



A brief story of how the internet works

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Practicalities

- Red pointers indicate policy aspects
- You can ask questions after the presentation
- More questions later? nina@centr.org
- This is a basic training (some corners were cut)



What is CENTR?

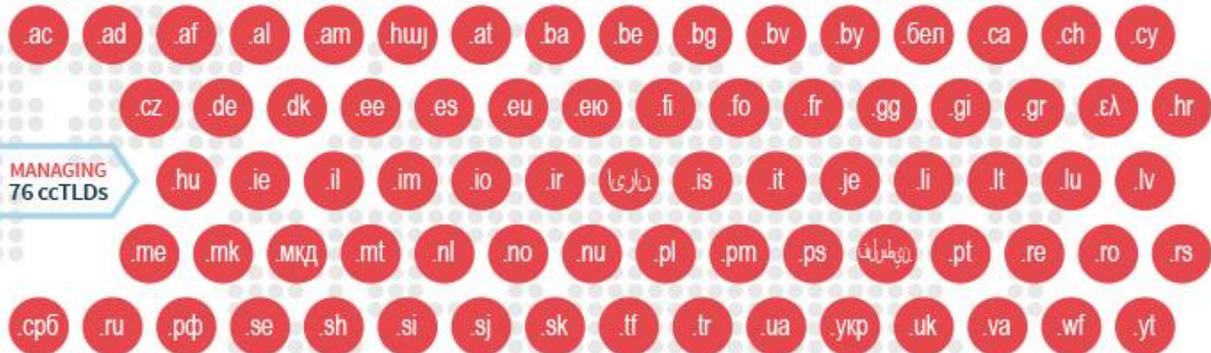
The association for exchange,
dialogue and innovation of country code
domain registries in Europe



54
FULL
MEMBERS

9
ASSOCIATE
MEMBERS

13
OBSERVERS



AfTLD	APTLD	EuroISPA	eco	EU Commission
ICANN	ISC	ISOC	LACTLD	Netnod
NLnet Labs	OARC	RIPE NCC		



GLOBAL MEMBER STATISTICS

>73M

REGISTERED
DOMAINS



>1,300

EMPLOYEES
(1-140 PER REGISTRY)

50%

OF REGISTERED
ccTLDs
WORLDWIDE



80%

OF REGISTRIES ARE
NOT-FOR-PROFIT
ORGANISATIONS



What CENTR does (services to members)



GLOBAL TLD MARKET

DOMAINS	GROWTH (Q1 2017)	ccTLDs(CENTR)	MEDIAN DOMAIN GRO
ccTLDs	143.5		
Legacy gTLDs	161.5		
New gTLDs	24.6		

Source: CENTR/APTLD/LACTLD/ICANN/2006/ For more detail see latest DomainWire reports

EUROPEAN ccTLDs

2016	
ccTLD Growth	3.4%
Retention Ratio	85.3%
Adds Ratio	19.1%
Churn Ratio	15.7%
ccTLD geo-marketshare	51.4%
Domain Price (1Y/EUR)	6.5

Source: CENTR, Averages (medians) sample Renewals/Adds/Deletes (57), Market Share (32), Market Share stats as at Jan of given year

Library

Library Legal case library

The CENTR library contains all CENTR documents and presentations going back to 2000. Only Full Mem across the whole library. A wide range of filters allow to narrow down the search results for all documents been applied to 2015 and 2016 documents only. All previous years' documents have been re-categorised

Featured publications

DomainWire Global TLD Report 2017/1

[DOWNLOAD](#)

IETF98

Search the library

Filter by:

Select type: Select event or policy document: Select category:

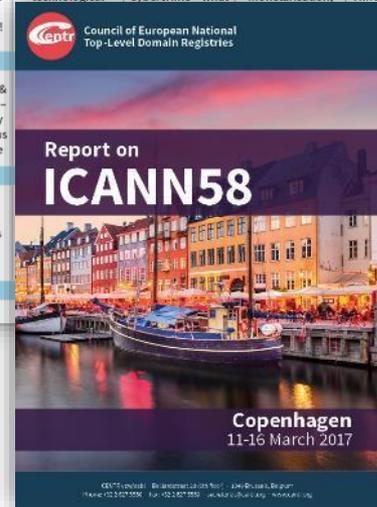
Title	Category
2017 CENTR Board of Directors offsite conclusions	CENTR Document
DomainWire Global TLD Report 2017/1	Statistics report
CENTR Comment on the Interim Paper of the Cross-Community Working Group on Use of Names of Countries and Territories as Top Level Domains	Policy document

CENTR Jamboree 2017

Agenda Practical information Participants

DAY 1 DAY 2 DAY 3

	Room 1	Room 2	Room 3	Room 4	Training room
9.00	New biz: e-ID, trust framework & others	DDoS protection	Domain name abuse	Domain usage statistics - Lookin' Up, Makin' Up	GDPR basics (training)
10.30	break				
11.00	Break down the wall of confusion with Chocolate, LEGO and Scrum!	Blockchain: a technological	Dealing with Cybercrime - what	Business intelligence: Value, monetisation,	Time Management
12.30	break				
13.30	Security Incident & Event Monitoring - Creating visibility in a heterogeneous ICT infrastructure	Crisis communications (training)			
15.00	break				
15.30	Crisis communications (training)				
17.00	break				





What will you learn today?

- What the internet really looks like (it's not a cloud)
- What IP addresses are
- How they connect to each other
- How networks work
- How the domain name system (DNS) works
- Why the root is important and why IANA matters
- Who does what in the technical layers of the internet
- Why this all matters for the Internet Governance discussions



One year ago in the news

The screenshot shows the ZDNet website interface. At the top, there is a search bar with the text "Recherchez sur ZDNet". Below the search bar is a navigation menu with categories like "News", "Blogs", "Livres blancs", "4G Monitor", "Speedtest", "Progiciels", and "Carrières IT". A secondary menu includes "FR", "Windows 10", "4G", "Sécurité", "DevOps", "PC et métiers", "Transfo Numérique", "Avenir de l'IT", "Chiffres clés IT", and "Partenaires".

The main banner features a Dell EMC Forum advertisement for "PARIS" on "MARDI 22 NOVEMBRE - Carrousel du Louvre". The ad includes the text "LET THE TRANSFORMATION BEGIN" and a "Je m'inscris" button. A red banner with the word "Blocking" is overlaid on the bottom right of the ad.

Below the banner is a yellow bar with the text "ZDNET.FR SUR LINKEDIN : Rejoignez le Club des professionnels et décideurs de l'IT".

The main article is titled "Google down : Orange bloque et redirige par erreur ses internautes vers le ministère de l'Intérieur [MAJ]". The sub-header reads "ZDNet.fr > News > Google down : Orange bloque et redirige par erreur ses internautes vers le ministère de l'Intérieur [MAJ] >".

The article text states: "Réseaux : Depuis ce matin, les abonnés de chez Orange qui souhaitent se rendre sur le site de Google, de Wikipedia ou encore d'OVH rencontrent des difficultés. Certains utilisateurs se sont même vu servir une page du ministère de l'Intérieur, signalant le blocage administratif d'un site. Une erreur de DNS est en cause."

At the bottom of the article, it says "Par La rédaction de ZDNet.fr | Lundi 17 Octobre 2016".

On the right side, there is a sidebar with a "Hewlett Packard Enterprise Avenir de l'IT" advertisement and another "publicité" placeholder.

So what happened?



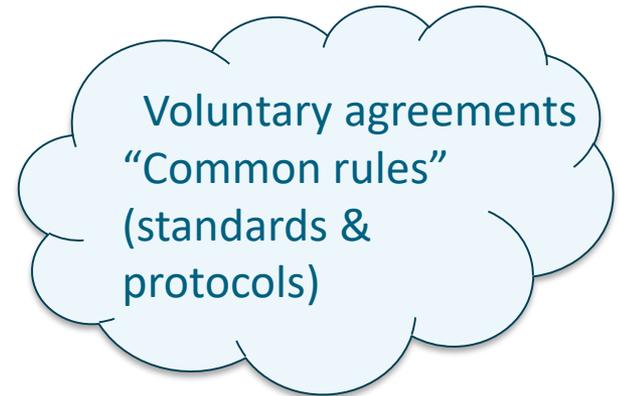
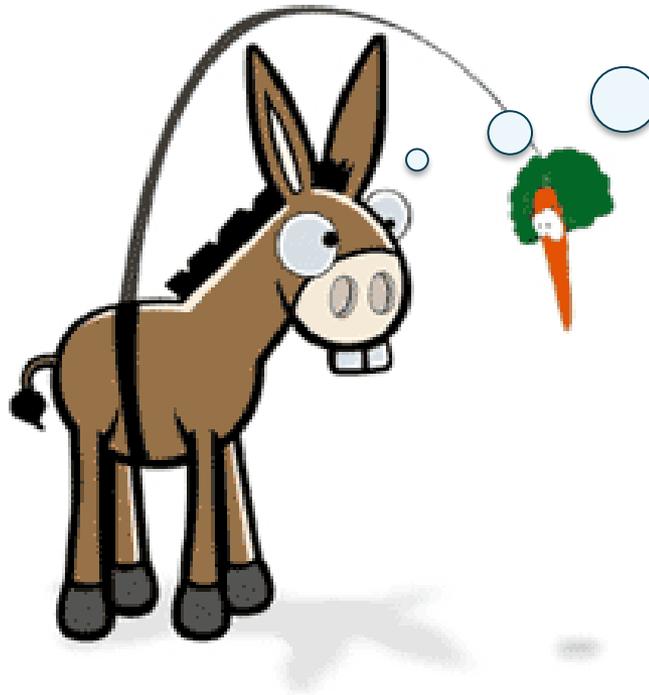
What the internet is made of



What the internet is made of

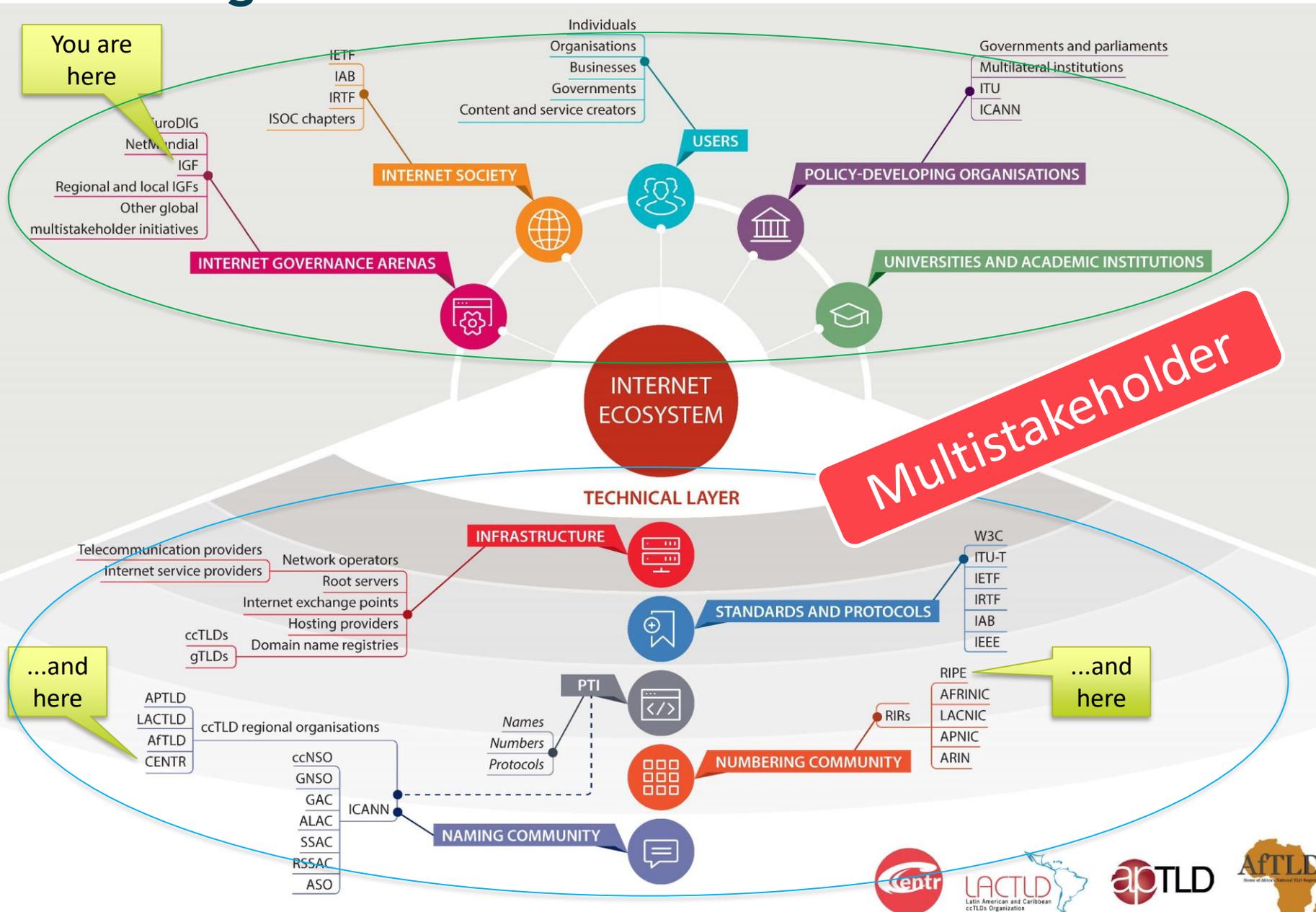


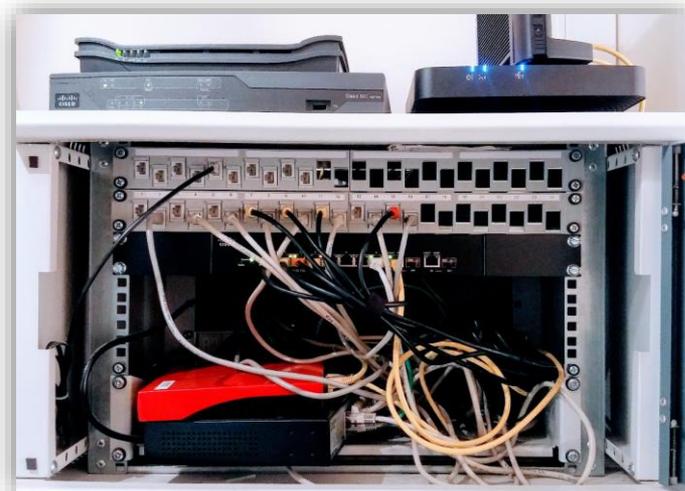
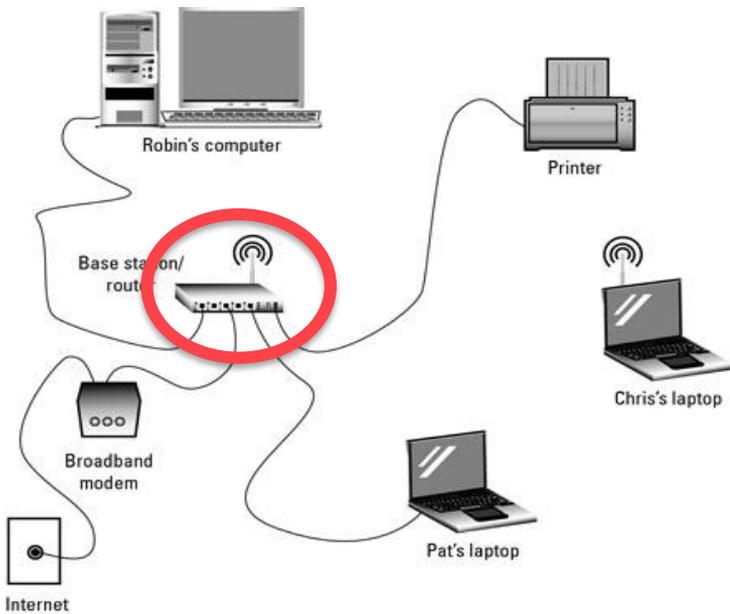
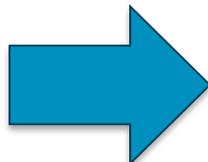
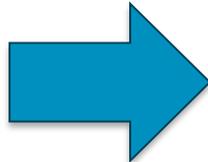
- No sanctions
- No one (really) owns the internet
- No one sets the rules for all
- No overall controlling network

