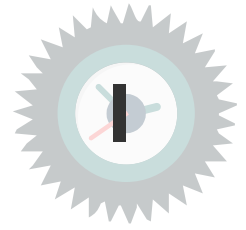


Centralization and decentralization of the Internet

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Introduction: when a Gafam gets down or becomes evil...



1. #googledown (2020)

14th of december 2020, Google services shutdown for a few hours...

- BBC. « Google Outage: YouTube, Docs and Gmail Knocked Offline ». BBC News, 2020-12-14. <https://www.bbc.com/news/technology-55299779>.

Twitter : #googledown until:2020-12-15 since:2020-12-14 lang:en

« I went to Google to ask how to solve an error... But Google was itself down from an error »

User stories

« @covid19indiaorg Google services briefly disrupted today. Student with limited access to internet/electricity/device, trying to attend online classes: "My daily story". »

« @RugbyBarrister Listening to stories of Google customers (who have gone full Google mode at home with the home app) unable to turn on/off their lights today. »

« @drisso1893 TFW you spend 10 months organizing a conference and the only thing that you did not consider is Google being down preventing your attendees to sign onto the platform! #googledown #disasteraverted #EuroBioc2020 »

Panicking...

« @cykwek77 @googlecloud Your links do not work. Is there any number that I can call or any live chat that I can reach for assistance? »

« @JohnnyICS @googlecloud After the DOWN of 14.12.2020 I can no longer log into my Gmail. I get response ad if it no longer existed, as if it had been deleted. Will the error really be "temporary"? H E L P !! »

« @Mubashirshafi @googlecloud Getting notifications for password breach. Do I need to worry about it? »

Joking...

« @shashishankar Today, after years of wanderlust, my searched for life's meaning was about to end and at the same moment #Google came down. »

« @Surbhi_Vedi Maybe #google is trying to teach us a lesson- it provides us access to infinite information for free, yet some of us make ill-informed decisions all the time. »

« @Cleobatta Here's a theory: Google was down on purpose as a social experiment to motivate the visibility of its value and impact. They're measuring our future willingness to pay for their services. »

Thinking...

- « @KrishnamHQ Google just tested it's effect on humanity. The might have switched off the services for sometime and might be laughing at the back enjoying the chaos. We should understand and realise how these tech giants can do to humanity. #techfiction #googledown »
- « @pzwsk Google is an infrastructure (web) relying on another infra (internet) relying on another infra (electricity) and all those infra are there because we have the power to move things (oil). You are excited about #googledown? You are going to enjoy #peakoil ... »
- « @CoinDesk This morning was a jarring reminder of the hidden costs of the easy-to-use, centralized systems that permeate the web. #googledown »

2. #facebookdown (2021)

Facebook's Apps Went Down. The World Saw How Much It Runs on Them.

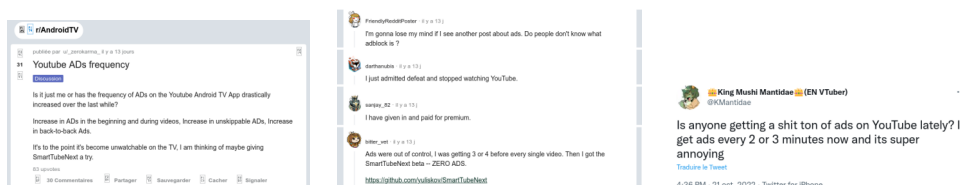
Raymond Zhong and Adam Satariano, 2021, Facebook's Apps Went Down. The World Saw How Much It Runs on Them, The New York Times. <https://www.nytimes.com/2021/10/05/technology/facebook-down-ig-down-whatsapp-down.html>

- « The Facebook outage on Monday was a planetary-scale demonstration of how essential the company's services have become to daily life. Messenger have long been more than just a way to chat and share photos. They are critical platforms for doing business, arranging medical care, conducting virtual classes, carrying out political campaigns, responding to emergencies and much, much more. »
- «
- In Mexico, politicians were cut off from their constituents.
 - In Turkey and Kenya, shopkeepers couldn't sell their wares.
 - And in Colombia, a nonprofit organization that uses WhatsApp to connect victims of gender-based violence to lifesaving services found its work impaired.
- »

3. #youtubeads (2022)



Don't be evil was Google's motto till 2018 (en.wikipedia.org¹).



Youtube ads frequency increase

YouTube tests users' tolerance for ads

- « YouTube is trying to figure out exactly how many ads its users will tolerate before heading elsewhere. Some social media users in recent weeks have complained about seeing eight or even 10 consecutive unskippable pre-roll ads; before a video begins, YouTube typically will display two pre-roll ads. (Goldman, 2022) »

1. https://en.wikipedia.org/wiki/Don%27t_be_evil

« We like to think of Bumper ads as [a quick and fun format and as] little haikus of video ads – and we're excited to see what the creative community will do with them. (Lupier, 2016) »



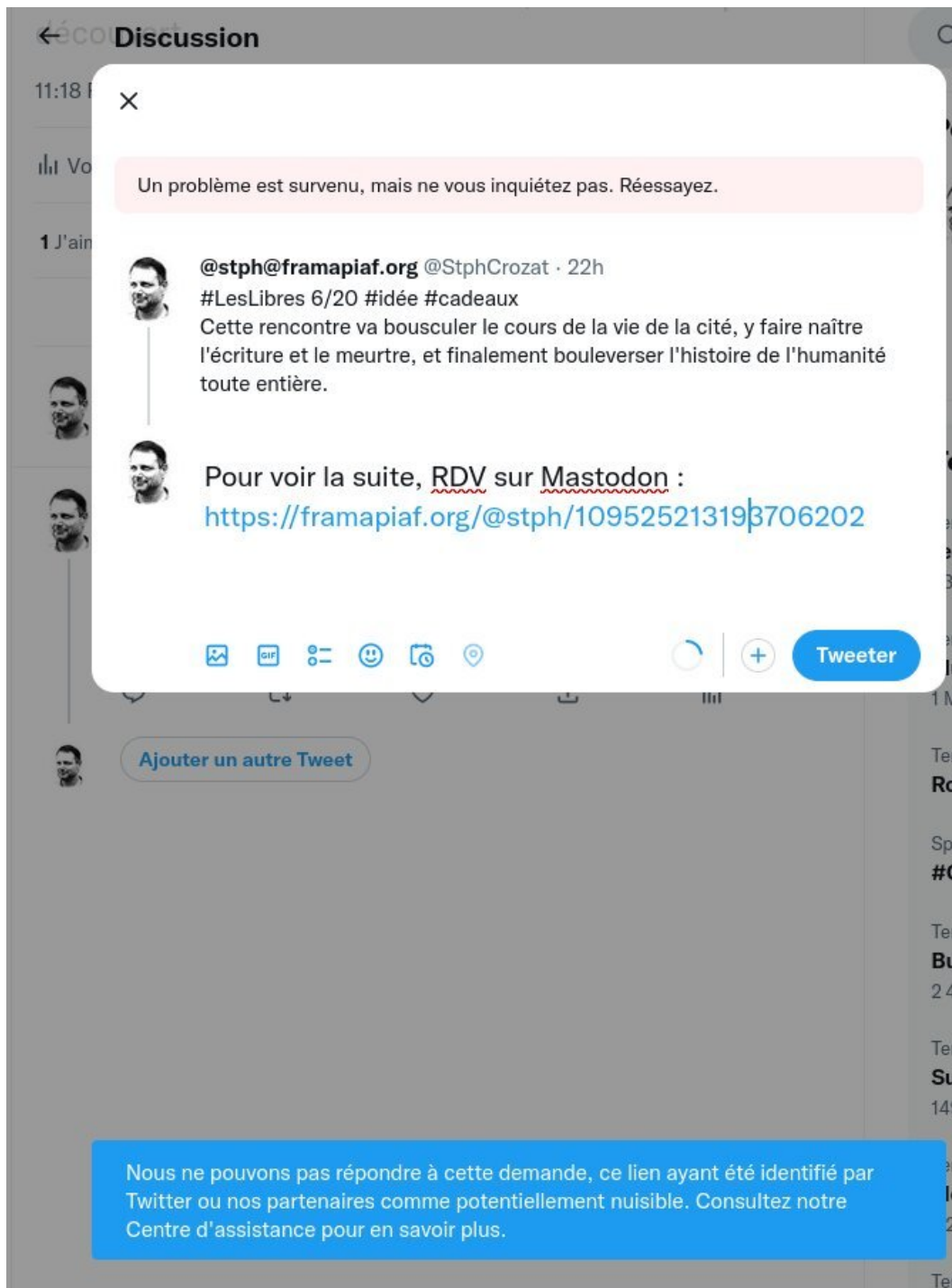
Goldman, Jeremy. 2022. « YouTube tests users' tolerance for increased ad loads ». Insider Intelligence eMarketer (blog). 2022. <https://www.insiderintelligence.com/content/catherine>.

