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5G Sets Sail Around the Globe

5G Mobile Platforms

The third annual Qualcomm Snapdragon Technology Summit was held on Maui, Hawaii, on 4–6 December 2018. This event featured several industry milestones related to 5G mobile communication systems and the Snapdragon mobile platforms. During the second day of the technology summit, Qualcomm Technologies unveiled the Snapdragon 855 chipset, the company's newest generation in the Snapdragon 8 Series Mobile Platform. This is the world's first commercial mobile platform supporting, collectively, multigigabit 5G, industry-leading artificial intelligence (AI) and immersive extended reality, ushering in a new decade of revolutionary mobile devices. Using new chip architectures built on leading 7-nm process technology, the Snapdragon 855 will offer users long-lasting battery life and enhanced experiences in such areas as imaging, audio, gaming, and extended reality.

The Snapdragon 855 is the first mobile platform to support the new Qualcomm 3D Sonic Sensor, the world's first commercial ultrasonic fingerprint solution supported under the display. This is the only mobile solution that can accurately detect fingerprints through numerous contaminants. Furthermore, this technology enables sleek, cutting-edge form factors while distinguishing itself from alternatives with higher levels of security and accuracy.

The Snapdragon 855 Mobile Platform is currently sampling to customers and is expected to begin shipping in commercial devices in 2019. The Snapdragon 855 chipset will power the next generation of premium flagship devices and launch a new decade of more immersive and connected user experiences.

For additional information, visit Qualcomm's website [1].

5G Chipsets and Devices

On 24 January 2019, Huawei announced that the company has officially launched its 5G multimode chipset Balong 5000 together with the first commercial 5G device powered by it, the Huawei 5G customer premises equipment (CPE) Pro router. Balong 5000 officially unlocks the 5G era. This chipset supports a broad range of 5G products in addition to smartphones, including home broadband devices, vehicle-mounted devices, and 5G modules. It will provide consumers with a new 5G experience across multiple scenarios.

With its small form factor and high degree of integration, Balong 5000 supports 2G, 3G, 4G, and 5G on a single chip. The chipset effectively reduces latency and power consumption. It will significantly enhance the user experience in the early stages of commercial 5G deployment.

Balong 5000 is the first chipset to perform to industry benchmarks for peak 5G download speeds. At sub-6 GHz, the chipset can achieve download speeds up to 4.6 Gb/s. On the millimeter-wave (mm-wave) spectrum, Balong 5000 can achieve download speeds up to 6.5 Gb/s, which is 10 times faster than top 4G LTE download speeds available previously.

Balong 5000 is also the world's first chipset that supports both standalone (SA) and nonstandalone (NSA) network architectures for 5G. With NSA, the 5G network architecture is built on top of legacy 4G LTE networks, while the SA 5G architecture, as the name implies, has its own independent architecture. The Balong 5000 chipset can flexibly meet different user and carrier requirements for connecting devices throughout various stages in the development of 5G.

Balong 5000 is the world's first multimode chipset that supports vehicle-to-everything communications, providing low-latency and highly reliable solutions for connected vehicles. Huawei's 5G smartphones, powered by Balong 5000, were released at this year's Mobile World Congress in Barcelona.

Powered by Balong 5000, the Huawei 5G CPE Pro router supports both 4G and 5G wireless connections. On a 5G network, a 1-GB high-definition

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(HD) video clip can be downloaded within 3 s, and an 8,000-pixel video can be streamed smoothly without lag. This sets a new benchmark for CPE devices. In addition to homes, the Huawei 5G CPE Pro router can also be used by small- and medium-sized enterprises for superfast broadband access. Adopting the new Wi-Fi 6 technology, the Huawei 5G CPE Pro router delivers speeds of up to 4.8 Gb/s. It is the first 5G CPE that supports Huawei HiLink protocols, bringing smart homes into the 5G era.

5G Smartphone Trials

Together with Ericsson and Qualcomm Technologies, Telecom Italia Mobile (TIM) has announced that the company successfully completed the first 5G connection in Italy, using the country's first 5G prototype smartphone on TIM's live network.

