

# New Energy

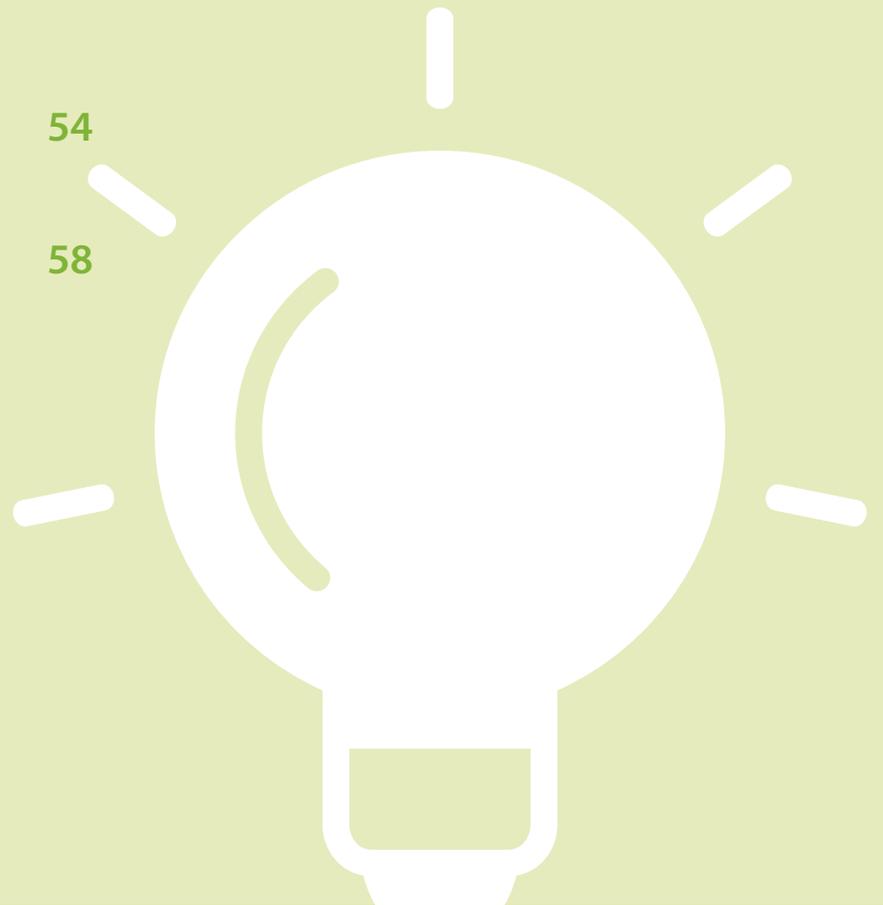
## FOSTERING NEW VALUE IN INNOVATIVE DEVELOPMENT

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## NEW ENERGY: Fostering New Value in Innovative Development

China Unicom is focused on strengthening its new energy for innovation development. Innovation is the primary driving force for development and a sharp tool for converting the old energy to a new one. With a consistent emphasis on innovation as the basis for development, China Unicom has been vigorously driving the construction of smart networks and stepping up with deployments in areas such as cloud computing, Big Data and Internet of Things (IoT), as well as actively involved in AI and blockchain with a strong focus on the application of new technologies in daily life and industries to bring pioneer developments that are innovation-driven and leveraging on the first-mover advantage, with a view to the comprehensive enhancement of customer service.

### Measures adopted in 2018

- Carried out futuristic network technology research, introduced SDN/NFV to gradually build smarter networks, and completed scale 5G pre-commercial trial and testing.
- Faster deployments in cloud computing, IoT, Big Data, AI, blockchain and etc., and initiated innovation business and service innovation.
- A diverse range of “Smart+” applications rolled out and new products were continuously developed.

### Actions to be taken in 2019

- To carry out ongoing R&D and applications of SDN/NFV technologies, expediting 5G technology R&D, and trial deployment, as well as to actively unfold 5G experimental network and trials relating to the testing of 5G features.
- To further enhance capabilities in new Internet technologies such as cloud computing, IoT and Big Data, so as to develop more diverse informatisation application services.
- To further enhance planning and guidance in the research of futuristic technologies and to further improve the systems and regulations for R&D operation and management.

