CONNECTING TO THE CLOUD: COST OF THE LAST MILE

A Gulf Cooperation Council (GCC) Review

White Paper Series

Connecting to the Cloud: Cost of the Last Mile
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About this report

The report lays out the results of a study undertaken by the MENA Cloud Alliance (MENACA) on the impact of last mile connectivity costs on cloud adoption in the GCC.
MENA Cloud Alliance is a neutral industry association with a focus on accelerating cloud adoption in the Middle Eastern & North African region. We encourage all regional and international stakeholders to contribute to this work by providing feedback.
To learn more about our works in this space, please visit **www.menacloud.org** .

Advanced global economies are marked by competitive and dynamic markets in sectors such as finance and telecoms. In recent years, IT and technology including cloud availability and usage have emerged as an equally important strategic measure. For this reason, any factor considered as an inhibitor to the adoption of the cloud must be viewed with concern and fully understood in order to try to mitigate the impact.

The Connectivity Working Group, a subcommittee of the MENA Cloud Alliance, has long held the view that whilst several factors impact the pace of cloud adoption in our region, one of the primary inhibiting influences in the GCC could be the cost of connectivity. This report lays out the results of a study commissioned to explore this matter in depth using both qualitative and quantitative research.

Andrew Grenville
Chairman - Connectivity Working Group,
MENA Cloud Alliance
CEO - Orixcom

The report highlights that there is indeed a significant negative impact from the cost of connectivity on cloud adoption in the GCC. We provide a breakdown of the main contributory factors and suggest where action is required across commercial areas, policy & regulatory, and competitive technology innovation. Doubtless, there is more detailed work to be done and further conclusions to be drawn in this important area, and we would welcome comments, input, and engagement from all relevant and interested stakeholders.

The Connectivity Working Group has a remit to promote and enhance the adoption of cloud in the region by ensuring suitable connectivity exists for cloud services (both in-country and international). As a neutral body, we bring together industry experts to provide thought leadership around best practices and make available a forum for informed debates.

EXECUTIVE SUMMARY

The challenge

The importance of cloud computing as an enabler for digital transformation has long been discussed and proven. However, as transformative as the cloud is, it requires a high quality, reliable and affordable underlying infrastructure to be able to live up to its true potential. For the past few years, MENA Cloud Alliance (MENACA) has been engaging major cloud ecosystem stakeholders including enterprises in a series of dialogues to understand local pain points and in turn address those issues with the help of the community. Connectivity prices have long been deemed expensive in our region compared to those in Europe or North America, and in various conversations with cloud customers as well as cloud service providers, a pattern started to emerge. Most businesses require dedicated connectivity - commonly called the ' last mile' connectivity - from their premises to cloud service providers. Suppliers of this last mile connectivity are telecoms companies and other service providers who can provide the required bandwidth and service-level agreements (SLAs). We noticed that extremely costly last mile connectivity options slowed down or even completely stalled cloud migration and consequently digital transformation projects. The recurrence of this theme in our interactions with the community prompted MENACA to investigate the issue further.

The approach

To identify the underlying factors contributing to the problem, MENACA's Connectivity Working Group began to conduct a region-wide survey as well as a series of in-depth interviews with major cloud buyers, providers and consultants to gauge the ecosystem sentiment and to gather first-hand local intelligence on issues pertaining to the cost of connecting to the cloud. MENACA also invited member organisations to provide relevant insights, reviewed existing literature and data points on the subject and reached out to major incumbent telecom providers across the region in an effort to identify the root cause of the disproportionally expensive cloud connectivity options across our region.

The simulation

We dissected the enterprise cloud connectivity journey into four distinct cost components i.e. last mile, direct connect port, egress traffic and cloud service. Using data gathered from telecoms companies and major cloud service providers with a presence in the region, we then developed a cloud Total Cost of Ownership (TCO) model. To present a realistic picture, the model assumes typical cloud and connectivity demands among large, medium and small organisations within the GCC and then calculates what the total spend would be in the region compared to the cost of similar services in Western Europe.

The impact

The GCC countries have ambitious plans to transform their economies through digital technologies, but cloud adoption in the GCC is lagging with IT spending still heavily geared towards on-premise IT compared with other regions of the world: ~50% of IT on-premise in the GCC vs a 25% average globally. Our investigation reveals that the cost of connectivity hinders cloud adoption in the GCC. The last mile connectivity cost is not only delaying cloud adoption and digital transformation, but ultimately putting at risk GCC countries' ambitions to transform their economies through digitisation.

The available literature illustrates that whilst the GCC benefits from International connectivity, with 39 submarine cables landing in the Middle East connecting the region to Asia and Europe, its connectivity is amongst the most expensive in the world. GCC organisations with a typical cloud demand spend up to 77 times more in connectivity than similar organisations in Western Europe.

We found out that the industry overwhelmingly regards the high cost of last mile connectivity as a hurdle in its digitisation journey. We also realised that there is low awareness within the ecosystem when it comes to the proportion of budgets that should be allocated to acquiring connectivity to the cloud from the incumbent operators compared to the cost of cloud services provided by cloud service providers.

Our cloud TCO model also highlights that connectivity represents 35% of the TCO for large, 22% for medium, and 16% for small organisations. In comparison, organisations in Western Europe with the same cloud demand only spend 1-2% on last mile connectivity. As a result, GCC organisations pay a premium to access the cloud, which depending on the connectivity needs, ranges from 22% to 61% more than they would pay in Western Europe.

The solution

Going forward, the GCC can break the connectivity bottleneck through a combination of policy & regulatory, commercial, and technology innovation. Telecom operators can unlock cloud adoption by launching distinct cloud access connectivity products at a discounted price (commercial innovation). This requires enabling policies and regulations that carve out connectivity to cloud from standard connectivity solutions (policy & regulatory innovation). In parallel, there is also a need for enhanced awareness of innovative technology solutions from alternative service providers using for example SD-WAN, which can alleviate the cost of connectivity (technology innovation).

MENACA and its membership are keen to engage with the telcos and policy makers to find a solution to the last mile connectivity issue. The alliance also, on behalf of the cloud industry, welcomes the opportunity to receive more feedback from the ecosystem and to work with different stakeholders toward more cloud adoption in our region.