Lupei, Zach. 2016. « Built for Mobile: Bumper Ads Drive Incremental Reach and Frequency, Particularly on Smartphones ». Google Ads & Commerce Blog (blog). 2016. <https://blog.google/products/ads/bumper-ads-drive-incremental-reach-and-frequency/>.

Rey, Nancy. 2022. « YouTube Free teste discrètement 5 publicités, au lieu de 2, avant le début de votre vidéo ». Developpez.com (blog). 2022. <https://www.developpez.com/actu/336604/YouTube-Free-teste-discretement-5-publicites-au-lieu-de-2-avant-le-debut-de-votre-video-la-fonctionnalite-est-en-cours-d-e-test/>.

4. #musk (2022-2023)

Mastodon censured (2022)



Twitter blocks users from sharing Mastodon links

◀ Mastodon is divided into groups, called servers, based on many topics including the UK, snooker, and security.

Twitter has blocked links to some of the largest servers which users would join, including the most popular "social" channel.

And Twitter is also stopping users from adding links to their Mastodon account in their bios - calling them "malware". ▶

Tom Gerken, december 2022, BBC News. [bbc.co.uk](https://www.bbc.co.uk)²

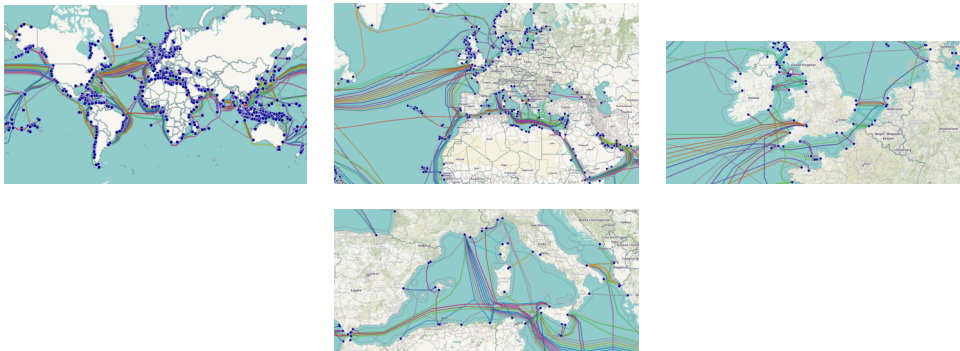
². <https://www.bbc.co.uk/news/technology-63999452>

How does Internet works and how can everyone be a part of it ?



1. Internet actors

Internet is cables



Carte des câbles sous-marins du réseau Internet

Internet Service Provider



An Internet Service Provider (ISP) is an organization that provides services for accessing, using, or participating in the Internet.

- An ISP serves as the access point and the router that provides a user access to everything available on the Internet.
- Internet services typically provided by ISPs can include Internet access, Internet transit, domain name registration, web hosting...

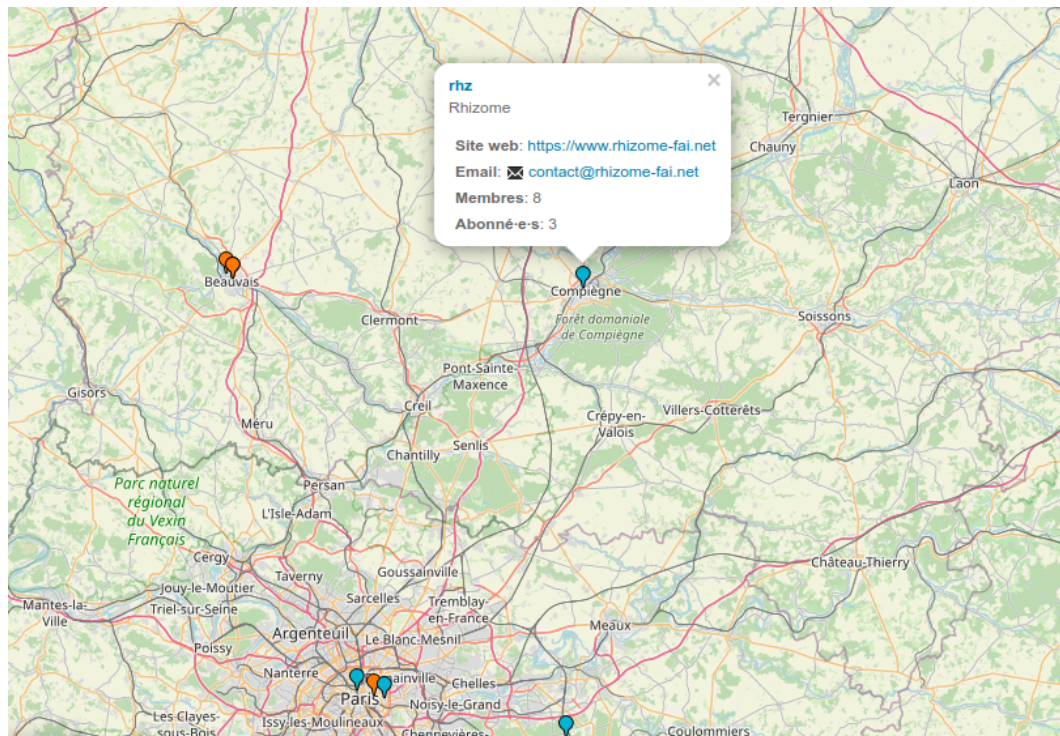
https://en.wikipedia.org/wiki/Internet_service_provider



- Internet service providers can be organized in various forms, such as commercial, community-owned, non-profit...
- Main commercial actors in France : Orange, Bouygues, SFR, Free, etc.
- In France, the FFDN³ is a federation that gathers more than 30 associations acting as ISP.

³. <https://www.ffdn.org/>

? Exemple



Rhizome, un FAI de la FFDN — rhizome-fai.net

Content and application providers

🔑 Définition

Any individual or organization that provides content and/or application to the other users, such as websites, mail access...

? Exemple

- GAFAM (Google, Amazon, Apple, Facebook, Microsoft).
- NATU (Netflix, Airbnb, Tesla, Uber)
- BATX (Baidu, Alibaba, Tencent, Xiaomi)
- Yandex

? Exemple

- Telegram
- Wikipedia
- ProtonMail
- Framasoft
- ...

Server

🔑 Définition

An Internet **server** is a computer connected to the Internet which provides services to other users, names **clients**.

How does Internet works and how can everyone be a part of it ?

- It hosts **services** (web pages, videos access, agenda, mails...).
- It serves other users answering their **requests**.

Internet hosting service



Définition

An Internet hosting service runs Internet servers for other users.

In France



Exemple

Gandi, OVH or Scaleway are Internet hosting service.

2. Internet network

Peering



Définition

Peering is an interconnection of separated networks : each actor gives access to its network to the other.