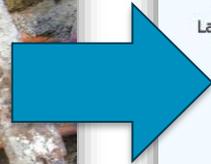
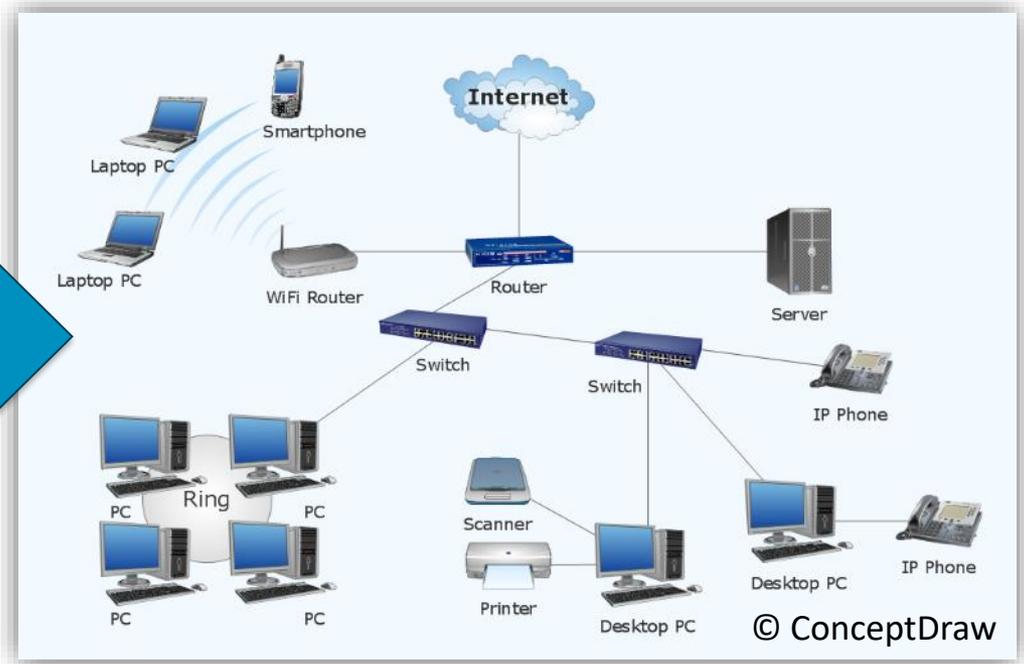
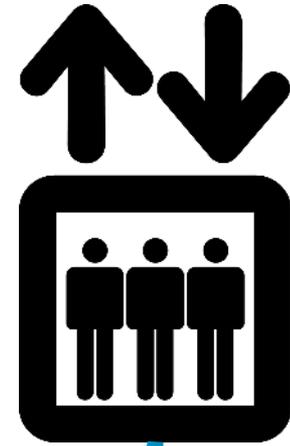
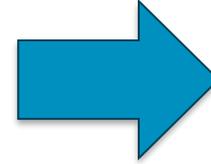
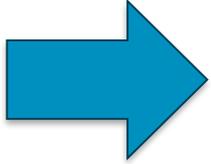


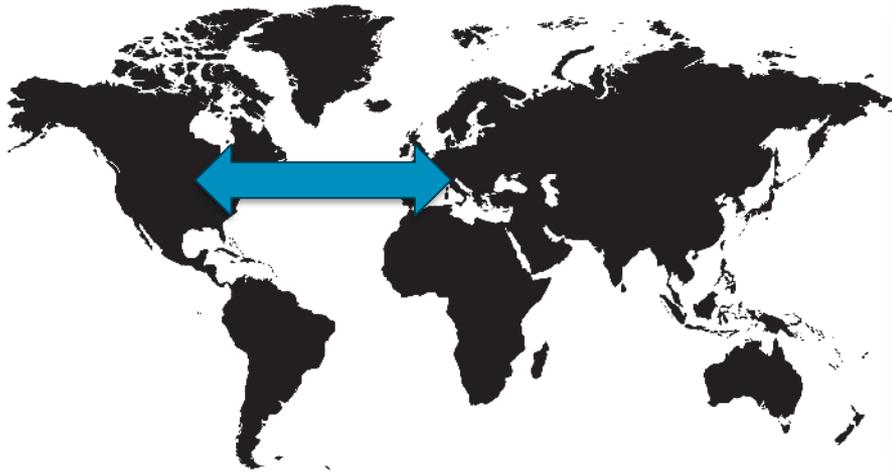
Standardization

Who “governs” the internet?



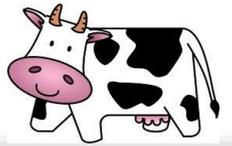
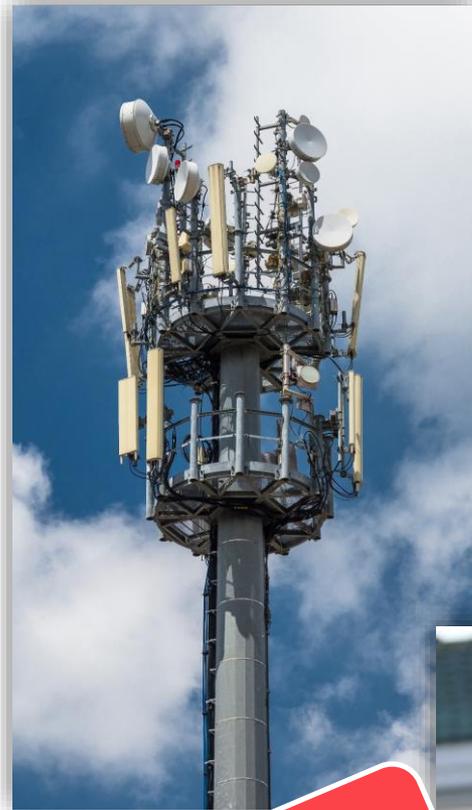








Not only cable...



Spectrum
(allocation of frequencies)



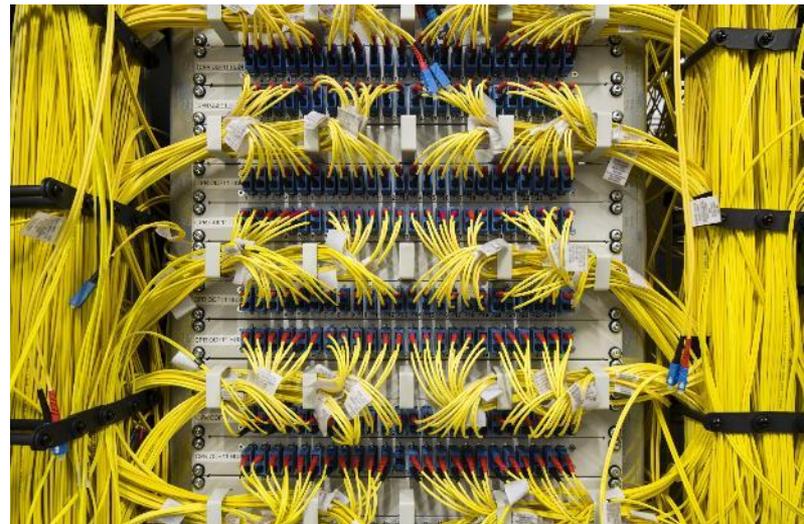
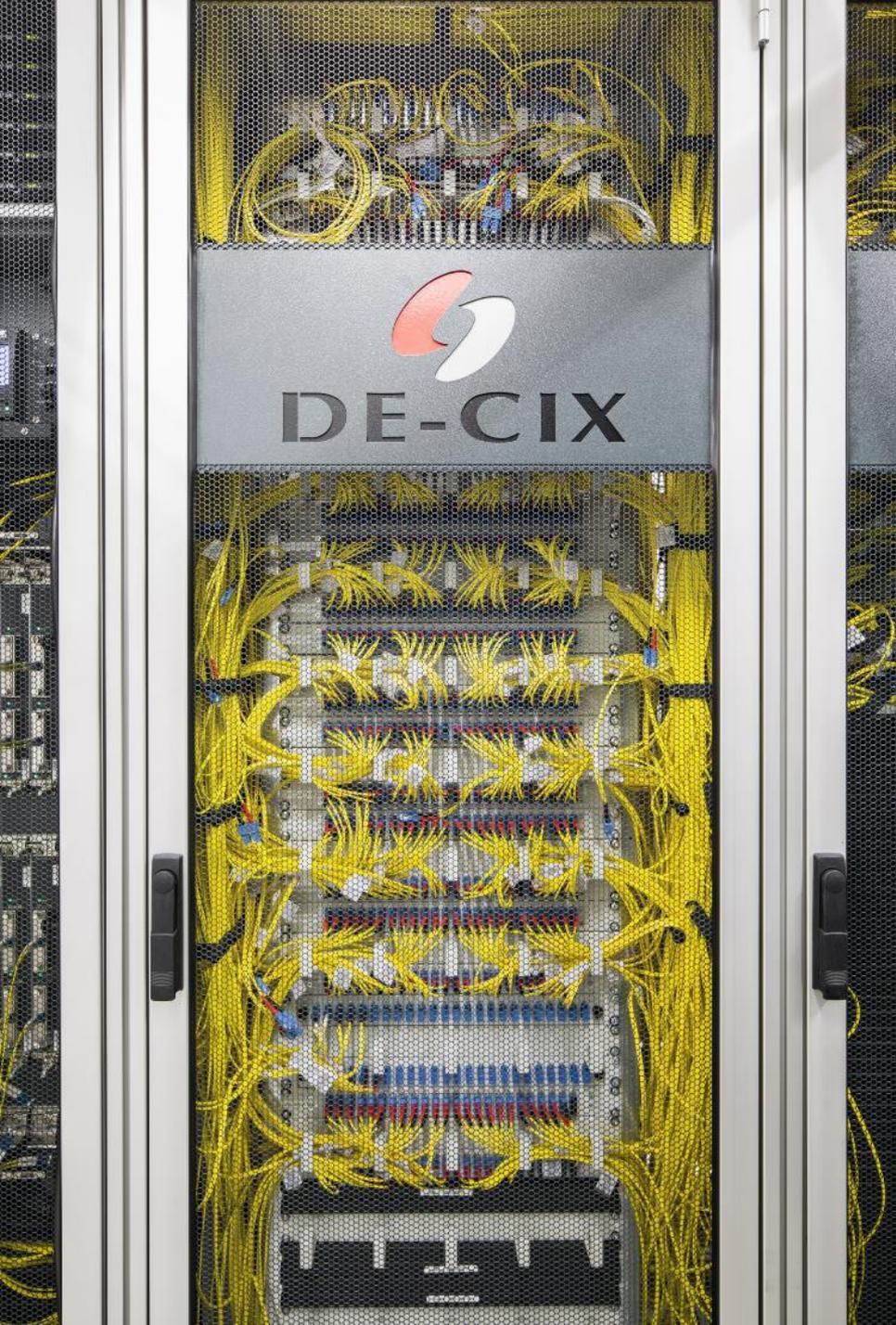
AT&T Inc.



ePrivacy
(protection of personal and metadata)

Free flow of data
(no localisation requirements)





NIS Directive
(network & information security
of critical infrastructure)

North America (ARIN)

Europe (RIPE)

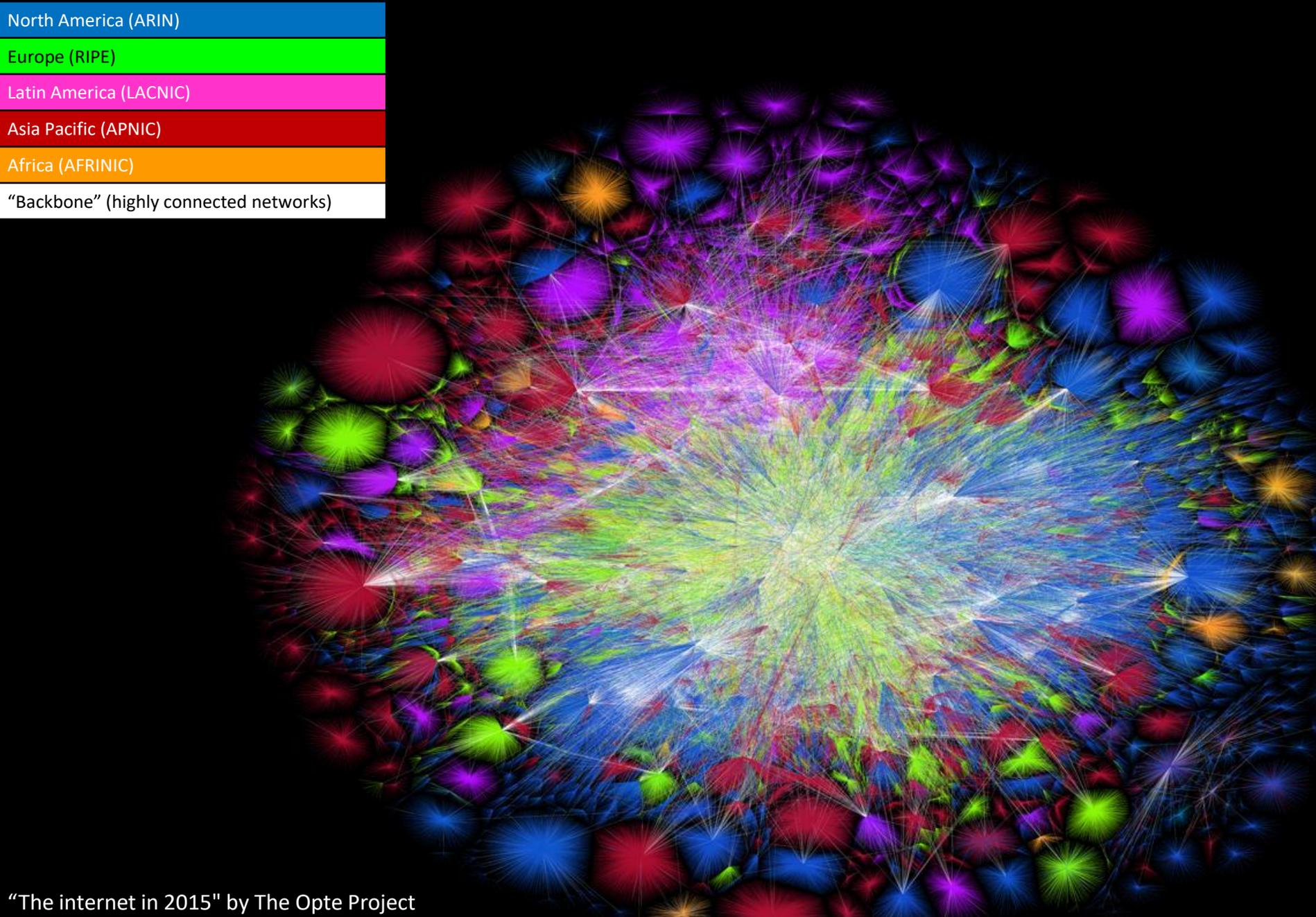
Latin America (LACNIC)

Asia Pacific (APNIC)

Africa (AFRINIC)

"Backbone" (highly connected networks)

"The internet in 2015" by The Opte Project





Let's add the domain name system (DNS)

- Why do we need the DNS?
- How does it work?
- The Root
- The top-level domain



www.europa.eu

www.hyves.nl

www.allegro.pl

www.bbc.co.uk

blog.orange.fr

info@standaard.be

www.google.it

рнидс.срб



Why do we need the DNS?