## CONTRIBUTING TO THE BUILDING OF SMART INDUSTRIES

### Enhancing cloud servicing ability

Led by the cloud business, China Unicom has developed a new ecology of Cloud + Network integration in the joint effort with its cooperation partners. While actively exploring new paths for Internet-oriented operations, an operating system with an integrated platform has been built to facilitate a one-stop service for service validation, billing and settlement on the WO Cloud platform, driving Internet-oriented maintenance, products, operation and management in full force to provide swift, flexible and demand-driven dedicated network cloud access services for users.

- In connection with public cloud, cooperation with strategic partners in the mixed-ownership reform has been enhanced, as the “Cloud Fibre Smart Enterprise” special cloud initiative for SMEs has launched close to 100 products for the comprehensive development of an integrated Cloud + Network product system, serving 34,000 customers during the year.

- In connection with private cloud, China Unicom consistently focused on six key sectors and 36 key areas, leveraging the unique advantages of WO Cloud in Cloud + Network integration, multiple cloud and hybrid cloud management to provide customers with premium one-stop private cloud solutions.

- In connection with cloud services, a dedicated operation team has been formed to provide integrated construction + maintenance services underpinned by fast response to demands, fast delivery of resources, uniform management of operations and maintenance and safe operations. A customer service appraisal system has been developed, under which customers’ feedback are collected through a monthly service appraisal form to facilitate settlement through internal coordination. A centre for centralised monitoring of operations and maintenance has been set up to further optimise the process for solving escalated breakdowns and to provide rigorous time limits for the handling of breakdown problems, so as to enhance customer perception.

- A total of 41 public resource pools and 44 exclusive private cloud resource pools have been deployed nationwide. Computing capacity of more than 500,000 cores has been commissioned and storage capacity has reached 40PB, while network capacity has exceeded 1,000G. The four major cloud data centres provide 20,199 cabinets and all data centres are directly linked to the core backbone network of China 169 with latency of less than 5ms and total outlet bandwidth of approximately 3.24T.

- China Unicom has actively sought memberships with domestic and international organisations for cloud computing standards, while owning 15 cloud computing software copyrights. The number of employees holding top-level cloud computing certificates has increased substantially.

In 2018, China Unicom became the domestic cloud storage service provider of Guizhou-Cloud Big Data’s iCloud. Meanwhile, the Company has received the 2018 PRC Trustworthy Cloud Technology Innovation Award, Outstanding Products and Solutions in Cloud Computing and Big Data Service Award, PT Expo China Annual Award for Outstanding Scenario Application, and Annual Award for Outstanding Power Source Project Management Team.

China Unicom Chuzhou in the Anhui province has built an underlying cloud platform for the Chuzhou taxi (including online car hailing) monitoring platform with cloud computing, Big Data and IoT technologies to carry out centralised management of taxis (including online car hailing). The platform can enable real-time monitoring of taxi (including online car hailing) and providing timely report of vehicles in unusual operation, so that relevant authorities can adopt measures to provide convenience and safety assurance for the travelling public.

## Building Big Data paradigm

Backed by the China Unicom Big Data Company, China Unicom provides professional specialised data intelligent services to government and corporate clients in a bid to become an “integrator of data resources, guider of innovative applications and developer of industry ecology”. The Company has made innovative proposition of the data value regime to create a Big Data security system covering the entire life cycle based on scientific data values, which has received ISO/IEC2700 and Grade III national classified protection converging with international standards in data security.

- **Data asset integration capability:** Stressing the focus on key areas and scenarios for “data” and “smart” demands in key industries, China Unicom provides clients and partners with data sharing and application development services, and others, subject to safety and compliance, in an effort to becoming an expert in the operation of data intelligent services.

- **Data monetisation ability:** a three-tier industry solution (elementary, standard and platform-grade) with 12 major operating products, including 8 well-formed regimes, have been developed. Over 1,000 partners have signed up with broadly enthusiastic response from the industry.

- **Ability to operate the data platform:** in accordance with the standard design of a three-tier structure, two core platforms (production and capability exposure) complemented by two auxiliary platforms for data security and data governance have been created to enhance three servicing capabilities, namely, data capability, infrastructure components and production operations.

