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## Countdown to the Full-Scale Development of 5G New Radio

### 5G Readiness

The first implementable fifth generation (5G) New Radio (NR) standard was successfully completed at the Third Generation Partnership Project (3GPP) Technical Specification Group Radio Access Network (RAN) Plenary Meeting in Lisbon, Portugal, on 21 December 2017. The following corporations have stated that the completion of the first 5G NR standard has set the stage for the global mobile industry to start full-scale development of 5G NR for large-scale trials and commercial deployments as early as 2019:

- AT&T
- British Telecommunications
- China Mobile
- China Telecom
- China Unicom
- Deutsche Telekom
- Ericsson
- Fujitsu
- Huawei
- Intel
- Korea Telecom (KT) Corporation
- LG Electronics
- LG Uplus
- MediaTek Inc.
- NEC Corporation
- Nokia
- Nippon Telegraph and Telephone (NTT) DOCOMO
- Orange

### SAMSUNG ELECTRONICS AMERICA HAS ANNOUNCED ITS DECISION TO SUPPLY VERIZON WITH COMMERCIAL 5G FIXED WIRELESS ACCESS NETWORK SOLUTIONS.

- Qualcomm Technologies
- Samsung Electronics
- Sunkyong Telecom
- Sony Mobile Communications Inc.
- Sprint
- Telecom Italia Mobile
- Telefonica
- Telia Company
- T-Mobile USA
- Verizon
- Vodafone
- Zhongxing Telecommunication Equipment.

In Barcelona, Spain, on 27 February 2017, leaders of the global mobile industry announced their support for the acceleration of the 5G NR standardization schedule, which introduced an intermediate milestone to help complete the first implementable specification for nonstand-alone 5G NR operations. As a result of this announcement, the schedule acceleration was agreed on at the 3GPP RAN Plenary Meeting in Dubrovnik, Croatia, on 9 March 2017. This first specification was completed as part of the 3GPP release 15.

The completion of this standard is an essential milestone that enables the cost-effective, full-scale development of 5G NR, which will greatly enhance the capabilities of 3GPP sys-

tems as well as facilitate the creation of vertical market opportunities. The 3GPP plans to continue to develop release 15, including the addition of support for stand-alone 5G NR operations, also agreed on by the 3GPP in Dubrovnik. The 5G NR lower layer specifications have been designed to support stand-alone and nonstand-alone 5G NR operations in a unified way to ensure that the 3GPP benefits the global industry with a large-scale single 5G NR ecosystem.

### 5G Commercial Launch

Samsung Electronics America has announced its decision to supply Verizon with commercial 5G fixed wireless access (FWA) network solutions. The two companies will begin by launching commercial 5G services in Sacramento, California, in the second half of 2018.

In early 2017, Samsung and Verizon began 5G customer trials across seven U.S. cities, and have successfully tested and verified 5G performance using millimeter-wave (mm-wave) techniques to provide FWA precommercial service. These trials were conducted in California, Georgia, New Jersey, Massachusetts, Michigan, Texas, and Washington, D.C.

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Samsung will provide Verizon with commercial 5G home routers, 5G radio access units comprised of a compact radio base station and virtualized RAN elements, as well as 5G radio-frequency (RF) planning services. To provide these services, Samsung has leveraged in-house technology and assets to develop the first commercial 5G modems based on application-specific integrated circuits (ICs) and mm-wave RF ICs.

### 5G Live Over-the-Air Tests

KT Corporation, Qualcomm Technologies, and Samsung Electronics Co. announced the successful completion of multivendor 5G NR interoperable testing that is compliant with the recently completed 3GPP release 15 nonstand-alone 5G NR global standard. Following the guidelines of KT Corporation, the live, over-the-air interoperable testing demonstrated data connections operating in 3.5 GHz and 28 GHz bands, utilizing precommercial 5G NR base stations from Samsung and 5G NR user equipment (UE) prototypes from Qualcomm Technologies. The achievement is a significant milestone on the path to standard-compliant mobile 5G NR trials starting in 2018, leading to commercial 5G NR network deployments and multimode smartphone launches anticipated in 2019.

