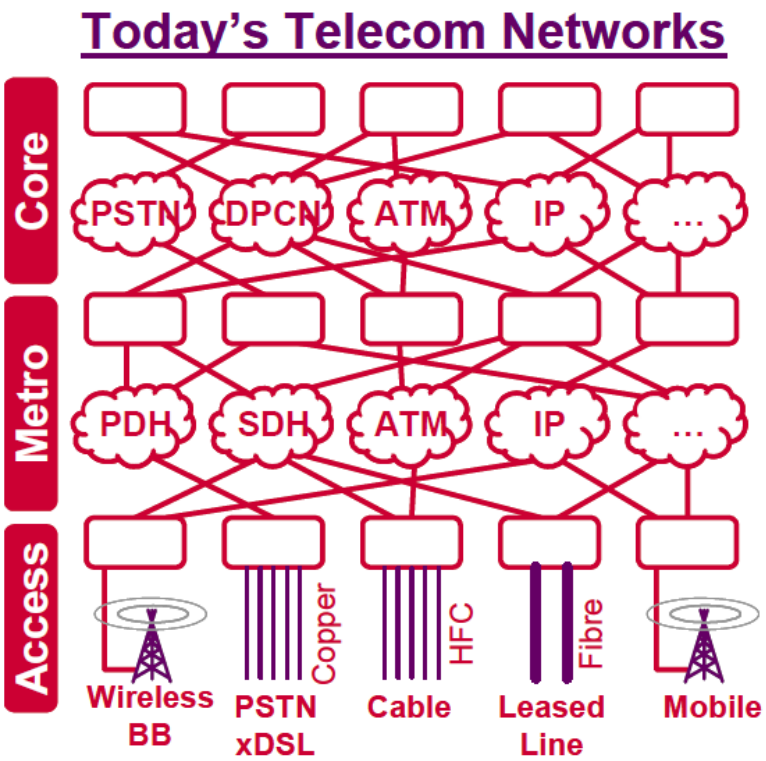
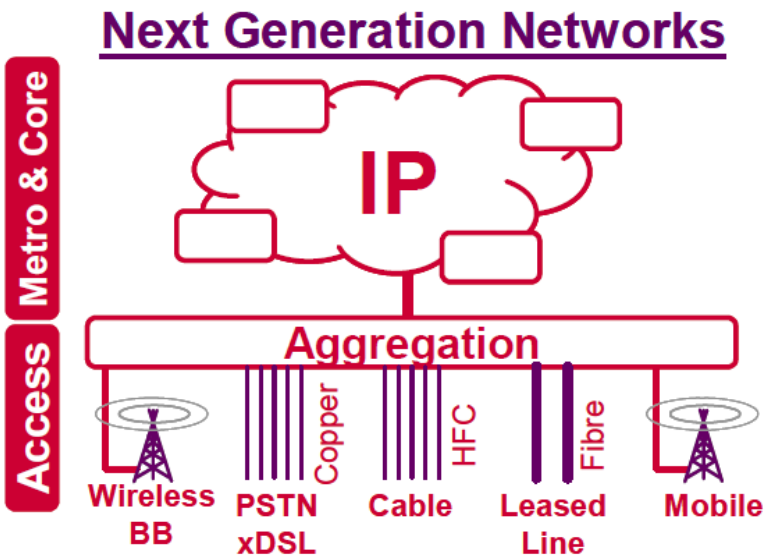
IP interconnection – market developments

March 2015

Legacy networks are being migrated to common IP platforms

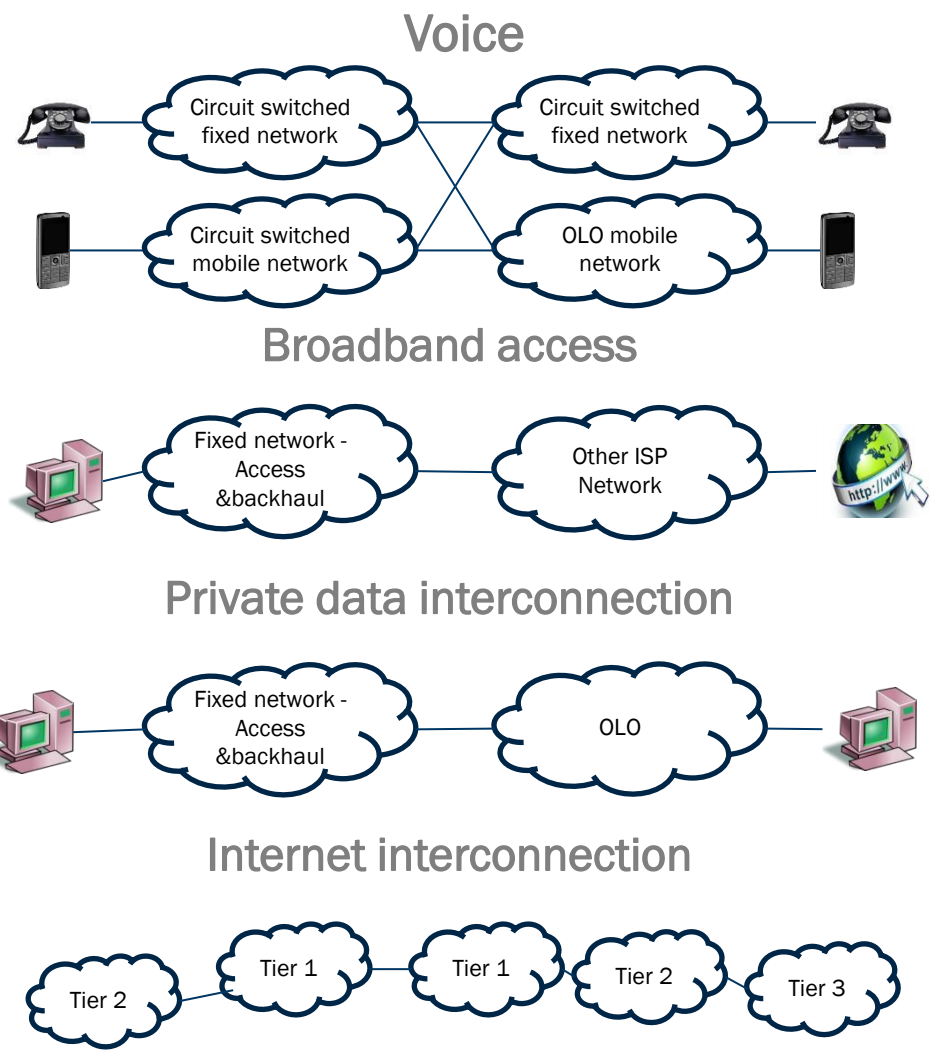




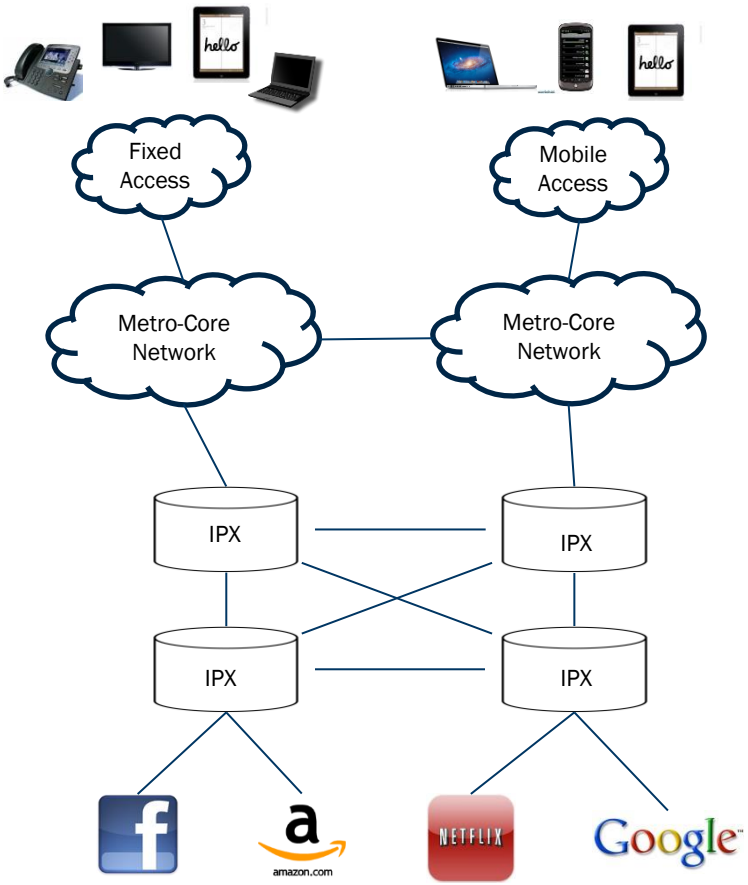
Ofcom, Next Generation Networks: Further consultation, 30 June 2005

