The race to gigabit fiber

Gigabit fiber is driving take-up of new services

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Arthur D Little

Content

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Acknowledgment for bringing in global best practices and insights in fiber roll-out and take-up from Asia-Pacific, South-East-Asia and Middle East: Morsi Berguiga, Shinichi Akayama, Tomasz Izydorczyk

Executive summary

We increasingly see deployment of applications and services provisioned by underlying gigabit broadband. This is enabling people, machines, and applications to collaborate effectively and intelligently in order to enhance quality of life, improve our mobility, grow our economies and empower our decision-making.

Fiber optic broadband infrastructure continues to be deployed throughout the world - there are 20+ markets with at least 50% fiber coverage, and 8+ markets with more than 90% fiber coverage. We see an even bigger jump in take-up of fiber driven by effective migration of legacy technology customers to fiber and competition driving demand for high-speed broadband.

Increasing availability of fiber based broadband in turn is driving the take-up of other innovative services such as gigabit speed broadband to the home, 4K TV, increased share of triple/ quadruple play services and use of high end gigabit routers. The recent PyeongChang Olympics 2018 and FIFA World Cup 2018 for the first time saw large scale availability of 4K live sports content broadcast in more than 30+ countries.

We expect fiber rollout to continue to expand to more markets as non-telco operators like utilities, municipalities, private equity firms are also now investing into fiber infrastructure. Fiber take-up will continue to increase driven by effective migrations as well as competition for higher speeds creating demand for new innovative services like gigabit broadband, 4K TV and others.

1. Gigabit broadband is here

In this 4th edition of our report, we observe that applications enabled by gigabit broadband speeds are becoming buzzwords. In this scenario, people, machines, and applications collaborate effectively and intelligently in order to enhance quality of life, improve our mobility, grow our economies and empower our decision-making. For further details on how gigabit broadband enables use cases in a "gigaworld" society, see our reports, "Creating a gigabit society"[1] and "Unlocking Gigaworld innovation"[2].

Gigabit broadband can be delivered using cable DOCSIS, fiber or other 5G-based technologies. In this report we focus on the rollout, take-up and services delivered with fiber[3]-based gigabit broadband networks. We especially focus on the developments made in fiber take-up and gigabit services enabled by fiber. See the previous edition of this study, "Race to gigabit fiber: Telecom incumbents pick up pace"[4] for further details on which markets are taking the lead on fiber rollout and the deployment models used for it.

Figure 1: Previous editions of Arthur D. Little's Fiber Report

FTTH: Double squeeze of Incumbents – Forced to Partner?

High speed cable & FTTx networks deployed by Alt-Nets & utilities put incumbents into a double squeeze

National Fiber Strategies

Is it a national economic imperative or just another private industry task?

Race to Gigabit Fiber

Telecom incumbents pick up pace and take the lead in fiber deployment with partnerships with governments, other telecom operators and investors

The race to gigabit fiber

Fiber is driving take up of new services such as gigabit speed broadband, triple play bundles, 4K TV and high end home WiFi experiences

Source: Arthur D. Little

1 http://www.vodafone.com/content/dam/group/policy/downloads/Vodafone_Group_Call_for_the_Gigabit_SocietyFV.pdf
2 http://www.adlittle.com/en/insights/viewpoints/unlocking-gigaworld-innovation
3 In this report we refer to FTTH/B as fiber
4 http://www.adlittle.de/en/insights/viewpoints/race-gigabit-fiber

