Università Federico II di Napoli
Scuola Politecnica e delle Scienze di Base
Complesso Napoli Est

Mercoledì 9 **Aprile** 2025
ore 9:30 – 18:00

neacademy

Introduzione al mondo degli Internet Exchange Point

Simone Morandini - MIX

Service Development Manager

streaming

shopping
on-line

update
software

social network

gaming on-line

Siete già passati da noi…

streaming

shopping on-line

update software

social network

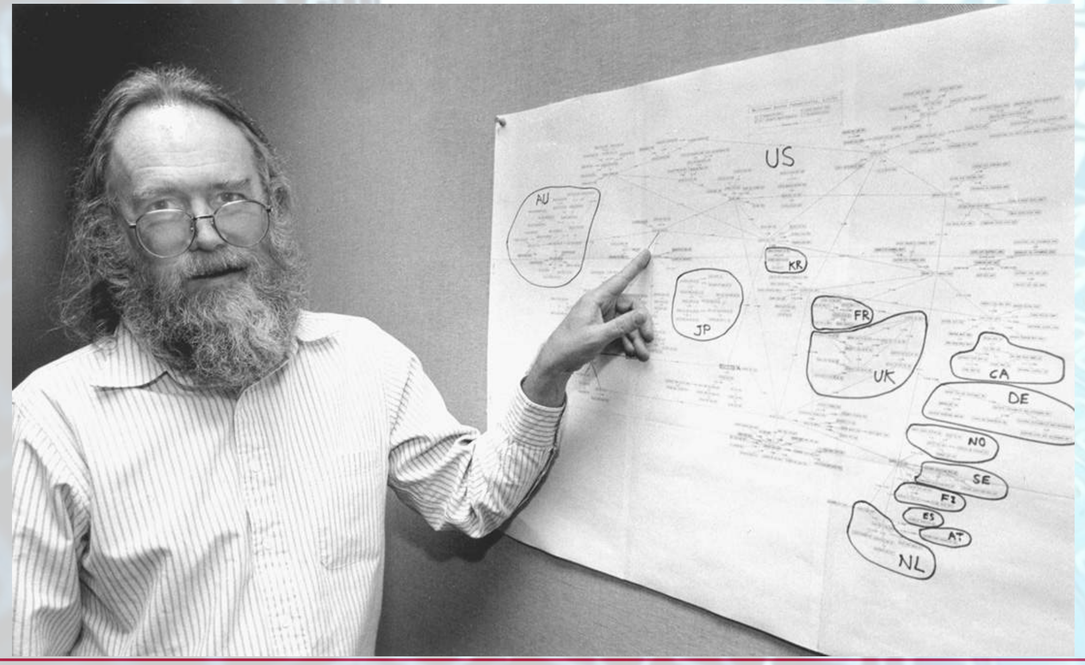
gaming on-line

…forse senza saperlo

A name indicates what we seek.

An address indicates where it is.

A route indicates how to get there.



Jon Postel
RFC 791
1981

Indirizzi IPv4/IPv6

- IPv4, 32 bit, ~4 miliardi di indirizzi
- IPv6, 128 bit, una valangata di indirizzi
  - Ma poche volte li dobbiamo gestire esplicitamente

Vi siete mai chiesti…

Come sono gestiti gli indirizzi IP?

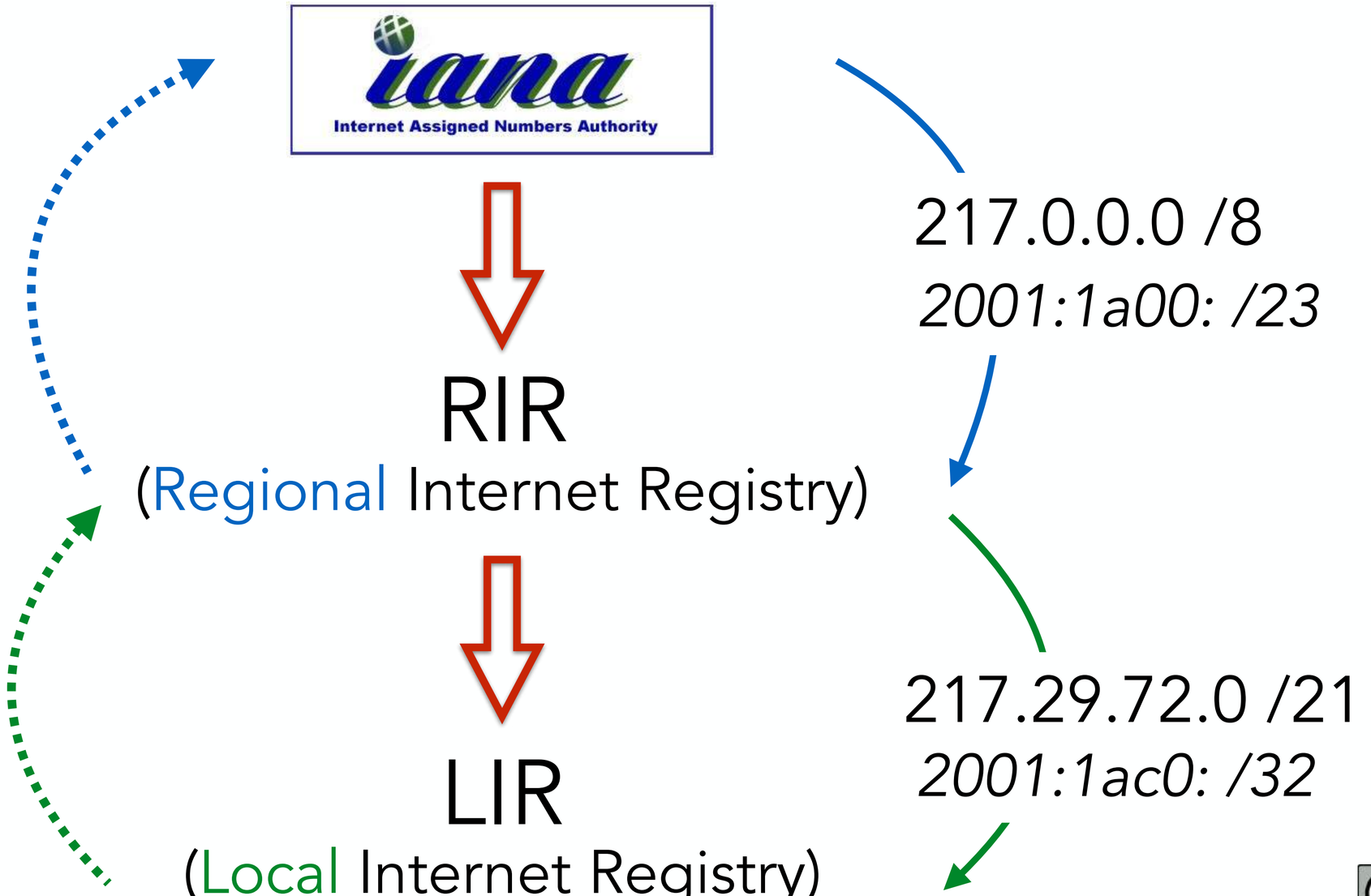
Da dove viene quello che sto usando?

Gestione indirizzi IP

1. Ente centrale (IANA) che gestisce tutto lo spazio di indirizzamento
2. IANA assegna dei “blocchi” ai vari continenti
3. Per ogni continente esiste un Registro (Regional Internet Registry - **RIR**) che assegna dei blocchi più piccoli agli operatori di rete locali
4. Ogni operatore al proprio interno gestisce in modo **autonomo** il blocco assegnato

Gestione indirizzi IP

Gestione indirizzi IP



Gestione indirizzi IP

217.0.0.0 /8

2001:1a00: /23

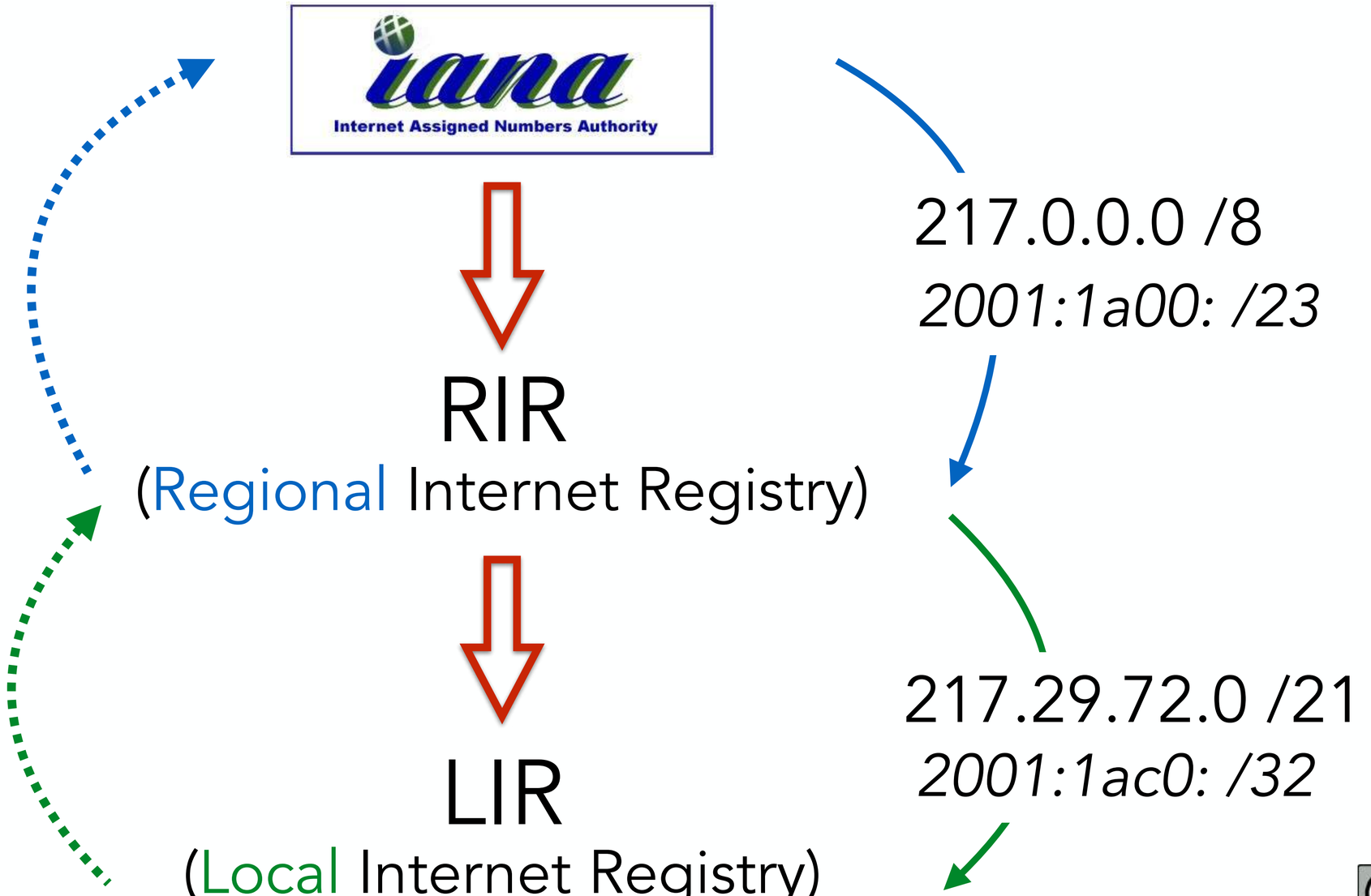
217.29.72.0 /21

2001:1ac0: /32

LIR

(Local Internet Registry)

Gestione indirizzi IP



Gestione indirizzi IP

iana
Internet Assigned Numbers Authority

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LIR
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Gestione indirizzi IP

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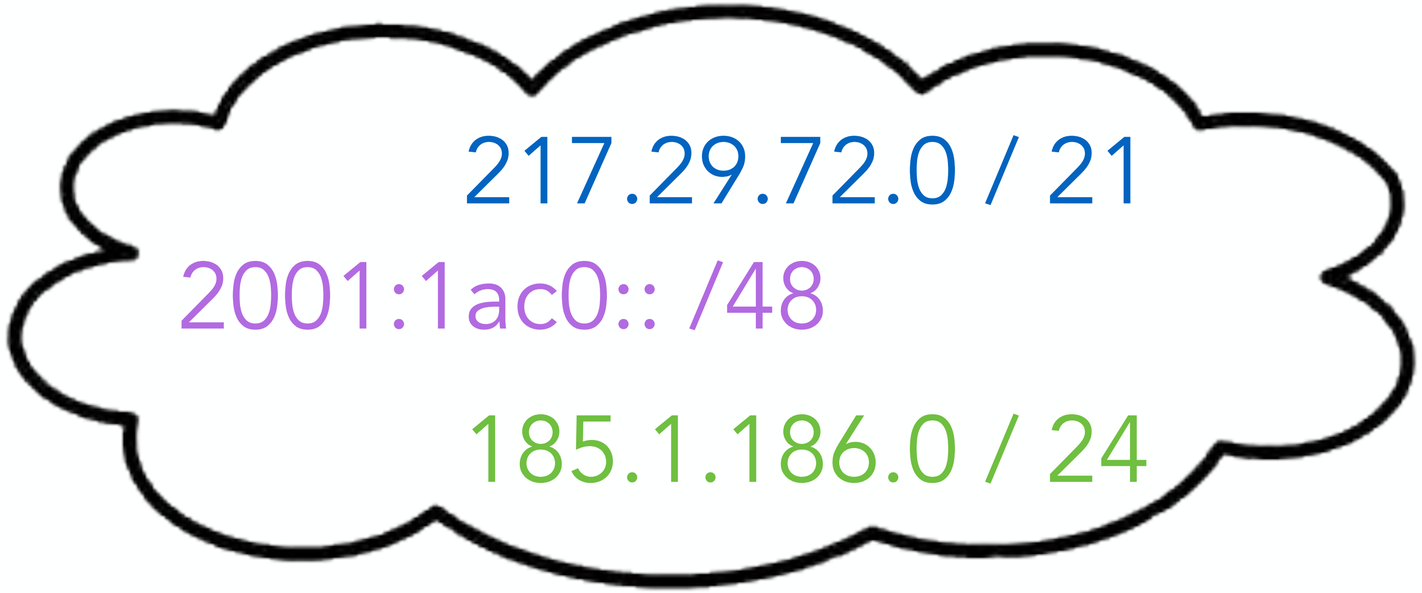
Autonomous System



- Indica una “famiglia” di reti e router
- Parametro essenziale per il corretto scambio di traffico su internet
- È un numero univoco
- Assegnato da RIPE NCC (o altro RIR)

RIPE NCC

IPs & ASNs | Analyse | Participate | Community | Support | Publications | About

RIPE.NET | RIPEstat
LIR Portal | RIPE Atlas
RIPE Database | RIPE NCC Academy
RIPE Labs | RPKI

Welcome to the RIPE NCC

As the Regional Internet Registry for Europe, Middle East and Central Asia, we serve over 20,000 members in 76 countries. We register IP addresses and ASNs, and act as the secretariat to the RIPE community.

About the RIPE NCC → LIR Portal

www.ripe.net

Latest news

→ Community Projects Fund 2024: Call for Applications

The 2024 call for applications for the Community Projects Fund is now open. The deadline for the applications is 31 July 2024 at 23:59 (UTC).

04 Mar 2024 community projects fund +1

→ RIPE NCC Sanctions Transparency Report (Q1 2024)

Our latest Quarterly Sanctions Transparency Report (Q1 2024) is now available.

04 Mar 2024 news +3

→ Member Update: February 2024

Read the monthly RIPE NCC member update for February 2024.

28 Feb 2024 member update +3

Esaurimento IPv4

- I 4 miliardi di indirizzi IPv4 sono **esauriti**
- Nuovi fenomeni registrati:
  - assegnazione razionata
  - recupero risorse inutilizzate
  - compravendita spazi IPv4
- Nessuna catastrofe all'orizzonte!
- IPv6 argomento centrale

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17 Aprile 2018
Assegnata l'ultima /22
all'interno dell'ultima /8

https://labs.ripe.net/Members/wilhelm/so-long-last-8-and-thanks-for-all-the-allocations

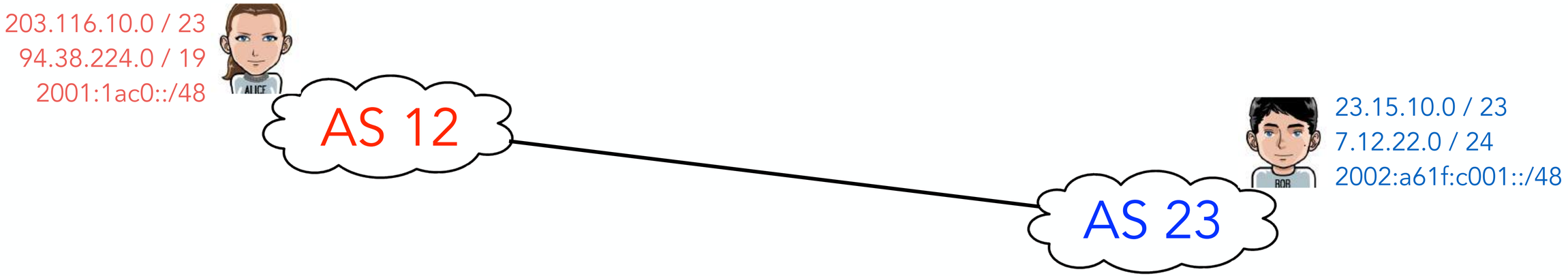
2 Ottobre 2019
Assegnata l'ultima /22 contigua
all'interno dello spazio recuperato