There are three main reasons:

- Remembering addresses
- Flexibility (the underlying IP address/servers can change without any impact on the users)
- Security (Requests can be diverted to avoid server overload)

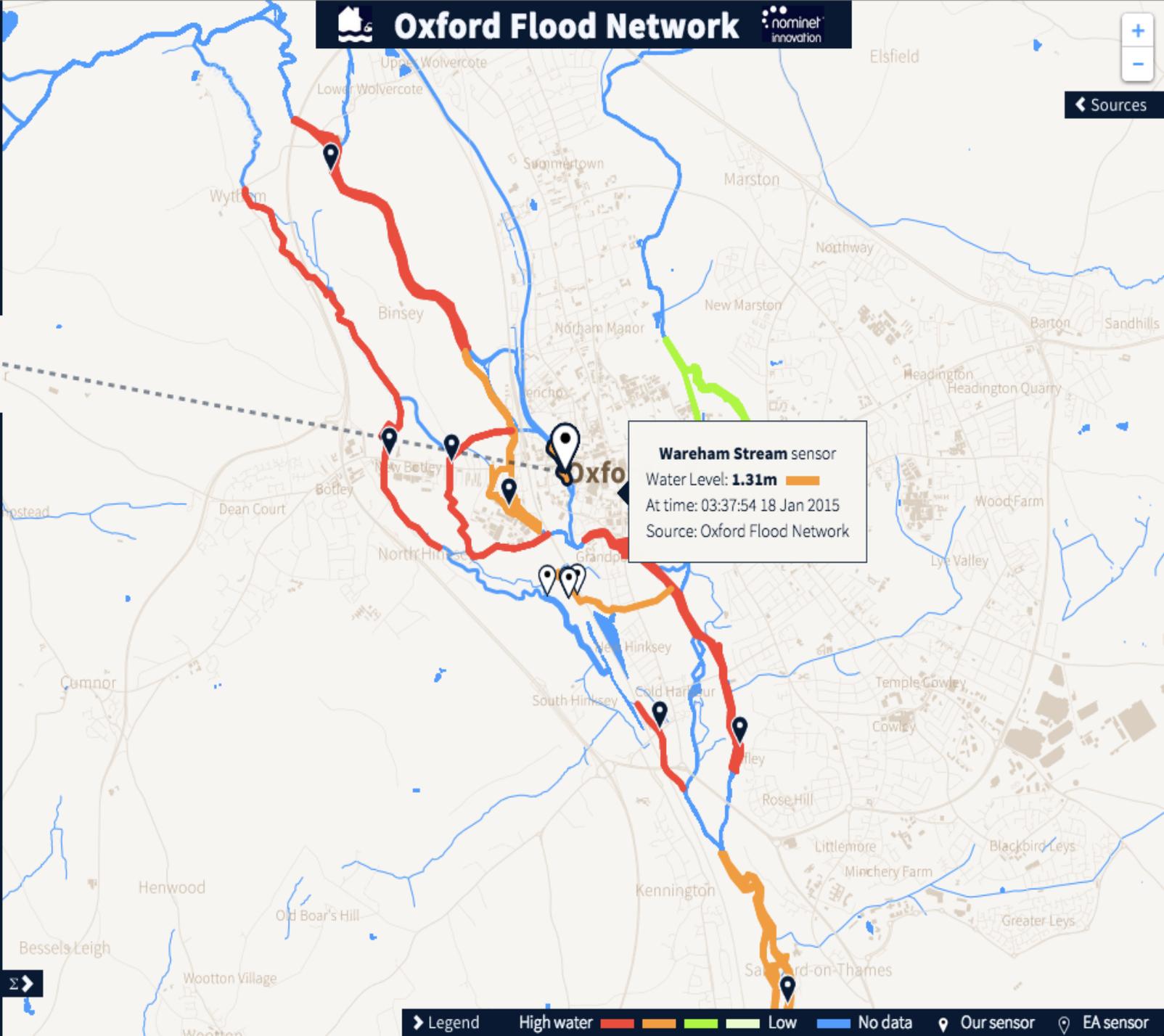
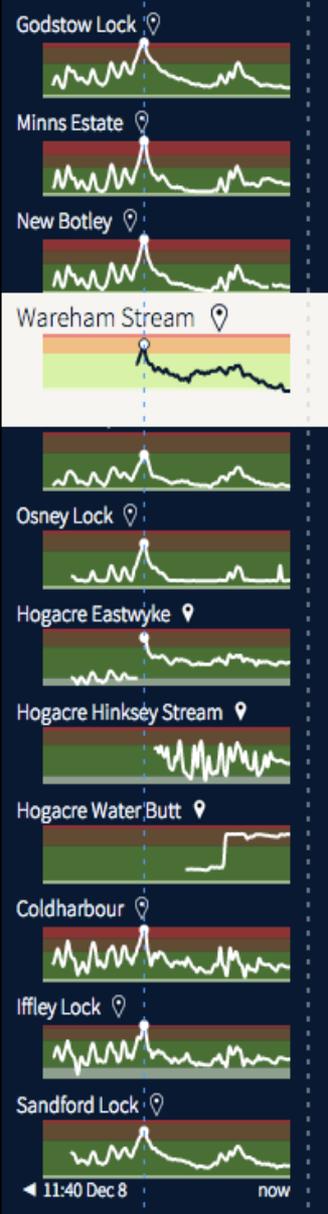
(And a fourth one)

- (Internet of Things [e.g. flood early warning system])



Live River Levels

PRE-RELEASE ALPHA - FOR EXPERIMENTAL PURPOSES ONLY



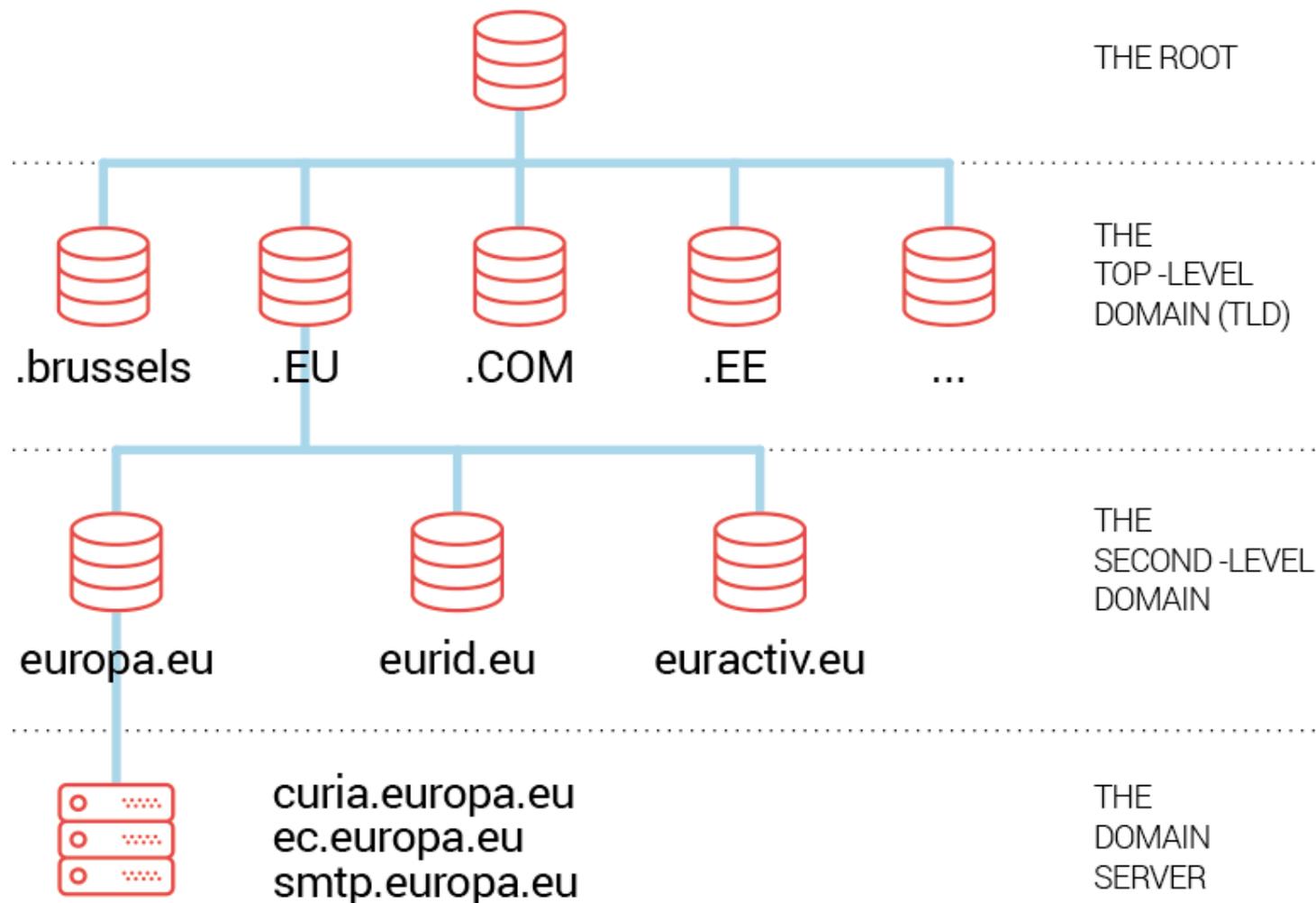
Wareham Stream sensor
Water Level: **1.31m**
At time: 03:37:54 18 Jan 2015
Source: Oxford Flood Network

The DNS explained



<https://www.youtube.com/watch?v=vZ007Vi5HIM>

CENTR on YouTube: CENTRDNNS





ROOTZONE

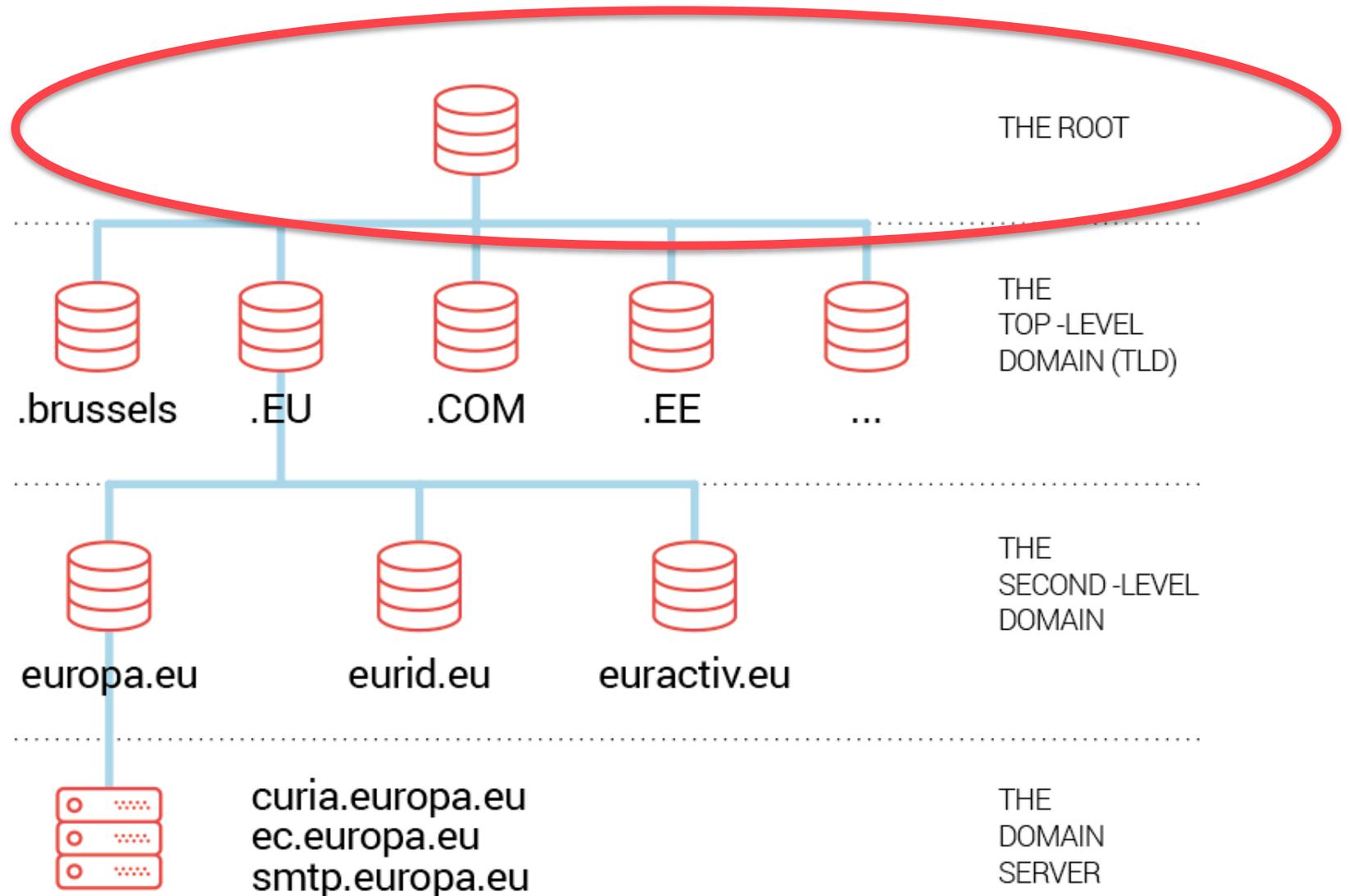
Rootzone Maintainer (IANA)

TLD ZONEFILE

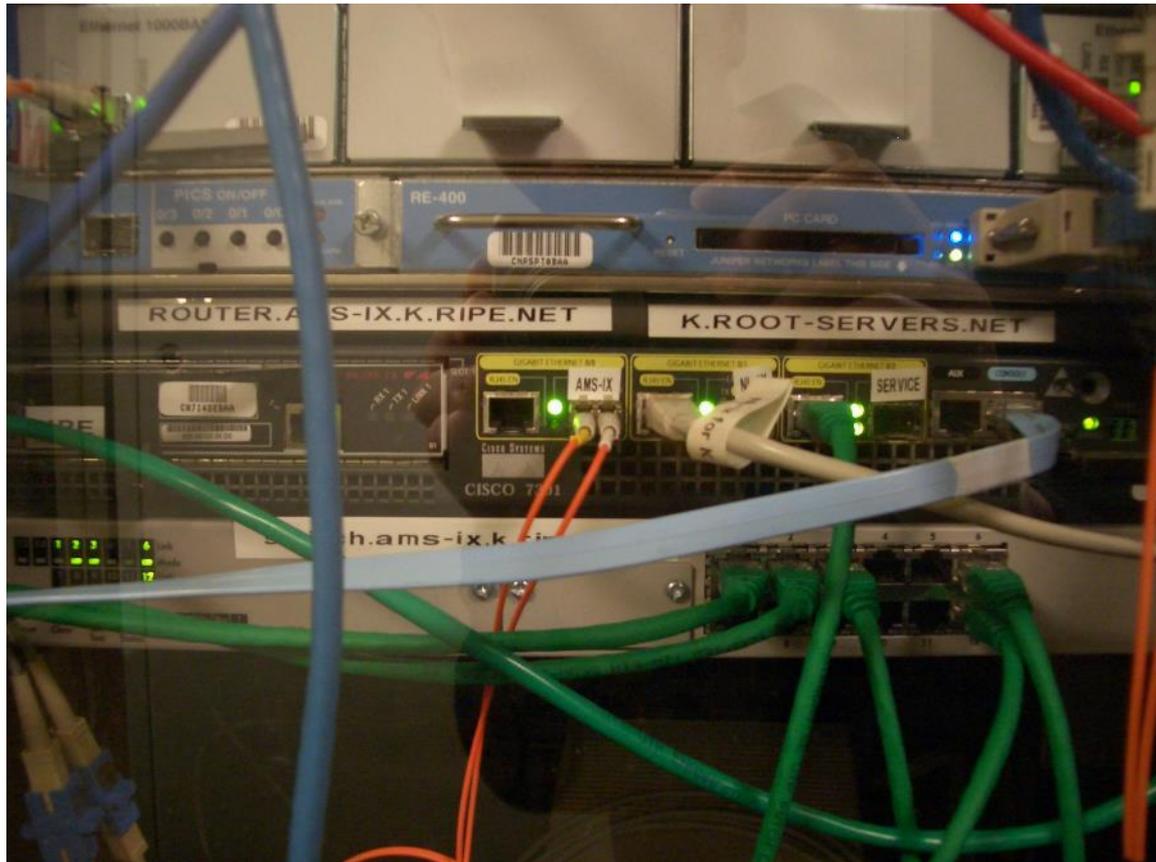
TLD Registry (EURid)

DOMAIN

Domain Admin (Commission)



1. The Root



1. The Root

- IANA manages the root zone database
 - The root zone file is extracted from the root zone database
- The root zone file is hosted on 13 identical root servers, managed by different organisations (2 by EU orgs: RIPE & NetNod)
- Each of those 13 has many copies around the globe
- 4 of those copies are hosted in Brussels
- The US government (NTIA) no longer oversees the IANA function (transition occurred on 1 October 2016)



1. The Root - root zone file (root servers)

```

eu.                172800 IN      NS      x.dns.eu.
eu.                172800 IN      NS      y.dns.eu.
eu.                172800 IN      NS      cz.dns.eu.
eu.                172800 IN      NS      nl.dns.eu.
eu.                172800 IN      NS      si.dns.eu.
eu.                172800 IN      NS      uk.dns.eu.
EU.                86400  IN      DS      61179 7 1 87E2B3544884B45F36A0DA72DADCB0239C4D73D4
EU.                86400  IN      DS      61179 7 2 3B526BCC354AE085AD9984C9BE73D271411023EFF421EF184BCE41ACE3DE9F8B

EU.                86400  IN      RRSIG   DS 8 1 86400 20150411170000 20150401160000 48613 .
bCTz3iQYxp7pTGQI7hG3jZiSuQ5pP3mkDbOl1QPRoejWtSnpf9caiovgI9Z49MN1bc8nWpbN6cVjB0HaswkHSOcJ0VMD6ZsXlIMNGtHPnWcBujayiGG2EdEaavBbUu
xH39zJcb1R73qZtzocbVAizuYRVlQEvTz6rg7RgXl/nE=

cz.dns.eu.        172800 IN      A       93.190.128.138
nl.dns.eu.        172800 IN      A       91.200.16.100
si.dns.eu.        172800 IN      A       193.2.221.60
si.dns.eu.        172800 IN      AAAA    2001:1470:8000:100:0:0:0:1
uk.dns.eu.        172800 IN      A       195.66.241.178
x.dns.eu.         172800 IN      A       194.0.1.19
x.dns.eu.         172800 IN      AAAA    2001:678:4:0:0:0:0:13
y.dns.eu.         172800 IN      A       194.146.106.90
y.dns.eu.         172800 IN      AAAA    2001:67c:1010:23:0:0:0:53
ns6.nominum.eu.  172800 IN      A       81.200.69.35

eu.                86400  IN      NSEC    eurovision. NS DS RRSIG NSEC

eu.                86400  IN      RRSIG   NSEC 8 1 86400 20150411170000 20150401160000 48613 .
Y2+jPipksunT5NSn9BGs6XUpOnFCFX8wlYwZug1+Hh4xrh3f+YzoHAMtm3maHqN/A2QwB+tWKxbQhLx9bIR4vFaj2H8fEGOFs+P6e3X2IRRxYOcEkubx+v9QweLpSq
5yp5uA6OVpOUUQ/phShZLDVVfCTbL0XbBacFeXTQFSLZjQ=

