

# How is interconnection model changing in IXP?

---

Flavio Luciani – Namex CTO

[f.luciani@namex.it](mailto:f.luciani@namex.it)



# About me

## **Namex CTO**

[www.namex.it](http://www.namex.it)

## **MANRS Steering Committee member**

[www.manrs.org/about/governance/steering-committee/steering-committee-members](http://www.manrs.org/about/governance/steering-committee/steering-committee-members)

## **Selection Committee for the RIPE NCC Community Projects Fund**

[www.ripe.net/support/cpf/selection-committee](http://www.ripe.net/support/cpf/selection-committee)

## **IXP Neutrality Project WP member**

[neutral-inter.net](http://neutral-inter.net)

## **Internet netizen**

[twitter.com/flavioluciani81](https://twitter.com/flavioluciani81)

[www.linkedin.com/in/flavio-luciani-19681213a/](https://www.linkedin.com/in/flavio-luciani-19681213a/)

## **Routing security supporter**



# Disclaimer

What you will hear shortly may offend someone's sensibilities.

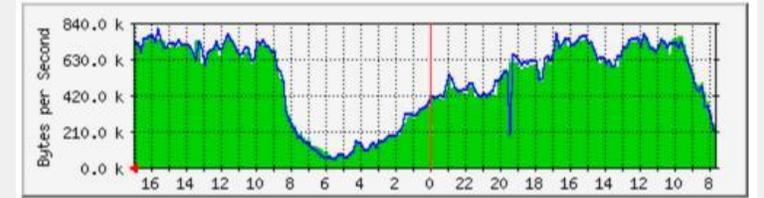
The statements within this presentation are the author's personal opinion. All references to facts, people, companies are purely accidental. The author takes full responsibility for all things written and spoken.

Joking...

# Peering emerges in Europe

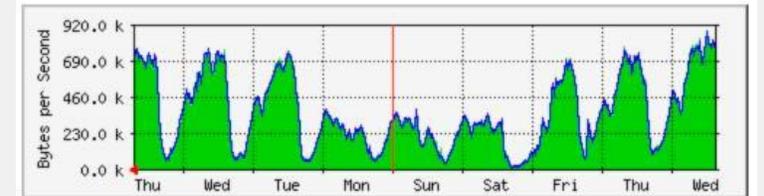
- Following the deregulation in the early 1990s - ISPs and competitive operators are formed
- Players are starting to form peering policies
- The basic rule of “both networks that peer must benefit” is emerging
- Peering as service differentiation

‘Daily’ Graph (10 Minute Average)



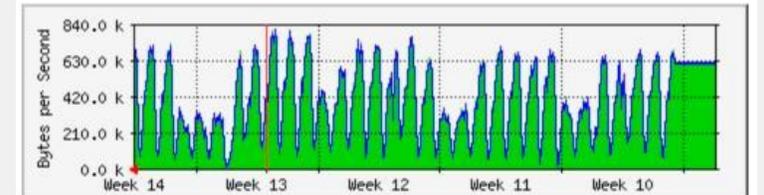
Max In: 771.4 kB/s (61.7%) Average In: 412.3 kB/s (33.0%) Current In: 611.2 kB/s (48.9%)  
Max Out: 700.0 kB/s (56.0%) Average Out: 393.3 kB/s (31.5%) Current Out: 593.5 kB/s (47.5%)

‘Weekly’ Graph (30 Minute Average)



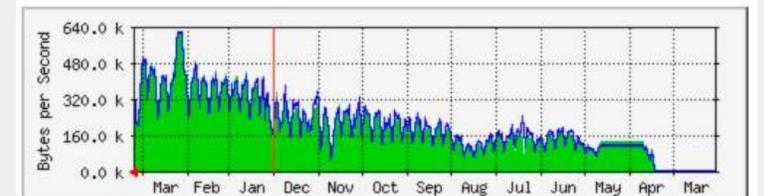
Max In: 715.4 kB/s (57.2%) Average In: 376.2 kB/s (30.1%) Current In: 635.8 kB/s (50.9%)  
Max Out: 700.4 kB/s (56.0%) Average Out: 359.3 kB/s (28.7%) Current Out: 625.8 kB/s (50.1%)

‘Monthly’ Graph (2 Hour Average)



Max In: 680.5 kB/s (54.4%) Average In: 348.0 kB/s (27.8%) Current In: 540.7 kB/s (43.3%)  
Max Out: 777.9 kB/s (62.2%) Average Out: 334.9 kB/s (26.8%) Current Out: 513.1 kB/s (41.0%)