This migration to IP will affect many telecom markets

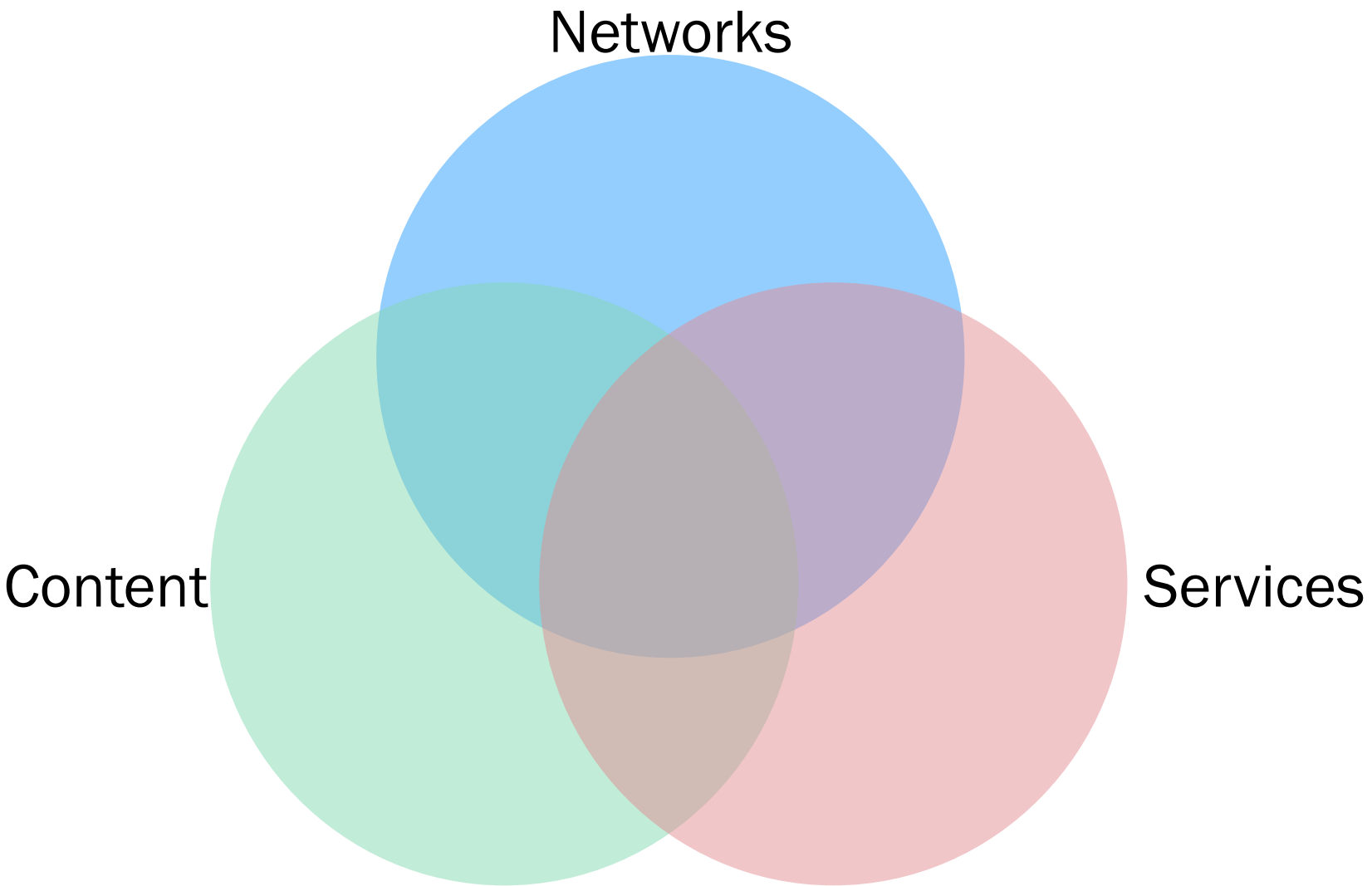
Segmented market



Market convergence

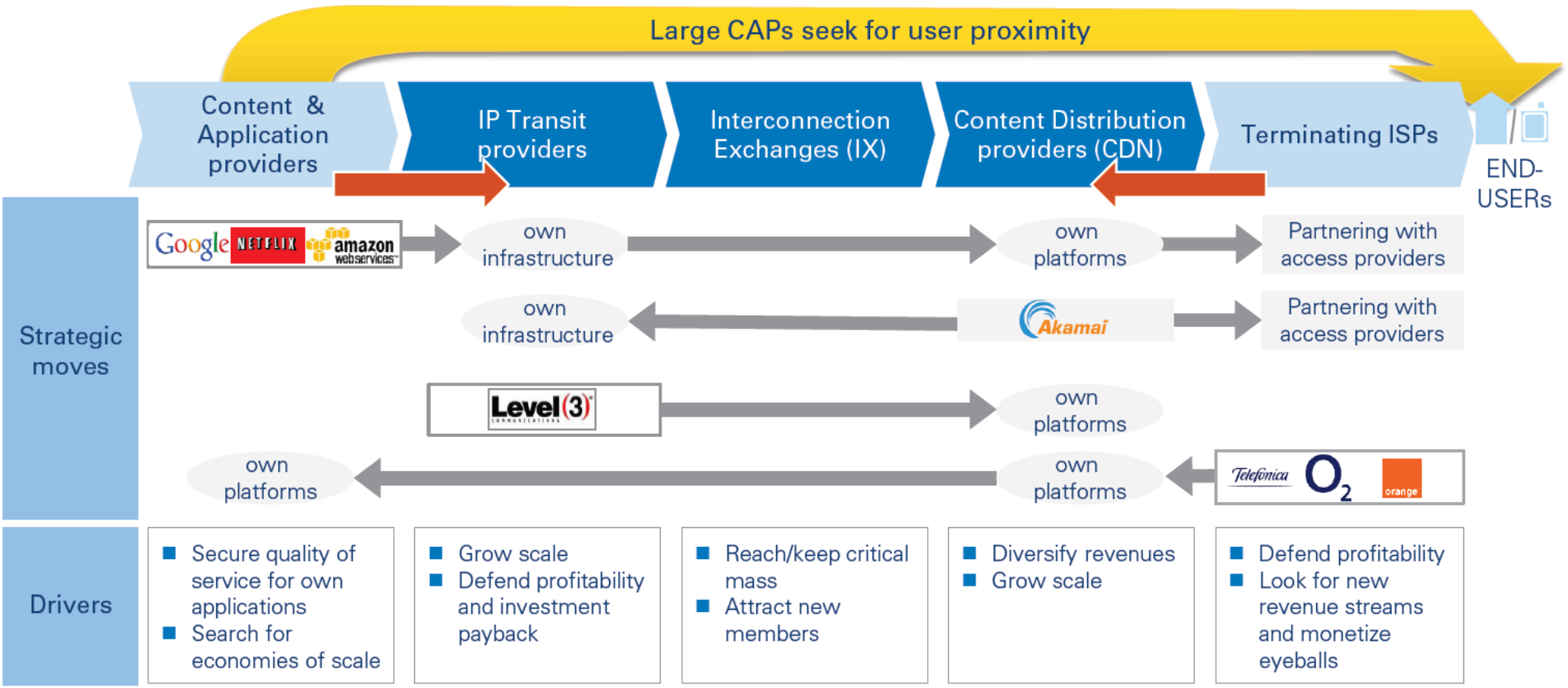


Convergency is driving major structural changes in the sector



Firms are moving across the IP value chain

Figure C – Trends over the IP Interconnection value chain



Source: Arthur D. Little analysis

Internet companies and device manufacturers are disrupting the market

Google Voice

FaceTime

Microsoft skype™

Google fiber

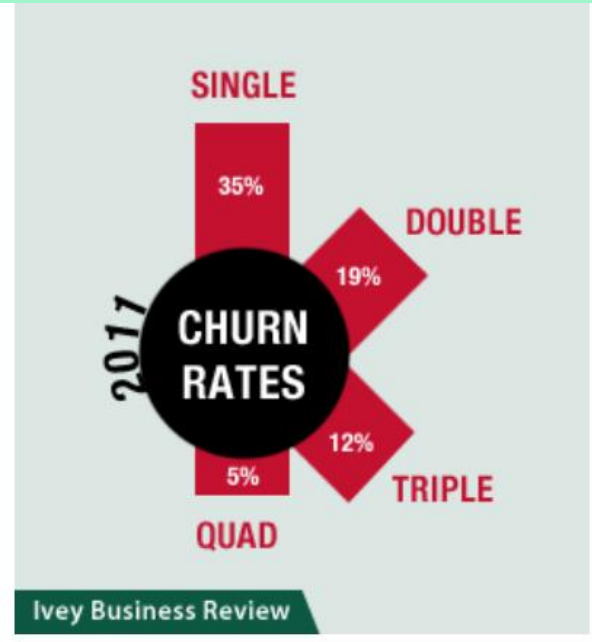
And telcos are pursuing different models of vertical and horizontal integration

Ireland: O2 merger with Hutchison 3G

Details of other M&A deals focus on middel east

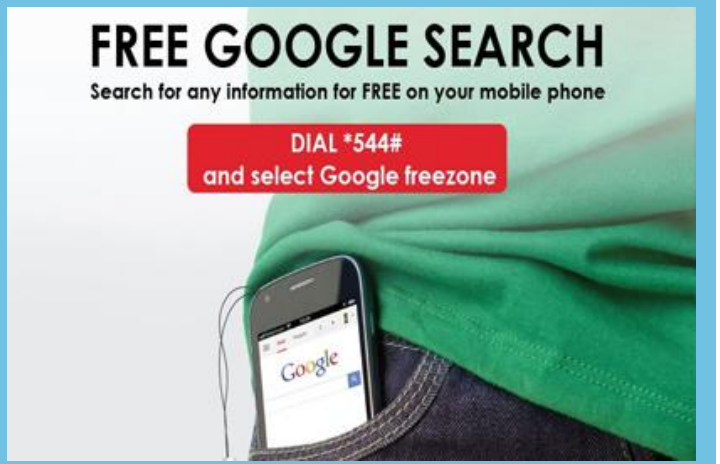
Traditional retail pricing models are becoming challenged

Bundling



http://iveybusinessreview.ca/cms/4800/wind-mobile-quad-play-fourth-place/

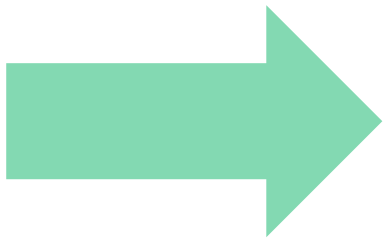
Zero rating



WIKIPEDIA | zero

What can telcos do?