25 Novembre 2019
Assegnata l'ultima /22 equivalente

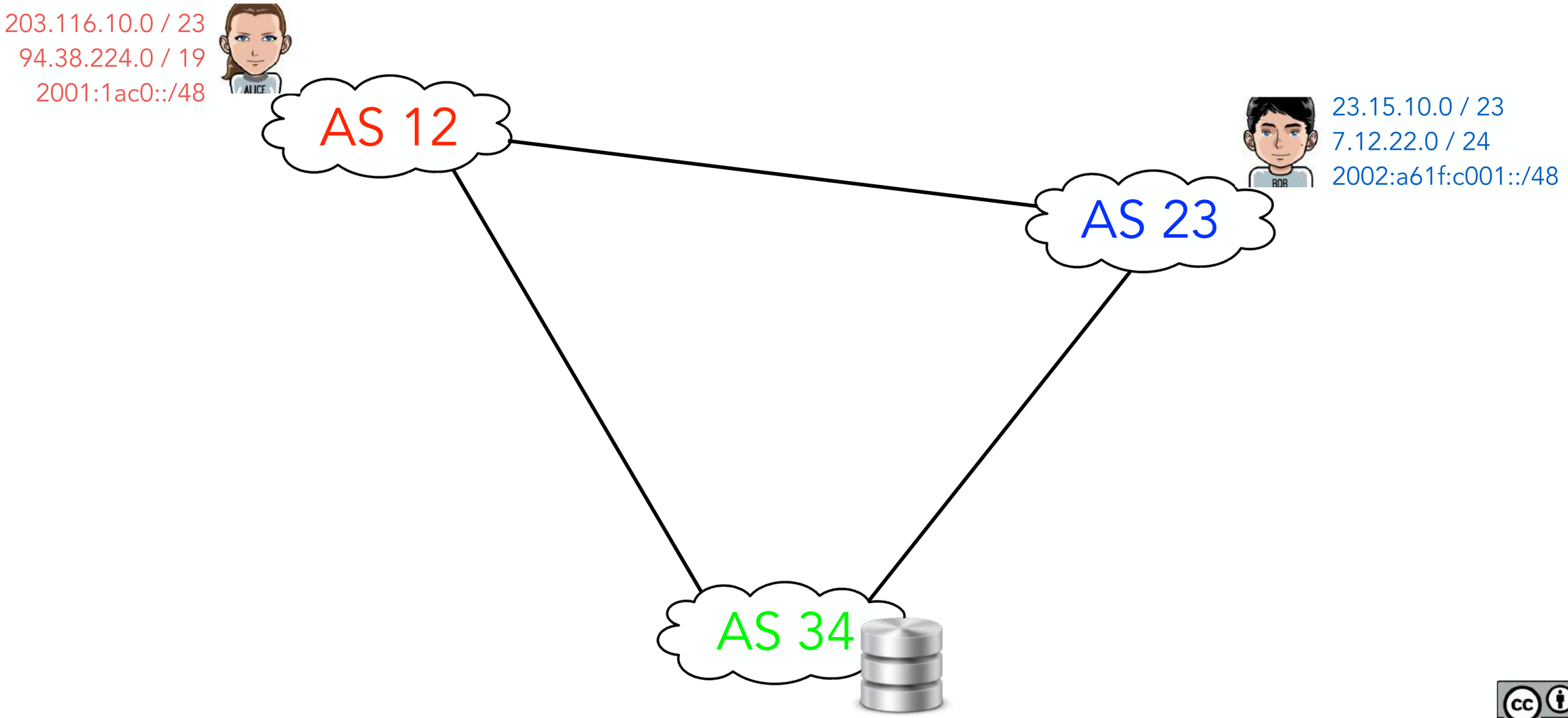
Adesso
Lista d'attesa per una /24

~980 LIR in coda
~540 gg di attesa

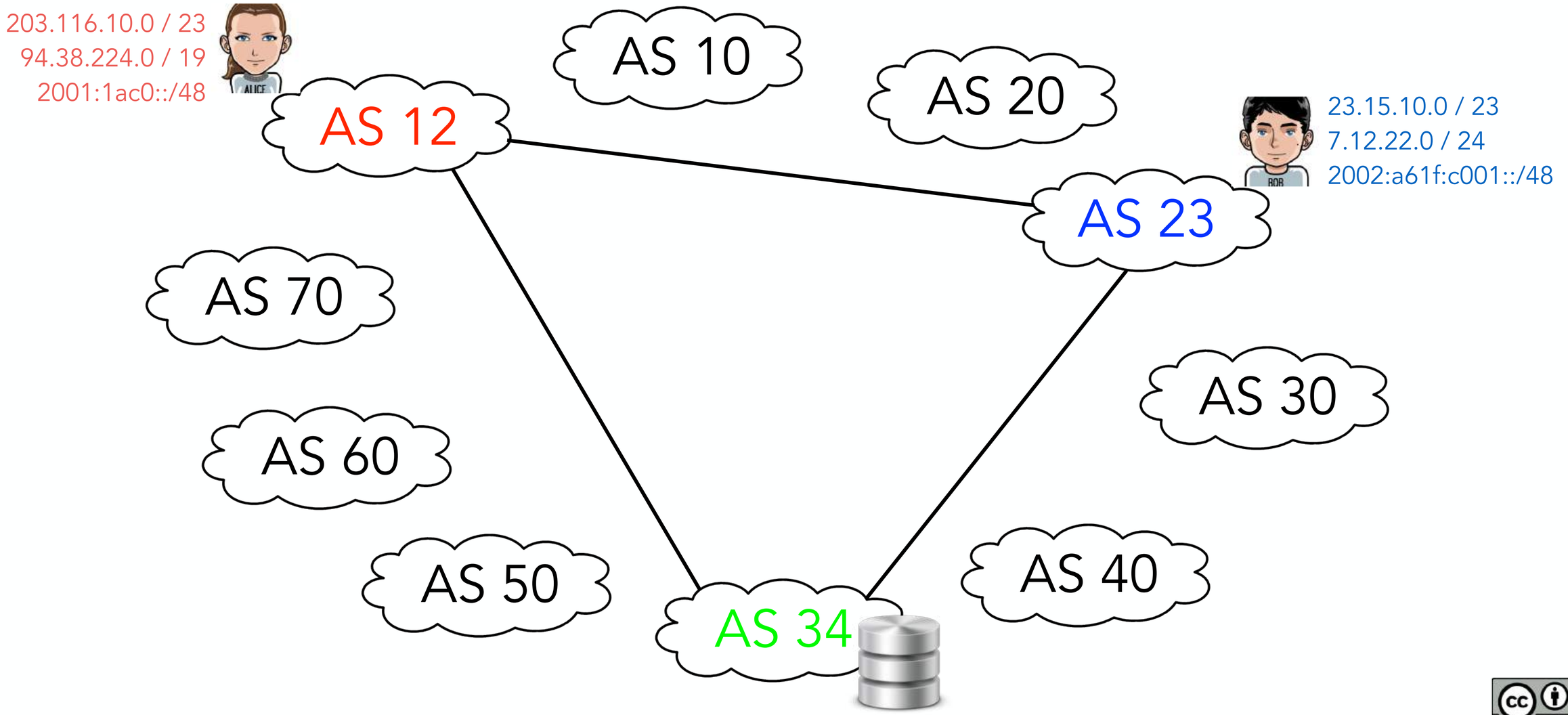
Interconnessioni



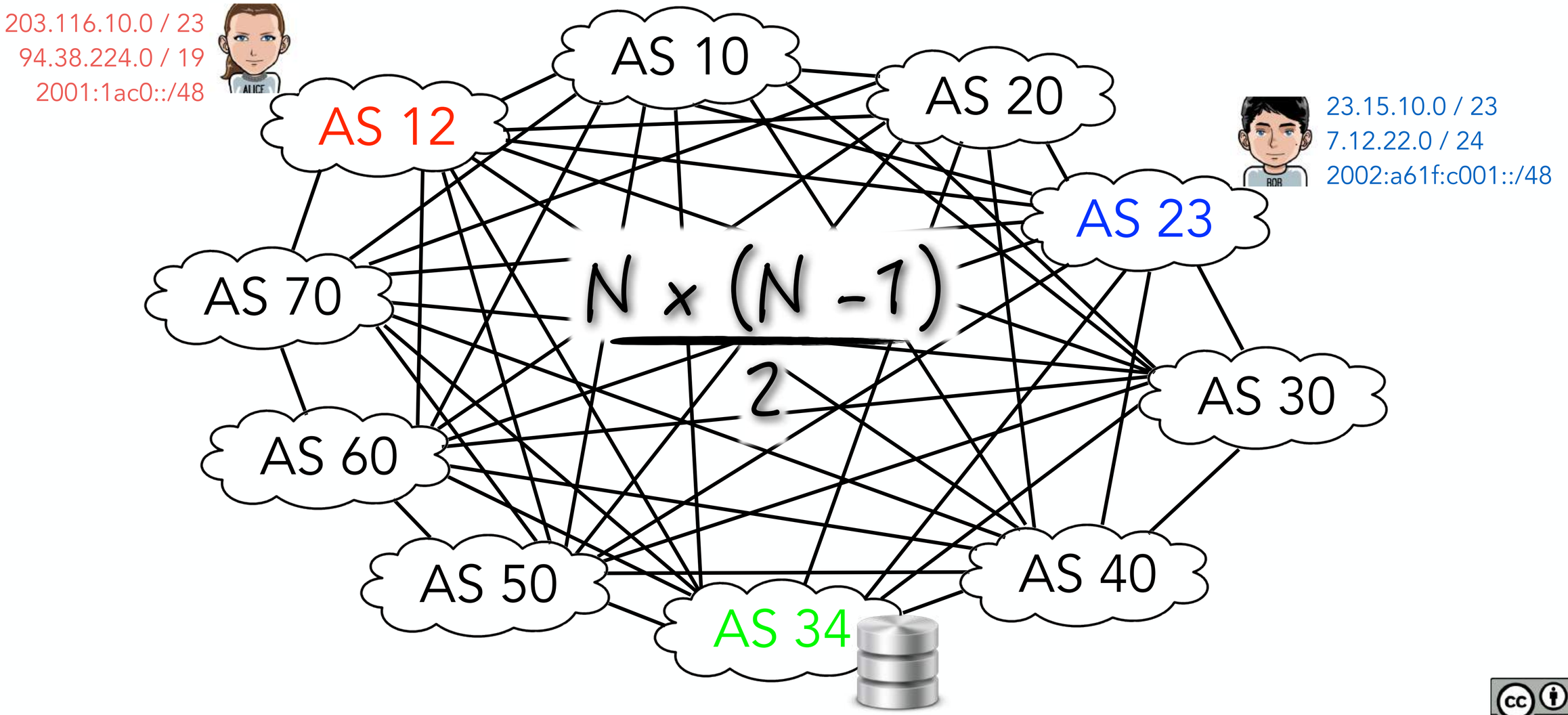
Interconnessioni



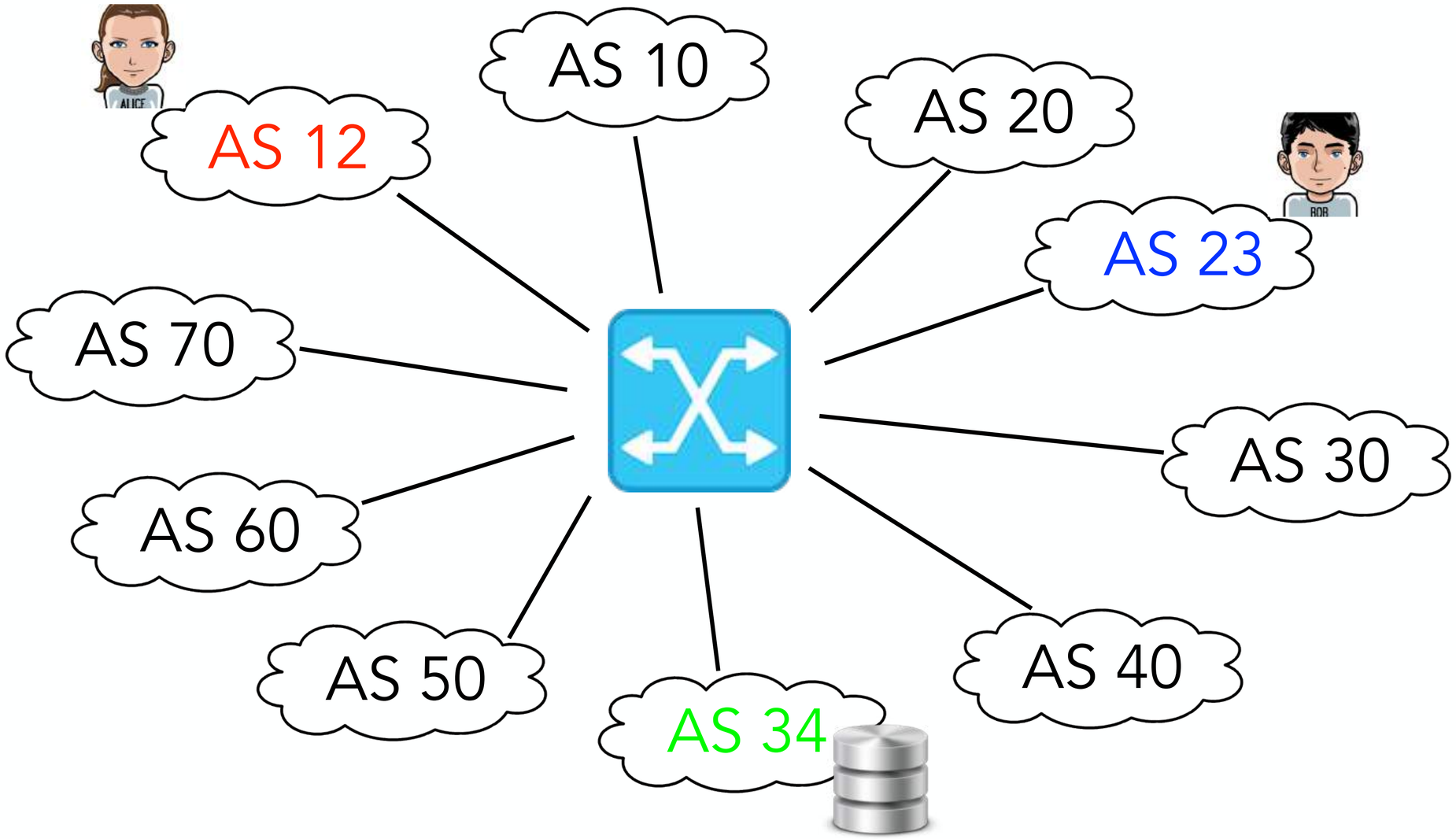
Interconnessioni



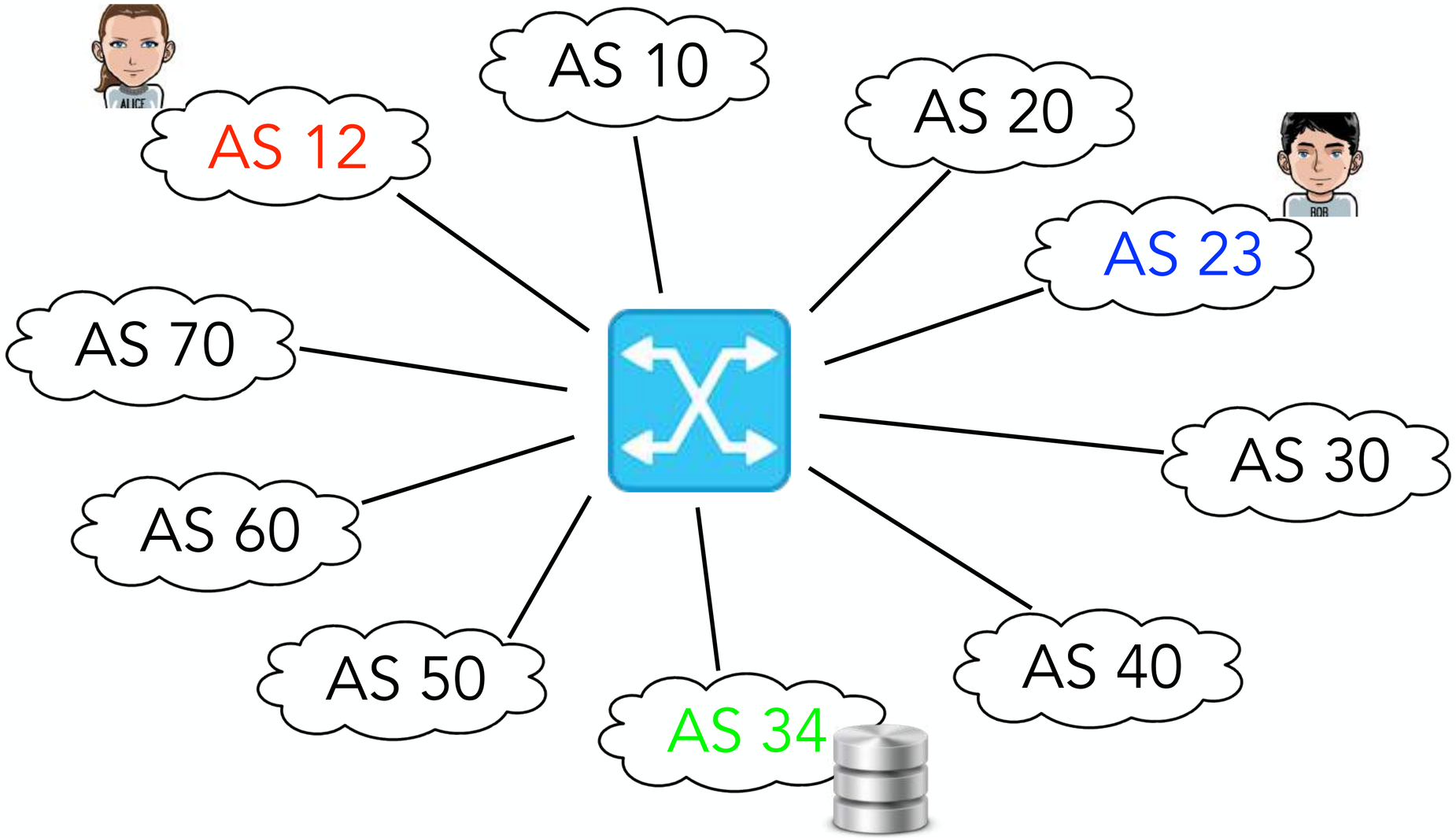
Interconnessioni



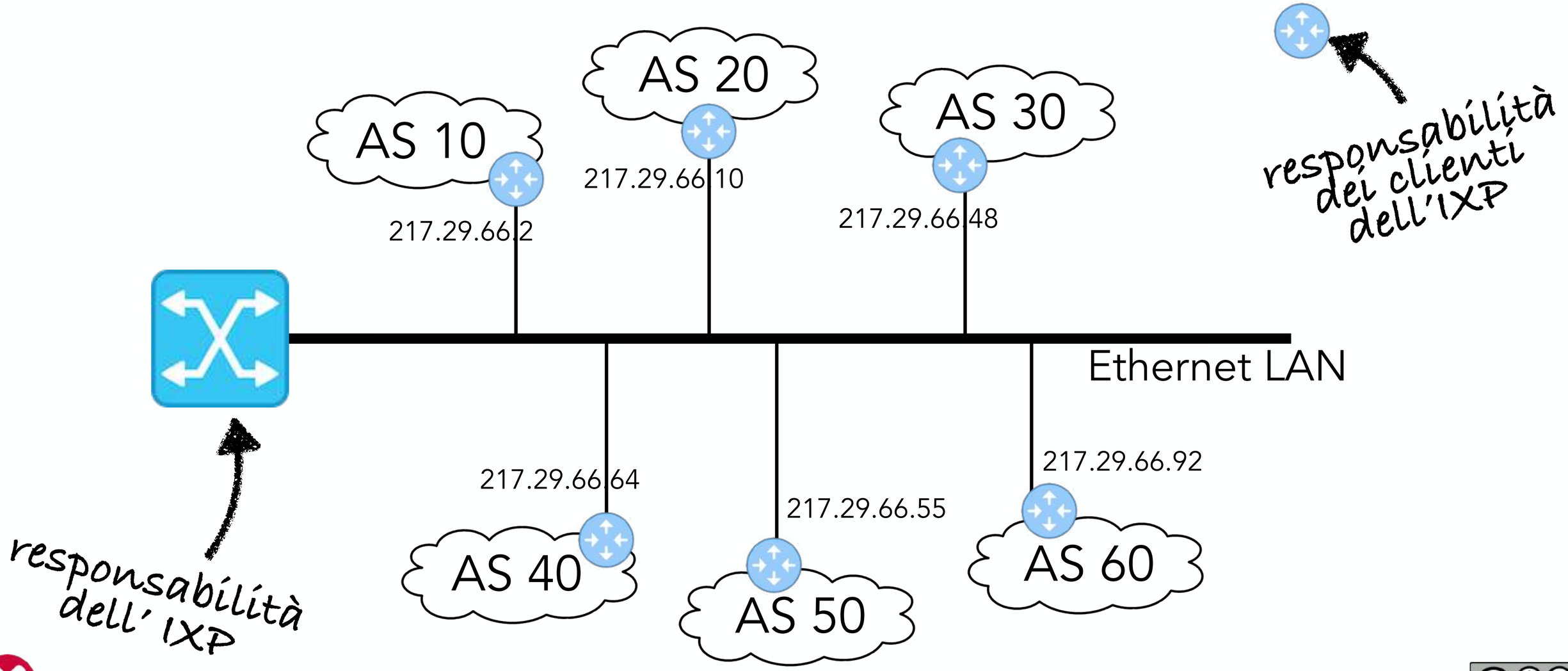
Internet eXchange Point

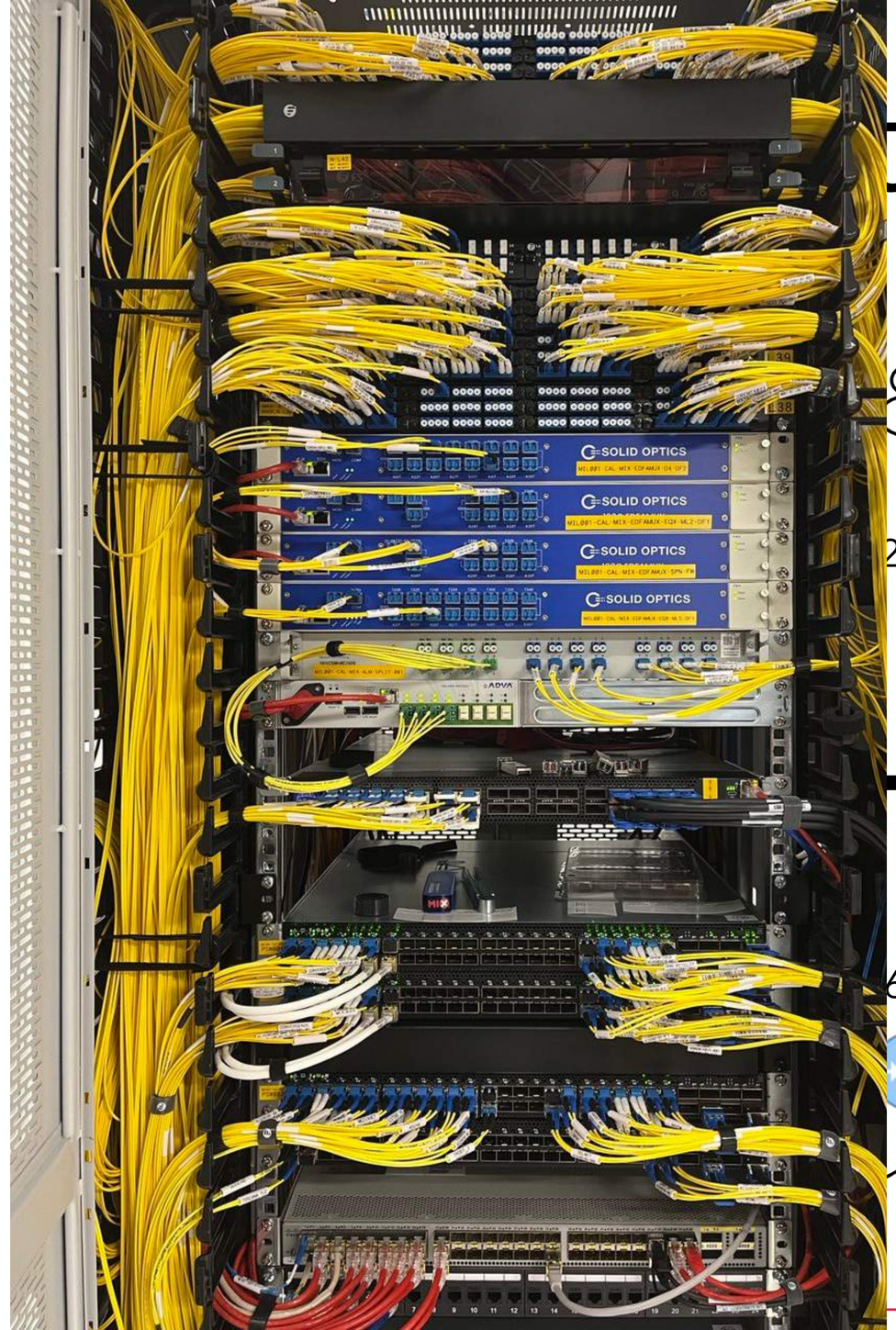


Peering

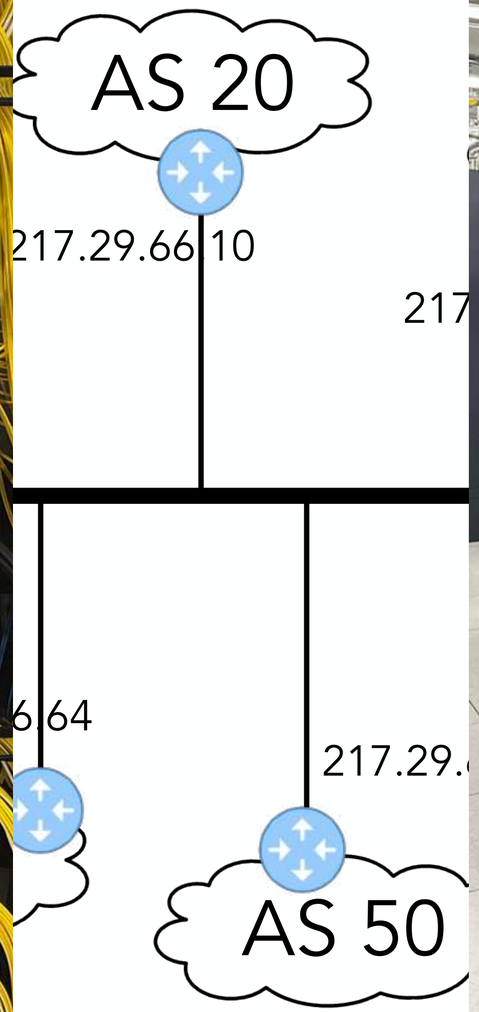


Internet eXchange Point

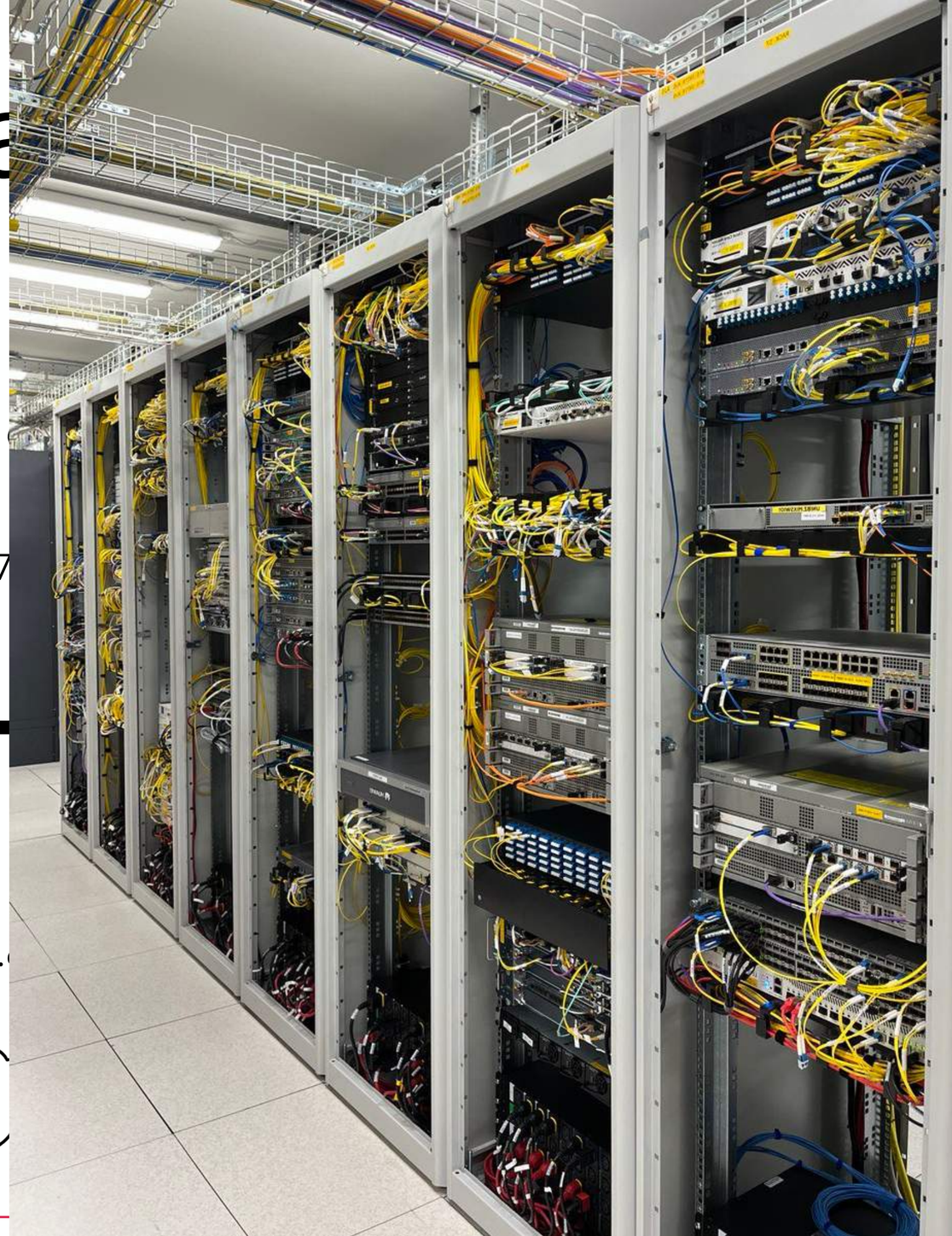



SOLID OPTICS
SOLID OPTICS
SOLID OPTICS
SOLID OPTICS
ADVA

t eXcha


AS 20
217.29.66.10
6.64
217.29.
AS 50

217

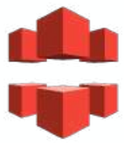


Operatori collegati ad un IXP

ISP

Carrier

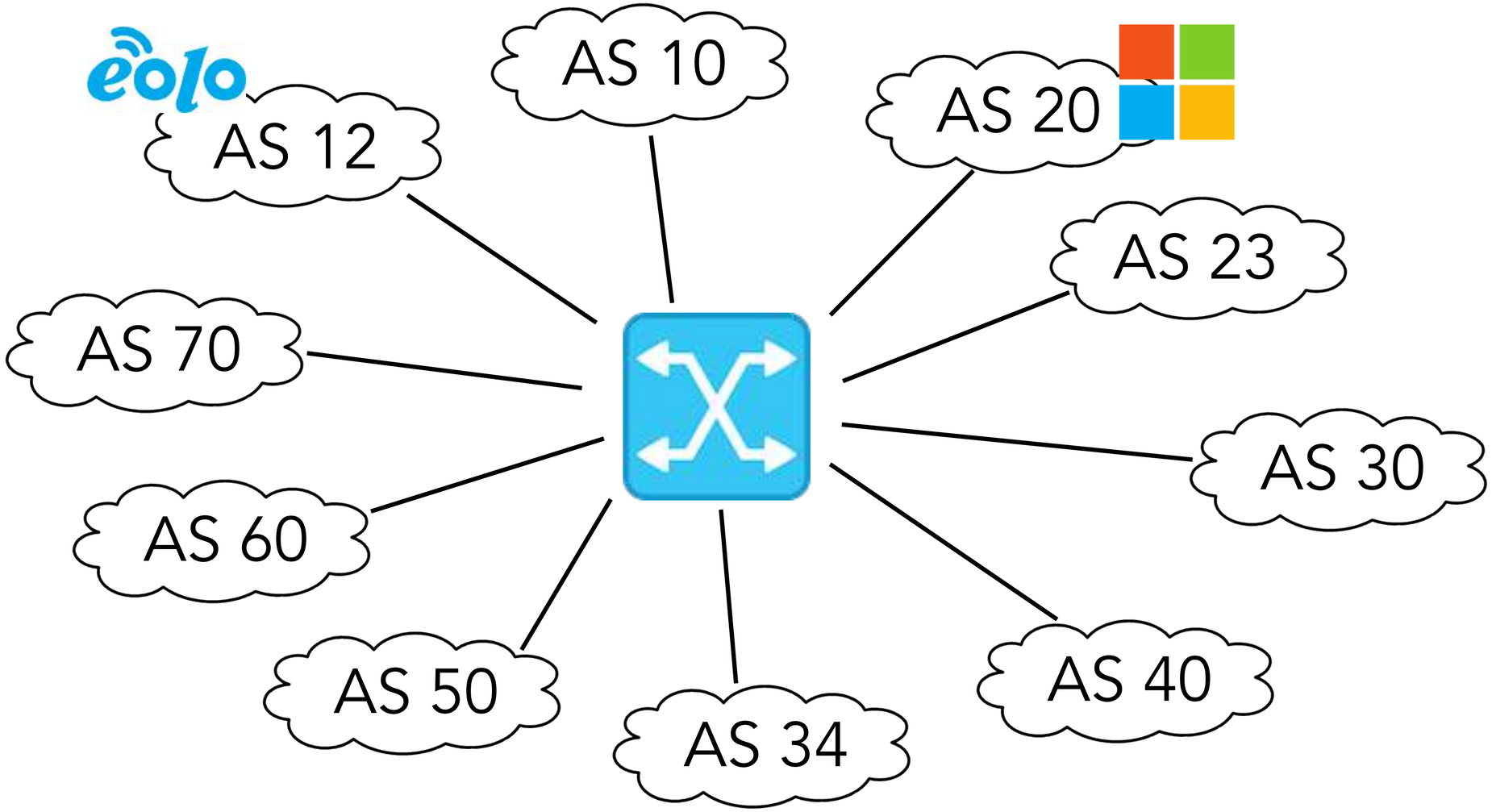
CDN



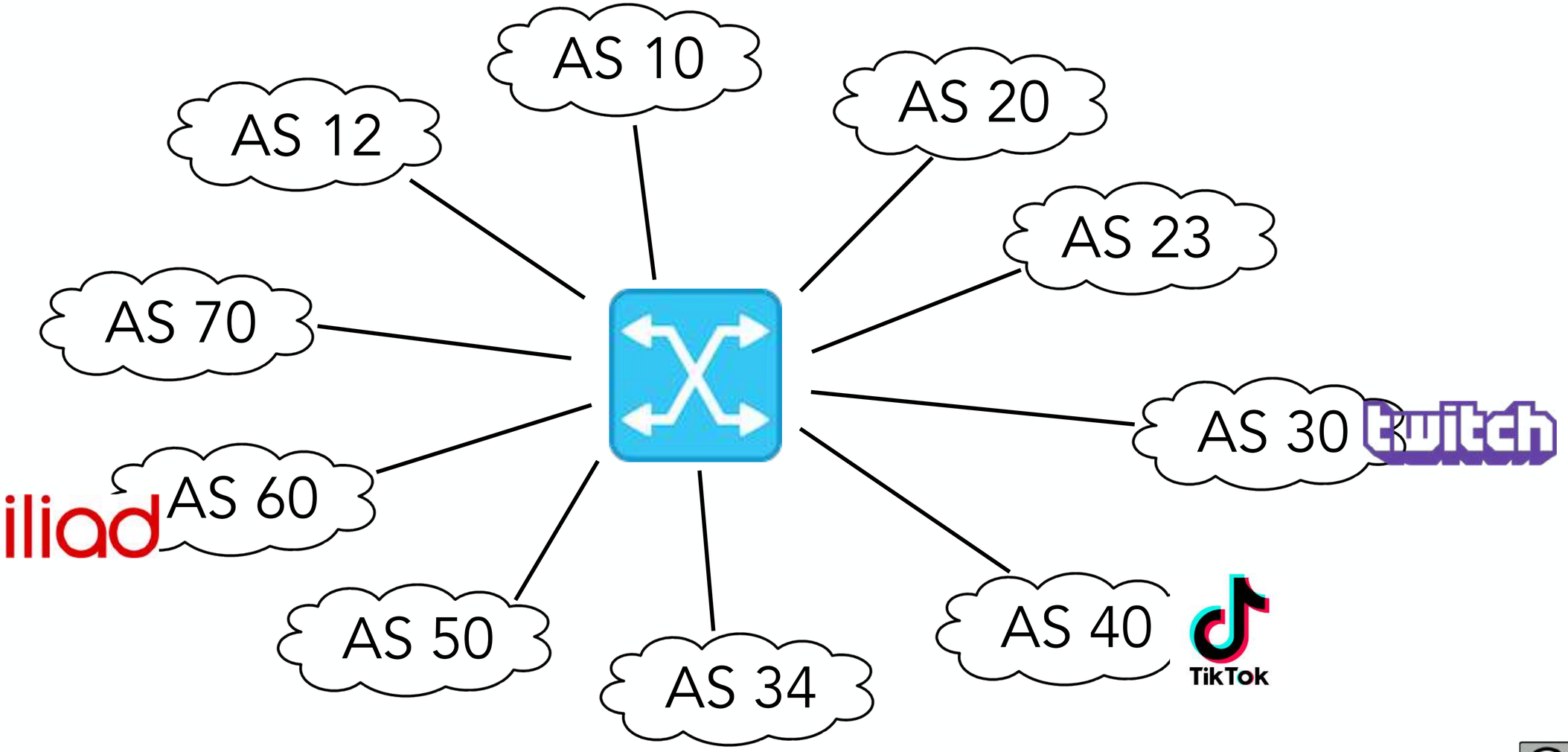
Cloud provider

Content provider

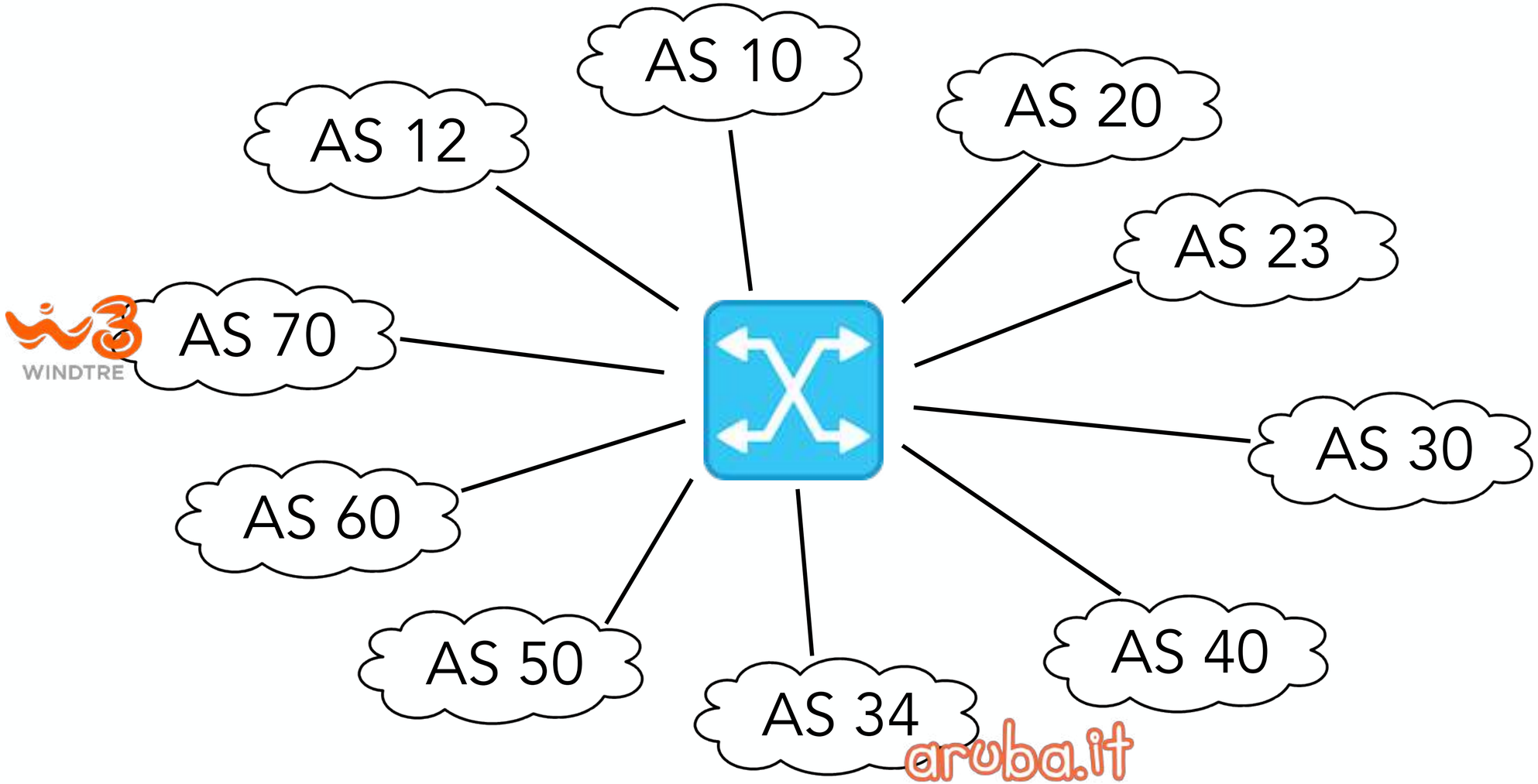
Esempi di peering



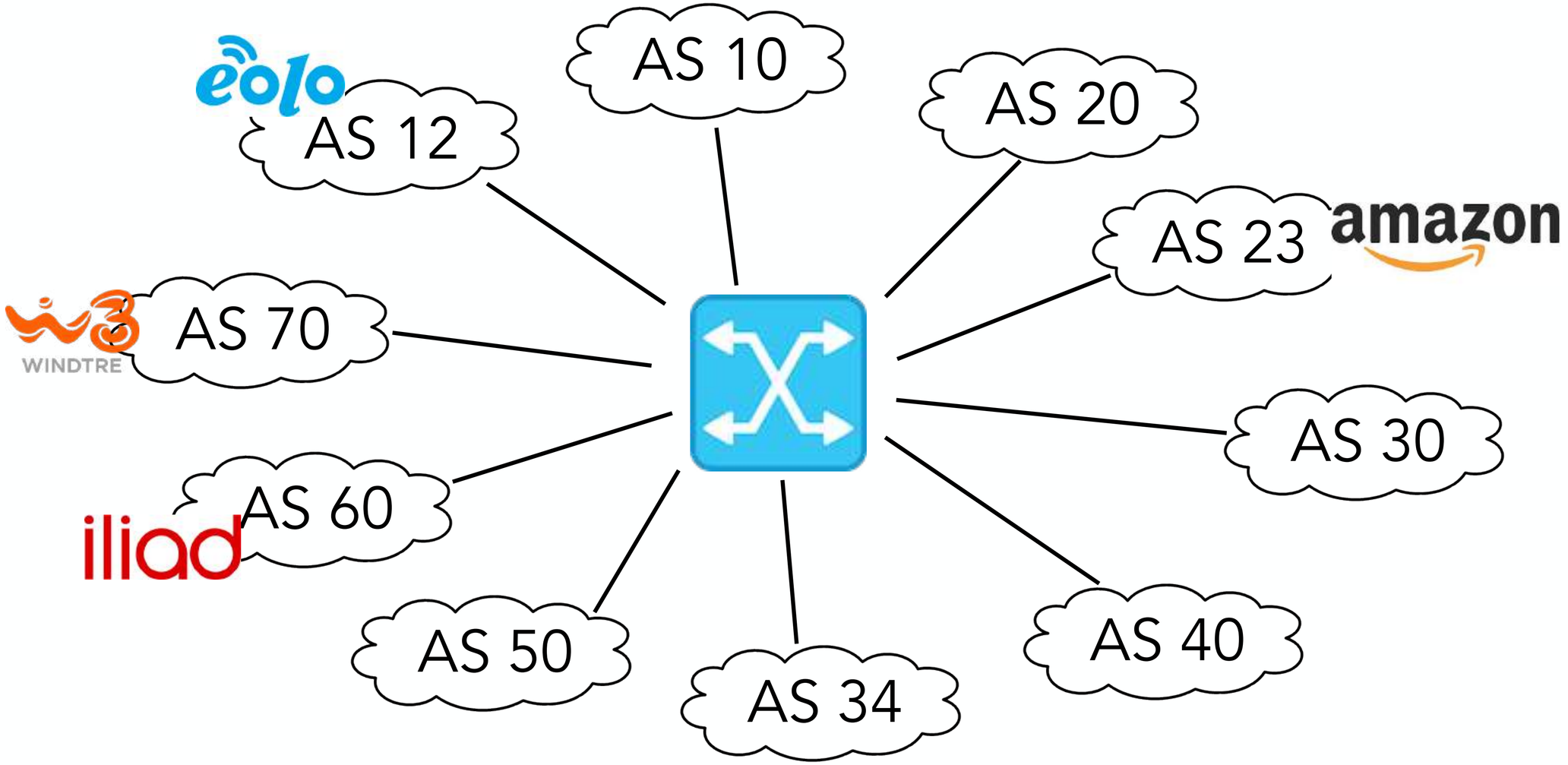
