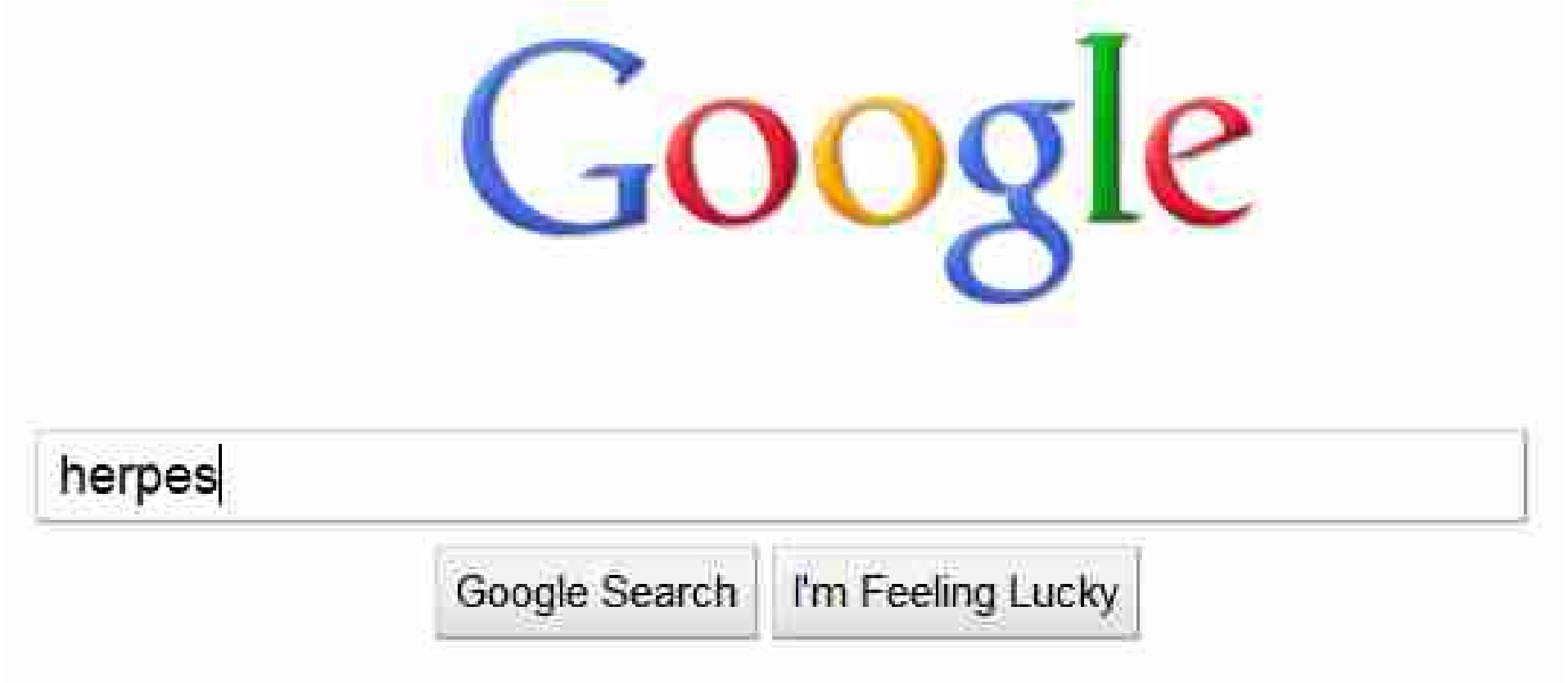
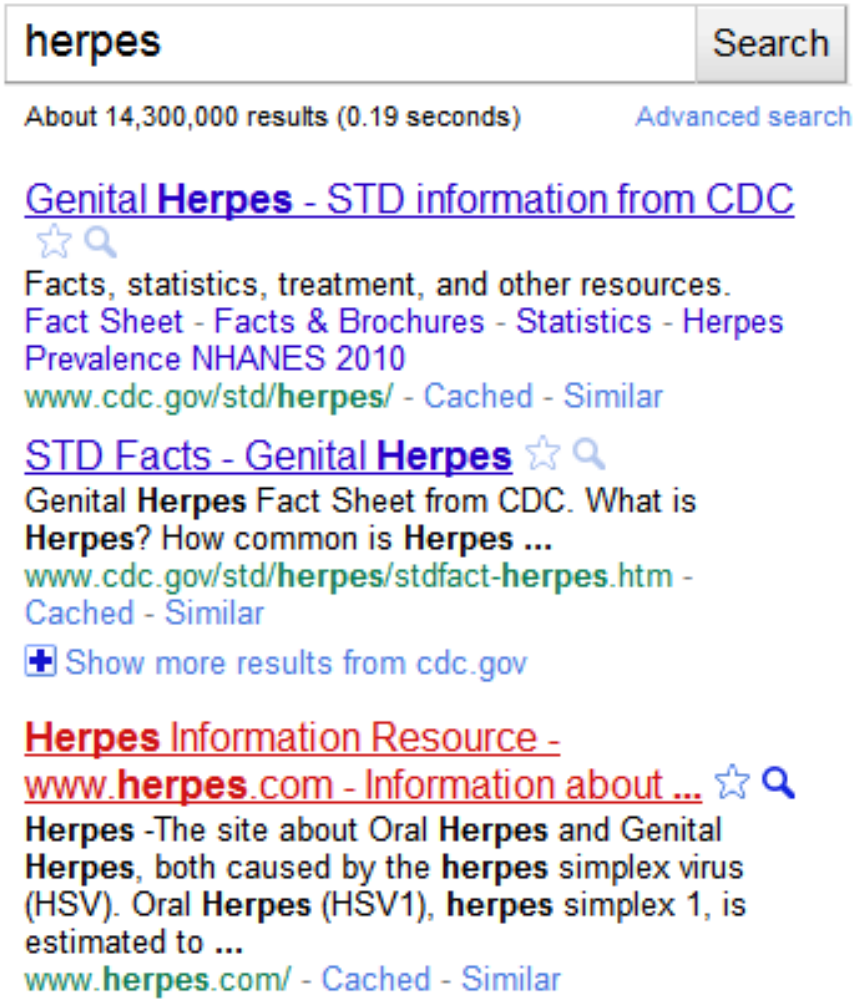
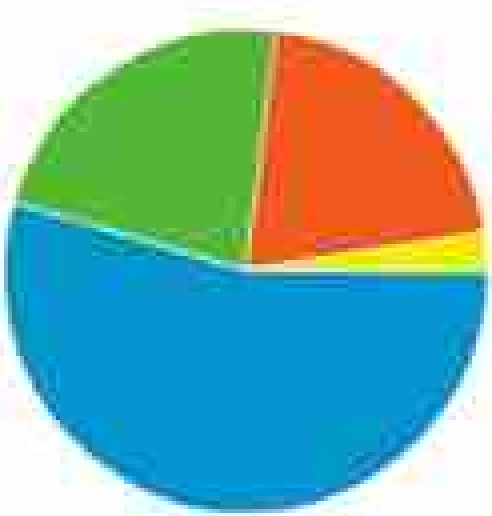
Methodically Modeling the Tor Network

Workshop on
Cyber Security Experimentation and Test
2012

Rob Jansen *- U.S. Naval Research Laboratory*
Kevin Bauer – University of Waterloo
Nick Hopper – University of Minnesota
Roger Dingledine – The Tor Project