Serving more than **20** sectors  
More than **1,000** clients and partners developed

China Unicom Beijing has implemented a Big Data governance system with “two horizontal and three vertical dimensions” to manage and assure on the structure. It is a technology-driven platform with security and management as basis, supported by security management and reflected in service management, ultimately resulting in the realisation of Big Data value. During significant national events such as the NPC and CPPCC, “Belt and Road” summit and the 19th CPC Congress, Big Data technologies were employed to facilitate real-time monitoring of pedestrian flow and public sentiment monitoring in successful completion of various important assurance tasks. The Company helped the government and relevant public transport authorities to determine the locations for building highways and public transport stations such as metro stations, and to improve the arrangement of public transport frequency. In the meantime, there were analysis in the trends of the spread of epidemic diseases in cooperation with medical and health authorities to realise the social value of enterprises.

## Facilitating IoT development

China Unicom’s IoT is built around the strategy of an “IoT + platform” ecology featuring end-to-end overall servicing ability. With persistence in an innovation-driven approach, cooperative development and synergy advances, the Company teamed up with up/downstream partners along the value chain in coordinated innovation to contribute to transformation towards city digitalisation so that the mass may enjoy a smart life. As at the end of 2018, there were nearly 110 million IoT connections serving more than 15,000 corporate clients and covering key industrial sectors such as manufacturing, agriculture, transportation and logistics. China Unicom ranked among one of the top ten in “2018 WIOTRL”, the international world IoT convention.

- **Network ability:** through latest virtualisation technologies and common servers, a dedicated core NB-IoT network has been built. NB-IoT commercialisation in major Chinese cities has launched, as eMTC out-field pilot tests have been completed in Guangdong, Changsha, Xiamen and other locations.

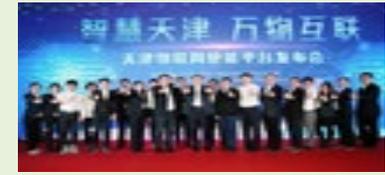
- **Platform ability:** a stronger and more secure new-generation connection management platform has been announced. The platform’s strong ability in secondary operation provides more convenience to SMEs engaged in the development of customised innovative products and new commercial models.

- **Product ability:** global connected products are created to meet the requirement of domestic enterprises with global users for contract-signing and management at a single point, giving a boost to the international development of the enterprises. Meanwhile, more than 20 products were provided to solve social issues in the service of smart living.

- **Ecological ability:** through the joint establishment of the China Unicom IoT Industry Alliance, Innovation Expedition Centre and Incubation Laboratory, China Unicom has been consistently driving the growth of the IoT value chain towards maturity. Meanwhile, the IoT Developer Initiative has been launched and close to 100 applications received, providing a testing ground for SME innovation and business venture.

Nearly **110 million** IoT connections  
Over **90 million** connection in fundamental platform  
Serving over **15,000** corporate clients

The China Unicom Tianjin IoT platform provides one-stop IoT solutions to corporate clients with intelligentisation upgrade requirements, helping them to facilitate fast equipment access, management and in-depth analysis at lower costs, so that clients could acquire IoT capability, achieve product upgrade and enhance competitiveness. To partners in IoT ecology, the Company provides a platform for resource sharing and inter-connection of channels, ultimately accomplishing the aim of jointly facilitating fast development of the IoT industry by combining the strengths of all parties.



### Innovative industry solutions

On the back of its competitive edge in cloud computing, Big Data, IoT and AI, China Unicom continued to step up with deployment in industry Internet. An industry Internet product centre was set up at the headquarters and 12 industry Internet companies were established across the nation to further improve the national support service regime, enhancing the servicing ability in proprietary integration and operation. In the meantime, product capability in industry Internet has been improved with the launch of 10+3 standard products and Internet solutions for key sectors.

- **Capability in solutions:** China Unicom has formulated and completed 74 innovative integration solutions relating to novel smart cities, with a 26% year-on-year increase in solutions available for nationwide application. The “Security Risk Control Platform Solution” was named for the “Top 10 Solutions in Network Security and industry Internet for Central Enterprises Award”, while the “Smart Livestock IoT Platform Solution” was named for the “2018 Exemplary IoT Application Project of China Award”.

- **Capability in integrated implementation:** a cloud relocation laboratory was built with a dedicated nationwide cloud relocation team supported by 227 staff to provide full support for the “cloud fibre smart enterprise” activity. The Company provided leadership in a number of large-scale cloud integration projects and fostered end-to-end business capabilities. The Snow Bright Project was honoured with the title “Excellent Industrial Solution in Safe Construction”.

