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Unlocking Digital Growth:
The Role of Internet Exchange Points (IXPs) in the Middle East

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Executive Summary

In this report, we examine the Internet Exchange Point (IXP) landscape in the Arabic-speaking countries of the Middle East and consider what success means for an IXP. There is no one-size-fits-all model for building an IXP. Different IXPs in the region, even within the same country, are established to fulfil different needs and must operate in different environments. This means there are many factors to consider when assessing an IXPs effectiveness. These include the traffic volume exchanged, the number of peers, reachable Autonomous System Numbers (ASNs) and potential savings on international bandwidth by avoiding tromboning (sending traffic outside of a country and then back).

In this report, we define four main criteria for benchmarking the success of IXPs in the Middle East (and elsewhere):

(1) Keeping the local traffic... local!
(2) Fostering local interconnection for developing a digital economy
(3) Attracting global cloud and content players
(4) Becoming a hub for exchanging regional traffic

Given the diversity of roles the region's IXPs must perform, not every IXP will deliver on all of these goals. However, we present a benchmarking framework that can be used by IXPs operators or by other decision makers to evaluate the overall impact and effectiveness of their operations.

We also cover the other enabling circumstances that allow these objectives to be achieved. Laws and regulations are one major factor in fostering digital inclusion or hosting foreign content and players. These and other aspects need to be considered when assessing the possibilities for an IXP in a particular environment.

Background

The Middle East has been undergoing a digital transformation that is reshaping economies, societies and the way people live and work. At the heart of this transformation lies the critical role of network infrastructures, and in particular IXPs, in accelerating data exchange.

Everyday activities have moved online, from healthcare to education, online shopping, e-government services and even conference organisation. However, to make these services accessible to societies, individuals and businesses, and to achieve sustainable development, it is essential to build and develop a solid digital infrastructure ecosystem.

The Middle East has recognised the urgency of this change. Governments and the private sector are investing in digital infrastructure, skills and innovation. Yet one of the enablers of this transformation is often overlooked: IXPs.

IXPs are physical locations that facilitate the interconnection of networks such as Internet Service Providers (ISPs), content providers, hyperscalers, enterprises or academia. Overall, IXPs are a fundamental component of the Internet infrastructure, contributing to its efficiency, resilience and overall user experience.

Prior to the 2010s, IXPs played a limited role and were not really part of the interconnection scene in the Middle East. A few IXPs were created during this period, but with limited activities. Most Internet traffic had to be routed through Europe or Asia, resulting in high latency and costly data transit.

Recognising the need to improve domestic digital infrastructure, different groups, including technical, civil and governmental entities, initiated efforts to establish IXPs. The oldest IXP of the region that is still in operation today is the Beirut Internet Exchange, which went live in December 2007.

However, the last decade witnessed a large boom in the peering and interconnection landscape in the region, with currently around 15 operational exchanges spread across nearly 10 countries (figure 1).

Figure 1:
Main IXPs in the Middle East

1. Keeping local traffic local

1.1 Connecting service providers for seamless traffic exchange

By studying the development of the Internet in the Middle East a recurring pattern emerges. A local monopoly or small oligopoly that tightly controls the international gateways of their respective countries. This phenomenon, while presenting perceived advantages, also harbours significant drawbacks.

The notion behind these monopolistic or oligopolistic structures is rooted in the economic principle that a select group of players, holding exclusive control over the international communication channels, would be economically incentivised to keep local traffic circulating within the confines of their national borders. The presumed advantage lies in the efficiency gained by routing all local communications through domestic infrastructure rather than costly international routes. This, in theory, fosters a more economically viable model for the incumbents involved.

However, the downside of this seemingly pragmatic approach becomes evident when examining the limitations it imposes on the broader telecommunications landscape. In such scenarios, the incumbent or the small oligopoly wielding control over the international gateways becomes the gatekeeper, dictating who can access international circuits and on what terms. This restrictive environment stifles competition and innovation, hindering the growth potential of other market players whose expansion models may demand access to international circuits beyond what the incumbent allows.

A modern day example of this is Lebanon, where the incumbent and Ministry of Telecom still has sole control over the International gateways. The industry's reaction to this was the emergence of the first IXP in the region, still in operation today, Beirut-IX (established in 2007).

Beirut-IX adheres to a governance framework firmly grounded in the member-based approach. Under this model, Beirut-IX functions as a cooperative platform, guided by the collaborative efforts of its member organisations. In this model, each member possesses a significant stake in the decision-making processes of the IXP. The level of a member's participation directly correlates with their influence on shaping operational policies.

This member-driven governance model is designed to create a critical mass to help with peering negotiations with content providers, with the explicit goal of ensuring that the diverse interests of all participants are duly considered.

In other Middle Eastern countries a different kind of governance model emerged where the IXP is a governmentally owned platform with regulatory oversight. Under this model, the government or regulatory body takes an active role in the ownership, management, and/or operation of the IXP, shaping its policies and operations in alignment with broader national telecommunications strategies and objectives. Examples of IXPs operating within this framework include Kuwait IX (established in 2018) and Palestine IX (established in 2020).

Some IXPs observed an intermediate approach known as multistakeholder governance. This inclusive model involves active participation from entities such as governments, regulatory bodies, telecom operators, and other peering members. An example of this approach is evident in the governance structure of SAIX (established in 2017) in the Kingdom of Saudi Arabia and the proposed structure for LEB-IX (still not operational) in Lebanon.

On the other hand, there were countries like Bahrain which implemented pioneering telecom sector reforms in the early 2000s. This bold move aimed to break away from the traditional concentrated market control model and instead embrace a liberalised telecommunications market. While this liberalisation allowed multiple players to freely build and purchase international circuits, there were also significant hurdles that emerged.

One such hurdle was the perceived absence of neutral IXPs within Bahrain. Unlike the concentrated market control model above, where an incumbent tightly controlled international gateways, the newfound liberalisation allows various telecom operators to exchange traffic as they saw fit for their expansion plans. However, the absence of neutral IXPs created a conundrum for operators who were wary of peering with local competitors and providing them access to their infrastructure, hosted content and users. The fear of enabling competitors to capitalise on one's network investments acted as a deterrent to establishing local peering arrangements.

This led to the phenomenon of "tromboned routes", where data took circuitous paths through international IXPs located outside the region. These roundabout routes increased latency, consumed more bandwidth, and incurred additional costs, as data would journey through extended pathways before eventually reaching its local destination.

Moreover, the overpricing of local physical infrastructure further fueled the trend of opting for indirect, inefficient routes. The cost dynamics and lack of a neutral playing field created a scenario where operators, driven by competitive pressures or financial considerations, preferred international detours over local peering.