- Rethink price – cost relationship
- Look at whole value chain



- Implications for:
  - Interconnection prices
  - Regulation
  - Tax

Fixed operators will be migrating PSTN to VOIP to reduce costs

- Incumbents now looking to switch off their PSTN networks:
  - PSTN switching technologies approaching the end of their life
  - TDM equipment not supported
  - Likely rise in cost per TDM voice customer
  - Lower cost of VOIP network
  - Price pressure from VOIP providers
- Already happening in US
- Plans elsewhere
  - Deutsche Telekom – plans to migrate by 2018
- Migration plans will depend on a number of factors

Analysys Mason, Roadmaps for the transition to new fixed and mobile voice technologies, Final report for Ofcom, October 2014

Fixed operators will be migrating PSTN to VOIP to reduce costs

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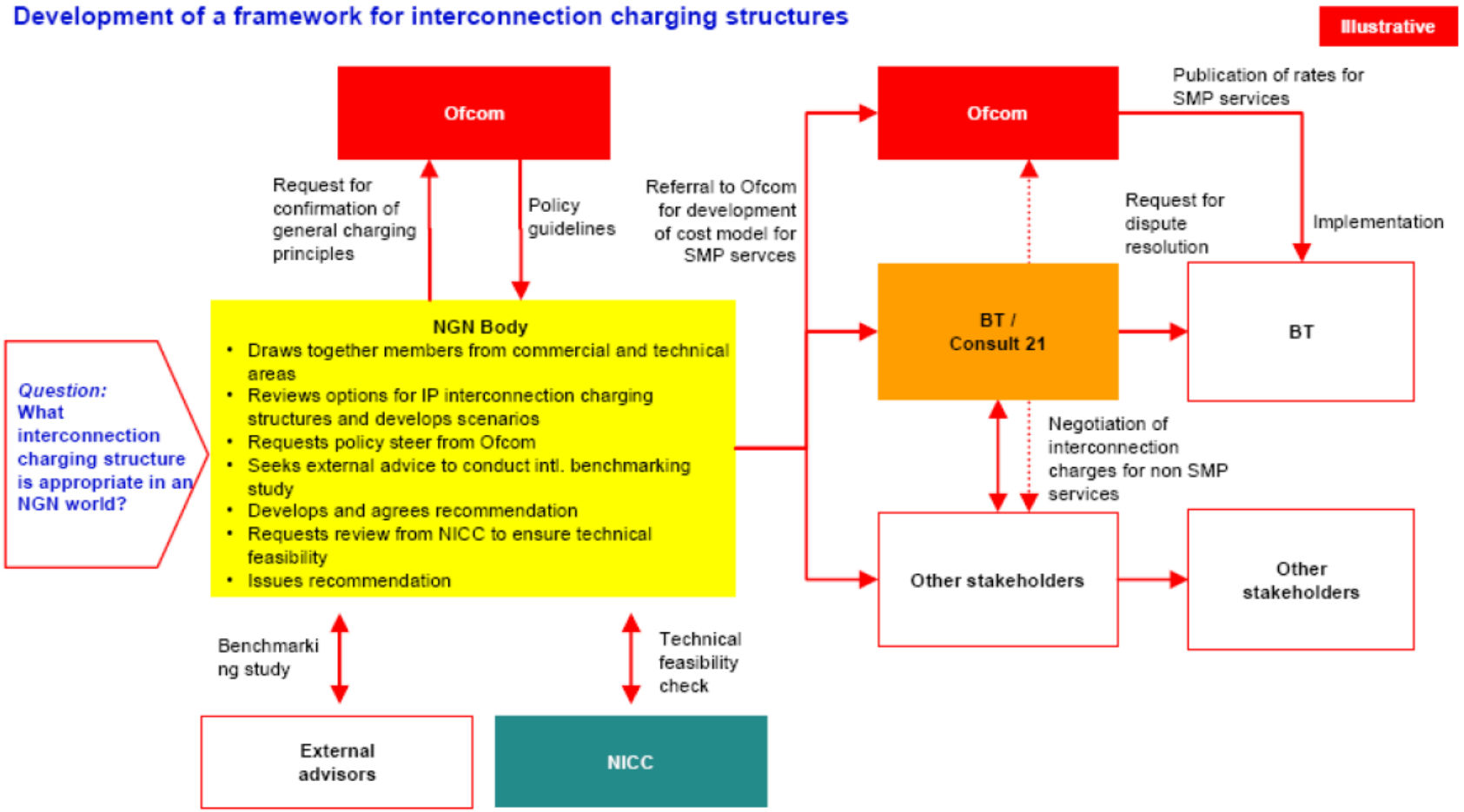
Reduction in network nodes for IP network

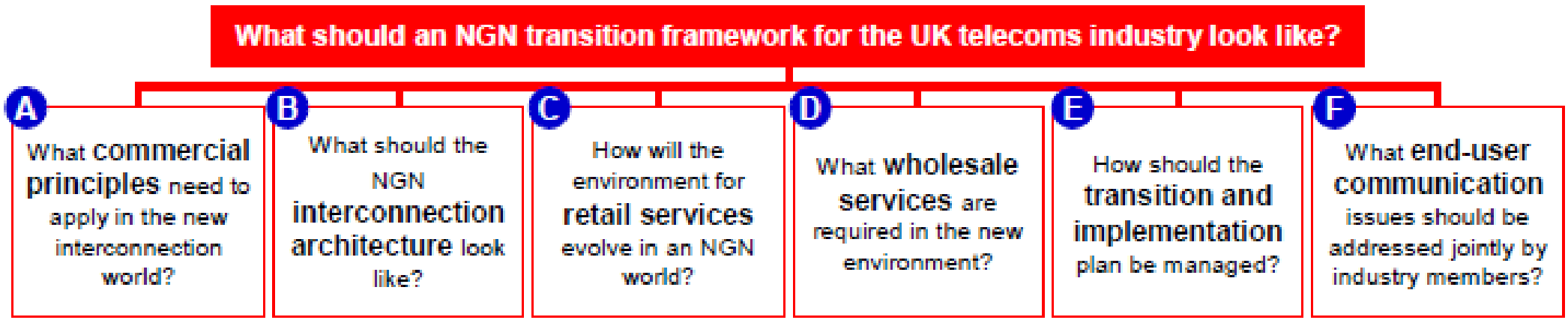
Network section	Level	Equipment		Locations	
		PSTN/ISDN	IP-BBN	PSTN/ISDN	IP-BBN
Core	Top	WVSt (trunk exchange)	LSR	23	15
	Bottom	BVSt (local exchange)	LER/LSR	475	74
	Interface	BVSt (local exchange)	BRAS-ATM TS	475	74
Access	Top	TVSt (access exchange)	ATM-Con	625	500
	Bottom	APE (remote peripheral unit)	DSLAM	6700	5000

Analysys Mason, Roadmaps for the transition to new fixed and mobile voice technologies, Final report for Ofcom, October 2014

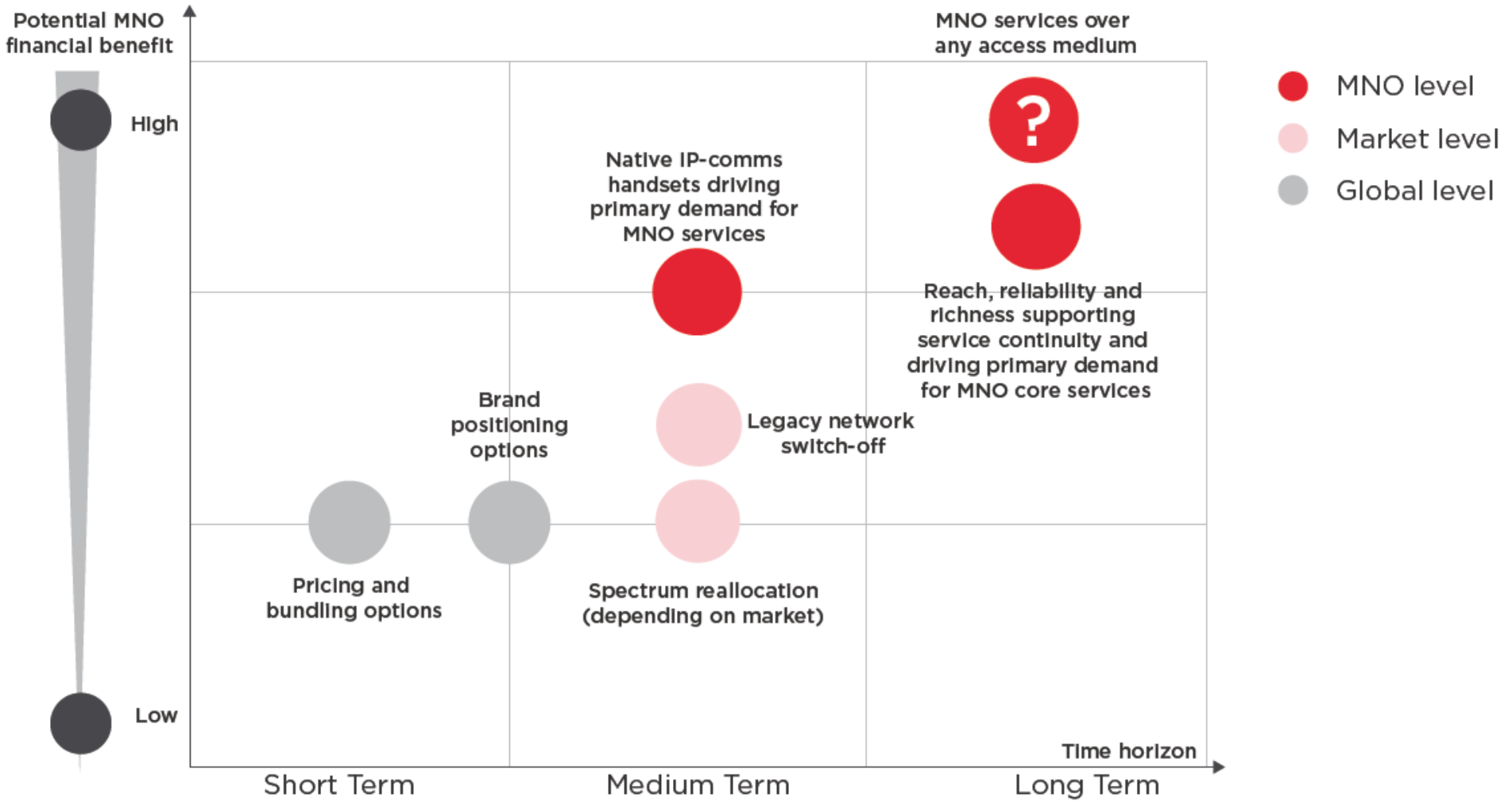
Development of new interconnect structures will need to be developed