Transit



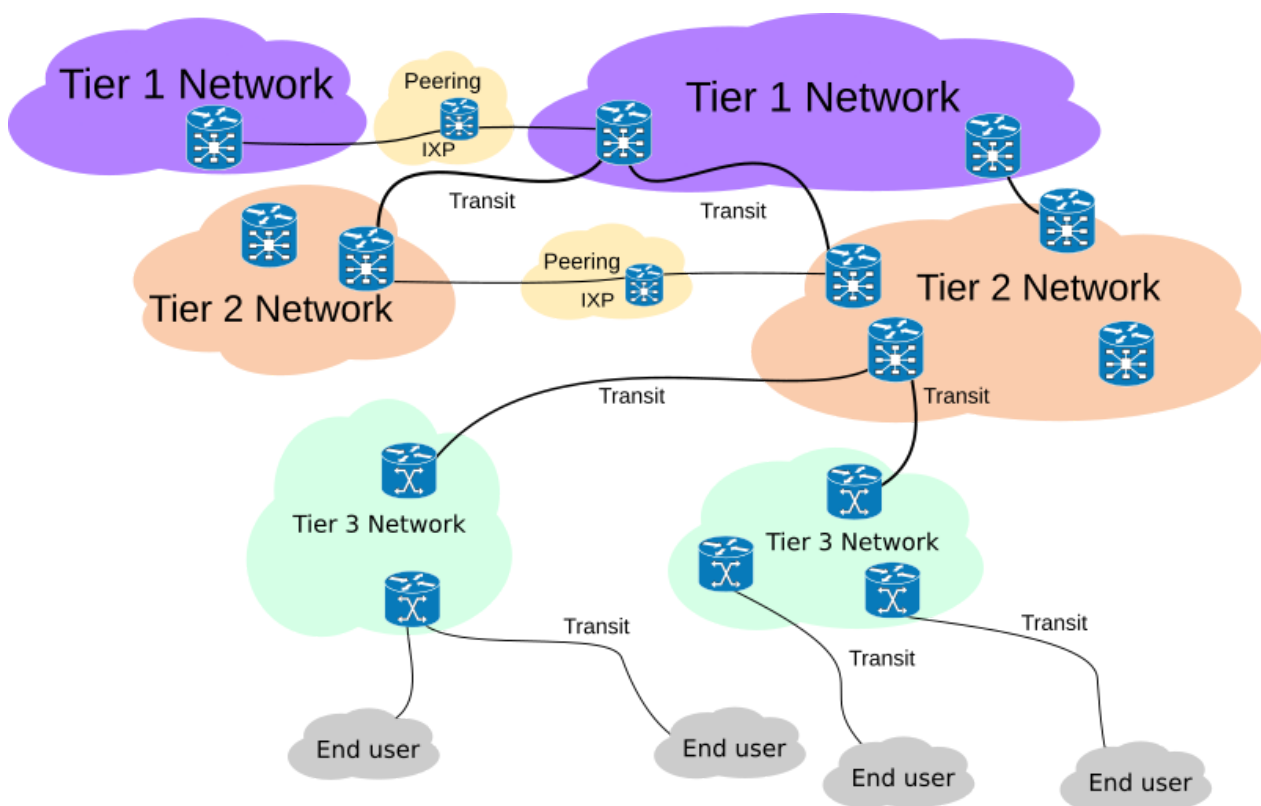
Définition

Transit is a way for a small actor to buy access to a bigger actor.

Classement des opérateurs d'Internet



Définition



Transit et peering entre opérateurs Internet de niveau 1 à 3

- Tier 1 : transit with other tier 1 actors.
- Tier 2 : peering and transit from tier 1 actors.
- Tier 3 : transit only

Consulting a Wikipedia page from a home computer

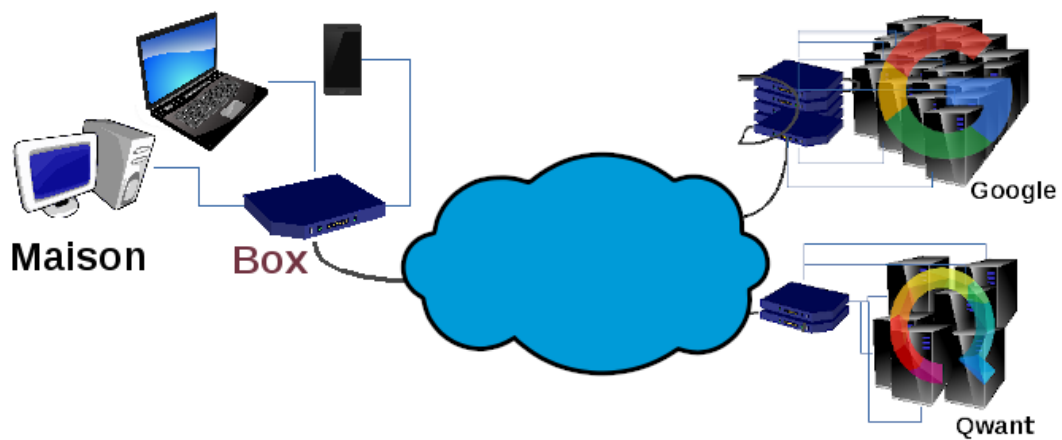
? Exemple

- Local computer (client)
- → Box
- → ISP network (generally tier 3)
- → other networks by transit and/or peering
- → ISP network which connect Wikipedia server
- → Wikipedia server

3. Internet machines

Server and clients

🔑 Définition

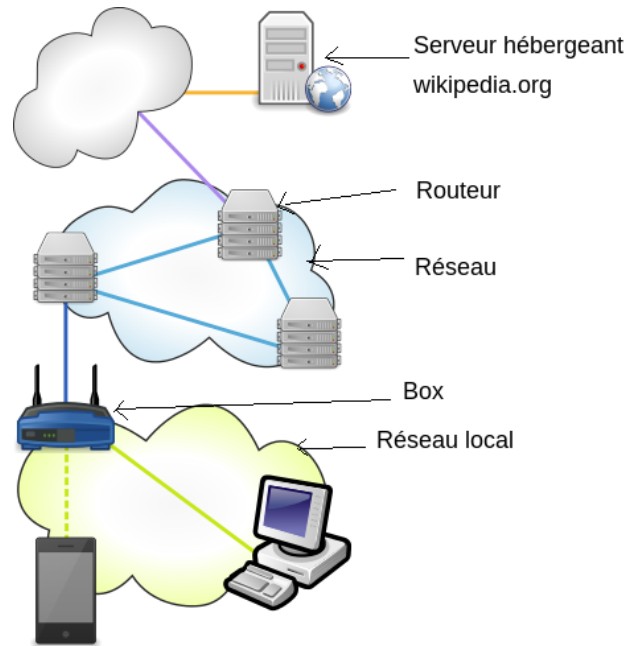


Clients, box et serveurs

In the middle : routers

🔑 Définition

Routers are computers that transport requests from client to server and back answer from server to client.