This situation highlighted the intricate balance required in liberalised telecommunications markets. While the reforms aimed to foster competition and diversity, the absence of neutral IXPs, reluctance to let go of competitive advantages, and cost considerations led to unintended consequences.

The mindset that control over international gateways would provide a source

of strategic advantage may have also been influenced by a desire to maintain a centralised authority over the flow of information. Decision-makers may have perceived this control as a means to safeguard national interests or to manage and regulate telecommunications infrastructure more effectively. However, the unintended consequence was a delay in acknowledging the positive impact that embracing competition and fostering neutral IXPs could have on the overall efficiency and growth of the telecommunications sector.

As a result, the delayed rise of IXPs in the region meant missed opportunities for enhanced local traffic exchange, reduced latency, and improved cost-effectiveness. The absence of neutral grounds for operators to freely exchange traffic limited the potential for collaboration, innovation, and the creation of a robust digital ecosystem.

The story changed in the region with the establishment of the UAE-IX in 2012 that introduced the "powered by" IXP model. The IXP was established under the licence of one of the duopoly operators in the United Arab Emirates (Du) while DE-CIX, a Global Internet Exchange operator, was to manage and develop the IXP from its inception.

This "powered by" model quickly became the most common model among the IXPs in the region where the IXP is owned by an established telecommunications operator but the management of the IXP itself is delegated to an external IXP operator. For example, UAE-IX is managed by DE-CIX, JEDIX is managed by LINX and Manama-IX is managed by AMS-IX.

But not all telecommunications operators decided to outsource the management of their IXP to another entity. For example, SmartHub IX (established in 2013) is an IXP that is operator-owned and managed. The IXP falls under the operational and organisational umbrella of an established telecom operator in the country.

Some IXPs observed an intermediate approach known as the hybrid model: where an independently established IXP may use a combination of the above models to tailor their governance structure to their specific needs. Aqaba-IX and Iraq-IX entered into a partnership with DE-CIX under their IXP as a service model.

When examining the financial governance models, diverse structures exist, each with its unique characteristics. Cost-recovery models, like the one Beirut-IX embraces, operate as a non-profit entity. The IXP aims to prioritise the collective benefit of its participants over profit-driven motives.

Subsidised IXPs often enjoy government funding, ensuring, and often mandating, accessibility to all local operators without financial barriers. As of now, connections to ix.kw in Kuwait are free of charge.

While the economic and financial challenges of establishing and maintaining IXPs in some countries can be significant, they are not insurmountable. A balanced approach that combines revenue diversification, affordability, public-private partnerships and awareness of broader economic benefits can contribute to the long-term sustainability of the IXP.

Several strategies can address this challenge. These include tiered pricing structures that cater to different types of participants, such as large ISPs and startups. Additionally, offering value-added services, such as colocation and cloud services, can diversify revenue streams and contribute to sustainability.

Figure 2:
Measuring the proportion of local traffic that remains local in the Middle East

Source: *RIPE Atlas*
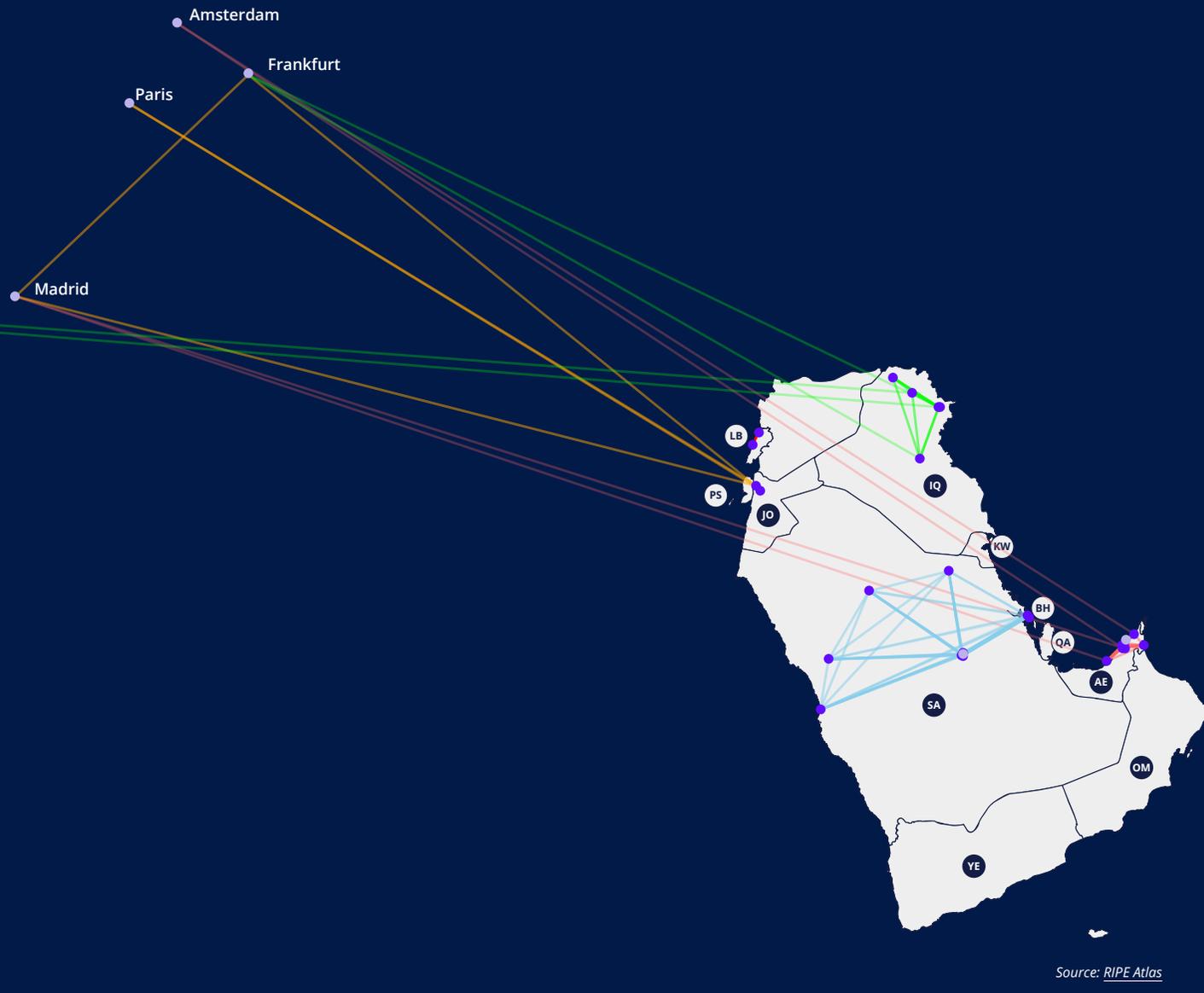
To test to what extent the local traffic is kept local (either via local IXPs or via other circuits), we ran a series of measurements in five countries (Saudi Arabia, Lebanon, UAE, Jordan and Iraq) using our RIPE Atlas Probes (figure 2). The measurements were a series of traceroutes between the probes of the same country and then we analysed the paths these traceroutes took. For Saudi Arabia and the four probes in Lebanon we did not detect foreign IP addresses. It is still possible that some of the hops are abroad (IP geolocation is not perfect), but we do know foreign IXPs were not involved. The UAE also appears clearly on the map, with only two traces with IP addresses located in Europe. In both Saudi Arabia and the UAE the local IXPs are seen in a good part of the traceroutes. For Iraq and Jordan, we see more traces leaving the country which indicates a suboptimal level for the local routing optimisation.

