Peering market at a glance

Trends, transformations, and regional dynamics of Internet interconnection

Flavio Luciani
Namex CTO

John Souter
Namex Advisor

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Abstract

Over the past decade, the Internet's interconnection landscape has been shaped by sustained traffic growth, changing content distribution models, and increasingly complex relationships between networks. Internet Exchange Points sit at the center of these dynamics, yet their evolution is often interpreted through simplified metrics that do not fully reflect how the peering ecosystem is actually changing.

The peering market is not in decline, it is in transformation. Global Internet traffic continues to grow relentlessly, yet traditional metrics such as IXP membership counts and headline capacity figures are no longer sufficient to explain the forces reshaping interconnection. This paper presents an experience-driven analysis of how Internet Exchange Points are evolving worldwide, examining long-term trends across Europe, Latin America, Africa, Asia-Pacific, and North America.

Using data from *peeringDB* and the *ISOC pulse IXP tracker*, interpreted through decades of hands-on involvement in the design and operation of peering ecosystems, the paper shows that the slowdowns observed at large, mature IXPs are neither anomalous nor cause for concern. Instead, they reflect a structural shift: traffic is becoming more concentrated, interconnection strategies more selective, and alternative models, such as private network interconnects (PNIs), in-network caching, and edge-oriented architectures, are increasingly complementary to public peering rather than substitutes for it.

The analysis identifies the factors that truly determine IXP success and sustainability: telecommunications market liberalization, local content demand, population scale, data center ecosystems, and national infrastructure policy. Growth in emerging markets remains strong, while major historical hubs are evolving into complex interconnection platforms serving a far broader range of participants than traditional ISPs and content networks.

Far from being obsolete, IXPs are becoming strategic assets for digital resilience, data sovereignty, and national connectivity. Their future value will not be measured solely in terabits per second, but in their ability to keep traffic local, support critical services, absorb extreme traffic surges, and enable ultra-low-latency applications at the edge. In an increasingly unstable geopolitical and technological environment, this paper argues that peering, and the IXPs that enable it, remains a cornerstone of a robust, decentralized, and resilient Internet.

1 Introduction

We sometimes find ourselves writing articles about IXPs, often sharing our experience and what we have learned after working in this ecosystem for more than twenty years. At the same time, we also frequently find ourselves listening to others, who do not work directly in IXPs, expressing their views on what IXPs should be today and where they are heading.

In general, we have observed a number of presentations over time in which similar arguments are put forward. These suggest that over the past twelve months IXPs have not shown significant growth, and that much of the increase in traffic and interconnection is now happening outside of IXPs, with a growing share of traffic no longer flowing through traditional exchange points. It is also often argued that, for some networks, peering is becoming more expensive than transit, challenging a long-standing assumption. In addition, these presentations highlight a rapid migration toward 100-GE ports as 100G replaces 10G, together with a strong increase in the use of private network interconnections instead of public peering at IXPs. Finally, they claim that many "traditional" peerings are no longer being established and that, in some cases, major networks are even leaving IXPs in favor of alternatives such as transit or private interconnection.

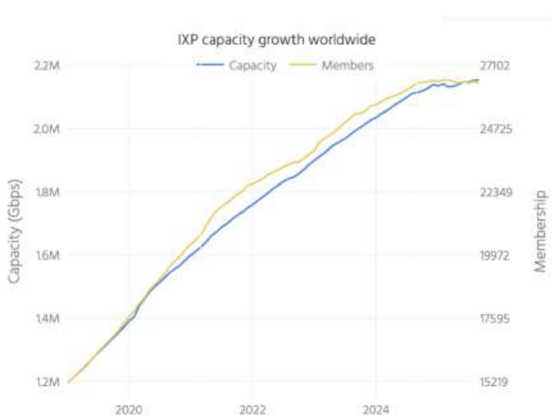
The purpose of this contribution is therefore to share some reflections on the peering market and how it has evolved over the years, with a particular focus on the most recent period.

The questions we asked ourselves essentially revolve around some main points: how traffic has evolved over the years, what is happening today, and what future trends in peering growth might look like. We have already had the chance to discuss this topic in some previous articles (see https://labs.ripe.net/author/flavio_luciani_1/), but we would now like to analyze the international situation in a bit more detail focusing not only on Europe but also on the rest of the world.

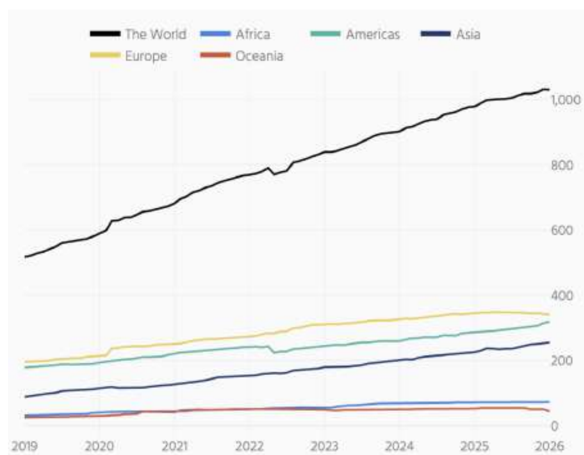
There are several sources from which data can be drawn. We will use the graphical analyses provided by the ISOC Pulse IXP Tracker (see https://pulse.internetsociety.org/en/ixp-tracker/), as they are well-structured, easy to consult, and based on the PeeringDB dataset (in terms of capacity and membership).

It is important to note that PeeringDB, valuable though it is, consists of user-generated data. In particular, it relies on key staff within network operators maintaining the data after they have been initially accepted into the database. As a consequence, there can sometimes be a lag in how up-to-date the data is, as compared to automatic measurements of things like traffic data, which can be collected from source via APIs or screen scraping. Ratios of PeeringDB data with traffic data - especially when there are significant changes in the ratio, should therefore be treated with caution.

To begin with, we would like to take a global view, and at first glance it seems clear that the capacity allocated at IXPs has grown over the years and at a remarkable pace. At the same time, we also observe growth in the number of networks that have joined IXPs over the years taking into account more than a thousand IXPs worldwide registered at PeeringDB. Although there is a slight decline in the number of ASes present at IXPs recently, in the last year the capacity continues to grow at a slower pace, but it is still increasing.



(a) Overall growth in traffic and members



(b) Growth in the number of IXPs worldwide

Looking at public peering data brings into focus the whole issue of peering strategy by access and content networks. In general, their policies will be determined by two things: their size and the nature of their traffic.

Larger networks will tend to prioritise more sophisticated forms of interconnection, such as in-net caching and private interconnects (PNIs), and this will be especially true of the very largest content networks. For some types of traffic, in-net caching is either impractical/inappropriate or undesirable, so that leaves us with PNIs as the higher priority mechanism, before or alongside consideration of public peering. Many networks using PNIs will have threshold values that need to be met, before the economics of PNIs really work, but this could have the side effect of siphoning traffic away from public peering, if that has already been established.

Namex and LINX are somewhat unusual in the IXP world in that they facilitate PNIs for their members. This is driven by the fact that they are member organisations, and are therefore primarily focused on what their members want - driven by an understanding of peering strategy and hierarchy of needs. Both organisations know (via private information derived directly from their members) that the total traffic passing over PNIs is much, much greater than their public peering fabrics.

None of this diminishes the importance of public peering. Public peering is used by a far wider spectrum of networks than PNIs, so its reach and utility is in no way undermined by the fact that other peering mechanisms exist.

2 Methodology: country selection criteria

To conduct a meaningful and representative analysis of the global peering landscape, you could examine every country individually. However, a more effective approach is to focus on a subset of countries that meet the following criteria:

- **Presence of IXPs:** the country must host one or more Internet Exchange Points.
- **Robustness of IXPs:** the IXPs present should be at least of medium size and stability, ensuring that they play a significant role in local interconnection.
- **Established peering market:** there should be a sufficiently developed peering ecosystem, with active participation from networks and content providers.
- **Continental representation:** the selected countries should collectively represent all continents to provide a global perspective.
- **Availability of reliable data:** only countries where PeeringDB and ISOC Pulse data are complete and up to date are included.
- **Traffic significance:** priority is given to countries whose IXPs account for a substantial share of regional traffic (e.g. among the top IXPs in terms of peak throughput).
- **Growth dynamics:** where possible, the selection includes both mature and emerging markets in order to illustrate not just the current state but also the evolution of peering worldwide.
- **Population of the region:** one of the clear criteria for the establishment and success of IXPs is to be serving, via connected access provider networks, significant numbers of domestic and business users (often dubbed 'eyeballs' for short). Without this, there is nowhere for content traffic to flow to! The scale of eyeballs represented at an IXP will therefore have an impact on the measurements shown in this report, and the more established IXPs (with millions of connected eyeballs) will almost certainly be less prone to exaggerated peaks and troughs.

Based on these selection criteria, we will now identify a number of countries and IXPs for each continent, let's take a closer look at them.

3 Analysis of world regions

3.1 Latin America & Caribbean

For the South American region, this analysis mainly focuses on Argentina, Chile and Brazil. Starting with Argentina, both the capacity and the number of networks connected to IXPs appear to follow the same trend observed globally, as shown in the previous section.

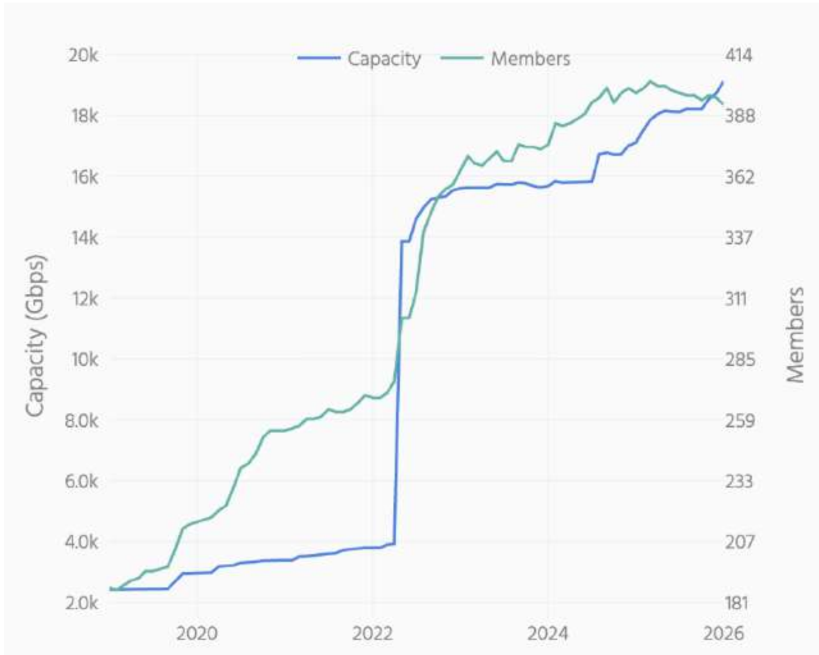


Figure 2: Argentina

A slight decrease in the number of ASes can be observed, but the capacity shows a clear upward trend. According to Pulse, there are four IXPs operating in the country, with CABASE Argentina handling the majority of the traffic. It counts more than 500 active members and currently reports a peak traffic volume well above 4Tbps. Although periods of growth and decline alternate over time, the overall picture clearly shows a positive trend.

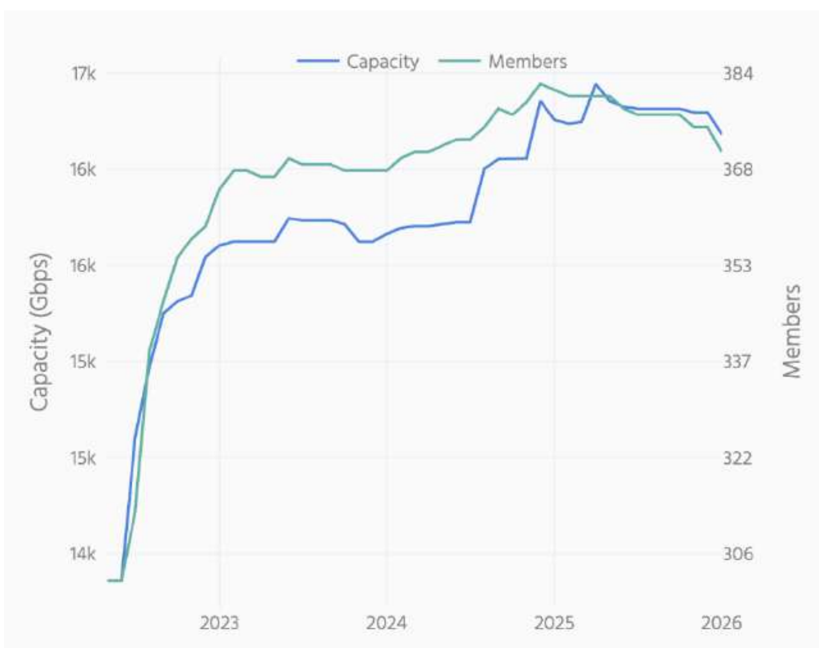


Figure 3: Cabase IXP

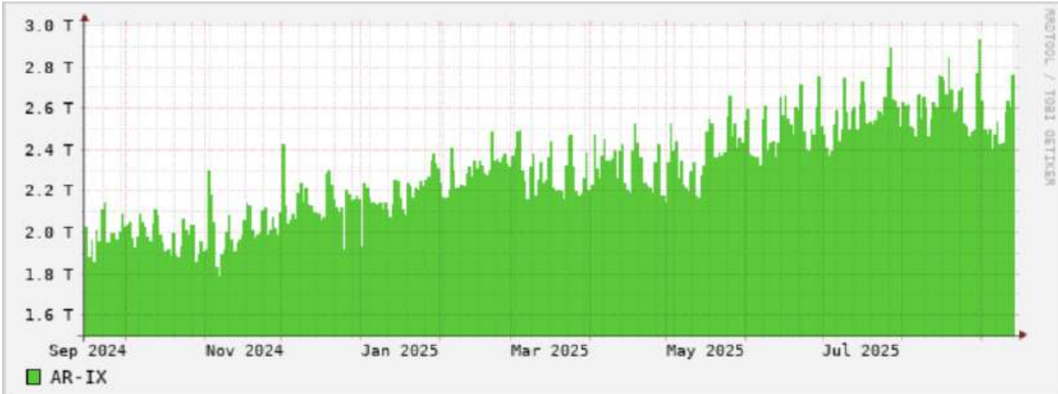


Figure 4: Cabase yearly graph

In Chile, there has been a noticeable dip in the past year. The capacity is now recovering, whereas the number of networks connected to IXPs has remained relatively stable, suggesting a resilient core of participants despite short-term fluctuations.

