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Telecom in Europe

Industry perspective

Halldor Sigurdsson | March 2019

- **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 capex[1]
EUR billions

~+30%

~40

~55
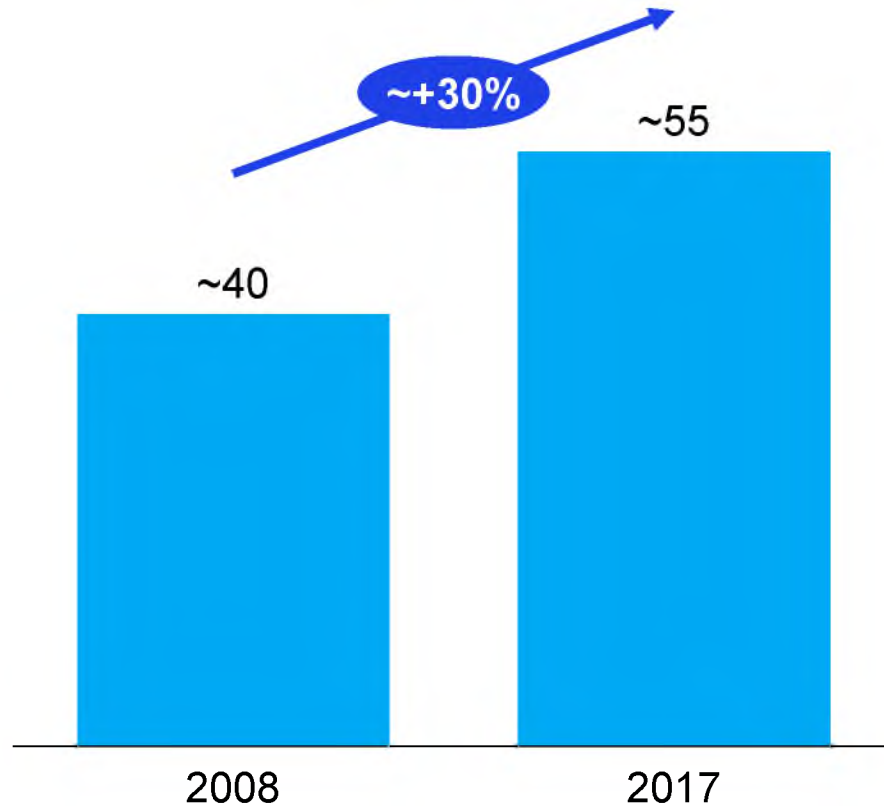
2008

2017

Yearly revenues, changes between 2008 and 2017
EUR[2]?


Europe   -20%

U.S.   +50%
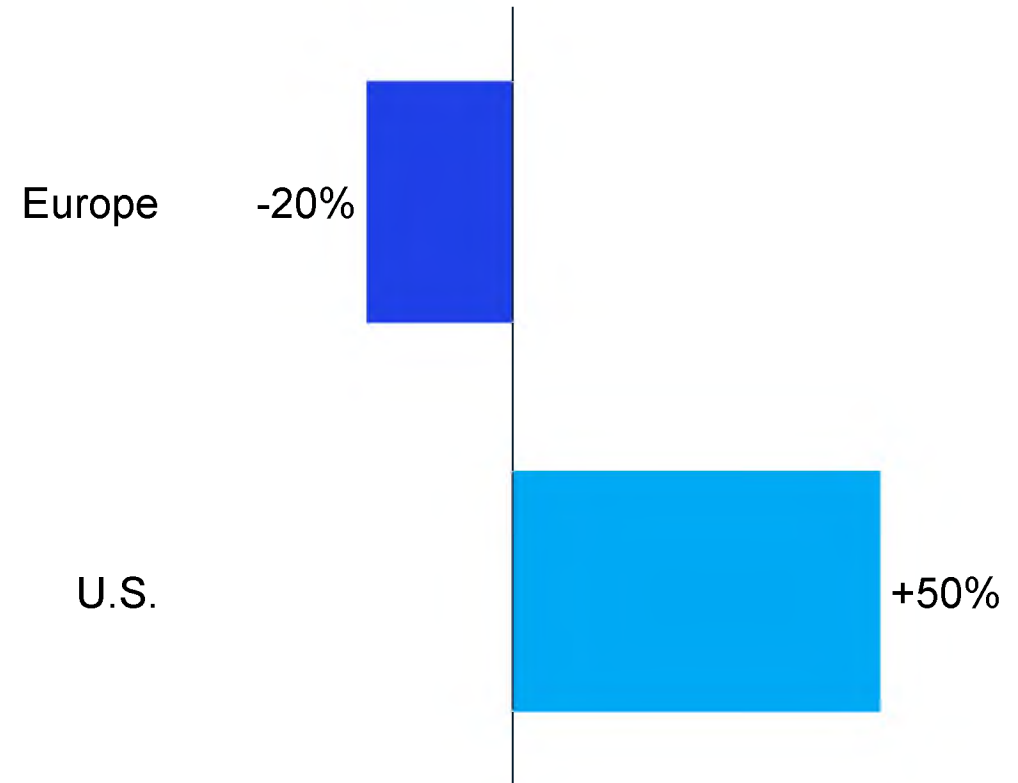
1 Excluding licenses, Ovum
2 Capex and licenses
3 Percent households, DESI 2018; 4 % households, >30Mbps overall NGA coverage considered (VDSL , FTTP and DOCSIS 3.0), DESI 2018