Esempi di peering



Esempi di peering



Esempi di peering



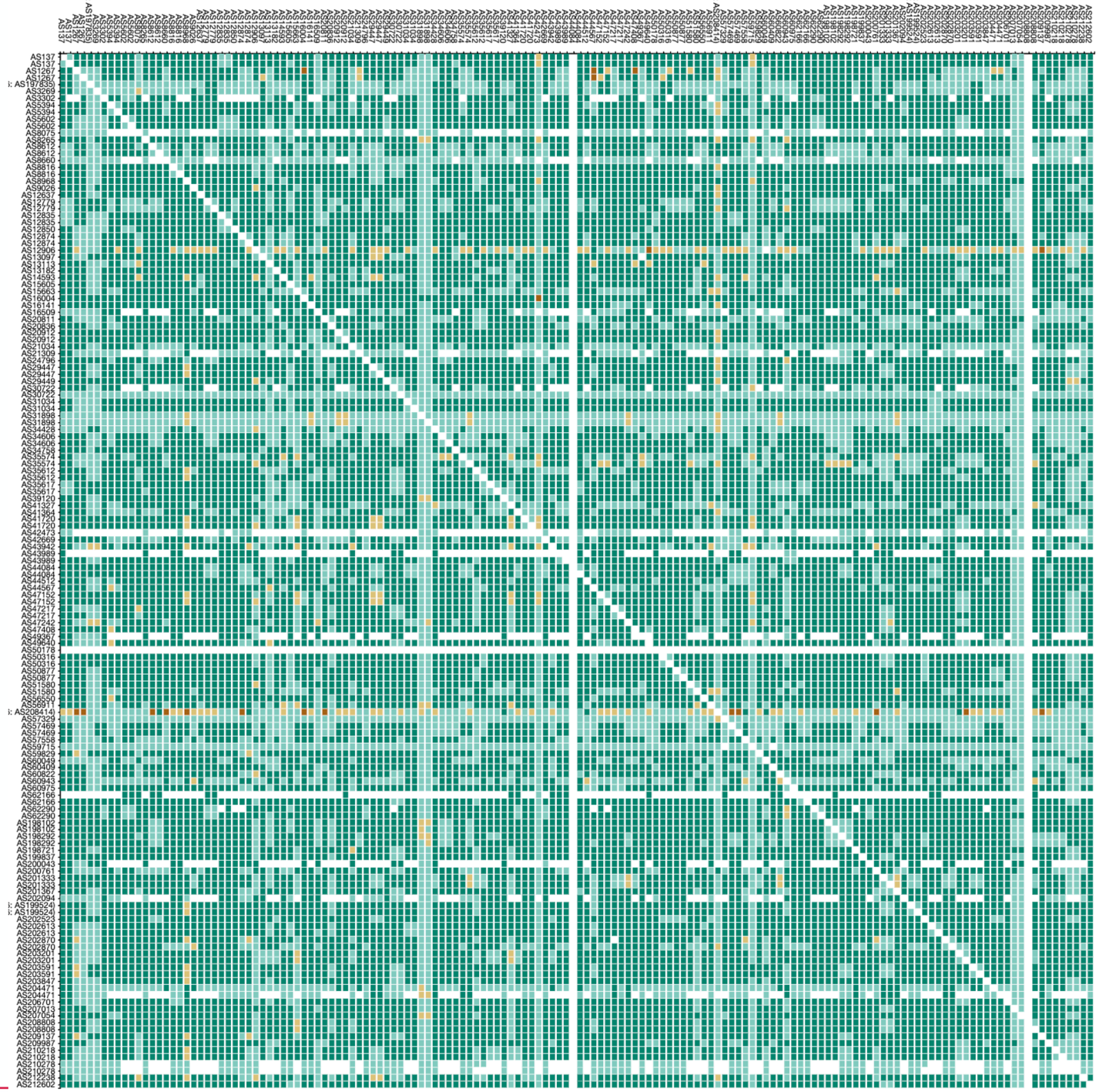
RIPE NCC
RIPE NETWORK COORDINATION CENTRE

atlas.ripe.net

IXP Jedi

(country)

- IXP IPs: YES, out-of-country IPs: NO
- IXP IPs: YES, out-of-country IPs: YES
- IXP IPs: NO, out-of-country IPs: NO
- IXP IPs: NO, out-of-country IPs: YES



https://jedi.ripe.net/latest/IT/ixpcountry/index.html

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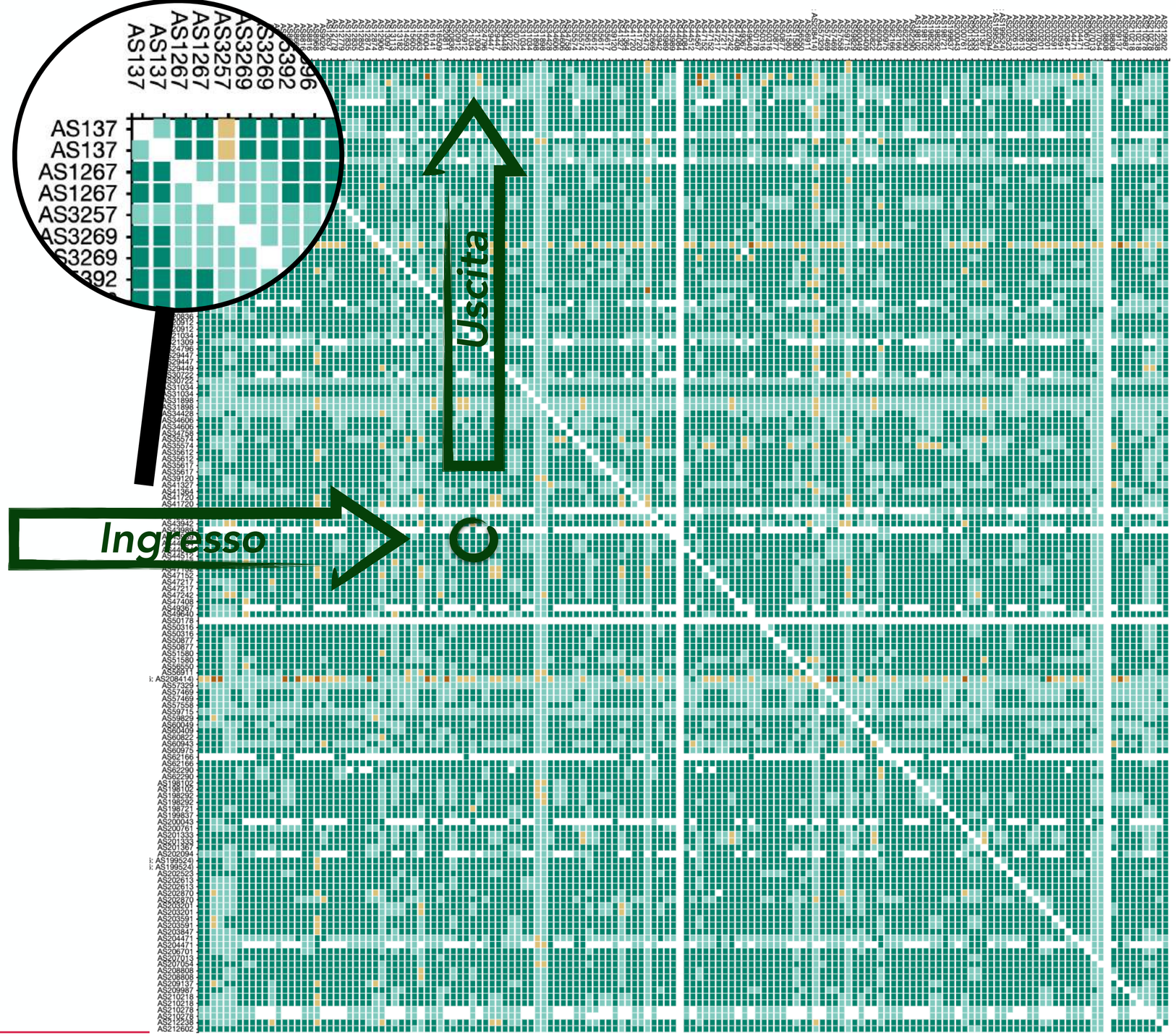


https://jedi.ripe.net/latest/IT/ixpcountry/index.html

IXP in Italia

- MIX-IT
- MIX Palermo
- MIX Bologna
- MIX Roma
- MIX Caserta
- Minap
- Namex
- Namex Bari
- Namex Napoli
- Top-IX Torino
- VSIX Padova
- Ge-Dix Genova

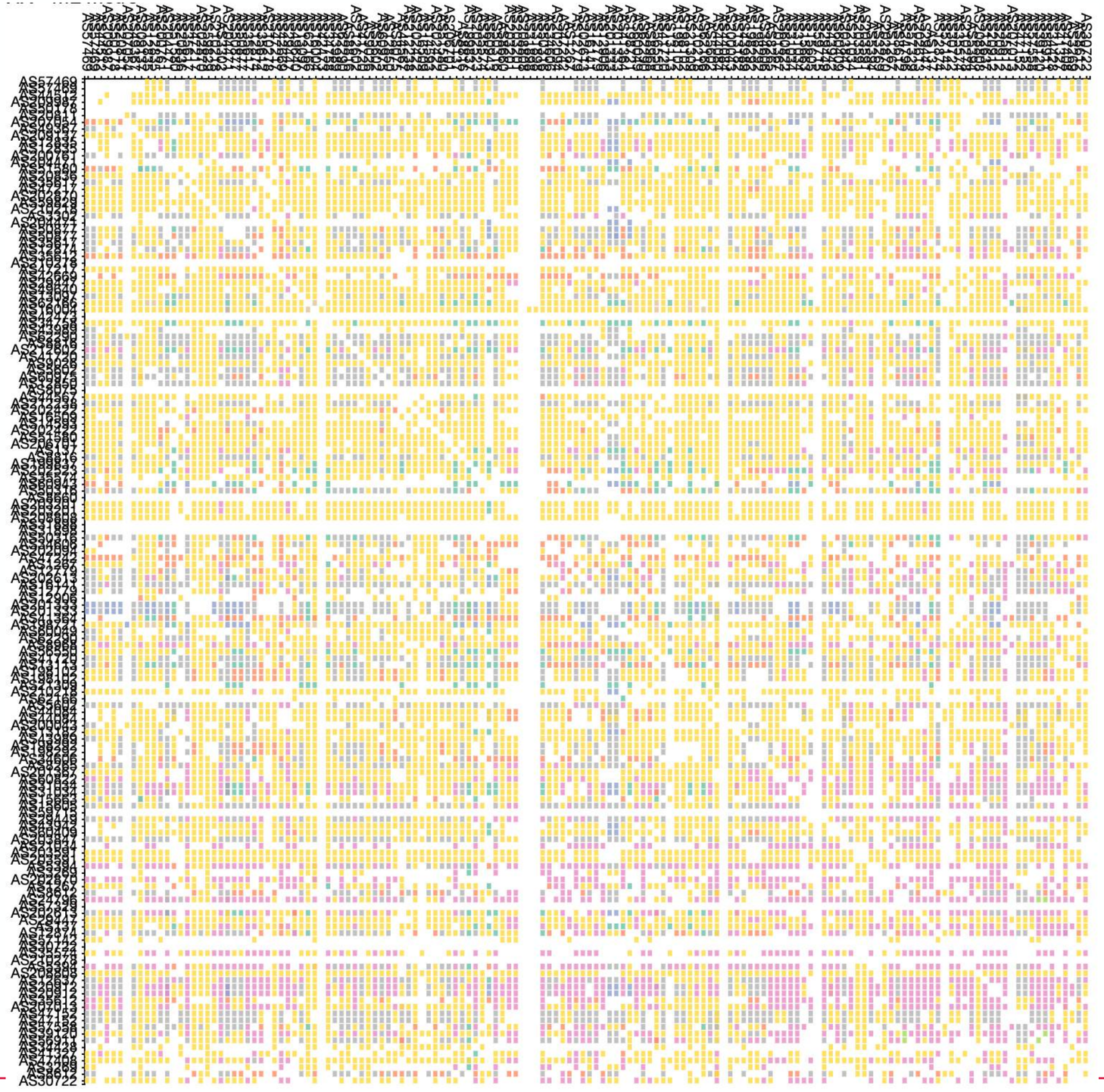
RIPE NCC
RIPE NETWORK COORDINATION CENTRE

atlas.ripe.net

IXP Jedi

(IXP LAN)

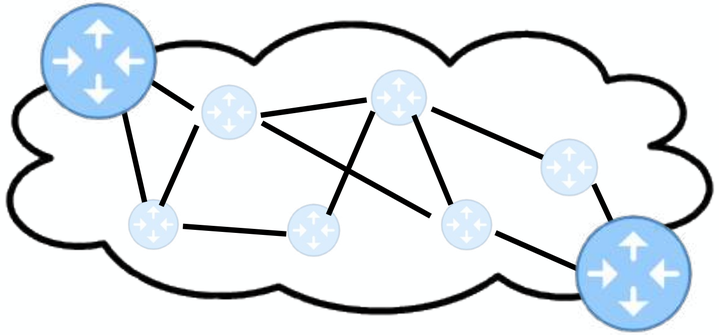
- VSIX-Primary
- TOP-IX-Public Peering VLAN
- PCIX
- Namex Rome-VLAN Peering
- Namex Napoli
- MIX-IT
- MIX Bologna
- MINAP Milan-MINAP
- Ge-DIX
- Equinix Milan-Equinix IX - ML

