



Where is the Internet?

Answers from **YAHOO! ANSWERS** :



(G. Whilikers) Out there.



(Mike) the way I see it, the "internet" has to be somewhere. a router collects the internet to my house sure. but somewhere on earth there HAS to be some where that the internet originates by sending out the first signal so others can collect it. where is that place? also is it like... a box or something? I'm so confused. one more for those who want to answer, if some maintenance guy were to spill coffee on it would the worlds internet crash? like... everywhere?



(tp5com) Everywhere. It's not really a physical being.



(evaohell) The internet is stored in a little black box with a blinking light:



And what does it look like?



The Network Geography of the Internet*

Péter Hága

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Budapest, Hungary

Spotter
GEOLOCATION SERVICE



* *Spotter: A Model Based Active Geolocation Service*, INFOCOM 2011

* *On the Network Geography of the Internet*, INFOCOM 2011

* *On the Spatial Properties of Internet Routes*, submitted to Journal on Selected Areas of Communications



Geolocation in general

Geolocation in general

- **passive geolocation**

- extracting location information from domain names (DNS)
- registries, Whois databases, commercial databases
- large and geographically dispersed IP blocks are allocated to a single entity **prohibiting the study of several geographic aspects**

- **active geolocation**

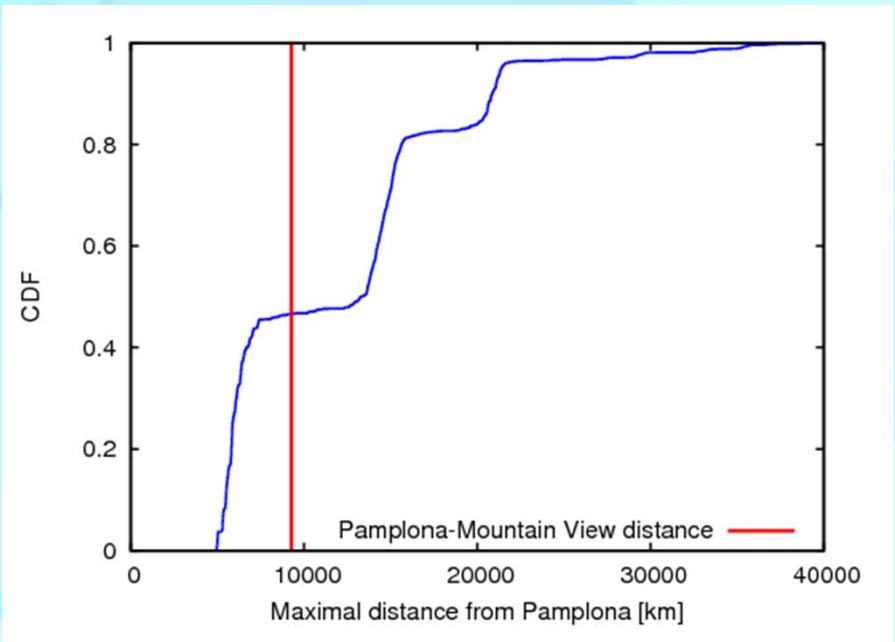
- active probing (delay, topology)
- measurement nodes with known location
- constraint based techniques

Whois based location estimation

example for passive geoloc

LOCATIONS OF NORTH AMERICAN IPV4 ADDRESSES ASSIGNED TO GOOGLE INC.

Registered location	number of distinct IPv4 address
Mountain View, CA, US	222340
Plano, TX, US	331
Chicago, IL, US	46
Irvine, CA, US	30
Waterloo, ON, CA	22
San Francisco, CA, US	21
Atlanta, GA, US	15
Phoenix, AZ, US	15
Southfield, MI, US	15
Mequon, WI, US	14
Pittsburgh, PA, US	14
Gladwyne, PA, US	7
Richardson, TX, US	7
Total	222877



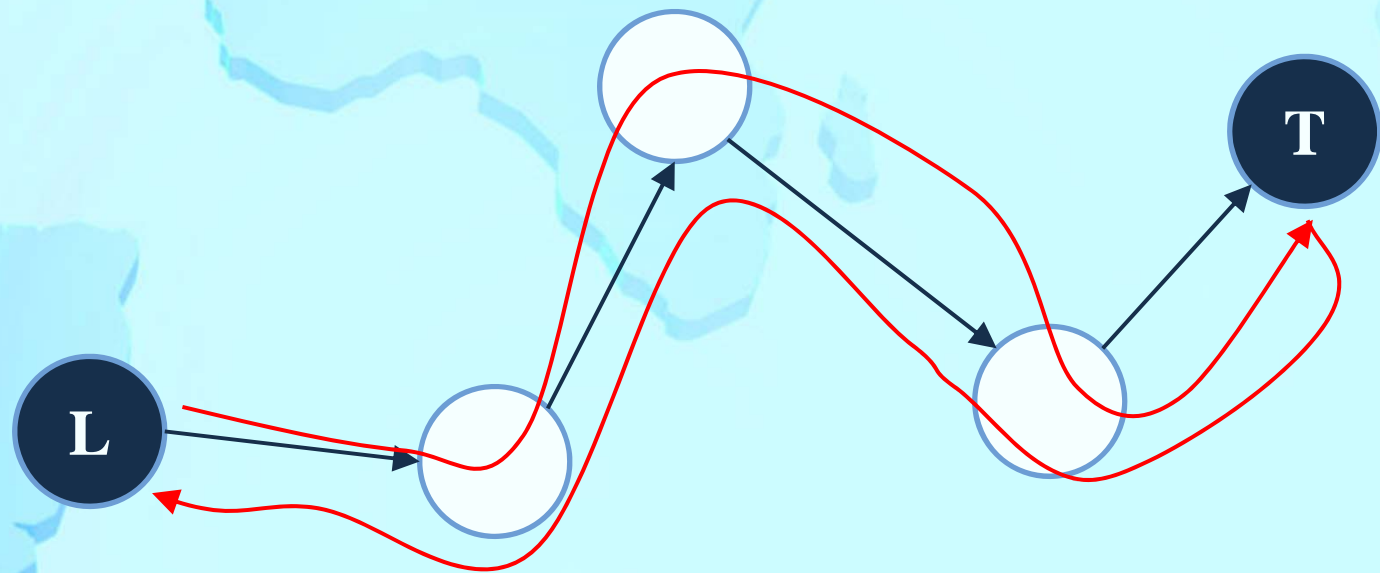
Cumulative distribution of the maximal distances from Pamplona, Spain to 4000 Google IPs. The maximal distances are calculated from the network delays assuming 200000 km/sec signal propagation speed. The vertical line represents the real geographical distance between Pamplona and Mountain View, CA, showing that 47% of the nodes must be closer to Pamplona than Mountain View.



Spotter – theoretical background

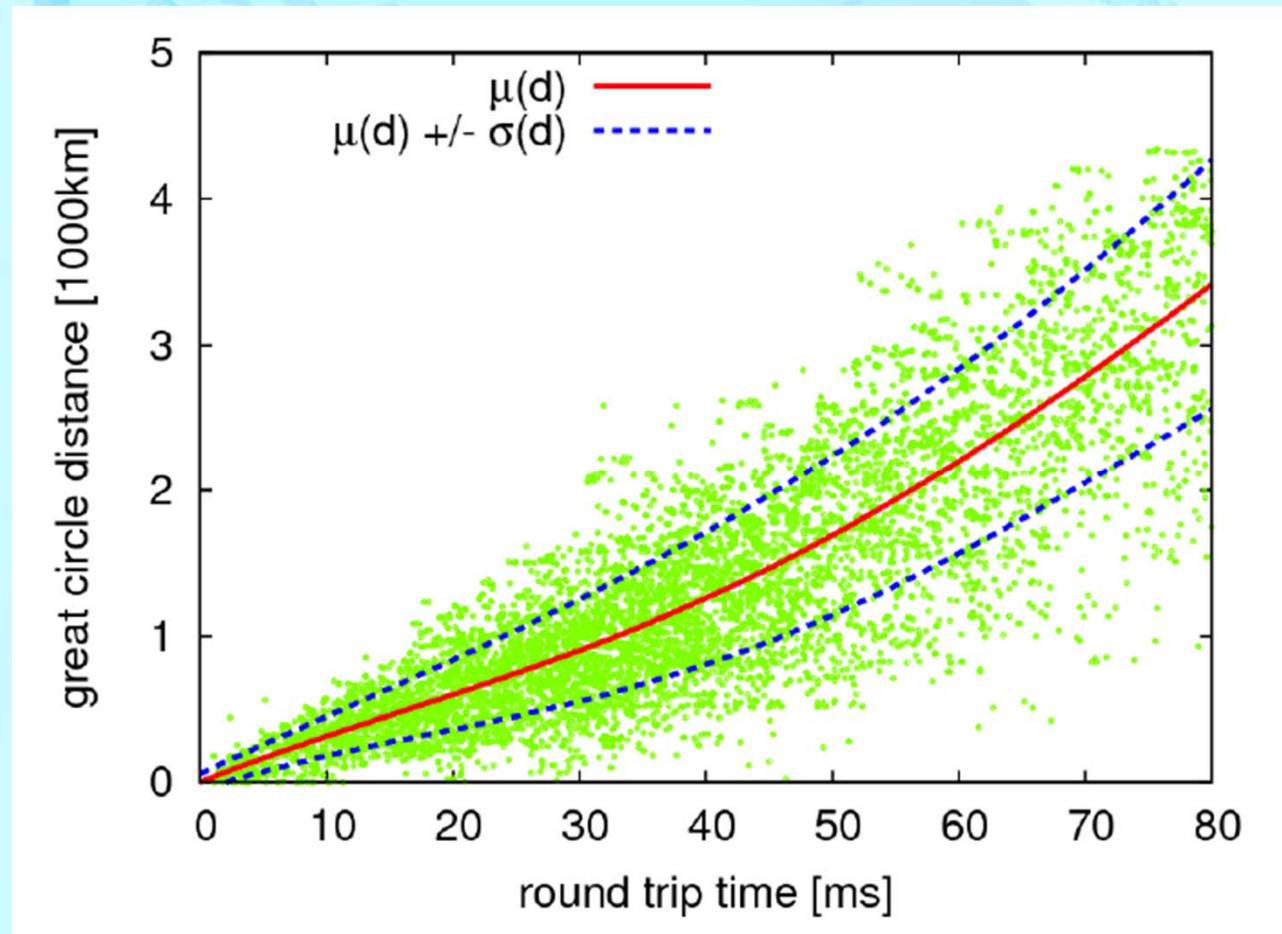
Spotter – theoretical background

- roundtrip travel time measured between the landmark (L) and the target (T) node by ping
- RTT is transformed to geographic distance
- "triangulation" from multiple landmarks



