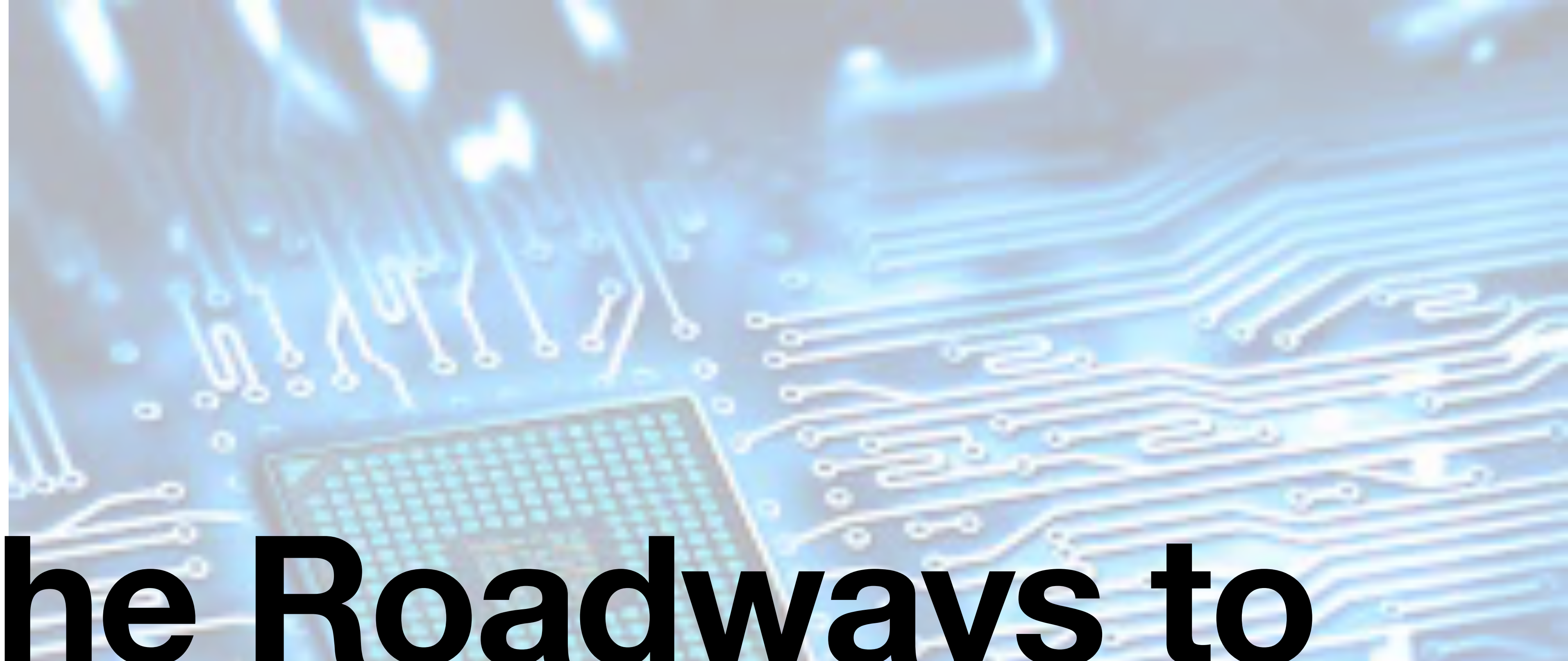


From the Roadways to the Forum

Protecting Societies in the Digital Age

Juan-Antonio Cordero-Fuertes,
École Polytechnique, France

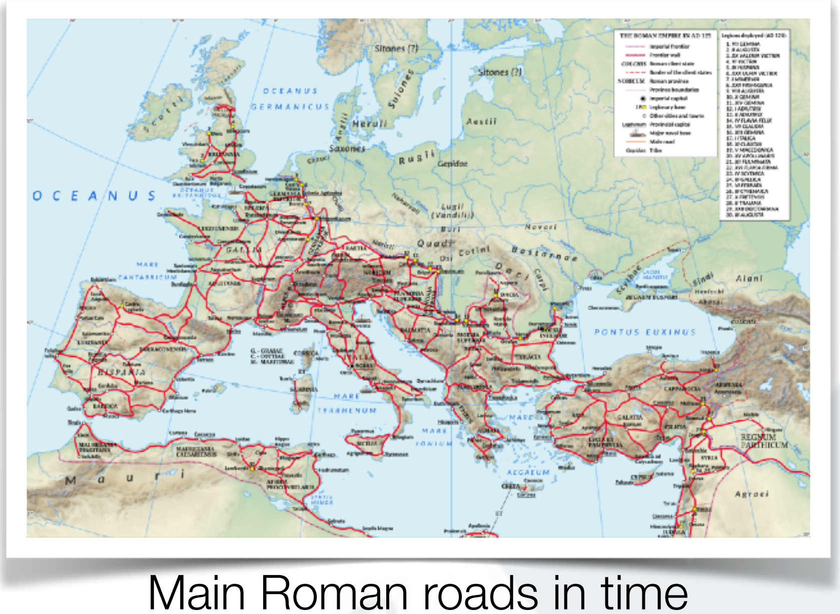
EMILDAI Summer School 2025
León, Spain, July 2nd

EMILDAI

All roads lead to Rome

OMNES·VIAE·ROMAM·DUCUNT

Golden Milestone (*Milliarium Aureum*),
Roman km 0, in the Roman Forum



Main Roman roads in time
of Hadrian (r. 117-138)

Roman Forum

Via Appia (Wikipedia)

Roads and forums

- *Roads* and *forums* are critical elements in every civilization

Forums

Discussion, representation, collective decision (forum, *agora* ἀγορά, or square/*plateia* πλατεία), commercial exchange points (market, bazar or souk سوق)