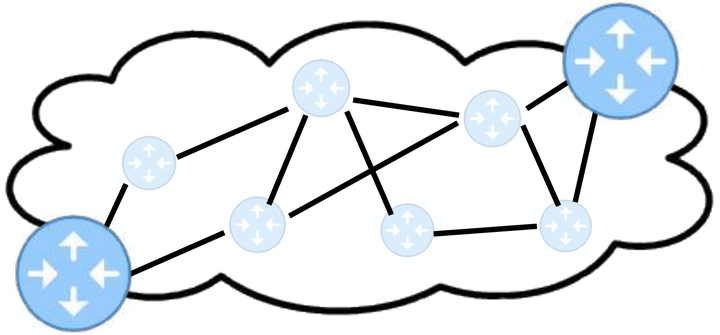


https://jedi.ripe.net/latest/IT/ixplans/index.html

Border Gateway Protocol

RFC 4271

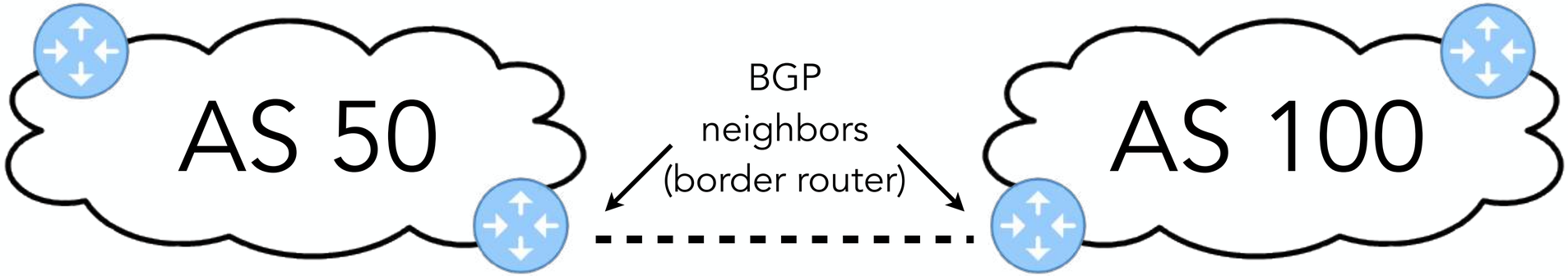




Border Gateway Protocol

RFC 4271

Dialogo tra Autonomous Systems



50.49.18.0 / 24
50.49.19.0 / 24
2001:D50:: / 32

100.95.0.0 / 16
100.1.112.0 / 20
100.75.12.0 / 21
100.44.20.0 / 21
2001:100:: / 32

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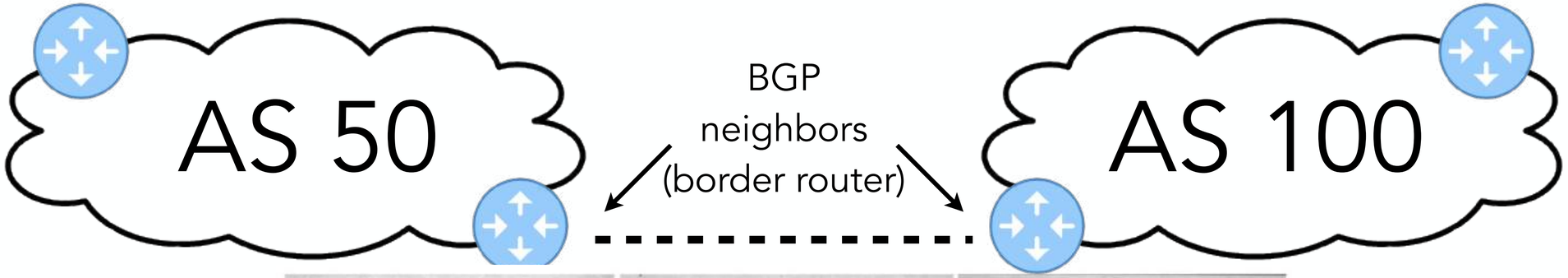

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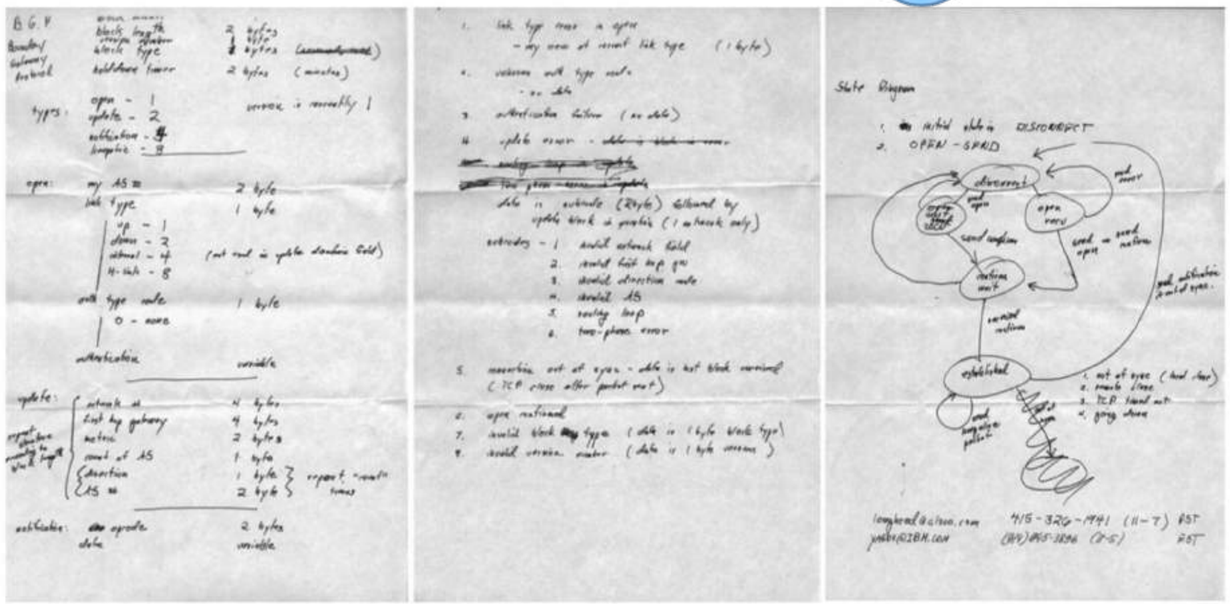
50.49.19.0 /
2001:D50:: /



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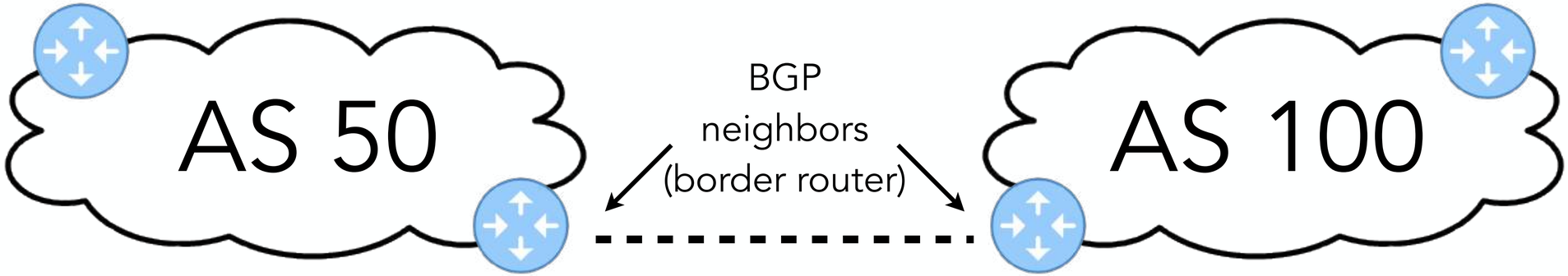

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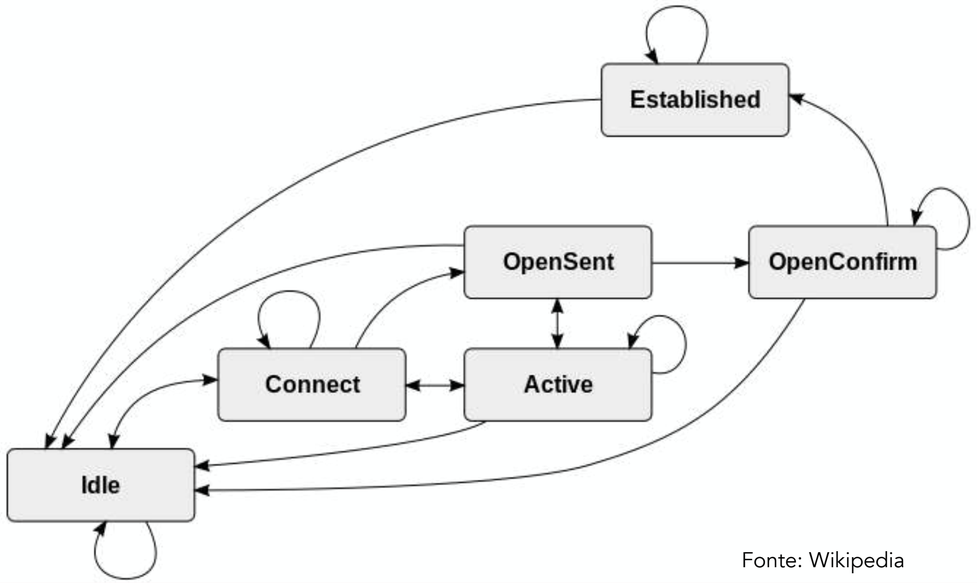
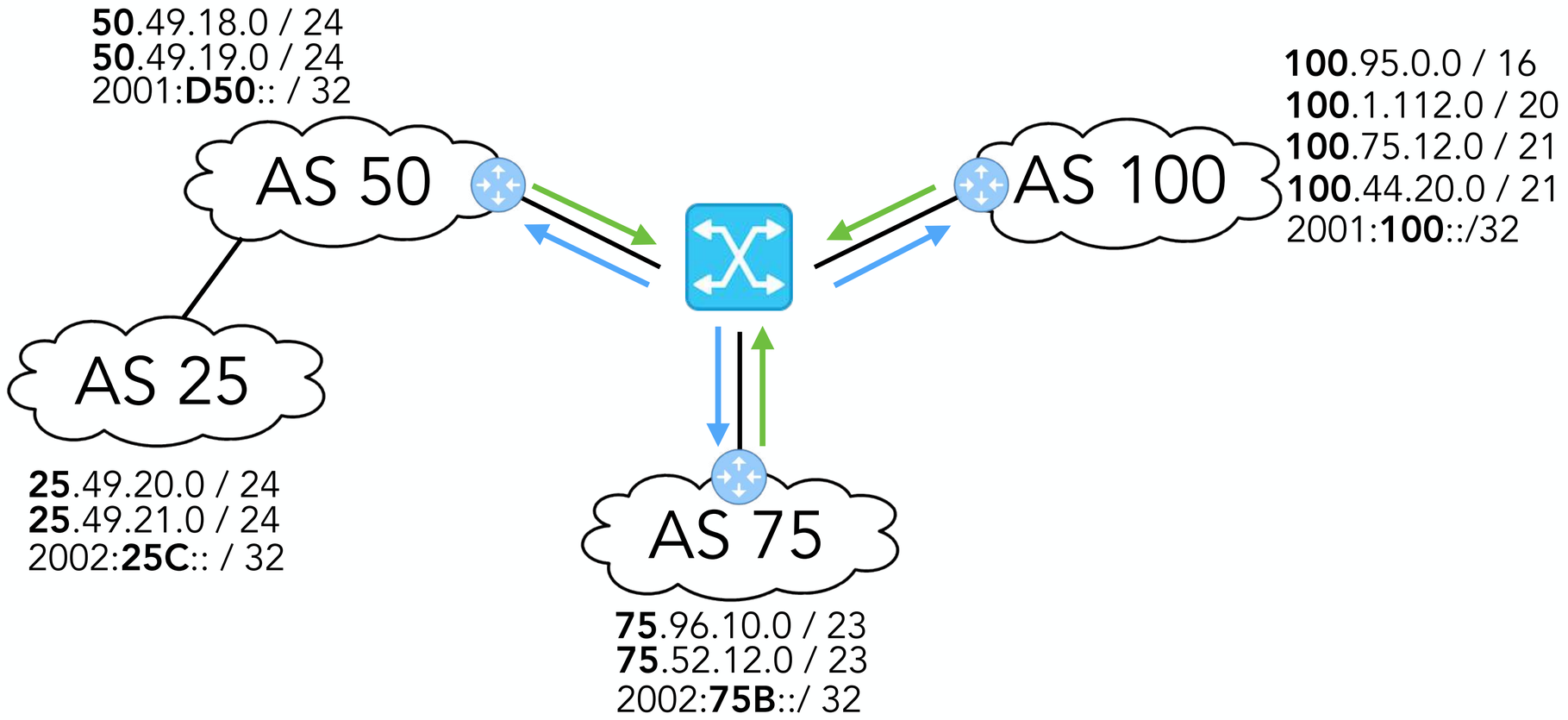


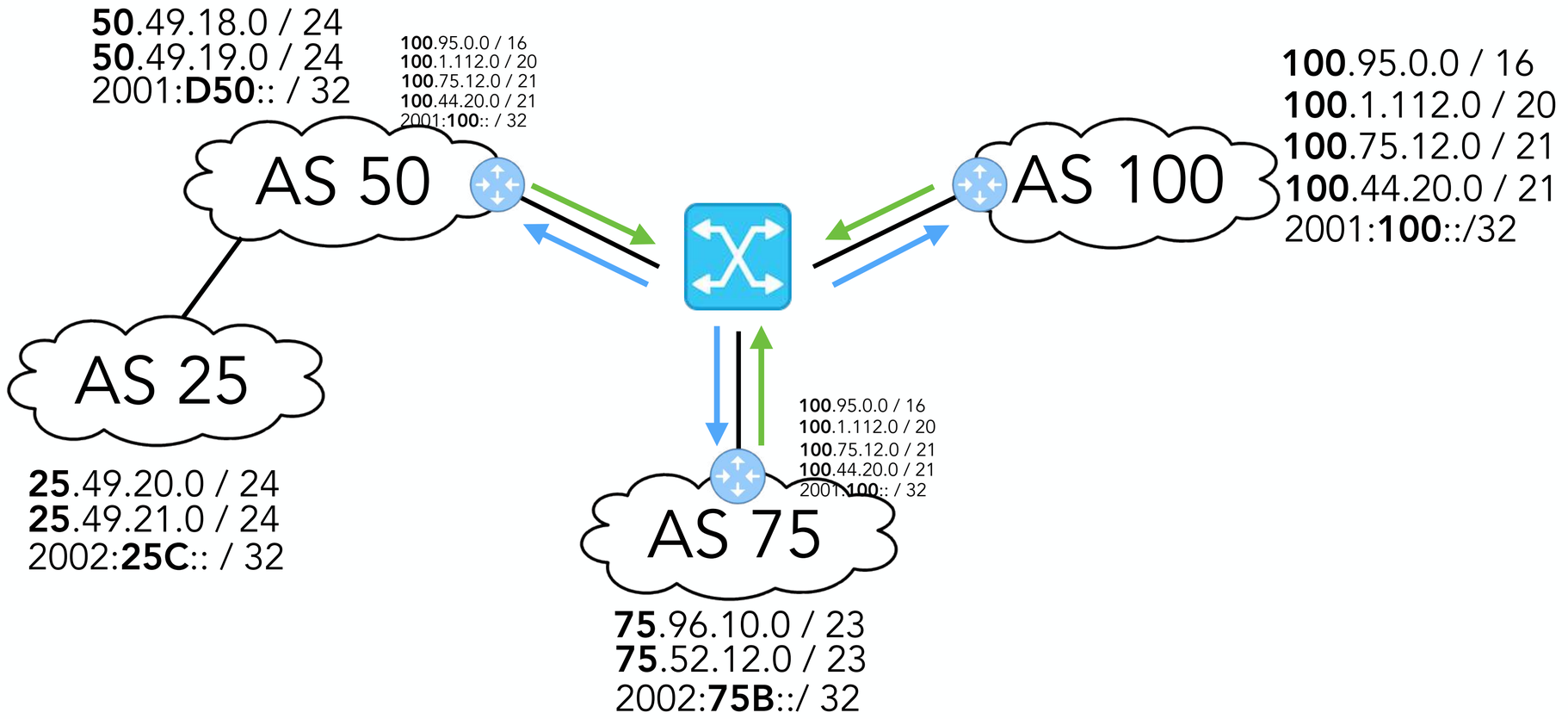
100.95.0.0 / 16
100.1.112.0 / 20
100.75.12.0 / 21
100.44.20.0 / 21
2001:100:: / 32

Fonte: Wikipedia

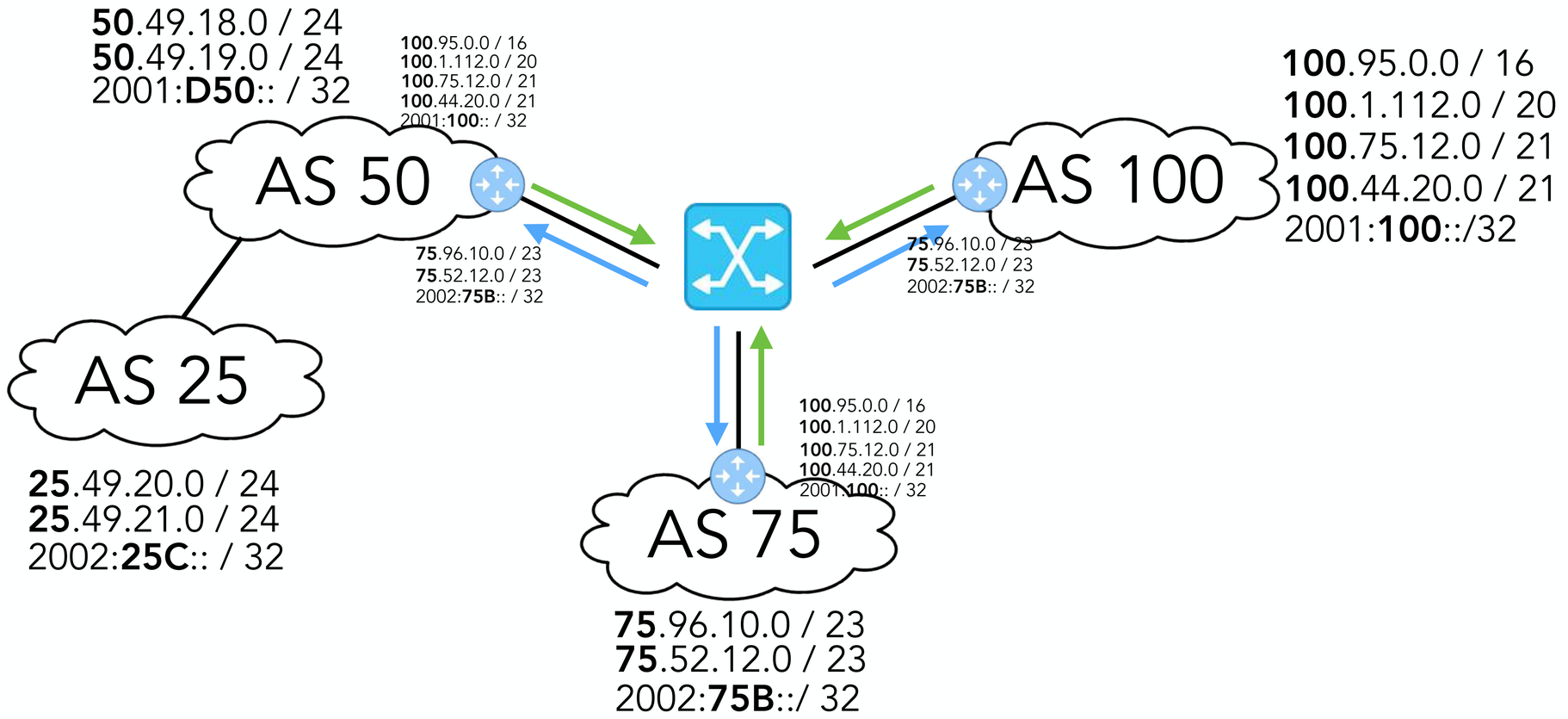
Modellino in scala



Modellino in scala



Modellino in scala



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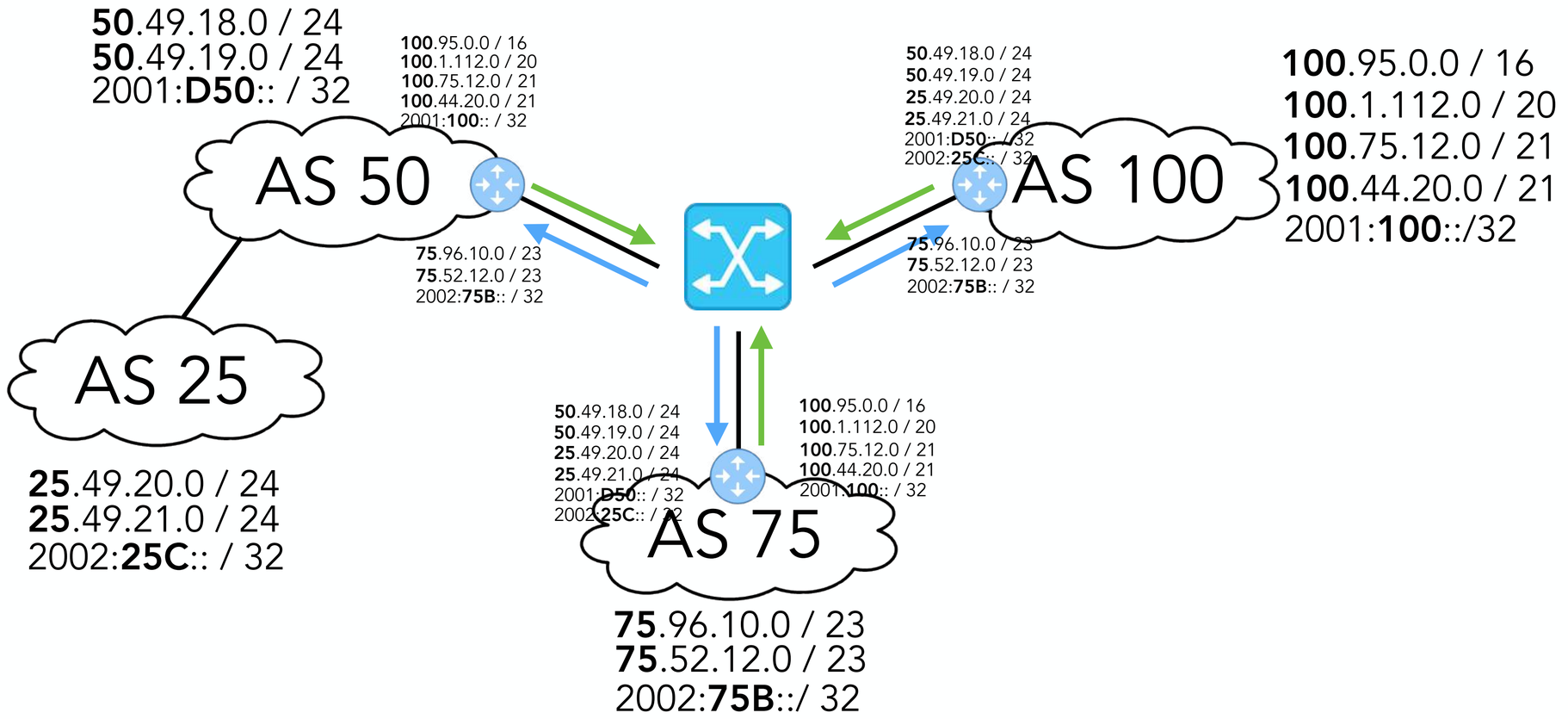

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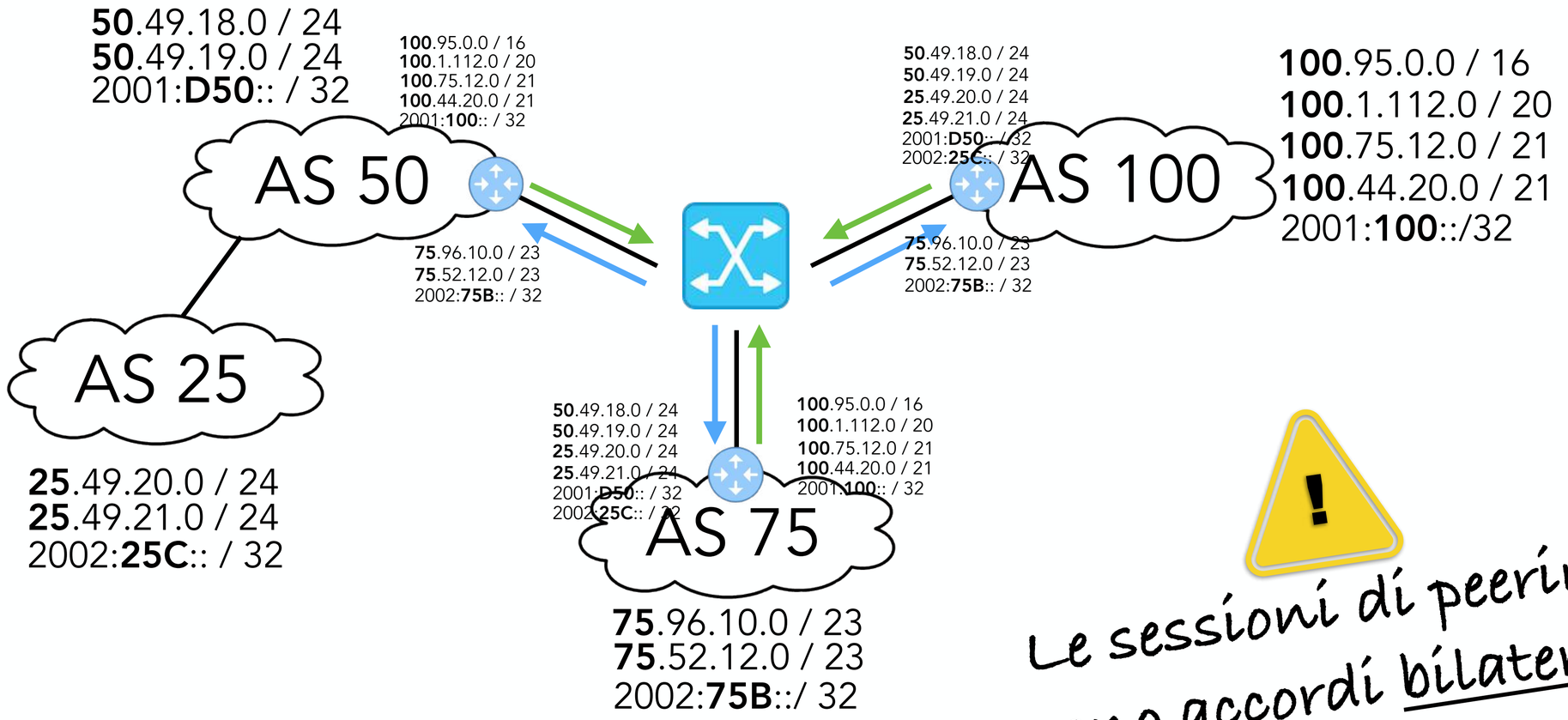