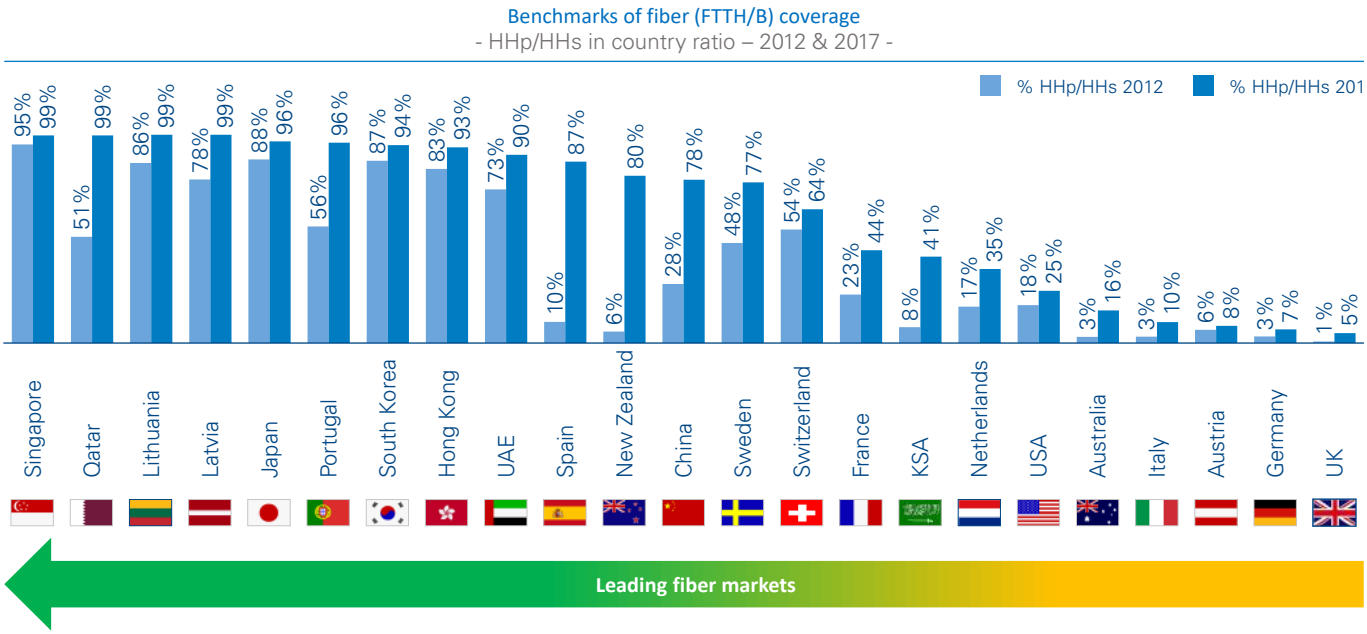
2. Fiber rollout is picking up steam in almost all markets

Since the publication of the first edition of Arthur D. Little's FTTH report in 2010, we have seen tremendous progress in fiber rollout throughout the world. There are 20+ markets with at least 50 percent fiber coverage, while 8+ markets have at least 90 percent coverage nationwide. In most of these markets, the incumbent telecom operators have taken lead roles in rolling out fiber (e.g., Qatar), often with government support (e.g., New Zealand), and sometimes partnering with other telecom operators (e.g., Singapore), collaborating with municipalities (e.g., Switzerland) or setting up joint ventures with investors (e.g., the Netherlands).

Non-telecom entities such as energy companies, railway operators and local municipalities are also entering the market, with large fiber rollout plans in fiber-lagging countries such as Italy, Germany and Austria, to bridge the gigabit broadband gap.

With 5G deployment models crystallizing[6], operators are also considering 5G-based technologies to complement high-cost, last-mile fiber access, especially in rural areas. For example, we have seen innovative start-ups such as Globtel[7] in Slovenia use 5G-based wireless triple-play solutions to deliver multiple-hundred-megabit broadband and hundreds of TV channels to scattered settlements in the mountainous regions of suburban and rural Slovenia.

Figure 2: Fiber (FTTH/B) households passed



We observe four fiber hot-spots: 1) GCC: Qatar & UAE 2) Baltics: Latvia & Lithuania 3) Iberia: Spain & Portugal 4) South & East Asia: Singapore, Japan, South Korea, Hong Kong

Source: Arthur D. Little Analysis, Euromonitor, FTTHCouncil.eu, FTTHCouncilMena.org, IDATE World FTTx market 2017

