

# Networking Trends: World According to Google



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/cse570-13/>



- ❑ What is Google Trends?
- ❑ Google trends on recent advances in networking
  - Data Center Networking
  - Network Virtualization
  - Cloud Computing
  - SDN
  - Big Data
  - IoT

# Current Trends

- ❑ Big data  $\Rightarrow$  End of privacy  
You walk in a store and your face tells them your name and life-time purchase history.
- ❑ Information Fog vs. Information Fountain  
(Information from people rather than from news media)
- ❑ 3D printing  $\Rightarrow$  Virtual manufacturing
- ❑ Body-area networking and computing
- ❑ Self-Driving Cars

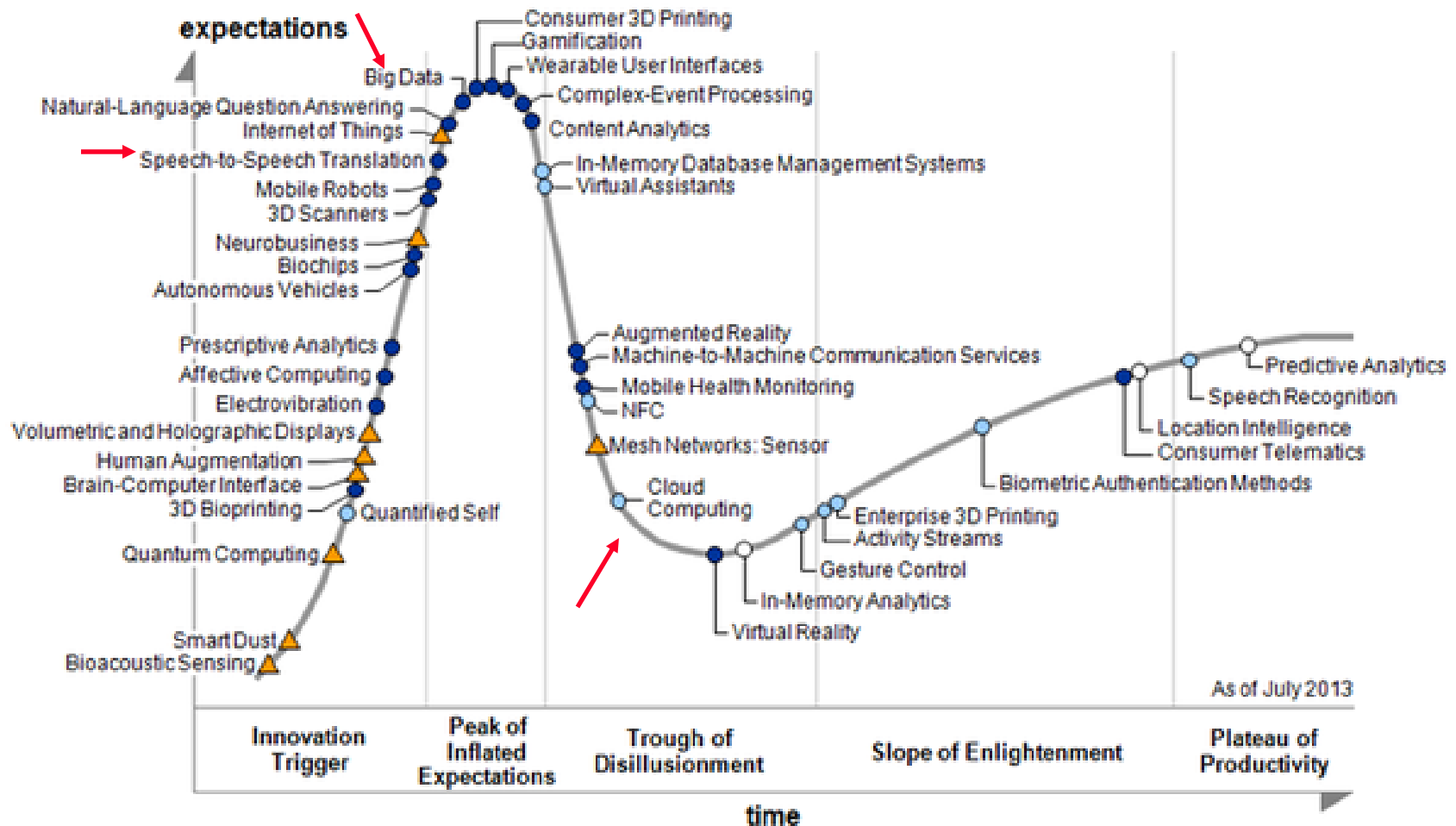
# Sources of Trends

- ❑ 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.”