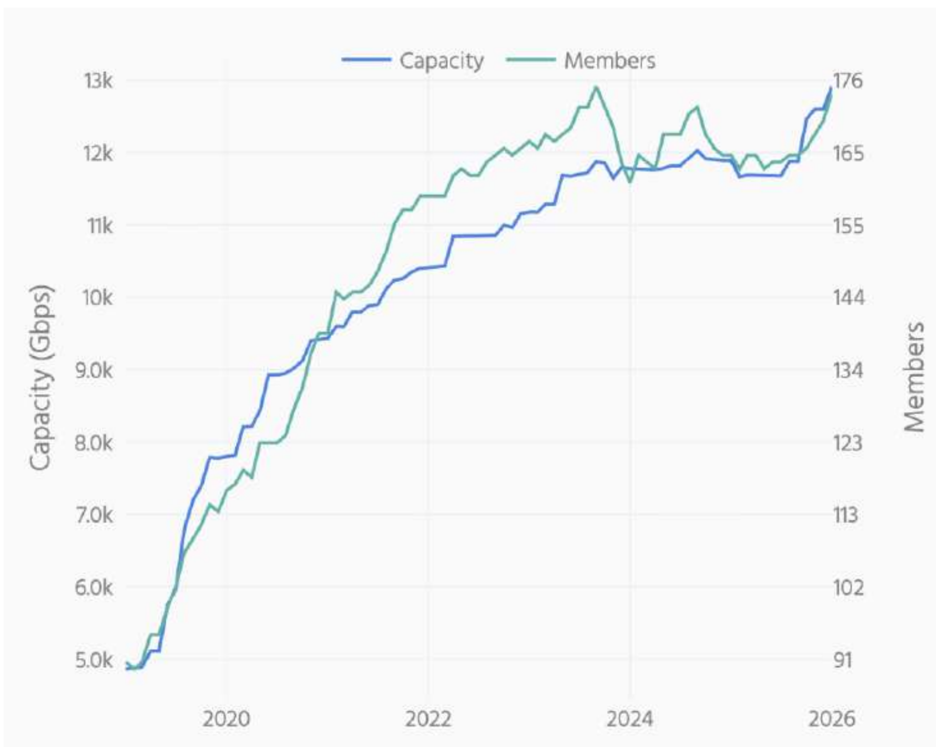


Figure 5: Chile

This observation is further supported by the chart for PIT Chile Santiago (more than 12Tbps of exchanged traffic), presented below. Chile has a population of around 20 million people, so these are quite high traffic numbers as a ratio to population. As a benchmark, it is several times that of corresponding exchanges in Italy and the UK. The transient peaks in the annual graph below are probably the result of measurement/reporting errors, as indicated by their absence from the in-graph summaries. A curiosity for further examination?

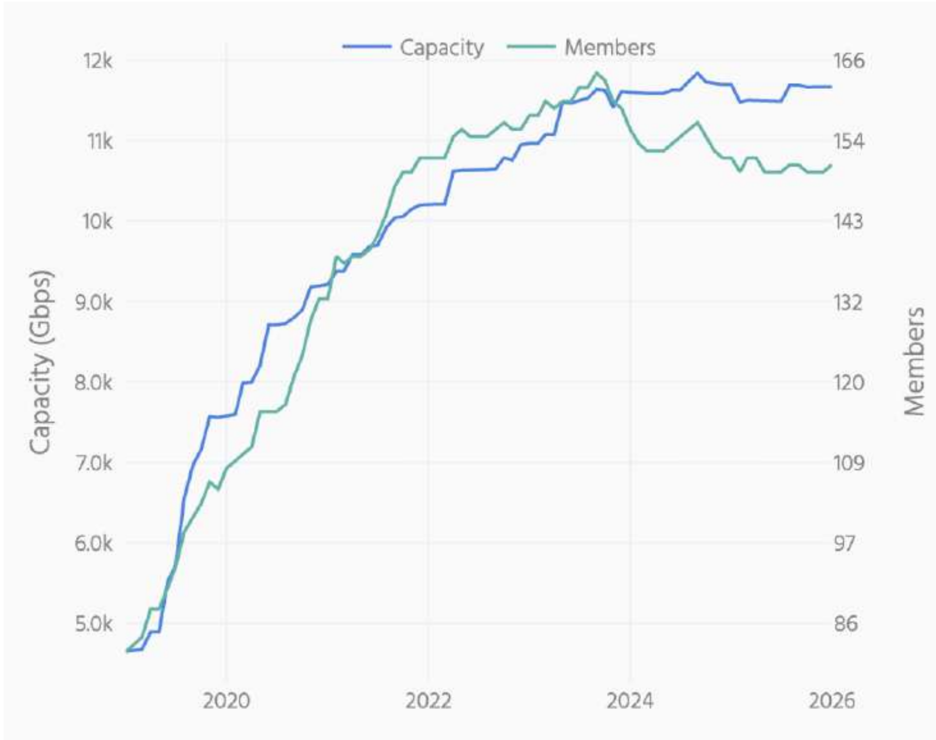


Figure 6: PIT Chile

Figure 7: PIT Chile traffic

Now let's look at Brazil, which has the largest IXP in the world, IX.br. Let's first take a look at the country's data:

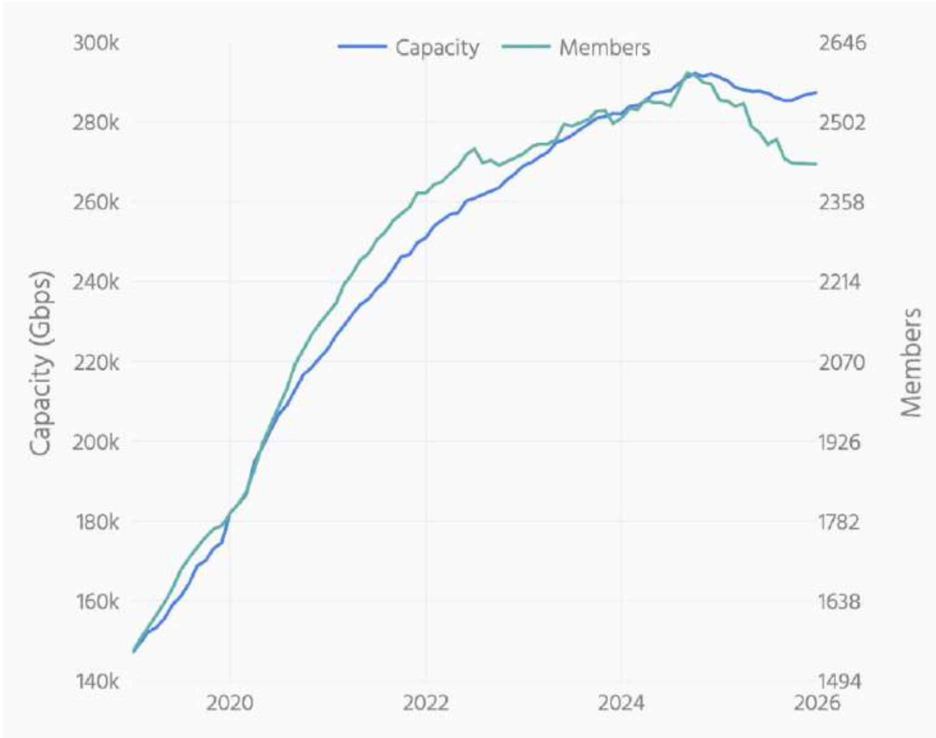


Figure 8: Brazil

In Brazil, there seems to be a much more pronounced dip compared to Argentina and Chile, both in terms of capacity and peers. These figures are supported even when we look only at IX.br in São Paulo, which has over 1,700 members and peering traffic peaks exceeding 40 Tbps!

We contacted IX.br to find out why there was an apparent decline in the number of members, and they responded as follows: "*We've been cleaning up our user base, removing inactive users who were hogging number resources. On the other hand, we've seen new users joining, consuming more bandwidth, replacing departing ASNs. However, the net result is a decrease in the number of ASNs and an increase in bandwidth consumption.*"

The following graph shows their internal ASN count and capacity/member count:

Figure 9

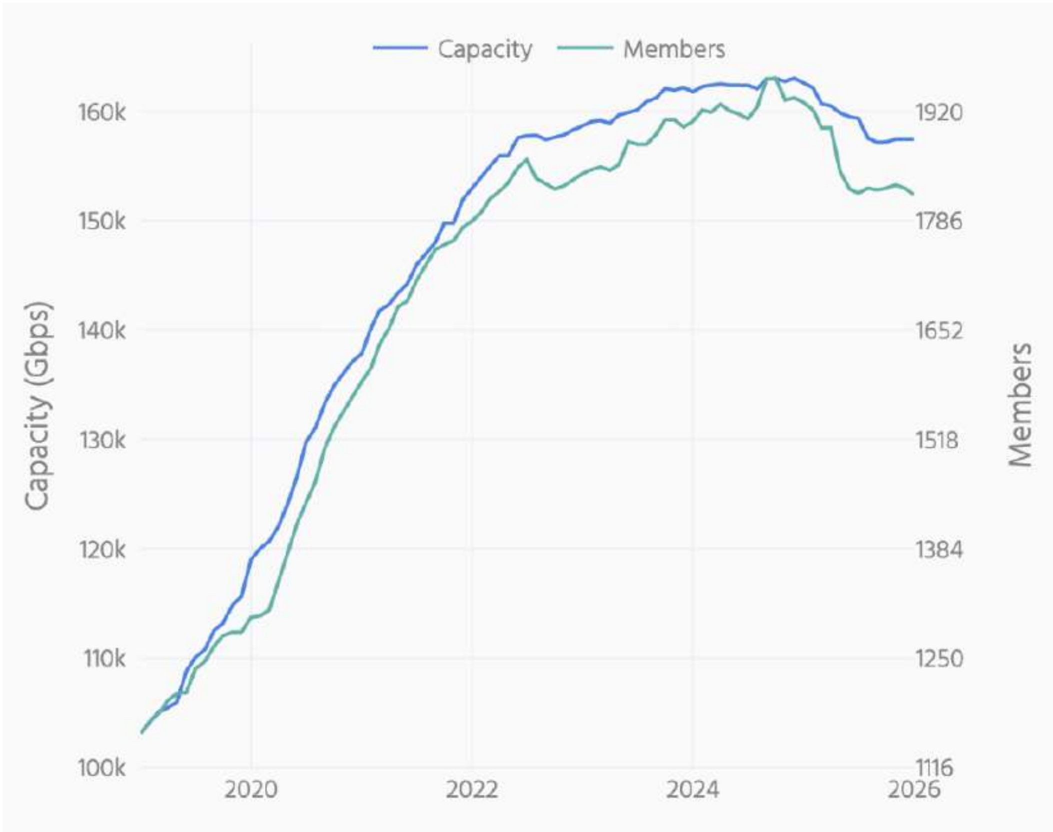


Figure 10: IX.br San Paolo

As we can see from the following traffic chart for the past year, there is no clear growth trend. However, when we look at the broader picture, from 2019 to today (decadely), it clearly shows the significant growth that peering has experienced and continues to experience over the years.