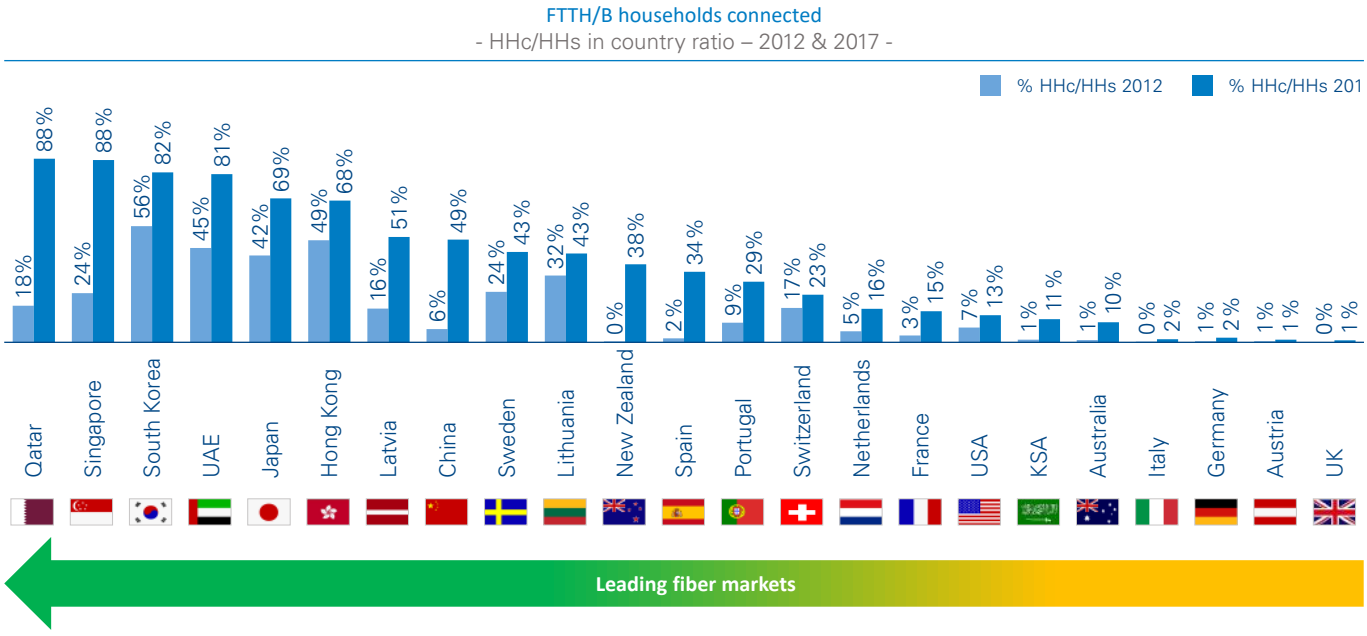
5 http://www.adlittle.com/en/NationalFiber
6 http://www.adlittle.com/en/5Gdeployment
7 http://www.globtel.si/

3. Effective migration and competition are driving fiber take-up

While there were big improvements in fiber rollout from 2012 to 2017, take-up was still lagging behind, even though several markets invested large amounts of capex into nationwide fiber. However, we now see take-up rapidly improving, driven by both effective migration of legacy customers to fiber and competition driving demand for higher-speed broadband adoption at home.

Some markets, such as Qatar, the UAE and New Zealand, conducted effective migration projects, moving all their legacy customers to fiber by visiting home-by-home, swapping routers and upgrading customers to higher-speed, triple-play bundles. In other markets, such as Singapore, Hong Kong, Sweden, Portugal and Spain, competition for high-speed broadband between telecom operators and cable operators, as well as migration, helped the take-up of fiber-based, higher-speed broadband plans.

Figure 3: Fiber (FTTH/B) households connected



Effective migration programs (e.g., Qatar, UAE), competition on common infrastructure (Singapore, S. Korea) and competition with others (Switzerland, Netherlands) are driving fiber connectivity

Source: Arthur D. Little Analysis, Euromonitor, FTTHCouncil.eu, FTTHCouncilMena.org, IDATE World FTTx market 2017

4. Fiber is driving innovative services

Increasing use of fiber, in turn, is driving take-up of innovative services. A common fiber-enabled new service is gigabit-speed broadband offerings, often combined with 4K TV. Fiber use is also enabling the share of multi-play bundles (triple and quadruple play) and the use of high-end gigabit routers at home.