The live demonstration, which was held in Samsung's lab in Suwon, South Korea, achieved multigigabit per second downlink speeds as well as latencies as low as 1 ms. The fiber-like speeds and low latencies will be essential to meeting the increased connectivity requirements of emerging mobile broadband experiences, such as virtual reality (VR) and augmented reality (AR), as well as for enabling new, high-reliability low-latency services for industrial control, autonomous vehicles, and drones, among other use cases.

The end-to-end 5G NR interoperability testing demonstrated the essential components of the 5G NR air interface, which is fully compliant with the 3GPP release 15 5G NR

specifications, including scalable 5G NR orthogonal frequency-division multiplexing (OFDM) technology, advanced 5G NR channel coding and modulation schemes, low-latency 5G NR slot structure, and 5G NR control and data channel support for massive multiple input, multiple output (mMIMO) and mobile mm-wave.

### 5G Field Trials

The Hamburg Port Authority, Deutsche Telekom, and Nokia have commissioned an 8,000-ha area to be used to carry out key tests of various aspects of 5G functionality, including network slicing. The 5G functionality will be tested with use cases like traffic lights management, data processing from mobile sensors, and VR. To provide connectivity, an antenna has already been installed on the Hamburg television tower at a height of more than 150 m.

The primary focus of the project is on testing 5G applications in an industrial setting in the Port of Hamburg, Germany. Such settings require a telecommunications network that is highly reliable and secure. Moreover, it needs to support a diverse range of services and applications.

The Port of Hamburg, which is both a logistics hub and a tourist attraction, provides an environment for testing a variety of use cases that place very different demands on a 5G network. For example, the Hamburg Port Authority wants to use mobile communications to manage traffic lights within the port area as well as to collect and process environmental measurement data in real time. Finally, VR applications can be applied to monitor critical infrastructure, e.g., watergates and construction areas, thus enhancing safety in the port.

The project partners are testing whether these services, each of which have specific network demands, are reliably working on just one mobile network infrastructure. This is made possible by using dedicated virtual networks, known as *network slices*, in the 5G testbed. Each of these supports a specific

service, e.g., separate virtual networks will be used to control traffic lights and to transmit environmental measurement data.

Network slicing is a key architectural feature of 5G, enabling networks to dynamically and flexibly adapt to the requirements of different applications. The Hamburg project will test several network slices under live conditions in an industrial setting.

### 5G Interoperability Testing

Qualcomm Technologies and Huawei announced the successful completion of 5G NR interoperability and development testing (IODT) based on the 3GPP release 15 global standard. The testing, which utilized Qualcomm Technologies' UE prototype and Huawei's commercial 5G system, is an important development toward helping to accelerate the maturity of the 3GPP release 15 5G NR ecosystem.

IODT lays the foundation for guaranteeing the interoperability between the UE, RAN, and core network. It is an essential step toward the commercialization of 5G NR networks and devices. The successful IODT conducted by Qualcomm Technologies and Huawei will significantly promote the industry's 5G NR end-to-end commercialization efforts spanning networks and devices.

During the interoperability testing, the two companies jointly verified key 3GPP 5G NR technologies, including synchronization, channel coding, frame structure, and scalable OFDM numerology components. The companies tested the synchronization, control, and data channels between the 5G NR UE, and networks operating in the 3.5 GHz band.

### 5G Long-Distance Trials

Huawei and NTT DOCOMO recently announced that they have successfully completed a joint field trial for 5G mobile communications over a long-distance radio link in Yokohama, Japan, in the 39-GHz band. During this trial, a maximum downlink data transmission rate of more than

2 Gb/s was achieved using a test vehicle, which was traveling at a speed of more than 20 km/h. The test vehicle was equipped with UE that was equivalent to a mobile phone.

This successful long-distance trial opens up new opportunities for applications and deployments of 5G mm-wave technology. Long-distance mobility transmission using mm-wave techniques is one of the technologies that enables 5G enhanced mobile broadband systems.

Achieving wide-area coverage combined with user mobility remains a technological challenge for the 5G industry. The high propagation path loss of mm-wave signals limits the coverage area; narrow directional beams, which are required to focus the transmission power, impose high demands on the tracking of the mobile device over long-distance radio links.