Réseau avec deux clients et wikipedia.org comme extrémités

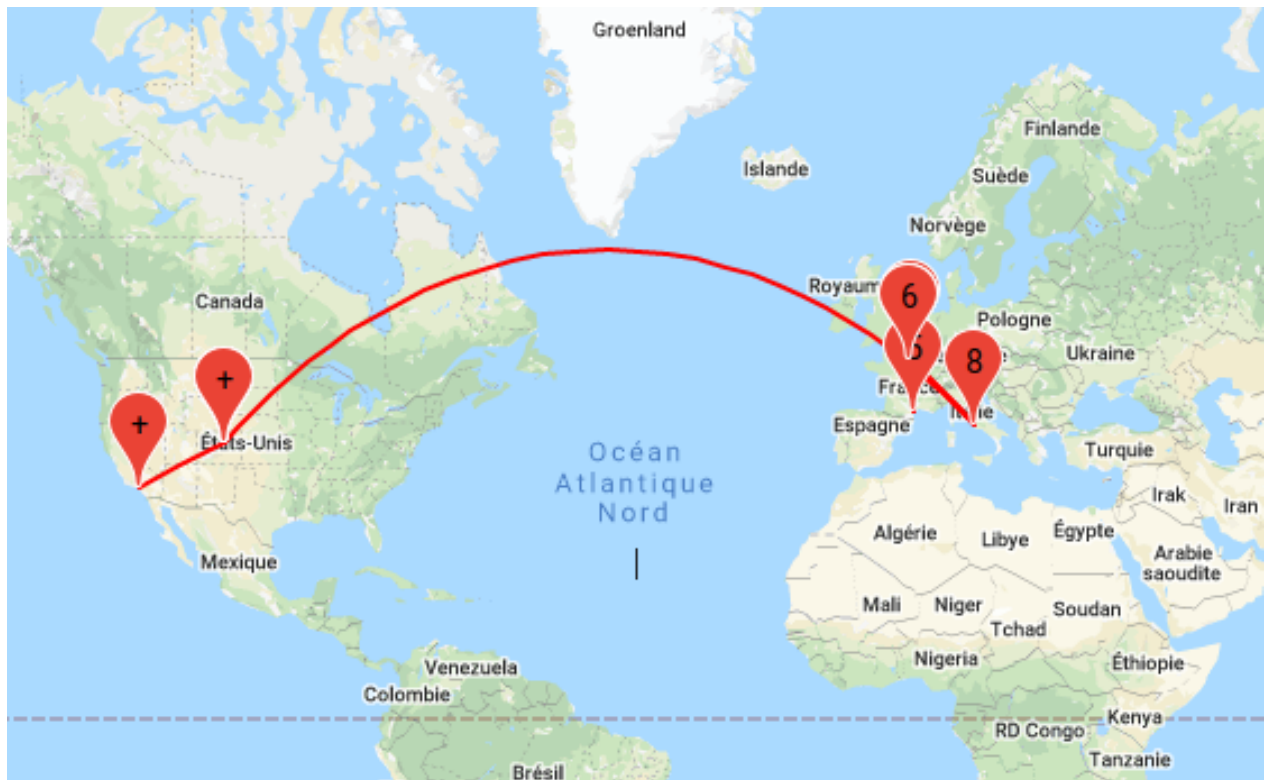
1. The client send its request to the router it is connected to (example : the box).
2. If the router knows the server (example : it is in the same network), it delivers the message (the request).
3. If not, it delivers the message to another router known to be nearer the server.
4. The next router does the same.
5. One last router finally knows the server and delivers the message.
6. The same process is used for the answer.

traceroute

```

1 traceroute www.icann.org.
1 traceroute to www.icann.org. (192.0.32.7), 30 hops max, 60 byte packets
2 1 * * *
3 2 10.24.0.1 (10.24.0.1) 72.344 ms 72.283 ms 72.305 ms
4 3 192.168.253.30 (192.168.253.30) 72.306 ms 72.302 ms 77.540 ms
5 4 192.168.255.6 (192.168.255.6) 77.569 ms 77.566 ms 78.655 ms
6 5 ppp18-metz.isdnet.net (194.149.166.145) 78.681 ms 80.408 ms 80.434 ms
7 6 ppp6-metz.isdnet.net (194.149.166.133) 78.654 ms 38.479 ms 38.291 ms
8 7 * * *
9 8 be4204.ccr32.par04.atlas.cogentco.com (149.11.115.13) 42.493 ms 42.424 ms
42.369 ms
10 9 be2067.ccr31.par04.atlas.cogentco.com (130.117.3.33) 41.388 ms 41.284 ms
41.180 ms
11 10 ae-29.r04.parsfr01.fr.bb.gin.ntt.net (129.250.8.125) 39.545 ms 39.478 ms
39.708 ms
12 11 ae-23.r24.amstnl02.nl.bb.gin.ntt.net (129.250.4.137) 49.371 ms 40.029 ms
42.071 ms
13 12 ae-3.r25.amstnl02.nl.bb.gin.ntt.net (129.250.4.69) 39.909 ms 46.701 ms
49.333 ms
14 13 ae-5.r23.asbnva02.us.bb.gin.ntt.net (129.250.6.162) 139.280 ms 145.858 ms
140.580 ms
15 14 ae-0.r22.asbnva02.us.bb.gin.ntt.net (129.250.3.84) 126.531 ms 123.791 ms
115.589 ms
16 15 ae-5.r23.lsanca07.us.bb.gin.ntt.net (129.250.3.189) 185.790 ms 177.418 ms
183.428 ms
    
```

```
17 16 ae-5.r01.lsanca20.us.bb.gin.ntt.net (129.250.6.49) 180.727 ms 204.185 ms
    201.918 ms
18 17 ge-100-0-0-16.r01.lsanca20.us.ce.gin.ntt.net (204.1.254.150) 199.037 ms
    186.855 ms 185.762 ms
19 18 www.icann.org (192.0.32.7) 187.313 ms 239.217 ms 232.851 ms
20
```



traceroute www.icann.org, depuis la France

4. TCP/IP network

Internet two main protocols are TCP and IP.

IP



- Addresses : each machine is identified by an IP adress
- Routing : to find a machine you must find a route
- Packet fragmentation : messages are cut in small packets

	1	2	3	4		
1	Version	IHL	Type of service	Total length		4
5	Identification		Flag	Fragment offset		8
9	Time to live		Protocole	Header checksum		12
13	Source IP adresse				16	
17	Destination IP adresse				20	
21	Options			Padding		24
25	DATA				28	
29					32	
33					36	
37					40	
41					44	
45					48	
49					52	
53					56	
57					60	
61					64	
65					68	
69					72	
73					76	
77					80	
81	84					
85	88					
89	92					
93	96					
97	100					
101	104					
105	108					
109	112					
113	116					
117	120					
121	124					
125	128					

Codage d'un paquet IP

TCP



TCP is in charge of reordering packets and solving transmission errors in order to allow correct message transmission.

5. IP addresses

Adresses IP



An IP address is a number that identify a machine.
 Every machine connected to the Internet has an IP address.

- IPv4, example 192 . 168 . 3 . 200
- IPv6, example : 2001 : 0db8 : 0000 : 85a3 : 0000 : 0000 : ac1f : 8001

Static or dynamic IP

**Attention**

An IP address can be static or dynamic:

- only machines with static IP can work as servers
- other machines are content consumers only (example : the smartphones)

IPv4 shortage

**Complément**

Most of the IPv4 addresses are already in use and IPv6 is still not implemented by major actors.

This creates a shortage of static addresses.

6. Domain names

Nom de domaine

**Définition**

A domain name is a symbolic address.

- They are easier to use for human beings.
- They create an abstraction that allows to change machines (and IP) without changing website names or email addresses for instance.

**Exemple**

91.198.174.192 can be associated with wikipedia.org.

DNS

**Définition**

A domain name server is a server that knows how to translate domain name into IP addresses.

Résoudre une IP

**Exemple**

```

1 $ host www.wikipedia.org
2 www.wikipedia.org is an alias for dyna.wikimedia.org.
3 dyna.wikimedia.org has address 91.198.174.192
4 dyna.wikimedia.org has IPv6 address 2620:0:862:ed1a::1

```

7. Exercice : Be an Internet actor

Question

[solution n°1 p. 30]

What do we need to host a website ?

Indice :

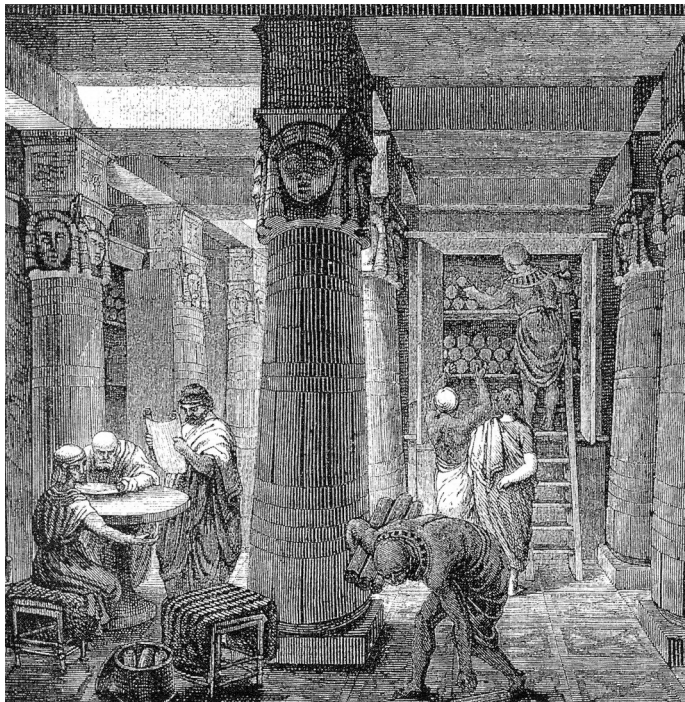
Not much...