Figure 4: Innovative services are being driven by fiber

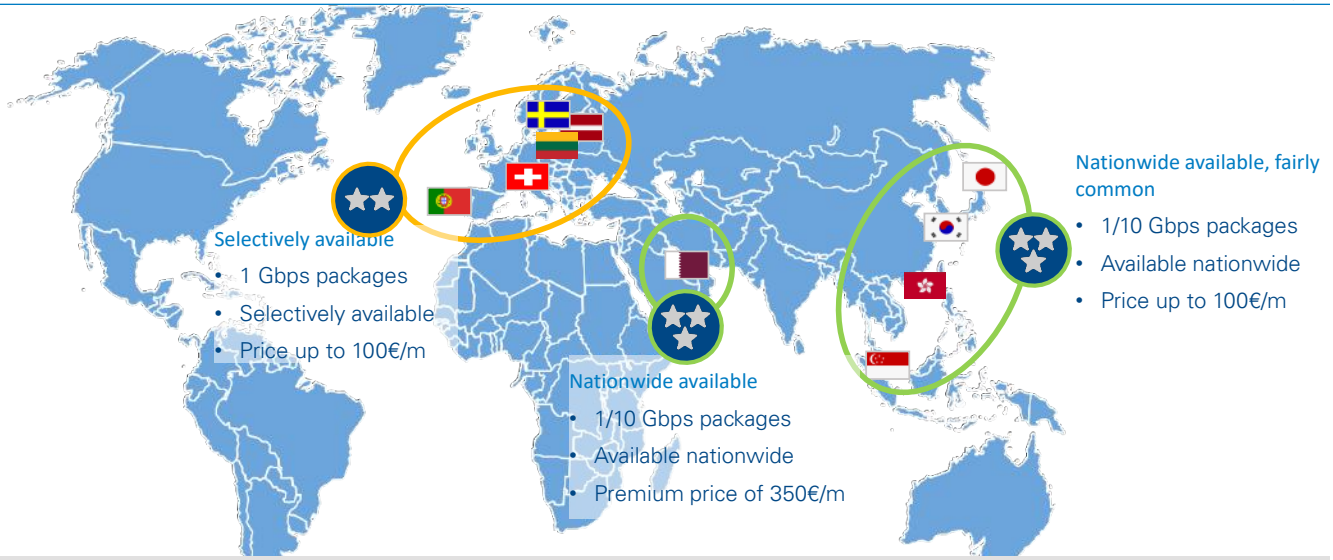
Source: Arthur D. Little

5. Fiber is enabling gigabit broadband

Although 30+ markets have announced launches of gigabit broadband pilots in the past few years, in reality only a small number of markets have gigabit broadband available nationwide or in large areas of their countries.

Figure 5: Gigabit broadband deployments

Fiber driving gigabit broadband



Gigabit broadband is available nationwide in select regions of the world, and is slowly gaining popularity

Source: Arthur D. Little Analysis, respective operator websites.

In South East Asian markets, such as Singapore, Hong Kong, Korea and Japan, gigabit broadband is available nationwide for a small premium (1,000 Mbps, usually for less than 100€/m) compared to basic triple-play bundles (usually 200–500 Mbps for 35€/m). In markets such as Qatar, gigabit broadband is available nationwide, but at a premium (1,000 Mbps for approx. 350€/m) compared to basic triple-play bundles (usually 50–100 Mbps for 100€/m). In some markets, such as Switzerland, Portugal and Sweden, gigabit broadband is available in large areas of the population for small premiums (1,000 Mbps, usually for around 50€/m).

Figure 6: Gigabit broadband examples

Fiber driving gigabit broadband

	Global champion: Highest nationwide speeds in the world	**Global champion:** Highest nationwide speeds in the world	**Regional champion:** Highest nationwide speeds in the region
Speed	Up to **10** Gbps	Up to **10** Gbps	Up to **1** Gbps
Price range	~100€/m for 1 Gbps	~350€/m for 1 Gbps	~100€/m for 1 Gbps
Availability	Nationwide	Nationwide	Selected regions
Example of operator	Singtel	ooredoo	swisscom

Singapore is the leader in gigabit broadband, with operators offering 500 Mbps as the entry-level package, while 1 Gbps is available nationwide for less than 100€/m

Source: Arthur D. Little Analysis, respective operator websites.

