

Telecom in Europe

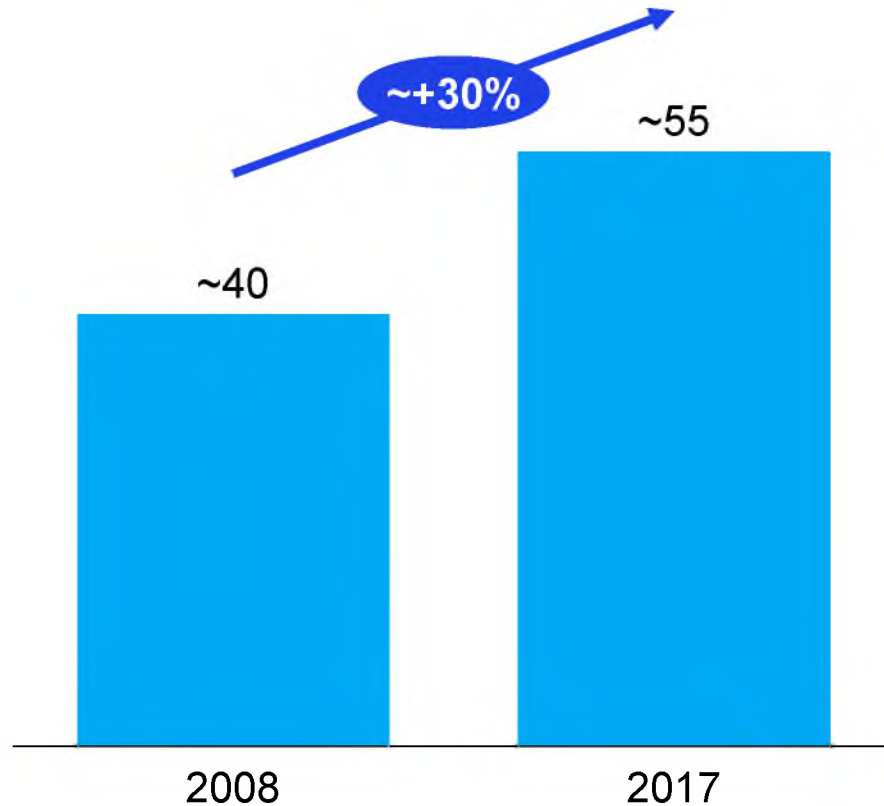
Industry perspective

Halldor Sigurdsson | March 2019

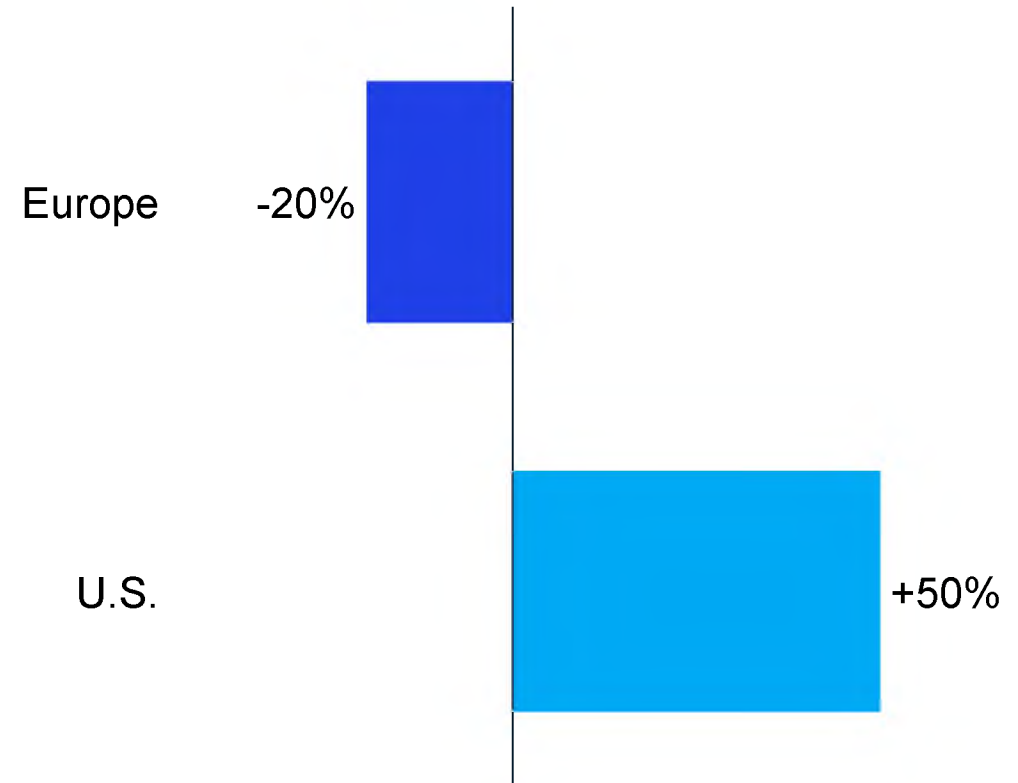
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- **Overall industry perspectives for telecom in Europe**
 - Perspectives on deployment and sharing of fixed infrastructures in Europe and Iceland

European telcos have invested more than EUR 500 billion in the last 10 years but at the same time seen revenues fall by ~20% ...

Yearly capex¹
EUR billions



Yearly revenues, changes between 2008 and 2017
EUR^{2?}



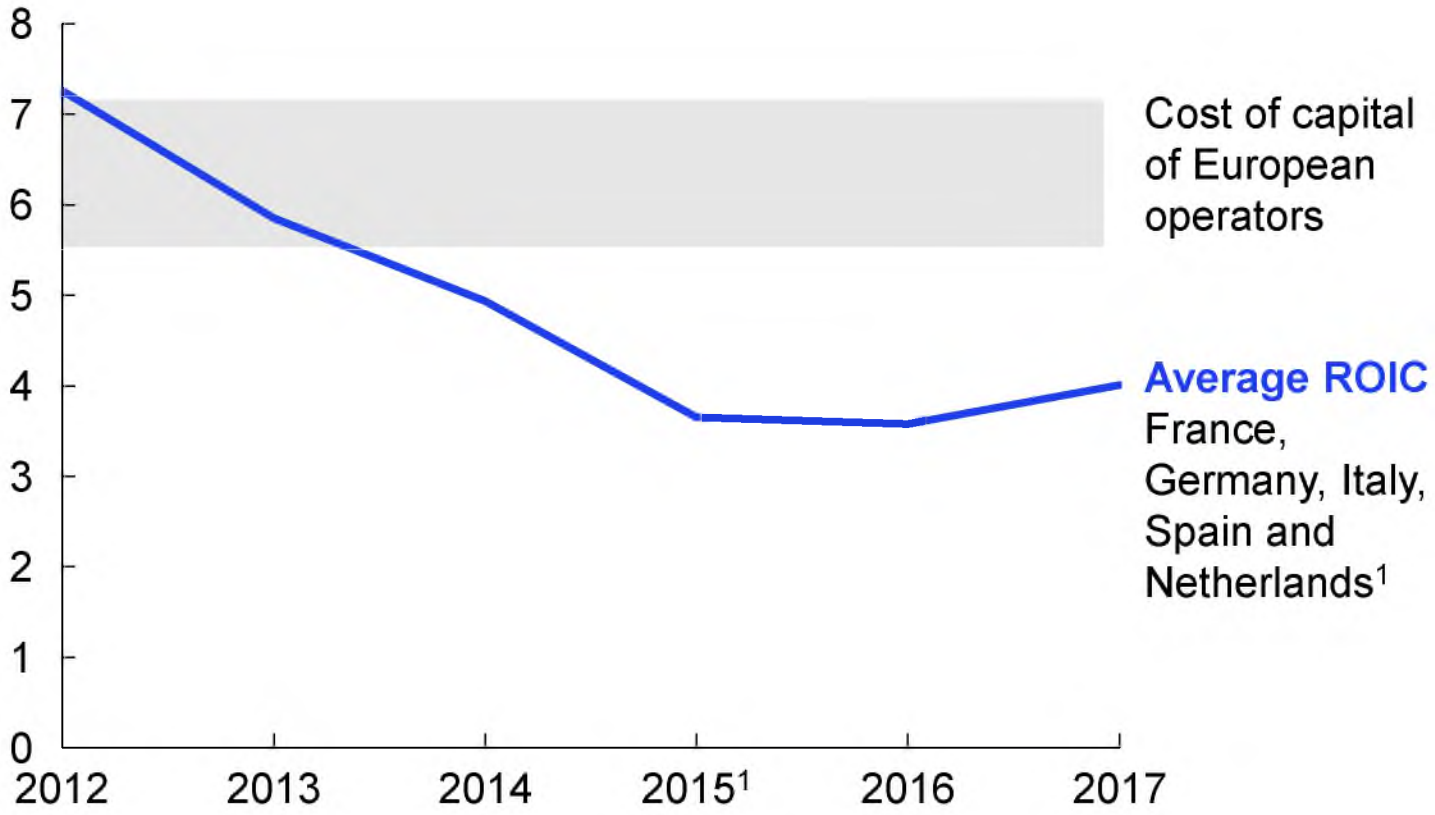
¹ Excluding licenses, Ovum

² Capex and licenses

³ Percent households, DESI 2018; ⁴ % households, >30Mbps overall NGA coverage considered (VDSL, FTTP and DOCSIS 3.0), DESI 2018

... which in turn has led to a dangerous decline in return of capital for the industry