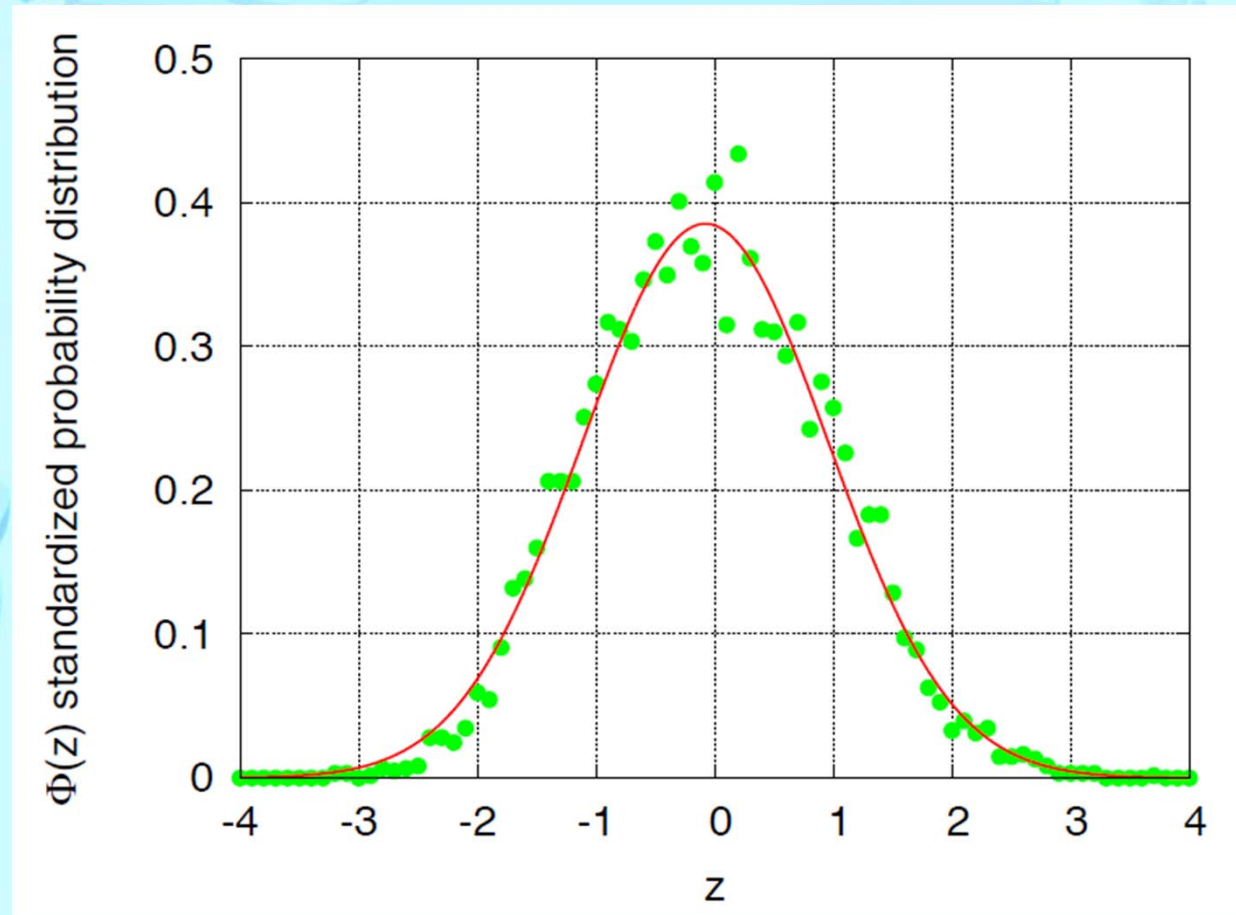
Travel time – distance relation

- reference dataset (nodes with known location)
- distance between the source and destination
- measured RTT

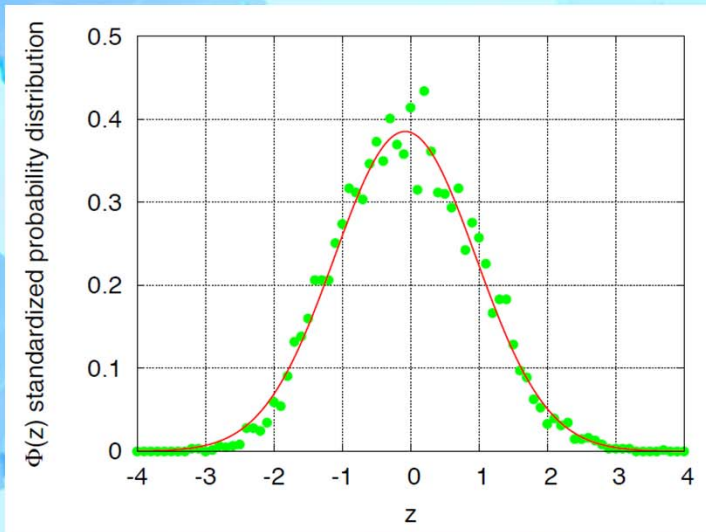


Standardized travel time – distance distribution

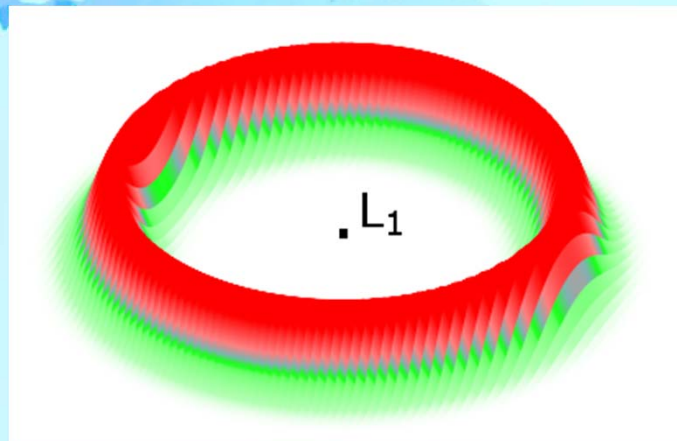
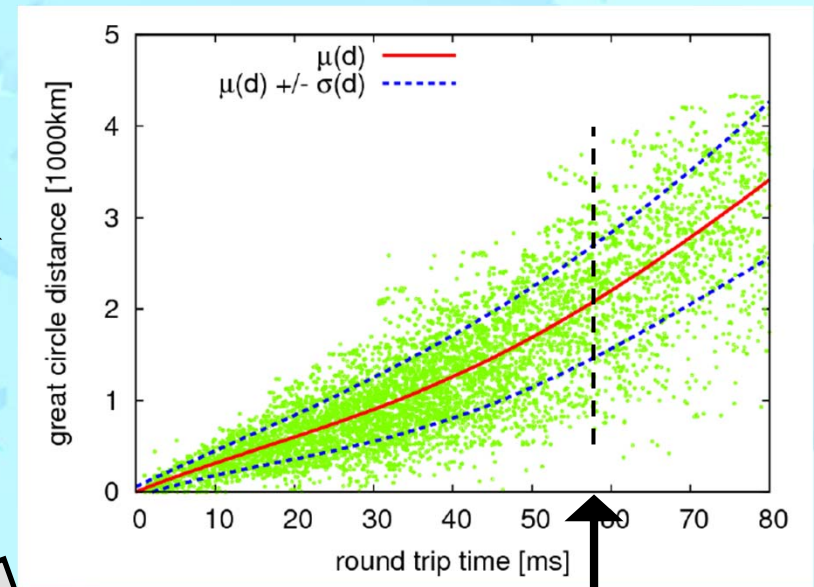
- Standardized values, fitted normal distribution