# Gartner Hype Cycle 2013



As of July 2013

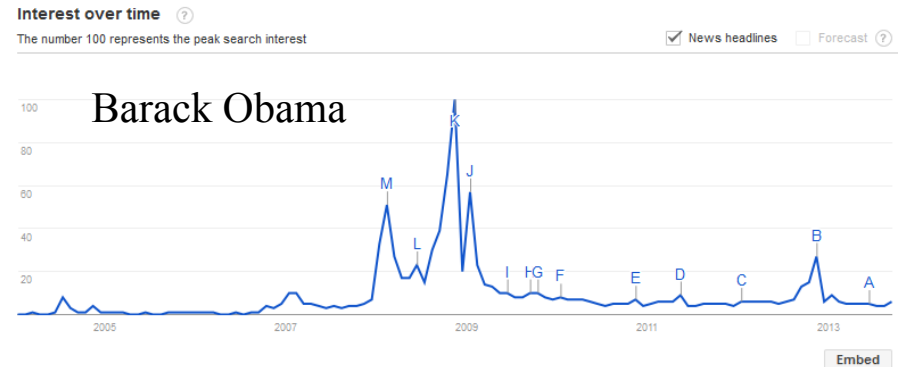
Plateau will be reached in:

- less than 2 years
- 2 to 5 years
- 5 to 10 years
- ▲ more than 10 years
- ⊗ obsolete before plateau

Ref: <http://www.zdnet.com/gartners-2013-emerging-technologies-hype-cycle-focuses-on-humans-and-machines-7000019564/>

# 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 USA and Africa



<https://www.google.com/trends/explore#q=barack+obama>

# Google Trends and GDP

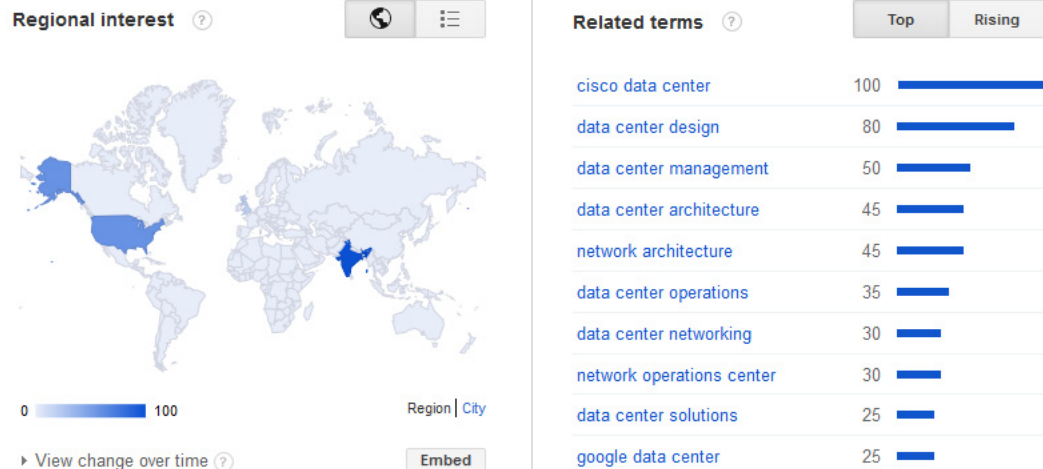
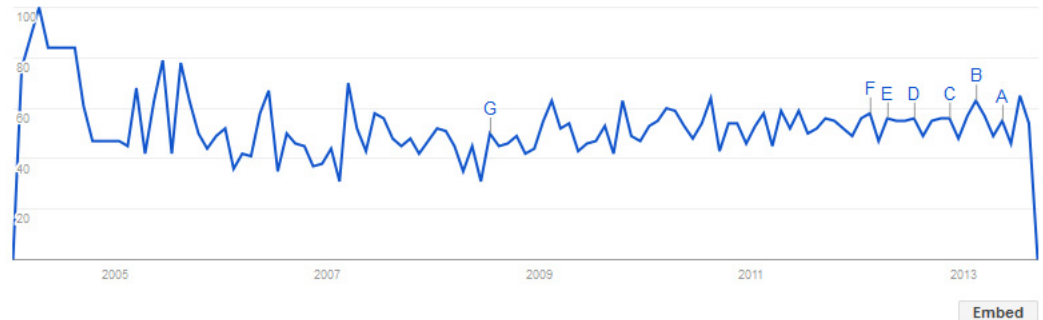
- ❑ Internet users from countries with higher GDP are more likely to search for future topics than about the past.
- ❑ Economic indicators are correlated to on-line behavior.

