Networking Trends

Raj Jain
Washington University in Saint Louis
Saint Louis, MO 63130
Jain@cse.wustl.edu

Audio/Video recordings of this class lecture are available at:
http://www.cse.wustl.edu/~jain/cse570-15/
Sources of Trends
- Processor, Storage, Clouds and Mobile Apps
- Cisco Visual Networking Index
- Gartner Hype Cycle 2014
- Google Trends
Sources of Trends

- Activities in technical industry organizations: IEEE, IETF, ITU
- NSF funding areas
- Venture capital investments
- Industry analytics companies like Gartner
- Google searches by people all over the world

“VCs have a herd mentality.”
Processor Growth: Moore’s Law

Ref: https://www.reddit.com/r/askscience/comments/32f8us/did_moores_law_calculate_correctly/
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Storage Capacity

- PC hard drive size

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Clouds and Mobile Apps

- August 25, 2006: Amazon announced EC2
  ⇒ Birth of Cloud Computing in reality
  (Prior theoretical concepts of computing as a utility)

- *Web Services To Drive Future Growth For Amazon* ($2B in 2012, $7B in 2019)
  - Forbes, Aug 12, 2012

- June 29, 2007: Apple announced iPhone
  ⇒ Birth of Mobile Internet, Mobile Apps
    - Almost all services are now mobile apps: Google, Facebook, Bank of America, …
    - Almost all services need to be global (World is flat)
    - Almost all services use cloud computing

Networks need to support efficient service setup and delivery
Cisco Visual Networking Index

1. 2014 mobile data traffic was $2.5 \times 10^{18}$ B/month. 30× the size of the entire global Internet in 2000 (75 PB/mth).
2. Mobile video traffic was more than 55% of the mobile traffic in 2014.
3. 7.4 B mobile devices and connections in 2014 26% of these devices and connections were “Smart Phones”
4. A smart phone generates 22× traffic of a non-smart phone.
5. 4G connections generate 10× the traffic of a non-4G
6. 109 Million wearable devices in 2014 generating 15 PB/month
7. 46% of mobile traffic was offloaded through WiFi or femtocell
8. 27% mobile devices were potentially IPv6 capable

Gartner Hype Cycle 2014

Gartner Hype Cycle 2013

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What is Google Trends?

- A time series graph of number of searches on any term of your choice
- Scaled to 100%. 100=Maximum over time
- Includes geographical distribution of those searches
- Includes major news items
- Example: “Barack Obama”
  - K: Nov 2008 election
  - B: Nov 2012 election
  - Popular in Ethiopia

https://www.google.com/trends/explore#q=barack+obama
Google Trends and GDP

- Internet users from countries with higher GDP are more likely to search for future topics than about the past.
- Economic indicators are correlated to on-line behavior.

Ref: C. Johnston, “Google Trends reveals clues about the mentality of richer nations,”
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Data Center Network: Google Trends

- Stable, Neither declining nor increasing
- Mostly in USA and India
- As much interest in Europe as in Africa
- USA and India are highly correlated probably because Indian IT industry services US companies

Network Virtualization: Google Trends

- Still before the knee
- Interest in USA, India

Virtualization: Google Trends

- Virtualization
  - Server
  - Storage
  - Network
- World is still learning about server virtualization


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SDN: Google Trends

- Started May 21, 2011: Open Networking Foundation formed
  ⇒ Announced standardizing OpenFlow
- Mostly USA and India
- Software defined networking, Software defined network, SDN have slightly different trends

OpenFlow: Google Trends

- Started April 2004
- Past the peak
  (Everyone who needs to know knows)
- Peak at Open Networking Summit (D: April 2012)
- High interest in Japan, Korea, Taiwan
- Some interest in China

Cloud Computing: Google Trends

- Past-Hype phase
  As in Gartner graphs
- Mostly in India

![Google Trends Graph]


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Big Data: Google Trends

- Near the peak
- Knee on March 27, 2012 (Point G): Obama goes big on big data. Federal agencies host a webcast outlining their plan for big data.

IoT: Google Trends

- Still before the knee
- High interest in South Korea, Taiwan, Vietnam

Other Trends

- IT/Network Automation
- Open Networking
- Mobility
- Security
- Analytics
- Containers – Docker
- DevOps: Developers and Operational personnel cooperation
Summary

1. Google trends is an interesting easy way to find world interest on a topic of your research interest.

2. Gartner hype cycle, Google trends, and Standards activities seem highly correlated. (Does Gartner look at Google trends before publishing their graphs? It would be unwise not to.)

3. IoT is at the peak. Cloud is main stream. Network virtualization, SDN are just beginning.

4. All forecasting is based on the past ⇒ Continuous. Real future is invented ⇒ Discontinuous.
Reading List

Acronyms

- EC  European Continent
- GDP  Gross Domestic Product
- IEEE  Institution of Electrical and Electronics Engineers
- IETF  Internet Engineering Task Force
- IoT  Internet of Things
- IT  Information Technology
- ITU  International Telecommunications Union
- NSF  National Science Foundation
- PB  Peta Byte
- PC  Personal Computer
- SDN  Software Defined Networking
- VCs  Venture Capitalists
- WiFi  Wireless Fidelity