```

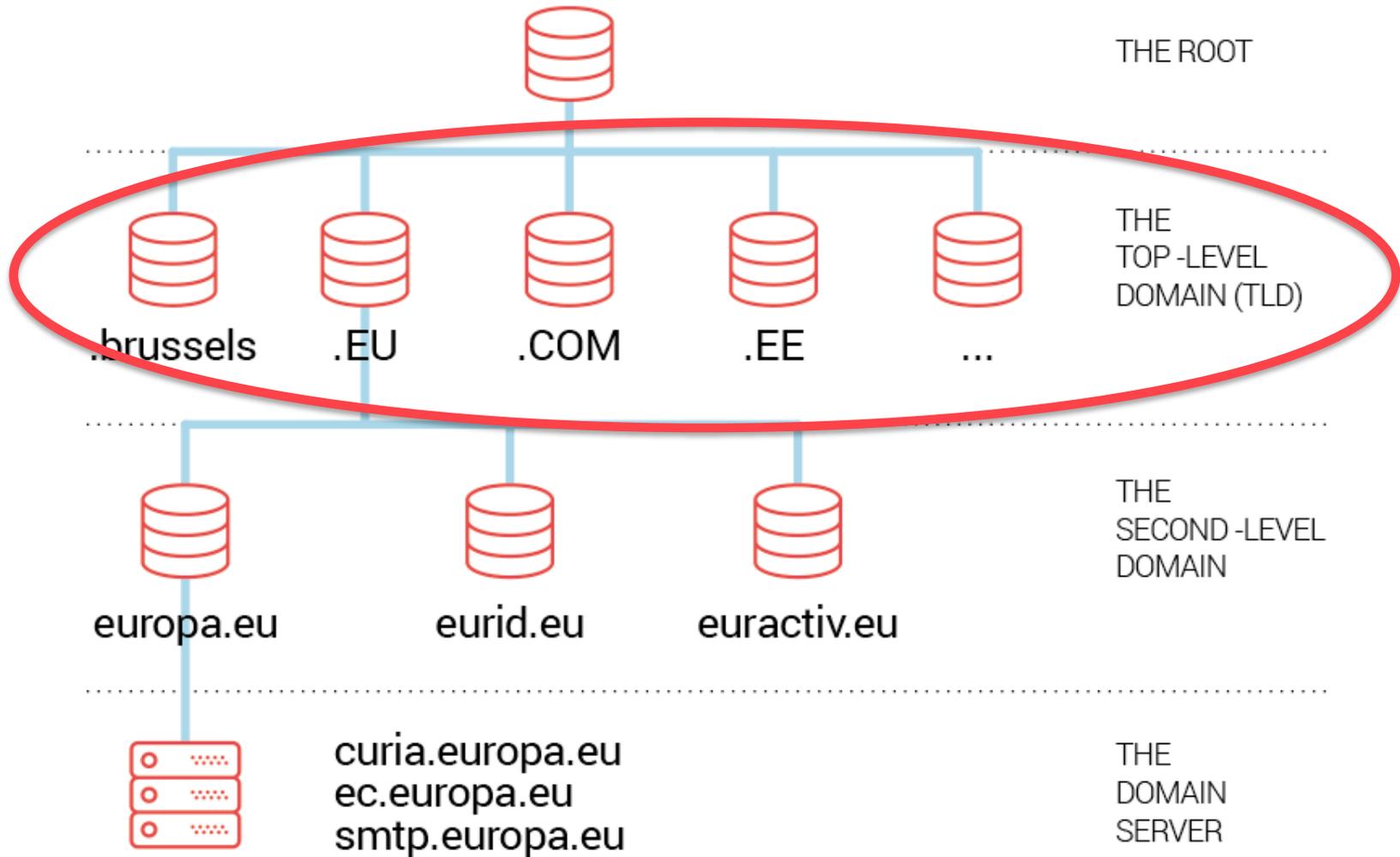
2. The top-level domains

- There are (currently) 1,532 top-level domains

ccTLDs	gTLDs
Country code top-level domains (ccTLDs)	Generic top level domains (gTLDs)
1200-ish ccTLDs	1200-ish gTLDs
Managed locally – serving the local internet community – funded by registration fees	Unrestricted but costly long ICANN process
Managed by independent operator under contract with ICANN – operator pays ICANN	Managed by independent operator under contract with ICANN – operator pays ICANN

Cyrillic .EЮ & Greek .Ευ

.wine / .vin





2. .eu WHOIS record for europa.eu

<https://whois.eurid.eu/en/>

TECHNICAL
Name Proximus DNS Masters

NAME SERVERS

ns1bru.europa.eu	158.169.131.22
ns2eu.bt.net	
ns3bru.europa.eu	2a01:7080:14:101::2
ns2lux.europa.eu	158.169.9.30
ns1lux.europa.eu	158.169.9.11
ns2bru.europa.eu	158.169.131.32
ns1.be.colt.net	
ns1.bt.net	
ns3lux.europa.eu	2a01:7080:24:101::2

Fax
Email
friedrich.kloibhofer@ec.europa.eu

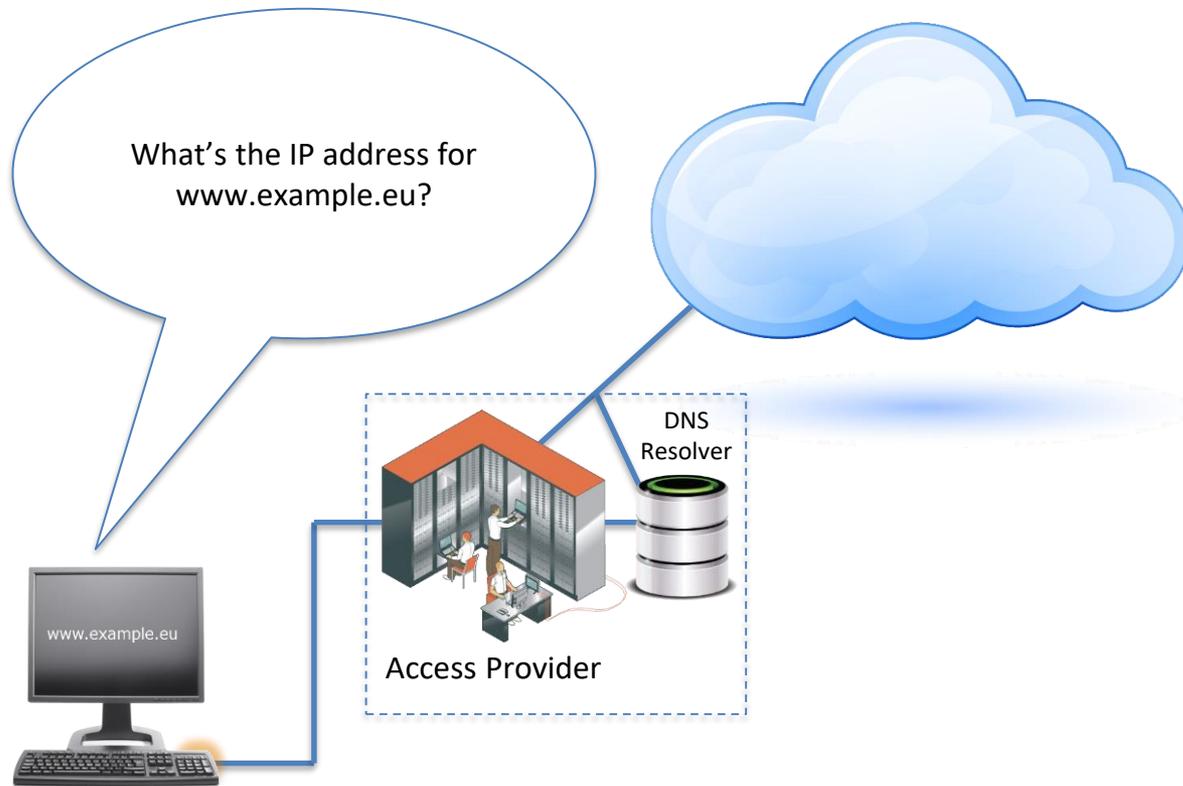
1. User types domain name into browser



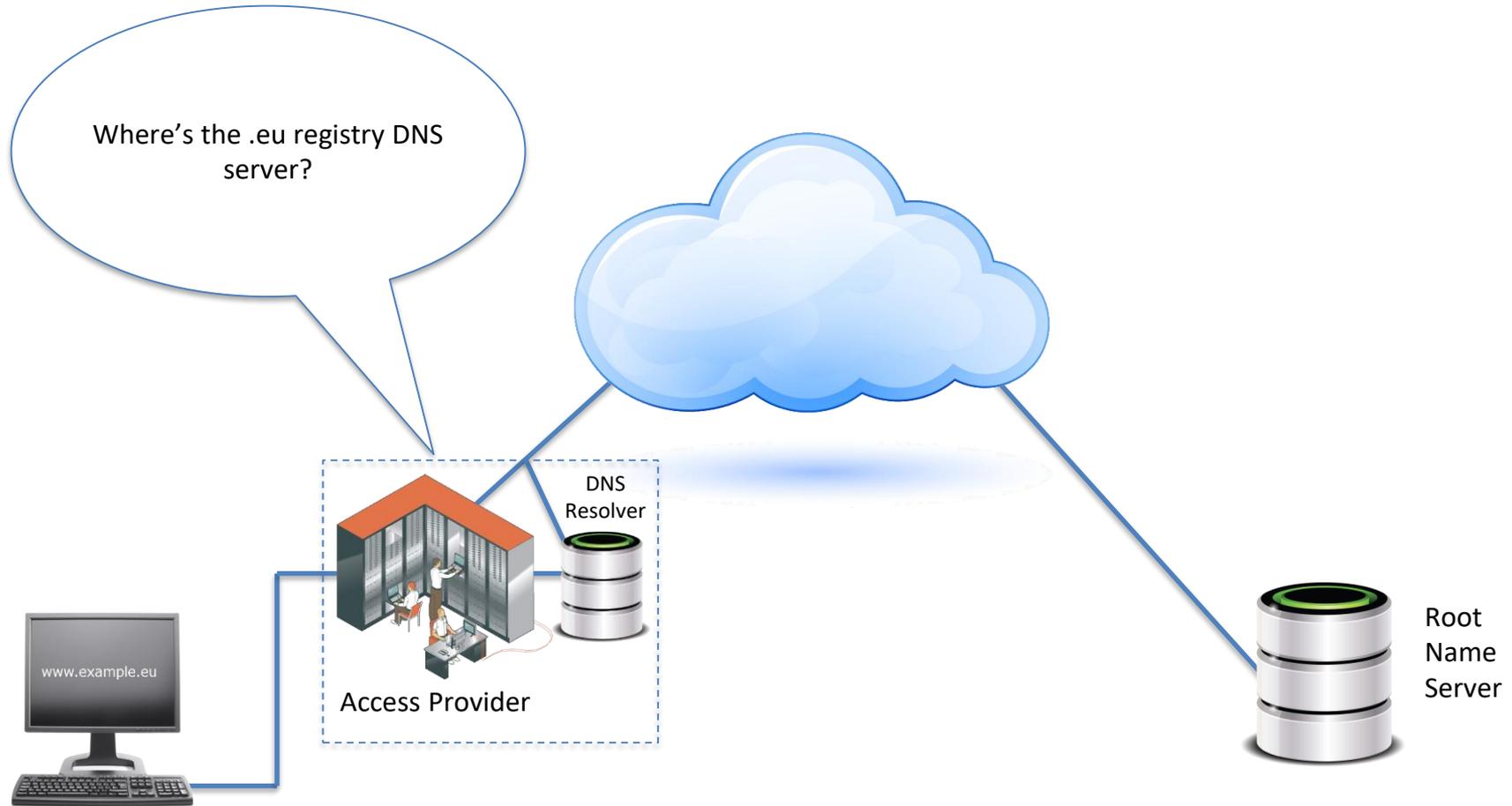
1. User types domain name into browser



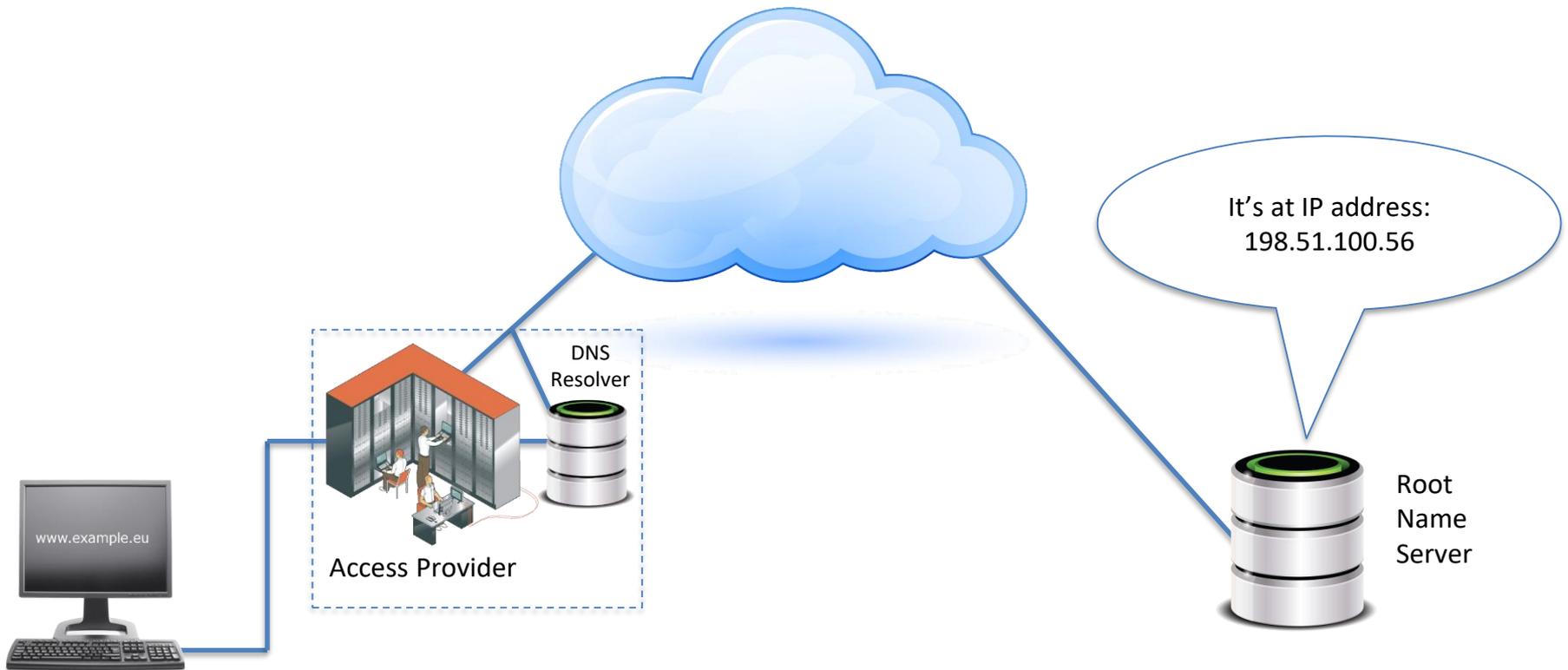
2. Browser asks Access Provider for IP address of www.example.eu



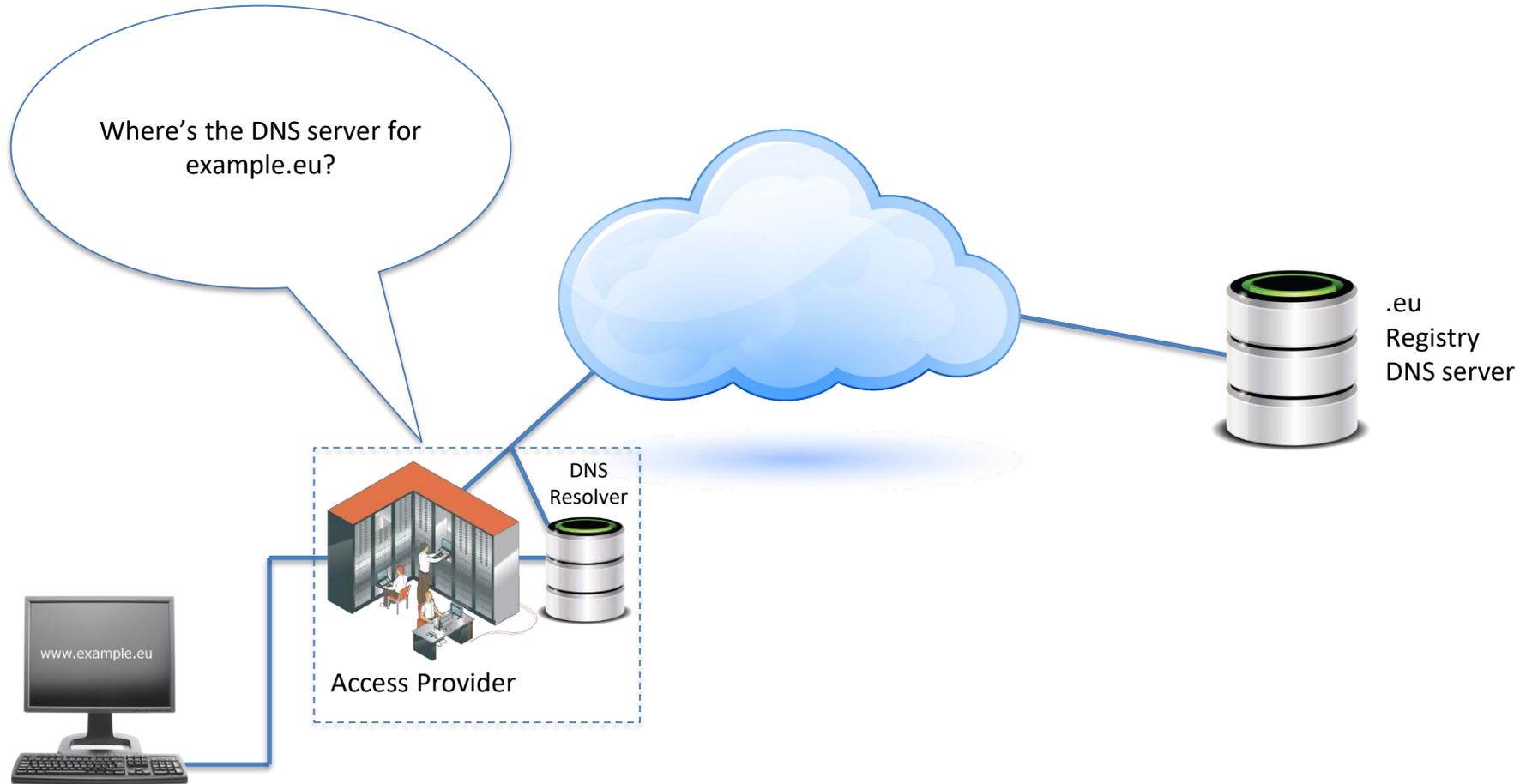
3. DNS Resolver asks Root Name Server for IP of a DNS server for .eu



