## GSMA - Mobile Spectrum

# Data demand explained

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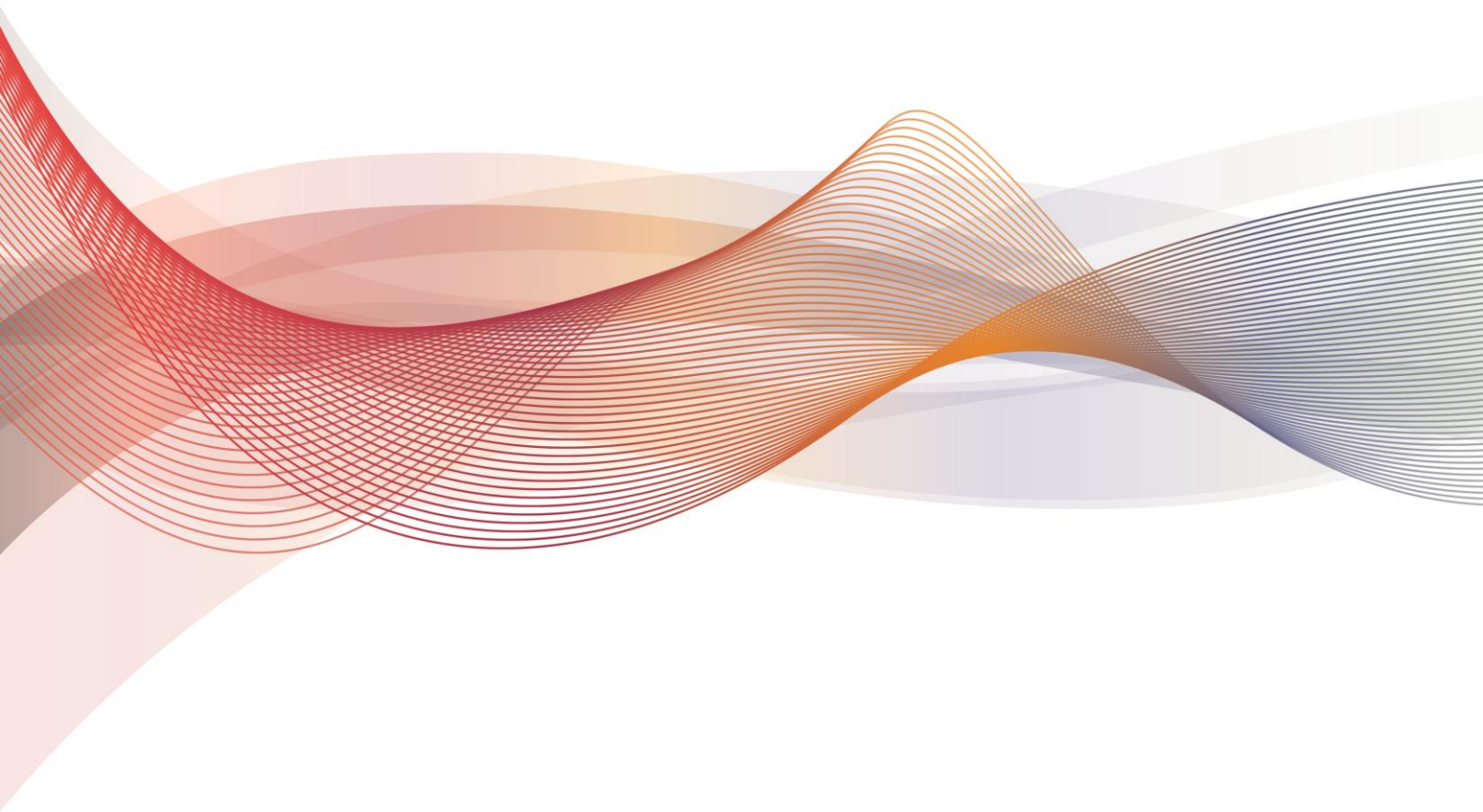

# Executive Overview

The more spectrum operators have, the more traffic they can carry. Even with the use of new wireless technologies and Wi-Fi, the GSMA has calculated, based on traffic growth estimates, 600-800MHz of additional spectrum will need to be made available for mobile broadband use by 2020.

Given it can take up to 10 years for new internationally-harmonised spectrum for mobile to be licensed and used to deliver services, it is vital that governments and regulators act now in order to meet the expected mobile data demands in 2020 and beyond. At the World Radiocommunication Conference 2015 (WRC-15), policy makers need to ensure that adequate spectrum is identified for mobile broadband services.

The rapid rise in traffic is putting mobile networks under strain during peak periods. Operators are only going to be able to keep up with demand in the medium-to-long term if they have access to more spectrum.

The availability of additional harmonised spectrum will be critical for the future vitality of the mobile industry and the broader digital economy.