Ref: C. Johnston, "Google Trends reveals clues about the mentality of richer nations,"

<http://arstechnica.com/gadgets/2012/04/google-trends-reveals-clues-about-the-mentality-of-richer-nations/>

# 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

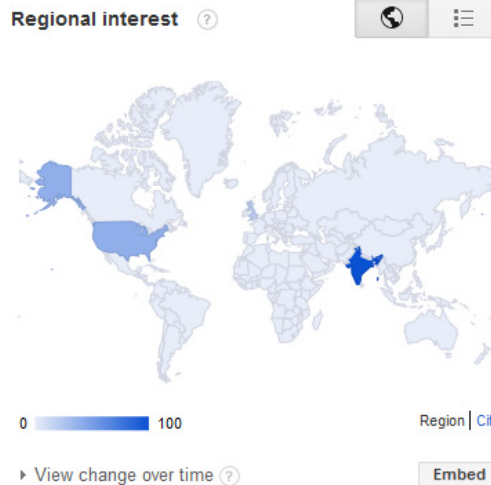
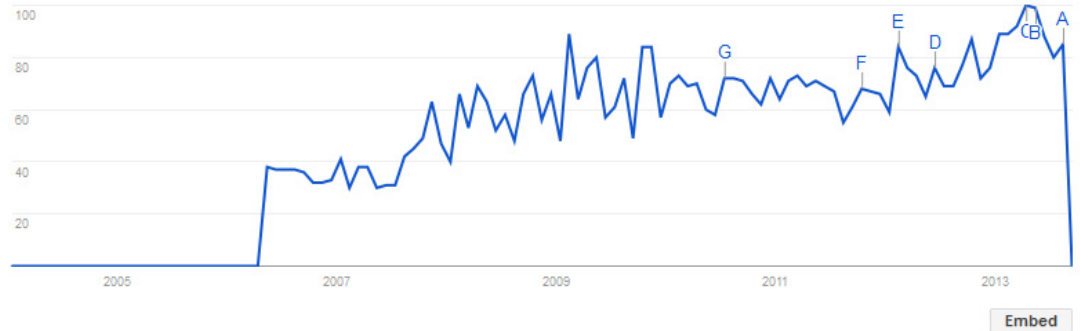


Snapshot: September 3, 2013



# Network Virtualization: Google Trends

- ❑ Still before the knee
- ❑ Interest in USA, India



Related terms	Top	Rising
server virtualization	100	
vmware network virtualization	65	
storage virtualization	50	
what is virtualization	45	
virtualization software	45	
network virtualization cisco	40	
virtualization security	30	
virtualization technology	30	
linux virtualization	30	
application virtualization	25	

Snapshot: September 3, 2013

# Virtualization: Google Trends

## Virtualization

- Server
- Storage
- Network

World is still learning about server virtualization

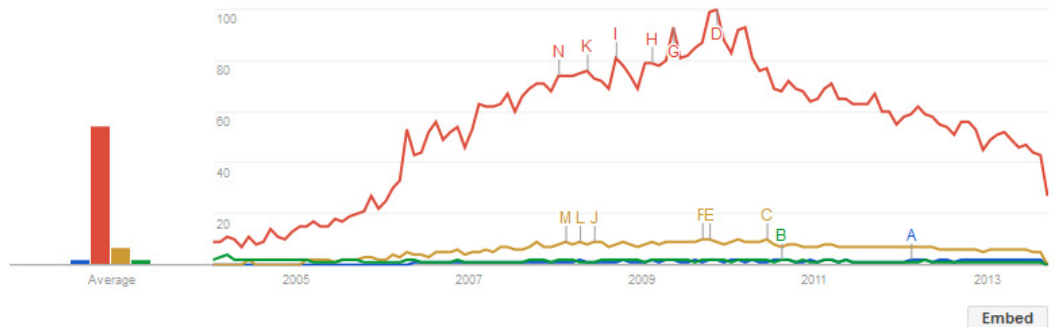
Search terms

- ✕ network virtualization
- ✕ Virtualization
- ✕ server virtualization
- ✕ storage virtualization