Figure 3:
ASNs routed through SAIX Riyadh

■ SAIX Saudi Arabia Riyadh

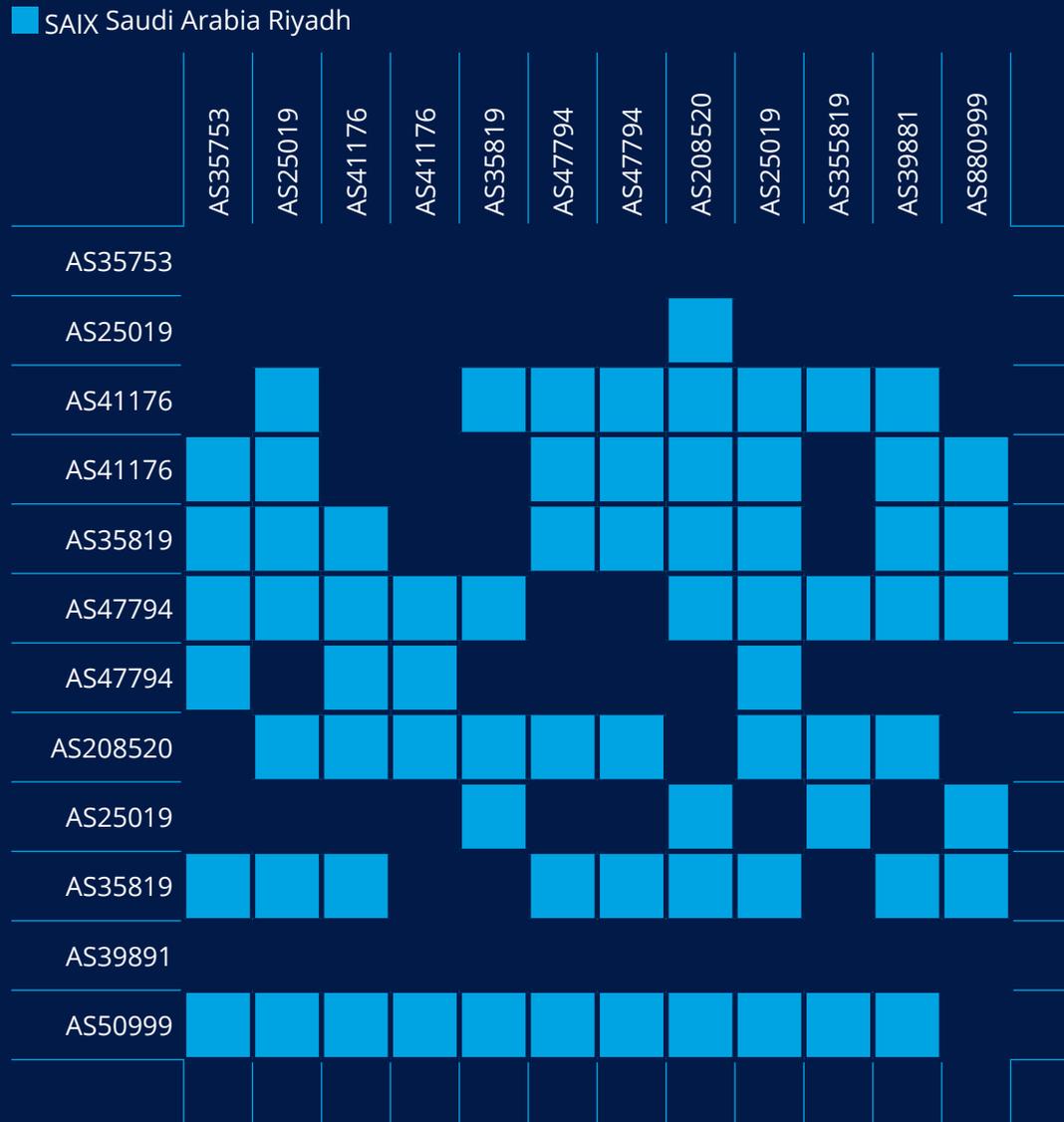|	AS35753	AS25019	AS41176	AS41176	AS35819	AS47794	AS47794	AS208520	AS25019	AS355819	AS39881	AS880999
AS35753												
AS25019								■				
AS41176		■			■	■	■	■	■	■	■	
AS41176	■					■	■	■			■	■
AS35819	■	■	■			■	■	■			■	■
AS47794	■	■	■	■	■			■		■	■	■
AS47794	■		■	■					■			
AS208520		■	■	■	■	■	■		■	■		
AS25019					■			■		■		■
AS35819	■	■	■			■	■	■	■		■	■
AS39891												
AS50999	■	■	■	■	■	■	■	■	■	■	■	

Figure 3 represents an analysis of traceroutes between RIPE Atlas probes deployed in different ASNs in Saudi Arabia. The blue squares indicate that the network path crosses through SAIX Riyadh. This supports the efforts of keeping local traffic (with local source and destinations) within the country.

1.2 Content localisation

In the early 2010s, being a content owner came with a significant challenge; the burden of exorbitant local hosting costs. Faced with this financial obstacle, many content owners made a strategic shift, choosing to host their content in more developed markets. Despite the inevitable increase in latency, the prospect of substantial cost savings in these mature markets proved appealing.

This meant that in order to offer local users access to content produced locally but hosted abroad, ISPs faced the inescapable challenge of incurring international transit prices for retrieval. Rather than directing their investments towards constructing robust local data centres and fostering diverse infrastructure paths within their home countries, content owners found themselves irresistibly drawn to the cost-efficient solutions presented by more developed markets.

In practical terms, this meant that in order for local users to access locally produced content hosted

abroad, Internet Service Providers (ISPs) were still incurring international transit prices for the content's retrieval, instead of directing these funds toward the construction of robust local data centres and the development of diverse infrastructure paths within their home countries.

With the advent of content delivery networks (CDNs), cloud services, and hyperscalers, new avenues emerged that promised not only affordability but also efficiency. Global players, armed with extensive reach and negotiating power, became the preferred choice for hosting local content. The ability to optimise content delivery through local caches, coupled with more economical infrastructure costs negotiated on a global scale made them an instant success heavily sought after by operators and governments alike.

