4 Telecoms and networks

4.1 Sector Overview

UK consumers are benefiting from faster fixed and mobile networks.

By June 2016, 44% of all fixed broadband connections were able to receive actual download speeds of 30Mbit/s or more, up from 38% a year previously. Nearly two-thirds of mobile subscriptions were enabled for 4G, up from 46% in 2015. Consumers are also using these networks more – average data use per fixed line residential broadband connection increased by 36% year on year to 132GB in June 2016, and average data use per mobile connection increased by 44% to 1.3GB.

Most households have both fixed broadband and a smartphone, and consumers are moving seamlessly between fixed and mobile connections. Our mobile-app-based research shows that around two-thirds of data connections made by our panel of Android smartphone users are via a Wi-Fi network, with the remaining third via a mobile network.

UK telecoms revenues grew by 0.4% in real terms (i.e. adjusted for inflation) in 2016 to £35.6bn.[1] This has been driven by the growing take-up of superfast broadband services, which resulted in a 9.5% increase in the average monthly price of a residential fixed broadband connection, to £20.45, in 2016.

Average monthly household spend on telecoms services increased by 0.9% and accounted for 3.8% of total household spend for the year.

Average retail revenue per fixed line increased by 0.9% in real terms to £21.13 in 2016, as providers increased line rental and bundled calls prices to offset the decline in fixed voice call volumes (down by 11.9% to 65 billion minutes). The number of fixed lines, however, remained relatively stable at 33.5 million, probably because most households in the UK need a landline to access fixed broadband services.

Average monthly retail revenue per mobile subscription increased in 2016 after years of decline (up by 1.1% in real terms to £15.19), as pre-pay consumers continued to migrate to post-pay services, and consumers used more data. Increasing use of over-the-top (OTT) instant messaging services such as WhatsApp and Facebook Messenger has led to a decline in total SMS and MMS messaging volumes, which fell by 5.5% in 2016 to 96 billion messages. Mobile-originated call volumes, however, increased to 151 billion minutes during the year (up by 5.7%).

In section 4.2 we use insight collected from our app-based research into Android smartphone users to discuss the convergence of Wi-Fi and mobile connectivity.

Section 4.3 provides an overview of the telecoms market including industry revenues, household spend and take-up of different technologies.

Section 4.4 examines trends in fixed telecoms, looking first at fixed voice and then at broadband.

Section 4.5 looks at mobile voice and data services.

[1] In a change from previous years, the total industry revenues shown here exclude those generated by corporate data services.

Figure 4.1: UK telecoms market: key statistics

	2011	2012	2013	2014	2015	2016
Total operator-reported revenue (£bn)	39.7	38.4	36.5	35.1	35.4	35.6
Operator-reported retail revenue (£bn) (excl. CDS)	30.1	29.7	28.8	28.4	28.9	29.6
Operator-reported wholesale revenue (£bn)	9.6	8.7	7.7	6.6	6.5	6.0
Average monthly household telecoms spend (£, 2016 prices)	84.72	83.74	81.26	82.03	84.46	85.26
Fixed access and call revenue (£bn)	9.7	9.2	8.9	8.5	8.4	8.5
Fixed internet revenue (£bn)	3.8	3.9	4.1	4.6	5.2	5.7
Fixed lines (millions)	33.3	33.4	33.4	33.6	33.7	33.5
Fixed broadband connections (millions)	20.7	21.8	22.8	23.7	24.7	25.3
Superfast broadband connections (≥30Mbit/s, millions)	1.0	3.1	5.3	7.1	9.2	10.8
Fixed voice call minutes (billions)	111	103	93	82	74	65
Average actual residential fixed broadband download speeds (Mbit/s)	7.6	12.0	17.8	22.8	28.9	36.2
Mobile retail revenues (£bn)	16.6	16.6	15.8	15.3	15.3	15.3
Mobile voice call minutes (billions)	131	132	134	137	143	151
SMS & MMS messages sent (billions)	150	151	129	110	102	96
Average monthly mobile data per active connection (GB)*	0.1	0.2	0.4	0.5	0.9	1.3
Active mobile subscribers (millions)**	86.5	88.4	88.8	90.3	91.9	92.0
4G subscribers (millions)	-	-	2.7	23.6	39.4	52.4
M2M subscribers (millions)	4.1	5.0	5.7	6.3	6.7	7.6

Source: Ofcom / operators / Ofcom Connected Nations Reports 2011- 2016
Notes: Connection figures are at year-end; in a change from previous years, the total industry revenues shown here exclude those generated by corporate data services; household spend data includes VAT and is CPI adjusted; All revenue data is adjusted for CPI (2016, prices); fixed voice minutes shown here are likely to be understated as they do not fully capture the use of VoIP services; fixed and superfast broadband connection figures include business connections; *average monthly mobile data per active connection for 2011 as of March, 2012-2016 as of June of each year; **active mobile subscribers include machine-to-machine subscriptions.

4.2 Key market developments

4.2.1 The convergence of mobile and Wi-Fi connectivity

In today's connected world, people increasingly expect to be able to access online services whenever they want and wherever they are.

There are two main ways in which users of mobile devices such as smartphones and tablets can access online services on their device: over a cellular network connection or using a Wi-Fi network.

Most UK homes use both fixed and mobile broadband services, although increasing mobile data allowances and faster connection speeds over 4G mean that cellular connectivity has become a viable alternative to fixed broadband for some households. The widespread provision of Wi-Fi routers by fixed broadband providers, and the increasing use of mobile devices such as tablets, smartphones and laptops which automatically switch to Wi-Fi where available, offer a comparable user experience inside and away from the home.

To investigate the networks that people using smartphones connect to, and the services they use, Ofcom set up a panel of mobile users who downloaded an app to their Android smartphone that captures a range of technical and behavioural metrics.[1] We published some of these findings in our report *Measuring Consumer Experience of Using Mobile Services*.[2]

In this section of the report we look in particular at how people use their smartphones to connect to both Wi-Fi and cellular networks.

Ofcom mobile research app

Last year we piloted a new methodology to measure the consumer experience of using mobile services across the UK. This approach involved establishing a panel of UK consumers who installed an Ofcom-branded research app on their Android smartphone.

The app, provided by our technical partner P3, passively measures the consumer experience of using mobile services, as panellists use their phones. The data used in this report was collected between 27 September 2016 and 23 December 2016.

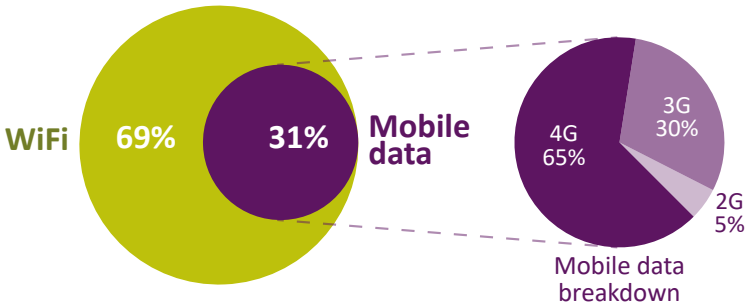
More information about this research can be found at https://www.ofcom.org.uk/research-and-data/telecoms-research/mobile-smartphones/consumer-mobile-experience.

[1] The app is currently only available on Android as the operating system used on Apple iPhones (iOS) has restrictions on apps running in the background and ability to access network performance data.

[2] https://www.ofcom.org.uk/about-ofcom/latest/features-and-news/consumer-mobile-experience

More than two-thirds of data app connections were to Wi-Fi rather than a cellular network

Our research indicates that Wi-Fi is a fundamental part of consumers' use of smartphones. Among consumers who had a 4G mobile handset and contract, 69% of connections to data applications on their mobile phone were to a Wi-Fi connection.



Most consumers favour a Wi-Fi connection for using YouTube

Video streaming is one of the most data-hungry online activities that consumers undertake, and YouTube is a popular video streaming app. Data recorded by the Ofcom mobile research app indicate that consumers typically wait until they are connected to the internet via Wi-Fi to use YouTube: 76% of panellists'

YouTube app sessions were over a Wi-Fi connection in Q4 2016,[1] while 8% of the sessions used a 4G mobile connection and 7% were over 3G (the remainder of the sessions either used a mixture of technologies, 2G or had no data transfer).

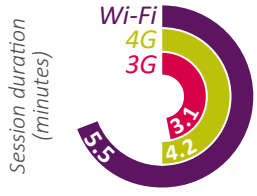
Over **75%** of YouTube sessions were over a Wi-Fi connection

...and consumers use YouTube for longer when connected to Wi-Fi

Similarly, the average duration of YouTube app sessions varied by network technology. Average YouTube session duration, when connected to 3G and 4G, was 3.1 and 4.2 minutes respectively, while the average session time over a Wi-Fi connection was longer, at 5.5 minutes.

This suggests that users may adapt their behaviour according to the type of data connection that they are using.

The duration of YouTube app sessions differs widely by technology



[1] The analysis is based on test results run between 27 September and 23 December 2016

Consumers appear to be aware of which activities consume the most data

There are a number of reasons why users may prefer to use Wi-Fi to access YouTube. First, the majority of smartphone users purchase their mobile service on a pay-monthly basis,[1] paying a fixed monthly fee for an allowance of calls, messages and data.

The inclusive data allowances offered with fixed broadband services tend to be more generous than those offered with smartphones; tariff data collected by PurePricing in May 2017 show that just over half (55%) of pay-monthly plans offer a data allowance of 5GB or less, while most fixed broadband plans (94%) offered 'unlimited' data.[2] Video streaming is data-hungry; an hour of 1080p full-HD video viewed on YouTube requires around 750MB of data, so users may wait until they can access a Wi-Fi network before using YouTube, to conserve their mobile data allowance.

Second, streaming video content requires a reliable connection, and benefits from higher connection speeds, as these allows better-quality video to be delivered with fewer buffering events. Wi-Fi connections offer higher average speeds than mobile data connections, with data collected by the Ofcom mobile research app in Q4 2016 showing that the average speed recorded when using YouTube over Wi-Fi was 6.6Mbit/s, compared to 3.8Mbit/s over 4G and 2.7Mbit/s with 3G.[3] It is therefore likely that Wi-Fi, rather than a mobile data connection, will provide a better user experience for YouTube viewing.

The proportion of use that is over Wi-Fi varies by app

The proportion of use that takes place over Wi-Fi varies by application. For example, while 76% of YouTube use was over Wi-Fi, just 57% of WhatsApp sessions were, with 30% of WhatsApp sessions over mobile networks[4] (in the remainder of cases there was no data transfer, or a mixture of technologies was used).[5] For RingGo, a cashless parking app, just 22% of sessions were over Wi-Fi, 32% over 4G and 29% over 3G. This is probably because there is likely to be lower Wi-Fi availability in places where cars are parked (i.e. outdoors and or in private multi-storey car parks). The remainder of the RingGo sessions either had no data transfer, or were on 2G or mixed technologies.

Variations in the proportion of an app's use over Wi-Fi may be due to a variety of factors, including when and where the app is used, and the data and bandwidth requirements. Apps that are used more by younger people may also be more likely to be used over a mobile network; young people are heavier users of data services on smartphones.

[1] Data from Ofcom's Technology Tracker showed that 84% of smartphone users used a pay-monthly contract in H1 2017

[2] Mobile data are from PurePricing monthly mobile pricing database, June 2017 and represent tariffs for post-pay handset and SIM-only plans offered by BT, EE, iD, O2, Plusnet, Sky, TalkTalk, Tesco, Three, Virgin Mobile, Vodafone in May 2017. Fixed broadband data are from PurePricing monthly broadband pricing database, May 2017, and represent dual-play and triple-play tariffs offered by BT, TalkTalk, Sky, Virgin Media, EE, Plusnet and Vodafone.

[3] https://www.ofcom.org.uk/research-and-data/telecoms-research/mobile-smartphones/consumer-mobile-experience

[4] Use of some apps (including WhatsApp) may be understated as the research does not capture apps running in the background or if the app is open for less than 5 seconds.

[5] 'No data transfer' refers to a session for which there was no measured connection on any technology.

The number of Wi-Fi hotspots connected to per day varied widely between panellists

The increasing availability of public Wi-Fi hotspots allows consumers to connect to Wi-Fi networks in a wide variety of places, and analysis of Ofcom mobile research app data shows that, on average, panellists connected to 1.9 unique Wi-Fi hotspots per day,[1] although the range of unique hotspots used varied widely, from less than one hotspot per day to more than 30.

Virgin Media recently began enabling Wi-Fi hotspot functionality on routers in its residential customers' premises, allowing access to more than a quarter of a million hotspots across the UK. BT has offered a similar service for a number of years, and many other providers offer either free or paid-for Wi-Fi hotspot services in public spaces.