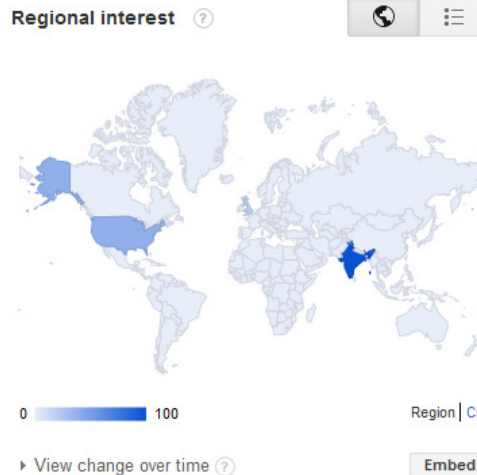
+ Add term

Limit to

- Web Search
- Worldwide
- 2004 - present
- All categories



network virtualization | virtualization | server virtualization | storage virtualization



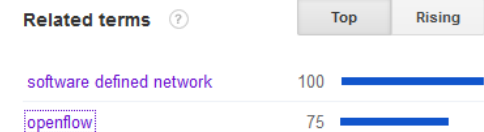
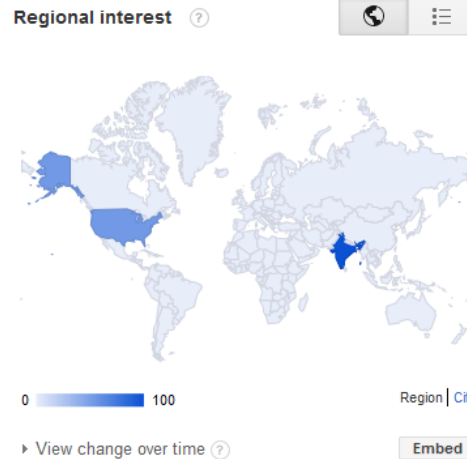
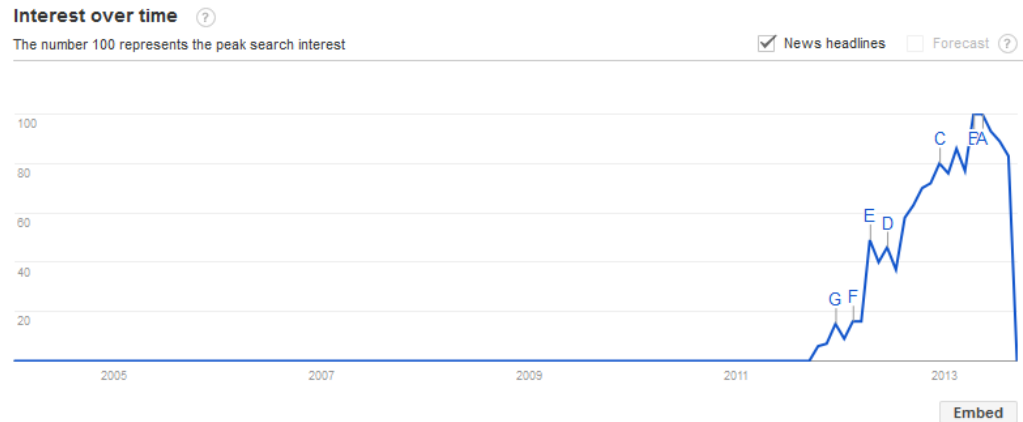
Related terms

Term	Score
server virtualization	100
vmware network virtualization	65
storage virtualization	50
what is virtualization	45
virtualization software	45
network virtualization cisco	40
virtualization security	30
virtualization technology	30
linux virtualization	30
application virtualization	25

