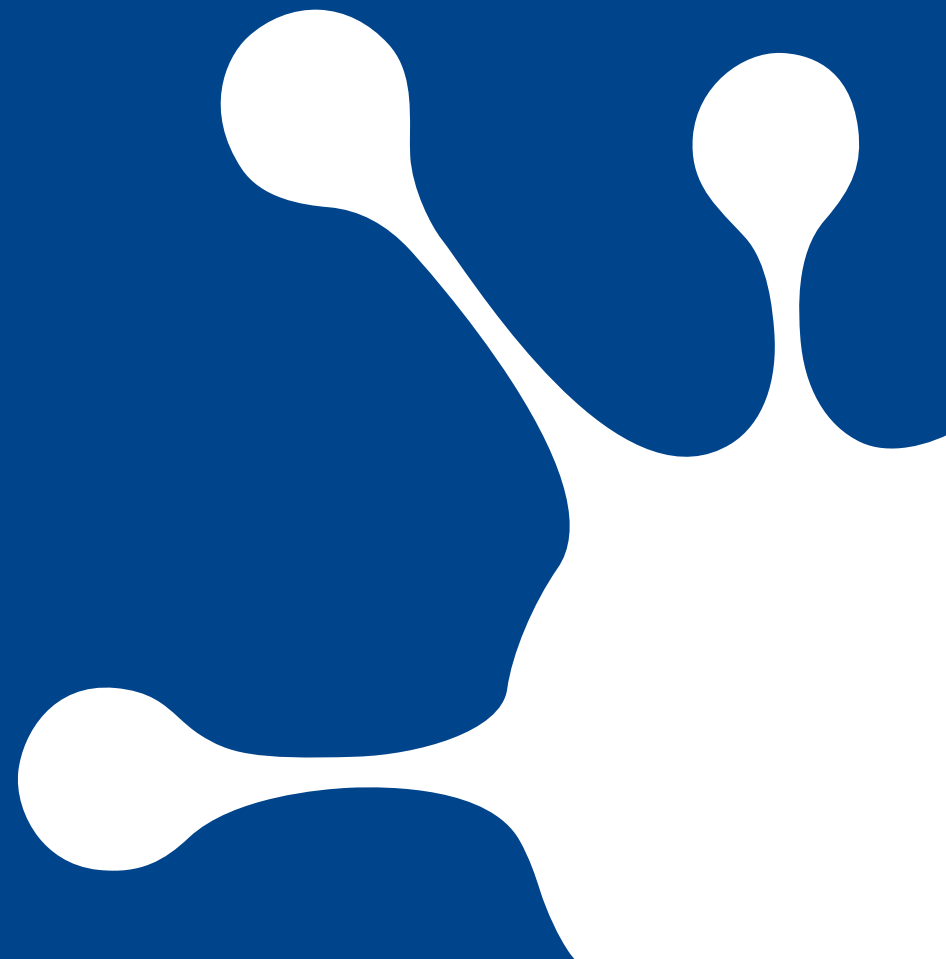


THIS INTERNET OF OURS...

Who owns it?

Who runs it?

Is it democratic?



WHO AM I?

Head of Outreach & Communications at Netnod

Member of the ISOC-SE board

Former member of the Internet Governance Forum
MAG

ABOUT NETNOD

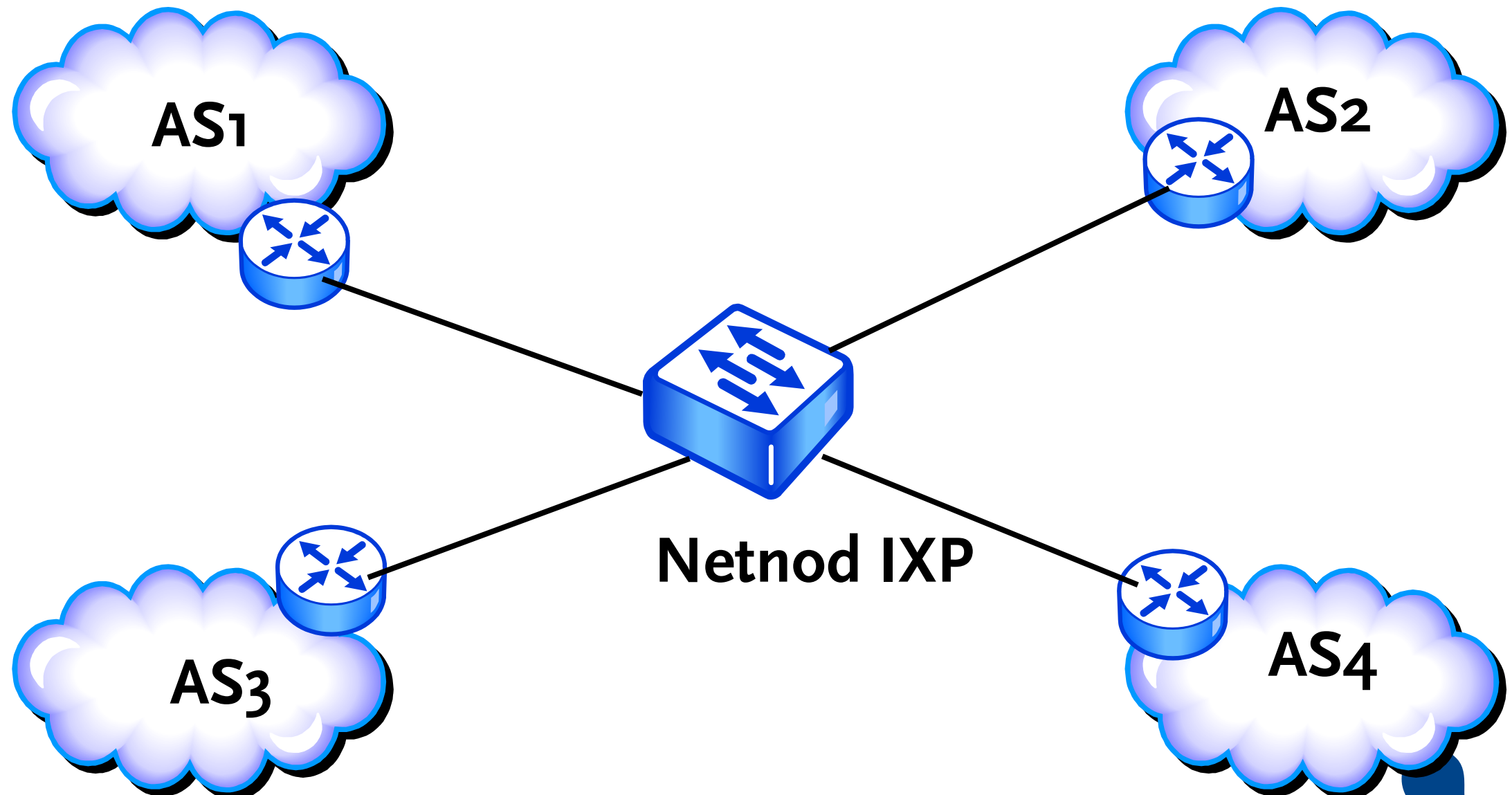
Non-profit Internet infrastructure organisation

Operates IXPs in five cities in Sweden

Manages i.root-servers.net

Provides DNS anycast services worldwide

What's an Internet Exchange Point?

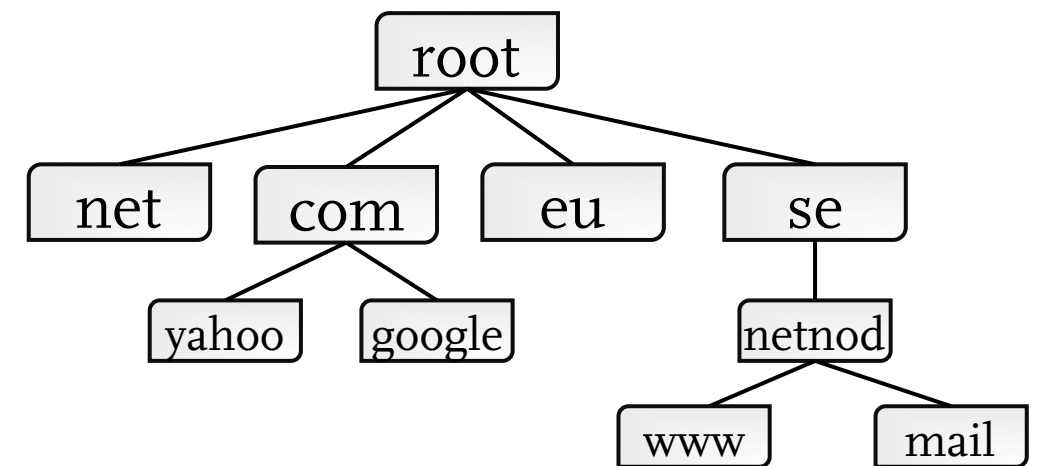


*Lower cost & latency
increased speed, better resilience*

i.root-servers.net

13 root servers

- **In practice, now 377 instances worldwide**
 - (and growing) thanks to anycast
 - **Operated by 12 different organisations**
 - Diversity increases robustness!