Performed at the TIM laboratories based in Turin, the first over-the-air connection trials were compliant with the 3rd Generation Partnership Project (3GPP) 5G New Radio Release 15 specifications, featuring Ericsson technology that uses massive multiple-input, multiple-output (MIMO) solutions. The test employed a smartphone based on Qualcomm's Snapdragon X50 5G chipset, the first such use in Italy. This chipset will be employed in some of the first 5G smartphones available on the market in 2019.

For these latest 5G transmission trials, the prototype 5G device was connected to the TIM network using a portion of the 3.4–3.8-GHz frequency band. This band was assigned to the operator following a recent spectrum auction conducted by the Italian Ministry for Economic Development. This demonstration was a primary step toward the implementation of 5G in Italy to benefit TIM customers.

TIM continues to consolidate its strengths in the Italian mobile communications industry through the recent acquisition of new frequency bands, a fundamental asset for developing future 5G services that will revolutionize the lives of citizens, consumers, and businesses. 5G is expected to usher in an era where everything will be smarter and more connected, from public safety to transport and from environmental monitoring to health, tourism, and culture, including applications in the fields of media, education, and virtual reality (VR).

Standard-Compliant 5G Calls

The largest mobile phone operator of Turkey, Turkcell, has announced that the company reached another groundbreaking milestone in its 5G efforts. Turkcell and Ericsson have successfully made Turkey's first standard-compliant 5G call in Istanbul. Thanks to its 5G-ready network and in collaboration with Ericsson, Turkcell is one of the first operators in the world to achieve an end-to-end, 3GPP-compliant, multivendor 5G data call on the 3.5-GHz band.

This call, the first of its kind in Turkey and a rare achievement for operators across the globe, used Ericsson Radio System solutions and Ericsson Cloud Core, along with test devices from ecosystem partners, over Turkcell's 5G test network. As there are currently no commercial terminals available that support 5G technology, data transmissions were carried out using the Intel Mobile Trial Platform device and Turkcell's 5G-compatible subscriber identity module card. The tests in Istanbul used 5G systems over Turkcell's existing Gigabit LTE (4.5-G) network, proving that Turkcell's network is ready for 5G.

As long-term partners and R&D collaborators, Ericsson and Turkcell are working together to bring 5G to Turkey and make room for future growth of the telecom industry in the country.

5G in Railway Stations

China Mobile Shanghai has launched a 5G network in Shanghai's Hongqiao Railway Station, making it the first railway station to be equipped with a 5G digital indoor system (DIS). The deployment aims to achieve deep indoor 5G coverage within the entire station by the end of 2019, thus providing easy access to fast 5G network services for all passengers.

The railway station's 5G network is seen as a key milestone in Shanghai's commercial 5G deployment, laying a solid foundation for Shanghai as a dual-gigaband city, with gigabit network speeds on both mobile and fixed networks. The Shanghai Hongqiao Railway Station is one of Asia's largest traffic hubs in terms of passenger throughput. It handles more than 60 million passengers every year, with more than 330,000 people passing through every day during peak hours.

As the 5G era approaches, one key concern for telecom operators will be how to use 5G networks to meet the needs of high-density areas, with thousands of people simultaneously using the network for phone calls, accessing the Internet, and making mobile payments. 5G offers high bandwidth, low latency, and massive connections. However, it uses high frequencies, which means network signals will lose a lot of their energy when penetrating buildings. This makes it difficult to provide full 5G coverage in indoor environments. A huge building, such as Hongqiao Railway Station with a large number of passengers generating vast dataflows, increases the challenge.

China Mobile Shanghai selected Huawei's 5G DIS, which is currently the industry's only commercially available solution for 5G indoor

coverage. The product was developed in Shanghai and is now ready for mass delivery. Most 5G base stations are currently being deployed outdoors. The 5G DIS will ensure that 5G network coverage extends into every scenario in every corner of the city.

At the launch event, China Mobile Shanghai and Huawei demonstrated the 1.2-Gb/s peak rate enabled by the 5G DIS. This will mean that, after logging on to a network supported by the system, passengers can download a 2-GB HD film in fewer than 20 s. They will be able to enjoy a seamless entertainment experience as they wait, board, and ride their train.