... 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

Cost of capital of European operators

Average ROIC
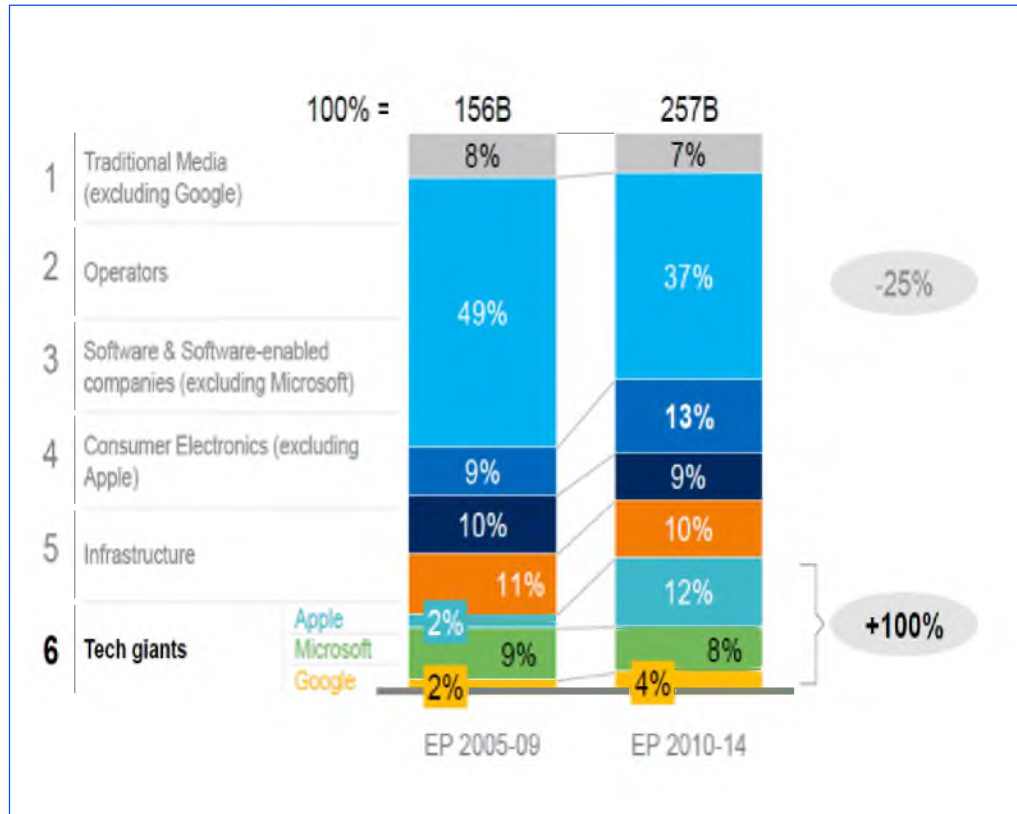France, Germany, Italy, Spain and Netherlands[1]
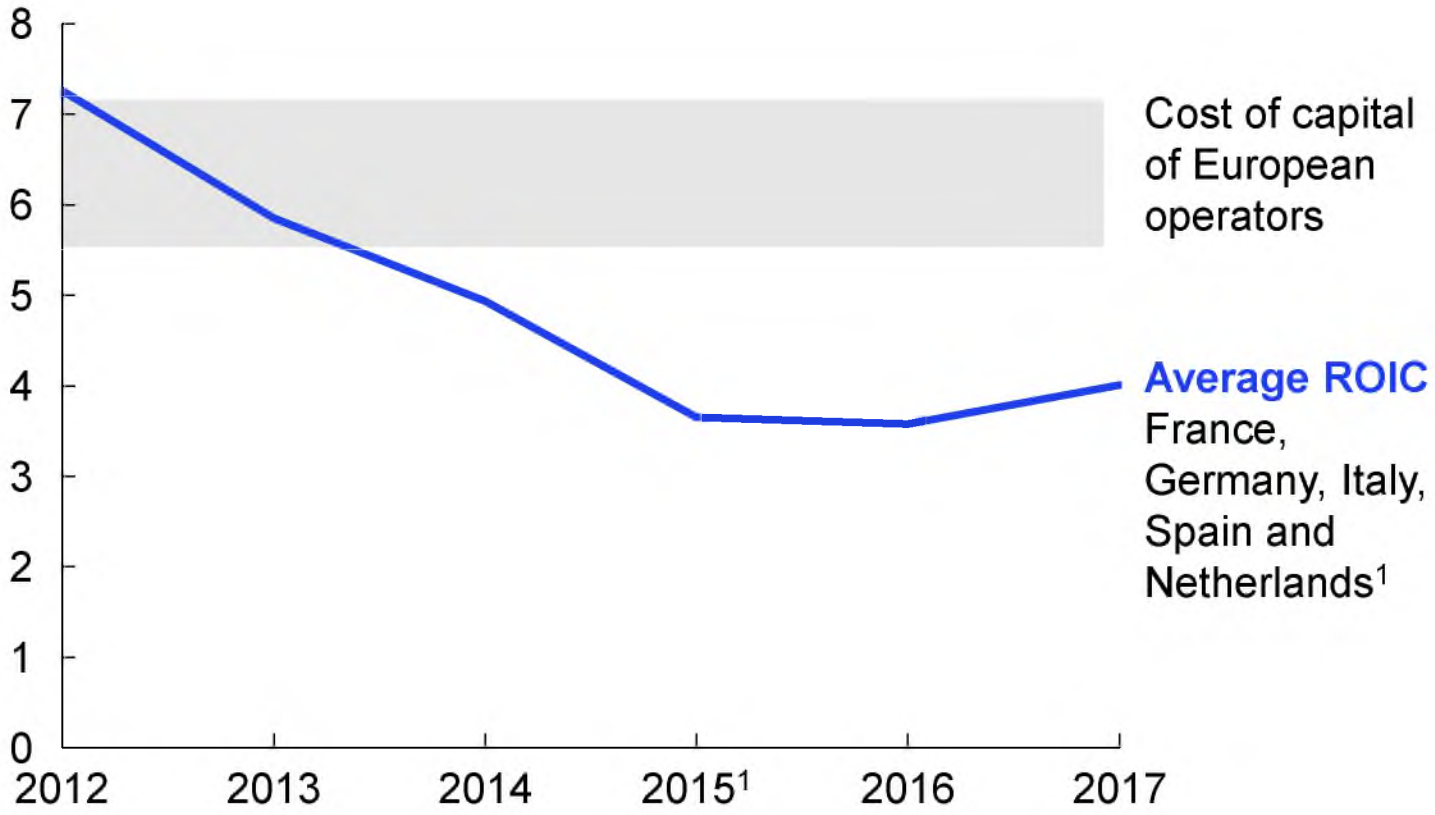
Without and inversion of trend, further investment in the sector would look increasingly unattractive
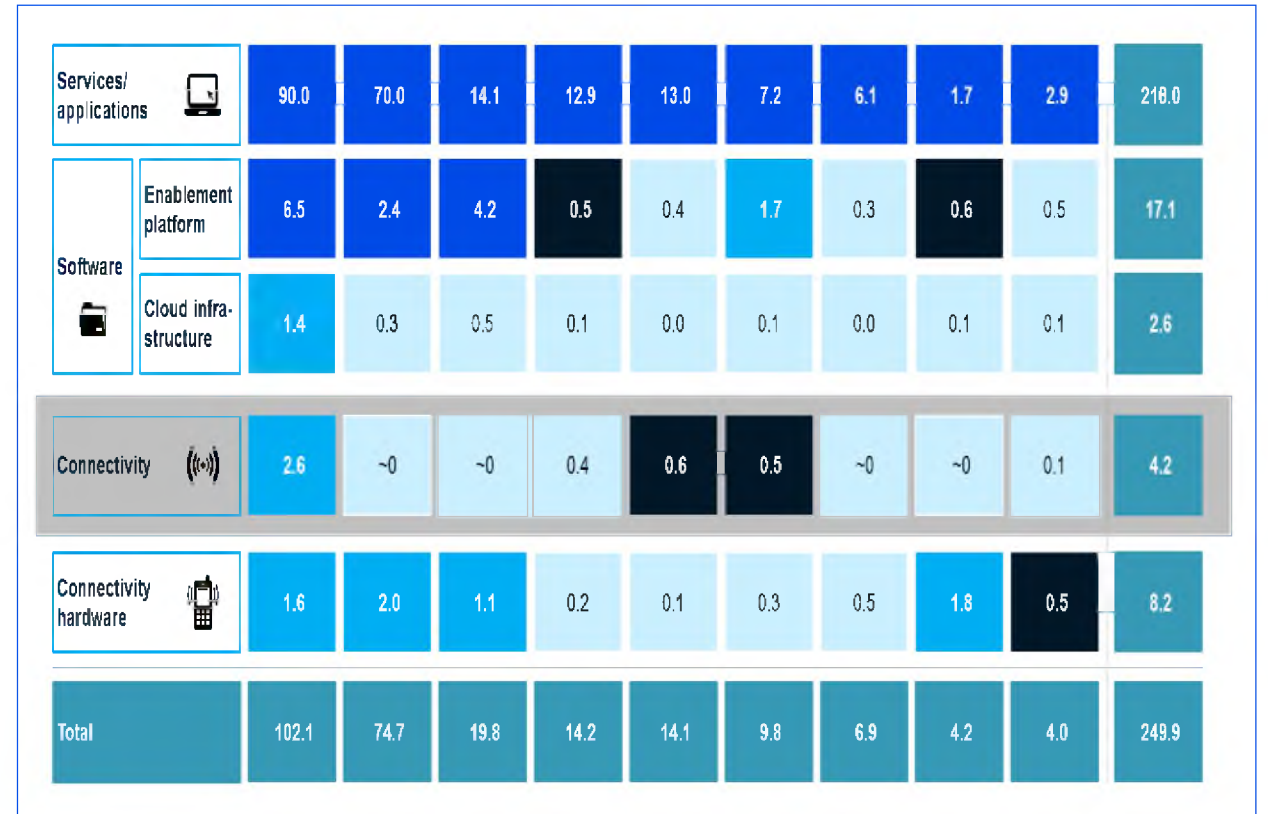
1 Does not include Movistar (Telefonica) figures for Spain in 2015 due to the temporary impact of a plan for voluntary employment suspension

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

Distribution of economic profit by Tech, Media and Telecom sub-sector[1], 2005-14
USD billions

	EP 2005-09	EP 2010-14
100% =	156B	257B
1 Traditional Media (excluding Google)	8%	7%
2 Operators	49%	37%
3 Software & Software-enabled companies (excluding Microsoft)		13%
4 Consumer Electronics (excluding Apple)	9%	9%
5 Infrastructure	10%	10%
6 Tech giants — Apple	11% / 2%	12%
Tech giants — Microsoft	9%	8%
Tech giants — Google	2%	4%

-25% (Operators)
+100% (Tech giants)

IoT market outlook 2020 by vertical
EUR billions

												Total
Services/applications		90.0	70.0	14.1	12.9	13.0	7.2	6.1	1.7	2.9		218.0
Software	Enablement platform	6.5	2.4	4.2	0.5	0.4	1.7	0.3	0.6	0.5		17.1
	Cloud infra-structure	1.4	0.3	0.5	0.1	0.0	0.1	0.0	0.1	0.1		2.6
Connectivity		2.6	~0	~0	0.4	0.6	0.5	~0	~0	0.1		4.2
Connectivity hardware		1.6	2.0	1.1	0.2	0.1	0.3	0.5	1.8	0.5		8.2
Total		102.1	74.7	19.8	14.2	14.1	9.8	6.9	4.2	4.0		249.9

- Overall industry perspectives for telecom in Europe

- **Perspectives on deployment and sharing of fixed infrastructures in Europe and Iceland**
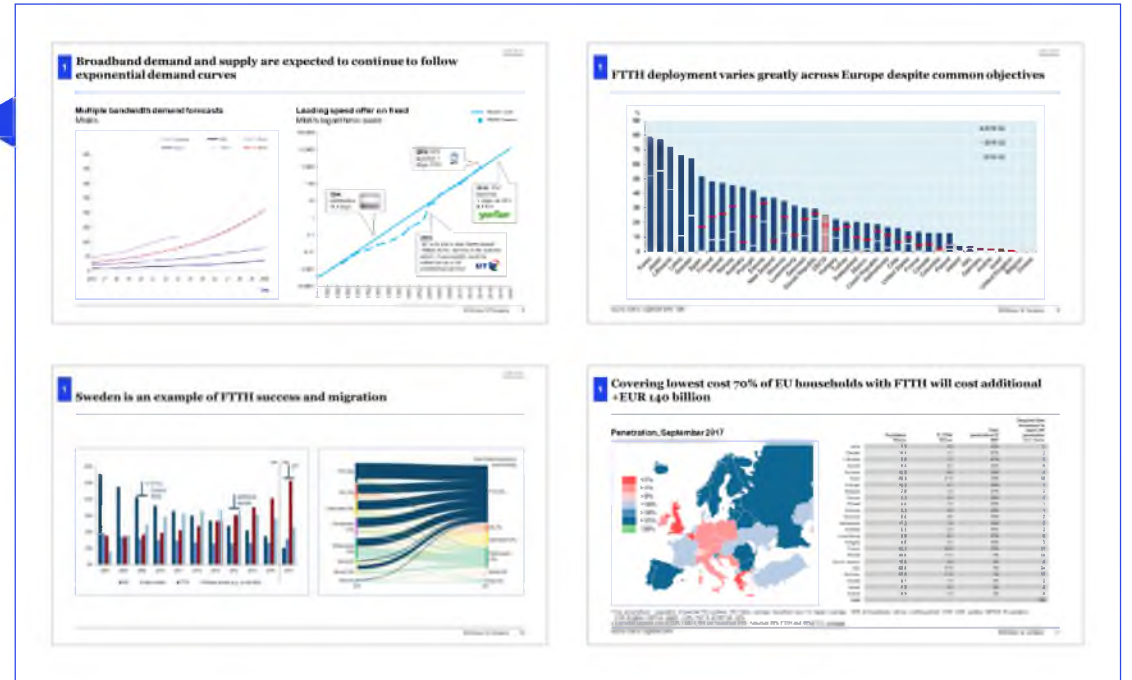
Selective deep dive today