Evolution of European MNOs return on invested capital
Percent

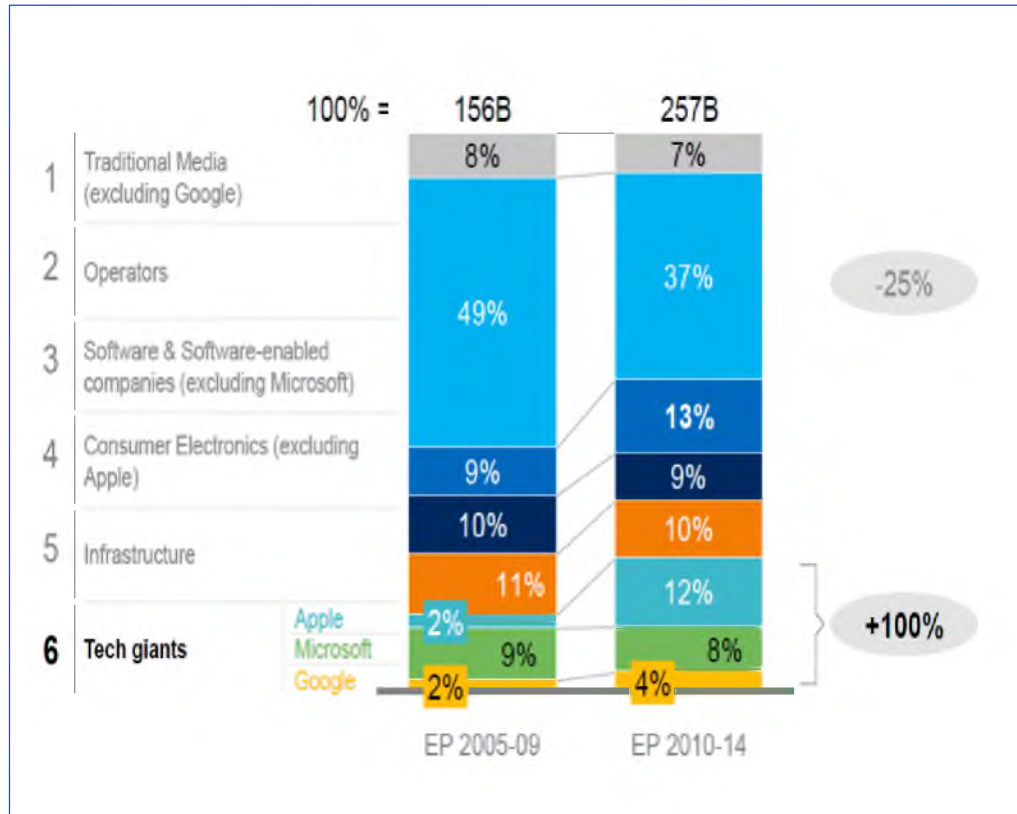


Without and inversion of trend, further investment in the sector would look increasingly unattractive

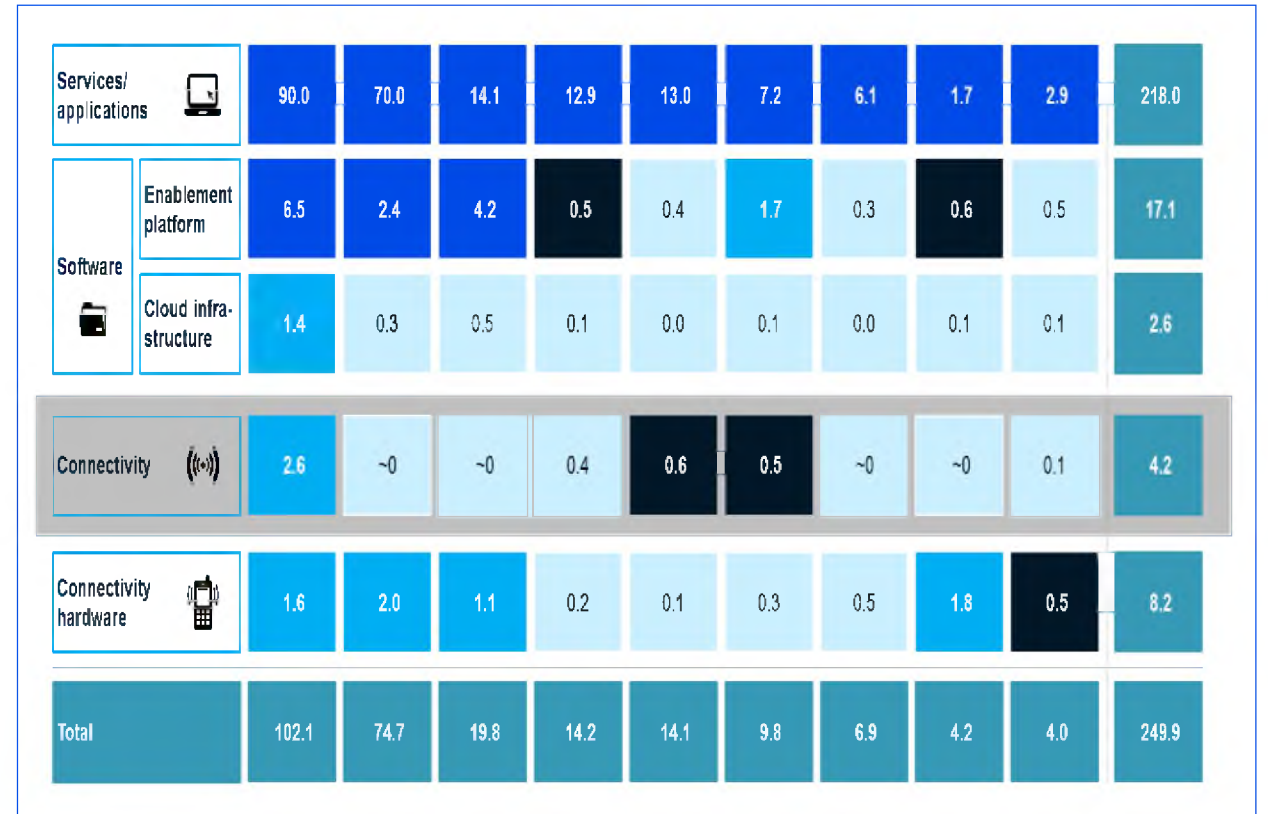
¹ Does not include Movistar (Telefonica) figures for Spain in 2015 due to the temporary impact of a plan for voluntary employment suspension

Recently profit-pool of telecom operators is being squeezed as relevance of connectivity diminishes

Distribution of economic profit by Tech, Media and Telecom sub-sector¹, 2005-14
USD billions



IoT market outlook 2020 by vertical
EUR billions



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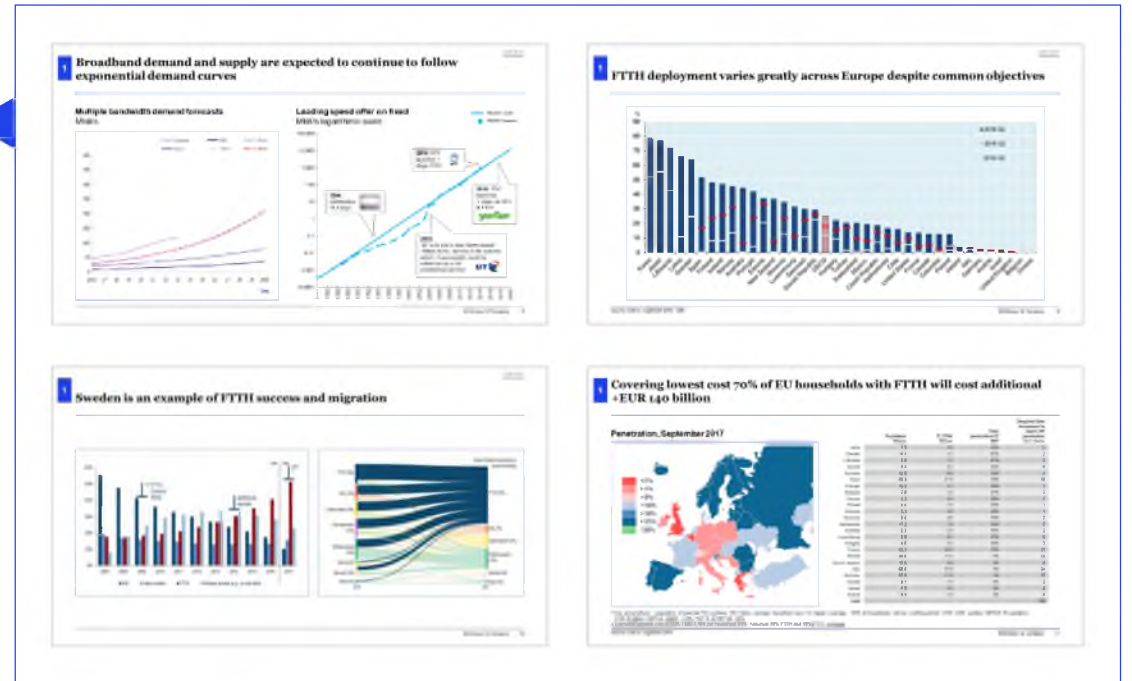
Selective deep dive today