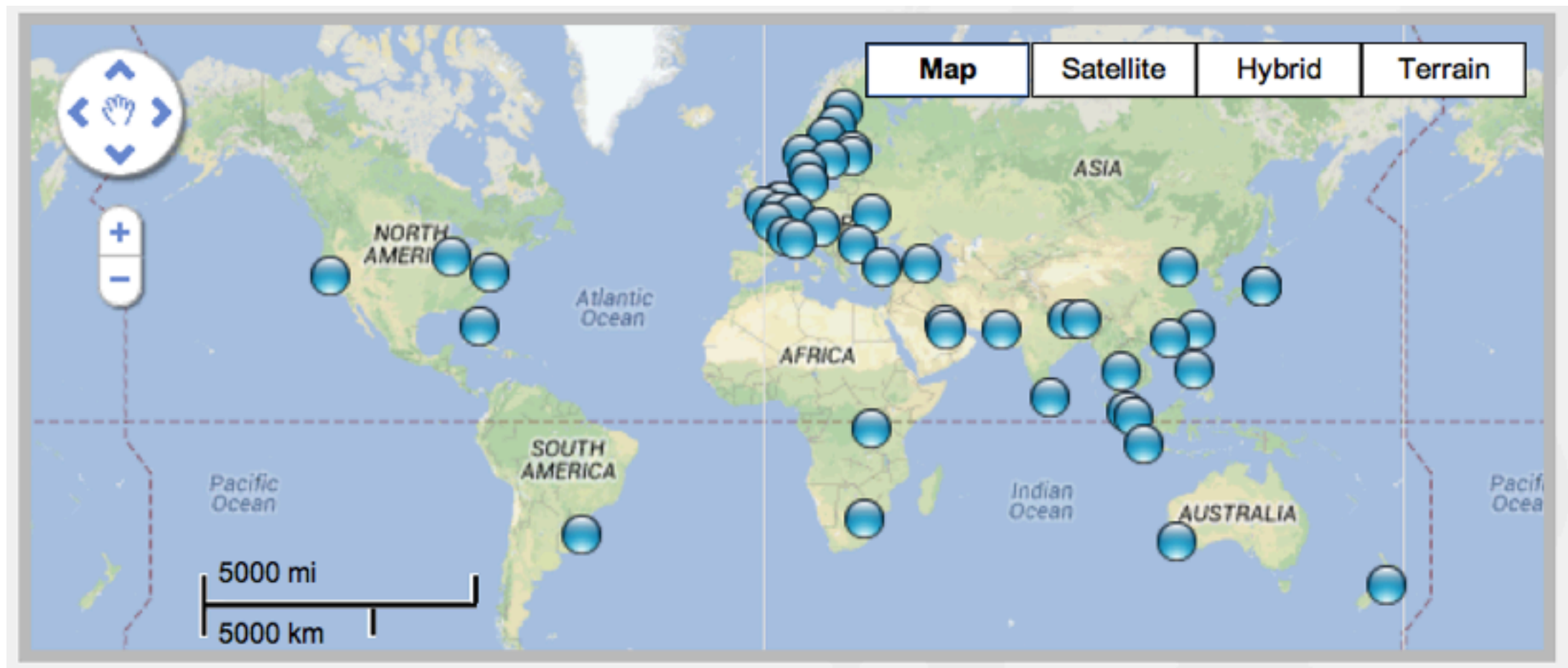
l-root

- **47 i-root instances worldwide**
- **i.root-servers.net originally hosted by NORDUnet**
 - Academic network, early IP adopter, large footprint.
 - July 28, 1991 - the first outside the US!
 - **Operated by KTHNOC (= NORDUnet NOC).**
 - “Transferred” to Netnod (together with some of its staff :) 1998

DNSNODE anycast services

Anycast slave services of TLD infrastructure

- **.SE, .EU, .DE, .FR, .NZ** etc...
- **47 sites around the world**



Maslow's hierarchy of needs



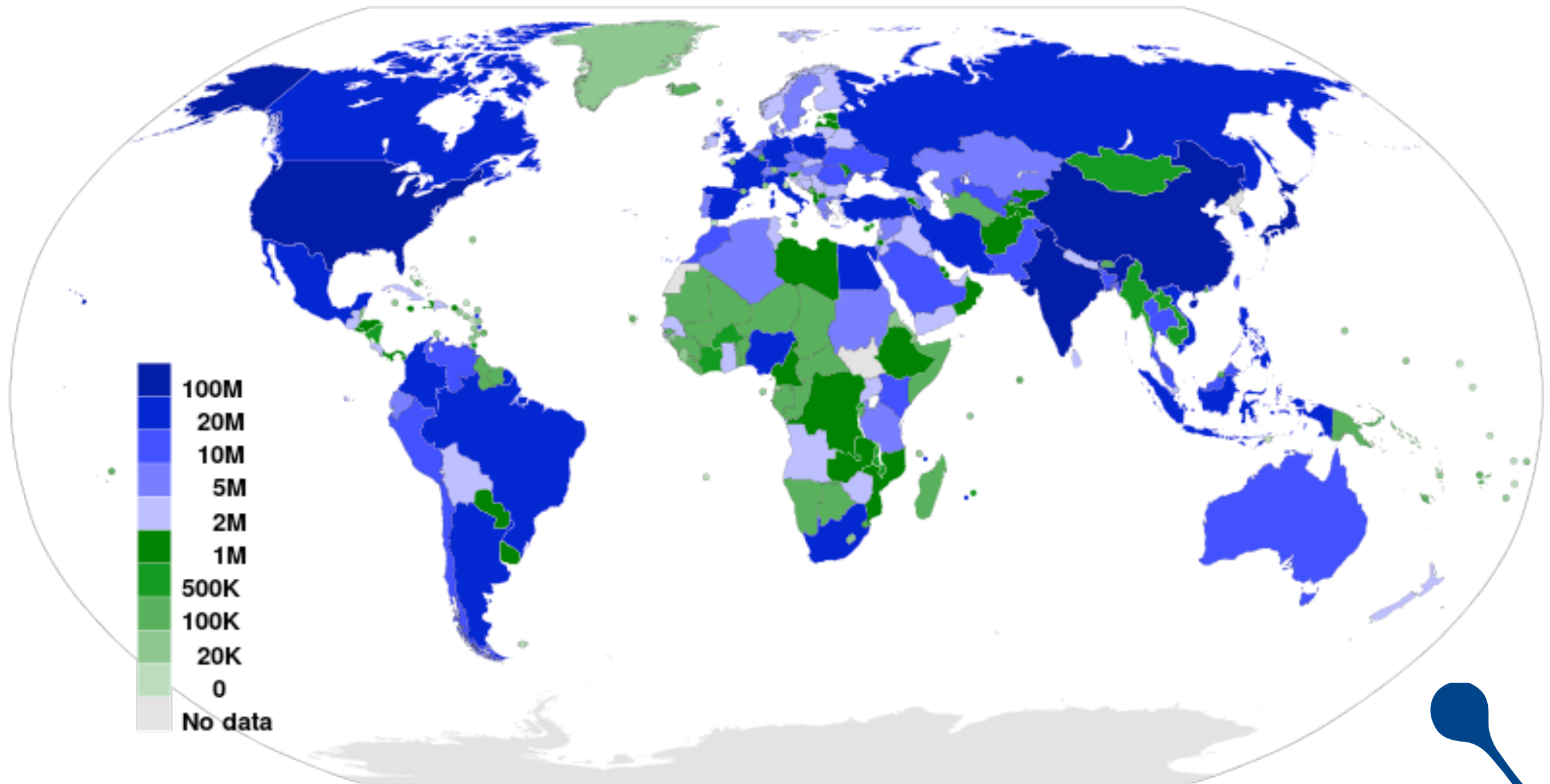
Maslow's hierarchy of needs - UPDATED!