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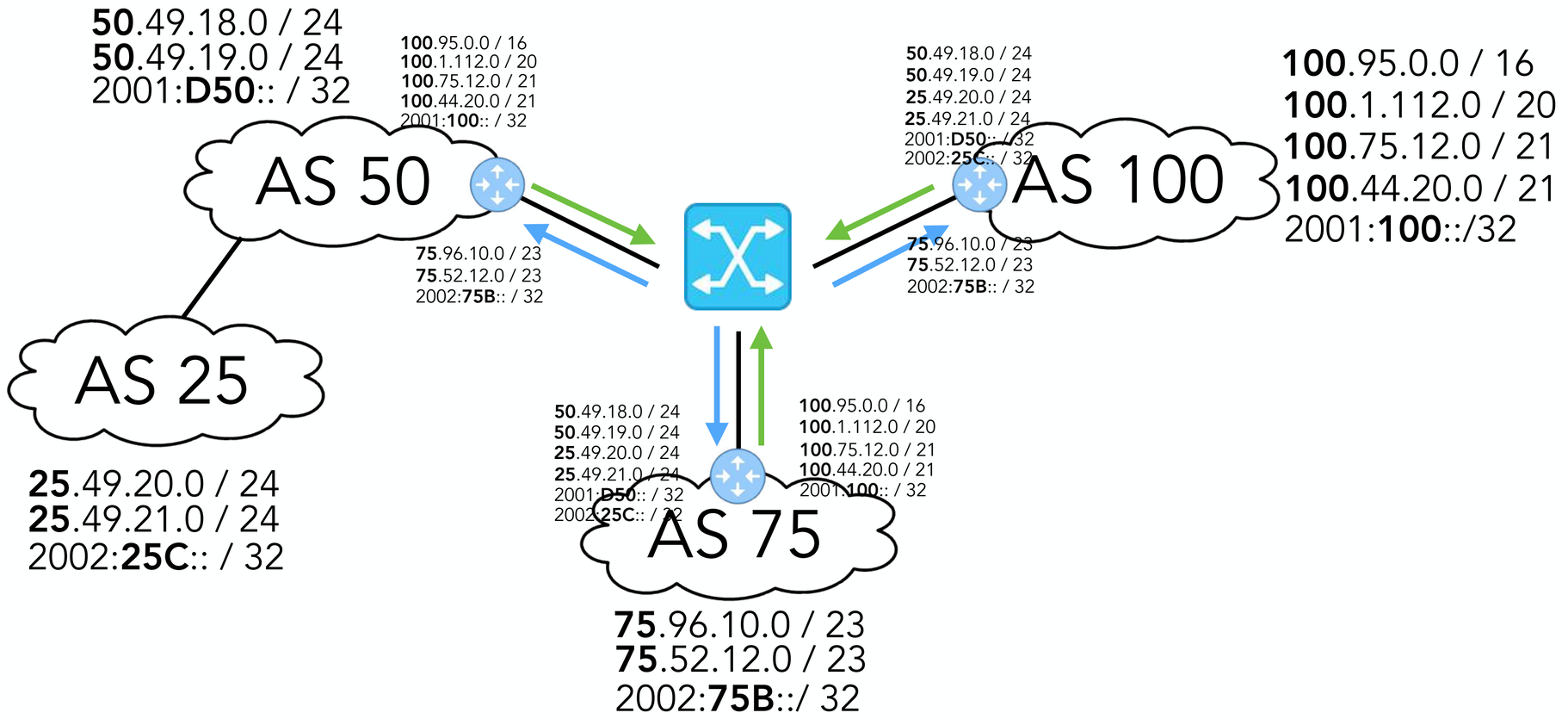
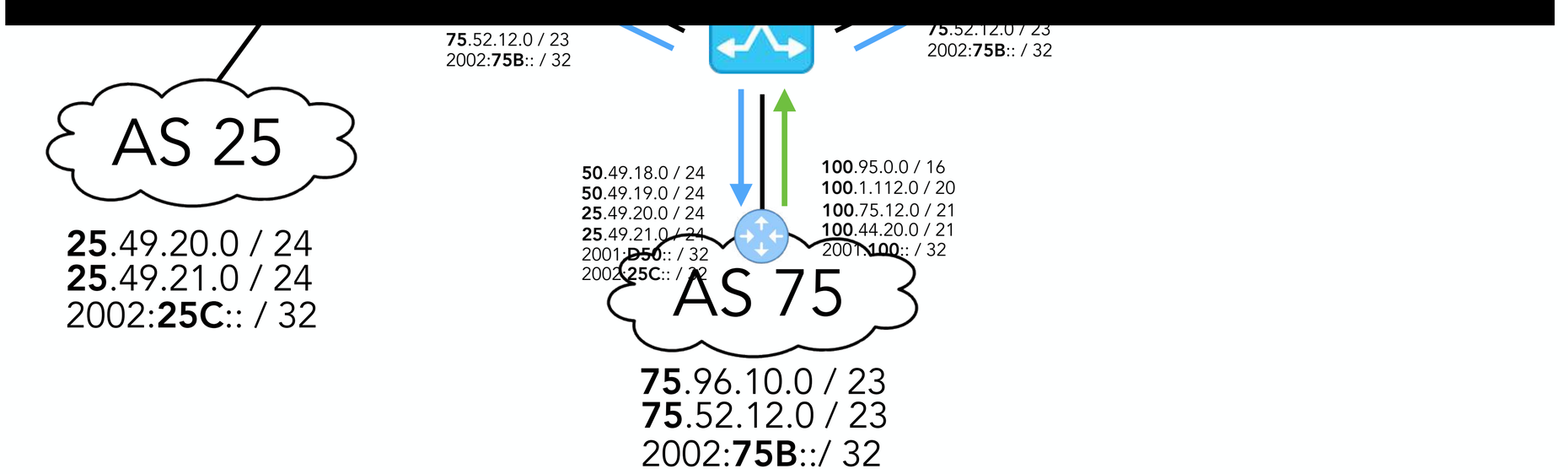


Modellino in scala

```
gw1>show ip bgp summary

Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
217.29.66.117   4        16509   26857   28354  7021297    0    0 1w2d              7
217.29.66.71    4        16265       0       0        1    0    0 never    Active
217.29.66.118   4        49524   51075   49206  7021297    0    0 4w3d             13
217.29.66.123   4        43531   93968   97571  7021297    0    0 4w3d           1507
217.29.66.131   4        32934     818     851  7021297    0    0 06:28:31         30
217.29.66.37    4        35193       0       0        1    0    0 1w2d     Idle
217.29.66.133   4        57495   44664   49256  7021297    0    0 4w3d              2
```



Modellino in scala

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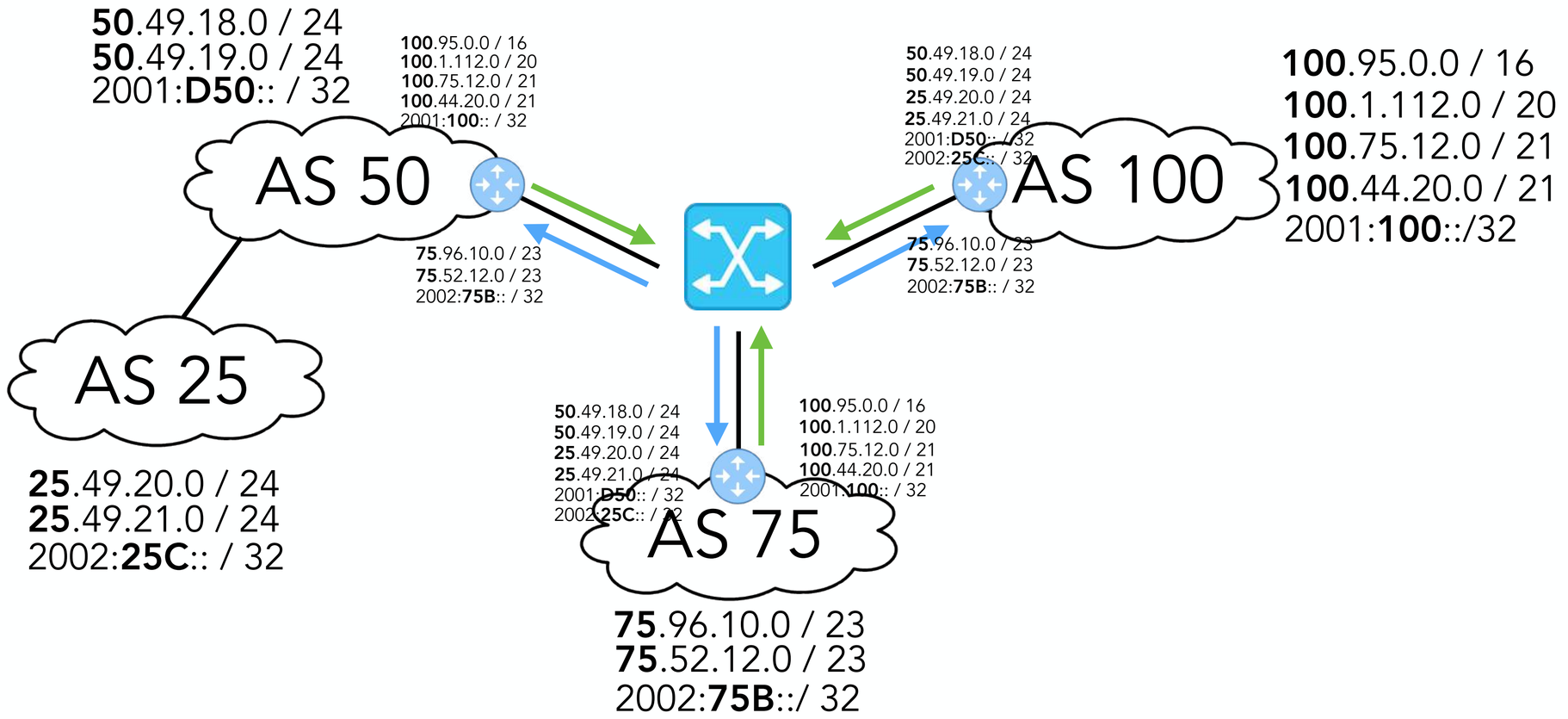
Neighbor        V           AS MsgRcvd MsgSent   TblVer  InQ OutQ Up/Down  State/PfxRcd
217.29.66.117   4        16509   26857   28354  7021297    0    0 1w2d              7
217.29.66.71    4        16265       0       0        1    0    0 never    Active
217.29.66.118   4        49524   51075   49206  7021297    0    0 4w3d             13
217.29.66.123   4        43531   93968   97571  7021297    0    0 4w3d           1507
217.29.66.131   4        32934     818     851  7021297    0    0 06:28:31         30
217.29.66.37    4        35193       0       0        1    0    0 1w2d     Idle
217.29.66.133   4        57495   44664   49256  7021297    0    0 4w3d              2
```

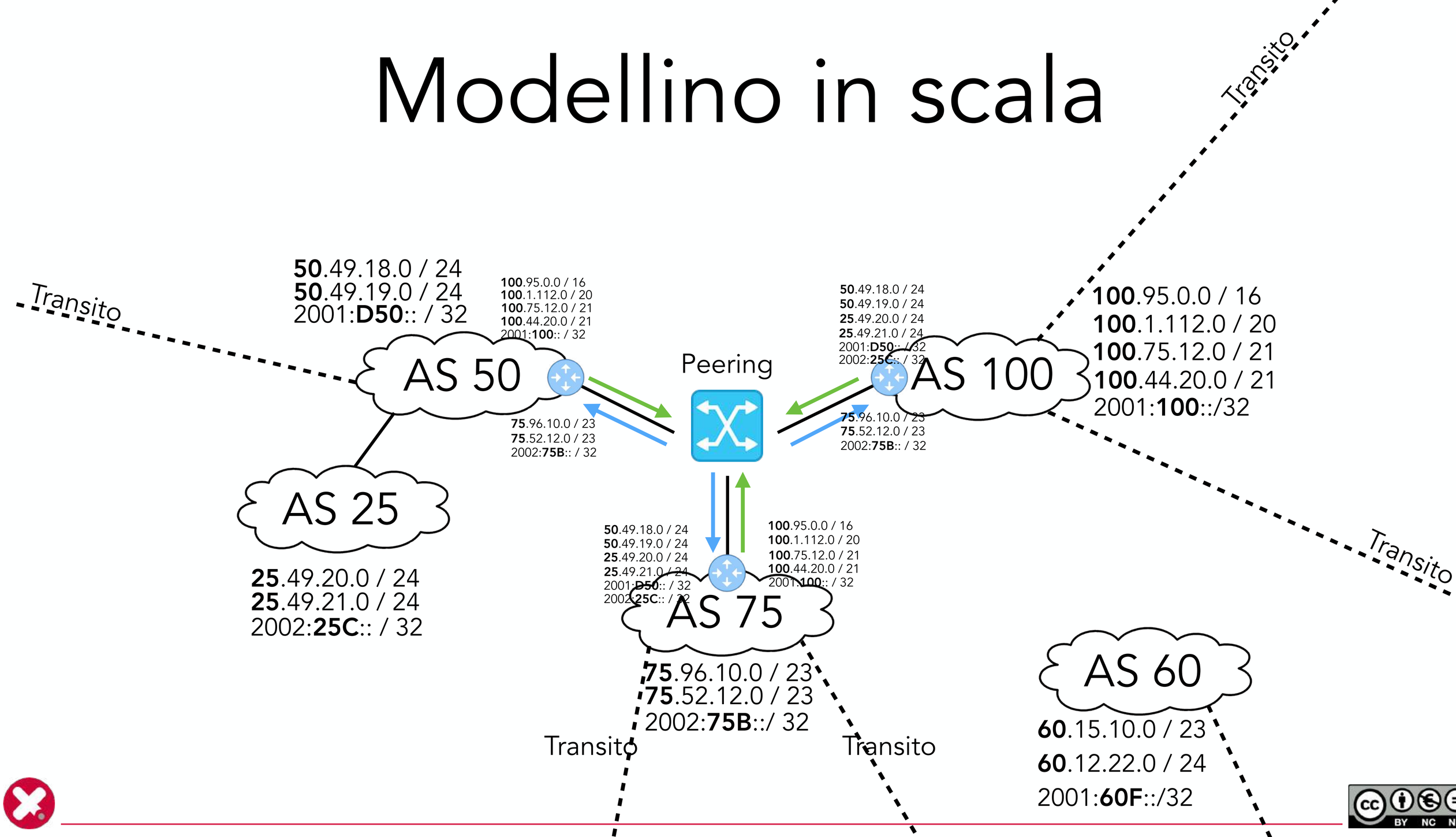
```
gw1>sh ip bgp neighbors 217.29.66.118 received-routes