‘Yearly’ Graph (1 Day Average)



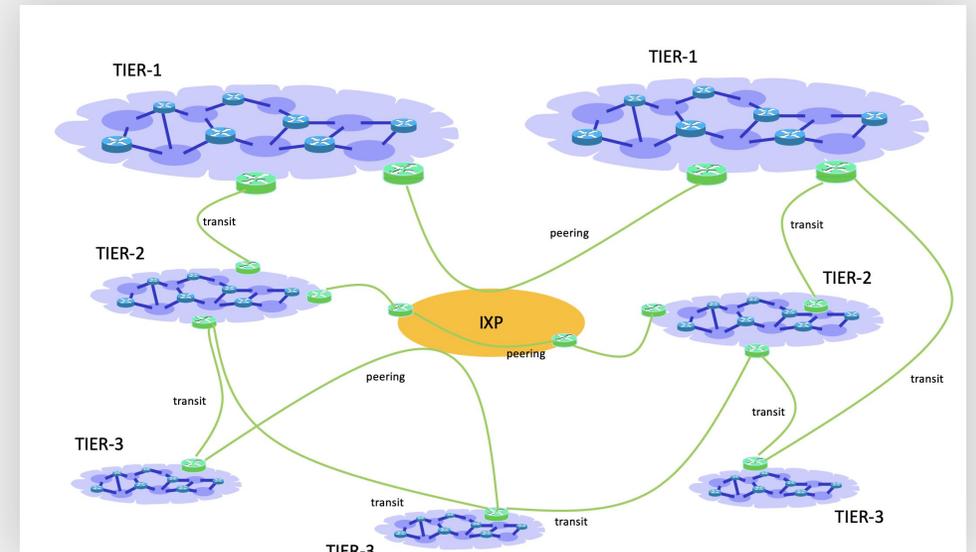
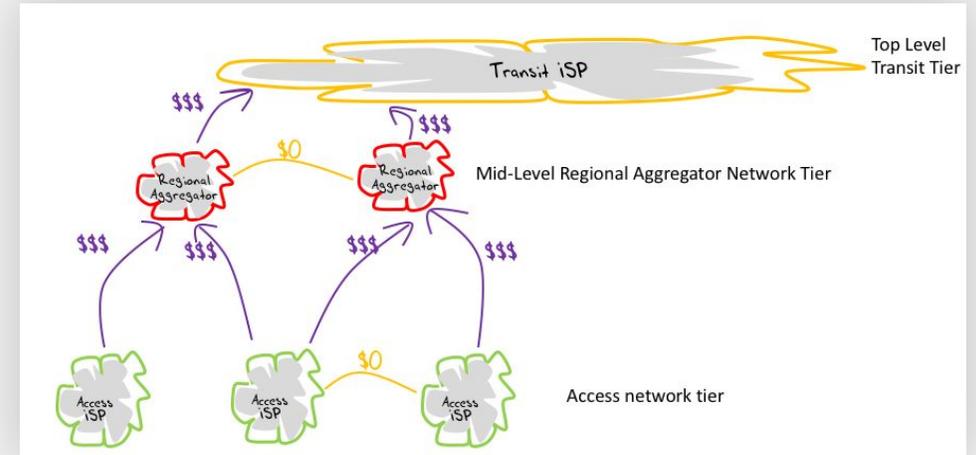
*The first bits of Namex late 90s*

# Interconnect as a new value

- While hard to prove, the dense interconnects in Europe helped innovate services and content
- Peering provided a way to lower end-user costs
- Interconnects helped create a competitive market
- It also made the European Internet much more resilient

# 01 A brief history about interconnect

- 1990-2000 Internet was very much a hierarchy where large players sat at the top  
- content was a single server
- Late 90s early 2000s saw the growth of Internet Exchange Points (IXPs)  
- drove costs down - improved performance
- Content Delivery Networks started to emerge which further drove traffic at IXPs
- By Mid 2000s the CDN's traffic had grown so large they started to deploy inside ISP networks



Source: <https://blog.apnic.net/2016/10/28/the-death-of-transit/>

# A brief history about interconnect

- The emergence of in-network caching again changed interconnects
- (Traffic) Growth shifted to be inside access networks
- Growth at IXPs slowed
- Initially IXPs had been important in scaling and delivering content
- Gradually the role of IXPs shifted to provide access for CDNs to the “long-tail” and backup for in-network caching

