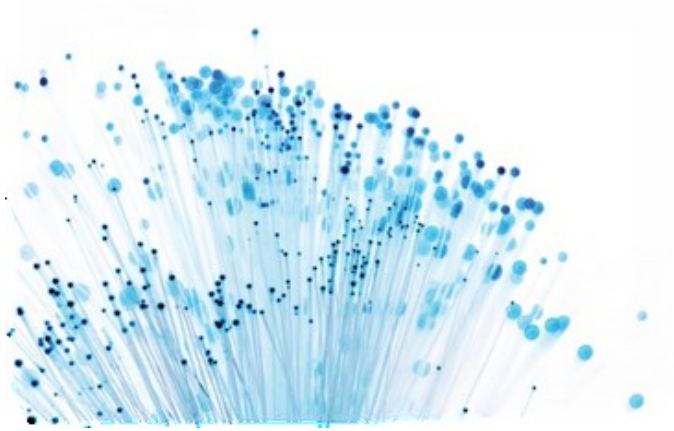
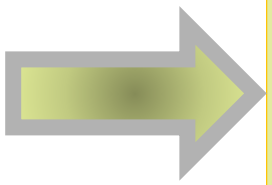


WORKSHOP ON COMPETITION AND TARIFF REGULATION

Access and Interconnection

Interconnection and access

INTERCONNECTION is the linking of communications networks to ensure that users of one telecommunications network can access the telecommunications networks and services of other telecom operators.

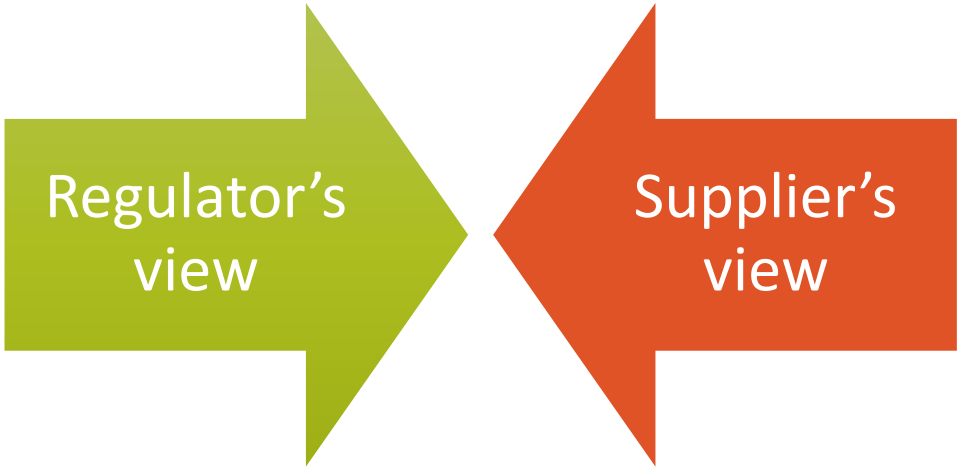


ACCESS means the making available of facilities and/or services, to another undertaking, under defined conditions, on either an exclusive or non exclusive basis, for the purpose of providing electronic communications services.

BOTH are necessary to promote effective market competition in a multi-network, multi-operator environment.

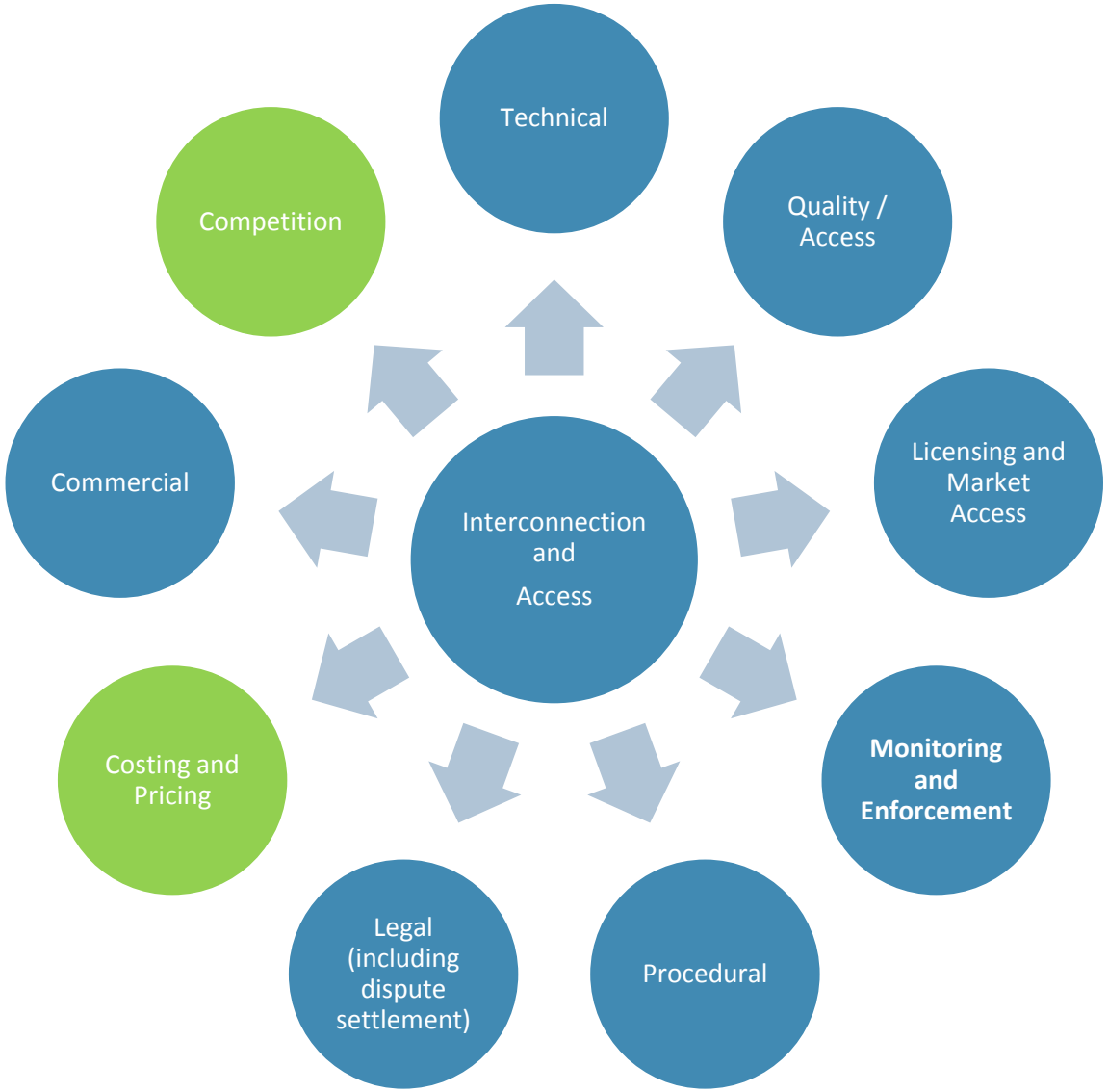
The perspectives of suppliers and regulators in terms of interconnection…

