

# 4.5G is tomorrow's tech today

## Many innovative new mobile services won't depend on 5G



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5G will transform the mobile industry, the world economy, and life for all. But that won't happen in the short-to-medium term: realizing the full potential of 5G will require both a new radio interface and new spectrum.

By Steve Costello

**M**obile operators' commercial 4G networks are evolving in new and exciting directions. Operators can now upgrade their existing 4G infrastructure to 4.5G, which can support a wide range of innovative new services for both consumers and businesses, such as ultra-HD entertainment and ultra dense sensor networks. In fact, 4.5G infrastructure, which will co-exist with the 5G networks arriving in 2020, is likely to play a major role in the wireless ecosystem for the next decade and beyond.

While 5G will use a radio interface based on new orthogonal frequency division multiplexing (OFDM), 4.5G harnesses a clutch of advanced technologies for enhancing performance that can be achieved with the existing LTE radio interface. Over the next four years, 4.5G will foster new services, user behaviors, business models, and industry value chains, paving the way for 5G and attuning the market to the potential of wireless to transform everything from consumer entertainment to heavy industry.

First unveiled by Huawei in October 2014, 4.5G has since been standardized by 3GPP as LTE-Advanced Pro. Over the past two years, 4.5G technologies have progressed rapidly to the point where leading operators, such as Vodafone, Telefónica, Deutsche

Telekom and China Mobile, are now building commercial 4.5G networks. Huawei estimates there will be more than 60 4.5G commercial networks up and running by the end of 2016. By contrast, the first pilot 5G networks are likely to appear from 2018 onwards, ahead of commercial deployment from 2020 onwards.

Over time, 4.5G and 5G networks will become increasingly interwoven into a broader wireless ecosystem and standardization process. Release 14 of the 3GPP standards is due in 2017, and will incorporate both 4.5G and 5G technologies.

### What will 4.5G do for operators and their customers?

The deployment of 4.5G technologies promises to boost the effectiveness and efficiency of today's 4G networks. That will enable operators to both maximize ROI on existing infrastructure and prepare for 5G.

First, a combination of 4.5G technologies can boost network capacity sixfold, enabling mobile broadband speeds of up to 1 Gbps. For most operators, that will represent an eightfold increase in peak data rate, and a tenfold increase in throughput speeds at the cell edge. This radical improvement in network performance will help



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mobile operators accommodate the ongoing rise in traffic and support compelling, but demanding, services. Huawei sees 4.5G as delivering Experience 4.0. For example, operators will be able to offer HD voice services with MP3 music level quality, while delivering ultra-HD (2K/4K) video, giving consumers a highly immersive experience. At the same time, 4.5G networks will support virtual reality, augmented reality and advanced online games, as well as enable the remote control of drones and robots.

Secondly, 4.5G technologies will help operators roll out Internet of Things solutions designed for specific sectors like manufacturing, utilities, agriculture, and public safety. New low power wide area technologies will enable operators to bring much higher levels of connectivity to a wide range of vertical industries. For example, NB-IoT (Narrowband Internet of Things) technology can enable connected devices to have a decade-long battery life, while extending coverage deep inside buildings, below ground, and across rural areas. It's now practical to connect energy meters, irrigation systems, and sensors in previously inaccessible locations, enabling companies to remotely monitor a wide range of assets. At the same time, operators will be able to use LTE-based broadband trunked (LiTRA) systems to provide reliable connectivity for emergency services such as the fire brigade, the police, and ambulance services. Moreover, 4.5G networks have the capacity and throughput to bring broadband to offices, factories, farms, and other workplaces that aren't connected to high-speed fixed lines.

## How mature is the 4.5G ecosystem?

Many of the key 4.5G technologies were standardized in release 13 of the 3GPP standards, which were completed in March 2016. Chipset and terminal manufacturers are now building 4.5G technologies, such as multi-antenna (MIMO) technology, multi carrier aggregation, and 256QAM (quadrature amplitude modulation) technology, into their products. Both Qualcomm's Snapdragon 820 and Huawei's HiSilicon Kirin 950 chipsets, unveiled at the end of 2015, and three channel (3CC) carrier aggregation are likely to become a standard configuration in mid-range and high-end smart phones in 2016, enabling end-users to benefit from the deployment of 4.5G technologies in mobile networks.