- **Servicing ability in operations:** 24 nationwide operating system training sessions and provincial site training sessions were completed and more than 1,800 support initiatives were provided in various provinces in the country. The construction of the nationwide integrated operating system has progressed rapidly to provide the government and large enterprises such as central enterprises with assurance in operating services, while assurance for the “online policy deliberations and remote consultation” activity of the NPC and CPPCC has been completed with success.

#### Launch of standardised solutions

- **Smart brain for public administration:** in support to the nation’s drive for the “one net, one gate, one-time” reform in government services and faster progress in the construction of an “one-stop nationwide public administration online servicing platform”, China Unicom has committed full efforts to the building of the “3+X” smart public administration services products. Driven by the “cloud network” and guided by “digital intelligence” orienting towards government service and citizen service, China Unicom has facilitated real-time consolidation of data resources with the use of advanced AI technologies to enable an in-depth re-engineering of the service processes, with a view to achieving sound administration and benefits for the people through integrated online and offline high-efficiency services.

- **Smart brain for ecological environment:** focusing on the current requirements of eco-environmental governance, China Unicom has created the “Eco-environmental Brain 2.0” thanks to breakthroughs facilitated by AI and Big Data technologies. Based on the service cycle of monitoring, analysis, decision-making and governance, special efforts are dedicated to the making of products such as the blockchain-based reliable data platform for the monitoring of the ecological environment, joint eco-environmental protection and control, intelligent monitoring of public opinions on the eco-environment and smart river/lake chief 2.0, to provide strong informatisation support for eco-environmental management.

- **Novel smart cities:** guided by the city development strategy and riding on the strengths and expertise in new-generation information technology ahead of peers, China Unicom has fostered five major elements – a neural network with in-depth sensory abilities, a cloud-end heart providing shared high efficiency, a data-driven city brain, an administrative hub with joint command and a mutually beneficial industry alliance – for the construction of a data-centred and open-ended 4+N novel smart city regime: namely, one net (the integrated aerial and land intelligent sensory network), one cloud (the scalable cloud computing data centre), one data (a shared and open Big Data service platform) and one centre (a high-efficiency joint city command centre). On the back of the comprehensive abilities derived from the four “ones” described above, an open and reliable “strong platform” has been provided. Through extensive industry cooperation, N smart city was launched with strategic partners to offer “flexible applications” covering public administration service, as well as enterprises and the public, in a joint effort to create a new smart city ecology.

#### Launch of industry Internet 10+3 key products

##### 10 proprietary products:

Industry	Public administration service						Ecological environment		General industries	
Name of product	Public administration service data sharing and exchange platform	One-stop public administration services	Internet + targeted poverty alleviation	Smart CPC organisation development	Confidential information integration	New county and region smart city cloud platform	Smart river (lake) chief integrated administration platform	Smart work site	Service outsourcing	Corporate commercial region

##### 3 joint cooperation products:

Industry	Name of product
Medical care	Medical imaging cloud
Transportation and tourism	Industry surveillance and emergency command platform
General industries	Vehicle fleet administration platform

#### Smart education

China Unicom’s continuous efforts in the education sector has been repeatedly commended by the Ministry of Education as “China’s only carrier providing informatisation solutions in a systematic manner on the main battlefield of education”. In the education sector, China Unicom has provided integrated services comprising cloud platform and premium teaching resources to municipal, county and district education bureaus and helped to realise the cloudification of

education authorities and schools. For fundamental education, vocational education, higher education and teachers' training institutions all have rolled out the cloud desktop service, which has effectively enhanced the standard of education informatisation and management efficiency of schools and education management authorities. For pre-school, primary and secondary education, the nationwide project of "three connections and two platforms" has commenced, serving more than 620,000 teachers and students. "All Class Access" was also implemented nationwide in more than 500,000 classes and "All People Access" covered 9.2 million people.

China Unicom Jiangsu has sequentially built standardised examination venues for localities and schools in Nantong, Suqian and Nanjing University. Through upgrading the HD systems, it has enabled HD online patrolling and HDTV conferences, while a new full-frequency fraud prevention system has been built. Personal identification function has been introduced to the examination service to enable real-time transmission of examination data. Through extensive and in-depth application of modernised information technology in examinations, it committed to assuring a fair and unbiased examination setting, so as to help local authorities to advance the development of national standardised examination venues, contributing to the national education and examination reform.