Evaluation process



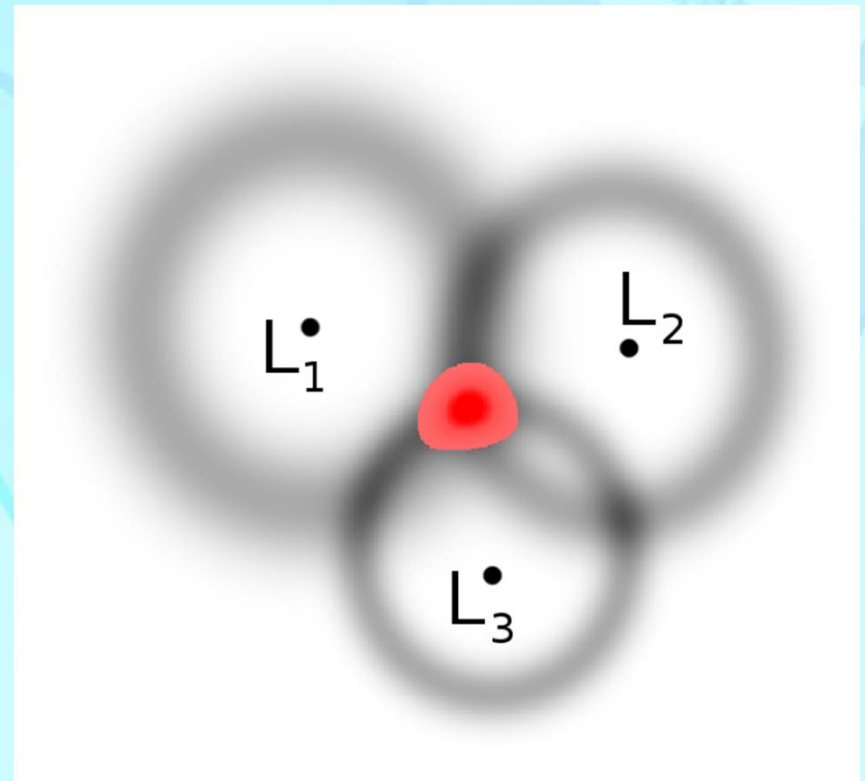
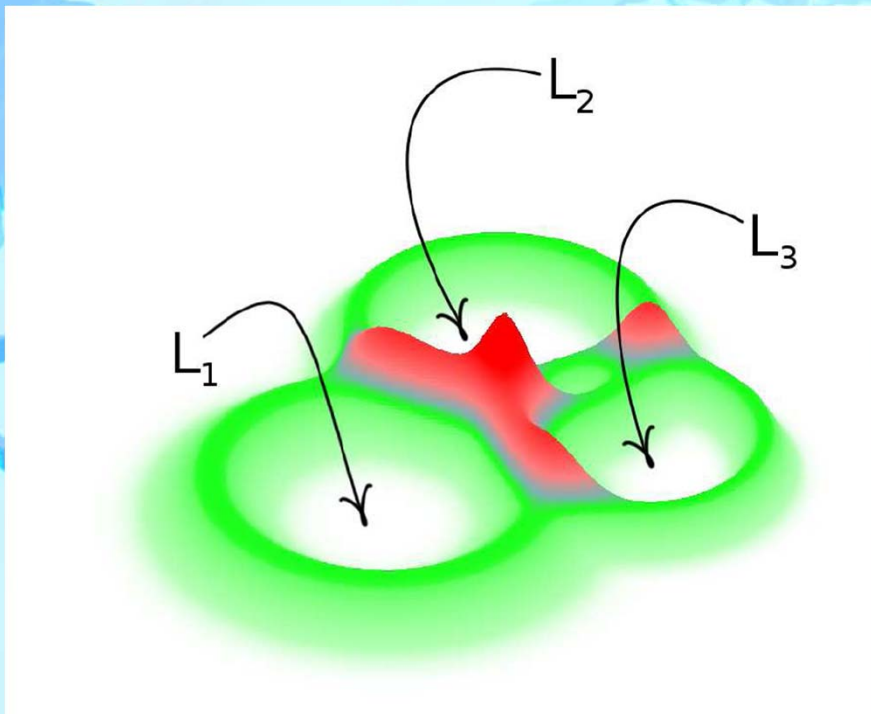
The distances are normally distributed for a given RTT



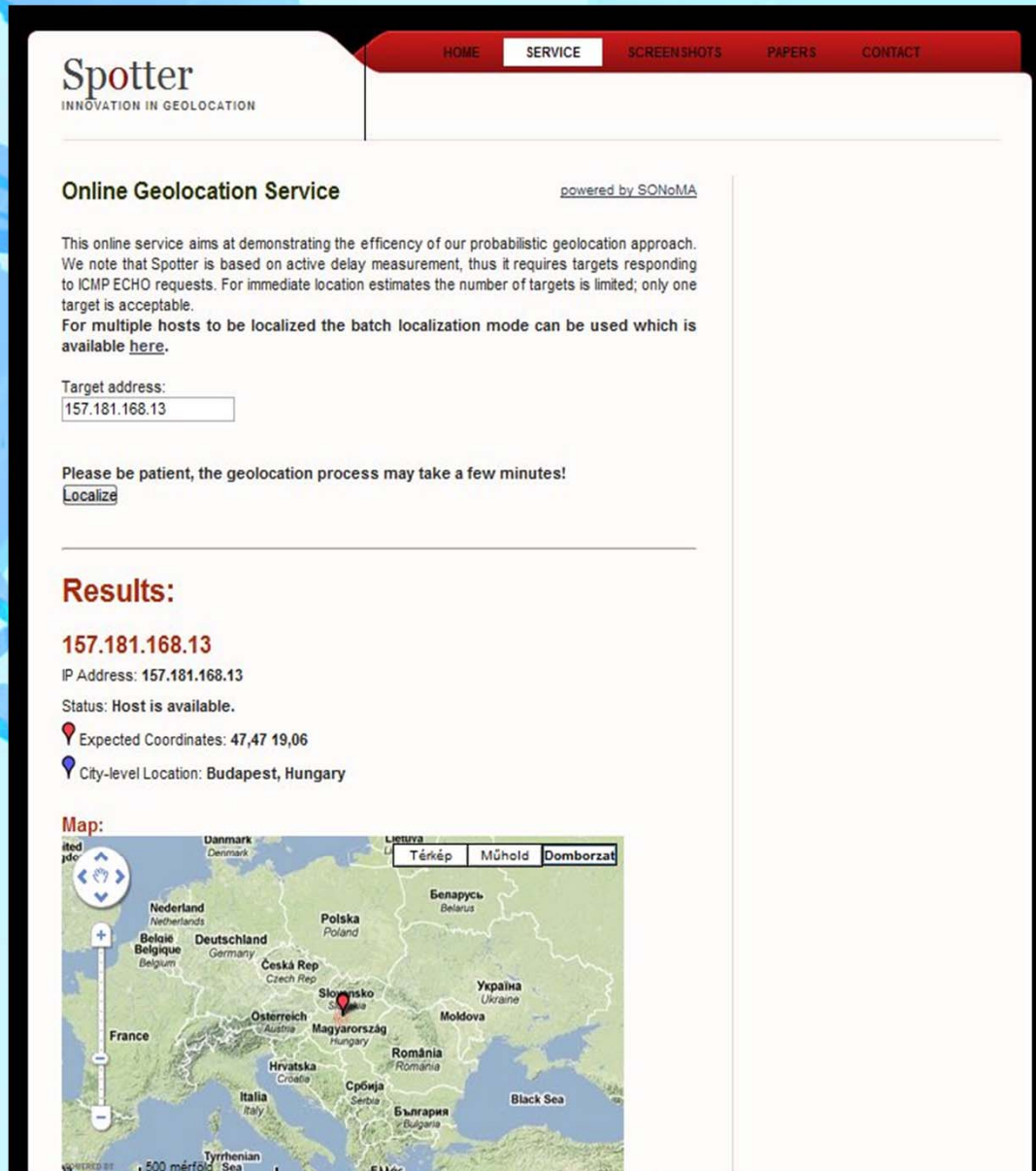
each RTT point out a radial profile with $\mu(d)$ and $\sigma(d) \Rightarrow$ which defines the spatial probability distribution of the target

"Triangulation"

The target's location must satisfy all the individual spatial constraints.



Spotter - online geolocation service



Spotter
INNOVATION IN GEOLOCATION

HOME SERVICE SCREENSHOTS PAPERS CONTACT

Online Geolocation Service powered by SONoMA

This online service aims at demonstrating the efficiency of our probabilistic geolocation approach. We note that Spotter is based on active delay measurement, thus it requires targets responding to ICMP ECHO requests. For immediate location estimates the number of targets is limited; only one target is acceptable.
For multiple hosts to be localized the batch localization mode can be used which is available [here](#).


Target address:

Please be patient, the geolocation process may take a few minutes!
[Localize](#)

Results:

157.181.168.13
IP Address: 157.181.168.13
Status: Host is available.
Expected Coordinates: 47,47 19,06
City-level Location: Budapest, Hungary

Map:




- online: free, easy to use
- offline: batch mode
~15k addresses/day
- to fix: DNS resolve problem

visit and use!

<http://spotter.etomic.org>

Where is the WikiLeaks site (46.59.1.2)?

hostip.info



My IP Address Lookup and GeoTargeting
Community Geotarget IP Project – what
country, city IP addresses map to

[IP Address Lookup](#) [API](#) [Data](#) [Contribute](#) [Forum](#) [FAQ](#) [About](#) [Ecommerce](#)

Domain to IP or Host name lookup

wikileaks.ch

Host name: wikileaks.ch
IP address: 46.59.1.2
Location: ... actually we haven't a clue. ([change](#))

Are you an ISP / host? [Update an entire block](#)

About
Hostip.info is a community-based project to geolocate IP addresses, making the database freely available (see below) but it needs you to put in your city to make it work. It only takes 10 seconds, and you'll get a warm fuzzy feeling of 'doing the right thing' :-)

Try the example to the right for an IP Trace, or to Lookup IP Addresses.