Migration from PSTN to VPOI raises lots of questions



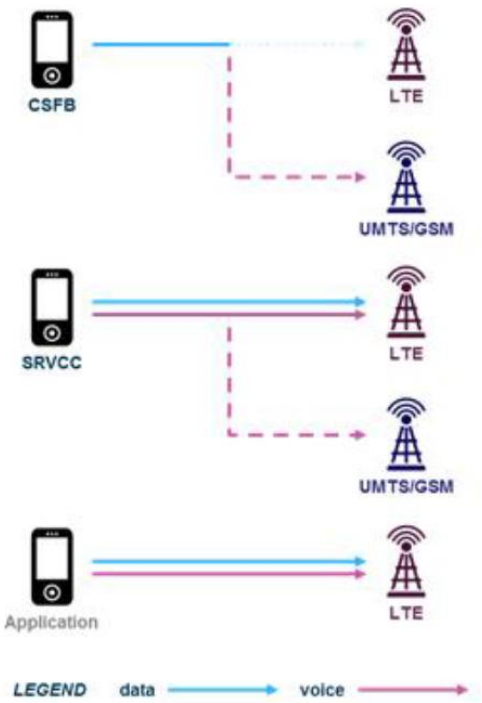
The benefits to MNOs of moving to VoLTE



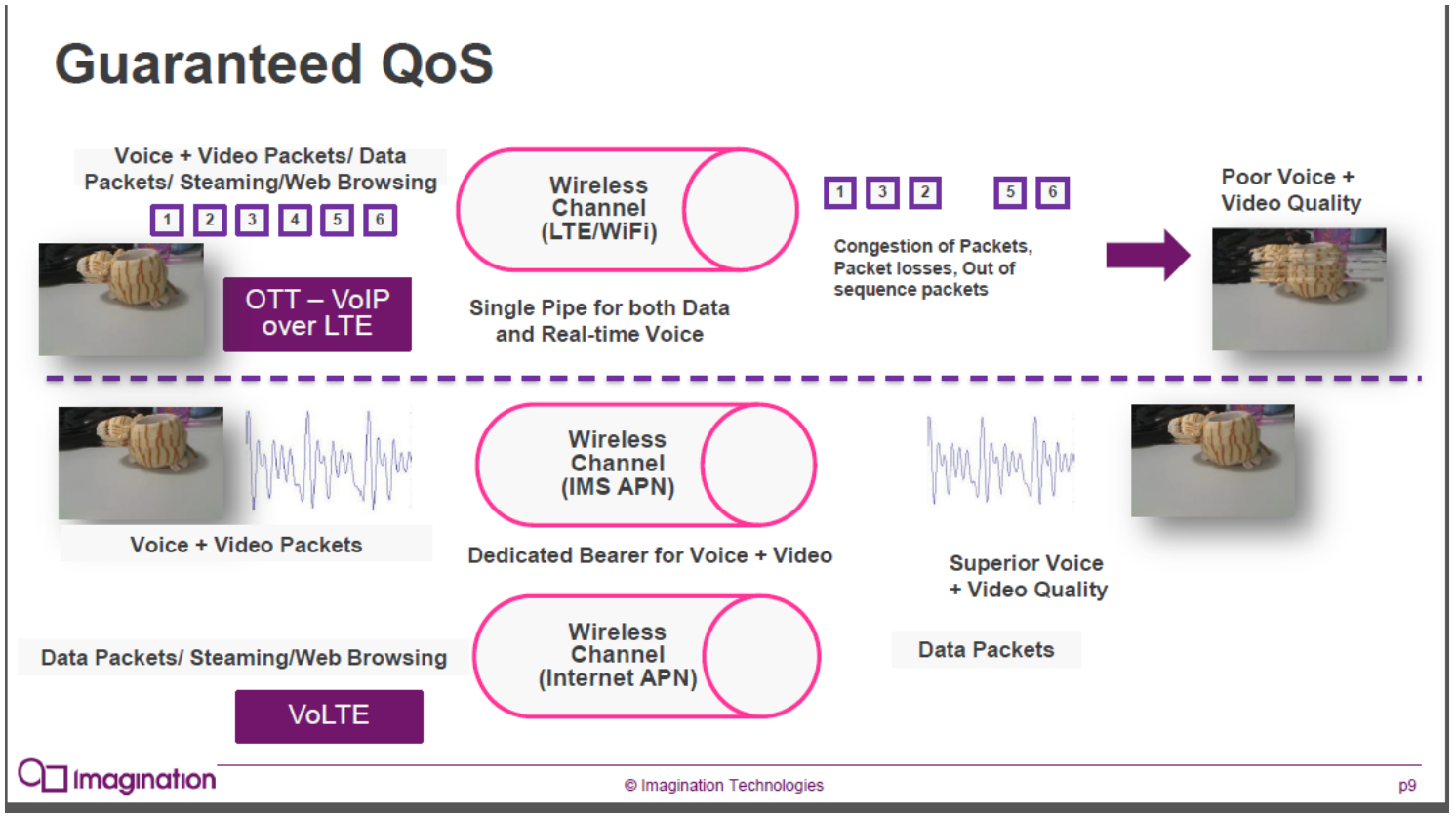
GSMA Intelligence Building the case for an IP-communications future, February 2015

Mobile termination rates - VoLTE

- **Circuit-switched fallback** (CSFB). This uses the LTE infrastructure for data, but "falls back" to the legacy UMTS and GSM networks to make or receive voice calls
- **Simultaneous voice and LTE (SVLTE).** Certain handsets on CDMA networks have a dual radio system and can transmit data over LTE and voice over CDMA simultaneously
- **VoLTE** requires the deployment of IP Multimedia Subsystem (IMS) core elements which control how calls are initiated and directed in the network.
- **Single radio voice call continuity** (SRVCC) is a technology that can bridge 4G coverage gap. SRVCC allows a VoLTE call to transition to the legacy networks when LTE coverage is insufficient
- **Application-based voice services** using the packet-switched LTE network as their data transport mechanism



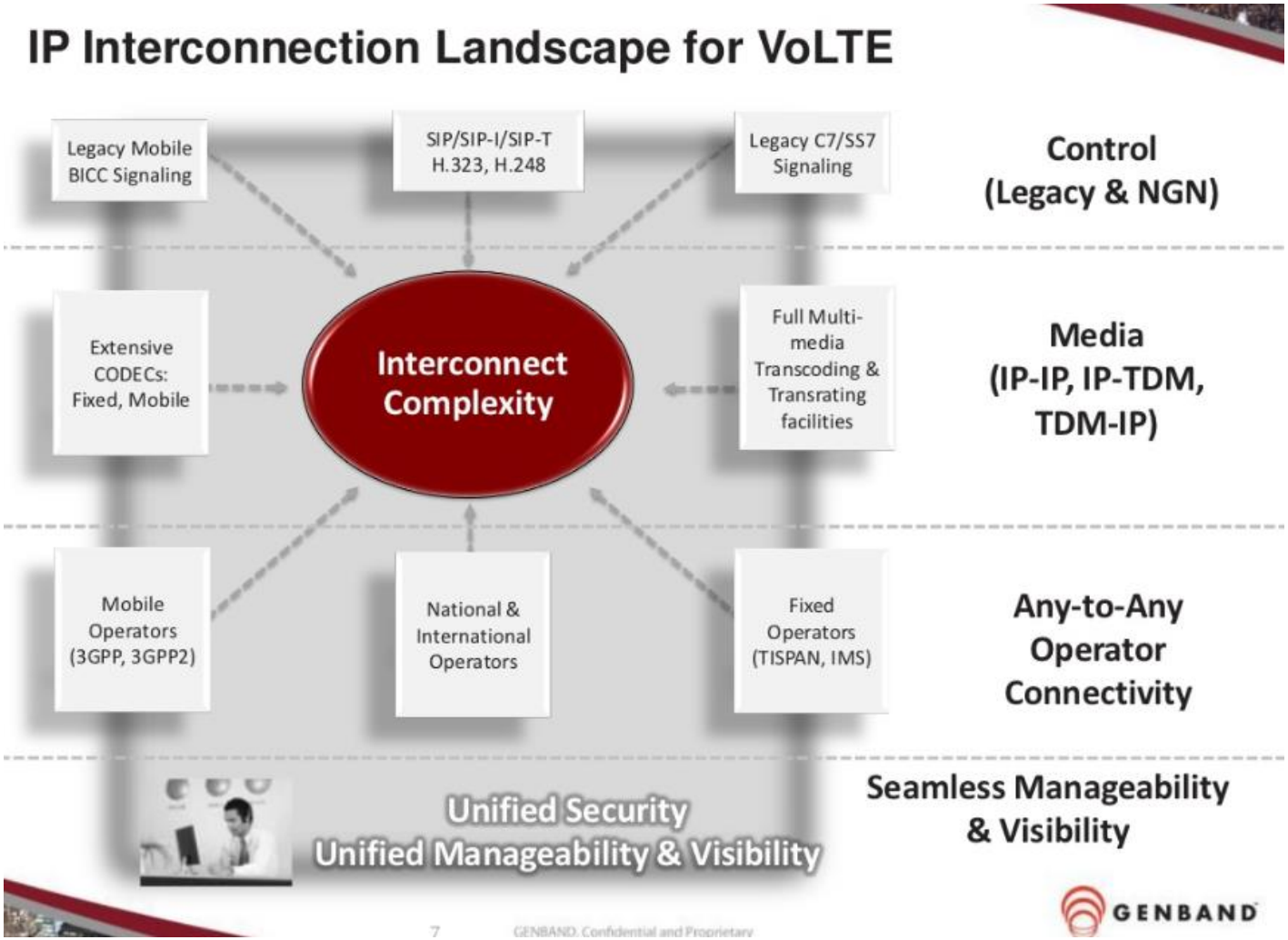
Superior quality of VoLTE compared to BB internet VOIP could justify interconnection charges



VoLTE or VoIP over LTE – Who is the Ultimate Winner – imgtec , March 2013

But prices will be constrained by competition from VoIP and 2G/3G

VoITE interconnection is still being worked on



Likely standard is IPX

IPX

GSM Association (GSMA)

- Most active, standardising **"IP eXchange (IPX)"** since 2007.
- Defines **IP interconnect for wireline & wireless, including IMS**.
- **Assumes world is SIP -** Does not cover TDM (&SS7)–IP interconnect.
- **Carrier focused** - Covers both **commercial and technical framework**
- **IPX is evolution of GSX** – mobile version currently used by majority of mobile operators.