GCC governments have put in place ambitious strategies to transform their economies through digitisation and diversify away from hydrocarbon-based resources. Saudi Vision 2030, UAE Vision 2021, Bahrain 2030 for instance, are placing Digital Transformation (DX) at the core of their strategy. Government-led DX projects, combined with high Internet usages from a young population,[1] translate into a high level of IT spending growing by CAGR 2.4% before the Covid-19 crisis. Covid has shown the importance of building resiliency through digitisation, thus resulting in an acceleration of IT spend growth by 2-3 times in sectors such as Education, Healthcare, Media, and Financial Services. As a result, IT spending on GCC markets is expected to increase by CAGR 4% from $16.5B in 2019 to $20B in 2024.[2] Within IT, public cloud spending is expected to more than double value by 2024, growing from $956m in 2020 to $2.35bn at a 25% CAGR.[3] GCC public cloud growth is slightly below the global growth rate for public cloud estimated at 26% in 2019.[4]

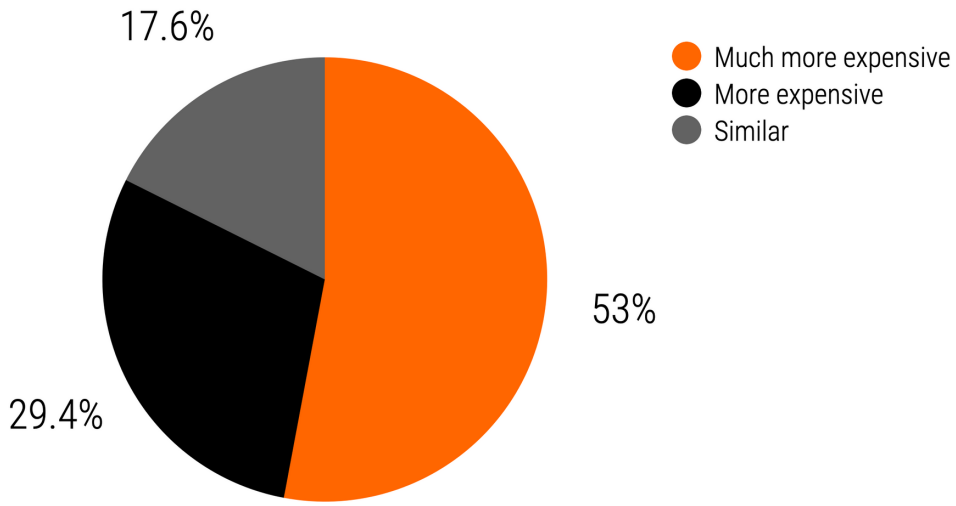
One would expect an above-average growth of public cloud spend in GCC, considering that spending in the cloud in the GCC is starting from a very low base with ~50% of IT on-premises in the GCC vs a 25% average globally. Still, investments in on-premises IT are continuing to increase by 1.1% per year in the region.[5] There are multiple reasons that explain the lag in public cloud adoption in the GCC. This report focuses on the impact of the last mile connectivity costs.

While the GCC benefits from advanced connectivity infrastructures, lack of competition and access regulation results in prices amongst the highest in the world, up to 77 times more expensive for reference domestic connectivity products, and 8 times more expensive on GCC international connectivity routes than transatlantic routes.

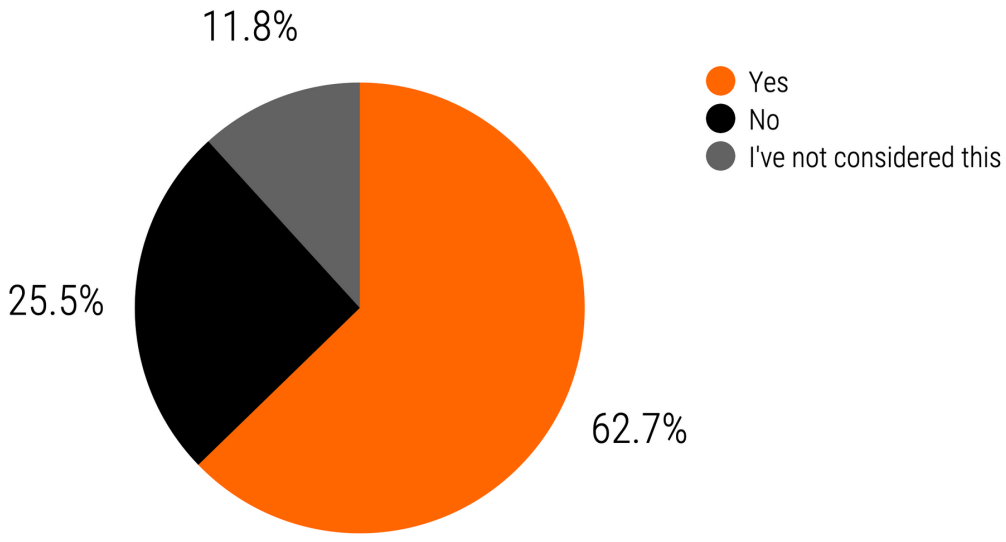
This section presents the highlights of a survey conducted by MENACA to gauge the industry sentiment on GCC connectivity costs. The survey results are complemented with perspectives from experts who were interviewed for this study.

Respondents from five GCC countries: the UAE, KSA, Oman, Qatar & Bahrain participated in our survey. These are individuals with intimate knowledge of cloud infrastructure who hold related positions in large and medium-sized enterprises. For more details on the survey, please refer to Appendix I at the end of this document.

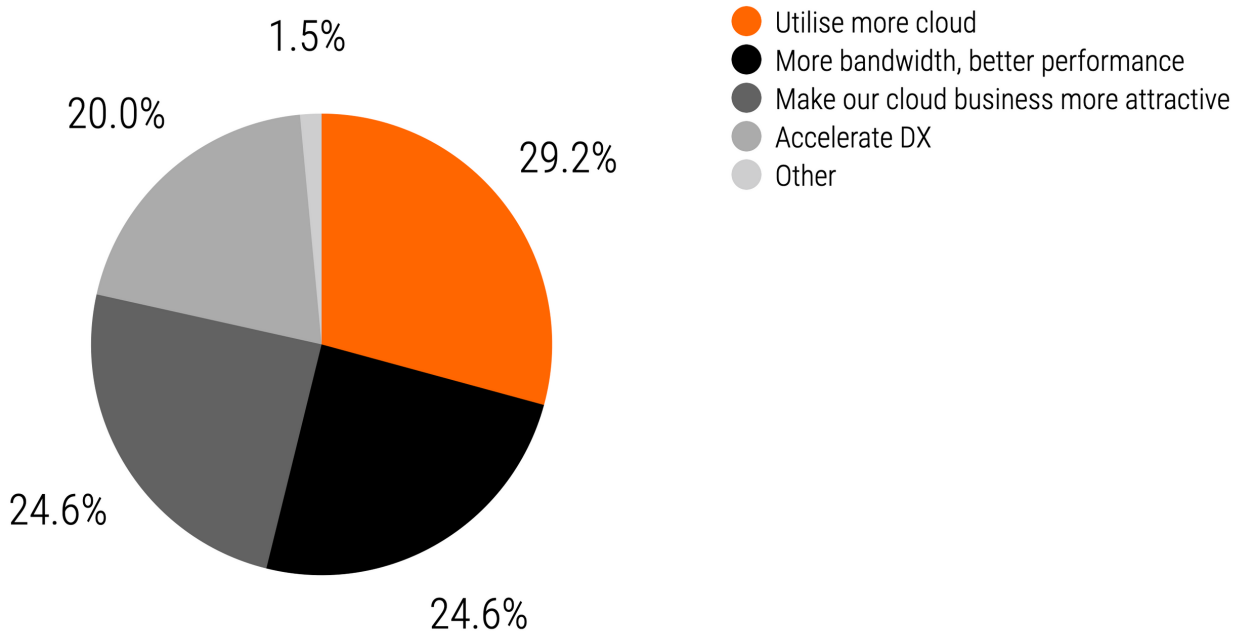
Q. How would you say that the cloud connectivity cost in the GCC compare with that of other regions in the world?