This joint field trial successfully demonstrated that the 39 GHz mm-wave technology can be used for long-distance radio transmissions in both stationary and mobility scenarios, even in urban complex deployment environments. The Huawei-NTT DOCOMO collaboration recorded more than 2 Gb/s downlink throughput on the stationary UE at a distance of 1.8 km, while more than 3 Gb/s could be achieved at a distance of 1.5 km. The trial has validated and proved the effectiveness of the two companies' mm-wave technology to provide 5G services in macrocell areas.

Operating in the 39 GHz band, the test system consisted of a base station located on the Yokohama Media Tower and UE on a test vehicle. This trial boasted innovative technology based on a compact focal lens antenna with a maximum gain of 31 dBi, which was achieved by using advanced beamforming techniques. An advanced beam-tracking technique was employed to track the UE on the test vehicle traveling at a speed of more than 20 km/h.

According to Huawei, this 5G trial was the first industry field trial to verify the long-distance mm-wave technology for mobility applications in macrocell coverage scenarios.

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**ERICSSON'S MASSIVE MIMO PORTFOLIO IS EXPECTED TO BE AVAILABLE IN 2018 AND WILL BE COMPARABLE TO COMMERCIAL SMARTPHONES WITH THE TM9 COMPATIBLE CHIP SET, WHICH ARE EXPECTED TO HIT THE MARKETS IN THE FIRST HALF OF 2018.**

### **Prestandard 5G Life Demo**

Vodafone Ireland and Ericsson announced that they have successfully completed the first live demonstration of prestandard 5G technology in Dublin, Ireland. In a special event at the Douglas Hyde Gallery at Trinity College, the two companies demonstrated their ability to achieve a data transfer speed of 15 Gb/s with a latency of less than 5 ms. Vodafone also tested prestandard 5G across Vodafone's recently acquired 3.6 GHz spectrum. The event showcased real-life customer applications ranging from remote experts and AR, to high-speed, low-latency, immersive gaming. With 5G, the technology allows for a vast array of services to be delivered simultaneously in a superfast and efficient manner. Gradually, 5G will enable various use cases over time.

- *Drive super-high-speed broadband and media:* supporting increased traffic demands from video services and interactive applications, e.g., video streaming with a horizontal screen display resolution in the order of 4,000 pixels (4K), video analytics, and holograms.
- *Connect massive numbers of devices:* the exponential growth of connected Internet of Things (IoT) devices is driving more use cases, such as smart vehicles (from asset tracking and remote monitoring, to vehicle-to-everything), with the next-generation network needing to provide a reliable response to billions of devices.
- *Provide faster, secure, reliable, and robust connectivity:* this is essential to delivering mission-critical services, e.g., real-time video surveillance, self-driving cars, remote surgery for eHealth, and remote patient monitoring.
- *Provide ultralow latency for human-machine interaction:* supporting real-

time response requirements for VR, AR, and real-time control of robotics.

The launch event displayed what customers and businesses can expect from 5G through an engaging demonstration of future technology. The Internet of Skills presented exciting educational opportunities that will help support the health-care industry. This support will enable doctors to operate in a VR environment using a haptic glove, while students join the class and experience the operation through the use of VR glasses. Remote technical experts would make it possible for technicians to avoid hazardous situations by using AR to provide on-site assistance, while intelligent infrastructure has the potential to revolutionize the transport industry. The presentation also demonstrated how federated network slicing orchestration would work and the benefits it would provide for businesses.

### **mMIMO Trials**

On the path to 5G, Verizon, Qualcomm, and Ericsson completed the first successful mMIMO trial with a fully compatible customer device. During this trial, the three companies used the latest Ericsson mMIMO software and hardware on Verizon's network in Irvine, California, along with a mobile test device powered by the Qualcomm Snapdragon 845 mobile platform with X20 long-term evolution (LTE) using Transmission Mode 9 (TM9). TM9 is an enhancement for consumer devices that will make them fully compatible with mMIMO, enabling a better experience.

mMIMO is a key technology component of the transition to 5G, and it has the potential to greatly improve the network capacity and the average data rate available to the user. To realize these gains, both the network

and the devices need to support new TM9 functionality, which leverages advanced beamforming schemes between the network equipment and the mobile devices.

Ericsson's mMIMO portfolio is expected to be available in 2018 and will be comparable to commercial smartphones with the TM9 compatible chip set, which are expected to hit the markets in the first half of 2018.