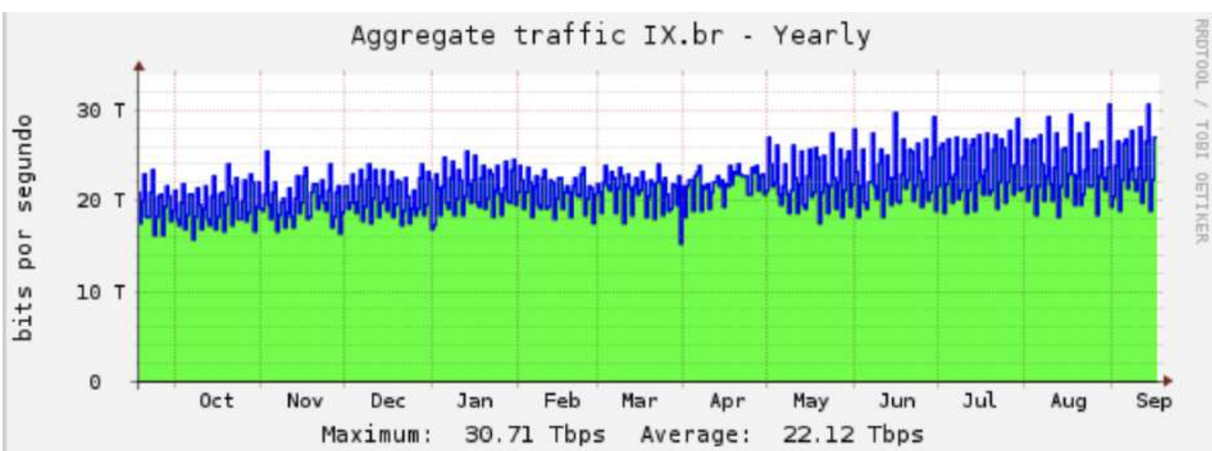


Figure 11: IX.br yearly graph

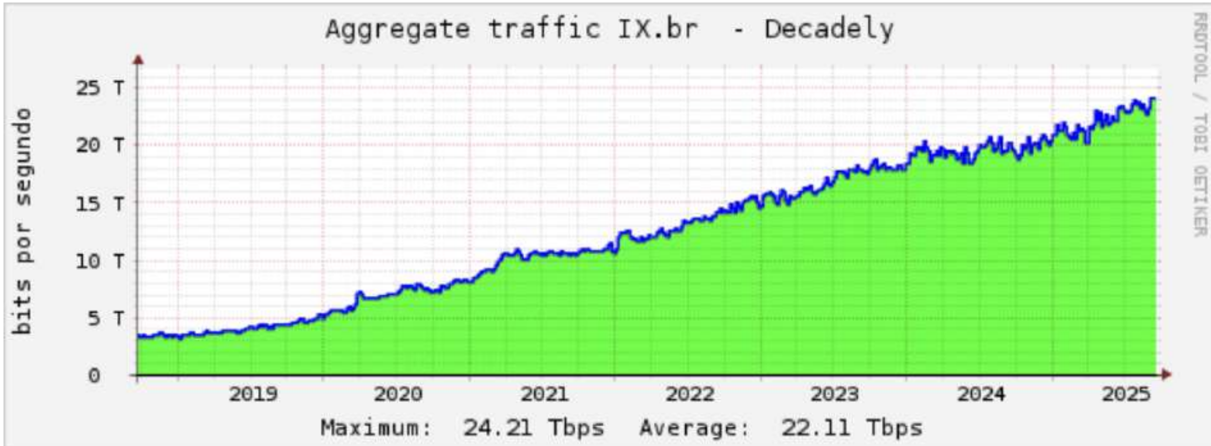


Figure 12: IX.br decadely graph

IX.br is a stand-out phenomenon in the IXP world. Not only is it the largest IXP in terms of connected ASNs (over 2,800), the amount of peak traffic (around 45Tbps aggregated across all of their exchanges) but also the number of exchanges operated across Brazil - currently 39.

There are other IXPs in Brazil (for example, operated by Equinix in their data centres), but it is fair to say this massive IXP dominates Brazil, and also dwarfs the other exchange operators in South America.

How do we explain this phenomenon?

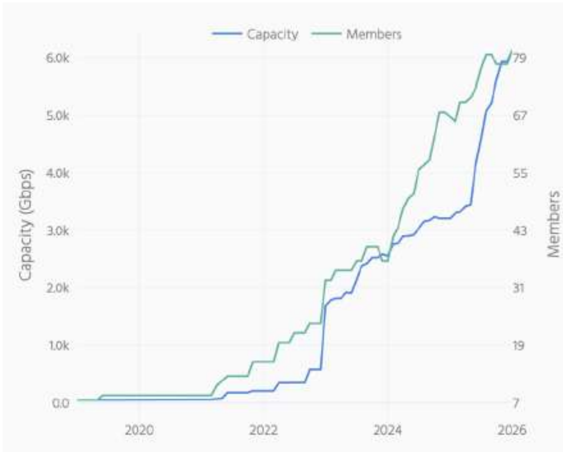
Well, firstly it is the nature of Brazil itself: the seventh largest by population (well over 210 million), the sixth largest by physical size (bringing all sorts of challenges to building IXPs) but also by the fact that Brazil is a Portuguese-speaking country - and uniquely so in South America. The last aspect means that much of the Internet traffic will stay in Brazil, rather being routed to and from neighbouring countries, and the huge size of the population, and their relatively high Internet literacy (in global terms) means that there will be a lot of it! Add to that the complexity already mentioned of building IXPs in a physically large country of quite diverse geographic and physical features - then building IX.br has been a tremendous achievement.

Secondly, IX.br has benefitted hugely by being fostered and hosted by the Brazilian Internet Registry (NIC.BR). This has provided significant economic and organisational benefits, and we think it is fair to say that it would have been virtually impossible to achieve what has been done without this support. Quoting directly from the IX.br website:

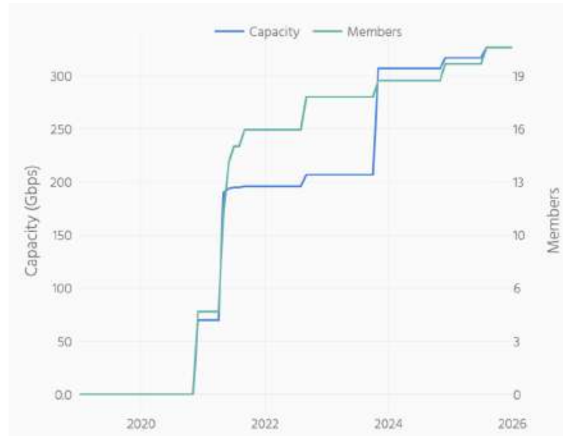
- One of the main advantages of this model is the rationalization of costs, since the traffic balances are resolved directly and locally and not through third-party networks, often physically distant.
- Another major advantage is the greater control that a network can have regarding the delivery of their traffic as close as possible to their destination, which usually results in better performance and quality to their customers and more efficient operation of the Internet as a whole.
- IX.br is thus an interconnection in metropolitan area network interconnection points (pixes), commercial and academic under centralized management.

Other IXPs in Latin America

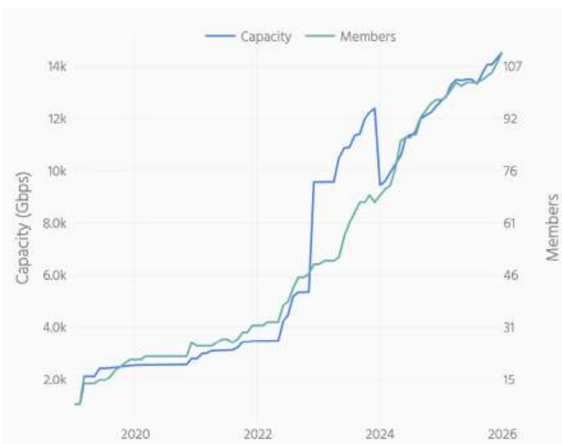
Looking at some of the smaller IXPs in the region, the growth is clearly tangible. In ecosystems where there is a need for local traffic exchange and the IXP is still young, there is considerable room for growth both in the number of ASes present and in the volume of capacity. For example Mexico with 7 IXPs, Bolivia with 2 IXPs, Colombia with 7 IXPs and Perù with 10: here, the growth is visible and there is no dip in the graphs.



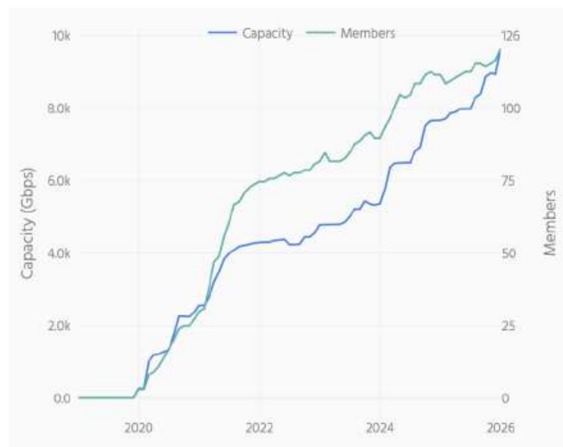
(a) Mexico



(b) Bolivia



(c) Colombia



(d) Perù

We talked with LAC-IX, the South American association of Internet Exchange Points, to gather insights on potential emerging countries. They explained that Mexico is a very large market that was, for a long time, heavily regulated and dominated by the Telmex monopoly. In recent years, however, the landscape has been changing, with the rollout of new metropolitan and national fiber-optic networks, the construction of data centers, particularly in Querétaro and the emergence of new IXPs.

3.2 Europe

The big three European IXP 'hubs'

Europe is the region with the highest density of IXPs and with the highest concentration of networks located in the three most interconnected hubs: London, Amsterdam, and Frankfurt. Other central areas are also experiencing growth, and the southern region is particularly noteworthy: the digital divide is narrowing, demand for connectivity is increasing, and consequently new Internet Service Providers are emerging. And not only that. The revolution in the distribution of certain football championships via live streaming on the Internet has significantly increased traffic peaks at IXPs (especially in Italy, Germany, Spain, and France), further highlighting the importance of peering services.

Let us first examine the graph showing the capacity and ASNs in the UK, the Netherlands, and Germany.

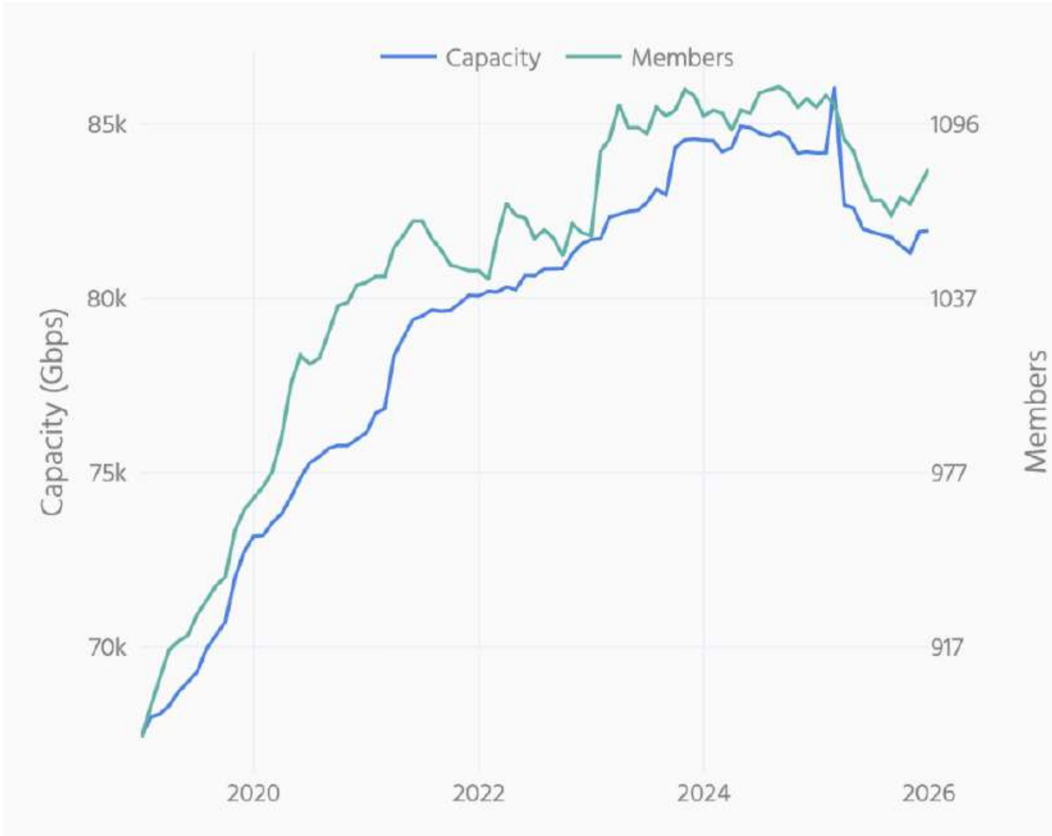


Figure 14: United Kingdom

In the UK, the downturn over the past year seems quite noticeable, both in terms of connected networks and capacity. We contacted LINX, and they responded as follows: "*Between 2021 and 2025 the number of peers at LINX (LON1, LON2 and Manchester) has risen by 21 (+2%). In 2025, average daily traffic compared to 2021 has gone up +54% at LON1, +13% at LON2 and +345% at LINX Manchester. In terms of average daily traffic, over the last year LINX Manchester has risen close to similar levels as LON2.*"

In 2021, LONAP was seeing daily average traffic of 300-400Gbps, while in 2025, its average daily traffic is regularly over 1Tbps (see charts below). This indicates its traffic is growing faster than its membership, i.e. members are passing more traffic per member than before.