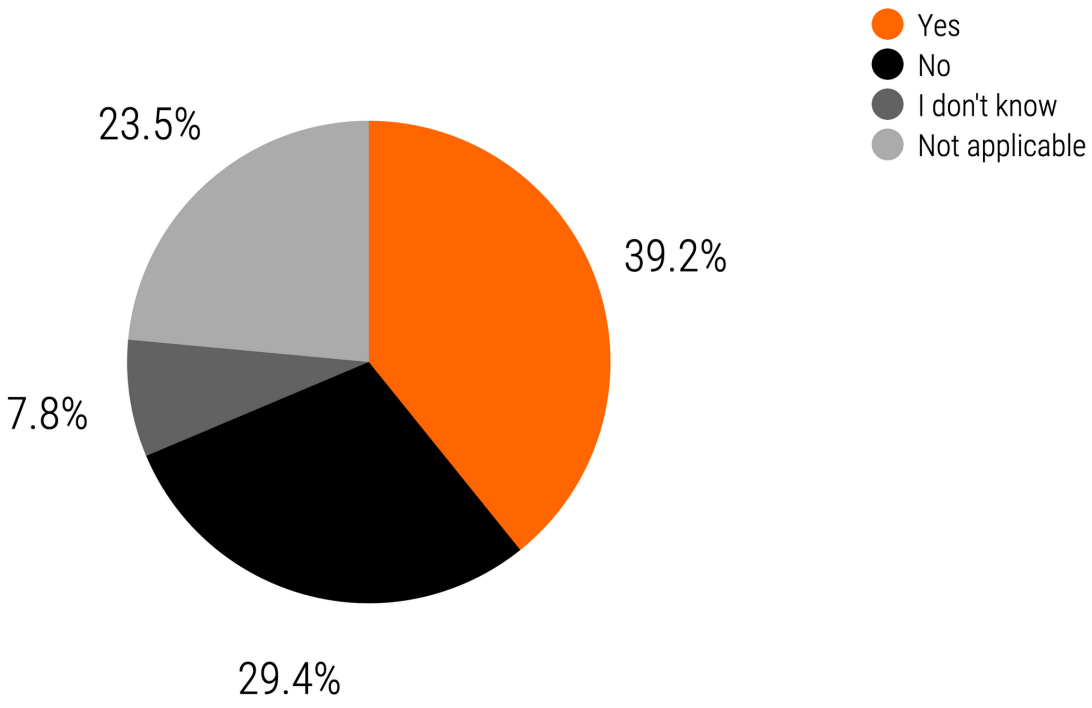
Q. Are the current cloud connectivity costs preventing migration from on-premises IT to cloud services?



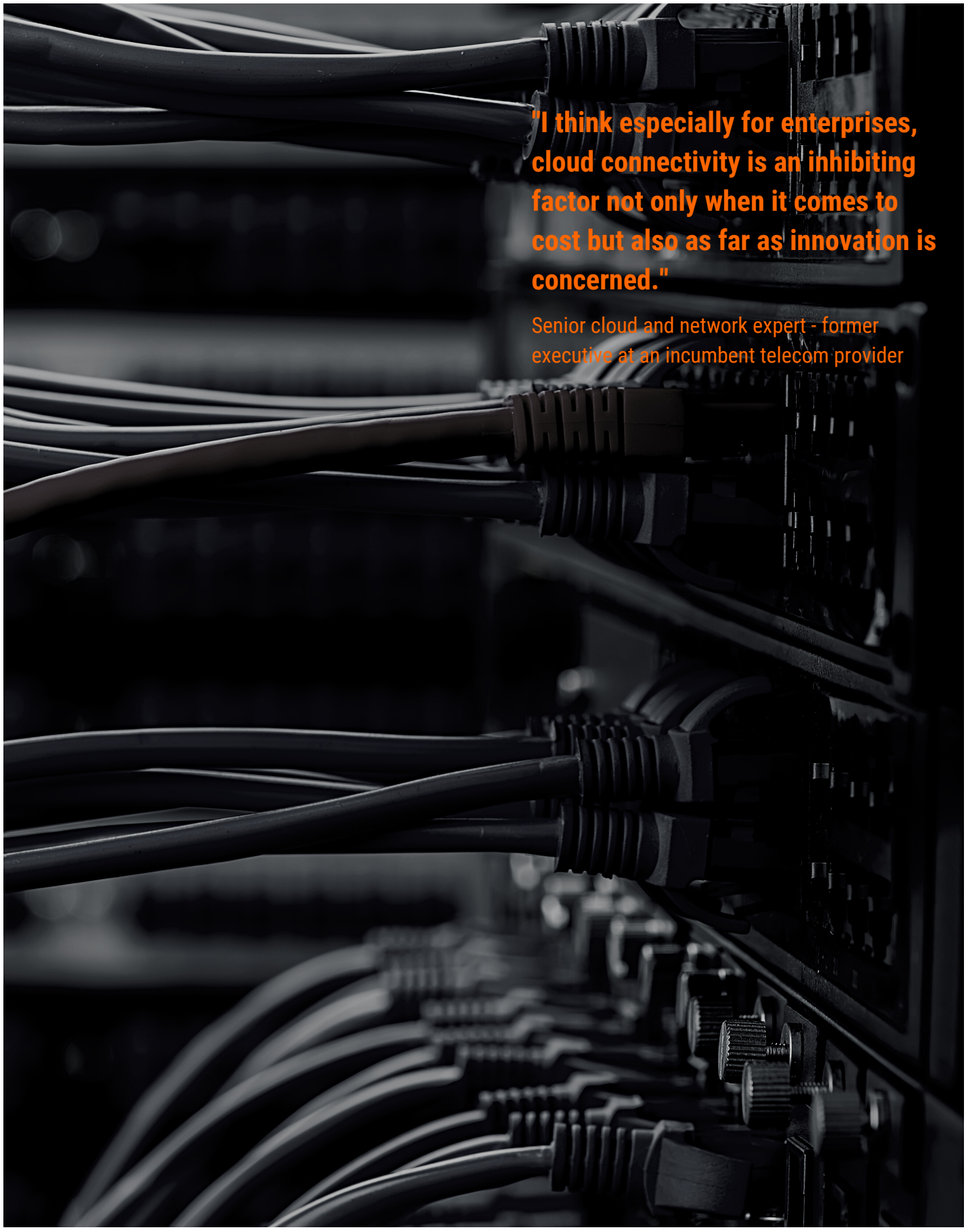
Q. If cloud connectivity costs were less expensive than they currently are, how would that benefit your IT / Digital Strategy?



Q. In the past 24 months, have you had to delay or cancel a digital transformation or cloud adoption project due to the high cloud connectivity costs?