Additionally, a number of town and city centres offer Wi-Fi connectivity, either through sponsorship by local businesses, or funded by town and district councils. This process was kick-started by the Government's SuperConnected Cities Programme,

On average panellists connected to **1.9** different Wi-Fi hotspots a day

which lead to the roll-out of public Wi-Fi in over 1,000 public buildings, across city centres and in over 1,200 buses, trains and trams in cities across the UK.[2]

Most data still transmitted over fixed networks

Despite the widespread use of mobile data services, there is still a large disparity between fixed and mobile data consumption; in June 2016 just 4% of total UK data volumes were transmitted over mobile networks.[3] While average mobile data use per connection is increasing, reaching 1.3GB per month in June 2016 (up from 0.9GB in June 2015)[4], it is significantly lower than the 132GB per month average recorded over residential fixed broadband connections.

Differences in average use per connection are due to the greater capacity constraints that exist in mobile data networks, partly due to the finite availability of radio spectrum. It is therefore beneficial for both consumers and the mobile networks to offload data use from mobile to fixed data networks, as this relieves capacity problems on mobile networks and, typically, provides a better user experience. For YouTube app use, around 83% of the measured data volumes were over a Wi-Fi connection, with 6% over 4G, 4% over 3G, and 7% over a mix of technologies. This closely matches the proportion of app sessions over each technology.

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[1] This figure is an estimate, based upon location data measured in the mobile research app. It should be taken as indicative only.

[2] https://www.gov.uk/government/publications/2010-to-2015-government-policy-broadband-investment/2010-to-2015-government-policy-broadband-investment#appendix-3-investing-in-superconnected-cities

[3] Ofcom Connected Nations Report 2016, https://www.ofcom.org.uk/__data/assets/pdf_file/0035/95876/CN-Report-2016.pdf

[4] https://www.ofcom.org.uk/__data/assets/pdf_file/0035/95876/CN-Report-2016.pdf

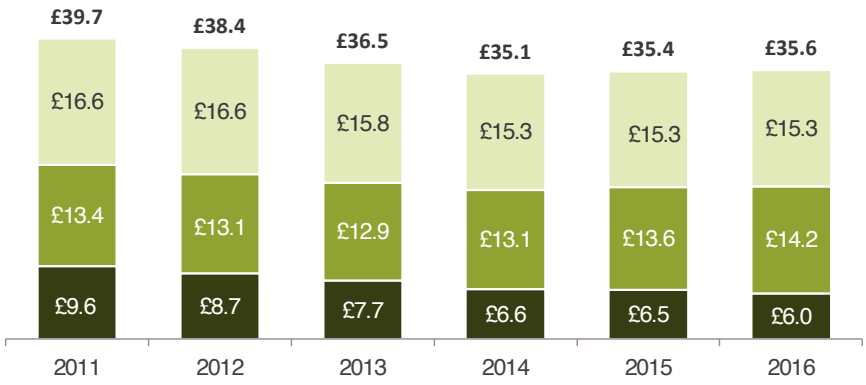
4.3 Telecoms market overview

4.3.1 UK telecoms services generated £35.6bn in revenue in 2016

Total revenues generated by UK telecoms services increased by £0.1bn (0.4%) in real terms to £35.6bn in 2016.

The increase was largely due to a 4.3% real-terms increase in fixed retail revenues to £14.2bn, mainly due to the growing take-up of superfast broadband services. Revenues from retail mobile services have been stable over the past three years at £15.3bn, while wholesale service revenues fell in 2016.

Figure 4.2: Summary of UK telecoms revenues (£bn)



	2016 change	5 year CAGR
Total	**0.4%**	**-2.2%**
Retail mobile	0.3%	-1.6%
Retail fixed	4.3%	1.1%
Wholesale Services	-7.6%	-9.0%

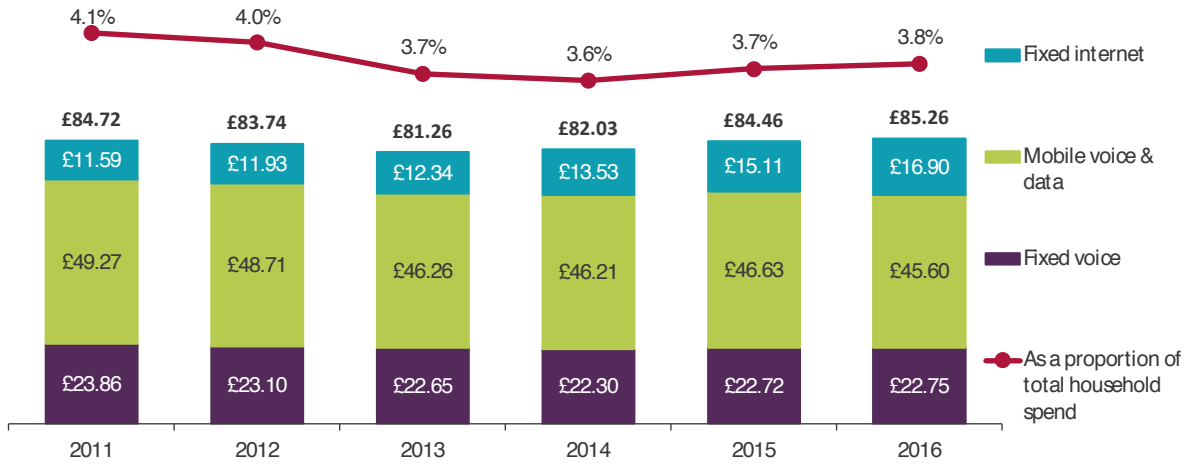
Source: Ofcom / operators
Notes: In a change from previous years, the total industry revenues shown here exclude those generated by corporate data services; data have been adjusted for CPI (2016 prices).

Average household spend on telecoms services increased to £85.26 per month

Average household spend on telecoms services, comprising fixed voice, fixed internet and mobile voice and data services, increased by £0.80 (0.9%) in real terms in 2016, to £85.26 per month. This increase was primarily due to an 11.8% increase in average monthly spend on fixed internet access, caused mainly by the continued migration to superfast broadband services. Overall, spend on telecoms services accounted for 3.8% of average total household spend during the year, the highest proportion recorded since 2012.

Spend on fixed voice services was flat in 2016, despite a significant fall in use (outbound fixed call volumes declined by 11.9% during the year). This was due to increasing line rental and call prices (our analysis attributes line rental to fixed voice services, although it is also required for most fixed broadband services). Average spend on mobile voice and data fell in 2016, down £1.03 in real terms to £45.60 per month, following a shift in the pricing of mobile services away from voice and towards data services.[1]

Figure 4.3: Average household spend on telecoms services (£ per month)



Source: Ofcom / operators / ONS
Notes: Includes estimates where Ofcom does not receive data from operators; adjusted for CPI (2016 prices); includes VAT. Average household spend is calculated by dividing residential telecoms service revenues by the number of UK households.

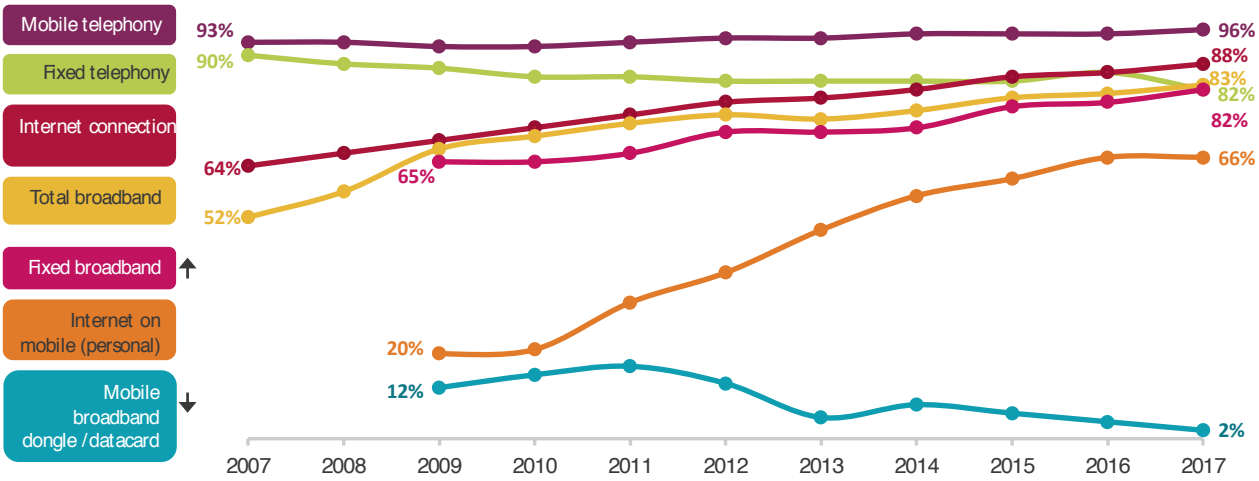
[1] In the Pricing trends for communications services in the UK report, published in March 2017, Ofcom analysed the pricing of mobile voice and data services, noting that most post-pay tariffs now offer large allowances of calls and texts, with tariffs tiered according to the inclusive data allowance- https://www.ofcom.org.uk/__data/assets/pdf_file/0028/98605/Pricing-report-2017.pdf

The proportion of households with fixed broadband increased to 82% in 2017

There were two statistically significant changes in the take-up of telecoms services in 2017: the proportion of respondents who had a fixed broadband connection at home increased by 3pp to 82%, while the proportion who used a dedicated mobile data service (i.e. who used a mobile network to access data services on a device other than a mobile phone, such as a laptop or tablet computer) halved, to 2%. The decline in the take-up of mobile datacards/ dongles may be due to increased smartphone take-up, and the ability to use a smartphone to create a personal Wi-Fi hot spot to 'tether' a laptop or tablet computer to the smartphone's mobile data subscription.

The proportion of respondents who used a mobile phone to access the internet was unchanged at 66% in 2017, despite smartphone take-up having increased by five percentage points during the year, to 76%.

Figure 4.4: Take-up of key telecoms technologies (proportion of households / adults)

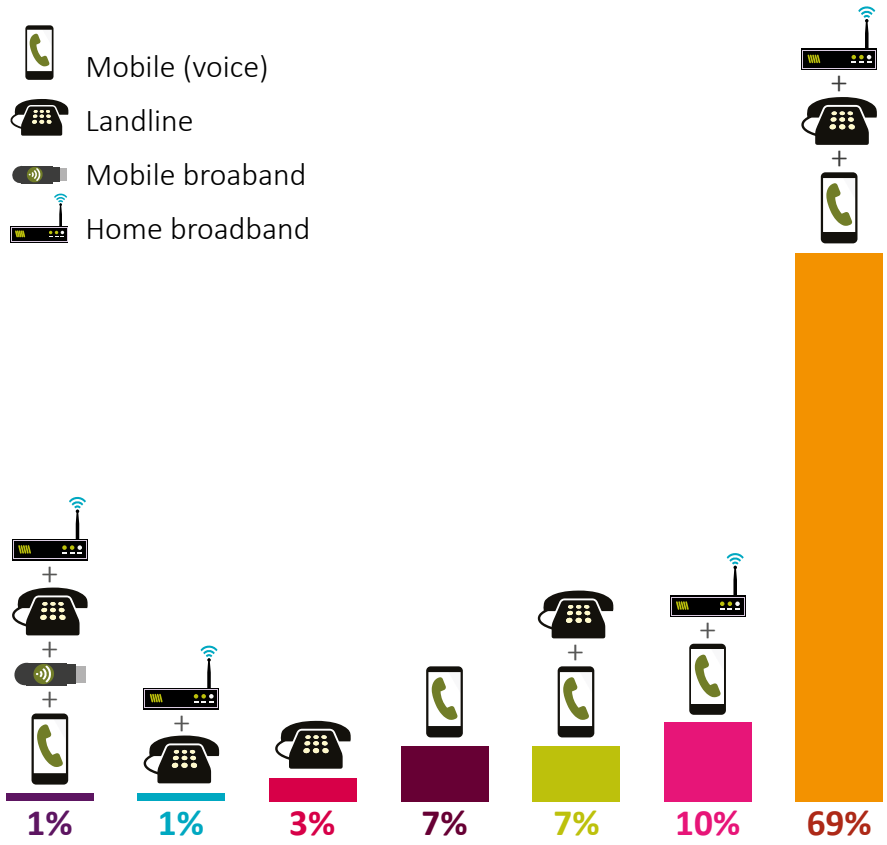


Source: Ofcom Technology Tracker. Data from Q1 of each year 2007-2014, then H1 2015-2017.
Base: All adults aged 16+ (2017 n=3743).
Significance testing: Arrows indicate any significant differences at the 99% confidence level between UK 2016 and UK 2017.
QC1: Is there a landline phone in your home that can be used to make and receive calls? QE1: Does your household have a PC or laptop computer? / **QE2:** Do you or does anyone in your household have access to the internet/ world wide web at home (via any device, e.g. PC, laptop, mobile phone etc.)? / **QE12 (QE9):** Which of these methods does your household use to connect to the internet at home?
Note: Use of internet on mobile is personal take-up measure, whereas the other data relate to household take-up.

