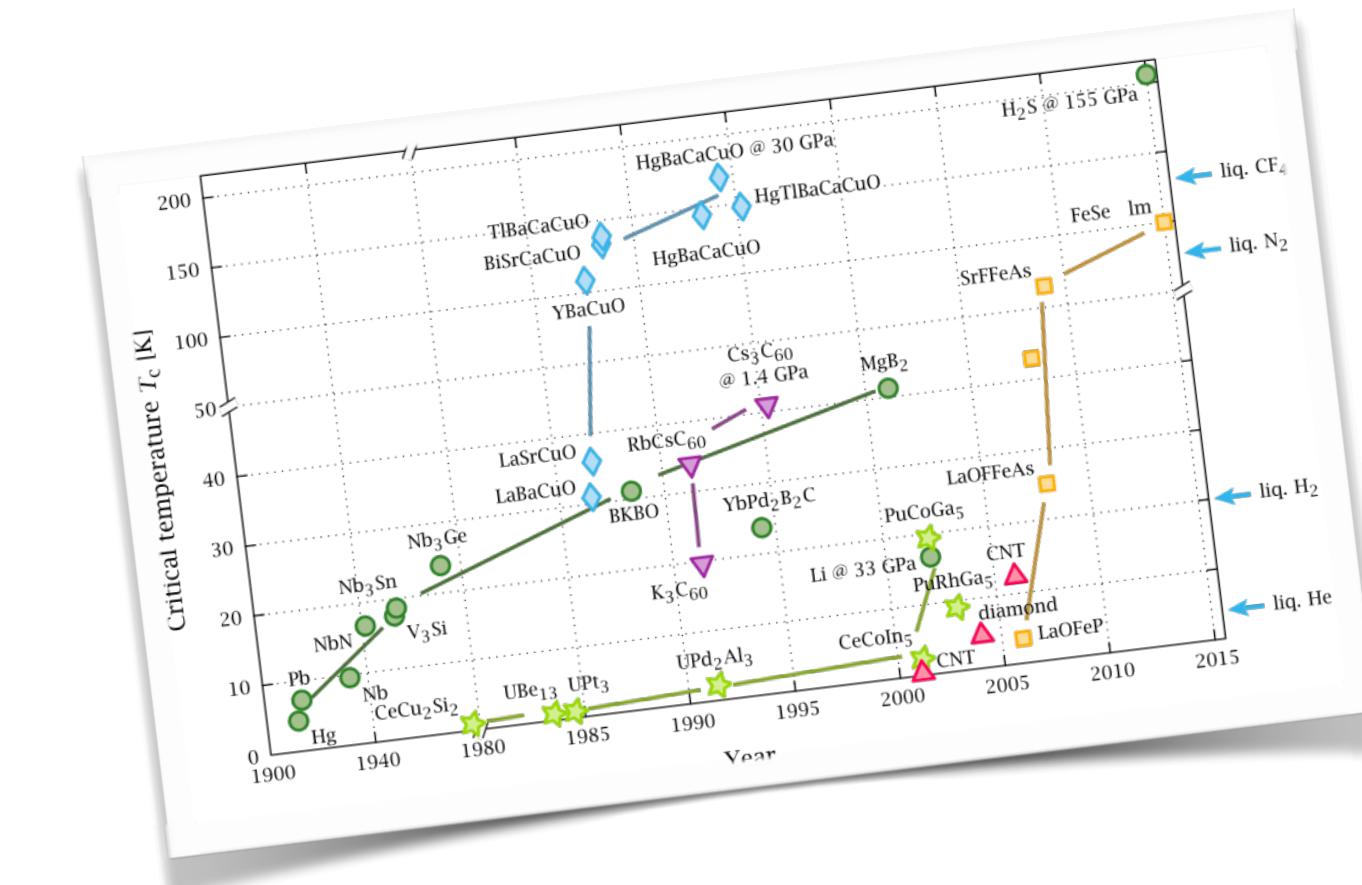


[Behnam Esfahbod via Wikimedia]

What's networking's grand challenge?

- 6.0 / 6.0 ?
- Debopam's / Vojislav's research project?
- ?

Security? Reliability?
Performance? Automation?



No laptops in class!