Roads and infrastructure

Transport, exchange of goods, information and communication flows

Roman Forum

Via Appia (Wikipedia)

- …also at the digital age

Cybersecurity as cryptography

- What typically matters in communication ?
  - Data confidentiality
  - Data integrity
  - Entity authentication

Cybersecurity in the digital age

- What typically matters in communication ?
  - Data confide
  - Data integrity
  - Entity authen

*…in an increasingly digital society, “***security/safety in the cyberspace***” is broader:*

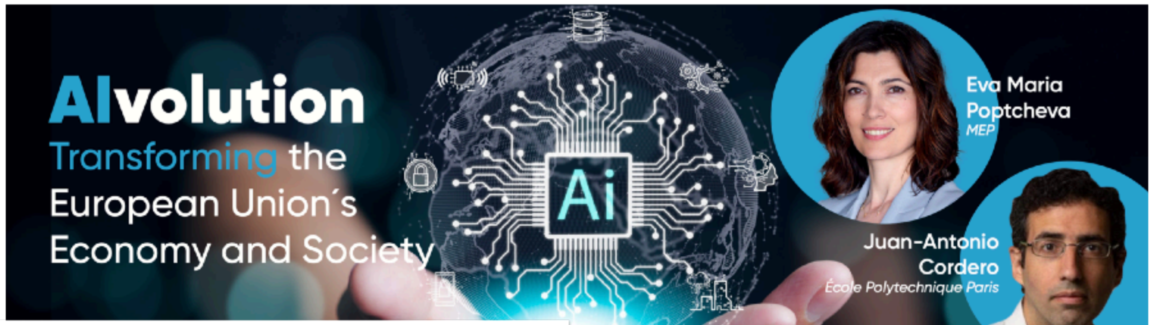
- *Digital connected infrastructures (hardware)*
- *AI-dependent digital services (software): fairness, transparency*

Assessing the impact of digital technologies

- Two interdisciplinary and intersectoral conferences in Brussels, about digital technologies and policy
  - AIvolution 2023, on November 16th
  - EUDTP 2025, on May 14th-15th

    www.eudtp.sciencesconf.org

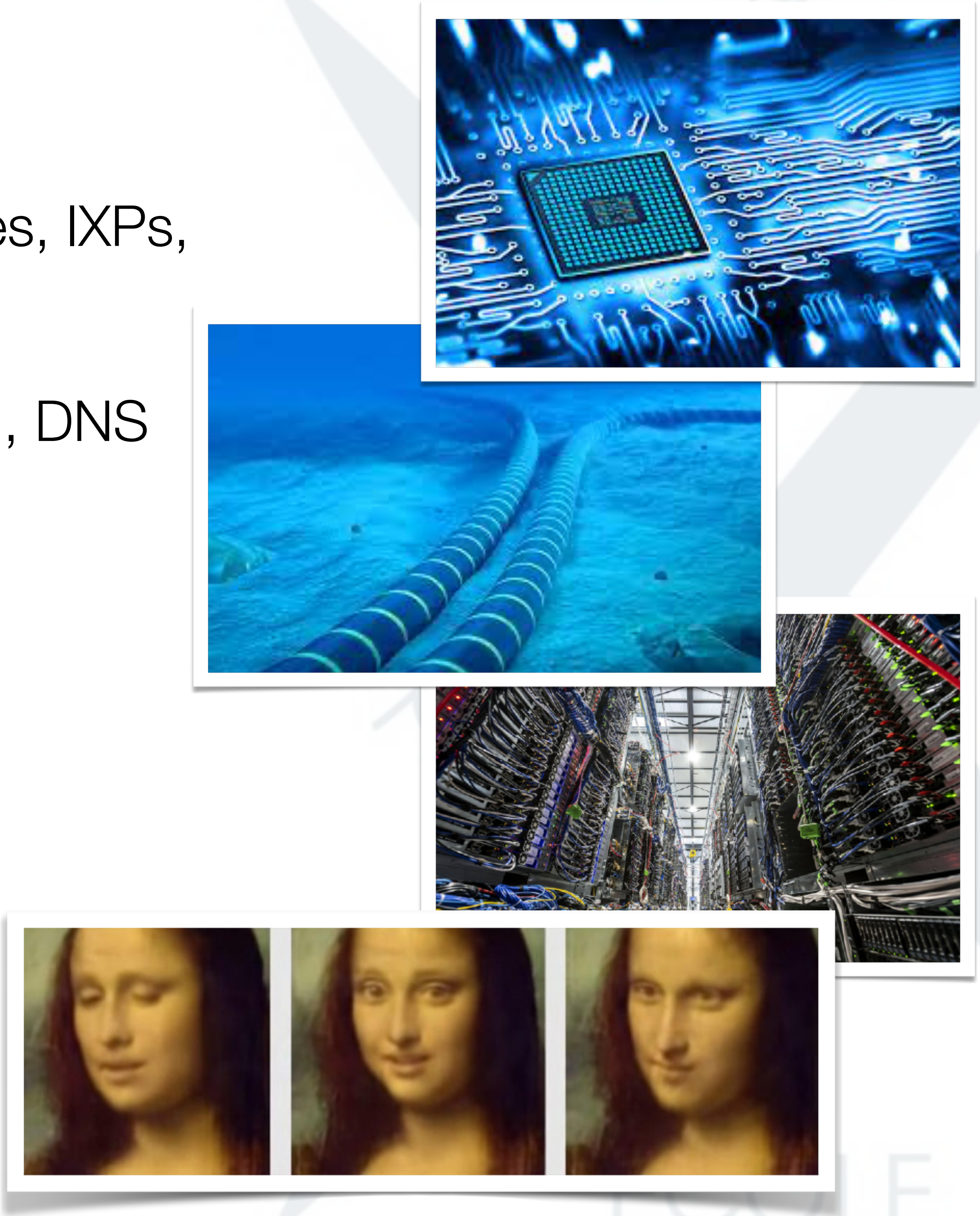
HAL science ouverte


AIvolution
Transforming the European Union´s Economy and Society
Ai
Eva Maria Poptcheva MEP
Juan-Antonio Cordero École Polytechnique Paris
INSTITUT POLYTECHNIQUE DE PARIS