1 Deployment of FTTH across Europe varies and getting to 80% will cost EUR >200 billion

2 There are four primary models available for sharing of FTTH access networks

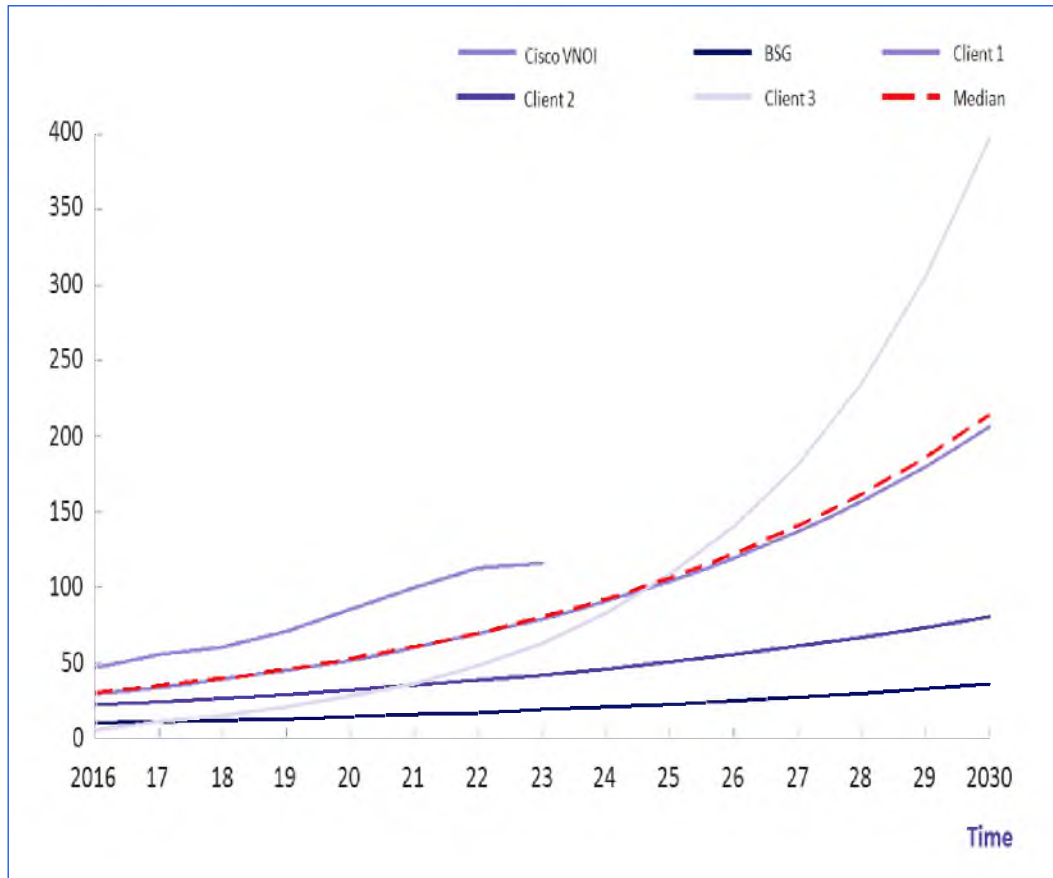
3 Sharing and wholesale affect the profit distribution and nature of competition