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
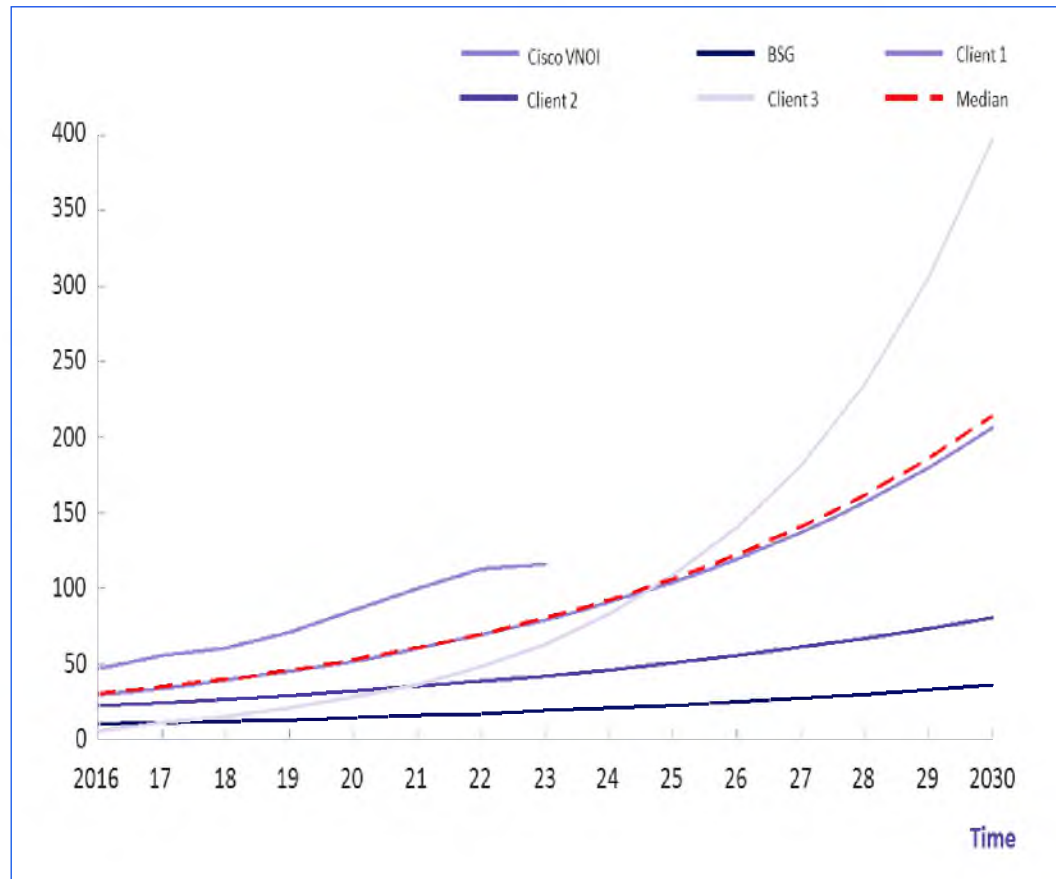
3 Sharing and wholesale affect the profit distribution and nature of competition
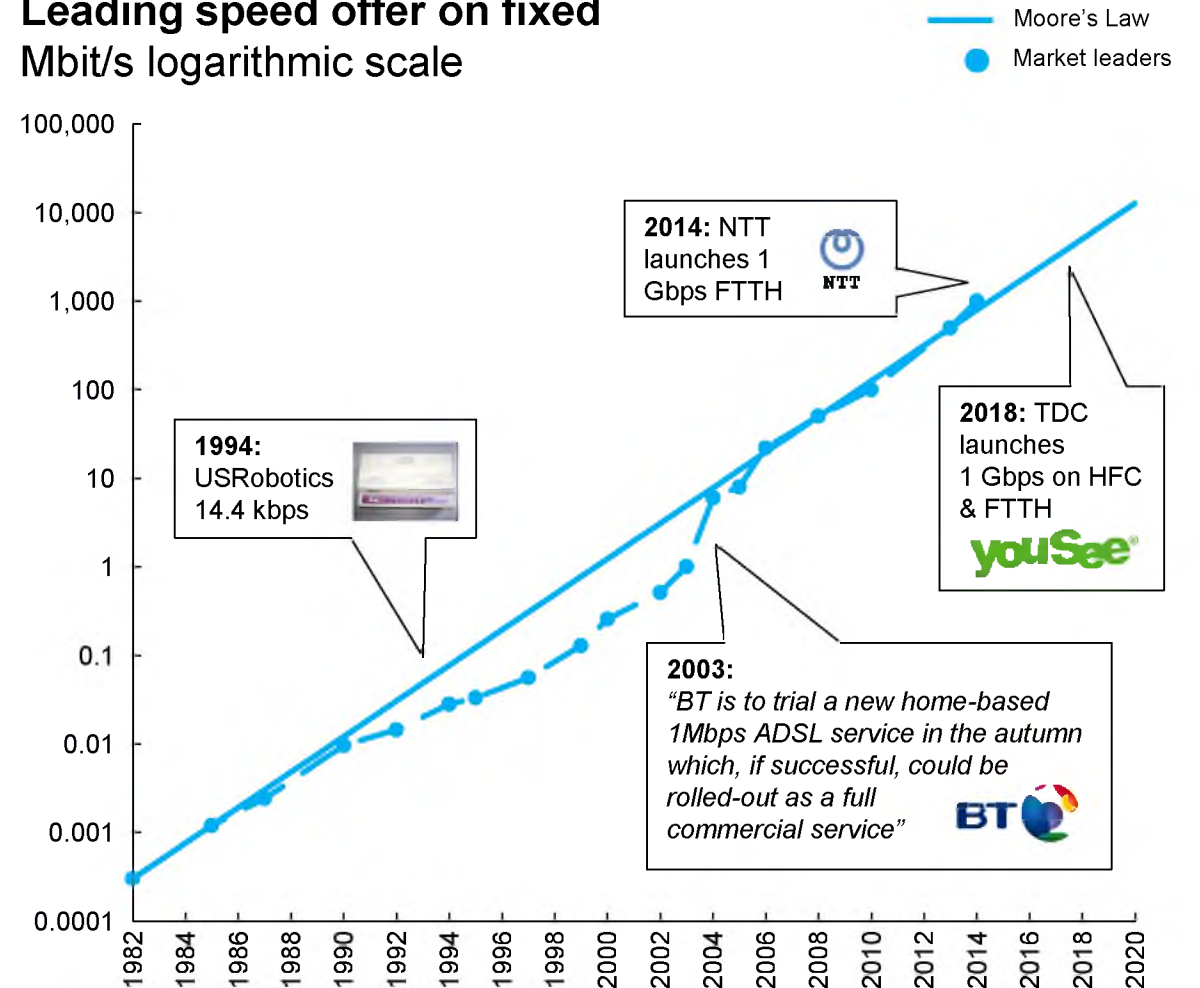
4 Out-side-in reflections on Icelandic telecom market

1 # Broadband demand and supply are expected to continue to follow exponential demand curves
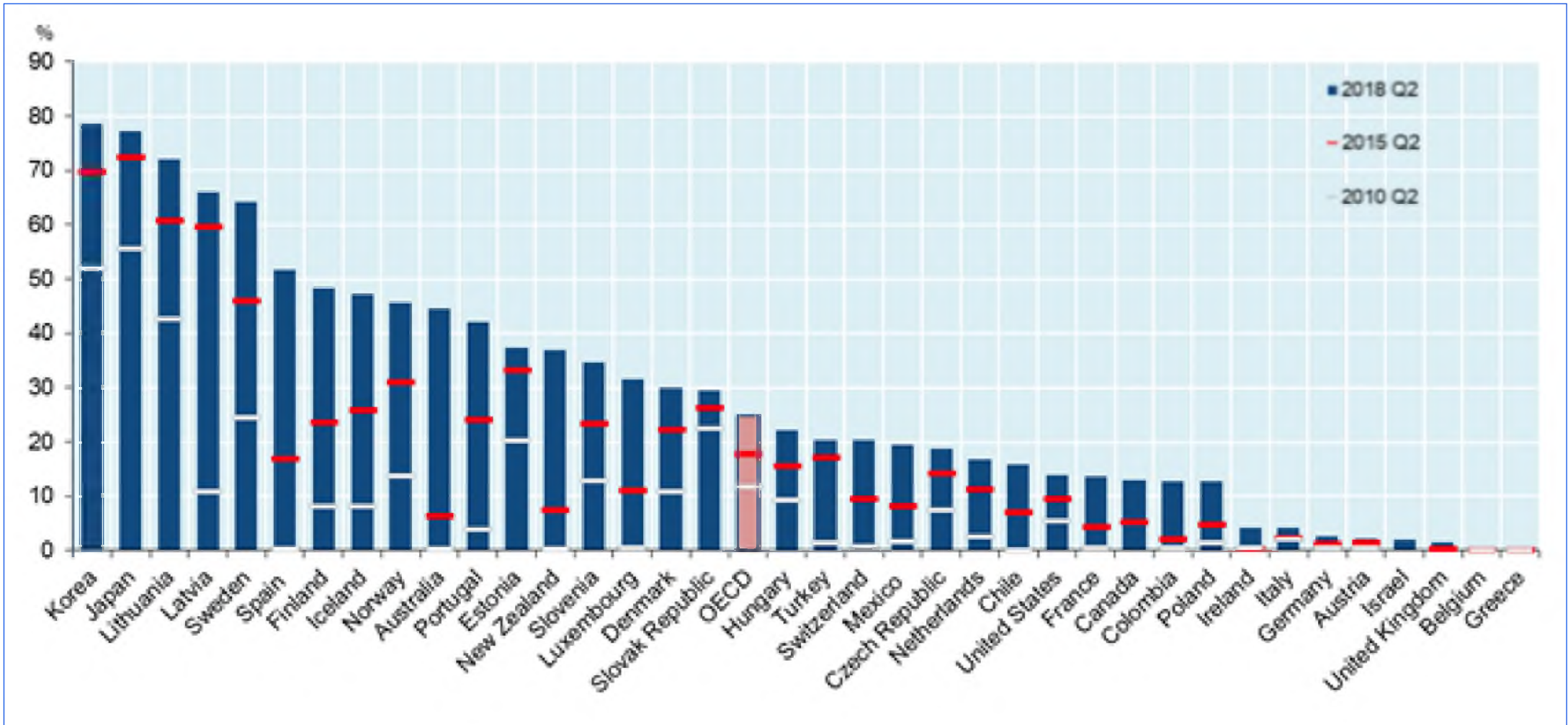
Multiple bandwidth demand forecasts
Mbit/s