The impact on local infrastructure development was noticeable. The entry of CDNs and hyperscalers prompted the establishment of local data centres and IXPs, bringing a new wave of opportunities to the region.

Despite the benefits accruing to the local Internet landscape, the advantage still resides firmly with global players. Local hosting providers, now in direct competition with these global giants possessing deeper pockets, extensive content portfolios, and better-negotiated deals, face a formidable challenge that threatens the survival of their businesses in the hosting sector. Moreover, this trend towards reliance on global players contributes to a more centralised Internet landscape, raising concerns about the potential impact on local development and the diversity of the digital ecosystem.

The existence of global players has undoubtedly contributed to the improvement of local infrastructure, but the disadvantage faced by local players poses challenges for local development and raises questions about the long-term consequences of a more centralised and globally dependent Internet.

Striking a balance between global collaboration and the preservation of local autonomy is essential for fostering a robust and diverse digital ecosystem.

The importance of optimising routing and keeping local Internet traffic within national borders is increasingly recognised in the contemporary digital landscape. Industry leaders, policymakers, and regulators are more aware than ever of the benefits associated with these strategies, and steps have been taken to enhance the localisation of digital infrastructure in the Middle East.

A regulatory framework that encourages fair competition and open access to IXPs at affordable prices fosters innovation and ensures that all network operators have equal opportunities to connect and exchange traffic.

2. Fostering local interconnection for developing a digital economy

2.1 Open and inclusive membership policies

In the ever-shifting landscape of the digital economy, the Middle East stands at a critical crossroads, urging a reconsideration of conventional strategies regarding IXPs to profoundly influence the speed of growth and innovation. IXPs, traditionally perceived in the region as exclusive meeting grounds for licensed Internet service providers, have inadvertently marginalised the role of other vital network operators, including governmental, enterprise, or academic networks. This, in part, can also be the result of external factors such as the regulations in some countries limiting the categories of networks that can connect at an IXP or the absence of proper local loops and circuit providers that would connect other network operators in a cost-efficient manner. This exclusive stance has led to a scenario where only a handful of licensed service providers, often viewing each other as competitors, remain hesitant to partake in building and developing the IXP in their country.

Adding to the complexity, licensed service providers see other network operators in the country as customers, and express apprehensions about potential revenue loss should they include them at these IXPs. This concern acts as a formidable barrier, impeding the growth of the peering and interconnection landscape locally. This presents a big conflict of interest in the case where the IXP is running under the umbrella of a service provider.

IXPs provide an easy and efficient way for network operators in the country to have more control over how to shape their traffic flows and where to send it. This coupled with the IXPs innate nature of reducing latency and data transition costs empower startups to efficiently develop and deliver services. This accelerated pace of innovation is indispensable for maintaining competitiveness in the digital age.

The impact of IXPs extends beyond the tech sector, influencing other facets of the economy. They stimulate the growth of digital content industries, software development, and e-commerce. Startups often depend on these sectors for support, generating a ripple effect that propels economic diversification and job creation.

A report by the Internet Society, focusing on IXPs in Kenya and Nigeria, highlighted several benefits, including enhanced e-government access, increased usage of educational and research networks, and the repatriation of previously externalised financial platforms for online banking services in Nigeria.

In another report from the Internet Society titled "Moving Toward an Interconnected Africa: The 80/20 Initiative", a positive correlation was found between the number of members in an IXP and the amount of traffic that moves through it. This correlation emphasises the benefits of having more connected networks, suggesting a generative impact of increased membership on the exchange of traffic, thereby aiding countries in reaching higher stages of Internet ecosystem development.

Beyond these advantages, when IXPs adopt open and inclusive membership policies, they welcome a diverse range of network operators. This inclusivity promotes competition, innovation, and a sense of ownership within the IXP community.

IXPs do not operate in isolation; they thrive in an ecosystem where knowledge sharing and expertise exchange are the norm. The cultivation of a collaborative culture among IXP peers leads to the accumulation of collective knowledge and best practices.

2.2 Who should connect at the IXP?

→ **Research Centers and Universities:** Research institutions can utilise IXPs to access and share academic resources, collaborate on research projects, and engage in data-intensive experiments. The low-latency environment offered by IXPs is particularly valuable for real-time data analysis and scientific research.

→ **Financial Institutions:** The financial sector relies on low-latency, high-speed connectivity for real-time trading, financial data exchange, and secure transactions. By connecting to IXPs, financial institutions can ensure that critical financial data flows efficiently and securely within the region.

→ **Startups and Entrepreneurs:** Startups and entrepreneurial ventures often operate on tight budgets. IXPs provide them with cost-effective access to high-speed Internet connectivity, reducing operational costs and enabling faster time-to-market for their digital products and services.

→ **Government Entities:** Government agencies and ministries can leverage IXPs to enhance their digital infrastructure and improve the delivery of online services to citizens. This fosters greater transparency, efficiency, and accessibility in governance. For example, the Ministry of Interior in Qatar is connected to QIX, the Saudi Data and Artificial Intelligence Authority (SDAIA) is one of the members at SAIX and the Communications and Information Technology Regulatory Authority in Kuwait is present at ix.kw.

→ **Healthcare Institutions:** In the era of telemedicine and digital health solutions, healthcare institutions benefit from reliable and low-latency connectivity. IXPs support the seamless exchange of medical data, facilitating remote consultations and healthcare services.

→ **IoT and Smart City Initiatives:** The Internet of Things (IoT) and smart city projects require robust connectivity for data collection, analysis, and decision-making. IXPs provide the infrastructure necessary to support IoT deployments and smart city initiatives.

However, it is crucial to note that this is an area where most, if not all, IXPs in the region seem to falter. The predominant focus remains highly centred on attracting service providers and some content creators, rather than embracing these vital networks as peers in the collaborative journey towards a more interconnected digital landscape. This represents a missed opportunity for holistic growth and innovation within the region's digital infrastructure.

By promoting a peering and interconnection environment where multiple sectors can connect and collaborate, IXPs become hubs of digital transformation, fostering economic growth and technological advancement. The higher the interconnection density is between network operators the more reliable and resilient the Internet is for everyone.

To achieve this, the local laws and regulations should be in favour of allowing this diverse spectrum of players to connect and provide their services at the IXPs. Imposing restrictions on who can be present at an IXP would not help fostering a positive environment for the IXP.

