The Mobile Economy
North America 2016

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The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with almost 300 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai and the Mobile 360 Series conferences.

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Executive Summary

Mature market with limited subscriber growth, focused on new technologies

North America is one of the most mature mobile markets, with high rates of subscriber penetration, mobile broadband and smartphone adoption, and strong levels of usage. Canada is less mature than the US in terms of subscriber penetration and will grow at 3.1% annually to 2020, compared to 2.0% growth in the US.

At 75%, smartphone adoption in North America is already by some distance the highest of any region. Operators have built extensive 4G coverage, and users continue to migrate rapidly to the newer networks; nearly 60% of connections were on 4G in June 2016. Although coverage levels are high, the US is behind South Korea and China in network speeds; more investment is needed to support greater capacity and faster speeds.

4G-enabled data explosion driven by increasing video consumption over mobile

High levels of 4G and smartphone adoption are driving strong data usage growth in North America. Cisco projects this to continue through to 2020, with usage per subscriber in North America reaching 9 GB per month, a CAGR of 38%. Video content consumed over mobile devices is driving much of this growth. By 2020, more than 75% of data consumption will be video, an annual growth rate of almost 50%. Operators are attempting to monetise this data in different ways: AT&T will offer three streaming options for DirecTV content, while Verizon has developed a mobile-only content platform, Go90.

The US is also a leader in mobile usage and engagement. The majority of US adult mobile owners watch video content on their mobile devices at least daily, a figure that rises to much higher levels in younger demographics. Americans are also heavy users of social networking on their mobile devices, with almost 60% of adults saying they access social networking sites via their mobile devices daily, according to GSMA Intelligence survey data.

Competition a challenge, driving down ARPU across the sector

T-Mobile remains the most aggressive competitor in the US and has gained three percentage points of market share in two years, leading to service ARPU declines for all US operators at an average of 8% year on year. However, operators are increasingly emphasising total billings per customer, including any device payments. On this basis, ARPU levels look much healthier, with low single-digit declines at present.

US mobile revenues have turned slightly negative given the market's maturity, intense price competition (particularly between Sprint and T-Mobile) and already high ARPU levels compared to other countries. Canada, however, as a much less mature market, will continue to see modest revenue growth for the rest of the decade. Revenues for the region overall are forecast to show marginal growth to 2020, highlighting the need for operators to continue developing new revenue streams.

Capex levels have peaked in this cycle; cashflows remain strong

Over the past few years, operators have invested significant sums in both spectrum and network equipment, enabling them to reach the high levels of 4G coverage today. This allows capex over the coming years to be lower than in the peak years, and significantly lower as a percentage of revenues. Total operator capex is forecast at almost $170 billion over the five years to 2020, driven in the nearer term by a focus on network densification through deploying small cells. This is still the largest level of investment over this period of any region – with the exception of Asia Pacific, which has a vastly larger population.

Despite the revenue picture, the reduction of handset subsidies and other cost-saving measures allow the operators to broadly remain quite profitable and, with capex subdued for the next several years, healthily cash generative. Cashflow margins for North America overall are forecast to remain around 17% over the next few years. At a country level, the impact of greater competition in the US, which has four large operators, means margins there are closer to 16%. In contrast, Canada which has three main players, has higher profitability and cashflow margins around 25%.

Mobile supporting growth and jobs

In 2015, mobile technologies and services generated 3.6% of GDP in North America, a contribution that amounted to approximately $710 billion of economic value added. In the period to 2020 this figure will increase to almost $1 trillion (4.5% of GDP), as the region experiences strong growth in productivity brought about by the fast adoption of machine-to-machine (M2M) technology and the increased digitisation of industry and services.

The mobile ecosystem supported 2.3 million jobs in 2015. This includes workers directly employed by mobile operators and the ecosystem, and jobs that are indirectly supported in the rest of the economy by the activity generated by the sector. The sector also makes an important contribution to the funding of the public sector, with $82 billion raised in 2015 in the form of general taxation and an additional $46 billion in government revenues from spectrum auctions.

North America leading the next wave of mobile innovation

North America continues to drive innovation across the mobile ecosystem and help realise the potential of the Internet of Things (IoT). Across the region cities are striving to become smart cities, while in the first quarter of 2016 the US market saw the number of connected car additions pass the number of new smartphone additions. Nearly 15% of total cellular connections in the US are already cellular M2M connections – a figure that is over 50% higher than in Europe and one that will increase to around 30% of total cellular connections by 2020.

New low-power wide area (LPWA) networks are being deployed in North America, using both licensed and unlicensed spectrum. These networks will drive rapid growth in connected devices and allow innovative new cases and opportunities for operators and other ecosystem players. Mobile operators continue to play an active role in these developments, looking to partner with other industry players as well as connecting a growing range of devices.

The region is home to many of the most innovative companies in the broader mobile ecosystem, while venture-capital (VC) flows in the US into IoT continue to show healthy growth. Total VC investments in North America across the mobile and telecoms sector totalled $16.5bn in 2015, up 41% from 2014. Regulation and government policy continue to support the development of IoT, as well as efforts to agree standards and facilitate the first wave of 5G deployments.

The mobile and broader internet economy continues to evolve at a rapid pace. While smartphone growth is stalling in many developed economies, operators in North America are looking to connect a growing range of devices, from cars to drones. Companies in the region are also leading the way in realising the potential of the 'screenless' world, utilising the potential of artificial intelligence (AI) in voice-activated personal assistants and other new technologies such as virtual reality.

The road to 5G: US vying with Asia for leadership

Operators from across the world are looking to drive the development of 5G mobile technologies, with the leading players coming from North America, Europe and Asia. In the US, the FCC voted in mid-July on rules to identify and open up spectrum for 5G networks, potentially making the US the first country to do so for 5G network and applications. The rules aim to balance different spectrum access approaches, including exclusive use licensing, shared access and unlicensed access, to meet different needs and use cases. The Commission also adopted a number of flexible service and technical rules to allow new technologies and innovations to evolve and develop without the challenge of overly prescriptive regulations.

MOBILE ECONOMY NORTH AMERICA

Unique subscribers

2015
284m

2020
315m

2015 - 2020
2.1%
CAGR

2015
79.0%

2020
84.5%

PENETRATION RATE

SIM connections

Excluding M2M

371m
2015
103.3%
PENETRATION RATE

414m
2020
110.9%
PENETRATION RATE

2015 - 2020
2.2%
CAGR

Data traffic and revenue growth

Mobile data traffic per user expected to grow at

38% CAGR

over 2015-2020 to nearly 9 GB per month compared to a global average of 48% and 5 GB

(source: Cisco)

Total revenue growth forecast
2015 - 2020
0.2%
CAGR

Smartphones and 4G

2015

Smartphones
74%
of connections

2015
4G

4G
55%
of connections

North America at the centre of the mobile ecosystem

Operating systems from the region accounted for over **95%** of sales globally in **2015**

The region is home to many of the most innovative companies in the broader mobile ecosystem, while VC investments in North America across the telecoms sector totalled **$17 billion** in **2015**, up **41%** on 2014

Cellular M2M connections totalled over **60 million** in **2015** and will grow at a **24% CAGR** to over **175 million** in **2020**

Mobile industry contribution to GDP

2015 **$710bn** **GROWING TO, BY 2020**

2015 **3.6%** GDP

ALMOST **$1tn**

2020 **4.5%** GDP

Public funding

2015

Direct contribution to public funding of

$82bn

Additional contribution of

$46bn

through spectrum auctions

Employment

Jobs directly and indirectly supported by mobile ecosystem in 2015

2.3m

1 Industry overview

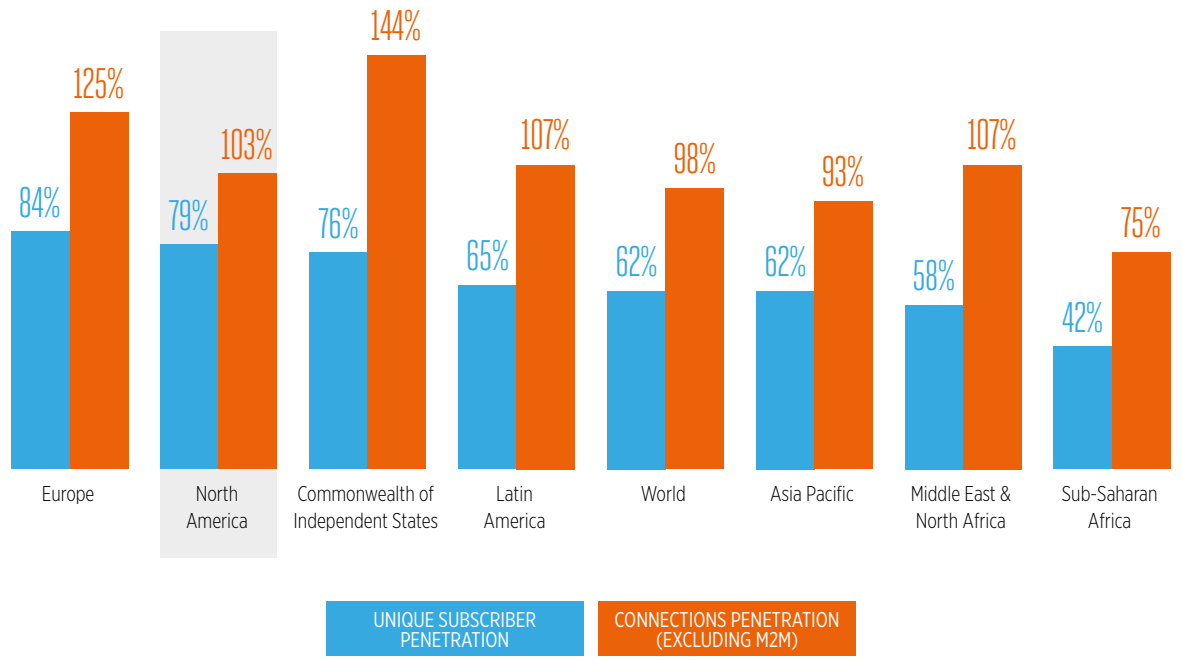
1.1 The US is a very mature market; Canada has room for further subscriber growth

Unique subscriber penetration in North America at the end of 2015 stood at almost 80%, slightly below the developed market average of 84% and suggesting scope for only modest subscriber growth going forward. In Canada, penetration stood at 73%. Given these disparities, US subscriber growth will be 2.0% annually to 2020, while Canada will grow at a 3.1% annual rate.

At the end of 2015, there were just over 1.3 SIM cards for every person in North America, well below the global average and the comparable figure in Europe (both around 1.45), reflecting the relative lack of prepaid in the region. Connection penetration in the US stood at 103% at the end of 2015. In Canada, the SIM ratio was significantly lower, at just under 1.2, giving a connection penetration rate of just 84%.

Figure 1

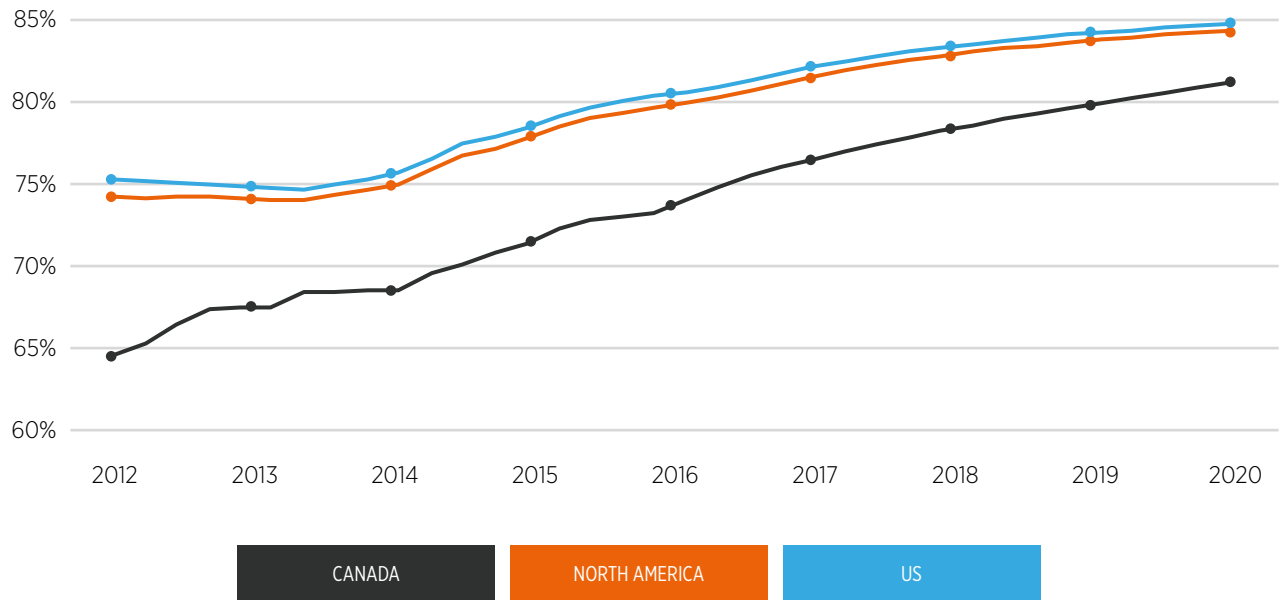
The North American mobile market overall is mature