With the application of the 5G DIS in more diverse scenarios, the 5G railway stations of the future will meet passenger demand for high-speed connectivity and mobile payments anytime, anywhere. They will also support services including 4,000-pixels (4K) HD video calling and multiway ultra-HD video uploading. These new services will create a better travel experience for passengers.

5G in the Skies

Ericsson and Panasonic Avionics Corporation have announced that Ericsson's Core Network as a Service (CNaaS) solution is now fully operational and delivers services to Panasonic customers worldwide. Ericsson's CNaaS solution will help Panasonic and its subsidiary AeroMobile, a global telecommunications operator, to provide data, voice, and messaging services to the millions of airline passengers who use these services in flight. The collaboration among Ericsson, Panasonic, and AeroMobile started in 2016.

As part of Panasonic's initiative to bring a superior connected experience on board commercial aircraft, Panasonic and Ericsson have seamlessly migrated the existing service operating across a global fleet of aircraft onto the core network, delivered as a service, while maintaining network performance and customer experience. Every passenger whose mobile service provider has a roaming agreement with AeroMobile can use the service, which is supported by mobile operators across the globe. The service is provided in flight to more than 20 of Panasonic's global commercial airline customers. The geo-redundant solution, which includes virtualized network applications such as packet core, unified data management, mediation, and mobile switching, is able to support 5G services to passengers and airlines.

The two companies will explore other services to address further market segments and opportunities, while ensuring service continuity and the constant evolution of the live network, including exploring new 5G use cases.

5G in Large Buildings

Nokia and the China Mobile Research Institute launched the industry's first hybrid indoor radio solution with location services, to meet 5G connectivity demands inside large, busy buildings such as business campuses and shopping malls.

Research conducted by China's Ministry of Industry and Information Technology has shown that 70% of 5G business application consumption will take place indoors, with high-value customers likely to spend 80% of their working hours in indoor environments. As a result, indoor coverage has become a key area for operators developing new 5G services. China Mobile has long utilized distributed access systems (DASs) for 4G indoor coverage and wanted a solution that would meet the demands of 5G while reducing costs as it introduces innovative new services.

Nokia and China Mobile jointly developed the industry-first 5G low-cost hybrid distributed indoor system to meet these challenges. This active, smart indoor coverage system leverages the Nokia 5G Pico Remote Radio Head system together with passive DAS antennas and Bluetooth Low Energy technology. With fewer active elements to deploy compared to Pico systems, the solution reduces deployment costs to the levels associated with traditional passive-only DASs, while delivering greater capacity than a DAS.

The ability to leverage both active and passive indoor distribution technologies enables the delivery of intelligent operations and maintenance services, making it easier to monitor, locate, and correct any disconnected elements. The new services enabled include weak coverage analysis, indoor positioning, traffic flow analysis, easy expansion, and elastic scalability. In a shopping mall, for example, the location services can enable such functions as remote security monitoring and sending shoppers information about busy locations to decrease congestion. Additionally, the integration of third-party services, such as geofencing and hot-spot identification, will allow retailers to send coupons and store information to mall customers who have opted in to the service.

Massive MIMO Pilots

On 5 February 2019, Nokia and Zain Kingdom of Saudi Arabia announced the start of a massive MIMO pilot in the city of Jeddah on a time-division LTE network using the 2.6-GHz spectrum. The pilot employed Nokia's 5G-ready AirScale massive MIMO antenna for 4.9-G calls to improve network capacity and provide data speeds greater than 700 Mb/s per user, enabling customers to enjoy extreme broadband applications without experiencing any buffering.

Massive MIMO is especially useful in helping service providers add capacity in densely populated urban environments. Massive MIMO uses a 64-transmit/64-receive system that allows unprecedented gigabit-level throughput, enabling users to enjoy new use cases, including augmented reality (AR) and VR. Nokia's 5G-ready AirScale massive MIMO antenna paves the way for the transition to 5G and coexistence with LTE on the 2.6-GHz frequency band, delivering better network capacity,

improving coverage, and significantly enhancing the uplink and downlink data speed.

An overview of the solution used for the massive MIMO pilot can be found in [2].