4 Out-side-in reflections on Icelandic telecom market

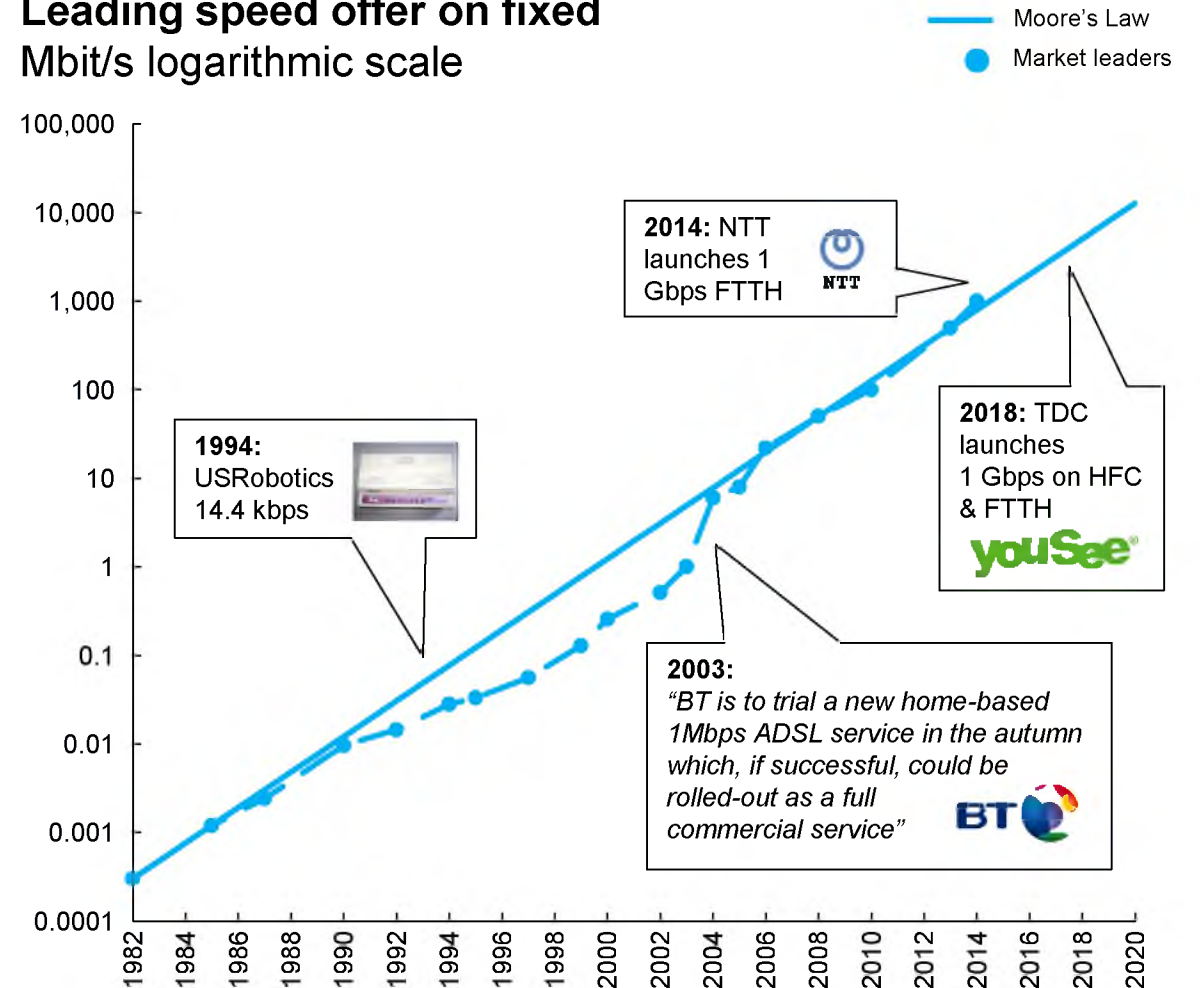


1 Broadband demand and supply are expected to continue to follow exponential demand curves

Multiple bandwidth demand forecasts
Mbit/s

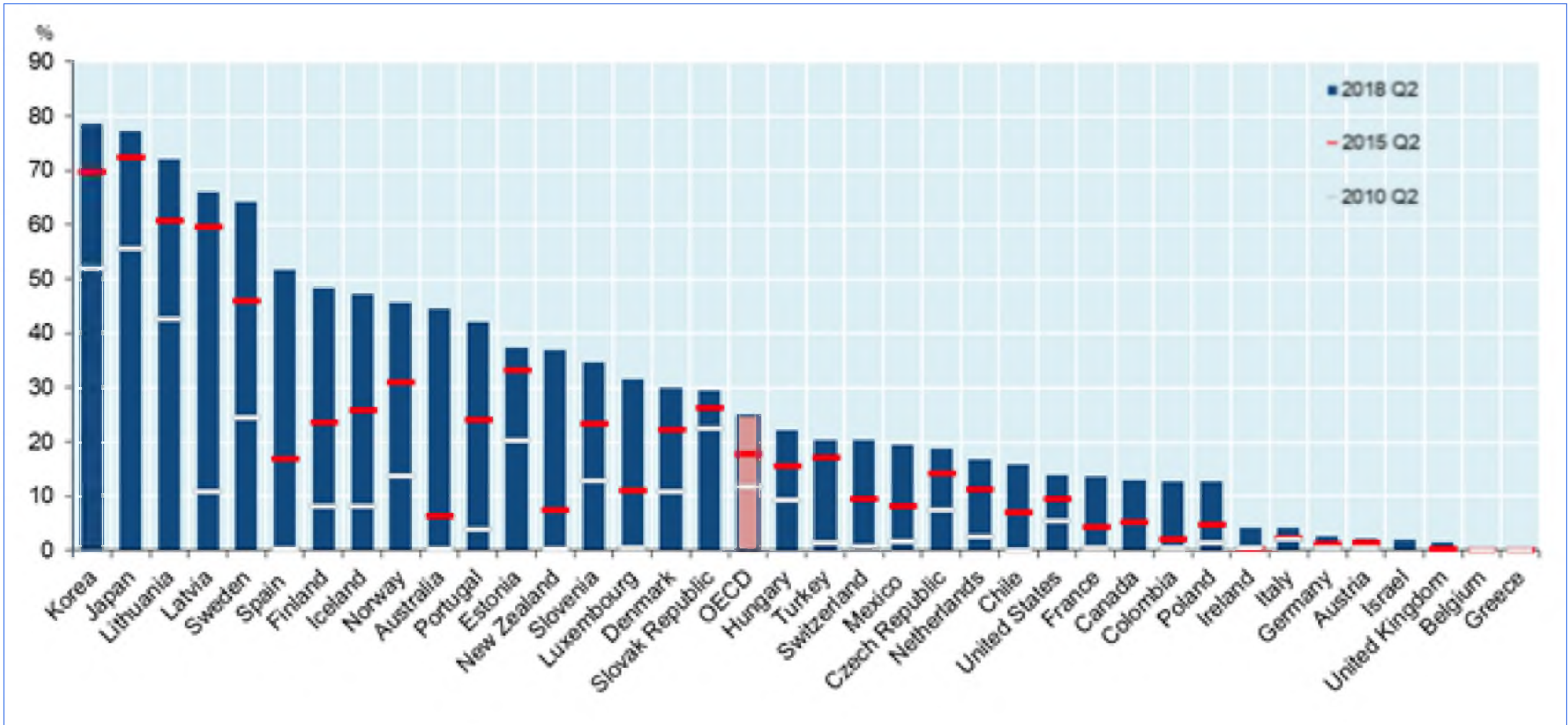


Leading speed offer on fixed
Mbit/s logarithmic scale



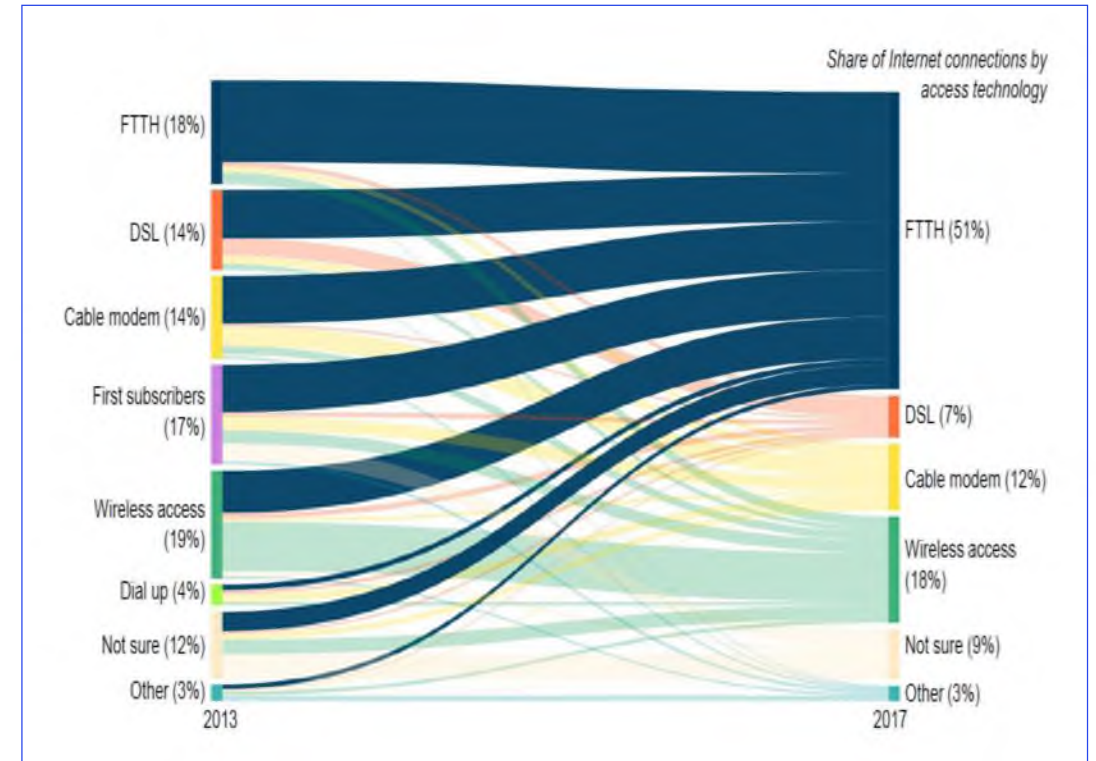
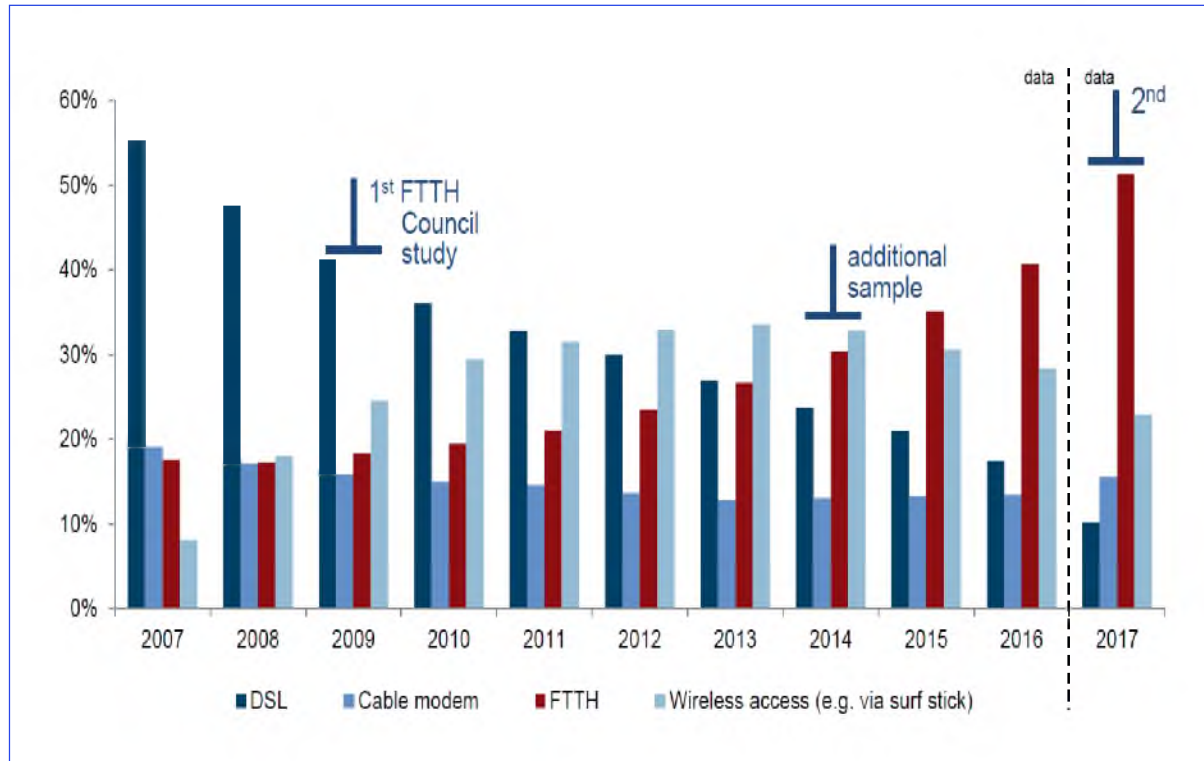
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FTTH deployment varies greatly across Europe despite common objectives



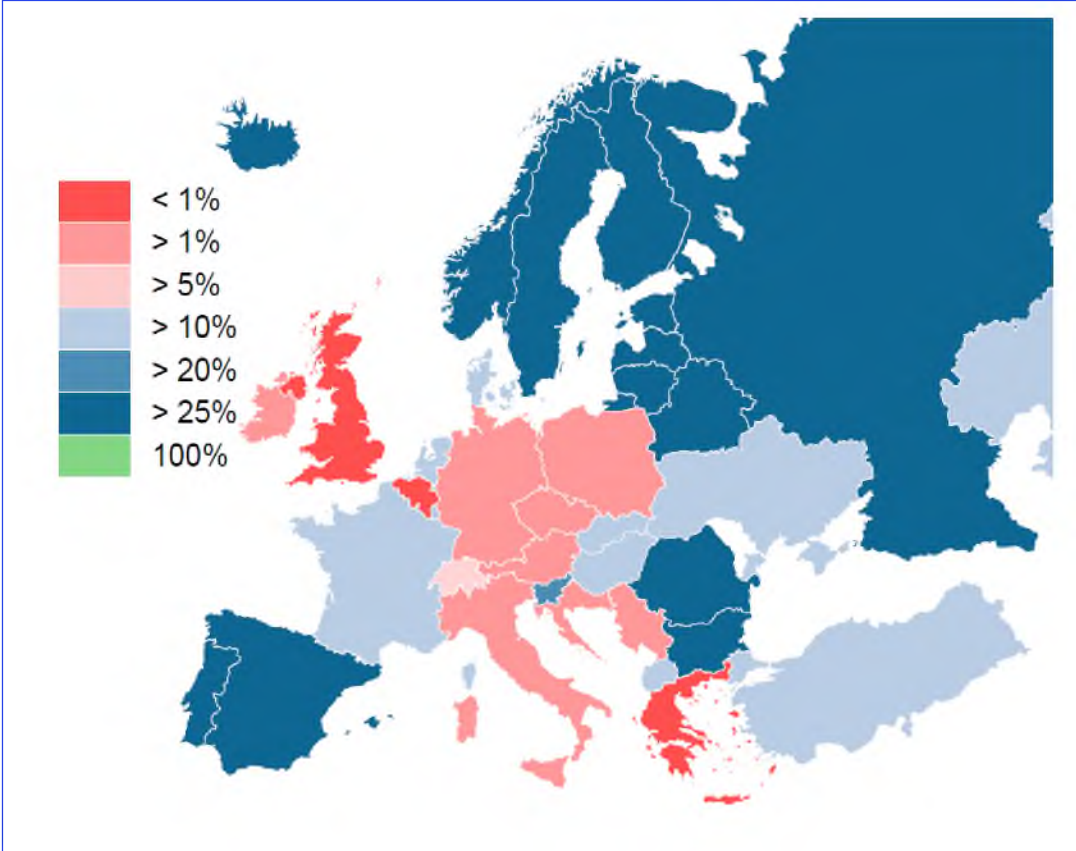
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Sweden is an example of FTTH success and migration



Covering lowest cost 70% of EU households with FTTH will cost additional +EUR 140 billion

Penetration, September 2017



	Population Millions	# of HHs Millions	Fiber penetration Q3 2017	Required fibre investment to reach 70% penetration EUR billions
Latvia	1.9	0.9	52%	0
Sweden	10.3	4.7	43%	2
Lithuania	2.8	1.3	43%	0
Iceland	0.4	0.2	35%	0
Romania	19.6	8.9	35%	4
Spain	46.3	21.0	34%	10
Portugal	10.3	4.7	28%	3
Bulgaria	7.0	3.2	27%	2
Estonia	1.3	0.6	26%	0
Finland	5.5	2.5	25%	1
Slovenia	2.1	0.9	22%	1
Denmark	5.8	2.6	19%	2
Netherlands	17.2	7.8	18%	5
Slovakia	5.4	2.5	18%	2
Luxembourg	0.6	0.3	17%	0
Hungary	9.8	4.4	16%	3
France	65.1	29.6	15%	21
Poland	38.0	17.3	4%	15
Czech republic	10.6	4.8	4%	4
Italy	60.8	27.6	3%	24
Germany	82.8	37.6	3%	33
Croatia	4.1	1.9	2%	2
Ireland	4.9	2.2	2%	2
Austria	8.9	4.0	2%	4
Total				139

1 Key assumptions – population of selected 10 countries: 316 million; average household size: 2.5; target coverage: ~90% of households; roll-out cost/household: EUR 1,300; wireline EBITDA 10 operators: EUR 28 billion; EBITDA CAGR: -3.6%; FCF % of EBITDA: 50%