EU Digital Technologies and Policies
14-15 May 2025, Brussels
INSTITUT POLYTECHNIQUE DE PARIS
ENSTA
PONTS
ENSAE
TELECOM Paris
TELECOM SudParis
EuroTech Universities Alliance
EuroTeQ Engineering University
SSIT

Some thoughts to share

- On the digital *roads*
  - Physical Internet infrastructure: cables, IXPs, devices, datacenters
  - Logical layers: ASes, routing, filtering, DNS
- On the digital *forums* (*agoras*, markets)
  - Disinformation
  - Digital consumer protection



On the digital roads

Netscape - [Yahoo!]
File Edit View Go Bookmarks Options Directory Window Help
Back Forward Home Reload Images Open Print Find Stop
Location: http://www.yahoo.com/
What's New? What's Cool? Destinations Net Search People Software
Auctions Messenger Check Email
YAHOO!
What's New Personalize Help
Search advanced search
Document: Done

Yahoo! Auctions
coins, cards, stamps, cars

All of Yahoo! at a click!
Get Yahoo! Companion Now!

Yahoo! Mail
free email for life

Shop · Auctions · Classifieds · Shopping · Travel · Yellow Pgs · Maps **Media** · News · Sports · **Stock Quotes** · TV · Weather
Connect · Chat · Clubs · Games · GeoCities · Greetings · Invites · **Mail** · Messenger · Personals · People Search · For Kids
Personal · My Yahoo! · Addr Book · Calendar · Briefcase · Photos · Alerts · Bookmarks · Companion · Bill Pay **more...**

Yahoo! Shopping - Thousands of stores. Millions of products.

Departments		Stores	Features
Apparel	Flowers	Eddie Bauer	Father's Day
Luxury	Sports	Sports Authority	Graduation
Computers	Music	Banana Republic	J.K. Rowling
Electronics	Video/DVD	Macy's	Gift Ideas

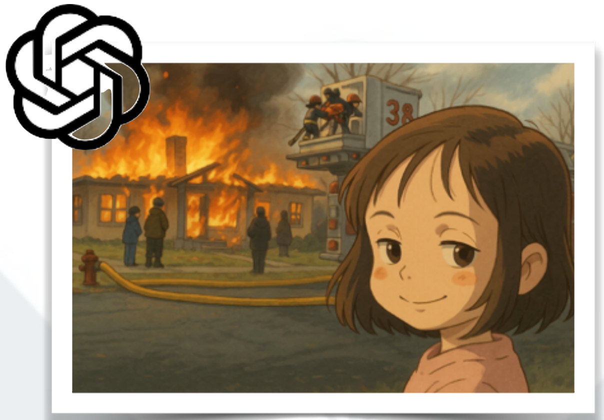
In the News
- Microsoft files breakup response
- Police capture escaped Fla. inmate
- Solomon Islands violence intensifies
- Corzine wins NJ Senate slot in costliest campaign ever

more...

Marketplace

Arts & Humanities
Literature, Photography...

News & Media
Full Coverage, Newspapers, TV...



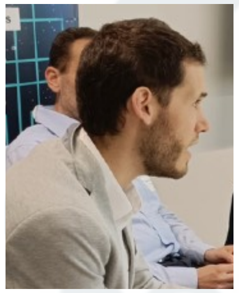
Digital services (and in particular, AI-based services) depend on fragile physical infrastructures (Internet, IXPs, 56/6G, datacenters, cables) and hardware (chips)

- Digitized services are “*as vulnerable as their weakest component*”: added vulnerabilities, cybersecurity threats

- Energy: digital and ecological transition may *not* be compatible

- Raw materials: scarcity, sustainability, recycling and reutilisation, geopolitical challenges