Brief History of the Internet

- 1961 First paper on packet switching theory (Leonard Kleinrock)
- 1962 J.C.R. Licklider "Galactic Network" concept
- 1967 Lawrence G. Roberts publishes plan for "ARPANET"
- 1968/69 ARPANET
- 1973 Vint Cerf and Robert Kahn invents TCP/IP
- 1976 Queen Elizabeth sends her first email
- 1982 The word "Internet" is used for the first time
- 1983 Paul Mockapetris invents DNS
- 1986 1st meeting of the IETF
- 1989 Tim Berners-Lee Creates WWW
- 1996 ~45 M Internet users
- 1999 First IPv6 address allocations made
- 2002 544 M Internet users
- 2011 IANA runs out of IPv4 addresses

World Internet users today



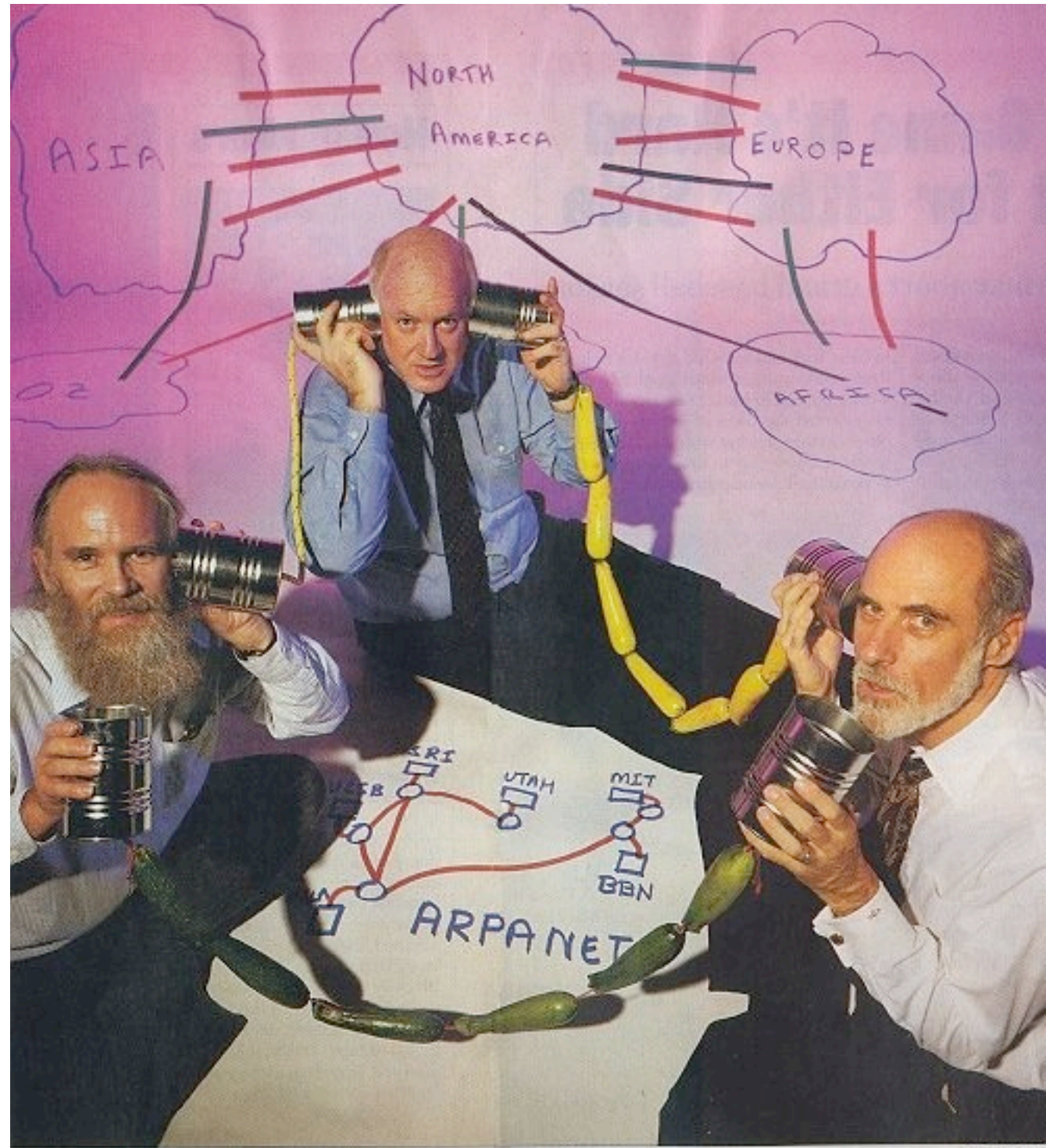
In the beginning... there was ARPANET

Jon Postel

Steve Crocker

Vint Cerf

“Note that this network can't work - there is no mouth/ear link anywhere!!!”
- Vint Cerf



The first ARPANET link

Between the University of California, (UCLA) and the Stanford Research Institute 22:30
October 29, 1969.

"We set up a telephone connection between us and the guys at SRI ...", Kleinrock ... said in an interview: "We typed the L and we asked on the phone,

"Do you see the L?"

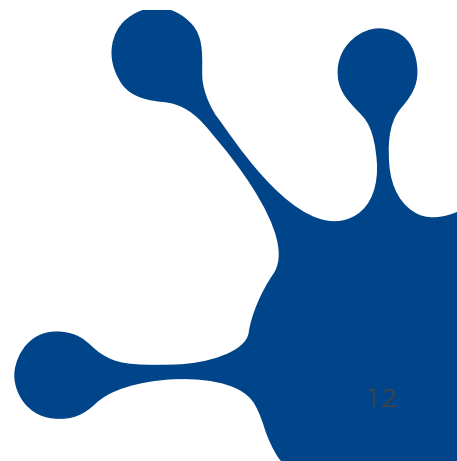
"Yes, we see the L," came the response.

We typed the O, and we asked, "Do you see the O."

"Yes, we see the O."

Then we typed the G, and the system crashed ...

Yet a revolution had begun"



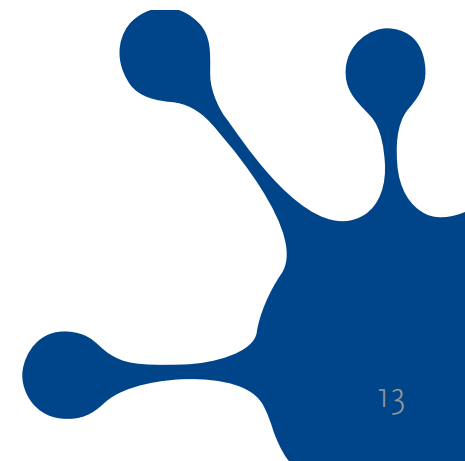
Four ground rules critical to Kahn's early thinking:

Each **distinct network** would have to **stand on its own** and no internal changes could be required to any such network to connect it to the Internet.