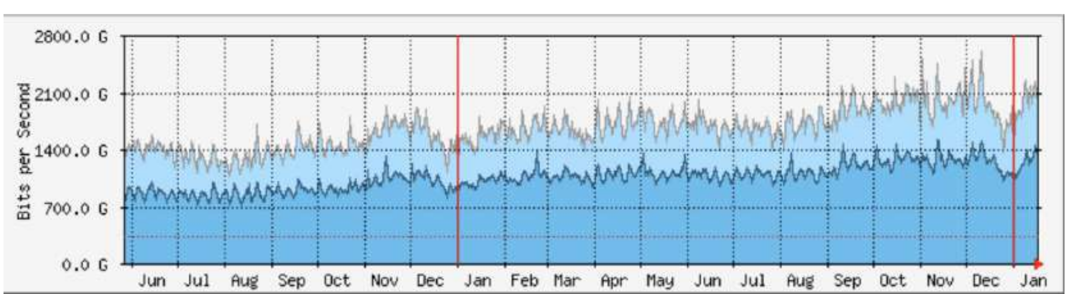
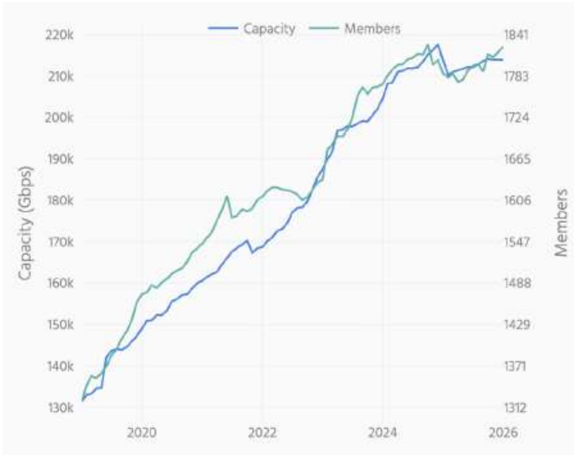
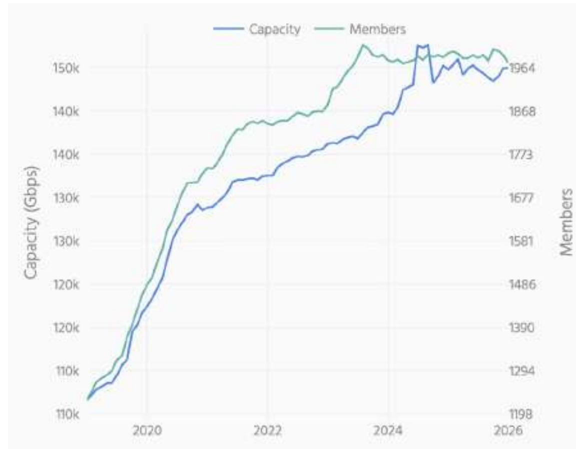


Figure 15: Lonap traffic

The situation is slightly different when looking at the Netherlands: after a slight downturn, by the end of 2024 the trend seems to be gradually recovering.



(a) The Netherlands



(b) Germany

In Germany, we see a stable picture, no growth but also no decline. Looking at the peering traffic graphs published by the three IXPs we just analyzed, we find some confirmation of what has been said, noting that there are many IXPs in these three countries and it would be wrong to characterise them just from these 3-4 IXPs. The situation is not dramatic; it seems more like a stalemate, but with slight signs of change.

Figure 17: AMS-IX

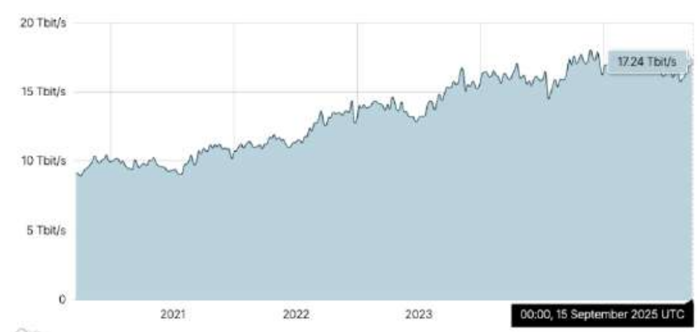


Figure 18: DE-CIX

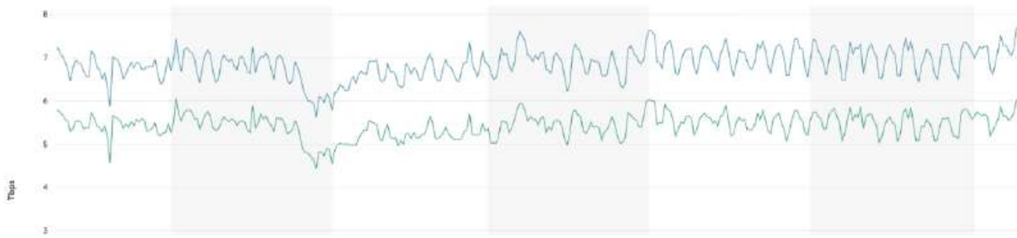


Figure 19: LINX

One thing that should be noted about certain large European IXPs is just how much they have become international marketplaces, much as famous ports for worldwide shipping traffic did several centuries ago. You can see similarities in the success of such ports in Holland and the UK, and perhaps to a lesser degree in other European countries.

To this can be added another phenomenon, which is the reluctance of large European ISP/Telcos to do public peering at IXPs - especially the large IXPs in their own home country. Some of this is to do with the Tier-1[1] status of the ASNs concerned, or that they have such a market dominance that they feel that they don't need to peer at IXPs, as anyone who wishes to exchange traffic with them can do so by buying transit from them.

Sometimes these arrangements are called "paid peering" - but it is functionally the same. It is 'peering' where the two parties don't treat each other as equals, when it comes to traffic exchange, payment etc.

So, in particular we can observe that in some of these very large European IXPs, it is not correct to think that they are just handling domestic traffic that is local to their country of location. With this in mind, you don't necessarily expect to see the usual diurnal effect of peaks during daytime and troughs during night-time - or other characteristics that depend on what the people of that country are doing (such as watching mass audience sports events over the Internet). In fact, these IXPs can be the exchange point of choice for networks from two quite unrelated countries (because, for example, there are no suitable IXPs in their countries) muddies any analysis.

The Italian case

Reinforcing our view that the South of Europe is experiencing strong growth, Italy is of particular interest: with four major IXPs, it shows an absolutely positive trend, both in terms of capacity and in the number of members connected to these hubs (https://www.namex.it/ixp-stats.html).

As we have already described in a couple of previous articles (see: https://labs.ripe.net/author/flavio_luciani_1/), the live streaming phenomenon has generated traffic waves in Italy since 2021. The distribution of Serie A by DAZN and later the UEFA Champions League by Amazon Prime Video has enabled the Content Delivery Networks present at the IXPs to carry massive amounts of traffic, especially during exclusive matches. And it doesn't stop there: other events are gradually moving from satellite to Internet distribution, so the phenomenon is clearly on the rise. Spain shows a similar situation from this perspective.

[1]Tier-1 networks, in general, only peer with each other. Indeed, it could be argued that they would lose or confuse their Tier-1 status if they agreed to do public peering with ASNs that aren't Tier-1s. You can see an explanation and a detailed discussion of who is really a Tier-1 on the fascinating Wikipedia page and its associated author/commentator discussions. See here: https://en.wikipedia.org/wiki/Tier_1_network. Many large European ISP/Telcos - especially the ex-PTTs, such as Deutsche Telecom, Telia, Telecom Italia, France Telecom and Telefonica either are Tier-1s or have a Tier-1 ASN as a subsidiary company.

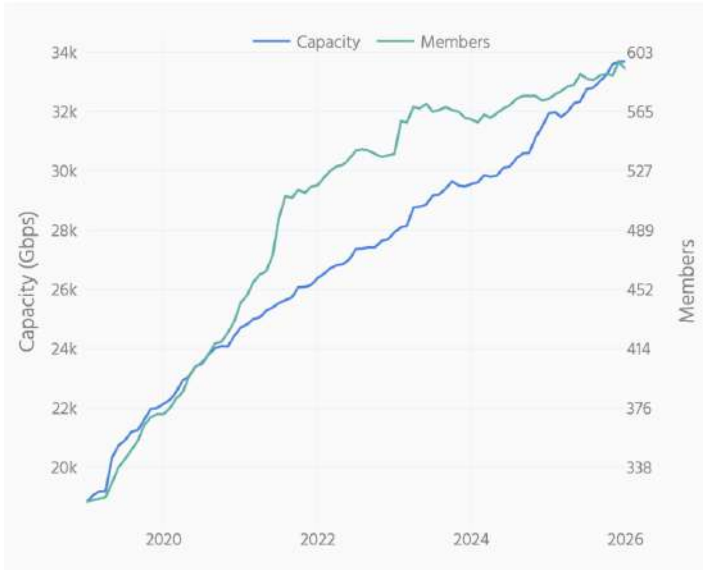
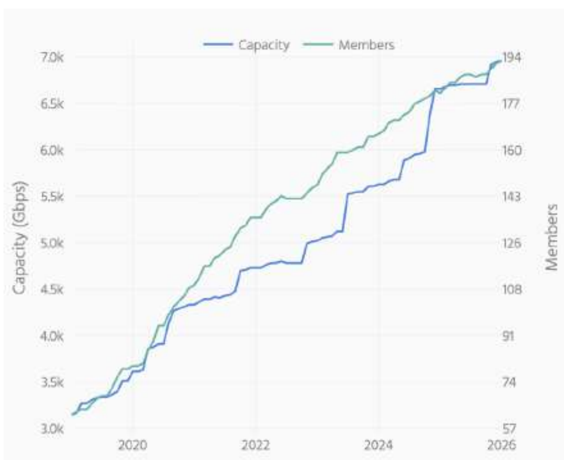
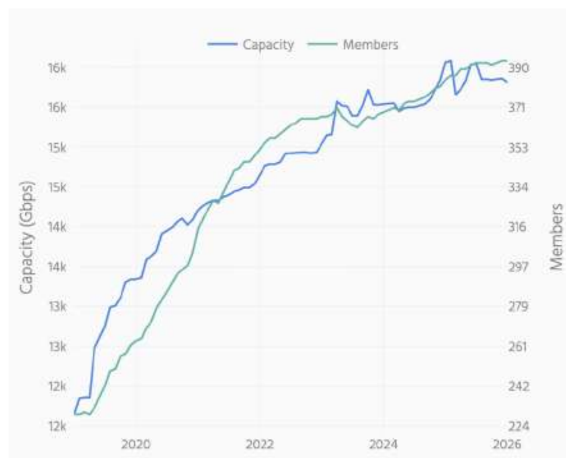


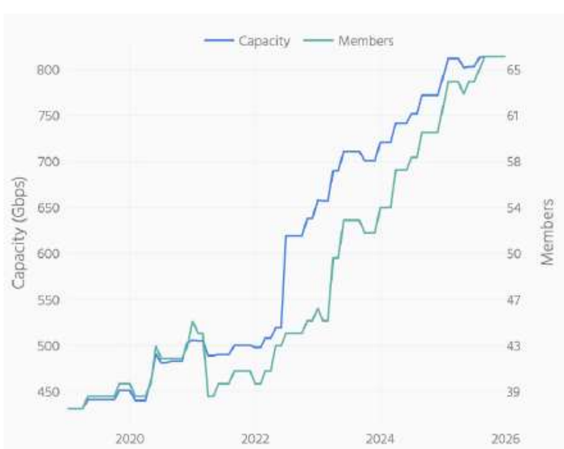
Figure 20: Italy



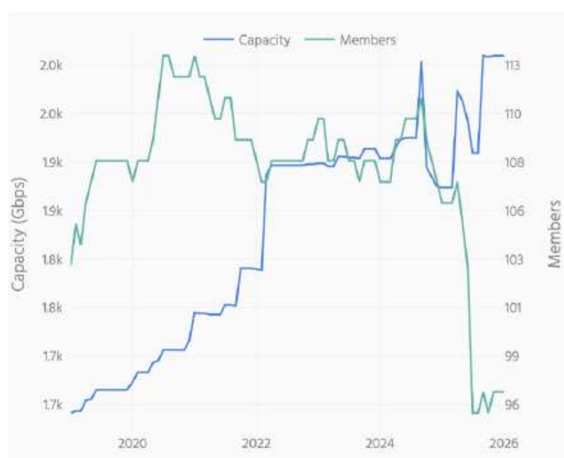
(a) Namex



(b) MIX



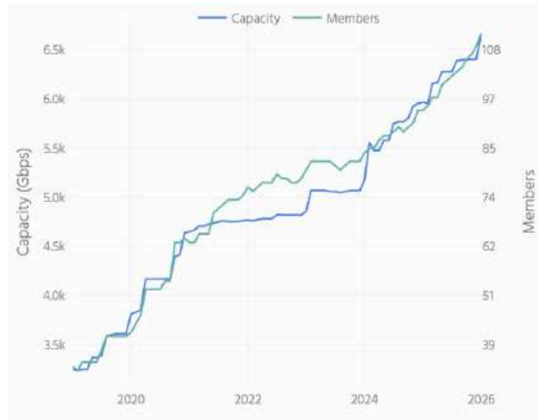
(c) VSIX



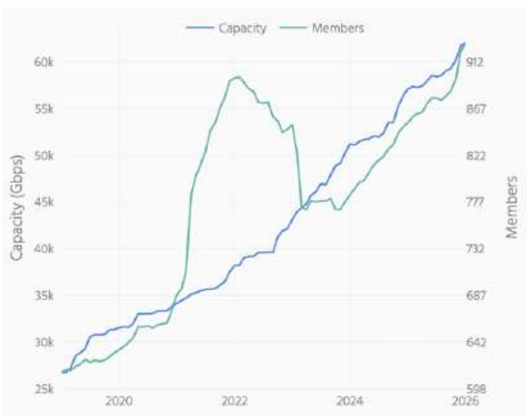
(d) TOP-IX

Analyzing other IXPs in Europe, we can observe the following: France, with 18 exchange points, shows a positive trend in terms of capacity allocated, Greece is growing (6 IXPs) as well as Poland (15 IXPs) and Bulgaria (7 IXPs).

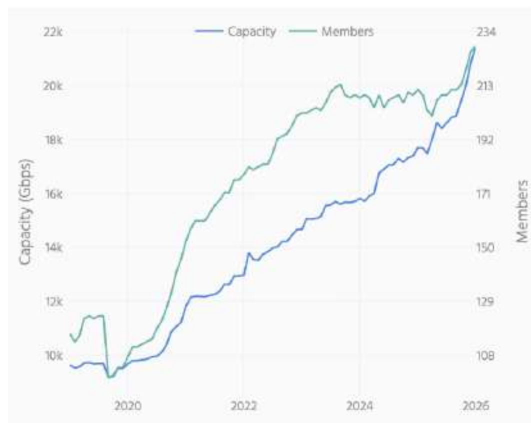
(a) France



(b) Greece



(c) Poland



(d) Bulgaria

Spain, with 11 active IXPs, showed a dip at the beginning of 2025 and now seems to be slightly recovering.

