International telecommunication/ICT economic and policy issues

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Progress report and next steps: for the Terminology and Taxonomy Report on the Costs of International Internet Connectivity

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Introduction

The costs of International Internet connectivity (IIC) play a vital role in influencing the accessibility and affordability of internet services around the globe. The International Telecommunication Union (ITU) collects data, indicators, and metrics that are a natural starting point for analysis of country and regional differences in their costs of international internet connectivity.

The purpose of this work is to organise a Taxonomy for these metrics and indicators that the ITU uses to quantify and evaluate the global costs associated with international internet connectivity.

Suggestions for improvements, of either the metrics, underlying concepts, or practical data access that make the use of this valuable data easier for policy makers..

Key Cost Categories of IIC

- Infrastructure Costs
- Bandwidth Costs
- Operational Costs
- Regulatory Costs
- Market and Competitive Costs
- Geographic and Environmental Costs
- End-User Costs

The Internet Supply Chain

Definition: Steps in transmitting internet content from source to destination

Key segments: International Mile, Middle Mile, Last Mile, First Mile, and the Invisible Mile

International Mile

Definition: Connects a country to the global internet via undersea cables, satellites, and cross-border fiber-optic cables

Significance: Critical for global internet access

Middle Mile

Definition: Backbone network linking international gateways to national/regional networks

Components: National Backbones, Intercity Networks, IXPs, and Content Delivery Networks (CDNs)

Importance: Reducing dependency on international bandwidth

Last and First Miles

Last Mile: Connects end users to broadband services via fiber, DSL, wireless, or satellite

First Mile: End-user devices connecting to local networks

Challenges: High costs in rural areas

The Invisible Mile

Definition: Non-physical infrastructure elements, including regulatory frameworks, cybersecurity, and data governance

Significance: Ensuring efficiency, security, and accessibility

Infrastructure Costs

These costs are due to technical-costs aspects and to economic, market and potentially regulatory aspects, governing the economic transactions among the different operators that own the relevant components of the infrastructure used for the IP data transfers.

Major cost components:

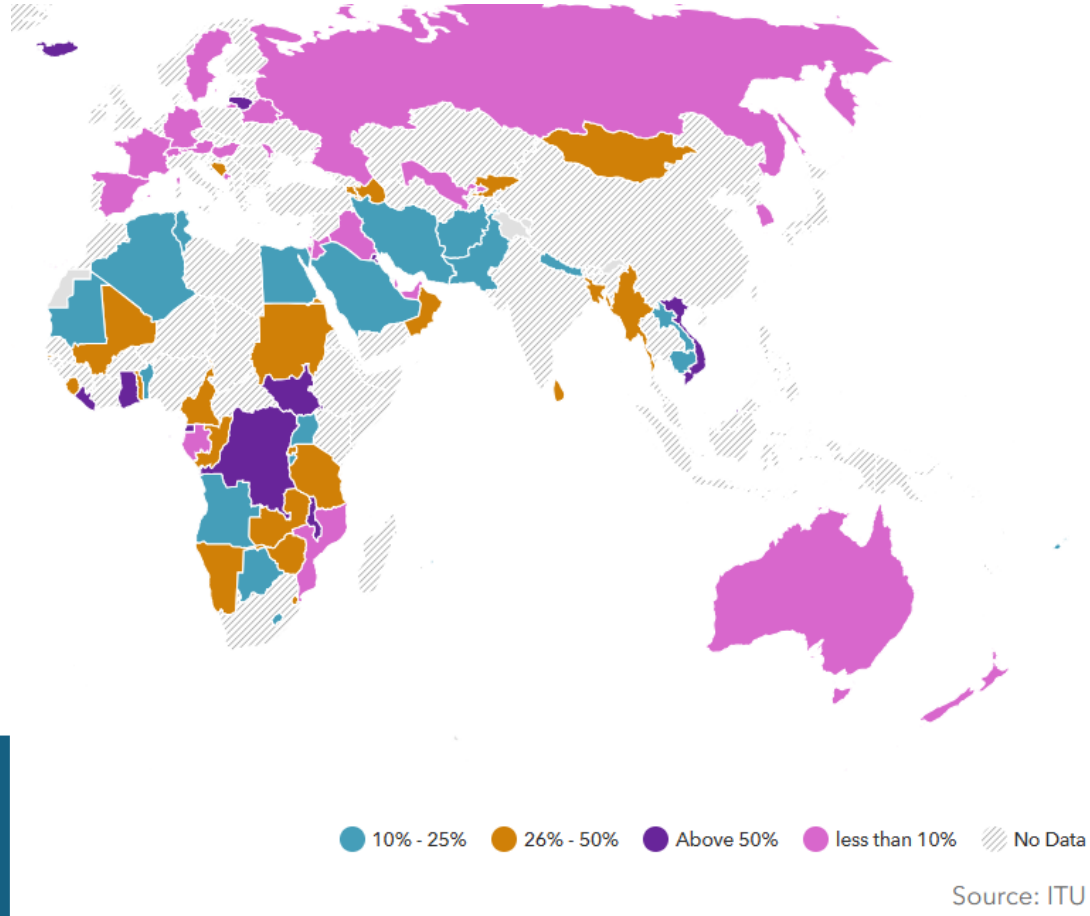
- Submarine Cable Infrastructure
- Satellite Infrastructure
- Internet Exchange Points (IXPs)

