5G standaardisatie en haar onbehagen

Platform Internetstandaarden
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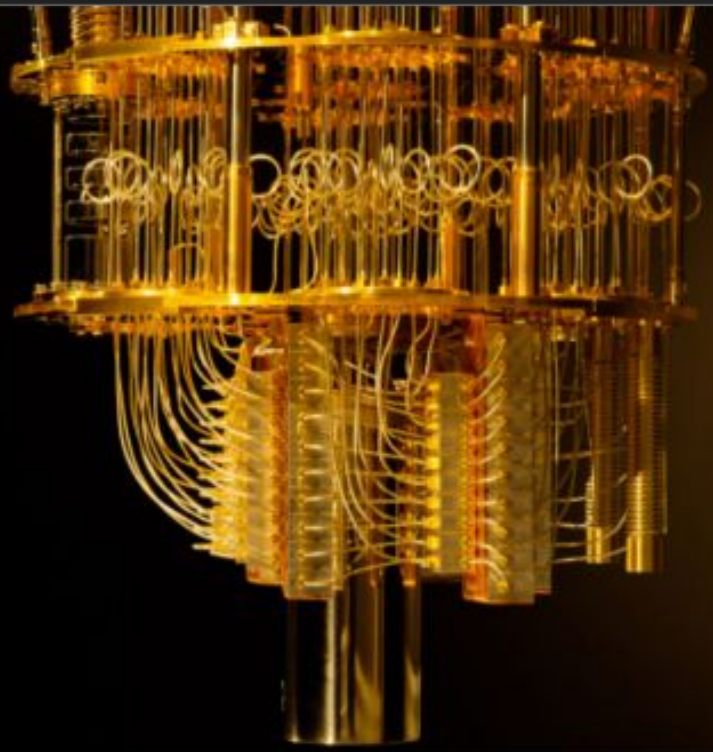




IN-SIGHT.it

Citizenship and standard-setting in digital networks

Co-designing for public values in standards-making and governance

University of Amsterdam - Media Studies & Datascience
University of Groningen - Law
In partnership with NEN
Funded by NWO




Why?

‘Infrastructure sets the invisible rules that govern the spaces of our everyday lives’

‘changes to the globalising world are being written, not in the language of law and diplomacy, but rather in the language of infrastructure’

- Keller Easterling

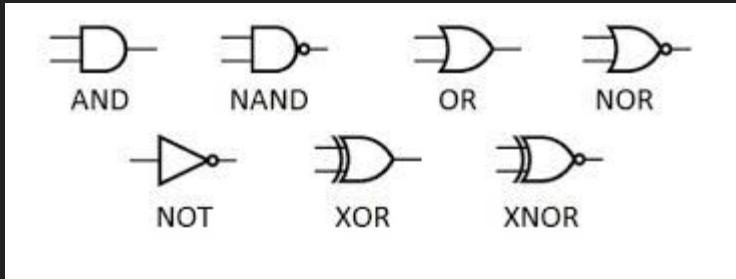
What? (i)

5G-NR (new radio) is a new set of standards and protocols for a Radio Access Network

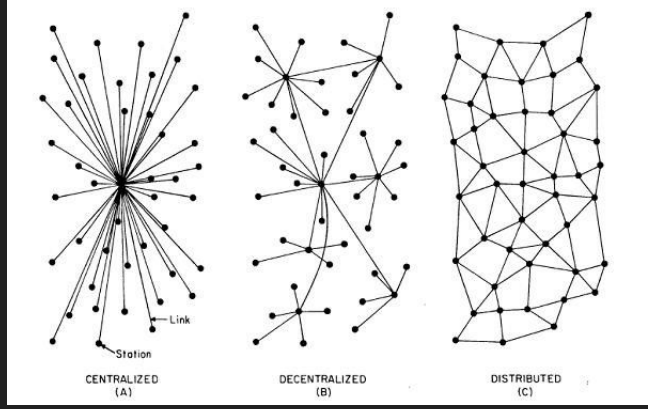
- Massive MIMO (multiple input, multiple output devices)
- Beamforming (more efficient antenna usage)
- New frequences (mmWave -> 28 GHz - 39 GHz)

This needs new hardware (routers + antennae)

New generation routers are implementing many things in software what previous router did through dedicated hardware (such as logic switches)



What (ii)



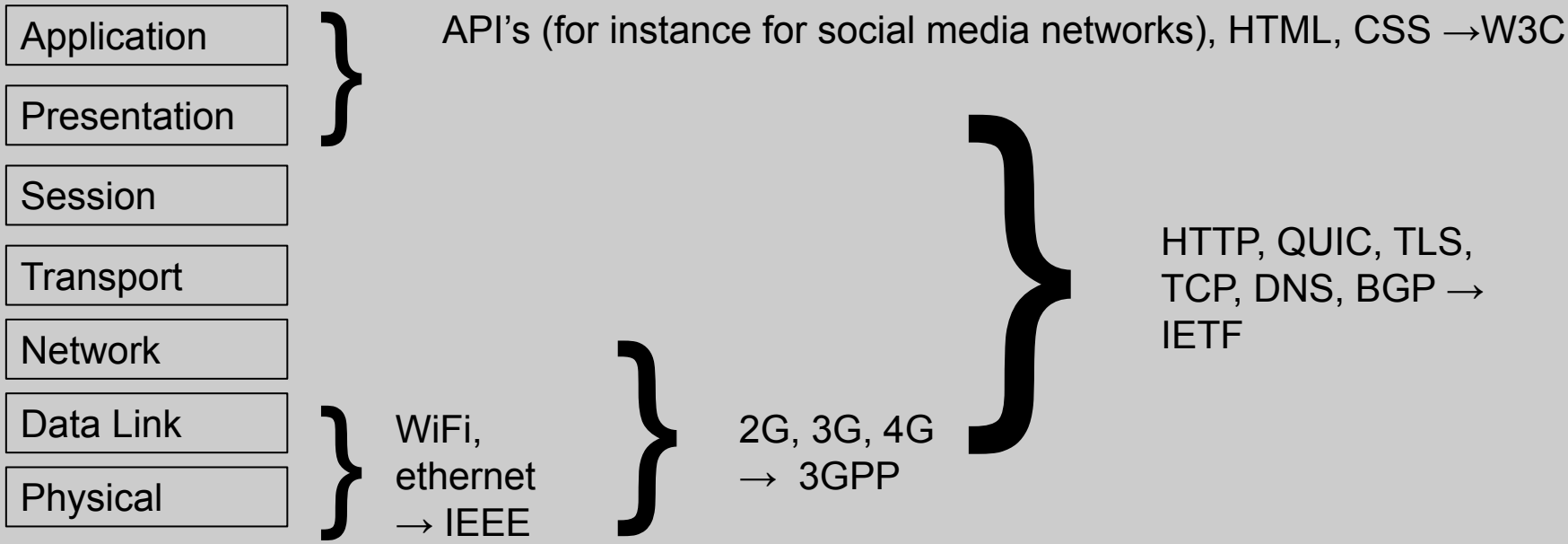
Software based routers allow for network architecture re-engineering:

- Edge networks
- Software Defined Networking
- Network Function Virtualization
- Slices
- Distributed Computing