Source: GSMA Intelligence

Figure 2

Unique subscriber penetration: US is mature; Canada has room for growth



Source: GSMA Intelligence

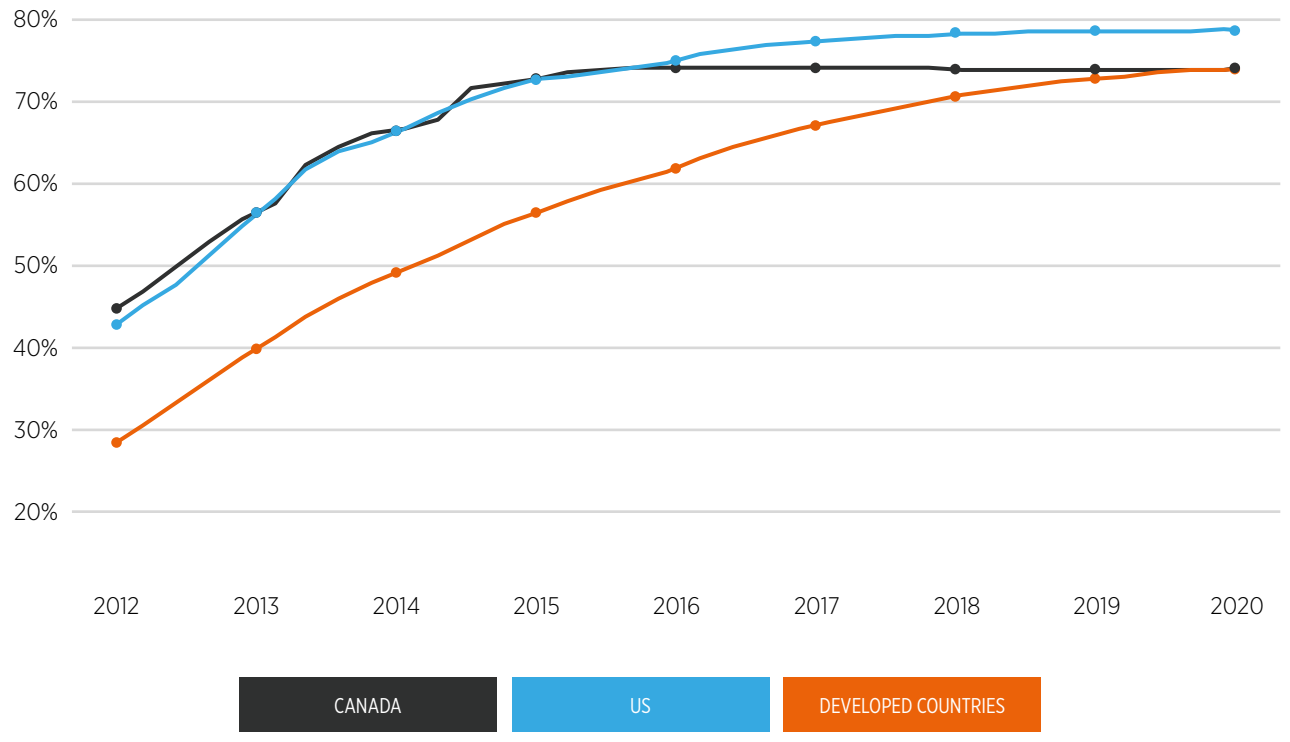
The latest unique mobile subscriber statistics are based on the results of an extensive global consumer survey conducted by GSMA Intelligence in 2015, a study that was considerably expanded and improved compared to previous years.[1] These survey results are used to calculate unique mobile subscribers, based on the number of active SIMs used by an individual, who can account for multiple mobile connections. Measuring unique subscribers is therefore a significantly more meaningful representation of the true reach and impact of the mobile industry than connections.

1.2 Technology shift largely complete

Smartphone adoption has now reached more than 75% of connections in North America, and will continue to expand albeit at a slower pace than recently. Smartphone growth is slowing globally, though the trend is a particular feature of developed markets. Factors driving this slowdown include less availability and generosity of handset subsidies by operators and the slowing pace of innovation in the smartphone market, reducing consumer appetite for new devices. Consumers are also increasingly purchasing handsets unlocked directly from manufacturers, which have introduced their own instalment programmes. For example, Apple introduced the iPhone upgrade programme in the last year.

Figure 3

Rapid smartphone adoption



Source: GSMA Intelligence

1. Moving beyond subscriber growth, GSMA Intelligence, February 2015

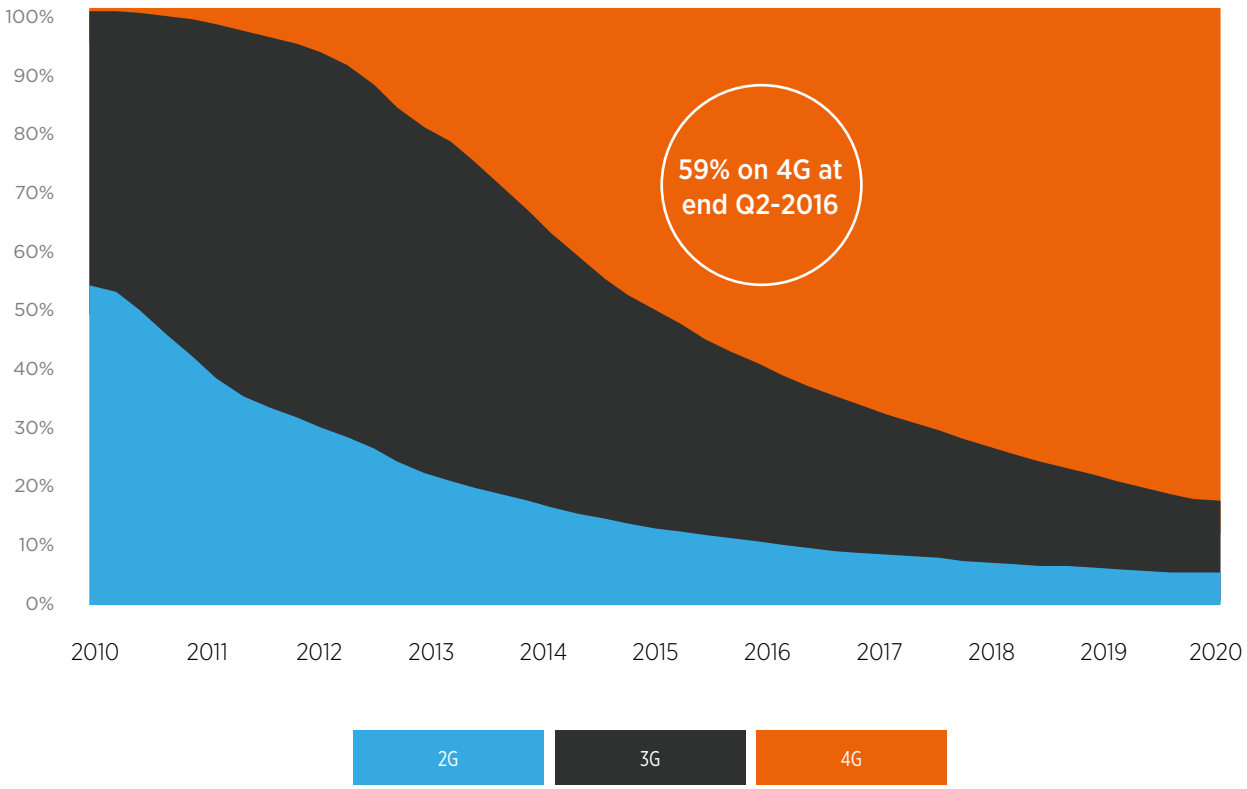
Over the past year, operators in both Canada and the US have largely built out their 4G networks, with significant sums spent on spectrum in the AWS and 700 MHz bands. In the US, 4G population coverage as of June 2016 ranges from 86% (Sprint) to 98% (Verizon); in Canada, the range is 94% to 97%.

Users are rapidly migrating to the higher-quality networks, with nearly 60% on 4G plans as of June 2016, well ahead of Europe at 28%. The 4G figure is forecast to rise to more than 80% by 2020. The US market specifically will have 84% of connections on 4G by this date, reflecting its status as one of the world's leading 4G markets (behind only South Korea and Japan).

Figure 4

Users rapidly migrating to 4G in North America

Percentage of connections (excluding M2M)



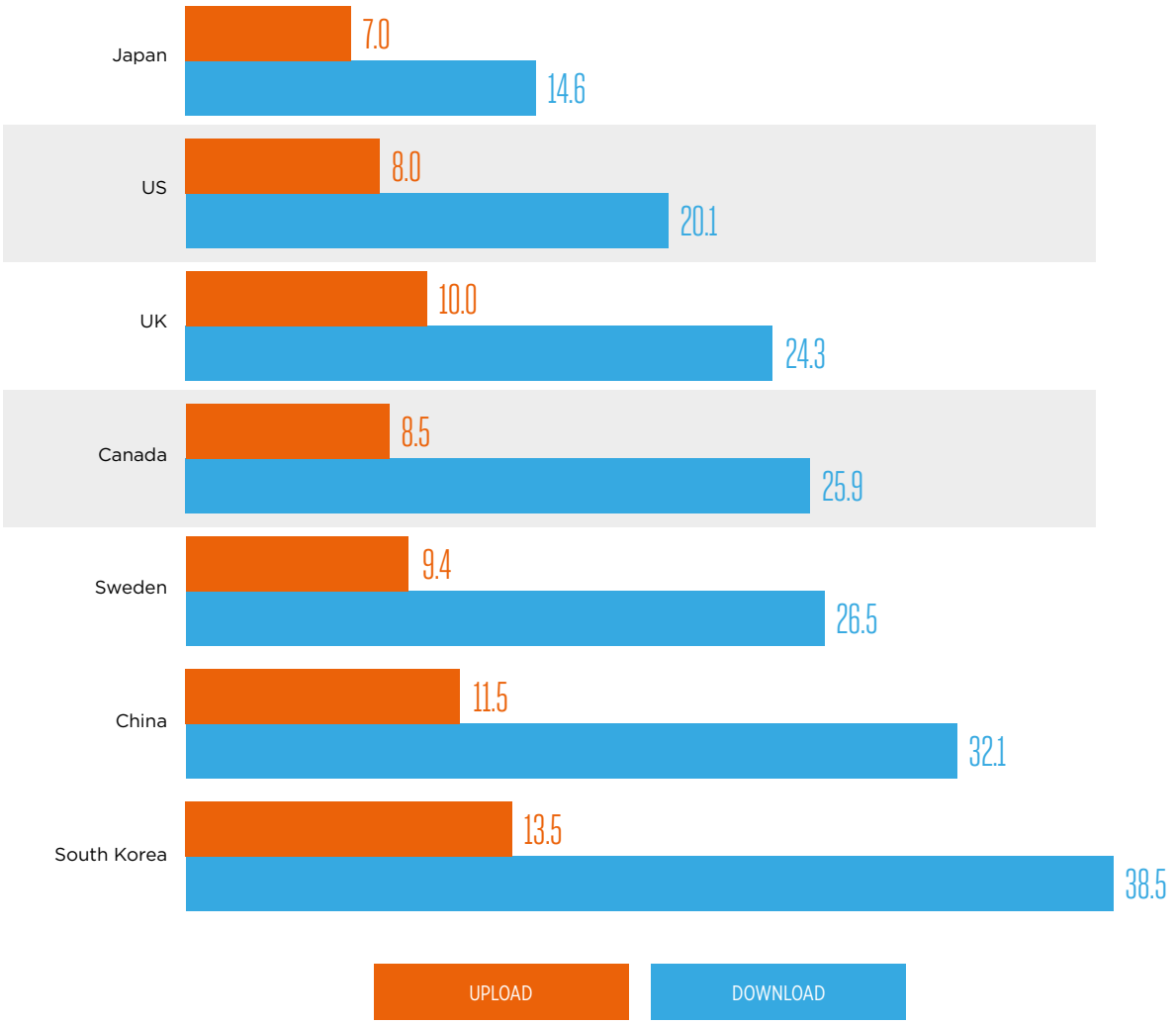
Source: GSMA Intelligence

US network speeds do not compare well with other advanced countries such as China, South Korea and Sweden. Although US operators are doing well in terms of 4G coverage and migrating customers to 4G devices and plans, more investment is needed to support greater capacity and faster speeds. Compared to some markets, operators in the region have been slower to deploy LTE Advanced (using carrier aggregation across bands), though this is now beginning to change. Verizon announced LTE-A deployments in more than 400 cities across the US in mid-2016, and Sprint recently announced that LTE-A was available in over 200 markets.

Figure 5

Average network speeds

Mbps



Source: Speedtest Intelligence from Ookla, August 2016 data

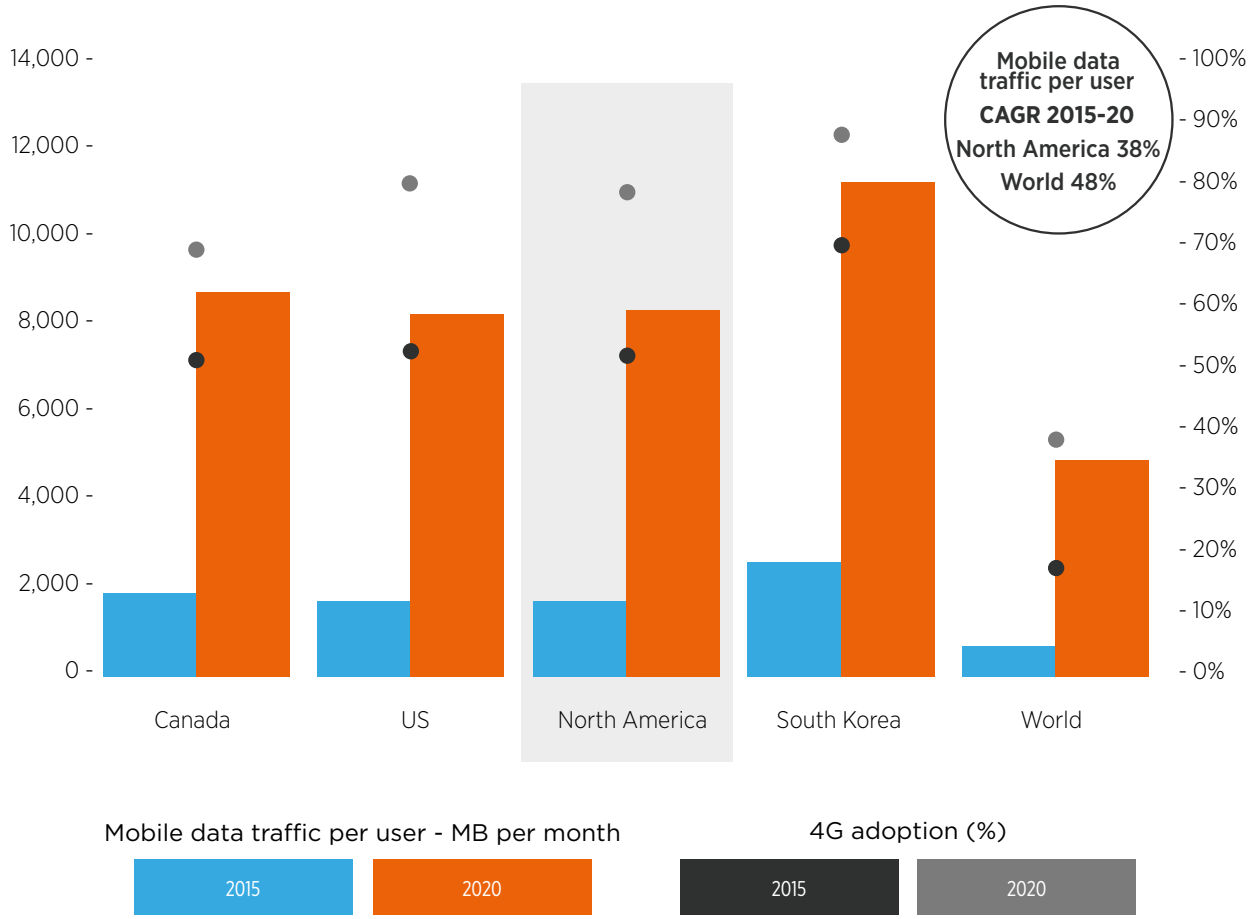
1.3 Smartphones and 4G driving an explosion in data usage

Operators are seeing huge growth in data usage, enabled by mobile broadband networks and widespread smartphone adoption. For example, in Q2 2016 Verizon reported that 93% of its data traffic is carried on its LTE network and that overall data volumes grew by 44% year-on-year.