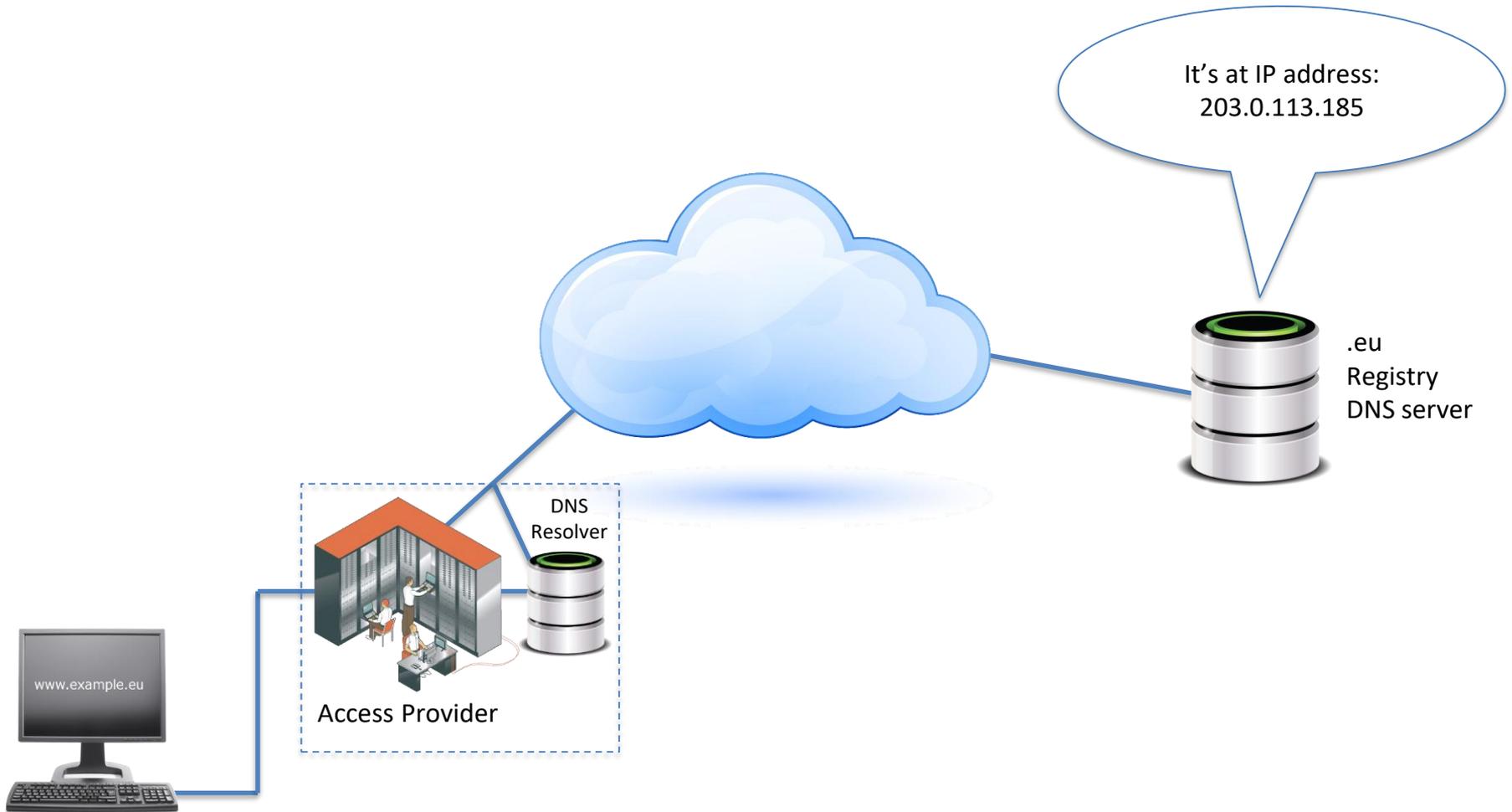
3. DNS Resolver asks Root Name Server for IP of a DNS server for .eu



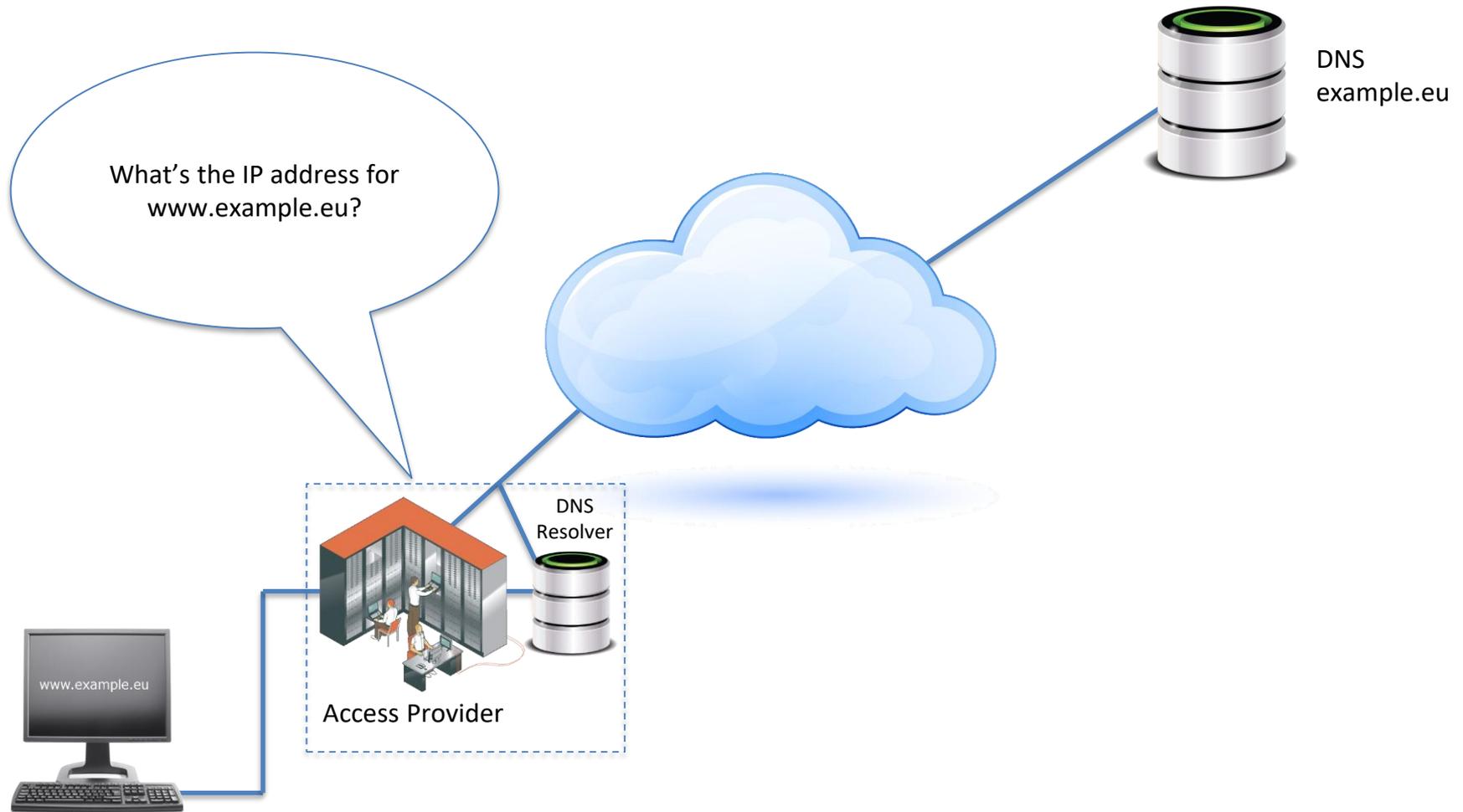
4. DNS Resolver asks .eu DNS server for IP of the DNS server for example.eu



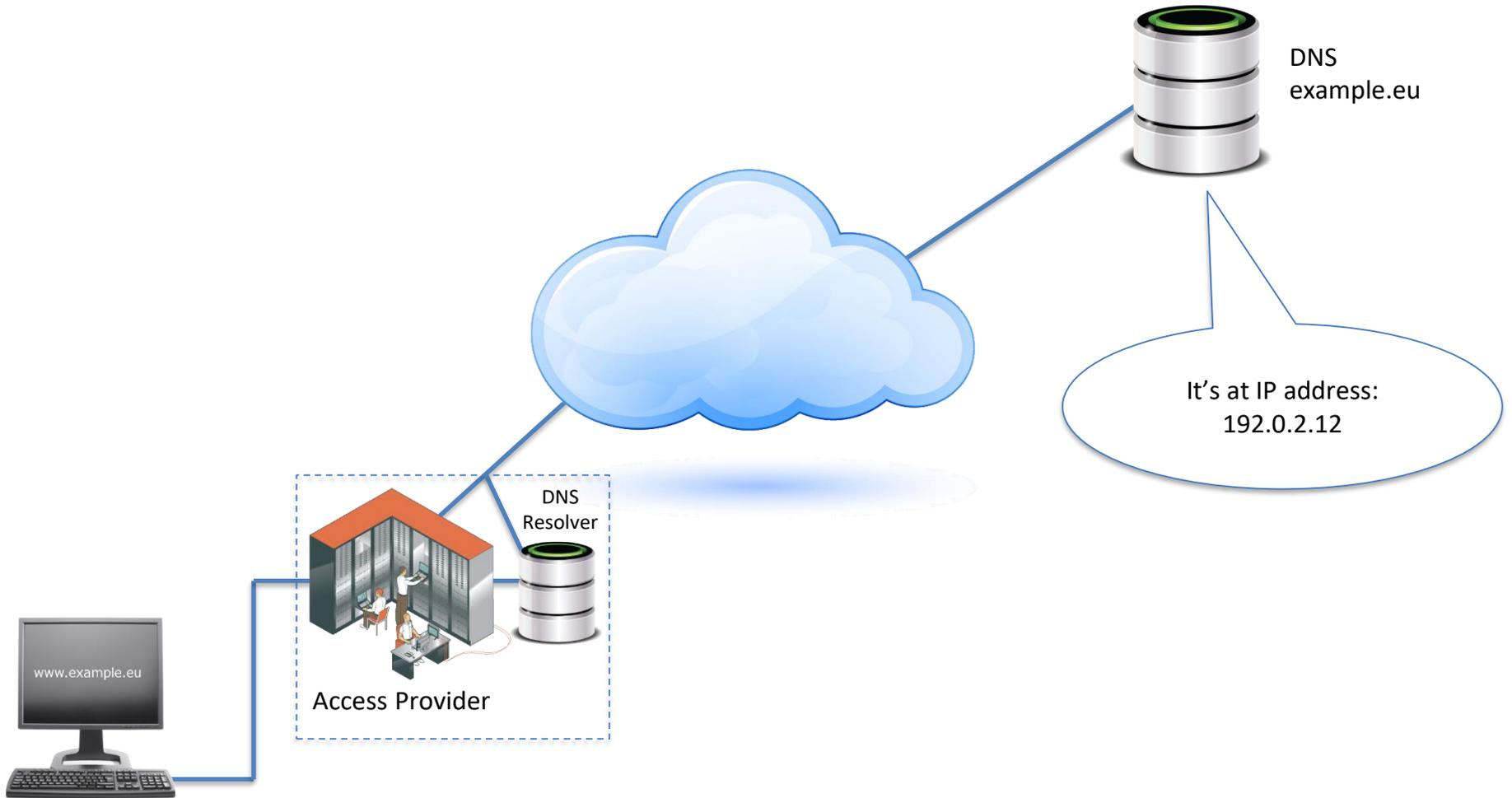
4. DNS Resolver asks .eu DNS server for IP of the DNS server for example.eu



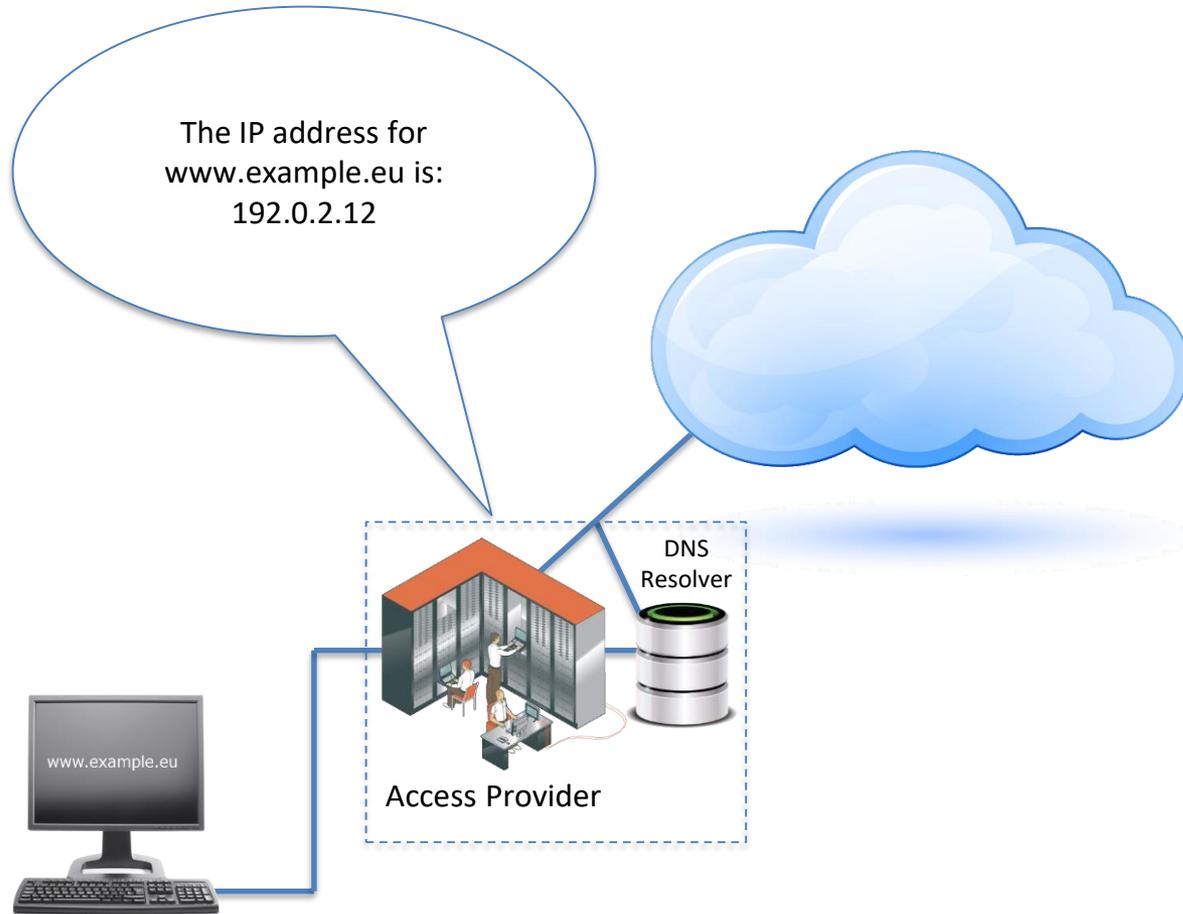
5. DNS Resolver asks for the IP address for www.example.eu ...