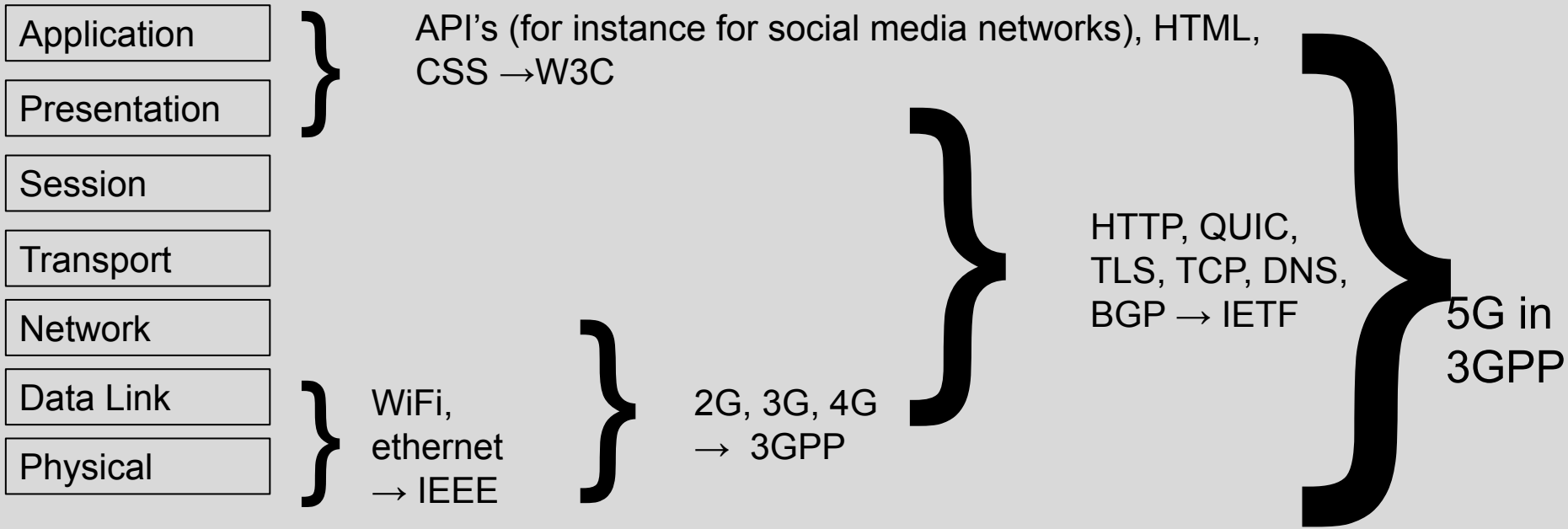
Together with network ownership consolidation, this could lead to a network that departs from the end-to-end characteristic of the Internet.

In other words: the network becomes smarter and gains more power, end-users lose transparency and control.

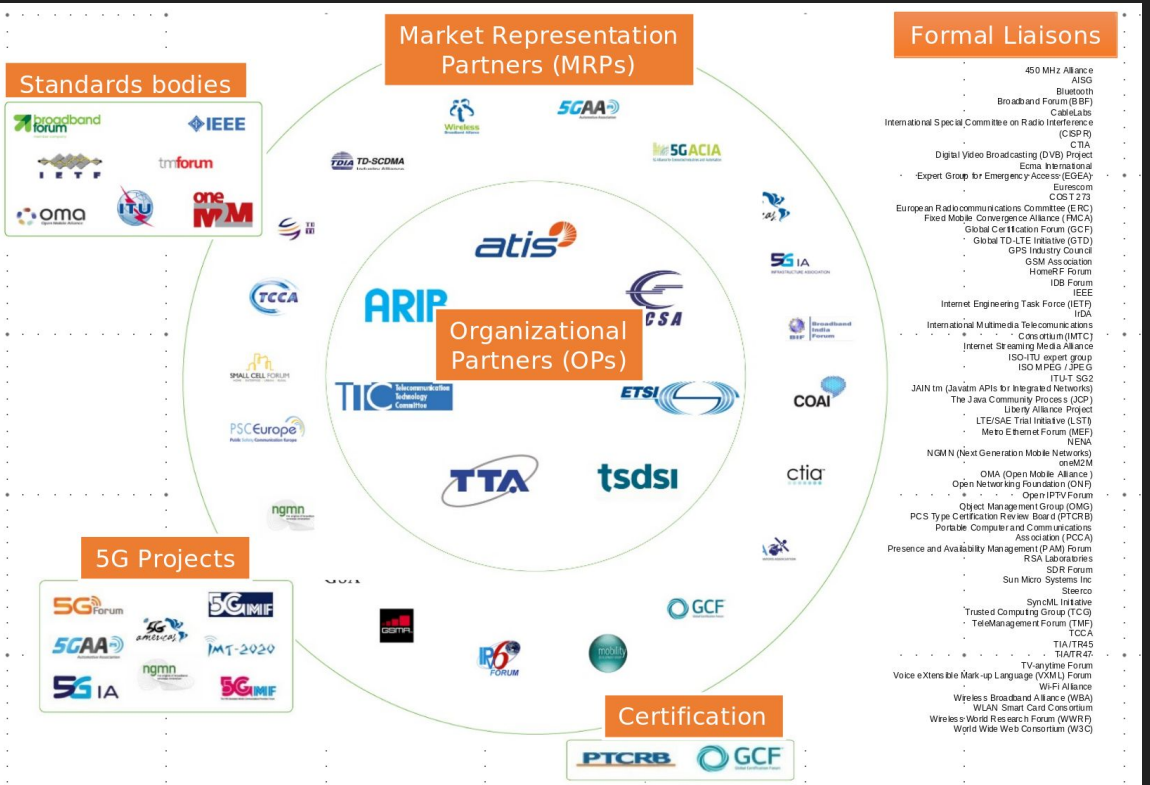
Infrastructure architecture intermezzo (vi)



Infrastructure architecture intermezzo (viii)



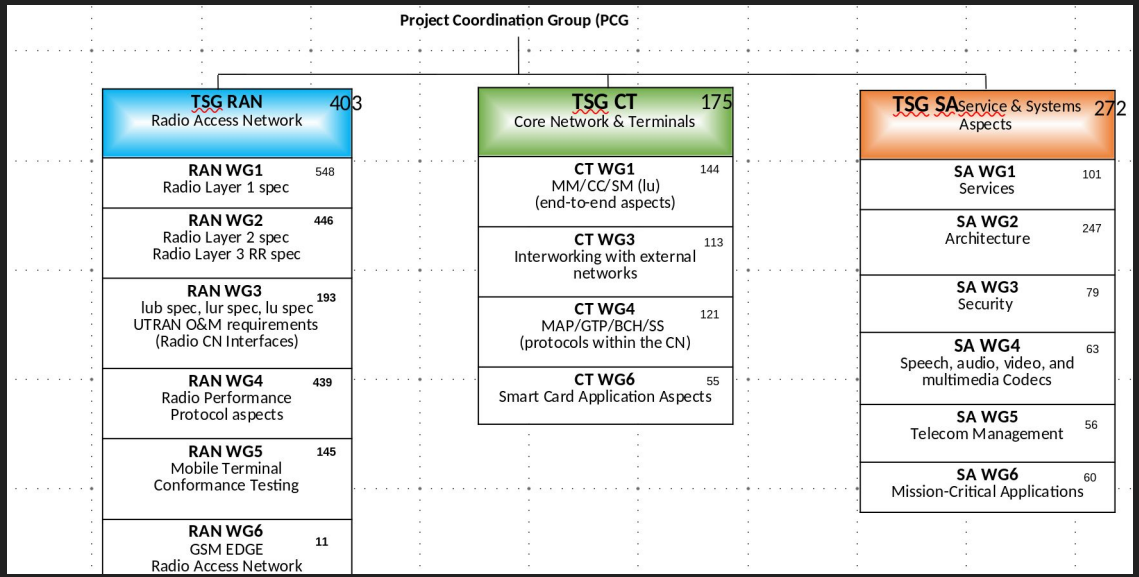
Where (i)