Sometimes they are in conflict …

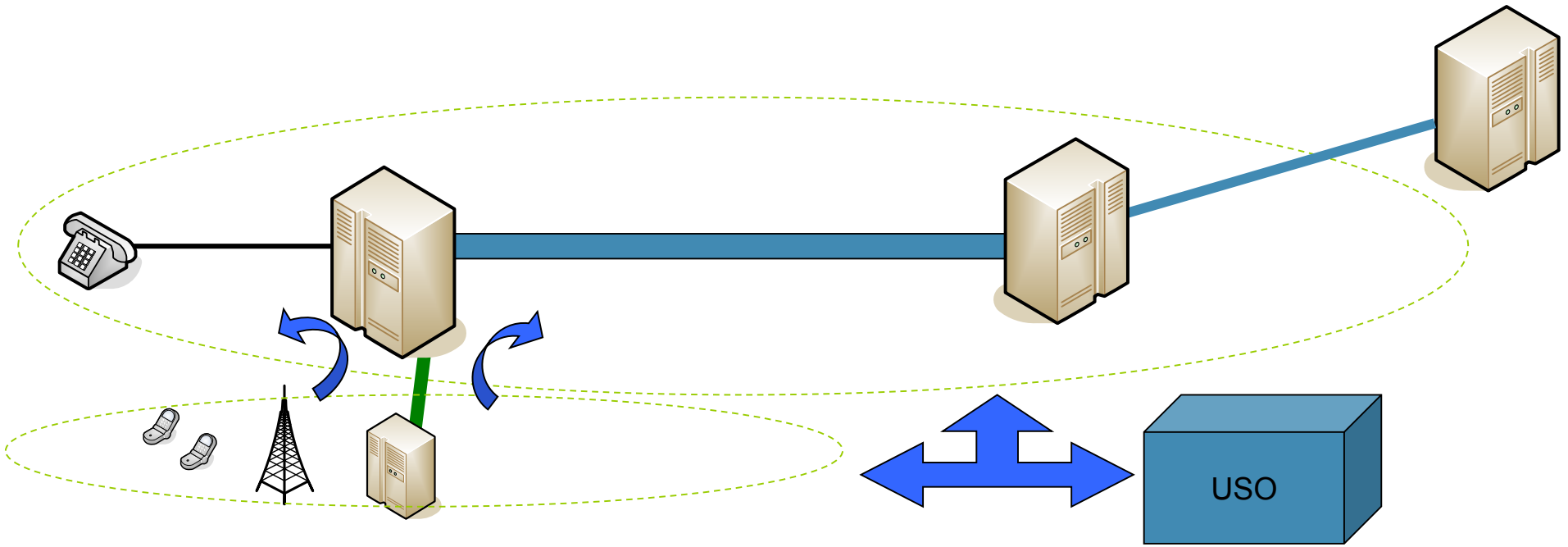


… but sometimes they come together

Interconnection and access have many dimensions



Inter-linkages between USO, Infrastructure Sharing, Interconnection and Access



Different characteristics; different requirements

Access	Interconnection
A one-way transaction: service provider purchases access to a network operator's facilities	A two-way transaction: two suppliers exchange traffic across a Point of Interconnection
Danger of anti-competitive practices based on bottleneck control of essential facilities and economies of scale/scope.	Some balance of power between the parties, with less risk of competitive abuse. Internet connectivity proves that commercial agreements are possible.
Need for on-going ex-ante regulation	Potential to remove ex-ante regulation and rely on ex-post competition law

A shift in the regulatory balance

The need for regulated cost-based interconnection is reducing

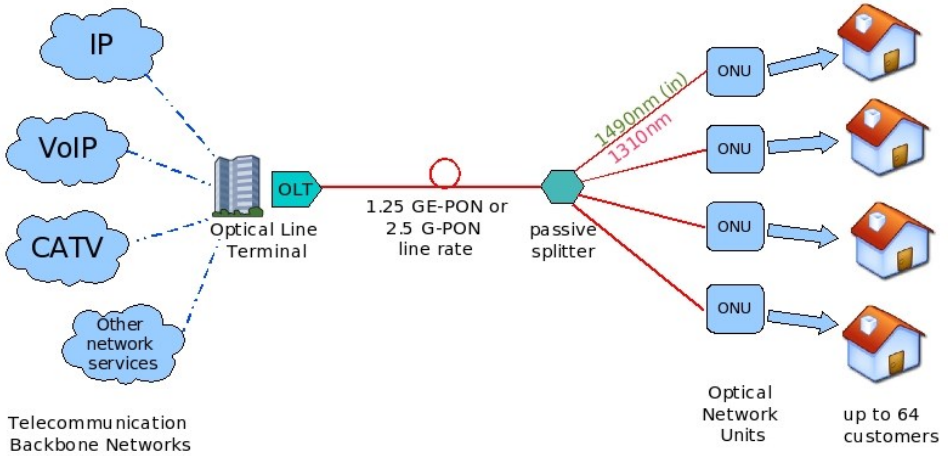
The need for regulated cost-based access is increasing

Access means …

- Access to facilities



- The access network (i.e. access to the facilities that provide access to the customer)



Access to facilities cost models

- Looks at the cost of supplying space in passive or active infrastructure (e.g. tower, duct, submarine cable) in different locations.
- Assume a three-stage costing process:
  - Identify the fixed and variable costs of the relevant assets
  - Identify the cost savings from sharing fixed costs
  - Identify the incremental costs of establishing access to the facility
- Model output is typically a cost per-month of leasing space at or on a specific facility.

Cost models for various forms of Facilities Access may be needed

Interconnection charges roadmap

ISPs Commercial Agreements

Transit

Consumer ISP covers all the costs

Peering

Public Peering

(Sender Keep All)

Private Peering
(Based on Peering Policy)

Interconnection practices (1)

Indicator		Number of countries/economies						
		Africa	Arab States	Asia & Pacific	CIS	Europe	The Americas	Total
Interconnection issues: Which approach do you apply for costing regulated interconnection prices? *	Benchmarking	6	3	0	1	8	2	20
	FDC Current Cost Accounting	0	0	1	0	4	1	6
	FDC Historical Cost Accounting	3	1	0	1	1	3	9
	FDC Hybrid	2	0	1	0	0	1	4
	LRIC	4	0	4	1	0	5	14
	Pure LRIC	4	0	0	0	6	1	11
	LRIC+	7	3	0	0	3	1	14
	LRAIC	1	1	1	0	2	2	7
	None	2	0	3	1	0	2	8
	Other	2	0	2	0	1	0	5
Total responses from countries		31	8	12	4	25	18	98
Region size		44	21	40	12	43	35	195

* This indicator allows multiple choice question per country/economy

Year: 2016 or latest available data.