Marceau Coupechoux
Télécom Paris, France

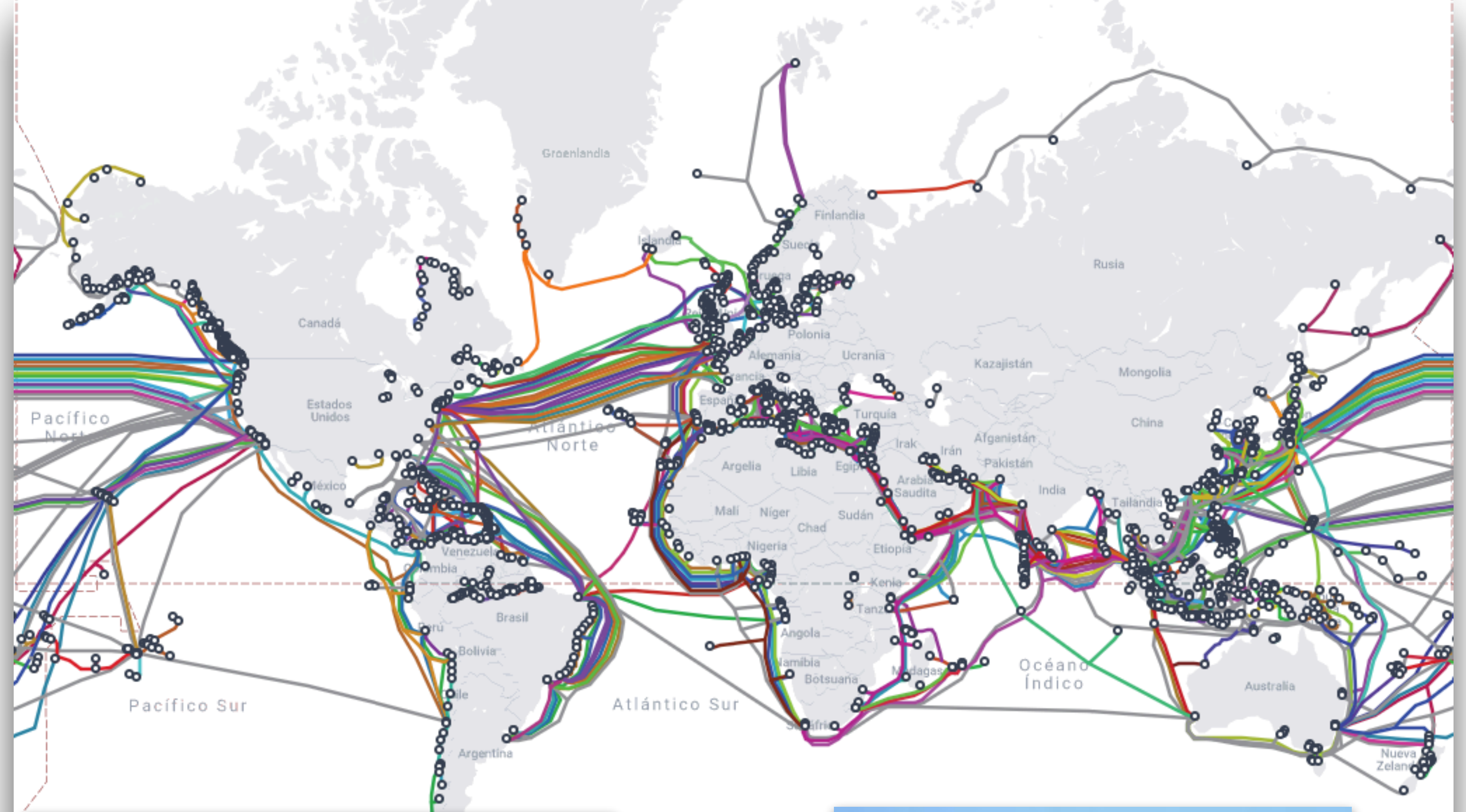


Juan Herrera
UPM, Spain

Romain Jacob,
ETH Zürich,
Switzerland

Internet (submarine) cables

- Physically, the Internet is a set of (mostly undersea) cables, each able to carry tens of Tbps…



Stefano de Luca
EPRS, EU

- carrying ~99% of Internet data traffic
- subject to physical attacks
- vulnerable to foreign technology dependency

- …current priority of EC

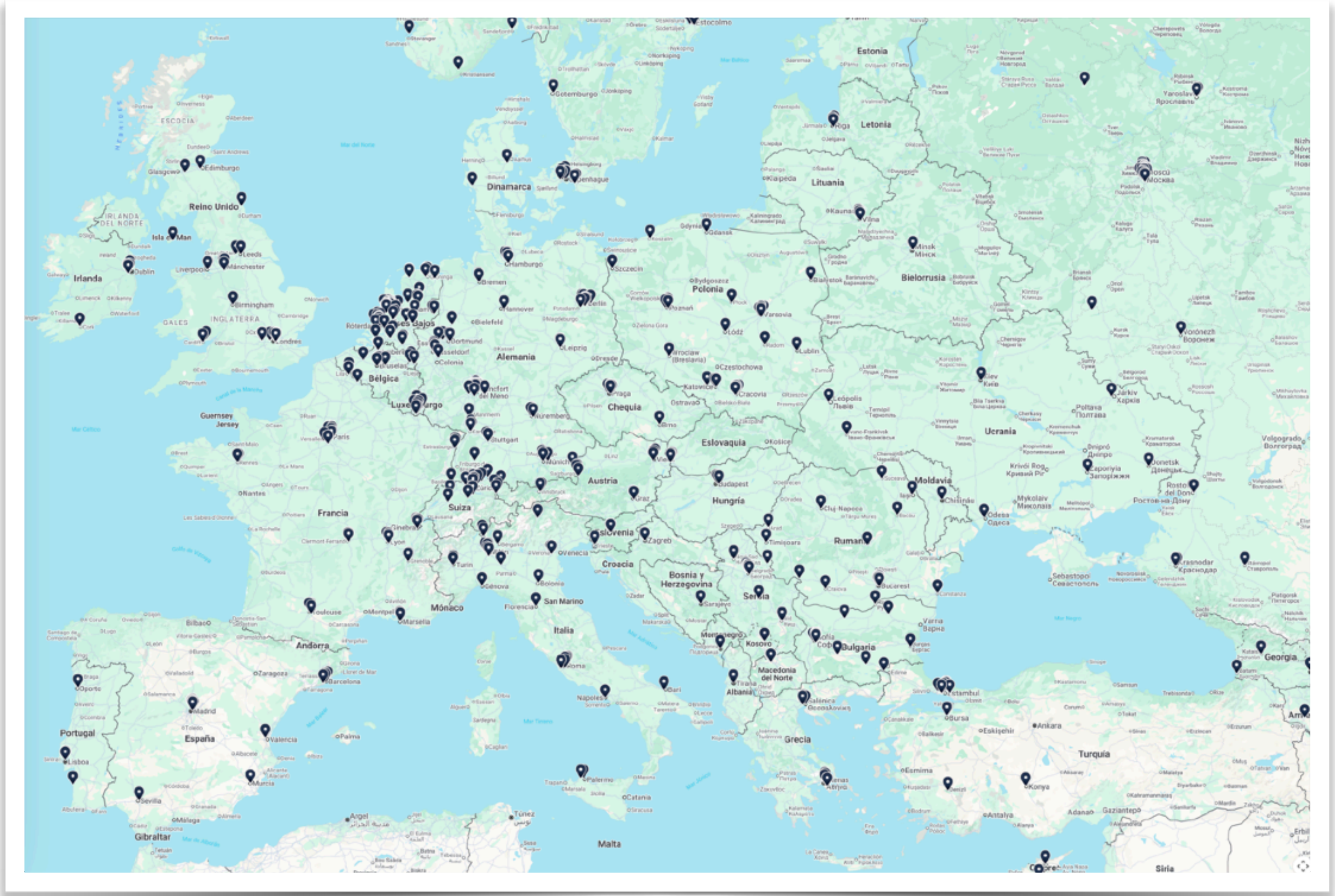
Source: http://www.submarinecable.map.com (2025)