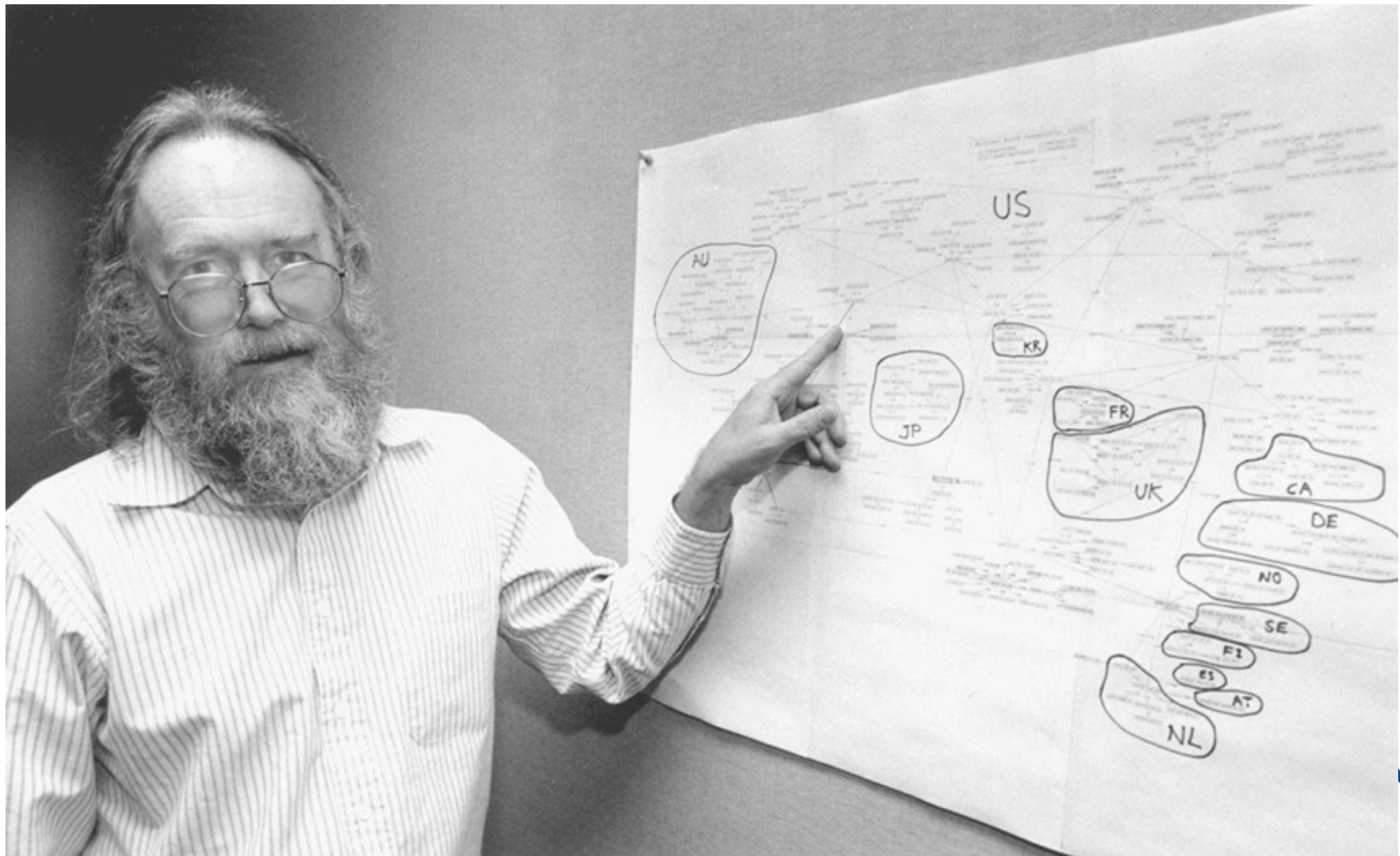
Communications would be on a **best effort basis**. If a packet didn't make it to the final destination, it would shortly be retransmitted from the source.

Black boxes would be used to connect the networks; these would later be called **gateways** and **routers**. There would be **no information retained by the gateways** about the individual flows of packets passing through them, thereby keeping them **simple** and avoiding complicated adaptation and recovery from various failure modes.

There would be **no global control** at the operations level.



Jon Postel



Jon Postel - A true pioneer

"I think they called me the closest thing to a God of the Internet. But at the end, that article wasn't very complimentary, because the author suggested that I wasn't doing a very good job, and that I ought to be replaced by a "professional."

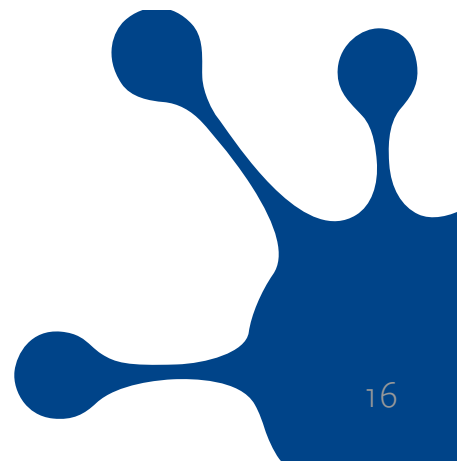
Of course, there isn't any "God of the Internet. The Internet works because a lot of people cooperate to do things together."

"The Internet should not be managed by any government, national or multinational."

"Be conservative in what you send and liberal in what you accept."

The Tao of IETF (Internet Engineering Task Force)

"We reject kings, presidents and voting. We believe in rough consensus and running code".



IETF principles

- **Open process**
 - any interested person can participate in the work, know what is being decided, and make his or her voice heard on the issue.
 - Public documentation
- **Technical competence**
 - ...issues where the IETF has the competence needed to speak to them, and that the IETF is willing to listen to technically competent input from any source.
 - Sound network engineering principles ("engineering quality")
- **Volunteer Core**
 - our participants and our leadership ... want to "make the Internet work better".
- **Rough consensus and running code**
 - Standards based on the combined engineering judgement of our participants and our real-world experience in implementing and deploying our specifications.
- **Protocol ownership**
 - ...IETF accepts the responsibility for all aspects of the protocol ...
 - Conversely, when the IETF is not responsible ... it does not attempt to exert control over it

Consensus based decision making

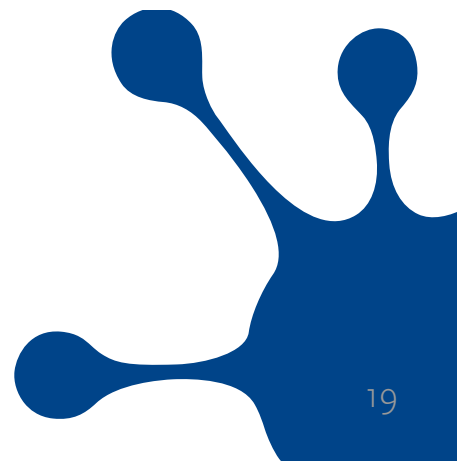
The Internet community

- **ICANN, IANA**
 - Managing domain names, IP addresses etc
- **RIRs**
 - Managing and distributing IP addresses to their regions
- **The Internet Society**
- **The IETF**
- **The operators' community**

Consensus-based, bottom-up, transparent, inclusive

“Consensus doesn't mean everyone agrees. It means you continue until all reasonable objections have been addressed.”