Figure 4:
Local ASNs, total number of peers and number of local peers connecting to the main IXPs in the Middle East

AE
UAE
Local ASNs: 91

IXP
UAE-IX

IXP
SH-IX

7
82

2
33

BH
Bahrain
Local ASNs: 20

IXP
Manama IX

6
21

Non-Local Peers — Local Peers

SA
Saudi Arabia
Local ASNs: 148

IXP
SAIX Riyadh

IXP
JEDIX

8
17

3
19

PS
Palestine
Local ASNs: 38

IXP
PSIX

5
16

JO
Jordan
Local ASNs: 45

IXP
Aqaba IX

5
13

LB
Lebanon
Local ASNs: 146

IXP
Beirut IX

IXP
Advance IX

6
20

2
13

KW
Kuwait
Local ASNs: 71

IXP
IX.KW

7
9

QA
Qatar
Local ASNs: 14

IXP
QIX

3
9

OM
Oman
Local ASNs: 19

IXP
Equinix Muscat

2
6

Source: HE / Source: PeeringDB

Figure 4 shows the number of local peers that connect to the IXPs in their respective countries compared to the number of non-local peers at those IXPs. The number of local ASNs is also mentioned to give an idea of the number of network operators in the countries.

Note: Not all local ASNs MUST be present at IXPs. It is mentioned here to give an idea on the potential size of the local addressable market.

2.3 Cultivating a collaborative knowledge ecosystem

The concept of building communities around IXPs extends beyond the technical aspects. It encompasses the creation of a cohesive and collaborative environment where peers from diverse backgrounds socialise while exchanging thoughts, ideas, and experiences.

Most Internet exchanges around the world engage in some form of information sharing meetups. These events, typically focused on Internet infrastructure developments and IXPs, provide opportunities for in-depth discussions and networking. By bringing together a diverse community of professionals, these events encourage the exchange of ideas and experiences, offering a broader perspective on global IXP trends. The UAE-IX, for example,

organises an annual workshop and peering cruise to allow for more networking opportunities.

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Network Operators' Groups (NOGs)
NOGs are grassroots organisations that bring together network operators, technicians, and professionals from the telecommunications and Internet sectors. They provide a platform for knowledge sharing, troubleshooting, and networking. Active participation in NOGs fosters personal connections and strengthens the IXP community.

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A common approach in the IXP world is that they organise Network Operators' Groups (NOGs) as well as mailing lists and other online forums offering continuous channels for knowledge sharing and support. Participants can seek advice, share troubleshooting tips, and collaborate on technical projects, fostering a sense of belonging and providing a support network for IXP staff.

Sharing best practices, experiences, and insights helps the IXP community learn from one another and adapt to evolving technologies and market dynamics. MENOG, the Middle East Network Operators Group Meeting and Peering Forum, offers a platform for key Internet builders in the region to learn from their peers and other leaders in the Internet community from around the world.

Here are some key areas where sharing best practices and experiences can be particularly beneficial:

→ **Technical Optimisation:** Peers exchange insights on optimising network configurations, reducing latency, and enhancing the efficiency of traffic exchange. Sharing technical best practices ensures that IXPs operate at peak performance.

→ **Security Measures:** Cybersecurity is a top priority in the digital age. Peers regularly collaborate on sharing cybersecurity best practices and strategies to protect IXPs and the broader digital ecosystem from threats.

→ **Technical Assistance:** International organisations, such as the Internet Society (ISOC) and the Packet Clearing House (PCH), among others, provide technical assistance and resources to nascent IXPs. They offer guidance on infrastructure setup, security measures, and operational best practices.

→ **Business Models:** IXPs can learn from successful business models adopted in other regions. Understanding how different pricing structures, revenue diversification strategies, and sustainability measures have worked elsewhere can inform decision-making.

→ **Regulatory Soundboarding:** Government representatives and regulatory bodies can share insights into proposed regulatory approaches capitalising on the collective experience the peers have gained of the local, regional and global peering dynamics.

→ **Advocacy Groups:** Advocacy groups can champion the interests of IXPs within the broader digital ecosystem. They can raise awareness about the importance of IXPs, lobby for supportive policies, and promote the economic benefits of local Internet traffic exchange.

→ **Innovation Initiatives:** Collaboration can extend to innovation initiatives. Research centres, universities, and technology hubs can partner with IXPs to explore emerging technologies, such as 5G, IoT, and cloud computing, and their implications for IXPs and digital transformation.

→ **Capacity Building:** Initiatives focused on capacity building, training, and skills development are instrumental in nurturing talent within the IXP community.

→ **Workshops, seminars, and educational programs** can empower individuals and organisations to contribute effectively to the IXP ecosystem.

It is crucial to acknowledge that while IXPs contribute significantly to digital evolution, they are just one piece of the puzzle. Other enabling factors, including regulatory frameworks, must coexist for these benefits to materialise fully.

To stimulate holistic growth in the digital economy, it is imperative to redefine the role of IXPs as inclusive hubs for all network operators. This inclusive approach encompasses service providers, telecoms, and the dynamic community of startups that bring fresh ideas and innovations to the table, fostering an environment conducive to sustainable growth and innovation in the Middle East's digital landscape.

Redefining IXPs as inclusive hubs is not just about overcoming challenges; it is about unlocking the full potential of the digital era in the Middle East. It is about fostering an environment that encourages agility, adaptability, and innovation. As the region continues to embrace the digital future, a paradigm shift in the perception of IXPs will be pivotal in propelling the Middle East to the forefront of the global digital landscape.

Figure 5:
Cloud, CDN and OTT leaders in IXP participation in the Middle East
Only 100G ports are counted. This data was retrieved on 3 September 2023.

	SAIX RU	JEDIX	Equinix Jeddah	Equinix Muscat	UAE-IX	MN-IX	Number of IXPs	Total Port Capacity
Facebook/Meta				200		100	2	300
Google	200				200	100	3	500
Kaopu Cloud	100	100	100				3	300
Medianova	100	200			100		3	400
Zenlayer	100	100			100		3	300
Edgio		100		100	100		3	300
Amazon					200	400	2	600
Baishan	100	100					2	200
Microsoft					200		1	200
Fastly					100		1	100
Edgeuno	100						1	100
Meteversecloud	100						1	100
ACE CDN		200					1	200
Bigo		100					1	100
Akamai					100		1	100
MBC					100		1	100
Oracle					100		1	100

Source: *Transformation of peering in the Middle East, Bernd Spiess, DE-CIX/UAE-IX, MENOG 23*

3. Attracting global hyperscalers and content providers

The success of IXPs in the region hinges on the active participation of a diverse array of stakeholders. ISPs, content providers, cloud providers, hyperscalers and data centres are central to the peering ecosystem, each playing a unique role in enhancing connectivity, reducing latency and fostering innovation.