# A brief history about interconnect

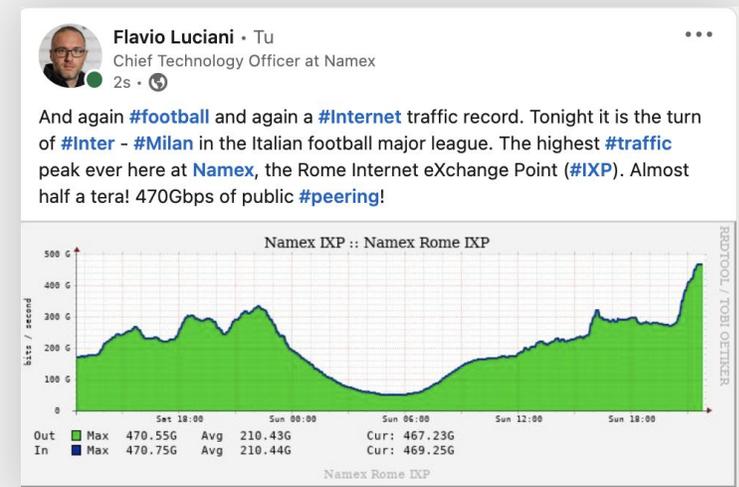
- From 2010 onwards, the OTTs (then Content Providers) begin to 'disengage' from the CDN
- CDNs represent a reinforcing element to the distribution
- Thus begins a new movement towards the edges of the network where peripheral IXPs start to grow faster
- On-demand services start to take hold on the Internet, large Northern European IXPs swell with content and new IXPs born
- At the same time, demand from the southernmost regions is increasing and thus the distribution of caches in the peripheral IXPs is increasing

# A brief history about interconnect

- Once again Content Providers traffic had grown so large they started to deploy inside ISP networks
- Once again growth at IXPs slowed
- Once again gradually the role of IXPs shifted to provide access for Content Providers to the “long-tail” and backup for in-network caching