Source: ITU World Tariff Policies Database

ITU ICT-Eye: http://www.itu.int/icteye

Interconnection practices (2)

Indicator		Number of countries/economies						
		Africa	Arab States	Asia & Pacific	CIS	Europe	The Americas	Total
Number of time bands used for interconnection charging purposes	One	13	15	19	5	18	16	86
	Two	15	4	4	0	14	6	43
	Three	7	0	1	0	2	5	15
	More than three	0	0	4	0	1	1	6
Number of national tariff zones (interconnection)	One	25	18	17	4	24	17	105
	Two	10	1	6	3	4	3	27
	Three	0	0	2	1	8	4	15
	More than three	5	1	5	0	2	7	20
Interconnection charging principle adopted	Symmetric	27	15	14	4	30	24	114
	Asymmetric	12	5	12	1	8	7	45
If asymmetric charging, how it was decided?		9	2	6	2	9	8	36
How often are the interconnection charges reviewed?	Quarterly	0	2	0	0	0	0	2
	Semi-annually	2	1	1	0	2	1	7
	Annually	23	10	6	2	18	8	67
	Other	11	6	17	4	17	22	77
Does this happen within a set Reference Interconnection Offer cycle?	Yes	9	5	1	0	7	3	25
	No	8	1	5	2	7	11	34
Charging regime for interconnection services applied	Calling Party's Network Pays	34	14	23	5	34	24	134
	Receiving Party's Network Pays	1	0	0	0	1	0	2
	Bill and Keep (Sender Keep All)	0	0	1	0	0	2	3
	Other	1	3	6	1	0	3	14
Are time bands still applied in your country?	Yes	6	1	4	0	5	7	23
	No	3	1	2	3	3	5	17
Which charging regime for mobile interconnection services is applied in your country?	Calling Party's Network Pays	32	12	14	6	31	20	115
	Receiving Party's Network Pays	2	0	0	0	1	1	4
	Bill and Keep (Sender Keep All)	0	1	2	0	0	1	4
	Other	0	0	5	0	0	3	8
Region size		44	21	40	12	43	35	195

* This indicator allows multiple choice per country/economy

Year: 2016 or latest available data.

Source: ITU World Tariff Policies Database ITU ICT-Eye: http://www.itu.int/icteye

Interconnection practices (3)

Indicator		Number of countries/economies						
		Africa	Arab States	Asia & Pacific	CIS	Europe	The Americas	Total
Are **commercial agreements** for National services used in your country?	Yes	19	8	16	6	20	21	90
	No	1	1	2	0	5	2	11
If commercial agreements are used is there any form of obligation of reporting or monitoring of such agreements by the regulatory authority? *	Contract filing requirements	16	5	8	4	10	15	58
	Service provider reporting requirements (e.g., call volumes, revenues, cost)	6	5	6	4	11	5	37
	Users or contract party complaints	4	5	7	2	10	7	35
	Other	4	3	1	0	3	4	15
How are consumer complaints resolved? *	Courts	6	7	4	5	17	7	46
	Regulators	20	9	14	5	17	21	86
	Arbitration	10	5	2	0	2	5	24
	Mediation	9	3	6	0	9	8	35
	Observation of Terms and Conditions	4	3	7	0	8	1	23
	Other	1	1	4	1	3	7	17
Region size		44	21	40	12	43	35	195

* This indicator allows multiple choice per country/economy
Year: 2016 or latest available data.

Source: ITU World Tariff Policies Database
ITU ICT-Eye: http://www.itu.int/icteye

Interconnection practices (4)

Indicator		Number of countries/economies						
		Africa	Arab States	Asia & Pacific	CIS	Europe	The Americas	Total
Are commercial agreements for International services used in your country?	Yes	16	9	10	5	23	17	80
	No	4	0	5	1	2	2	14
If yes, in what areas are these agreements used?	Interconnection	14	2	5	4	15	10	50
	Access	5	1	0	0	1	3	10
	Other	0	4	5	0	4	5	18
If commercial agreements are used is there any form of obligation of reporting or monitoring of such agreements by the regulatory authority? *	Contract filing requirements	13	4	4	3	6	10	40
	Service provider reporting requirements (e.g., call volumes, revenues, cost)	5	4	6	5	10	8	38
	Users or contract party complaints	2	3	4	2	6	6	23
	Other	2	2	2	0	1	4	11
How are disputes between providers resolved that result from commercial agreements? *	Courts	6	3	5	4	14	8	40
	Regulators	11	3	7	4	8	13	46
	Arbitration	6	3	1	0	4	9	23
	Mediation	6	2	3	0	4	8	23
	Observation of Terms and Conditions	3	1	5	1	4	1	15
	Other	1	3	0	0	0	4	8
Region size		44	21	40	12	43	35	195

* This indicator allows multiple choice per country/economy
Year: 2016 or latest available data.

Source: ITU World Tariff Policies Database
ITU ICT-Eye: http://www.itu.int/icteye

Infrastructure Sharing

Indicator		Number of countries/economies						
		Africa	Arab States	Asia & Pacific	CIS	Europe	The Americas	Total
Is infrastructure sharing practiced in your country in the mobile sector?	Yes	22	7	8	2	21	17	**77**
	No	1	0	2	2	2	3	**10**
If yes, is mobile infrastructure sharing based on commercial agreements or based on a regulatory mandate?	Commercial agreements	9	1	7	3	12	7	**39**
	Regulation	3	2	0	1	2	3	**11**
	Both	10	5	3	1	9	10	**38**
If yes, is mobile infrastructure sharing mainly active or passive or both?	Active sharing	1	0	0	2	0	1	**4**
	Passive sharing	11	2	6	1	10	10	**40**
	Both	10	6	5	2	11	6	**40**
Do you mandate national roaming in your country?	Yes	7	4	2	0	7	6	**26**
	No	12	3	7	5	14	11	**52**
If no, have mobile operators entered into national roaming agreements	Yes	3	3	4	1	9	2	**22**
	No	9	2	3	3	7	12	**36**
Is infrastructure sharing practiced in your country in the fixed sector?	Yes	11	7	6	4	21	14	**63**
	No	7	0	3	0	2	5	**17**
If yes, is fixed infrastructure sharing based on commercial agreements or based on a regulatory mandate?	Commercial agreements	6	0	6	1	3	1	**17**
	Regulation	3	2	0	1	5	3	**14**
	Both	4	5	3	3	15	11	**41**
If yes, is fixed infrastructure sharing mainly active or passive or both?	Active sharing	1	0	0	2	0	1	**4**
	Passive sharing	8	2	5	1	9	6	**31**
	Both	4	5	3	2	11	5	**30**
Region size		**44**	**21**	**40**	**12**	**43**	**35**	**195**

* This indicator allows multiple choice per country/economy
Year: 2016 or latest available data.