Cisco projects this growth to continue through to 2020, with usage per subscriber in North America reaching 9 GB per month. These usage levels are significantly higher than the global average, though the rate of growth is slower as the US and Canada are already mature. The usage levels rival South Korea, broadly acknowledged to be the world leader in 4G deployment and usage.

Figure 6

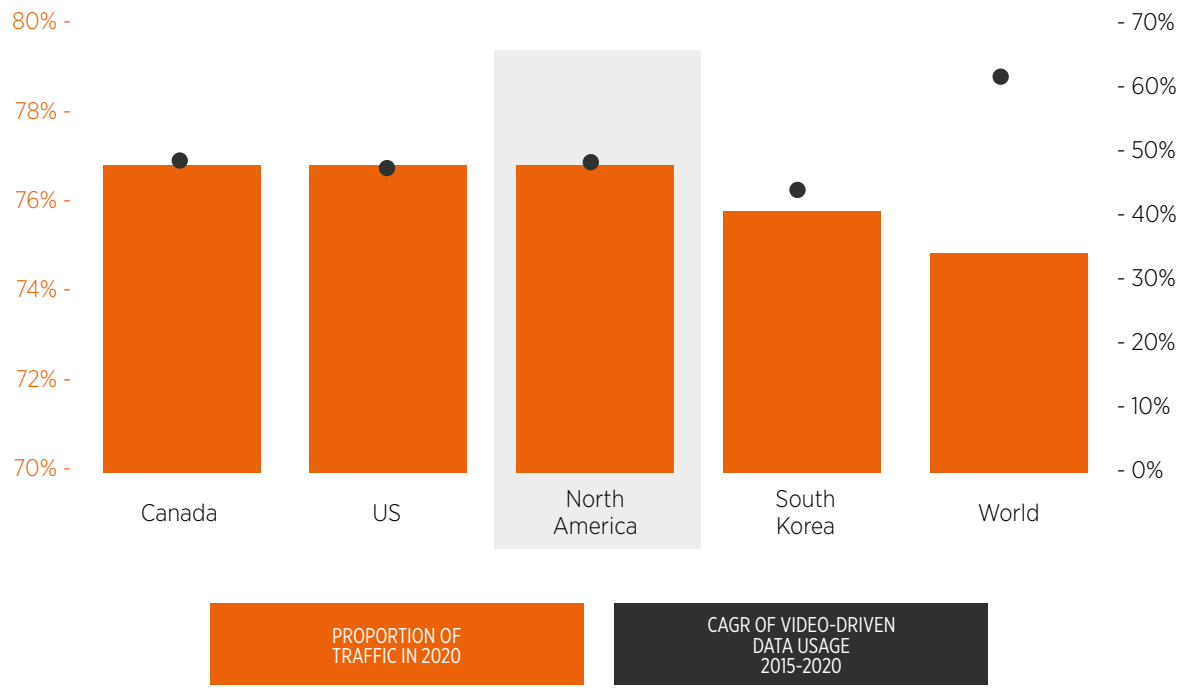
4G driving data usage growth



Source: GSMA Intelligence; Cisco

Figure 7

Video streaming enabled by 4G, rapidly growing



Source: Cisco

As in other markets around the world, the data growth is being driven largely by video streaming. The four largest US mobile operators are attempting to monetise video, and data more broadly, in a variety of ways. T-Mobile, for example, introduced its "Binge On" programme whereby a user can watch for free any video that meets T-Mobile's technical standards; as of June 2016, there were more than 100 video services included. Although videos are streamed at a lower quality, the data usage does not count towards the customer's data allowance, which some have claimed may violate net neutrality principles.

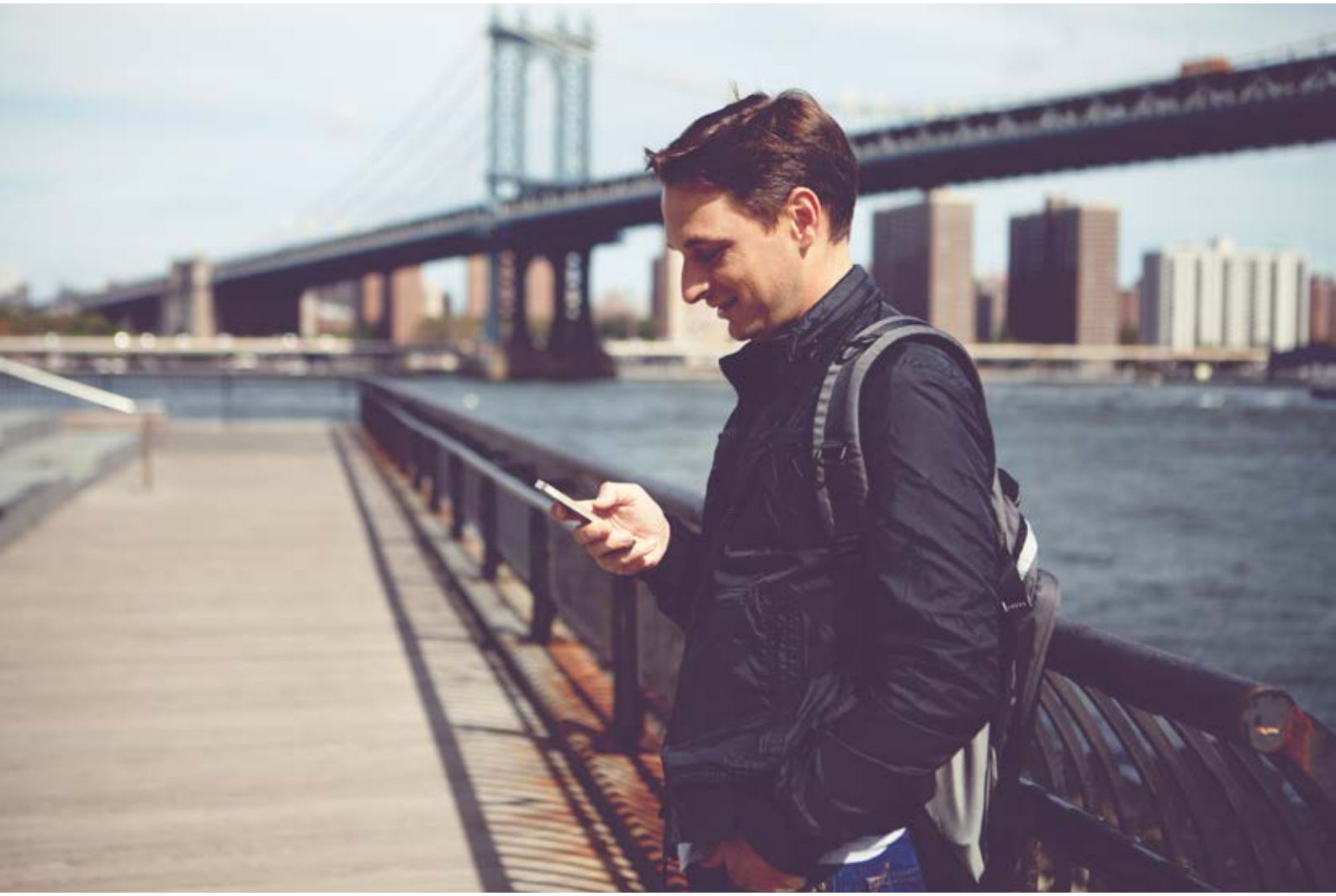
AT&T acquired satellite broadcaster DirecTV in 2015, which brought the company an extensive content library, including live NFL broadcast rights. Its mobile strategy with regards to DirecTV so far has largely involved bundling mobile plans with broadband and TV. However, from the fourth quarter of 2016, AT&T will offer three streaming options for DirecTV content, building on its purchase of the satellite broadcaster. These will include a slimmed down, ad-supported free offering available over fixed or mobile broadband as well as an affordable, mobile-first offering open to subscribers of any network.

To date, Verizon has made the most extensive moves to monetise the growth in video. It has developed, mostly organically, a mobile-only, millennial-focused video offering called Go90. While it is still early days and little in terms of financial or operational results is available, the offering has several goals. By targeting millennials – the least likely to have a fixed broadband or pay-TV package – it is attracting users to its network. Go90 is a free, ad-supported mobile app, open to subscribers of any network. As well as data traffic, the platform aims to attract advertising revenues on the back of the youthful demographic in the user base.

Verizon created content for the service by partnering with a range of content providers, including Sony Music, AwesomenessTV and Vice Media, as well as the National Football League and National Basketball Association for sporting events. Verizon's acquisitions of AOL and, more recently, of Yahoo bring significant expertise in advertising technology and data analytics that could make Go90 a profitable proposition.

There are strong indications that US consumers are keen to watch video over mobile devices. The GSMA Intelligence Consumer Survey 2016 revealed that 32% of US adults already watch free video online every day (and 69% at least monthly) while a further 19% watch paid-for content daily (and a majority do at least once monthly). In other words, a majority overall are already watching video content on their devices on a daily basis. Demographic changes and improving network and device quality are likely to increase these rates even further. In the 18-34 age ranges, more than 90% watch free video daily and more than 70% watch paid-for content.

Beyond the pure financial implications of these propositions, mobile operators in the region are intent on remaining relevant in consumers' lives, rather than just a means of connectivity. They may be able to stay relevant by curating unique and exclusive content that can only be accessed with their apps and over their networks.



1.4 Auction of 600 MHz spectrum continues

The relatively complicated 600 MHz spectrum auction, which began in March 2016, is ongoing. In the first phase, a reverse auction took place whereby broadcasters indicated at what price they would be willing to part with the spectrum. This yielded a reserve price of $88.4 billion. Having failed to reach this target in the first round of bidding, the auction has now entered stage two. The FCC has reduced the initial 126 MHz of spectrum on offer to 114 MHz, with another reverse auction now set to derive a new reserve price before the operators then resume bidding.

Expectations as reported widely in the press going into the auction were that bidding would total between $30 billion and $40 billion, far less than the broadcasters wanted for the full 126 MHz, particularly given the enormous sums operators have spent on spectrum in recent years. Operators may also be less keen on bidding heavily at this time, saving financial firepower for other investments. Given the gap between broadcasters' and operators' valuations of the spectrum, it is possible that the auction will not end before 2017.

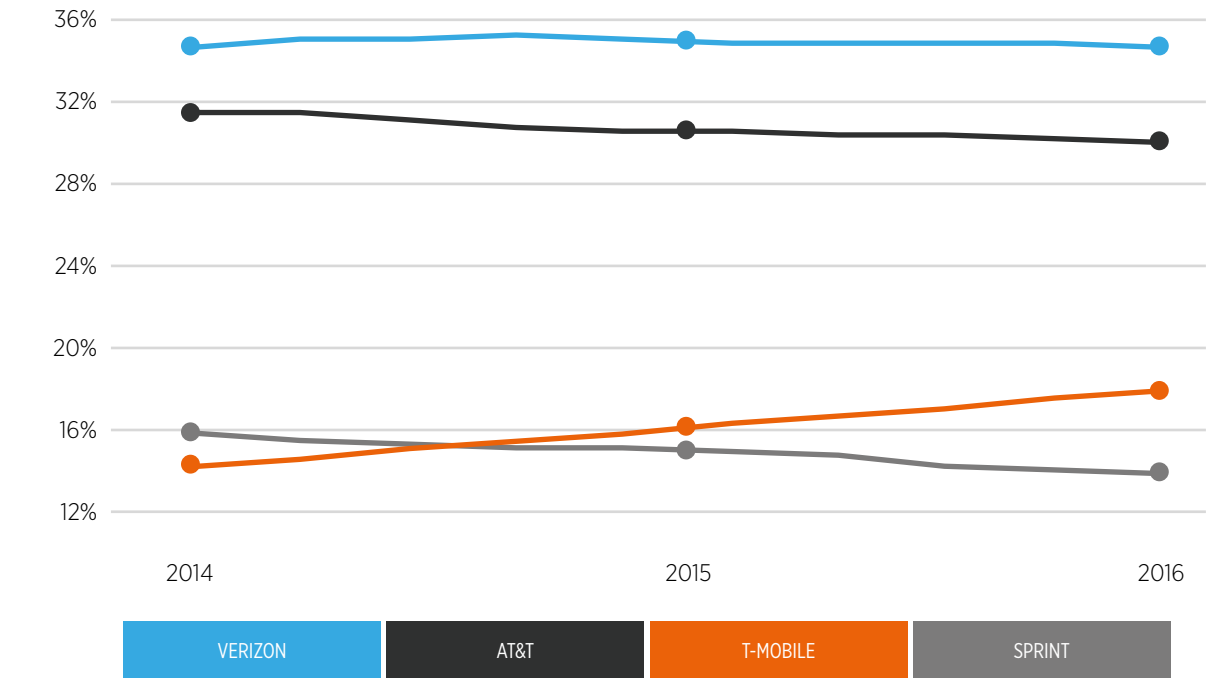
1.5 Competition remains intense, with re-introduction of unlimited data plans

The four major operators in the US, which account for 97% of connections, are engaged in intense competition following the failure of consolidation moves in recent years. However, one operator in particular – T-Mobile – has for several years been the most aggressive competitor, and its actions appear to have worked; it has not only gained subscriber market share but its EBITDA margins have improved too. Of the other three operators, T-Mobile has gained the most share from Sprint. In the past year, T-Mobile has gained 1.5 percentage points of market share and more than 3 percentage points over two years.