Hyperscalers, cloud and content providers, including global tech giants and local content creators, are equally vital to the peering ecosystem. These entities generate and host digital content like websites, applications and streaming services. Connecting to IXPs allows them to deliver content more efficiently to end users within the region, reducing latency and enhancing the user experience. Local content hosting at IXPs further accelerates content delivery, contributing to the growth of digital content industries.
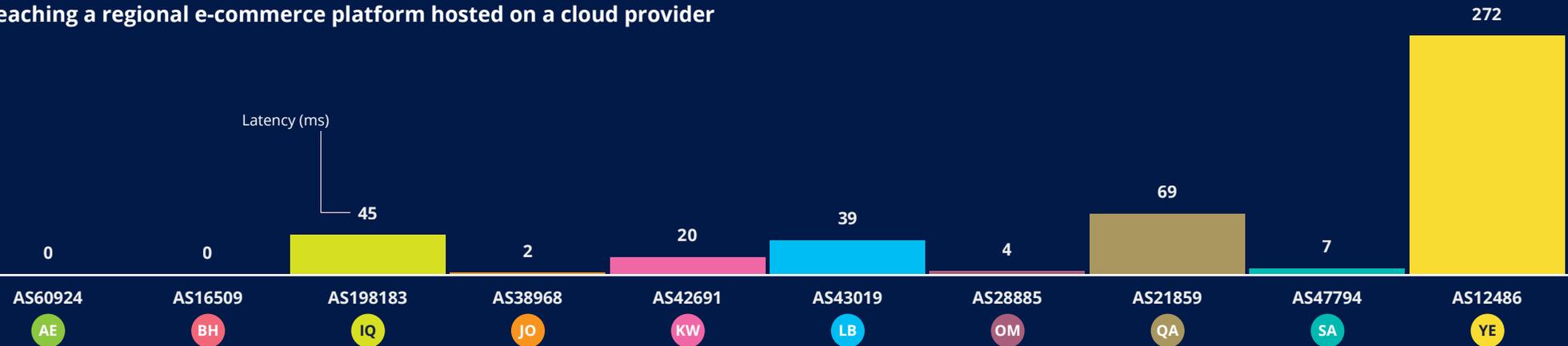
The Middle East has been successful in attracting and hosting hubs for these global players in the region. This not only enhances the region's connectivity and digital capabilities but also supports its goals in becoming a key player in the global digital landscape.

In 2023, cloud providers (AWS, Microsoft and Google) as well as content delivery networks (Cloudflare and Akamai) and over-the-top (OTT) media services (Meta and Shahid) have established peering connections in most of the IXPs in the region. Not all these players are present in all countries at the same time, their distribution reflecting market needs and other commercial and regulatory considerations.

Figure 5 represents the different IXPs in the region where content/cloud providers are present (in different capacities).

Figure 6:
Reaching a regional e-commerce platform hosted on a cloud provider

Latency (ms)

AS60924	AS16509	AS198183	AS38968	AS42691	AS43019	AS28885	AS21859	AS47794	AS12486
0	0	45	2	20	39	4	69	7	272
AE	BH	IQ	JO	KW	LB	OM	QA	SA	YE

Source: RIPE Atlas

A series of measurements (figure 6) were run using RIPE Atlas probes deployed in the Middle East. These tests measured the performance and latency of the connections originating from the probes towards a regional e-commerce platform hosted on a cloud provider that were present in the region.

Out of all the countries in the region, the probes in Qatar and Yemen faced significant delays in reaching this destination. The low latency is the result of having nearby servers or access to those servers in neighbouring countries/locations through inter-regional peering.

Data Centres

Data centres provide the physical infrastructure and colocation facilities required for efficient IXP operation. They serve as neutral meeting points where service, content providers and other network operators can interconnect. Data centres ensure high availability, security and scalability, enabling IXPs to handle increasing volumes of Internet traffic.

Additionally, data centres may offer value-added services, such as cloud hosting and disaster recovery, further enriching the IXP ecosystem.

However, it's noteworthy that in the Middle East, a significant proportion of data centres are owned and operated by telecom companies. Traditionally, IXPs thrive in carrier-neutral facilities, providing an environment where multiple network operators can host their infrastructure without the influence of a single telecom entity. The proliferation of carrier-neutral data centres contributes to a more diversified landscape, offering increased options for hosting, peering, and interconnecting.

This diversity is fundamental for fostering competition, innovation and a resilient digital infrastructure within the region. A recent development in the region is Equinix entering the Middle East market in Oman and the UAE, offering peering and interconnection opportunities for its customers. Encouraging the growth of carrier-neutral data centres is essential for promoting competition, innovation and resilience of the digital infrastructure.

Figure 7:
Measuring interconnections with countries outside the region
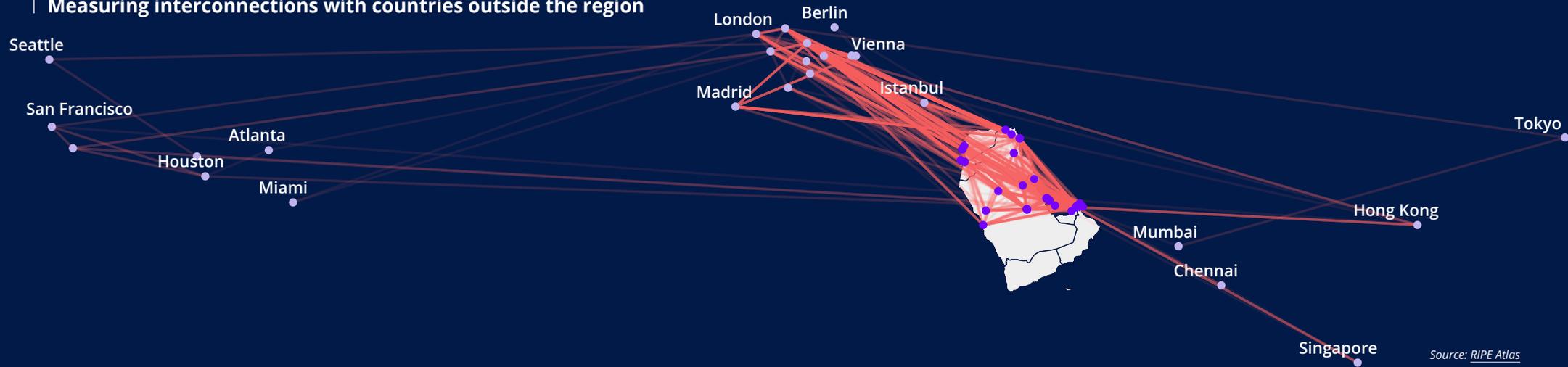
Source: *RIPE Atlas*

4. Becoming a hub for exchanging regional traffic

4.1 Enhancing regional and global digital connectivity

Beyond local improvements, IXPs play a crucial role in improving both regional and global connectivity. Geographically situated at the crossroads between Asia and Europe, the Middle East holds a strategic position as a hub for international data traffic. This unique positioning makes the region increasingly attractive for global investment, collaboration and content distribution.