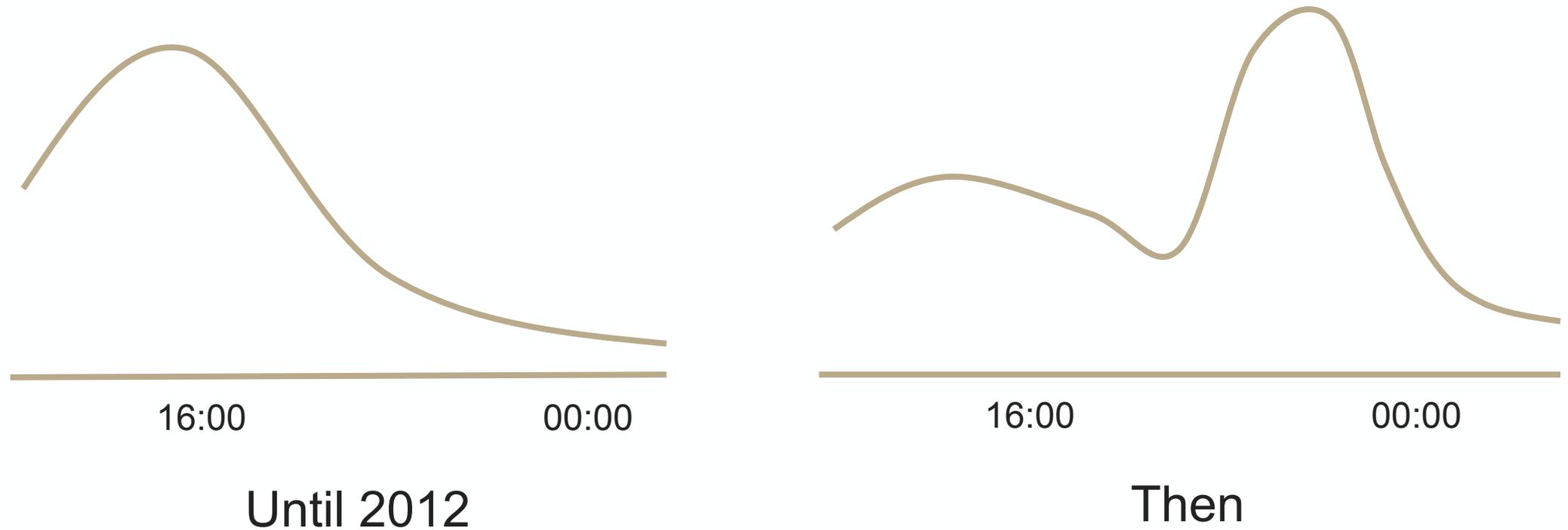
# 05 A brief history about interconnect

- Then came live streaming, which immediately followed the 'distribution within the big ISPs' and 'distribution in the IXPs for the long tail and backup' model
- Over the years, a demand for 'other services' by network operators in IXPs becomes more and more visible (e.g. Content Providers need cache-filling capacity, Transit etc.)
- and...



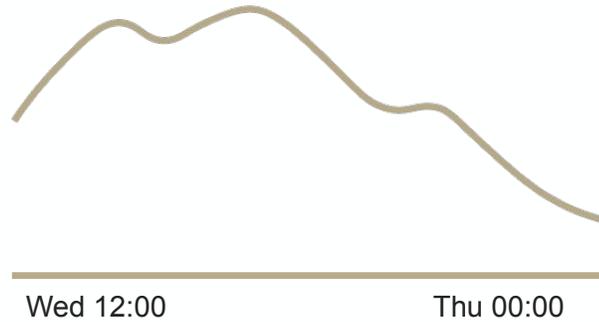
# IXPs and traffic patterns

IXP traffic patterns reflect this movement

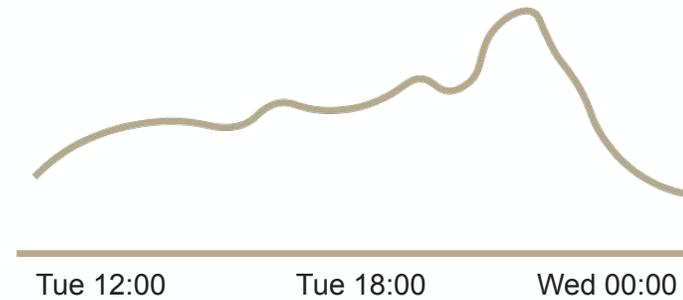


# IXPs and traffic patterns

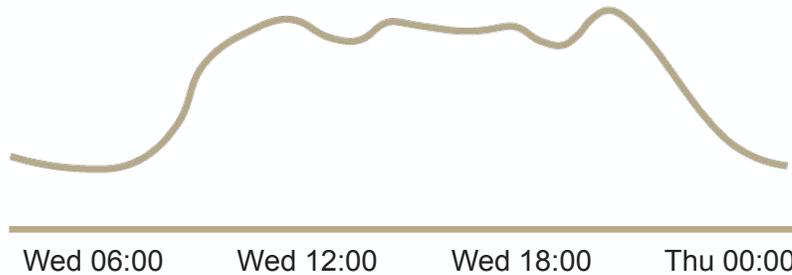
IXP traffic patterns reflect this movement



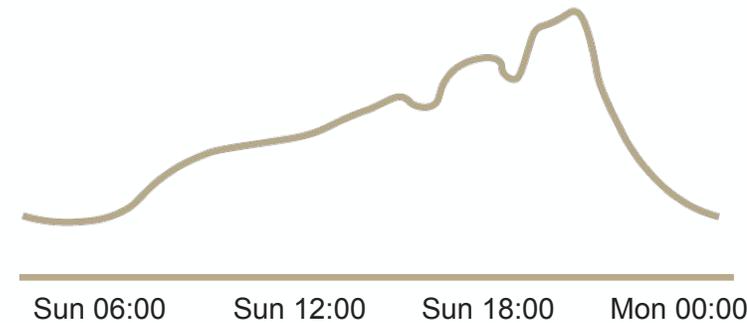
Prehistory  
No series and movies on internet  
(Until 2012)



Entertainment services #ondemand  
(2012 until today)