N: 51 - MENACA Survey Q1 2021



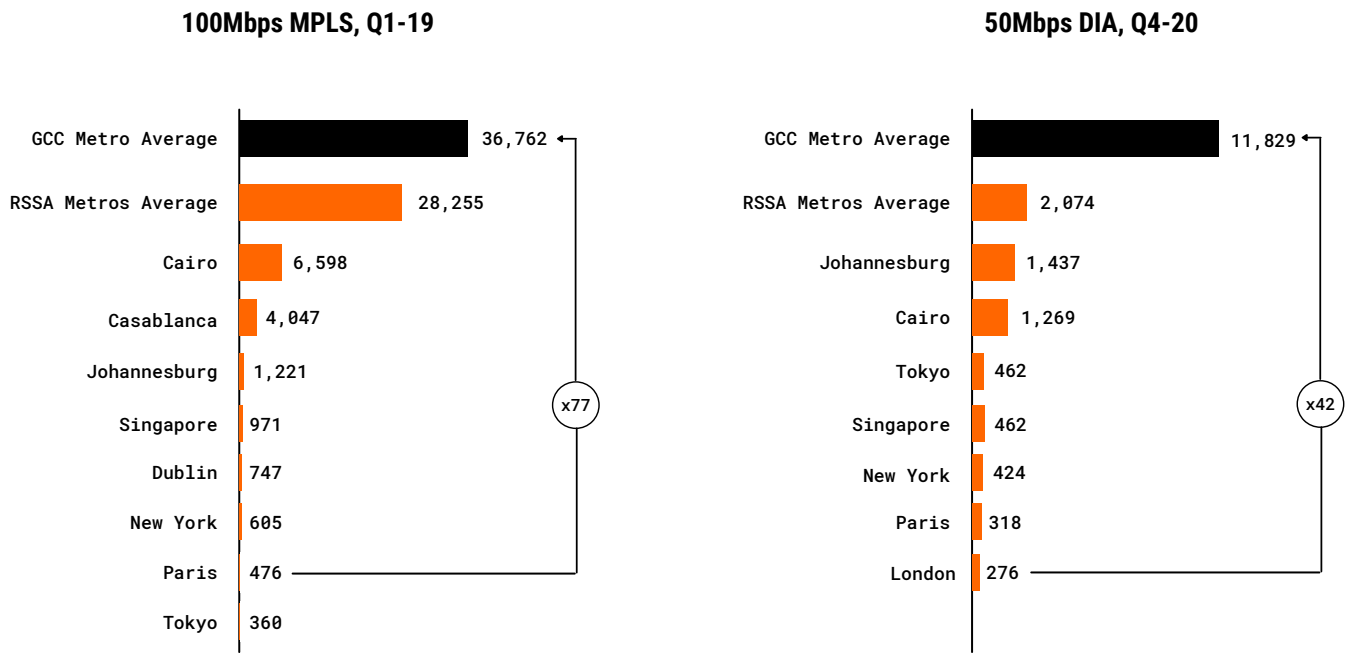
"I think especially for enterprises, cloud connectivity is an inhibiting factor not only when it comes to cost but also as far as innovation is concerned."

Senior cloud and network expert - former executive at an incumbent telecom provider

Domestic Connectivity

The GCC provides world-class domestic broadband networks, with both UAE and Qatar ranking respectively 1st and 2nd in terms of FTTH penetration.[6] Telcos in the region are also leading globally in next-generation mobile broadband with 5G already commercially launched in the UAE and KSA. Yet lack of competition and access regulation remain an issue and result in high retail prices.[7] According to a Deutsche Bank study, Dubai in the UAE ranks as the city with the highest Internet price in the world; followed in the GCC by Riyadh ranking 8th – other GCC countries are not included in the ranking. For enterprise connectivity, a range of products is available including business broadband, Dedicated Internet Access (DIA), or MPLS Fast Ethernet. In GCC urban areas, an MPLS 100Mbps connectivity has a Median Monthly Recurring Cost (MRC) of $36,762 in H1-19, i.e., up to 77 times; DIA in the GCC has a median MRC of $11,829, i.e. up to 42 times more expensive than in Western Europe (Figure 1).

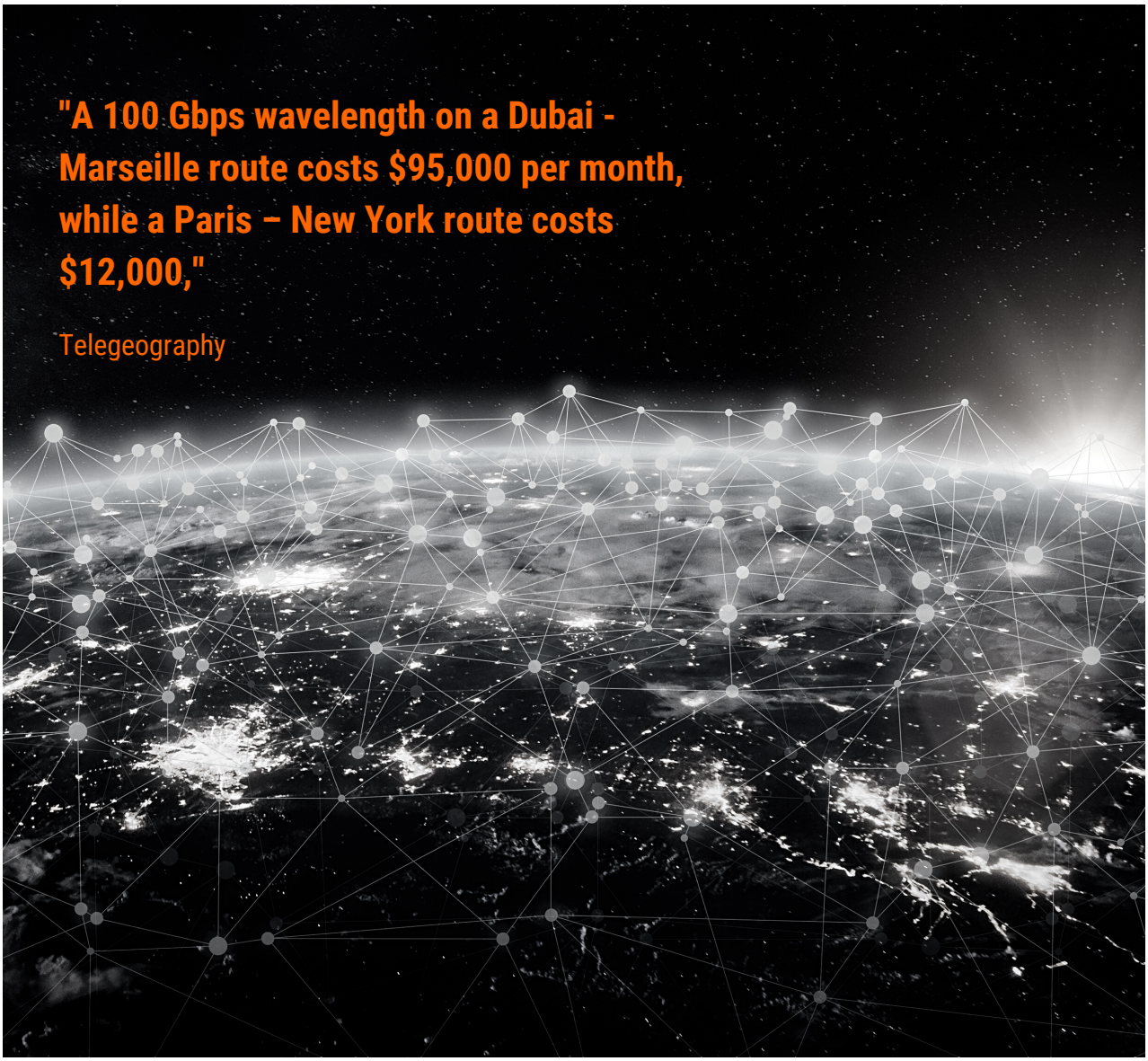
Figure 1: Median MRC of Last Mile Connectivity Products in GCC vs Rest of the World, in US$