Source: ITU World Tariff Policies Database

ITU ICT-Eye: http://www.itu.int/icteye

Emerging ICT Infrastructure and Policy and Regulatory issues

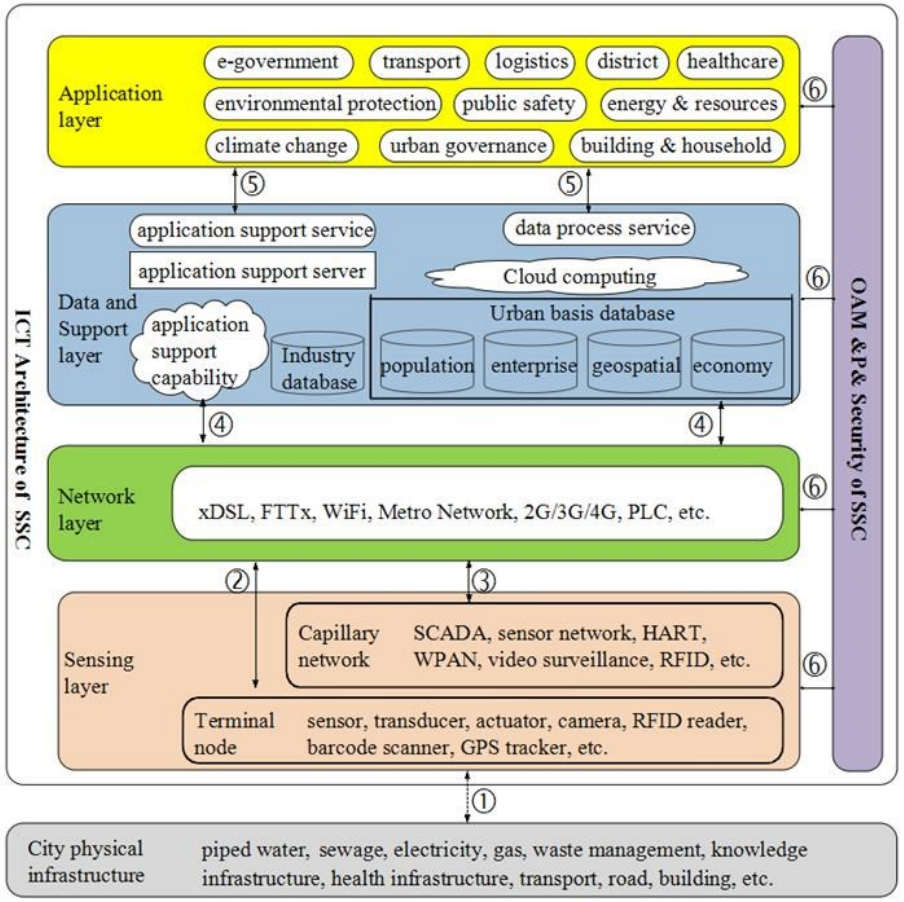
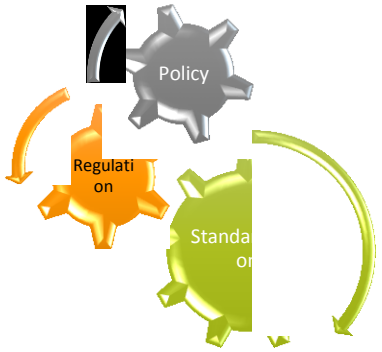


Figure source: ITU-T Focus Group on Smart Sustainable Cities: *Overview of smart sustainable cities infrastructure*

A multi-tier SSC (smart sustainable city) ICT architecture from communication view (physical perspective)

Telecom/ ICT Sector Issues (examples)



- Cross-Sector Collaboration
- Competition
- Investment
- Licensing
- Spectrum
- HetNets
- Broadband
- Cloud
- Roaming
- Interoperability
- QoS/QoE, Consumer
- Numbering & Addressing
- Big Data & Open Data
- Security
- Privacy
- Right of Way
- Green ICTs
- Infrastructure Sharing
- Data Centres
- e-Waste
- Number Portability
- Emergency Telecommunications