### 5G New Radio

Ericsson has announced that all of its radio products delivered since 2015 within the Ericsson Radio System portfolio will support 5G NR capability, which will be achieved through a remote software installation. This applies to more than 150 different radio variants in Ericsson Radio System that are active in more than 190 networks around the world, meaning that Ericsson Radio System legacy radios from 2015 can support 5G NR. This 5G NR readiness also applies to Ericsson's delivered microradios in Ericsson Radio System and existing radio dot system products; in short, all Ericsson Radio System products are ready for 5G NR. Operators will have the possibility to run fourth generation (4G) and 5G in the same band with the same radio and the same baseband. It will also be possible to share the spectrum between 4G and 5G with side-by-side carriers in the same band as well as with overlapping carriers using dynamic spectrum sharing functionality.

According to the latest Ericsson Mobility Report [1], global mobile data traffic will increase to eight times its current size by 2024, while 5G subscriptions are expected to reach 1 billion by the end of 2023. This will place more demand on operators to continue to expand capacity costs efficiently, while addressing their 5G evolution at the same time.

### 5G Indoor Mobile Systems

With this anticipated surge in mobile traffic and 5G subscriptions, mobile operators must meet rising consumer and enterprise demand for applica-

tions, such as high-data-rate video streaming, VR/AR, and immersive media. This increases the need for indoor coverage, which cannot be addressed by traditional indoor systems or by outdoor radio deployments since modern building materials can block outdoor radio signals.

Ericsson is meeting this challenge by introducing the so-called 5G Radio Dot [2], which is a small-cell radio solution designed to satisfy the advanced indoor mobile broadband performance requirements demanded by 5G. The 5G Radio Dot is a natural evolution of the previous generation of the Ericsson Radio Dot System. Compared to other indoor solutions, it takes less than half the time to install the system and it is able to support the new 5G midbands (3–6 GHz) with speeds of up to 2 Gb/s.

Operators will be able to deploy the 5G Radio Dot next to 4G solutions using the same cabling infrastructure, the same network architecture, and dot locations. This innovative small-cell solution, which provides a simple upgrade path for existing radio dot system deployments by adding 5G technology capabilities, enables frequency, capacity, and technologies to be added seamlessly.

The radio dot system has been successfully deployed for many indoor applications used in large areas, e.g., office buildings, shopping malls, hospitals, and airports. Over time, the small-cell solution will also support 5G industrial applications ranging from connected factories to more extreme cases, such as connected mining. The collaboration of Ericsson and Boliden [3] shows how radio dot technology can improve safety and efficiency through the remote control of machines that keep people out of the most dangerous areas of the mine at the most dangerous times.

The 5G Radio Dot will undergo trials in late 2018 and will be commercially available in 2019.

### Gigabit LTE

Telstra, Ericsson, NETGEAR, and Qualcomm Technologies, a subsidiary of

Qualcomm Incorporated, announced that they have achieved record-breaking 4G speeds of up to 2 Gb/s in lab testing using a new, commercially announced chip set. The top speeds were made possible using Ericsson's Baseband 6630, Radio 4415, and the latest gigabit LTE network software. The extreme speeds are enabled by aggregating five 20-MHz LTE carriers across three different frequency bands with each carrier using  $4 \times 4$  MIMO and 256 quadrature amplitude modulation technologies. The demonstration saw 2 Gb/s speeds achieved by aggregating 100 MHz of spectrum across bands 1, 3, and 7 using a NETGEAR Nighthawk mobile router equipped with a Qualcomm Snapdragon X24 LTE modem, the world's first-announced Category 20 LTE modem.

The four companies showcased the lightning-fast 2 Gb/s speeds in a live demonstration at the Mobile World Congress, which was held in Barcelona, Spain, from 26 February to 1 March 2018.

### LTE for Remote Areas

Altaeros Energies, a Boston-based start-up launched out of the Massachusetts Institute of Technology, and Ericsson recently announced that they have launched a new tethered-aerial infrastructure product to deliver high-speed broadband for remote areas. The two companies have demonstrated a new SuperTower to help operators deploy LTE systems in hard-to-reach rural communities using tethered aerostats, which are the industrial versions of blimps. In late 2017, the companies successfully installed a multisector LTE base station on a SuperTower in rural Maine to provide broadband speeds with streaming video. Rural markets like Maine are ideal for operators to deploy SuperTowers, which reach heights six to eight times higher than most cell towers, offer greater flexibility for site placement, cost up to 70% less to roll out, provide coverage equivalent to a network of 30 conventional cell towers, and have less impact on the environment. The



innovative radio technology installed on the SuperTower is of special interest to people living in rural areas who often have limited or no access to high-speed broadband. The aim of Altaeros is to change this deficiency by providing consumers access to the benefits of affordable broadband services, especially in the health-care and education sectors.