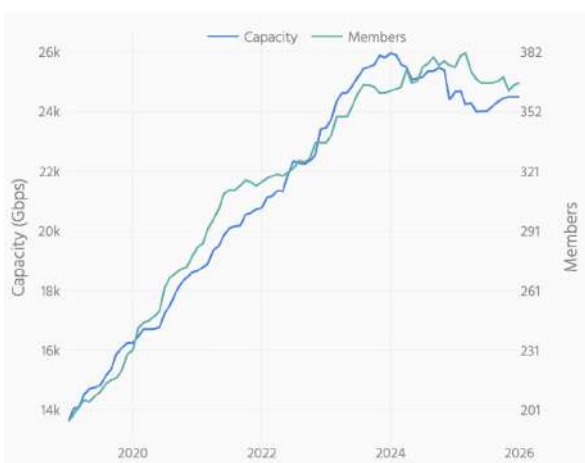


Figure 23: Spain

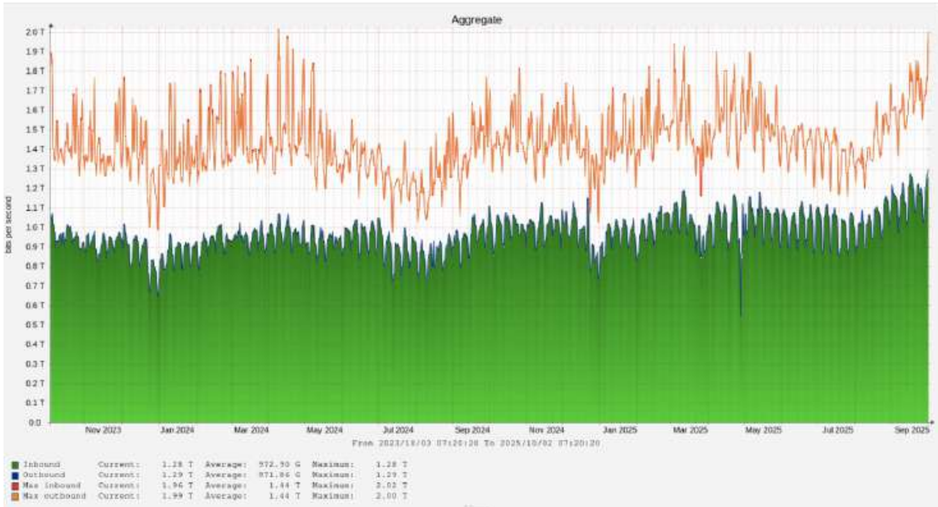


Figure 24: Espanix

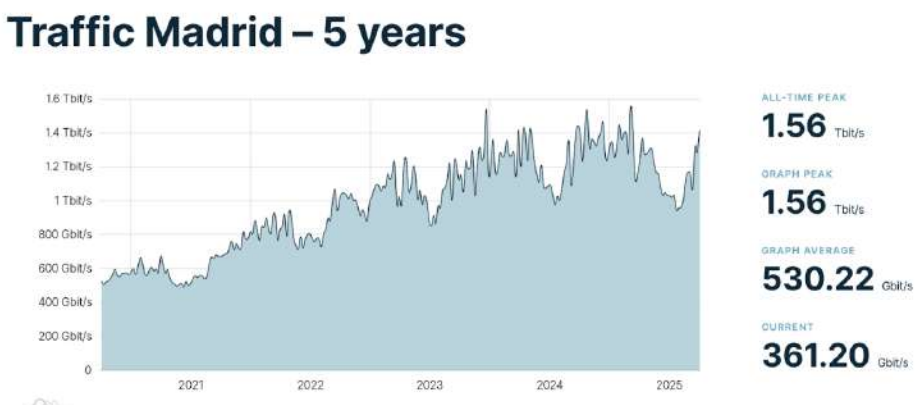


Figure 25: DE-CIX Madrid

Sweden

An interesting case is Sweden, where the data suggests a significant drop in the number of networks connected to the 20 IXPs in the region, yet the capacity continues to grow. We contacted Netnod about this, and they said: "*As we interpret your findings, they are not the whole truth since they are based on peering-db records (not compulsory to register in their database) and that poses some challenges. On a technical level our IXPs are built around two separated switch-fabrics, one is designated Blue and one is designated Green, and to make it even more complicated, we provide two VLANs for each color at least this is a thing with our IX in Stockholm. We have noticed that members forget, or skip to, registering their attendance on some LANs in peering-db for some reason. Our member numbers are higher if we look in our customer database and compare to peering-db.*"

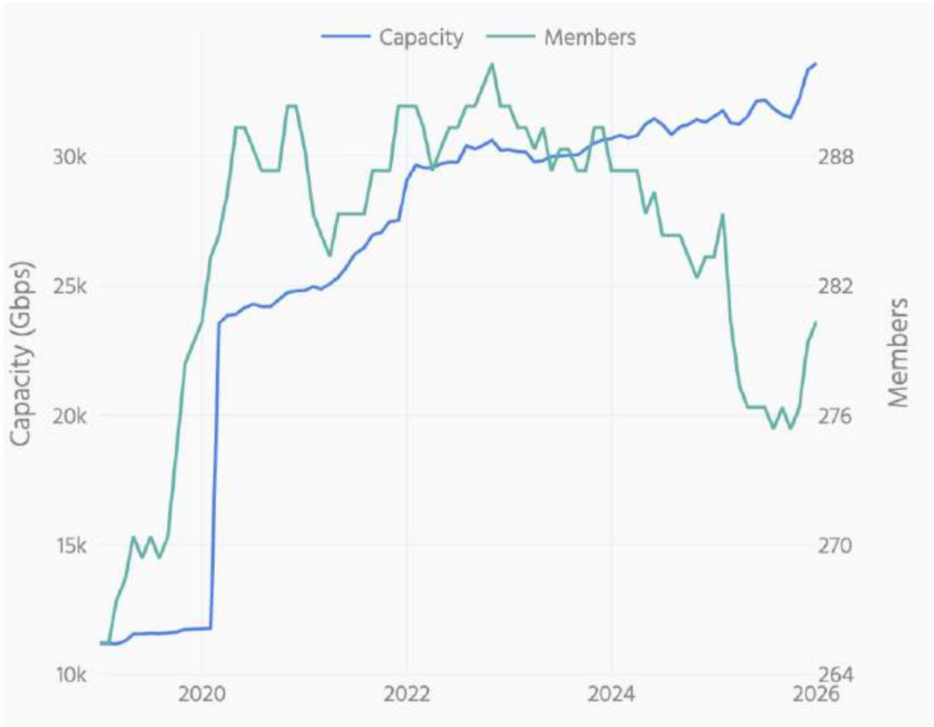


Figure 26: Sweden

3.3 Africa

Africa is a unique region, where the highest concentration of IXPs is found in the central and southern areas, while the north has very few IXPs, and these are virtually all in their infancy. There are quite a lot of factors at work which make the northern region atypical of the rest of the continent (or the world), and we will deal with this shortly. A fairly up to date map of IXPs in the African region can be found here: https://af-ix.org/ixps-map. Our observations about the IXP scene in Africa are overshadowed by one of the key factors that impacts peering, and thus the possibility of meaningful development of Internet exchanges. For peering to occur, there must be a significant degree of telecommunications market liberalisation. Sadly, in many African countries, this has not occurred, and either the state telecommunications company (PTT) still holds a monopoly or near monopoly in the market in that country. Even if this is only true of fixed telecommunications services, and there are two or more competing mobile network operators, this is nowhere near to true market liberalisation - it is just a restricted oligarchy rather than a monopoly. Such monopolies and restricted oligarchies have essentially the same characteristics, and they inhibit the spread of peering as an interconnection mechanism. Without that, there is little hope of establishing a successful IXP.

Nevertheless, things are definitely improving, and we contacted Kyle Spencer of the African IXP Association for comment - and he said: "*While there are still markets in Africa where monopolies exist, they are few, and I believe that most markets are now liberalized enough to qualify as competitive despite various limitations in various markets (e.g. international gateway monopolies, backbone monopolies, etc). There is a growing amount of cross-border fibre, infrastructure sharing, and carrier neutral data center development throughout the region. There are now 58 active IXPs located in 48 cities in 36 countries (see: https://af-ix.org).*" Starting from the south of the region, we observe a situation of complete stability, with no signs of decline.

The undoubted success story in the whole continent is South Africa. Telecommunications was liberalised there first (not without problems!) and this has led to a vibrant IXP scene, as you can see from the overall country graph from Pulse below. The largest IXP in South Africa is close to being in the top ten in the world. NAPAfrica has capacity of approaching 40Tbps and peak traffic exceeding 5.6Tbps. It should be noted that this has been encouraged by not charging for port or membership fees (the IXP is owned by a data centre operator).

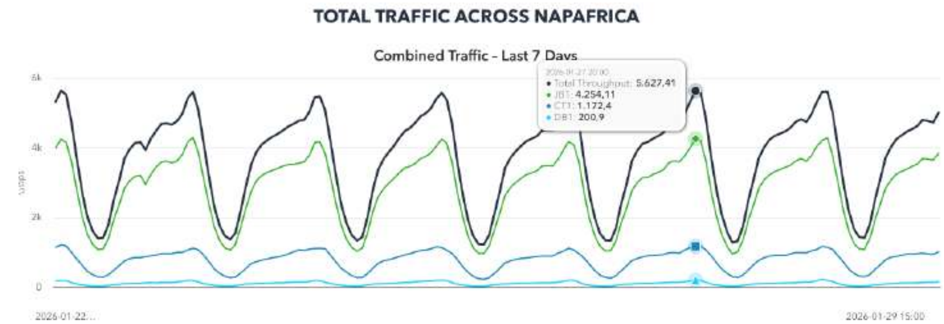


Figure 27: NAP Africa

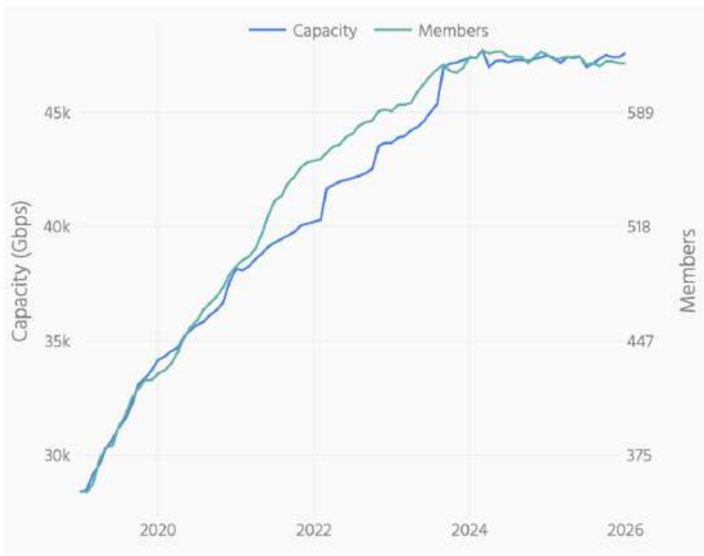


Figure 28: South Africa

A particularly interesting region is Kenya, which has also attracted the attention of some Northern European IXPs. Here, both capacity and the number of connected networks are clearly growing.

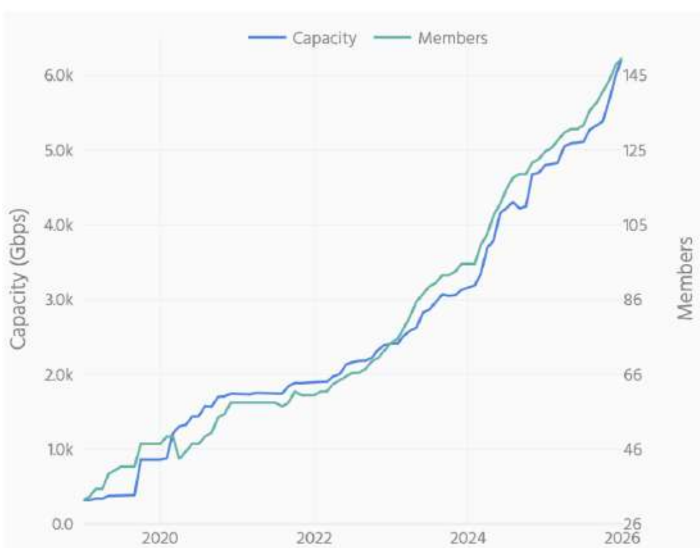


Figure 29: Kenya

Kenya IXP today counts more than 100 interconnected networks and reaches a peak of nearly half a terabit of exchanged traffic.