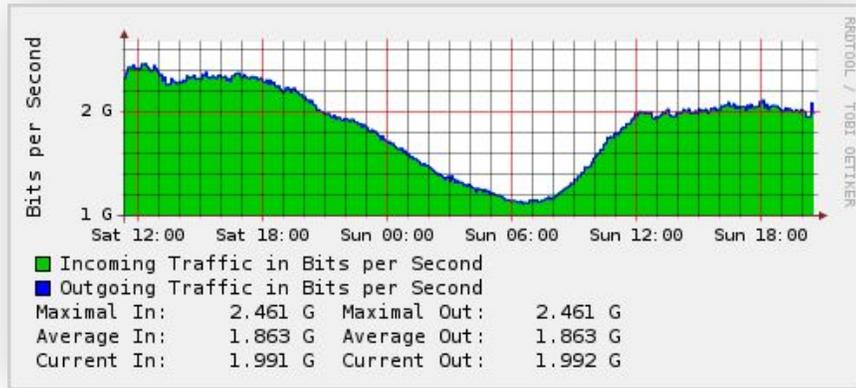
Health Emergency #covid  
(2020)



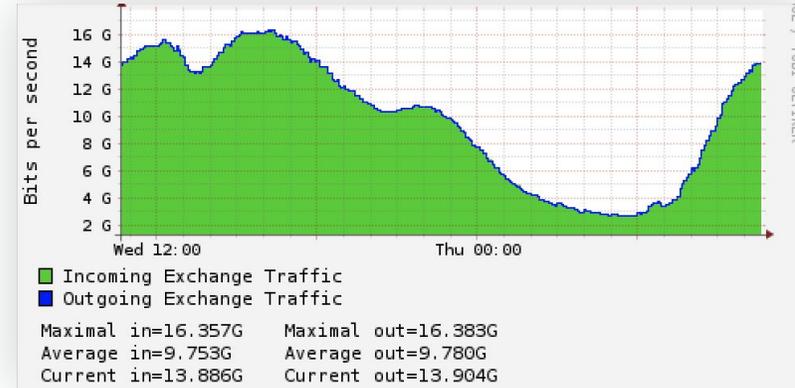
Entertainment services + live streaming #DAZN  
(2021)

# IXPs and traffic patterns

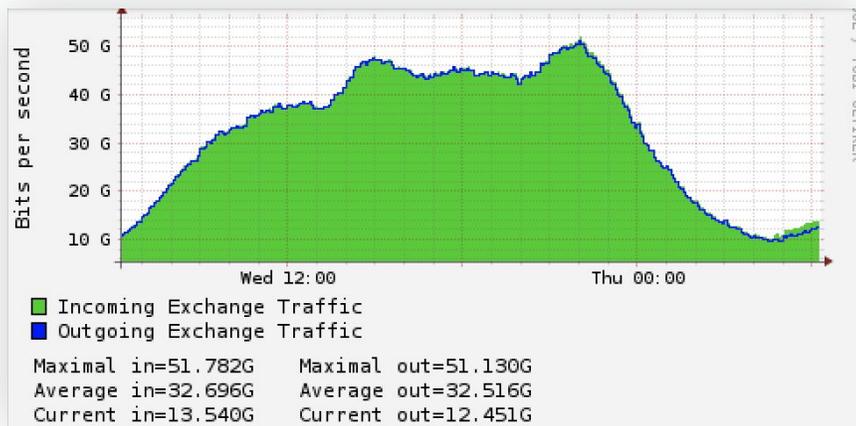
IXP traffic patterns reflect this movement