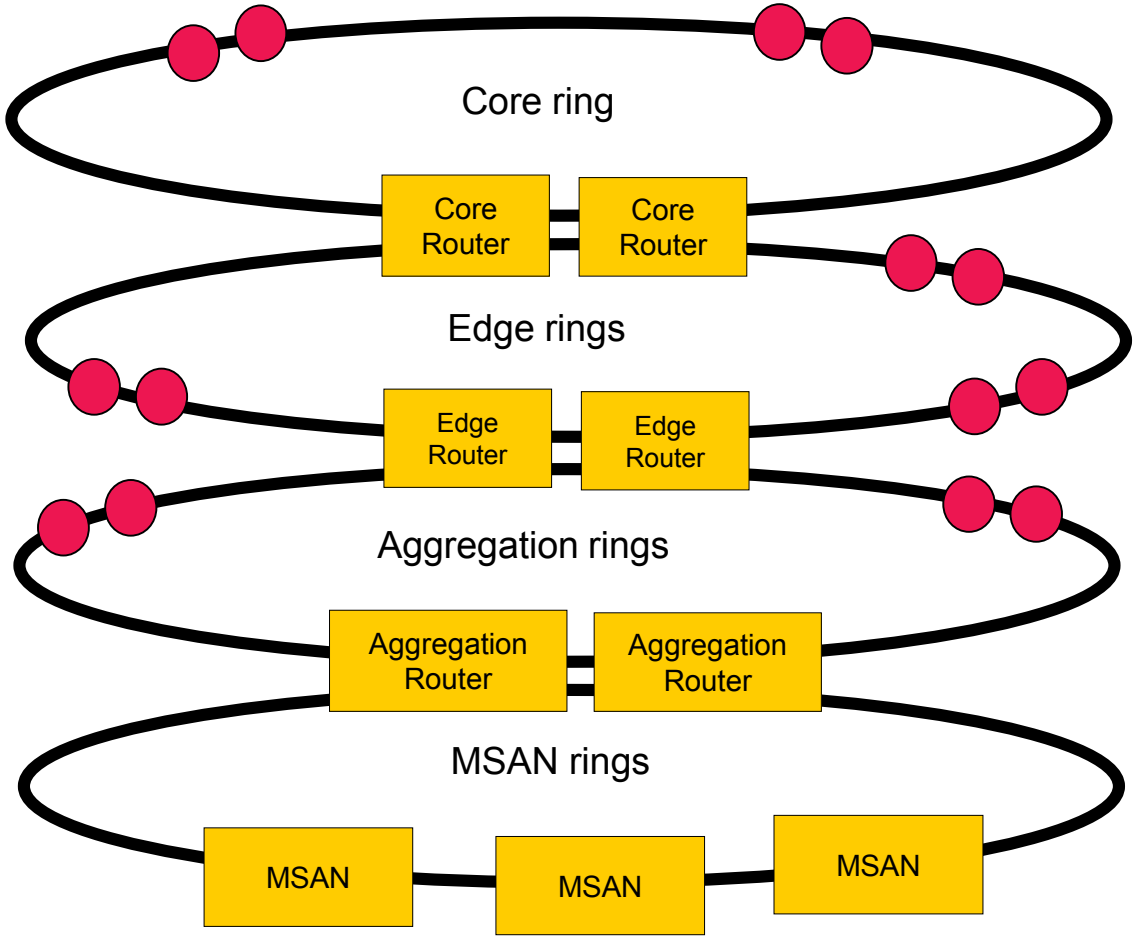
A typical NGN Architecture

Ring rather than star topology

Routers rather than switches

Fewer nodes

Costs driven by capacity rather than minutes of traffic



Shared transmission paths

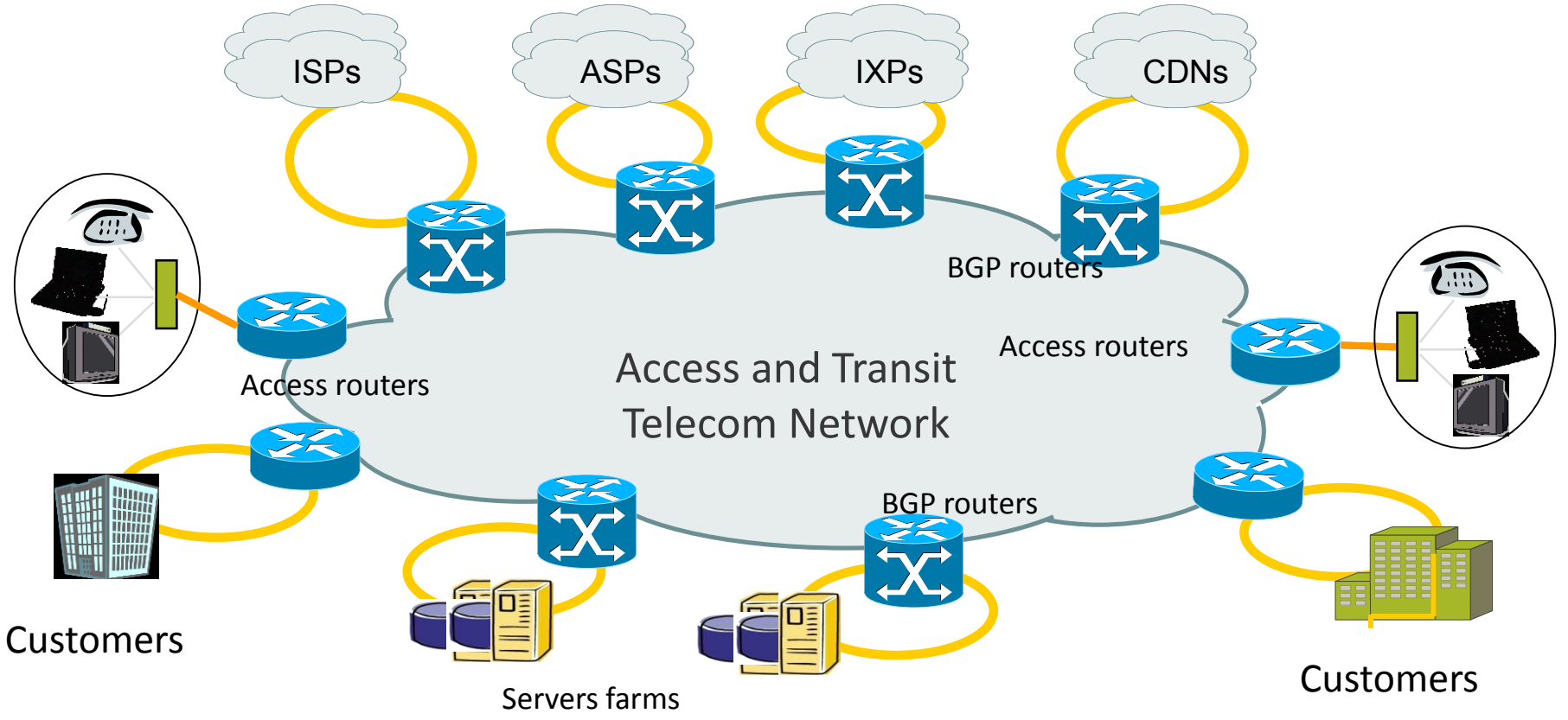
End of SDH technology; Ethernet and DWDM

Access nodes further from customer

Key changes relevant to cost modelling

- Asset-base changes:
  - Need to obtain new prices and asset lifetimes
  - Recalibration of numbers and types of nodes
- Cost drivers change:
  - Element costs need to be broken into fixed costs (chassis) and variable costs (per Mbps).
  - Treatment of other costs..
- Redesign the transmission network:
  - Each layer has to be costed separately (even where infrastructure is shared)
  - Costs to be allocated amongst traffic on capacity requirement and probability of usage by each service.