The trend indicates that global connectivity players are forging partnerships with IXPs in the region in order to extend connectivity across borders, even connecting networks remotely to these IXPs. That is why it is important for carriers to foster economic integration that brings more value for customers.

Enhanced regional connectivity has manifold benefits. It fosters economic integration among neighbouring countries, facilitates cross-border trade and bolsters

the exchange of knowledge and cultural content. It also contributes to disaster resilience, as local data IXPs can continue to function even when international links are disrupted. This proved vital for Internet resiliency in Ukraine after interconnection links were damaged during the war. In March 2022, we measured the paths between all the networks in which we had RIPE Atlas probes. We saw 13 IXPs in these paths. This indicates there were still many active IXPs, which facilitated resilient interconnection.

To better understand the regional landscape, we ran a series of measurements using RIPE Atlas Probes (figure 7) deployed in the Middle East. These included traceroutes between pairs of probes located in different countries. The paths depicted in the traceroutes' results (based on geolocation data) are depicted in figure 7.

Figure 8:
Measuring interconnections with countries outside the region (zoomed in)
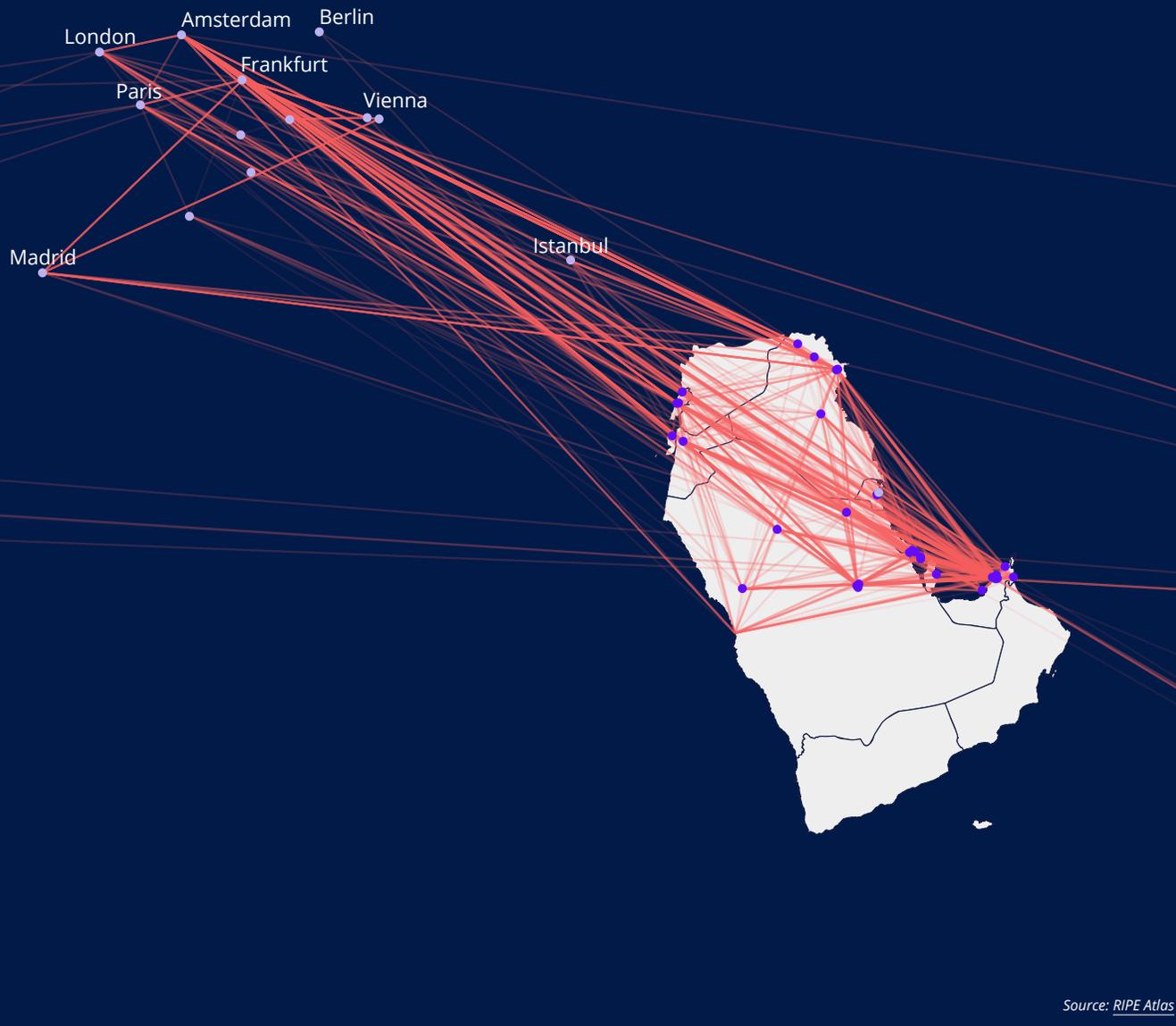
Source: _RIPE Atlas_

A closer look at the region (figure 8) shows more details.

A notable amount of the traceroutes between Atlas probes do pass over an IXP LAN (UAE-IX, SH-IX, SAIX, Manama-IX, JEDIX and Advanced-IX in Lebanon), but we also detect a fair amount of paths leaving the region, some to as far away as Tokyo and San Francisco. There is room for progress in this space.

On a global scale, IXPs in the Middle East contribute to the decentralisation of Internet traffic. This reduces reliance on a few international gateways and mitigates the risks associated with potential chokepoints or network failures. The diversification of global Internet routes leads to greater stability and security for the entire digital ecosystem.

Moreover, enhanced global connectivity has a direct impact on the competitiveness of the region. It positions these nations as attractive destinations for multinational companies seeking strategic data distribution centres. This influx of international businesses brings investments, job opportunities and knowledge transfer, further stimulating economic growth and digital innovation.

This advantage becomes even more significant if there are regional operators peering at IXPs in

Figure 9:

Reaching a gaming platform provider in UAE-IX using an IPv4 destination

Latency (ms)

AS60924	AS16509	AS57908	AS8376	AS42961	AS43019	AS204170	AS42298	AS47794	AS12486
AE	BH	IQ	JO	KW	LB	OM	QA	SA	YE
0	9	39	41	19	151	14	15	12	136

Source: *RIPE Atlas*

neighbouring countries. As pointed out earlier, most of the cloud and content providers have established a presence in the region, however, not all of them are present in all the countries in the region. The more regional operators peer in neighbouring countries, the better the regional latency becomes.