Most UK households use a combination of fixed and mobile services

Using Ofcom Technology Tracker data, we can see how UK households use fixed and mobile voice and data services. Our analysis shows that 7% of households were mobile-only (i.e. they solely used mobile voice and data services, and did not use any fixed-line services) while 4% only used fixed telecoms services. Most UK households used a combination of these services, with more than two-thirds (69%) taking a landline, fixed broadband and mobile voice service.

Figure 4.5: Take-up of telecoms services



Source: Source: Ofcom Technology Tracker H1 2017

4.4 Fixed voice and data services

4.4.1 Average revenue per fixed line increased in 2016, despite falling call volumes

Despite falling call volumes, average retail revenue per fixed line increased in real terms in 2016, up by 20 pence (0.9%) to £21.13 per month.

The main driver for this was a 5.0% increase in average line rental and bundled call revenue, to £15.76 per month, equating to 75% of total average monthly spend. Average line rental prices have increased by 34% in real terms over the last decade, despite a fall in the underlying wholesale costs related to providing these services.[1]

These increases have come as operators have sought to maintain fixed voice revenues as call volumes decline, and to offer cheap broadband prices in order to attract new customers (line rental is required for most fixed broadband services).[2] While line rental increases have affected all fixed-line users, the impact of fixed voice price increases is likely to have been disproportionately high for those who purchase fixed voice-only services, as they do not benefit from the discounts that are available when buying service bundles.[3]

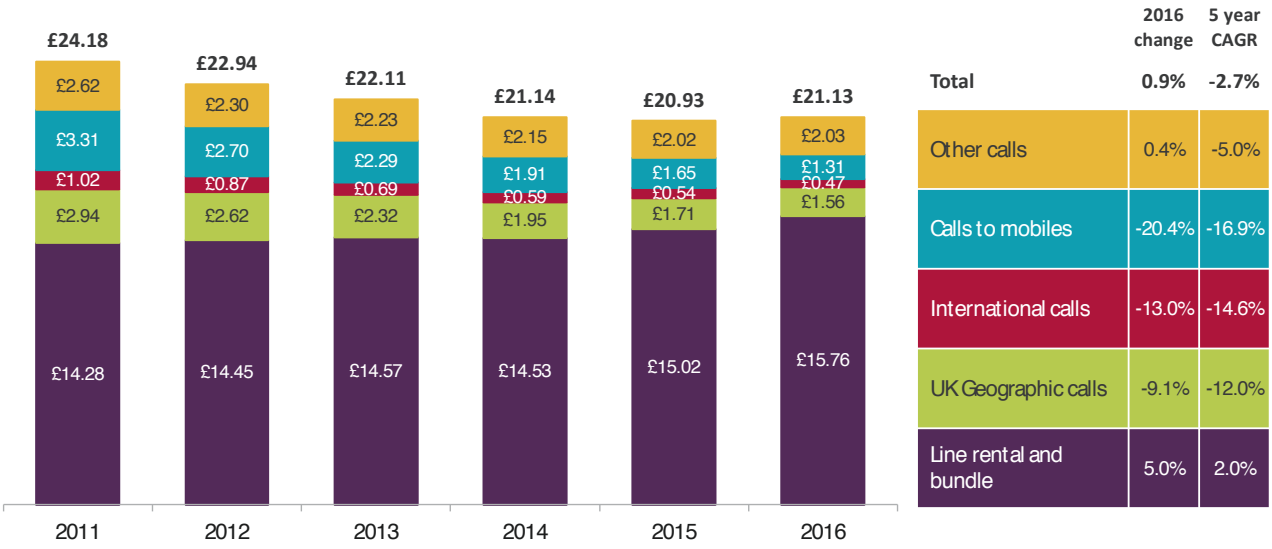
On 31 October 2016, new Advertising Standards Authority (ASA) guidelines on broadband advertising came into force: these require broadband advertising to show an all-inclusive monthly price for the service, so that the price of the line rental is not shown separately from the broadband service price. As a result, some operators which do not offer a standalone fixed voice service (i.e. those who only sell fixed voice services as part of a bundle), such as TalkTalk, have stopped identifying a separate line rental price.

[1] See Ofcom, Pricing trends for communications services (March 2017), p15

[2] See Ofcom, Pricing trends for communications services (March 2017), p14

[3] See Ofcom, Pricing trends for communications services (March 2017), p14

Figure 4.6: Average monthly retail voice revenue per fixed voice connection (£ per month)

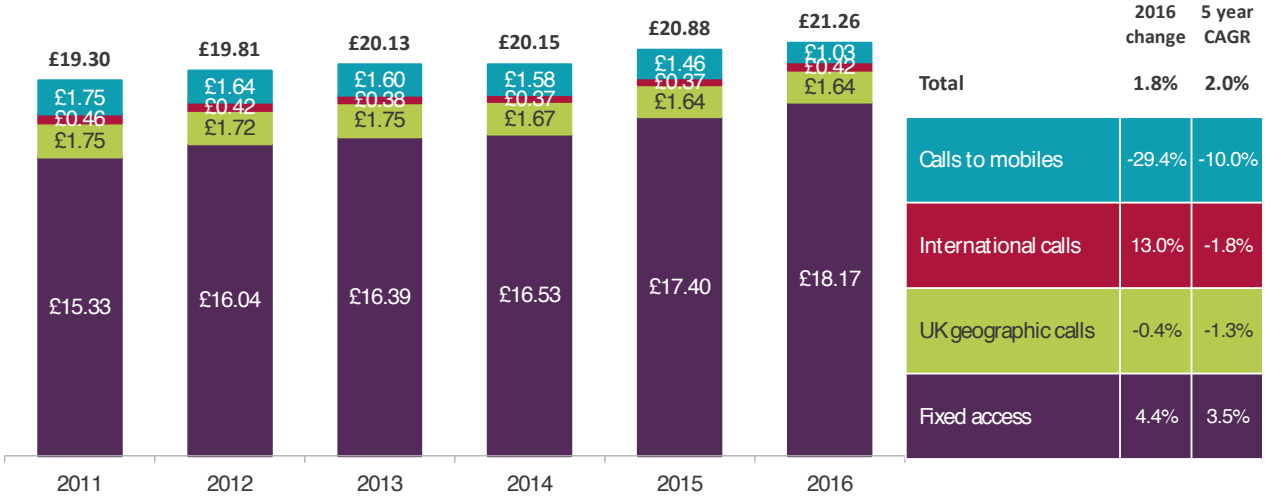


Source: Ofcom / operators
Notes: Adjusted for CPI (2016 prices)

The price of a basket of fixed voice services increased by 1.8% in real terms in 2016

In order to monitor residential landline prices, we track the price of a basket of residential telephony services over time. The basket consists of a landline with average use of outgoing UK geographic calls, international calls and calls to mobiles in 2016. Our analysis shows that the price of this basket increased by 1.8% (38 pence per month) in real terms in 2016, and by an average of 2.0% a year in the five years to 2016.

Figure 4.7: Real price of a basket of residential fixed voice services (£ per month)

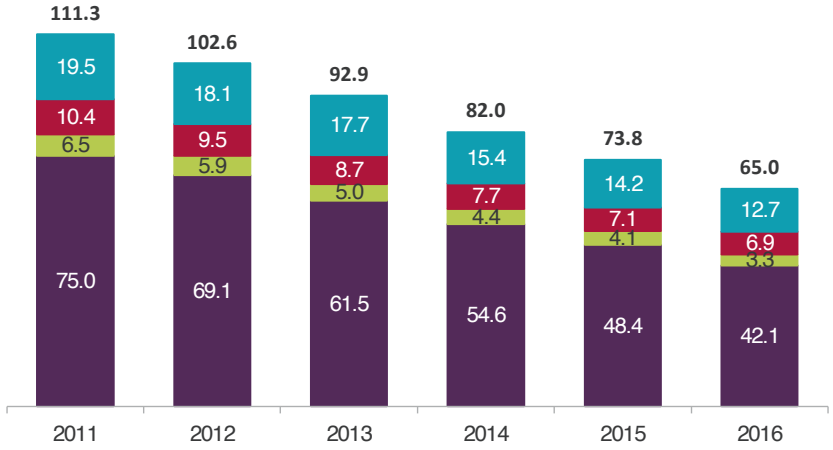


Source: Ofcom / operators
Note: Includes estimates where Ofcom does not receive data from operators; excludes non-geographic voice calls; adjusted for CPI (2016 prices); includes VAT.

Outgoing fixed call volumes fell by 12% in 2016

Total outgoing fixed call minutes fell by 11.9% to 65 billion minutes in 2016 as consumers increasingly used mobile and internet-based voice and messaging services instead of fixed-line calls. As in previous years, calls to UK geographic numbers made up the largest proportion of total outgoing fixed call volumes in 2016 (65%).

Figure 4.8: Outgoing fixed call volumes, by type of call (billions of minutes)



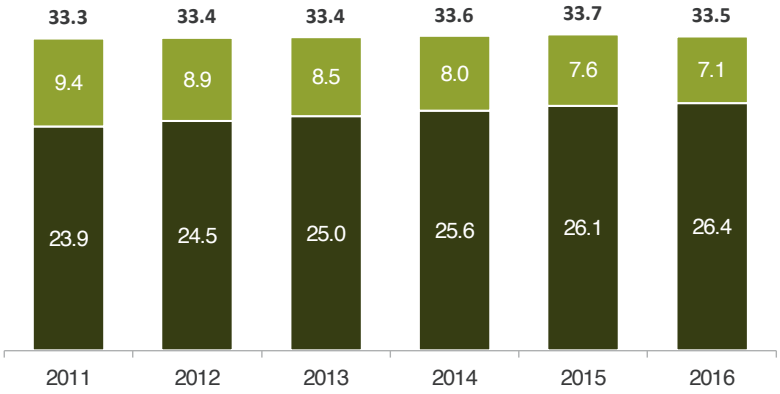
	2016 change	5 year CAGR
Total	-11.9%	-10.2%
Other calls	-10.5%	-8.1%
Calls to mobiles	-2.8%	-7.9%
International calls	-18.4%	-12.6%
UK geographic calls	-13.0%	-10.9%

Source: Ofcom / operators
Note: VoIP call volumes are not fully captured in this chart and so totals may be understated.

The number of residential landlines increased in 2016

In contrast to the large decline in fixed-originated call volumes, the total number of fixed lines remained relatively stable in 2016, at 33.5 million (down 0.6% since the previous year). The total number of fixed lines comprised 26.4 million residential lines and 7.1 million business lines (78.8% and 21.2% of the total respectively). The number of residential fixed lines increased by 0.3 million (1.3%) in 2016, due to an increase in the number of households, and because most UK homes require a fixed line to access broadband services. Conversely, the number of business lines fell by 7.0% in 2016, largely due to the increasing use of managed VoIP services (which is not fully captured in our data).

Figure 4.9: Number of fixed lines (millions)



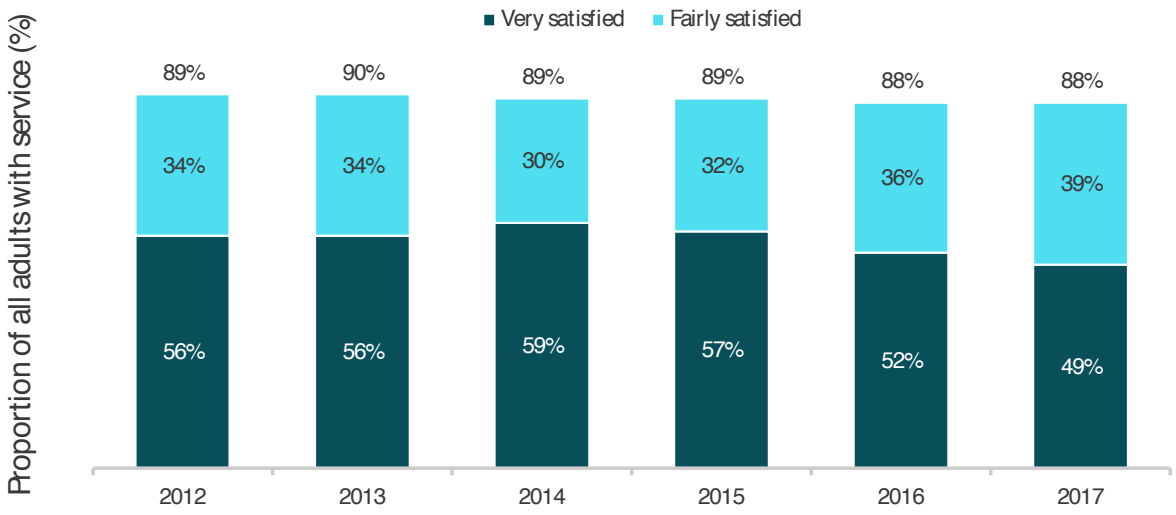
	2016 change	5 year CAGR
Total	-0.6%	0.1%
Business	-7.0%	-5.4%
Residential	1.3%	2.0%

Source: Ofcom / operators

Satisfaction with fixed voice services remained stable in 2017

Satisfaction levels among fixed voice users have remained largely flat over the past year; almost nine in ten (88%) users said they were 'very' or 'fairly' satisfied with their service in 2017.