IP Network Architectures: Interconnection of IP networks

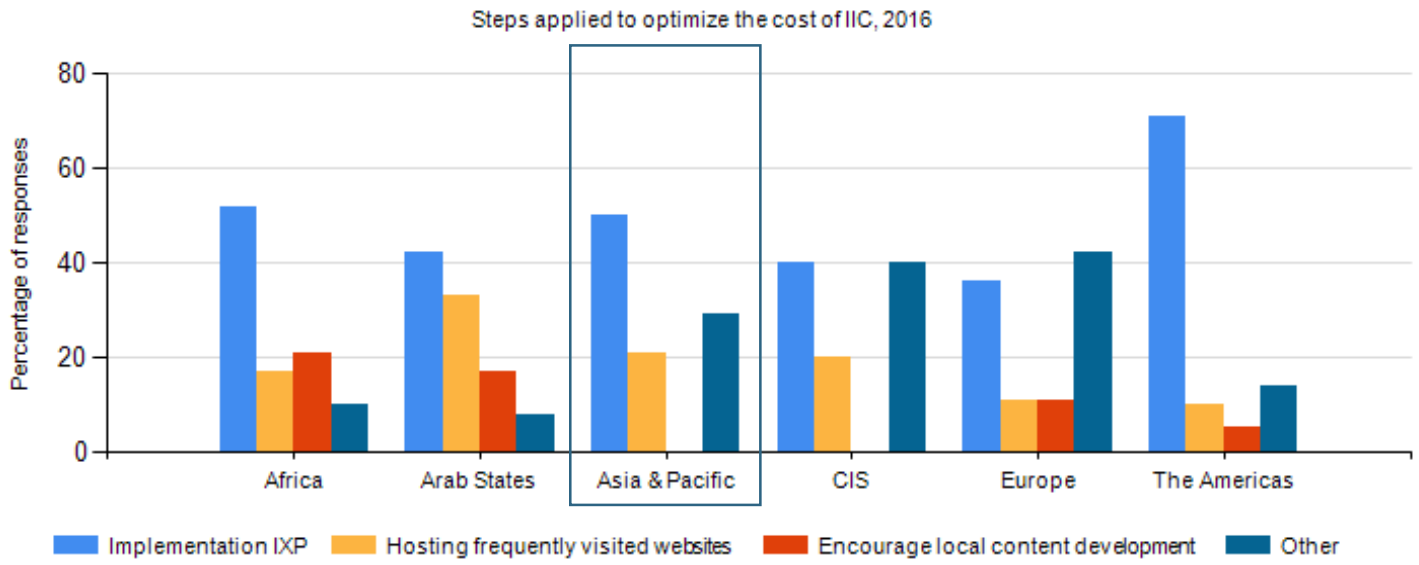


IP Network Architectures: IXP functional elements

- An **Internet exchange point** (**IX** or **IXP**) is a physical infrastructure through which Internet service providers (ISPs) and Content Delivery Networks (CDNs) exchange Internet traffic between their networks (autonomous systems).

- IXPs reduce the portion of an ISP's traffic which must be delivered via their upstream transit providers, thereby reducing the average per-bit delivery cost of their service.

- The increased number of paths learned through the IXP improves routing efficiency and fault-tolerance. In addition to that, IXPs exhibit the characteristics of what economists call the network effect.

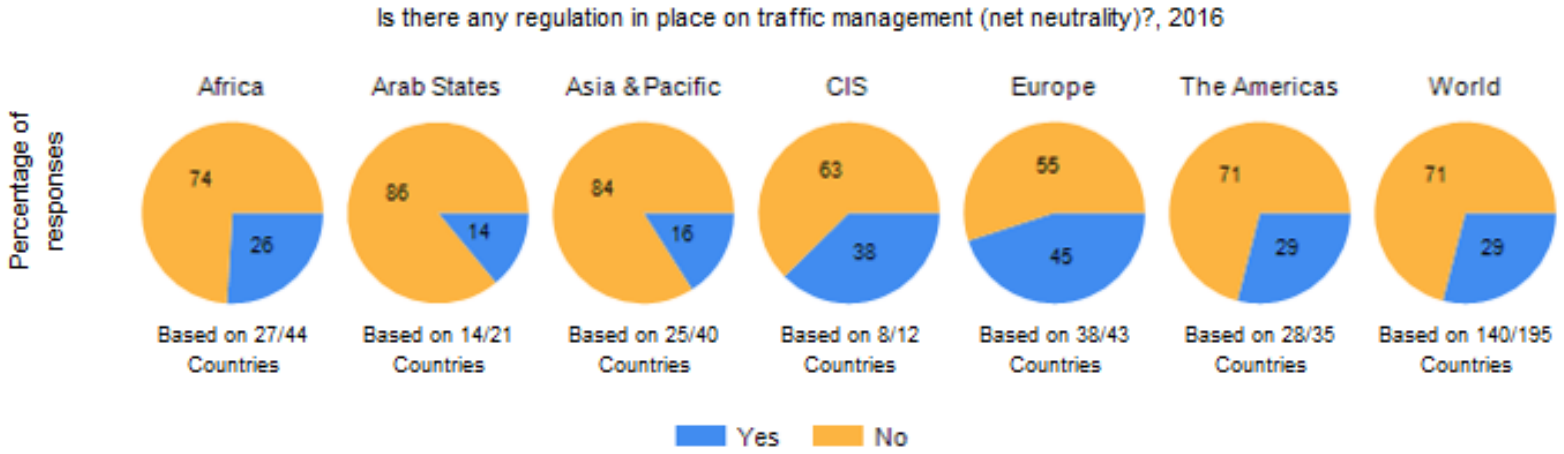


Net Neutrality

		Number of countries/economies						
		Africa	Arab States	Asia & Pacific	CIS	Europe	The Americas	Total
Is there any regulation in place on traffic management (net neutrality)?	Yes	7	2	4	3	17	8	41
	No	20	12	21	5	21	20	99
If Yes, in what legal instruments (legislation in force) is the concept defined? *	Broad overarching policy	0	1	0	0	0	2	3
	Law /legislation	4	0	1	2	9	3	19
	Regulation	5	1	0	0	2	3	11
	Other	2	0	1	1	7	0	11
Region size		44	21	40	12	43	35	195

Source: ITU World Telecommunication/ICT Regulatory Database

ITU ICT-Eye: http://www.itu.int/icteye



IP Interconnection: BEREC Study

- Internet traffic volumes continue to increase - mainly driven by video streaming services.
- Prices for transit or CDN services are still declining. BEREC considers that the price decline for transit services indicates that the market is highly competitive but at the same time put under pressure, both from peering services as well as CDN services.
- Costs of delivering data packets (on a per unit basis) continue to decline.
- Recent developments with regard to business models (e.g. CDNs), changes in traffic delivery and institutional arrangements (e.g. peering).
- Internal servers such as on-net CDNs or cache servers are becoming more prevalent within the market reducing the need for interconnection capacity.
- The increasing importance of CDNs as a means of traffic delivery coincides with the general growth in traffic, in particular video, as well as the gaining relevance of large CAPs with huge volumes of content.
- Some large CAPs also participate in different network infrastructure projects. It can be generally observed, that the Internet becomes more densely interconnected than in the past.
- Informal “handshake” agreements concluded without a written contract continue to make up for than 99% of all peering agreement. However, the evidence suggests that paid peering is not uncommon involving some larger European Internet access service providers.
- Also, traffic volumes exchanged at the biggest European IXPs – DE-CIX, AMS-IX, LINX continue to grow.