Cost reduction strategies: Increased local hosting and improved network infrastructure

The ITU collects this data about the Portion of access costs to international connection in retail price .

This is a crucial variable to understand the link between international internet connectivity and affordability.

It is evident that for the 7.65 % countries in the world for which this represents more than 50% and this percentage rises to 15,90% for African countries.



https://datahub.itu.int/data/?i=11901

Portion of access costs to international connection in retail price	World	Africa	Arab States	Asia & Pacific	CIS	Europe	Americas
Above 50%	7.65%	15.90 %	4.54%	10%	0%	4.34%	2.85%
26% - 50%	9.18%	22.70 %	9.09%	7.50%	11.10 %	2.17%	2.85%
10% - 25%	11.20%	20.50 %	13.60 %	15%	0%	2.17%	8.57%
less than 10%	10.20%	2.27%	18.20 %	2.50%	22.20 %	19.60 %	8.57%

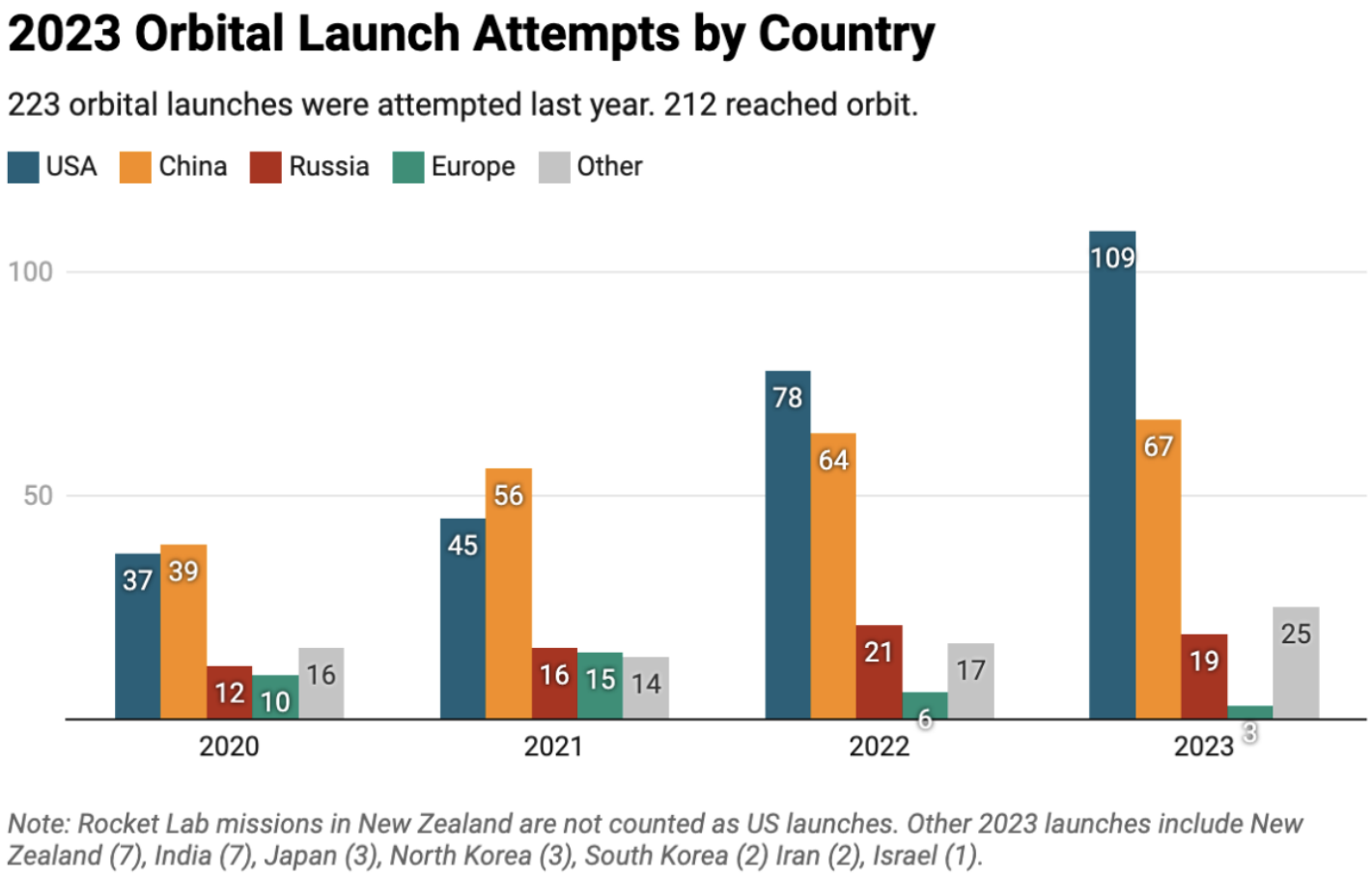
Table Modalities of International Internet Connectivity

This indicator allows multiple choice per country/economy, Source: ITU World Tariff Policies Database

Indicator		Africa	Arab States	Asia & Pacific	CIS	Europe	The Americas	To
Does your country have access to international connectivity?	Yes	40	17	28	6	39	31	16
	No	0	0	0	0	0	0	0
If yes, by which modes? *	Submarine cable	33	16	22	1	23	30	12
	Satellite	32	14	26	4	25	21	12
	Fibre	30	12	16	6	32	20	11
	Other	2	1	3	0	7	1	1
How many international landing stations do you have in your country? Please indicate the number of points per type. *	Submarine cable	26	15	21	1	11	22	9
	Satellite	24	11	21	3	6	12	7
	Fibre	22	13	11	5	9	11	7
	Other	4	0	1	0	4	1	1
Who has control over the landing points in your country? *	Incumbent operator	19	13	20	4	19	17	9
	Government	11	4	6	2	3	4	3
	Private and Public Partnership (PPP)	12	1	3	1	8	2	2
	Consortium of alternative operators	5	3	4	0	3	4	1
	Other	10	6	11	2	20	15	6
Region size		**44**	**22**	**40**	**9**	**46**	**35**	19