6. Fiber is enabling 4K TV as part of triple-play bundles

A successful 4K TV offering requires the right combination of devices, content and connectivity:

- There are more than 100 4K devices currently available
- 4K content is also slowly picking up pace, via traditional linear TV channels as well as non-linear video on demand
- 4K connectivity is increasingly available to homes

Figure 7: 4K TV – devices, content, connectivity

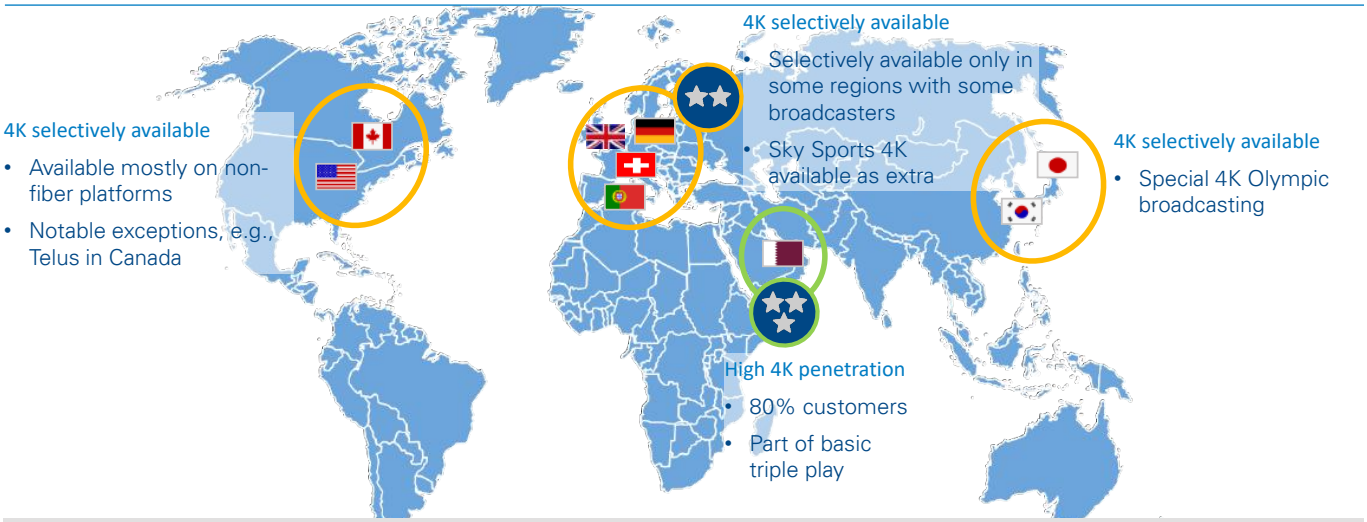
Fiber driving 4K TV

Devices	Content	Connectivity
		
■ Multi 100+ 4k devices available today at reasonable prices ■ In MENA – 4k TV sales from 0.2m (2014) to 1m (2015) to 3m (2017) ■ Examples: – Samsung, Panasonic, Phillips 4k TVs – Chromecast, Roku, Xbox, PS4, etc.	■ 4k content is becoming common, with selected live sports & many series ■ Live sport is the most valuable 4k content – BeIN Sports 4k – 2018 Winter Olympics and FIFA World Cup – BT Sport 4k – UEFA CL, EPL ■ Netflix, Amazon, Hulu, and YouTube already have 4k content libraries ■ Most video games are in 4K – Halo 5, Assassin's Creed	■ 4k broadcast is still in launch phase, with only a few fiber/cable/DTH providers ■ Ooredoo provides 4K TV as part of its basic triple-play bundle ■ Other operators such as Swisscom, Singtel offer 4K TV as add-ons to TV bundles ■ In 2018, the largest TV events, such as the FIFA World Cup, will be 4K ready

Source: Arthur D. Little Analysis, public research

Figure 8: 4K TV deployments

Fiber driving 4K TV



Ooredoo is a leader in 4K TV, offering two 4K TV channels as part of its standard triple-play bundle, resulting in 4K TV channel penetration of more than 70% nationwide

Source: Arthur D. Little Analysis, respective operator websites.