Source: **BEREC Report on IP-Interconnection practices in the Context of Net Neutrality, 1 June 2017**

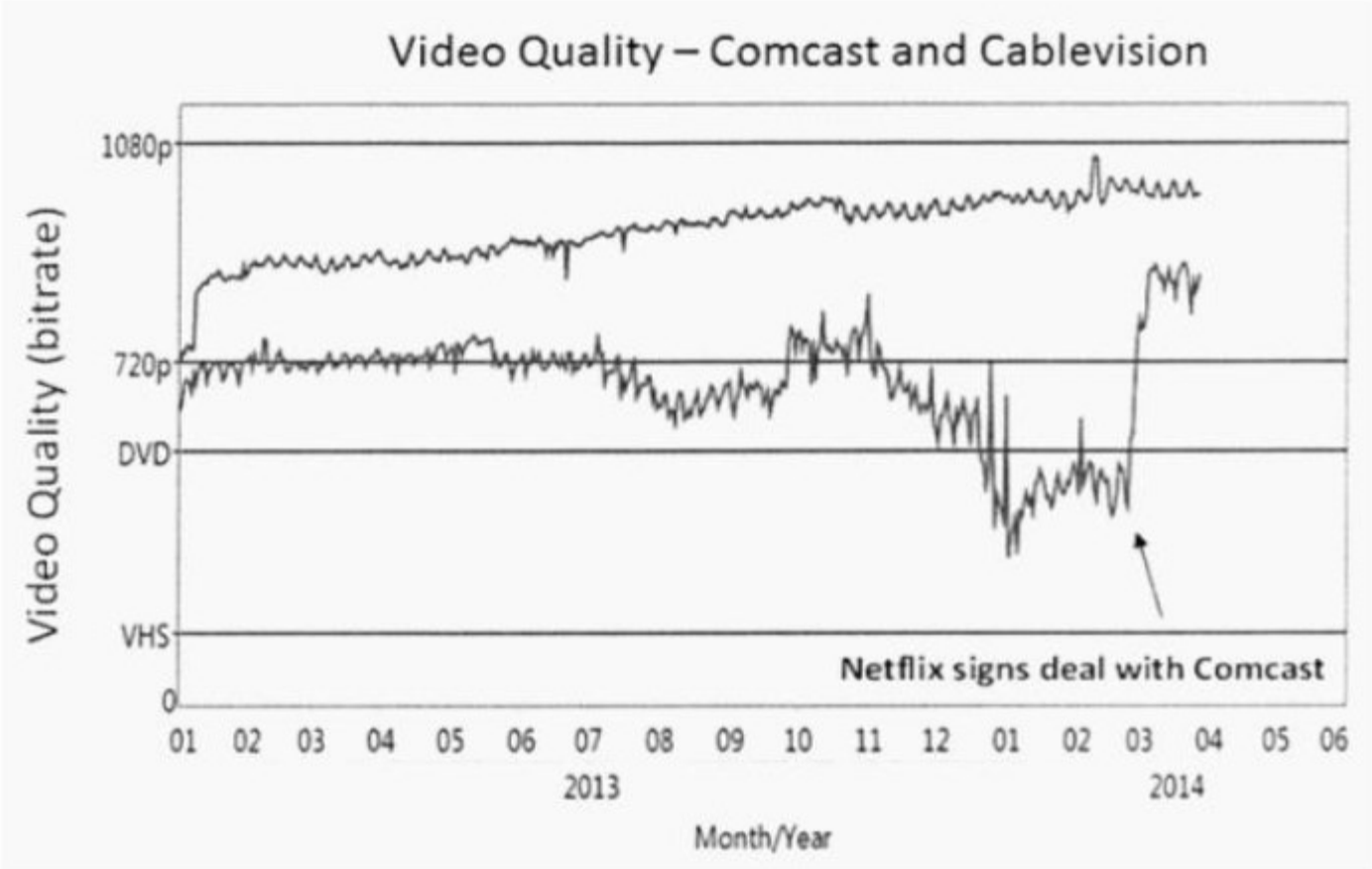
IP Interconnection: BEREC Study

Based on the evidence provided in this report BEREC draws in particular the following conclusions:

- While aggregate Internet traffic volumes continue to grow, prices for transit and CDN services also continue to decline. BEREC considers that the **Internet ecosystem's ability to cope with increasing traffic volumes is still given**.
- Where disputes have emerged in practice these seem to involve **complex relationships** as well as **economic/strategic considerations** of the providers.
- They were typically solved in the market **without regulatory intervention**. However, NRAs should carefully monitor whether this continues to be the case.
- **Competition and transparency for consumers remain key factors** ensuring that market forces work efficiently
- NRAs should continue to apply a **careful approach** when considering whether regulation is actually warranted.

Source: **BEREC Report on IP-Interconnection practices in the Context of Net Neutrality, 1 June 2017**

Figure 4-1: Netflix Video quality[33]

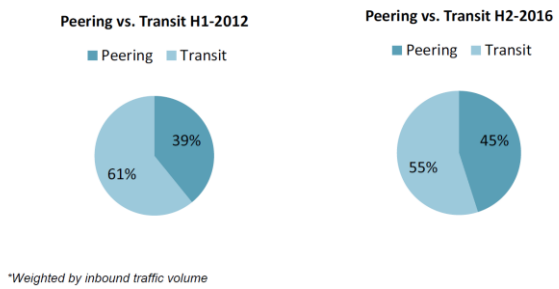


Source: https://qz.com/256586/the-inside-story-of-how-netflix-came-to-pay-comcast-for-internet-traffic/

IP Interconnection: BEREC Study

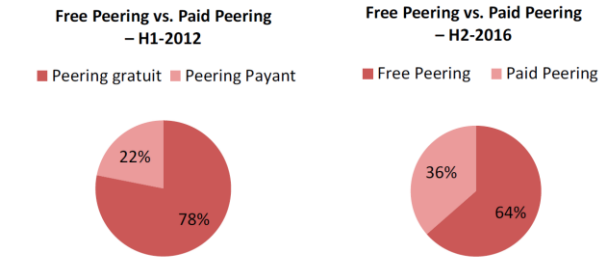
France

Figure 6-1: Peering vs. Transit in France*



*Weighted by inbound traffic volume

Figure 6-2: Free Peering vs. Paid Peering in France*



*Weighted by inbound traffic volume

"In 2011 a Cogent vs Orange dispute was taken to the competition authority by Cogent over the opacity of Orange's interconnection offers and the financial terms asked. Cogent considered that Orange was abusing its dominant position by asking to be paid for extra bandwidth capacity. Cogent and Open Transit International (Orange transit operator) had a peering agreement where the exchange of traffic between the operators was free, based on an asymmetry ratio threshold set at 2.5 to 1. ARCEP provided an expert opinion to the competition authority that held the view that requiring compensation for the provision of extra bandwidth capacity in peering agreements in case of a significant traffic imbalance was not to be considered as anti-competitive behavior. The authority validated Orange's behavior after the latter committed to some transparency measures."