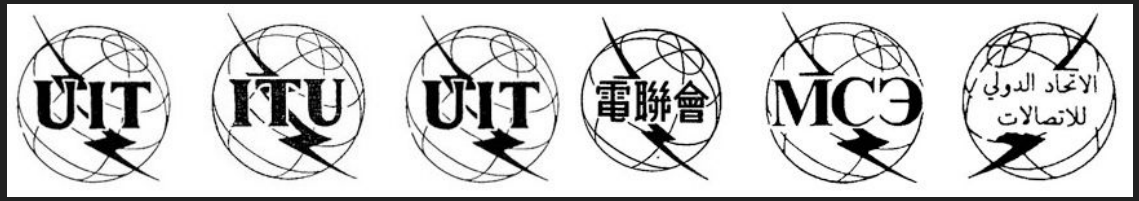


3GPP™

A GLOBAL INITIATIVE

Where (ii)


Project Coordination Group (PCG
TSG RAN
Radio Access Network
403
RAN WG1
Radio Layer 1 spec
548
RAN WG2
Radio Layer 2 spec
Radio Layer 3 RR spec
446
RAN WG3
lub spec, lur spec, lu spec
UTRAN O&M requirements
(Radio CN Interfaces)
193
RAN WG4
Radio Performance
Protocol aspects
439
RAN WG5
Mobile Terminal
Conformance Testing
145
RAN WG6
GSM EDGE
Radio Access Network
11
TSG CT
Core Network & Terminals
175
CT WG1
MM/CC/SM (lu)
(end-to-end aspects)
144
CT WG3
Interworking with external
networks
113
CT WG4
MAP/GTP/BCH/SS
(protocols within the CN)
121
CT WG6
Smart Card Application Aspects
55
TSG SA
Service & Systems
Aspects
272
SA WG1
Services
101
SA WG2
Architecture
247
SA WG3
Security
79
SA WG4
Speech, audio, video, and
multimedia Codecs
63
SA WG5
Telecom Management
56
SA WG6
Mission-Critical Applications
60


UIT
ITU
UIT
電聯會
MCE
الاتحاد الدولي
للاتصالات

Who?

Equipment Vendors

Apple // Blackberry // Broadcom // CATT // Cisco // Ericsson // ETRI // Futurwei // Google // HP // Huawei // Infineon // Intel // Interdigital // Juniper // Kapsch // Kyocera // Lenovo // LG // Matrixx Sw // Mavenir // MediaTek // Mitsubishi // Motorola Mobility // Newtec // Nokia // OPPO // Samsung // Sandvine // Sharp // Sony // Spirent // Vivo // XiaoMi // ZTE

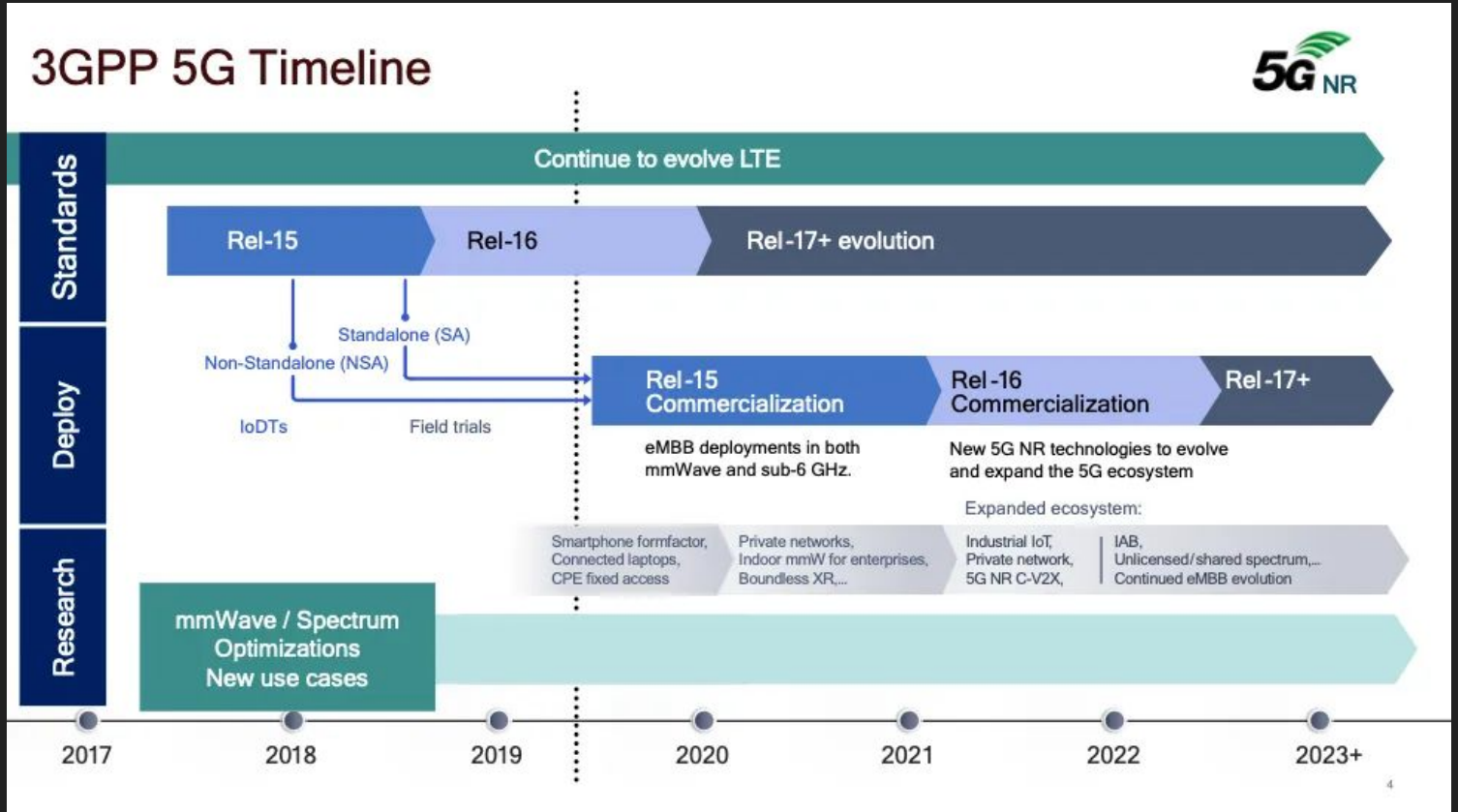
Network Operators

AT&T // Avanti // Bell Canada // BT // CableLabs // CAICT // Charter // China Mobile // China Telecom // China Unicom // CISA // FirstNet // Hughes // Inmarsat // Intelsat // KDDI // KPN // KT // LG U+ // NTT DoCoMo // Orange // Rogers // SES // SK Telecom // Softbank // Sprint // Telecom Italia // Telefonica // Telenor // Leonardo // Telia // Telstra // Telus // T-Mobile // Turkcell // UK HO // Verizon // Vodafone

‘Verticals’ (applications, end-users devices, cars, police, industry)

ABS, Airbus, Alibaba, BBC, Bosch, Convida, DLR, EBU, ESA, Eutelsat, Fraunhofer, IRT (Germany), IPCom, ITRI, ligado networks, NHK, Novamint, Omesh, Philips, Sennheiser, Siemens, Suomen Virveverkko, Tencent, Thales, NL Police, TNO, Toyota, UIC, Volkswagen, ZITiS

When?