Figure 4.10: Overall satisfaction with residential fixed voice services

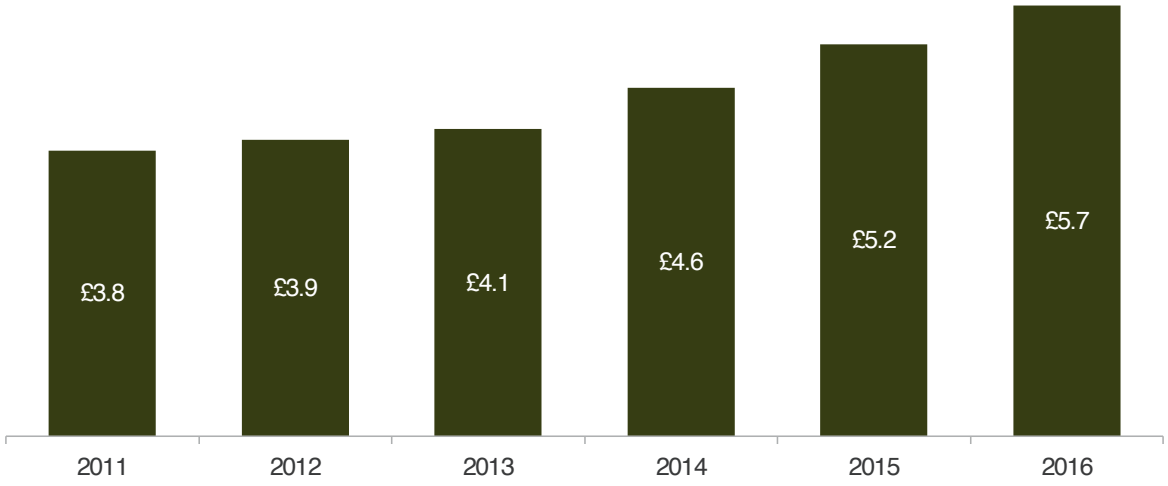


Source: Ofcom Technology Tracker. Data from Q1 2009-2014, then H1 2015-2017
Base: All adults aged 16+ with a fixed line phone (2017=3074)
Note: Includes only those who expressed an opinion.
Significance testing: Arrows indicate any significant differences at the 99% confidence level between UK 2016 and UK 2017.
QC8A (QC13A): Thinking about your home phone service only, please use this card to say how satisfied you are with the overall service provided by (MAIN SUPPLIER)?

Increasing superfast broadband take-up is driving fixed internet revenue growth

The continued migration to superfast fixed broadband services resulted in a 9.9% real-terms increase in fixed internet revenues in 2016, to £5.7bn. Superfast products are generally more expensive than their standard broadband equivalents- at the end of 2016, across the leading residential providers, the price of the lowest-cost dual-play bundle that includes superfast broadband was £4 higher per month than the lowest-cost standard broadband dual-play bundle.[v1] Fixed internet revenues increased by an average of 8.6% a year in the five years to 2016, driven both by an increase in the overall number of broadband connections and by an increase in the proportion of these which are superfast.

Figure 4.11: Retail residential and SME fixed internet revenues (£bn)



Source: Ofcom / operator data
Note: all revenue data includes VAT and is adjusted for CPI (2016, prices)

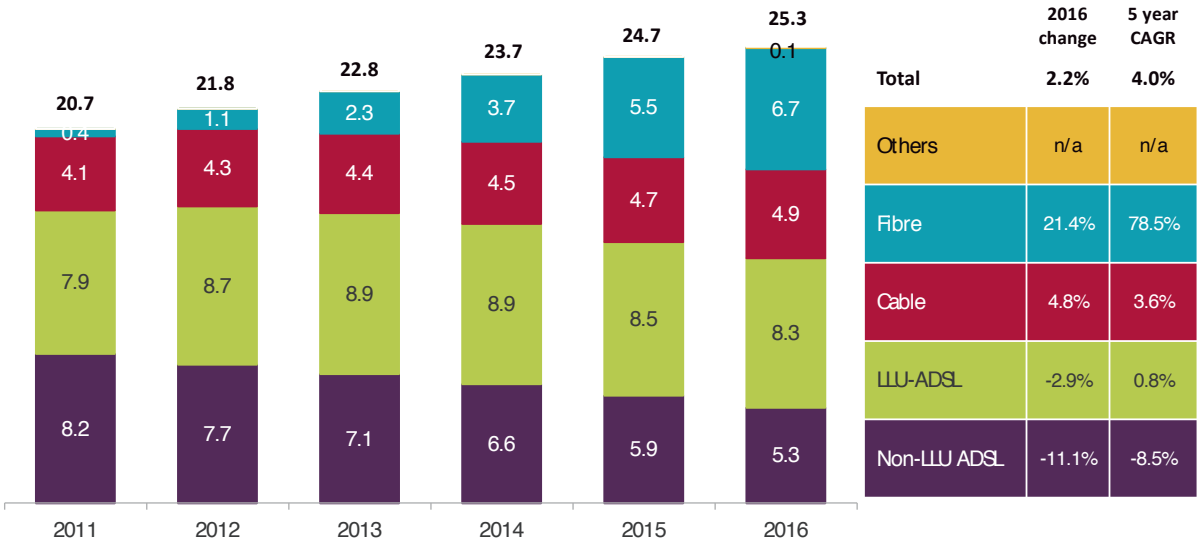
[1] Ofcom, Pricing trends for communications services (March 2017), p34

The number of fibre broadband connections increased by 21% in 2016

The migration to superfast broadband is reflected in a changing mix of technologies used to deliver fixed broadband services. The total number of fibre broadband lines, predominantly fibre-to-the-cabinet (FTTC) but also some fibre-to-the-premises (FTTP), increased by 21% to 6.7 million in 2016, while the number of cable broadband lines reached 4.9 million (up 4.8% since 2015). Conversely, the number of standard (ADSL) broadband lines fell to 13.6 million in 2016 (down 6.2% year on year).

Cable and fibre lines accounted for 46.0% of all fixed broadband lines in 2016, a 4.7 percentage point increase on 2015. In 2016, for the first time, we also collected satellite fixed broadband connection figures from the UK's largest satellite service providers (included in the 'others' category); these data indicate that there were around 80,000 such connections at the end of the year.

Figure 4.12: Retail fixed broadband connections (millions)



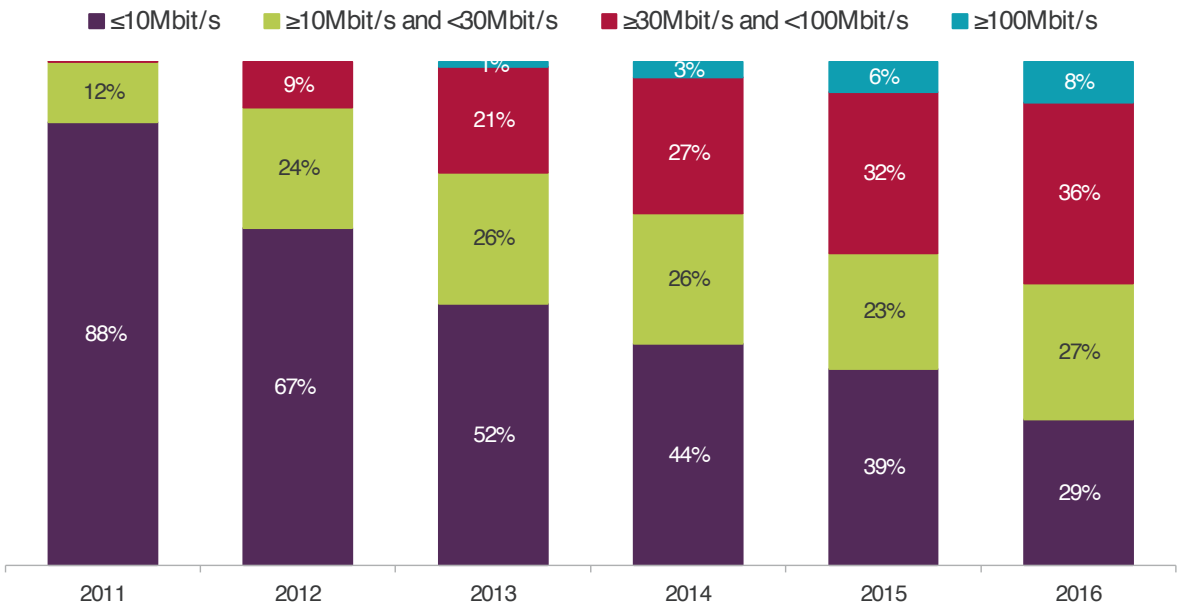
Source: Ofcom / operator data

Forty-four per cent of residential fixed broadband connections received an average download speed of 30Mbit/s or higher in 2016

Ofcom's UK home broadband performance research[1] measures the performance of UK residential fixed broadband connections using a panel of volunteers who connect a measurement unit to their home broadband router. The research shows that 44% of residential connections received an average speed of 30Mbit/s or higher in 2016 (up from 38% in 2015 and from less than 1% in 2011), while 8% of connections had an average speed of 100Mbit/s or higher.

Conversely, 29% of residential connections had an average download speed of less than 10Mbit/s (the download speed that we regard to be the minimum required to fulfil the basic needs of the average UK household)[2] in November 2016, a 10pp year-on-year decrease.

Figure 4.13: Distribution of average actual residential broadband download speeds



Source: UK home broadband performance reports 2011- 2016

[1] https://www.ofcom.org.uk/research-and-data/telecoms-research/broadband-research/broadband-speeds

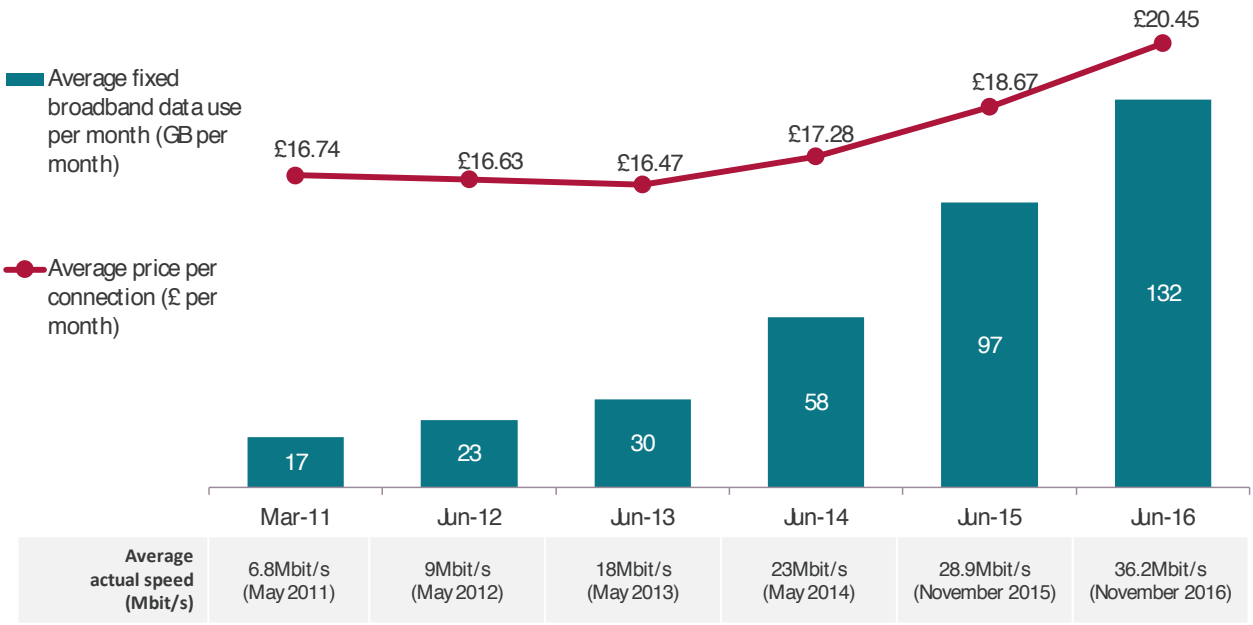
[2] Ofcom, Connected Nations, 2016

Faster connection speeds contributed to a 36% increase in average data use in 2016

In June 2016, the average residential fixed broadband line used 132GB of data per month, a 36% rise from the 97GB average in June 2015.[1] This increasing data use has coincided with an increase in broadband speeds; our UK home broadband performance research found that average residential connection speeds were 36.2Mbit/s in November 2016, up from 28.9Mbit/s in November 2015.[2] Faster connection speeds enable better connectivity for multiple devices on the same connection, and this, combined with the increasing popularity of video-on-demand services, has boosted average broadband data use.