Source: **BEREC Report on IP-Interconnection practices in the Context of Net Neutrality, 1 June 2017**

Termination Charges Regulation: Case of India

2003

Uniform termination charge of Re.0.30 per minute for all types of calls

2009

The termination charge for local and national long-distance voice calls to fixed-line and mobile was revised downwards from the erstwhile charge of Re.0.30 per minute to Re.0.20 per minute.

2015

Table : Termination Charges prescribed through the Telecommunication Interconnection Usage Charges (Eleventh Amendment) Regulations, 2015

Type of call	Type of traffic	Termination charge
Local and national long distance call	Wireless to wireless	₹ 0.14 per minute
	Wireless to wireline	0 (Zero)
	Wireline to wireline	0 (Zero)
	Wireline to wireless	0 (Zero)
International call	International incoming call to wireless and wireline	₹ 0.53 per minute

* Wireless means full mobility, limited mobility and fixed wireless access services.

2017

- Wireless to wireless termination charge should be reduced from existing 14 paisa (Re 0.14) per minute to 6 paisa (Re 0.06) per minute
- Bill and Keep (BAK) regime should be implemented for all types of domestic calls from 01.01.2020

Source: THE TELECOMMUNICATION INTERCONNECTION USAGE CHARGES (THIRTEENTH AMENDMENT) REGULATIONS, 2017; 19th September 2017

Some Take-aways

- Concentrate on wholesale prices controls as far as possible
  - Avoid price controls if the market is competitive;
  - Not all prices need detailed costing;
- Recognise that operators have to be able to cover their costs
  - A reasonable return on capital employed;
  - Consider the investment risks involved and capital expenses;

- Promote investment is important – perhaps more than in the past…
  - Setting the right investment incentives to expand or upgrade networks;
  - Encourage co-investment strategies (e.g.: between network operators - content producers - OTTs) and infrastructure sharing;
- Regulatory obligations need to become more competition-policy likely
  - Closer co-operation between NRAs and NCAs;
  - Avoid duplication of tasks;
- Specific market conditions matter - One size does not fit all
  - When benchmarking consider differences between countries (infrastructure, geography, market; economic development…);
  - Regulatory policy prescriptions should be developed and adapted based on the Telecommunication/ICT context of each country.

GSR17
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GSR17

BEST PRACTICE GUIDELINES

ON POLICY AND REGULATORY INCENTIVE FOR AFFORDABLE ACCESS TO DIGITAL SERVICES

Regulating the ever-changing ICT sector requires skills, foresight and innovation. Developing and using best practices is the best way to fast-track our efforts to adapt to change and embrace new technologies to foster development and business.

"The rich promise of the transformative digital economy is within our reach. The world needs to move towards an open, collaborative, incentive-based regulatory approach and the leadership of ICT regulators is crucial in this endeavour. This leadership will help navigate through the profound technology change of today and deliver on its rich promise tomorrow, with life-changing benefits for many millions. I am sure that this year's GSR Best Practice Guidelines will provide useful guidance in forging regulatory frameworks for the ICT sector as the basis for the digital economy today and for the future."

Organized on the initiative of Mr Brahima Sanou, Director, Telecommunication Development Bureau (BDT), ITU

"The deliberations that have informed these GSR Best Practice Guidelines represent the collective wisdom of decades of global ICT regulatory experience, applied to the paradigm facing regulators as the world adapts to the next generation of technologies and approaches total connectivity. The cooperative and collaborative approach to regulation envisaged in these guidelines recognizes that policy maker, regulator and industry must work together to deliver on the promise of tomorrow's technology's dividend. URCA is proud to be coordinating the consultative process this year and we are confident that the guidelines will represent an invaluable tool for regulators designing the ICT regulatory frameworks to meet our countries' needs."

Coordinated by Mr. Stephen Bereaux, Chief Executive Officer, URCA, Bahamas

www.itu.int/en/ITU-D/Conferences/GSR/Pages/GSR2017/

i. Strengthening the regulatory foundation for affordable access to digital services

Recognizing the transformative power of the following regulatory instruments for reducing the cost of ICT infrastructure deployment and the adoption of end-user services, we reiterate their relevance and call for strengthening and further streamlining rules and practices with regards to:

- Adopting and leveraging national digital policies, strategies and plans which seek to ensure that broadband and IP technologies are available to as wide a community of users as possible
- Adopting a flexible, transparent approach to promoting robust competition in the provision of network access and end-user digital services
- Designing flexible, incentive-based and market-oriented policy and regulatory frameworks with regard to allocation and assignment of spectrum, in particular for broadband services
- Promoting cross-border fiber networks as well as the build-out of pervasive national backbone networks complemented by terrestrial wireless and satellite infrastructure where necessary
- Synchronizing domestic network demand with international capacity deployment
- Encouraging the deployment of Internet exchange points as well as content distribution networks at the national, regional and international level
- Removing barriers to market entry at all levels and adopting incentives for open access and infrastructure sharing at the international and regional levels, with a view to reducing the cost of connectivity to submarine cables, regional fiber backbone and satellite infrastructure
- Adopting innovative licensing regimes and incentivizing new business models for covering remote and rural areas that more effectively integrate the use of terrestrial, satellite, and submarine telecommunication infrastructure.
- Fostering multi-infrastructure mapping and deployment, including working with local government to lift restrictions on infrastructure deployment
- Monitoring and, if necessary, setting mobile and fixed interconnection rates, including through sound regulatory accounting
- Requiring dominant incumbent providers to provide wholesale, unbiased access to its network for the purposes of interconnection and infrastructure sharing
- Enabling number portability over fixed and mobile networks
- Considering the efficiency of licensing and spectrum fees
- Using holistic universal access and service strategies and financing mechanisms for both network expansion, connectivity for public institutions and the community as well as demand-stimulation measures, such as end-user subsidies.
- Promoting the development of innovative new technologies that enhance rural and remote coverage at lower cost

We recall and reconfirm the importance of such measures and incentives, as iterated in the GSR best practice guidelines from previous years.

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Thank You