IP Geolocation API
Find the location of IP addresses in Realtime. IP Location Webservice
www.ipaddressapi.com

Bldg Automation Gateway
Easily interface legacy/proprietary to BACnet LonWorks Modbus Metasys
www.FieldServer.com

[<](#) [>](#) Ads by Google

Commercial Geodatabases



Where is the WikiLeaks site (46.59.1.2)?

IPligence

IPligence™

Home Products Free Tools Lite Free

IP Geolocator

Find the city and country location of IP Addresses, hostnames or web addresses.

IP Address Database Lookup

Your IP address is 46.59.1.2
City:
Country:
Continent:
Time Zone: [more demo?](#)

North America Atlantic Ocean Africa Indian Ocean Australia South America Pacific Ocean

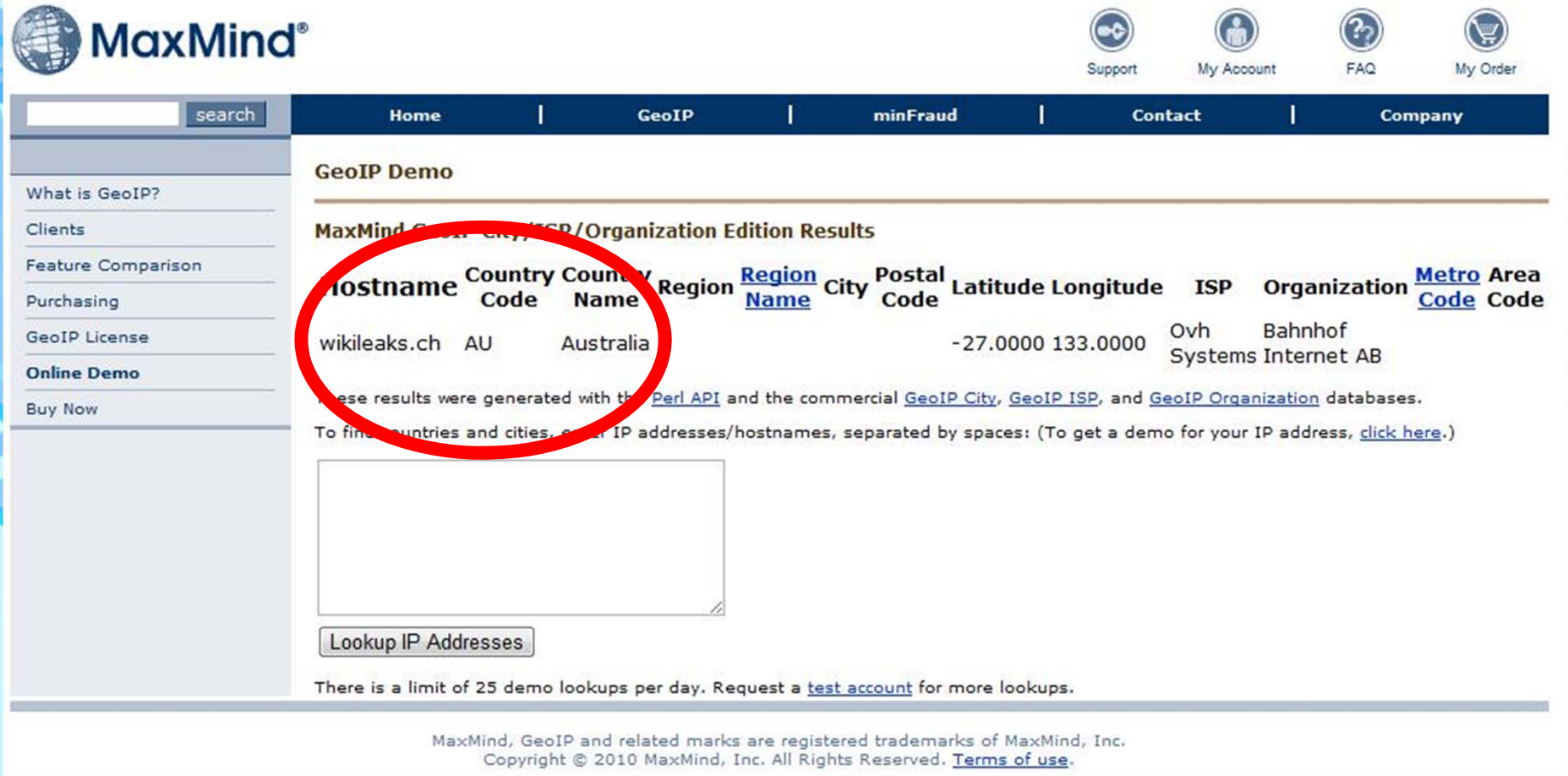
POWERED BY [Terms of Use](#)

Enter IP Address / Hostname / URL:
46.59.1.2 Data obtained from IPligence Max [Learn more...](#)



Where is the WikiLeaks site (46.59.1.2)?

MaxMind



The screenshot shows the MaxMind website interface. At the top, there is a navigation bar with links for Home, GeoIP, minFraud, Contact, and Company. Below this is a search bar and a sidebar with various links like 'What is GeoIP?', 'Clients', and 'GeoIP License'. The main content area displays 'GeoIP Demo' and 'MaxMind GeoIP City/ISP/Organization Edition Results'. A table shows the lookup results for 'wikileaks.ch', which is circled in red. The table columns include Hostname, Country Code, Country Name, Region, City, Postal Code, Latitude, Longitude, ISP, Organization, Metro Code, and Area Code. Below the table, there is a text box for entering IP addresses or hostnames and a 'Lookup IP Addresses' button. At the bottom, there is a footer with copyright information.

Hostname	Country Code	Country Name	Region	Region Name	City	Postal Code	Latitude	Longitude	ISP	Organization	Metro Code	Area Code
wikileaks.ch	AU	Australia					-27.0000	133.0000	Ovh	Bahnhof Systems Internet AB		

These results were generated with the [Perl API](#) and the commercial [GeoIP City](#), [GeoIP ISP](#), and [GeoIP Organization](#) databases.

To find countries and cities, enter IP addresses/hostnames, separated by spaces: (To get a demo for your IP address, [click here](#).)

There is a limit of 25 demo lookups per day. Request a [test account](#) for more lookups.

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Where is the WikiLeaks site (46.59.1.2)?

Spotter

Results:

wikileaks.ch

IP Address: 46.59.1.2

Status: Host is available.

Expected Coordinates: 59,35 17,94

City-level Location: Stockholm, Sweden

Map:



Where is the WikiLeaks site (46.59.1.2)?