Source: MENACA Intelligence

International Connectivity

The GCC benefits from unparalleled international connectivity, with 39 submarine cables landing in the Middle East and connecting the region to the US, Asia, and Europe. Submarine connectivity in the GCC is complemented by terrestrial connectivity such as the Middle East –Europe Terrestrial System (MEETS), which connects Kuwait, Saudi Arabia, Bahrain, Qatar, and the UAE. Yet, as mentioned earlier the lack of local competition and access regulation on international gateway markets translate into excessive prices. Routes from GCC to Europe are reported to be 8 times more expensive than transatlantic routes. For instance, a 100 Gbps wavelength on a Dubai - Marseille route costs $95,000 per month, while a Paris – New York route costs $12,000.[8] New capacity from SeaMeWe-5 (Dec 2016) and AAE-1 (June 2017) resulted in a price decrease in 2017, but since then prices have been relatively stable but still high.



CLOUD TOTAL COST OF OWNERSHIP (TCO) MODEL

As part of this study, and with support from the cloud industry, the MENACA developed a Cloud TCO Model to highlight the relative contribution of the last mile connectivity cost to overall cloud TCO. This section provides an overview of the technical components of cloud access & the results of the TCO model.

Components of Cloud Access

The MENACA TCO model identifies the four components an organization requires to access the cloud service of a typical Cloud Service Providers (CSP) (Figure 2). Each CSP has its own specificities and standards, yet the components and their pricing structure are broadly consistent:

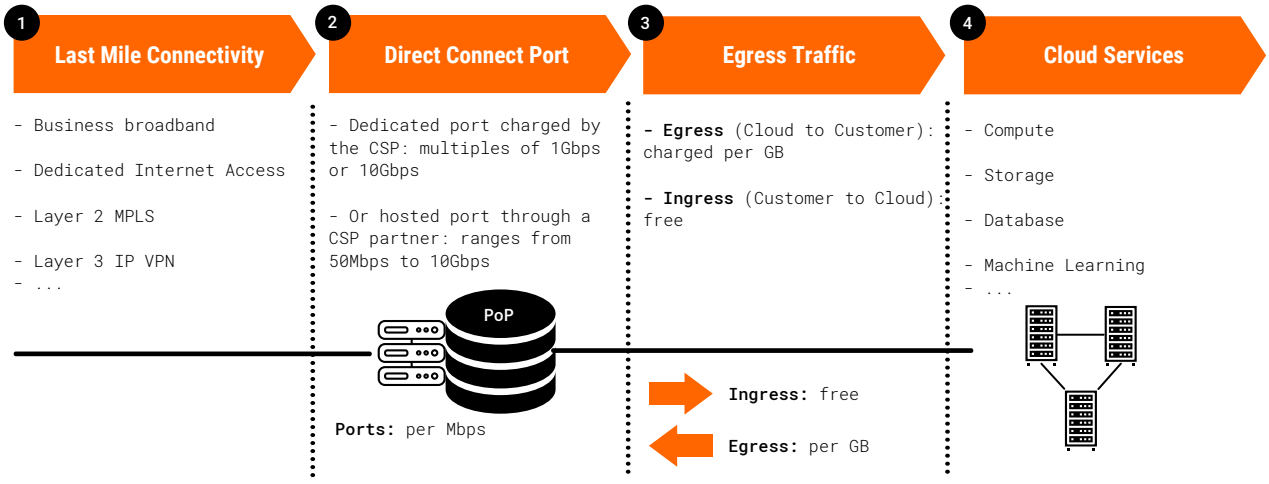
(1) **Last mile connectivity**. This is from the enterprise's premises to the Point of Presence (PoP) of the CSP. Depending on the size of the enterprise and constraints in terms of latency and bandwidth, the enterprise might utilise either standard business broadband or dedicated links with guaranteed SLAs, e.g. layer 2 MPLS or Layer 3 IP VPN. These connectivity products are charged by the local Telco or Carrier to the organization. Costs are dependent on the bandwidth and SLA requirements;

(2) **Direct connect port**. This is charged by the CSP and consists of a port charge (capacity and hour of use). The port can be dedicated in which case it is usually offered at 1Gbps or 10Gbps, or hosted through a partner dedicated interconnection, in which case the access to the port is provided from 50 Mbps to 10Gbps increments;

(3) **Egress traffic**. CSPs use international capacity acquired from carriers to carry cloud traffic between their PoPs and data centers. The CSPs charge the enterprise per GB of egress traffic, i.e., the traffic downloaded from the CSP data center to the organization. CSPs do not charge for the ingress traffic, i.e., the traffic uploaded from the organization to the CSP data center;

(4) **Cloud service**. Computing, storage, database service, each with their own pricing but usually usage based.

