

5G On the verge of a smart future

At Mobile World Congress (MWC) 2018, Huawei released the industry's only 5G end-to-end (E2E) product and solution based on the 3GPP standard. Focusing on enhanced mobile broadband (eMBB) services, we completed the world's first interoperability test of 3GPP R15-based commercial products and we've been working with world-leading operators on large-scale 5G verification tests in commercial environments – Huawei is ready for large-scale 5G rollout.

By Zhou Yan



E2E and all-scenario

Our 5G E2E products and solutions cover the core network, bearer network, base stations, and terminals. Huawei's 5G core network solution is designed with all-cloud architecture, with software architecture based on microservices. The solution can simultaneously support 2G, 3G, 4G, and 5G, and enable smooth evolution in non-standalone (NSA)



and standalone (SA) scenarios. Its flexible, distributed network architecture applies control plane and user plane separation (CUPS), helping operators deploy the control plane in a central data center and flexibly choose the deployment location for the user plane according to the service scenario.

The all-cloud 5G core network provides the basis of network slicing, which will enable operators to offer various services on a single network and transform their businesses from the mass market to the vertical industry market.

Huawei's X-Haul 5G bearer solution supports multiple technologies, including IPRAN, PTN, OTN, and microwave, covering active to passive and 5G microwave to IP bearer networks. To meet 5G network capacity requirements and help operators solve the challenges large-scale 5G deployment will bring for mobile bearer networks, Huawei has launched a 5G bearer product portfolio that suits various scenarios, media, and forms. The portfolio includes a series of 5G microwave products for backhaul scenarios that can provide 10-Gbps bandwidth and 25-ms latency on traditional microwave frequency bands; a 50 GE/100 GE adaptive slicing solution that supports smooth evolution from

10 GE to 50 GE and 100 GE for on-demand gradual deployment; an active FO OTN fronthaul solution that supports up to 15 channels of service access, lossless switching, and integrated access for multiple services; and a centralized WDM fronthaul solution that uses a colorless optical module to simplify site delivery and O&M.

Huawei provides a range of base station products covering all site forms, including tower sites, pole sites, and small cells. Diverse site forms are required to meet the needs of complex deployment scenarios, provide continuous coverage, and satisfy capacity requirements for indoor and outdoor hotspots.

The first wave of 5G deployment will take place in buildings and densely populated urban areas. Huawei's C-band 64T64R and 32T32R Massive MIMO AAU both support 200 MHz large bandwidth and 3D beamforming. This allows for the flexible and accurate control of cell coverage radius. The vertical plane improves coverage for tall buildings, while the horizontal plane enhances coverage at near points and far points horizontally in buildings, enhancing cell capacity and user experience.

Huawei's mmWave products support 1 GHz bandwidth, with

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antenna port equivalent isotropically radiated power (EIRP) hitting 65 dBm, the highest in the industry.

Huawei's wireless products are integrated, compact, and light. They slash space requirements on the antenna installation platform and reduce installation complexity. The fronthaul optical interface speed for the hardware is less than 25 Gbps, reducing transmission requirements, which is ideal for large-scale 5G deployment.

Huawei's base station products support both distributed and centralized deployment. BBU5900, which is for distributed sites, is the most integrated site solution currently available in the industry. It supports all RATs (2G, 3G, 4G, and 5G) and all frequency bands, and offers 50 Gbps backhaul capabilities, which meets the long-term development needs of 5G services. CBU5900, which is for centralized sites, requires many BBUs to support C-RAN (Centralized RAN) architecture, simplifying remote sites, reducing the need for equipment rooms, and contributing to quick satellite clock synchronization across the entire network. This approach reduces the number of site visits during maintenance and installation, allowing sites to be added on demand, greatly reducing future site construction and maintenance costs. Centralized site deployment also enhances the edge user experience and the performance of the entire network through large-scale site coordination.

Huawei's new compact 5G Massive MIMO 5G C-band and mmWave products can

be deployed on streetlamp poles to fill coverage holes and boost hotspot capacity. Huawei has also launched 5G LampSite, an indoor 5G small base station product. The solution is backwards-compatible with 4G and harnesses existing CAT6A network wires or optical cables to achieve indoor 4G and 5G co-deployment with zero cable adjustment or site addition. 5G LampSite is the industry's first multi-frequency integrated indoor small base station that supports both 5G and LTE.

On the device side, Huawei has invested heavily in developing 5G chipsets and customer premise equipment (CPE) to help operators achieve first-mover advantages in the 5G market. Huawei released its Balong 5G01 5G chipset, the industry's first commercial 5G device chipset that supports the 3GPP standard. It supports all the main 5G frequency bands, including sub-6 GHz and mmWave, provides Gbps-level data downlink speeds, and supports NSA and SA networking.

Huawei's 5G CPE is based on 3GPP standards and chipset architecture. Compact with low power demands, it's currently the only miniaturized 5G commercial terminal. In Seoul and Canada, we've seen the first batch of users of 5G CPE. In 2019, Huawei plans to launch 5G mobile phone chips and a 5G smartphone.