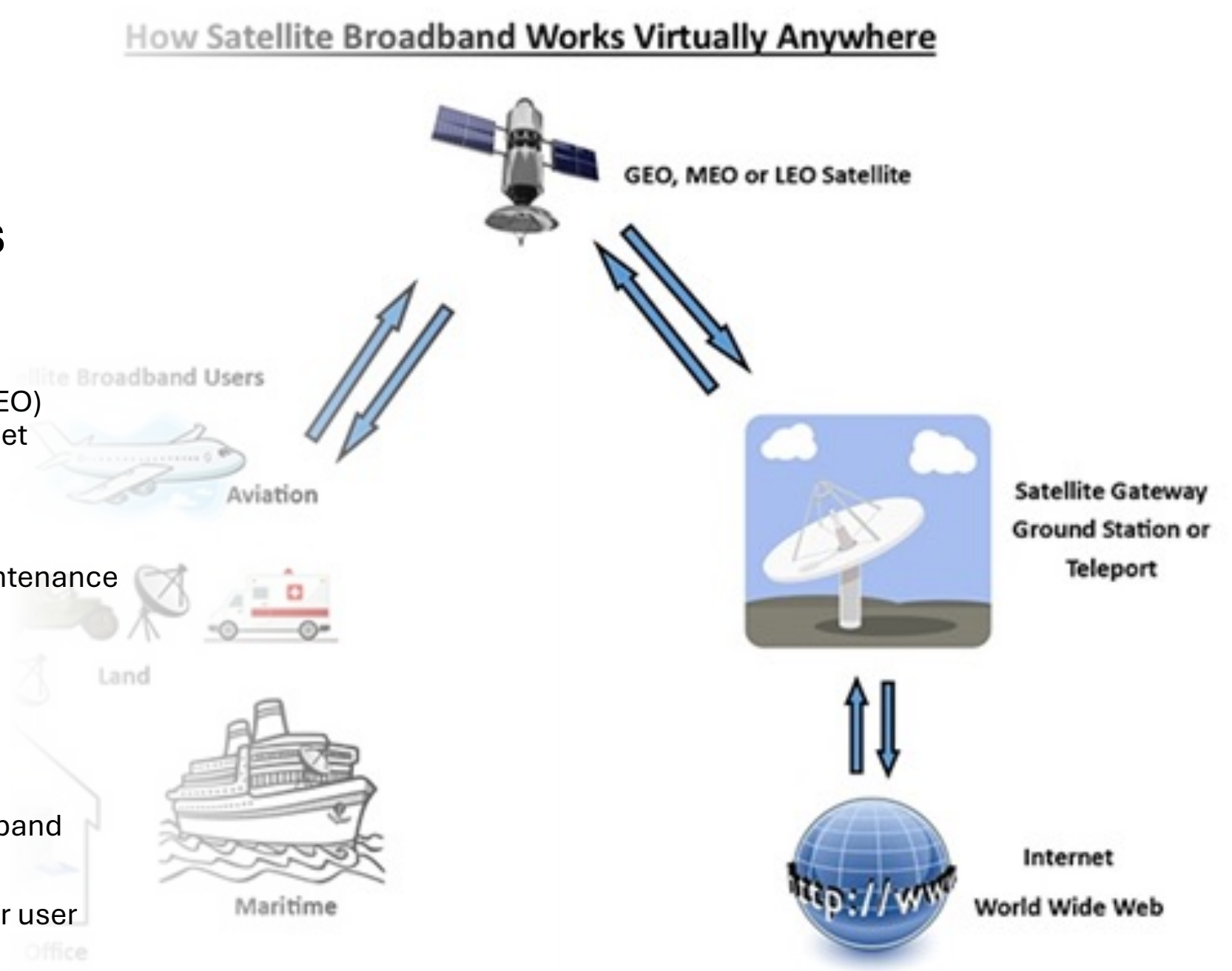
Satellite Infrastructure

- Costs related to satellite communication systems used for international internet connectivity, including satellite launches, ground stations, and satellite bandwidth. Typical data sources for Satellite Infrastructure are Reports from satellite operators.
- Source https://payloadspace.com/2023-orbital-launches-by-country/