Holographic Communications

Operators are starting to explore the ultrahigh-bandwidth and extremely low-latency boundaries of 5G. Volumetric display, also known as *3D holographs*, is one example of an application that can only be carried over 5G mobile networks. With potential applications for medical imaging, videoconferencing, and gaming, 3D holographic communication requires about four times as much data as a streamed 4-K video. This means that only 5G has the speed and sufficiently low latency to support applications like these on a mobile network.

In a recent demonstration, Ericsson and Vodafone Germany teamed up to power a live holographic interview combining 5G and connected transport. During an interview with the German newspaper *Bild*, Vodafone Germany's chief executive officer (CEO), Hannes Ametsreiter, appeared as a hologram in a moving, electrical minibus. In real life, Ametsreiter was at the company's laboratory in Düsseldorf, Germany, some 70 km away. The demonstration, which used the first 5G masts from Vodafone in Germany, was supported by Ericsson's 5G Radio and Cloud Core solutions.

A similar demonstration was conducted by Vodafone Ireland and Ericsson during the launch of the service provider's first live 5G network site. As part of the launch, Vodafone Ireland's CEO, Anne O'Leary, participated in Ireland's first international holographic call. Ericsson again supplied the 5G solution to power the call.

Another European operator, COSMOTE in Greece, took the concept one step further and demonstrated a holographic music concert in which band members in different physical locations were holoported on stage such that they were able to play together in real time as one band. This demonstration was conducted during the InfoCom World Conference in Athens. For the demonstration, special cameras capable of capturing in-depth information were used to create a 3D representation of a live person. The latency needed for this kind of application is about one-tenth the latency of the current 4G technology. In Greece, Ericsson provided the 5G trial system that operated on mm-wave spectrum capable of reaching a data rate upward of 7 Gb/s.

5G Americas News

The 5G technical standardization procedure and successful trials have led to the first globally commercial 5G deployment. The number of commercial launches is expected to increase and deployment of 5G to broaden during the next few years, particularly in North America and key markets across Asia Pacific and Europe.

5G Americas, the industry trade association and voice of 5G and LTE for the Americas, published the white paper "5G Spectrum Vision" [3] in February 2019. The white paper outlines spectrum inventory opportunities for 5G in the Americas and other parts of the world. The paper brings forward a pertinent industry analysis of the characteristics of a range of bands along with challenges and opportunities in using different bands for 5G. In addition, the paper identifies bands that have a potential for use in 5G services. It also recommends mechanisms for spectrum clearing and spectrum sharing as well as the industry and regulatory actions required to move toward more licensed spectrum for progress of 5G technologies.

The key factors that will assure investments in 5G as well as the success of 5G are largely contingent upon the availability of a sufficient supply of spectrum. "5G Spectrum Vision" offers recommendations including the following:

- Operators need to have access to a sufficient supply of harmonized low-band, midband, and high-band spectrum to deliver on 5G promises.
- Processes in North America must accelerate to introduce spectrum necessary for supporting the developing global 5G ecosystem.
- Spectrum identification and allocation opportunities below 3 GHz must continue to be considered.
- Licensed use of spectrum in the range of 7–24 GHz must also continue to be explored.
- All or a significant portion of the 3.70–4.20-GHz band for licensed flexible deployment should be made available as soon as possible.

Next Generation: Beyond 5G

NTT DOCOMO and Rohde & Schwarz (R&S) have joined forces to set up the world's first ultrawideband channel sounder for mobile communications exceeding 100 GHz. The companies conducted radio wave propagation experiments at frequencies up to 150 GHz. The frequency bands from 100 to 300 GHz are expected to enable further high-speed and large-capacity communications for the next generation beyond 5G.

In the experiments, the two companies measured and analyzed the effects of radio wave propagation characteristics and shielding effects in the mm-wave range. As a result, they pioneered new frequency bands and contributed to the realization of terabit-class mobile communication systems.

In the 100–300-GHz frequency bands, wider bandwidths are available than in those used for 5G. However, these higher mm-wave frequency bands are strongly affected by persons, vehicles, trees, and environmental conditions such as rain. It is therefore necessary to research the influence of such objects on radio-wave propagation characteristics.