2 Estimated upgrade cost of EUR 1,000-1,400 per household (HH). Assumes 50% FTTH and 40% FTTC coverage

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2 Different options for FTTH wholesale

Model	Description	Implications
Wholesale	<ul style="list-style-type: none"> Network provider Access to incumbent network through an IP connection 	<ul style="list-style-type: none"> Lower duplication of investments but risks SPs ability to differentiate services or drive innovation
VULA	<ul style="list-style-type: none"> Understanding of virtual line from central office to end users Access to customer base to run OPEX 	<ul style="list-style-type: none"> SPs keep control over their gateways, but lose some independence with regard to QoS assurance and network IP TV etc.
LLU / dark fiber	<ul style="list-style-type: none"> SP gets access to fiber strand from distribution frame to co-location / exchange SP needs to full suite equipment access, rack and IT 	<ul style="list-style-type: none"> Full flexibility of SP to drive service differentiation and innovation but at the cost of duplication of active equipment
Duct access / co-locating	<ul style="list-style-type: none"> SP rents out fiber network using available ducts 	<ul style="list-style-type: none"> Remains O.U. but SP has to invest in own strand of fiber in ducts

3 Application of wholesale models varies between countries based on situation

FTTH coverage against DOCSIS coverage 2013

Wholesale FTTH access regulation

Country	Model	Regulation
Spain	Wholesale	Access to the network
France	Wholesale	Access to the network
UK	Wholesale	Access to the network
Italy	Wholesale	Access to the network
Germany	Wholesale	Access to the network
Netherlands	Wholesale	Access to the network
Sweden	Wholesale	Access to the network
Denmark	Wholesale	Access to the network
Poland	Wholesale	Access to the network
Czechia	Wholesale	Access to the network
Slovakia	Wholesale	Access to the network
Slovenia	Wholesale	Access to the network
Lithuania	Wholesale	Access to the network
Latvia	Wholesale	Access to the network
Estonia	Wholesale	Access to the network
Belgium	Wholesale	Access to the network
Austria	Wholesale	Access to the network
Portugal	Wholesale	Access to the network
Greece	Wholesale	Access to the network
Cyprus	Wholesale	Access to the network
Malta	Wholesale	Access to the network
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Malta	Wholesale	Access to the network
Ireland	Wholesale	Access to the network
Finland	Wholesale	Access to the network

4 Future development includes harmonization and growth of wholesale products

Diagram illustrating the structure of wholesale products and their evolution over time, showing the transition from traditional services to wholesale products.

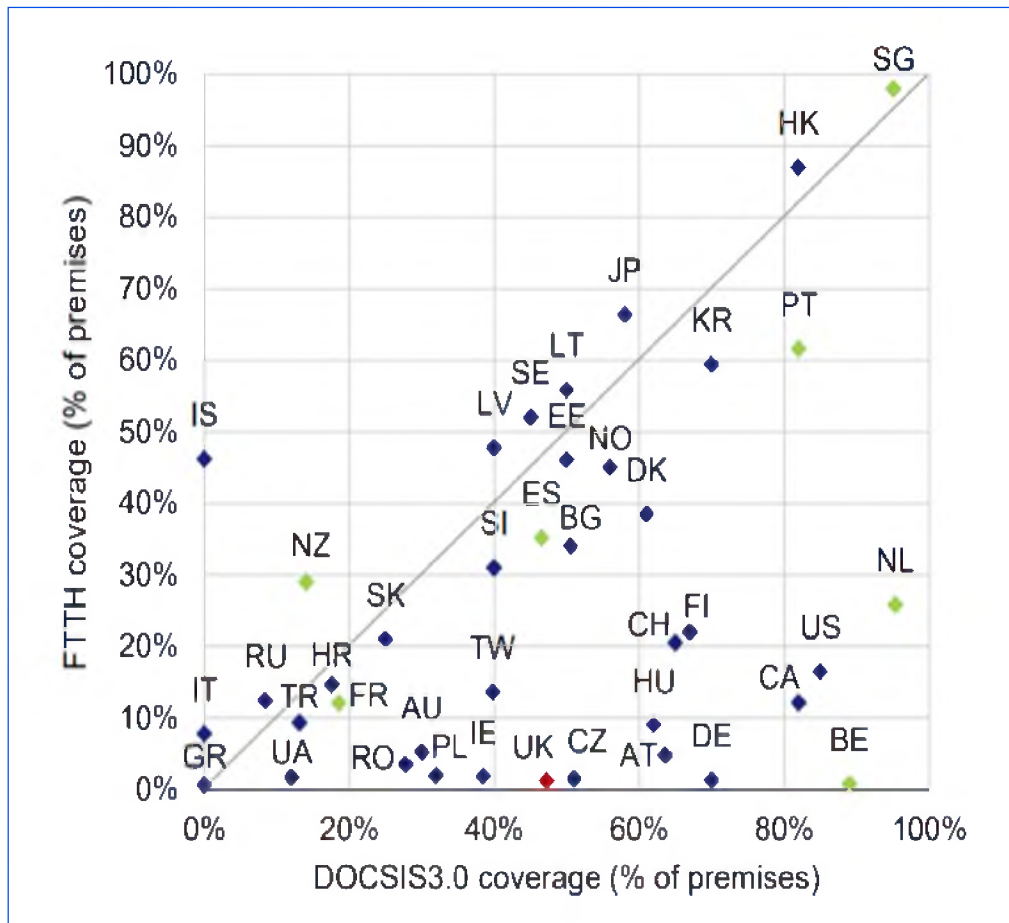
Different options for FTTH wholesale

Unbundling option

	Description	Implications
Bitstream	<ul style="list-style-type: none"> ▪ Network provider ▪ Attacker connects to incumbent network through an IP connection 	<ul style="list-style-type: none"> ▪ Lower duplication of investments but limits SPs ability to differentiate services or drive innovation
VULA	<ul style="list-style-type: none"> ▪ Unbundling of virtual line from central office to end users ▪ Attacker connects customer lines to own CPE 	<ul style="list-style-type: none"> ▪ SPs keep control over home gateways, but lose some independence with regard to QoS assurance and multicast IPTV etc.
LLU / dark fiber	<ul style="list-style-type: none"> ▪ SP gets access to fiber strand from distribution frame in co-location / exchange ▪ SP invests in full active equipment access, core and IT 	<ul style="list-style-type: none"> ▪ Full flexibility of SP to drive service differentiation and innovation but at the cost of duplication of active equipment
Duct access / co-digging	<ul style="list-style-type: none"> ▪ SP rolls-out fiber network utilizing available ducts 	<ul style="list-style-type: none"> ▪ Same as LLU but SP has to blow / invest in own strand of fiber in ducts

Application of wholesale models varies between countries based on situation

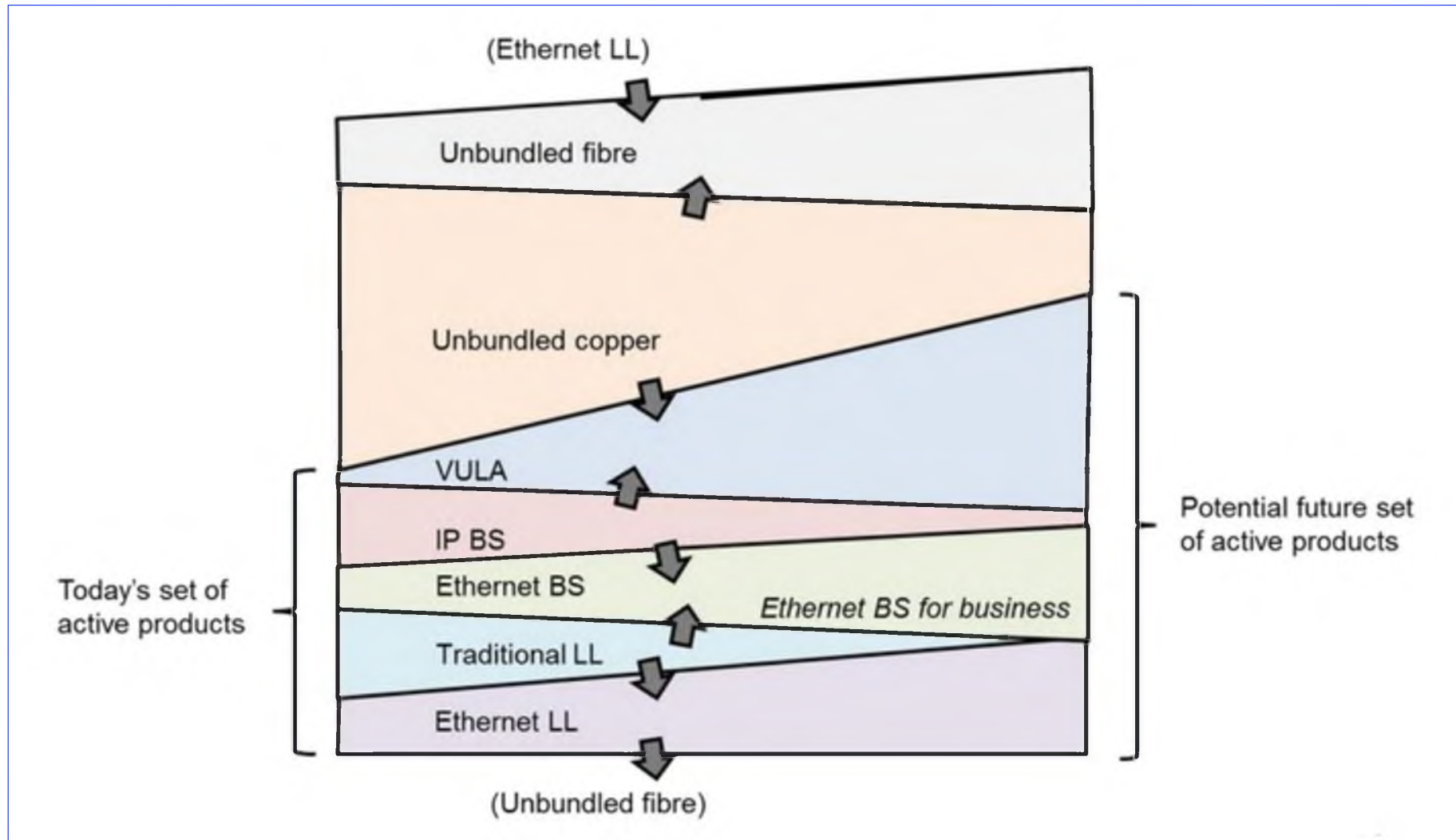
FTTH coverage against DOCSIS3.0 coverage 2014