Although policy makers might be tempted to see the spectrum crunch as a long-term problem that can be tackled at a later date, it actually needs to be addressed now. To offer commercially viable services, operators need to use globally, or at least regionally harmonised spectrum so that equipment makers can gain economies of scale and mobile devices will work in many different countries. The identification of harmonised spectrum requires considerable international coordination and that takes time.

## Now is the time to act

> *"The rise of mobile broadband is a game changer for global development. But delivering affordable ubiquitous services depends on access to sufficient harmonised spectrum in the right frequency bands."*
> **Suvi Linden, UN Broadband Commissioner and former Minister of Communications for Finland**

# Multimedia unleashed by mobile broadband

> *"Today, it's all about mobile, mobile, mobile. And to me that means spectrum, spectrum, spectrum. To keep pace with a transforming mobile sector, expanding ecosystem, and soaring consumer demand for data, we need to release more airwaves for new broadband data use – and use the airwaves we have more efficiently. Spectrum, after all, is the lifeblood of mobile broadband."*
> **Commissioner Jessica Rosenworcel, FCC.**

Behind the scenes, advances in mobile network technology are enabling consumers to access multimedia applications that would have been impossible on the first and second generation mobile networks. The deployment of mobile broadband services has unleashed a multitude of multimedia services and a corresponding explosion in data traffic.

Vodafone[1] reported that data traffic on its mobile networks in India doubled year-on-year in the six months to September 31, 2013. China Mobile, China's largest mobile operator, reported its mobile data traffic in the fourth quarter of 2013 was almost double that of the same quarter of 2012 at 161 billion MB (150 petabytes).

In the world's most advanced mobile markets, the deployment of LTE or 4G, is driving a surge in data usage: 4G users typically consume twice as much data per month as other users, according to GSMA Intelligence[2].

For a glimpse of the future, we can look at South Korea. With 100% 4G population coverage and LTE accounting for more than half the mobile connections, the country is the world's most advanced 4G market. The average monthly data consumption of its 4G users almost doubled between the fourth quarter of 2011 and the first quarter of 2013, rising from 1.1 gigabytes to 2.1 gigabytes, while data usage via HSPA (a 3G technology) remained flat.

GSMA Intelligence notes that users in South Korea have also begun to shun Wi-Fi networks - continuing to use 4G even when Wi-Fi is available - to maintain the consistency of their experience, especially when the 4G network provides a faster download/upload speed than a Wi-Fi service.

Operators in the U.S. are seeing similar trends. In October 2013, Verizon Wireless announced that the 38% of its retail customers connected to its 4G network were responsible for 64% of its total data traffic.

In Saudi Arabia, where the fixed broadband penetration is lower, the average data per unique subscriber is 3.5 GB[3] in early 2014.

## Data traffic will continue to soar

Although mobile data traffic has grown dramatically in the past five years, there are plenty of reasons to believe there is far more growth still to come. In the next ten years, billions more people and machines will use mobile networks to access online services and connect with each other. At the same time, smartphones will become increasingly ubiquitous and each new smartphone user will send and receive far more data than they did with their previous handset.

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[1] Vodafone financial update November 2013
[2] https://gsmaintelligence.com/analysis/2014/1/4g-driving-dta-usage-but-not-all-markets-reaping-the-rewards/412/
[3] Estimated from Mobily announcement of 1.3 PB of mobile traffic per day in MWC14

**Conversion of mobile traffic growth to additional spectrum requirements**

*A mobile operator's radio spectrum requirements depend on the total amount of traffic it needs to carry in high user-density locations during the busiest periods.*

*Operators design their networks to support the traffic generated by users taking into consideration the time-of-day usage variations, cell size for geographic coverage, user density, and performance parameters, such as access failures, call drops, and acceptable error rate. Additionally, the radio networks are designed to carry the traffic cost-effectively.*

*Different radio technologies have different spectral efficiency in terms of the amount of traffic they can carry per second over a unit of spectrum bandwidth. The mix of technologies (e.g. GSM, HSPA, LTE) in use will determine how much spectrum a mobile operator will need to meet the demand for traffic in the busiest periods in a specific location. All these elements are taken into consideration to estimate the amount of spectrum required to meet the growth in mobile traffic.*

Moreover, usage of video-on-demand services will continue to rise and the resolution of these videos will continue to improve. Vodafone has reported that high definition video (at 1080p) requires a data connection of 3.8Mbps, versus 400kbps for a 240p video (i.e. almost ten times faster). By 2020, people will expect to be able to watch videos in HD regardless of how the content is being streamed to their device.

## A tidal wave of traffic

The growing popularity of high definition video and other rich multimedia content is going to fuel a further surge in mobile data traffic. While market forecasts vary significantly, there is a consensus that the traffic on mobile networks is going to grow dramatically for the rest of this decade.