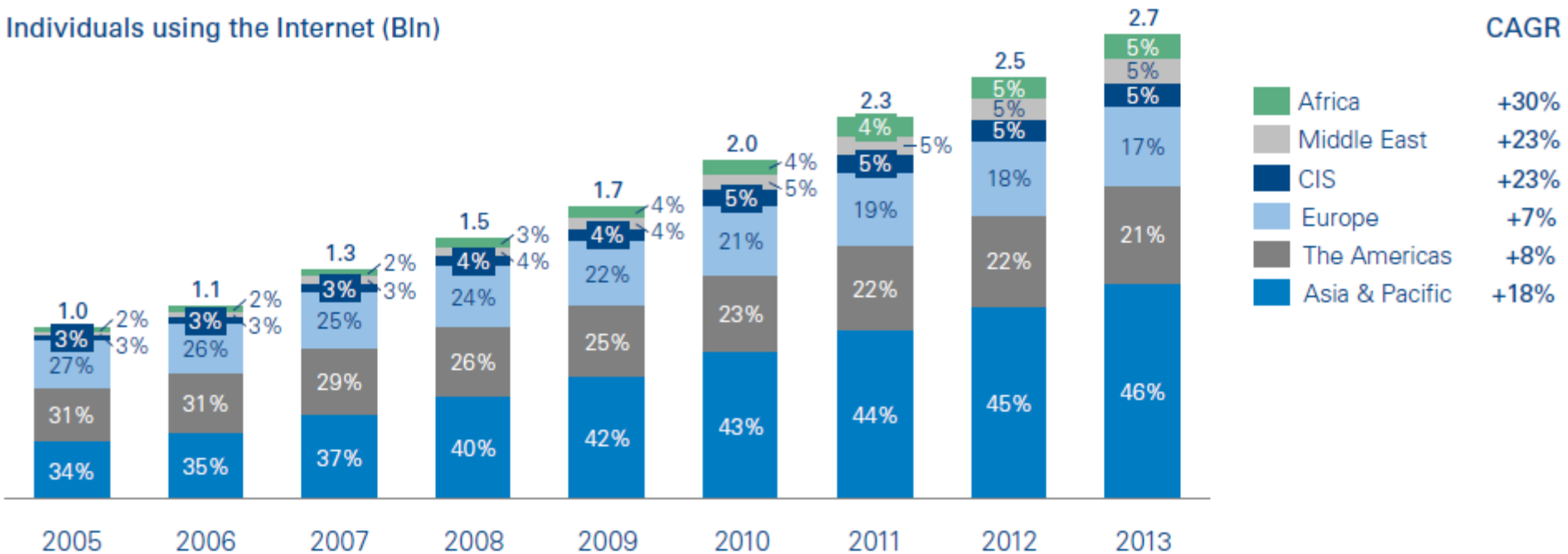
VoLTE developments

Figure 4.2: Activities relating to VoLTE by selected operators, 2011–14 [Source: Analysys Mason, 2014]

Date	Event
February 2011	Verizon Wireless (USA) completed first VoLTE call
August 2012	SK Telecom (South Korea) deployed first HD VoLTE service and LG U+ launched VoLTE service
August 2012	MetroPCS (USA) launched limited VoLTE service
October 2012	KT (South Korea) launched VoLTE
April 2013	EE (UK) announced network upgrades to provide support for new services including VoLTE
1Q 2014	Telefónica Germany (O_2) will demonstrate VoLTE
2Q 2014	AT&T and T-Mobile launched VoLTE service commercially in the USA
4Q 2014	China Mobile will launch VoLTE

The IP traffic market is growing rapidly to meet demand

Figure 2: Individuals using the Internet



Source: ITU, Arthur D. Little analysis

Video streaming drives internet bandwidth requirements

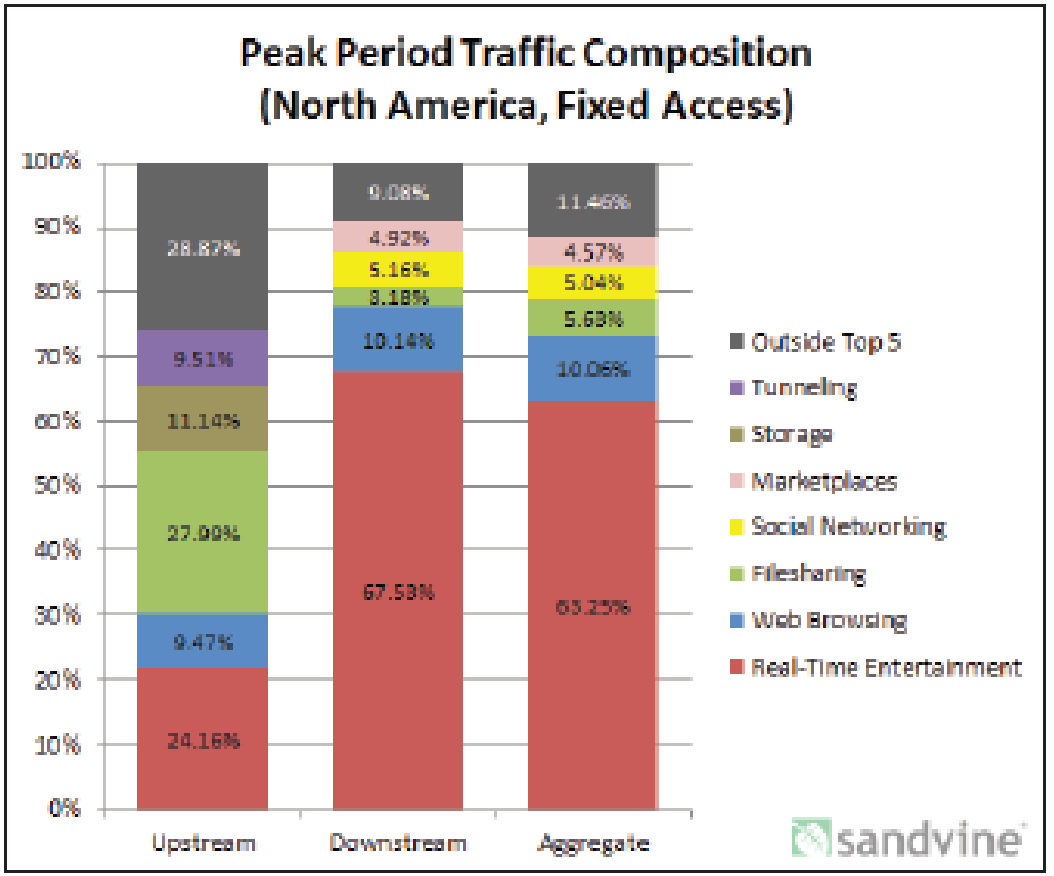


Figure 1 - Peak Period Aggregate Traffic Composition - North America, Fixed Access

	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	BitTorrent	25.49%	Netflix	34.89%	Netflix	32.39%
2	Netflix	9.48%	YouTube	14.04%	YouTube	13.25%
3	HTTP	7.18%	HTTP	8.62%	HTTP	8.47%
4	SSL	7.05%	Facebook	2.98%	BitTorrent	5.03%
5	YouTube	6.14%	BitTorrent	2.80%	Facebook	2.94%
6	iCloud	4.41%	iTunes	2.77%	SSL	2.63%
7	Skype	2.77%	MPEG - OTHER	2.66%	iTunes	2.55%
8	Facebook	2.60%	Amazon Video	2.58%	MPEG - OTHER	2.44%
9	FaceTime	2.38%	SSL	2.14%	Amazon Video	2.37%
10	Dropbox	1.48%	Hulu	1.41%	Hulu	1.20%
		68.98%		74.89%		73.28%

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Table 2 - Top 10 Peak Period Applications - North America, Fixed Access

Monthly Consumption - North America, Fixed Access		
	Median	Mean
Upstream	1.8 GB	8.5 GB
Downstream	20.4 GB	48.9 GB
Aggregate	22.5 GB	57.4 GB