Cisco VNOI — BSG — Client 1 — Client 2 — Client 3 — Median

Leading speed offer on fixed
Mbit/s logarithmic scale

— Moore's Law
● Market leaders

2014: NTT launches 1 Gbps FTTH — NTT

2018: TDC launches 1 Gbps on HFC & FTTH — youSee

1994: USRobotics 14.4 kbps

2003:
"BT is to trial a new home-based 1Mbps ADSL service in the autumn which, if successful, could be rolled-out as a full commercial service" — BT
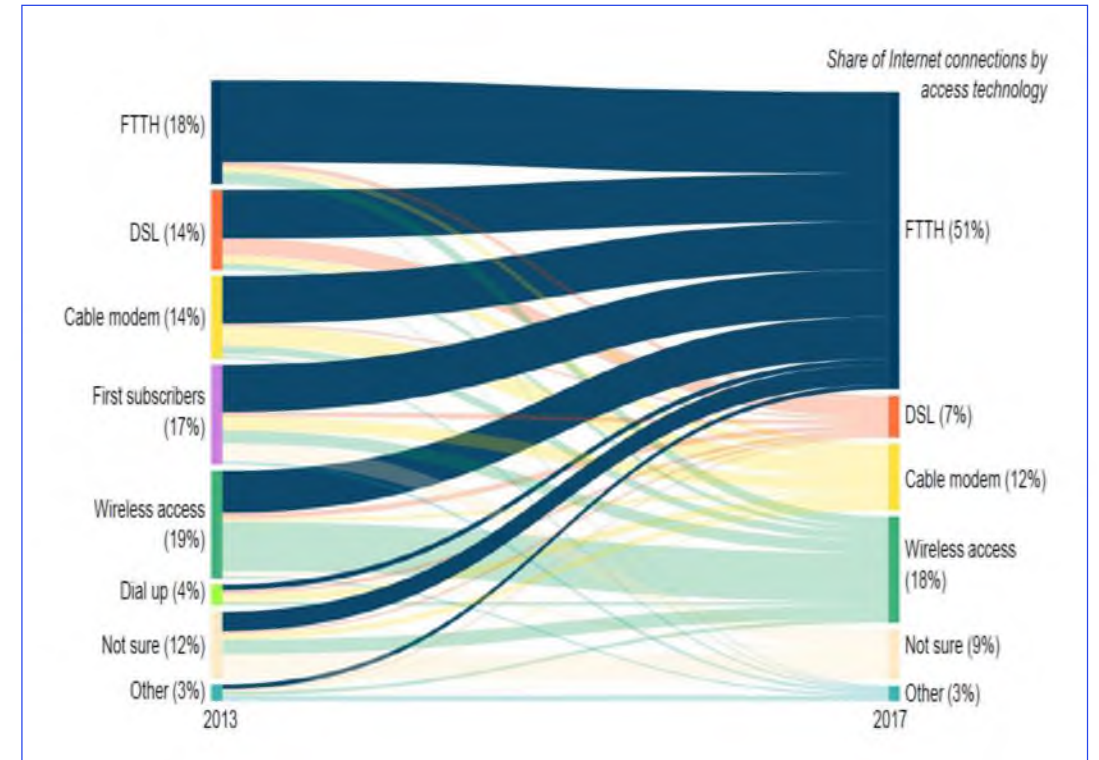
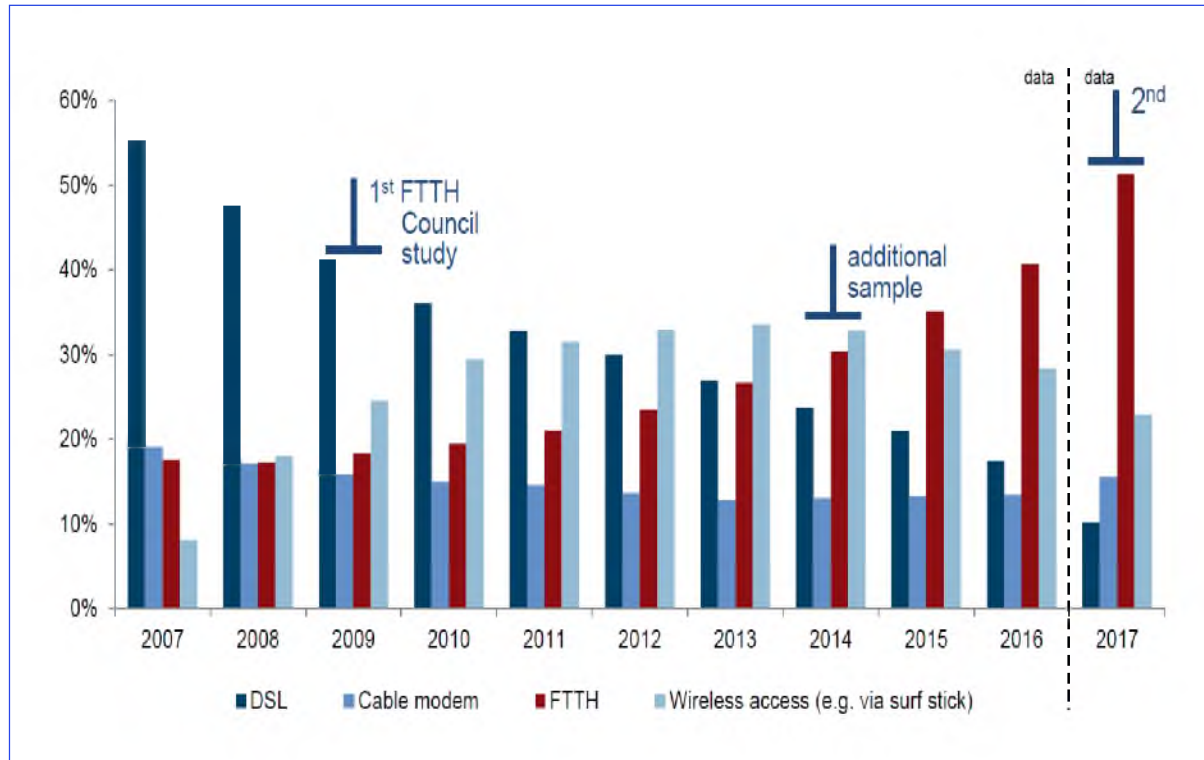# 1 FTTH deployment varies greatly across Europe despite common objectives

1 Sweden is an example of FTTH success and migration

Share of Internet connections by access technology

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

Penetration, September 2017

Legend:
- < 1%
- > 1%
- > 5%
- > 10%
- > 20%
- > 25%
- 100%
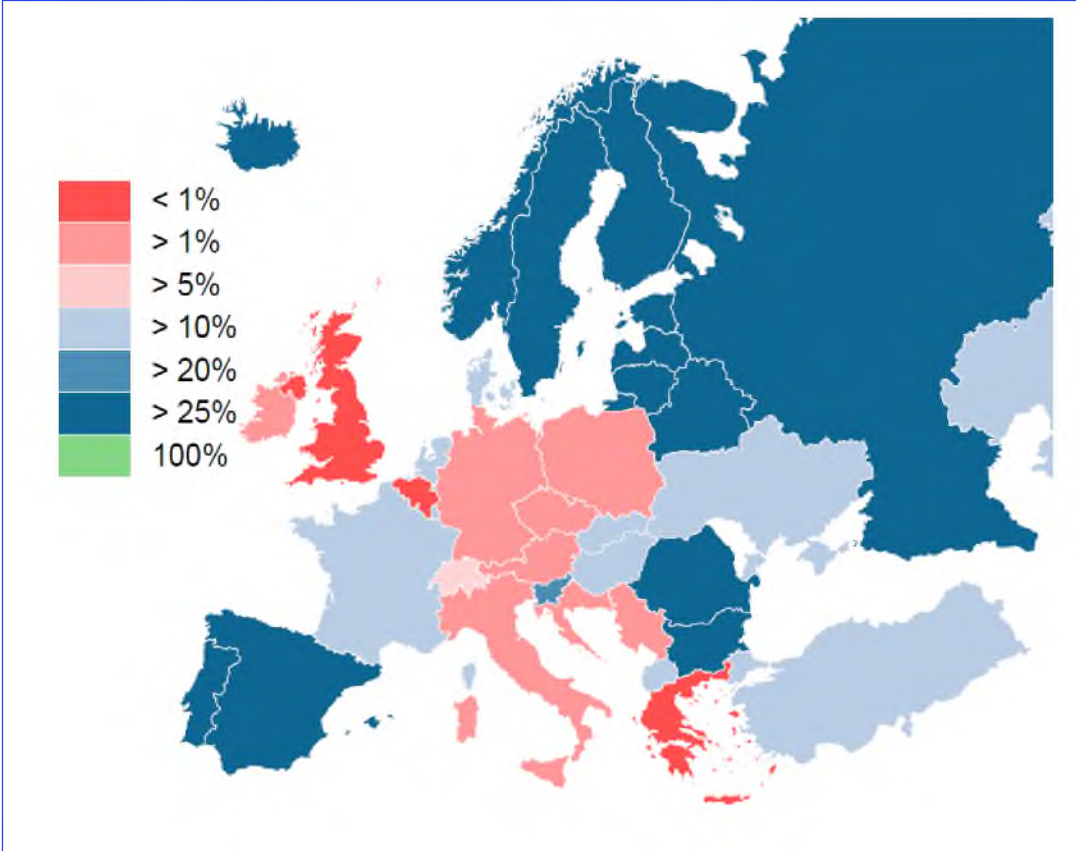
	Population Millions	# of HHs Millions	Fiber penetration Q3 2017	Required fibre investment to reach 70% penetration EUR billions
Latvia	1.9	0.9	52%	0
Sweden	10.3	4.7	43%	2
Lithuania	2.8	1.3	43%	0
Iceland	0.4	0.2	35%	0
Romania	19.6	8.9	35%	4
Spain	46.3	21.0	34%	10
Portugal	10.3	4.7	28%	3
Bulgaria	7.0	3.2	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
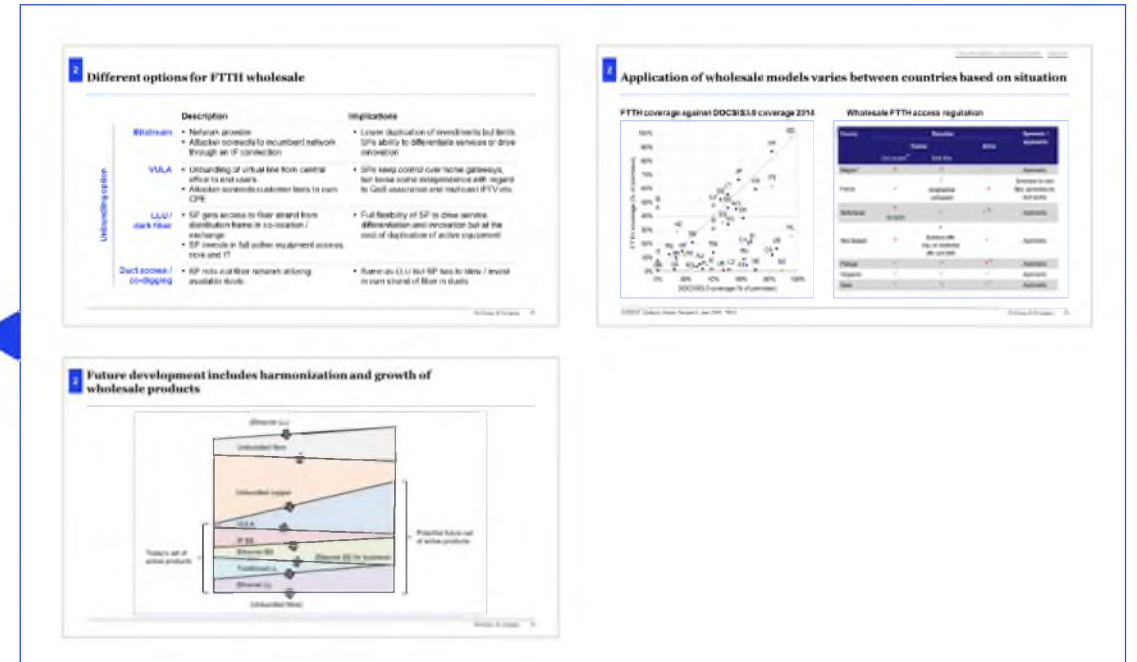
Selective deep dive today