Snapshot: September 3, 2013

# SDN: Google Trends

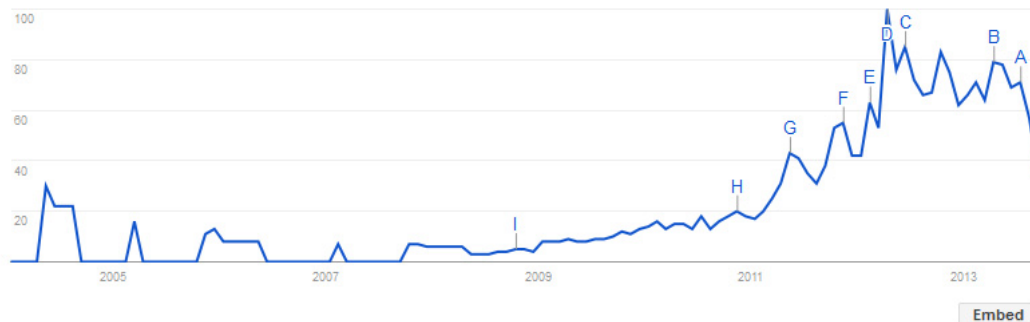
- Started May 21, 2011:  
Open Networking  
Foundation formed  
⇒ Announced  
standardizing  
OpenFlow
- Mostly USA and India
- Software defined  
networking, Software  
defined network, SDN  
have slightly different  
trends



Snapshot: September 3, 2013

# 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



## Regional interest



0 100

Region | City

View change over time

Embed

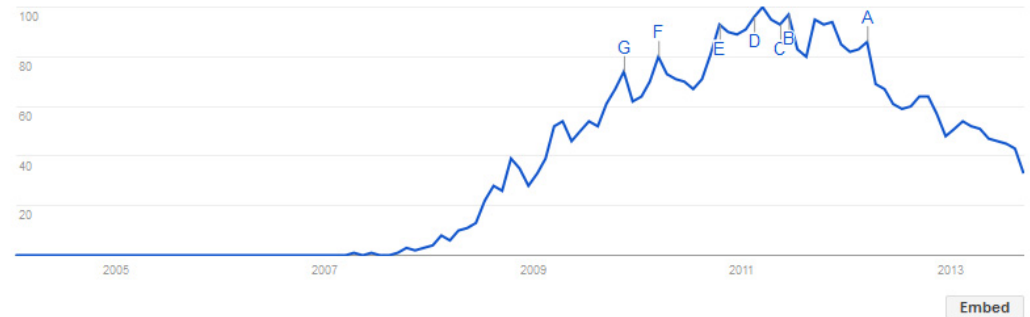
## Related terms

	Top	Rising
openflow sdn	100	
openflow switch	80	
openflow network	60	
openflow cisco	60	
openflow controller	50	
openflow tutorial	45	
nox openflow	40	
openflow networking	40	
nec openflow	35	
openflow google	35	