<http://www.youtube.com/watch?v=qwlATf9xse4>

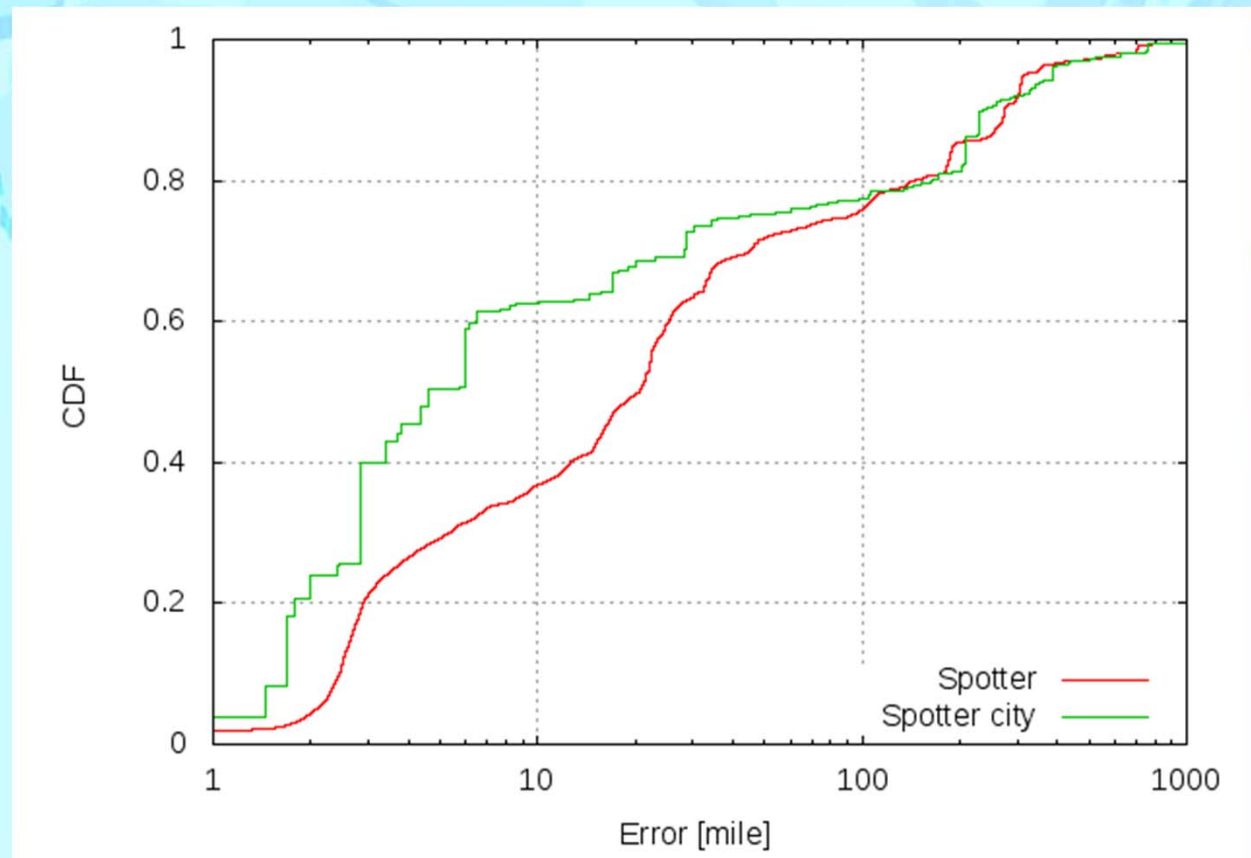


The image shows a YouTube video player interface. At the top left is the YouTube logo. To its right is a search bar with the text "Keresés" and a magnifying glass icon. Further right are links for "Böngészés" and "Feliratkozás". Below the search bar is the video title "Episode 11 - White Mountain, Fit For A James Bond Villain!". Under the title, the channel name "datacenterpulse" is displayed, along with "40 videó" and a dropdown arrow, and a "Feliratkozás" button. The main video area shows a satellite-style map of Europe. A red line starts from the Atlantic Ocean, curves across the North Atlantic, and ends at a red dot labeled "Stockholm" in Sweden. The video player controls at the bottom include a play button, a volume icon, a progress bar showing "0:14 / 9:12", a Creative Commons license icon, a resolution icon set to "360p", and icons for full screen, playlist, and repeat.



Spotter's accuracy

- Estimation accuracy for reference node set
(thanks to Bradley@CAIDA)
- Spotter – „pure probabilistic method”
- Spotter city – population density as extra constraint

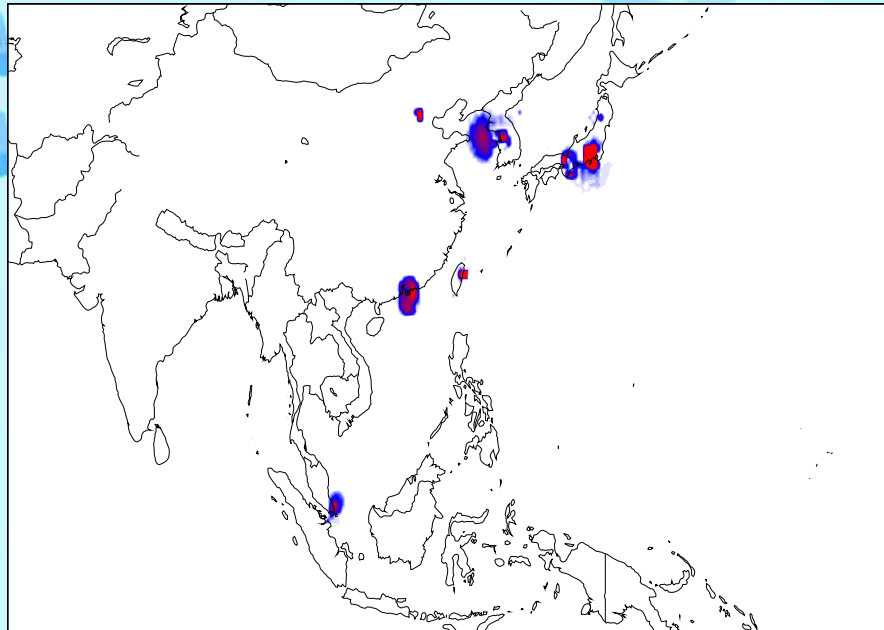
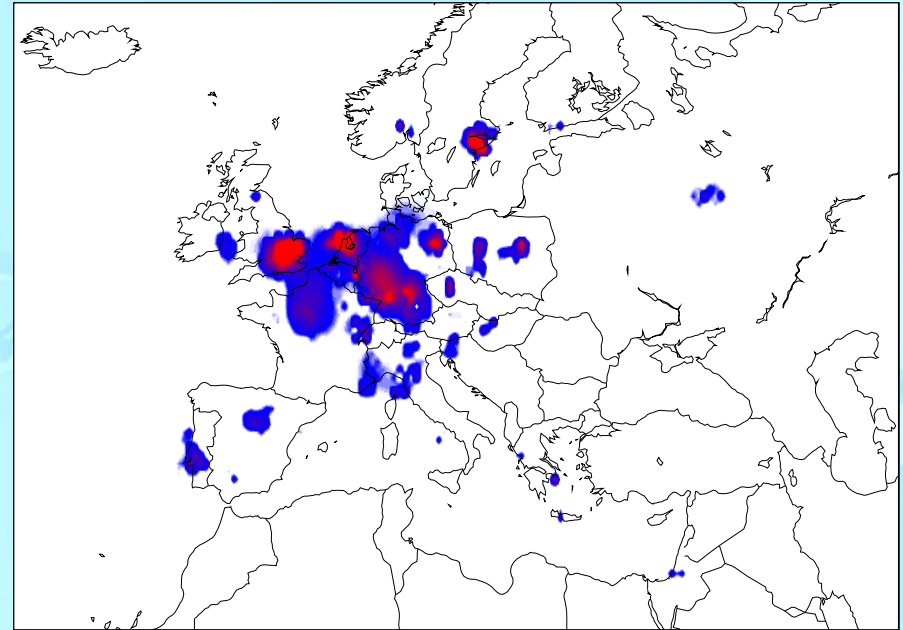
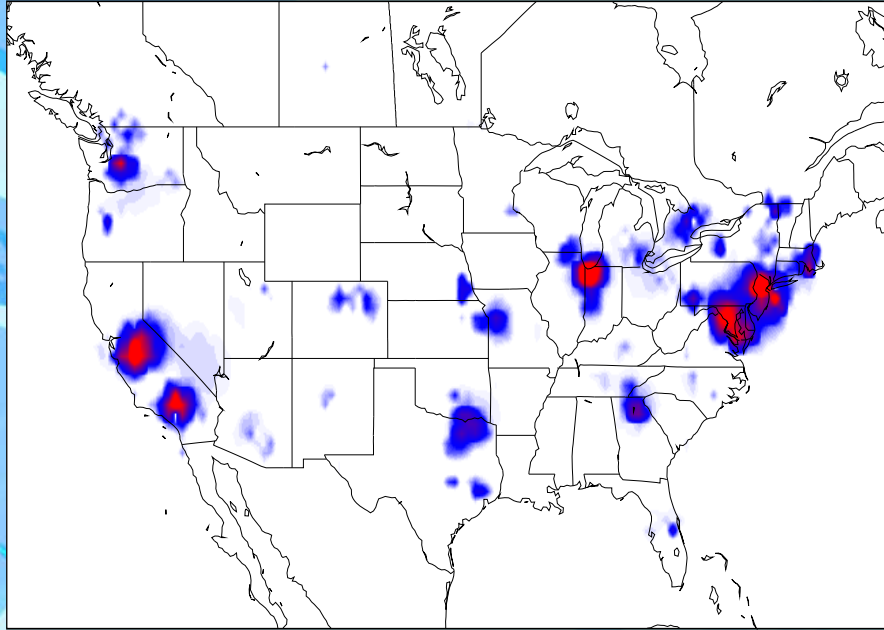




Some basic geographic properties of the Internet

- Are there typical link lengths?
- How circuitous are the network paths?
- What is the extent of route asymmetry?

Router density visualization



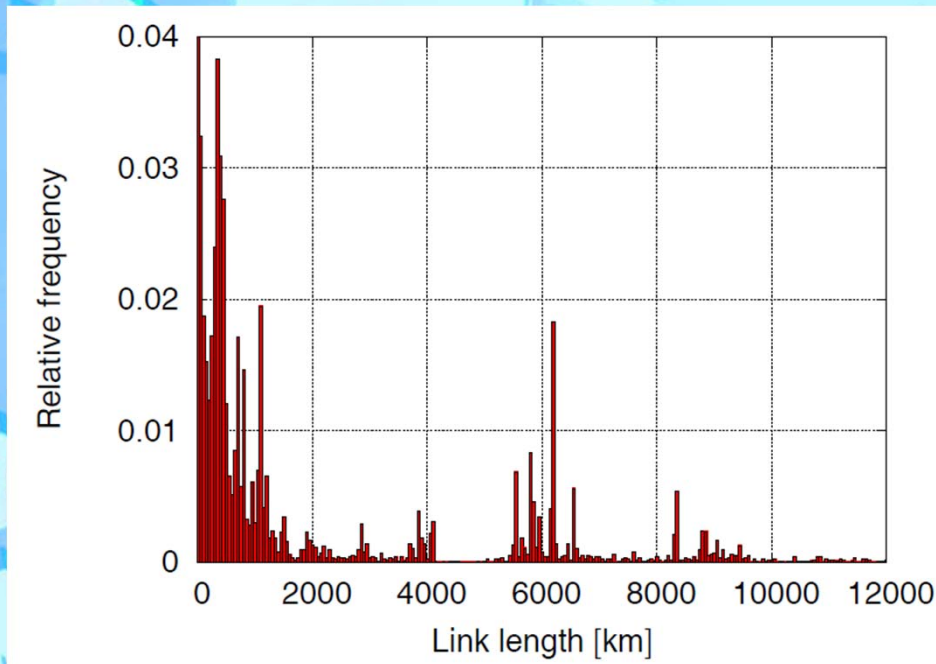
- routers of the full-mesh PlanetLab topology (700x700)
- discovered by traceroute
- both academic and commercial ISPs
- IP level network
- approx. 16.000 addresses