Altaeros developed the SuperTower to offer operators a new infrastructure option that provides the broad coverage advantages of satellites and aerial platforms, while seamlessly integrating with existing handsets by using the same radios, antennas, and permitting processes as standard towers. The offering utilizes Altaeros's proprietary tethered aerostat design and automation technology as a platform for Ericsson's 5G-ready high-performance radio system with MIMO-capable radios. SuperTowers, which can also be deployed for temporary disaster relief or special events, will be available to operators in late 2018. An overview of the SuperTower can be seen on YouTube [4].

### **Voice over LTE**

Ericsson has announced that the company is Eastlink's lead core network supplier for voice over LTE (VoLTE). This will enable the Canadian telecom operator to provide enhanced and more resilient services and lays the foundation for Wi-Fi calling and future 5G services.

Eastlink will deploy the Ericsson Fast VoLTE solution, a complete pre-integrated virtual internet protocol multimedia subsystem solution that facilitates rapid deployment and scaling. It supports high-definition (HD) voice and other communication services over LTE and Wi-Fi access networks. Eastlink will work with Ericsson to deploy a geo-redundant and 5G-ready core network, ensuring robust and reliable services. The project team with Ericsson's on-site expertise and global resources will also modernize customer and front-end databases, such as the home

location register and the home subscriber service. The network upgrade is expected to be completed during the second half of 2018.

### **Mobile Platforms**

Qualcomm Technologies, Inc., a subsidiary of Qualcomm Incorporated, unveiled a new VR reference platform based on the powerful Qualcomm Snapdragon 845 Mobile Platform. With this mobile platform, the company is supporting the next wave of smartphone and stand-alone VR headsets for their customers and developers to create the immersive applications and experiences of the future.

The Snapdragon 845 Mobile Platform features a variety of new architectures and subsystems engineered to deliver one-of-a-kind experiences that blur the lines between the physical and virtual worlds. It builds on the success of its predecessor model, the Snapdragon 835 Mobile VR Platform, which powered award-winning VR devices at the Consumer Electronics Show (CES) 2018.

The Snapdragon 845 Mobile Platform uses the latest Qualcomm Adreno 630 visual processing subsystem, which offers outstanding integrated graphics, video, and display processing technologies. This translates to 30% faster graphics performance, 30% better power efficiency, and more than twice as much display throughput compared to the previous Snapdragon 835 Mobile Platform. Another new extended reality technology innovation is Adreno Foveation, which combines a graphics rendering with eye tracking to understand where the user is looking. It is engineered to direct the highest graphics resources to where the user is physically looking, providing the sharpest visuals possible.

### **Mobile Artificial Intelligence**

Huawei and Baidu have announced a comprehensive strategic cooperation agreement that spans from artificial intelligence (AI) platforms and technology to Internet services and content ecosystems. The two companies aim to cultivate an open mobile and AI eco-

system built on shared success, while spurring the development of new AI applications and providing global consumers with AI that knows you better.

The two companies will work together on voice and image recognition for smart devices to enable a more seamless human-machine interaction. They will also jointly build an AR ecosystem, combining hardware and software to create a more immersive and accessible AR experience for everyday consumers.

Regarding Internet services and content ecosystems, the companies will strengthen cooperation in areas such as search and feed to bring consumers a wealth of quality content with a more intuitive and convenient service experience.

After a decade of rapid progress, the mobile phone industry has reached a critical inflection point in its development, and the next generation of smartphones is just over the horizon. Interactive technologies, including voice recognition, machine vision, and AI, will propel the industry forward. Originally developed to be personal tools, mobile phones will become a natural extension of the human body and AI-powered assistants for consumers.