While average broadband revenue per connection has been increasing year on year, the average revenue per GB has been falling; from almost £1 per GB in 2011, to £0.15 in 2016 (a negative 5-year CAGR of 31%).

Figure 4.14: Average fixed broadband revenue per connection and data use per month



Source: Ofcom Connected Nations Reports 2011- 2016 / UK home broadband performance reports 2011- 2016
Note: Average price adjusted for CPI (2016 prices)

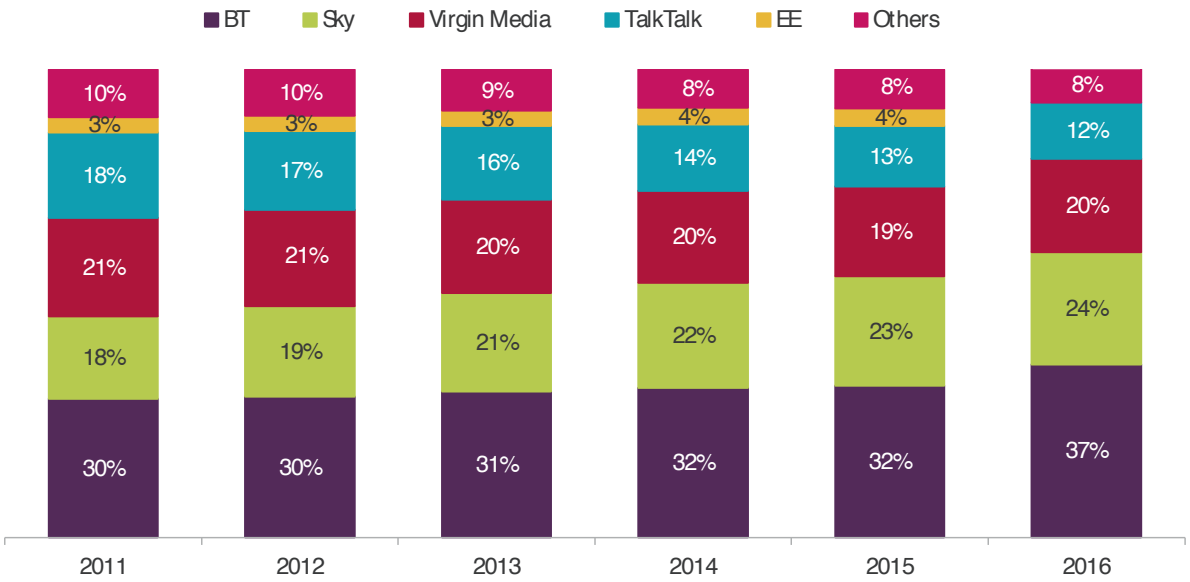
[1] Ofcom, Connected Nations, 2016

[2] Ofcom, UK fixed-line broadband performance, November 2016

BT's acquisition of EE helped increase its fixed broadband share to 37% in 2016

BT's retail market share increased by five percentage points to 37% following its acquisition of EE in 2016. Sky's and Virgin Media's market shares increased by one percentage point each in 2016, while TalkTalk's share declined by one percentage point over the same period.

Figure 4.15: Retail fixed broadband market share (%)

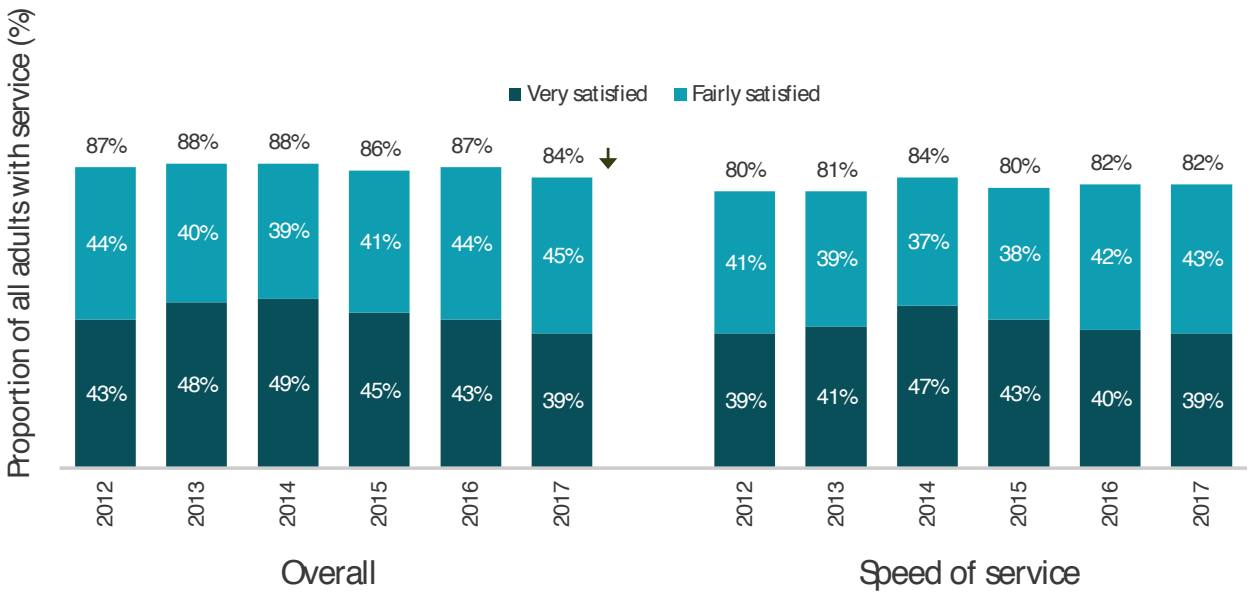


Source: Ofcom / operator data
Note: BT and EE are shown separately up to 2015, as the merger between these two organisations was not completed until 2016.

Overall satisfaction with fixed broadband services declined in 2017

The proportion of respondents who said they were 'very' or 'fairly' satisfied with their overall fixed broadband service was 84% in 2017, down 3pp from 2016, while the proportion of users who were 'very' or 'fairly' satisfied with the speed of their fixed broadband service was unchanged, at 82%.

Figure 4.16: Satisfaction of all adults with a fixed broadband service



Source: Ofcom Technology Tracker. Data from Q1 2009-2014, then H1 2015-2017
Base: All adults aged 16+ with a fixed broadband connection (2017=2928)
Note: Includes only those who expressed an opinion.
Significance testing: Arrows indicate any significant differences at the 99% confidence level between UK 2016 and UK 2017.
QE29A/B (QE8A/B): Thinking about your fixed broadband internet service, please use this card to say how satisfied you are with your main supplier for... The overall service/ The speed of your service while online (not just the connection) provided by MAIN PROVIDER/

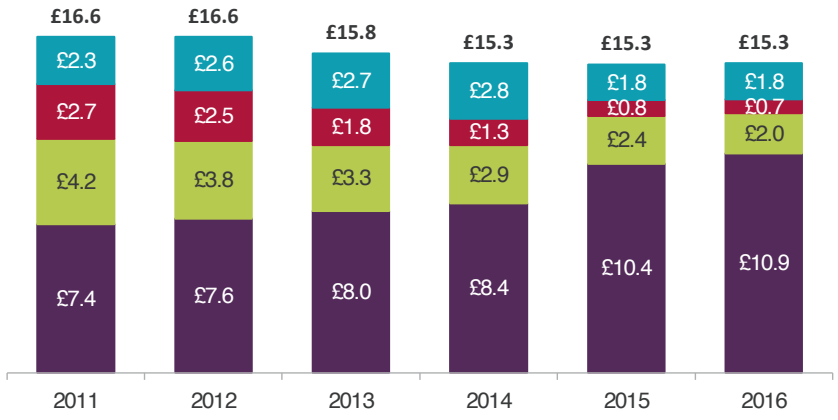
4.5 Mobile voice and data services

4.5.1 Mobile retail revenues remained flat at £15.3bn in 2016

Retail mobile revenues were flat in real terms for the third consecutive year in 2016, at £15.3bn, despite growing use of mobile voice and internet services.

An increase in revenue from access and bundled services (up £0.5bn to £10.9bn), due to the continued migration from pre-pay to post-pay services, was offset by a £0.4bn fall in revenue from out-of-bundle calls and a smaller fall in out-of-bundle messaging revenue.

Figure 4.17: Mobile retail revenue, by service (£ billions)



	2016 change	5 year CAGR
Total	0.3%	-1.6%
Out-of-bundle data	0.2%	-5.2%
Out-of-bundle messaging	-8.2%	-23.6%
Out-of-bundle calls	-15.6%	-14.0%
Access and bundled services	4.5%	8.1%

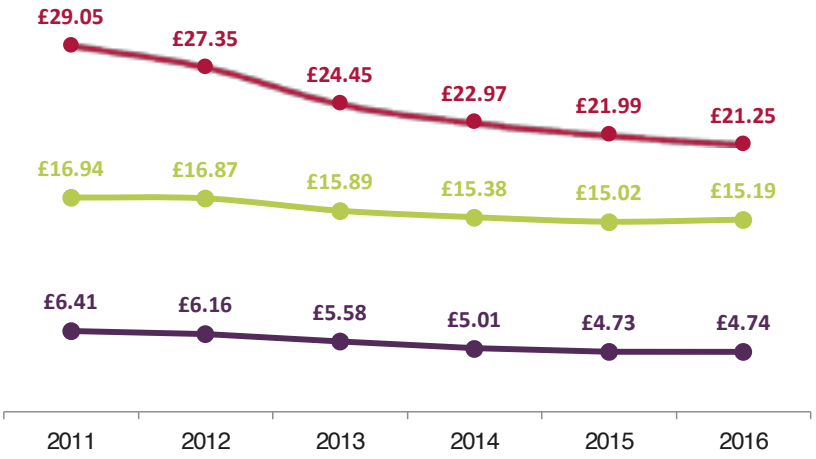
Source: Ofcom / operators
Notes: In 2015 one of the major operators redefined how it reported bundled and out-of-bundle revenues, this way of reporting continued in 2016, so figures not directly comparable before 2015; adjusted for CPI (2016 prices)

Average monthly retail revenue per mobile subscription increased slightly in 2016

Average post-pay monthly revenues continued to fall, from £21.99 in 2015 to £21.25 in 2016 (down 3.3% in real terms), mainly due to the migration of pre-pay customers (who, on average, have lower levels of use) onto post-pay services. There was a small (0.1%) increase in average pre-pay monthly spend in real terms, to £4.74.[1]

After years of decline, the average monthly retail revenue per mobile subscription increased in 2016, up 17 pence (1.1%) in real terms, due to the increasing proportion of post-pay mobile subscribers, who typically have higher average spend than pre-pay customers.