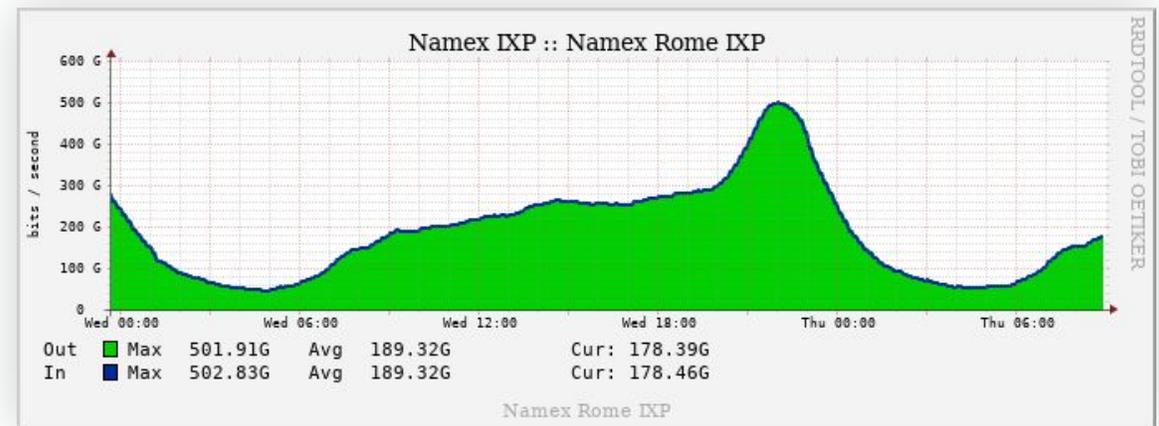
Namex 2007



Namex 2012



Namex 2018



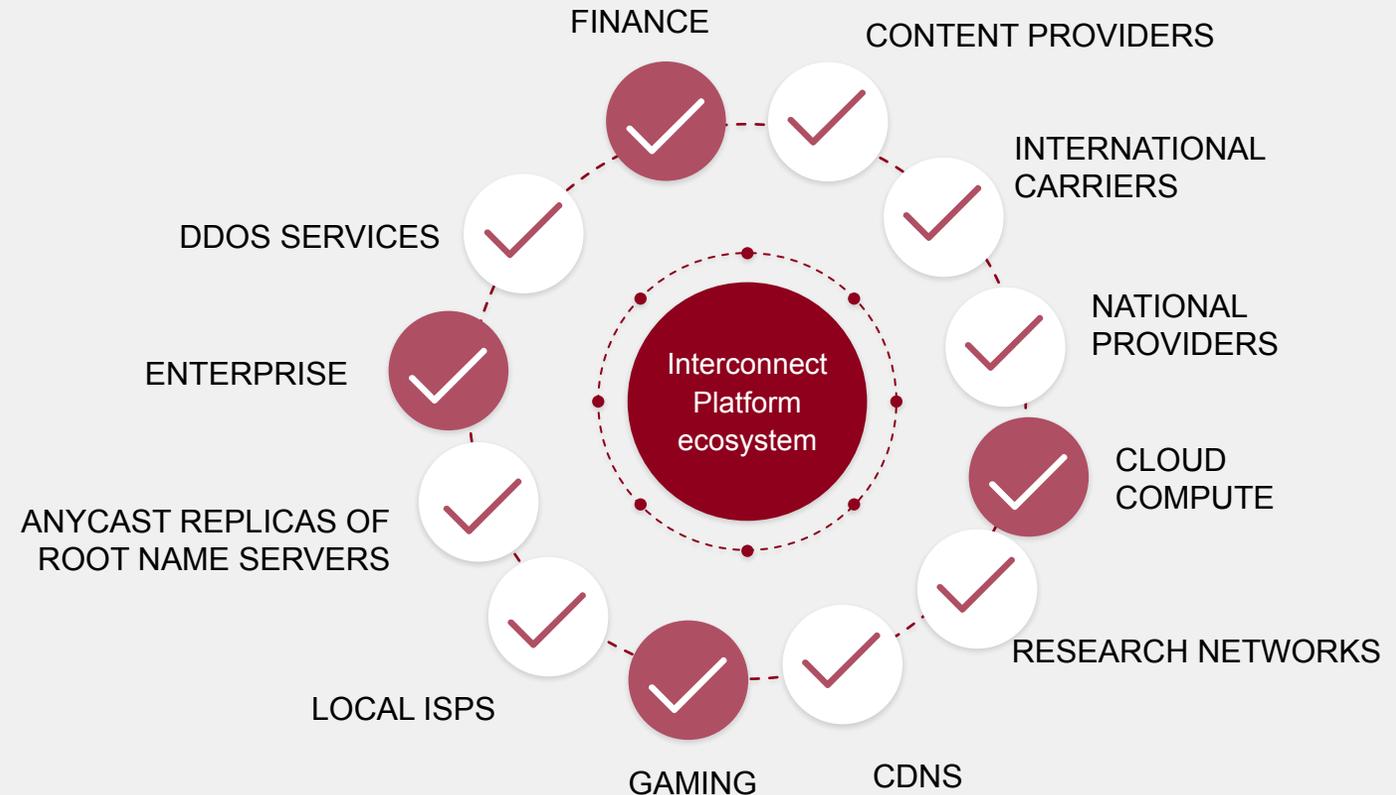
Namex today

# Are we facing new needs?

- and...
- Since several ISPs tend to cover the same geographical area, it becomes challenging for CDNs/CPs to deploy a finer distribution (close to the edges)
- Caches need more capillarity (they also start to be present inside long-tail network operators)
- the ecosystem of companies operating on the Internet tends to expand (e.g. enterprise, finance)
- Interconnects no longer about just ISP to ISP or ISP to Content traffic (the future holds much more complex relationship)
- Local communities have (also) different needs related to interconnection
- SO...