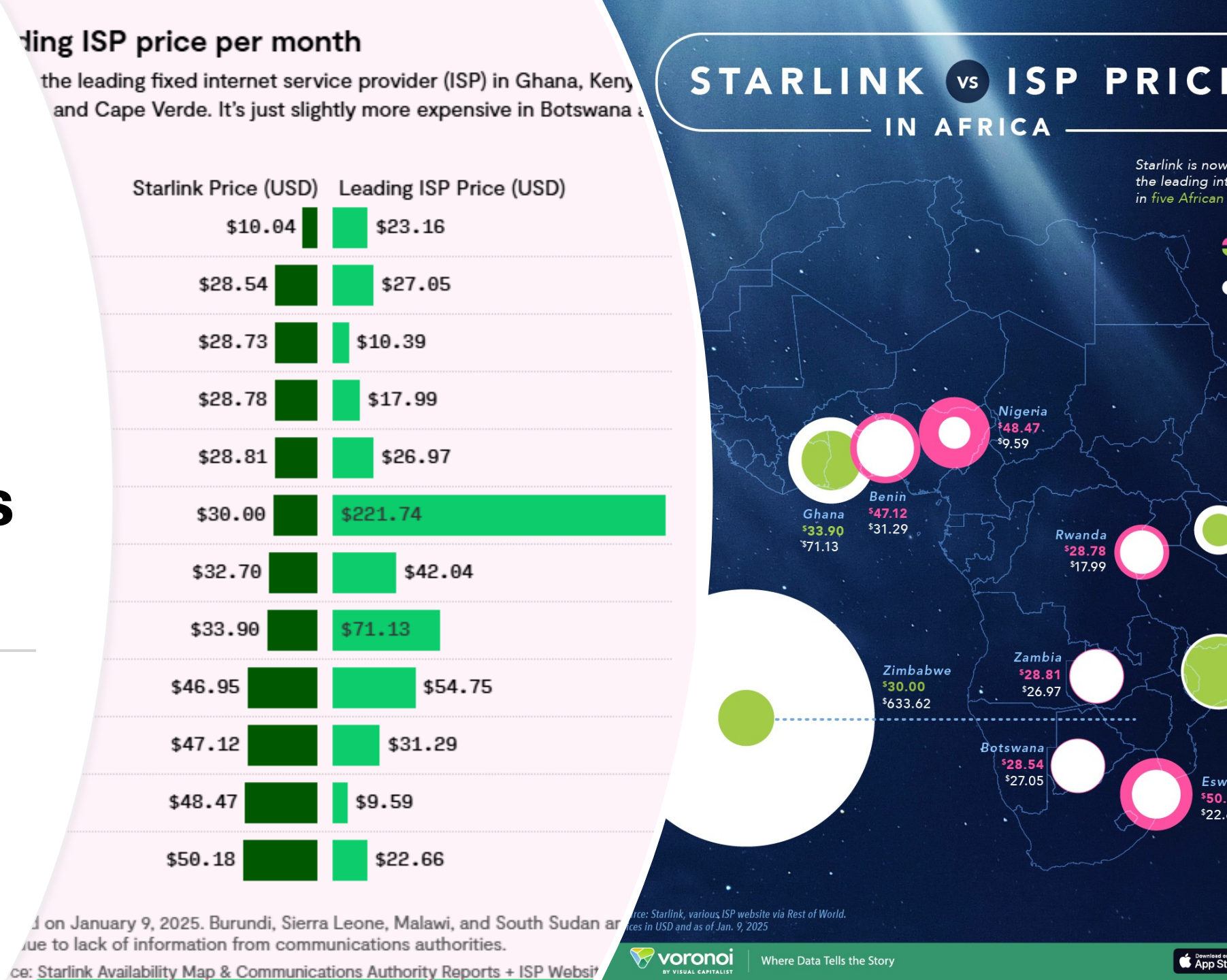


Example: LEO Satellite Costs Across Countries (Part 1)

- **Definition:** Low Earth Orbit (LEO) satellites provide global internet coverage
- **Cost Factors:**
- Satellite deployment and maintenance
- Ground station operations
- Spectrum licensing fees
- **Regional Differences:**
- Developed nations: Higher investments in satellite broadband
- Developing nations: Limited infrastructure, higher costs per user