   Network          Next Hop            Metric LocPrf Weight Path
*  46.141.0.0/17    217.29.66.118                          0 49524 i
*  46.141.12.0/22   217.29.66.118                          0 49524 i
*  46.141.24.0/22   217.29.66.118                          0 49524 i
*  46.141.128.0/17  217.29.66.118                          0 49524 i
*  94.230.76.0/22   217.29.66.118                          0 49524 3356 3302 49265 i
*  109.104.240.0/22 217.29.66.118                          0 49524 49265 i
*  109.237.160.0/22 217.29.66.118                          0 49524 i
*  109.237.160.0/20 217.29.66.118                          0 49524 i
*  109.237.164.0/22 217.29.66.118                          0 49524 i
*  109.237.168.0/22 217.29.66.118                          0 49524 i
*  109.237.172.0/22 217.29.66.118                          0 49524 i
*  185.82.224.0/22  217.29.66.118                          0 49524 201102 i
*  185.194.4.0/22   217.29.66.118                          0 49524 201102 i
```

Modellino in scala



Modellino in scala



RIPE NCC

IPs & ASNs | Analyse | Participate | Community | Support | Publications | About

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RIPE Database | RIPE NCC Academy
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Welcome to the RIPE NCC

As the Regional Internet Registry for Europe, Middle East and Central Asia, we serve over 20,000 members in 76 countries. We register IP addresses and ASNs, and act as the secretariat to the RIPE community.

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PeeringDB

Cerca qui per una rete, IXP, o struttura.

Ricerca Avanzata

Registrati o Login

Italiano (italiano)

The Interconnection Database

www.peeringdb.com

Join. Search. Grow your network.

PeeringDB is a freely available, user-maintained, database of networks, and the go
global interconnection of networks at Internet Exchange Points (IXPs), data centers
interconnection decisions.