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**

2

Different options for FTTH wholesale

		Description	Implications
Unbundling option	**Bitstream**	• Network provider • Attacker connects to incumbent network through an IP connection	• Lower duplication of investments but limits SPs ability to differentiate services or drive innovation
	VULA	• Unbundling of virtual line from central office to end users • Attacker connects customer lines to own CPE	• SPs keep control over home gateways, but loose some independence with regard to QoS assurance and multicast IPTV etc.
	LLU / dark fiber	• SP gets access to fiber strand from distribution frame in co-location / exchange • SP invests in full active equipment access, core and IT	• Full flexibility of SP to drive service differentiation and innovation but at the cost of duplication of active equipment
	Duct access / co-digging	• SP rolls-out fiber network utilizing available ducts	• Same as LLU but SP has to blow / invest in own strand of fiber in ducts

2

Application of wholesale models varies between countries based on situation

FTTH coverage against DOCSIS3.0 coverage 2014
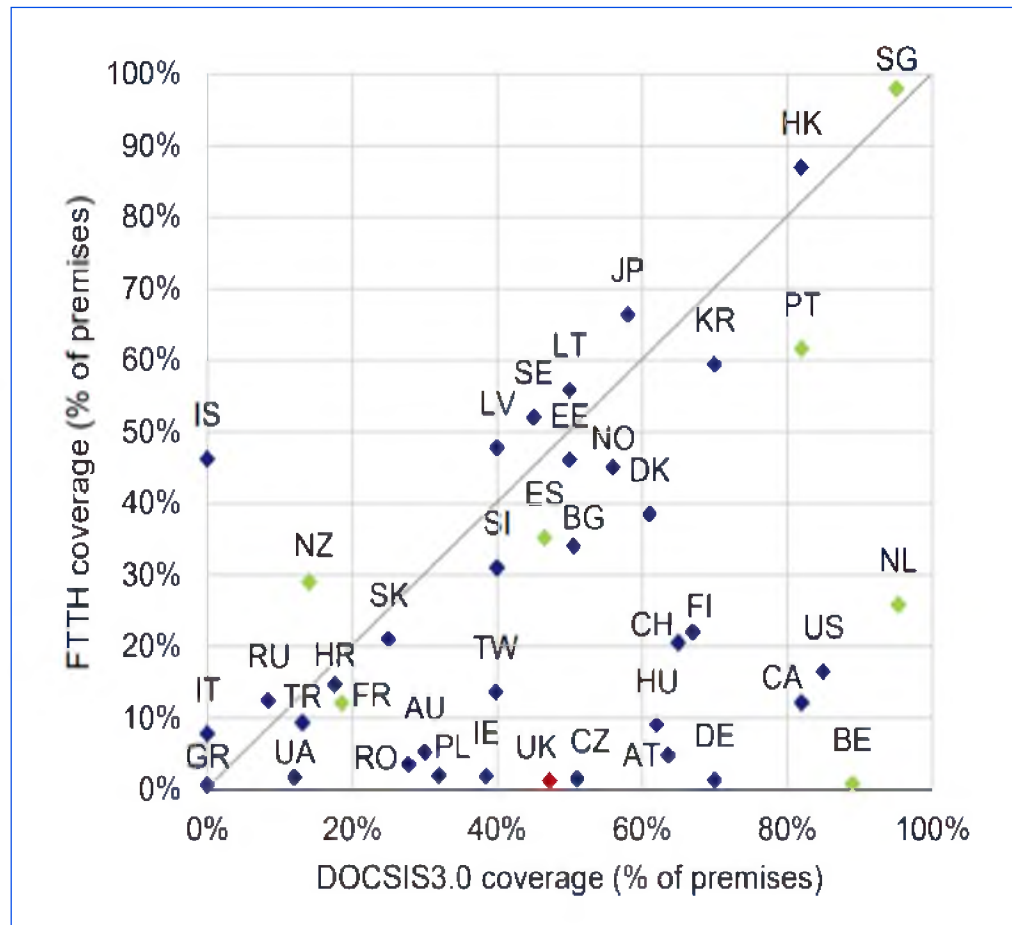
Wholesale FTTH access regulation

Country	Remedies			Symmetric / asymmetric
	Passive		Active	
	Duct access[30]	Dark fibre		
Belgium*	✗	✗	✓	Asymmetric
France	✓	✓ (above) Geographical component	✗	Symmetric for dark fibre; asymmetric for duct access
Netherlands	✗ No ducts	✓	✓[31]	Asymmetric
New Zealand	✗	✗ (above) Business offer only; no residential offer until 2020	✓	Asymmetric
Portugal	✓	✗	✗[32]	Asymmetric
Singapore	✓	✓	✓	Asymmetric
Spain	✓	✗	✓[33]	Asymmetric

Future development includes harmonization and growth of wholesale products
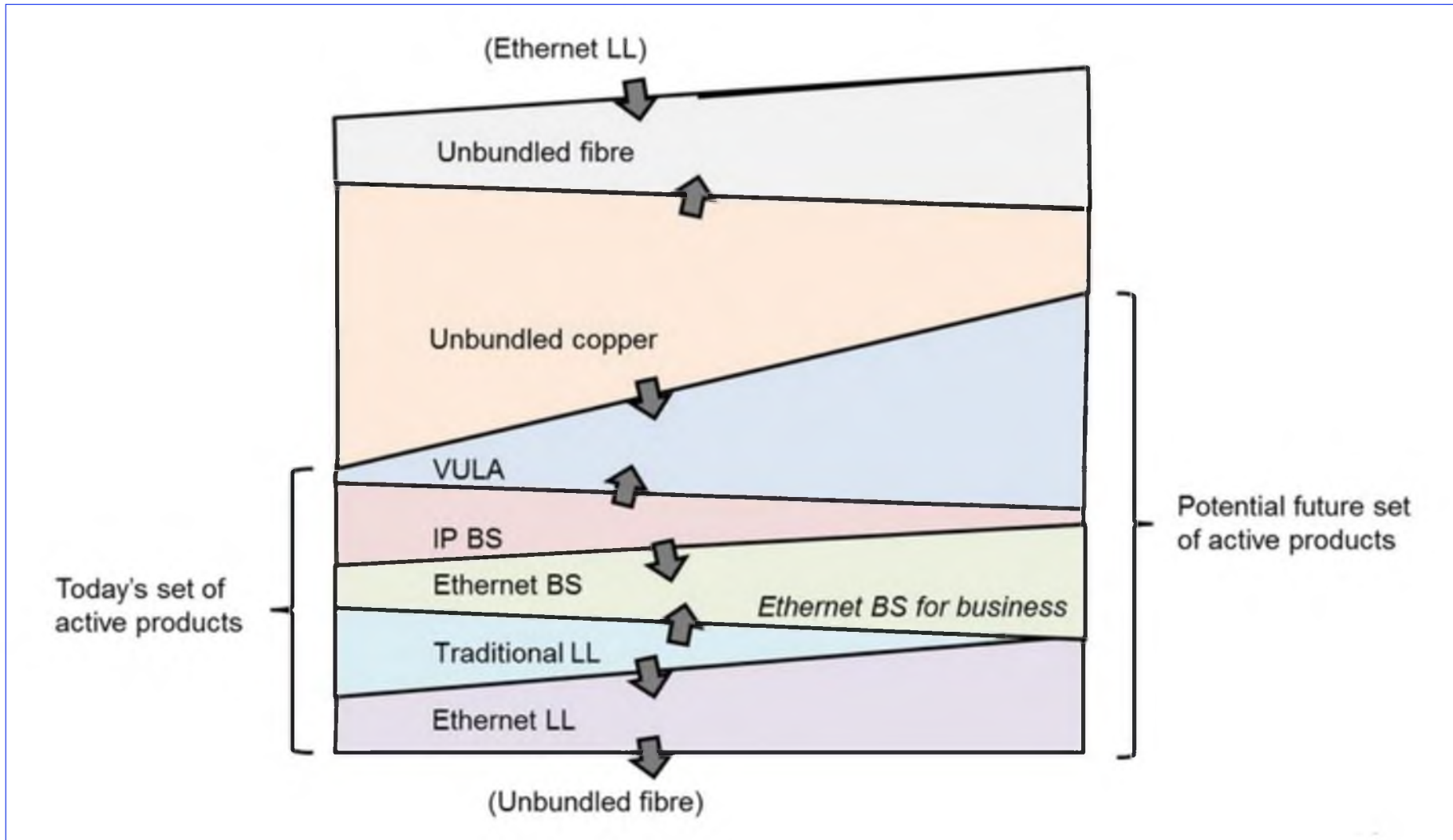
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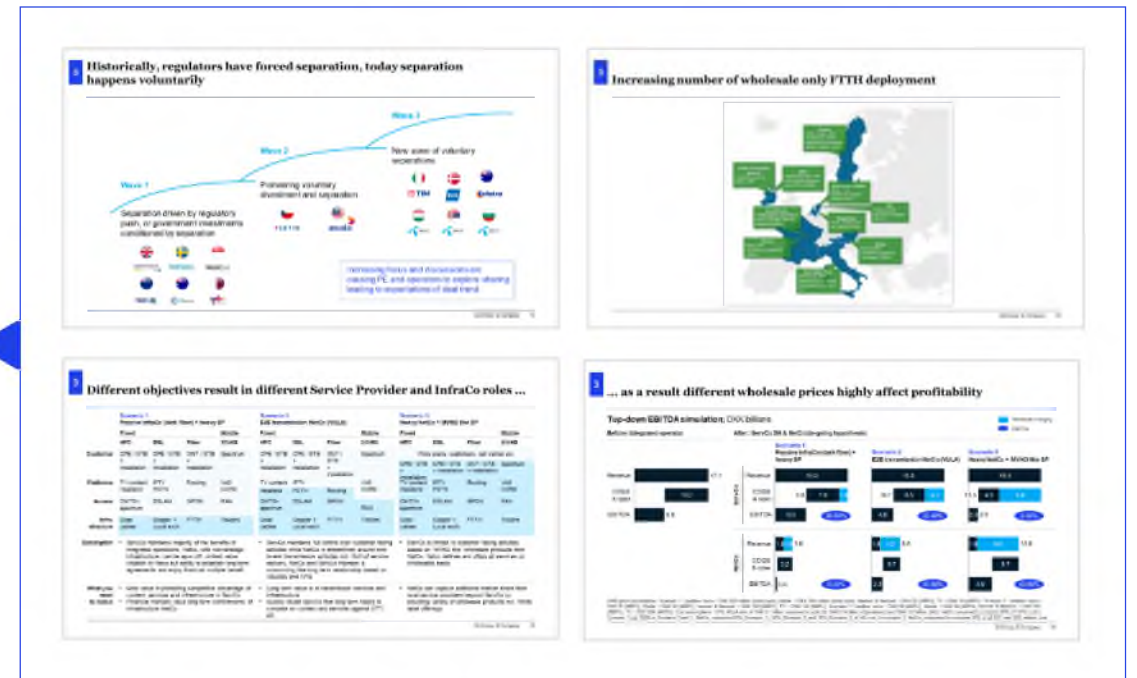
Historically, regulators have forced separation, today separation happens voluntarily