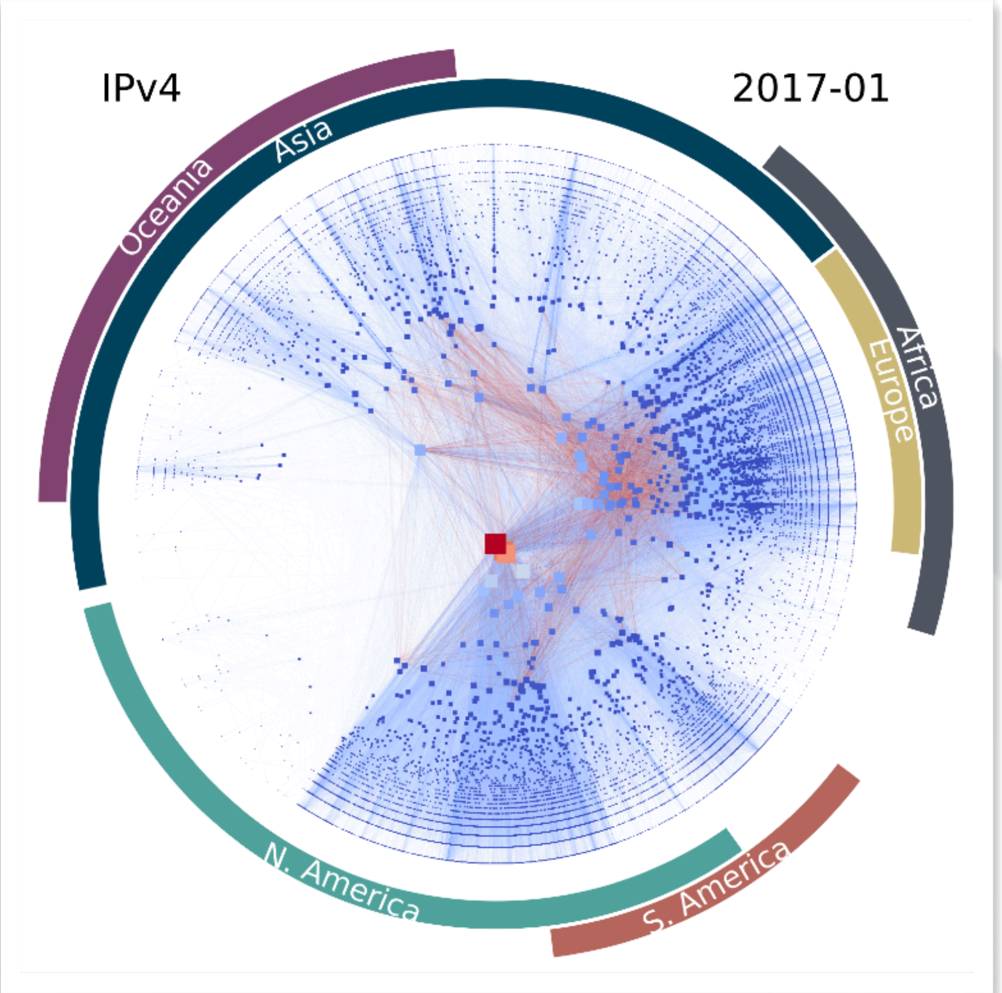
Internet infrastructure: it’s there until it’s not

- Undersea and ground cables meet in Internet eXchange Points (IXPs), networks are handled through regional/entreprise Autonomous Systems (ASes)

- Vertical integration in communications infrastructure: increasing involvement of GAFAM
  Examples: Grace Hopper (USA-UK-Spain, 340 Tbps, Google), APRICOT (Asia-Pacific, 190 Tbps, Google/Meta)…

- Net neutrality at risk, as traffic and services concentrate in few powerful (integrated) operators