Wholesale FTTH access regulation

Country	Remedies		Symmetric / asymmetric
	Passive	Active	
	Duct access ³⁰	Dark fibre	
Belgium*	x	x	Asymmetric
France	✓	Geographical component	Symmetric for dark fibre; asymmetric for duct access
Netherlands	x No ducts	✓	Asymmetric
New Zealand	x	Business offer only; no residential offer until 2020	Asymmetric
Portugal	✓	x	Asymmetric
Singapore	✓	✓	Asymmetric
Spain	✓	✓ ³³	Asymmetric

2 Future development includes harmonization and growth of wholesale products



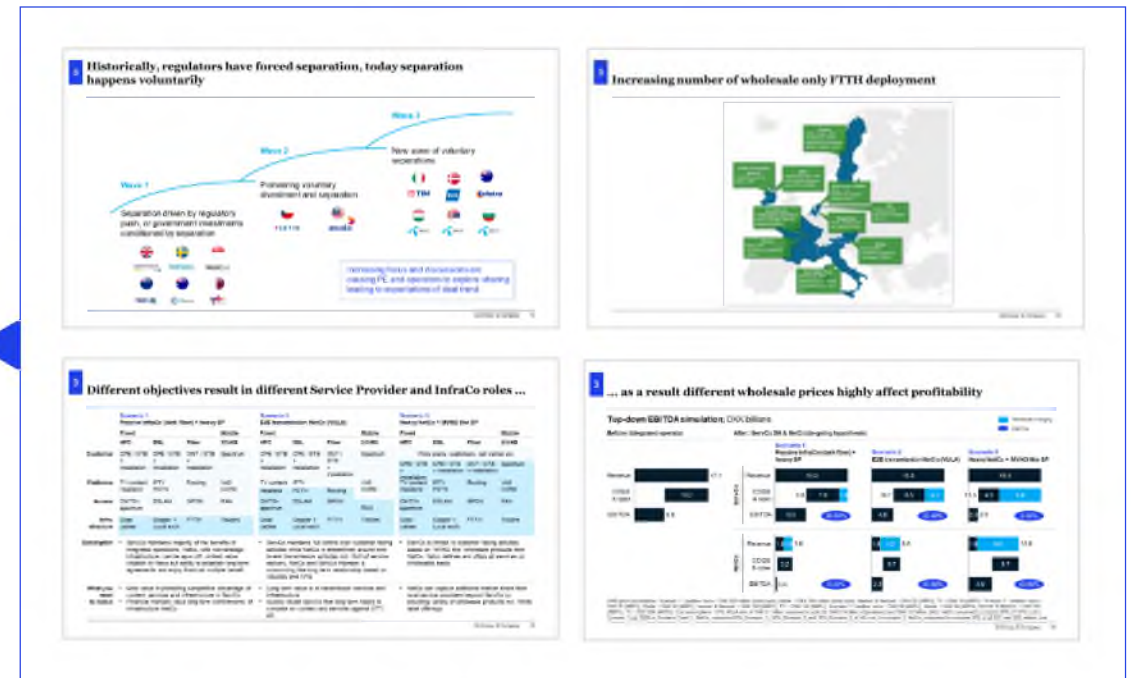
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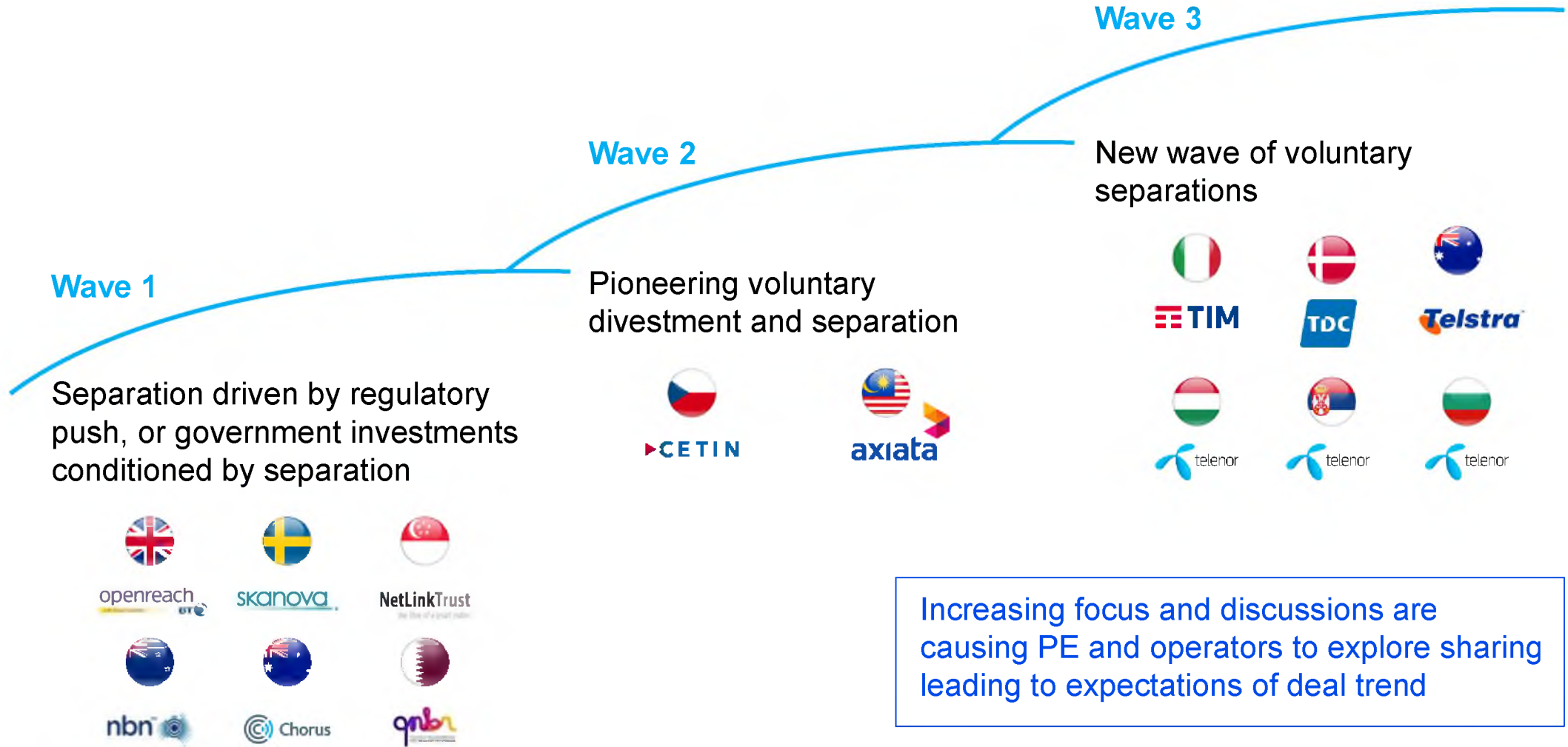
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3 Historically, regulators have forced separation, today separation happens voluntarily



Increasing number of wholesale only FTTH deployment



Different objectives result in different Service Provider and InfraCo roles ...

	Scenario 1: Passive InfraCo (dark fiber) + heavy SP				Scenario 2: E2E transmission NetCo (VULA)				Scenario 3: Heavy NetCo + MVNO like SP			
	Fixed			Mobile	Fixed			Mobile	Fixed			Mobile
	HFC	DSL	Fiber	2/3/4G	HFC	DSL	Fiber	2/3/4G	HFC	DSL	Fiber	2/3/4G
Customer	CPE / STB + installation	CPE / STB + installation	ONT / STB + installation	Spectrum	CPE / STB + installation	CPE / STB + installation	ONT / STB + installation	Spectrum	Price plans, customers, call center etc.			
Platforms	TV content Headend	IPTV PSTN	Routing	VAS CORE	TV content Headend	IPTV PSTN	Routing	VAS CORE	TV content Headend	IPTV PSTN	Routing	VAS CORE
Access	CMTS+ spectrum	DSLAM	GPON	RAN	CMTS+ spectrum	DSLAM	GPON	RAN	CMTS+ spectrum	DSLAM	GPON	RAN
Infra-structure	Coax cables	Copper + Local exch.	FTTH	Towers	Coax cables	Copper + Local exch.	FTTH	Towers	Coax cables	Copper + Local exch.	FTTH	Towers
Description	<ul style="list-style-type: none"> ServCo maintains majority of the benefits of integrated operations, Netco, with non-strategic infrastructure, can be spun off. Limited value creation in Netco but ability to establish long term agreements and enjoy financial multiple benefit 				<ul style="list-style-type: none"> ServCo maintains full control over customer facing activities while NetCo is streamlined around end-to-end transmission activities incl. QoS of service delivery. NetCo and ServCo maintain a outsourcing like long term relationship based on volumes and KPIs 				<ul style="list-style-type: none"> ServCo is limited to customer facing activities based on "MVNO like" wholesale products from NetCo. Netco defines and offers all services on wholesales basis 			
What you need to believe	<ul style="list-style-type: none"> Most value in competitive advantage of integrated connectivity, content, and services in ServCo Financial markets value long term commitments of infrastructure NetCo 				<ul style="list-style-type: none"> Long term value is in transmission services and infrastructure ServCo needs to compete and differentiate on integrated content and services against OTT, etc. 				<ul style="list-style-type: none"> NetCo can capture additional market share from local service providers beyond ServCo by providing variety of wholesale products incl. White label offerings 			