In contrast, market shares in Canada are virtually unchanged over the past year.

Figure 8

Market share of connections in US (excluding M2M)



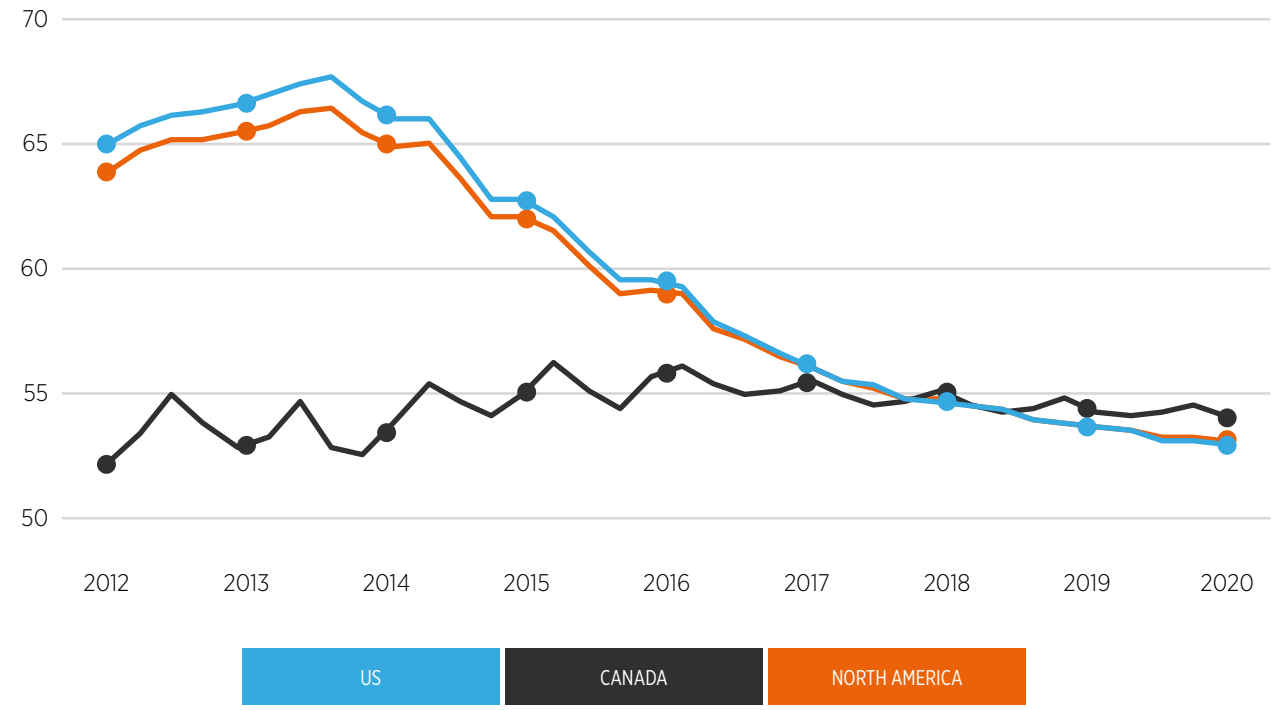
Source: GSMA Intelligence

ARPU levels have been affected among all operators, with service ARPU down 7.6% in the 12 months to March, and T-Mobile's, as the most aggressive competitor, down by more than 11%. However, operators are increasingly focusing on average billings per customer, including device instalment payments. On this basis, ARPU levels look much healthier. For example, including device billings, ARPU for Verizon is up 2.6% year-on-year rather than down 8.9% on service revenues alone.

Figure 9

Service ARPU per subscriber

$ per unique subscriber per month



Source: GSMA Intelligence

As in the past, there is a clear division among the top four US operators. Verizon and AT&T are in the lead on all metrics – market share, ARPU, revenues and margins – and do not attempt to compete directly with Sprint or T-Mobile on price but rather quality of service and reputation. Going forward they are looking to remain competitive and relevant on the basis of content and other value-added services.

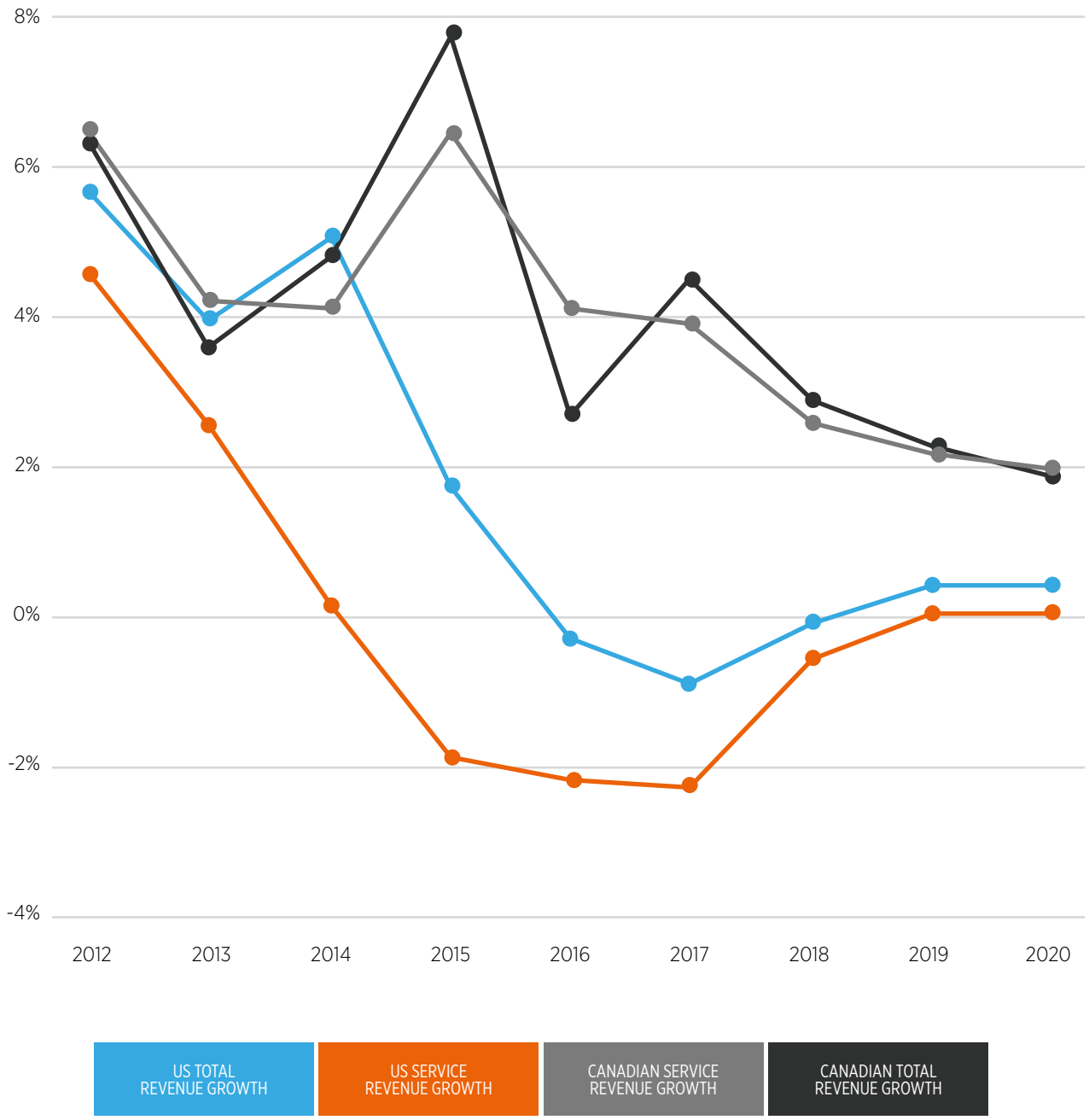
Recent events bear this out; in August, T-Mobile offered an unlimited data plan for $70 per month while Sprint countered with a $60 offer. AT&T only offers an unlimited mobile data plan to subscribers of its broadband and TV service, and zero rates DirecTV's Everywhere app to pay-TV subs, while Verizon does not offer any unlimited plans but will allow subscribers who go over their allowances to continue to browse with no additional cost but at throttled speeds. Indeed, the most recent price moves by AT&T and Verizon have been to increase monthly subscription fees but also increase the data allowance, providing similar value to customers while protecting ARPU.

Given the moves by all operators to reduce or eliminate handset subsidies and bill customers separately for their mobile service and handset instalment, over time total revenues and service revenues will converge. US mobile revenues have turned slightly negative given the market's maturity, intense price competition (particularly between Sprint and T-Mobile) and already high ARPU levels. Canada, however, as a much less mature market, will continue to see modest revenue growth for the rest of the decade.

Figure 10

Revenue growth

Year-on-year change



Source: GSMA Intelligence

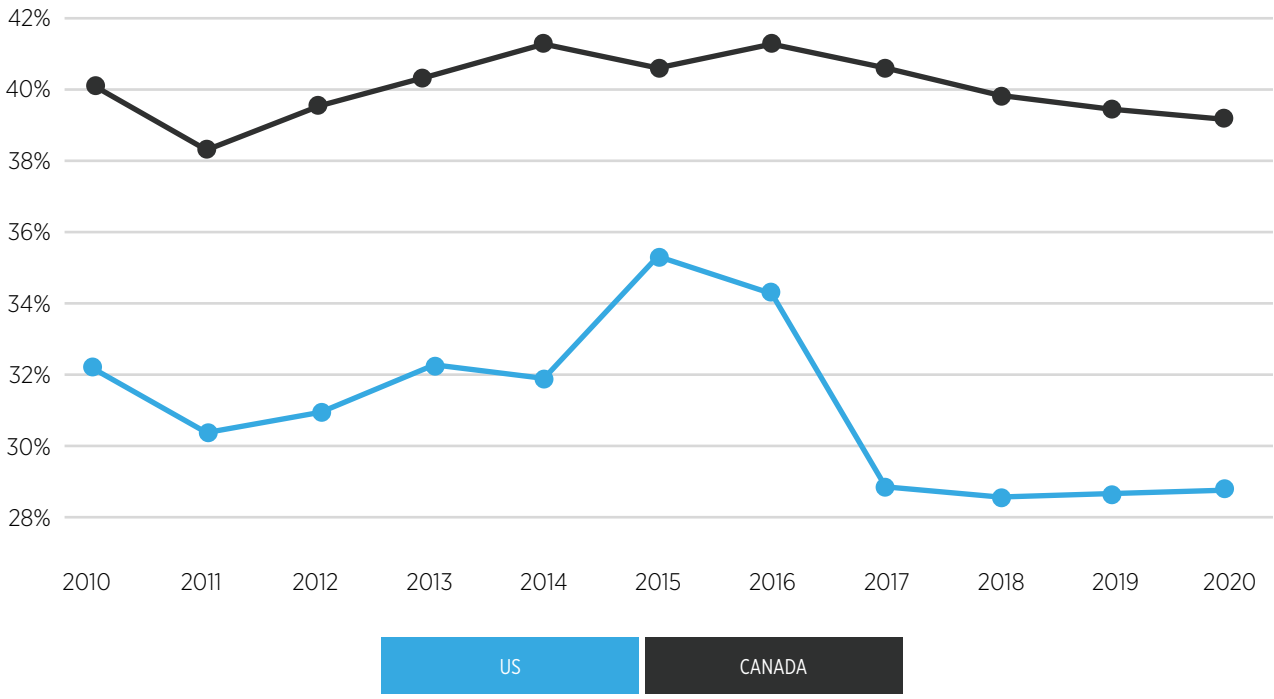
1.6 Profitability improvement across the board, despite competitive dynamics

This disparity is also reflected in EBITDA margins, where the top two operators – AT&T and Verizon – maintain margins of 35-45%. However, T-Mobile's market share gains and Sprint's cost control efforts have allowed their margins to rise, exceeding 30% in some quarters. It is worth noting that the sharp rise in margins across the US sector in 2015 and 2016 is principally due to accounting differences between handset subsidies, which are being phased out, and equipment instalment plans which produce a temporary, positive variation in margins while the new payment methods are being phased in. Ultimately once subsidies are nearly fully eliminated, the effect will revert to normal.

Again, in contrast to the US market, there is little variation at all in EBITDA margins in Canada; all three major operators report EBITDA margins within about one percentage point of one another quarter after quarter.