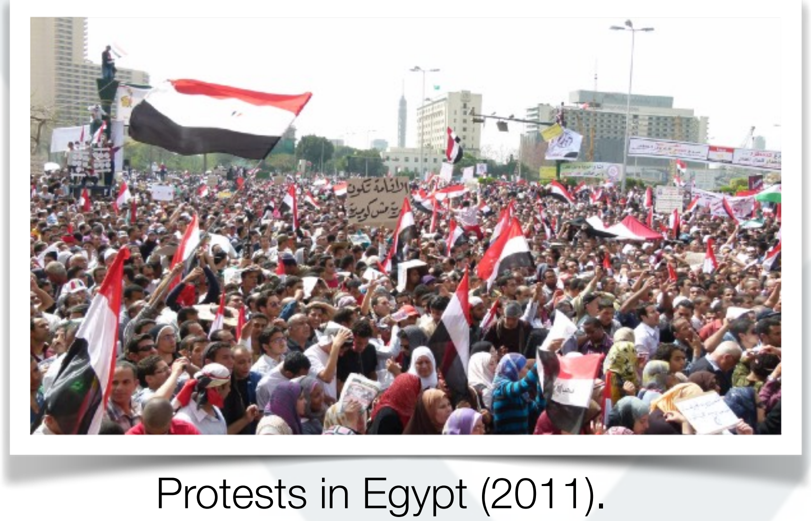




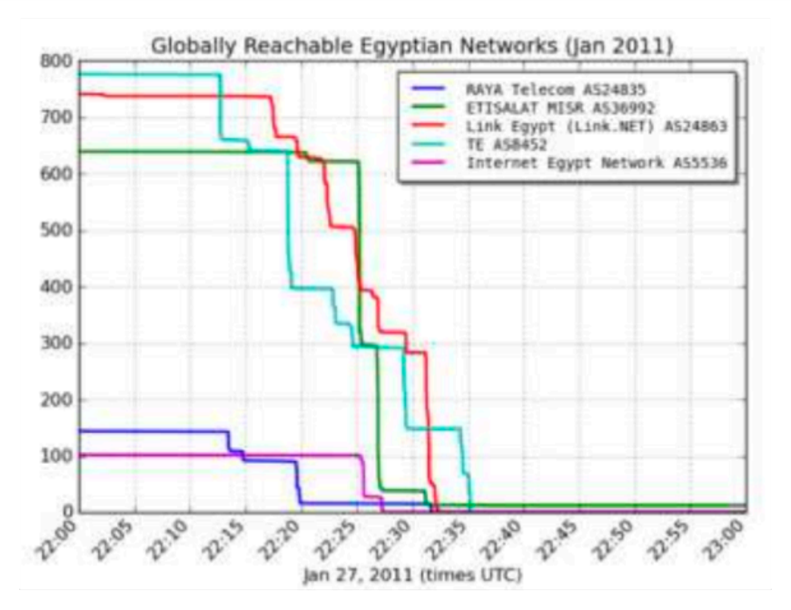
Sources: Internet Exchange Map (www.internetexchangemap.com), A Map of the Internet (G. Peltonen, U. of Glasgow, 2017)

Internet infrastructure: it’s there until it’s not

- Why do they matter?
  - Arab springs (2011),
  - Chinese digital wall (*wang guan* 网管, network wall),
  - Russian “sovereign Internet” (RuNet Рунет) project...



Protests in Egypt (2011).

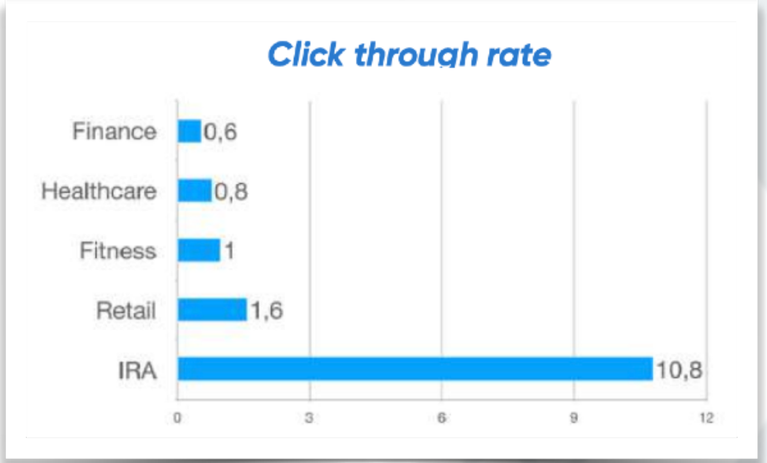


Withdrawal of BGP routes from Egyptian networks (ASes), in Jan. 2011.

- Careful with “**sovereignty**”: may mean *autonomy*, but also *restriction*/*suppression*
- Towards a fragmented Internet?

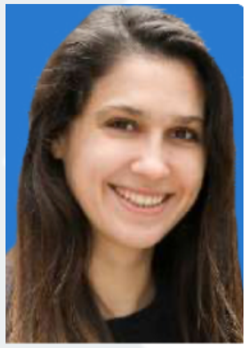
On the digital forum: disinformation

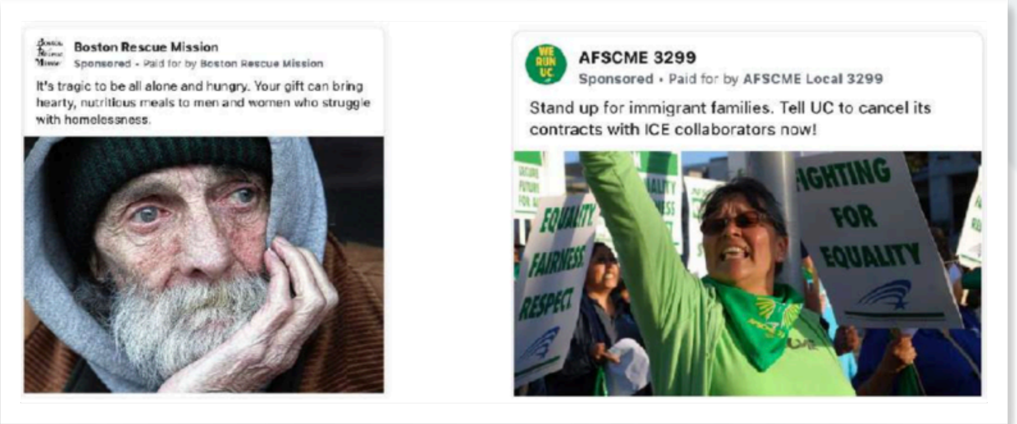
- *Disinformation: not a great term!*
    - …rather, disruptions in the circulation of information
- AI and automated content generation: not about people (writing, painting, playing), but about data availability and computing power
    - We use ChatGPT (or Grok, Gemini, etc.) as oracles, not as language models (trained on data, humanly parametrized) — but we already did so with Google, with Wikipedia, etc.
    - Most multimedia content in the Internet will be (*already is?*) synthetic
    - More vulnerable to bots, online campaigns, political micro-targeting in online platforms
    - ...but, disinformation-related concepts are often ill-defined