Source: McKinsey analysis

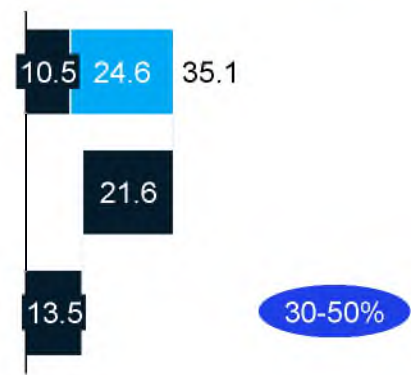
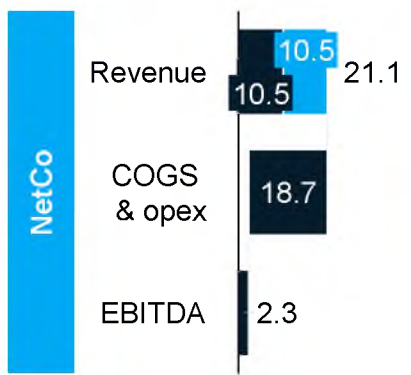
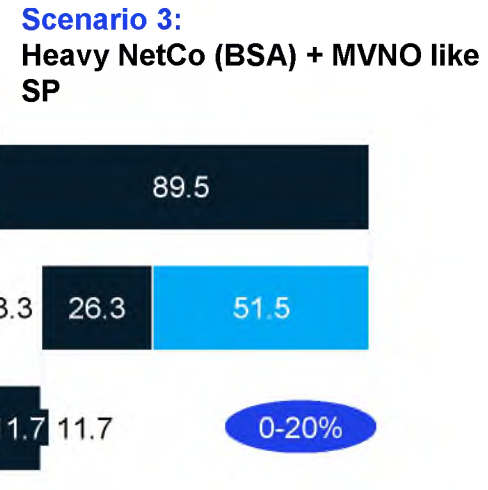
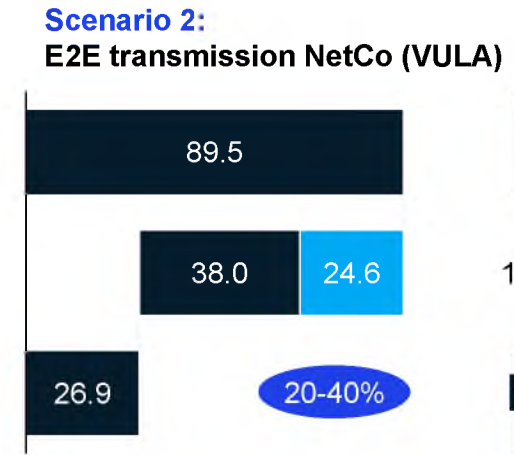
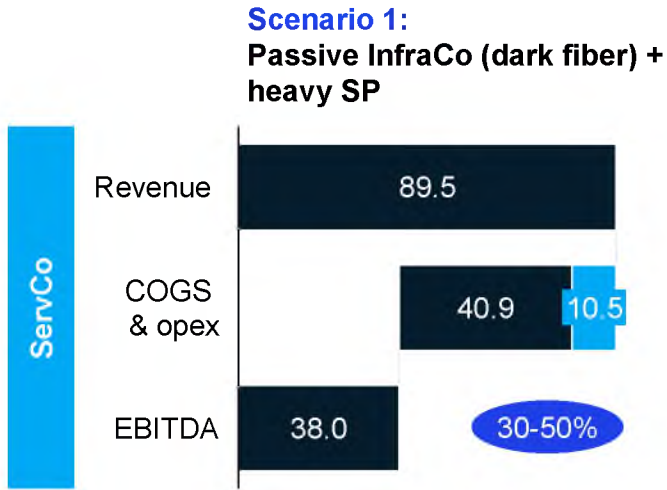
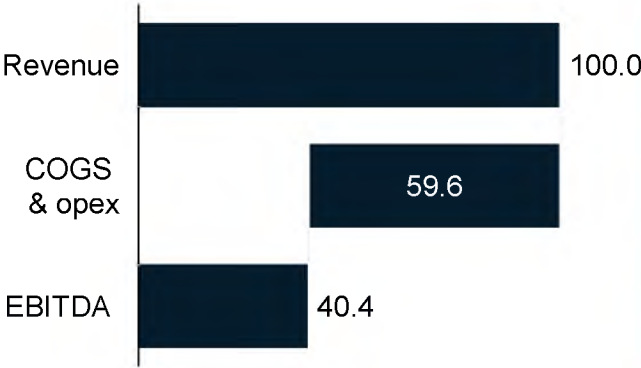
... as a result different wholesale prices highly affect profitability

Top-down EBITDA simulation

- Wholesale charging
- EBITDA

Before: Integrated operator

After: ServCo DK & NetCo (in-going hypothesis)



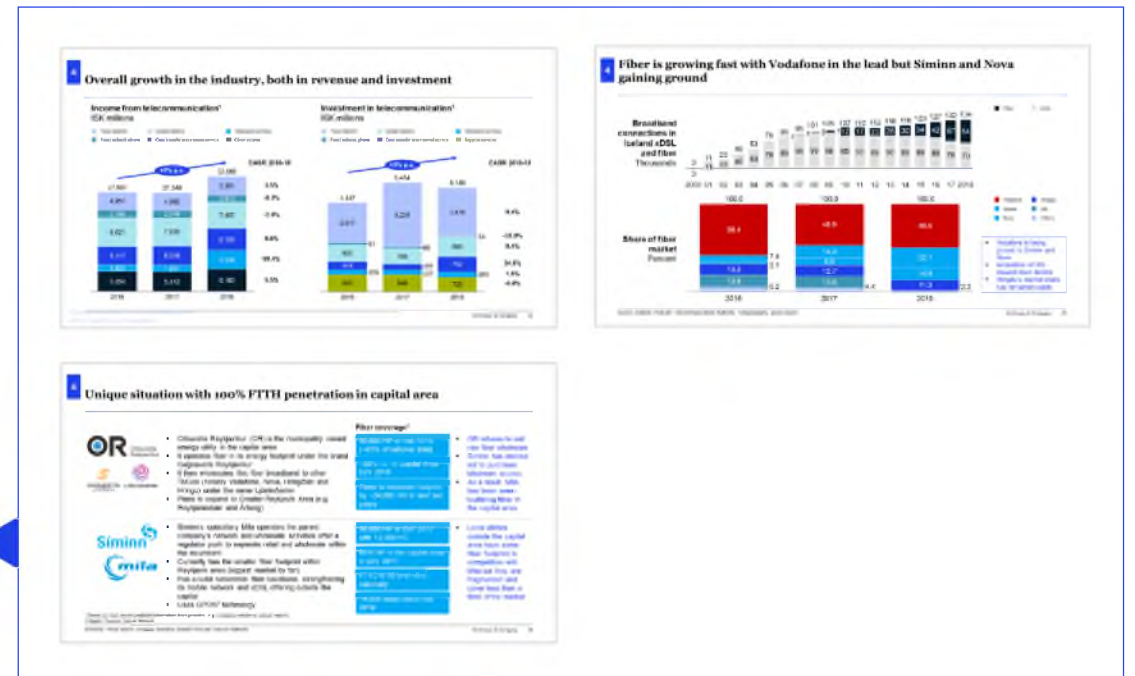
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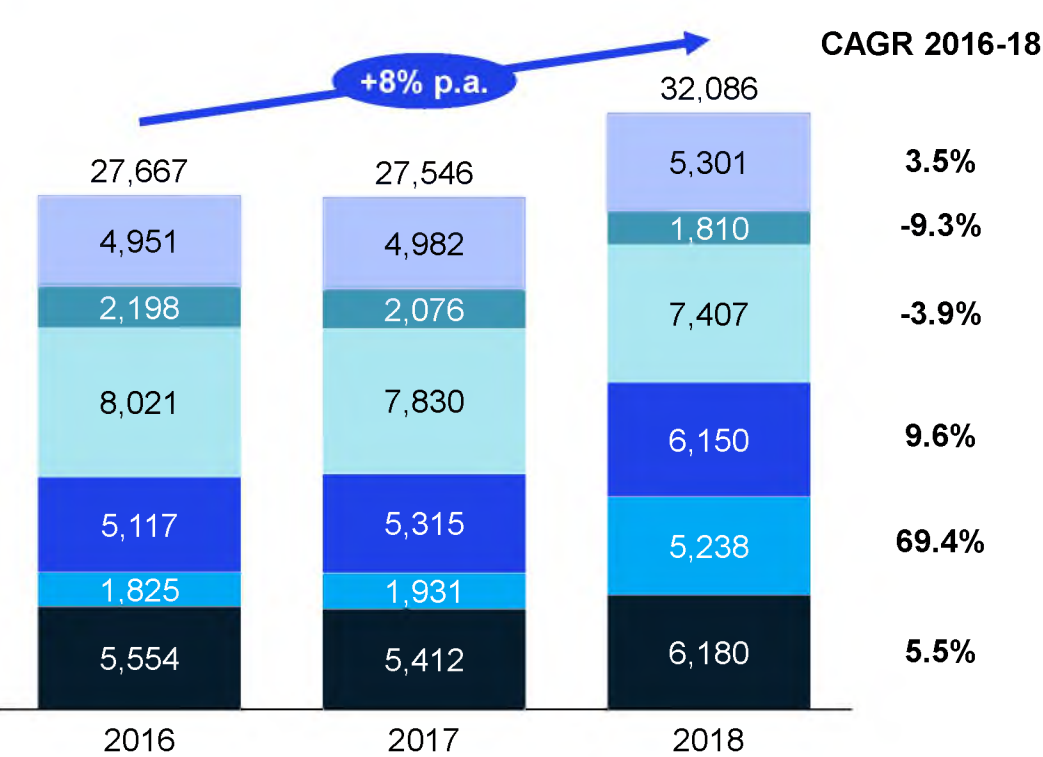
4 Out-side-in reflections on Icelandic telecom market