Using test and measurement equipment from R&S, NTT DOCOMO

has developed a novel ultrawideband mm-wave channel sounder to measure the radio wave propagation characteristics necessary for evaluating mm-wave mobile communication systems exceeding 100 GHz. The measurement parameters include the propagation loss (degree of attenuation of radio waves), power delay profile (arrival time of radio waves), and angular profile (indicator of the spread of radio wave arrival).

In the test system, the R&S SMW200A signal generator together with the R&S SMZ frequency multiplier generates the mm-wave bands, while the R&S FSW85 signal and spectrum analyzer equipped with the R&S FS-Z170 analyzes it using a scalable wide analysis bandwidth of up to 2 GHz. The setup offers a highly convenient user interface with a high-resolution, multitouch display directly displaying the radio-wave propagation characteristics in real time.

LTE-Connected Drones

Nokia and Smart Communications, the leading wireless provider in the Philippines, have announced that they are collaborating with the Philippine Red Cross (PRC) to bring innovative technology such as LTE-connected drones and a portable network into areas struck by disaster. On 23 November 2018, the collaboration was unveiled at an event in the PRC logistics and training center in Subic Bay, Philippines. The event also served as the inauguration of the nonprofit Nokia Saving Lives (NSL) solution, which PRC will now incorporate into its tool kit for demanding search and rescue activities.

The event showcased how the NSL solution integrates with Red Cross teams and how a high-capacity mobile broadband network combined with drones and on-site computing power can effectively support Red Cross emergency operations. Aerial insights and data analytics improve situational awareness and help the incident commander prioritize resources for people in distress. The demonstration also highlighted how NSL provides a critical communication channel in remote areas where no network coverage exists or when a disaster destroys the existing network infrastructure. The collaboration with PRC and Smart Communications is the first deployment of the NSL concept.

The solution is composed of a portable LTE network that connects to drones equipped with cameras, sensors, and speakers; a high-performance server; and analytics applications. A team of 25 Nokia employees has been trained as technical experts to serve as volunteers in the Red Cross organization. In addition to the technical training, these volunteers have thus far contributed 1,000 person-hours to Red Cross disaster preparedness education in support of Nokia's commitment to United Nations sustainable development goals.

Critical Broadband Communications

Ericsson has announced the launch of its critical broadband communications portfolio for service providers. This will enable service providers to meet the business- and mission-critical needs of industries and public safety agencies, as digitalization and modernization of land mobile radio (LMR) communications increases. LMR systems are person-to-person voice communication systems widely used by emergency first responder organizations, such as police, fire, and ambulance services, and other governmental organizations.

Communication disruptions lasting minutes, seconds, or even milliseconds can have huge consequences for business operations or serious implications for public safety. The need for fast and reliable communication is therefore paramount. Critical communications are used in many areas, from first responders and nationwide emergency services to workforce safety in enterprises. For such use cases, there is a growing demand for business- and mission-critical broadband communications. This requires service providers to deliver the highest level of availability, reliability, and security.

To meet users' need for critical communication systems, Ericsson has developed a new portfolio [4] comprising the following three offerings:

- *Critical network capabilities*: This offering includes advanced features for critical network performance. It covers high network availability, multinetwork operation with spectrum-sharing techniques, and coverage and capacity for critical applications. It also includes network security capabilities to ensure that network services are maintained even when the infrastructure is under attack.
- *Critical broadband applications*: This covers Ericsson GroupRadio, which provides mission-critical push-to-talk, data, and video services. This will enable, for example, blue-light personnel such as the police to be more effective in performing community services that require advanced mobile broadband network solutions.
- *Flexible deployments for private networks*: Ericsson's flexible deployments for private networks range from network slicing to fully dedicated networks, enabling service providers to offer scalable critical broadband network solutions and services for critical industries.

Cellular Internet of Things

In January 2019, Ericsson unveiled the next steps in the evolution of the cellular Internet of Things (IoT) in four market segments: massive IoT, broadband IoT, critical IoT, and industrial automation IoT. The broadband and industrial automation IoT segments are new. Broadband IoT adopts mobile broadband capabilities for the IoT and supports higher data rates and lower latencies than massive IoT. Industrial automation IoT will enable advanced industrial

automation applications having extremely demanding connectivity requirements.