History: Centralization, decentralization, recentralization, redcentralization



1. Exercice : Centralization

The Great Library of Alexandria



Évocation de la bibliothèque d'Alexandrie sur une gravure du XIXe siècle

Question 1

[solution n°2 p. 30]

What is the problem with this model ?

Indice :



L'incendie d'Alexandrie

The Mundaneum (Paul Otlet)



Tiroirs du Mundaneum

Collecting the whole knowledge of the world in one single place.

- Michael Buckland. Paul Otlet, Pioneer of Information Management. <https://people.ischool.berkeley.edu/~buckland/otlet.html>
- Michael Buckland. Selected Writings about Paul Otlet. <https://people.ischool.berkeley.edu/~buckland/otletbib.html>
- Alex Wright. Cataloging the World: Paul Otlet and the Birth of the Information Age. Oxford University Press, 2014.

Question 2

[solution n°3 p. 30]

What is the problem with this project?

Indice :

The Mundaneum was closed far before having being able to classified all the knowledge in the world...

Mainframe computers

Before the Internet (in the 60's and 70's) the first networks where local networks built around big central computers.



Ordinateur mainframe IBM 7090 (NASA, 1962)

Question 3

[solution n°4 p. 30]

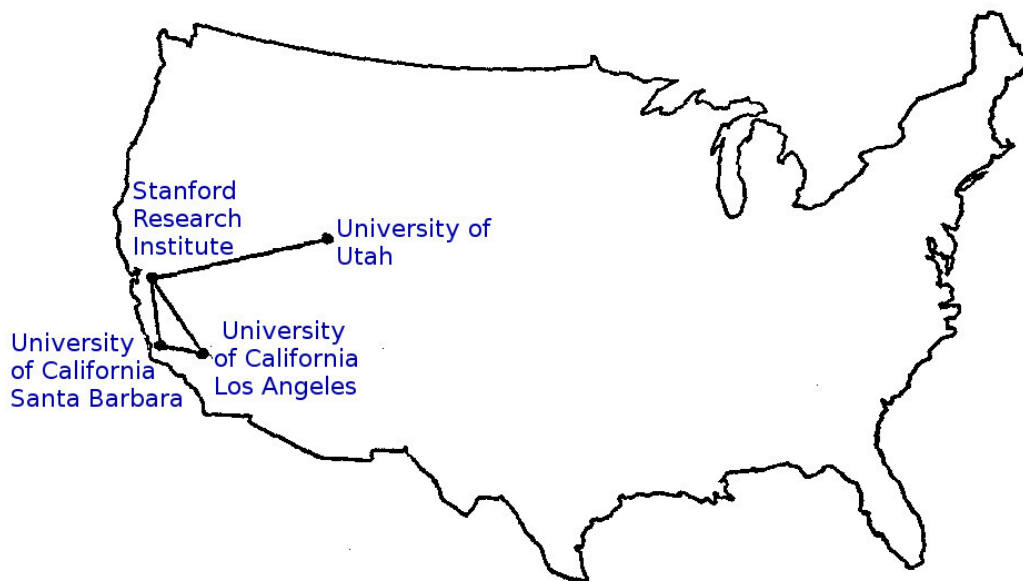
Another problem with centralization ?

Indice :



IBM 7090 console

2. Decentralization (Internet)



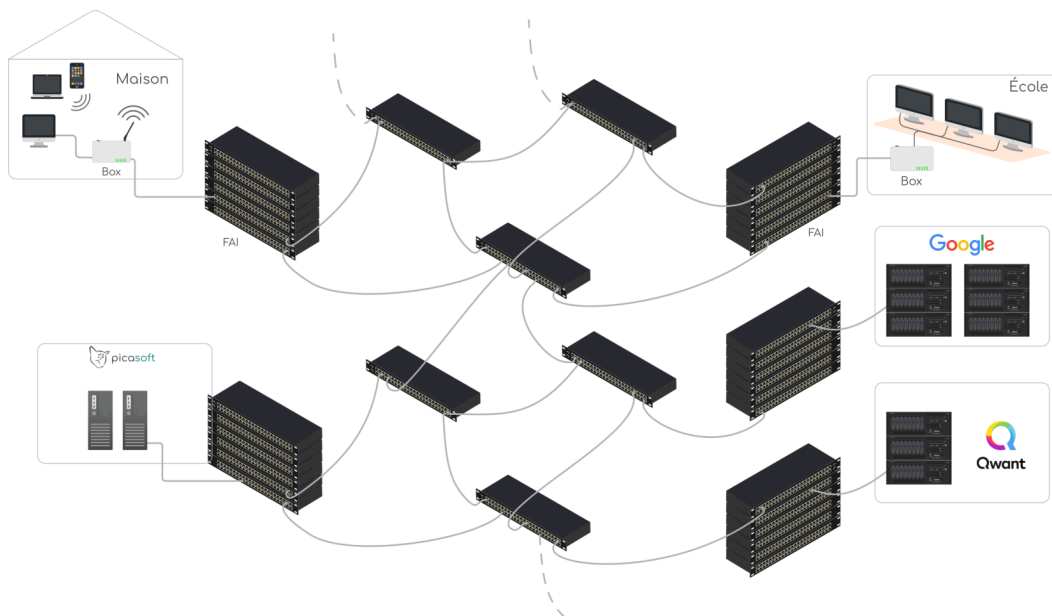
The ARPANET in December 1969

Arpanet en 1969

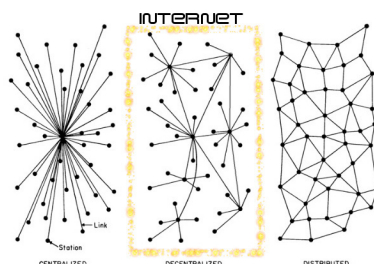
Arpanet, 1969

Invention of packet fragmentation and routing.

Decentralized communication on the Internet



Anyone can plug itself to the Internet, without authorization of any central authority, use and provide contents and services.



3. Exercice : Decentralization origin

Question

[solution n°5 p. 30]

Who are at the origins of the decentralized model of the Internet ?

Indice :

Think 60' and 70'...