Google
herpes
Google Search
I'm Feeling Lucky


herpes
Search
About 14,300,000 results (0.19 seconds)
Advanced search
Genital Herpes - STD information from CDC
Facts, statistics, treatment, and other resources.
Fact Sheet - Facts & Brochures - Statistics - Herpes Prevalence NHANES 2010
www.cdc.gov/std/herpes/ - Cached - Similar
STD Facts - Genital Herpes
Genital Herpes Fact Sheet from CDC. What is Herpes? How common is Herpes ...
www.cdc.gov/std/herpes/stdfact-herpes.htm - Cached - Similar
Show more results from cdc.gov
Herpes Information Resource - www.herpes.com - Information about ...
Herpes -The site about Oral Herpes and Genital Herpes, both caused by the herpes simplex virus (HSV). Oral Herpes (HSV1), herpes simplex 1, is estimated to ...
www.herpes.com/ - Cached - Similar



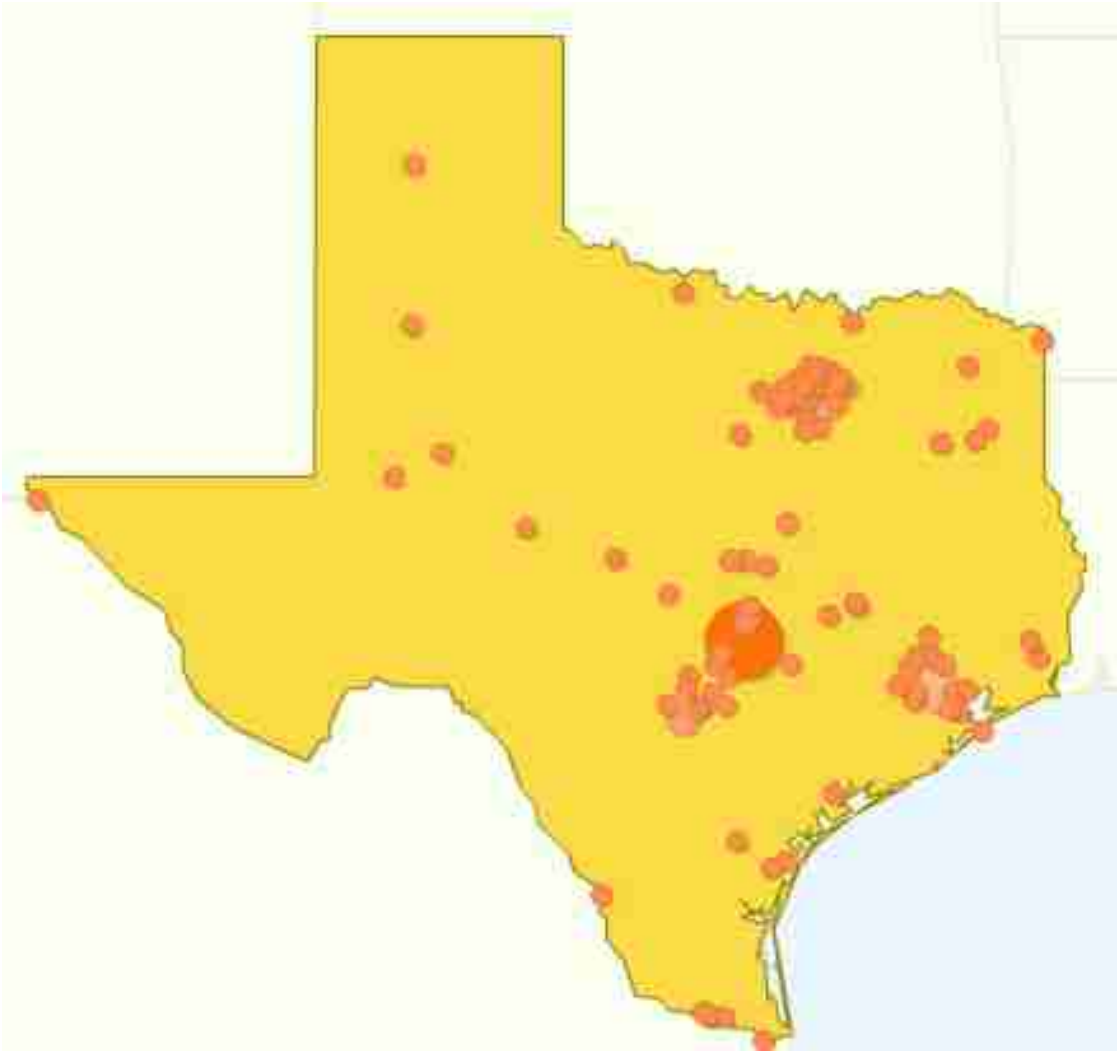
Referring Sites
10,657.00 (54.54%)

Direct Traffic
4,389.00 (22.46%)

Search Engines
3,991.00 (20.43%)

Other
502 (2.57%)

Keywords	Visits	% visits
herpes	216	5.41%





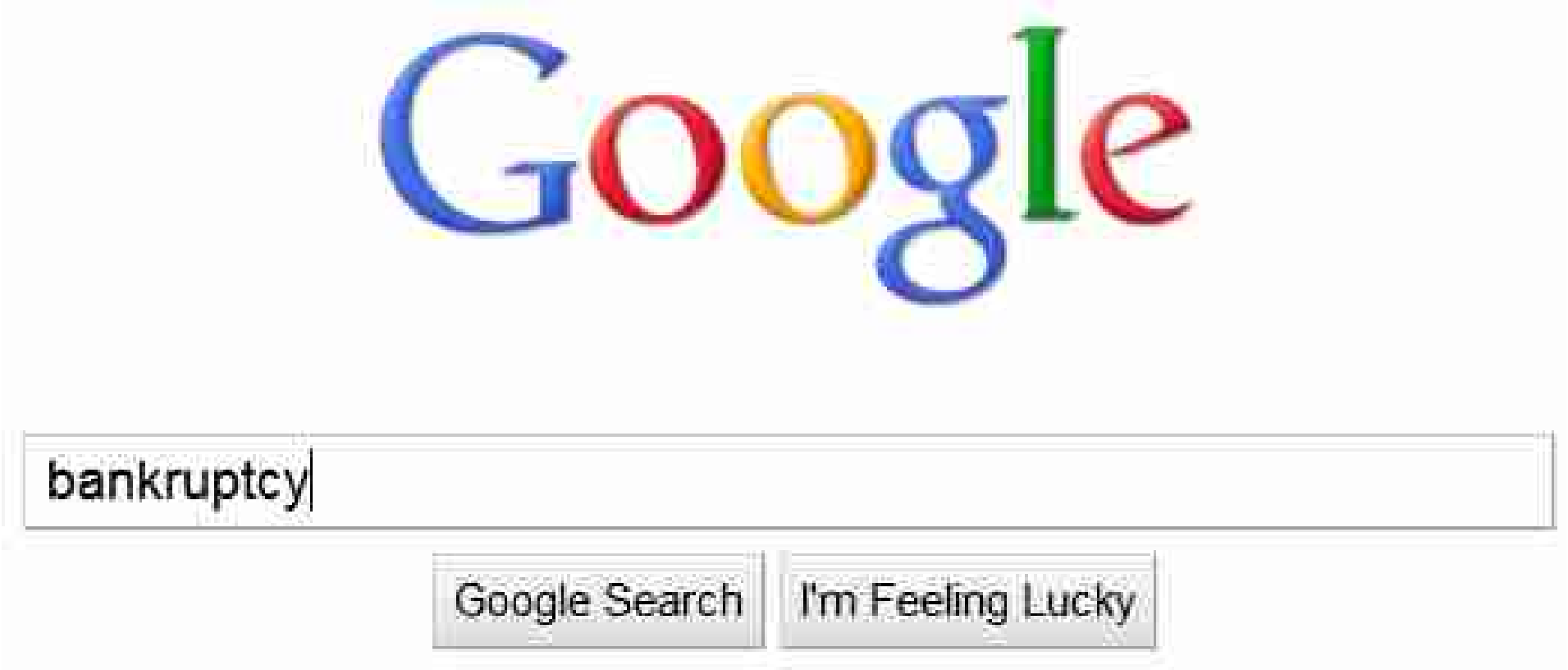

AVIRALEX
Topical
Treatment
for
Immediate
Results!
H-Balm
Organic
Topical Herpes
Treatment
Confidential Herpes Testing
private
DIAGNOSTICS
and STD Testing