Figure 4.18: Average monthly retail revenue per mobile subscription (2016 prices)



	2016 change	5 year CAGR
Post-pay	-3.3%	-6.1%
Blended	1.1%	-2.2%
Pre-pay	0.1%	-5.9%

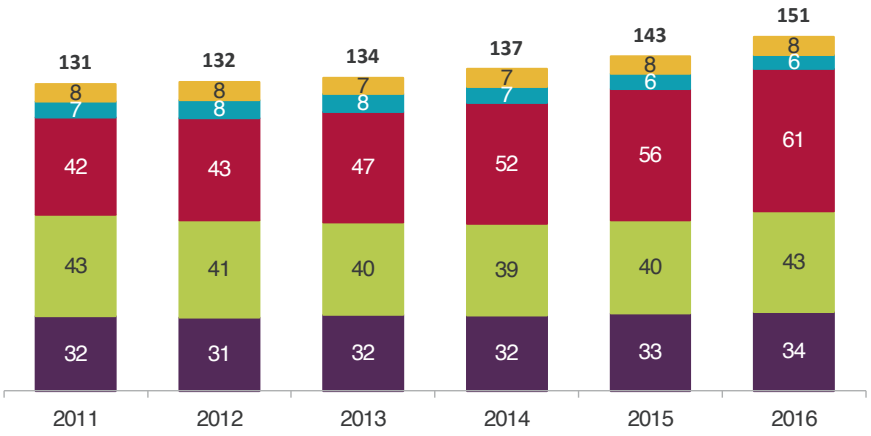
Source: Ofcom / operators
Notes: Mobile voice revenues include revenues from bundled messaging and data services; adjusted for CPI (2016 prices); revenue from handsets included in the monthly post-pay cost will be included in revenues, while up-front handset costs will not be.

[1] Changes in revenue over time do not take into account improvements in quality of service

Outgoing calls from mobiles increased by 5.7% to 151 billion minutes in 2016

Total outgoing mobile call volumes increased by 8 billion minutes to 151 billion in 2016; the largest increase was in call volumes to on-net mobiles (up 8.6%). Calls to mobiles continued to account for the majority of outgoing mobile call minutes in 2016, at 68.6% of the total (67.0% in 2015). The only decrease was in international calls, down 8.5% in 2016, which may be due to the growing use of OTT services such as Skype and Apple Facetime to make these more expensive calls.

Figure 4.19: Outgoing mobile call minutes, by type of call (billions)



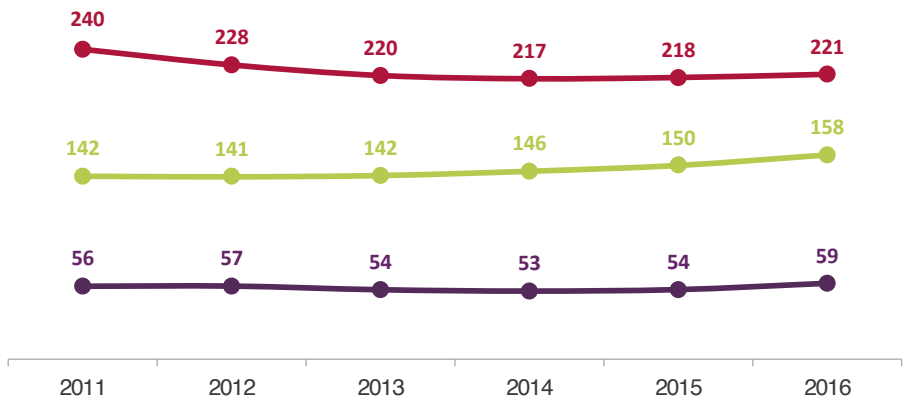
	2016 change	5 year CAGR
Total	5.7%	2.9%
Other calls	4.0%	0.6%
International	-8.5%	-2.5%
Off-net mobile	8.0%%	7.8%
On-net mobile	8.6%	-0.1%
UK geographic	1.7%	1.2%

Source: Ofcom / operators

Average outgoing mobile call minutes per subscription continued to increase in 2016

On average, post-pay customers made 221 minutes of outbound calls per month in 2016, an increase of 1.1% compared to 2015. This may be partly due to the inclusion of large or 'unlimited' inclusive call allowances with pay-monthly services, as monthly prices are increasingly structured according to the volume of inclusive data. Pre-pay customers, on average, made 59 minutes of calls per month (up 8.8%), with higher use associated with a switch away from per-minute pre-pay charges towards pre-pay 'add-on' packs; top-ups for these include an allowance of data, messages and calls that typically expires after a period of time.

Figure 4.20: Average monthly outbound mobile call minutes, by subscription type (minutes per month)



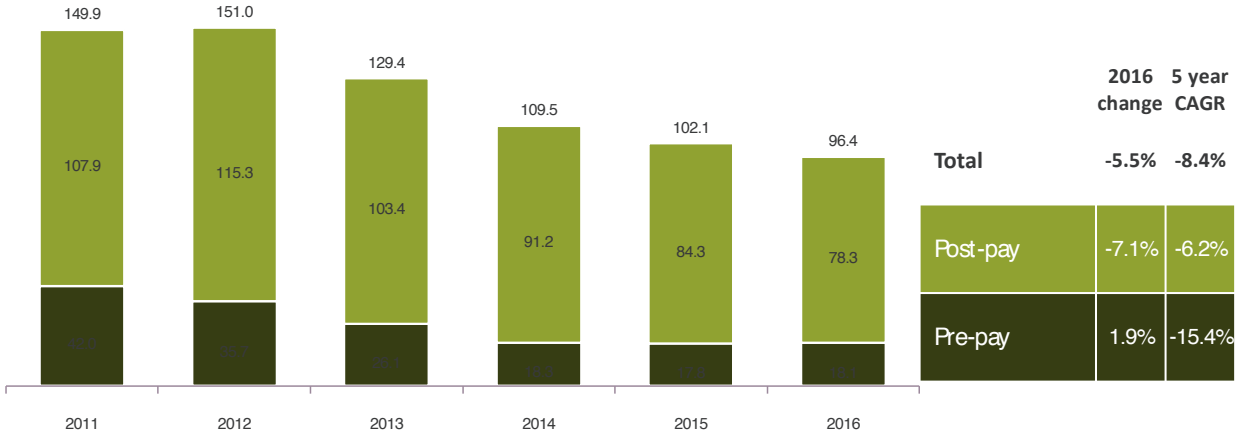
	2016 change	5 year CAGR
Pay monthly	1.1%	-8.0%
Blended	5.4%	11.6%
Pre-pay	8.8%	3.9%

Source: Ofcom / operators
Note: Includes estimates where Ofcom does not receive data from operators.

Use of traditional mobile messaging services continues to decline

Use of SMS and MMS continued to decline in 2016, down by 5.6 billion (5.5%) to 96.4 billion messages in 2016, despite a slight increase of 1.9% in pre-pay mobile messaging, which may be due to the increasing popularity of 'add-on' pre-pay services that offer an inclusive allowance of messages. The main reason for declining traditional message volumes is the increasing take-up of smartphones, which give easy access to alternative communication methods such as email and instant messaging (e.g. WhatsApp and Facebook Messenger). The total number of SMS and MMS messages dropped by 35.6% between 2011 and 2016.

Figure 4.21: Outgoing SMS and MMS messages (billions)

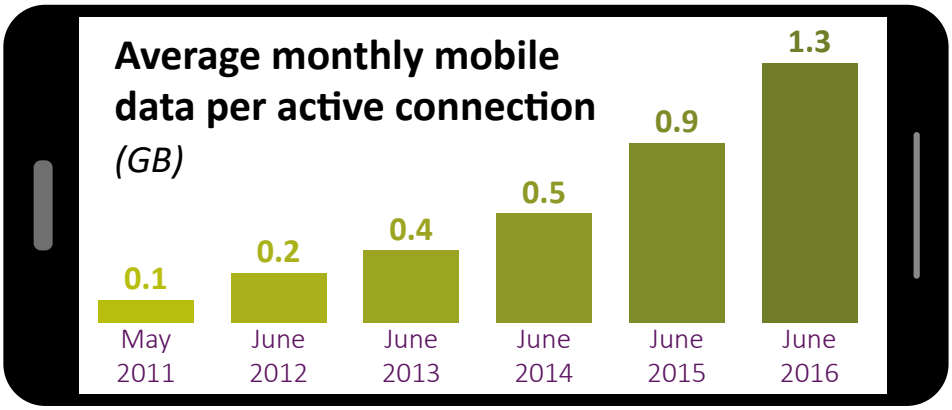


Source: Ofcom / operators

Increasing 4G mobile coverage is driving consumers' demand for, and use of, mobile data

The increase in 4G availability and take-up, along with the availability of mobile tariffs with generous inclusive data allowances, contributed to a 44% year-on-year increase in average mobile data consumption – 1.3GB per connection in June 2016.

Figure 4.22: Average monthly mobile data per active connection (GB)

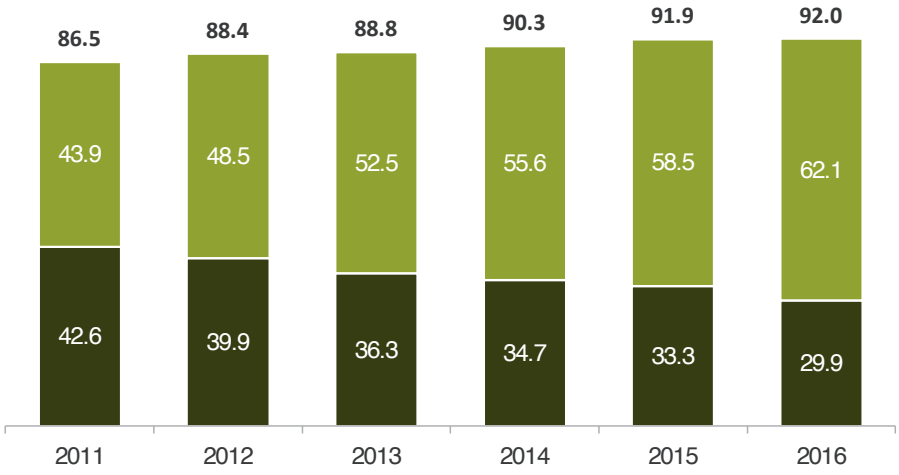


Source: Source: Ofcom / operators / Ofcom Connected Nations Reports 2011- 2016

Mobile customers continued to switch from pay-as-you-go tariffs to pay-monthly tariffs in 2016

The total number of mobile subscriptions continued to increase in 2016, reaching 92.0 million at the end of the year. While the total number of post-pay subscriptions increased by 6.1% to 62.1 million in 2016, mainly due to the increasing popularity of low-cost SIM-only pay-monthly deals, but also due to a 0.9 million increase in M2M subscriptions, the number of pre-pay subscriptions continued to fall during the year, down by 3.5 million (10.4%) to 29.9 million. The proportion of mobile subscriptions that were post-pay increased by 3.8 percentage points to 67.5% in 2016.

Figure 4.23: Mobile subscriptions, pre-pay and post-pay (millions)



	2016 change	5 year CAGR
Total	0.1%	1.2%
Post-pay	6.1%	7.2%
Pre-pay	-10.4%	-6.8%

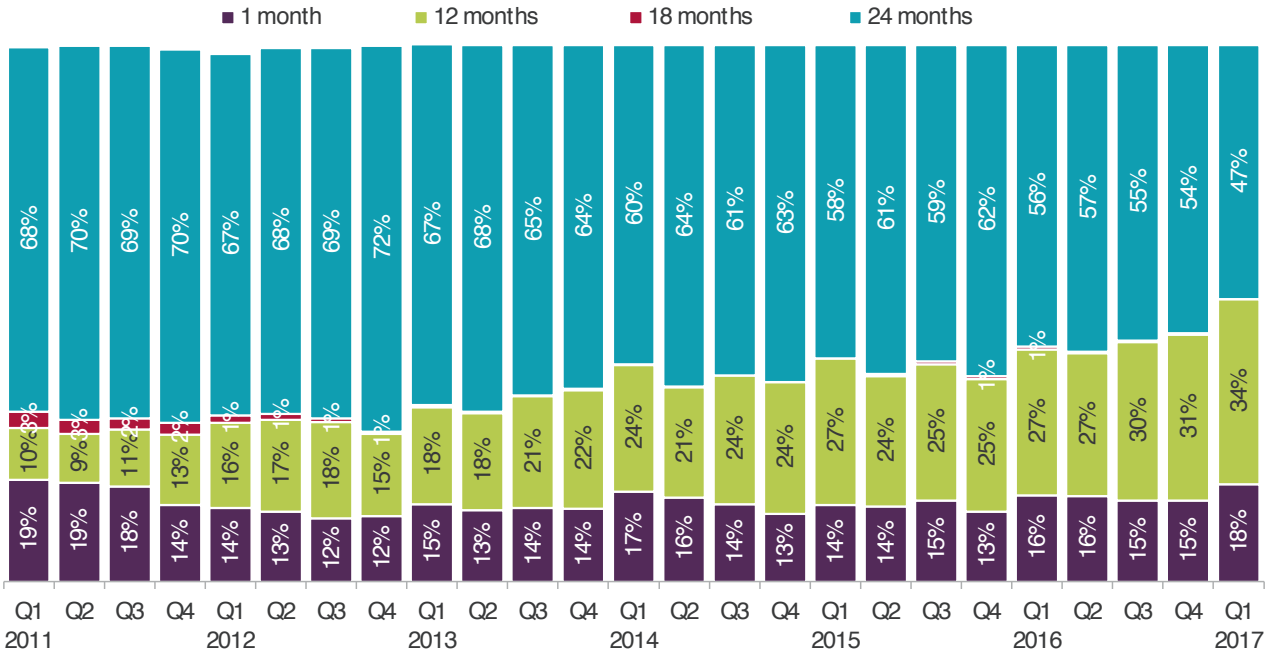
Source: Ofcom / operators
Note: Includes M2M

More than half of new mobile contracts had a minimum period of 12 months or less in Q1 2017

Post-pay mobile connections with a minimum contract period of 24 months are the most popular way for consumers to acquire a new handset with their mobile service; the device cost is paid off over the course of a contract as part of the monthly fee.