Wave 3

Wave 2

New wave of voluntary separations

Wave 1

Pioneering voluntary divestment and separation

Separation driven by regulatory push, or government investments conditioned by separation

Increasing focus and discussions are causing PE and operators to explore sharing leading to expectations of deal trend
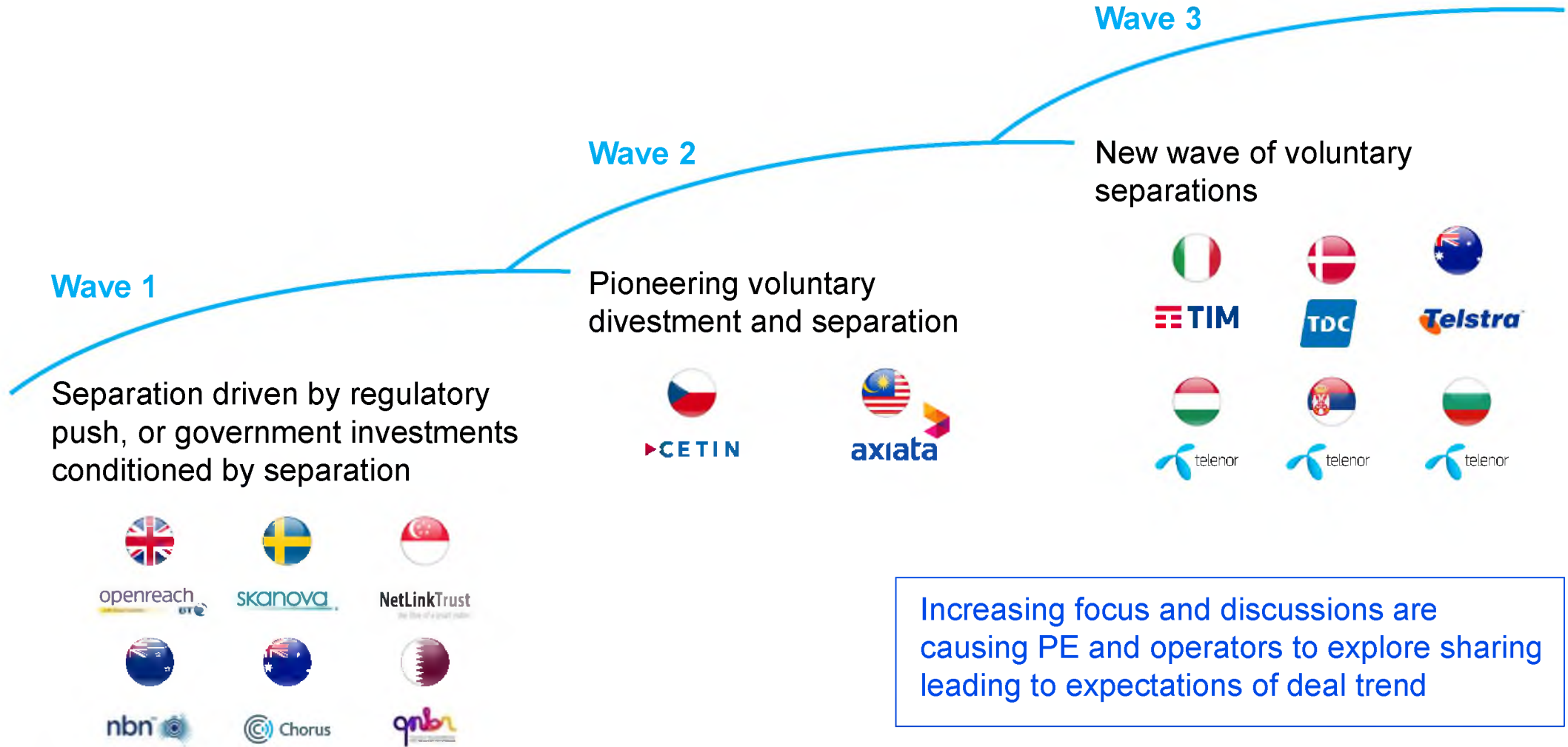
Increasing number of wholesale only FTTH deployment

Stokab
Urban, public, 90% households, 100% enterprises connected*; €540 m (1994 – 2012)

Dublin Docklands Network
Urban/commercial, public, €8m

SIRO
Urban/suburban, PPP 0.5m homes targeted (end 2018), €450m

Amsterdam CityNet
urban, PPP 43,000 HH passed (2009); €30 m

CIP
Rural, private, 80,000 HH passed (2017)

Nord/Pas-de-Calais/Hauts-de-France
Rural, PPP 681,000 HH expected €900m

Reggefiber
Urban, private, 2m HH passed (2014)

Alsace
Rural, PPP 370,000 HH expected, €480m

Nögig
Rural, public, 35,000 HH passed in 1st phase; €100 m

Enel OpEn Fiber
Urban/rural, PPP expected 9.5 m homes connected (2021), €3.7 bn

Different objectives result in different Service Provider and InfraCo roles …

Scenario 1:
Passive InfraCo (dark fiber) + heavy SP

	Fixed			Mobile
	HFC	DSL	Fiber	2/3/4G
Customer	CPE / STB + installation	CPE / STB + installation	ONT / STB + installation	Spectrum
Platforms	TV content Headend	IPTV PSTN	Routing	VAS CORE
Access	CMTS+ spectrum	DSLAM	GPON	RAN
Infra-structure	Coax cables	Copper + Local exch.	FTTH	Towers

Description
- 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

What you need to belive
- Most value in competitive advantage of integrated connectivity, content, and services in ServCo
- Financial markets value long term commitments of infrastructure NetCo

Scenario 2:
E2E transmission NetCo (VULA)

	Fixed			Mobile
	HFC	DSL	Fiber	2/3/4G
Customer	CPE / STB + installation	CPE / STB + installation	ONT / STB + installation	Spectrum
Platforms	TV content Headend	IPTV PSTN	Routing	VAS CORE
Access	CMTS+ spectrum	DSLAM	GPON	RAN
Infra-structure	Coax cables	Copper + Local exch.	FTTH	Towers

Description
- ServCo maintains full control over customer facing activites while NetCo is streamlined around end-to-end transmission activites incl. QoS of service delivery. NetCo and ServCo maintain a outsourcing like long term relationship based on volumes and KPIs

What you need to belive
- Long term value is in transmission services and infrastructure
- ServCo needs to compete and differentiate on integrated content and services against OTT, etc.