One of the game changers in the landscape of peering and interconnection pioneering IXPs in the region was UAE-IX in Dubai, launched in 2012. This IXP played a key role in changing the paradigm and perception of IXPs in the region, serving as a model other countries later followed. The density of regional telecom companies peering at UAE-IX in Dubai led to a significant decrease in latency in reaching content hosted at the IXP (or even in the UAE by extension) from sources in neighbouring countries. To test this, a series of measurements were run using RIPE Atlas probes deployed in the Middle East. These tests
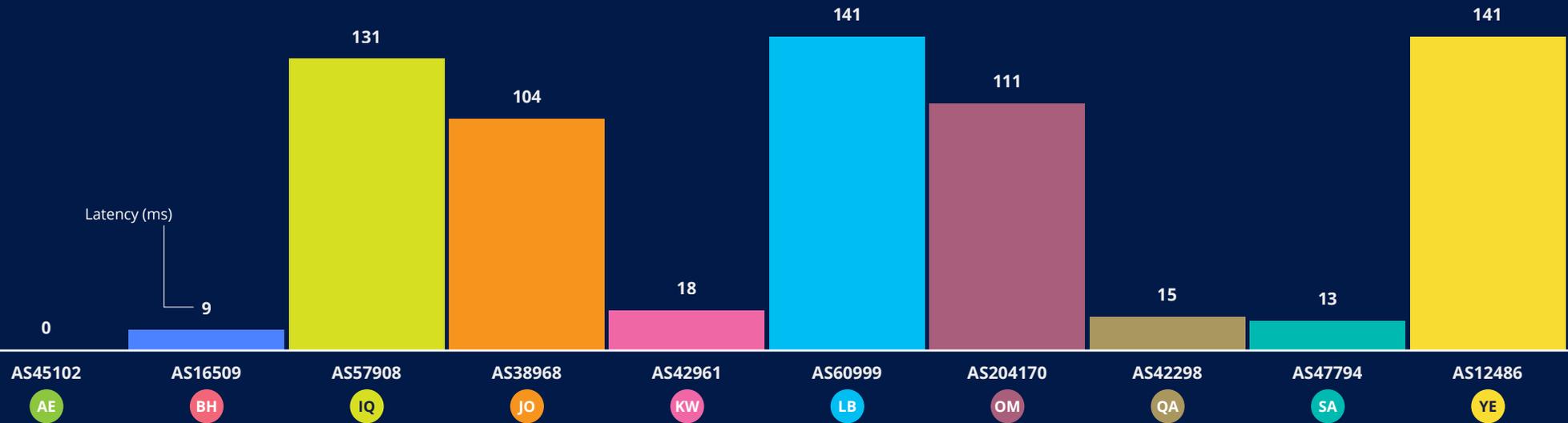
measured the performance and latency of the connections originating from the probes towards certain destinations hosted in regional IXPs.

A quick analysis of this data (figure 9) shows that probes located in Lebanon and Yemen experience considerable delays (around 150 ms) to reach a gaming platform provider, as opposed to probes in Bahrain or Saudi Arabia that only need 9 and 12 ms respectively to reach the same destination. The reason behind this delay is that there are no operators or carriers from Lebanon and Yemen peering at UAE-IX.

Technical collaboration among ISPs is essential for efficient routing and traffic exchange. By working together to optimise network configurations, ISPs and other network operators can enhance the overall performance of IXPs. In

Figure 10:

Reaching a regional streaming platform in UAE-IX using an IPv4 destination

Latency (ms)

AS45102 AE	AS16509 BH	AS57908 IQ	AS38968 JO	AS42961 KW	AS60999 LB	AS204170 OM	AS42298 QA	AS47794 SA	AS12486 YE
0	9	131	104	18	141	111	15	13	141

Source: RIPE Atlas

fact, having a presence at an IXP is not enough on its own to optimise the exchange of traffic. Traffic engineering and shaping techniques, in parallel to mutual agreements between the relevant networks, are needed to optimise the exchange of traffic.

While an earlier measurement test (figure 9) towards a gaming platform provider destination hosted in UAE-IX showed considerably low latencies across probes from eight of the ten countries observed, a similar test (figure 10) towards a regional streaming platform destination hosted in UAE-IX shows low latencies from probes in only five of the ten countries.

5. Summary and future outlooks

5.1 Looking ahead

One trend to anticipate in the Middle East will be increased access to the IXP market. This could take the form of IXP licences being issued that allow for more neutral operators to enter the market.

Countries with large geographical and demographical distribution could see a move towards a distributed IXP platform, where the same IXP operator has an interconnected presence in different cities.

At the same time, more foreign IXP operators will likely establish their own IXPs in the region. There will probably not be the same rate of growth for new IXPs due to the size of the countries in the region and the low density of operators and ISPs.

The need for regional connections is increasing and market pressure is helping to ease certain regulations concerning cross-border connections in the region. This will allow for more players than just the big operators to access resources (e.g. cloud, content providers) in nearby countries. Alongside this, traffic volume exchanged between IXPs will likely increase to meet the demand for content and cloud products. However, these trends could be subject to change if enabling conditions such as supportive regulation are not met.

5. 2 Recommendations from the field

In 2023, as part of the preparations for this report, a survey of IXP operators and managers in the Middle East was done to gather their advice for policy makers on how to ensure successful IXP operations:

→ Collaborate with industry stakeholders to develop a regulatory framework for a dedicated IXP licence. This should take into account the input of network operators and other relevant entities to ensure a holistic and well-balanced approach.

→ Establish open participation and peering policies that welcome all networks, regardless of size or scope, to peer at IXPs. Removing restrictions on network eligibility fosters a more inclusive environment, encouraging a diverse array of participants and promoting a richer exchange of data.

→ Reduce pricing for connectivity services directly related to connections leading to the IXP. This approach aims to alleviate financial barriers, making it more cost-effective for networks, especially small and medium-sized enterprises, to peer at exchanges.

→ Introduce Digital Free Zones designed to attract foreign businesses and tech players. These zones can offer favourable regulatory environments, tax incentives and streamlined processes, creating an attractive ecosystem for international companies to establish a presence in the country.

→ Promote the development of carrier-neutral data centres that are easily accessible and offer cost-effective solutions for IXP participants. This neutrality ensures fair competition among participants at IXPs, fostering an environment where networks of all sizes can connect and exchange data without facing undue biases or restrictions.

→ Encourage private sector investments in carrier-neutral data centres by offering incentives such as reduced regulatory hurdles or other financial benefits. This approach stimulates the growth of a competitive market for data centre services, ensuring a diversity of options for IXP participants.

→ Conduct regular assessments to gauge the impact of existing policies on IXPs. Solicit feedback from IXP service providers to evaluate the effectiveness of current regulations and identify areas for improvement, ensuring that policies are adaptive and responsive to the rapidly changing nature of the digital ecosystem.

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