5. DNS Resolver asks for the IP address for www.example.eu ...



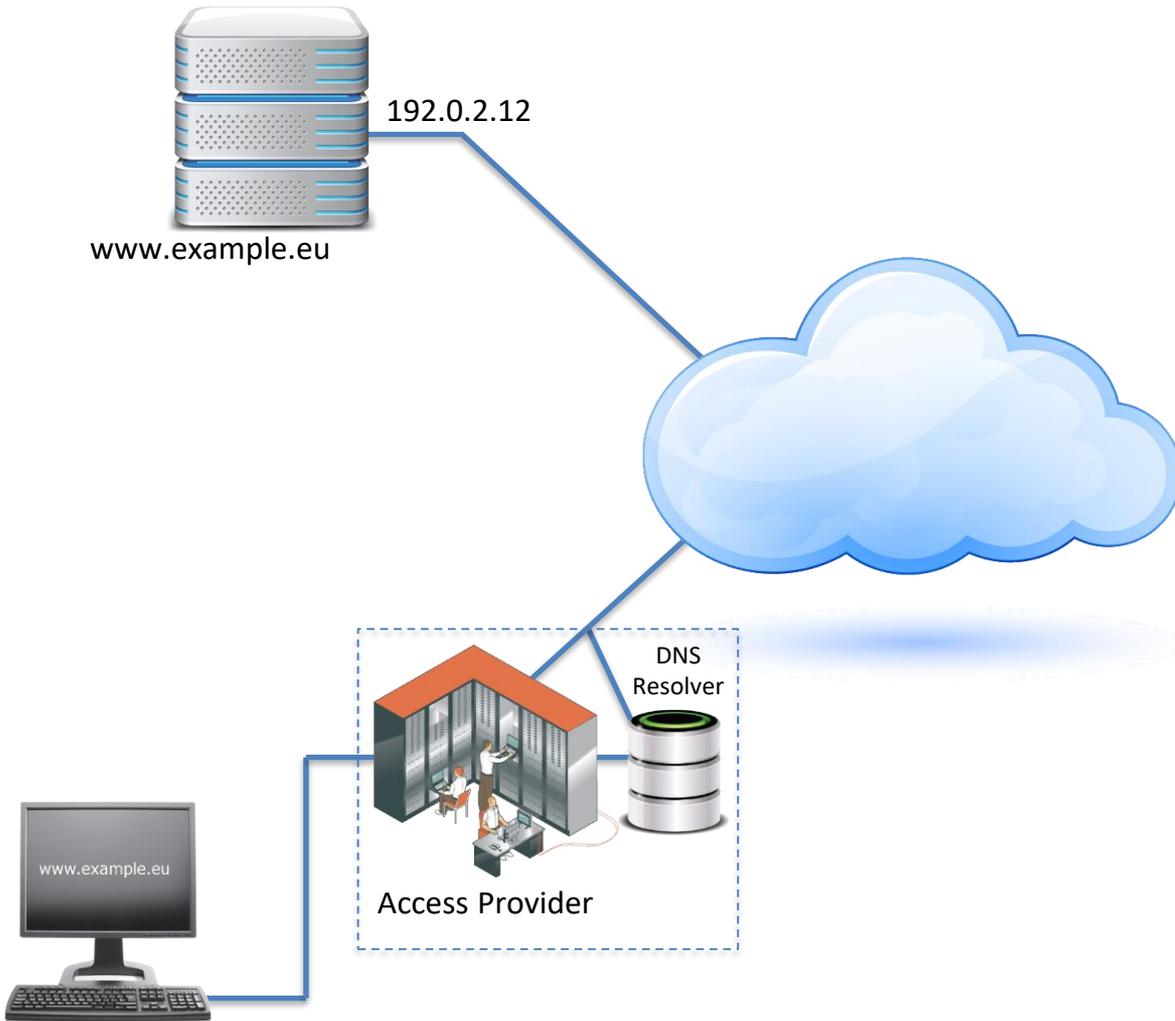
6. ... and passes the IP address back to the browser



7. ... which contacts the website host using the IP address



8. HTTP traffic begins

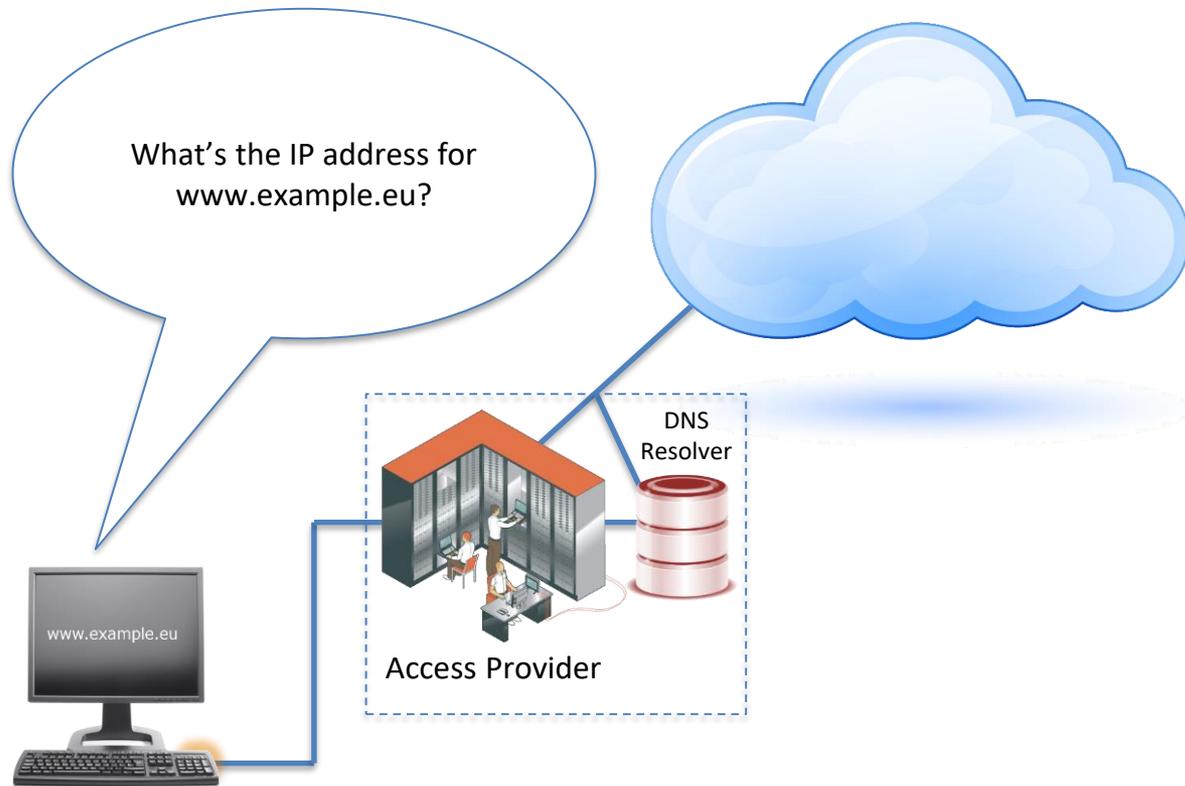


How DNS Blocking Works

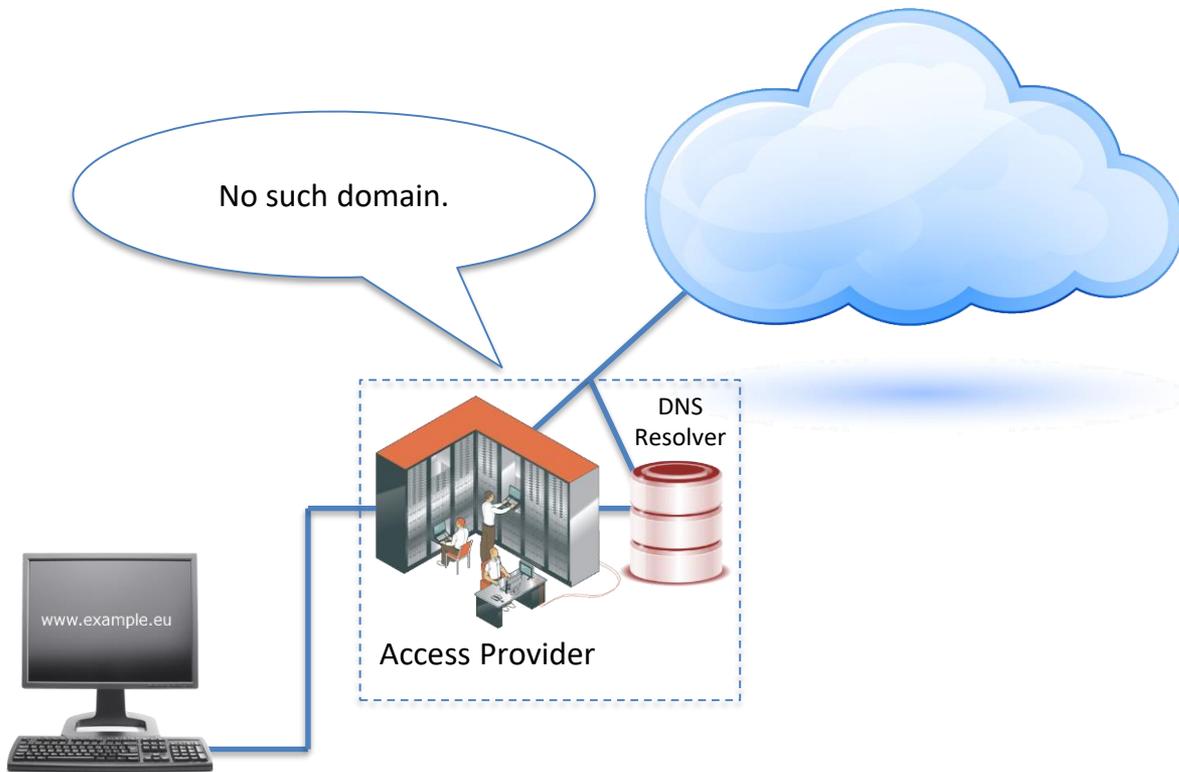


Blocking

How DNS blocking works



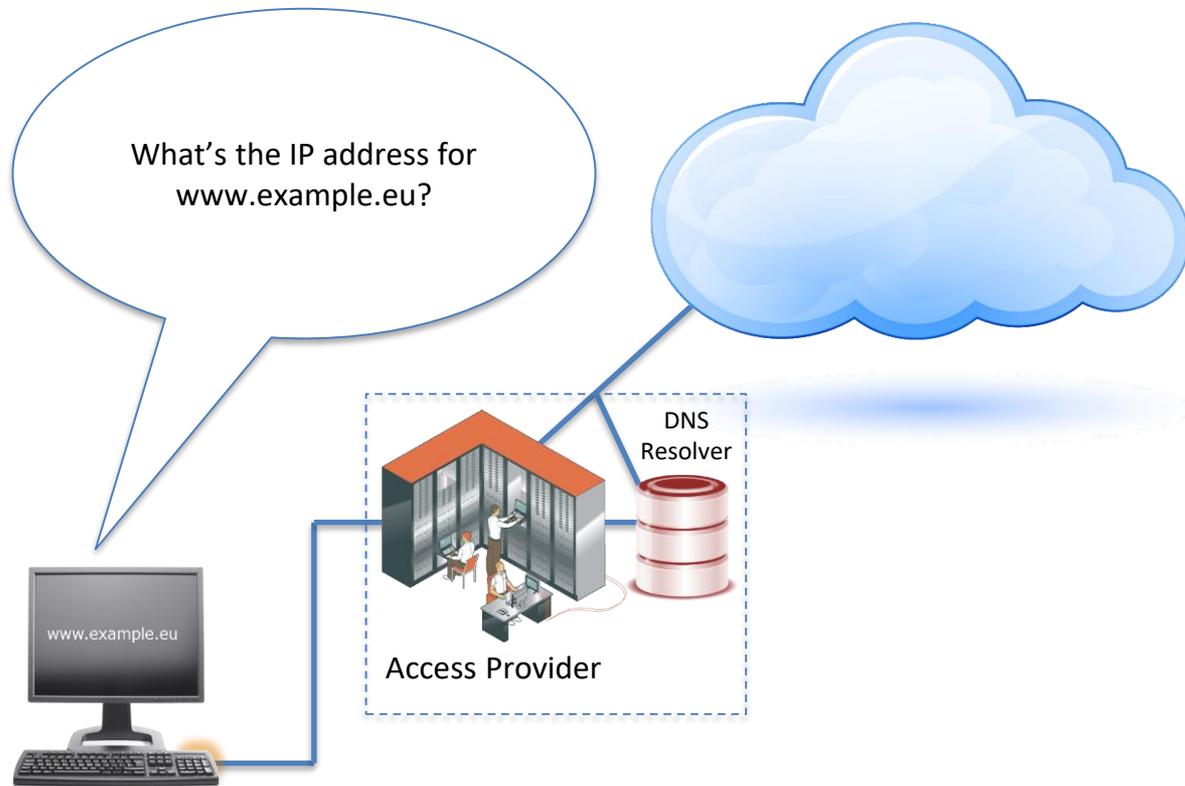
How DNS blocking works



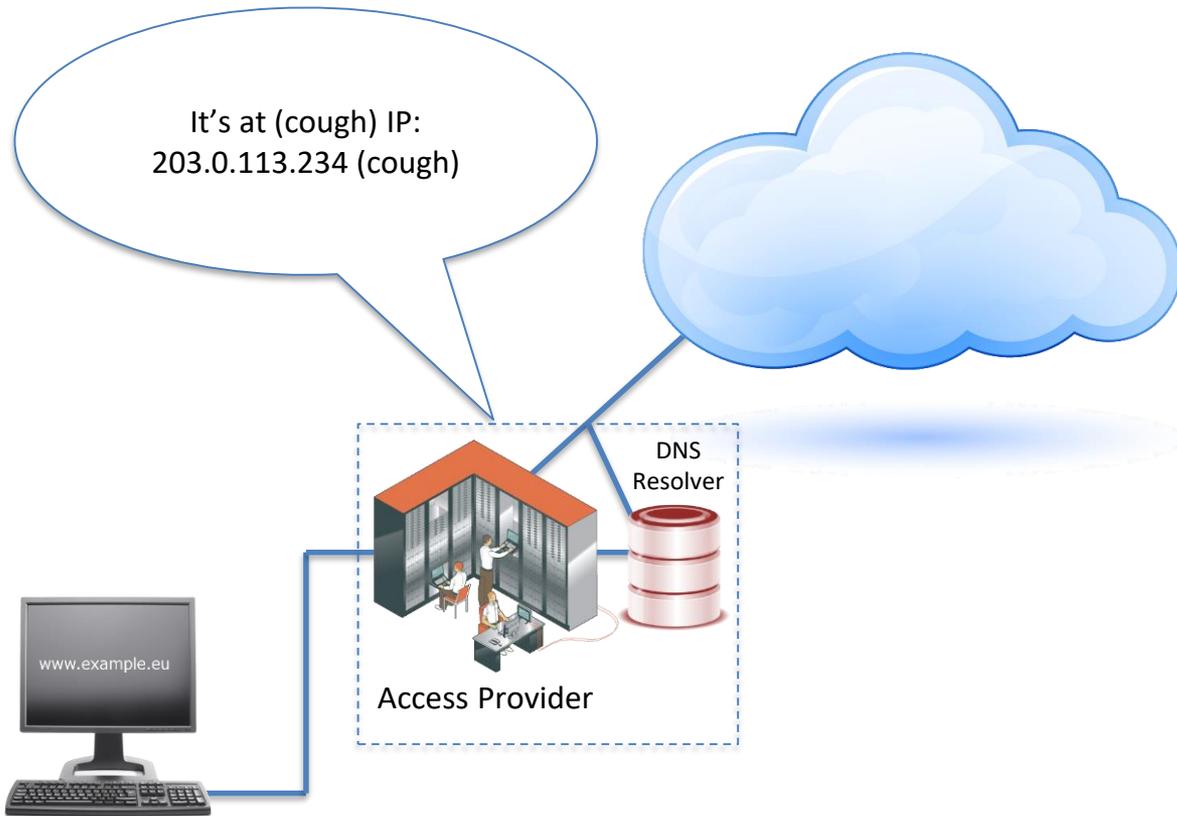
How DNS blocking works

Or...