Scenario 3:
Heavy NetCo + MVNO like SP

	Fixed			Mobile
	HFC	DSL	Fiber	2/3/4G
Customer	Price plans, customers, call center etc.			
	CPE / STB + installation	CPE / STB + installation	ONT / STB + installation	Spectrum
Platforms	TV content Headend	IPTV PSTN	Routing	VAS CORE
Access	CMTS+ spectrum	DSLAM	GPON	RAN
Infra-structure	Coax cables	Copper + Local exch.	FTTH	Towers

Description
- 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 belive
- NetCo can capture additional market share from local service providers beyond ServCo by providing variety of wholesale products incl. White label offerings
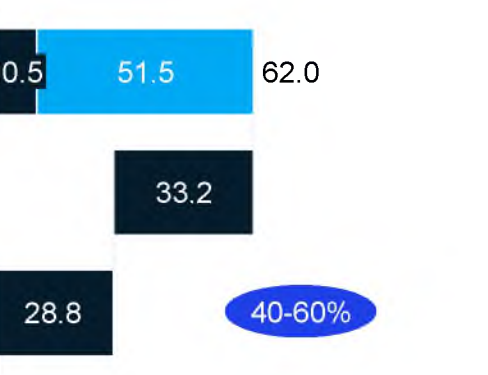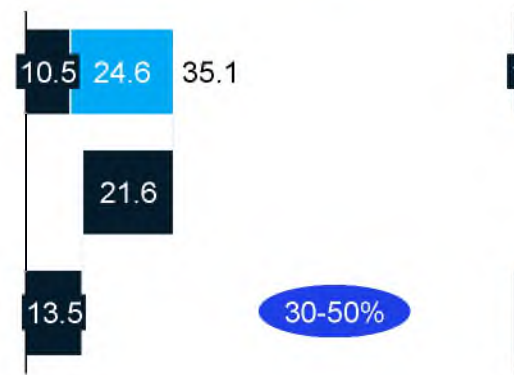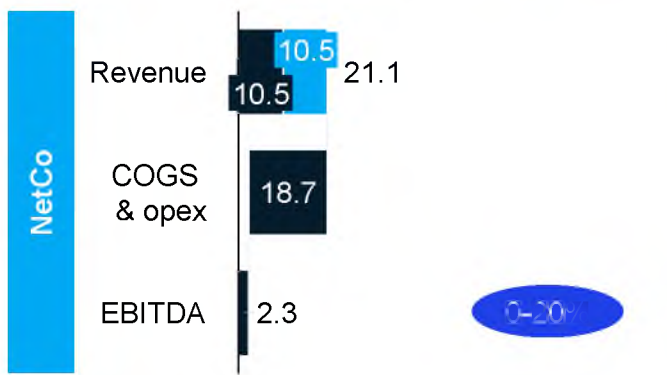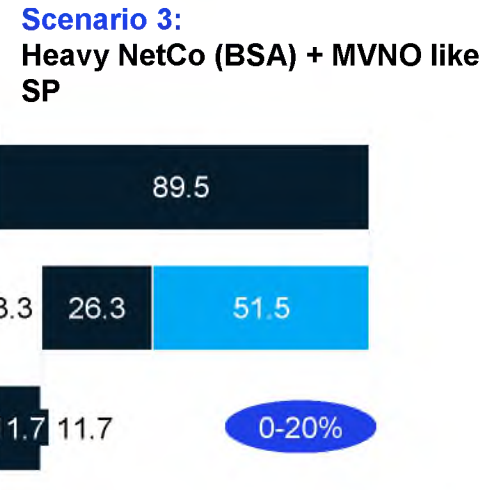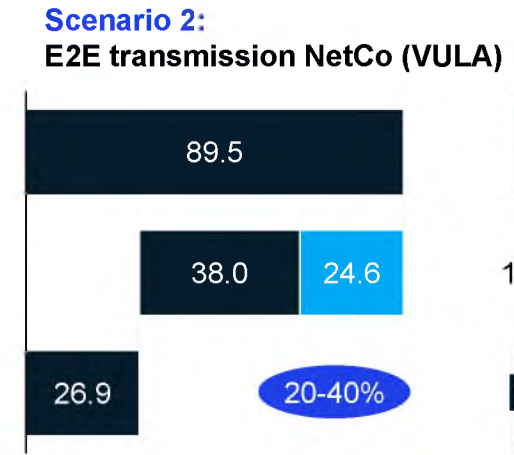
... as a result different wholesale prices highly affect profitability

Top-down EBITDA simulation

■ Wholesale charging
● EBITDA

Before: Integrated operator

After: ServCo DK & NetCo (in-going hypothesis)
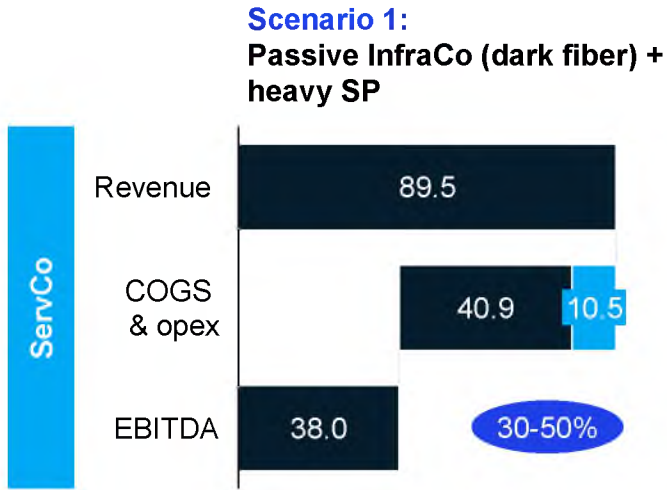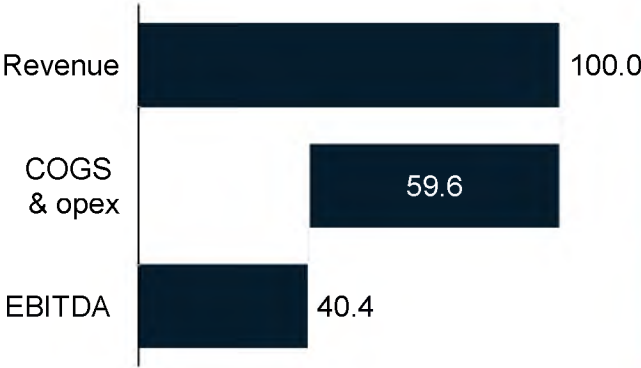
Scenario 1:
Passive InfraCo (dark fiber) + heavy SP

Scenario 2:
E2E transmission NetCo (VULA)

Scenario 3:
Heavy NetCo (BSA) + MVNO like SP

ServCo

	Before	Scenario 1	Scenario 2	Scenario 3
Revenue	100.0	89.5	89.5	89.5
COGS & opex	59.6	40.9 / 10.5	38.0 / 24.6	13.3 / 26.3 / 51.5
EBITDA	40.4	38.0 (30–50%)	26.9 (20–40%)	11.7 / 11.7 (0–20%)

NetCo

	Scenario 1	Scenario 2	Scenario 3
Revenue	10.5 / 10.5 → 21.1	10.5 / 24.6 → 35.1	10.5 / 51.5 → 62.0
COGS & opex	18.7	21.6	33.2
EBITDA	2.3 (0–20%)	13.5 (30–50%)	28.8 (40–60%)

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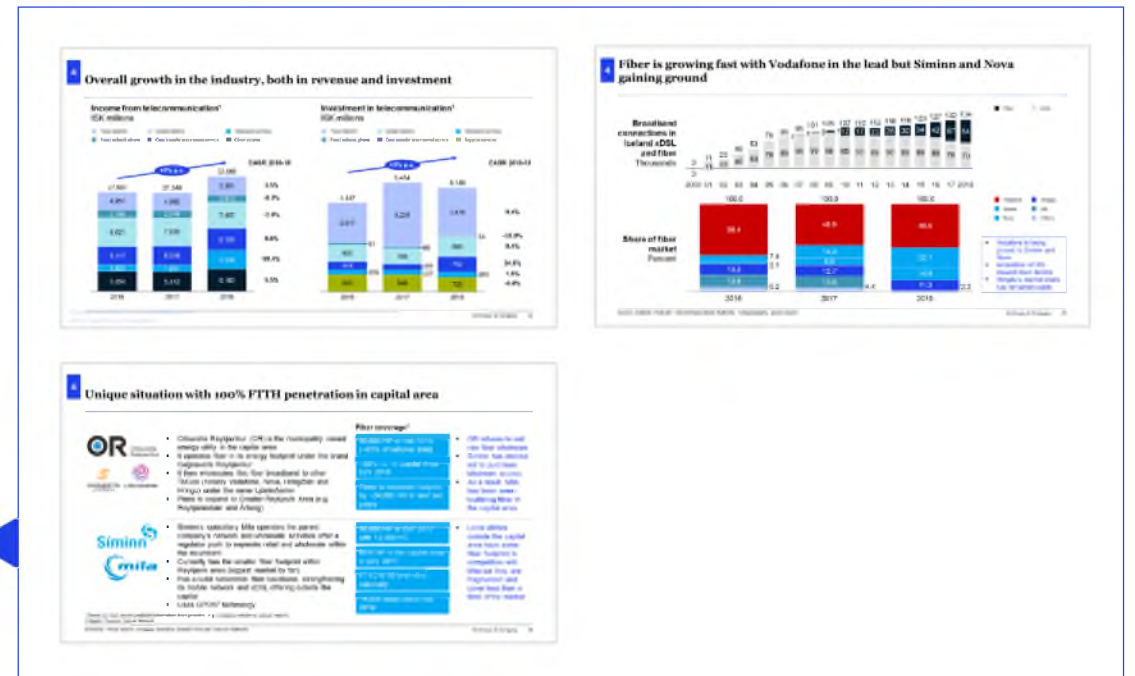
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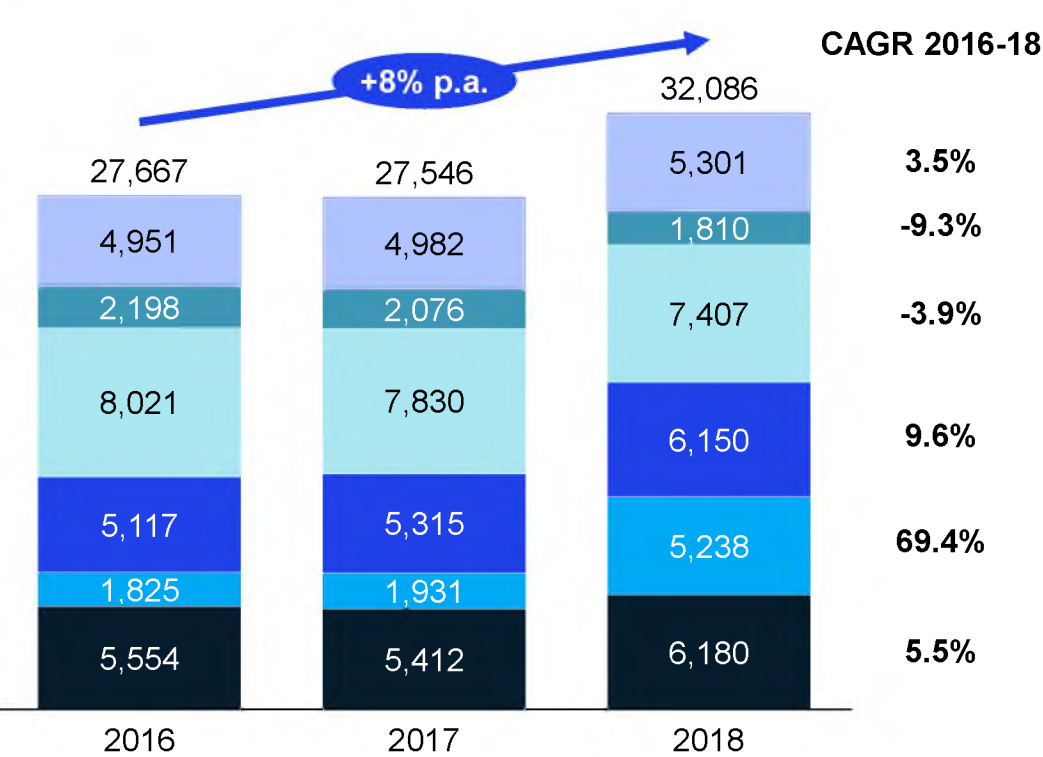
4   **Out-side-in reflections on Icelandic telecom market**