Age: 34
Sex: F
Likes: Herpes


Red Marine Algae
Proven Herpes Suppressant
Supress Herpes
with Vir-L-Lysine
Get immediate relief
AVIRALEX
Forces of Nature
H - BALM: THE HERPES SOLUTION
private
DIAGNOSTICS
Confidential Herpes
and STD Testing


THE UNITED STATES OF AMERICA


DENIED


Google
bankruptcy
Google Search
I'm Feeling Lucky


@gmail.com | Web History | Settings | Sign out
Search
Instant is off
Advanced search

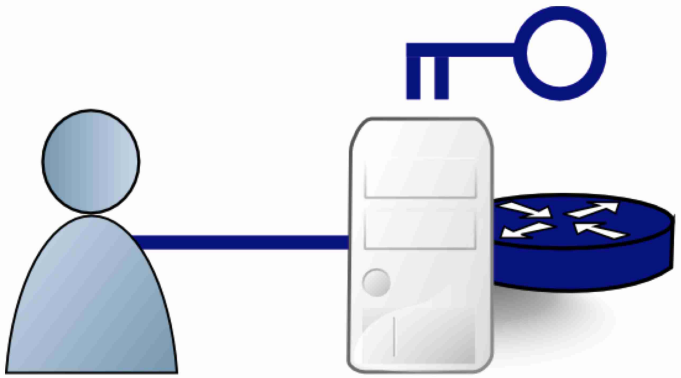



LEUPOLD


SYSTEM FAILURE


?
Anonymous

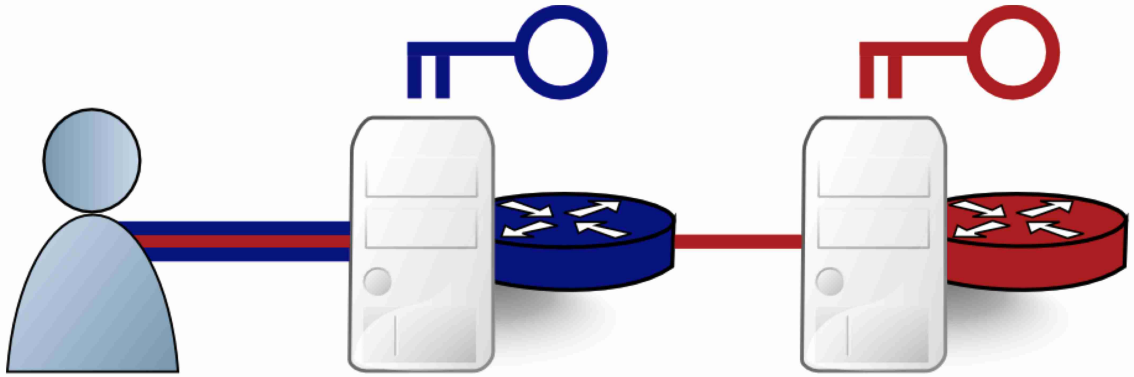
Onion Routing with Tor



Client

Relays