# Are we facing new needs?

- so...
- A new model of interconnection is required and...
- ... a greater decentralisation of services is appropriate (in order to offer more opportunities and to satisfy local demand)
- New stakeholders start shifting the market from a supply chain to a constellation model



# A new definition of IXP

## Definition of an Internet Exchange Point (by IX-F)

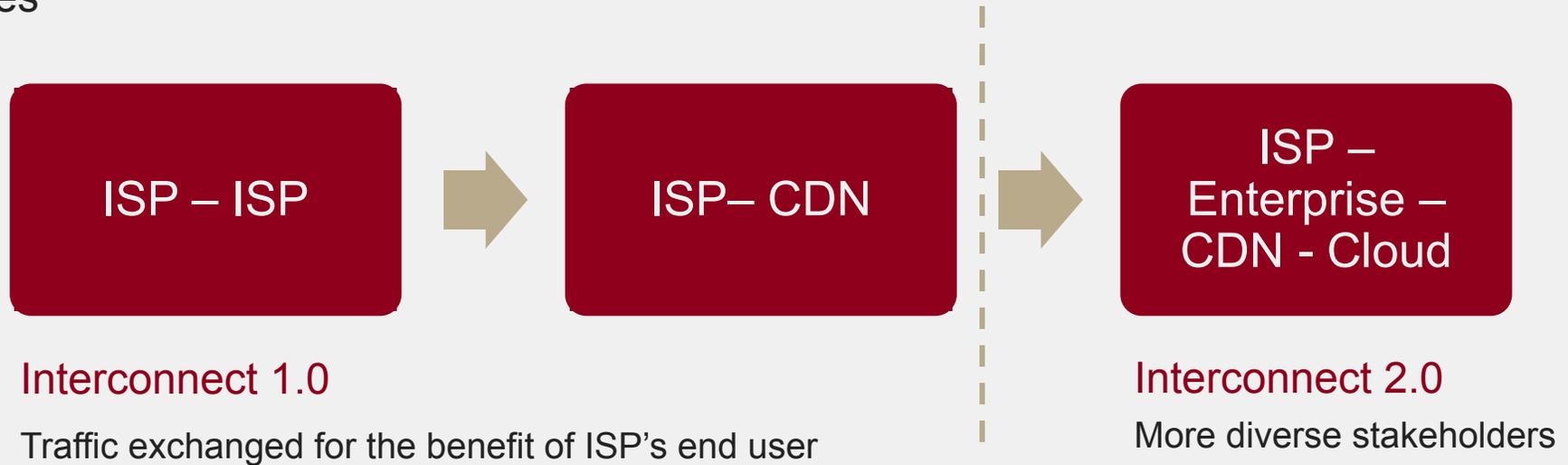
An Internet Exchange Point (IXP) is a network facility that enables the interconnection of more than two independent Autonomous Systems, primarily for the purpose of facilitating the exchange of Internet traffic.

## A new definition of IXP (by me)

An IXP is a **physical infrastructure** that enables the interconnection of more than two independent Autonomous Systems, primarily for the purpose of facilitating the exchange of Internet traffic and **services**.

# There's more than peering

- Although peering is still the main service offered by IXPs, today the needs of network operators are changing and they 'would like' to find within IXPs a range of services that go far beyond the peering itself
- And this is especially true in areas where there is no neutral carrier ecosystem of data centres