3GPP 5G Timeline
5G NR
Standards
Deploy
Research
Continue to evolve LTE
Rel-15
Rel-16
Rel-17+ evolution
Standalone (SA)
Non-Standalone (NSA)
IoDTs
Field trials
Rel-15 Commercialization
Rel-16 Commercialization
Rel-17+
eMBB deployments in both mmWave and sub-6 GHz.
New 5G NR technologies to evolve and expand the 5G ecosystem
Expanded ecosystem:
Smartphone formfactor, Connected laptops, CPE fixed access
Private networks, Indoor mmW for enterprises, Boundless XR,...
Industrial IoT, Private network, 5G NR C-V2X,
IAB, Unlicensed/shared spectrum,... Continued eMBB evolution
mmWave / Spectrum Optimizations New use cases
2017
2018
2019
2020
2021
2022
2023+

What do we know:

- How 5G gets developed and standardized (in the 3GPP, ITU-T, ITU-R, etc.);
- How 5G works in edge networks (eg. Facebook's Magma);
- How 5G frequencies are being auctioned and deployments are being financed by govts;
- How 5G will strengthen network consolidation.

What do we *not* know:

- How the societal impact of such standards can be taken into account in technology development, standardization and implementation ?
- How people think about 5G ?
- How critical interpretative frames could be used to improve policy+technology making?

FAQ

Myth	Reality
5G is only about radio network	• If 5G is deployed in non-standalone mode then existing 4G core (EPC) is used. • If 5G is deployed in standalone mode, then an all new 5G core that enables the use cases discussed in this presentation is used.

5G means extreme throughput or 5G means speed	• 5G has different use cases – eMBB, URLLC and mMTC
	• Different use cases have different throughput and latency requirements
	• Throughput is a function of the radio bandwidth available, UE's location in the cell (which determines its SNR).
	  • Channel capacity limited by Shannon Theorem
	  • $C = B.\log_2(1+SNR)$ bps

All use cases of 5G – eMBB, URLLC, mMTC will be seen as soon as networks launch 5G	• NR radio design provides lot of flexibility. • Flexibility comes at a cost. • Its practically impossible to support all use cases on day 1. • Initial deployments will mostly target eMBB. • Where are the applications for URLLC and mMTC?
5G will kill WiFi	WiFi will co-exist. NR may be used for cases where grant based access and guaranteed latency is required.

5G is a health hazard	• The hazard **is not** a function of "radio frequency" but it's a function of "exposed power or energy levels".
	• Human body when exposed to any electro-magnetic radiation (including visible light) more than the prescribed power levels is harmful.
	• Power dissipates as the square of distance from base-station.
	• As long as the human body is away from the base station such that the receive power at the UE is < 32 dBm (~1.5 watts) the receive power is well within SAR limits (1.6 watts/Kg of tissue).
	  • $P_r = P_t / 4\pi d^2$
	  • Typical P_t = 40 watts (46 dBm)

Research Questions

Research Question: What are the critical interpretative frames of 5G on social media platforms, especially in regards to the infrastructural claims of 5G conspiracy theorists?

Sub-Question 1: What is a sub-categorization of the main motifs, symbols and epistemic phrases that epistomise 5G across platforms?

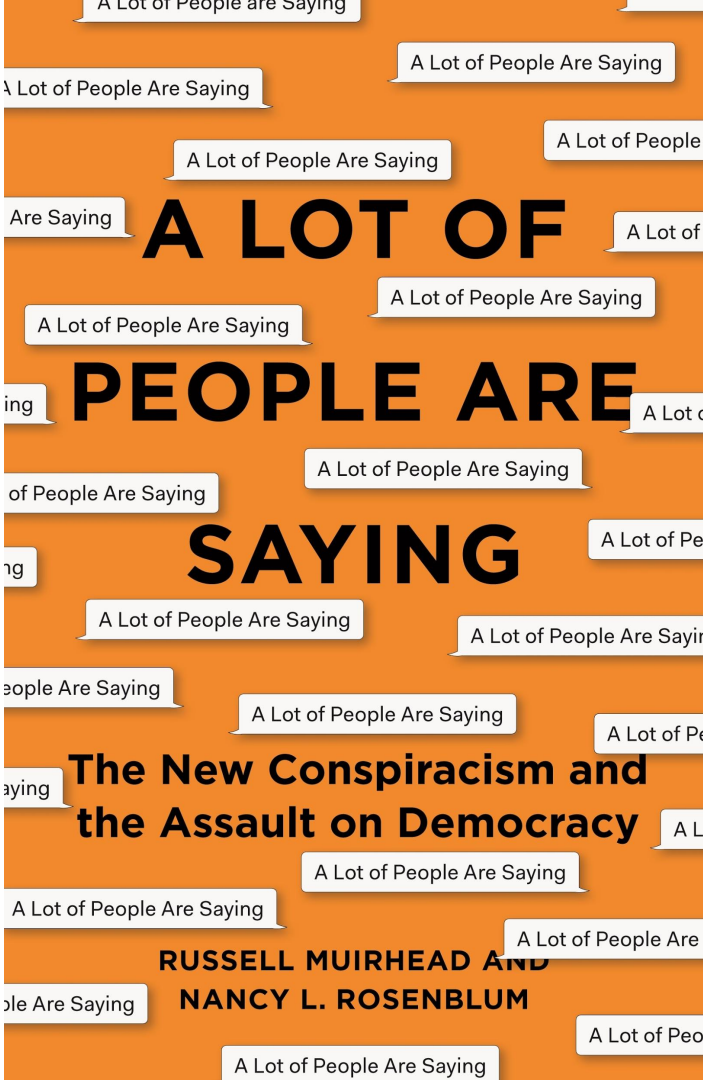
Sub-Question 2: How does 5G discourse evolve over time and space?

Sub-Question 3: Do 5G conspiracies mirror or overlap with the imaginaries of 5G providers?

Theoretical Framework

- Conspiracy without Theory (Muirhead and Rosenblum, 2019)
  → new conspiracism as conspiracy without explanation & argumentation

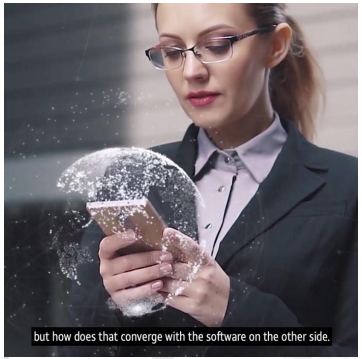
- Conspiracy Fragments vs. Theories
  → conspiracy theories as alternative forms of knowledge production



Main Takeaways

- 5G companies focus on marketing and self-presentation rather than concrete 5G technology benefits. Abstract language and images *fail to create a sociotechnical imaginary for 5G*.
  - This creates cognitive gaps that the users then fill with their own interpretative frames!
- Conspiracies arise and are mediated by the specificities of platform regulations & affordances (mainstream vs. fringe):
  - *Instagram:* discourse is fragmented due to robust pre-defined spaces and strict regulations: no in depth theories, this leads to “hardcore” users move to the fringe.
  - *Parler*: more argumentative, “scientific” discourse, more homogeneous user base, polarized towards few main narratives and conspiracy tribes

