

eXO: un ISP comunitario

Descripción y patrones de uso de los usuarios



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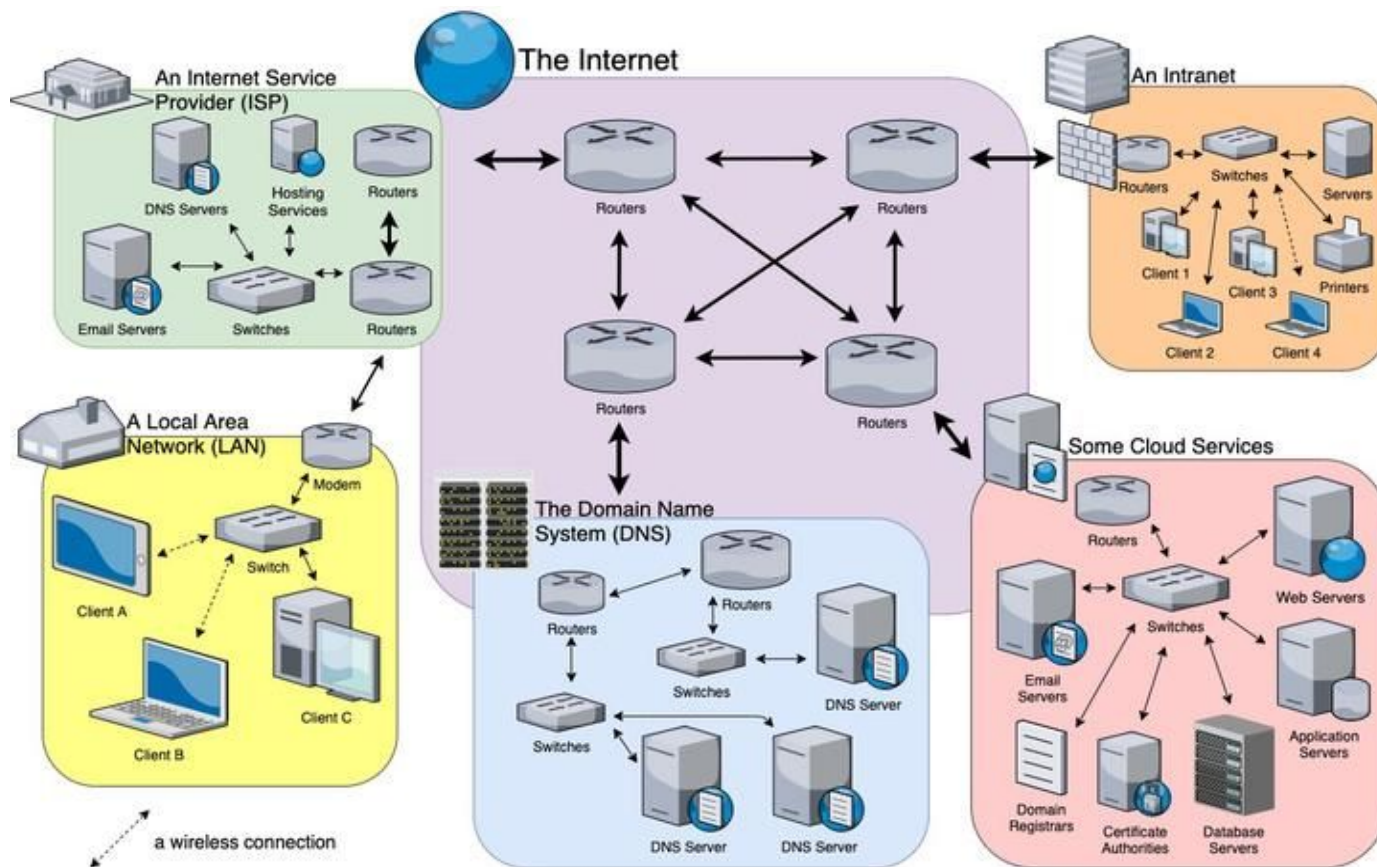
- Community networks (CNs)
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- eXO - *Description*
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Community networks (CNs): Background & motivation

- What is Internet?
 - “C’mon, I know, ‘the network of networks’”
- How do networks interconnect?
 - Peering (IXPs) vs. transit (NSPs)
- Which is the general structure of Internet?
 - Backbone, middle-mile, last-mile
- Who builds Internet? Who owns it? Who makes it work (operate)?
 - The States? The ISPs?
 - Who are the ISPs?
 - (Hint: in Western Countries the sector is liberalised)

... So, why not us, the people, the users?

The Internet Infrastructure: *a bird's eye view*



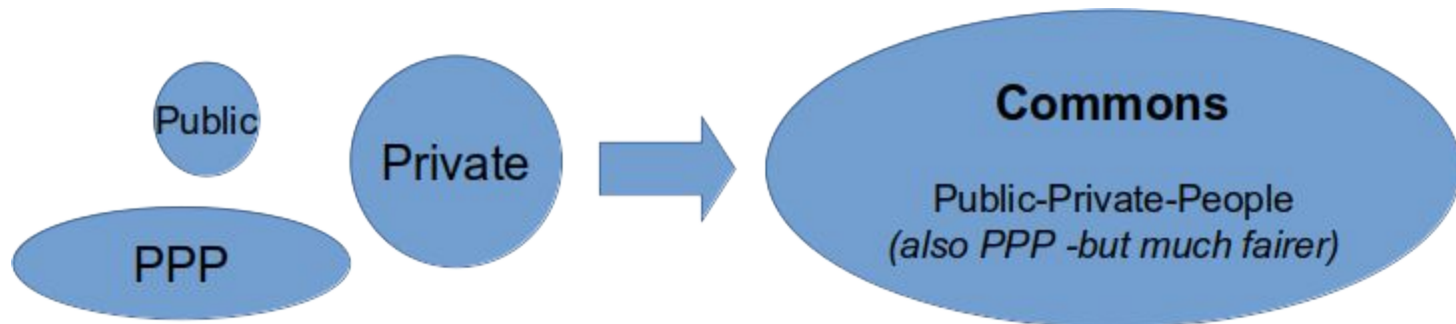
Source: <https://vahid.blog/post/2020-12-15-how-the-internet-works-part-i-infrastructure/>

Recommendation: read the whole blog post

Source: Vahid Dejwakh, 2020

Infrastructure models

- Well-known models:
- Public sector
- Public-private partnerships (PPP)
- Private sector
- As community network (CNs):



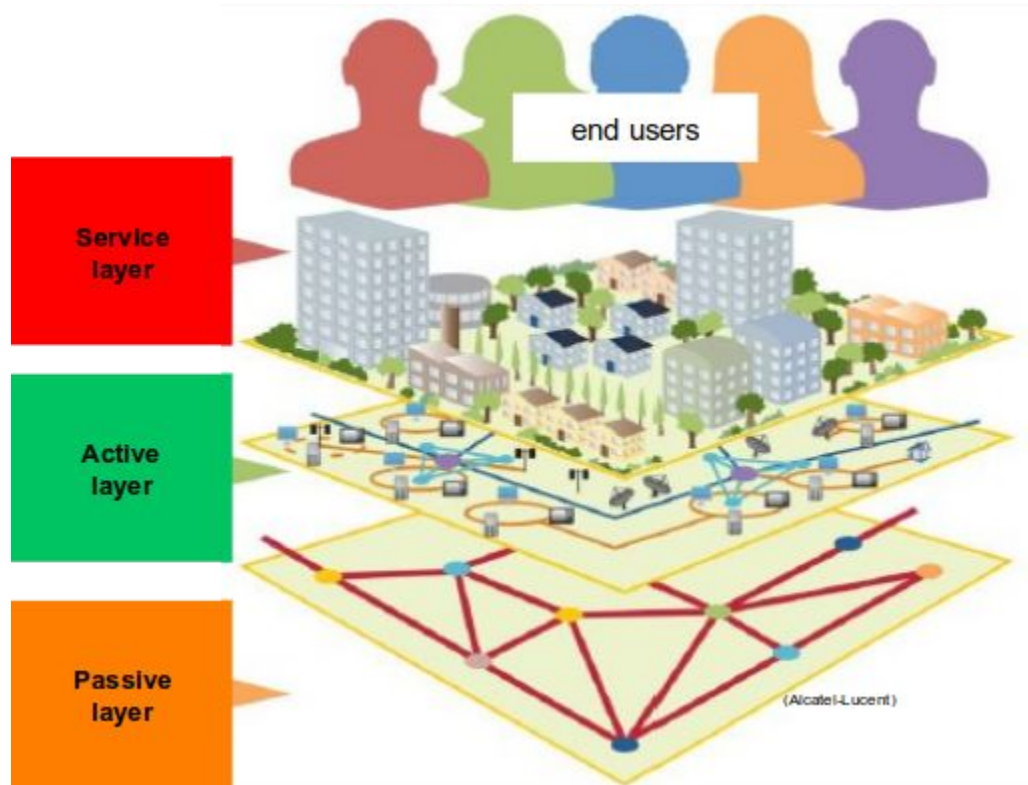
Research on infrastructure & the commons