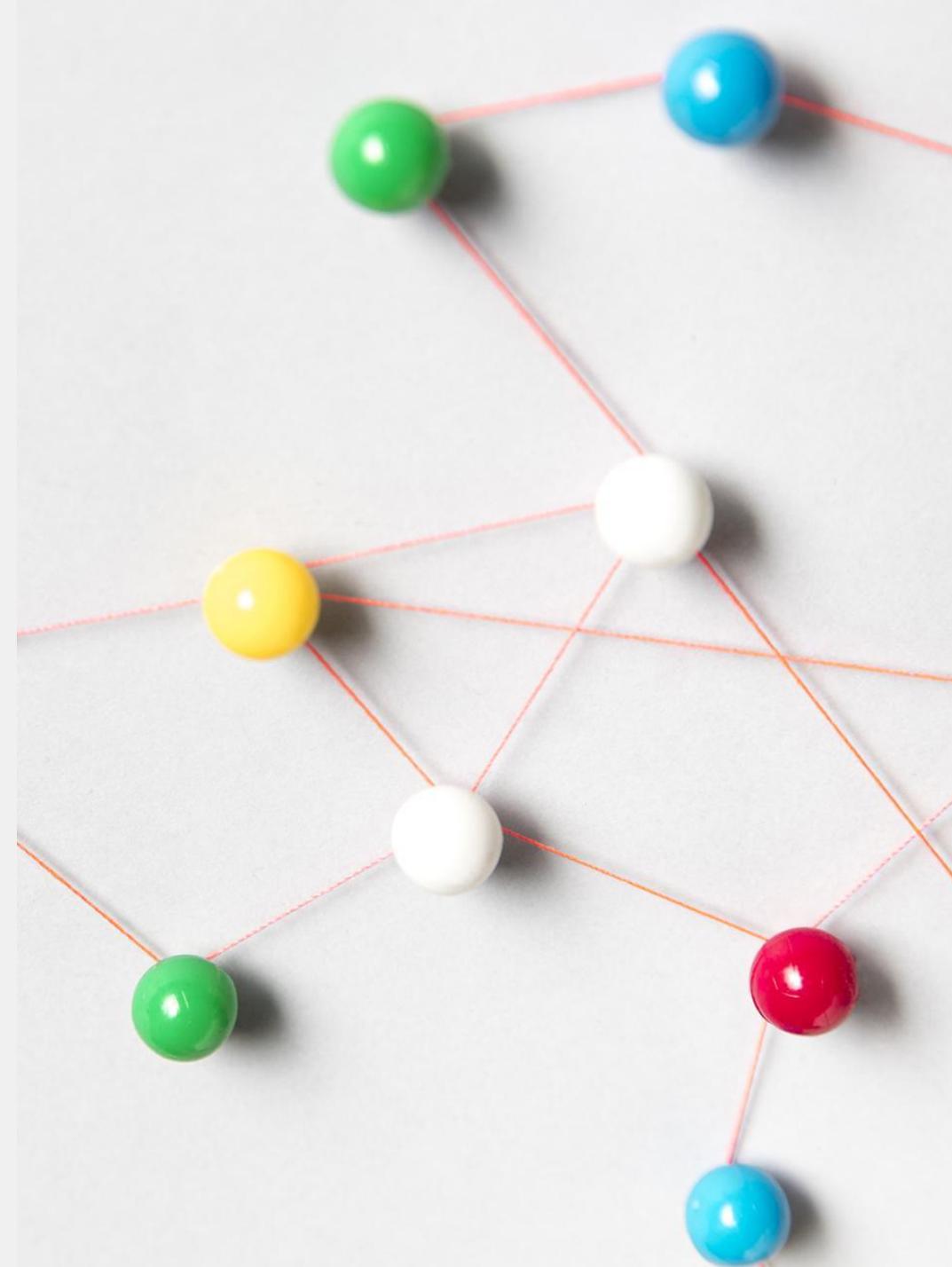


# Regional IXPs

A new interconnection model also includes smaller regional IXPs offering an easier access to essential and enabling services

A greater distribution of IXPs (and services):

- become a real benefit for local communities
- support CDNs and CPs to achieve a finer distribution of content
- boost the local economy
- contribute to the growth and proliferation of Internet services in backward areas
- allow small network operators to diversify their business



# New key elements of interconnect

So the key elements of this evolution are:

01

A sustainable and heterogeneous ecosystem of services (where everyone represents a value for the ecosystem)

02

According to local needs a greater decentralisation of access to services (... and the right ones!)

03

Interconnect needs will become more geographically dense

04

IXPs can help on all fronts



# Thanks!

**Flavio Luciani – Namex CTO** [f.luciani@namex.it](mailto:f.luciani@namex.it)

Thanks to Kurt Erik Lindqvist (The future of interconnects)

---

## References

[https://labs.ripe.net/author/flavio\\_luciani\\_1/the-elephant-effect-considerations-on-live-streaming-italys-serie-a-championship/](https://labs.ripe.net/author/flavio_luciani_1/the-elephant-effect-considerations-on-live-streaming-italys-serie-a-championship/)  
<https://peering-forum.eu/2022/wp-content/uploads/sites/5/2020/05/P6-From-Starlight-broadcasting...Flavio-Luciani-LR.pdf>