Lynn St Amour, The Internet Society

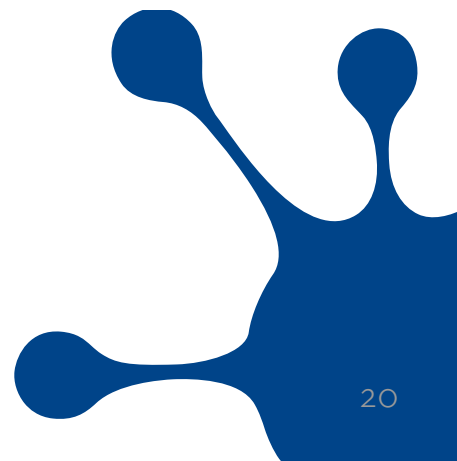


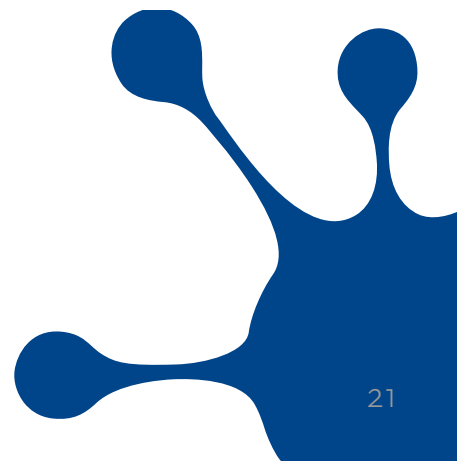
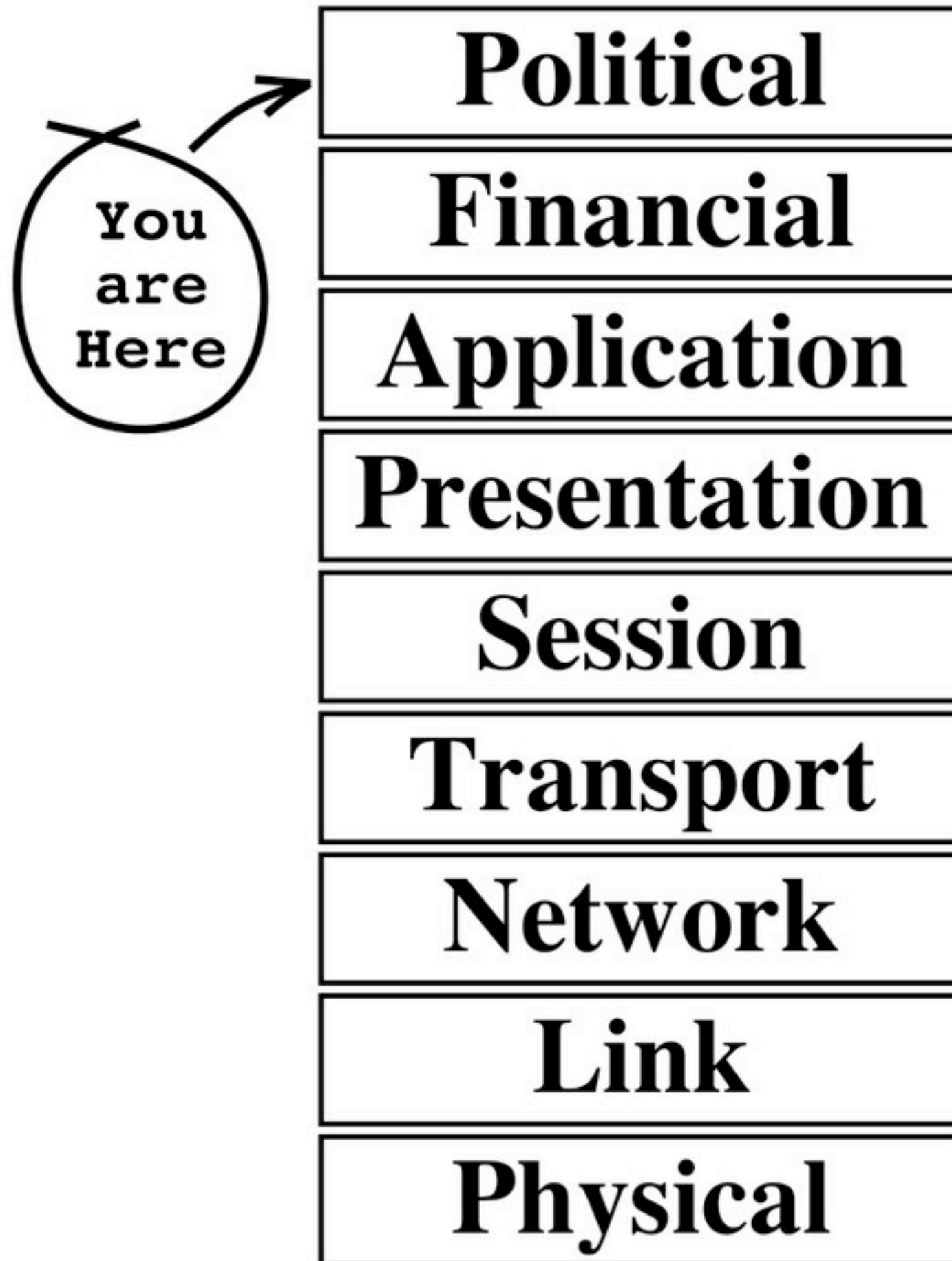
But once something becomes part of a country's vital infrastructure

... there's suddenly a lot more at stake

*Governments, business, civil society, the technical community
all feel they should have a say*

... and perhaps, rightly so







Internet Governance & the IGF

World Summit on the Information Society (WSIS) 2003

- **A UN (ITU) driven process**
 - **An attempt to define Internet governance**
 - **Very “UN” in culture**
 - Negotiations, speeches, suits, different coloured badges
 - Many discussions on “who should manage the Internet and how”
 - **Huge effort by the technical community to explain the basic workings of the Internet**
 - Concerns that tech community wouldn’t even be recognised as a stakeholder

Internet Governance Forum (IGF)

- **The outcome of the WSIS process**
 - **Defined by the Tunis Agenda**
 - <http://www.itu.int/wsis/docs2/tunis/off/6rev1.html>

The IGF “Tunis agenda”

§55. We recognize that the **existing arrangements** for Internet governance **have worked effectively** to make the Internet the **highly robust, dynamic and geographically diverse** medium that it is today, with the private sector taking the lead in day-to-day operations, and with **innovation and value creation at the edges**.

§73. The Internet Governance Forum, in its working and function, will be **multilateral, multi-stakeholder, democratic and transparent**. To that end, the proposed IGF could:

- **Build on the existing structures** of Internet governance, with special emphasis on **the complementarity between all stakeholders** involved in this process – **governments, business entities, civil society and intergovernmental organizations**.
- Have a **lightweight and decentralized structure** ...

“Internet governance” takes place in many arenas

IGF - A very non-UN, UN conference

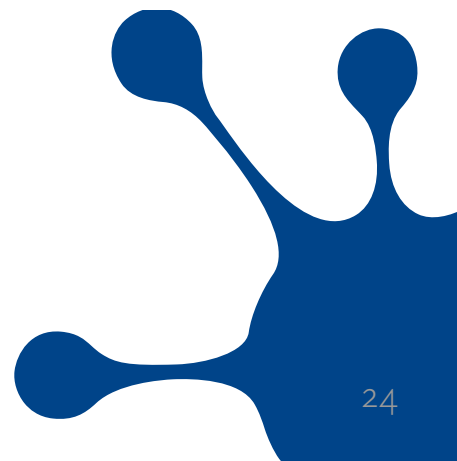
- **An open discussion forum**
- **Multistakeholder model**
 - Civil society, technical community, private sector, international orgs, governments
- **Equal footing**
 - Open to all, no accreditation, no fee
- **Non-binding, non-decision making**

UN based forums

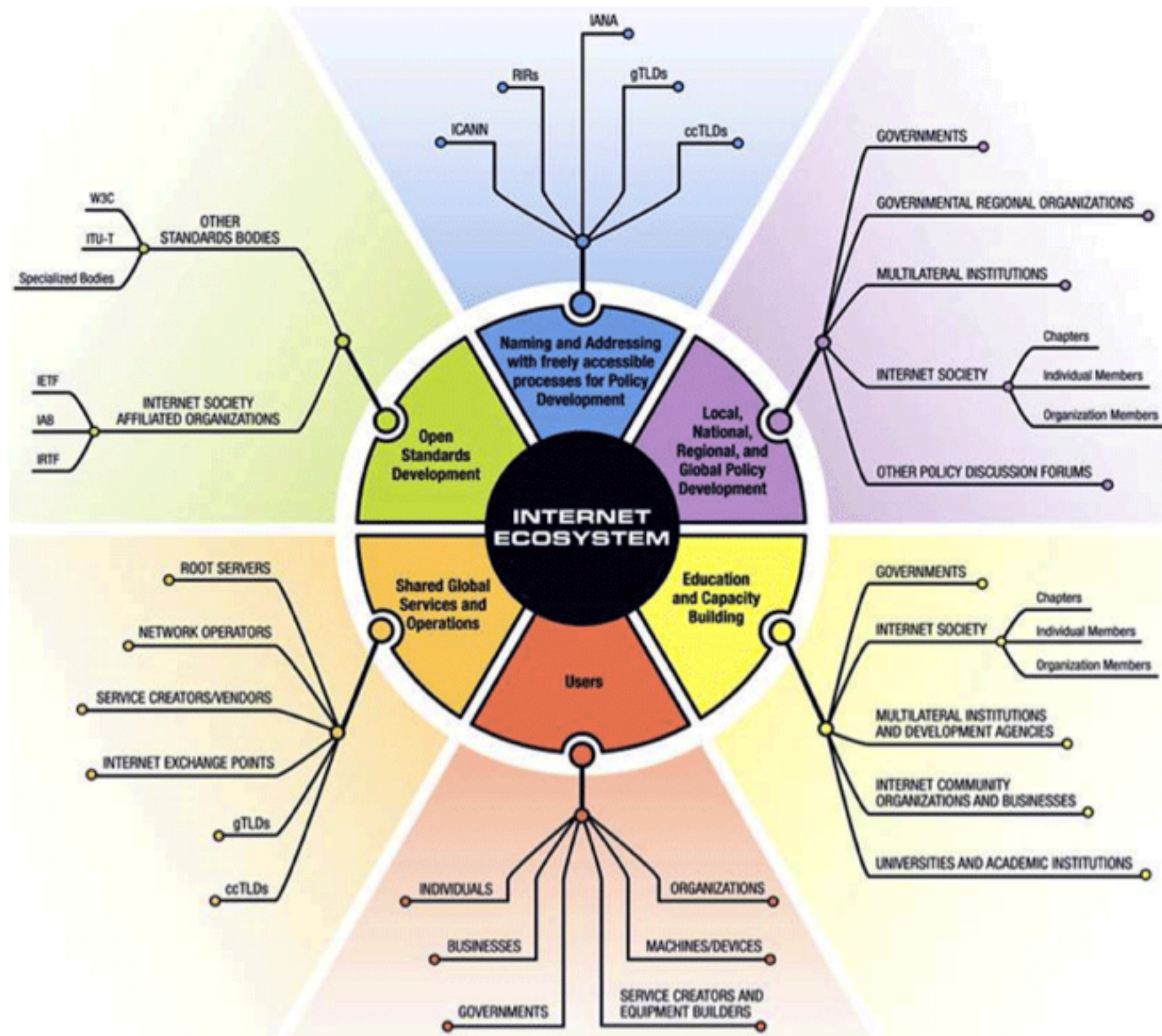
- **WCIT 2012, WTPF, UN (CSTD, UNCTAD etc)**