Indice :



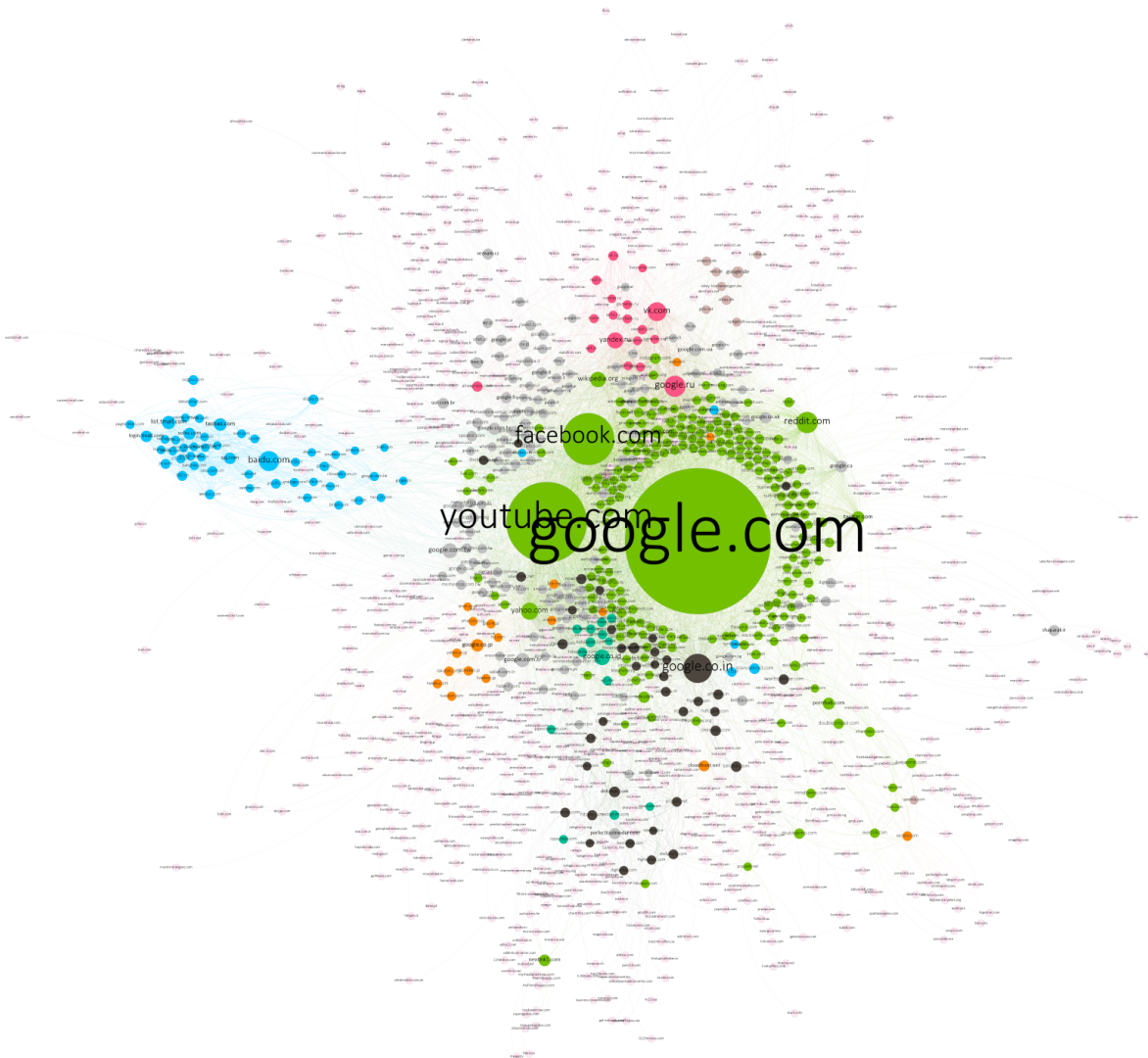
Nuclear Explosion (made with Blender)

Indice :



La foule au festival de Woodstock

4. Recentralization (GAFAM)



Cartographie du Web (top 500, 2018)

« “The web is already decentralized,” Mr. Berners-Lee said. “The problem is the dominance of one search engine, one big social network, one Twitter for microblogging. We don't have a technology problem, we have a social problem.” (Hardy, 2016) »

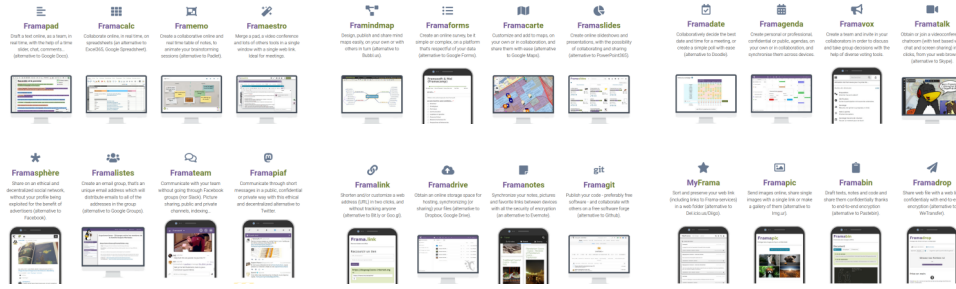
Hardy Quentin. 2016. The Web's creator looks to reinvent it. in The New York Times. www.nytimes.com/2016/06/08/technology/the-webs-creator-looks-to-reinvent-it.html.

5. Redcentralization (De-google-ify Internet)

Framasoft

? Exemple

- «
- The web giants centralize our digital lives in exchange for their services.
 - The Free Software community offers alternative ethical services.
 - The Framasoft network intends to prove it by hosting them.
- »



Framasoft services

Framasoft. De-google-ify Internet. degooglisons-internet.org⁴










CHATONS



SERVICES LIBRES EN LIGNE

Des services libres en ligne du collectif CHATONS pour décentraliser et découvrir un web à l'échelle humaine, solidaire et respectueux de votre vie privée.










En savoir plus

 <p>RÉDACTION COLLABORATIVE</p> <p>Un pad est un éditeur de texte collaboratif en temps réel. On peut y écrire simultanément.</p> <p>Instance <i>Etherpad</i> Fournie par <i>Infini</i></p> <p>Nom du pad (optionnel) CRÉER</p> <p>Autres instances et documentation</p>	 <p>VISIO-CONFÉRENCE</p> <p>Visio-conférence en petit groupe, sans inscription, directement dans le navigateur.</p> <p>Instance <i>Jitsi Meet</i> Fournie par <i>Tedomum</i></p> <p>Nom du salon (optionnel) CRÉER</p> <p>Autres instances et documentation</p>	 <p>PRISE DE RDV</p> <p>Planifier un rendez-vous ou prendre des décisions rapidement et simplement.</p> <p>Instance <i>Framadate</i> Fournie par <i>Colibris Outils Libres</i></p> <p>CRÉER UN SONDAGE</p> <p>Autres instances et documentation</p>
 <p>TABLEUR COLLABORATIF</p> <p>Tableur collaboratif en temps réel. On peut y écrire simultanément.</p> <p>Instance <i>Ethercalc</i> Fournie par <i>Domaine Public</i></p> <p>Nom du tableur (optionnel) CRÉER</p> <p>Autres instances et documentation</p>	 <p>PARTAGE DE FICHIERS</p> <p>Partage de fichiers volumineux de façon confidentielle et sans inscription.</p> <p>Instance <i>Lufi</i> Fournie par <i>UNDERWORLD</i></p> <p>TELEVERSER DES FICHIERS</p> <p>Autres instances et documentation</p>	 <p>PARTAGE D'IMAGES</p> <p>Partage d'images sous forme de galeries. Rapide et sans inscription.</p> <p>Instance <i>Lutim</i> Fournie par <i>Tedomum</i></p> <p>TELEVERSER DES IMAGES</p> <p>Autres instances et documentation</p>
 <p>TABLEAU DE POST-IT</p> <p>Collecter et organiser vos idées, rendre visible les lieux d'implication.</p> <p>Instance <i>Scrumbr</i> Fournie par <i>Framasoft</i></p> <p>Nom du tableau (optionnel) CRÉER</p> <p>Autres instances et documentation</p>	 <p>RACCOURCISSEUR DE LIENS</p> <p>Raccourcisseur de liens sans inscription.</p> <p>Instance <i>Polr</i> Fournie par <i>Zicli.fr</i></p> <p>RACCOURCIR UN LIEN</p> <p>Autres instances et documentation</p>	 <p>PARTAGE DE TEXTES SÉCURISÉ</p> <p>Outil de partage d'extraits de texte chiffré de bout en bout</p> <p>Instance <i>Privatebin</i> Fournie par <i>Zicli.fr</i></p> <p>CRÉER UN MESSAGE CHIFFRÉ</p> <p>Autres instances et documentation</p>

4. <https://degooglisons-internet.org/en/>

Un Chaton à l'UTC

L'association Picasoft a pour objet de promouvoir et défendre une approche libriste, inclusive, respectueuse de la vie privée, respectueuse de la liberté d'expression, respectueuse de la solidarité entre les humains et respectueuse de l'environnement, notamment dans le domaine de l'informatique.