However, an increasing number of consumers are either keeping their old handset or buying a SIM-free handset (i.e. purchasing one without a mobile service), and using it with a SIM-only post-pay mobile service. SIM-only post-pay services typically have a minimum contract period of either one month or 12 months, and sales data from GfK Retail and Technology indicate that more than half of new mobile contract sales (53%) were for a minimum contract period of 12 months or less in Q1 2017, compared to 43% a year previously. Consumers may do this to save money, or because they do not feel that the latest smartphone models provide a sufficient increase in functionality to warrant an upgrade.

Figure 4.24: Contract lengths for new post-pay mobile connections (proportion of sales)



Source: GfK Retail and Technology UK Ltd, Contract Handset Acquisitions: price segments.
Notes: England, Scotland and Wales only (excludes Northern Ireland); based on GfK's coverage of 95% of the consumer market; based on new post-pay connections; excludes contract renewals; only represents sales through consumer channels (excluding Apple Store and eBay).

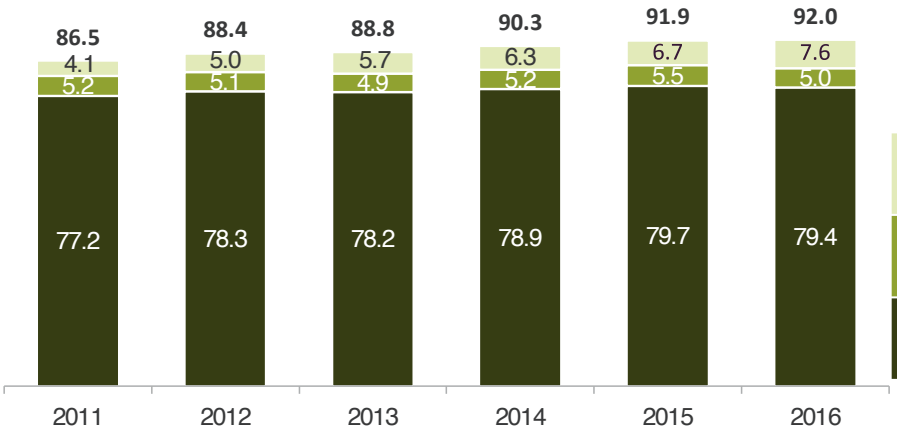
Increasing mobile subscription numbers are being driven by M2M

Growth in the total number of mobile subscriptions was driven by a 14.2% increase in the number of machine-to-machine (M2M) connections in 2016, to 7.6 million. The number of mobile handset connections fell marginally during the year, by 0.4%, while the number of dedicated mobile data subscriptions (such as mobile broadband dongles and data-only SIMs) fell by 9.8% to 5.0 million, as consumers increasingly use a smartphone to access mobile data services, including tethering or using Wi-Fi to access data services on tablets and laptop computers.

Machine-to-machine:

M2M stands for 'machine-to-machine'. The general definition of a M2M connection is a connection between devices, often wireless, where human input is not necessarily required. Commonly used examples of M2M are in smart metering (where the meter reports energy use back to a central billing database) and burglar alarms, which may contain a SIM card to enable communication with monitoring offices. Vending machines are another common example, as some use M2M to keep a central computer up to date with stock levels.

Figure 4.25: Mobile subscriptions, by connection type (millions)



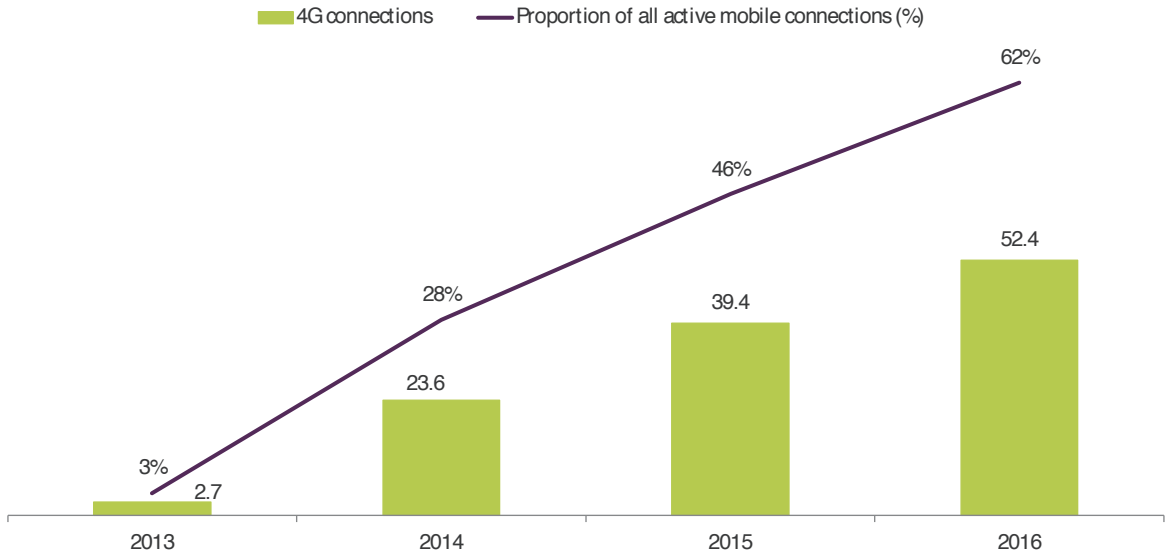
	2016 change	5 year CAGR
Total	0.1%	1.2%
M2M	14.2%	13.4%
Dedicated mobile data	-9.8%	-1.0%
Mobile handset	-0.4%	0.6%

Source: Source: Ofcom / operators

Nearly two-thirds of mobile connections were 4G-enabled at the end of 2016

The growing demand for faster connectivity, as consumers embrace mobile data services, resulted in the number of mobile subscriptions with access to 4G services increasing by 32.9% to 52.4 million in 2016. This equates to 62.1% of all UK mobile connections, up by 16pp since 2015. Conversely, over the same period the number of 3G connections fell, by 30.4% to 31.5 million. It should be noted that these figures are likely to overstate 4G use as they include all SIMs than can access 4G services, regardless of whether they are used with a 4G-enabled device, or in an area where their host network has 4G coverage.

Figure 4.26: Number of mobile connections with access to 4G services (millions)

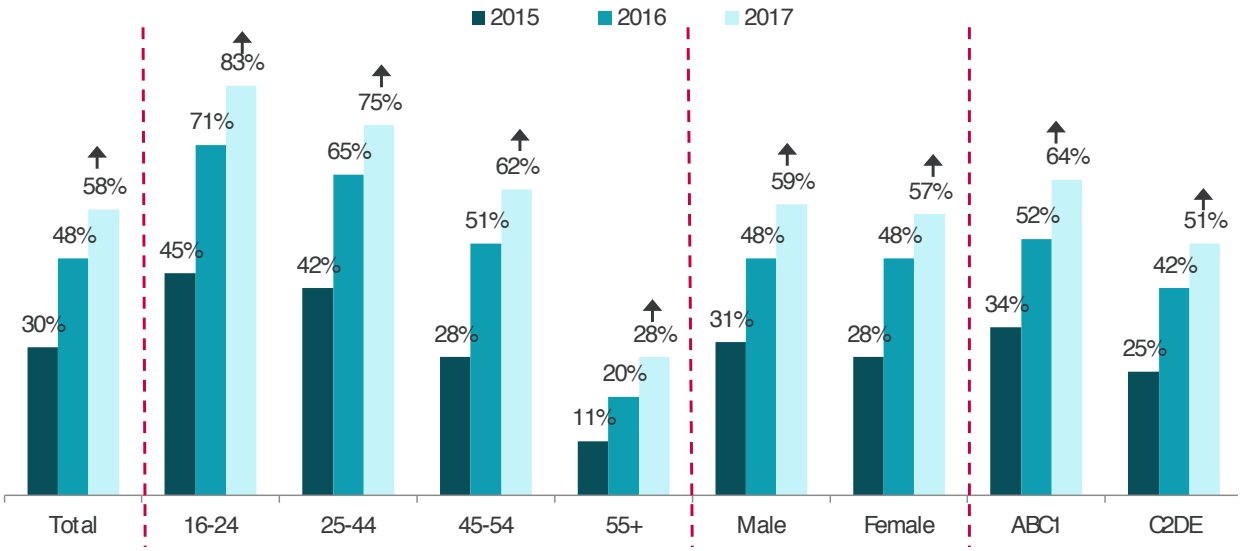


Source: Operator data
Note: Includes all consumers whose tariff allows them to access 4G mobile services, even those without a 4G-enabled device or in areas where their provider has no 4G coverage.

Take-up of 4G services increased across demographic groups in 2017

Almost six in ten (58%) adults aged 16+ said they had a 4G mobile service in 2017. Those in the youngest age group (16-24s) had the highest take-up (83%), while take-up was lowest among over-54s (28%). In line with the previous year, take-up was higher in the ABC1 socio-economic group (64%) than in the C2DE group (51%), and was similar among male and female respondents, at 59% and 57% respectively.

Figure 4.27: 4G take-up overall, by age, gender and socio-economic group (% of respondents)

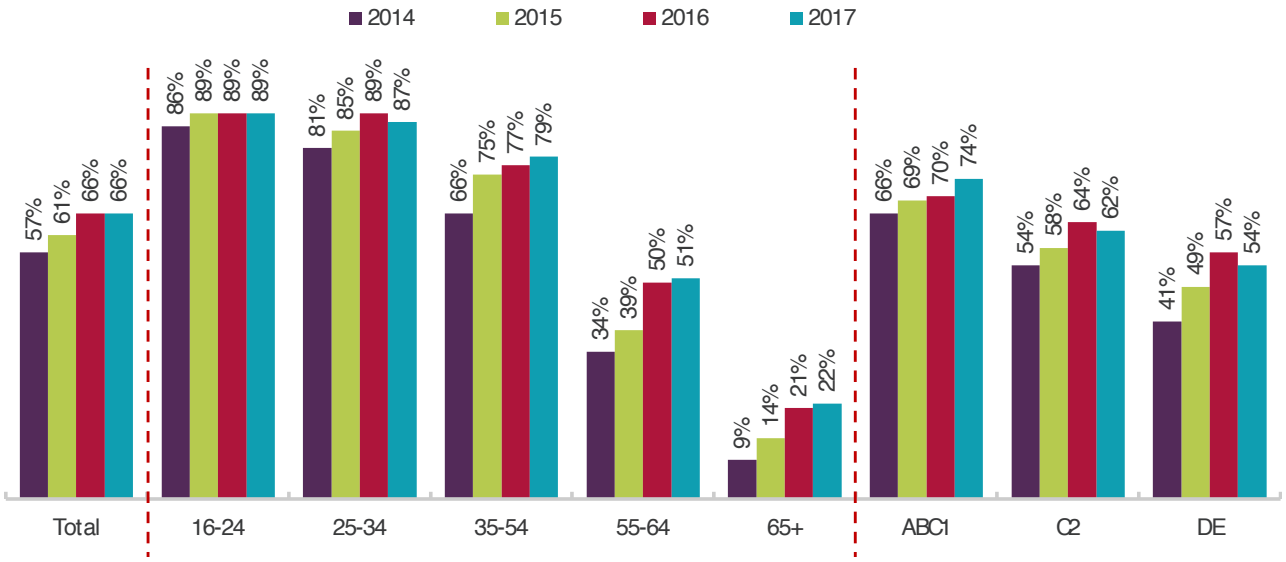


Source: Ofcom Technology Tracker. Data from H1 2015-2017
Base: All UK adults 16+ 2017 (3743), 16-24 (519), 25-44 (1206), 44-54 (570), 55+ (1442), male (1790), female (1947), ABC1 (1919), C2DE (1813)
Significance testing: Arrows indicate any significant differences at the 99% confidence level between UK 2016 and UK 2017, between each age group in 2016 and 2017, between each gender in 2016 and 2017 and between each socio-economic group in 2016 and 2017.
QD6 (QD41): Do you have a 4G service?