Internet Research Agency (IRA) malicious ads are way more effective than average (O. Goga, AIvolution 2023)

Oana Goga
CNRS, France





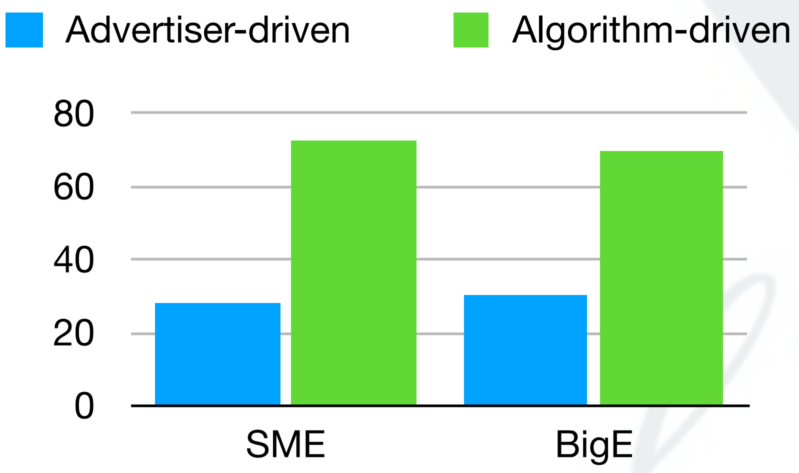
Boston Rescue Mission
Sponsored · Paid for by Boston Rescue Mission
It's tragic to be all alone and hungry. Your gift can bring hearty, nutritious meals to men and women who struggle with homelessness.

AFSCME 3299
Sponsored · Paid for by AFSCME Local 3299
Stand up for immigrant families. Tell UC to cancel its contracts with ICE collaborators now!

We may not agree on what a “political ad” is — and whether it should be subject to regulation (O. Goga, AIvolution 2023)

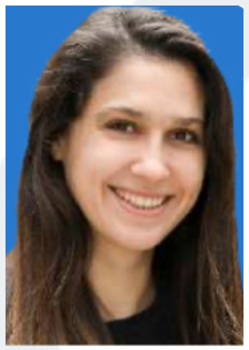
On the digital forum: consumer protection

- Data privacy, exploitation and risks of weaponization
  - Data is a hidden currency of digital services
  - Algorithmic-driven micro-targeting in social platforms is (implicit, automatic) user profiling — and is widely used by businesses

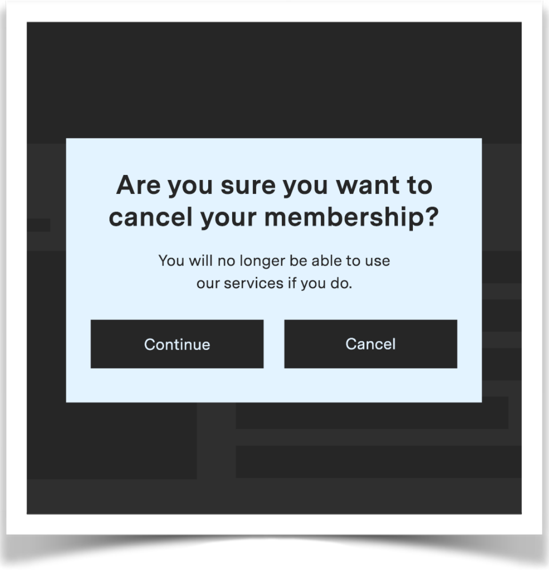


% use in micro-targeting, 2021

Oana Goga
CNRS, France

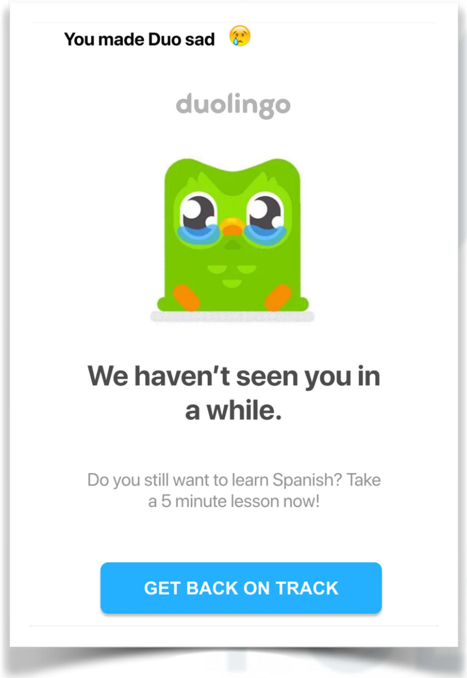


  - "Dark patterns" in digital design manipulate user behavior



Are you sure you want to cancel your membership?

You will no longer be able to use our services if you do.



You made Duo sad 😢

We haven't seen you in a while.

Do you still want to learn Spanish? Take a 5 minute lesson now!

Pratiksha Ashok
Tilburg University,
Netherlards

Is regulation the answer? Maybe, but...