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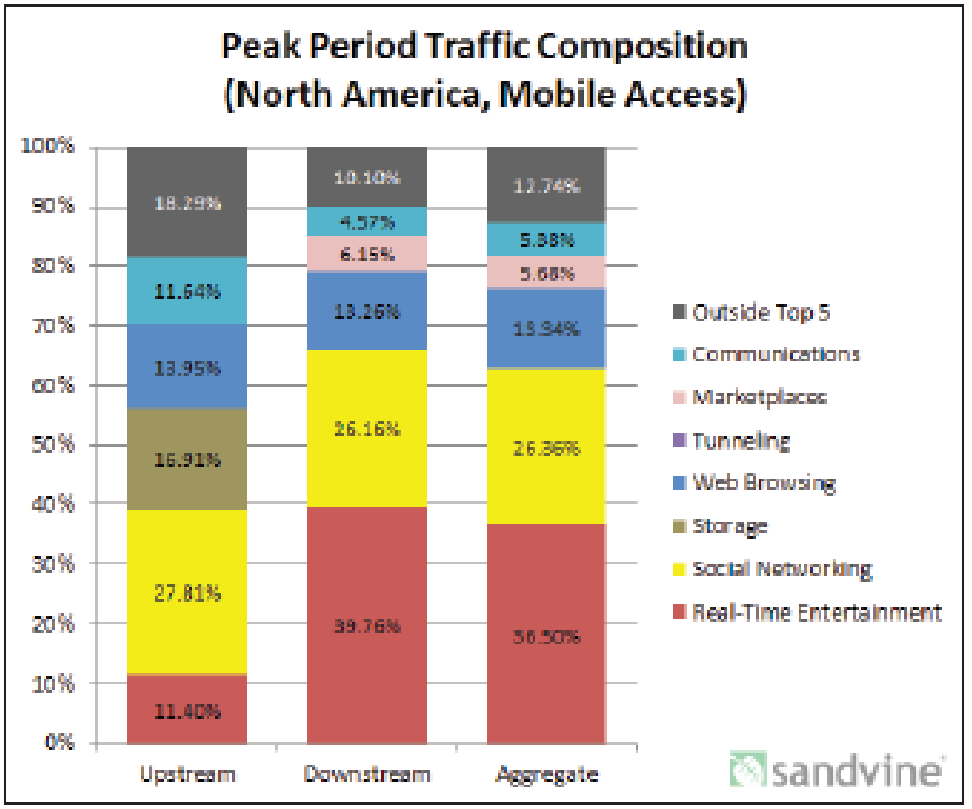
Social networks are more important on mobile networks



	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	Facebook	22.36%	YouTube	19.75%	Facebook	19.43%
2	Google Cloud	11.97%	Facebook	19.05%	YouTube	18.02%
3	HTTP	9.85%	HTTP	11.44%	HTTP	11.26%
4	SSL	9.22%	MPEG - OTHER	6.32%	MPEG - OTHER	5.72%
5	YouTube	4.56%	Netflix	4.51%	SSL	4.63%
6	Instagram	2.55%	Instagram	4.49%	Instagram	4.27%
7	Snapchat	1.94%	SSL	4.03%	Netflix	4.10%
8	BitTorrent	1.88%	iTunes	3.20%	Google Cloud	4.09%
9	FaceTime	1.59%	Google Cloud	3.07%	iTunes	2.96%
10	Skype	1.53%	Pandora Radio	2.72%	Pandora Radio	2.53%
		67.44%		78.57%		77.02%

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Monthly Consumption - North America, Mobile Access		
	Median	Mean
Upstream	19.7 MB	75.4 MB
Downstream	99.1 MB	506.5 MB
Aggregate	118.4 MB	521.9 MB

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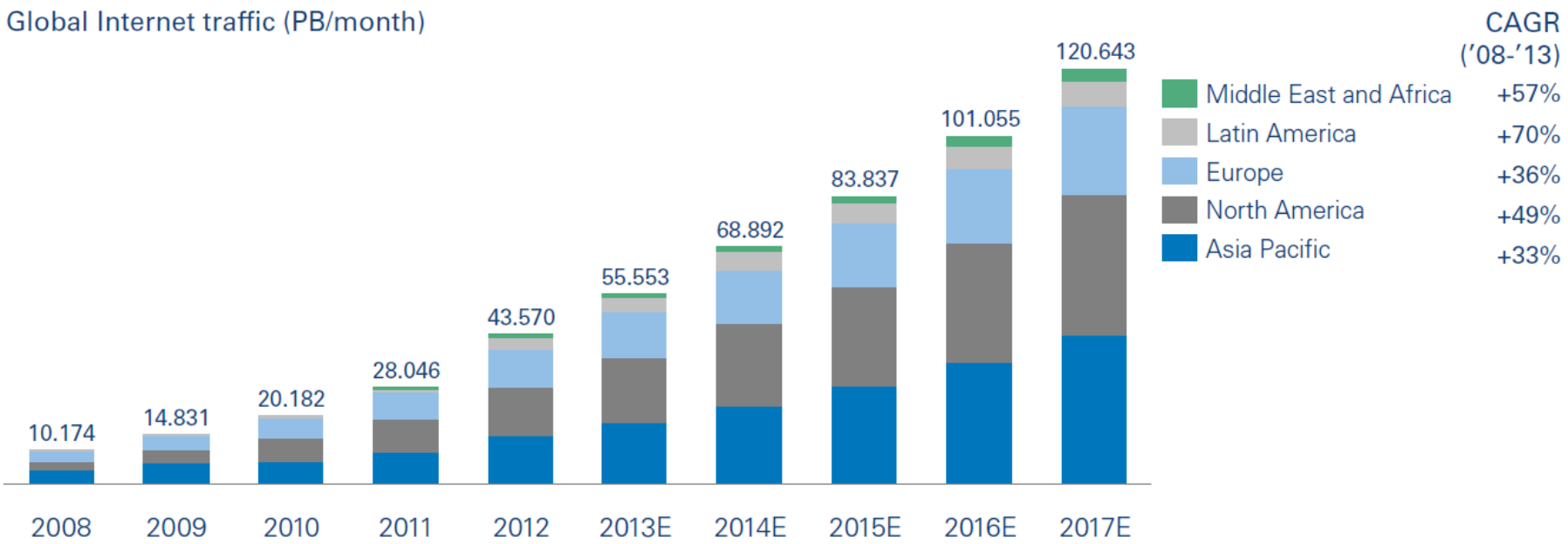
Sandvine Global Internet Phenomena Report 2H2014

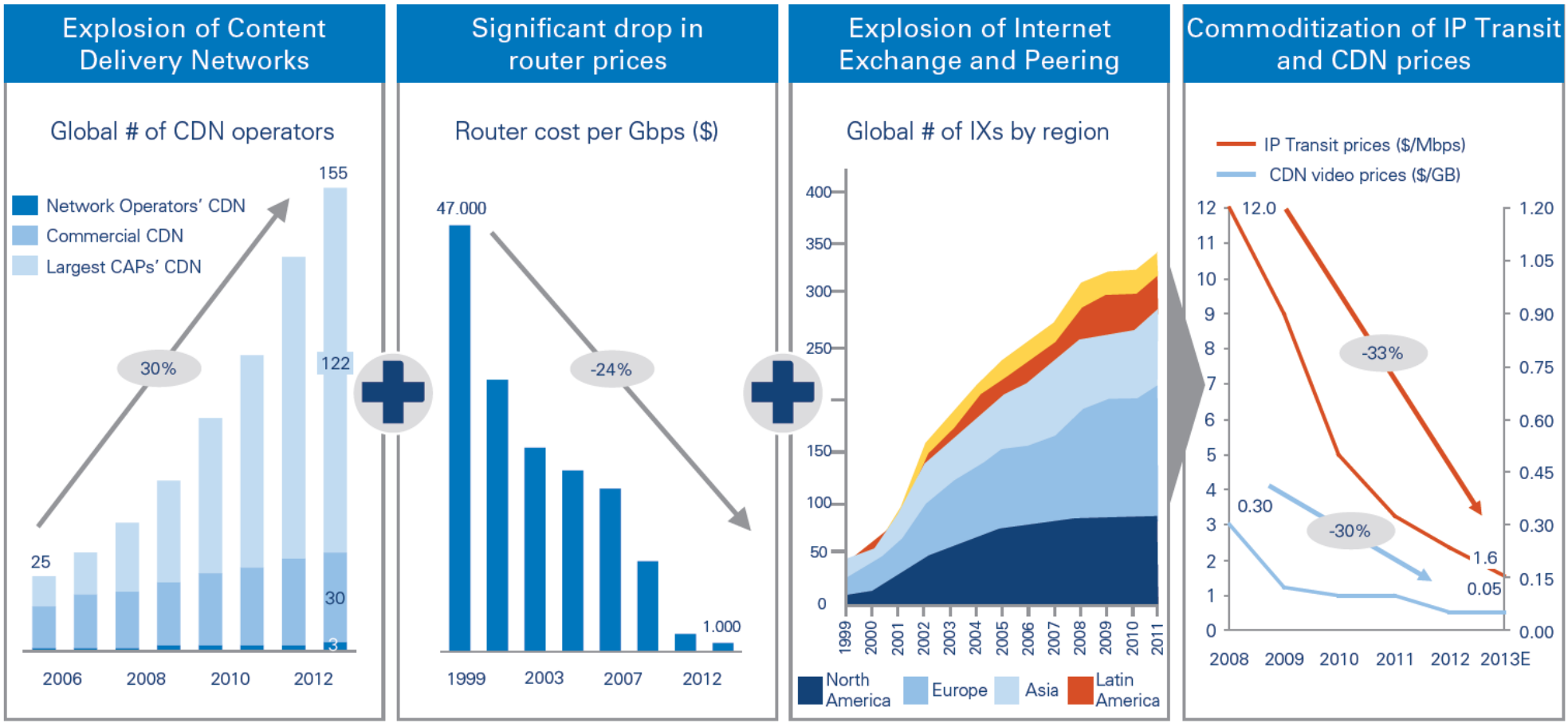
Annual traffic growth rates have been in excess of 50%