- B. Frischman [4]
 - Infrastructure: “a particular set of resources defined in terms of the manner in which they create value”
 - Commons: “a resource management principle by which a resource is shared within a community ... on nondiscriminatory terms”
- G. Hardin [2]
 - “The tragedy of the commons” **OMG!!!**
- E. Ostrom [3]
 - “The 8 design principles for long-enduring Network infrastructure as a common-pool resources (CPRs)” **Hooray!!!**

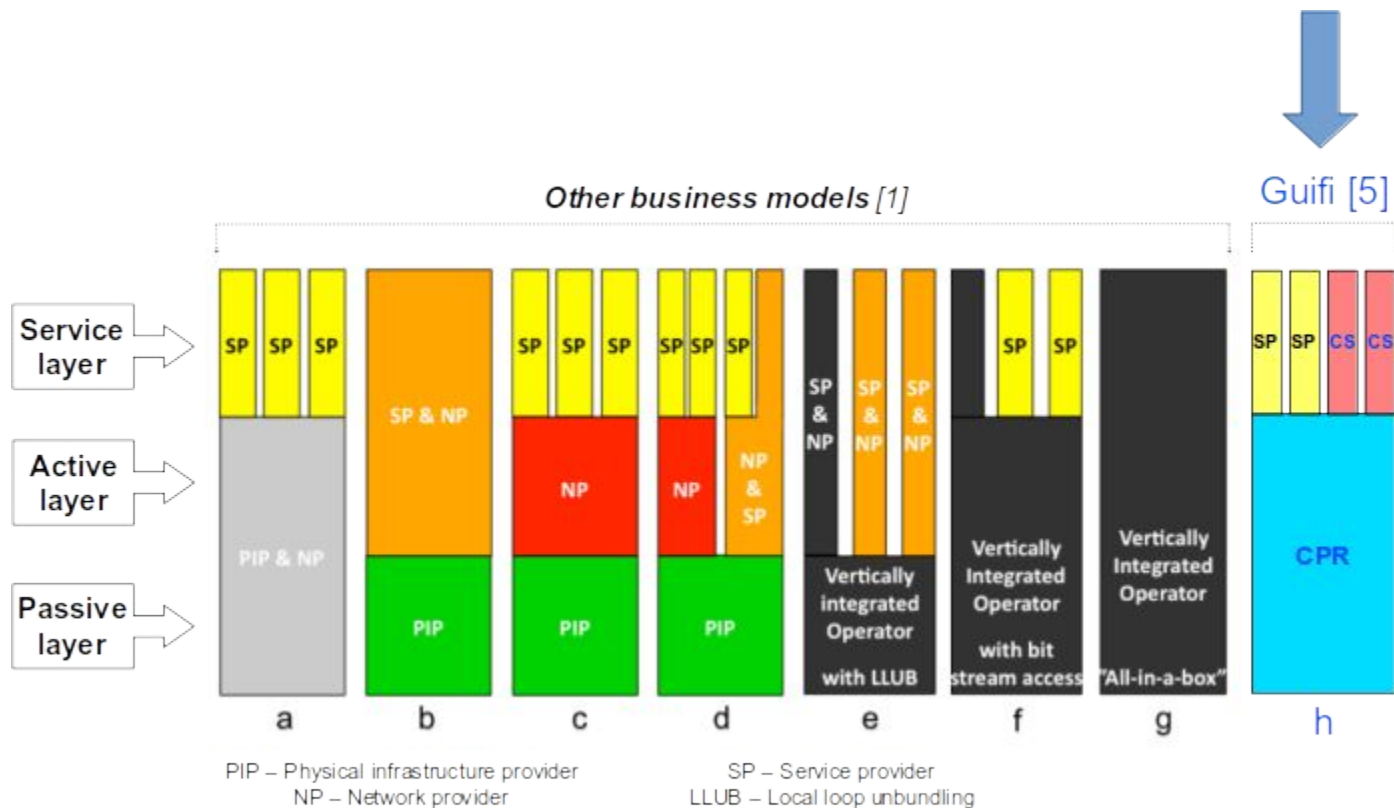
Commons-driven vs. Privately-driven

	Commons (CNs)	Private sector
Objective	Maximisation of the size and use of the shared good (social benefit)	Maximisation of the profit of the investors
Manages	Common-pool resources	Private goods & exclusive rights
Strategy	Optimisation of cooperation	Maximisation of the market-share (become a monopoly, ideally)
Investment	Long-term, collective	Short-term, speculative
Governance	Self-governance, self-regulation	Needs external legislation and regulation
Governance	Cost-oriented, inclusive, sustainable, redistributive, local	Directional pricing, extractive, market failures, speculative, transnational

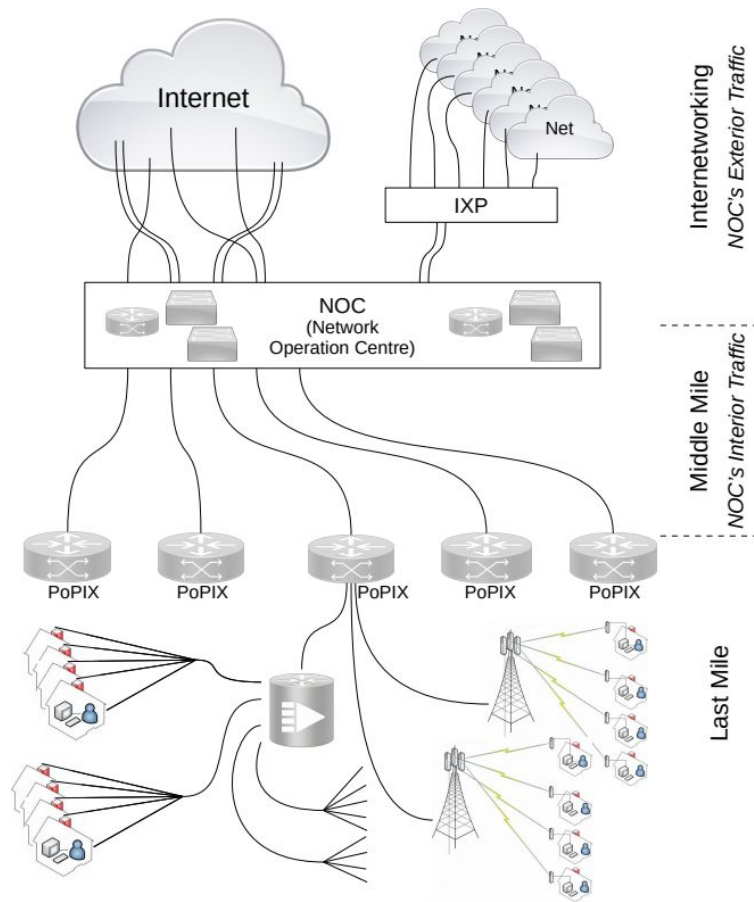
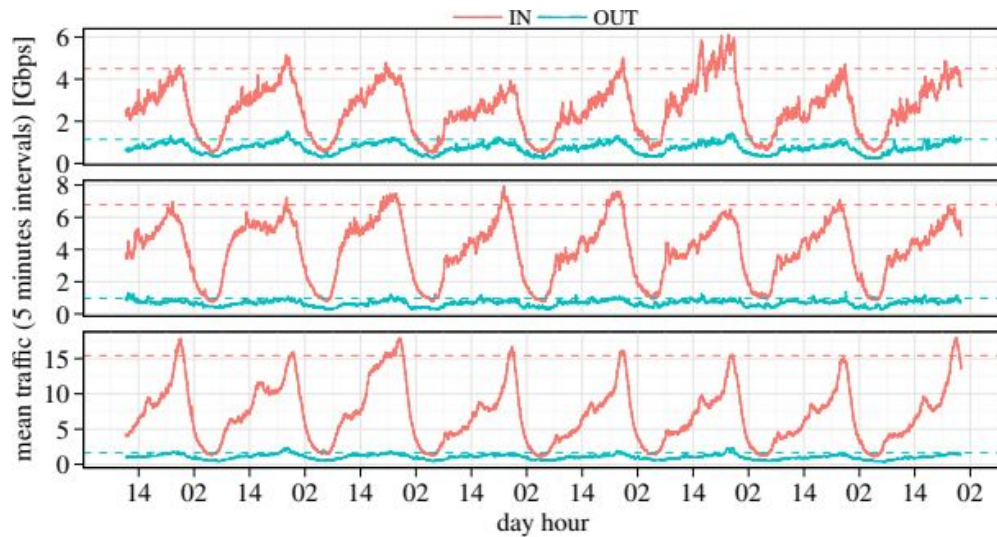
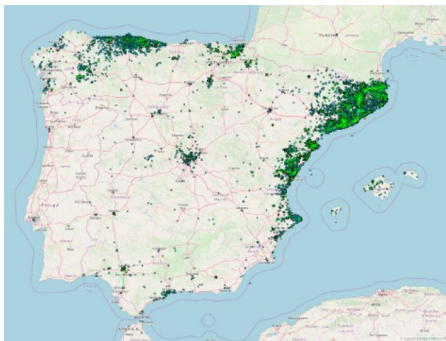
Infrastructure (network) layers