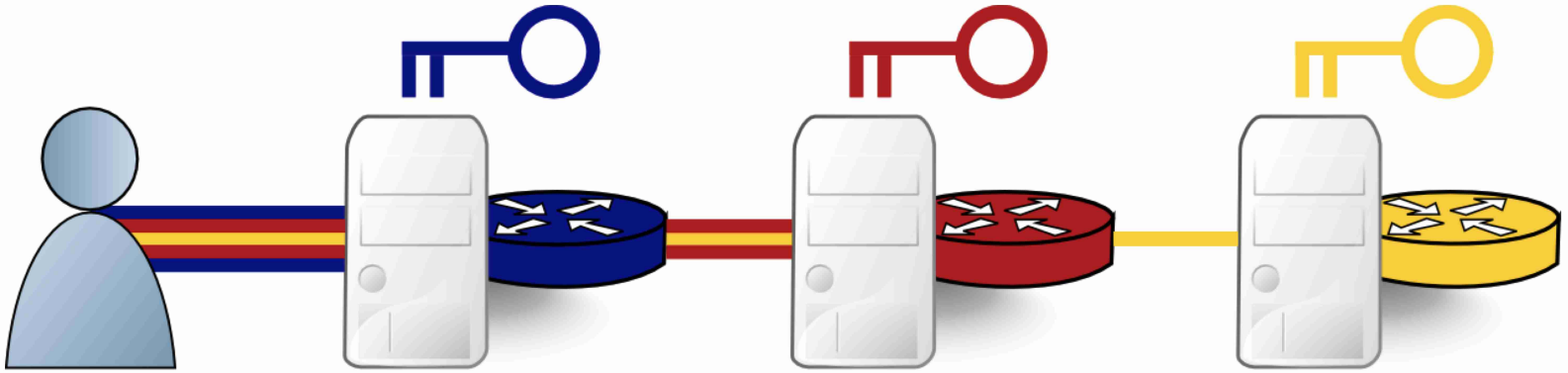
Onion Routing with Tor



Client

Relays

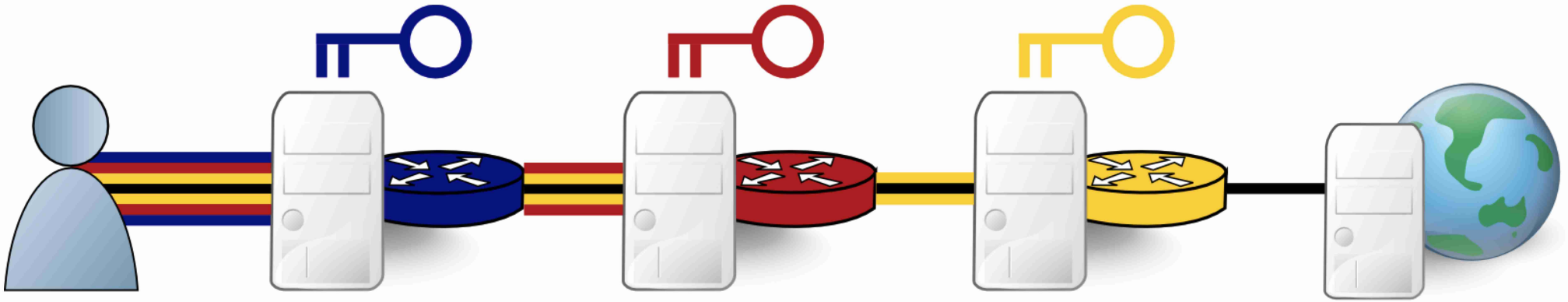
Onion Routing with Tor



Client

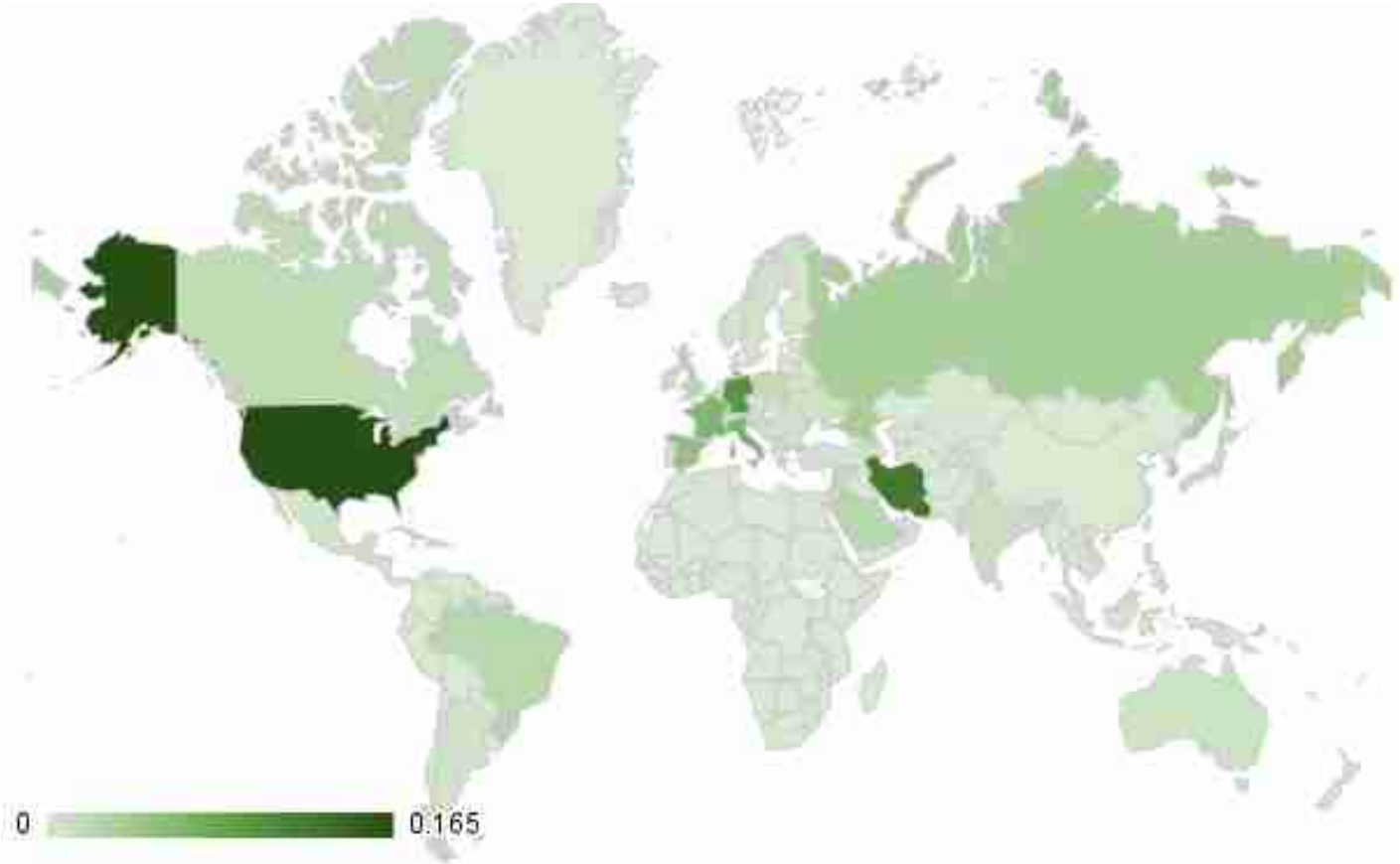
Relays

Onion Routing with Tor



Tor Experimentation

	Pros	Cons
Live Tor	Realistic, accurate	Hard to manage, privacy risks, lengthy deployment



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	Pros	Cons
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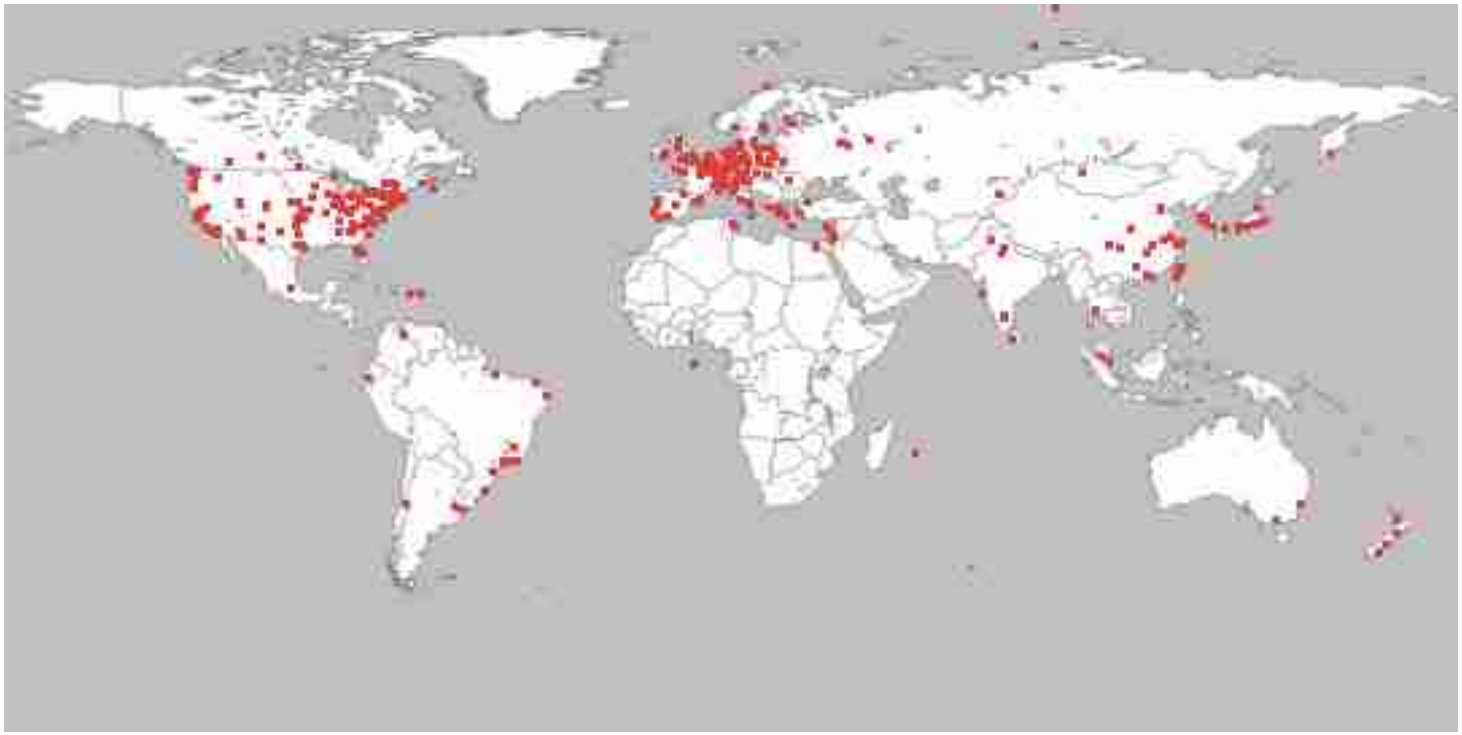
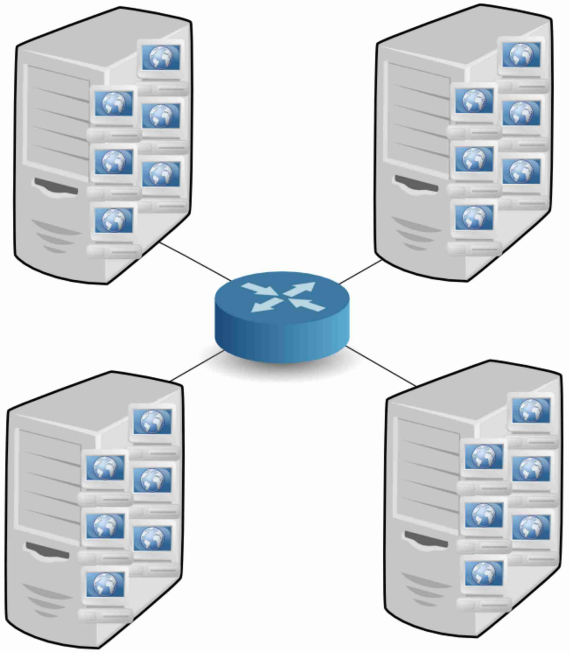
PlanetLab	Realistic	Hard to manage, not scalable, inaccurate