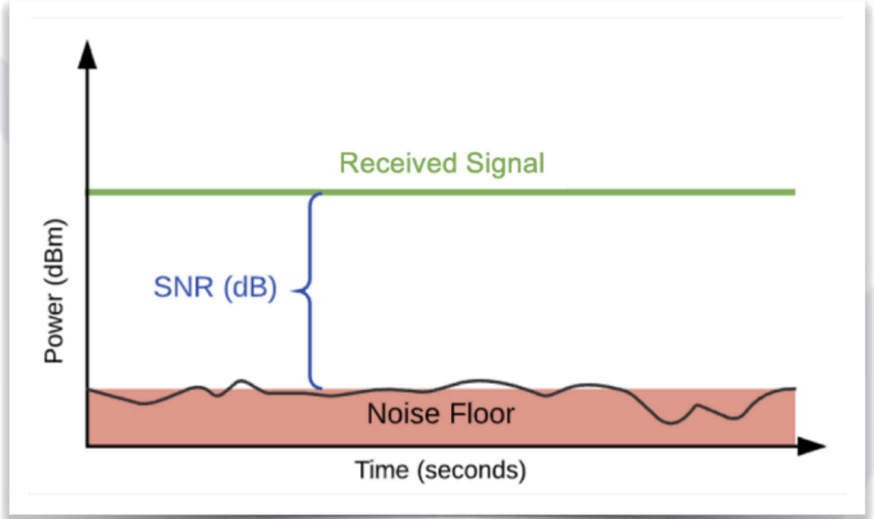
- From an engineering perspective:

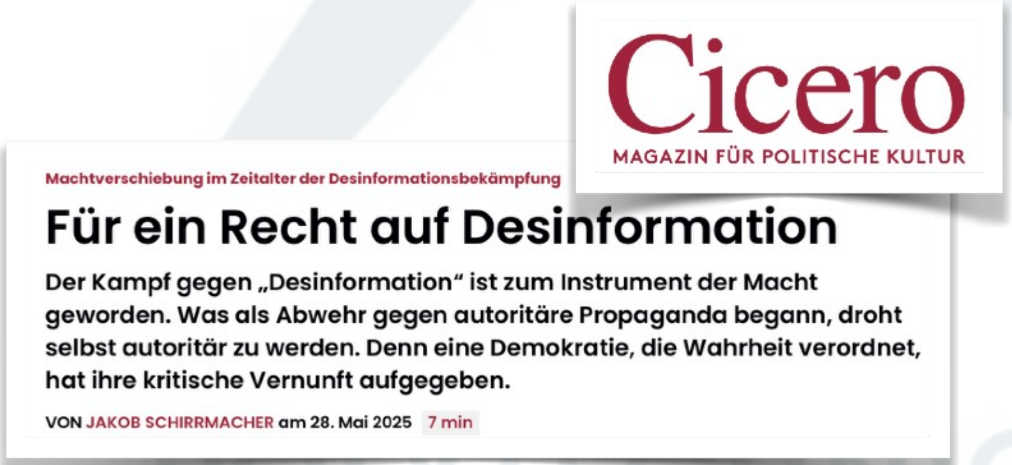
  Signal-to-Noise Ratio (SNR): $\frac{S}{N}$

  - Noise is growing, but its impact is amplified by the signal power (public trust) also decreasing
  - ...in part due to the banalization of "disinformation" and "fake news" claims by government officials

- The "disinformation" notion, and related regulation to attempt to control information flows, may be a double-edge sword

- No public trust without free, *unrestricted*, circulation of information flows + algorithmic transparency





Cicero
MAGAZIN FÜR POLITISCHE KULTUR

Machtverschiebung im Zeitalter der Desinformationsbekämpfung

Für ein Recht auf Desinformation

Der Kampf gegen „Desinformation" ist zum Instrument der Macht geworden. Was als Abwehr gegen autoritäre Propaganda begann, droht selbst autoritär zu werden. Denn eine Demokratie, die Wahrheit verordnet, hat ihre kritische Vernunft aufgegeben.

VON JAKOB SCHIRRMACHER am 28. Mai 2025 7 min

To conclude: sovereignty, democracy, rights

- Current AI phase is an *acceleration* of a larger revolution in automation & computing
  - AI relies on the ability to collect and exploit massive amounts of data: hidden currency of digital services
  - The Internet has become the backbone of digital societies: infrastructure for the *roads* and the *forum*
- Technology is **dialectical**: ambivalent effects on the environment
  - Augments overall capacities, at the cost of creating new dependencies (and new vulnerabilities!), which may also hurt individual autonomy
  - …also true for digital technologies
- *Forums* and roads
  - Internet infrastructure: risks of regional fragmentation and corporate concentration
  - Disinformation: public trust requires credible institutions, free flow of (quality) information, and algorithmic/institutional transparency
  - Digital sovereignty: both *technological autonomy* and power to *restrict/suppress dissent*

Thanks!

juan-antonio.cordero-fuertes@polytechnique.edu

China Internet control model : *wang guan* (网管, net wall)

- Some filtering techniques
(source: https://www.howtogeek.com/162092/htg-explains-how-the-great-firewall-of-china-works/)

- IP blacklists
- URL filtering
- Deep Packet Inspection over unencrypted packets
- VPN blocking

- DNS Poisoning
- TCP connections resetting

- …and a lot of manpower

- No measure is totally effective… but they only need to be sufficiently effective !

Russia Internet control model : RuNet / Рунет

- Developing an ability to “separate” the Russian Internet (source: https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/reassessing-runet-russian-internet-isolation-and-implications-for-russian-cyber-behavior/)

- Main legal framework:
  Sovereign Internet Law (Закон о «суверенном интернете»), 2019

- Towards a national DNS fork for Russia
- Deep Packet Inspection intrusive capabilities by Roskomnadzor
- Tracking of ASNs, IXPs and physical links connecting the Russian Internet to the outside
- Central Internet blacklist maintained by Roskomnadzor since 2012
- Website whitelisting
- …

- Periodic stability tests on the “isolated” Russian Internet
  - Tested for a full day in Chechnya, in 2024