While 4K TV is increasingly popular and currently available in more than 30 markets, in most of these markets 4K channels are marketed as add-ons to the basic triple-play bundles, and the quantity of 4K content is still limited.

According to our benchmark, Ooredoo Qatar is now the leader in 4K TV, with more than 70 percent nationwide penetration. It offers 4K TV channels and video-on-demand content with its basic triple-play bundle. In other markets, such as Telus in Canada and Swisscom in Switzerland, 4K TV channels include premium 4K sports as an add-on.

We expect availability of 4K content to continue increasing in the coming years. In 2016, Netflix was one of the first major content producers to offer 4K video-on-demand content. This was followed by culture/leisure 4K TV channels such as Love Nature 4K, Festival 4K and others. Lately, premium sports are also available in 4K, e.g., BeIN sports 4K and BT sports 4K showing the UEFA Champions League and other sports. The 2018 PyeongChang Olympic games were broadcast in 4K in some markets, as well as the FIFA World Cup 2018, giving a further push to 4K TV consumption.

Figure 9: 4K TV examples

Fiber driving 4K TV

	Global champion: 4K part of basic triple-play bundle	Regional champion: Selective 4K offering as an add-on	Regional champion: Selective 4K offering as an add-on
Positioning	Part of Basic bundle	Add-on	Add-on
4k channels	2 ch + STARZ Play On Demand + selective live sports (FIFA World Cup)	4 (incl. 2 live sports)	4 channels
Price	+0€	€80 add-on	€30 add-on
Example of operator	ooredoo	TELUS	swisscom

Ooredoo Qatar has a high penetration of 4K TV (more than 70%), as it is bundled along with the basic triple-play package

Source: Arthur D. Little Analysis, respective operator websites.

Figure 10: 4K TV content

Fiber driving 4K TV

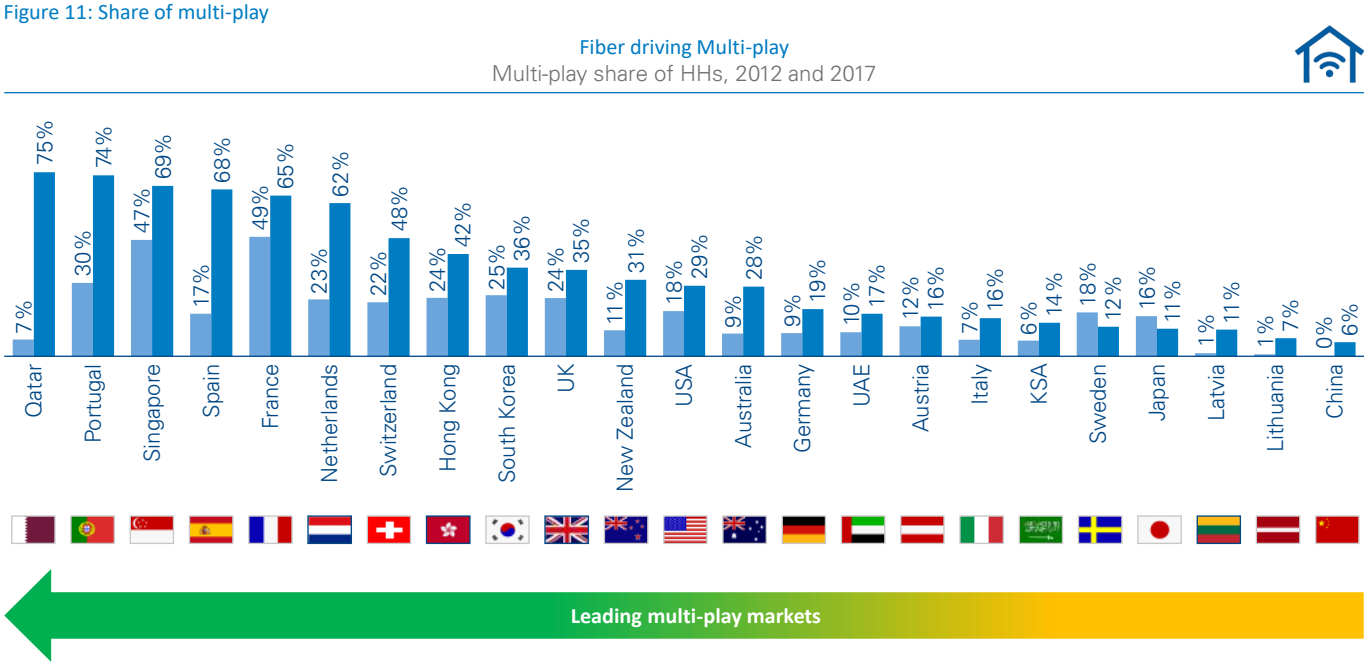
Live sports	beIN SPORTS 4K BT Sport 4K	■ Premium sports content shown live exclusively in 4K ■ Availability of channels is currently limited to certain regions, e.g., BeIn sports 4K, BT sport 4K, Sky Sports 4K in Europe ■ The FIFA World Cup 2018 and other sporting events is already broadcast in 4K
Thematic channels	Love Nature 4K festival 4K	■ Currently widest availability of 4K channels is thematic - nature-, travel- and culture-oriented ■ Mainstream TV channels are not yet broadcast in 4K
On demand	STARZPLAY YouTube NETFLIX	■ Availability of video on demand in 4K is much higher than for traditional broadcast TV channels ■ Example: Netflix broadcasts its most popular series in 4K, such as House of Cards ■ STARZ Play offers series such as "Power" and "Mars" in 4K, which Ooretoo TV customers can access for free