Tor Experimentation

- Shadow and ExperimenTor
  - Both run real Tor software
  - Network simulation (discrete events)
    vs emulation testbed (ModelNet)

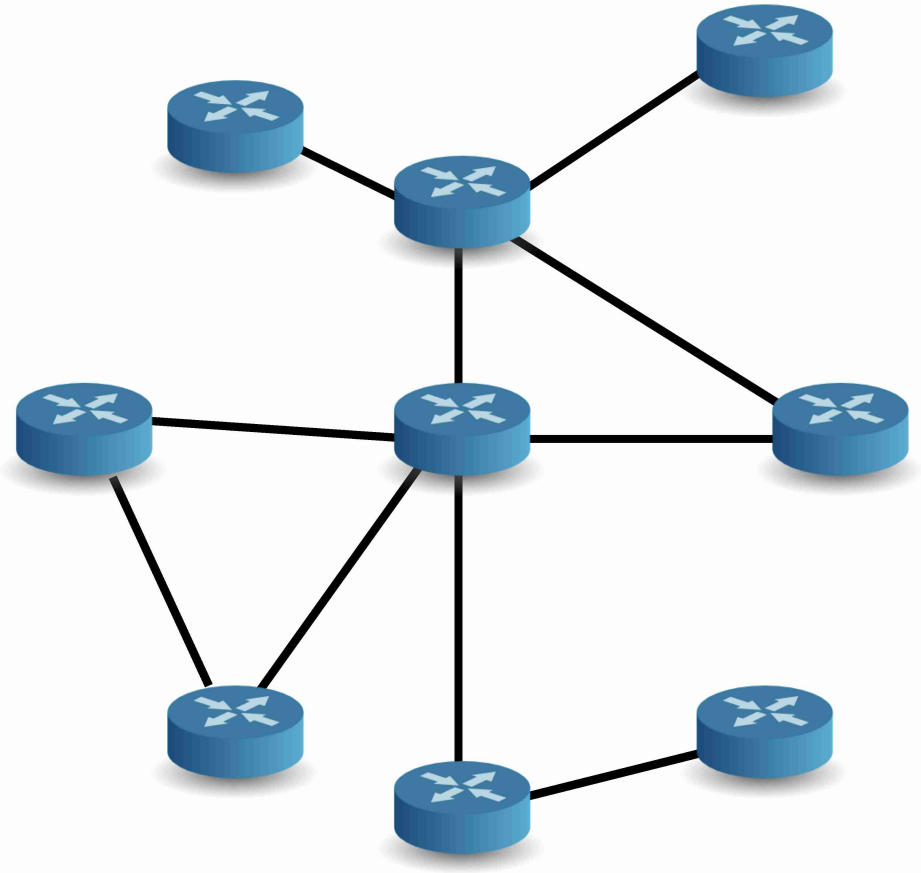




Modeling Choices

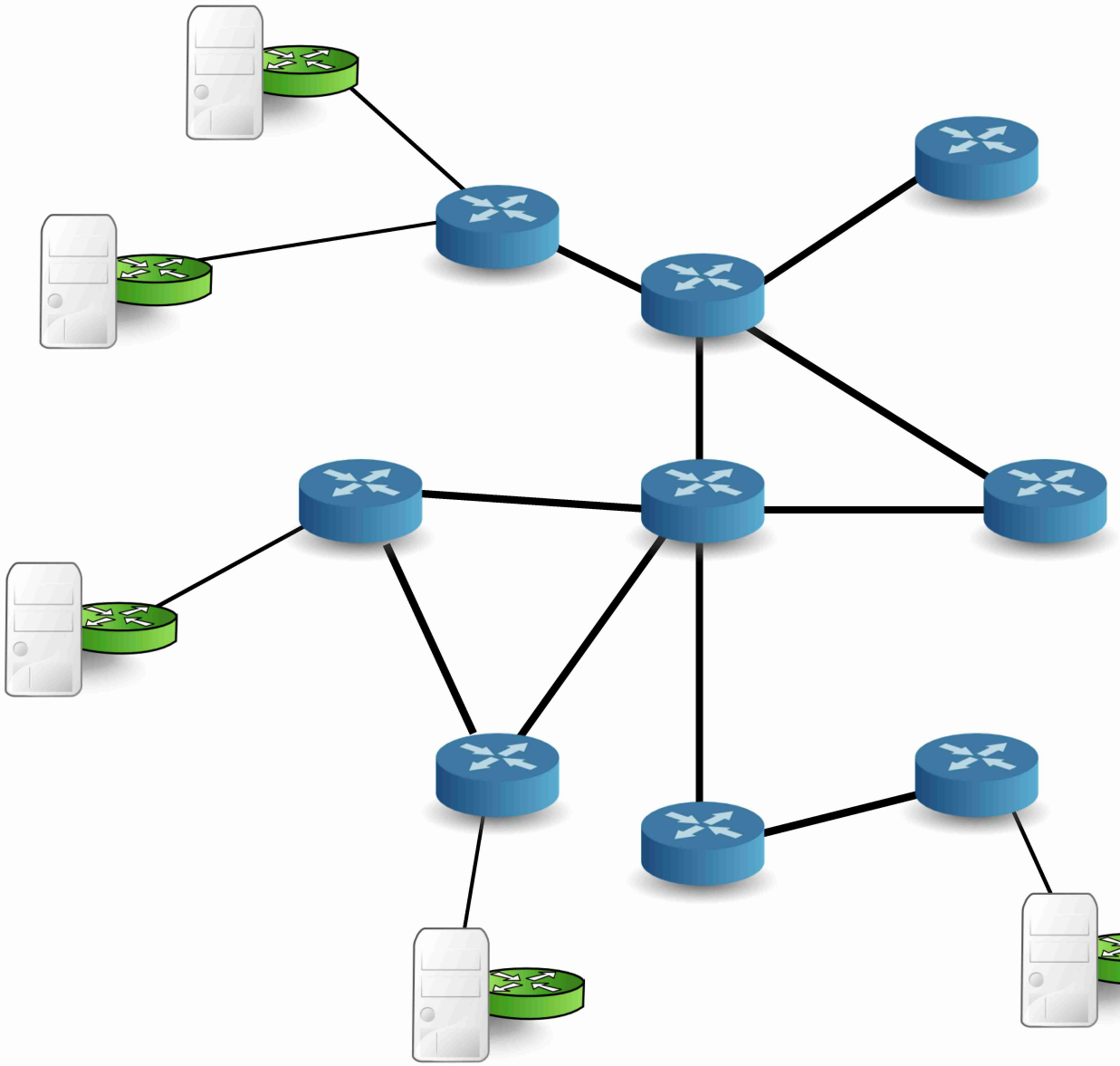


Internet Routers



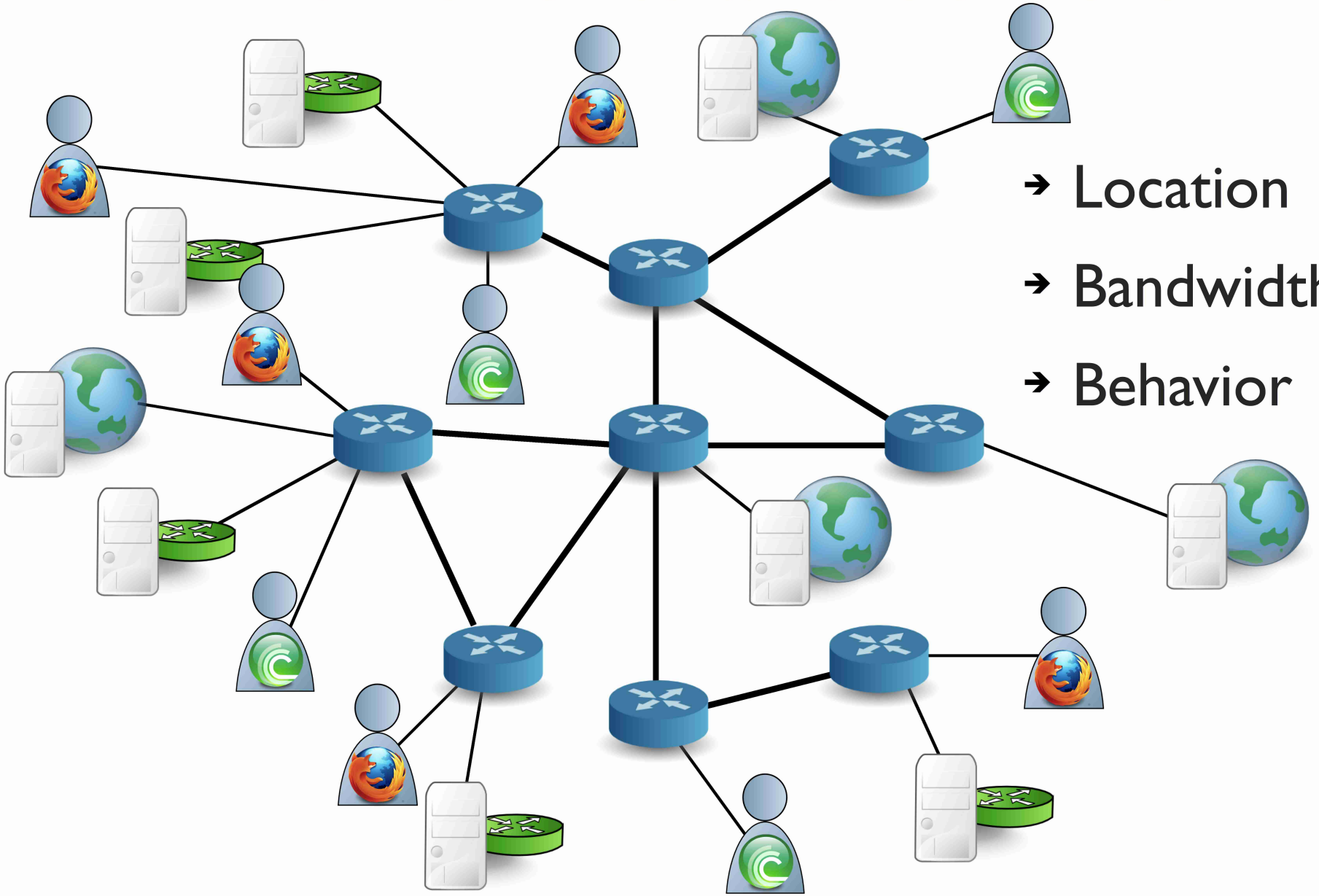
- Edges
  - Latency
  - Jitter
  - Packet loss
- Vertices
  - Bandwidth