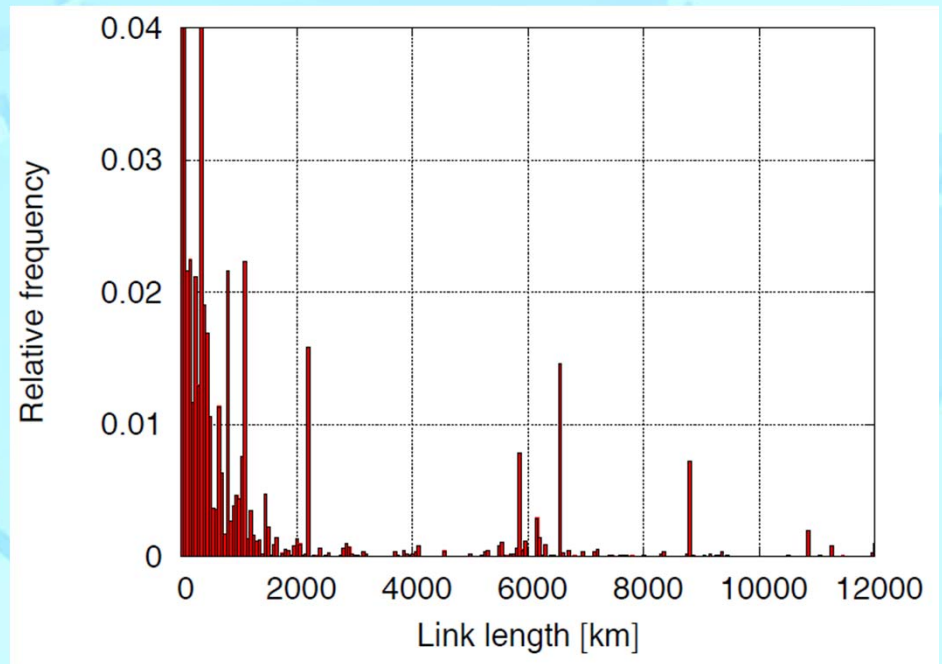
Link length frequency & distribution

Link length frequency

of identified IP level links: approx. 44.000



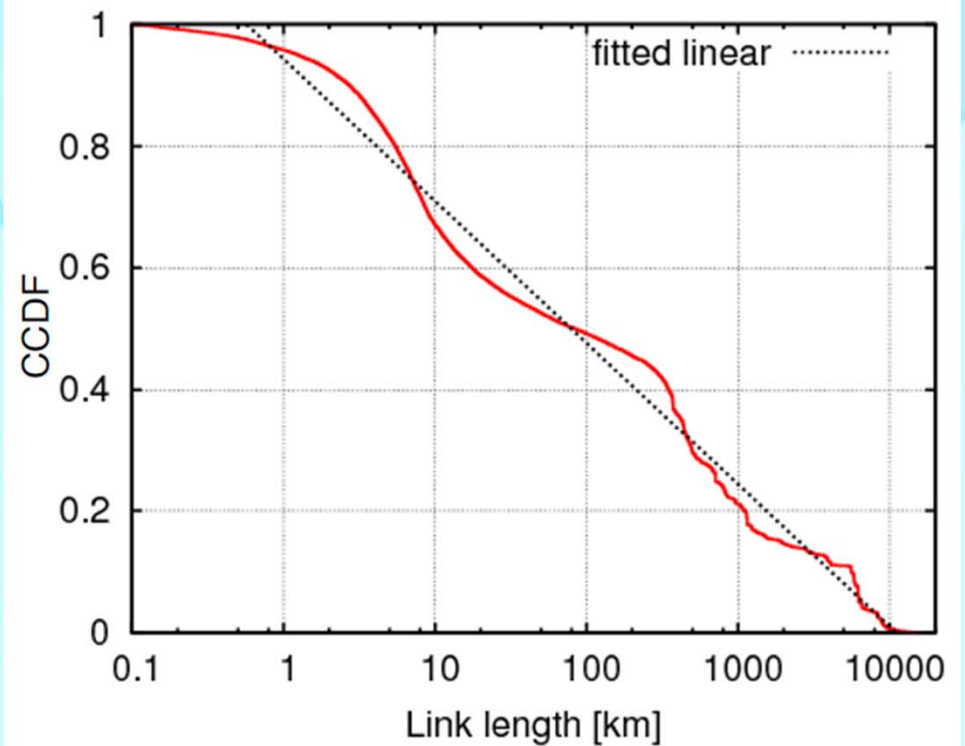
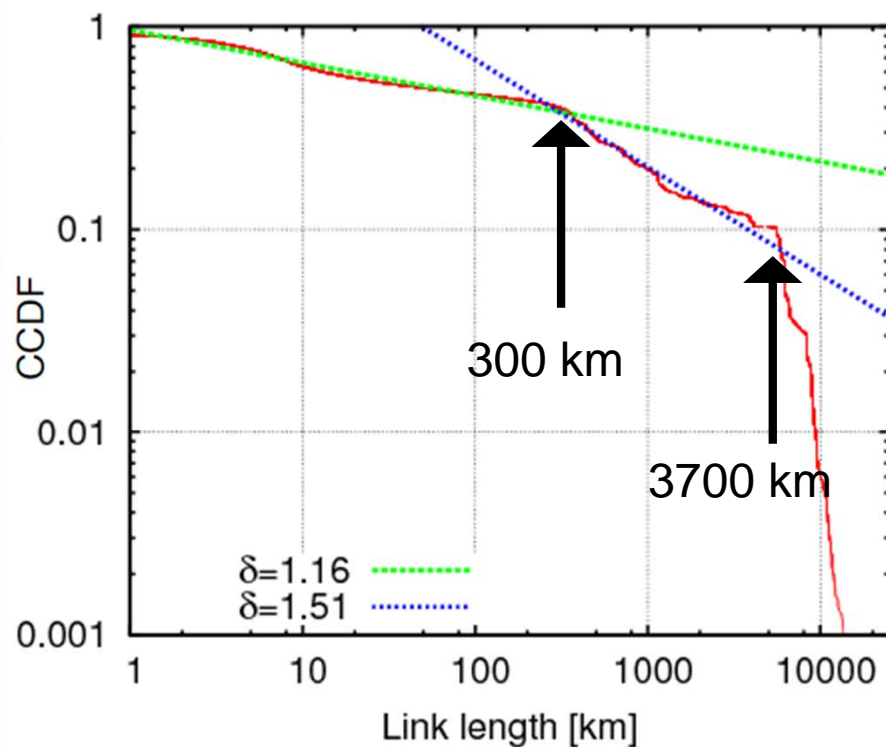
each unique link is represented once




links are weighted up with their prevalence in the traceroute data set collected at one time

Link length distribution

- power law, where $P(d) \propto d^{-\delta}$?
- logarithmic relation, where $P(d) \propto 1/d$?
- model behind the observation?