In line with its cellular IoT vision, Ericsson is launching enhanced functionalities for massive IoT and new solutions for broadband IoT. One example of massive IoT enhancement is the narrow-band IoT (NB-IoT) extended cell range of 100 km, which stretches the standards-based limit from around 40 km to 100 km through software updates without requiring changes to existing NB-IoT devices. This opens huge opportunities for IoT connectivity in rural and remote areas, particularly for logistics, agriculture, and environment monitoring. Ericsson has deployed NB-IoT data connections of up to 100 km with Telstra and DISH Network Corporation.

The broadband IoT solutions being launched include drone detection and link control, radio access network slicing, advanced subscriber group handling, and multigigabit LTE for 2-Gb/s data throughput and around 10-ms latency. The new solutions will enable a wide range of use cases. Ericsson's evolution concept delineates how cellular IoT can move beyond the more basic use cases of massive IoT, such as asset tracking and smart metering, to increasingly sophisticated use cases enabled by broadband IoT (e.g., infotainment in cars, AR/VR, drones, and advanced wearables) and then to critical IoT (e.g., autonomous vehicles) and industrial automation IoT (e.g., collaborative robotics in manufacturing).

This stepwise approach will make it easier for service providers to match cellular IoT capabilities with current and future use cases by continuing to enhance LTE networks while preparing for 5G. With effective use of techniques such as network slicing, service providers can support all four segments in a single network, allowing the optimization of assets and tapping into revenue opportunities within industries.

Mobile Solutions for Public Safety

Motorola Solutions has announced the launch of the Si200 body-worn camera, the newest addition to its digital evidence ecosystem. The Si200 integrates seamlessly with CommandCentral Vault, the company's software solution for digital evidence management, enabling agencies to efficiently and securely manage content from in-field capture to judicial sharing, all in one system.

The compact and lightweight Si200 body-worn camera captures HD video and features additional advanced capabilities. The importance of an integrated ecosystem for digital evidence management becomes clear when footage from the Si200 is uploaded to CommandCentral Vault. Digital evidence technologies and CommandCentral Vault sync to simplify the process of tagging video, automating redaction, correlating video with incident information in police records, and maintaining chain of custody when managing evidence.

The complete digital evidence ecosystem enables agencies to securely manage files, connect public safety workflows, and analyze digital evidence within one integrated platform. The Motorola Solutions digital evidence management platform can take in and manage digital evidence from different providers.

The Si200 body-worn camera and CommandCentral Vault are integral components of Motorola Solutions' consolidated digital evidence ecosystem. Both are available now in North America.

Telecom Industry Trends

The mobile telecom industry along with many other industries is eagerly anticipating what 5G might bring. The November 2018 edition of the "Ericsson Mobility Report" [5] takes a deeper look at the trends that lie ahead for the mobile telecom industry, currently going through a pivotal change.

As 5G hits the market, the mobile ecosystem will become larger, more widespread, and more extensive than ever. Momentum is building in many markets as service providers accelerate their plans for 5G rollout. By the end of 2024, 5G is expected to reach 40% of global population coverage and 1.5 billion subscriptions, making 5G the fastest generation of cellular technology to be rolled out on a global scale. This is driven by new and innovative solutions that reuse existing infrastructure and available spectrum.

North America and Northeast Asia are expected to lead the 5G uptake. In North America, 5G subscriptions are forecast to account for 55% of mobile subscriptions by the end of 2024. In Northeast Asia, the corresponding forecast figure is more than 43%. In Western Europe, 5G is forecast to account for some 30% of mobile subscriptions by the end of 2024.

In parallel with the 5G rollout, massive IoT cellular technologies, such as NB-IoT and Category M1, are taking off and driving growth in the number of cellular IoT connections worldwide. Of the 4.1 billion cellular IoT connections forecast for 2024, Northeast Asia is anticipated to account for 2.7 billion, a figure reflecting the ambition and size of the cellular IoT market in this region.