Provider imagery: Instagram & YouTube

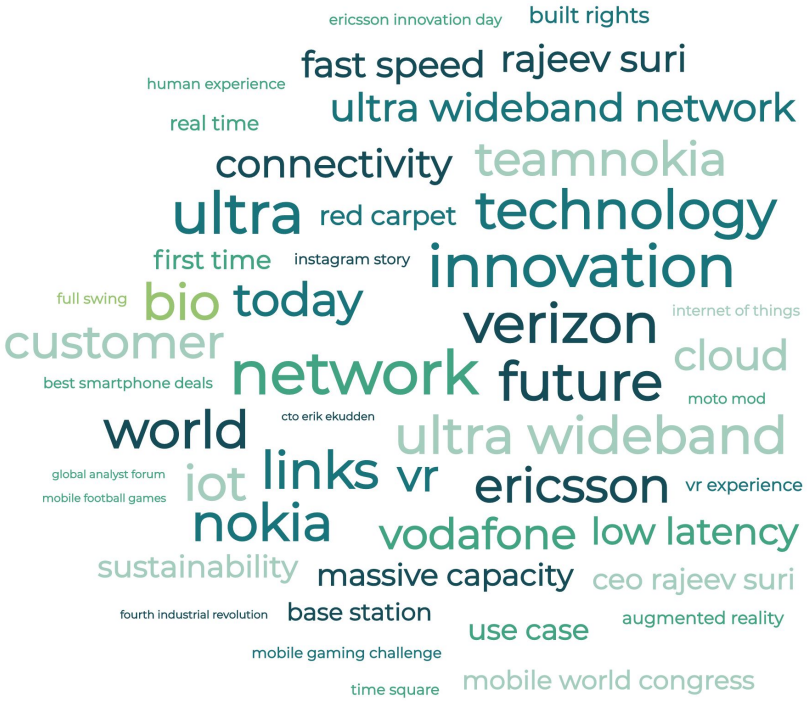


Instagram provider accounts sample posts

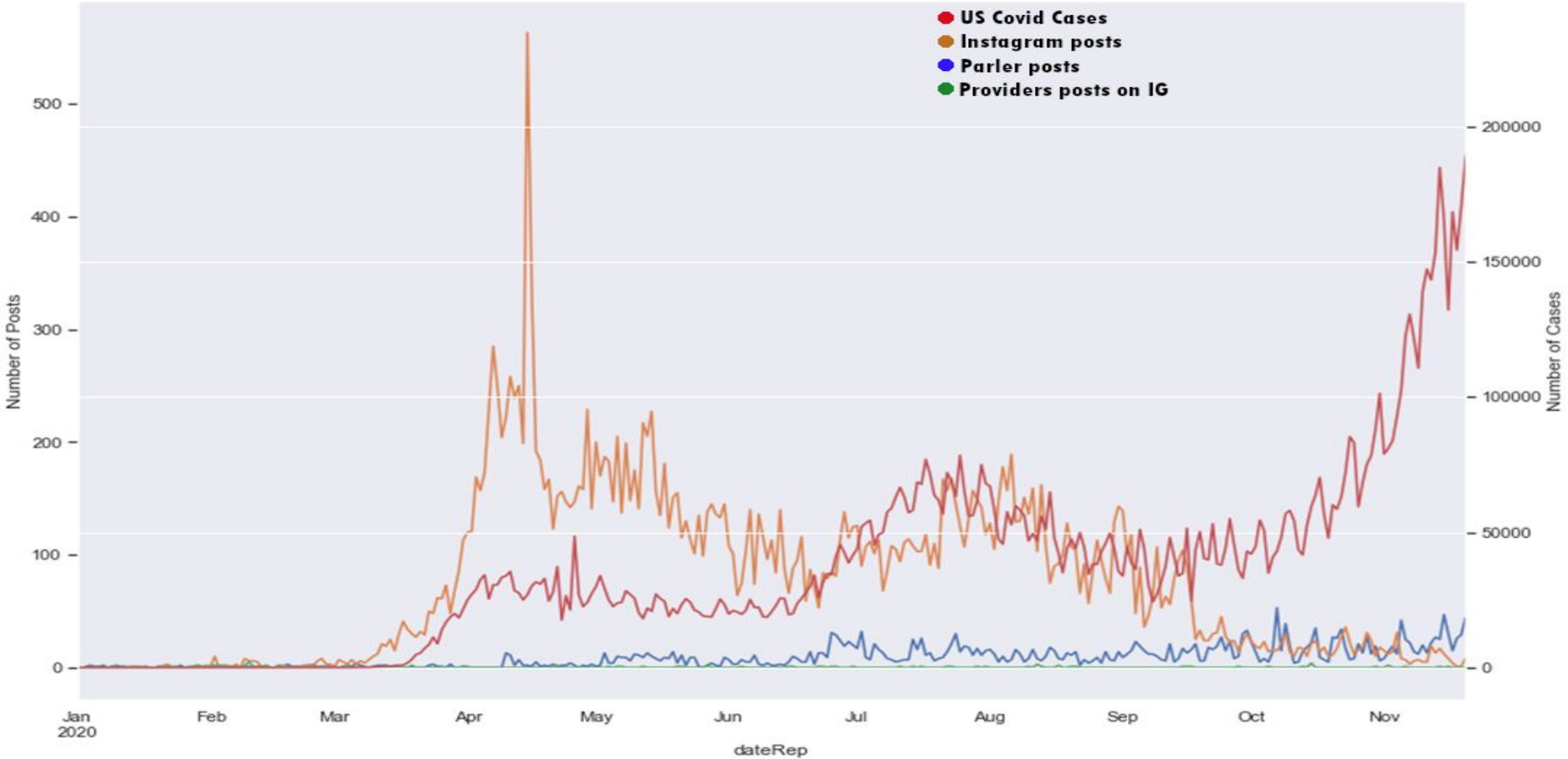
YouTube sample thumbnails from providers' videos