Overall growth in the industry, both in revenue and investment

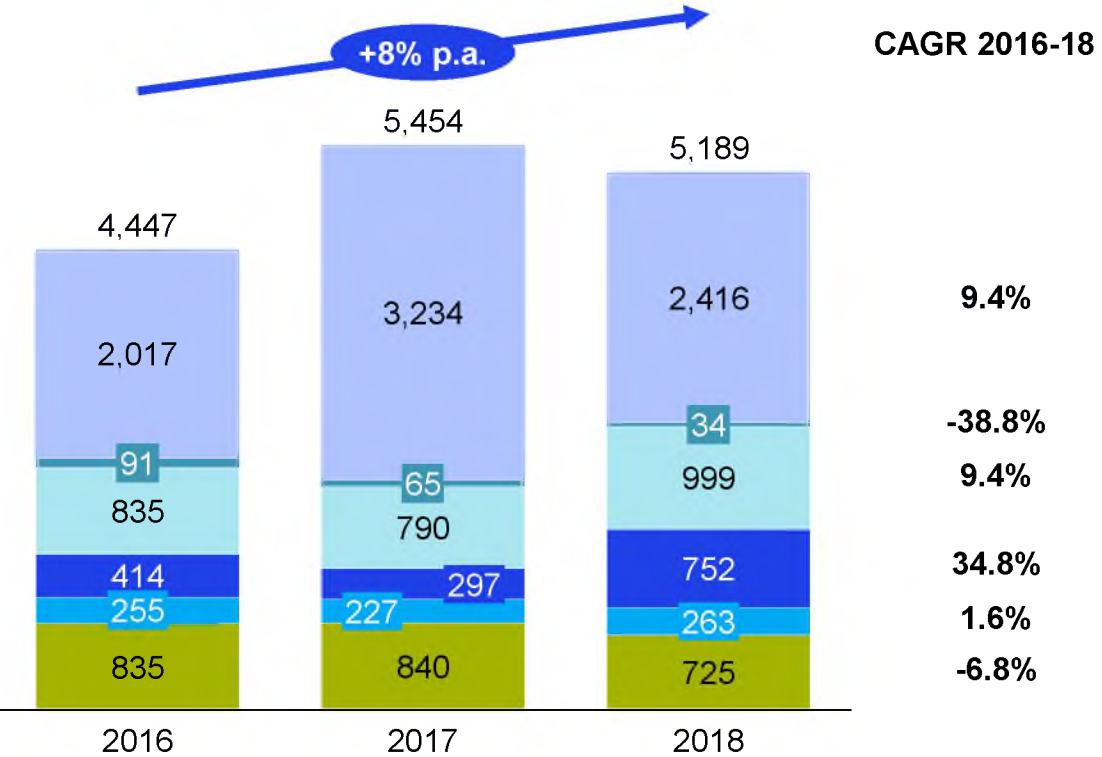
Income from telecommunication¹ ISK millions

- Fixed network
- Mobile network
- Television services
- Fixed network phone
- Data transfer and Internet service
- Other income



Investment in telecommunication¹ ISK millions

- Fixed network
- Mobile network
- Television services
- Fixed network phone
- Data transfer and Internet service
- Support services

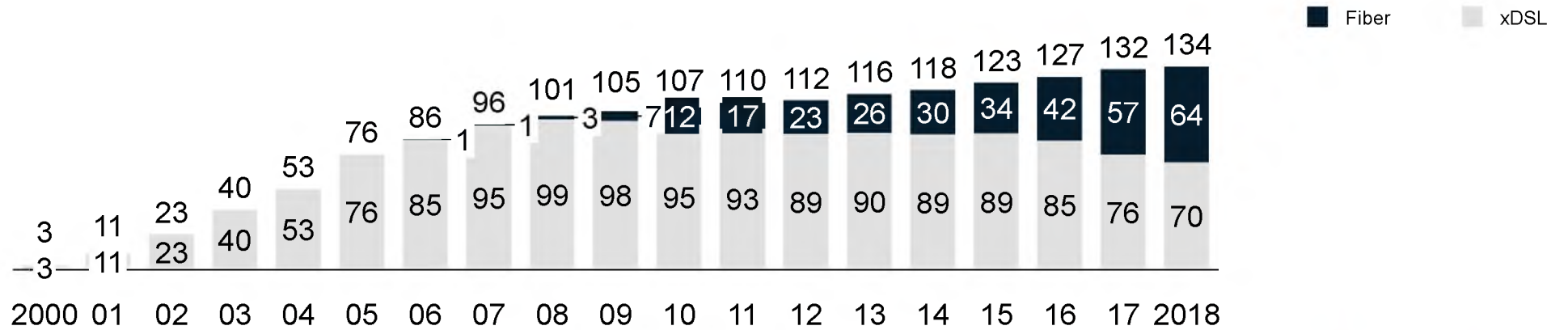


¹ Figures are half-year figures, based on latest availability for 2018

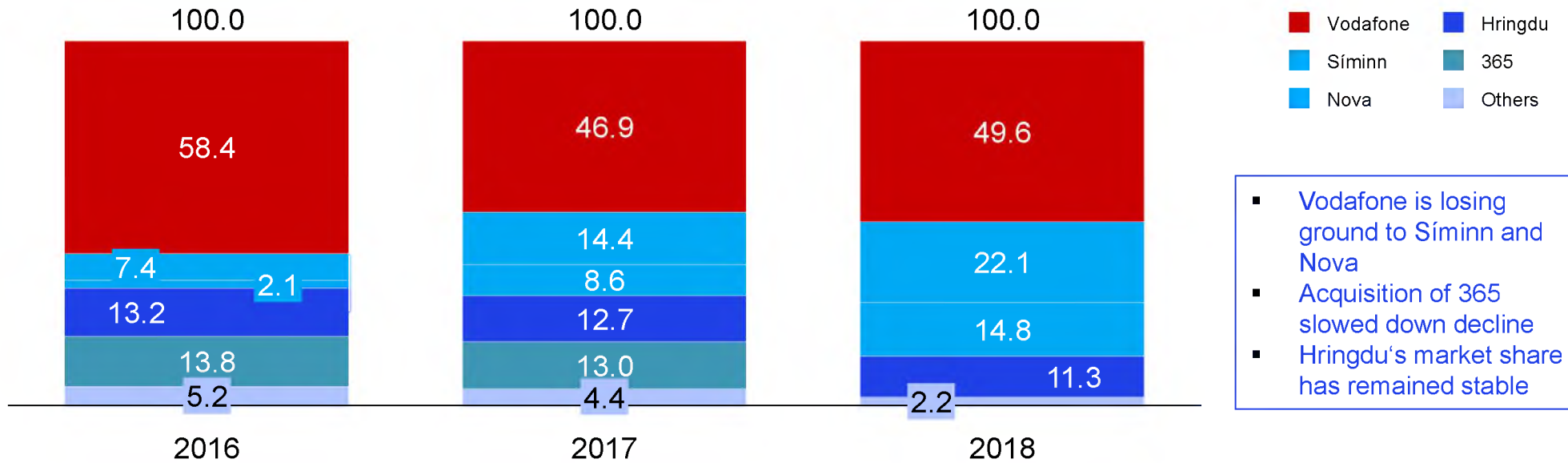
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Fiber is growing fast with Vodafone in the lead but Síminn and Nova gaining ground

Broadband connections in Iceland xDSL and fiber
Thousands



Share of fiber market
Percent



- Vodafone is losing ground to Síminn and Nova
- Acquisition of 365 slowed down decline
- Hringdu's market share has remained stable

Unique situation with 100% FTTH penetration in capital area



Orkuveita
Reykjavíkur



- Orkuveita Reykjavíkur (OR) is the municipality owned energy utility in the capital area
- It operates fiber in its energy footprint under the brand Gagnaveita Reykjavíkur
- It then wholesales this fiber broadband to other TelCos (notably Vodafone, Nova, Hringiðan and Hringu) under the name Ljósleiðarinn
- Plans to expand to Greater Reykjavík Area (e.g. Reykjanesbær and Árborg)



- Síminn's subsidiary Míla operates the parent company's network and wholesale activities after a regulator push to separate retail and wholesale within the incumbent
- Currently has the smaller fiber footprint within Reykjavík area (biggest market by far)
- Has a solid nationwide fiber backbone, strengthening its mobile network and xDSL offering outside the capital
- Uses GPON² technology

Fiber coverage¹

90,000 HP in mid 2018
(~65% of national total)

100% HP in Capital Area
EoY 2018

Plans to increase footprint
by ~24,000 HH in next two
years

- OR refuses to sell raw fiber wholesale
- Síminn has elected not to purchase bitstream access
- As a result, Míla has been **over-building fiber** in the capital area

55,000 HP in EoY 2017
with 12,000 HC

60% HP in the capital area
in EoY 2017

FTTC to 92% of HHs
nationally

14,000 subscribers mid
2018

- Local utilities outside the capital area have some fiber footprint in competition with Míla but they are fragmented and cover less than a third of the market

¹ Based on most recent available information from provider, e.g. company website or annual reports

² Gigabit Passive Optical Network



Halldor Sigurdsson is a Partner at McKinsey & Company where he serves clients on a broad range of technology, operations and strategic topics.

Halldor specializes in telecom and leads McKinsey's telecom network transformation service line globally where he has supported over 50 clients. He has supported telecom operators, vendors, TowerCos, regulators and 3rd parties in Europe, Middle East / Africa, Asia and Americas.

Before joining McKinsey, Halldor worked at Microsoft Research Asia, Iceland Telecom, and Icelandair Engineering.

He holds a Ph.D. and a M.Sc./Civ.Ing. in Telecom Engineering and Economics from the Technical University of Denmark, as well as a B.Sc. in Mechanical Engineering from the University of Iceland

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