Tor Relays



- Sample
- Location
- Capacity
- Configuration

Tor Clients and Servers



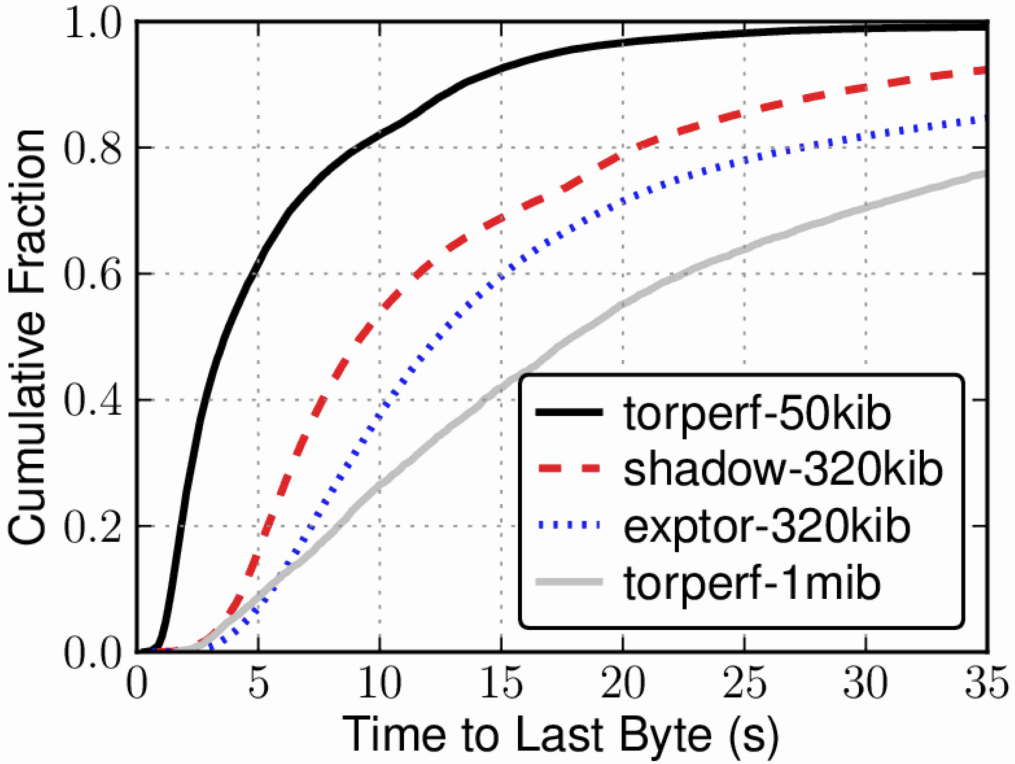
- Location
- Bandwidth
- Behavior

Modeling Decisions

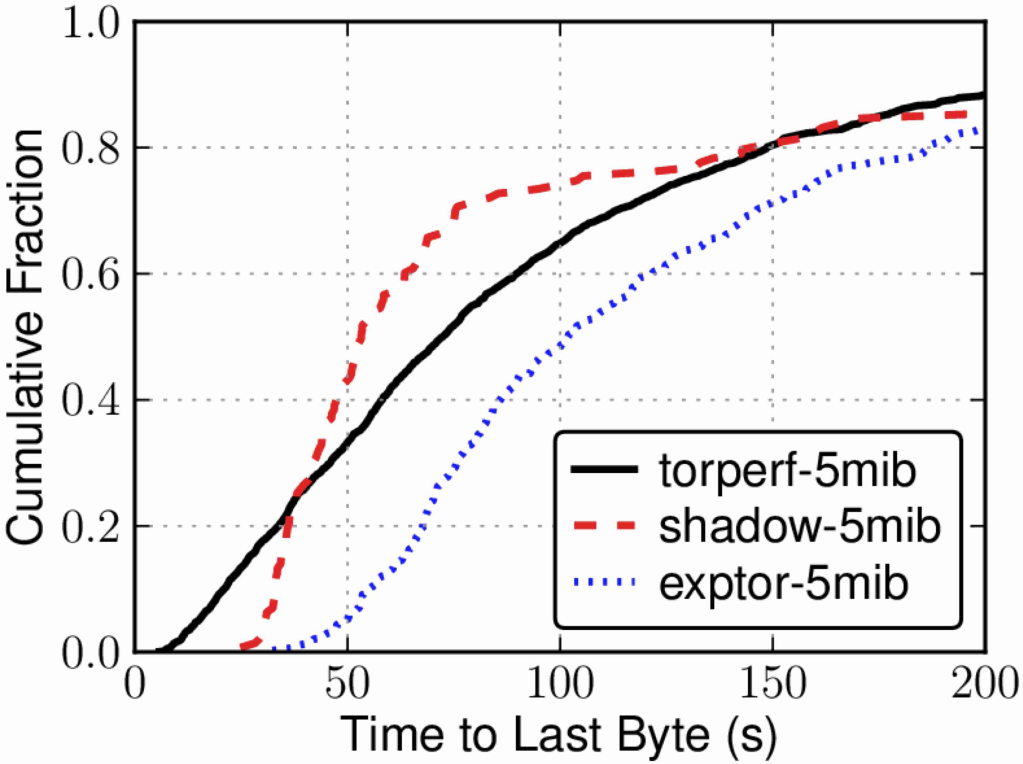
- Network topology → clustering by country
- Network latency → iPlane trace-routes
- Node bandwidth capacity → Net Index
- Tor relay sample → bin-median sampling
- Tor relay bandwidth rates → Tor metrics
- Tor web clients → 320 KiB, think [1,20] seconds
- Tor bulk clients → 5 MiB, no thinking
- Client, server placement → Tor metrics