The database is a non-profit, community-driven initiative run and promoted by volunteers. It is a public tool for the growth and good of the Internet. Join the community and support the continued development of the Internet.

Quanti sono globalmente i prefissi **IPv4** annunciati in BGP?

- **A:** 600k - 800k
- **B:** 800k - 1M
- **C:** 1M - 1.2M
- **D:** 1.2M - 1.4M

Quanti sono globalmente i prefissi **IPv4** annunciati in BGP?

- A: 600k - 800k
- B: 800k - 1M
- 1M - 1.2M
- D: 1.2M - 1.4M

Quanti sono globalmente i prefissi **IPv6** annunciati in BGP?

- **A:** 200k - 250k
- **B:** 250k - 300k
- **C:** 300k - 350k
- **D:** 350k - 400k

Quanti sono globalmente i prefissi **IPv6** annunciati in BGP?

200k - 250k

•B: 250k - 300k

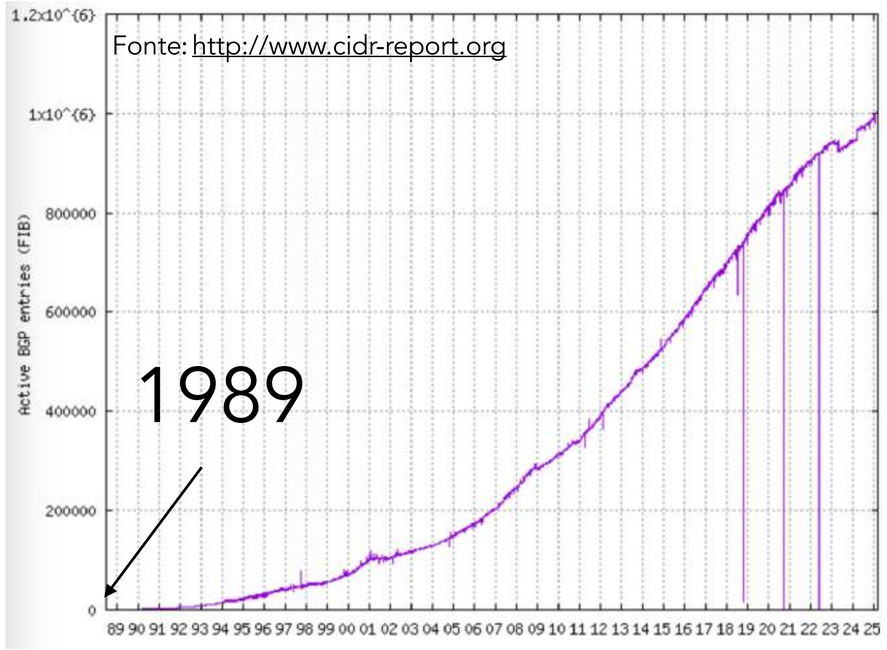
•C: 300k - 350k

•D: 350k - 400k

Full routing table (FRT)

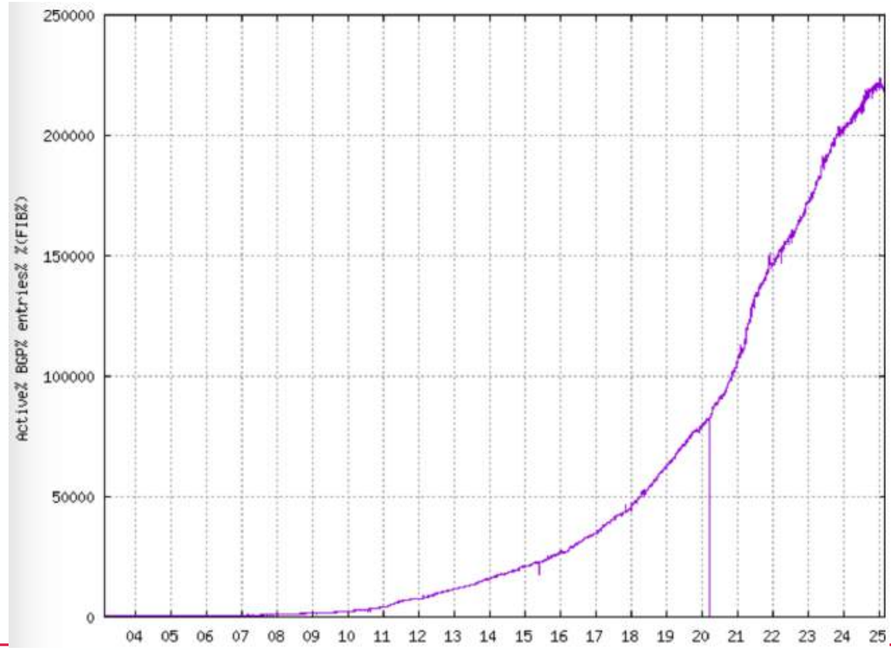
IPv4

Date	Prefixes
31-03-25	1003523
01-04-25	1005069
02-04-25	1003465
03-04-25	1003718
04-04-25	1004358
05-04-25	1004112
06-04-25	1004136
07-04-25	1004789



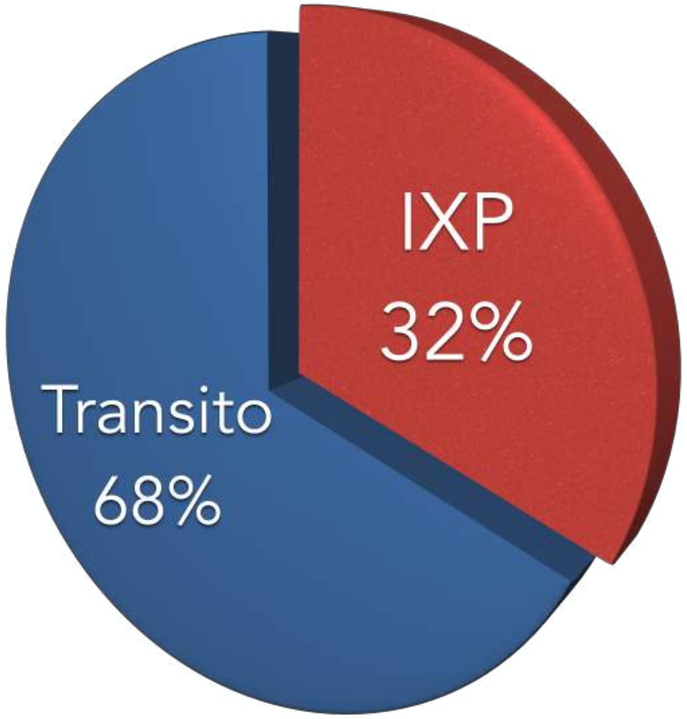
IPv6

Date	Prefixes
31-03-25	220538
01-04-25	221050
02-04-25	220992
03-04-25	221340
04-04-25	221271
05-04-25	221234
06-04-25	221426
07-04-25	221698



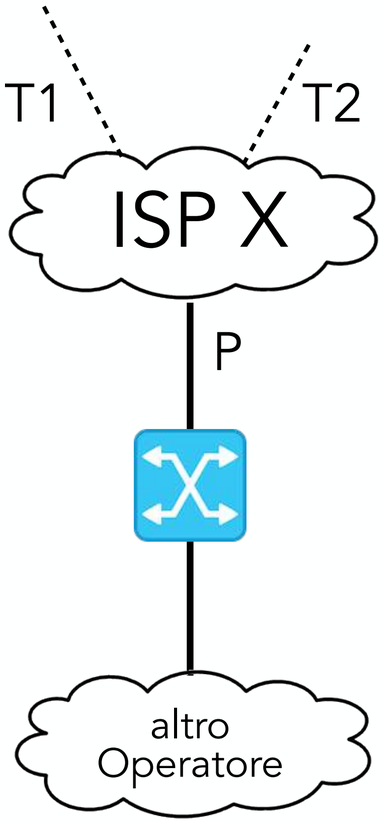
Peering & transito

Rotte ricevute

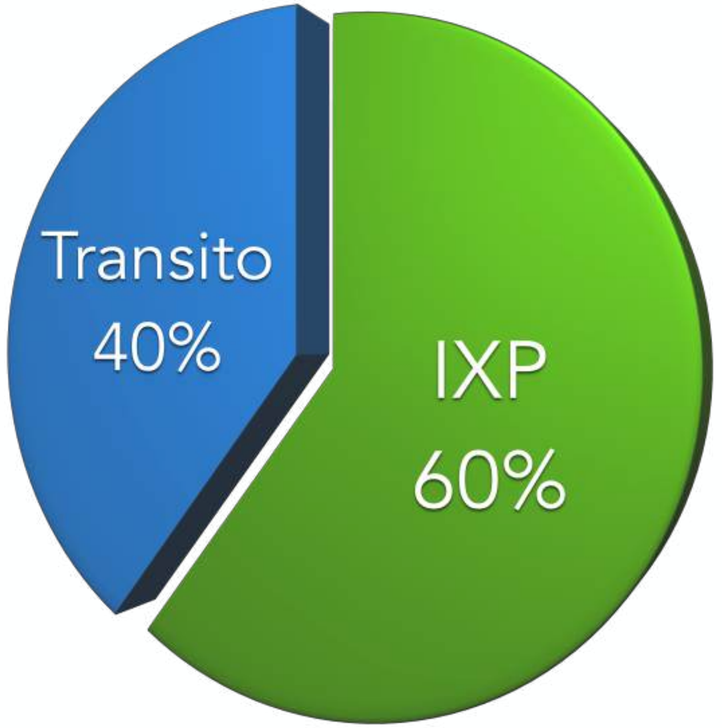


FRT

IPv4: 1M - IPv6: 220k



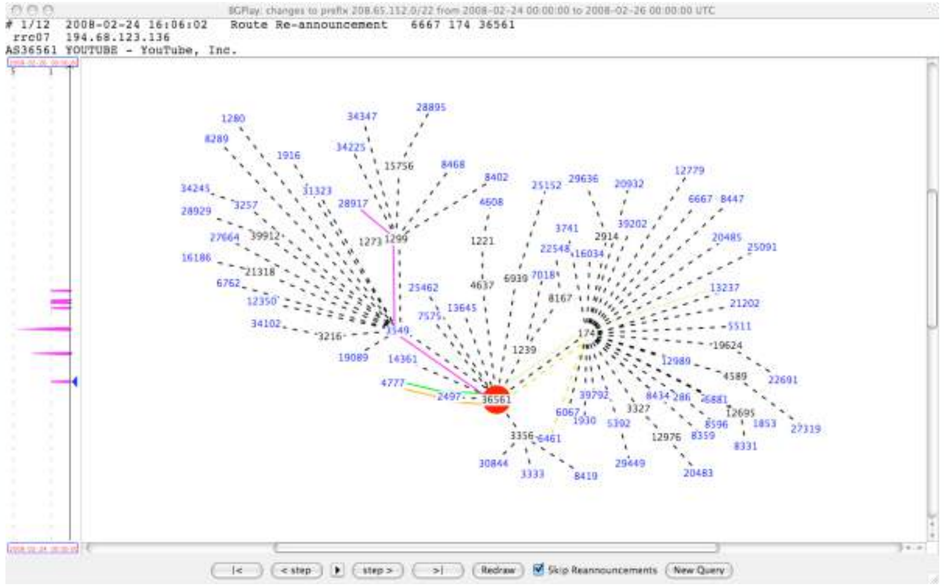
Traffico scambiato

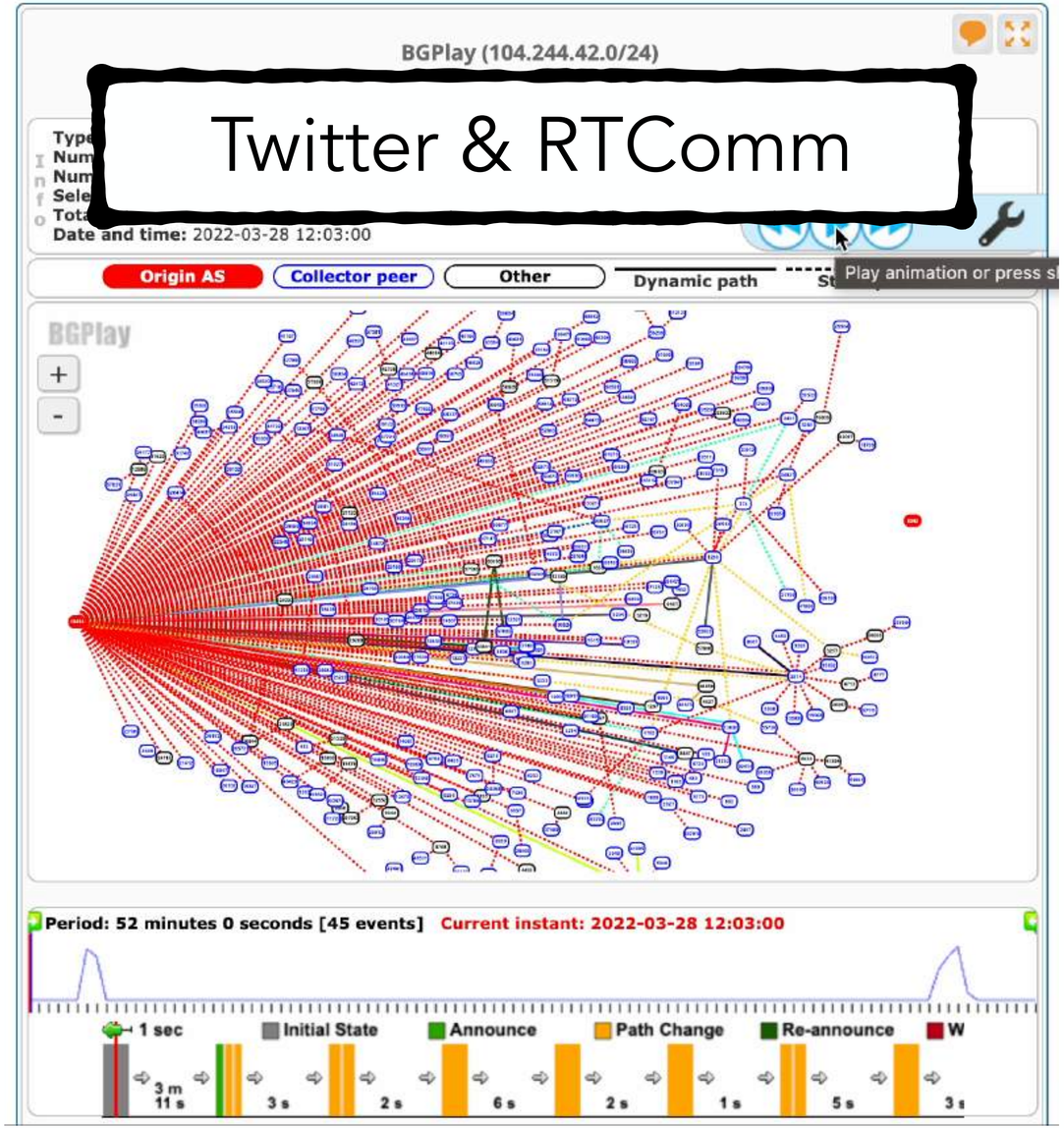


Se qualcosa va storto…

YouTube & Pakistan Telecom, un caso di hijacking

https://www.youtube.com/watch?v=IzLPKuAOe50





Se qualcosa va storto…

YouTub
ur

https://w

THE WHITE HOUSE

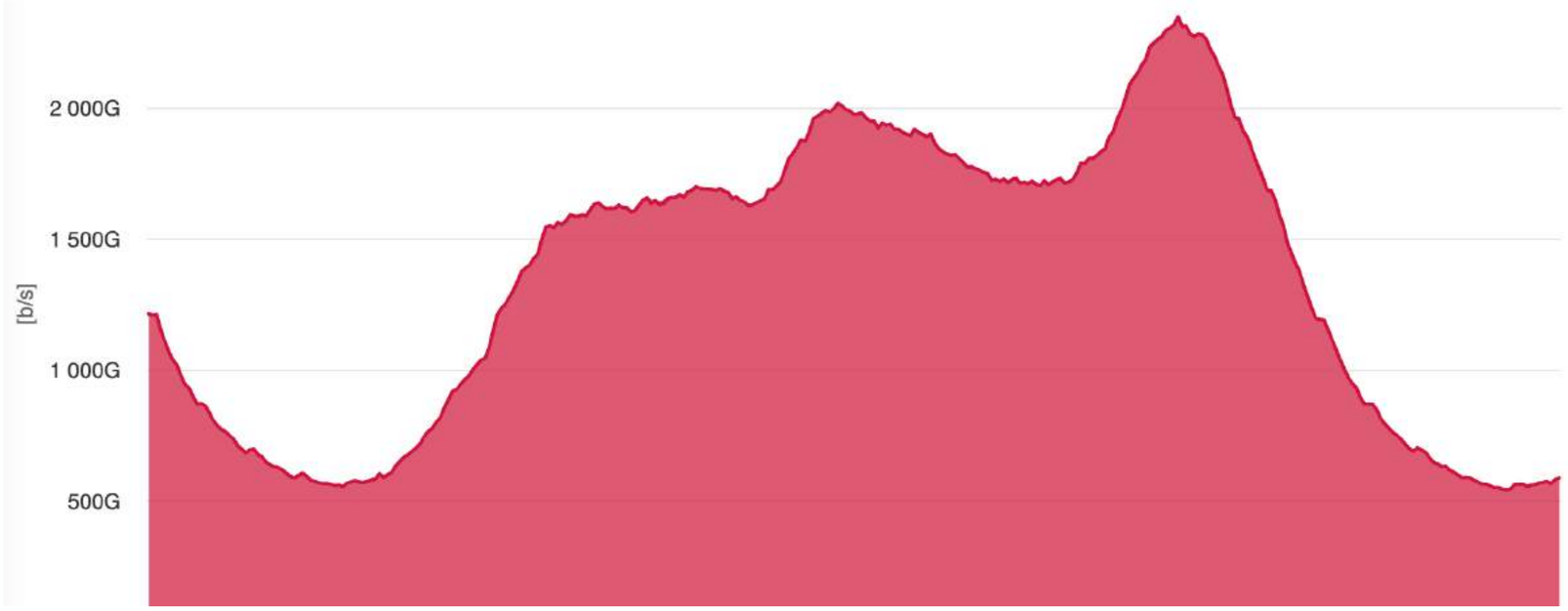
MENU

SEPTEMBER 03, 2024

Press Release: White House Office of the National Cyber Director Releases Roadmap to Enhance Internet Routing Security

ONCD ▸ BRIEFING ROOM ▸ PRESS RELEASE

Quanto traffico?

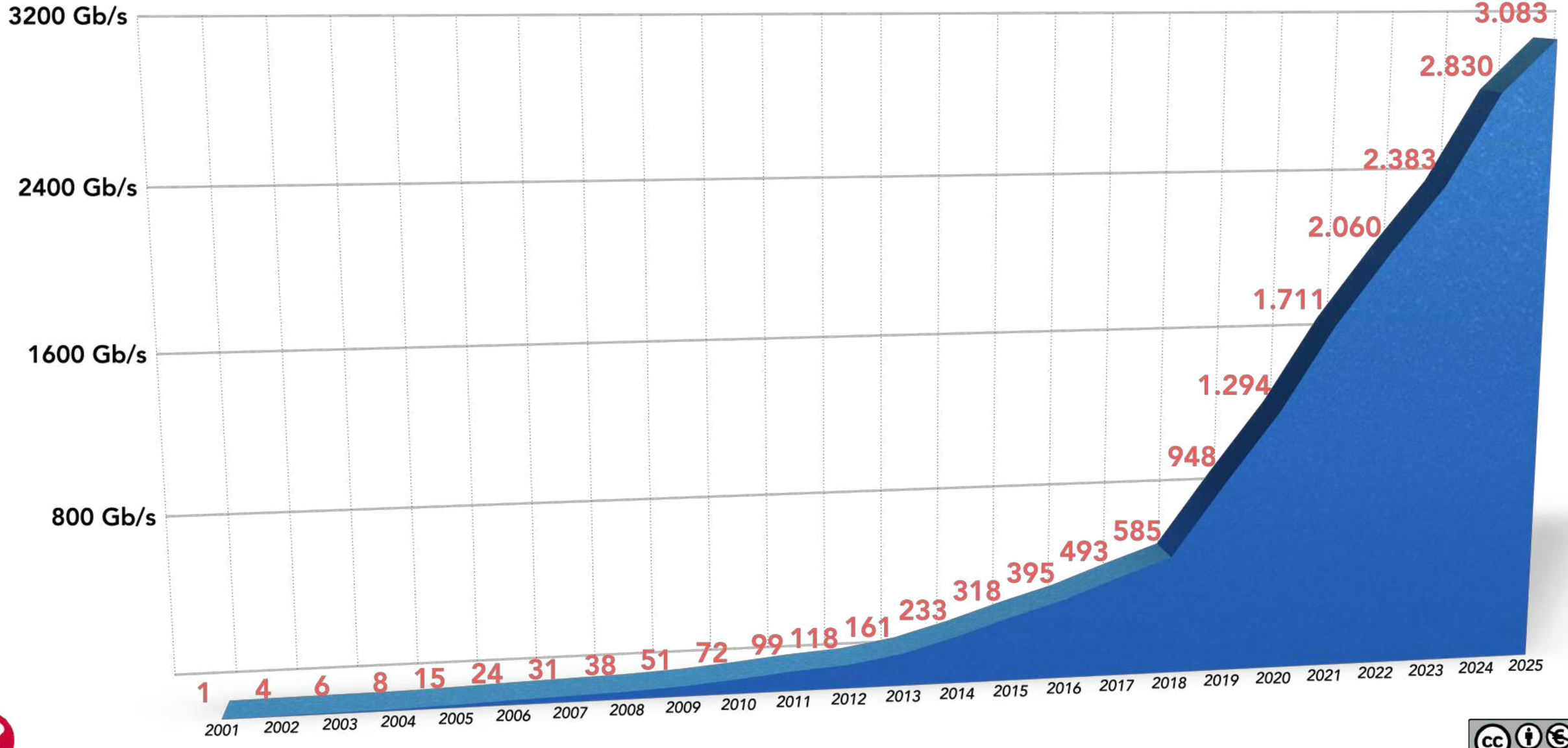


Aggregato MIX + Namex

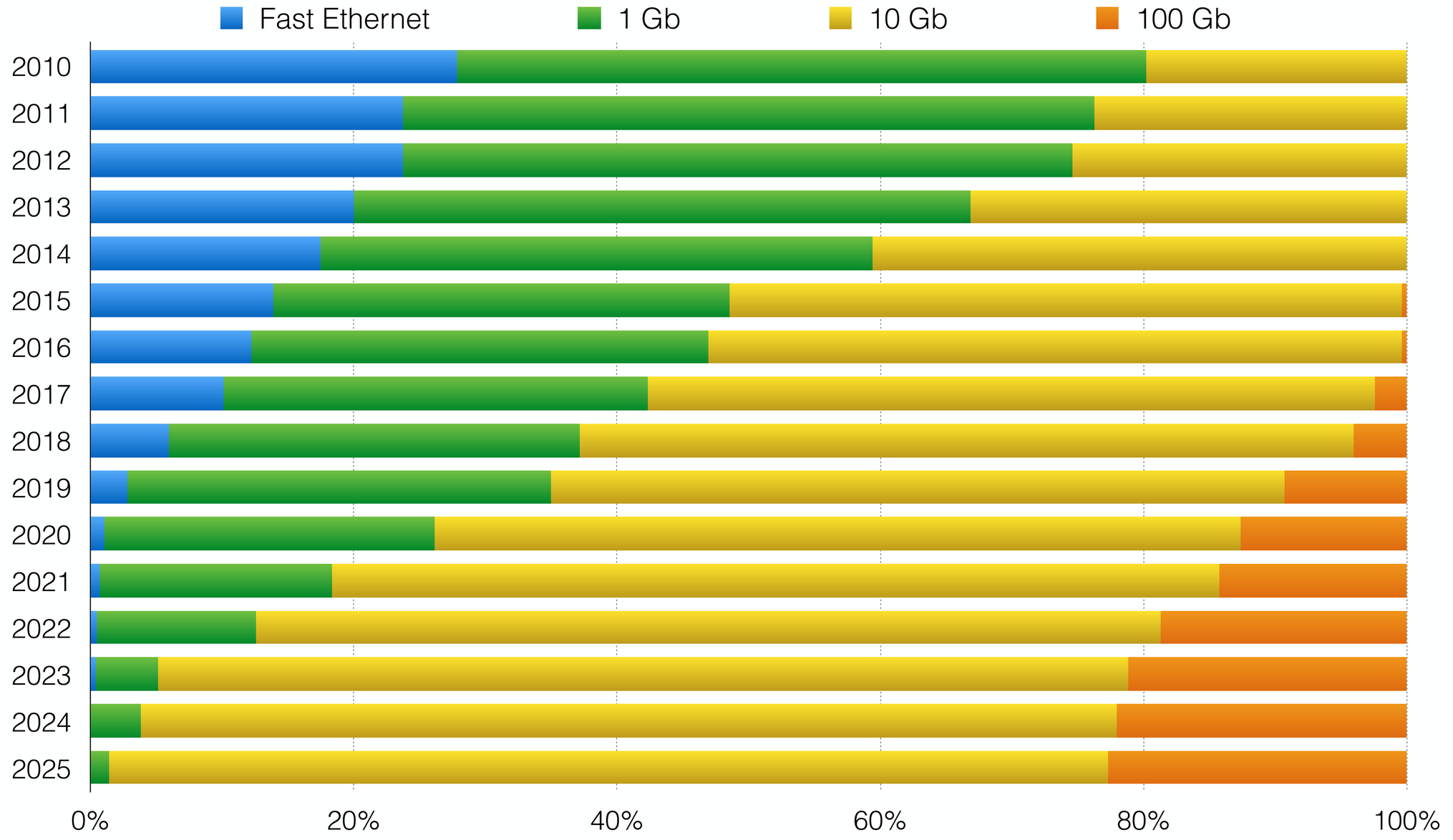
>4 Tb/s

- Picco minimo nella fascia 4-6 del mattino