EU & EC

As well as the traditional (technical) Internet communities...



Who runs and owns the Internet?



Is the Internet democratic?

Access

- **Internet Infrastructure**
- **Cost of access**

Robustness

- **Security, trust**
- **The Internet is an essential part of society's infrastructure**

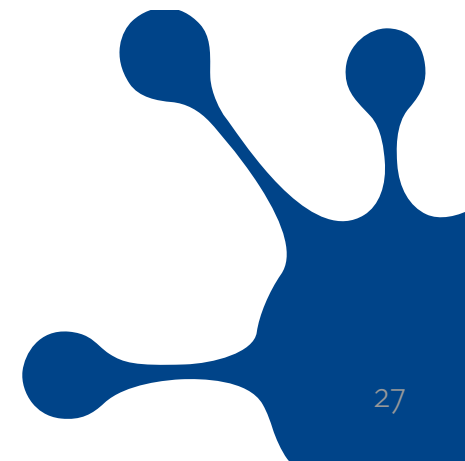
Democratic principles

- **Freedom of expression, human rights**
- **Openness, privacy, transparency, bottom-up**

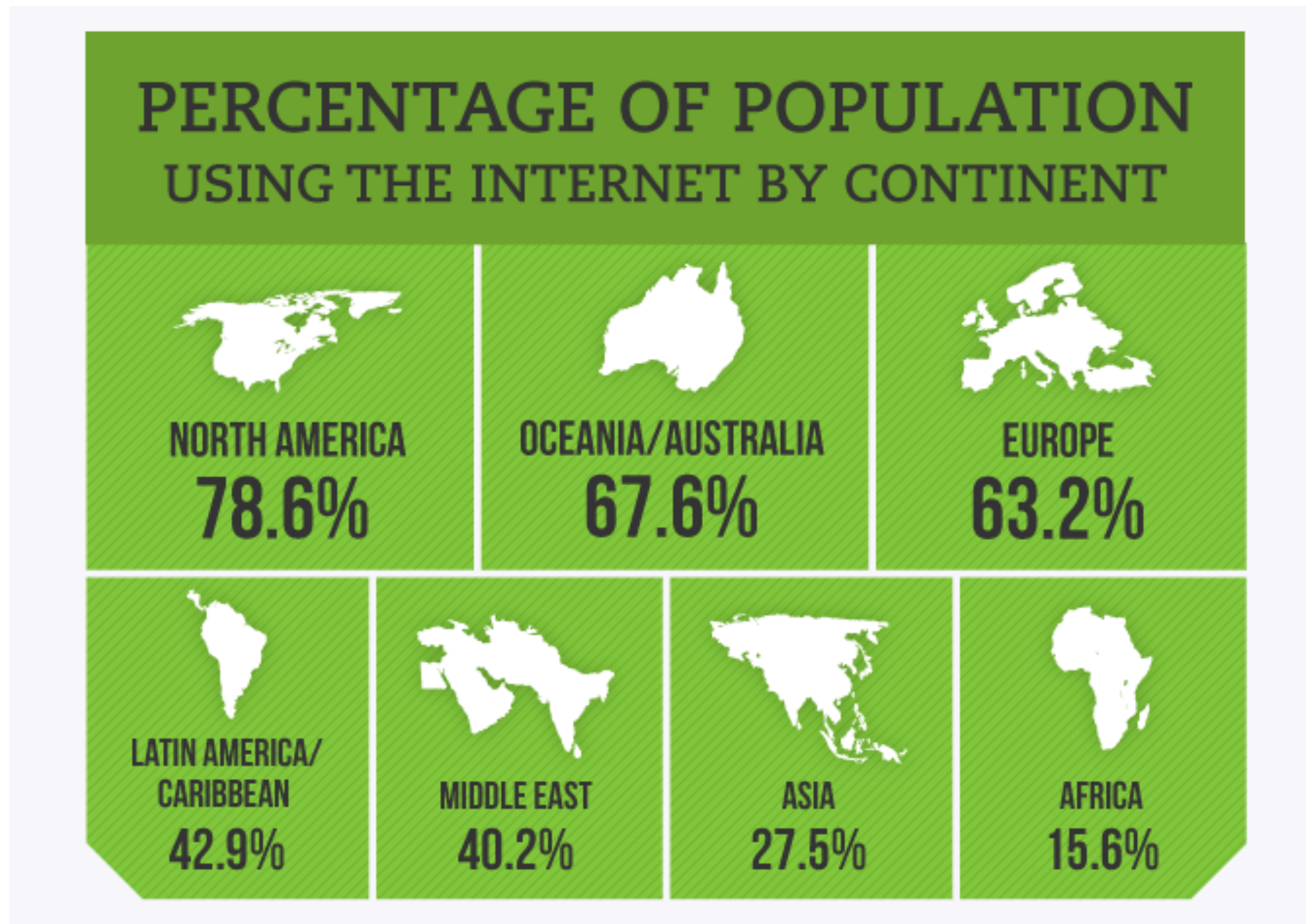
Can the Internet claim to be democratic if...

a huge part of the world doesn't have access?

a huge part of the world cannot afford Internet connectivity?



Internet usage around the world



Internet costs today

Togo

- **US\$90 / month (for 256kb/s)**
(Togo Telecom)
 - > min monthly salary

Sudan

- **US\$ 2.5 / month**
 - (Broadband access on a smart phone)

Kenya

- **US\$ 17 / month**
 - 1/3 min salary

Mozambique

- **US\$100 / month (4 Mbps)**
 - > min monthly salary

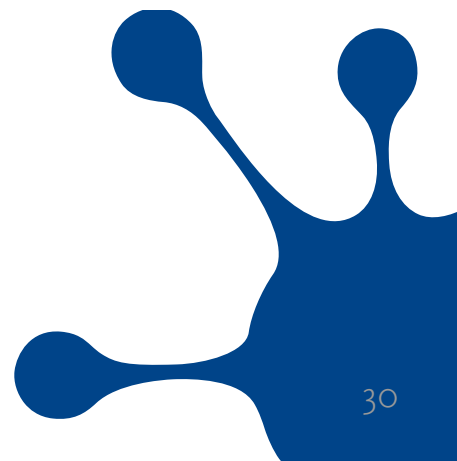
Cuba

- **US\$7 for 1 hour of Internet**
- (1/2 an average monthly salary)

Can the Internet claim to be democratic if...

*it is very vulnerable to cable cuts and attacks in some places,
but not others?*

if those in power can turn it off when it pleases them?