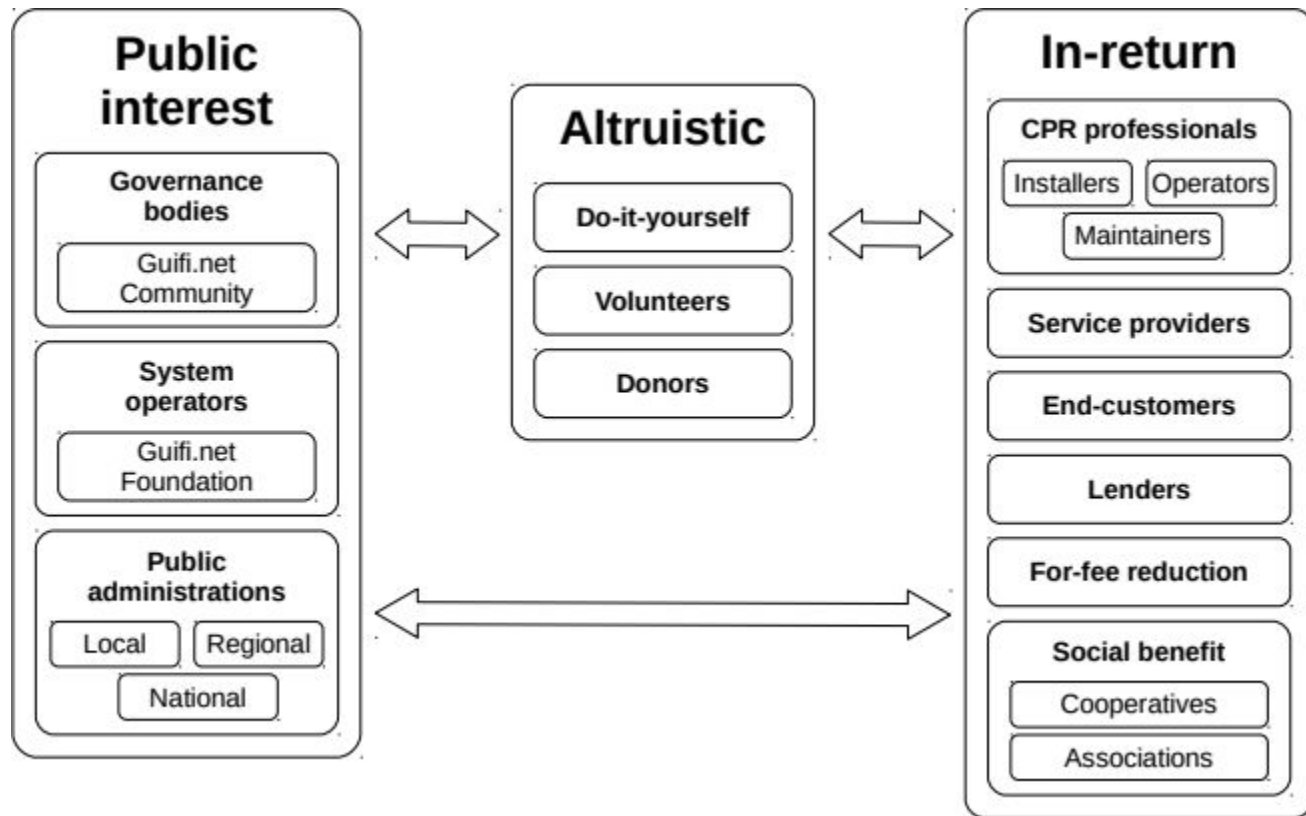
Business models [1]



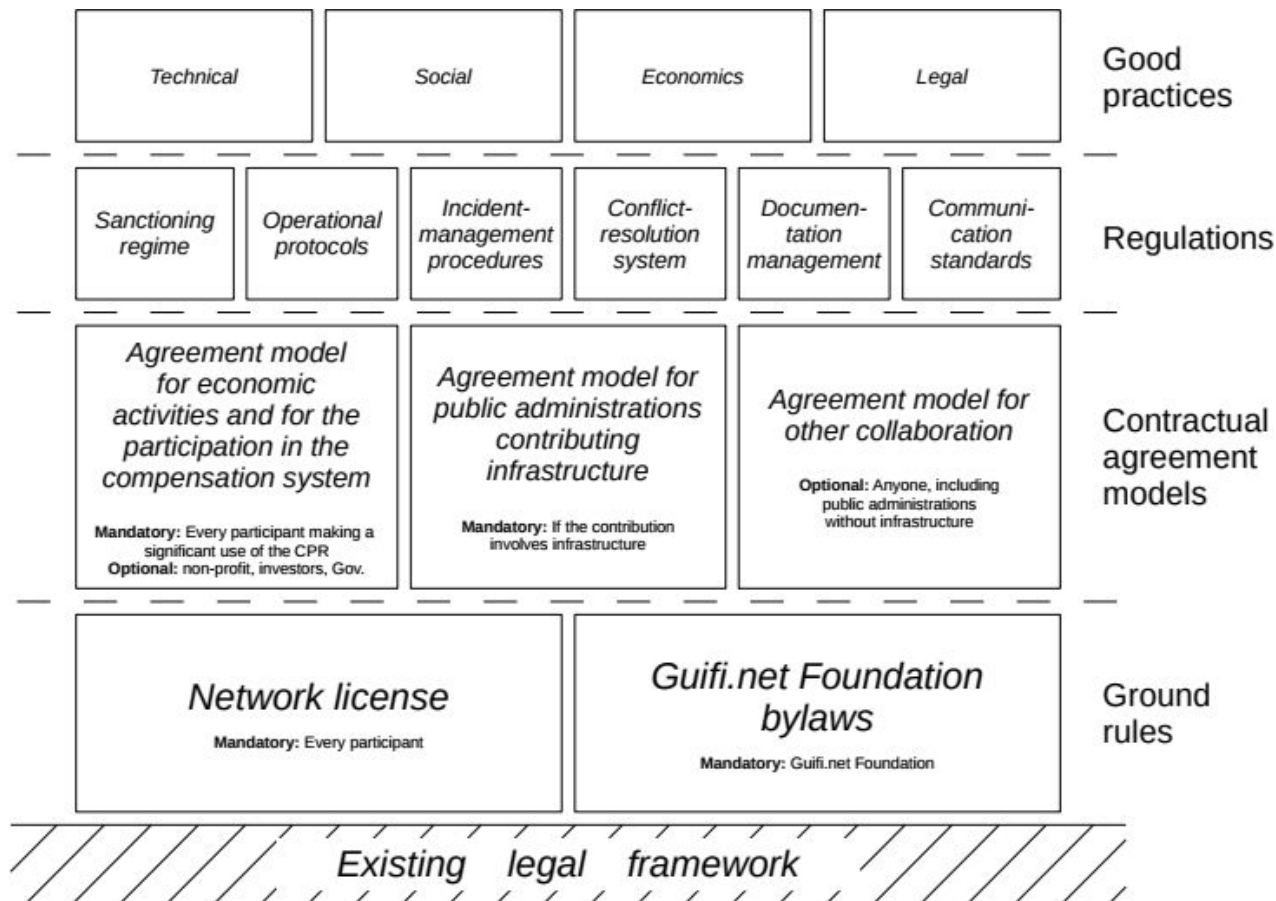
guifi.net Success indicators (2017)