Figure 11

EBITDA margins



Source: GSMA Intelligence

1.7 Heavy investment in spectrum and 4G rollout allows capex to plateau in advance of 5G

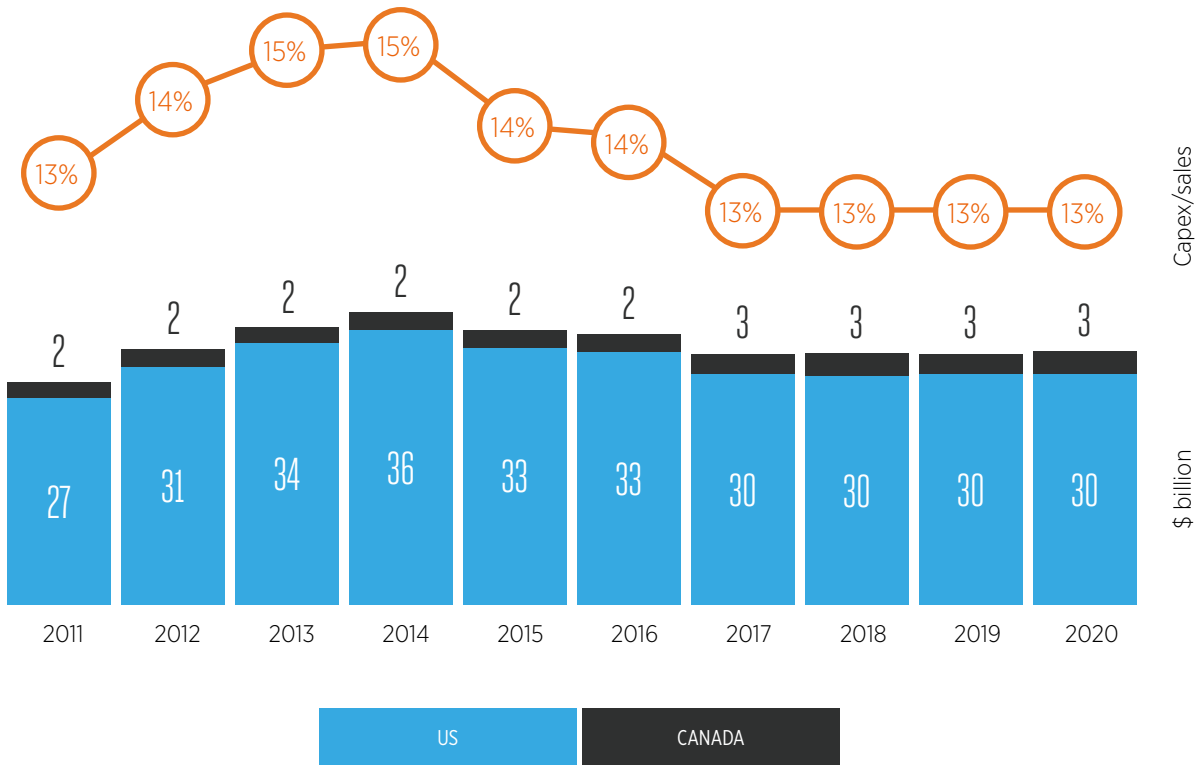
Over the past several years, operators have invested significant sums in both spectrum and network equipment, allowing them to reach the high levels of 4G coverage today. While network coverage will still need to be expanded and greater capacity will be required, along with more spectrum, capital investments over the coming years will be lower than in the peak 2013–2015 years, and significantly lower as a percentage of revenues.

Significant investment in 5G networks is not likely before 2020, though many operators have already begun trialling the technology. The nearer term focus of capex varies between operators, with T-Mobile still building out its LTE coverage using the 700 MHz spectrum, through a number of licences the company acquired over the last year. For both Verizon and AT&T, a key focus is on densifying the network through small cell deployments, as well as carrier aggregation to improve speeds.

Despite the lower investment level as a percentage of revenues, operators are still investing large sums of money in their networks. Total capex in the region is forecast at almost $170 billion over the five years to 2020. This is the largest level of investment over this period of any region with the exception of Asia Pacific, which has a vastly larger population (11 times as large) and far lower levels of coverage and capacity in most countries. Even Europe, with nearly 200 million more people, is investing about $30 billion less over the rest of the decade.

Figure 12

Capex has peaked in the current investment cycle



Source: GSMA Intelligence

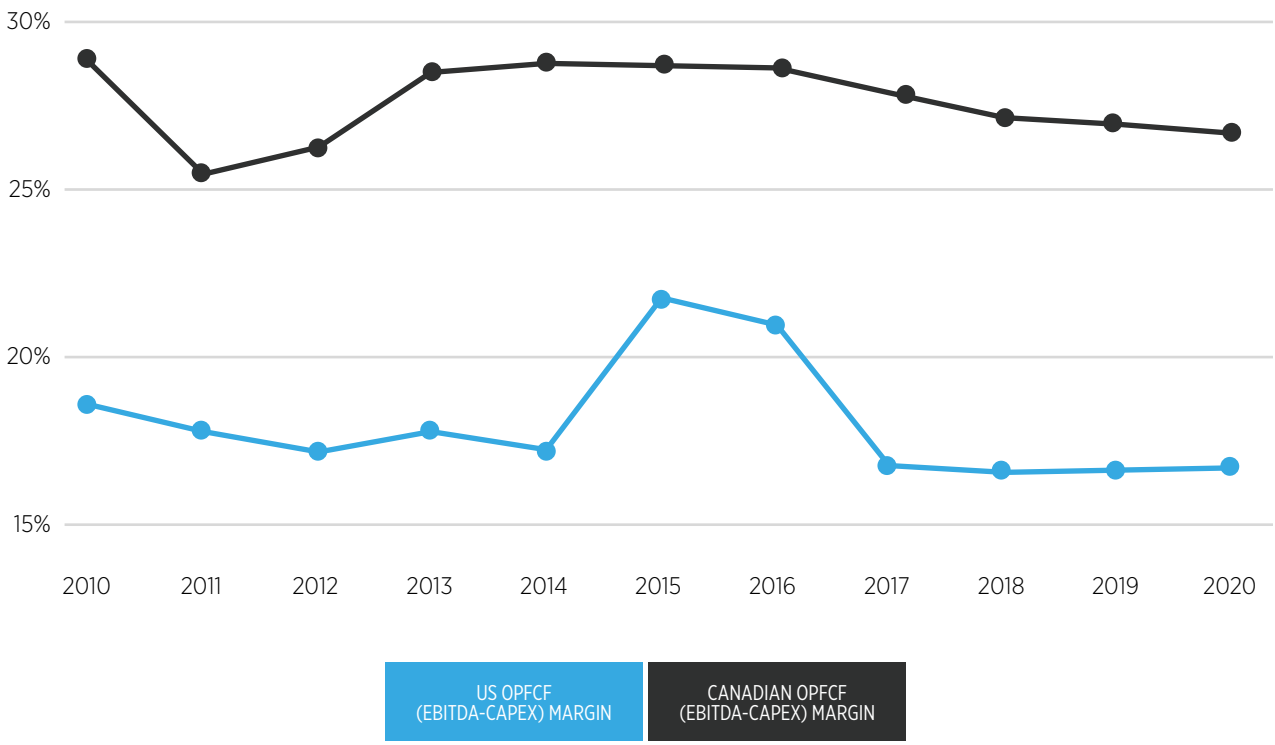
1.8 Despite competitive pressures, North American operators remain cash-generative

Although revenues are expected to fall slightly in the US and grow only slowly in Canada, the reduction of handset subsidies and other cost-saving measures allow the operators to broadly remain quite profitable and, with capex subdued for the next several years, cash-generative. Cashflow margins for North America overall are forecast to remain around 17% over the next few years. At a country level, the impact of greater competition in the US, which has four large operators, means margins are closer to 16%. In contrast, Canada (which has three main players) has higher profitability and cashflow, with cashflow margins around 25%.

The impact of greater competition in the US in comparison to Canada is clearly visible in lower profitability and cashflow. Consolidation among the top four US operators could improve their profitability and leave them with more cashflow to invest in innovation. However, previous merger attempts were blocked by regulators. Sprint's CEO Marcelo Claure recently stated that it is "not engaged in any serious discussions" with T-Mobile, but also previously claimed a tie-up between the two carriers was compelling, though unlikely under current regulation.[2]

Figure 13

North American operators remain cash generative



Source: GSMA Intelligence

2. "Sprint's Claure: 'We're not engaged in any serious discussions' with T-Mobile", Fierce Wireless, August 2016

2 Mobile contribution to economic growth and jobs

2.1 The direct economic contribution of the mobile ecosystem

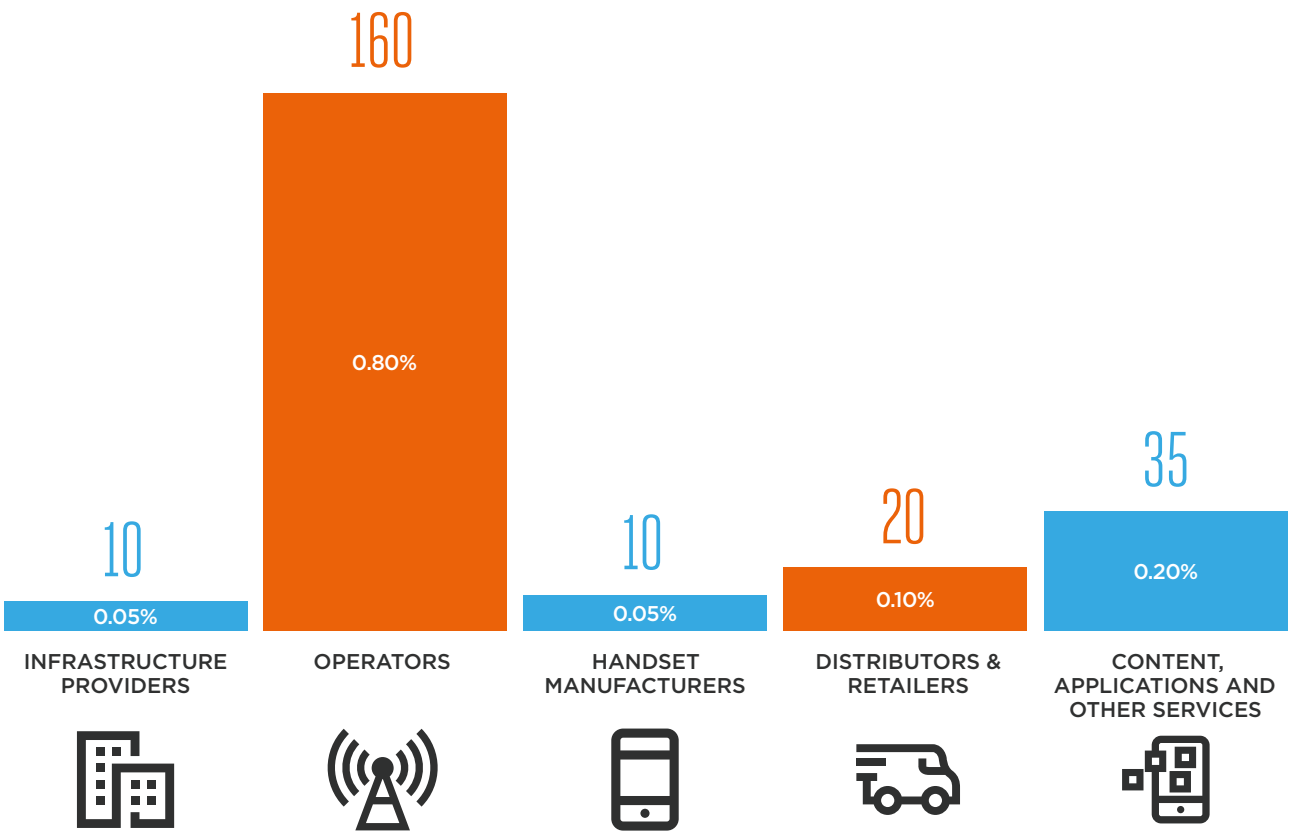
The mobile ecosystem consists of mobile network operators, infrastructure service providers, retailers and distributors of mobile products and services, handset manufacturers and mobile content, application and service providers. The direct economic contribution to GDP of these firms is estimated by measuring their value added to the economy, including employee compensation, business operating surplus and taxes.

In 2015, the total value added generated by the mobile ecosystem was around $235 billion (or 1.2% of GDP), with network operators accounting for the vast majority of this.

Figure 14

Direct GDP contribution of the mobile ecosystem

$ billion, % GDP 2015



Source: GSMA Intelligence

2.2 Indirect and productivity impacts of mobile technology

In addition to their direct economic contribution, firms in the mobile ecosystem purchase inputs from their providers in the supply chain. For example, mobile software developers require services from the broader information technology sector. Furthermore, some of the profits and earnings generated by the ecosystem are spent on other goods and services, stimulating economic activity in those sectors. In 2015, this additional economic activity generated a further $140 billion in value add (or 0.7% of GDP) in the region.

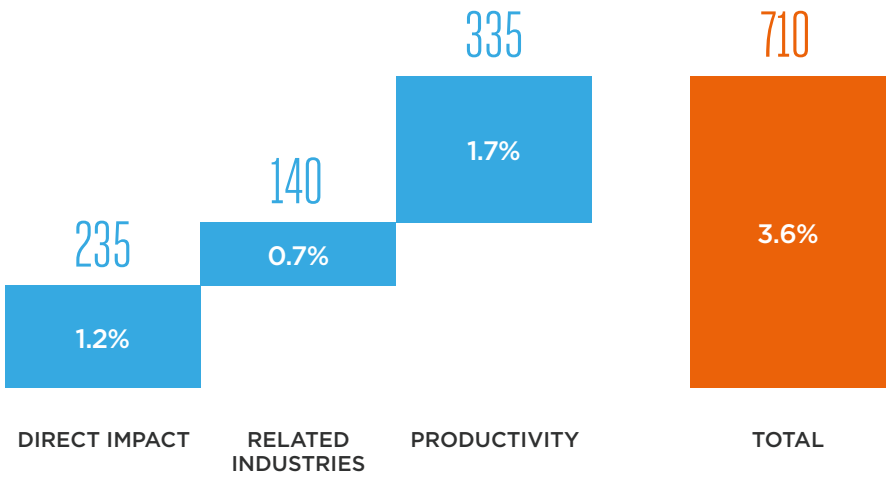
The use of mobile technology also drives improvements in productivity. There are three ways in which this takes effect. The first is through the use of basic mobile services such as voice and text, which results, for example, in reducing unproductive travel time. The second is the use of mobile internet technology, which allows workers and firms to use mobile data and internet services. Finally, the next generation of mobile services, in particular M2M and the Internet of Things, allows the digitisation of services and the improvement of industrial processes; for example, tracking real-time inventory or using intelligent energy management systems to help reduce costs. In total, we estimate that productivity impacts from mobile technology were worth around $335 billion in 2015 (or 1.7% of GDP).

Overall, taking into account the direct, indirect and productivity impacts, in 2015 the mobile industry made a total contribution of $710 billion to North America in value added terms, equivalent to 3.6% of the region's total GDP. This is slightly higher than in 2014 (3.5%), reflecting the increasing footprint of the sector in this region.