Snapshot: September 3, 2013

# Cloud Computing: Google Trends

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



## Regional interest



0 100

Region | City

View change over time

Embed

## Related terms

Top Rising

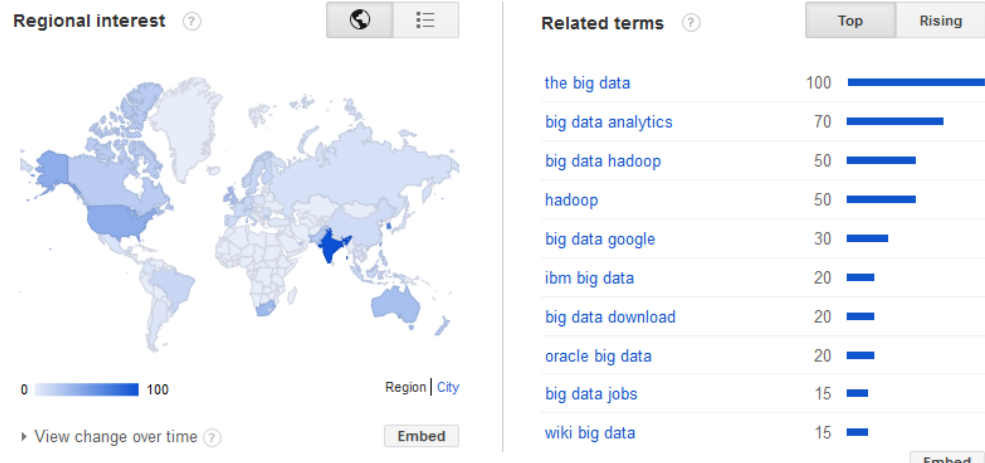
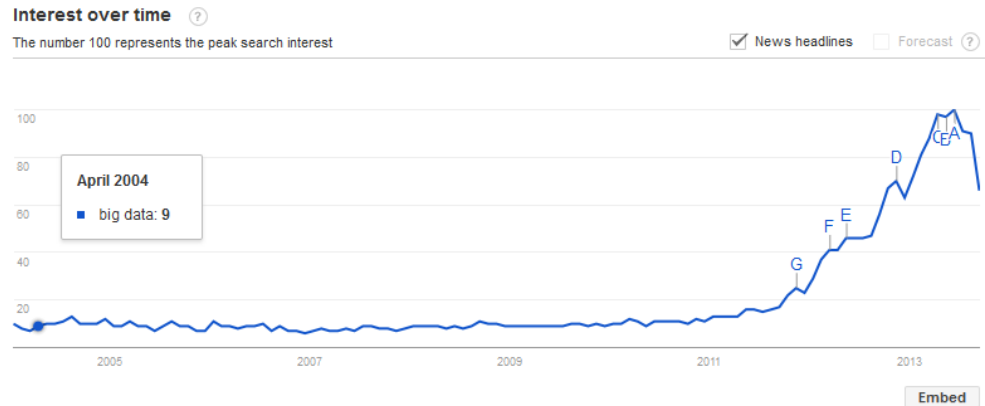
what cloud computing	100	<div style="width: 100%;"></div>
the cloud	60	<div style="width: 60%;"></div>
google cloud computing	45	<div style="width: 45%;"></div>
google cloud	40	<div style="width: 40%;"></div>
cloud computing ppt	30	<div style="width: 30%;"></div>
cloud computing pdf	30	<div style="width: 30%;"></div>
cloud computing security	25	<div style="width: 25%;"></div>
cloud computing free	25	<div style="width: 25%;"></div>
amazon cloud computing	25	<div style="width: 25%;"></div>
amazon cloud	25	<div style="width: 25%;"></div>

Embed

Snapshot: September 3, 2013

# Big Data: Google Trends

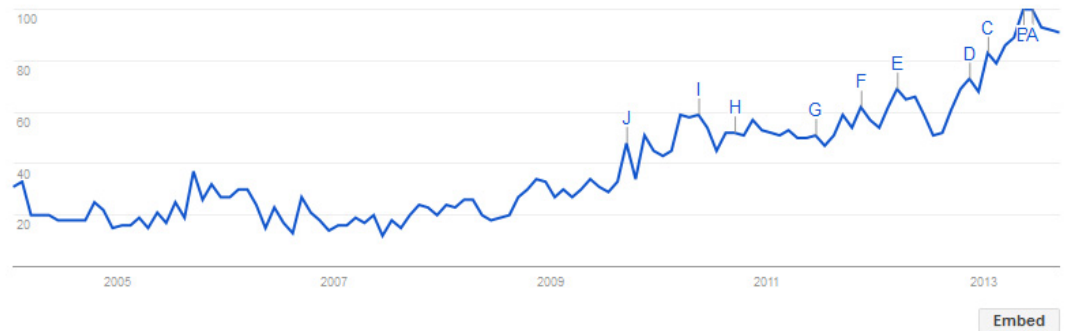
- ❑ Near the peak (As in Gartner's Hype cycle)
- ❑ Knee on March 27, 2012 (Point G): Obama goes big on big data. Federal agencies host a webcast outlining their plan for big data.
- ❑ Interest in India, USA
- ❑ Some in Australia, Russia, Brazil, Canada, China, South Africa



Snapshot: September 3, 2013

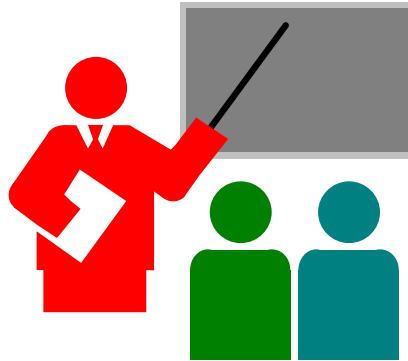
# IoT: Google Trends

- ❑ Still before the knee
- ❑ As in Gartner's graph
- ❑ High interest in China, India, USA
- ❑ Some in Australia and Canada



Snapshot: September 3, 2013

# 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. Big data is at the peak. Cloud is main stream.  
Network virtualization, SDN, IoT are just beginning.
4. All forecasting is based on the past  $\Rightarrow$  Continuous.  
Real future is invented  $\Rightarrow$  Discontinuous