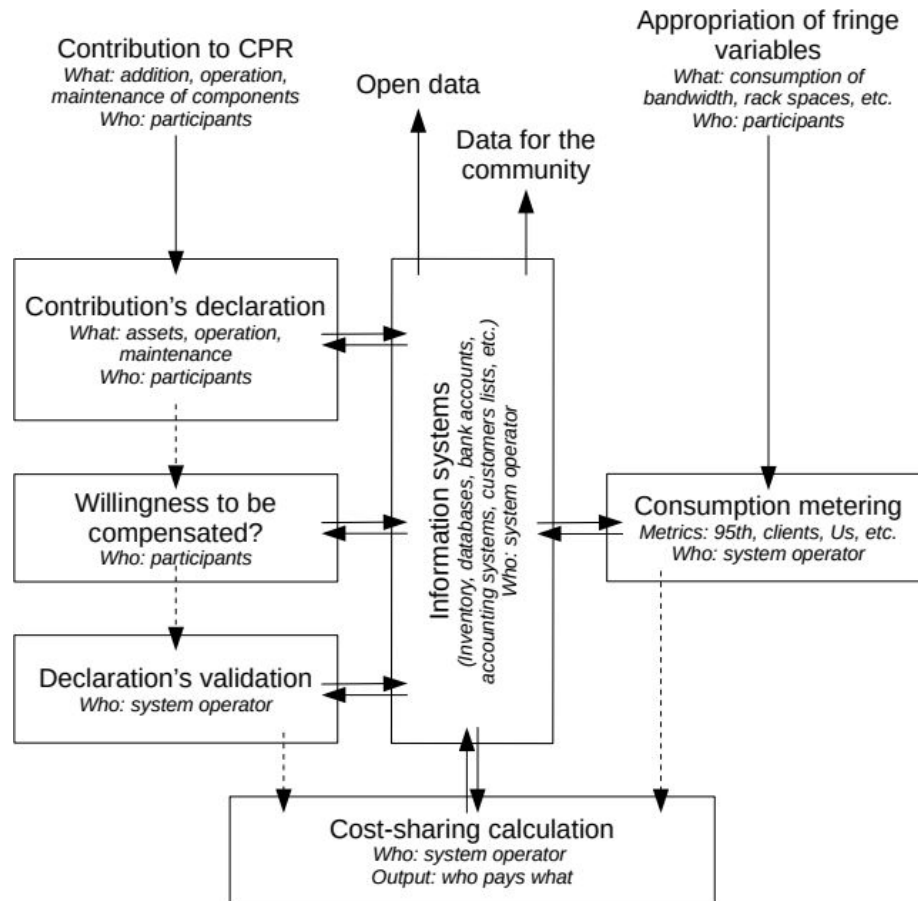
Stakeholders



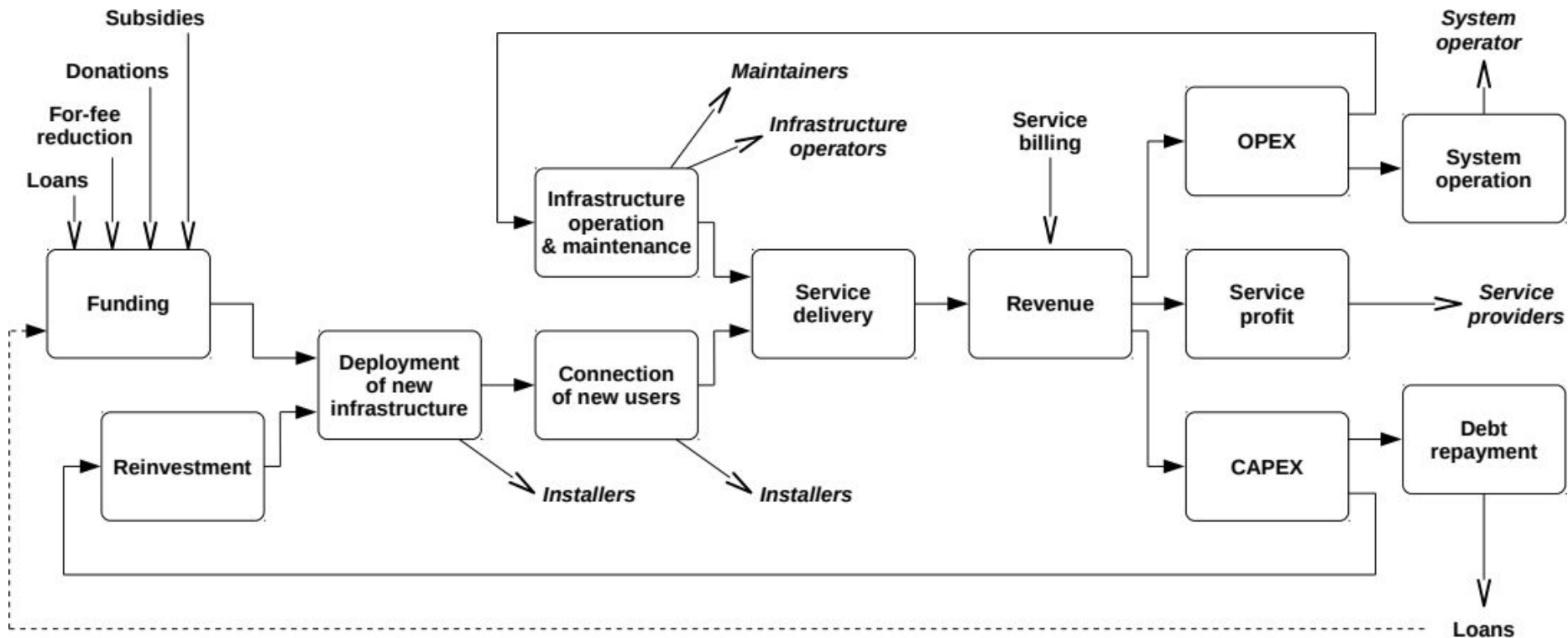
Internal regulation (self-regulation)



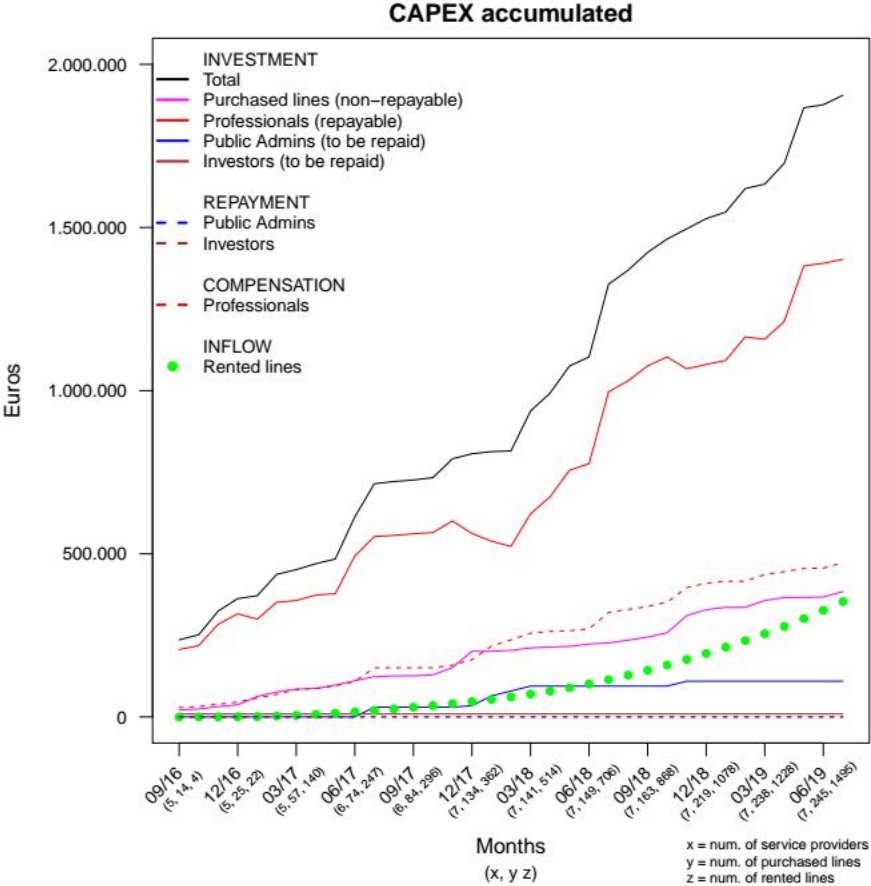
Cost-compensation system



Financial flows



Example of Capital expenditure (CAPEX)