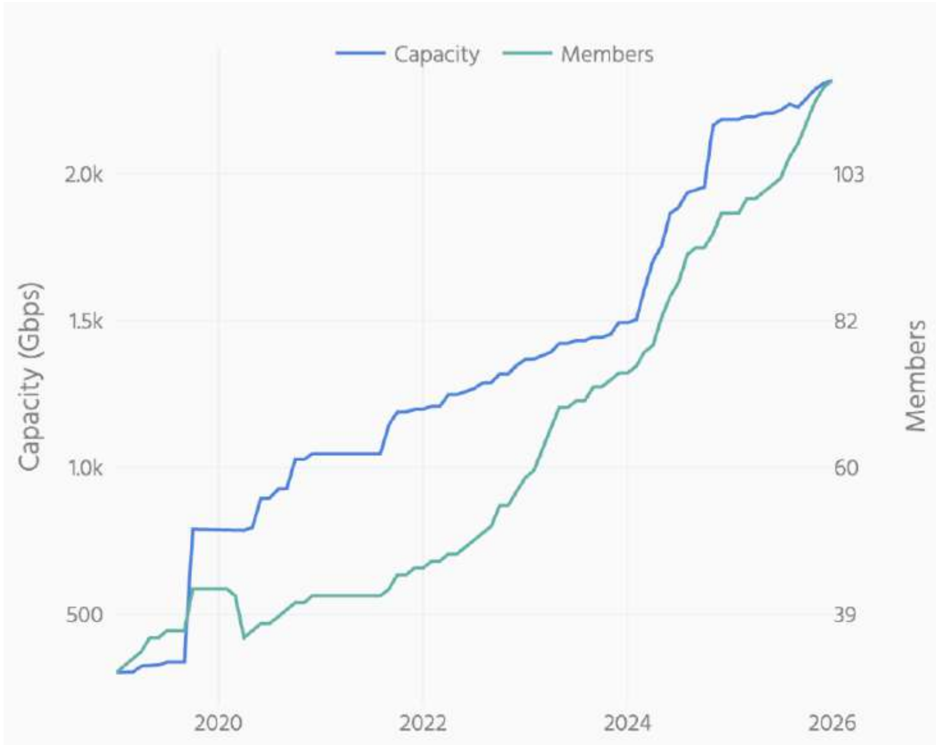


Figure 30: Kenya IXP

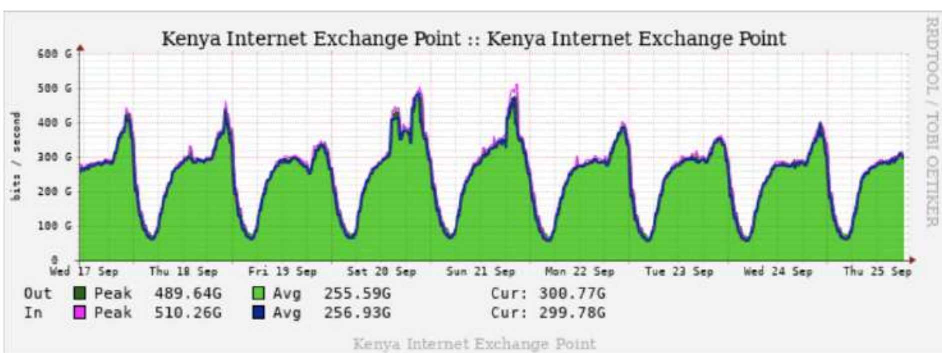


Figure 31: Kenya IXP traffic

Moving to the west coast, Nigeria is noteworthy with 5 active IXPs and an absolutely positive growth trend, as shown in the figure below. Nigeria has also seen a large number of carrier neutral data center investments, each wanting at least one IXP. Other countries in the sub-region are seeing similar growth. Ghana, Côte d'Ivoire, and even Kinshasa further east where two carrier neutral data centers are either active or soon-to-be.

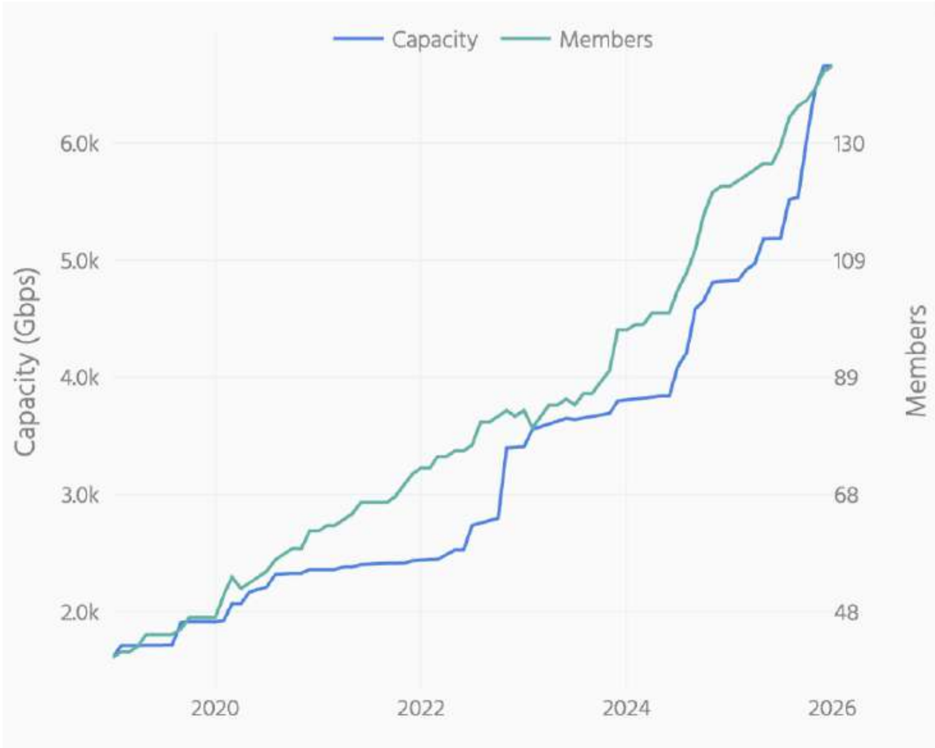


Figure 32: Nigeria

The Nigerian IXP today has more than 100 interconnected ASNs and growing traffic that exceeds one terabit per second.

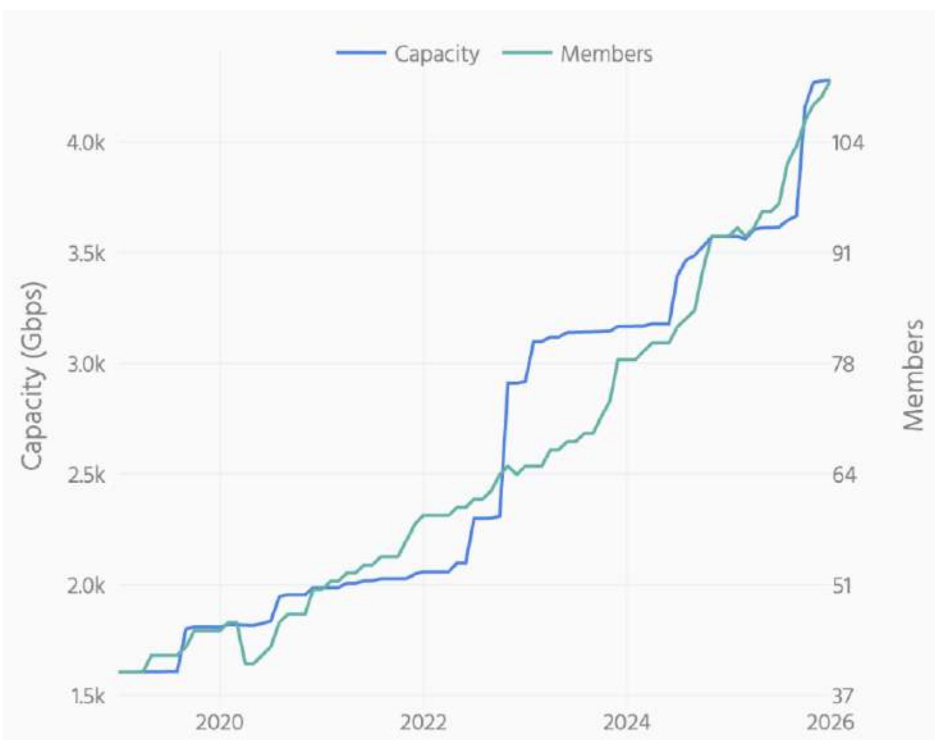


Figure 33: IXP Lagos

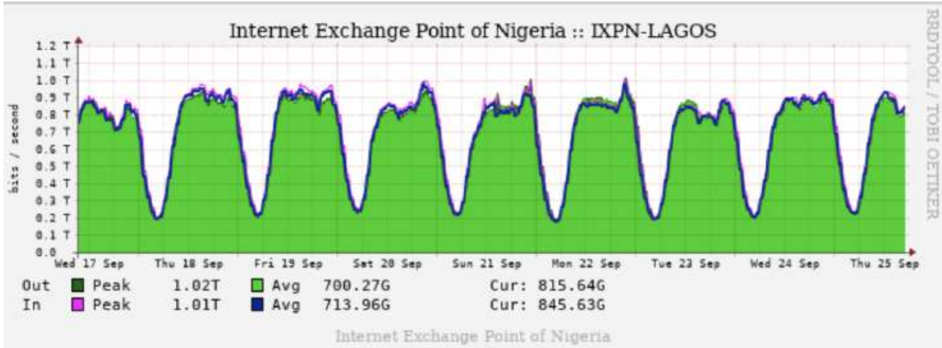


Figure 34: IXP Lagos traffic

3.4 Asia Pacific

The development of Internet Exchange Points in the Asia-Pacific region has followed markedly different trajectories from those observed in Europe and North America. Early exchanges often emerged from academic initiatives or local market needs, resulting in a wide variety of governance and neutrality models that continue to shape the region today.

The analysis begins by focusing on Japan. The country has 21 IXPs and shows a clear trend of growth, despite minor fluctuations in capacity.

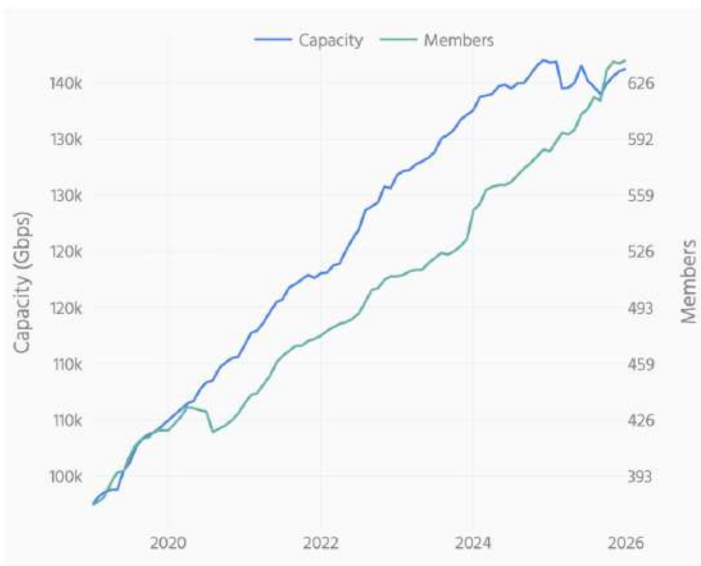


Figure 35: Japan

Our observations about Japan should be set in the context of the rather special peering scene in that country. Japan has a very large and prosperous population - currently the 12th largest in the world at around 123 million people, but also with very high population density. Add to that it is a nation of islands that are somewhat distant to its nearest neighbour, and has a language and associated character sets which are rather isolated to one country, and you have some special circumstances for Internet traffic. The main characteristic is that Japanese Internet traffic will tend to stay within the Japanese islands - and probably much more so than other large countries.

Why does this matter?

Chiefly, it provides a very fertile market for successful Internet exchanges. Japan liberalised telecommunications quite early in world terms (in the 1980s), and was also a global pioneer in mobile telephony, so all the underlying factors were supportive. Nevertheless, it got off to a fairly slow start, as we think it is fair to say that the Japanese are also fairly conservative, and it took a while for their peering ecosystem to grow to the huge levels that it has now achieved. Japanese industry and commerce has traditionally tended to coalesce into allied or semi-allied groupings, and you can see this reflected in the competition amongst large Japanese IXPs.

Long-term growth at JPNAP:

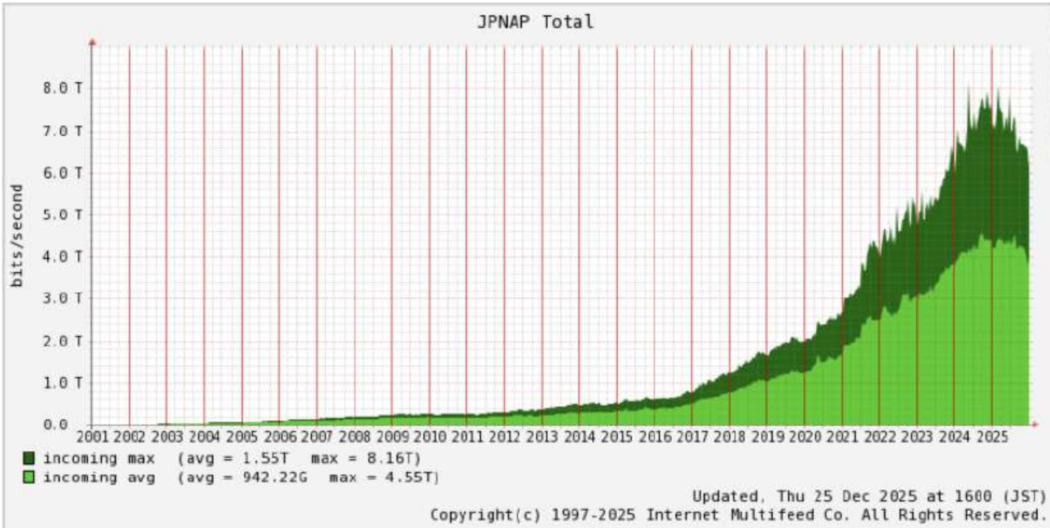


Figure 36: Jpnap

We asked JPNAP for input on these trends in Japan, and received some very helpful background information which puts these graphs in a much better context. The points made were as follows:

- Before 2005, exchanged traffic in Tokyo was growing steeply - driven by increased broadband Internet access penetration (ISDN/ADSL), which was very strong compared to almost anywhere in the world.
- In the late 2000s, it was almost the same as largest European IXPs - which is what you would expect given the relative economic prosperity;
- Around 2010, traffic growth in Tokyo seemed to slow a little compared to the largest European IXPs. There are several possible explanations for this, with perhaps all of them having some degree of impact (at least on the published data):
  - One of the applications to drive traffic growth in Japan was peer-to-peer file sharing. This came to a rapid halt when some individuals were arrested: accused of illegal copying of music and videos/films
  - The first big international content provider point of presence was established in Tokyo around 2010, but other content/cloud/CDN players did not follow until much later in the 2010s.
  - An established Japanese IXP adopted a low price strategy in late 2010 and attracted ASNs rapidly, but they did not publicly publish their traffic data until 2021; accordingly their traffic data was not counted in the aggregate data until 2021 (which is why the Tokyo combined graph jumps in that year).