Circuitousness of network paths

Circuitousness of network paths

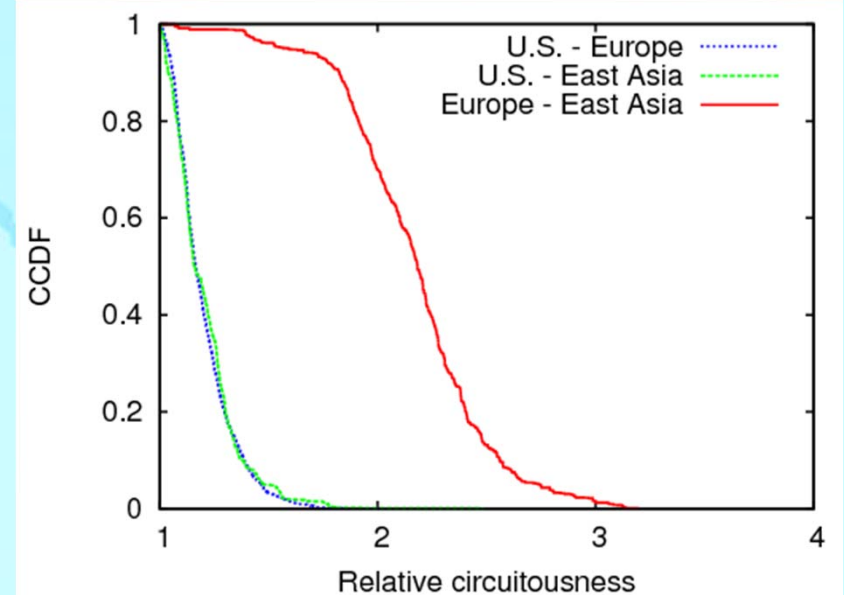
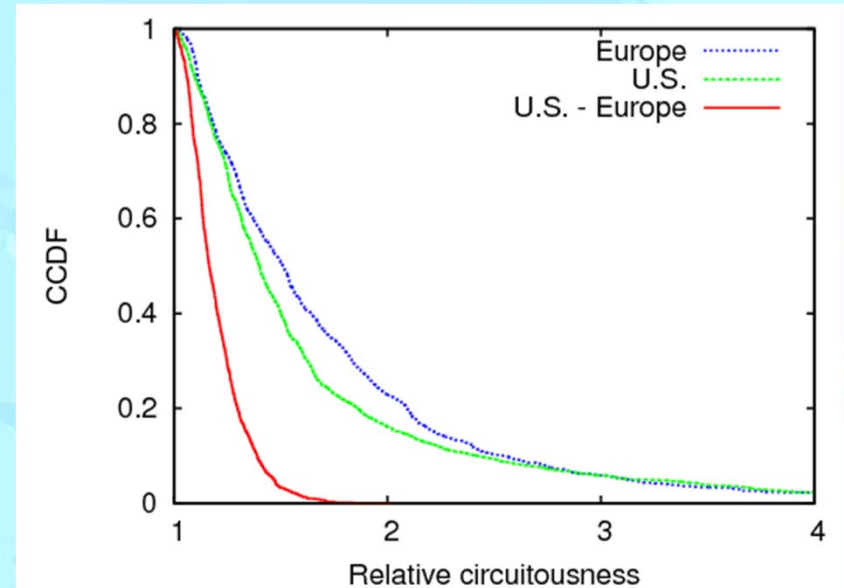
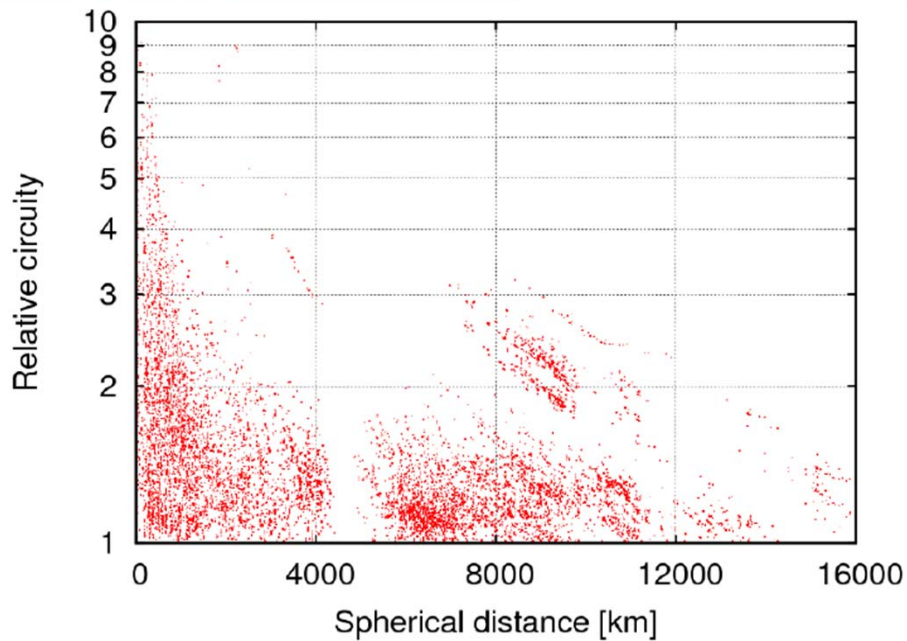


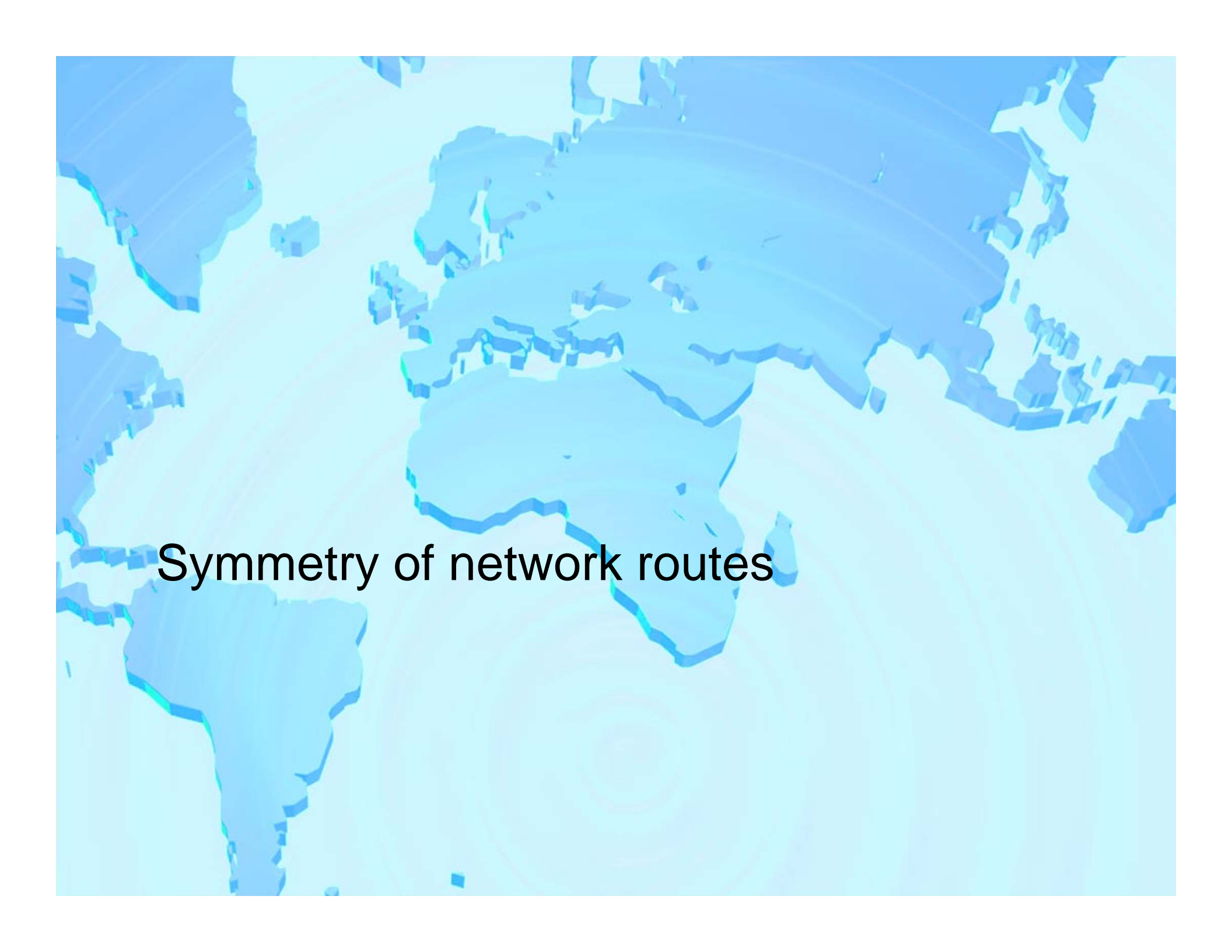
$$\text{relative circuitousness} = \frac{\text{aggregated link length}}{\text{spherical distance of the endpoints}}$$