Source: Arthur D. Little Analysis, respective operator websites.

7. Fiber is enabling an increasing share of multi-play

Fiber is enabling an increasing share of multi-play (triple play and quadruple play) in many markets. The chart below shows that all leading nationwide fiber markets also have large shares of multi-play customers. Migrating customers to fiber-based triple-play starter bundles from legacy broadband is an effective method of multi-play adoption that most of these operators follow. Ooredoo Qatar prices its triple-play bundles with attractive TV content on par with broadband-only packages, which has resulted in greater than 70 percent multi-play households. In Portugal, Singapore and Spain, TV is an add-on component to broadband-only packages, but the overall cost is less than 50€ for an attractive triple-play bundle, which has resulted in high triple-play household coverage.

Figure 11: Share of multi-play



Example: in Qatar, the price of a triple-play bundle is attractive compared to the price of broadband-only, and the quality of TV is much higher, eg., BeIN sports bundle offered for free

Source: Arthur D. Little Analysis, Ovum database, respective operator websites.

8. Fiber is enabling increasing use of gigabit WiFi routers at home

Telecom operators are realizing that providing just connectivity to homes is not sufficient for a high-end customer experience. They increasingly also have to manage WiFi connectivity, ensuring it reaches the corners of all the rooms in a home. This, in turn, is driving the trend of deploying high-end WiFi routers at home.

Google WiFi was one of the first to popularize high-end routers in 2016. Singapore was one of the first countries to bundle high-end routers (e.g., StarHub provides Google WiFi routers to its customers) with 12- and 24-month contracts. Ooredoo Qatar also provides Netgear Orbi mesh WiFi routers to its customers with attractive 12- and 24-month contracts.

Figure 12: Gigabit WiFi routers

State-of-the-art WiFi mesh

	NETGEAR		Google Wifi	NOKIA
				
2-pod reach	460m²	360m²	280m²	N/A
Technological edge	MU-MIMO,* dedicated backhaul band and superior app	MU-MIMO	Easy to configure and use via app	Software detects interference & enables remote customer service
Example of reseller	Launched in Jan '18, regional champion	Launched in Jan '17	Launched in Aug '17, regional champion	Launching in June '18

Ooredoo provides a high-end WiFi customer experience, with routers such as the Netgear Orbi offered to its broadband customers for an attractive price of 290€, which is collected over 12 or 24 months

Source: Arthur D. Little Analysis, product websites, PCmag.