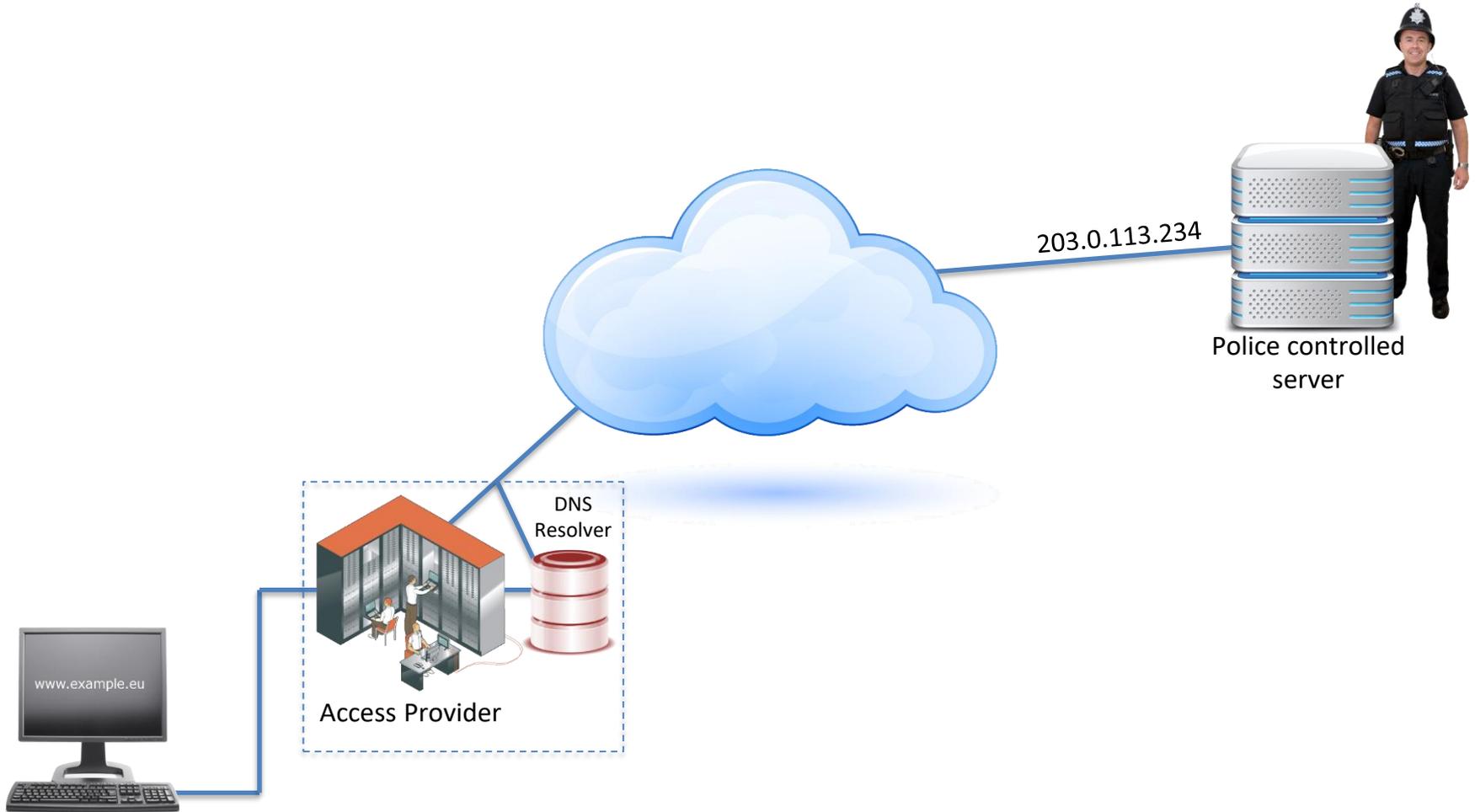
How DNS blocking works



How DNS blocking works



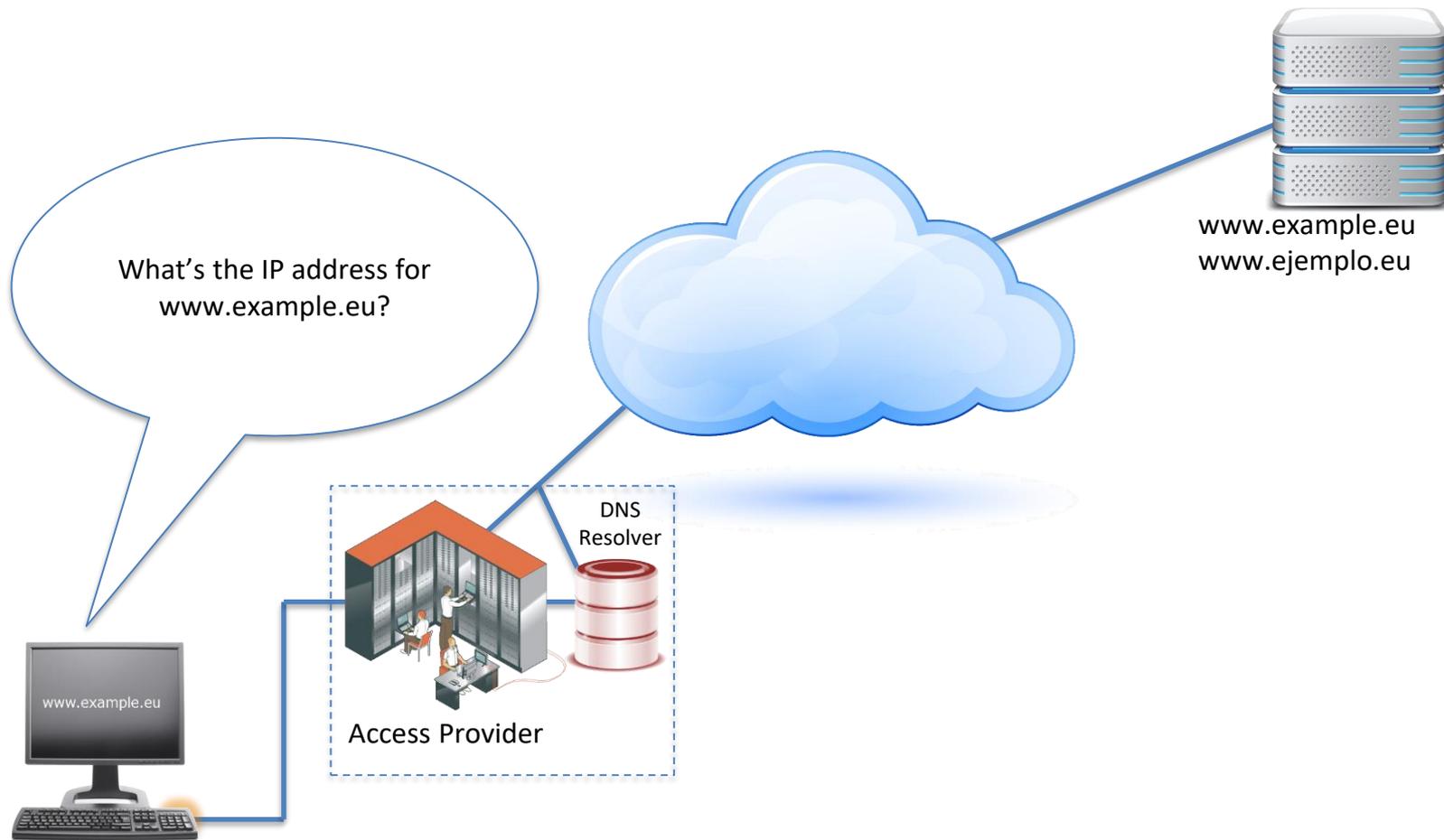
How DNS blocking works



Technical flaws in DNS blocking



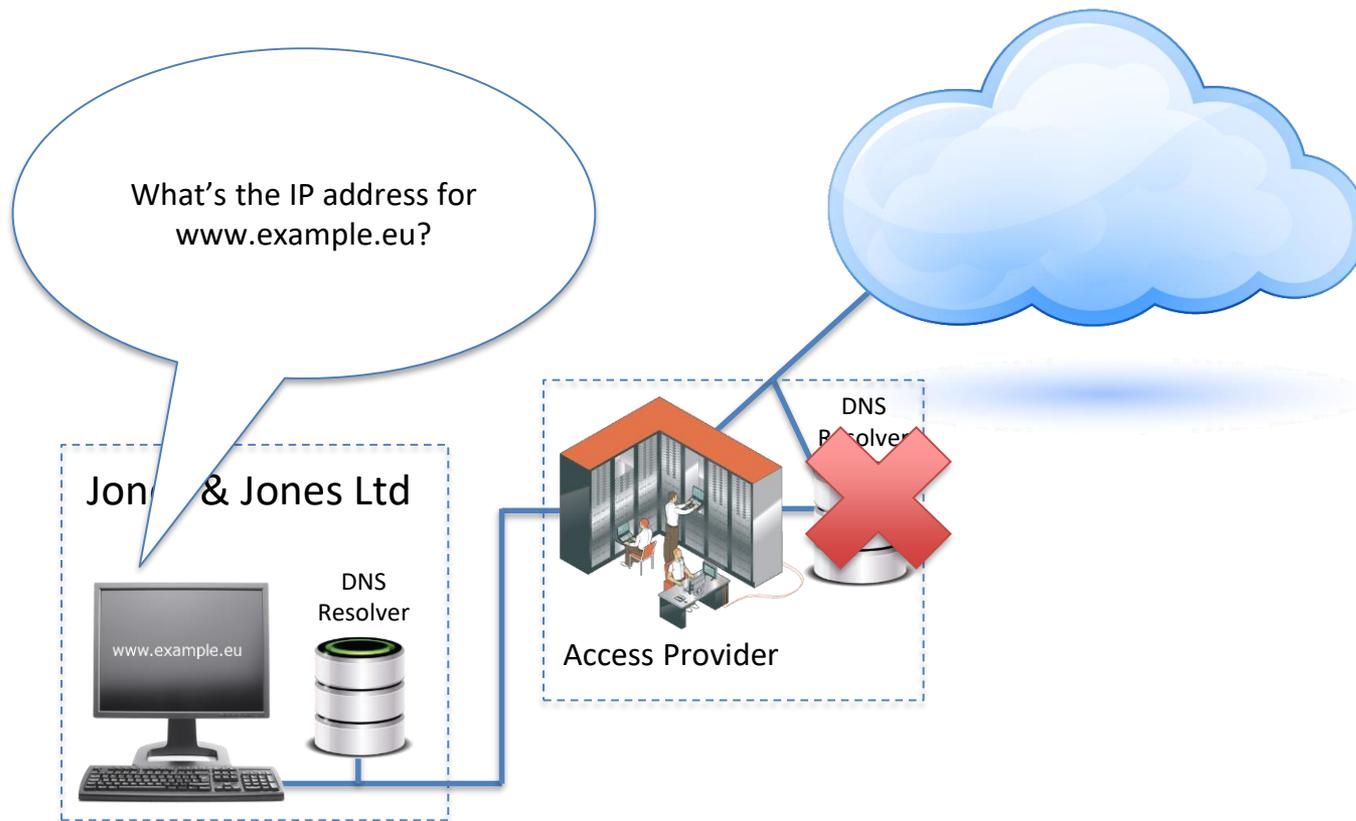
Technical flaws: multiple / changing domain names



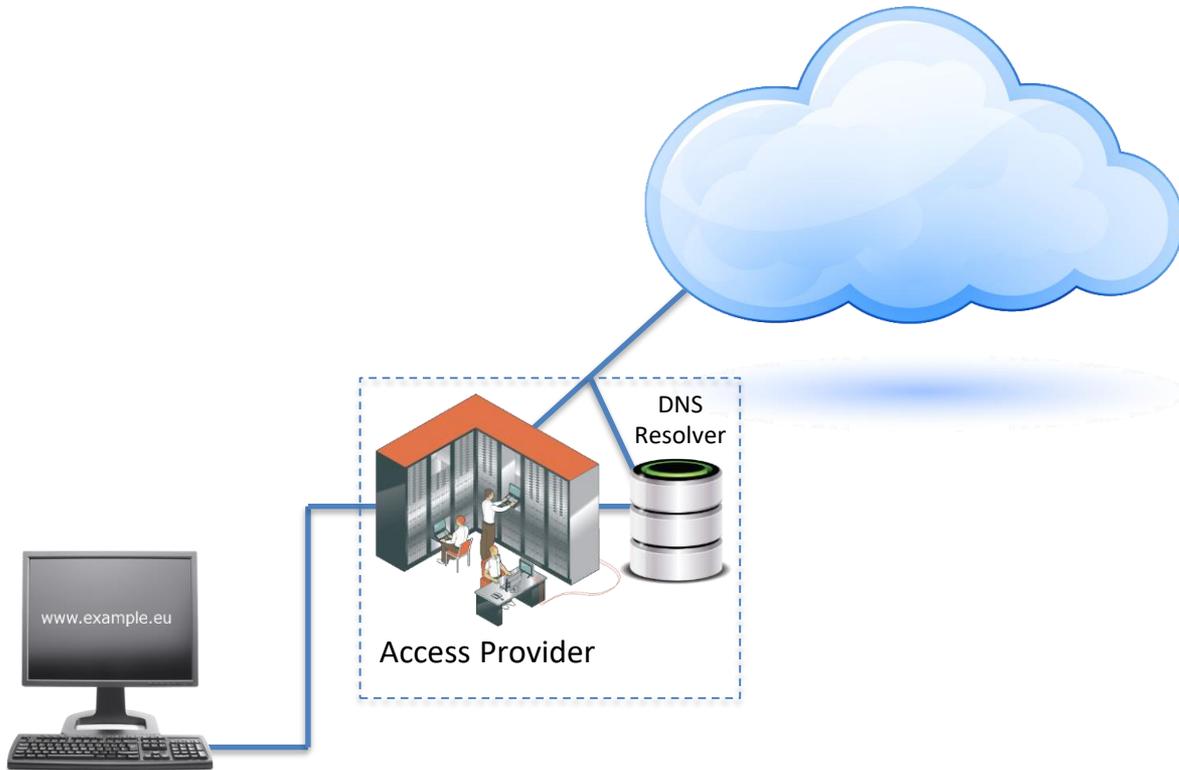
Technical flaws: user can bypass DNS by typing IP address directly into browser



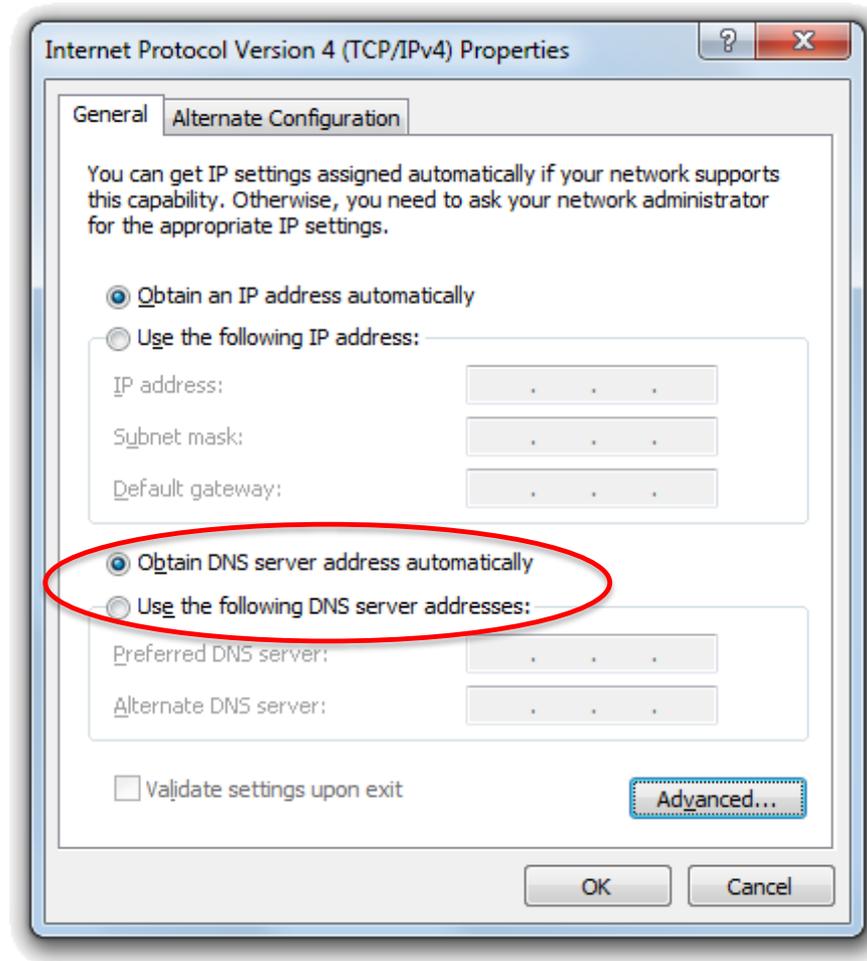
Technical flaws: many companies run their own DNS resolver