AI is driving a new round of industry transformation, and the in-depth strategic cooperation between Huawei and Baidu will open up more possibilities for the development of AI and other technologies. It will help lay the foundation for a sustainable mobile and AI ecosystem, so that future technology can better understand users, better serve people, and promote better economic and social outcomes around the world.

### **Mobile eHealth**

At the Mobile World Congress 2018, Altair Semiconductor, a leading provider of LTE chip sets, announced that its collaboration with Ericsson and Sony Mobile will lead to the introduction of a new device for diabetes patients. Powered by Altair's ALT1210 chip set and supported by Ericsson's commercially available

**MCPTT IS THE FIRST AND MOST IMPORTANT FUNCTIONALITY UNDER THE GROUP RADIO UMBRELLA DESIGNED TO ADDRESS BOTH BUSINESS AND MISSION-CRITICAL USE CASES.**

massive IoT network solution, the device is based on a wearable prototype from Sony Mobile. The wearable prototype is a wristband that connects, via Bluetooth or near-field communication, to a continuous glucose monitoring sensor provided by Senseonics. The wristband alerts the user when glucose levels have dropped and monitors activity, sleep, and heart rate. The wristband prototype is used in conjunction with the Sony cloud solution and Xperia smartphone application.

Altair's ALT1210 chip set provides the wearable device with LTE Category M1 (LTE Cat-M1 or LTE-M) connectivity to the cloud without having to depend on a smartphone for cellular coverage. LTE Cat-M1 is a low-power wide-area air interface that allows users to connect IoT and machine-to-machine devices with medium data rate requirements, i.e., 375 kb/s upload and download speeds in half-duplex mode).

The ALT1210 chip set is highly integrated with an on-chip power management unit, double data rate memory, and low-power application layer subsystem with a robust security framework for customer-developed applications, enabling designs with just a few external components. The chip set is ideal for a variety of IoT applications, e.g., trackers, wearable devices, sensors, and numerous other consumer and industrial IoT devices.

### **Public Safety**

Ericsson announced that it has demonstrated its own mission-critical push-to-talk (MCPTT) solution at Milipol Paris 2017, a homeland security exhibition. MCPTT is the first and most important functionality under the group radio umbrella designed to address both business and mission-critical use cases.

Together with Ericsson's wider mission-critical LTE and 5G portfolio, group radio enables mobile network operators and partners to target growth opportunities in many industries ranging from public safety to private enterprise. Group radio will also support a variety of deployment models spanning from private networks to commercial mobile networks. Mobile network operators and end customers, such as governments, nongovernmental organizations, and industries have been supporting the specification of this MCPTT functionality in 3GPP standards. Ericsson is now able to offer these services to customers as requested.

Next-generation push-to-talk is a key component of emerging LTE-based public safety agency solutions. This technology will complement the mission-critical capabilities provided by the land mobile radio networks that agencies currently depend on. This technology will also expand those networks to a greater number of users carrying smartphones and other devices. With MCPTT, governments are better able to safeguard society and save lives in times of crises. For mobile network operators, this solution enables them to win new business by catering to critical communication needs of governments and industries.

### **Mobile Biometrics Technology**

Motorola Solutions has announced that West Yorkshire Police, United Kingdom, is rolling out the company's automated mobile biometrics technology to 250 of its frontline police officers following a recent trial. West Yorkshire Police is the first police department in the United Kingdom to implement the mobile biometrics technology. This technology allows officers to check fingerprints against the national fingerprint database in less

than a minute by using handheld scanners attached to the officer's phone, which then accesses a new biometric services gateway system. The mobile biometrics technology runs alongside Pronto, which is Motorola's widely deployed mobile information system that delivers comprehensive and flexible mobile information solutions to police departments in the United Kingdom. According to Motorola Solutions, the mobile biometrics technology is an exciting addition to the Pronto offering and represents the type of advancements that are expected to digitally transform public safety agencies.

Until recently, identifying or collecting data from individuals involved costly outdated devices and paper-based processes. This new system is available via police departments' existing mobile devices and allows access from the field to a live database to get results in real time. This creates a seamless workflow by removing the need to travel between the field and office/station to process information. As officers are able to obtain the right information about suspects quickly, accuracy is also greatly improved.