Asia Pacific regions

It is difficult to generalise about the remainder of the Asia Pacific regions and countries. Why? Well they are mixture of vast island nations (such as the Philippines and Indonesia), vast mainland countries (such as China and India - the two most populous nations on earth) and then a large mixture of other countries, ranging from very poor and under-developed countries, small island states, states still economically and politically tied or dependent on others, to the very wealthiest such as Japan and Australia.

Accordingly, we have gathered as much interesting data as we could, but acknowledge that this is an area that merits much more study. Other than Japan and Australia, we think it is fair to say that Internet exchanges have been slow to develop in the Asia Pacific regions.

China is perhaps the oddest case, where the fully liberalised telecommunications - in the acknowledged Western sense of that phrase - has neither happened or is likely to happen any time soon. Accordingly, the graph from China presented below must be treated with extreme caution - it may just be an illusion.

On the other hand, the situation in Indonesia and the Philippines could be said to be astonishing! Indonesia is a very unusual island-based nation - with something like 6000 populated islands (out of about 18,000 in total). It must be extremely impractical to run multi-island IXPs (unless they are very close to each other), and so what we are seeing here is the IXPs on the larger populated islands. This is quite unlike any other country, apart from perhaps the Philippines. Nevertheless, this is very encouraging, and a fantastic achievement by the IXP operators - due no doubt in some part to the large populations - and hence great demand for IXP-like services.

The graphs we have collected are summarised in the following table:

Country	Number of IXPs	Population (2025 estimate)
China	12	1,416,096,094
India	32	1,463,865,525
Indonesia	56	285,721,236
Myanmar	2	54,850,648
The Philippines	12	116,786,962
Thailand	12	71,619,863

Table 1

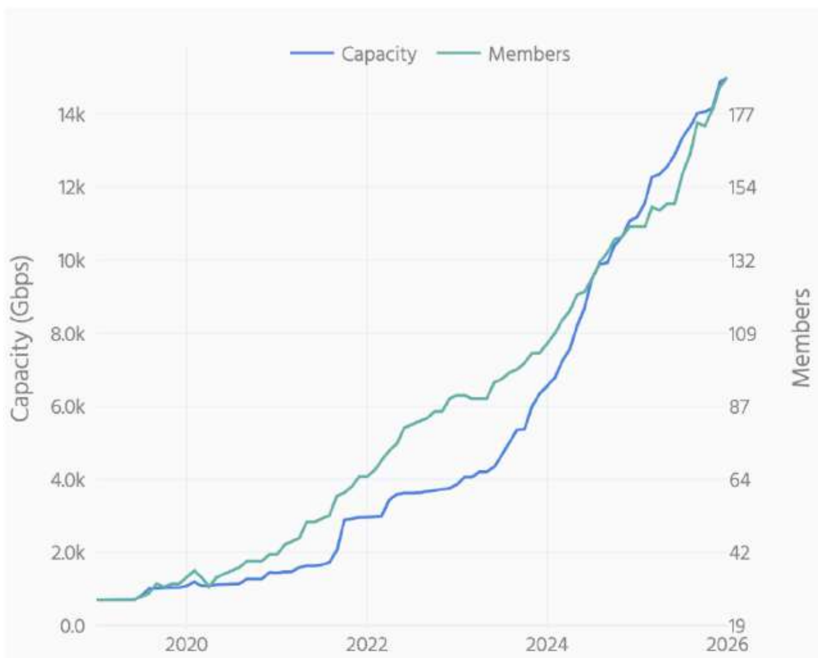
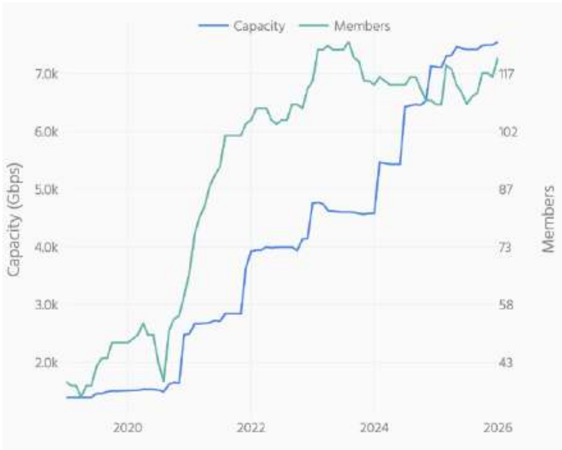
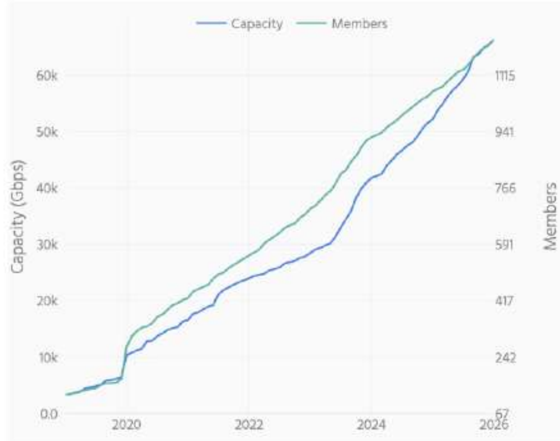


Figure 37: Philippines



(a) China



(b) Indonesia

One of the earliest significant examples is HKIX, active since 1995 and widely regarded as among the first "proper" IXPs in the Asia-Pacific region. Established through an initiative of the Chinese University of Hong Kong (CUHK), HKIX responded to the needs of a highly fragmented local market composed of numerous small ISPs. In its early years, it operated on a router-based architecture, later evolving toward a more conventional exchange model. Despite the emergence of other interconnection points in the Hong Kong area, HKIX remains the dominant player today, reflecting the robustness of its institutional and operational model.

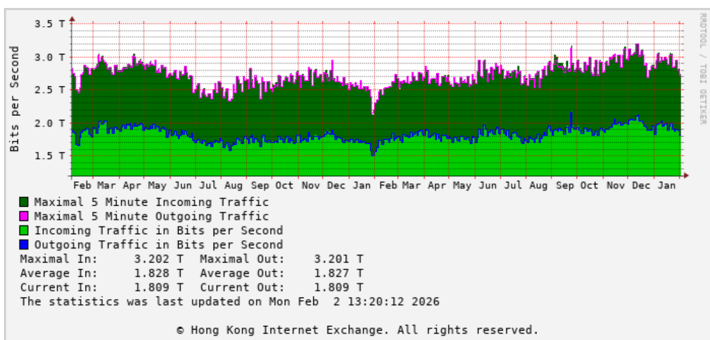


Figure 39: HKIX

The case of Singapore follows a different trajectory. Historically, SingTelIX did not operate as a truly neutral IXP, but rather as a transit carrier using the IX designation, in line with a practice commonly observed in ITU-influenced environments and in other regions. An attempt to introduce an alternative model was represented by SOX, promoted by the National University of Singapore, which, however, failed to achieve broad adoption. Today, the role of the main national IXP is held by SGIX, a widely recognised home-grown initiative that coexists with exchange platforms operated by global players such as Equinix within local data centres.

Figure 40: SGIX

In Malaysia, MyIX represents another long-standing IXP with strong local roots. Active for many years, MyIX experienced periods of strategic uncertainty, partly due to attempts to compete directly with ISPs by interconnecting multiple exchange points. Despite these fluctuations, it remains a relevant actor in the national landscape, well before the Johor Bahru IX evolved into what is now DE-CIX Malaysia.

New Zealand represents a case of relatively early maturity. While IX.NZ is today the reference IXP, earlier examples date back to exchanges operated by CityLink, such as WIX in Wellington and APE in Auckland, which helped foster a culture of local traffic exchange during the early stages of Internet development in the country.

Thailand presents a structurally complex situation in the development of Internet Exchange Points. The local landscape is characterised by the presence of numerous exchanges operated directly by ISPs, often conceived as private infrastructures serving their own customers rather than as neutral, shared interconnection points. Within this fragmented context, the launch of BKNIX represented an attempt to introduce an open and neutral IXP aimed at rationalising national interconnection. However, its establishment required considerable effort, as network operators could continue to rely on their own private exchanges at no cost, reducing incentives to converge toward a common infrastructure.

The complexity of the Thai Internet ecosystem is well illustrated by the maps developed by NECTEC, which are regularly updated and depict an extremely intricate and densely interconnected topology. In more recent years, the landscape has further evolved with the emergence of infrastructure, such as ThailandIX, supported by the National Telecom. While these initiatives expand the range of available exchange points, they also raise questions regarding operational neutrality and their role within an already highly fragmented ecosystem.

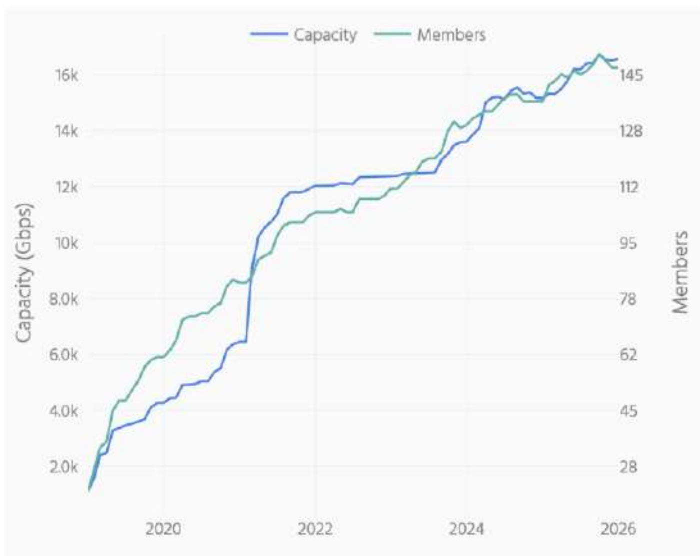


Figure 41: Thailand

In South Asia, the first widely recognised example of a neutral IXP is NPIX in Nepal, which continues to operate in line with its founding principles and is often cited as a model case for the region. Bhutan's IXP, while operational, serves a very small market and faces inevitable limitations of scale. In Bangladesh, BDIX operates within a complex national context that has constrained its development. In Sri Lanka, there are no genuinely open and neutral IXPs, with existing exchanges being operated directly by incumbent telecommunications providers.

India, on the other hand, shows a different trend, with a decline both in capacity and in the number of networks participating in the peering market. India represents a particularly distinctive case. For many years, interconnection between networks belonging to the same hierarchical tier was severely constrained, hindering the emergence of an open peering ecosystem. Early interconnections often took place informally or without public visibility. The first institutional attempt was NIXI, promoted by the government and characterised by mandatory multilateral peering. This requirement forced Tier-1 networks to fully peer with Tier-3 operators, creating significant distortions in practice.

In several cases, large providers complied only formally with their obligations by announcing one or two marginal routes at the exchange, which technically satisfied the peering requirement but provided little practical value. This approach generated considerable frustration among smaller ISPs, who had anticipated broader access to the incumbents' customer bases.

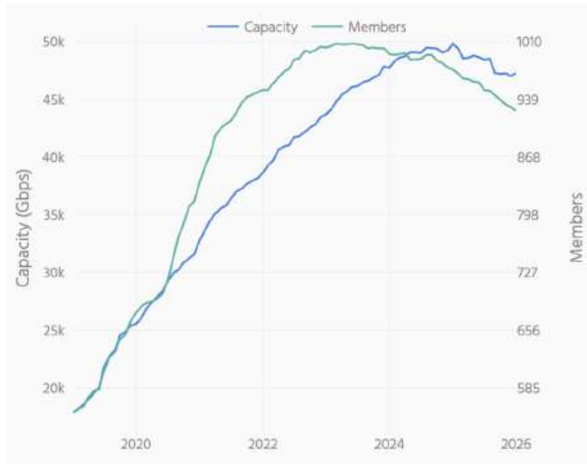


Figure 42: India

3.5 North America

The back story of the North American peering and IXP scene can be broken down into the story of the three constituent countries: Canada, Mexico and the USA.

Canada

The Canadian telecommunications market was liberalised in the late 1990s, and this paved the way for a competitive ISP scene, leading ultimately to the establishment of quite a large IXP in Toronto: TorIX, in 1997. In the absence of significant IXP scene across the border in the USA in the same period, TorIX flourished as a community-owned and operated IXP that had already become a common type in Europe, but which was largely absent in North America. This and subsequent efforts to establish IXPs across the vast width of Canada (noting the comparatively small population for such a massive country) were hugely supported by the Canadian Internet Registration Authority (CIRA), which had both the resources and interest to see that Canadians benefit from high quality interconnectedness. There are currently 12 Canadian IXPs listed in CIRA's website (https://www.cira.ca/en/net-good/network-resilience/ixps/).