Metrics for Accuracy

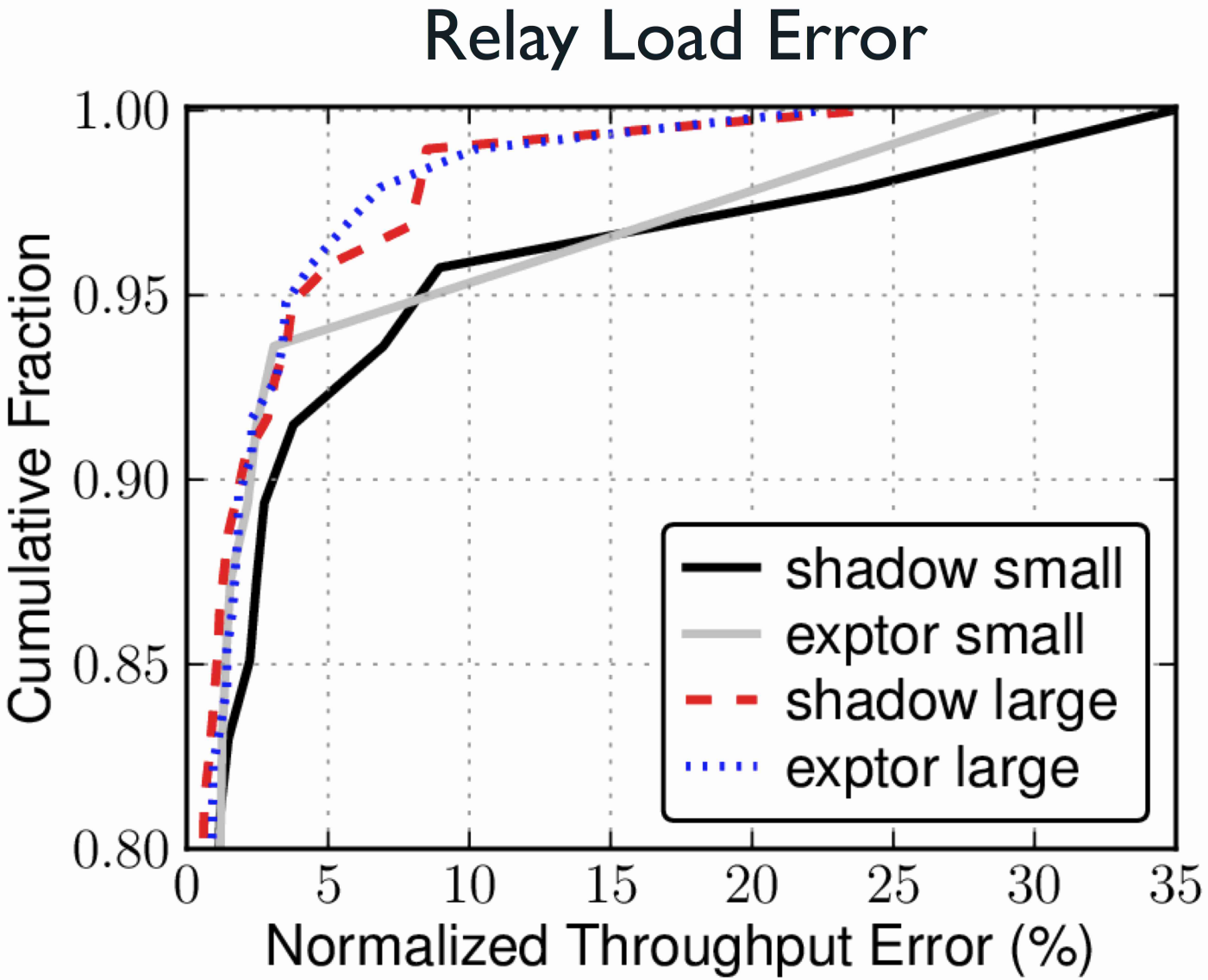
Web Performance



Bulk Performance

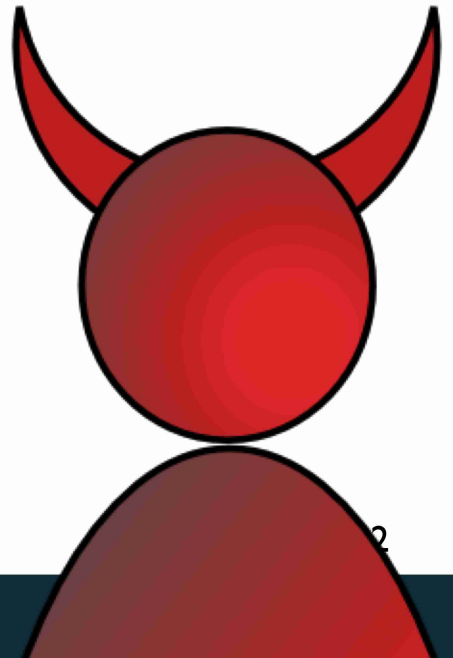


Metrics for Accuracy



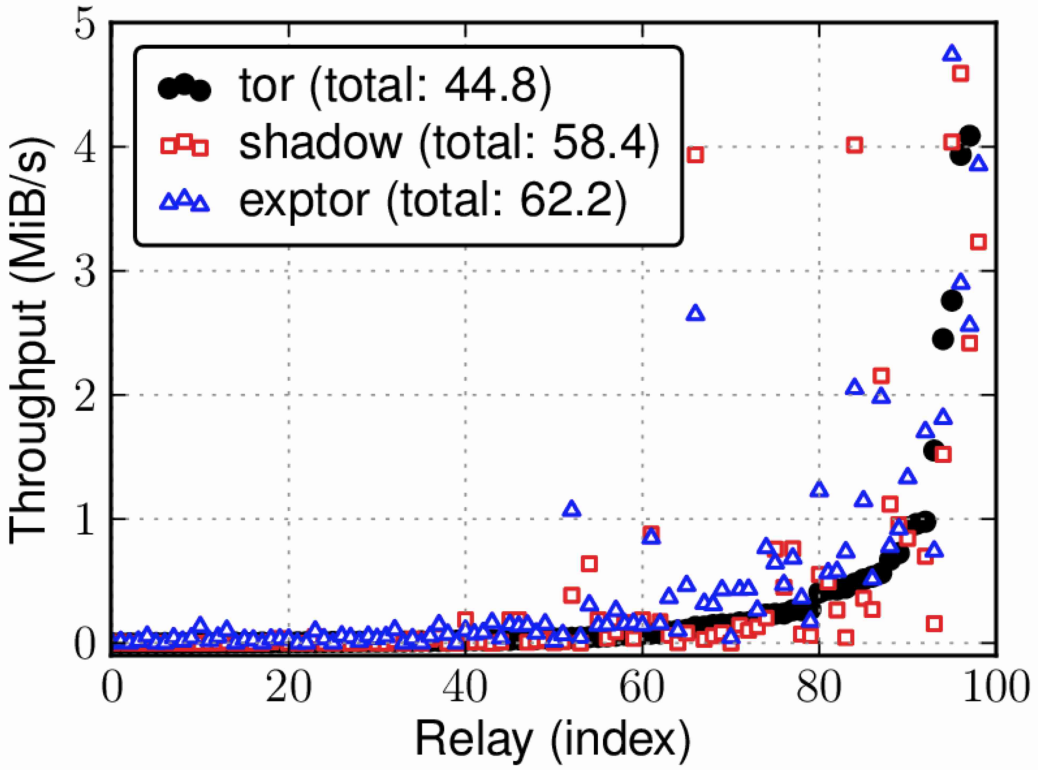
Questions?

- How much does faithfulness to Tor matter?
- How can we tell when experiments have "enough rigor" to produce meaningful results?