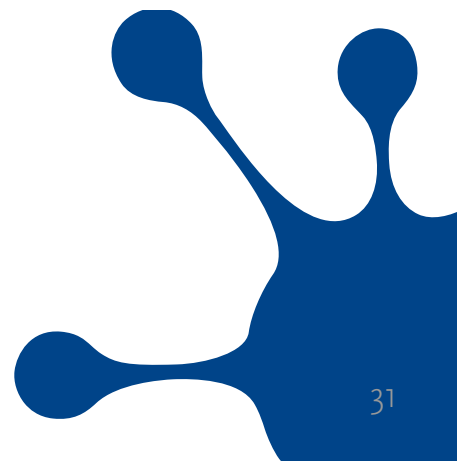
Internet robustness - analysis by Renesys

The Internet relies on locally fragile physical infrastructure:

- Submarine cables
- Terrestrial fiber networks
- Energy pipelines
- Power grids

The Internet survives and flourishes because it's designed for simplicity:

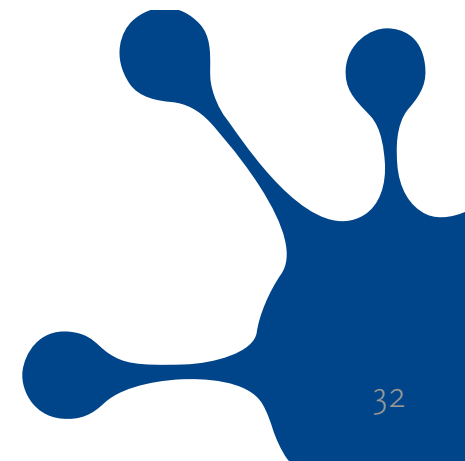
- rough consensus and running code, dumb core and smart edge, interoperability.
- The Internet can easily route around failures



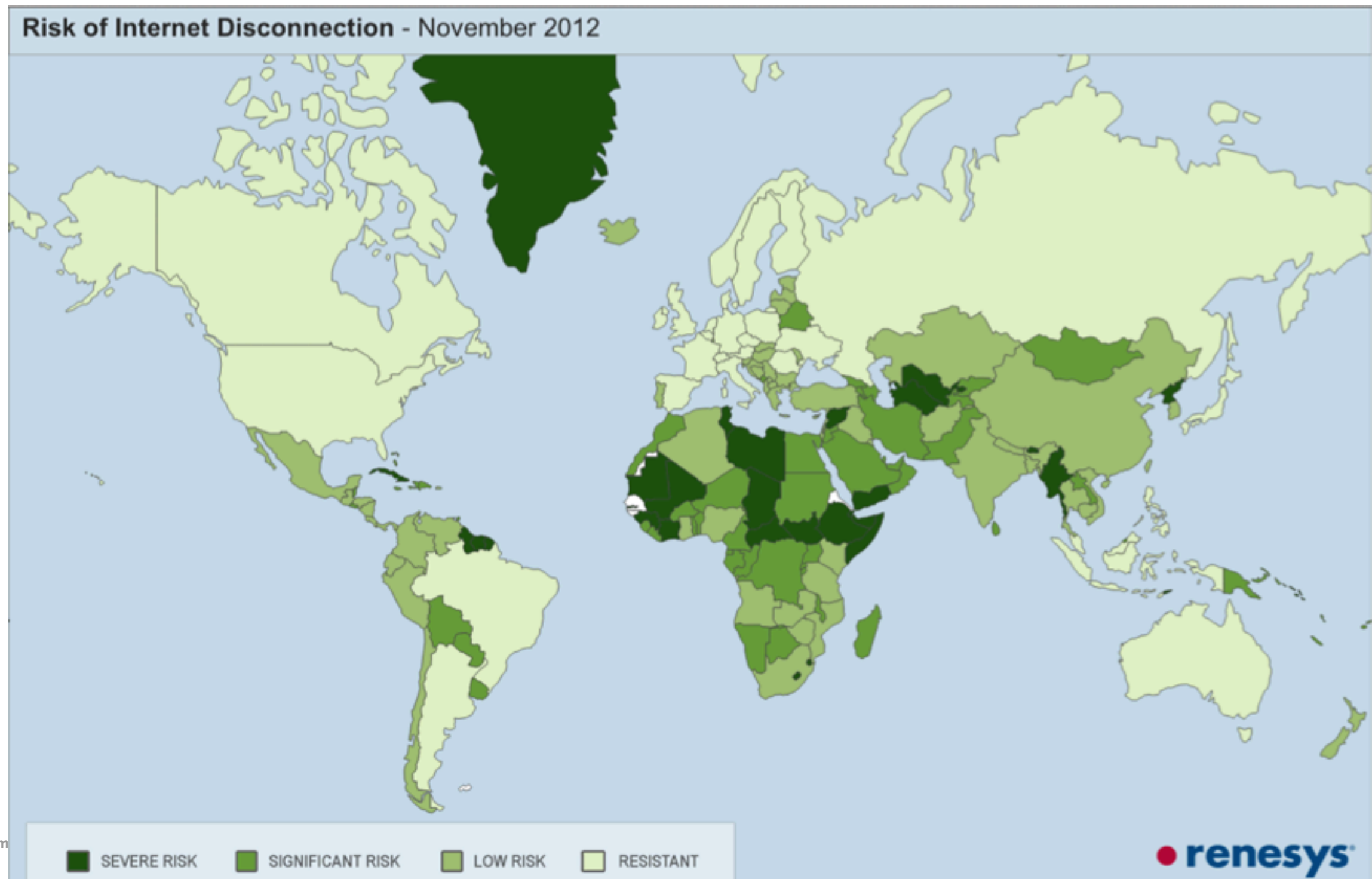
What makes a country vulnerable to Internet disconnection?

Renesys hypothesis: Provider diversity provides resilience

- **How many distinct institutions in your country have direct BGP transit relationships with international Internet providers?**
- **Severe risk: 1-2 providers at international frontier**
 - Cuba, Greenland, Libya, Syria, Myanmar, N Korea...
- **Significant risk: 3-9 providers at international frontier**
 - Bolivia, Uruguay, Egypt, Mongolia, Belarus...
- **Low risk: 10-39 providers at international frontier**
 - Mexico, Venezuela, Iceland, China, Afghanistan...
- **Resistant: 40+ providers at international frontier**
 - US, Canada, Brazil, UK, Russia, Japan, Sweden...



Risk of Internet disconnection by Renesys



How achieve diversification?

Government has a role to play in encouraging competition and diversification, particularly in low-diversity markets.

- **Over time, a self-sustaining Internet market that is large and competitive enough should require minimal regulation.**

“The human vulnerabilities of the Internet (temptations to meddle, monitor, censor, control, regulate) are now a greater danger than its physical weaknesses.”

Jim Cowie, Renesys

The world is changing...



"On the Internet, nobody knows you're a dog."

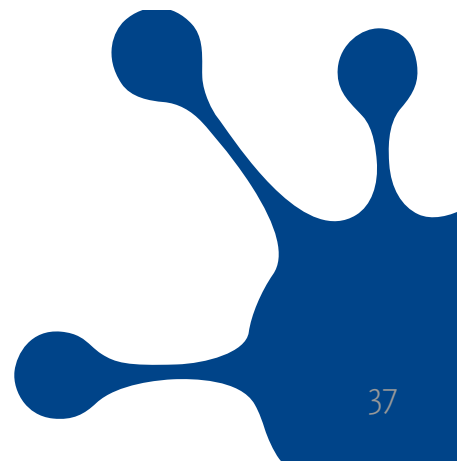
The world is changing...



*“On the Internet, nobody knows you’re a dog...
...except the NSA who even knows your favourite brand of dog food!”*

Can the Internet claim to be democratic if...

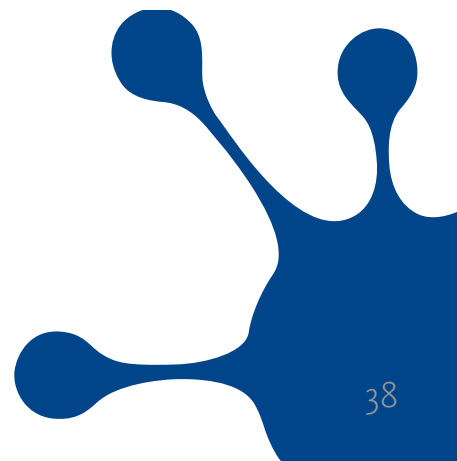
our government (or any other government for that matter), monitors our activities on the Internet without disclosure or review? Without democratic checks and balances?