Between the third quarter of 2017 and the third quarter of 2018, mobile data traffic grew nearly 79%, the highest rate since 2013. Increased data traffic per smartphone in Northeast Asia, mainly China, has pushed the global figure notably higher. With mobile data traffic growth per smartphone of around 140% between the end of 2017 and the end of 2018, the region has the second highest data traffic per smartphone at 7.3 GB per month. This is comparable to streaming HD video for approximately 10 h per month. North America still has the highest data traffic per smartphone and was expected to reach 8.6 GB per month by the end of 2018 (comparable to streaming HD video for more than 12 h monthly). From 2018 to 2024, total mobile data traffic is expected to increase by a factor of five, with 5G networks projected to carry 25% of mobile data traffic by the end of the period.

The "Ericsson Mobility Report" also provides insight into trends for realizing fixed wireless access, streaming video from megabits to gigabytes, and developing the smart wireless manufacturing market.

Hot Consumer Trends

Ericsson has released [6] the eighth edition of its ConsumerLab trend report, "10 Hot Consumer Trends 2019," representing predictions by 34 million early technology adopters.

The latest edition of the annual report evaluates consumer thoughts and predictions on near-future technology, including AI, VR, 5G, and automation. The report reveals that autonomous and mood-predictive technology could soon play a bigger role in people's everyday lives. According to the report, the 10 hot consumer trends for 2019 and beyond are as follows:

- *Awareables*: More than 60% of virtual assistant users think devices that understand our moods will be mainstream in three years.
- *Smart quarrels*: In excess of 65% of virtual assistant users believe smart speakers will argue like family members in three years.
- *Spying apps*: More than 45% of consumers think apps collect data about them even when they do not use the app.
- *Enforced agreement*: Always having to accept data collection cookies annoys 51% of consumers.
- *Internet of skills:* More than 50% of AR or VR users want apps, glasses, and gloves that give virtual guidance for practical, everyday tasks, such as cooking or carrying out repairs.
- *Zero-touch consumption*: About half of virtual assistant users want automated bills and subscriptions as well as self-restocking household supplies.
- *Mental obesity*: 31% of consumers soon expect to go to mind gyms to practice thinking, as everyday decision making becomes increasingly automated.
- *Eco me*: 39% of consumers want an eco-watch that measures their carbon footprint.
- *My digital twin*: 48% of AR or VR users want online avatars that mimic them exactly, so they can be in two places at once.
- *5G to automate society*: Roughly 20% of smartphone users believe 5G will better connect IoT devices, such as household appliances and utility meters.

The insights in the report are based on Ericsson ConsumerLab's global research activities during more than 23 years and primarily draw on data from an October 2018 online survey conducted of advanced Internet users in 10 influential cities across the world.

Visions of Connected Living

On 7 January 2019, Samsung Electronics unveiled its expanded vision of connected living, with improvements in smart technology that are rapidly transforming the rhythms of daily life. Today's growing families and new homebuyers bring a fresh outlook toward technology and how it fits their day-to-day lives. Technology is no longer something that needs to be learned but rather functions seamlessly to enhance lives, provides increased personalization, and allows people to spend time doing what matters most to them. A smart home is not about the devices, the data speeds, or the specs but rather the experiences, starting with the most basic daily routines.

Connecting people in new ways and helping them care for their homes and families is one of Samsung's biggest missions. A case in point is the expansion of connected living to include AI. Long viewed as something in the distant future, AI is here now. The centerpiece of Samsung's AI vision is Bixby, which, in a short amount of time, has leapfrogged from a simple voice assistant to a truly intelligent interface capable of more conversational interaction and simplified control of hundreds of devices.

LONG VIEWED AS SOMETHING IN THE DISTANT FUTURE, AI IS HERE NOW.

The impact of Bixby built into home appliances can be seen in everything from the Family Hub refrigerator's more personalized screen experience and expanded universe of voice-activated apps to an intuitive AI-powered laundry assistant in Samsung's new front-load washer that makes washing clothes the way you want easier and more intuitive.

In addition, during the past year, Samsung has consolidated all of its IoT apps into the simplified and streamlined SmartThings app. At the same time, the number of SmartThings-compatible devices has doubled and includes products from and partnerships with Amazon, Google, Plume, and Ring. The result is a broader and even more open network for connecting and managing life at home and the added convenience of getting daily tasks done as quickly and efficiently as possible. In other words, there is less focus on what is connected and how it is connected and more on what the user can accomplish by just saying what he or she wants to do.

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