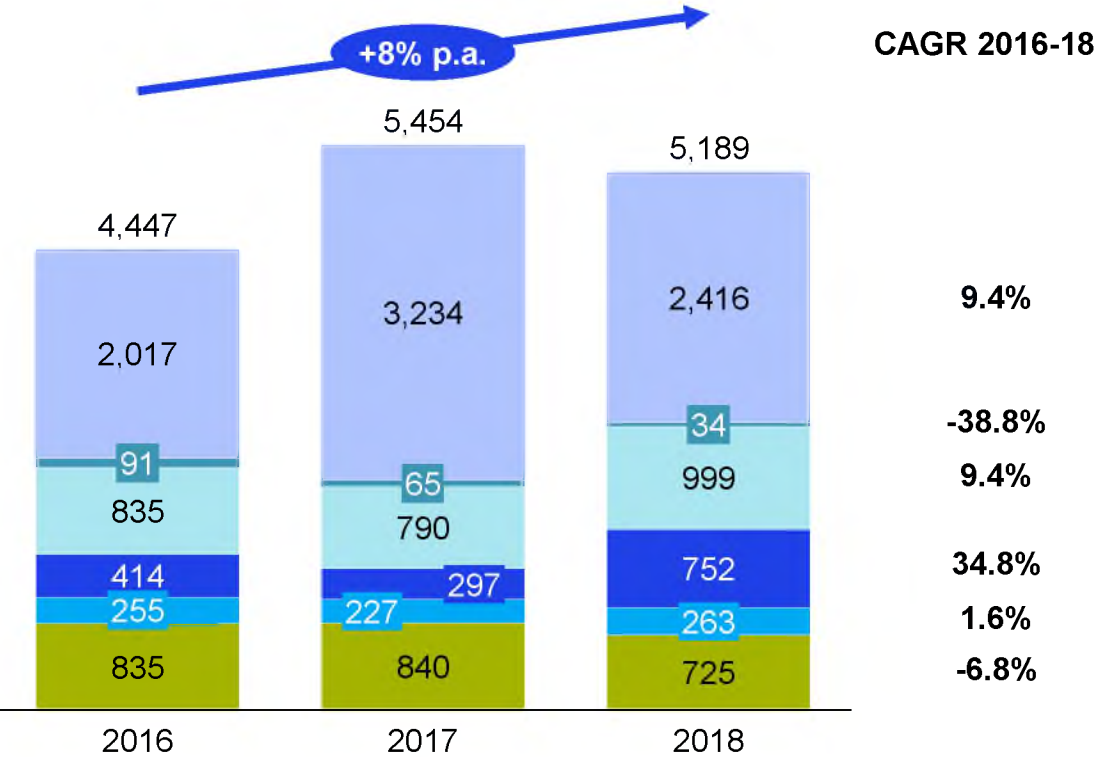# Overall growth in the industry, both in revenue and investment

Income from telecommunication[1]
ISK millions

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

+8% p.a.

CAGR 2016-18

	2016	2017	2018	CAGR 2016-18
Total	27,667	27,546	32,086	
Fixed network	4,951	4,982	5,301	3.5%
Fixed network phone	2,198	2,076	1,810	-9.3%
Mobile network	8,021	7,830	7,407	-3.9%
Data transfer and Internet service	5,117	5,315	6,150	9.6%
Television services	1,825	1,931	5,238	69.4%
Other income	5,554	5,412	6,180	5.5%

Investment in telecommunication[1]
ISK millions

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

+8% p.a.

CAGR 2016-18

	2016	2017	2018	CAGR 2016-18
Total	4,447	5,454	5,189	
Fixed network	2,017	3,234	2,416	9.4%
Fixed network phone	91	65	34	-38.8%
Mobile network	835	790	999	9.4%
Data transfer and Internet service	414	297	752	34.8%
Television services	255	227	263	1.6%
Support services	835	840	725	-6.8%

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

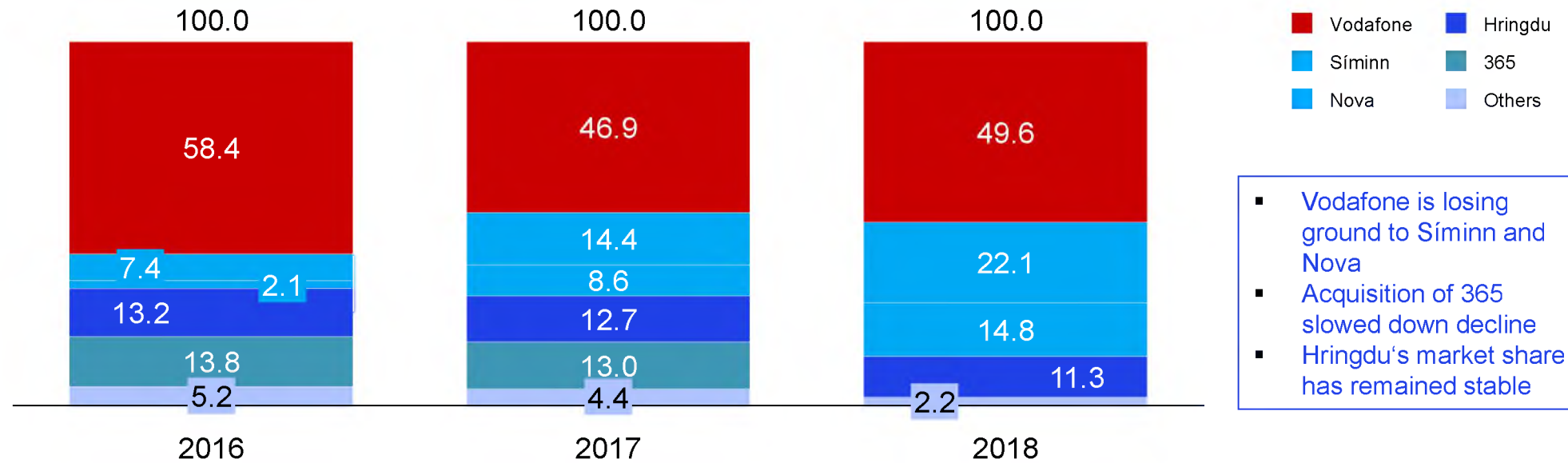# Fiber is growing fast with Vodafone in the lead but Síminn and Nova gaining ground

Broadband connections in Iceland xDSL and fiber
Thousands

Legend: ■ Fiber ▢ xDSL

Years: 2000 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 2018

Totals: 3, 11, 23, 40, 53, 76, 86, 96, 101, 105, 107, 110, 112, 116, 118, 123, 127, 132, 134

Fiber values: —, —, —, —, —, —, 1, 1, 1, 3, 7, 12, 17, 23, 26, 30, 34, 42, 57, 64

xDSL values: 3, 11, 23, 40, 53, 76, 85, 95, 99, 98, 95, 93, 89, 90, 89, 89, 85, 76, 70
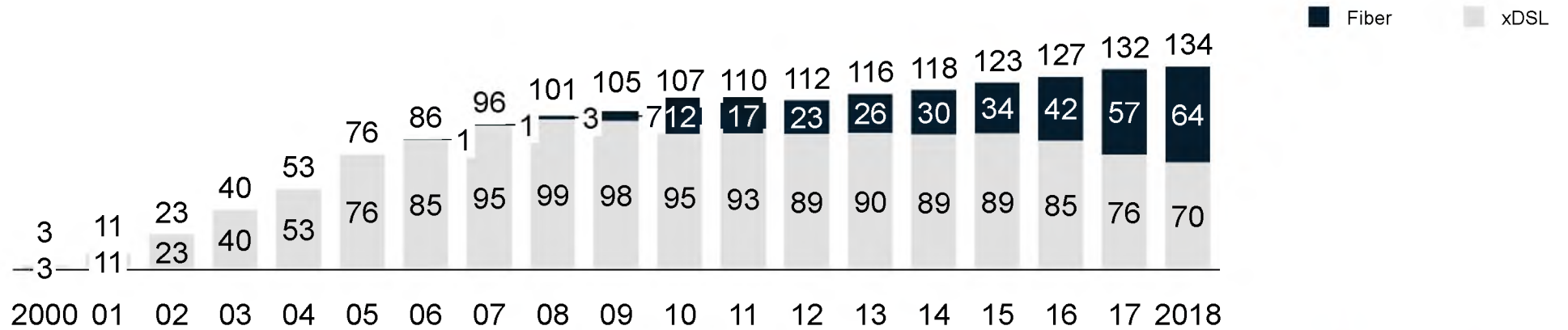
Share of fiber market
Percent

Legend: ■ Vodafone ■ Hringdu ■ Síminn ■ 365 ■ Nova ▢ Others

2016 — 100.0
- Vodafone: 58.4
- Síminn: 7.4
- Nova: 2.1
- Hringdu: 13.2
- 365: 13.8
- Others: 5.2

2017 — 100.0
- Vodafone: 46.9
- Síminn: 14.4
- Nova: 8.6
- Hringdu: 12.7
- 365: 13.0
- Others: 4.4

2018 — 100.0
- Vodafone: 49.6
- Síminn: 22.1
- Nova: 14.8
- Hringdu: 11.3
- Others: 2.2

- 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

Fiber coverage[1]

- 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)

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

- 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 GPON[2] technology

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

McKinsey & Company

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

Contact information:

Halldor_Sigurdsson@McKinsey.com

+45 51368514