Figure 15

Total (direct, indirect and productivity) contribution to GDP

$ billion, % GDP 2015



Note: totals may not add up due to rounding
Source: GSMA Intelligence

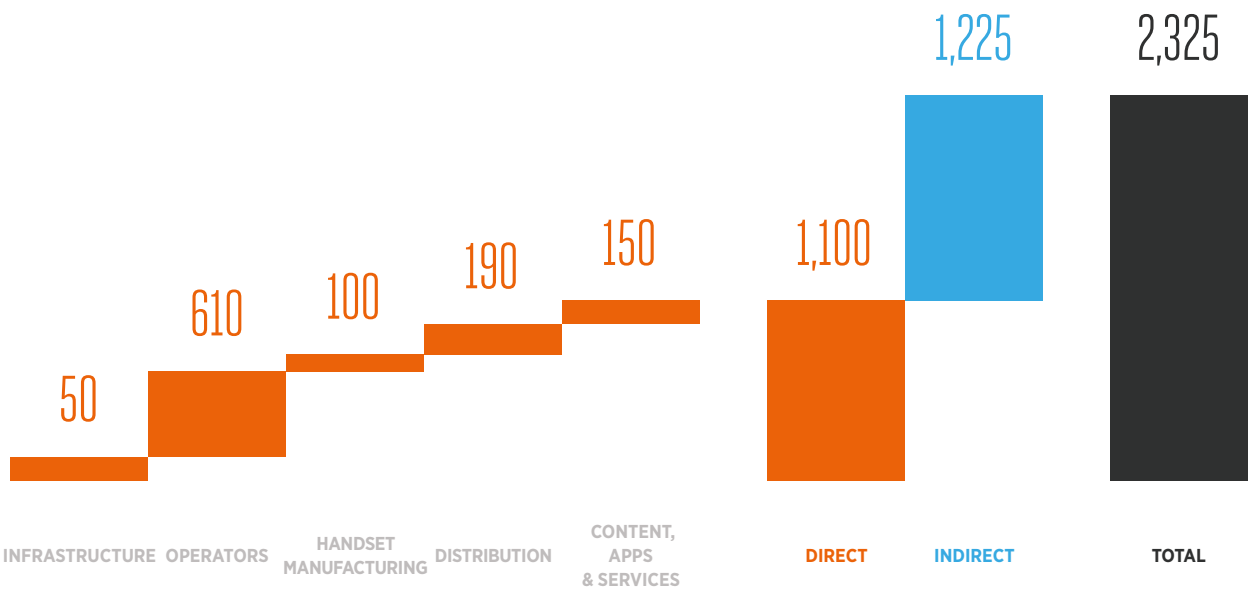
2.3 Employment and public funding contribution

In 2015 the mobile sector provided direct employment to approximately 1.1 million people in the region. As firms in other sectors provide goods and services as production inputs for the mobile ecosystem, the mobile sector indirectly generates jobs in other sectors. Furthermore, the wages, public funding contributions and profits paid by the industry are spent in other sectors, which provide additional jobs. Around 1.2 million jobs were indirectly supported in 2015, bringing the total impact (both direct and indirect) of the mobile industry to 2.3 million jobs.

Figure 16

Employment impacts

Jobs, thousands



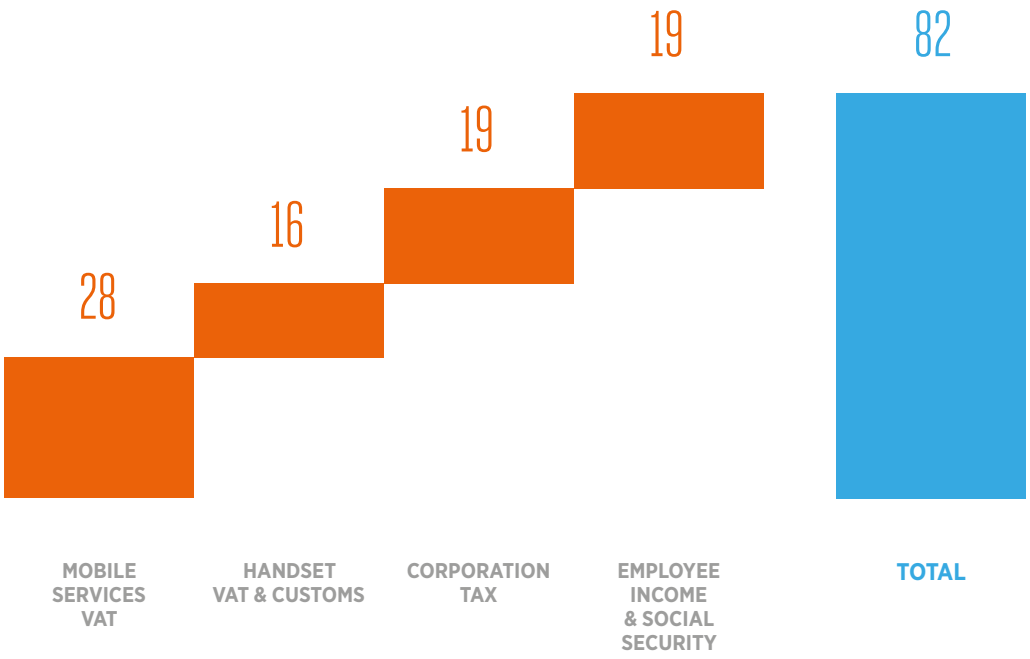
Note: totals may not add up due to rounding
Source: GSMA Intelligence analysis

The mobile ecosystem also makes a significant contribution to the funding of public sector activity in the region through general taxation in the form of sales and value added taxes, corporation tax, income tax and social security from firms and employees. We estimate that the ecosystem made a tax contribution to the public finances of the region's governments of $82 billion in 2015. In addition, $46 billion was raised through spectrum auctions in 2015 alone in the US and Canada.

Figure 17

Contribution to public funding by the mobile industry

2015, $ billion



Note: totals may not add up due to rounding
Source: GSMA Intelligence

2.4 Outlook and trends for 2015–2020

We expect the economic contribution of the mobile industry in North America to experience stronger growth than the rest of the economy. In value-added terms, we estimate that the impact by 2020 will be nearly $1 trillion, representing at that point 4.5% of GDP. The majority of this increase will be driven by improved productivity, particularly from the increasing adoption of M2M solutions.

Figure 18

Outlook to 2020

$ billion, % of GDP

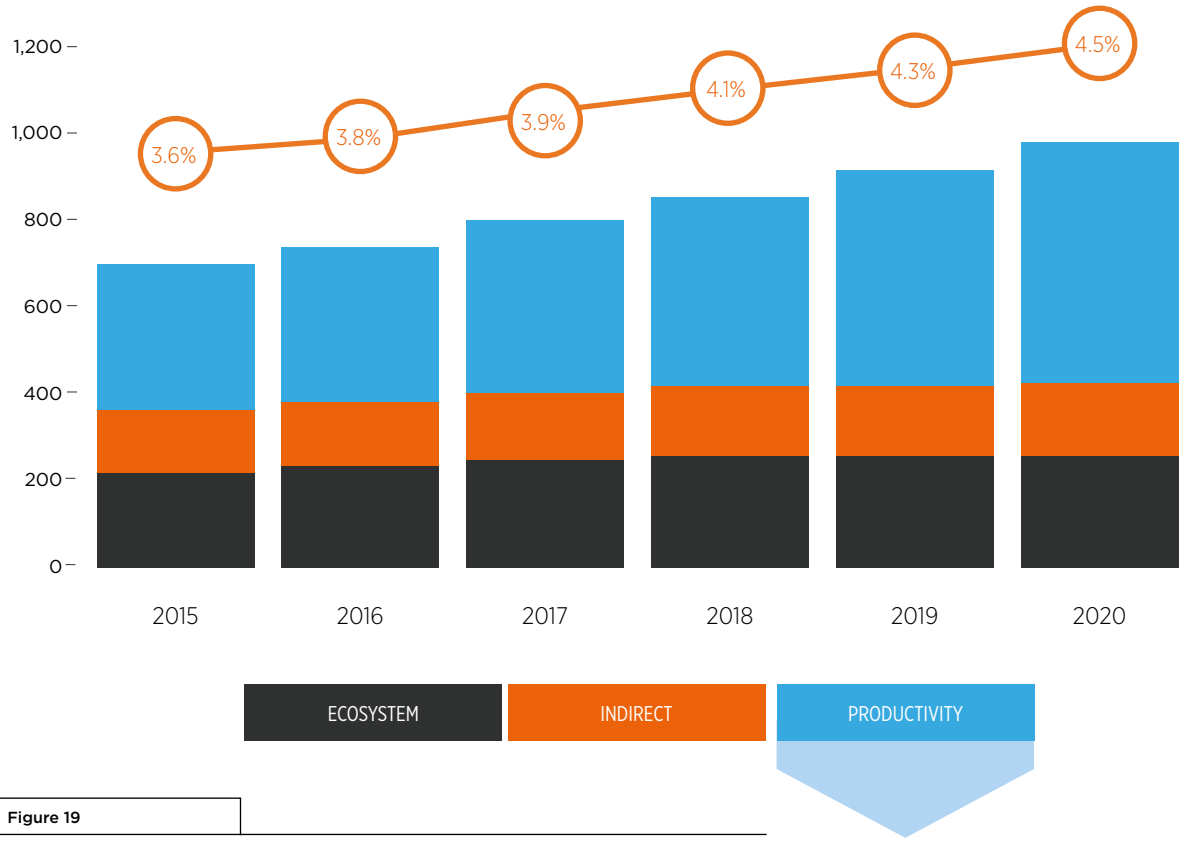
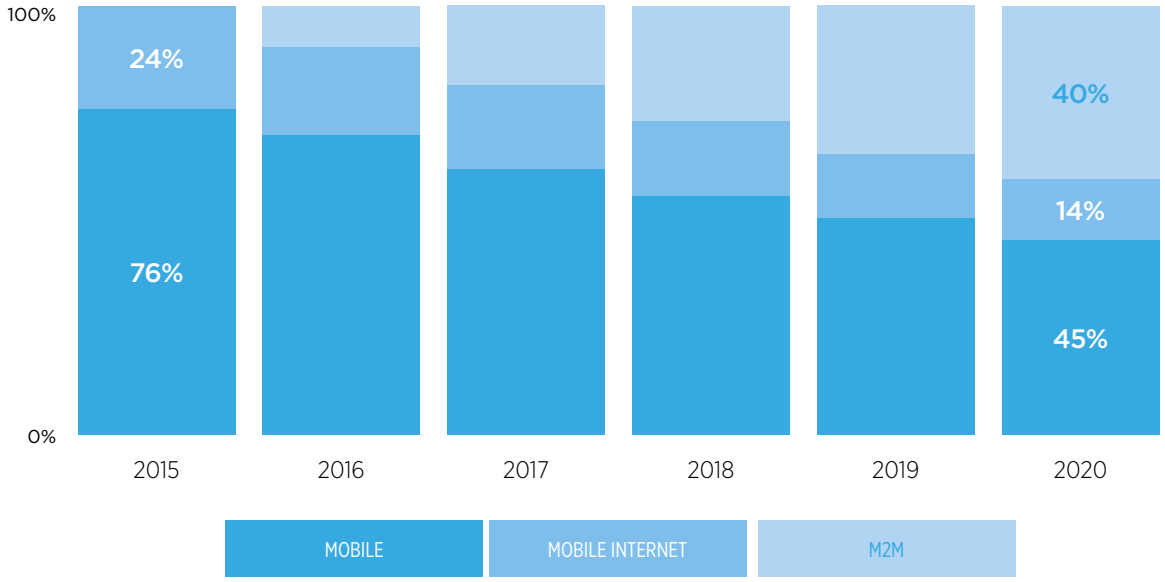


Figure 19

M2M driving productivity growth to 2020



Note: chart shows the proportion of the productivity increase generated by each mobile technology.
Source: GSMA Intelligence

3 North America leading the next wave of mobile innovation

North America continues to drive innovation and help realise the potential of the Internet of Things (IoT). Across the region cities are striving to become smart cities, while in the first quarter of 2016 the US saw the number of connected car additions pass the number of new smartphone additions. Although the first wave of IoT adoption focused on the consumer space, there is now growing traction in the enterprise market, particularly as the industry attempts to address issues around fragmentation and complexity that have hindered take-up of services.

Nearly 15% of total cellular connections in the US are already cellular M2M connections, over 50% higher than the comparable figure in Europe and one that will increase to around 30% of total cellular connections by 2020. The total number of connected devices by that date will be significantly higher, as many devices will be connected by a range of non-cellular technologies, including Wi-Fi, Bluetooth and other short-range technologies.

New low-power wide area (LPWA) networks are being deployed in North America, using both licensed and unlicensed spectrum. These networks will drive rapid growth in connected devices and allow innovative new cases and opportunities for operators and other ecosystem players. Mobile operators continue to play an active role in these developments, looking to partner with other industry players in the development of 5G standards, as well as through connecting a growing range of devices. The US is already a global leader in terms of the number of connected cars, while Qualcomm is testing drones on AT&T's network

The region is home to many of the most innovative companies in the broader mobile ecosystem, and venture-capital flows in the US into IoT continue to show healthy growth. According to CB Insights, total VC investments in North America across the telecoms and mobile sectors totalled $16.5 billion in 2015, up 41% from 2014. Regulation and government policy continue to support the development of IoT as well as efforts to agree standards and facilitate the first wave of 5G deployments.

The mobile and broader internet economy continues to evolve at a rapid pace. While smartphone growth is stalling in many developed economies, operators in North America are looking to connect a growing range of devices, from cars to drones. Companies in the region are also leading the way in realising the potential of the 'screenless' world, utilising artificial intelligence in voice-activated personal assistants and other new technologies such as virtual reality.