Figure 3: Global IP traffic by region



Source: CISCO, Arthur D. Little analysis

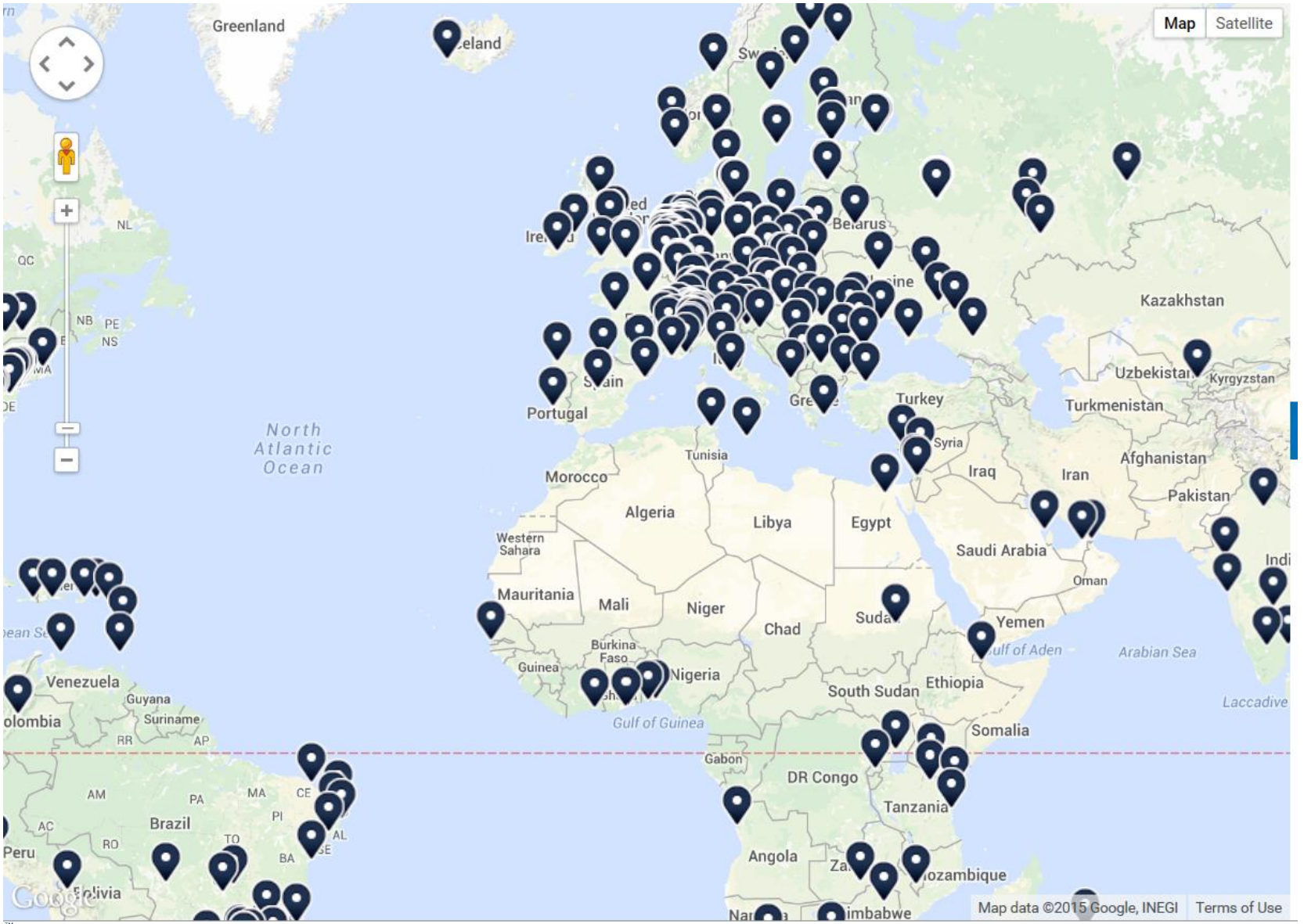
Transit prices falling rapidly



Source: ITU, Informa, Packet Clearing House, Dr. Peering, Cisco, streamingmedia.com, Web sites, Arthur D. Little analysis

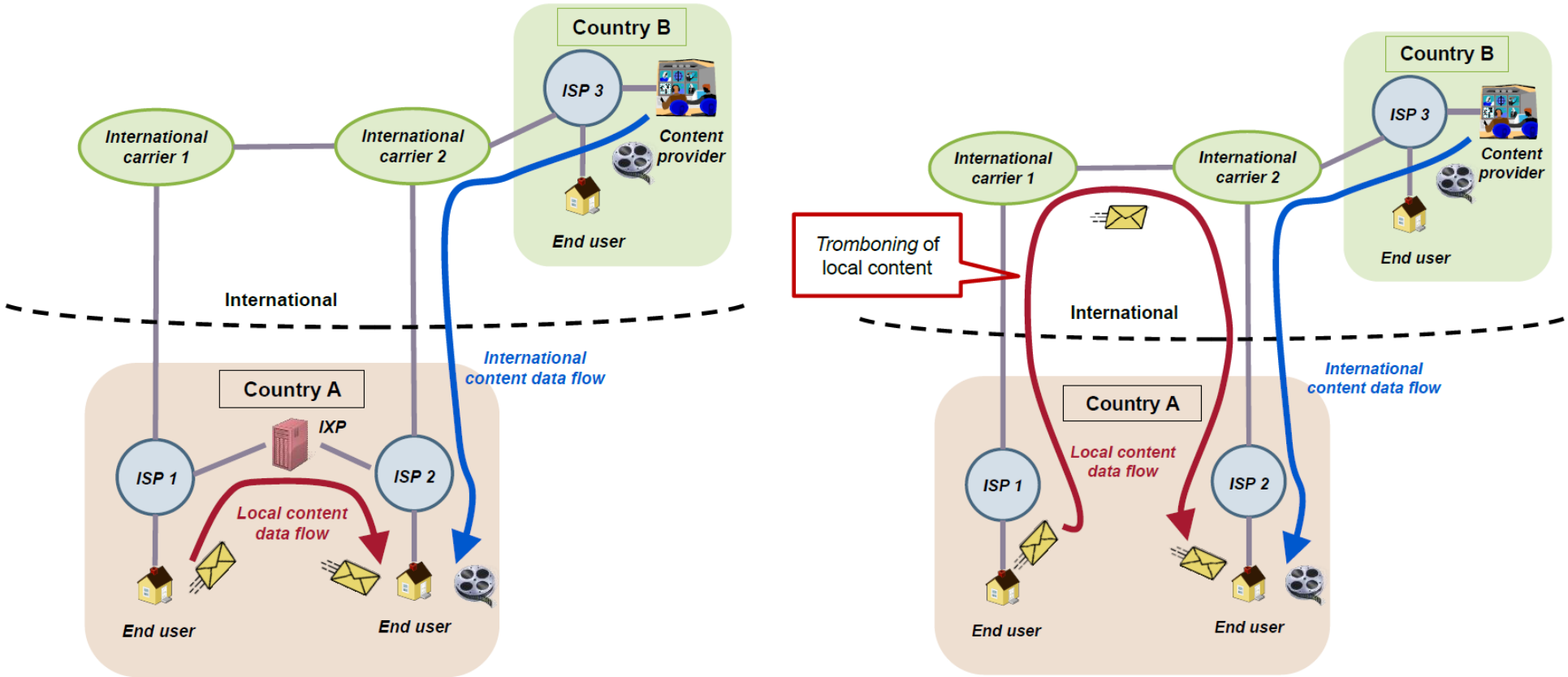
Source: Arthur D Litt;e, Liberty Global, The future of the Internet Innovatiopn and Investment in IP Interconnections May 2014

Internet exchanges are being installed in many countries



http://www.internetexchangemap.com/

A local IXP brings a number of benefits



Source: Analysys mason, 2012, Assessment of the impact of Internet Exchange Points – empirical study of Kenya and Nigeria, report for the Internet Society

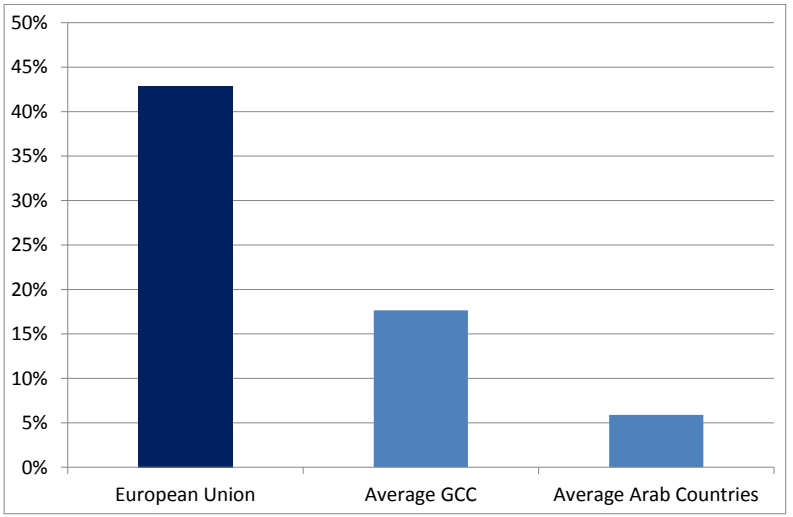
Benefits of local IXPs

Benefit	KIXP	IXPN	Summary
Latency	Reduced from 200-600 ms to 2-10 ms	Reduced from 200-400 ms to 2-10 ms	Noticeable increase in performance for end users
Local traffic exchange	1 Gbit/s peak	300 Mbit/s peak	Savings on international transit of over $1 million per year in each country
Content	Google network present locally, along with rehoming of domestic content	Same as in Kenya	Increase in usage and corresponding revenues for mobile data traffic
E-government	Kenya Revenue Authority gathers taxes online	Usage by education and research networks	Social benefits from e-government access to IXPs
Other benefits	An increasing amount of regional traffic exchanged at KIXP	Financial platforms hosted locally	Further economic benefits resulting from IXPs