Figure 2: Cloud Access Components



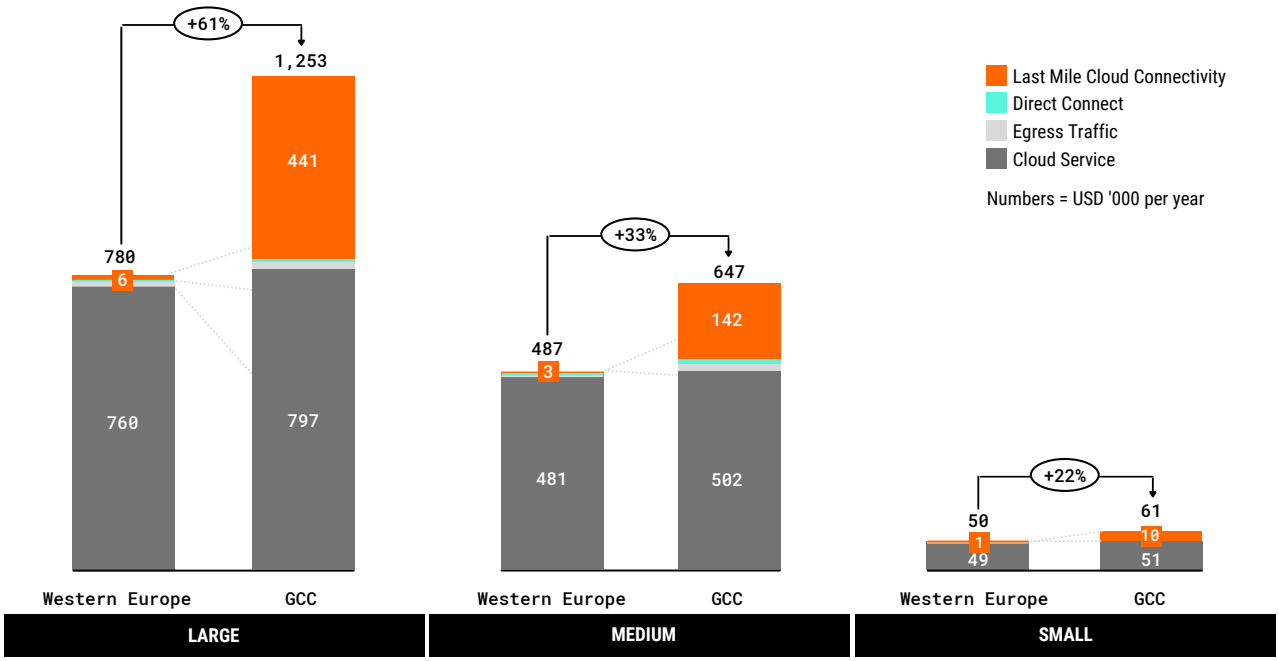
TCO Model Results

The TCO model considers three alternative sizes of organisations with representative cloud and connectivity demands: large organisations with a demand requiring 100Mbps symmetric guaranteed connectivity, medium organisations with a demand requiring 50Mbps symmetric DIA, and small organisations requiring asymmetric business broadband with no guaranteed bandwidth. We modeled the TCO for each size of GCC organization and compared it with the TCO that the same organization would face in Western Europe, to illustrate the relative impact of the last mile connectivity costs. Since the purpose of the model is to obtain a benchmark that is representative of the cloud industry, we averaged the TCOs calculated for three large CSPs with a presence in the GCC, i.e. AWS, Microsoft, and Oracle. To arrive at realistic figures, the model uses a series of assumptions. (See Appendix II for details)

The results highlight that organisations pay a significant premium to access cloud services in the GCC vs Western Europe, and that this premium increases with the cloud demand (Figure 3):

- For **large organisations** in the GCC, connectivity represents 35% of the TCO whereas it represents 1% of the TCO for the same organization in Western Europe. As a result, the GCC large organizations pay a +61% premium to access the cloud;
- For **medium organisations** in the GCC, connectivity represents 22% of the TCO whereas it represents 1% of the TCO for the same organization in Western Europe. As a result, the GCC medium organisations pay a +33% premium to access the cloud;
- For **small organisations** in the GCC, connectivity represents 16% of the TCO whereas it represents 2% of the TCO for the same organization in Western Europe. As a result, the GCC small organisations pay a +22% premium to access the cloud.

Figure 3: TCO Model Results



Limitations & Mitigation Methods

When collecting primary and secondary data, and as we conducted our TCO analyses, there were a number of limitations that our Connectivity Working Group had to mitigate throughout this work. These challenges included heterogeneous terminology use, data unavailability and inconsistency, and limited general awareness in the industry. MENACA designed specific methods and approaches to mitigate all these limitations and continues to welcome feedback from the ecosystem on our findings to continuously improve this study. (For a complete list of limitations and our mitigation methods see Appendix III)

RECOMMENDATIONS

The study highlights that the cost of connectivity hinders cloud adoption in the GCC. The TCO model shows that, in the GCC, the last mile connectivity represents a disproportionate share of the costs incurred by organisations to migrate from on-premise to the cloud (up to 35% for large organisations). The survey and expert interviews confirm the industry sentiment that the cost of the last mile connectivity in the GCC is hindering migration to the cloud, and is ultimately delaying digital transformation projects.

The liberalisation of GCC telecom markets started in the early 2000s, driven by the World Trade Organization (WTO) requirements for its members to open up telecom markets by 2005. Over the last 15 years, GCC countries have gradually opened their telecom markets, yet with a light-touch regulatory approach so as to avoid destructive competition and preserve industry margins. The GCC regulatory approach enabled governments to: 1) achieve global leadership on next-generation broadband infrastructures roll-out, with UAE and Qatar ranking respectively 1st and 2nd in terms of FTTH penetration; and 2) protect the telecom industry revenues, which are a major contribution to the budget of most GCC countries – either through the state ownership in local Telcos or through the taxes and royalties fees charged on Telcos.

However, the downside of telecom protectionism in the GCC is that fixed connectivity costs have remained very expensive compared with other regions. As shown in the study, connectivity cost in the GCC is a major impediment to cloud adoption and digital transformation. **As GCC governments are embarking on ambitious plans to transform their economies through digitisation, and considering the importance of cloud in digital transformation, it is becoming critical for the GCC to review their policy approach to cloud connectivity**.

MENACA believes that there is a path forward in the GCC to break the connectivity bottleneck for access to the cloud while continuing to encourage investments and preserving a healthy telecom industry. This path requires a combination of **policy and regulatory**, **commercial,** and **technology** innovation:

- **Policy and regulatory innovation**: unlocking access to the cloud starts with a change in policy to recognise that connectivity to the cloud is essential to the digital transformation ambition and as such warrants regulatory treatment distinct from standard connectivity. As part of their regular market reviews, regulators need to encourage separate connectivity products for cloud access, and accordingly allow offers from Telcos that provides connectivity to the cloud at attractive rates compared with standard connectivity products;

- **Commercial innovation**: Telcos typically offer one-size-fits-all connectivity products, whether connectivity is an on-ramp to cloud infrastructure, for accessing a remote site, or for Internet access. There is an opportunity for local Telcos to launch tailored products for cloud connectivity with pricing and SLAs that address the specific needs of organisations migrating

on-premise IT to cloud. For instance, instead of a typical “100Mbps Fast Ethernet” last mile product, Telcos could launch a “100Mbps Fast Ethernet Cloud Access”. This would allow Telcos to sell more connectivity as well as the cloud services associated with it, since the Telcos are often resellers of cloud services;

- **Technology innovation**: there are viable alternative technologies such as SD-WAN to access the cloud compared to the typical connectivity solutions offered by local licensed Telcos. But as evidenced by the survey, there is a lack of awareness of both the alternative technologies and the service providers offering these services. This is exacerbated by the local licensed Telcos natural advantages due to protectionism, highly leveraged customer relationships, uncertainty around regulation and the perceived risks of alternatives. Hence despite the fact that several of the CSPs themselves recommend these highly cost-effective alternative technology service providers, the default option for cloud connectivity in this region often becomes the local licensed Telcos. Breaking this cycle and letting healthy competition into the cloud connectivity market requires the alternative providers to be much more effective in their marketing to raise awareness amongst users.

MENACA hopes that the GCC policymakers will find this contribution useful, and welcomes the opportunity, on behalf of the cloud industry, to explain our views in greater depth and discuss how to implement our recommendations in practice.