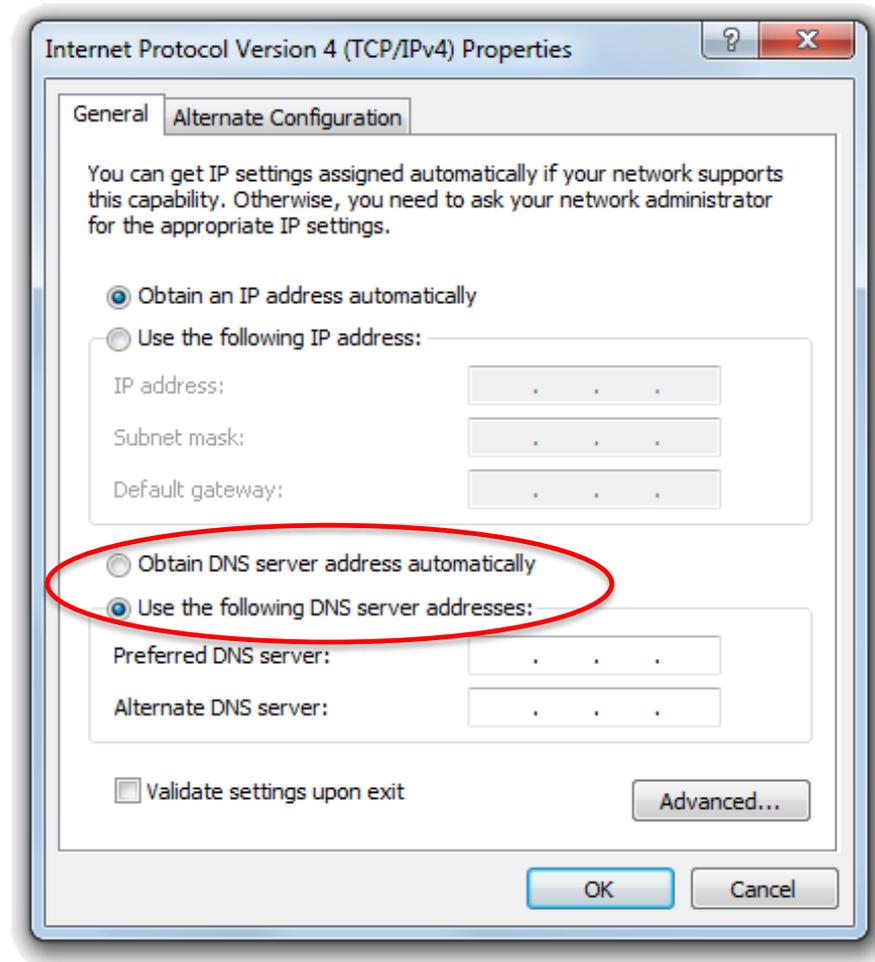
Technical flaws: client can use a third-party DNS resolver



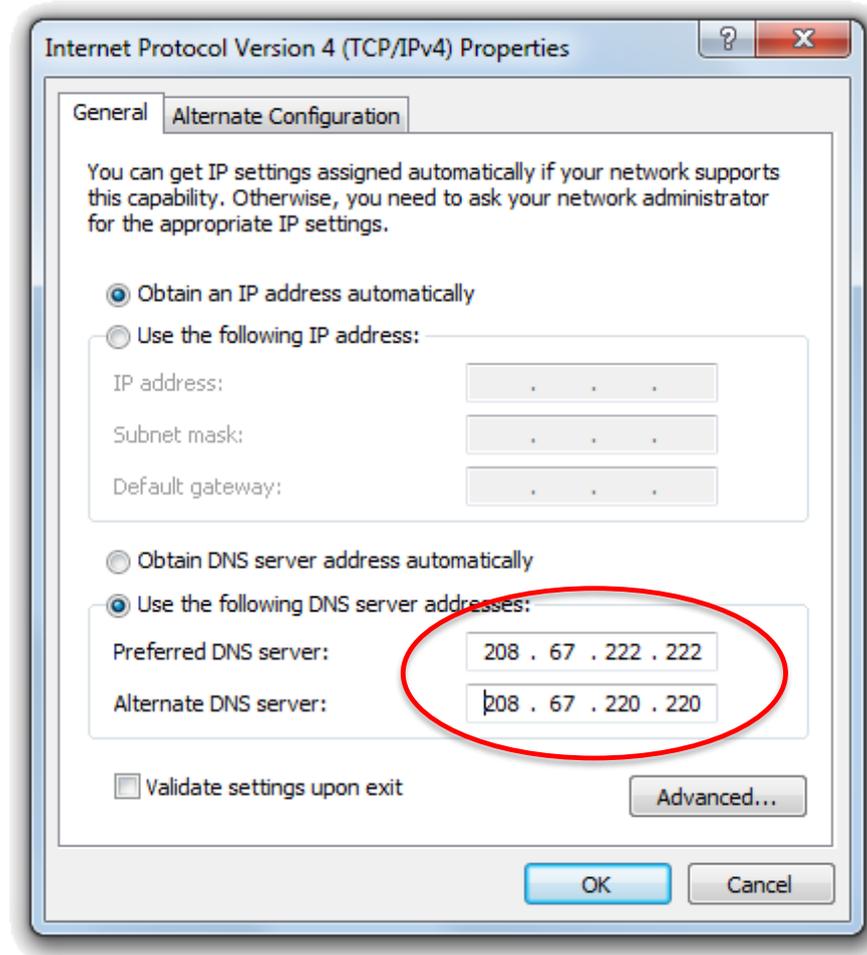
Technical flaws: client can use a third-party DNS resolver



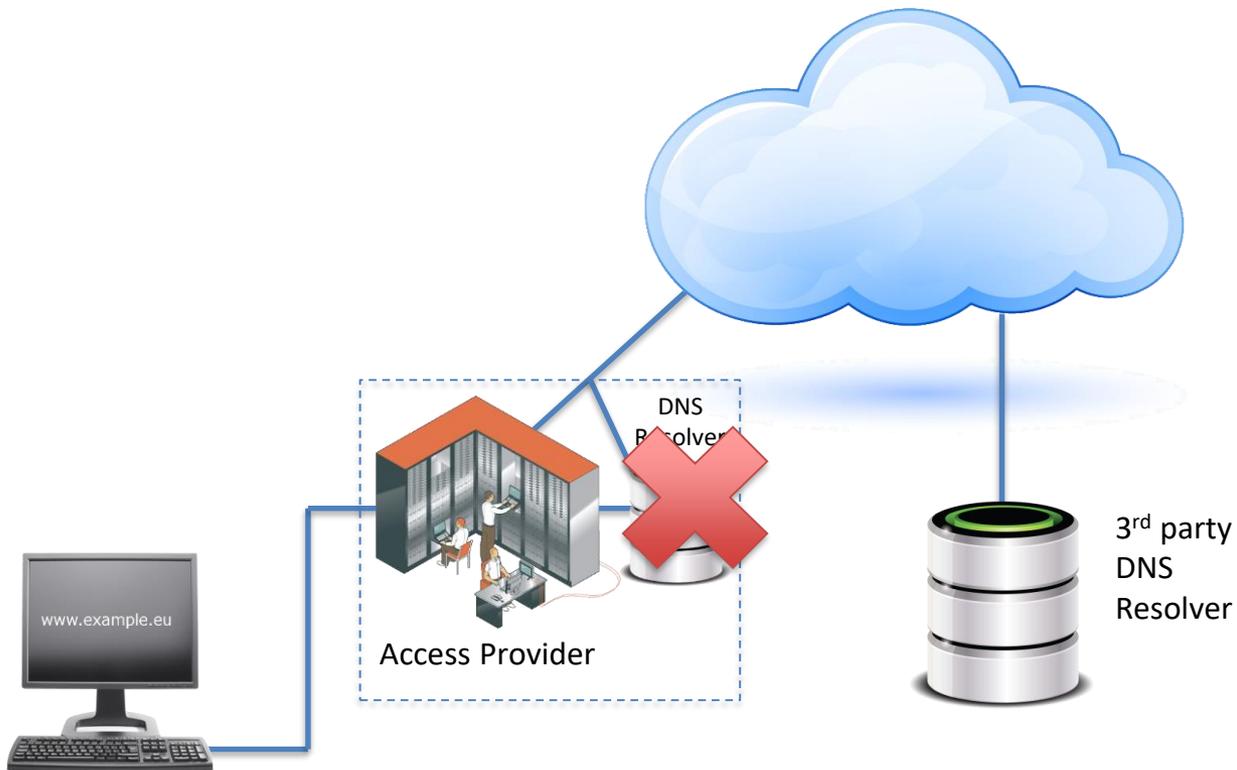
Technical flaws: client can use a third-party DNS resolver



Technical flaws: client can use a third-party DNS resolver



Technical flaws: client can use a third-party DNS resolver



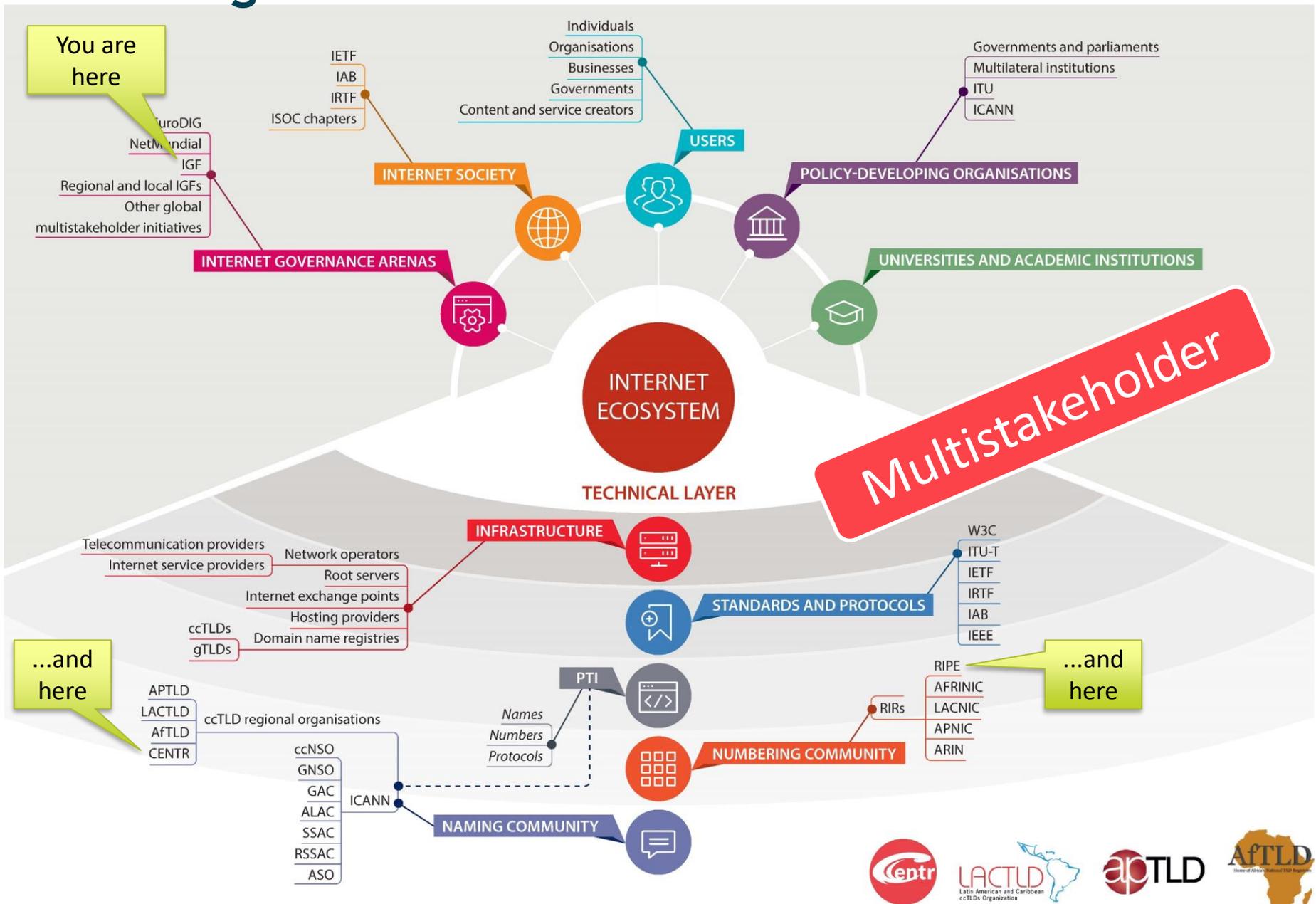
Conclusions

- “DNS blocking” is a technical term
 - It describes a technical procedure, not an outcome
 - It is not synonymous with “preventing access using DNS”
 - It is unlikely to prevent users from reaching content they are actively seeking
- There is a big difference between seeking to protect users from content they wish to avoid, and seeking to obstruct users from reaching content they seek
 - In the first case, you can enlist the support of users and the software and services they use
 - In the latter, there is always a way around any impediment, and these ways can and will be made easy for anyone to use



Time to wrap up

Who "governs" the internet?





What did we learn today?



What did we learn today?

www.europa.eu

94.100.119.1

www.allegro.pl

2610:a1:1015::17

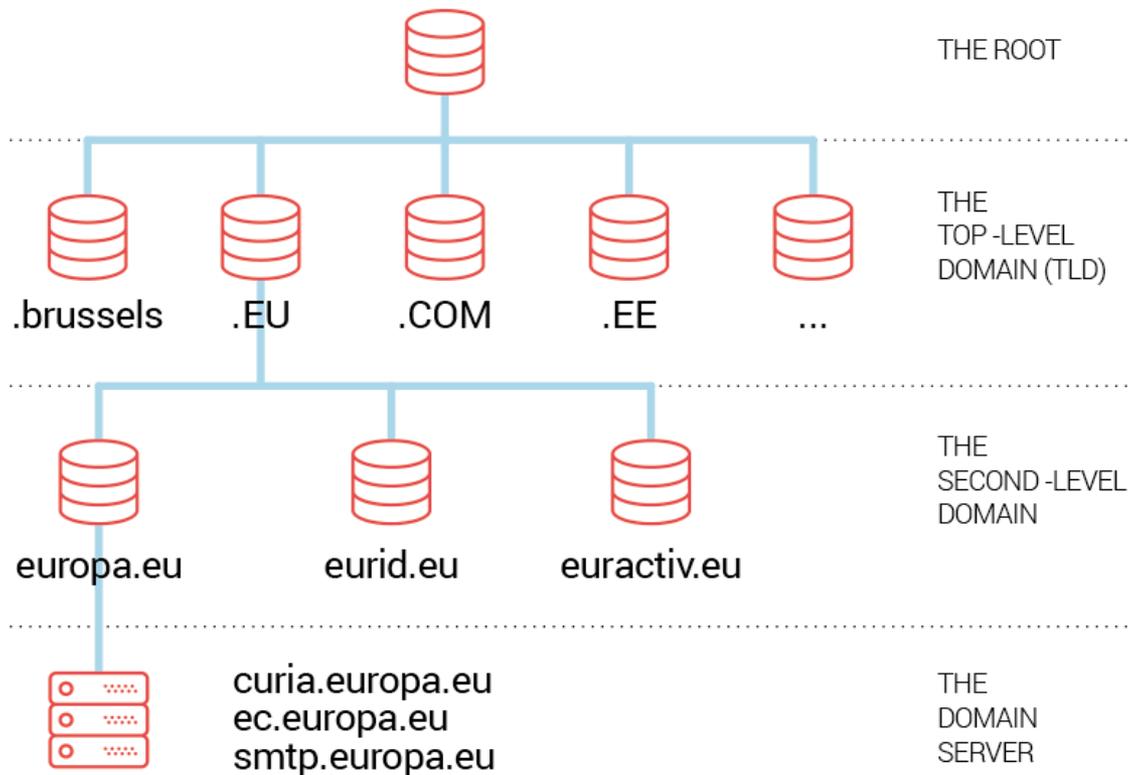
blog.orange.fr

info@standaard.be

74.125.77.106

рнидс.срб

What did we learn today?



One year ago in the news

The screenshot shows the ZDNet website interface. At the top, there is a search bar with the text "Recherchez sur ZDNet". Below the search bar is a navigation menu with categories like "News", "Blogs", "Livres blancs", "4G Monitor", "Speedtest", "Progiciels", and "Carrières IT". A secondary menu includes "FR", "Windows 10", "4G", "Sécurité", "DevOps", "PC et métiers", "Transfo Numérique", "Avenir de l'IT", "Chiffres clés IT", and "Partenaires".

The main banner features a Dell EMC Forum advertisement for "PARIS" on "MARDI 22 NOVEMBRE - Carrousel du Louvre". The ad includes the text "LET THE TRANSFORMATION BEGIN" and a "Je m'inscris" button. Below the banner is a yellow bar with the text "ZDNET.FR SUR LINKEDIN : Rejoignez le Club des professionnels et décideurs de l'IT".

The main article is titled "Google down : Orange bloque et redirige par erreur ses internautes vers le ministère de l'Intérieur [MAJ]". The sub-header reads "ZDNet.fr > News > Google down : Orange bloque et redirige par erreur ses internautes vers le ministère de l'Intérieur [MAJ] >". The article text states: "Réseaux : Depuis ce matin, les abonnés de chez Orange qui souhaitent se rendre sur le site de Google, de Wikipedia ou encore d'OVH rencontrent des difficultés. Certains utilisateurs se sont même vu servir une page du ministère de l'Intérieur, signalant le blocage administratif d'un site. Une erreur de DNS est en cause."

At the bottom of the article, it says "Par La rédaction de ZDNet.fr | Lundi 17 Octobre 2016".

A red diagonal banner with the word "Blocking" is overlaid on the right side of the article.



Some corners were cut in the making of this presentation.



Thanks to Malcolm Hutton (Linx)
for the fancy slides on blocking!



One more thing...

RIPE NCC and CENTR are signing a MoU!

You are very welcome to join us @ the NRO booth

Monday 18 December - 18.00 - 19.00



Thank you

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nina@centr.org