Following the advancement of standards in addition to the completion of key technologies and system verifications, Huawei has carried out large-scale engineering and performance verifications in real-world field environments to prepare for

5G commercial application. Using its leading 5G products and solutions, Huawei has already deployed large-scale 5G networks in more than 10 countries, including China, South Korea, Canada, Germany, the UK, and Italy. In typical densely populated urban areas, these products and solutions provide ubiquitous Gbps-level access rates, indoor access rates of hundreds of Mbps, and over 20 Gbps of user peak rates.

Partnerships, innovation, ecosystem

Huawei has deepened collaboration with industry leaders in device ecosystem, technological innovation, and network verification.

In early 2018, Huawei worked with Deutsche Telekom and Intel to complete the first ever 5G interoperability and development test in a carrier network environment using a commercial 5G site based on the 3GPP R15 Standard, carrying out 5G interoperability testing based on the 3GPP standards with Qualcomm.

At the 2017 Global Mobile Broadband Forum, Huawei and the BT subsidiary EE conducted the first field demonstration of 5G uplink and downlink decoupling technology, achieving a 70 percent increase in cell radius coverage. The technology flexibly shares the 1.8 GHz uplink frequency band with 5G without affecting user experience on the existing LTE 1.8 GHz band. 5G downlink continues to operate on the 3.5 GHz band. The solution compensates for insufficient

uplink coverage due to factors like high penetration loss and propagation loss in the 3.5 GHz band. Not only is cell coverage uplink improved, but the downlink performance of 3.5 GHz Massive MIMO is also maximized. Achieving C-Band and 1.8 GHz co-site deployment with the same coverage can greatly reduce requirements for new sites during 5G network construction, lowering operator investment in site construction and leasing.

Huawei and Bouygues Telecom have signed a 5G agreement to carry out the first 5G trial in Bordeaux. Huawei and Vodafone joined forces recently to complete the world's first 5G call and dual-connectivity test on a 5G commercial system. Huawei partnered with TELUS to conduct the first user friendly test of 5G CPE in North America, taking 5G from the lab toward the end user. Huawei, Telecom Italia, and Fastweb completed 5G verification achieving a single-user downlink rate of 3 Gbps. Huawei teamed up with Telefonica to demonstrate the first interactive virtual reality (VR) service using 5G E2E network slicing. Working with Deutsche Telekom, Huawei carried out the first high-level mmWave (73 GHz) field verification. Huawei and Vodafone jointly completed the world's first 5G microwave proof-of-concept (PoC) test, demonstrating a capacity of 2.7 Gbps on a single microwave link and single-hop latency of 50 microseconds. This will be able to fully meet the demands of 5G bearer networks for large bandwidth and low latency. Huawei became the first company to perform third-phase 5G validation tests in

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China, as organized by the IMT-2020 (5G) Promotion Group.

Huawei is committed to promoting 5G in vertical industries and plans to set up a 5G slicing alliance with industry partners. Huawei and Telefonica achieved the world's first PoC of 5G ultra-reliable and low-latency communication (URLLC) for connected vehicles.

From eMBB to fully connected and intelligent

The widespread adoption of Ultra HD video will be a defining feature of the 5G era. Interactive live broadcasts will become a new social entertainment experience that will exponentially increase requirements on network bandwidth. To drive the commercial adoption of 3GPP R15-based eMBB services, Huawei has been exploring services such as multi-channel Ultra HD video, VR, and 360-degree live broadcasts over a 5G network, and carried out a number of on-site demonstrations of these services at MWC 2018. We're actively seeking to innovate in areas that integrate technology, industry, and services for the 3GPP R16 standards for 5G.

Huawei and TPCAST performed the first PoC of CG Cloud VR. Huawei Wireless X Labs set up the Cloud VR/AR special interest group (SIG) with a number of partners to jointly conduct 5G pre-commercial field testing to promote the development of the 5G Cloud VR industry and transform concept into commercial reality.

Huawei's Digital Sky Initiative has now

moved a step closer to implementation. Huawei and the Civil Aviation Administration of China have completed low-altitude network testing and are promoting safety standards for connected drones.

On the smart factory side, Huawei has conducted several 5G verifications and demonstrations. Cloud and wireless connectivity are key technologies for smart factories. The increasing wireless nature of manufacturing equipment will make modularized production and flexible manufacturing in factories possible and slash maintenance costs. High uplink rates will help industrial vision systems analyze and locate issues in real time. The high-reliability and low-latency capabilities of 5G networks will enable high-precision synchronization between robots so they can work and coordinate seamlessly.

Huawei was a major member in setting up a special interest group for wireless connected healthcare, jointly publishing a white paper on the topic, a first in the industry. Huawei has worked with industry partners to build remote B-scan ultrasonography robots, providing real-time, reliable wireless connections for remote control, image acquisition, and diagnostic data for the robots.

Huawei is leading the way to 5G. We're not only dedicated to helping operators build the best 5G networks, but we will also work with industry partners around the globe to help operators achieve commercial success in 5G, explore innovative applications, and work together towards a fully connected, intelligent world. 