By 2020, there will be 2.5 billion 4G-LTE connections worldwide, up from 400 million at the end of 2013[4]. As 4G users generate far more data than 3G users that implies a massive increase in traffic over the next six years. Cisco VNI's[5] forecast for Japan states mobile traffic will reach 15GB per month per unique subscriber by 2018.

Studies carried out by the members of the International Telecommunications Union (ITU)[6], also show that mobile traffic will continue to grow very rapidly with an increase of between 44-fold and 80-fold in mobile traffic between 2010 and 2020 based on extrapolating market forecasts for the period between 2011 and 2015. GSMA's spectrum requirement estimates are consistent with other international forecasts.

## Mounting pressure on mobile networks

Mobile networks are like roads – they have limited space. If too much traffic arrives at once, they become congested and the traffic slows to a crawl or even grinds to a halt. Like roads, mobile networks have bottlenecks. And mobile networks also have rush hours – traffic tends to peak at certain times of the day. For example, the base stations near a railway station are most likely to get congested between 5pm and 7pm on a weekday. Similarly, the mobile networks in business centres (central business districts) could be inundated with traffic during the lunch hour when local office workers spill onto the streets.

If network congestion is allowed to rise unchecked, it could eventually stop the positive impact of mobile broadband services on the economy and on society.

[4] GSMA Intelligence

[5] http://www.cisco.com/assets/sol/sp/vni/forecast_highlights_mobile/index.html#~Country

[6] ITU 2014 report, Future spectrum requirements estimate for terrestrial IMT

# How to increase capacity

A mobile capacity crunch is inevitable. Mobile operators essentially have four inter-related ways to address the soaring demand for data traffic. These are:

1. Network densification – deploying more base stations.
2. Offloading traffic – steering more traffic towards Wi-Fi routers and away from mobile base stations.
3. Improving spectral efficiency – using new technologies to squeeze more traffic into a specific slice of spectrum.
4. Licensing more spectrum – increasing the amount of spectrum used to support mobile broadband services.

## 1. Network densification

Mobile operators can increase the number of base stations in those parts of the network that are becoming congested at peak times. In practice, this could mean deploying new base stations or it could mean harnessing so-called small cell technologies – attaching light weight transmitters to lampposts, buildings and other locations to take the pressure off the existing base stations. All of this does come at a cost in both time and money. Deploying new sites involves more capital expenditure, more backhaul (fixed infrastructure) and time consuming processes to get planning for new locations in capacity limited areas.

## 2. Offloading traffic

Another way to reduce the pressure on existing base stations is to encourage people to connect to Wi-Fi hotspots. In some countries, mobile operators now provide their customers with access to Wi-Fi connections in coffee shops, restaurants, hotels and transport terminals. While these Wi-Fi hotspots can provide high-speed connectivity, their performance is highly dependent on the quality of the backhaul connecting the Wi-Fi router to the operator's network and the number of people using Wi-Fi in the vicinity. Furthermore, these networks do not provide secure communications

Although Wi-Fi, which uses unlicensed spectrum, can appear to be a low-cost solution to the capacity crunch, it isn't a panacea. Like a free beach or motorway, unlicensed spectrum tends to attract lots of users and can get very crowded. In city centres, Wi-Fi hotspots can be very congested and can interfere with each other.

## 3. Improving spectral efficiency

The spectral efficiency of mobile services increases with each new release of network technology. The mobile industry estimates that 3G technology is eight times more spectrally efficient than 2G technology, while LTE/LTE-Advanced is 20 times more spectrally efficient than 2G. Of course, fully realising these gains depends on the widespread deployment of new network technologies and uptake of compatible devices by end-users.

In some cases, a mobile operator will require new spectrum to deploy LTE. In other cases, where their licenses and market circumstances permit, mobile operators can deploy LTE in frequencies that had originally been used for 2G. However, not all spectrum can be 'refarmed' in this way: Operators may have to continue to support some 2G connections, such as those used by smart energy grids and other machine-to-machine applications with long lifespans.

## 4. Licensing more spectrum

The more spectrum operators have, the more traffic they can carry. Based on traffic growth estimates, even with the help of network densification, new wireless technologies and Wi-Fi, the GSMA has calculated, consistent with other industry estimates, 600-800MHz of additional spectrum will need to be made available for mobile broadband use by 2020. The amount of spectrum needed for each national market will vary depending on their data demand forecasts and national priorities but assigning this now will ensure harmonisation and lower costs in the longer term.

*In today's world, so many new innovations rely on high-bandwidth communication that's on demand, instant, available wherever. And that will only increase in future: think of music streaming, cloud computing, or the Internet of Things. And in that world, radio spectrum is economic oxygen."*
**Neelie Kroes, Vice-President of the European Commission.**

## Now is the time to act


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