Shortly after deploying the biometrics technology, West Yorkshire Police discovered how valuable rapid biometric identification can be. In one instance, police were able to identify a seriously injured individual, enabling medical staff to quickly offer accurate treatment and to contact the injured person's family. In another case, they identified and served a disqualified driver a summons to appear in court, and seized his vehicle on the scene without needing to travel to the police station to deploy an armed response vehicle.

### **Wireless Hearable Devices**

At CES 2018 held in Las Vegas, Nevada, Qualcomm Inc. announced that its subsidiary, Qualcomm Technologies, has introduced the new Qualcomm Low-Power Bluetooth System-on-Chip (SoC) QCC5100 series, which is designed to help manufacturers develop a new generation of compact, feature-rich,

wireless earbuds, smart headphones, and headsets. To help meet consumer demand for superior audio quality as well as extended battery life and playback time in wireless audio devices, the breakthrough SoC series was engineered to reduce power consumption by up to 65% for both voice calls and music streaming, compared to previous single-chip Bluetooth audio solutions. The QCC5100 series will open new avenues for extended-use hearable applications, e.g., virtual assistants, augmented hearing, and enhanced listening.

The SoC architecture supports low-power performance and includes a Bluetooth 5 dual-mode radio, low-power audio, and application subsystems. Designed to serve various on-the-go consumer use cases requiring robust, high-quality, truly wireless listening experiences, the platform supports advanced features, including Qualcomm TrueWireless Stereo, Qualcomm aptX HD audio, integrated hybrid active noise cancellation, and third-party voice assistant services.

### Mobile Traffic Jam Ahead

The Global System for Mobile Communications Association has published a new report [5] that examines the ability of mobile networks to meet the growing demand for mobile data in the world's largest and densest cities. The report finds that networks in so-called megacities, such as New York, Shanghai, Shenzhen, and Tokyo will encounter a significant shortfall between mobile data traffic demand and available network capacity, with as much as 48% of traffic demand going unserved in ultradense urban areas by 2025. The report notes that regulatory reform will be critical in closing the projected supply-demand gap and unlocking the economic potential of next-generation mobile broadband.

Factors such as 5G and the growth of the IoT will cause mobile data demand to grow by more than 50% in major cities worldwide by 2025. Con-

sequently, mobile operators' capital and operational expenditures in cities would need to triple to provide sufficient network capacity, a level of expenditure that is not sustainable under current conditions.

### Consumer Trends

Ericsson ConsumerLab has presented the seventh edition of its annual consumer trend report [6]. The report points to a paradigm shift, as consumers expect digital technology to increasingly operate on human terms. Body language, facial expression, and intonation will augment voice and touch to control consumer interaction with devices, making adaptation to the ever-increasing pace of technological change that much easier. The quantitative results referred to in the report are based on an online survey of 5,141 advanced Internet users in ten influential cities worldwide. The ten consumer trends for 2018 and beyond are as follows.

- 1) *Your body is the user interface*: more than 50% of current users of intelligent voice assistants believe that we will use gestures to interact with technological devices just like we do with people.
- 2) *Augmented hearing*: 63% of consumers would like earphones that translate languages in real time.
- 3) *Eternal newbies*: 30% of consumers say that new technology makes it hard to keep their skills up-to-date, but it also makes us instant experts. Alternatively, 46% say the Internet allows them to learn and forget skills faster than ever.
- 4) *Social broadcasting*: Social media is being overrun by traditional broadcasters. However, 50% of consumers say AI would be useful for checking facts posted on social networks.
- 5) *Intelligent ads*: Advertisements may become too smart for their own good. More than half of AR or VR users think advertisements will become so realistic they will eventually replace the products themselves.

- 6) *Uncanny communication*: 50% of respondents think not being able to tell the difference between humans and machines would spook them out.
- 7) *Leisure society*: 32% of students and working people do not think they need a job to develop a meaningful life. Furthermore, 40% say they would like a robot that works and earns income for them, freeing up leisure time.
- 8) *Your photo is a room*: Imagine being able to walk into a photo and relive a memory; 75% of consumers believe that in only five years they will use VR to walk around in smartphone photos.
- 9) *Streets in the air*: City streets may be choked with traffic, but the skies remain free; 39% of respondents think their city needs a road network for drones and flying vehicles.
- 10) *The charged future*: more than 80% of consumers believe that in five years we will have long-lasting batteries that will put an end to charging concerns.

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