Example: Starlink LEO Satellite Costs Across Africa



Internet Exchange Points (IXPs)

- Typical data sources for costs associated to **Internet Exchange Points** can be found in Databases and directories of IXPs (PeeringDB), reports from internet exchange organizations, (e.g the European Internet Exchange Association (Euro-IX) that gathers 70 IXPs from around the world, or the Internet Exchange Point Report by the Internet Society. the ITU Data hub.
- **Table 1: IXPs and their Governance**

		Number of countries/economies								
Indicator		Africa	Arab States	Asia & Pacific	CIS	Europe	The Americas	**Total**		
How many Internet Service Providers are connected to each IXP in your country?		21	7	9	3	12	16	**68**		
Are IXPs in your country for profit or not for profit? *	Profit	5	2	7	4	16	5	**39**		
	Not profit	18	9	12	2	16	15	**72**		
	Other	2	0	1	0	3	0	**6**		
Is paid peering allowed at the IXPs in your country?	Yes	3	4	8	1	18	6	**40**		
	No	16	5	7	1	1	7	**37**		
Is private peering allowed at the IXPs in your country?	Yes	6	6	7	3	15	7	**44**		
	No	11	3	7	0	1	6	**28**		
Region size		**44**	**22**	**40**	**9**	**46**	**35**	**196**		
* This indicator allows multiple choice per country/economy										
Year: 2021 or latest available data. Source: ITU World Tariff Policies Database Section 9. Part 4: Access to International Facilities (International Connectivity) ITU Tariff Policies Survey - results 2021										

International Bandwidth Usage

Trends: Increasing demand for international bandwidth (~30% annual growth) [Source: ITU, World Bank]

Regional Disparities:

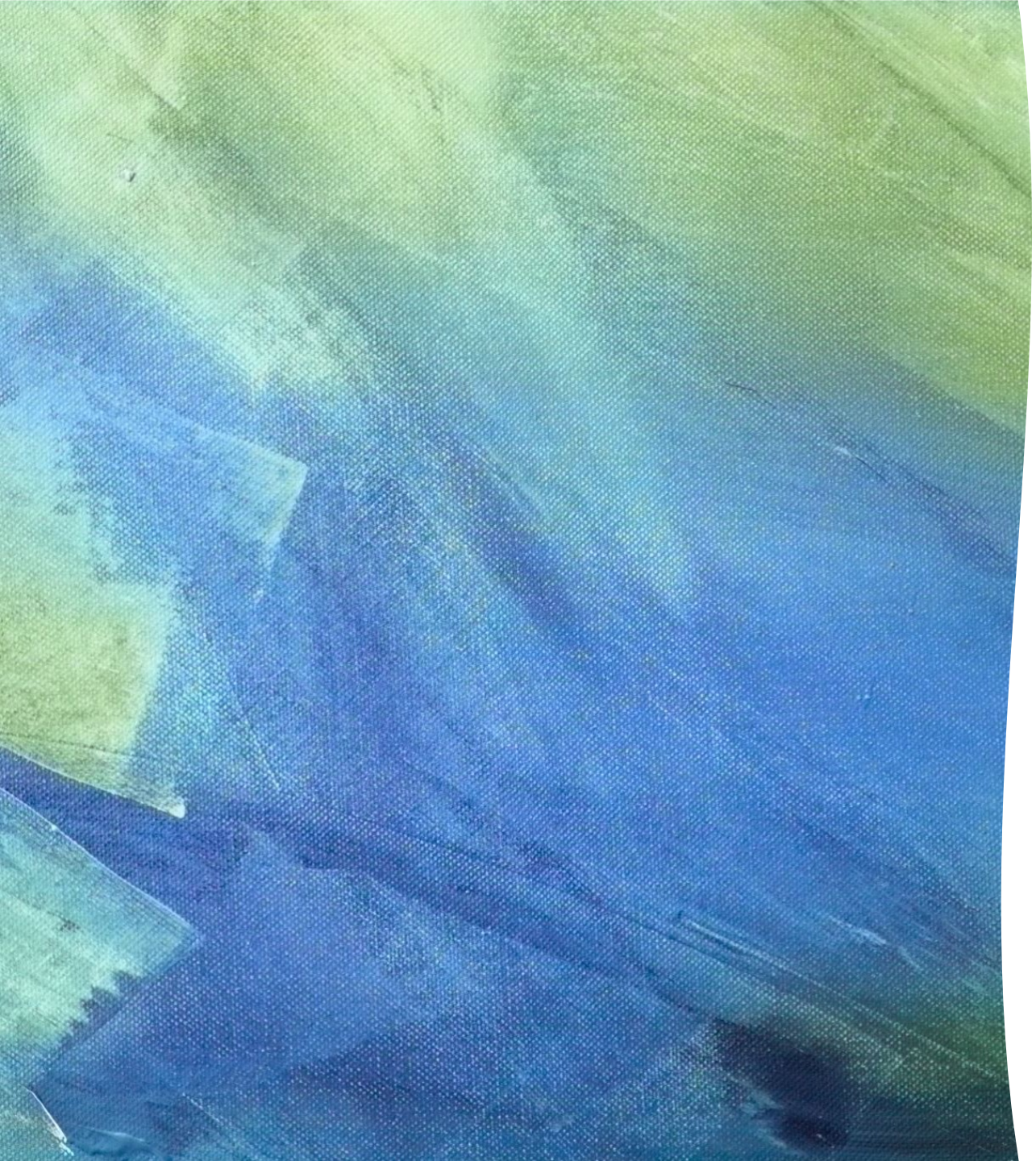
Developed countries: High bandwidth availability (~200-400 Mbps per user)