APPENDIX I. SURVEY QUESTIONS

Questions	Answers
1. How would you say that the Cloud Connectivity cost in the GCC compare with that of other regions in the world?	Much more expensive
	More expensive
	Similar
	Cheaper
	Much cheaper
	I don't know
2. What proportion of your organisation's own IT requirements are currently provided by cloud infrastructure?	None
	Less than 10%
	More than 10% but less than 50%
	More than 50% but less than 70%
	Over 70%
	I don't know / does not apply to me
3. Have you previously done a Total Cost of Ownership (TCO) assessment for consuming cloud services?	Yes
	No
	I don't know
	Not applicable
4. What proportion of your total cloud spend is related to the Last Mile costs?	Under 20%
	More than 20% but less than 40%
	More than 40% but less than 60%
	More than 60% but less than 80%
	Over 80%
	I don't know
	Other (please specify)
5. What proportion of your total cloud spend is related to the Cloud Egress costs?	Under 20%
	More than 20% but less than 40%
	More than 40% but less than 60%
	More than 60% but less than 80%
	Over 80%
	I don't know
	Other (please specify)
6. If Cloud Connectivity costs were less expensive than they currently are, how would that benefit your IT / Digital Strategy? [choose any applicable]	Increase the bandwidth for better performance
	Accelerate our digital transformation
	Utilise more cloud services
	Make our cloud business case attractive
	Other (please specify)
7. Is the current Cloud Connectivity costs preventing migration from on-premises IT to cloud services?	Yes
	No
	I've not previously considered this
8. In the past 24 months, have you had to delay or cancel a digital transformation or cloud adoption project due to the high Cloud Connectivity costs?	Yes
	No
	I don't know
	Not applicable

APPENDIX I. SURVEY QUESTIONS

Questions	Answers
9. Name any available suppliers of Cloud Connectivity in your country/countries of operation. (name at least 1 or up to 5 suppliers in your order of preference)	Supplier 1
	Supplier 2
	Supplier 3
	Supplier 4
	Supplier 5
10. Apart from your chosen answers in the previous question, are you aware of any alternative Cloud Connectivity suppliers?	Yes
	No
	I've not previously considered this
11. Do you expect to see Cloud Connectivity prices decreasing significantly in the next 1-3 years?	Very likely
	Likely
	Neither Likely nor unlikely
	Unliklely
	Very unlikely
12. What technologies would you consider suitable for Cloud Connectivity?	MPLS
	SASE (over the standard internet)
	Synchronous internet (DIA or internet leased line)
	IP-SEC
	Asynchronous internet (broadband)
	SD-WAN (over internet)
	I don't know
	Other (please specify)
13. What factors are impeding Cloud Connectivity cost reduction?	Margin pressure in providers
	Lack of competition
	Lack of regulatory pressure
	Lack of demand
	Other (please specify)
14. Do you have any other comments?	

APPENDIX II. TCO MODEL ASSUMPTIONS

This section details the assumptions for each of the components of the TCO (summary on Figure 4)

(1) Last mile connectivity

***Large Organisations**. The model assumes a layer 2 MPLS last mile connectivity (Fast Ethernet) with a symmetric guaranteed bandwidth of 100Mbps. While 100Mbps might be low for large organizations in Western Europe, it is representative of medium to large organizations in the GCC. For the pricing of connectivity products, the report uses an average of the median MRCs provided by MENACA Intelligence for the 0-5km FastE Product as of H1-19. The model calculates average costs for both GCC (Bahrain, Kuwait, Qatar, UAE, and KSA for which data points are available) and Western Europe.*

***Medium Organisations**. The model assumes a DIA product with a symmetric bandwidth of 50Mbps. Unlike for layer 2 MPLS connectivity, DIA's bandwidth is not guaranteed; the model assumes a contention ratio of 80% (average bandwidth available / peak bandwidth offered). For the pricing of connectivity products, the report uses an average of the Median MRCs provided by MENACA Intelligence for the 0-5km DIA 50 Mbps Product as of Q4-20. The averages are calculated for both GCC (Bahrain, Qatar, UAE, KSA for which data points are available) and Western Europe.*

***Small Organisations**. The model assumes an asymmetric business broadband connectivity product such as 500Mbps/50Mbs. Those products are, by design, not guaranteed bandwidth. The model assumes a contention ratio of 10%. The TCO price inputs used for GCC and Western Europe are representative of the publicly available prices from Telcos in each region.*

Figure 4: Last Mile Connectivity Assumptions

		GCC			Western Europe		
		LARGE	MEDIUM	SMALL	LARGE	MEDIUM	SMALL
1 Last Mile Connectivity		Layer2MPLS, 100Mbps	Symmetrical Dedicated Internet Access	Business Broadband, asymmetric 500/60	Layer2MPLS, 100Mbps	Symmetrical Dedicated Internet Access	Business Broadband, asymmetric 600/60
Product		FastE	50Mbps	Mbps	FastE	50Mbps	Mbps
Bandwidth	Mbps	100	50	10	100	50	10
Annual Connectivity Cost	$ per year	441,143	141,957	9,600	5,708	3,311	840

(2) Direct connect port

The model assumes port sizes commensurate to the last mile connectivity bandwidth for each organization size, i.e. 100Mbps for large organizations and 50Mbps for medium organizations. Small organizations would typically not purchase direct connect but instead connect to the CSP through Internet best effort; as such the model assumes small organizations do not carry direct connect costs. Price ports are charged per hour with a typical value of $0.06 per hour for a 100Mbps port and $0.03 for a 50Mbps port. The model multiplies the hourly prices by the number of hours in a month, i.e. 730 hours.

The large global CSPs use different product names for this service element, such as ExpressRoute for Microsoft, Direct Connect for AWS and Fast Connect for Oracle.

Figure 5: Direct Connect Assumptions

		GCC			Western Europe		
		LARGE	MEDIUM	SMALL	LARGE	MEDIUM	SMALL
2 Direct Connect							
Port Size	Mbps	100	50	-	100	50	-
Price Per Hour	$ per hour	0.06	0.03	-	0.06	0.03	-
Annual Port Cost	$ per year	526	263	-	526	263	-

(3) Egress traffic

The model assumes that the egress traffic (from the CSP data centre to the customer) is commensurate to the total storage assumed for each size of organisation, i.e. the more data the customer has in the cloud, the more they are likely to download data. We assume a ratio of egress traffic / storage of 12%, commonly used in TCO cost models. While the ratio normally varies depending on customer type, IT services, and industries, refining the ratio is not necessary considering that the egress traffic cost ultimately represents less than 1% of the TCO.

A sanity check was conducted to ensure that the egress traffic is coherent with the last mile connectivity products, based on the assumptions of contention ratios. We find out that the last mile connectivity resource usage is 36.5% for large organizations, 18.3% for medium organizations, and 73.1% for small organizations. These usage rates are high, but they are reflective of behaviors in the GCC: because of the high cost of connectivity, organizations tend to under dimension their connectivity needs.