Evolution over time: 2003–2019, the heyday

YEAR	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
FACTS	PROJECT INCEPTION <ul style="list-style-type: none">VolunteersCommunity empowermentWiFi technology			WEBSITE <ul style="list-style-type: none">MapsUnsolcllc (HW auto-conf)	WEBSITE <ul style="list-style-type: none">Crowdfunding	BAD PRACTICES <ul style="list-style-type: none">Some SMEs working below expectationsBad reputation for the whole project	PROFESSIONAL AGREEMENTS <ul style="list-style-type: none">Formalisation of duties to pursue a professional activity	ISPs: LACK OF COOPERATION <ul style="list-style-type: none">Not pooling services due to lack of collaborative tools and habits	ISPs: TRADE WAR, CARTELS, ETC. <ul style="list-style-type: none">Poor reportingLack of transparencyPrivate deployments	CONFLICT-RESOLUTION SYS. <ul style="list-style-type: none">DevelopmentActivation	SANCTIONING REGIME <ul style="list-style-type: none">DevelopmentActivation	DISINVESTMENT <ul style="list-style-type: none">Because CAPEX is not yet taken into account.	ISPs: JOINT LOBBY <ul style="list-style-type: none">Complaint about the cost-compensation syst. efficiencyAttempt to impose radical changes under threats of massive abandonment of the system	COMMUNITY <ul style="list-style-type: none">Identification as a major challengeReactivation of non-profit participantsJoint (for-profit, non-profit, Foundation, pub. adms.) long & fruitful discussionsOn-going work	COST-COMPEN. SYS. & OTHERS <ul style="list-style-type: none">Joint review startedOn-going work	ISPs: BREACH OF DUTY AGAIN <ul style="list-style-type: none">Old + new bad practices
	WEBSITE <ul style="list-style-type: none">Initial version															
	FIRST PUBLIC AdMs <ul style="list-style-type: none">Village councils to fight lack of InternetLocal public funds for supernodesInternet via proxy connected to precarious DSLs			ISPs: INITIAL ECONOMIC ACTIVITY <ul style="list-style-type: none">Local SMEs to carry out Councils' projects and to connect end-usersInitial Internet access delivered by ISPs as a service (using DSLs)	DISINVESTMENT <ul style="list-style-type: none">Due to lack of reinvestment. Strong competition in prices does allow ISPs to maintain the existing network mostly deployed by volunteers and public funds	COST-COMPEN. SYS. <ul style="list-style-type: none">At carrier houseCost orientedCosts shared according to resource usage	COST-COMPEN. SYS. <ul style="list-style-type: none">OPEXPer PoPIX	ECONOMIC ACTIVITY AGREEMENT <ul style="list-style-type: none">Mandatory for all professionalsEnforcing participation in the cost-compensation sys.Commitment based commons								
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Evolution over time: from 2019, decadence & revamp?

- Facts

- 2019–21: (coordinated?) offensive by the largest ISPs
 - Representing over 90% of the bandwidth and infrastructure
- 2020–ongoing: Several lawsuits ISPs vs. the Foundation

- Personal thoughts on the Foundation mistakes

- Alienation from the community
 - due to its focus on ISPs in previous years
- Shifts in economic and financial policies
 - End of participation in European research projects
 - Shift from a zero-debt policy to an over-indebtedness policy
 - Excessive Personnel

- 2024 onward

- Foundation: new board members
- Foundation: attempt to dismissal lawsuits against the ISPs by agreement between the parties
- Community: still engage

eXO: a Commons-based Community Network Internet Service Provider, Description and Subscribers Usage Patterns

Roger Baig^a, Llorenç Cerdà-Alabern^{a,c}, Pedro Vílchez^{a,c}, Efraín Foglia^{b,c}

^a*Universitat Politècnica de Catalunya, Spain*

^b*Universitat Oberta de Catalunya, Spain*

^c*Associació Expansió de la Xarxa Oberta (eXO), Spain*

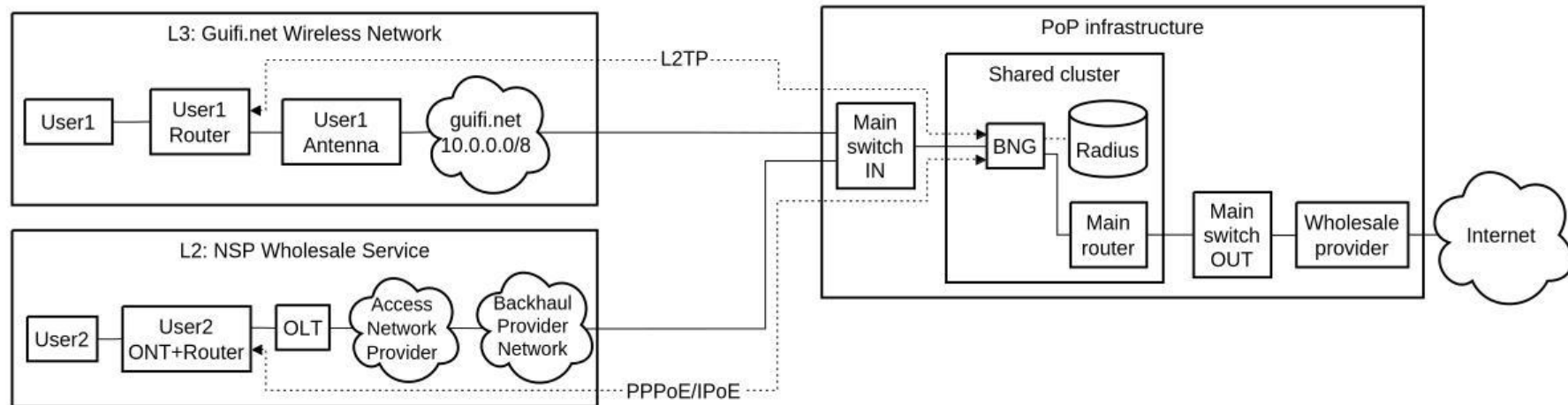
Computer Networks, Volume 254, 2024, 110765, ISSN 1389-1286,
<https://doi.org/10.1016/j.comnet.2024.110765>.

Description

- Association (non-profit)
- Since 2009
- Based in Barcelona
 - Catalan & Spanish legal framework
- Members: ~50
 - Including 3 associations
- CN under guifi.net umbrella
- Member of other local associations
- RIPE member
 - LIR (since 2019)
- Registered at the Spanish Telecommunications Registry

- Core activities:
 - Self Provisioning of
 - Internet connectivity
 - Digital services
 - Execution of projects
 - NGOs
 - Public administrations
 - but also for for-profit enterprises
 - Dissemination of CNs
 - DYI
- 2002 budget:
 - ~30.000 EUR
 - ~120.000 EUR

Network architecture



Subscribers Usage Patterns

- Objectives

- Characterize subscribers' Internet usage, and
- Detect possible differences due to
 - social origin, i.e., regular vs. subsidized users, or
 - type of access, i.e., Wi-Fi (1–50 Mbps) or fiber optic (300 Mbps).