Source: Analysys mason, 2012, Assessment of the impact of Internet Exchange Points – empirical study of Kenya and Nigeria, report for the Internet Society

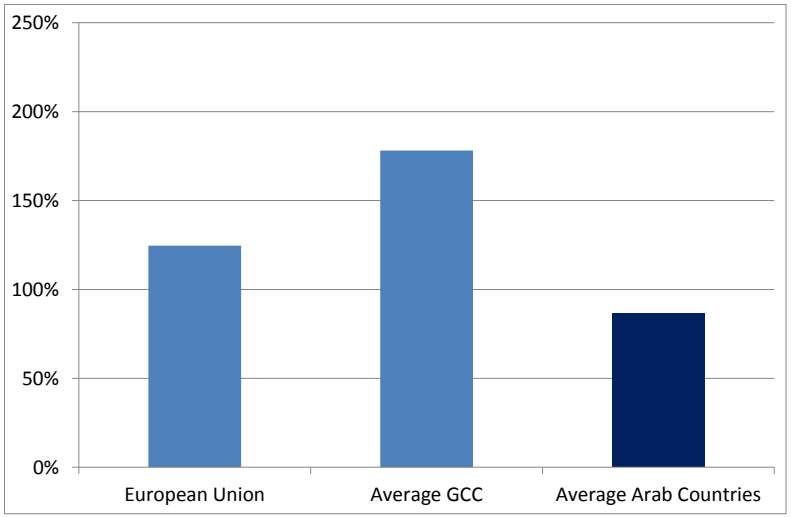
What's different in the Arab countries?

Fixed penetration



- Fixed penetration for Arab countries lower than developed countries
- Less than 10%, other than in GCC

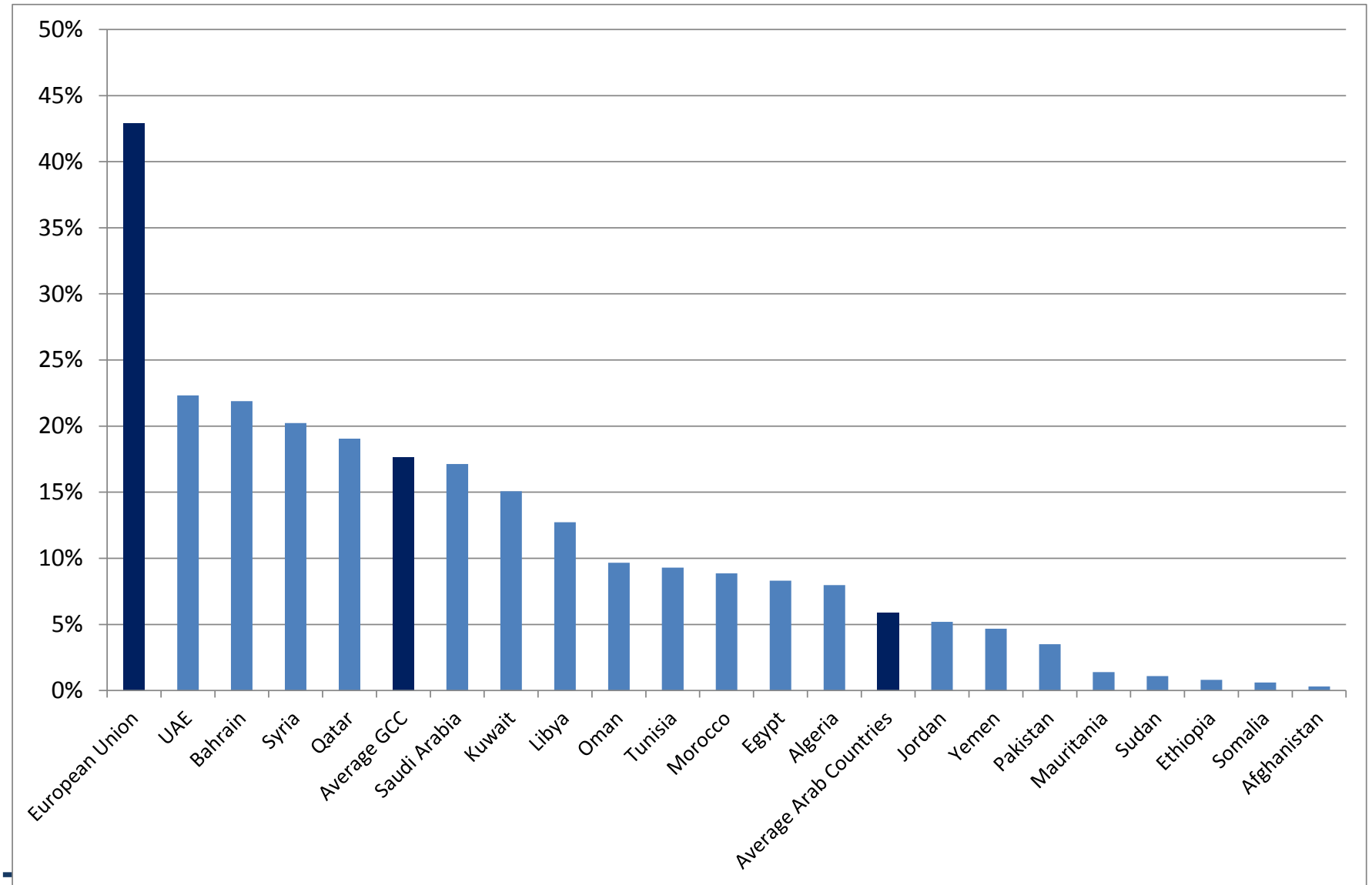
Mobile penetration



- Main telephone access is mobile
- Customers often use multiples SIMS to take advantage of offers

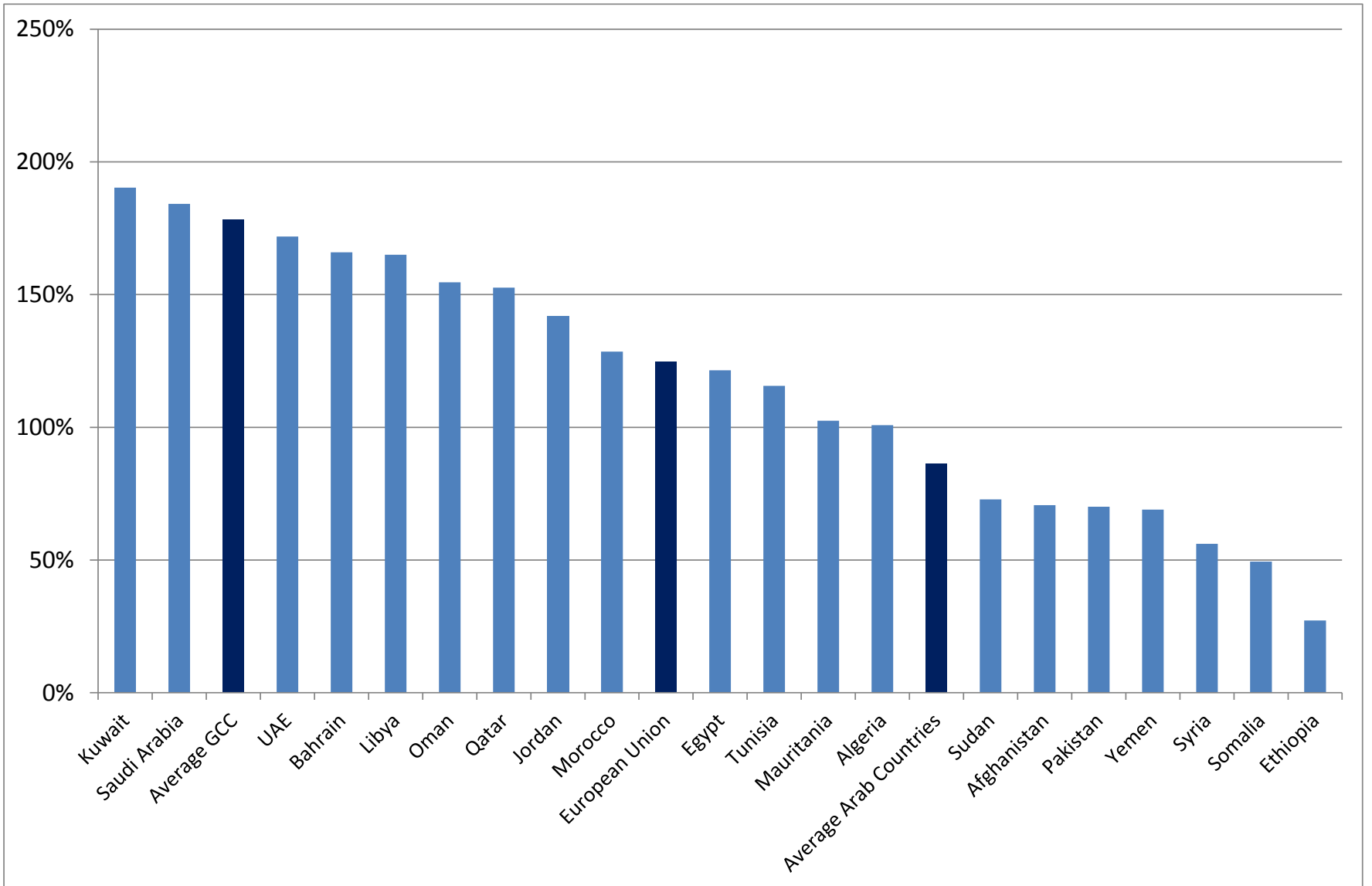
- The key to provide competition in these market is often the access by smaller operators to national and international transmission
- It is important to monitor the access to these services in order to grant access to telecom services at competitive prices

Wide variation in fixed line penetration



Source: ITU

Higher penetration of moobile



Source: ITU

LTE coverage 2013

https://gsmaintelligence.com/images/analysis/entries/2013-08-30-dashboard-lte-map.png

Very different make-up of fixed and mobile traffic