Providers' discourse: Webpages & Instagram

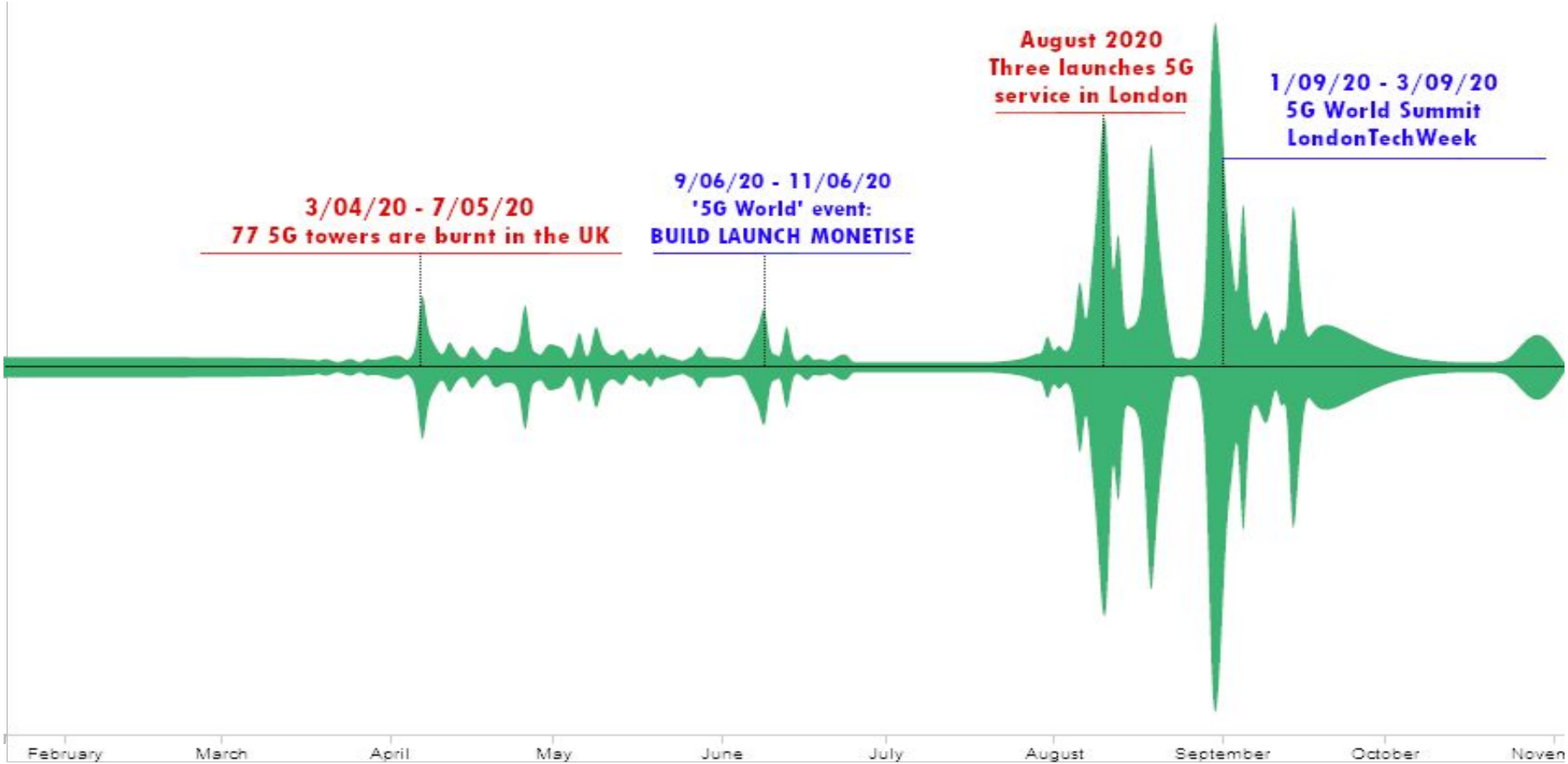
Word cloud comparison: Websites and Instagram posts of vendors and network operators

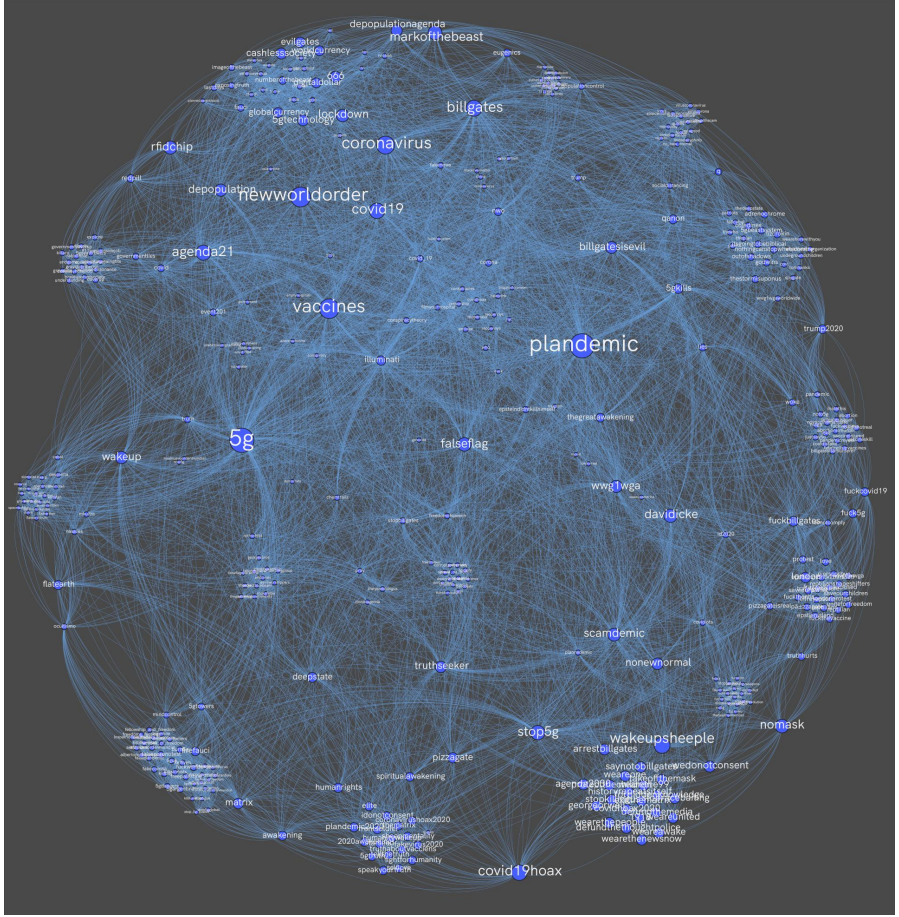


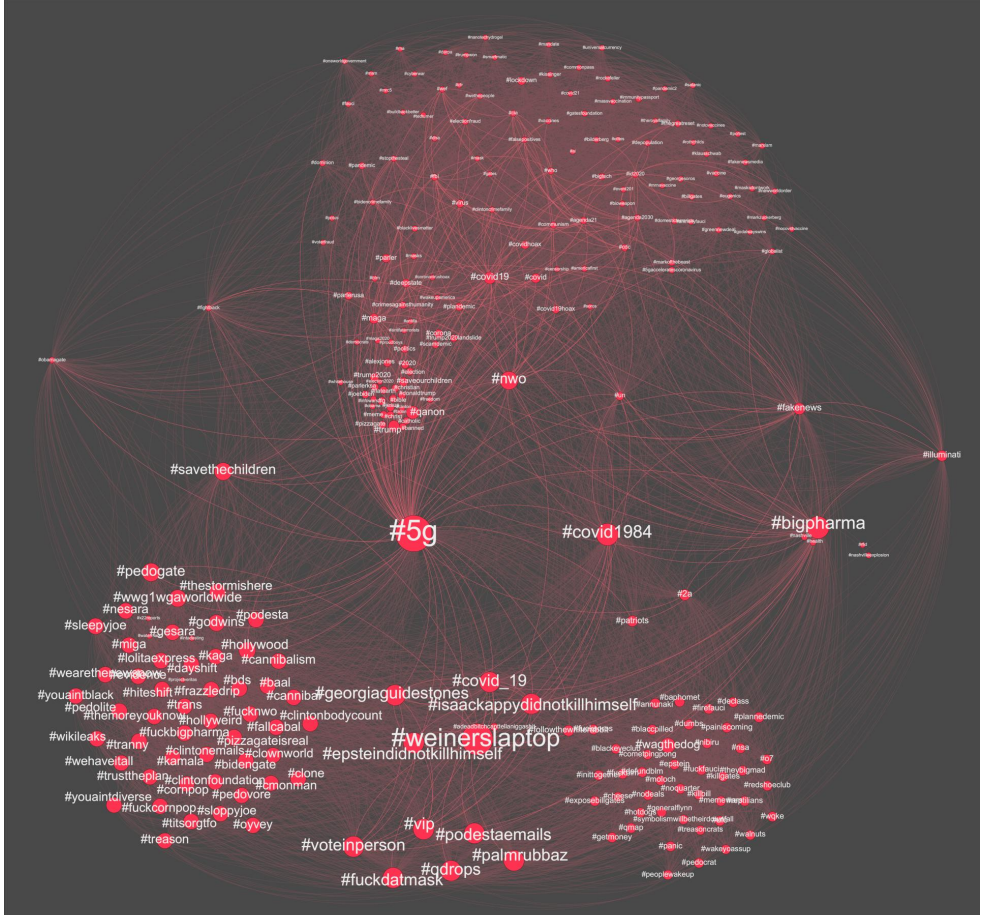
Time Series


US Covid Cases
Instagram posts
Parler posts
Providers posts on IG
Number of Posts
Number of Cases
500
400
300
200
100
0
200000
150000
100000
50000
0
Jan
2020
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
dateRep