9. Conclusion

Since the 2016 edition of our "Race to gigabit fiber" report, we have seen fiber rollout continue to increase in most markets. The most common model used for fiber deployment continues to be "Incumbent led with government support" . We continue to believe that successful fiber investments are built around partnerships – with the government, investors, municipalities, or other operators. (See our report, "Race to gigabit fiber – 2016"[9], for further details on how telecom operators can develop partnership-based models to invest in fiber.) We believe that a partnership-based model, especially with municipalities or local utilities, can create a viable fiber investment plan. There are still some markets which have not yet shown large gains in fiber deployment – e.g., the UK, Germany, Austria and Italy, where traditional non-telecom firms are making inroads into fiber deployment (e.g., energy company Enel announcing nationwide fiber deployment with its newly created subsidiary, OpEn Fiber).

On a positive note, fiber take-up has shown a big jump since our previous report – driven by effective migration and competition. Fiber markets are increasingly becoming demand driven instead of supply driven, as in the past. As customers demand higher broadband speeds, demand for fiber also increases. Markets that have shown the biggest jumps in fiber take-up are Qatar, Singapore, the UAE and New Zealand. Success in fiber take-up in these markets have been driven by effective migration and competition.

Fiber to the home, in turn, is driving take-up of innovative services such gigabit broadband, 4K TV and other ancillary products. Telco operators are moving away from providing just high-speed broadband to also bundling services enabled by this high-speed broadband. As telecom operators increase their presence inside their customers' homes with high-end WiFi routers and high-end services such as 4K TV, this might become an ideal platform to deliver future smart-home services[10].

8 http://www.adlittle.co.uk/en/insights/viewpoints/national-fibre-strategies
9 http://www.adlittle.de/en/insights/viewpoints/race-gigabit-fiber
10 https://www.eco.de/2017/news/smart-home-studienergebnisse-fuer-alle-interessierten.html

Notes on this report

This report, "The race to gigabit fiber," is the 2018 update to Arthur D. Little's Global FTTH study published in 2010, 2013 and 2016.

In this report we focus on how different countries are investing in next-generation fiber networks using FTTH/B. We evaluate the models used for investment and their success stories in terms of both rollout and take-up. We evaluate how fiber, in turn, is driving the roll-out and adoption of innovative new services. When we use the term "fiber" in this report, we refer to FTTH/B.

We acknowledge that that there are other options, such as FTTN/C with VDSL/vectoring/G.fast, HFC cable with DOCSIS 3.0/3.1, 4G with carrier aggregation/MIMO, WTTx (wireless-based fixed broadband), and future 5G with mm wavelength and antenna beamforming technology, which can also provide high-speed, next-generation networks. Different countries have different technologies that already provide high-speed broadband. For example, in the US and some European countries, such as Belgium, the cable operators with DOCSIS 3.0/3.1 provide high-speed broadband. Meanwhile, in other countries, such as Germany and Italy, the incumbent provides FTTN-/VDSL-/vectoring-/G.fast-based, high-speed broadband. In some other countries, such as the Netherlands, operators use a mix of all the above technologies – FTTH, FTTN/vectoring and cable DOCSIS 3.1. In 2016, the EU also defined a new term, "very high-capacity networks," or VHCs, which comprise FTTH/B, DOCSIS 3.0/1 and, to some extent, G.fast networks.

We are confident in the accuracy of our figures concerning fiber connections (HHc). However, figures concerning fiber coverage (HHp) may be overstated in some markets, due to less strict definitions of FTTH/B. Some sources also count other technologies, such as FTTN/C, as FTTH/B, which leads to overstating FTTH/B figures.

Terminology used

HHs – Households in the country

HHp – Households passed with FTTH/B fiber

HHc – Households passed with FTTH/B fiber

FTTH – Fiber to the house

FTTB – Fiber to the building

FTTC – Fiber to the curb

FTTN – Fiber to the node

DSL – Digital subscriber line

xDSL – All DSL-based technologies

VDSL – Very high bit-rate digital subscriber line

G.fast – DSL-based technology used to deliver 150–1,000 Mbps throughput over short copper loops

DOCSIS – Data over cable service interface specification

WTTx – Wireless to the x, based on 4/4.5/5G and FTTx

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