Mexico

The Mexico IXP scene is nothing like as positive as their northern neighbours. According to ISOC's Network Pulse: "There are 7 active Internet Exchange Points (IXPs) in Mexico, with a combined total of 78 members as of November 2025. IXPs are present in 3 of the 68 population centers over 300,000". On the face of it, this is quite surprising in a country of 132 million people, but once again, the lack of country-wide telecommunications liberalisation is at the heart of it.

USA

The USA IXP scene has a long and complicated history, and we can't do true justice to it in this report without doubling the length of what we intend to publish! So here is a quick summary, designed to provide context for what we see today. Firstly, the USA is an enormous country, with the third largest world population - currently standing at over 347 million. Perhaps more significantly, the USA is an immensely wealthy country, and it was where the Internet was born, initially by DARPA and then as an inter-university research network (ARPANET and NFSNET) and then the Internet as we know it today. To assist that early expansion from being a university-based and publicly funded network, the first IXPs were established (and called NAPs - network access points), to enable commercial traffic interconnection.

Out of the initial cluster, MAE East and MAE West emerged in the early/mid 1990s as the main points at which early ISPs interconnected. Sadly, both exchanges were eventually deemed failures by US network engineers, and became irrelevant and were discontinued. Summarising briefly, they were probably too early to benefit from robust switching equipment capable of operating reliably with large amounts of heterogeneous IP traffic.

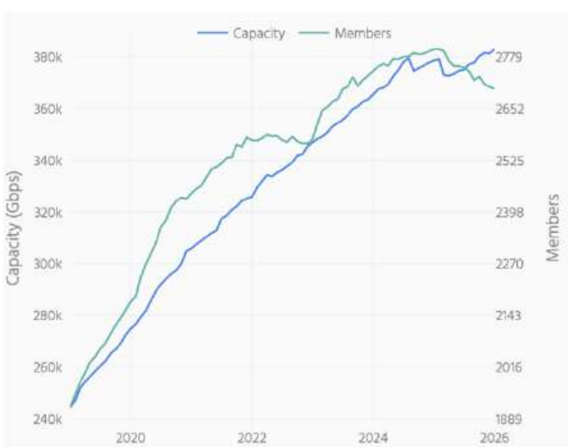
In the meantime, traffic was growing exponentially in the USA, and the folly of trying to interconnect at just two points in the USA led to a significantly different path being followed. The thriving Internet scene in the USA had also spawned a large number of data centres, and the data centres themselves became the Internet interconnection points, using very large volumes of PNIs. Eventually, the data centre operators began to offer their own multilateral peering points (IXPs as we now know them) - but since they made a great deal more money offering PNIs, these data centre IXPs were usually quite small and insignificant.

The role of US network engineers should be noted in passing here. The technical issues experienced by the early IXPs in the USA undoubtedly fostered an antipathy towards public peering, which took many years to fully and properly dissipate - hence the way that PNIs were embraced instead. Of course, this could only have happened with the easy availability of PNIs in large numbers of data centres, which is how things actually developed as MAE East and MAE West were failing. It is also worth mentioning that ultimately, investing in PNIs with **all** the networks that you interconnect with is neither practical nor affordable, so some sort of return to multilateral peering was always inevitable.

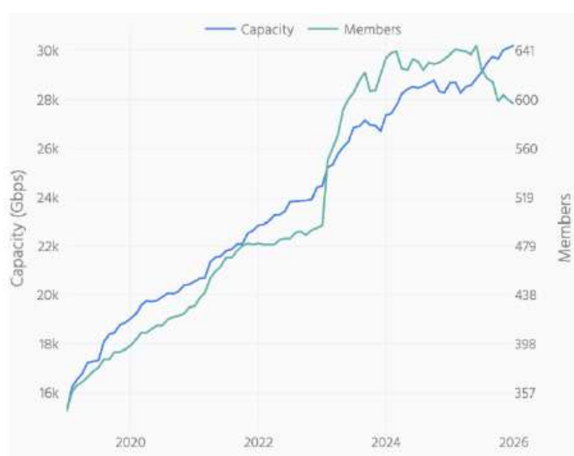
The big change came with the advent of large content networks, and the interconnection between large content providers and ISPs of all sizes led to a resurgence of IXPs in the USA. Indeed, some of the large content providers made it their business to foster IXPs in various ways, and all of this has led to the vibrant scene that we see today, with ISOC Pulse reporting 163 IXPs in the USA, a record for any single country, by quite a distance. Having said that, no US IXPs feature in the top 25 in the world measured by number of ASNs connected.

One more thing is worth mentioning briefly for emphasis and clarity. We should again note the huge size of the USA, and the emergence of clusters of telecommunications markets, based around their large metropolitan areas. This gives rise to the question: where to physically or geographically locate IXP(s) in the USA? In most European countries, where the first successful IXPs in the world became established, it was always pretty obvious where to site the IXP: the capital city or a proxy of it (London, Paris, Amsterdam, Frankfurt, Milan etc.). It is not so obvious where to do it in the USA - other than that you will need lots of them! This just compounds the difficulties in getting started with IXPs.

Here are the traffic/member trends for the USA and Canada:



(a) United States of America



(b) Canada

4 Conclusions

The analysis and data just presented highlight several interesting aspects of the peering market and its evolution. In our opinion, capacity is generally increasing when observing the trends from above and extending the picture to the entire globe. There are certainly cases of decline in the number of interconnected networks and in the amount of capacity allocated, but this is not a trend that can be generalized. These are instead specific cases: it depends on the region, the level of market saturation, or sometimes simply on a situation of stagnation caused by having reached a critical mass of participants, which makes further growth at these points more challenging.

We believe that the current dips seen in the capacity of some IXPs (especially the largest ones) over the past year are not sufficient to define a critical situation regarding their role in the network ecosystem. On the contrary, a period of stagnation can be a sign of transformation, one that will likely lead to a diversification of services, which the market is beginning to demand and which IXPs are starting to deliver. The ecosystem is becoming increasingly dense due to the entry of new players who are not directly involved in the traditional network operations model but benefit from it in terms of optimization, resilience, and security, such as banks and insurance companies, large manufacturing industries, public administrations and local authorities, healthcare, transportation, and logistics, to name a few. The model is shifting from a linear supply chain to a more hub-and-spoke approach, where these players are beginning to join IXPs and reap the benefits.

Capacity may decrease in volume but increase in quality and, above all, in importance (for example, with banks interconnected at IXPs). In our view, the trend over the next 10 years will still see growth in peering traffic and networks in regions where there is strong demand for connectivity, consequently leading to the creation or expansion of IXPs that are currently either nonexistent or still very young. In major distribution hubs, on the other hand, capacity may decline, but the number of interconnected networks will increase, along with the entry of new players into the ecosystem. And this will lead IXPs to further expand their range of interconnection-related services, in order to meet the new demands and needs of the ecosystem.

Beyond any conclusions that may be drawn from the analysis of the preceding data, the role of IXPs and peering remains an essential component of the network ecosystem. As data becomes increasingly strategic, we believe it is essential to ensure that traffic remains local and that there are strong guarantees for security, data protection, and resilience. In our view, policies should encourage the creation of domestic or local IXPs and provide incentives for infrastructure development. Clearly, IXPs must evolve, and they must do so in line with the evolution of the market, which means greater diversification of participants and a particular focus on the introduction of value-added services. Moreover, emerging applications (AI, IoT, augmented reality, autonomous vehicles, smart cities) require very low latency and processing close to the user. This will drive a wider rollout of local "micro-IXPs" as well as new edge infrastructure. Therefore, a more effective distribution of IXPs at the edge should be seriously considered.

Policies and strategies of operators are changing, especially among content providers, and we are witnessing a transformation in the role of IXPs. Over the years, we have seen the caches of major hypergiants move from IXPs into the networks of large access operators. Does this trend of moving caches closer to users mean that peering is dying or becoming less valuable? We would say no. It has simply taken on a new form, that of a domain of resilience and redundancy, which is essential, particularly during major traffic surges.

Internet Exchange Points today are complex entities, more complex than is sometimes assumed. As an example, it is worth mentioning the fact that there are IXPs (the three big European ones, for example) where the traffic is more international than national - AMS-IX and DE-CIX are the exemplars of this, with LINX to a lesser degree (since it carries a higher proportion of national traffic than the other two, and also is the hub of a massive amount of managed private interconnecting between its members). As can be seen from this, you really need to understand both the nature, ownership and the dynamics of individual IXPs - rather than just assume that they are all of one type and serve interconnection in the same way. In this context, home-grown IXPs remain essential and are by no means obsolete, but they must acknowledge that hyperscalers are no longer, and do not seek to be, their primary audience. The real value of IXPs increasingly lies in serving Tier-2 and Tier-3 networks, strengthening local interconnection, redundancy, and resilience, rather than in pursuing multinational players or "remote peering" models that often resemble transit in disguise. In an increasingly unstable geopolitical environment, and with growing dependence on external cloud infrastructure, a country's ability to continue operating in the absence of international connectivity becomes critical. Local infrastructure, in-country hosting, and domestic IXPs therefore take on renewed strategic importance. The assumption that "the cloud solves everything" is largely illusory: when external connectivity is disrupted, underlying structural fragilities, often underestimated by decision-makers, become immediately apparent, with potentially severe operational consequences. Far from being a relic of the early Internet, IXPs are evolving into strategic hubs for digital transformation. Their future will not be measured solely in terms of traffic volume, but in their ability to provide resilience, enable innovation, and support an increasingly diverse set of participants. As the demand for connectivity continues to rise and new applications emerge, IXPs will remain a cornerstone of the global network ecosystem, not just as traffic exchangers, but as enablers of a more efficient, secure, and decentralized Internet.

5 External expert perspective

To complement the data-driven analysis presented in this paper, we invited an external expert to provide an independent perspective on the evolution of the IXP ecosystem. Philip Smith, one of the most experienced practitioners in the Internet interconnection space, was asked to comment freely on the implications of the findings. His views are reported below.

> "The Internet ecosystem is effectively returning to a model in which Internet Exchange Points primarily serve 2nd- and 3d-tier network operators. What has fundamentally changed is the composition of the top tier itself. Traditional Tier-1 carriers, such as AT&T, NTT, Lumen, or Arelion, have gradually ceded their dominant role to hyperscalers. These actors have little incentive to participate in public IXPs as they prioritize tightly controlled interconnection environments with strict service-level agreements designed to deliver a differentiated end-user experience relative to competing hyperscalers. This rationale mirrors the arguments advanced by Tier-1 carriers in the 1990s, albeit articulated today by a different class of actors.
>
> Against this backdrop, the strategic future of IXPs appears increasingly bifurcated. One path is to refocus explicitly on serving Tier-2 and Tier-3 networks, however those categories are defined, by strengthening local interconnection, reducing dependency on external transit, and supporting regional traffic localization. The alternative path is to enter the transit market directly as many so-called "remote peering" IXPs have done. In such cases, the distinction between an IXP and a transit provider becomes largely semantic. Historical precedents exist for this blurring of roles, such as the marketing of transit services under exchange-branded names. However, this evolution introduces significant identity and governance challenges for large, well-established exchanges. Major exchange platforms, including AMS-IX, DE-CIX, LINX, BBIX, and to a lesser extent JPNAP and JPIX, now face a structural identity crisis. As hyperscalers progressively withdraw from shared exchange infrastructure, beginning with early movers such as Google, these IXPs lose a central element of their traditional value proposition: the promise of direct access to globally dominant content platforms. Whether such exchanges can successfully reorient toward their local and regional markets remains an open question, particularly given business models built around scale, global reach, and multinational participation.
>
> Competing directly with large global transit providers such as Lumen, Arelion, or NTT places IXPs in a crowded and highly commoditized marketplace with limited scope for differentiation. Moreover, poorly implemented remote peering models can significantly degrade network performance. Empirical evidence points to a growing incidence of inefficient routing patterns, including trombone-like traffic flows, which increase latency and operational complexity for ISPs. These effects have been documented in comparative analyses of indigenous versus multinational IXP deployments and represent a non-trivial risk to network stability and performance.
>
> At the same time, nation states are increasingly questioning the implications of global political instability for data locality and operational resilience. Concerns are being raised about the geographic placement of critical data and services, often hosted in foreign cloud

environments. The realization that essential national services, financial systems, content platforms, and creative or productivity tools, may depend on connectivity to external jurisdictions has prompted a reassessment of national Internet architectures. When asked whether their countries could continue functioning in the absence of external Internet connectivity, many operators and policymakers struggle to provide a clear answer, reflecting an underlying assumption that large-scale outages are improbable.

Everyday service workflows illustrate this fragility. Routine commercial interactions increasingly rely on complex chains of externally hosted cloud services, sometimes located outside the region entirely. The lack of contingency planning for disruptions to these dependencies highlights a widespread underestimation of systemic risk. As cloud centralization intensifies, so too does the potential impact of failures, what appears operationally efficient under normal conditions may prove highly brittle under stress.

Re-homing content, services, and critical platforms to domestic infrastructure would significantly improve performance, resilience, and sovereignty in many regions. Such a shift would also restore tangible demand for local interconnection and reinforce the relevance of home-grown IXPs. In this sense, strengthening local hosting and exchange ecosystems is not a regression, but a necessary adaptation to an increasingly uncertain and fragmented global Internet environment."

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