NB-IoT is also maturing fast. In November 2015, a group of operators and vendors formed the NB-IoT Forum to steer the development of the technology. Following the acquisition of UK-based NB-IoT specialist Neul, Huawei launched a pre-standard NB-IoT chipset in 2015 to enable operators to implement network trials, which will be followed by a standard commercial chipset before the end of 2016.

Huawei has worked with dozens of leading operators to deploy 4.5G pre-commercial networks. In the first half of 2016, operators in various countries, including Norway, Germany, Kuwait, Saudi Arabia, UAE,

China, Hong Kong, Japan, Canada, and Singapore, demonstrated 4.5G networks achieving peak data rates of more than 1 Gbps. Moreover, operators in the UK and South Korea have started to build national LiTRA broadband trunked radio networks to support public safety services. Now that 4.5G technologies have been standardized, large-scale commercial networks are set to go live throughout 2017 and 2018.

## What is distinctive about Huawei's approach to 4.5G?

Huawei has developed end-to-end solutions to support each of the key business benefits that will be delivered by 4.5G – gigabit throughput, Experience 4.0 services, and advanced Internet of Things solutions. Huawei's portfolio includes 4T4R MIMO multi-antenna technology, 4CC/5CC (four and five channel) carrier aggregation, 256QAM high-order modulation, better voice and video coverage, VMOS video evaluation, NB-IoT, and GigaRadio solutions.

Having conceived 4.5G, Huawei has a head start over its competitors, offering a more mature portfolio. Huawei was the first vendor to promote 2CC and 3CC carrier aggregation, and the unique IPRAN-based Inter-site carrier-aggregation solution. Huawei was also the first to test and demonstrate 4CC and 5CC carrier aggregation. Huawei's integrated 4T4R blade RF module and active antenna have been tested in Canada, Mexico, Saudi Arabia and Turkey.

At Mobile World Congress 2016, Huawei announced its GigaRadio solution, which supports gigabit peak speeds for individual users, gigabit throughput on a single module, single site x-gigabit capability, and a seamless indoor gigabit experience. Huawei estimates its GigaRadio solution is more than a year ahead of the industry in terms of capabilities, and will help drive technological innovation, compelling user experiences, and greater commercial success for operators.

During the Huawei Global Analyst Summit 2016, Huawei announced its CloudRAN solution. Leveraging cloud-based hardware and software, CloudRAN gives operators much greater flexibility by virtualizing network functions, moving resources to the cloud, and employing systematic cloud capabilities. Moreover, CloudRAN architecture is fully flexible, from topology to resource distribution. It supports 4G, 4.5G, 5G, and Wi-Fi for coordinating multiple technologies and multi-cells, so functions can be deployed on-demand in real time and non-real time, and enables network slicing – the provision of dedicated connectivity for specific applications. CloudRAN enables operators to employ flexible and efficient cloud architecture on 4G and 4.5G networks, so operators can directly and easily integrate 5G air interfaces into their existing networks.

Huawei's own network, device, and chipset operations give it an E2E perspective that allows it to work with a wide range of partners to address obstacles to 4.5G commercialization.

Huawei continues to co-operate closely with industry partners on the development of both 4.5G and 5G for consumer and business applications. For example, to accelerate the deployment of NB-IoT, Huawei is working with specialists in verticals, as well as operators, infrastructure vendors, chipset vendors, and module providers.

In summary, 4.5G is robust and ready to deliver many of tomorrow's mobile technologies today, opening up new opportunities for mobile operators. If they harness 4.5G sooner rather than later, mobile operators can meet existing customers' burgeoning demand for mobile connectivity and expand into new markets. But 4.5G is not a short-term fix: even after the 5G era begins in earnest in 2020, operators and their customers will rely on 4.5G for many years to come. [www.huawei.com](#)

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