3.1 High levels of mobile usage and user engagement

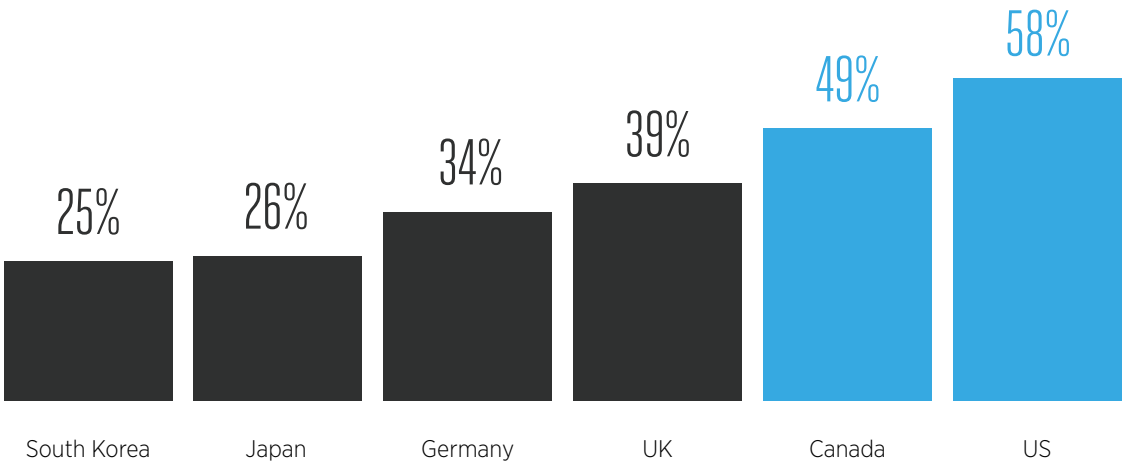
The US is also a leader in mobile usage and engagement. A majority of US adult mobile owners watch video content on their mobile devices at least daily, a figure that rises to much higher levels in younger demographics (18–34 year-olds).

Americans are also heavy users of social networking on their mobile devices, with almost 60% of adults accessing social networking sites via their mobile devices daily, according to GSMA Intelligence survey data. Nearly 50% of Canadians do likewise.

Figure 20

Daily usage of social networking on mobiles

% of adults surveyed



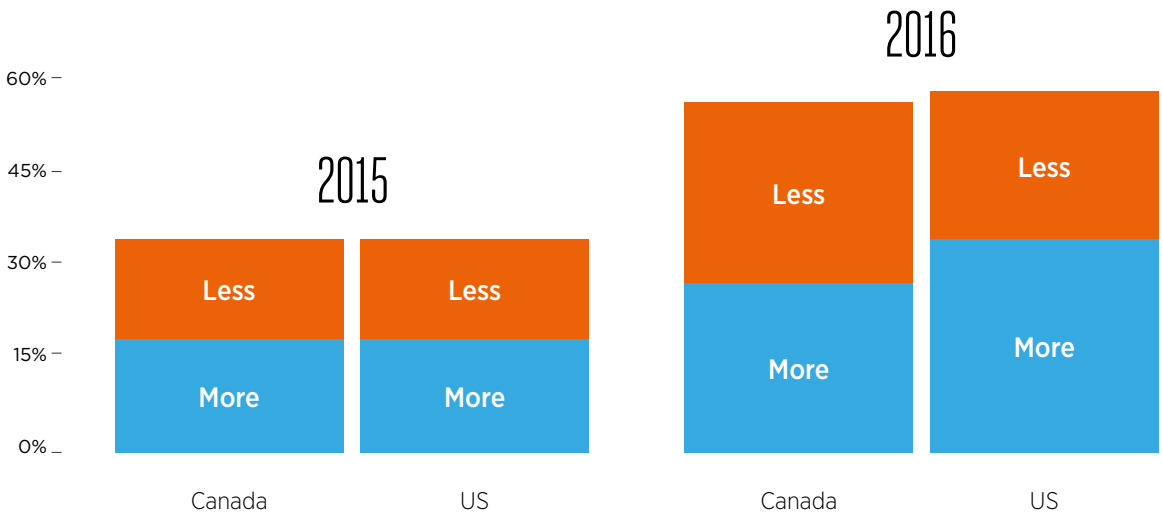
Source: GSMA Intelligence

North Americans are using IP messaging apps such as WhatsApp and Facebook Messenger more frequently. As most US mobile contracts include unlimited text messaging, there is less financial incentive to use these services as there is in other countries (other than for international messaging). Nevertheless, network effects and the richness of the features of some of the apps have seen their popularity rise, particularly in the past year. In 2015, in both Canada and the US, most survey respondents (66%) said they never used the apps, while a clear majority in both countries now do (56% and 58% in Canada and the US, respectively).

Figure 21

IP messaging app usage is on the rise

IP messaging app usage vs SMS



Source: GSMA Intelligence

3.2 Realising the potential of the Internet of Things

3.2.1 LPWA and other new network technologies

LPWA networks are being developed to support IoT services and offer a range of advantages. LPWA networks are designed for M2M applications with low data transmission levels that require long battery lives and that operate unattended for long periods of time. Some of the early LPWA network deployments in North America used unlicensed spectrum, including Ingenu, Sigfox and LoRa. Sigfox plans to cover 100 US cities by the end of 2016, while Senet (which uses LoRa) claims to already cover 100 cities across both the US and Canada, and will then double this number in 2017.

New opportunities for operators are emerging from 3GPP-approved LPWA standards in 3GPP Release 13 (Q2 2016) in licensed spectrum using their existing LTE or GPRS networks. These standards cover LTE Machine-Type Communication (LTE-M), Extended Coverage GSM IoT (EC-GSM-IoT) and Narrowband IoT (NB-IoT). Both LTE-M and NB-IoT run on LTE networks, while EC-GSM runs on 2G. The global addressable market for LPWA applications is large, totalling around 1.4 billion connections by 2020, with some industry watchers forecasting 5 billion by 2022.

Operators in North America are now beginning to deploy networks and services using these new LPWA standards, with a focus on using their existing LTE network infrastructure. For example, Verizon plans to launch an LTE-M network in Q4 2016. The company believes it will make its LTE network roughly as affordable as other networks such as Zigbee and Z-Wave for IoT connections. These modules use less bandwidth and have capped data speeds, with the modules themselves expected to be priced below $10.

Similarly, AT&T plans to use LTE-M for IoT applications such as wearables and smart metering. For other applications that are even lower power, the company will look to use NB-IoT modules in units such as smoke detectors and networked monitors. These modules will be tested on the network in 2016, with the goal of commercial deployment in 2017. T-Mobile has agreements in place to supply LTE MTC based on previous release (LTE Cat 1) modules as a starting point on its network as part of its IoT offering.

These developments should significantly improve the economics of IoT for use cases such as smart energy meters, industrial IoT sensors, asset trackers, smart city controllers and consumer wearables. The current developments in IoT networks are closely linked to future developments in 5G, with the goal for 5G networks to be more agile and capable of adapting to a variety of use cases and data speeds.

3.2.2 The road to 5G: US vying with Asia for leadership

Operators from across the world are looking to drive the development of 5G mobile technologies, with the leading players coming from North America, Europe and Asia. In Asia, South Korea, Japan and China are playing an active role. Asia and North America are competing for leadership in 5G, in a similar way to how Europe pioneered 3G and North America led 4G. However, 5G as a concept remains relatively broad, with no formal standards as yet agreed and differing approaches adopted by leading players.

Operators in the US, with the support of regulators, are actively involved in the development of 5G. The FCC voted in mid-July on rules to identify and open up spectrum for 5G networks, potentially making the US the first country to do so. The rules aim to balance different spectrum access approaches, including exclusive use licensing, shared access, and unlicensed access, to meet different needs and use cases. The Commission also adopted a number of flexible service and technical rules to allow new technologies and innovations to evolve and develop without the challenge of overly prescriptive regulations.

FCC Chairman Tom Wheeler highlighted the US approach of making the spectrum available and then letting the market lead on standard setting, in contrast to the consultations and government-led initiatives underway in other regions: "Rule number one is that the technology should drive the policy rather than the policy drive the technology."

Verizon has been among the most vocal of the North American operators, claiming in July 2016 that it had become the first US carrier to complete the radio specification for 5G. Verizon's 5G Technology Forum, which was established in 2015, comprises Verizon Wireless, Alcatel-Lucent, Cisco, Ericsson, Nokia, Qualcomm and Samsung. The company is already undertaking pre-commercial trails and has been delivering speeds of over 1 Gbps over distances of up to 500 yards. The company is targeting a commercial launch in late 2017 or early 2018, which would be well in advance of the expected 3GPP specification for 5G being finalised (expected in 2018–19).

However, Verizon is in the first instance focusing on developing 5G as a fixed wireless solution, as a cheaper alternative to fibre deployments. The operator has been testing on the 28 GHz millimetre wave (mmWave) bands, with the 37 GHz and 39 GHz bands next in line. There will need to be further work to adapt the solution for mobile use cases.

AT&T is following a similar strategy to Verizon and is currently undertaking field trails. It has also made it clear that for the next two to three years the use case will be as a fixed wireless solution. The company has announced discussions with a range of operators and equipment vendors with the goal of enabling faster deployments of 5G mobile networks once the 3GPP specifications are released.

T-Mobile, as a pure wireless operator, has less need to focus on the fixed wireless use case for 5G. It has started testing 5G technologies in four locations across the US, with this test phase expected to last around two years. The company stated it expects it to be 2020 at the earliest before consumers begin to see the benefits of 5G in smartphones and other cellular applications.

The US government has announced an initiative to help the development of next-generation networks – the Advanced Wireless Research Initiative (AWRI). This is led by the National Science Foundation, with support from both the domestic operators and other industry players. AWRI will receive $400 million from the government over the next seven years to develop and test new wireless networking technology in four "city-scale" testing platforms (likely to be built in 2017).

Many of the current developments represent the first phase of the technology, covering Release 15 specifications of the 3GPP standards group and spectrum bands below 6 GHz. However, these are unlikely to be transformative to the industry, or (in the case of Verizon and AT&T) true mobile solutions. The second phase of 5G developments is expected to focus on the higher frequency spectrum bands (above 24 GHz) and offer a broader range of performance enhancements. This could include areas such as ultra-scalable IoT and reliable low-latency services.

3.2.3 Connected and autonomous cars

The growth of connected cars in the US is accelerating. In the first half of 2016, the number of connected car additions passed the number of new smartphone additions. AT&T remains the largest player with around 9.4 million cars already connected at the end of June 2016. Just under 10% of cars in the US now offer embedded connectivity, with forecasts from Statista suggesting that this figure will be close to 20% by 2020; including smartphone tethering, a majority of vehicles on the road in the US are already connected.

There have been a number of developments and new announcements from operators:

- AT&T announced in January 2016 a deal with Ford to supply the connectivity for the auto company's SYNC Connect service, an LTE module used to access a range of features including remote locking and starting, as well as supplying a range of performance data on the vehicle. AT&T now has deals in place with several leading auto manufacturers to provide connectivity.
- Verizon has been expanding its activities in the connected car market, having recently acquired Telogis and Fleetmatics, suggesting a greater focus on the enterprise market. Telogis develops telematics and fleet-logistics solutions, with major customers including both Ford and GM. Fleetmatics is a more recent and larger acquisition, totalling $2.4 billion. The company offers GPS-vehicle tracking services, allowing Verizon to expand its presence in the commercial fleet management business.

Although the number of connected cars in North America continues to show strong growth, of particular note over the last year has been progress in the driverless car market. Players from across the technology and auto industries are advancing the development of autonomous/self-driving cars in North America, including Alphabet, Uber, Lyft/General Motors (GM) and reportedly Apple, while electric-car manufacturer Tesla has introduced autonomous features in its cars. Uber has recently launched its first autonomous vehicles in Pittsburgh, though the vehicles will be supervised by a human in the driver's seat.

The industry has been engaging with regulators on the issue of autonomous vehicles, with the Department of Transportation recently issuing the first official guidelines for the industry. These covered four main areas: a voluntary 15-point safety standard for the design and development of autonomous vehicles; a call for states to devise uniform policies for driverless cars; a clarification of how current regulations can be applied to driverless cars; and an acknowledgement that the door is open to new regulations on the technology.

There are further shifts underway in the auto industry that may spur even greater disruption in the future, particularly the move away from the internal combustion engines towards electric vehicles. The value in connected cars will increasingly be concentrated in software and applications over the hardware, and electric vehicles have the potential to accelerate this trend as they are mechanically much less complex, with a reduction in moving parts of up to 50%, easing the entry of new players. The connected car will have a vertical hardware stack closely integrated with a horizontal software stack. To dominate the market, a player would need to decide where their niche lies within the solution matrix.

Both Apple and Alphabet (Google) are active in these areas. Their existing apps, CarPlay and Android Auto, presently function essentially as entertainment and information consoles and a safer way for drivers to interact with their phones while driving. While Alphabet and Apple would like there to be a two-way flow of data between the car's systems and their own, automakers currently restrict them to very basic data, explicitly preventing any potentially valuable data about the cars or their drivers and passengers flowing to the tech giants. The OS leaders would also like to make the car a fully-fledged platform in its own right, rather than interfacing with a smartphone via a cable or dock and the relevant app, as is presently the case.

Alphabet has said, by way of example, that if Android Auto could detect that your car is developing engine trouble, Google Now could book a mechanic and plan your journey there. However, with value shifting from mechanics to software and services, automakers see this as an existential threat and have blocked Alphabet and Apple from obtaining much data that is of any use. But with Alphabet openly working on and road-testing an autonomous electric vehicle, and Apple widely rumoured to be working on one too, allowing the mobile OS duopoly further inside their vehicles or forming some form of partnership may be the least bad option for the automakers.