Least Developed Countries (LDCs): Limited bandwidth

Table 6: International bandwidth usage. International bandwidth divided by the number of Internet users.

Region	Value	Year
Africa	84.9	2022
Arab States	168	2022
Asia & Pacific	192	2022
CIS	117	2022
Europe	397	2022
Land Locked Developing Countries (LLDC)	86.5	2022
Least Developed Countries (LDC)	37.7	2022
The Americas	261	2022
World	233	2022

Source, ITU
https://datahub.itu.int/data/?i=242&u=per+Internet+user



Market and Competitive Costs

Issues:

Monopolization leading to high markups

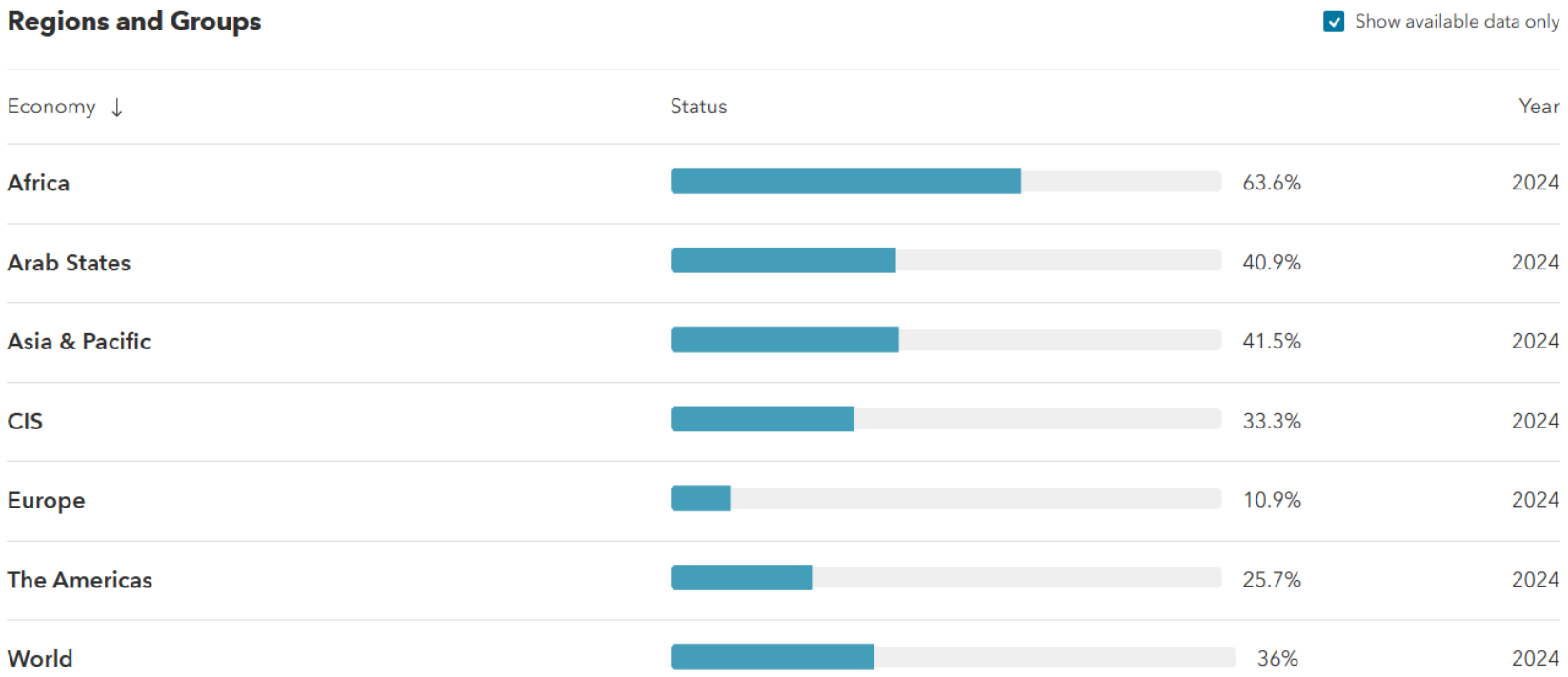
Lack of infrastructure sharing

Impact of gatekeepers on pricing

Regulatory measures:

Open Access Mandates, Peering Policies

National policy or regulation that mandates access to international facilities/landing points.



Assessing Gatekeepers and hierarchy in Internet connectivity

- A Gatekeeper brings the risk of increasing the price cost margins
- A Gatekeeper is a provider along the IP packets routing path that is very well connected, has high Network centrality, and its direct neighbors are poorly interconnected among themselves, so that they are unable to bypass such a central node, for example to access an international gateway.

Steps used to optimize costs of international connectivity. 2021

Steps used to optimize costs of international connectivity	World	Africa	Arab States	Asia & Pacific	CIS	Europe	The Americas