- Pausa pranzo/cena: intoccabile!
- Picco massimo nella fascia 21-23 alla sera

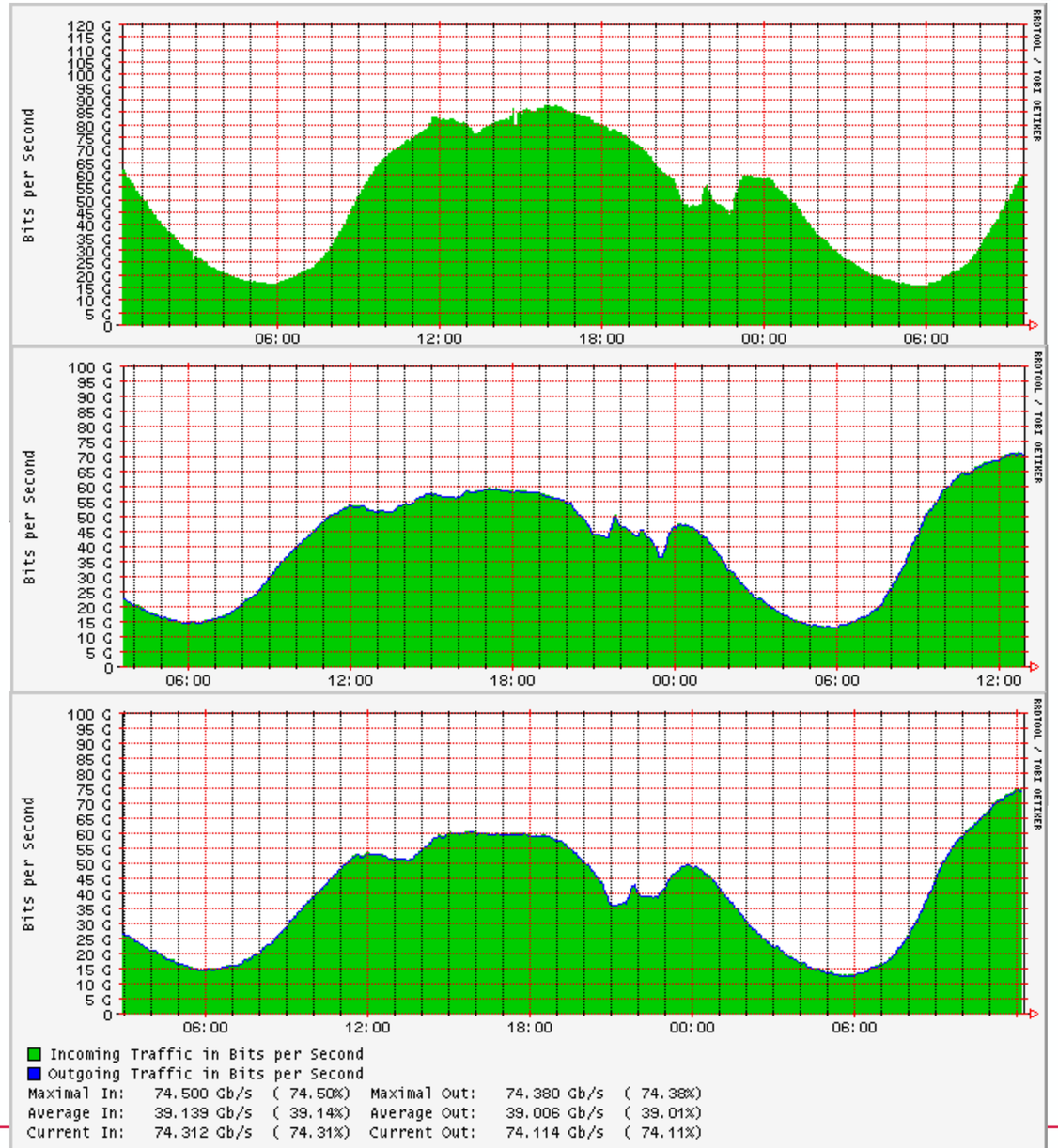
Progressione picchi traffico



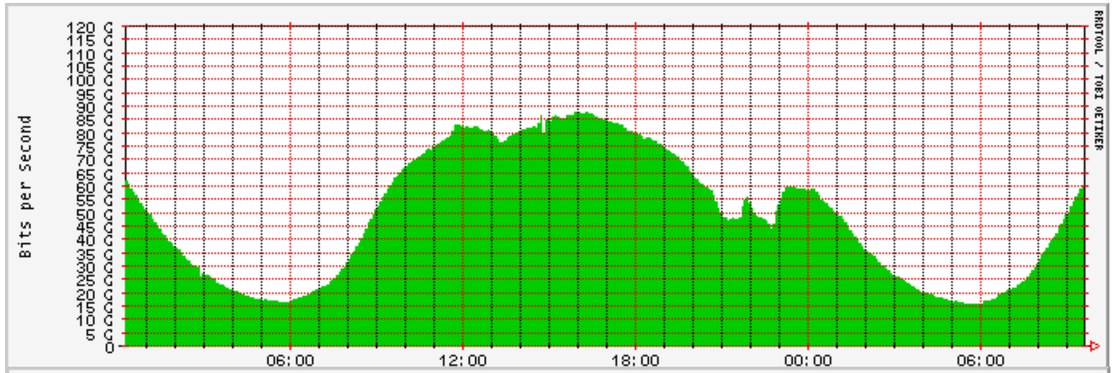
Evoluzione capacità (in %)



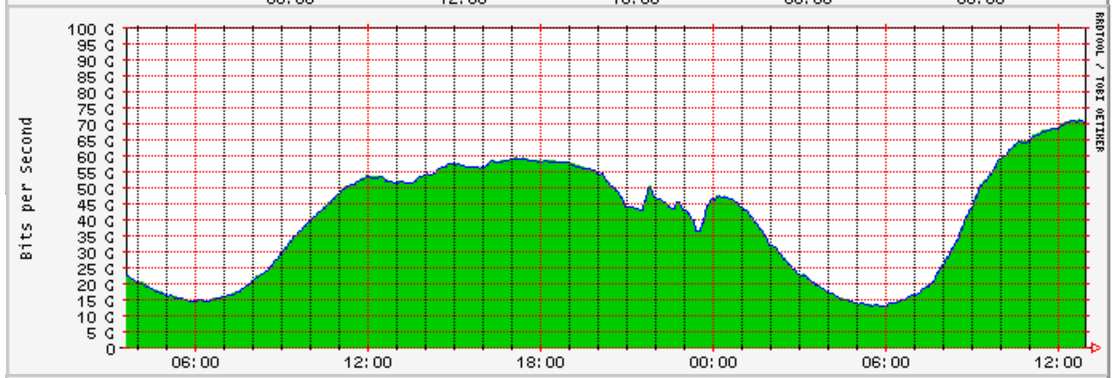
Eventi speciali



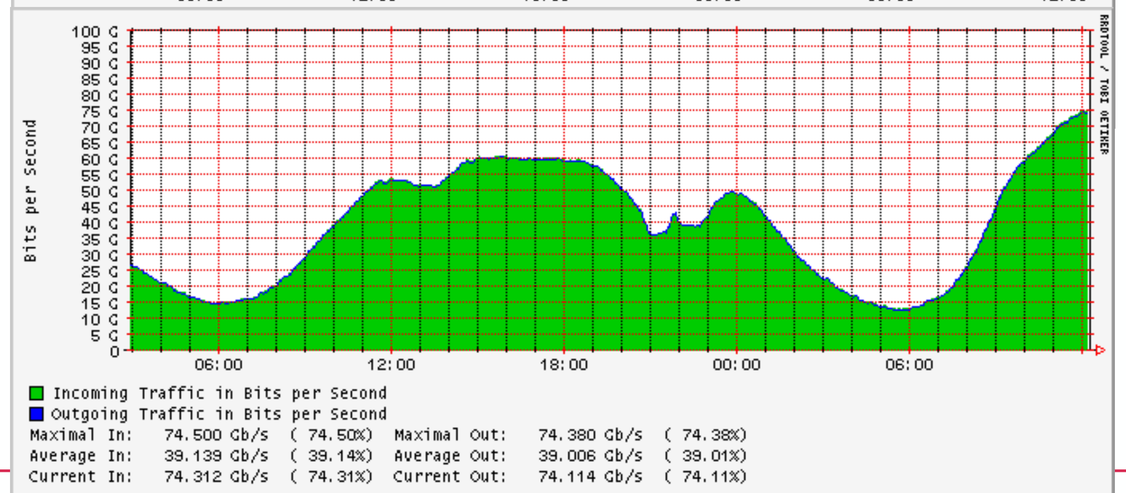
Eventi speciali



Italia - Germania

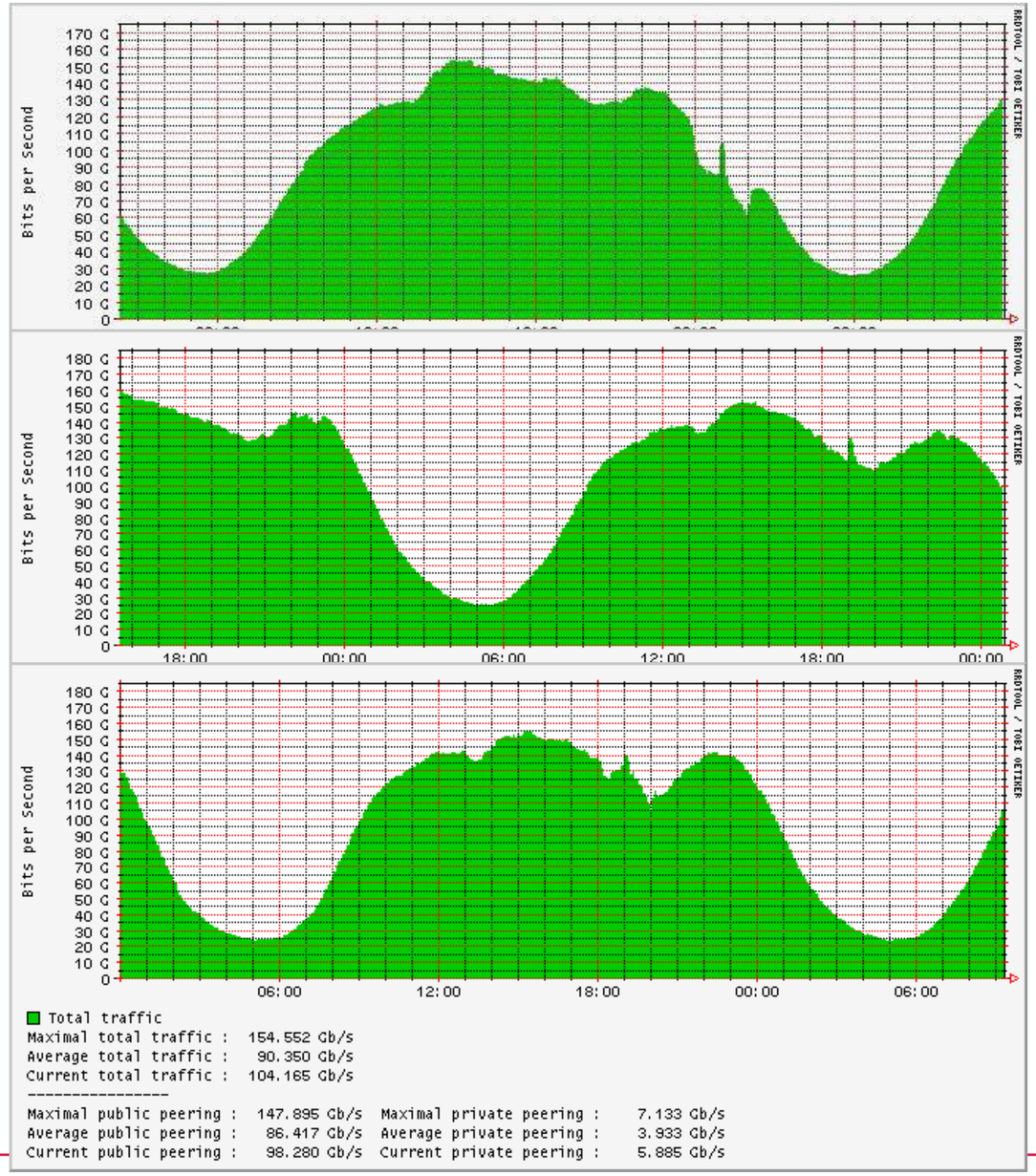


Italia - Inghilterra



Italia - Spagna

Eventi speciali



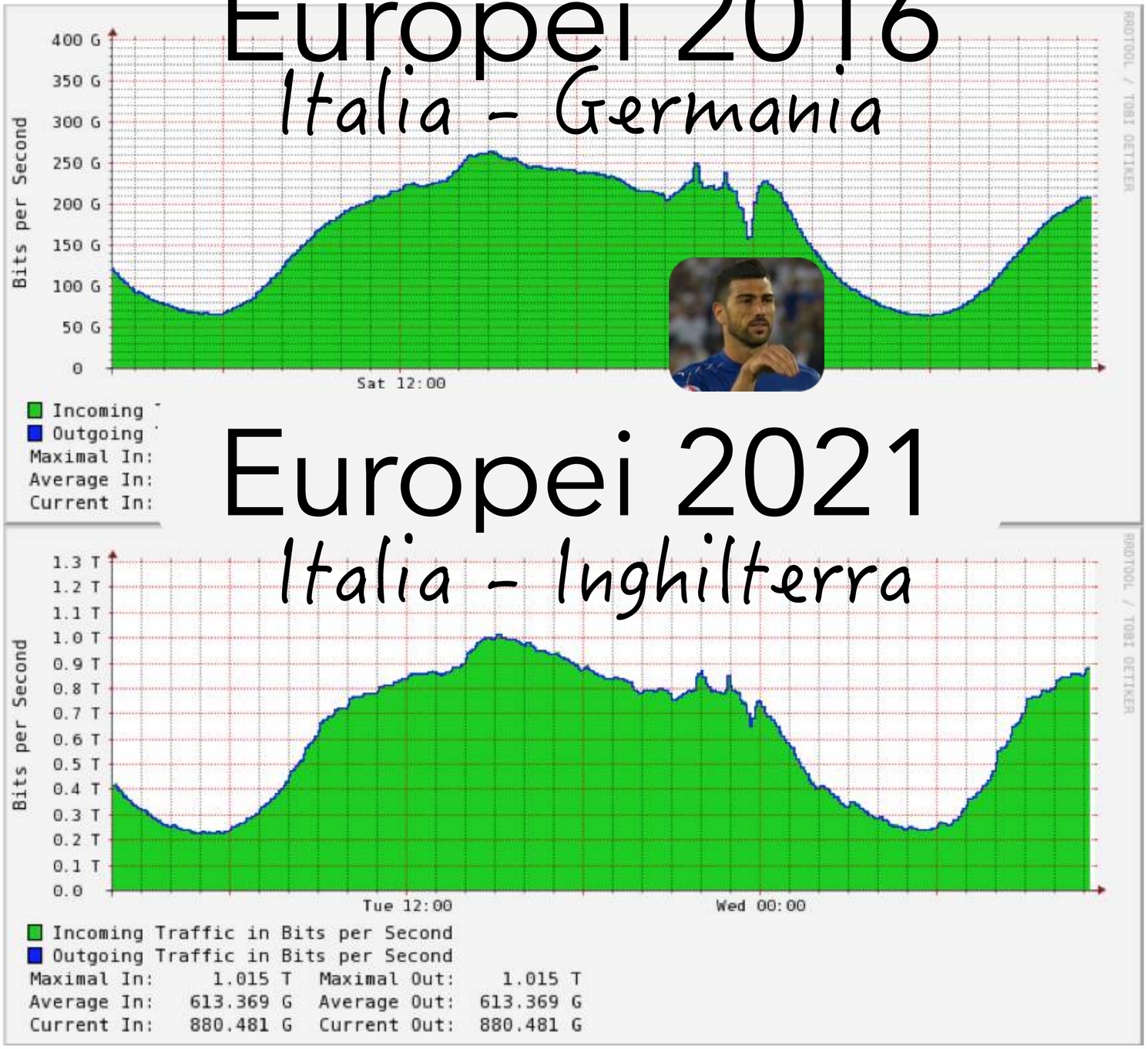
Italia - Inghilterra

Italia - Costarica

Italia - Uruguay

Europei 2016

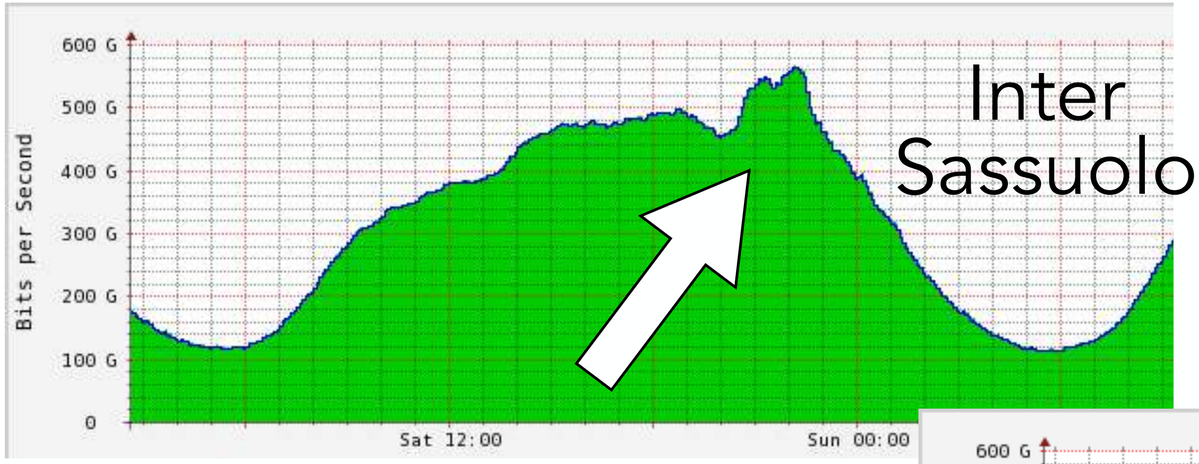
Italia - Germania

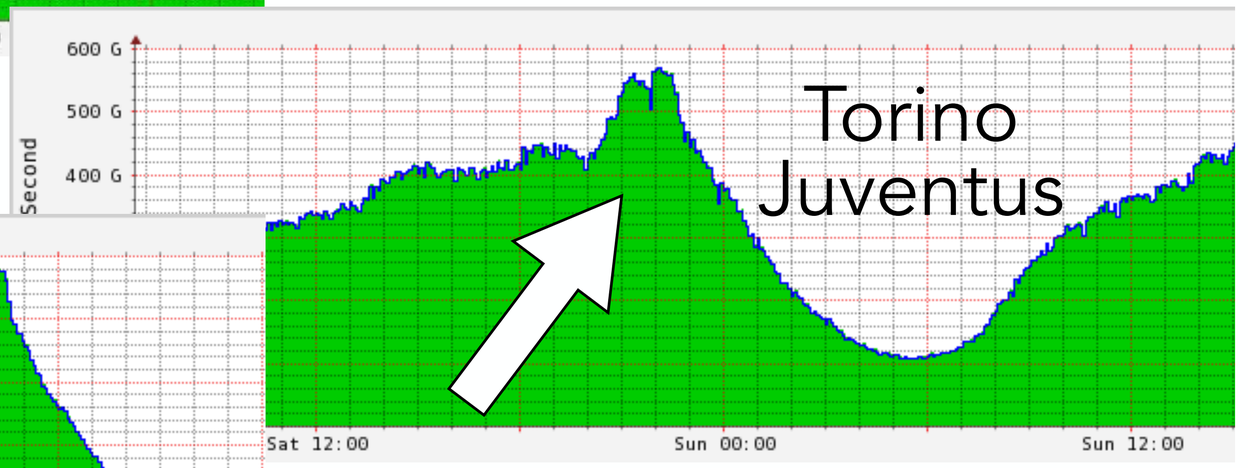


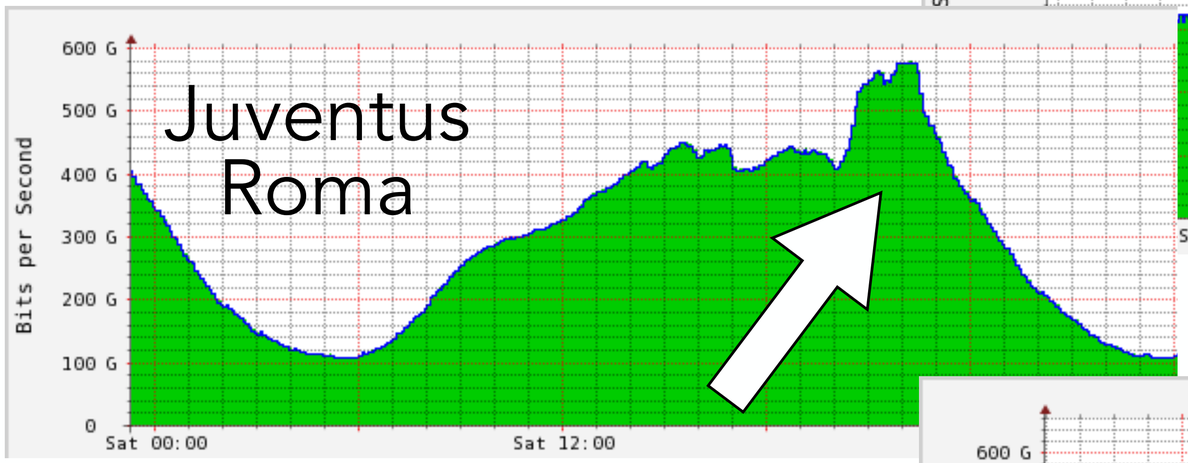
Europei 2021

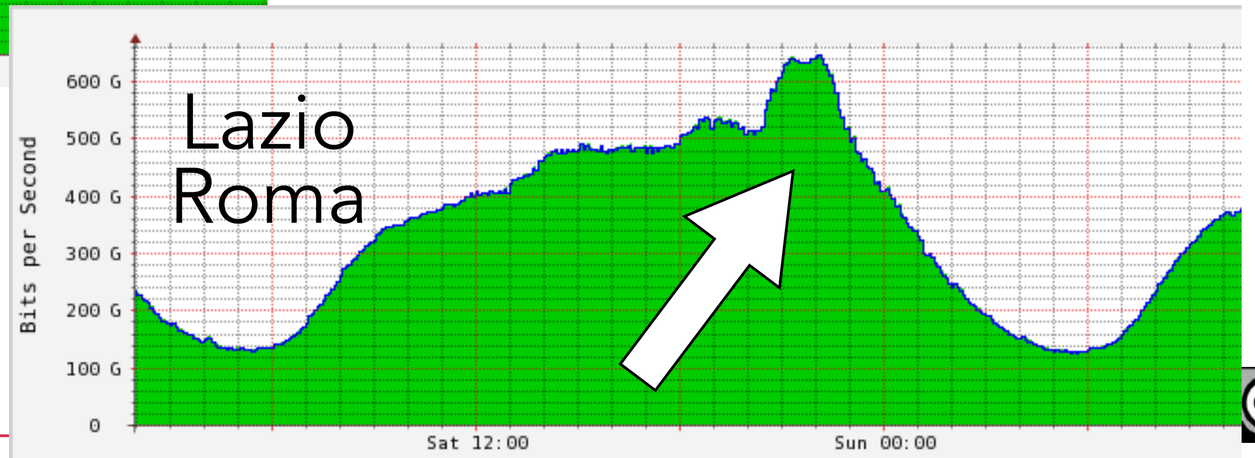
Italia - Inghilterra

Dal 2018...



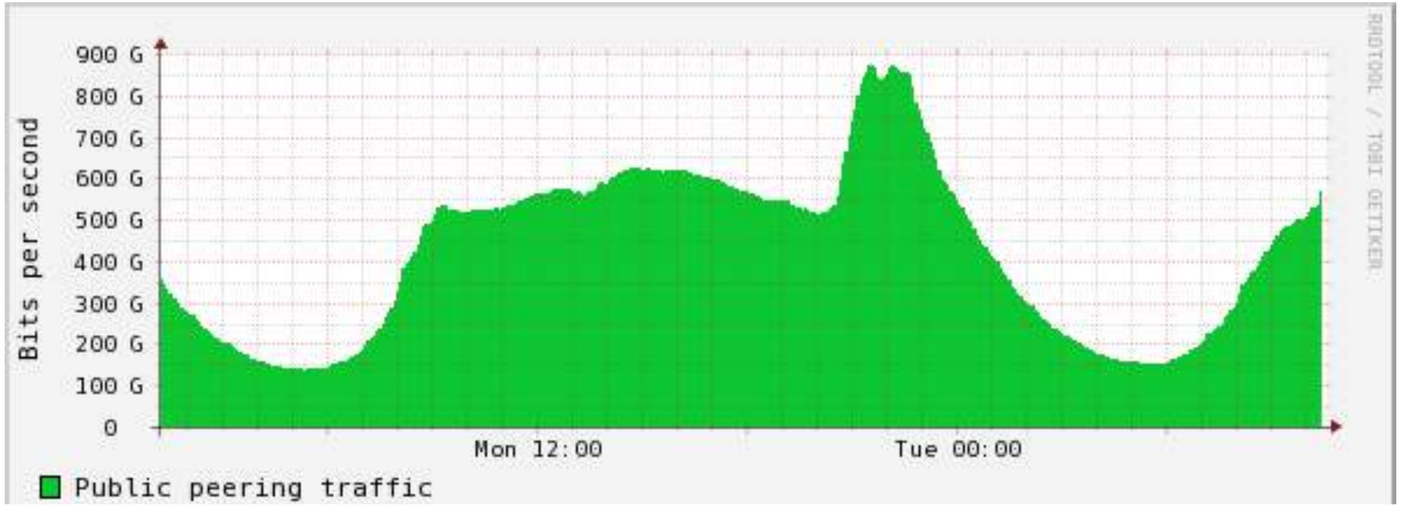






Effetto DAZN

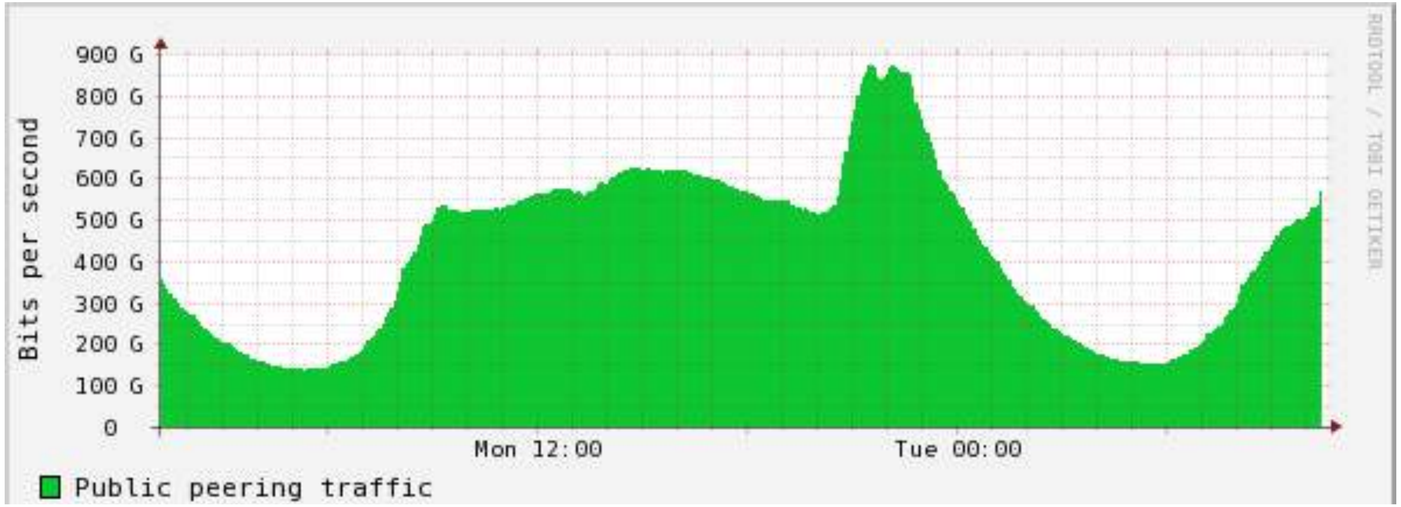
Nuovi record

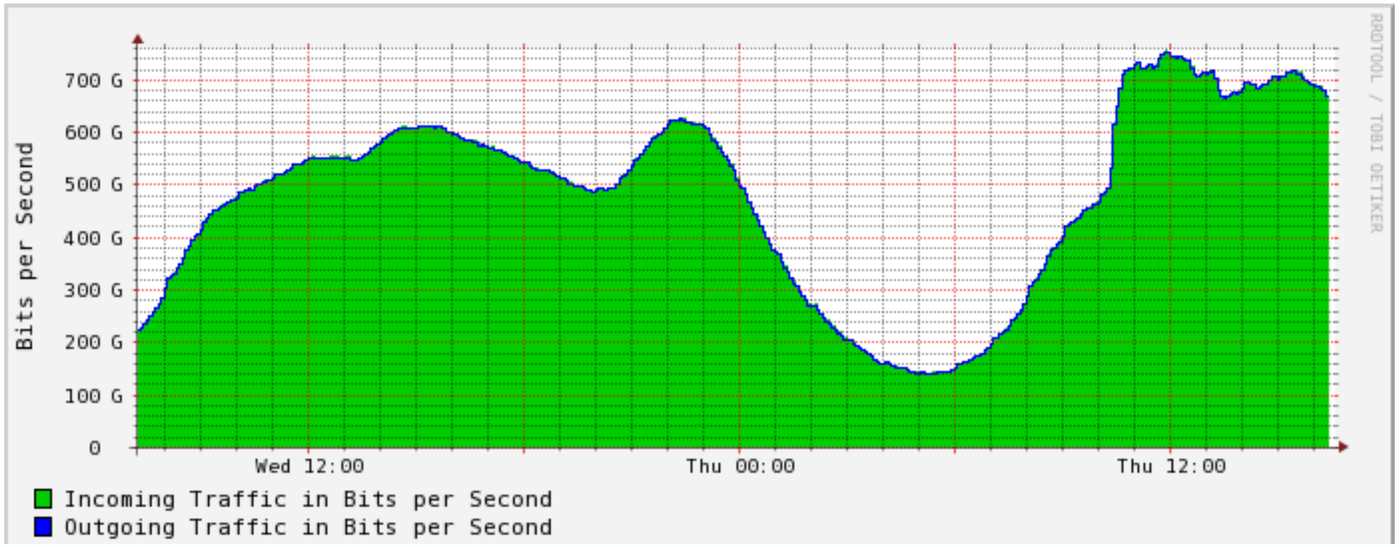


SERIE A

UEFA CHAMPIONS LEAGUE

Nuovi record





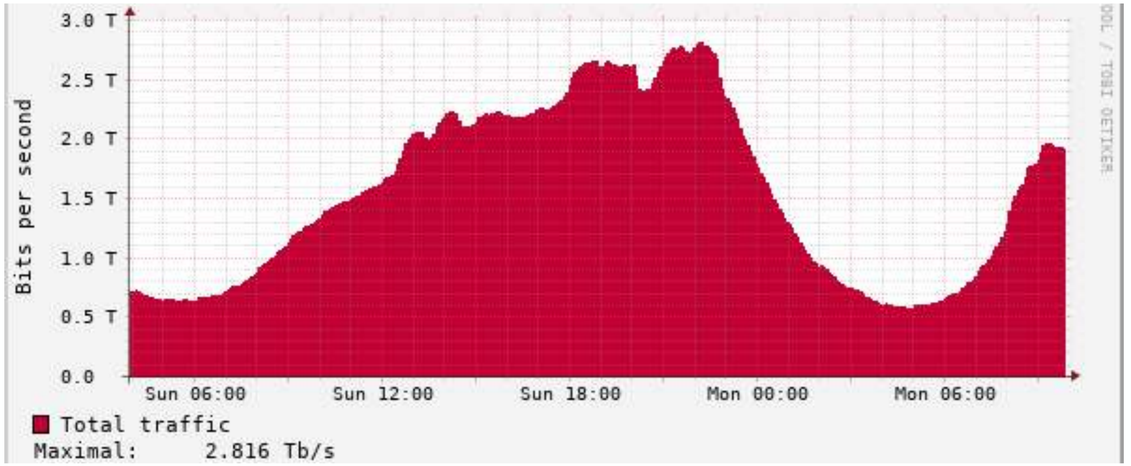
SERIE A

UEFA CHAMPIONS LEAGUE

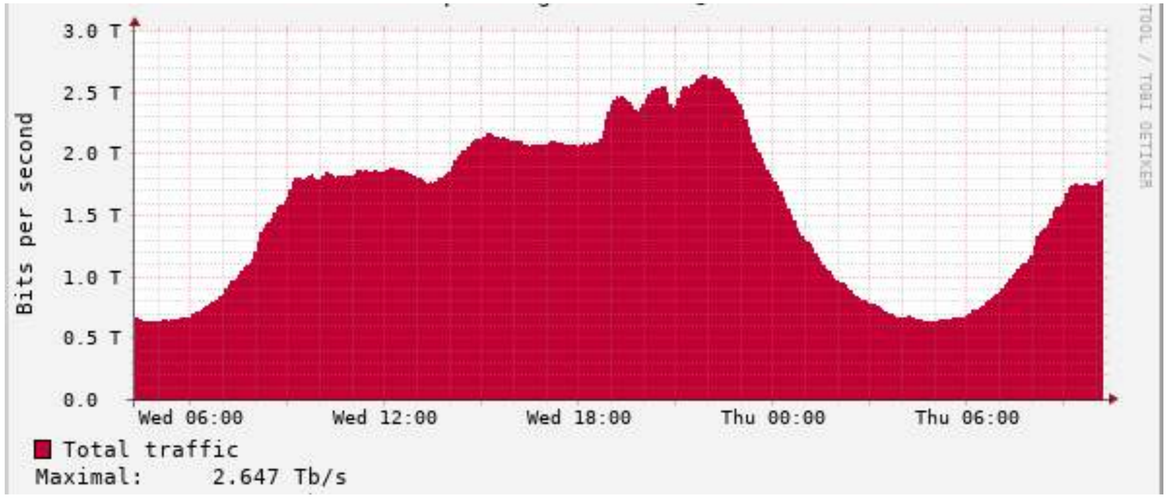
FORTNITE

Nuovi record

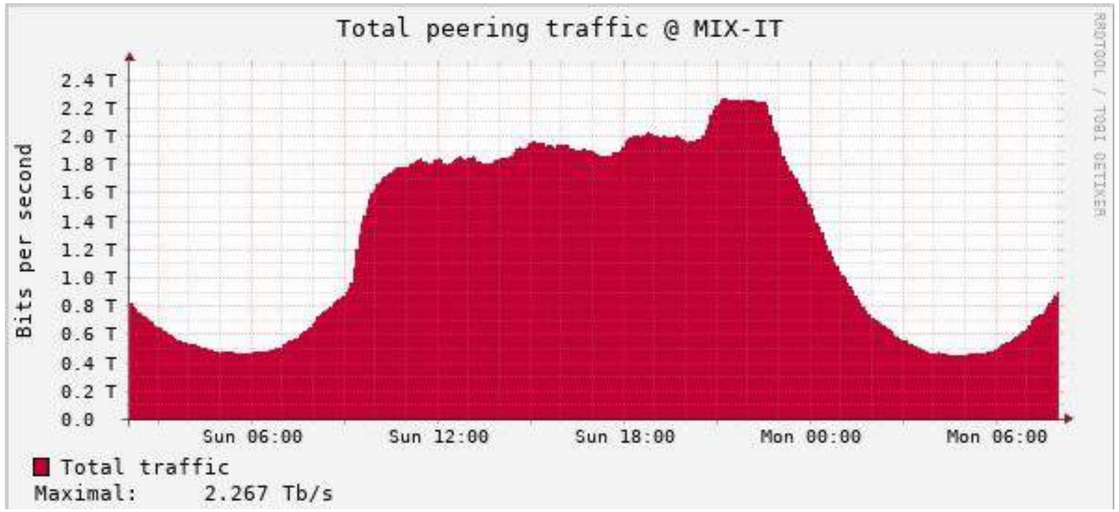
2 febbraio 2025 - Serie A



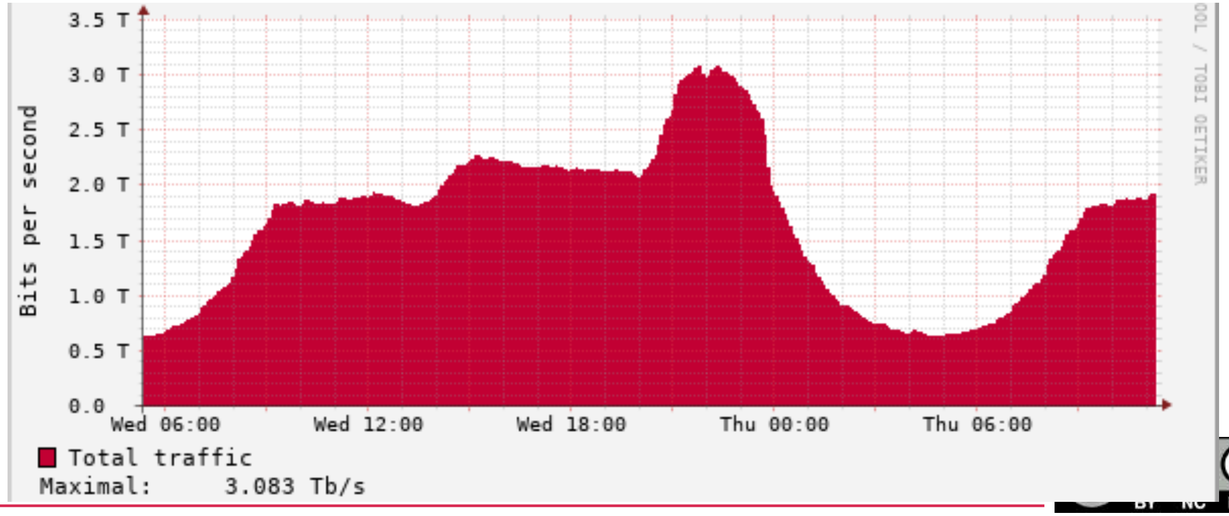
5 marzo 2025 - Feyenoord - Inter

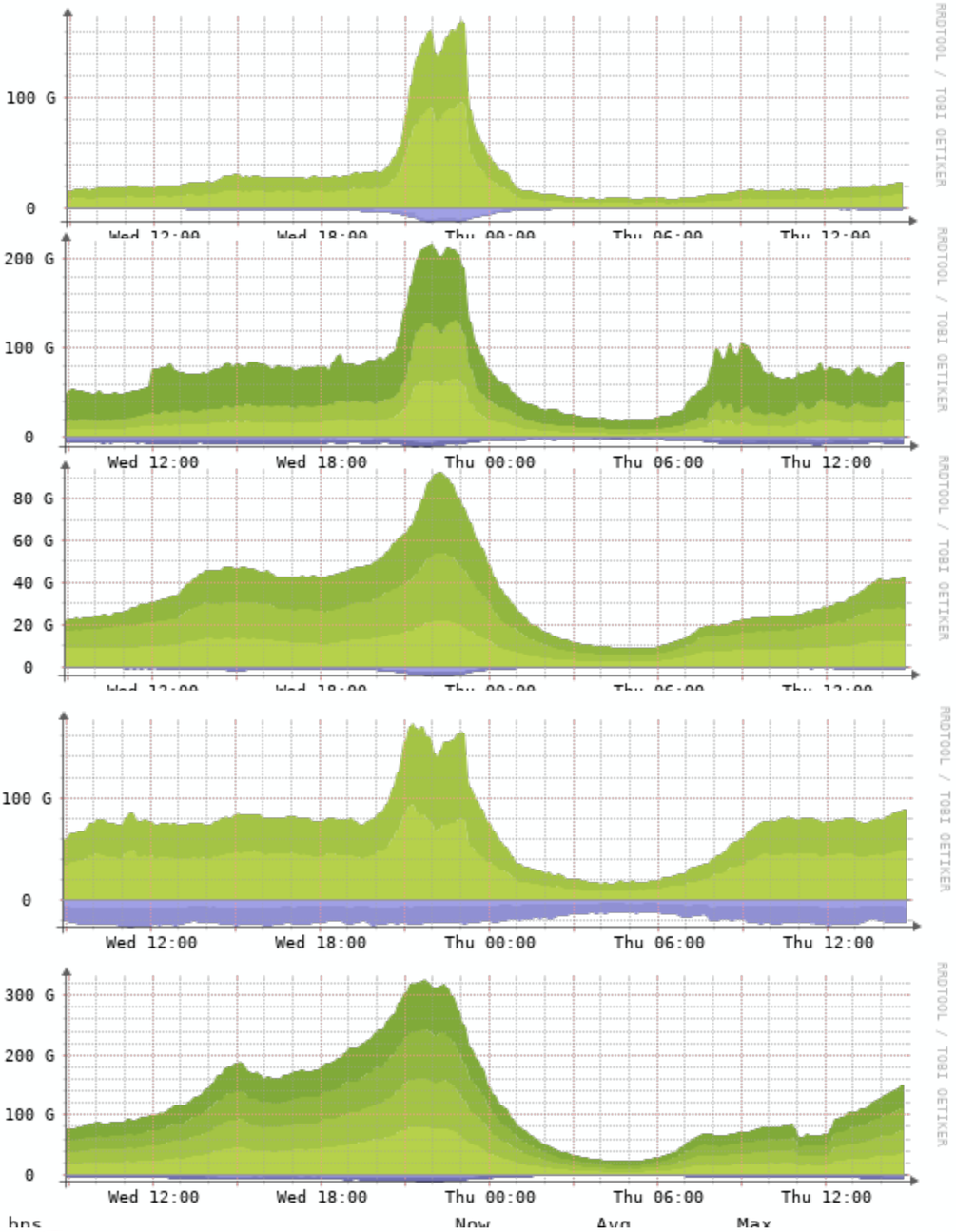


3 dicembre 2023 - Fortnite upgrade

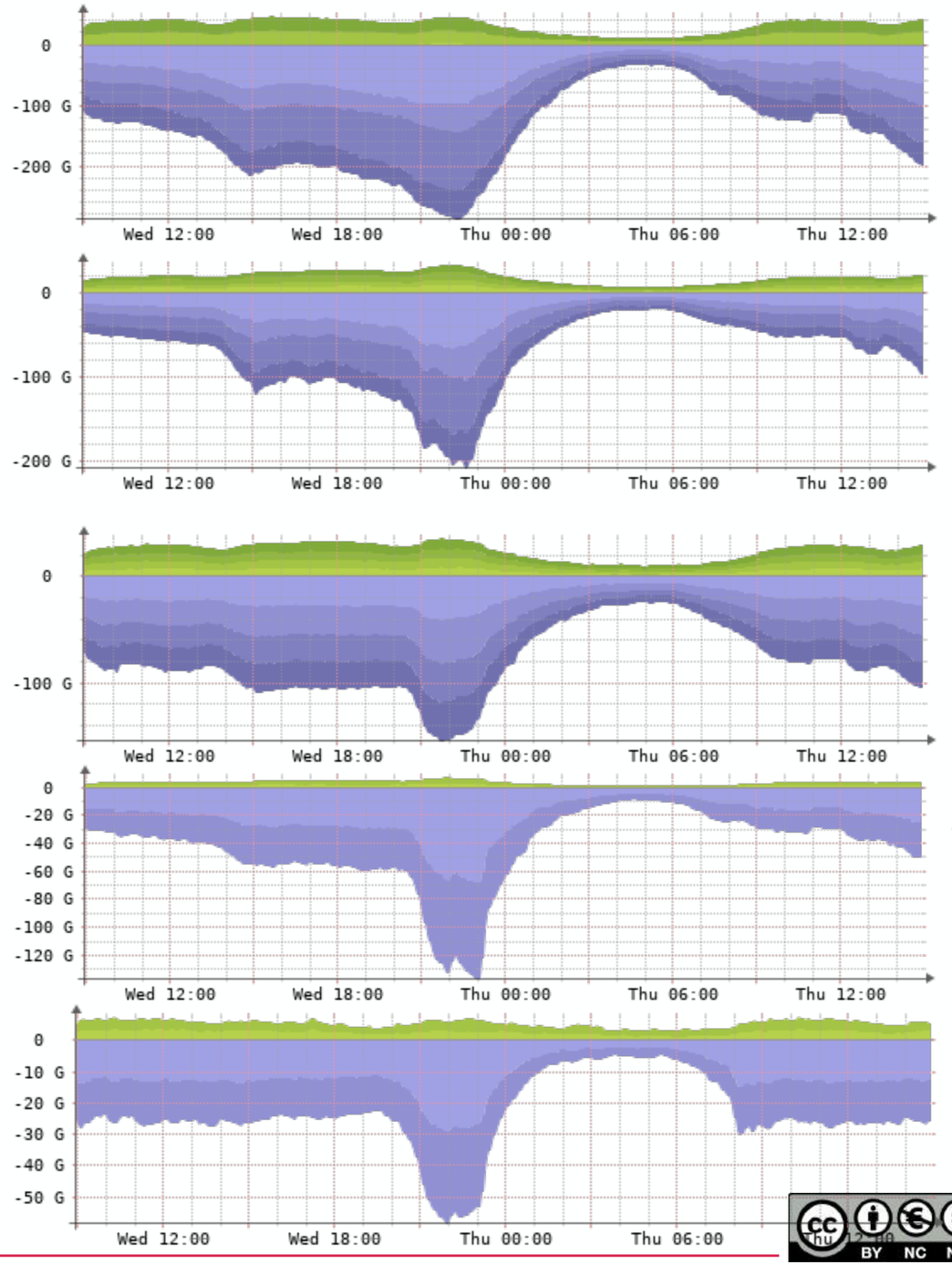


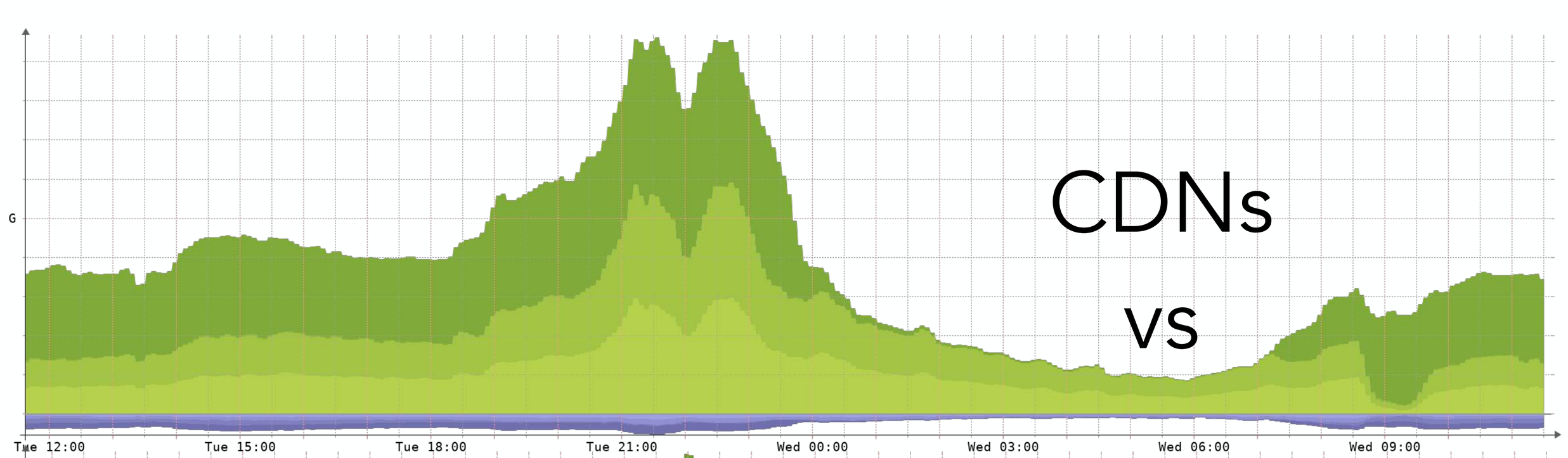
19 febbraio 2025 - PSV - Juventus





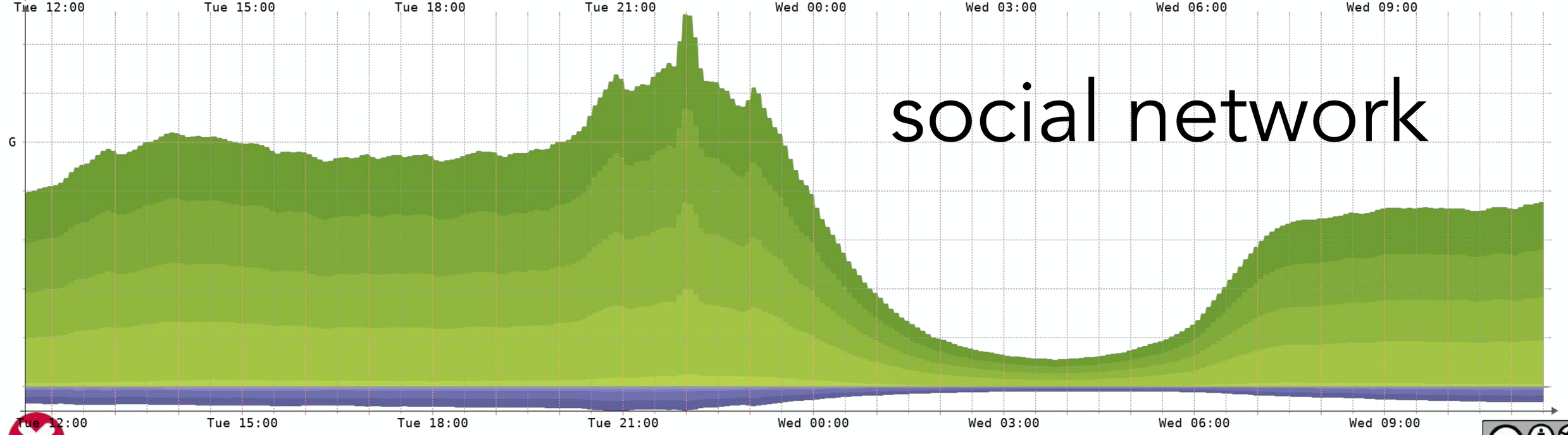
CDNs vs ISPs





CDNs

vs



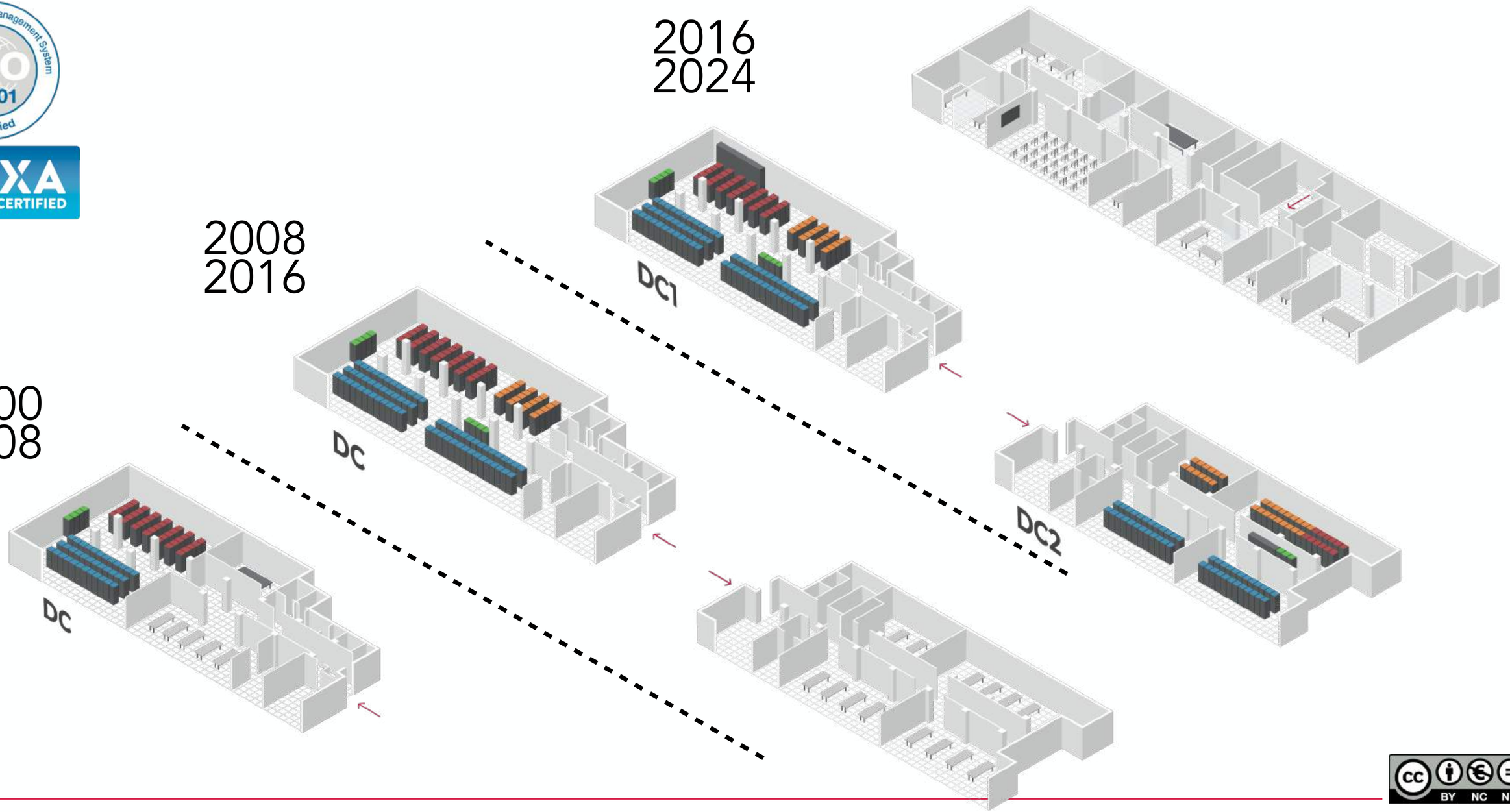
social network

Evoluzione datacenter MIX

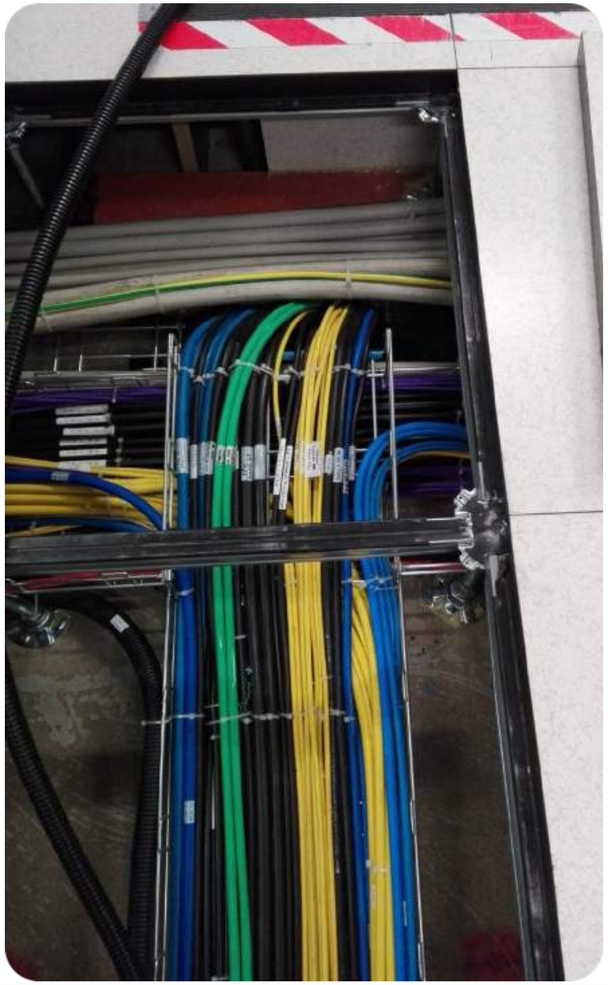
2016
2024

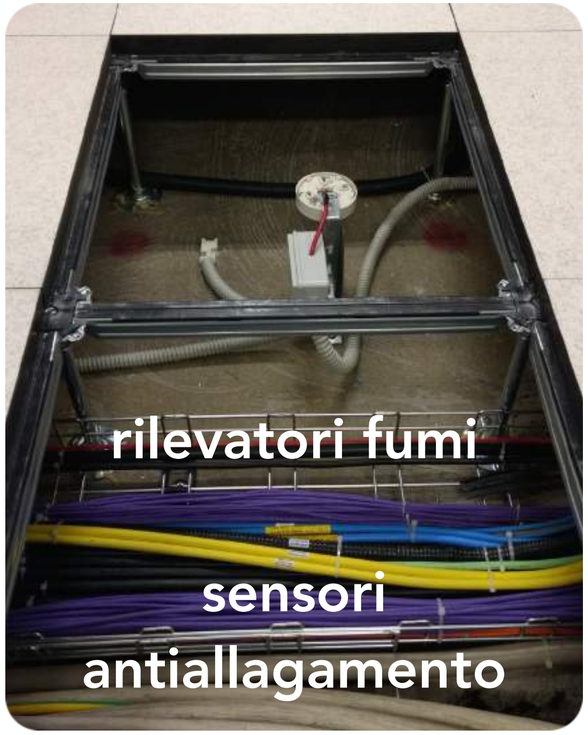
2008
2016

2000
2008

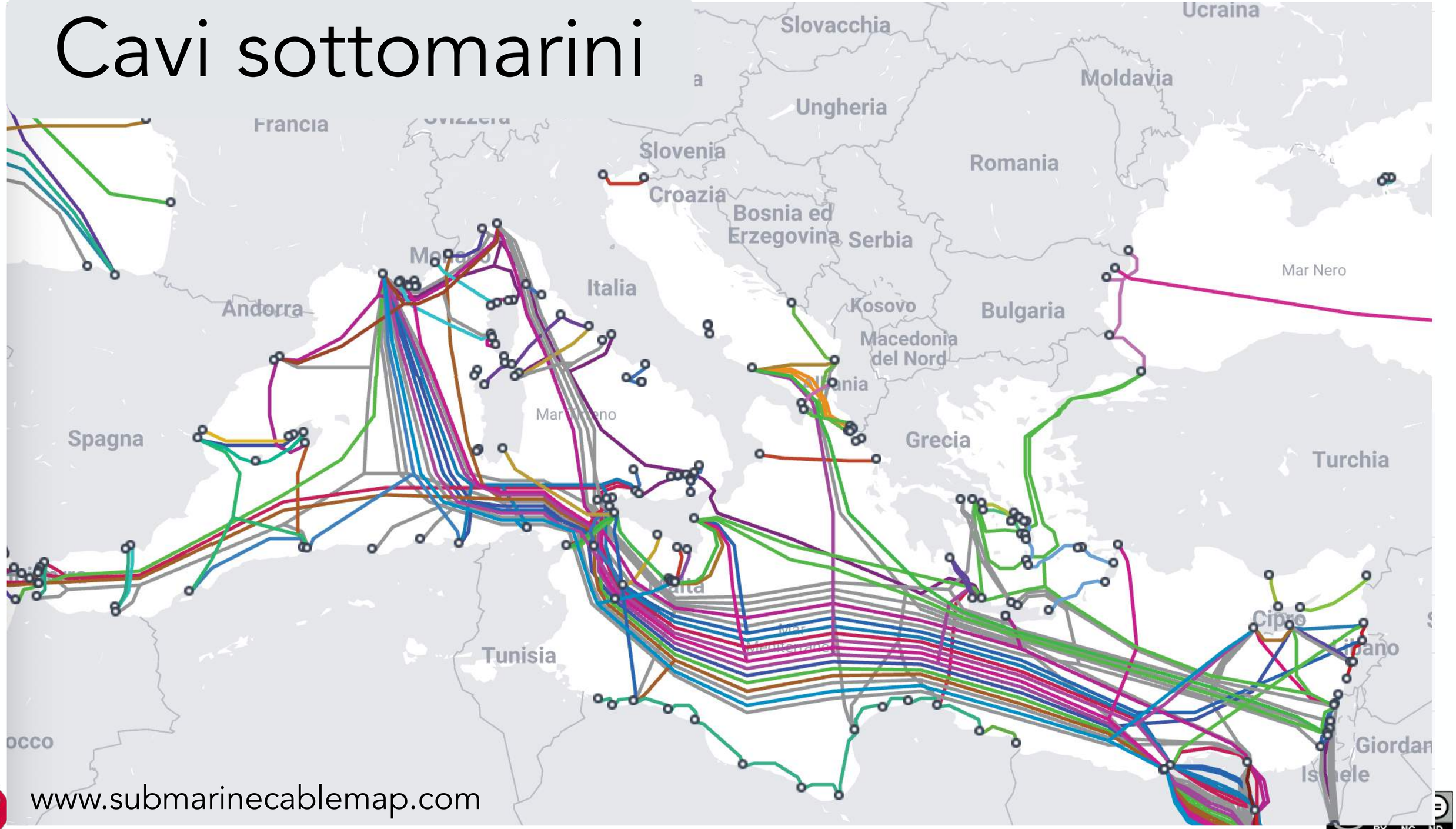


Uno sguardo in sala





Cavi sottomarini



www.submarinecablemap.com

Cavi sottomarini

www.submarinecablemap.com

Grazie!

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