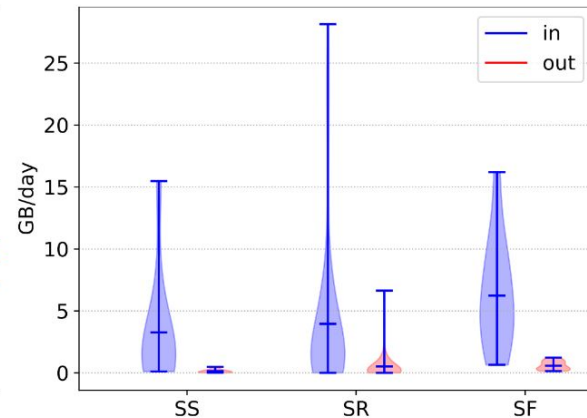
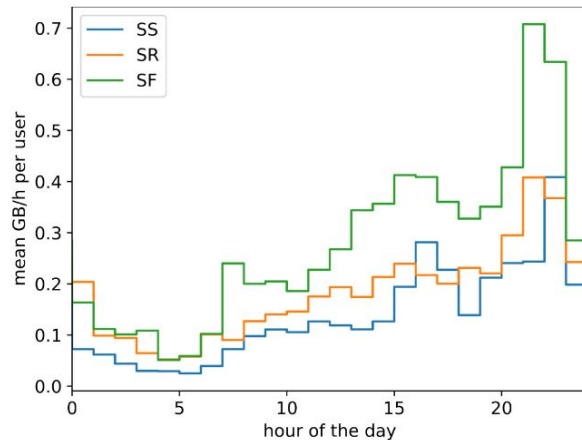
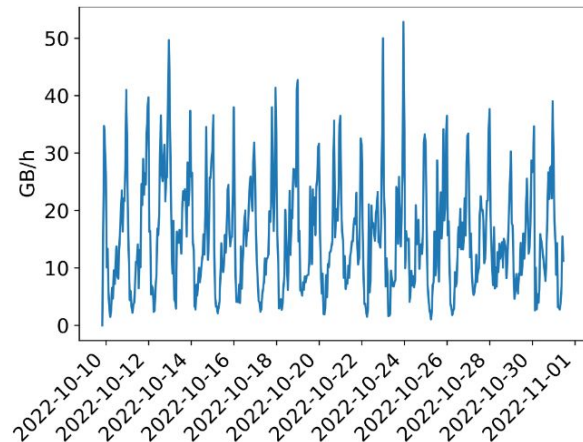
- Data gathering

- NetFlow traces from the Main router
- Unsamed NetFlows (src IP, dst IP address, src port, dst port, protocol)
- 21 days (October 2022)
- 17 GB of LZO1X-1 compressed data
- Dataset not published to protect the privacy of the subscribers.
- Traffic exchanged by 81 different subscribers (S)
 - social subscribers (SS), who reach the eXO's router using optical
 - fiber, and regular subscribers, who reach the eXO's router by radio (SR), and
 - optical fiber (SF).

- Data processing

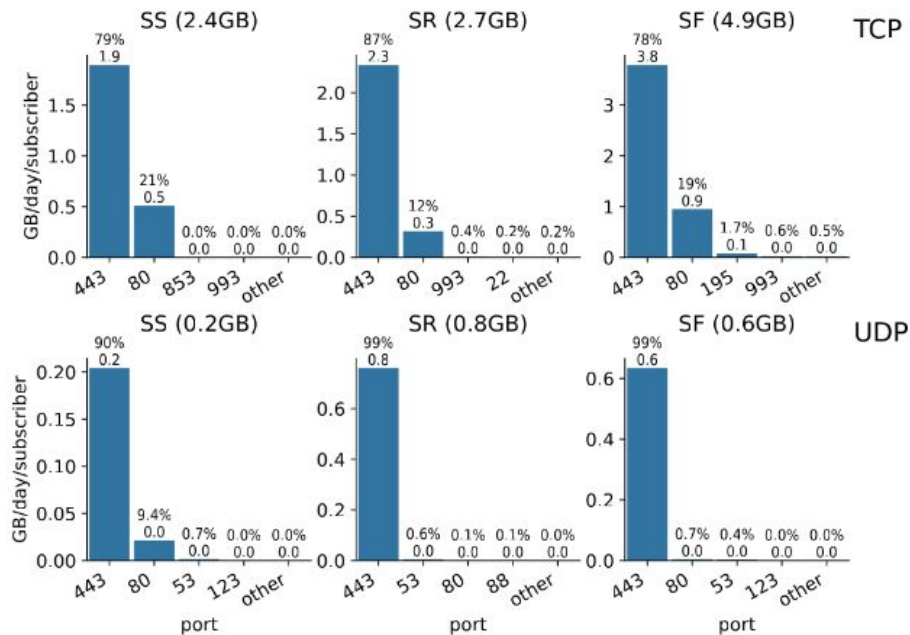
- nfdump

Traffic volume and Classification

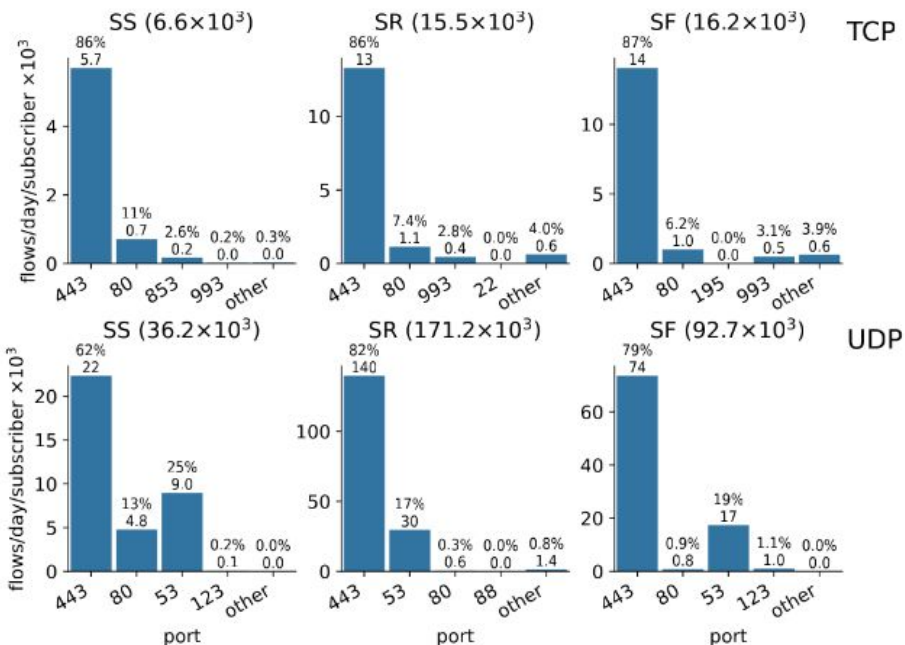


	S	IPv4	IPv6	TCP		UDP		other	
				in	out	in	out	in	out
SS	10	3.4	1.2×10^{-5}	3.0	9.6×10^{-2}	0.3	4.7×10^{-2}	2.4×10^{-4}	6.0×10^{-4}
SR	58	4.5	6.7×10^{-6}	2.8	0.3	1.2	0.2	4.5×10^{-3}	5.2×10^{-3}
SF	13	6.8	1.5×10^{-6}	5.1	0.3	1.1	0.3	9.4×10^{-3}	8.6×10^{-4}
S-sum	81	4.7	6.5×10^{-6}	3.2	0.3	1.1	0.2	4.8×10^{-3}	4.0×10^{-3}