 <p>L'asso</p> <p>Picasoft est une association de l'Université de Technologie de Compiègne fondée en 2016 par des étudiants et des enseignants.</p>	 <p>team.picasoft.net</p> <p>Mattermost est un service de discussion instantanée (documentation).</p>	 <p>pad.picasoft.net</p> <p>Etherpad est un éditeur de notes collaboratif en temps réel.</p>
 <p>md.picasoft.net</p> <p>CodiMD est un éditeur de documents collaboratif en temps réel.</p>	 <p>kanban.picasoft.net</p> <p>Wekan est un kanban numérique, il permet de gérer un projet ou une liste de tâches.</p>	 <p>voice.picasoft.net</p> <p>Mumble est un logiciel de VoIP, il permet d'échanger en audioconférence (documentation).</p>
 <p>drop.picasoft.net</p> <p>Lufi est un service de transferts de fichiers sécurisé (chiffé de bout en bout).</p>	 <p>mobilizon.picasoft.net</p> <p>Mobilizon est un outil pour se rassembler, s'organiser et se mobiliser (documentation).</p>	 <p>board.picasoft.net</p> <p>Whiteboard est un outil de tableau blanc collaboratif et en temps réel.</p>



<https://framasoftware.org/en/>

6. Exercice : Which problems with web centralization ?

Some digital services became essential to our personal or professional lives.

The centralization of these services in the hand of too few actors gives them great power with small democratic control.

Question 1

[solution n°6 p. 30]

Imagine some issues related to information power.

Indice :

« In 2015, six of the 10 websites in Myanmar getting the most engagement on Facebook were from legitimate media, according to data from CrowdTangle, a Facebook-run tool. A year later, Facebook (which recently rebranded to Meta) offered global access to Instant Articles, a program publishers could use to monetize their content.

One year after that rollout, legitimate publishers accounted for only two of the top 10 publishers on Facebook in Myanmar. By 2018, they accounted for zero. All the engagement had instead gone to fake news and clickbait websites. In a country where Facebook is synonymous with the internet, the low-grade content overwhelmed other information sources. >>

Karen Hao, How Facebook and Google fund global misinformation, MIT Technology Review, November 20, 2021. <https://www.technologyreview.com/2021/11/20/1039076/facebook-google-disinformation-click-bait/>

Question 2

[solution n°7 p. 30]

Imagine some issues related to political power.

Indice :

<< Le Parti Pirate vient de saisir le CSA après avoir été banni de Twitch pendant 48 heures à la demande de BFMTV. Sa faute ? La reprise de l'émission « 2022 le débat de la droite » de la chaîne d'Altice. Quand celle-ci dénonce une atteinte à ses droits, le PP oppose le nécessaire partage des débats politiques d'intérêt général. Next in pact diffuse la lettre de saisine. >>

Marc Rees, Censuré sur Twitch à la demande de BFMTV, le Parti Pirate saisit le CSA, Novembre 22, 2021. <https://www.nextinpact.com/article/48938/censure-sur-twitch-a-demande-bfmtv-parti-pirate-saisit-csa>

Question 3

[solution n°8 p. 31]

Imagine some issues related to economic power

Indice :

<< The online giant gives a leg up to hundreds of house brand and exclusive products that most people don't know are connected to Amazon. >>

Adrienne Jeffries, Leon Yin. Amazon Puts Its Own "Brands" First Above Better-Rated Products, October 14, 2021. <https://themarkup.org/amazons-advantage/2021/10/14/amazon-puts-its-own-brands-first-above-better-rated-products#amazon-mainstory-brand-quiz> (found on standblog.org⁵)

⁵. <https://standblog.org/blog>

Conclusion : Contributing to redcentralization



1. Changing things

Change your web browser

? Exemple

- Firefox (www.mozilla.org/fr⁶)
- Tor (www.torproject.org⁷)

Change your search engine

? Exemple

- Duckduckgo (duckduckgo.com⁸ ou ddg.co⁹)
- Qwant (qwant.com¹⁰ et qwantjunior.com¹¹)

Changer some web applications

? Exemple

- Chat on Mattermost : team.picasoft.net
- Write on Etherpad : pad.chapril.org
- Video conference on Framatalk : framatalk.org

Change more

? Exemple

- Switch to Linux
- Use a mail client (Thunderbird)
- Use encrypted services
- Limit apps on smartphones and tablets

6. <https://www.mozilla.org/fr/>

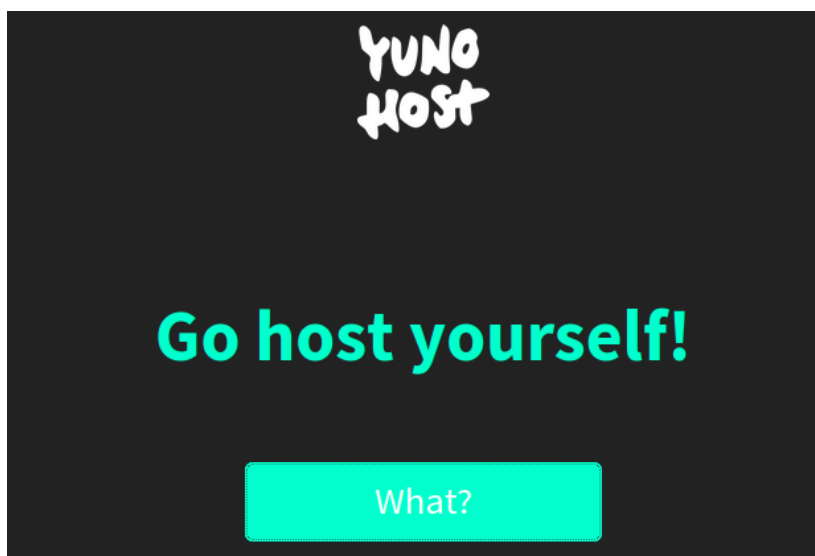
7. <https://www.torproject.org/>

8. <https://duckduckgo.com/>

9. <http://ddg.co/>

10. <http://qwant.com/>

11. <http://qwantjunior.com/>



Host your own Internet services.
yunohost.org

2. All around the word

- <https://thegood.cloud/>
- <https://cisti.org/>
- <https://devol.it/>
- <https://www.fairkom.eu/>
- <https://www.ggc-project.de/>
- <https://info.graz.social/>
- <https://feneas.org/>
- <https://www.anoxinon.media/>
- <https://cyberia.club/>
- ...

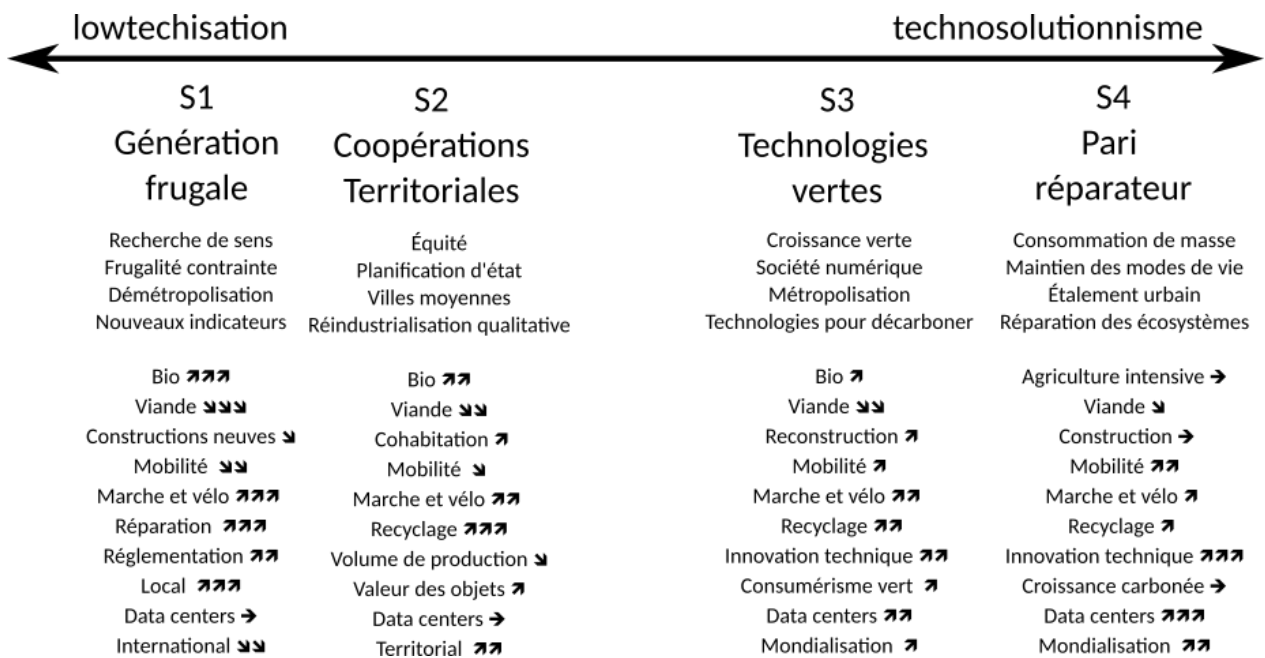
Community networks, associations that work at freeing the Internet, firms that propose alternative models...