Recent revelations about NSA monitoring

Some call it a wake up call.

...but will we hit the snooze button...?



Recent revelations about NSA monitoring

Some call it a wake up call.

...but will we hit the snooze button...?

... well, I guess that's up to you and me and all of us!

Bruce Schneier on the NSA

“One, we should expose ... We need whistleblowers.”

“Two, we can design. We need to figure out how to re-engineer the internet to prevent this kind of wholesale spying. We need new techniques to prevent communications intermediaries from leaking private information.”

“We can make surveillance expensive again. In particular, we need open protocols, open implementations, open systems.”

theguardian

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Comment is free

The US government has betrayed the internet. We need to take it back

The NSA has undermined a fundamental social contract. We engineers built the internet – and now we have to fix it

• Explaining the latest NSA revelations – Q&A



Bruce Schneier

The Guardian, Thursday 5 September 2013 20.04 BST

 Jump to comments (720)



'Dismantling the surveillance state won't be easy. But whatever happens, we're going to be breaking new ground.' Photograph: Bob Sacha/Corbis

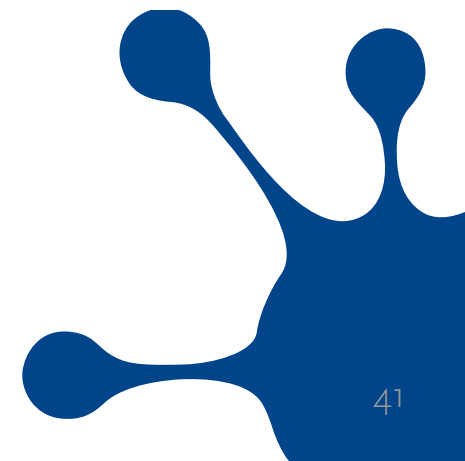
<http://www.theguardian.com/commentisfree/2013/sep/05/government-betrayed-internet-nsa-spying>

ISOC Responds to Reports of the U.S. Government's Circumvention of Encryption Technology

*“These reports describe government programmes that **undermine the technical foundations of the Internet** and are a **fundamental threat to the Internet’s economic, innovative, and social potential**. Any systematic, state-level attack on Internet security and privacy is a **rejection of the global, collaborative fabric that has enabled the Internet's growth to extend beyond the interests of any one country.**”*

*“**global interoperability and openness of the Internet are pre-requisites for confidence in online interaction***

<http://www.internetsociety.org/node/141026>





Security - ISOC's message

To every citizen of the Internet:

“Let your government representatives know that, even in matters of national security, you expect privacy, rule of law, and due process in any handling of your data.”



Security is a collective responsibility

- Those involved in **technology research and development**: use the **openness** of standards processes like the IETF to **challenge assumptions about security specifications**.
- Those who implement the technology and standards for Internet security: **uphold that responsibility** in your work, and be mindful of the damage caused by loss of trust.
- Those who **develop products and services** that depend on a trusted Internet: **secure your own services**, and **be intolerant of insecurity** in the infrastructure on which you depend.
- To **every Internet user**: ensure you are **well informed** about good practice in online security, and act on that information. **Take responsibility for your own security**.

So what about them government folks?

Respect the open, transparent principles of the Internet

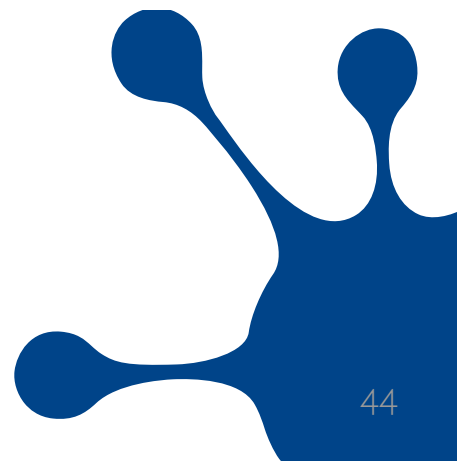
- **Simple core, innovation at the edges**
- **Global interoperability, Open standards**

Protect their citizen's rights

- **Human rights, Freedom of Expression, Privacy**

Delicate, light-handed, informed & constructive regulation

- **Diversification**
 - Good for the end users, makes for a robust Internet infrastructure
- **Create environment for innovation**
 - Open market - not stifle growth!



Good governance supports innovation

The Telegraph

Home News World Sport **Finance** Comment Blogs Culture Travel Life Women Fashion
Companies Comment Personal Finance Economics Markets Festival of Business Your Bu

HOME » FINANCE » NEWS BY SECTOR » MEDIA AND TELECOMS » **TELECOMS**

EU to end mobile roaming charges next year

Consumers will next year be able to use their mobile phones across the European Union for the same price as at home, it is planned, after officials voted to fast-track major reforms of telecoms regulation.



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The Economist explains
Why does Kenya lead the world in mobile money?
May 27th 2013, 23:50 by T.S.
Like 1.6k Tweet 294



PAYING for a taxi ride using your mobile phone is easier in Nairobi than it is in New York, thanks to Kenya's world-leading mobile-money system, M-PESA. Launched in 2007 by Safaricom, the country's largest mobile-network operator, it is now used by over 17m Kenyans, equivalent to more than two-thirds of the adult population; around 25% of the country's gross national product flows through it. M-PESA lets people transfer cash using their phones, and is by far the most successful scheme of its

Challenges for the future

Connecting the next 2, 3, 4... Billion users

2017_{another}
BILLION users

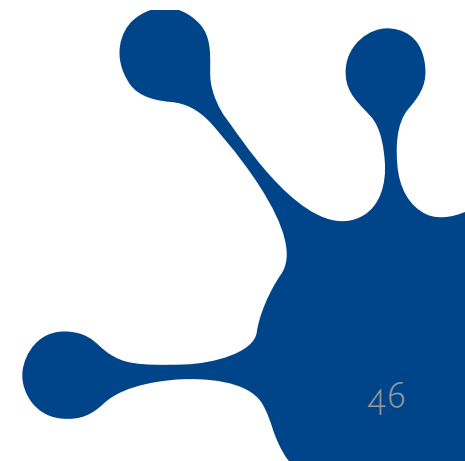
- **The next Billion will come from the developing world**
 - Bridging the digital divide

Governments to develop appropriate legislation & regulatory environment

- **To enables growth & innovation**
 - (the next Billion devices)
- **To support the open and free internet**
- **To handle challenges on the Internet**

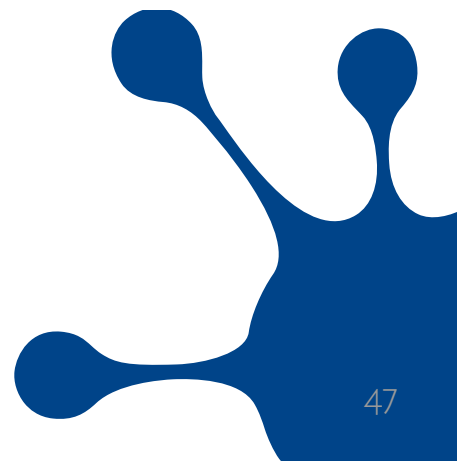
Engineering & Operators' community to

- **To support the growing Internet and its innovation at the edges**
 - Widespread IPv6 deployment
- **To meet increased need for security & privacy**



**The future is here.
It's just not evenly distributed yet.**

WILLIAM GIBSON



Thank you.

Nurani Nimpuno

nurani at netnod dot se
@nnimpuno

Want to know more?

The Internet Ecosystem

- <http://www.internetsociety.org/sites/default/files/Internet%20Ecosystem.pdf>

Brief history of the Internet

- <http://www.internetsociety.org/internet/what-internet/history-internet/brief-history-internet>

The Tao of the IETF

- <http://www.ietf.org/tao.html>

Internet Infrastructure: Virtual meets Reality

- <http://www.renesys.com/content/uploads/2013/09/Cowie-EPF8-September-2013.pdf>

The Internet revealed

- <http://youtu.be/a5837LcDHfE>

The IT Crowd: The Internet

- <http://youtu.be/iDbyYGrswtg>