TCP/UDP internal traffic

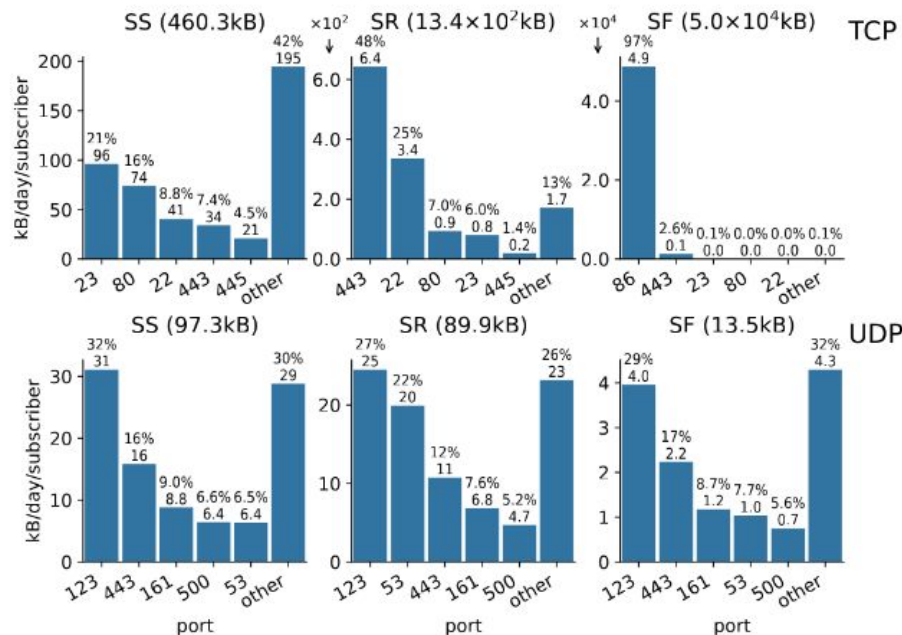


(a) Traffic

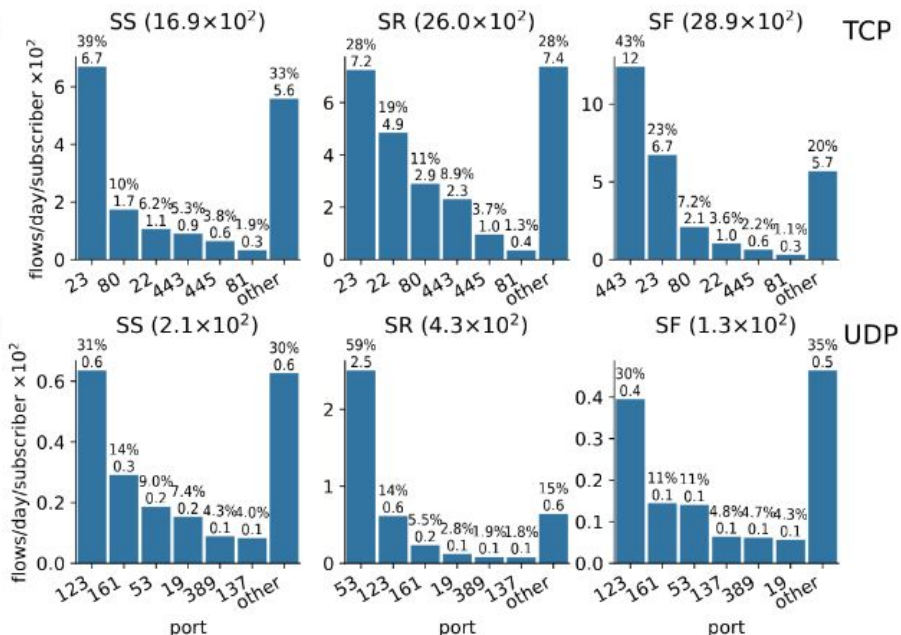


(b) Flow count

TCP/UDP external traffic

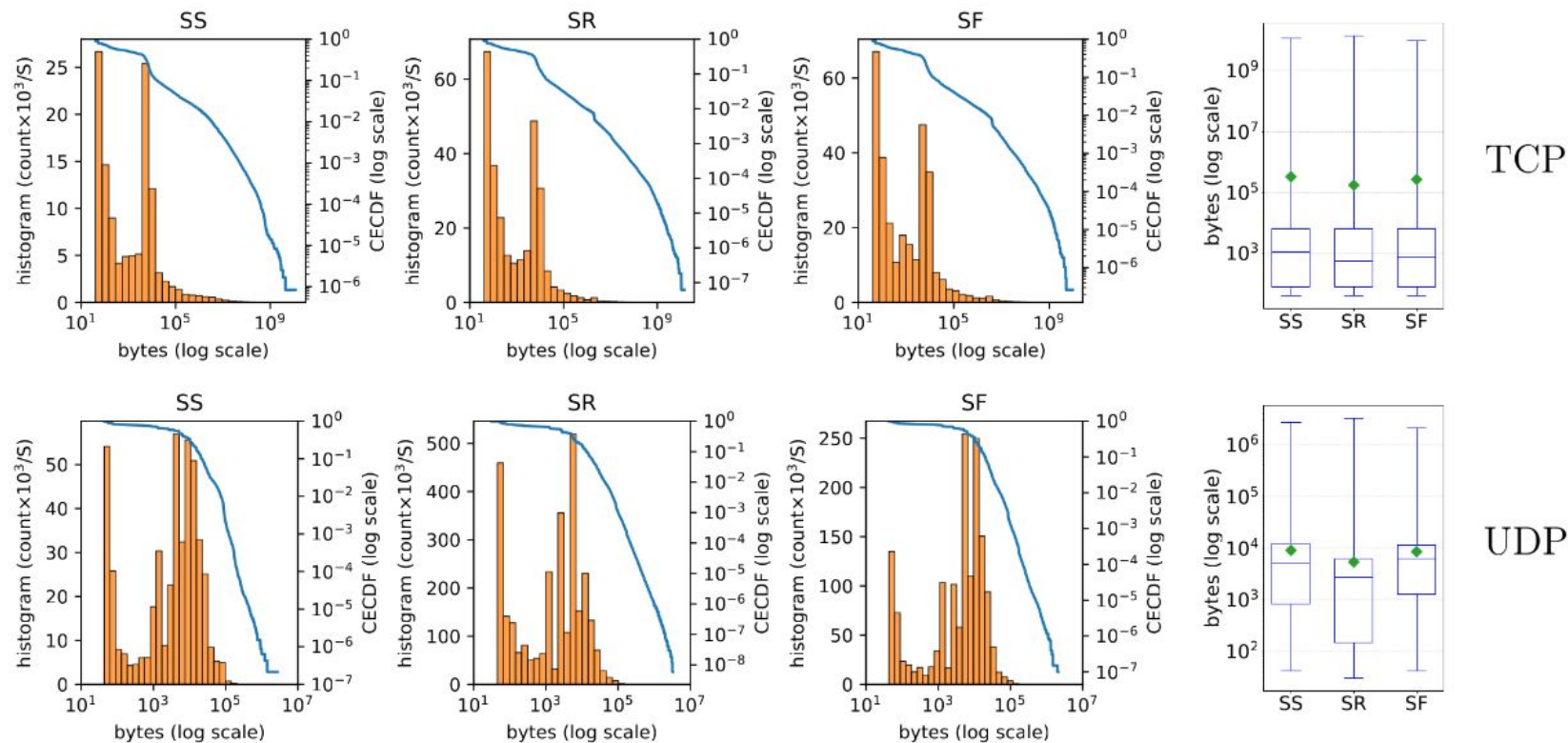


(a) Traffic



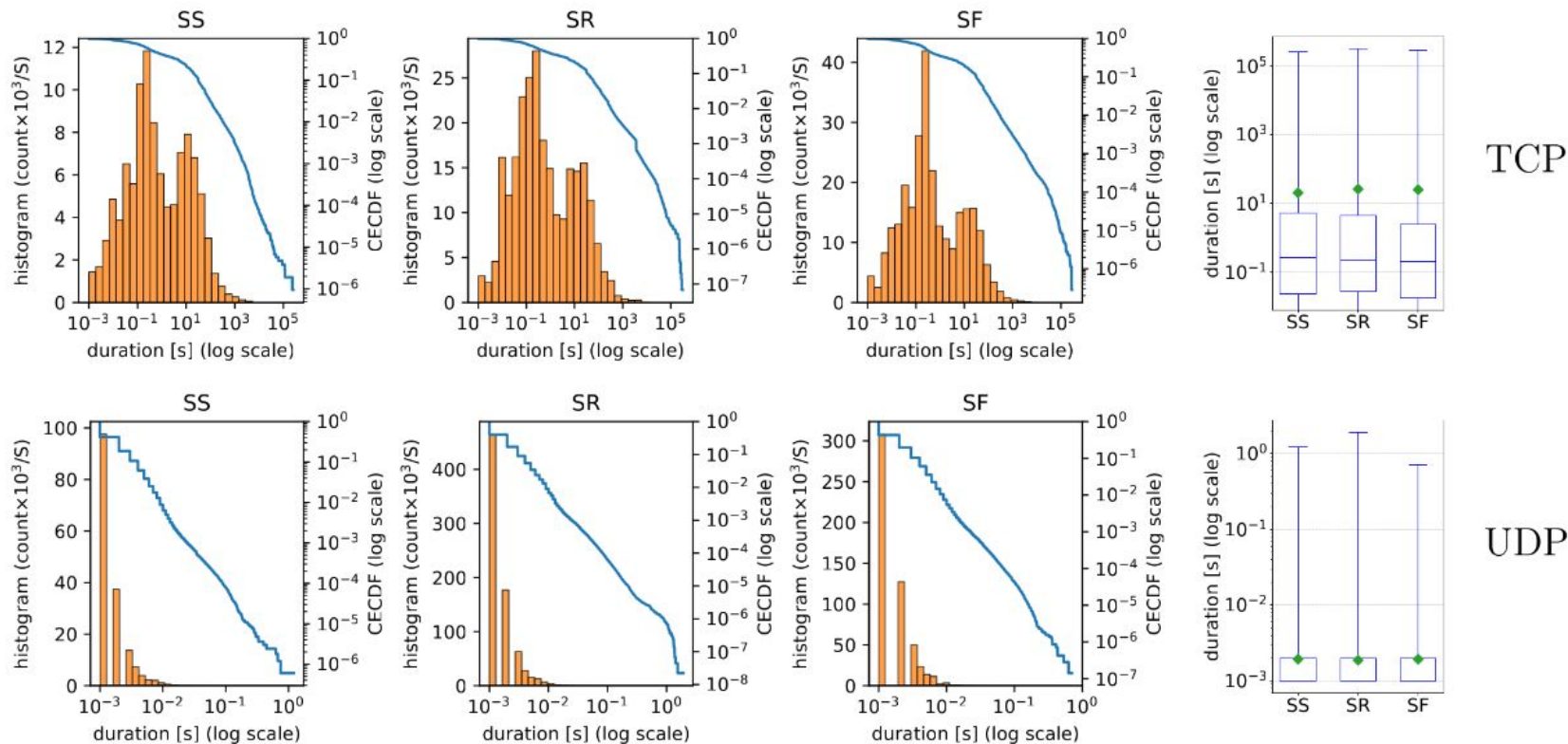
(b) Flow count

HTTPS traffic distribution



(a) downloaded bytes per HTTPS flow

HTTPS traffic distribution



(b) duration of HTTPS flows

Type of services based on IP addresses