Hosting of most frequently visited web sites (e.g. search engines, Data Centers, Content delivery network (CDN), Cache Servers, etc.)	11.70%	4.54%	13.60%	17.50%	11.10%	13%	11.40%
Encourage the development of local content	5.10%	6.81%	4.54%	5.00%	0%	4.34%	5.71%
Implementation of Internet Exchange Point (IXP)	23%	47.70%	18.20%	12.50%	11.10%	15.20%	20%
Other	12.80%	11.40%	18.20%	10%	11.10%	10.90%	17.10%

- The ITU considered 4 different policies seen as steps used to optimize costs of international connectivity. Below we report the distribution of these policies among regions. From this data we can see that the “Implementation of Internet Exchange Point (IXP)” is a step adopted by 47.70% of the African Countries, indicating this as a key priority, towards reducing the costs of international internet connectivity

Alternative Connectivity Models

Emerging Solutions:

Community Networks (~20%-40% cost savings in rural areas) [Source: Internet Society]

TV White Spaces (TVWS)

Spectrum Refarming

Access Infrastructure Sharing (e.g., Wholesale Open Access Networks)

Conclusion and Recommendations

Thank you!

Summary:

Cost structures of IIC are complex and vary by region

Addressing market inefficiencies can enhance affordability

Policy Recommendations:

Expand infrastructure investment

Improve regulatory frameworks

Encourage alternative connectivity models

International collaboration is key to reducing global internet connectivity costs

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