No change in the proportion of adults using mobile data services

Two-thirds (66%) of adults aged 16+ said that they accessed data services on a mobile handset in 2017, in line with the figure recorded in 2016. Nine in ten respondents aged 16-24 (89%) and 25-35 (87%) used data services on a mobile phone, compared to 22% of over-64s. The proportion of data users was higher among more affluent socio-economic groups (74% of ABC1s compared to 54% of DEs).

Figure 4.28: Use of data services on mobile phones, by age and socio-economic group (proportion of adults)



Source: Ofcom Technology Tracker. Data from Q1 2014, then H1 2015-2017
Base: All adults aged 16+ (2017 n=3743)
Note: Internet use includes accessing the internet, downloading and streaming content, connecting using Wi-Fi and using VoIP.
Significance testing: Arrows indicate any significant differences at the 99% confidence level between UK 2016 and UK 2017, between each age group in 2016 and 2017 and between each socio-economic group in 2016 and 2017.
QD12 (QD28A): Which if any, of the following activities, other than making and receiving voice calls, do you use your mobile for?

Use of non-traditional communications services is high among smartphone users

Ofcom mobile research app

Last year we piloted a new methodology to measured the consumer experience of using mobile services across the UK. This approach involved establishing a panel of UK consumers who installed an Ofcom-branded research app on their Android smartphone.

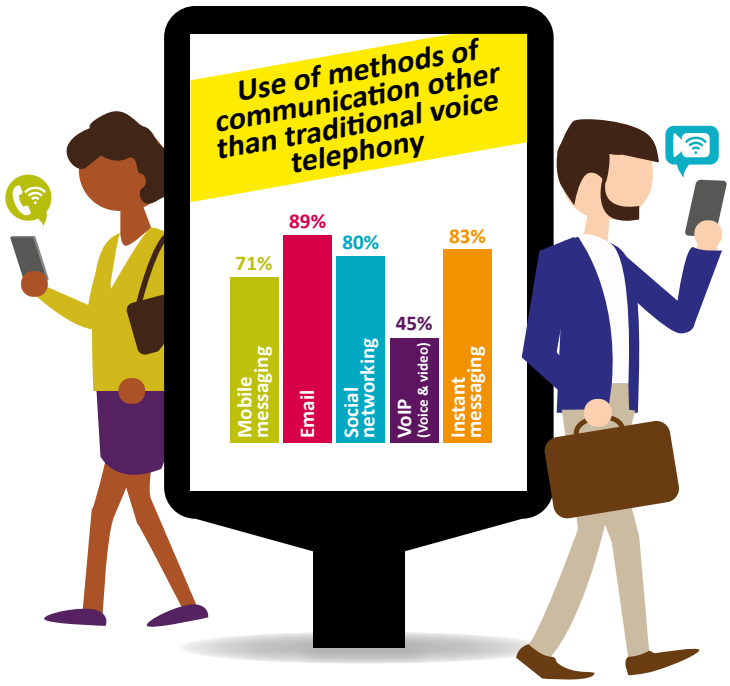
The app, provided by our technical partner P3, passively measures consumers' experience of using mobile services, as panellists use their phones. The data used in this report were collected between 27 September 2016 and 23 December 2016.

More information about this research can be found at https://www.ofcom.org.uk/research-and-data/telecoms-research/mobile-smartphones/consumer-mobile-experience.

We used data collected by our mobile research app in Q4 2016 to analyse use of alternatives to traditional mobile services among Android smartphone users. Our analysis shows that email had the highest reach among our panellists, (89% of our nationally representative panel checked their email at least once during the fieldwork), followed by instant messaging (83%) and using social networking sites (80%). Traditional mobile messaging (SMS/MMS) services were used by 71% of panellists.

Analysis of the number of app sessions per day shows that social networking was the most frequently undertaken activity, with an average user recording seven social networking app sessions per day, followed by instant messaging and email at around four a day. VoIP had the lowest reach (45%) and frequency (less than one session a day) among the five app categories included below.

Figure 4.29: Use of methods of communication other than traditional voice telephony



Source: Ofcom mobile research app, 27 September 2016- 23 December 2016
Base: Behavioural panel (1200 panellists)

Note: Includes use over Wi-Fi as well as mobile data. Usage of some apps may be understated as the research does not capture apps running in the background or if the app is open for less than 5 seconds (e.g. may impact WhatsApp). While the results below are representative of the UK Android mobile population, they are likely to be higher than those for the UK population as a whole (Android users make up around 46% of all smartphone owners, and in the UK, three in four adults own a smartphone).[1]
Mobile messaging category includes traditional messaging service; email- various email apps (Outlook, Gmail, Yahoo Mail, Email, Inbox, etc); Social networking – LinkedIn, Facebook, Google+, Instagram, Twitter, Snapchat and Pinterest; VoiP – Skype, Duo, Hangouts and Viber; Instant messaging – Facebook Messenger, WhatsApp, Kik and Allo.

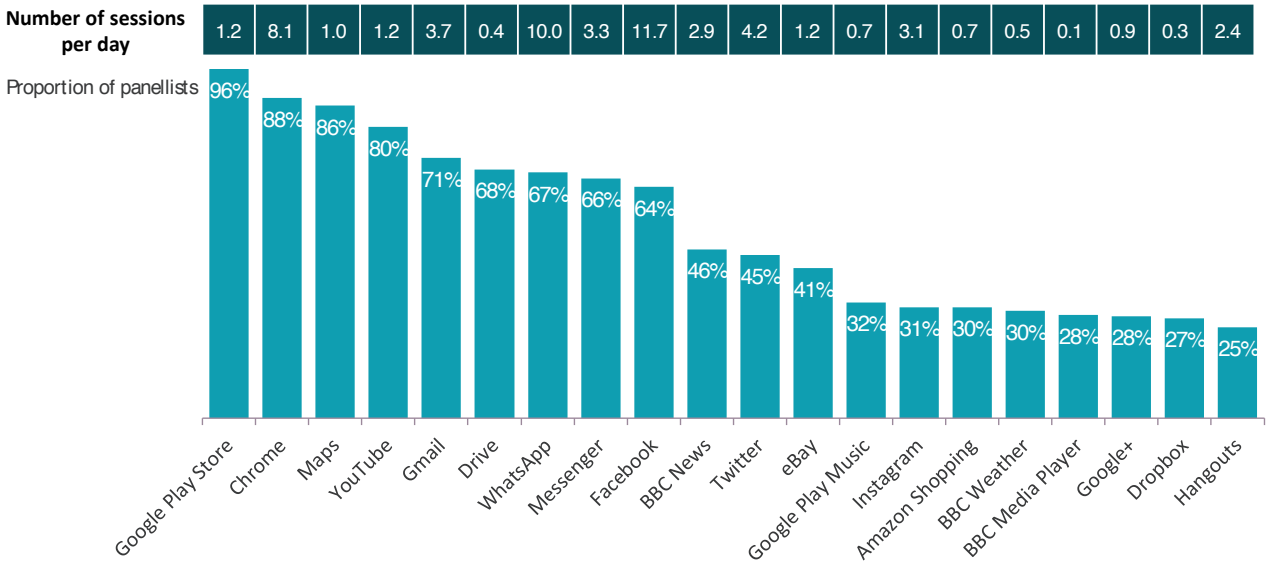
[1] Ofcom Technology Tracker, H1 2017

Google Play Store has the highest reach, while Facebook is used most frequently

The Google Play Store, which is the main way in which Android users download and update apps, had the highest reach among our panellists, with 96% using this app at least once during the fieldwork, followed by Chrome (88%), Maps (86%) and YouTube (80%).

Seven of the top 20 apps were for messaging and/or social networking (WhatsApp, Messenger, Facebook, Twitter, Instagram, Google+ and Hangouts). These apps were also among the most frequently used, with Facebook being opened almost 12 times a day, on average. WhatsApp also had very high levels of use (averaging ten sessions a day), followed by Chrome (just over eight per day).

Figure 4.30: Top 20 apps used by Android users, by reach



Source: Ofcom mobile research app, 27 September 2016- 23 December 2016
Base: Behavioural panel (1200 panellists)
Note: Includes use over Wi-Fi as well as mobile data. Use of some apps may be understated as the research does not capture apps running in the background or if the app is open for less than 5 seconds (e.g. may impact WhatsApp).

More than nine in ten mobile data downloads were successful

What is data service availability?

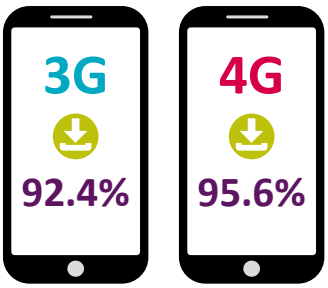
This metric measures the percentage of cases when the user can connect to the network and download data. It is measured via an automated test run in the background every 15 minutes, which attempts to download a small file and logs whether this is done successfully.

For this metric we only look at results when the screen was on during the test, i.e. when the panellist was using their phone. We do not take into account connection tests that happened while the phone was not in use ('screen off').

The mobile research app measures data service availability and found that in most cases (95.6%), 4G users were able to access a mobile network (be it 2G, 3G or 4G), and successfully download data when they used their phone. This proportion was slightly lower among 3G-only users (92.4%).

Figure 4.31: Data service availability

People able to access a mobile network and successfully download



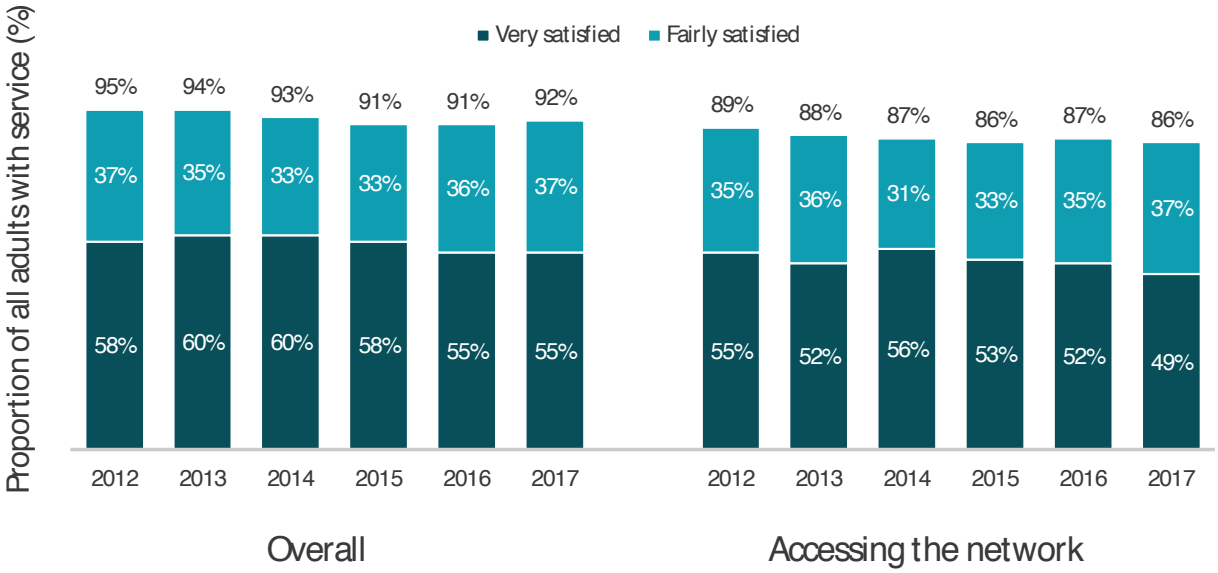
Source: Source: Ofcom mobile research app, 27 September 2016- 23 December 2016
Base: Nationally representative panel (c4300 panellists

Overall satisfaction with mobile services was stable in 2017

There were no significant changes in satisfaction with mobile services in 2017; more than nine in ten mobile phone users (92%) said that they were 'very' or 'fairly' satisfied with their mobile service.

Satisfaction with accessing the network was 86% in 2017, also in line with the previous year's figure.

Figure 4.32: Satisfaction with mobile service, all adults



Source: Ofcom Technology Tracker. Data from Q1 2009-2014, then H1 2015-2017 **Base:** All adults aged 16+ with a mobile phone (2017=3471) **Note:** Includes only those who expressed an opinion. **Significance testing:** Arrows indicate any significant differences at the 99% confidence level between UK 2016 and UK 2017. **QD19A/J (QD21A/J):** Thinking about your mobile phone service, please use this card to say how satisfied you are with your main supplier for... The overall service/ reception/ accessing network provided by MAIN PROVIDER/?