5G events and IG-conspiracy post frequency in London



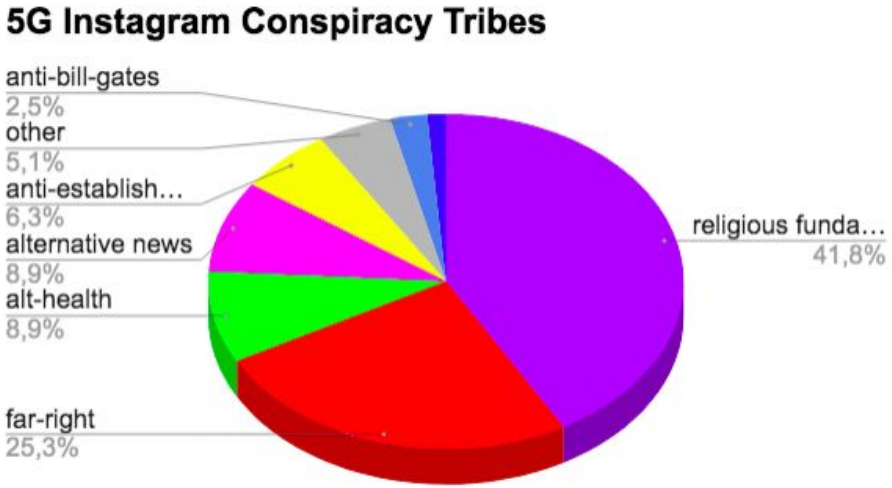


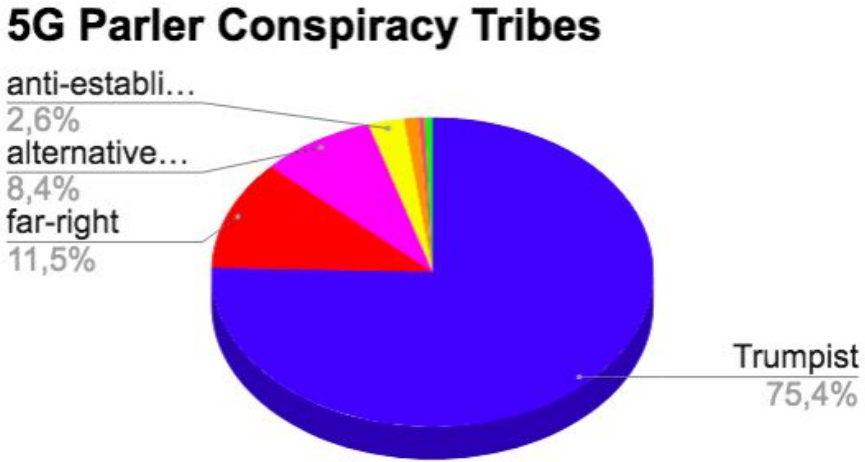


Instagram: Small, scattered clusters

Parler: Large, organized clusters

Conspiracy Tribes Instagram vs. Parler

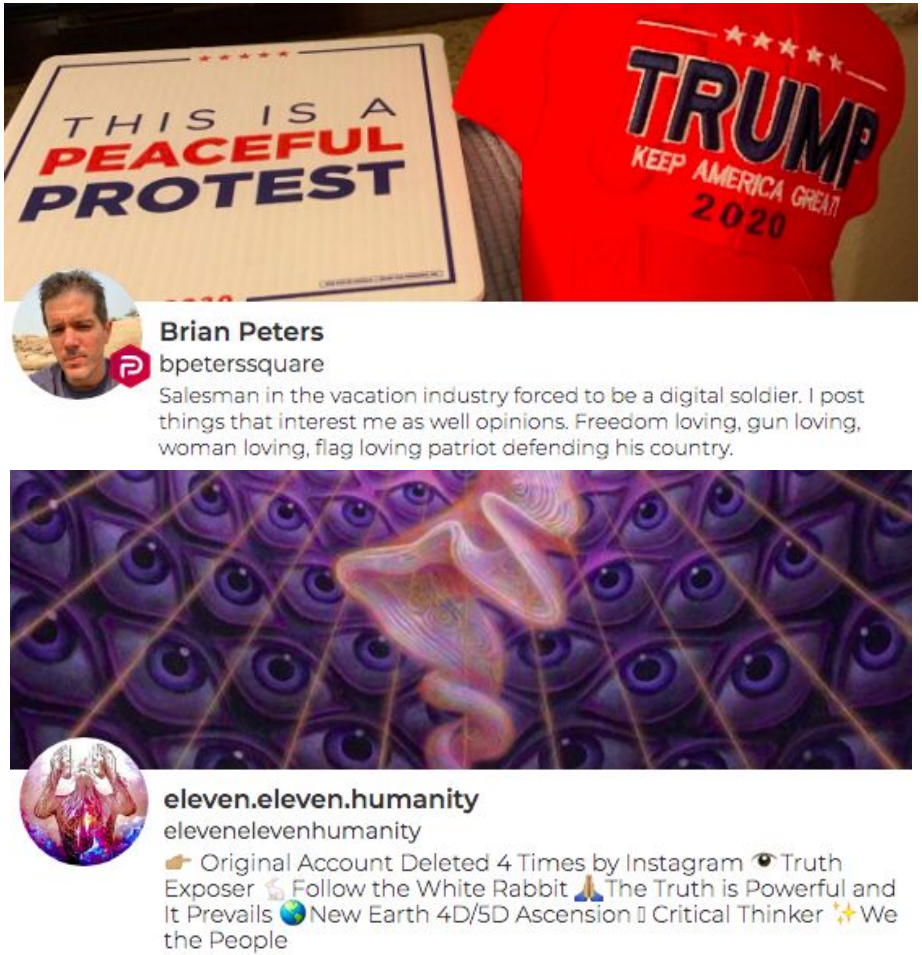




- over 50% of accounts deleted
- nearly 40% conspiracy theorists
- 10% ordinary users
- more diverse users & tribes

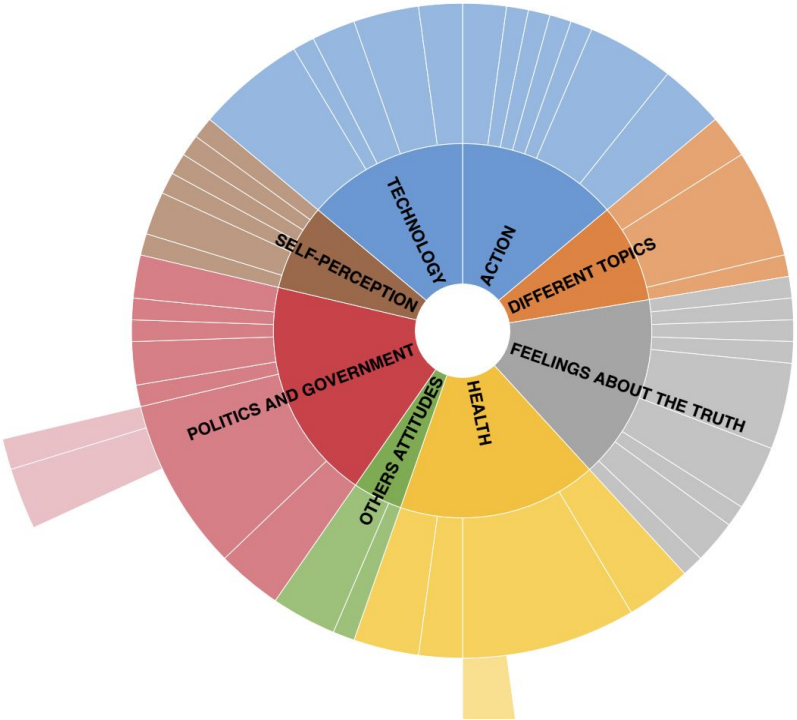
- one deleted account
- over 95% conspiracy theorists
- no regular users
- few independent media accounts