Circuitousness of network paths

Intra-continental routes: significant circuitousness

Inter-continental routes: determined by the intercontinental gateways

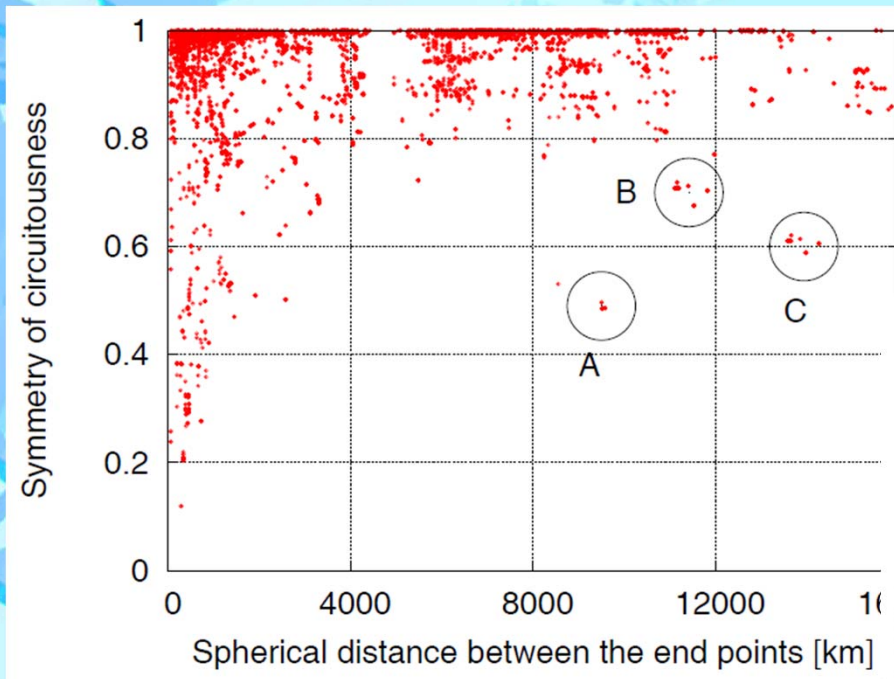




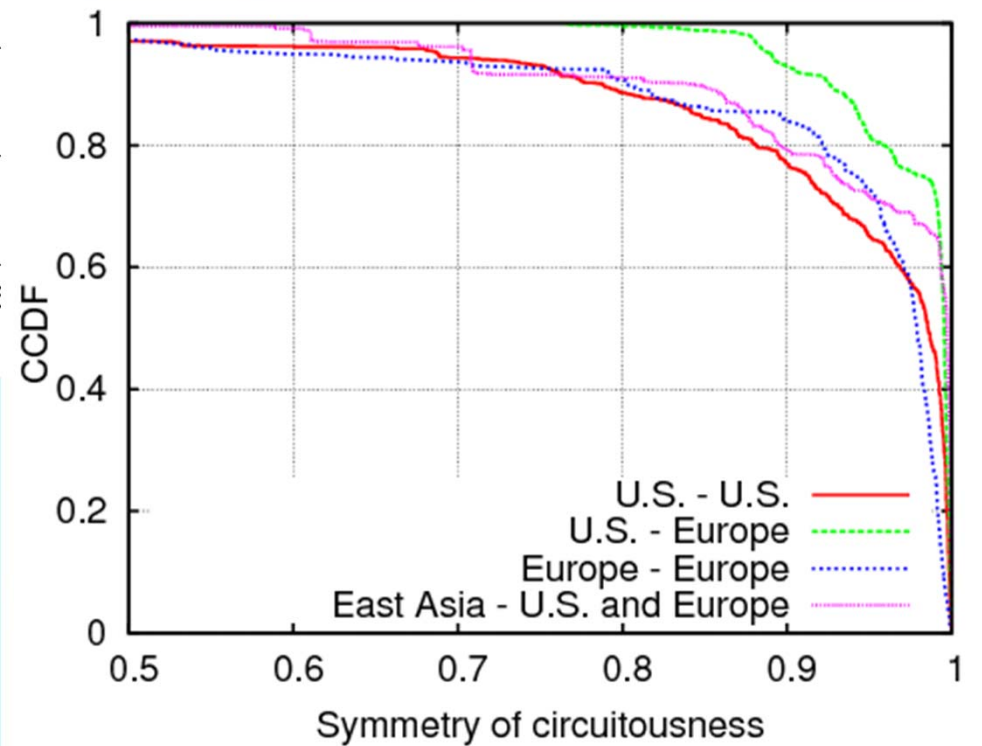
Symmetry of network routes

Symmetry of network routes

Ratio of the route lengths of the forward and the backward directions.



A: United Kingdom – Hong Kong
B: California, USA – Hong Kong
C: California, USA – Singapore



Around the world in 300 ms

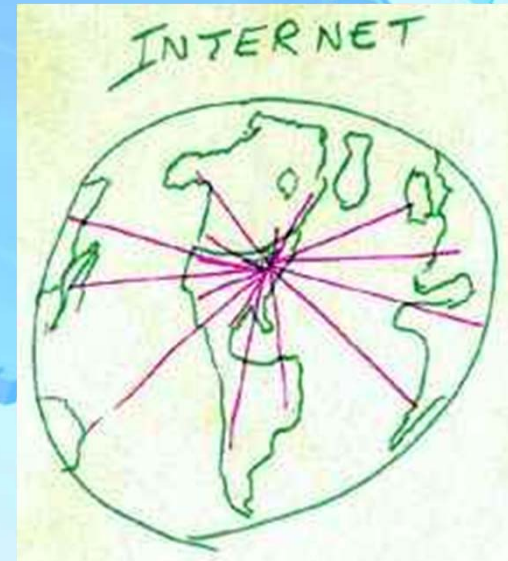


from the United Kingdom to Hong Kong:

- forward direction: eastward through Europe and Asia
- backward direction: eastward through the USA

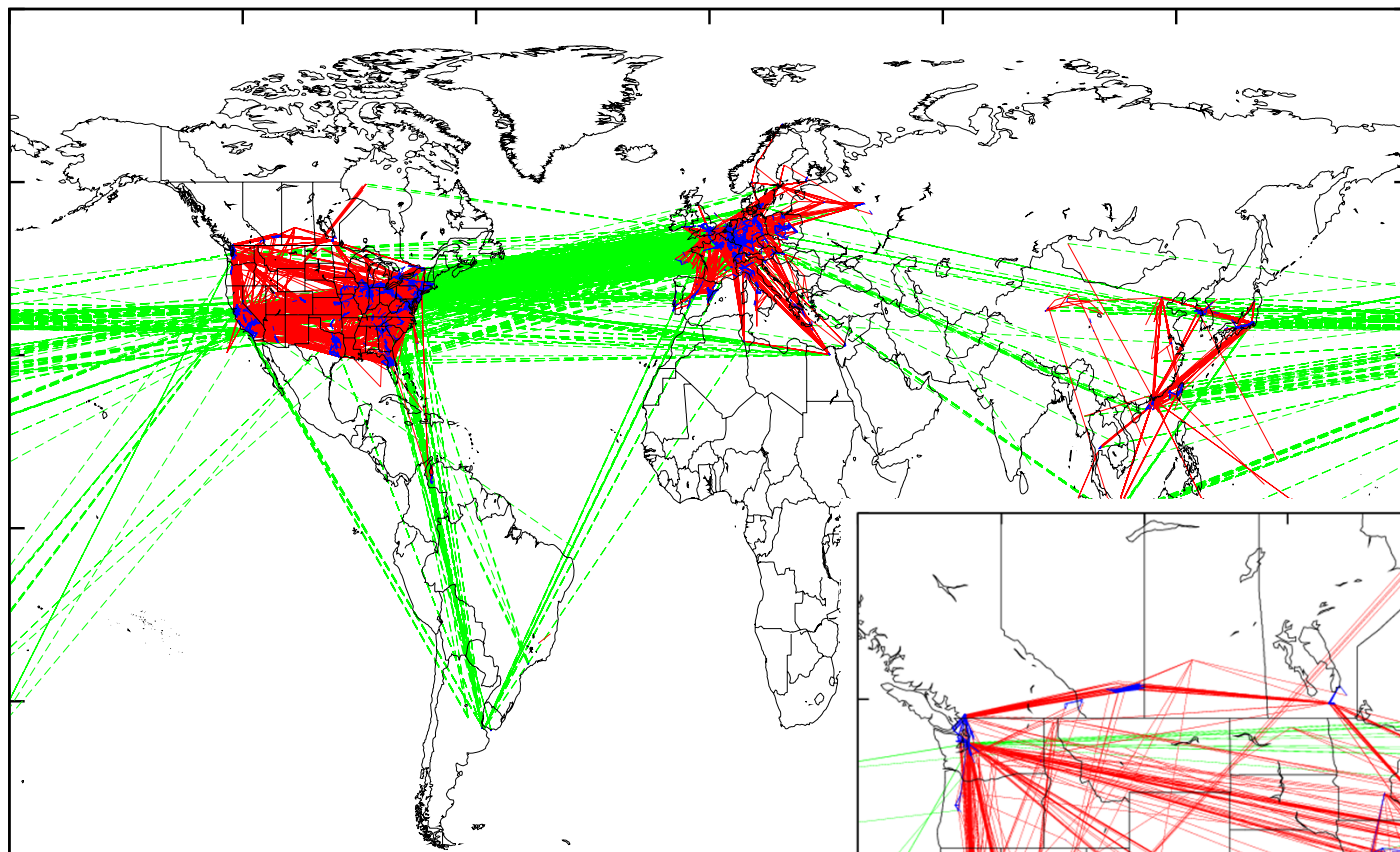
Where is the Internet?*

And what does it look like?*

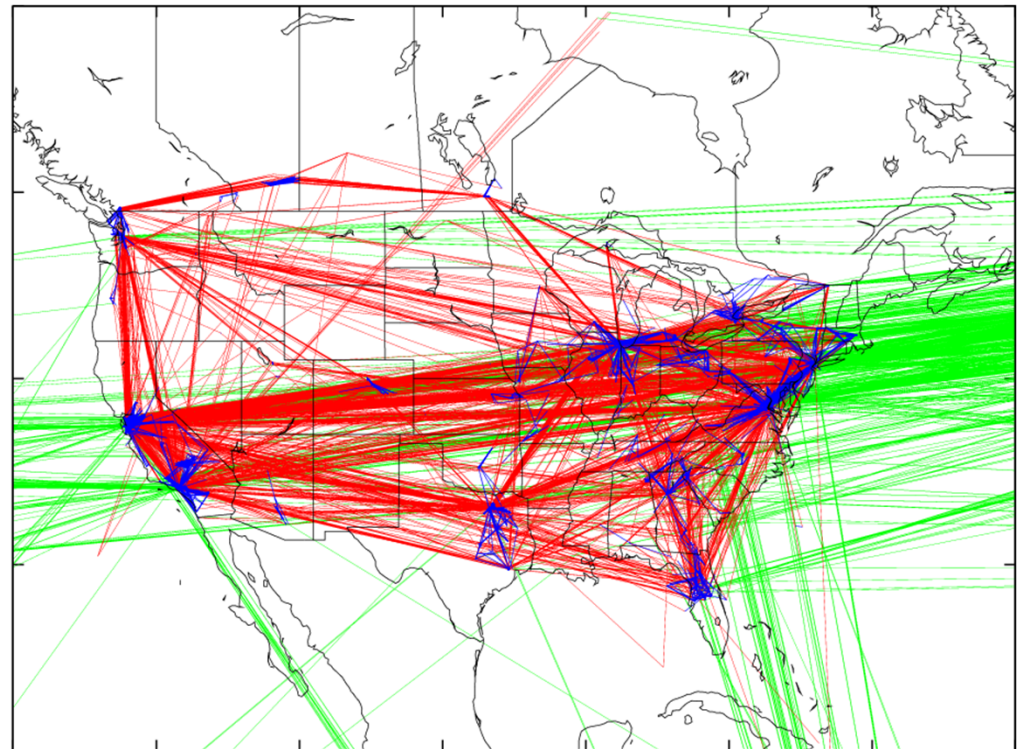


*as our dataset shows

Thank you for your attention!



for more info &
for the online service please visit:
<http://spotter.etomic.org>



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