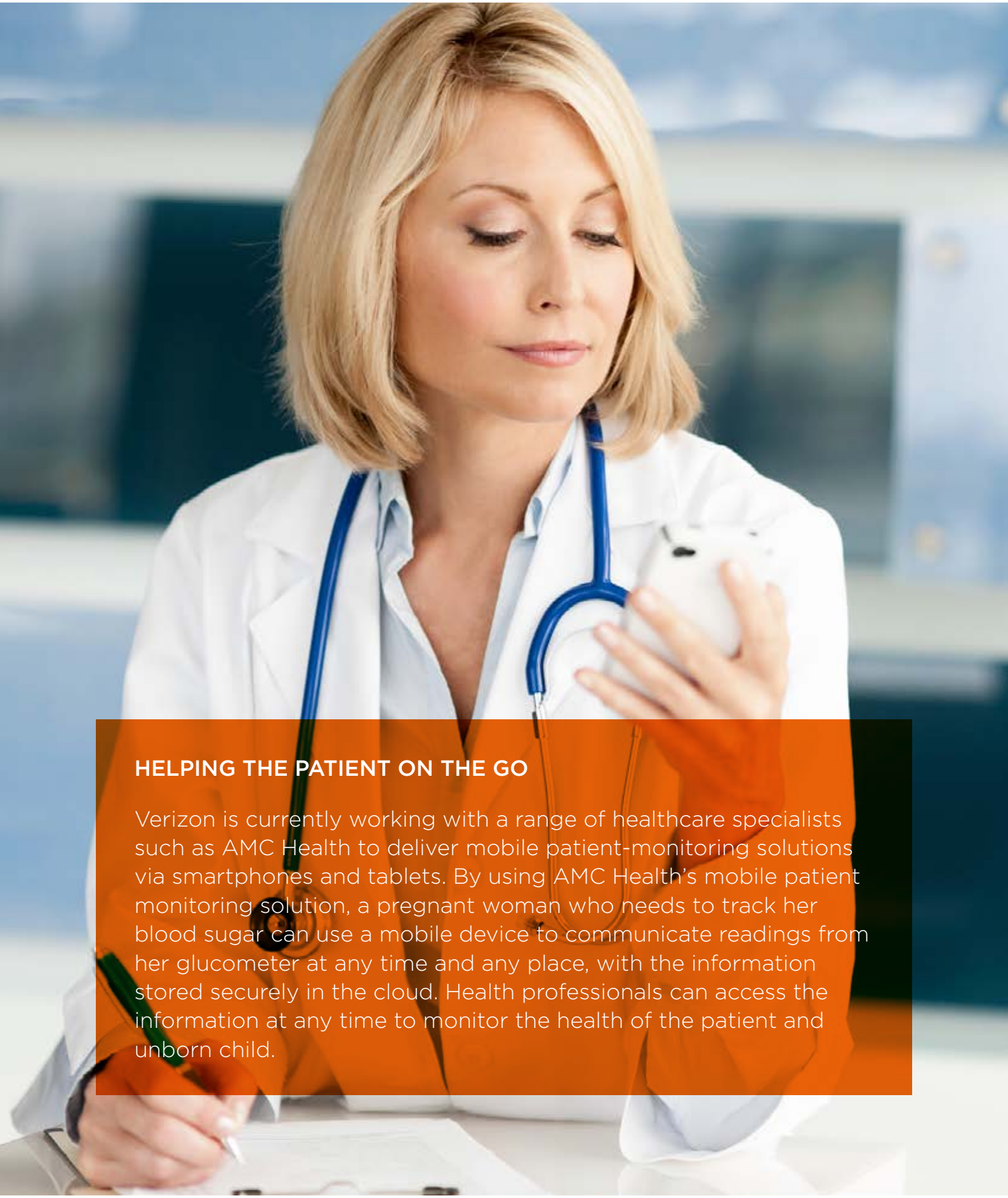
Beyond the OS duopoly, there are a broad range of new startups vying to unbundle increasingly softwarised cars; most are working on discrete areas such as navigation, tyres and batteries. None have broken out to become household names yet, but they are catching the attention of automakers. GM's purchase of Cruise Automation for a reported $1 billion+ is a high-profile example.

3.2.4 IoT and healthcare

One area where IoT and mobile ventures are already making a difference is healthcare, one of the largest sectors of the US economy and one where rising costs are an issue for individuals and healthcare providers. Some recent early-stage ventures that have received venture-capital funding include:

- Glooko, a diabetes management solution that enables clinicians to remotely access patients' blood glucose readings and related data by allowing people with diabetes to download glucose readings to their smartphone.
- Elemeno Health, a mobile app that compiles best practices for hospitals into a checklist tool, ensuring that caregivers eliminate errors and check-off every step of care.
- Moving Analytics, which enables hospitals to implement technology-enabled cardiac rehab programmes patients can do at home. The company's cardiac rehab programme includes a mobile application for patients and implementation support.

Mobile operators are also active in this space and beginning to deploy solutions and services. Verizon recently launched a new service, Verizon Intelligent Track and Trace. The service uses the company's 'ThingSpace' IoT platform to create a comprehensive approach to monitor and trace pharmaceutical products moving through the supply chain from manufacturing facility to pharmacy, clinic or hospital. The service aims to address key industry challenges, such as theft, channel diversion, counterfeiting and product safety.



HELPING THE PATIENT ON THE GO

Verizon is currently working with a range of healthcare specialists such as AMC Health to deliver mobile patient-monitoring solutions via smartphones and tablets. By using AMC Health's mobile patient monitoring solution, a pregnant woman who needs to track her blood sugar can use a mobile device to communicate readings from her glucometer at any time and any place, with the information stored securely in the cloud. Health professionals can access the information at any time to monitor the health of the patient and unborn child.

3.2.5 Smart cities

Operators, government bodies and a range of other players are collaborating to deploy new services to help realise the potential of smart cities in North America. AT&T has developed its Smart Cities Framework around three pillars, which it has developed through strategic partnerships:

- Connectivity; AT&T utilises its extensive connectivity in bidding for contracts, including fixed broadband, LTE, Wi-Fi, and also satellite connectivity that it acquired with the DirecTV deal and which could be useful in a disaster recovery situation where terrestrial communications are knocked out.
- Platforms, such as security and cloud computing.
- Five solutions ranging from lighting and parking to safety and building management.

In general, most cities contract for between three and five solutions, although AT&T is helping them to take a more holistic approach and realise the synergistic benefits of more solutions. Major cities and metro areas that AT&T has signed include Atlanta, Chicago, Dallas, Miami-Dade County and the university town of Chapel Hill, North Carolina. AT&T sees the greatest opportunity going forward in tier-two/three cities, where the needs are the same except on a smaller scale but the in-house expertise is often lacking.

The US Department of Transportation in June 2016 announced that it had chosen Columbus, Ohio as the first winner of its Smart City Challenge. The department has pledged up to $40 million to the city to help it define what it means to be a smart city and become the country's first city to fully integrate innovative technologies – self-driving cars, connected vehicles, and smart sensors – into the transportation network.

Verizon is also looking to expand its activities in the smart city space. The company recently acquired Sensity Systems. Its Internet of Things platform allows users to embed networking technology within new LED lights and deploy smart city applications to deliver great energy efficiency as well as help in areas such as public safety, parking management and location analytics. The acquisition will complement Verizon's existing solutions that cover areas such as traffic management, parking and security.

3.2.6 Industrial IoT: growing momentum

There is growing momentum in North America behind developing the potential of the industrial internet. This refers to connecting objects in the industrial context and promises new economic growth by reinventing key industry sectors. It is related to the concept of Industry 4.0 (or Industrie 4.0), which enables business model innovation in manufacturing by combining advanced robotics, AI, sensors, cloud computing, IoT, 3D printing, data analytics, platforms and connected devices to increase productivity. IDC has forecast that US companies will invest more than $232 billion in IoT hardware, software, services and connectivity in 2016 – a figure expected to reach more than $357 billion in 2019.

Connectivity will be a key driver of the future development of the industrial IoT, where the growing range of LPWA networks will help provide low-cost connectivity to the growing number of sensors, devices and machines that need to be connected. The greatest value will lie in the analytics that uses the data generated to realise efficiency improvements and cost reductions. The 3GPP-approved LPWA standards in licensed spectrum now being deployed by operators across the region, complemented by a range of other wireless technologies, will play a key role in these developments.

AT&T was a founder member of the Industrial Internet Consortium in 2014, along with the likes of Cisco, GE, IBM and Intel. The consortium's goal is to accelerate the development of the industrial IoT ecosystem. There are now more than 200 member companies, and the consortium is collaborating with Platform Industrie 4.0. The latter has been coordinating the shaping of the Industrie 4.0-driven digital structural shift of German industry. The organisation has also set up a number of testbeds using IoT in manufacturing, smart electric grids, smart city and preventative maintenance systems.

3.3 Advancing the development of artificial intelligence

North America played a leading role in the development of mobile commerce and social platforms, and similarly has been a driver of innovation in emerging technologies such as blockchain and the potential disruptive power of fintech. Artificial intelligence (AI) and its application in areas such as chatbots and smart personal assistants is increasingly the new focus area, and again the region is home to much of the innovation.

Data from Pitchbook shows that VC funding in US-based AI start-ups increased by 183% to reach almost $1 billion in 2014, with a slight decline to $842 million in 2015. Although AI is not a new concept, progress in related areas such as computer power and data analytics has allowed the current rapid development in AI and its use cases.

The development of AI is being led by a mixture of new start-ups, established players from the new internet ecosystem (Twitter, Apple, Google, Amazon and Facebook) and more established IT players such as Microsoft and IBM. Google has been particularly active with nine major acquisitions over the last three years, but other companies are also investing heavily in this area.

The initial focus of use cases for AI has been on virtual agents and chatbots (computer programs designed to simulate conversation with human users). Chatbots can respond to people in their native language, either verbally or in text, and can interact with both humans and other machines. The AI component allows chatbots to respond to more complex situations and continuously 'learn' so as to improve their effectiveness over time.

Table 1

Major AI players and personal assistants

Company	Assistant	Details
Facebook	M	Accessed via Facebook Messenger. Still in trial phase; mix of human and AI support.
Apple	Siri	Siri was the first personal assistant but now incorporates more AI (neural nets). Press reports of home speaker to allow access without iOS device.
Google	Google Assistant	Voice-controlled assistant accessible through Android devices and Google Home. Allo messaging app to be launched.
Microsoft	Cortana	Available on Windows 10 and both Android and iOS. Extension of Microsoft's new cross-platform and ecosystem strategy.
Amazon	Alexa	Accessible through devices such as the Echo and Dot. In talks with PC manufacturers to extend its addressable market.

Source: company data; GSMA Intelligence

Use cases for AI are likely to continue to develop and expand well beyond its application in chatbots and personal assistants. However, the key development is that AI enables the ability to build services and ecosystems that do not rely on a smartphone as a central hub or interface. Voice-activated assistants and their ability to control and interact with a growing range of other devices may also prove to be the catalyst to overcoming some of the key barriers to IoT adoption by consumers, particularly in areas such as wearables and the smart home.

3.4 GSMA Programme activities

Connected Living

The GSMA, through its Connected Living programme, aims to further develop the IoT market, both regionally and at the global industry level. The initial focus of the Connected Living programme is to accelerate the delivery of new connected devices and services in the M2M market through industry collaboration, appropriate regulation, optimising networks and developing key enablers to support the growth of M2M in the immediate future. The ultimate aim is to enable the IoT, a world in which consumers and businesses enjoy rich new services, connected by an intelligent and secure mobile network.

Working with its partners across the ecosystem and key verticals, the GSMA is active in a number of areas to drive forward this initiative:

- Mobile IoT: the GSMA is working with mobile operators and ecosystem partners to assess solutions for low-power, wide-area connections to enable further scaling of IoT.
- Remote SIM provisioning for M2M: the GSMA's vision is to unite all stakeholders behind a single, common and interoperable global embedded SIM specification to help accelerate the growing M2M market.
- IoT big data: the GSMA is looking to collaboratively establish an IoT big data ecosystem to unlock the full value of IoT big data across all vertical markets.
- The GSMA is encouraging industry engagement to align market perspectives, drive adoption and further develop the market across vertical sectors including smart cities, automotive and health.
- Secure IoT networks: the GSMA is working to establish security requirements for how machines should communicate via the mobile network in the most secure way.

Network 2020

Across the world, mobile operators are harnessing internet-style technologies to provide compelling and innovative services in an efficient and flexible way. The Network 2020 programme is right at the centre of this transformation, ensuring that new IP-based services are reliable, cost-effective and work across different devices and networks, in any market. The Network 2020 programme is making it straightforward for operators to harness the full potential of IP to deliver everything from group chat and advanced voice services to the Internet of Things and live HD video. These advanced communications services will raise the profile of operators and increase their profitability in an increasingly competitive and fragmented digital services market.

The Network 2020 programme has three key workstreams focused on:

- the development and deployment of IP services
- the evolution of 4G networks in widespread use today
- the 5G journey – developing the next generation of mobile technologies and services.

The Network 2020 programme is helping to transform the voice and messaging experience. Specifications and profiles developed by the GSMA, such as VoLTE, ViLTE, VoWiFi and RCS universal profile, now underpin an array of compelling multimedia communications services with reliability, security and reach that go far beyond Internet-based alternatives. Network 2020 is working with Google and other key players to ensure that new smartphones have built-in support for these services.

At the same time, the Network 2020 programme is supporting the adoption of advanced network technologies, such as LTE Broadcast, edge computing and network virtualisation, while helping the industry to take a holistic approach to 5G and sustainable investment paths for new technologies and services.

Personal Data

The GSMA's Personal Data programme is working with mobile operators that have launched identity services across the globe. The mobile industry needs to deliver common and consistent interfaces to a range of digital service providers, which need to offer seamless and convenient solutions to consumers.

The use of standards and interoperability are therefore key, particularly the need to create a common, industry-wide set of identity-related application programming interfaces (APIs). The GSMA is working closely with operators to establish a uniform set of APIs to underpin key mobile identity services.

Mobile Connect is a secure login solution that enables individuals to access their online accounts with just a single click or, where appropriate, automatically. Mobile Connect can provide different levels of security, ranging from low-level website access to highly secure bank-grade authentication. Mobile Connect promises to make passwords a thing of the past. To use the service, individuals subscribing to a participating operator simply need to click on a website's Mobile Connect button.

A new standard in digital authentication, delivered by a global network of mobile operators, Mobile Connect is well on its way to securing 1 billion enabled users for services ranging from content on the Web to more secure e-government and banking services.

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GSMA HEAD OFFICE
Floor 2
The Walbrook Building
25 Walbrook
London EC4N 8AF
United Kingdom
Tel: +44 (0)20 7356 0600
Fax: +44 (0)20 7356 0601