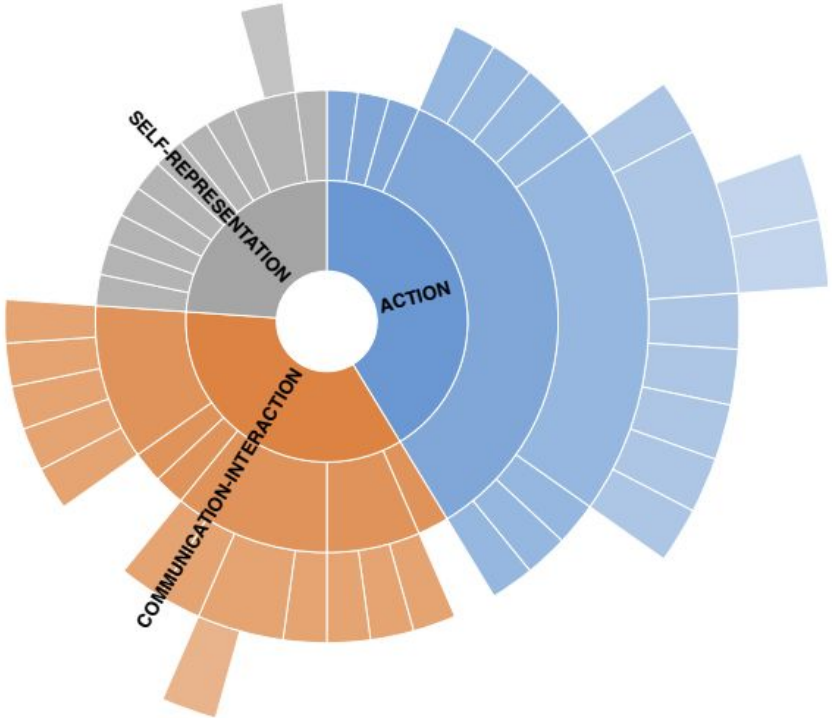
IG alt-health account sample post

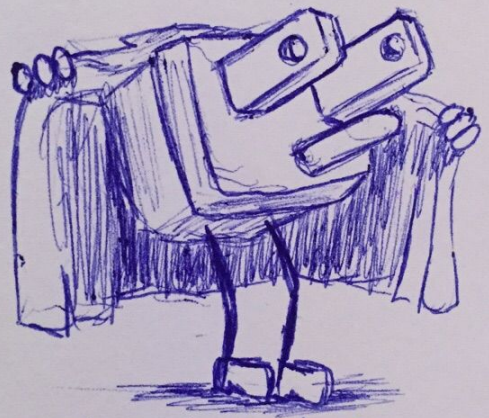


Parler sample bios (fig 1: Trumpist, fig 2: migrated user)

Text Analysis Instagram vs. Parler







Shameless plug

ARTICLE 19 and Catnip

HOW THE INTERNET REALLY WORKS

An Illustrated Guide to **Protocols, Privacy, Censorship,** and **Governance**

no starch press

The Map of the Internet

The internet isn't actually one big, unified network. Instead, it's a network made out of tens of thousands of smaller networks called **autonomous systems (AS)** belonging to universities, internet service providers (ISP), or telecommunications companies.

An internet user is always part of one such autonomous system.

Autonomous systems are so named because they're administered independently from each other.

When these networks interconnect, they constitute the internet as we know it. There are currently[1] about 94,000 such ASs.

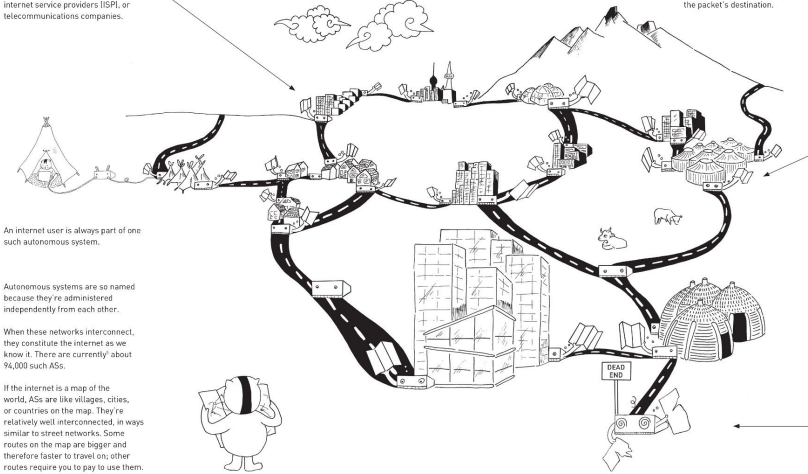
If the internet is a map of the world, ASs are like villages, cities, or countries on the map. They're relatively well interconnected, in ways similar to street networks. Some routes on the map are bigger and therefore faster to travel on; other routes require you to pay to use them.

Border Gateway Protocol (BGP)

The protocol that makes this interconnection possible is the **Border Gateway Protocol (BGP)**, the de facto routing standard on the internet.

BGP defines how information about IP packet routes are exchanged between ASs throughout the internet, making it possible to calculate the shortest and cheapest possible path from one place to the next, ultimately reaching the packet's destination.

With BGP, each AS controls its own map of the internet and references routes and distances to other networks from its own point of view. Very few BGP servers have a complete global map of all possible routes through the internet.



An AS is made up of many computers connected to each other through routers. Routers that act as entry and exit points of the whole AS are called **BGP routers**.

The BGP routers of different ASs talk to one another regularly, and when they initiate a talk, known as a session, they become **neighbors**. Whenever neighbors meet to talk, they exchange maps of all routes they know about and want to share. An AS uses BGP to keep track of routes in a table and calculates their priorities based on various attributes. BGP tends to favor an AS's own map relative to its own point of view, because an extra hop to a neighbor makes the path longer.

This system is very clever, but as you can guess, it's also quite prone to mistake. For example, if a neighbor shares the wrong map, or pretends to know how to get from one place to another when it actually doesn't, this can create an impasse or traffic congestion.

Internet Governance

As we've seen, the internet is a globally distributed network made up of many voluntarily interconnected autonomous systems that interoperate through protocols, hardware, and software.[2]

The development, coordination, and management of the internet across a broad range of principles, policies, and technical standards are what govern the internet and ensure that it operates and evolves over time.

Since the internet moves information across virtually all sovereign nations and since many different public and private entities own and operate its physical parts, the internet has no central governing body to manage this coordination.

Instead, **internet governance** is a patchwork of organizations and actors who are dedicated to developing and maintaining different aspects of the internet's global interoperability.

Policy changes on one aspect will have a direct impact on others.

While not an exact mapping, a simplified model of the five layers of the internet—social, content, application, logical, and infrastructural—can give us an understanding of internet governance. In this chapter, we'll look at each layer and the internet governance processes that concern themselves with these layers.