		GCC			Western Europe		
		LARGE	MEDIUM	SMALL	LARGE	MEDIUM	SMALL
TCO Summary							
1 Last Mile Connectivity	$ per year	441,143	141,957	9,600	5,708	3,311	840
2 Direct Connect	$ per year	526	263	-	526	263	-
3 Egress Traffic	$ per year	14,604	2,921	292	13,277	2,655	266
4 Cloud Service	$ per year	796,748	501,926	50,981	760,316	480,990	48,724
Total TCO	**$ per year**	**1,253,020**	**647,067**	**60,873**	**779,827**	**487,220**	**49,829**
TCO Breakdown							
1 Last Mile Connectivity	%	35%	22%	16%	1%	1%	2%
2 Direct Connect	%	0%	0%	0%	0%	0%	0%
3 Egress Traffic	%	1%	0%	0%	2%	1%	1%
4 Cloud Service	%	55%	84%	84%	97%	99%	98%
Total TCO	**%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
GCC vs Europe							
1 Last Mile Connectivity	%	7627.9%	4187.4%	1042.9%			
2 Direct Connect	%	0.0%	0.0%	0.0%			
3 Egress Traffic	%	10.0%	10.0%	10.0%			
4 Cloud Service	%	4.8%	4.4%	4.6%			
Total TCO	**%**	**60.7%**	**32.8%**	**22.2%**			

Source: MENACA TCO Model

Figure 6: Egress Traffic Assumptions

		GCC			WesternEurope		
		LARGE	MEDIUM	SMALL	LARGE	MEDIUM	SMALL
3 Egress Traffic							
Rate of egress / storage	**%**	12%	12%	12%	12%	12%	12%
Egress	**TB per month**	12.00	2.40	0.24	12.00	2.40	0.24
Annual Egress Cost	**$ per year**	14,604	2,921	292	13,277	2,655	266

		GCC			WesternEurope		
		LARGE	MEDIUM	SMALL	LARGE	MEDIUM	SMALL
Sanity Check							
Network Contention Ratio	**%**	100%	80%	10%	100%	80%	10%
Average Bandwidth	**Mbps**	100	40	1	100	40	1
Data Download Time	**Hour Per Month**	266.7	133.3	533.3	266.7	133.3	533.3
Network Resource Usage	**%**	36.5%	18.3%	73.1%	36.5%	18.3%	73.1%

(4) Cloud service

The cloud demand is assumed to consist of elastic compute and storage services.

***Elastic compute**. The model assumes a typical demand for the GCC region for large, medium, and small organizations. The compute demand is expressed in terms of the number of virtual machines, which are then spread between general purpose, compute optimized, and memory-optimized machines. These types of virtual machines are common across the cloud industry. The model multiplies the number of virtual machines by the unit prices publicly available for AWS, Microsoft Azure, Oracle (who have a presence in the GCC) and averages the annual costs between the different providers. The report provides the industry aggregate value, rather than the costs per CSP so as to avoid any comparison between CSPs, which the model is not designed to cater for.*

***Storage**. Based on discussions with industry stakeholders, the model assumes a storage capacity of 100 TB for large organizations, 20 TB for medium organizations, and 2 TB for small organizations. The breakdown between object storage and block storage assumes 40%/60% for large organizations, 30%/70% for medium organizations, and 20%/80% for small organizations. The model then multiplies the object and block storage by the unitary prices publicly available.*

***Other costs**. The model assumes other cloud service costs represent 3% of the total cloud bill.*

Figure 7: Cloud Service Assumptions

			GCC			WesternEurope		
			LARGE	MEDIUM	SMALL	LARGE	MEDIUM	SMALL
Cloud Service								
Elastic Compute								
VMs		#	139	94	10	139	94	10
General Purpose	Small		70	50	7	70	50	7
General Purpose	Medium		35	20	2	35	20	2
General Purpose	Large		10	10	1	10	10	1
Compute Optimized	Small		8	5	-	8	5	-
Compute Optimized	Medium		3	2	-	3	2	-
Compute Optimized	Large		1	-	-	1	-	-
Memory Optimized	Small		8	5	-	8	5	-
Memory Optimized	Medium		3	2	-	3	2	-
Memory Optimized	Large		1	-	-	1	-	-
Annual cost Compute		$ per year	681,328	466,629	47,234	655,250	448,328	45,260
Storage								
Capacity		TB	100	20	2	100	20	2
Object		%	40%	30%	20%	40%	30%	20%
Block		%	60%	70%	80%	60%	70%	80%
Object		TB	40.0	6.0	0.4	40.0	6.0	0.4
Block		TB	60.0	14.0	1.6	60.0	14.0	1.6
Annual Storage cost		$ per year	91,517	20,240	2,218	82,257	18,232	2,001
Other Cloud Service Cost			3%	3%	3%	3%	3%	3%
			23,902	15,058	1,529	22,809	14,430	1,462
Cloud Service Annual Cost		$ per year	796,748	501,926	50,981	760,316	480,990	48,724

APPENDIX III: LIMITATIONS & MITIGATION METHODS

Industry standard terminology

As connectivity technologies evolve at a rapid pace, not every expert uses the same term to refer to the same concept. This heterogeneity problem is exacerbated further when the telecom/connectivity community needs to communicate these technologies to the non-technical business decision-maker. Also, in an effort to make their offerings more attractive, operators tend to leverage a number of underlying transport technologies which might be perceived as one by customers. For example, telecom operators might bundle local access with a core network service (e.g., MPLS VPN) into a complete solution for one particular customer where they see fit. That very same product may also be purchased as separate services from local providers in other use cases.

MENACA made a conscious effort throughout this study to use consistent terminology to create awareness around the underlying factors contributing to the problem. Concepts were also carefully directed and presented when reaching out to the industry whether through survey campaigns or in-depth interviews. MENACA also refrained from using data that was not specifically collected on the intended technology or service.

Data availability & consistency

Pricing of the last mile cloud connectivity is often bespoke and confidential and as such the only retrievable data come from telecom operators' declarations. Furthermore, publicly available information does not necessarily reflect the reality on the ground as operators may quote widely differing prices for the same solutions based on a number of undisclosed factors including customer relationships. This makes it very difficult to arrive at a single price point for the last mile connectivity offerings.

Also, a number of cloud service providers have established edge locations within GCC countries. An edge location is the closest point to the customer (user) consuming public cloud services. In these edge locations, the server is not present but a small setup has been created to improve access to the service e.g. latency. However, when there is no cloud edge in-country, solutions may involve an internationally priced link, with those connections defined as non-domestic. This is further complicated by instances where a telecom operator prices a cloud connectivity setup as if it is an international link when in fact it is a domestic one within the borders of their country.

To mitigate this, MENACA reached out to the community of both members and non-members to gain reliable local data points. The connectivity working group also collected publicly available information on the last mile connectivity costs published for the region and compared those against prices made public by the incumbent telcos. Furthermore, the alliance reached out to many telecom operators to be able to collect as much accurate data as possible.

Limited awareness among experts

As impactful as last mile connectivity cost issue can be, there is very little awareness even among subject matter experts. As an example, we found out that even experienced cloud architects might not know of the high costs of last mile connectivity and hence rely on a vanilla architecture approach which could turn out to be not feasible to deploy. Also, many infrastructure experts have not been exposed to such conversations as the size of their respective organisations may have been too small to have to go through the costly last mile connectivity purchase process.

MENACA mitigated this by reaching out to individuals who were thoroughly informed on the issue either because of a previously held position with an incumbent telecom provider or because they were responsible for the IT infrastructure in a medium or large-size organisation. MENACA also did not rely solely on survey results, and conducted a number of in-depth interviews to be able to fully grasp the industry sentiment.

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Middle East and North Africa Cloud Alliance is the only home-grown, vendor-agnostic industry Association focused on monitoring, identifying and resolving issues around cloud adoption in the MENA region. MENACA strives to give the industry a unique voice and to provide a wide range of stakeholders with unbiased insights into the region's cloud ecosystem. Our founding members include global as well as regional leading technology thought-leaders with a vested interest in creating a dialogue around cloud computing and its impact on MENA's digital economies.

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