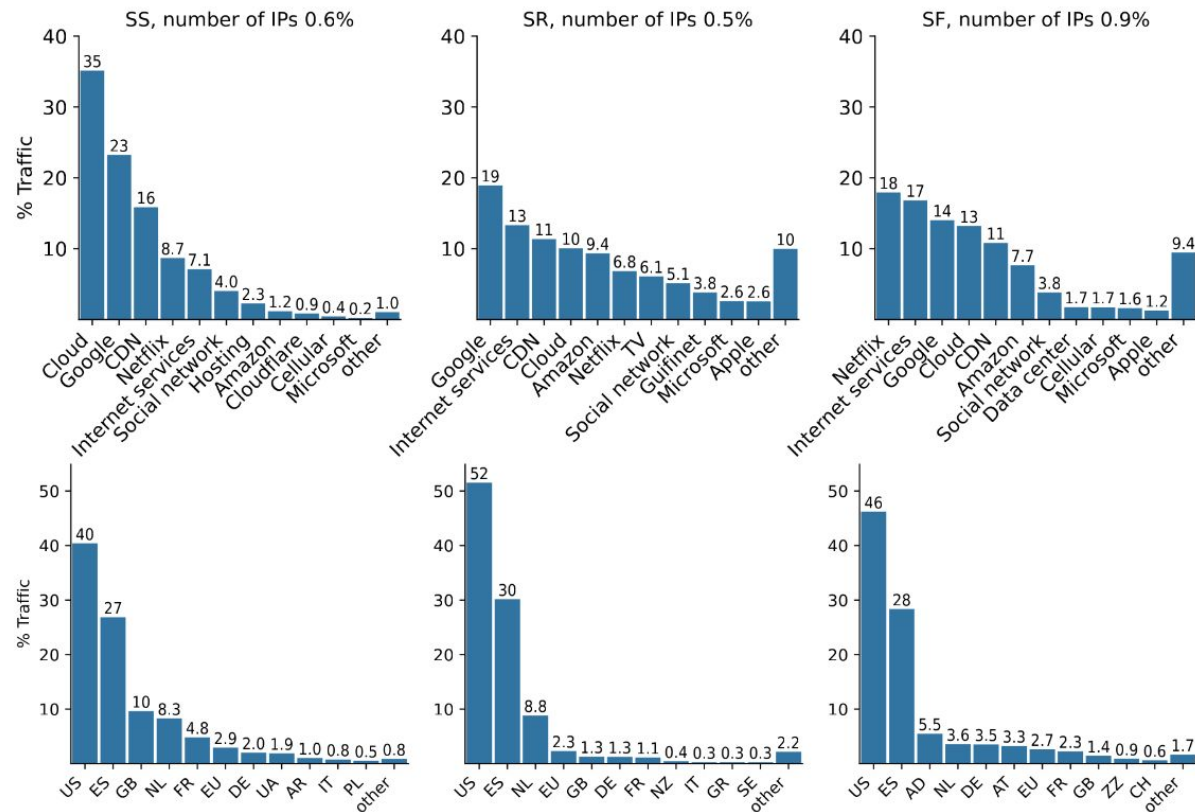


Figure 9: Classification of IPs carrying 95% of traffic by activity (top) and country (bottom).

Type of services based on IP addresses

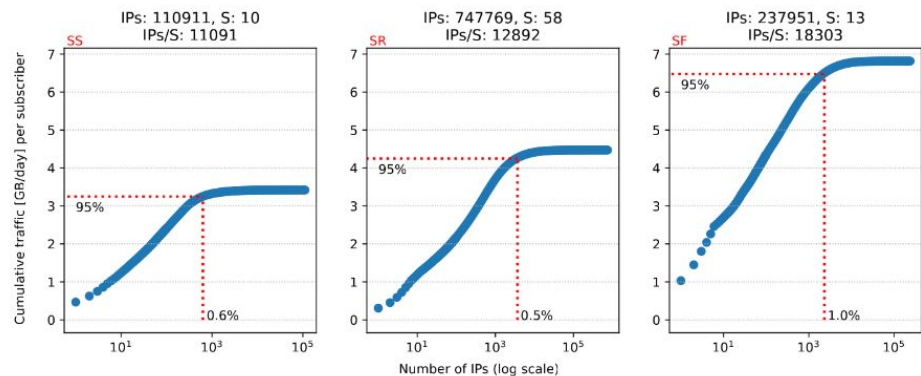


Figure 8: Number of different IP addresses sorted by decreasing traffic.

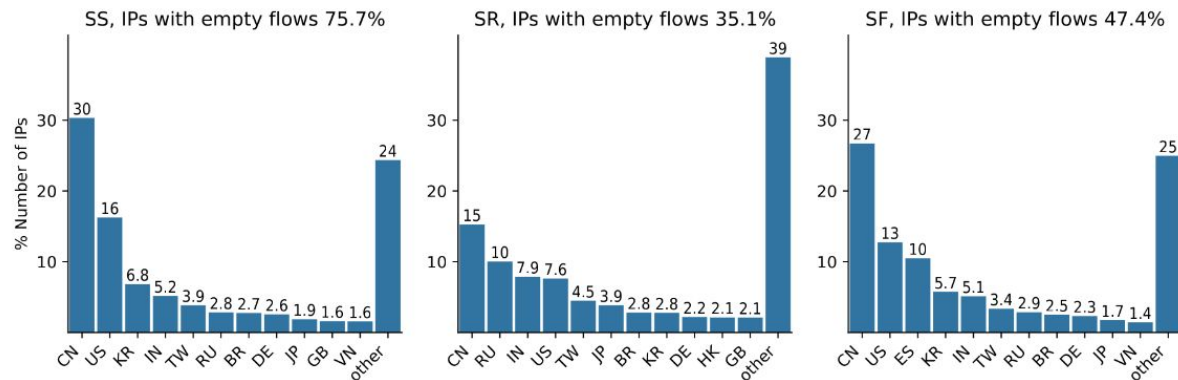


Figure 10: Classification of IPs with empty flows by country.

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