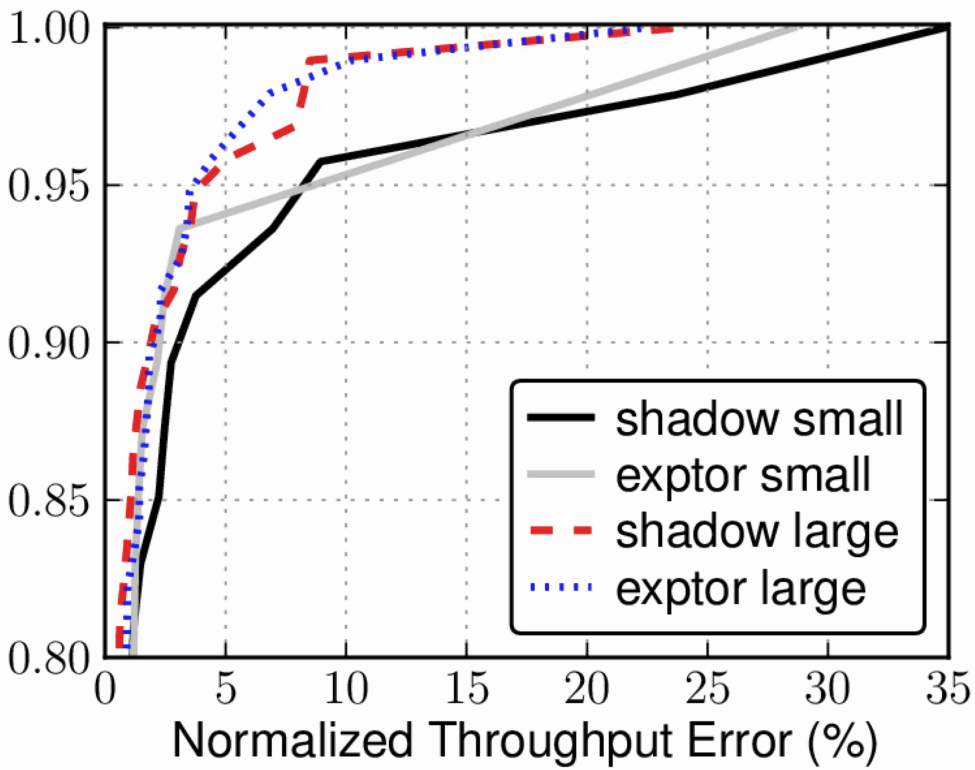


Metrics for Accuracy

Relay Load



Relay Load Error



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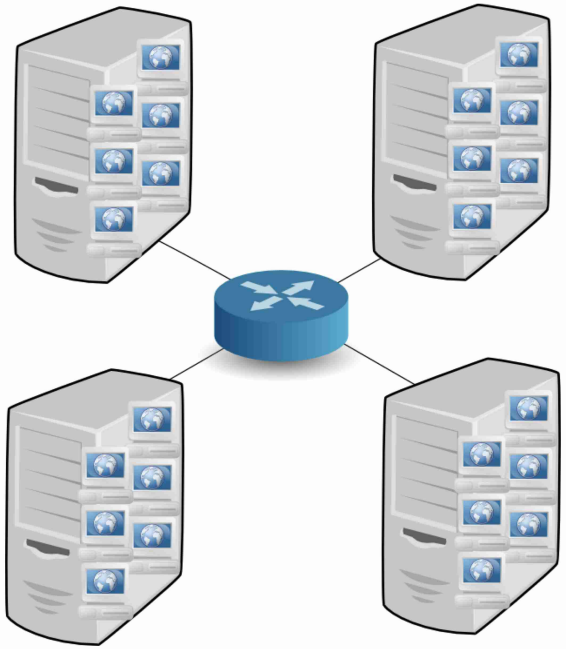

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Simulation	Scalable, controllable, reproducible	Unrealistic, inaccurate