3. Let's collectivize and convivialize Internet

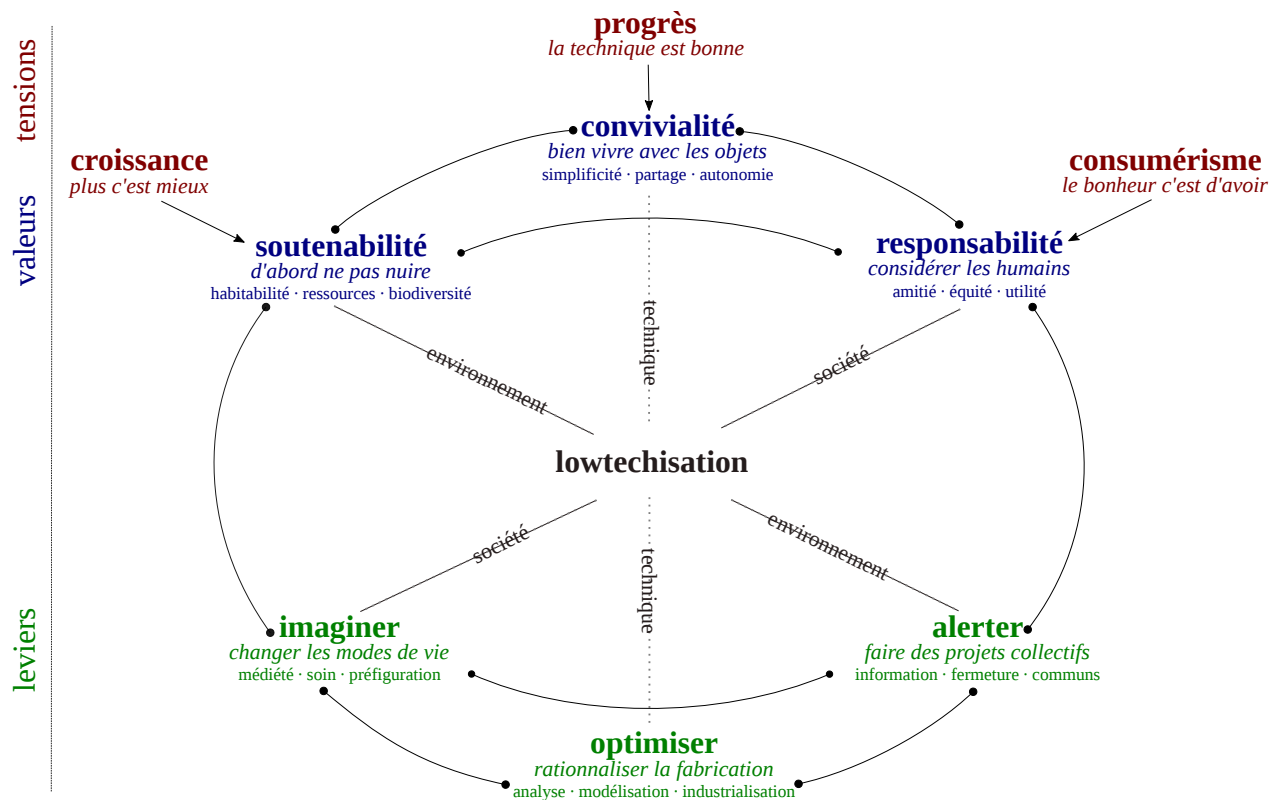


Collectivisons Internet & Convivialisons Internet

4. Bonus track : lowtechisation



Interprétation des scénarios Transitions 2050 de l'ADEME sur l'axe lowtechisation / technosolutionnisme



Solutions des exercices



[exercice p. 15] **Solution n°1**

- A machine connected to an ISP
 - at home behind a box
 - in a datacenter
- A web server software (Apache or Nginx are free software easy to install)
- A static IP address
- A domain name

? **Exemple**

<https://pic.crzt.fr/>

[exercice p. 17] **Solution n°2**

Resilience ! it may burns...

[exercice p. 18] **Solution n°3**

Information grows faster than anyone can store it (even Google can't !).

[exercice p. 18] **Solution n°4**

It confers control to information and power to whom manages the access.

[exercice p. 20] **Solution n°5**

Hippies and military men together...

Fred Turner. From Counterculture to Cyberculture : Stewart Brand, the Whole Earth Network, and the Rise of Digital Utopianism, Chicago, Ill., University Of Chicago Press, 2006.

[exercice p. 24] **Solution n°6**

[exercice p. 25] **Solution n°7**

[exercice p. 25] **Solution n°8**

Crédits des ressources



Rhizome, un FAI de la FFDN — rhizome-fai.net p. 9

db.ffdn.org

Clients, box et serveurs p. 11

Attribution - Picasoft

Réseau avec deux clients et wikipedia.org comme extrémités p. 12

Attribution - Partage dans les Mêmes Conditions - Ferran91 — Article Wikipédia en anglais (Internet access diagram)

traceroute www.icann.org. depuis la France p. 13

https://stefansundin.github.io/traceroute-mapper

Codage d'un paquet IP p. 14

Attribution - Partage dans les Mêmes Conditions - Stéphane Crozat

Évocation de la bibliothèque d'Alexandrie sur une gravure du XIXe siècle p. 16

Licence : Domaine Public - fr.wikipedia.org/wiki/Bibliothèque d'Alexandrie¹²

L'incendie d'Alexandrie p. 17

Licence : Domaine Public - Hermann Göll, 1876 (gravure sur bois).

Tiroirs du Mundaneum p. 17

Par fdecomite — Flickr: Drawers, CC BY 2.0, commons.wikimedia.org/w/index.php?curid=15888697

Ordinateur mainframe IBM 7090 (NASA, 1962) p. 18

Universel - Transfert dans le Domaine Public - en.wikipedia.org/wiki/IBM_7090

IBM 7090 console p. 18

Universel - Transfert dans le Domaine Public - en.wikipedia.org/wiki/IBM_7090

Arpanet en 1969 p. 19

Timothy B. Lee, 2014. https://www.vox.com/a/internet-maps

Nuclear Explosion (made with Blender) p. 20

Universel - Transfert dans le Domaine Public - Burnt Pineapple Productions — flickr.com¹³

La foule au festival de Woodstock p. 21

Attribution - Partage dans les Mêmes Conditions - Derek Redmond and Paul Campbell

¹². https://fr.wikipedia.org/wiki/Biblioth%C3%A8que_d%27Alexandrie

¹³. <https://www.flickr.com>

Cartographie du Web (top 500, 2018) p. 22

Attribution - Partage dans les Mêmes Conditions - Félix Boisselier, 2018

Collectivisons Internet & Convivialisons Internet p. 28

Attribution - David Revoy