#### ◎ Smart medical care

China Unicom has provided integrated solutions for Cloud + Network applications to the medical and healthcare industry, offering a high-quality, highly reliable and highly secure cloudification service for hospital informatisation systems to various local medical institutions. National health information service, regional medical coordination service and other integrated health services for the benefit of the people are being offered to medical administrations and authorities at all levels.

#### ◎ Smart public administration service

Adhering to the founding principle of "strong platform and flexible application" and offering to public administration clients the service model of "empowering platform + scenario application", China Unicom has enhanced the efficiency and effectiveness of the public administration services. Leveraging massive real-time public service operating data, China Unicom has proactively learned and continued to optimise the service process through multi-dimensional perception, thorough observation, real-time decision-making and ongoing progression. The Company has facilitated the transformation of public administration service management from "passive service" to "intelligent service", from "experience-based management" to "scientific management", from "manual service" to "systematic service", and from "public administration service informatisation" to "public administration service intelligentisation", introducing a new form of smart public administration service.

China Unicom Xianning in the Hubei Province provided assistance to the government to develop the digitised city administration platform. Based on digitised mapping and unit grid division to integrate multiple data resources of basic geography, area codes, and municipal and community servicing, and introducing an integrated city administration and public service command system that collects information from city supervisors and citizen service hotline. Through information sharing among multiple departments and coordinated operation, a new mechanism for public supervising and processing city administration and public service has been established underpinned by swift communication, accurate accountability, timely handling and efficient operation, leading to a comprehensive enhancement of the standard in city administration and public administration services.

#### ◎ Smart transportation

In connection with smart transportation, China Unicom has actively explored to formulate improvement plans for smart transportation organisation work aimed at "eliminating traffic jams and keeping traffic smooth to alleviate traffic pressure". With technology-based and intelligentised transportation safety management as basis, smart transportation organisation improvement plan was formulated in order to bring new experiences in smooth traveling to the mass.

With the aim of "combining the remote and the vicinity, tackling root causes as well as perceived problems, working in relation to the near term, seeking active progress and enabling smart travelling", China Unicom Ningxia has contributed to the construction of intelligent transportation in Wuzhong City in Ningxia through the building of an intelligent integrated transportation management and control platform, a Big Data vehicle management and control platform, intelligent electronic police surveillance equipment and cloud storage systems, among others. Since the implementation of the construction project, transportation in Wuzhong City had significantly improved and illicit behaviors in transportation reduced substantially, bringing positive experiences in travelling to its residents.

#### ◎ Smart environmental protection

In vigorous response to the national informatisation and strategic plan of the "uphill battle for prevention and control of pollution", China Unicom has integrated innovative technologies including Cloud, Big Data, IoT and AI and built on its river chief system and Ali Cloud Environment Brain 1.0 products to form a data closed-loop from the four segments of environmental monitoring, analysis, decision-making and governance through the four principal platforms of data management, data resources, learning algorithms and operating services in support of environmental authorities' effort to build a continuous circulation system of ecological improvements, in a powerful drive of the in-depth integration of the Internet and the development of ecological civilisation.

In July 2018, China Unicom Baoshan in Shanghai successfully implemented the first intelligent system for monitoring garbage spillovers, further cementing the achievements as a national hygiene town, as well as enhancing the standard of living quality for its residents.

#### ◎ Smart tourism

China Unicom has consolidated industry resources and capabilities, and actively participated in open data cooperation to expand its fundamental data resources, to cementing the leading ability in data collection integration capability based on different content and types of data. Diverse application services on transportation and traveling data have been provided to build the tourism Big data platform (2.0), as well as premium products including tourism industry monitoring and emergency command platform, integrated scenic area management platform, and the Lexiang hotel platform.

China Unicom Xin'an in the Henan Province has consistently driving the development of a "smart tourism" platform as part of "Smart Xin'an" to apply the abilities of intelligent equipment in various city scenarios, so that its city life will become more efficient and more comfortable. With the help of the "smart tourism" project, Longtan Grand Canyon and Daimei Mountain Scenic Area have been accredited "One Diamond Smart Scenic Attraction" at the national tourism promotion conference.

#### ◎ Smart manufacturing

To respond positively to the call of the State for transformation and upgrade of industrial manufacturing, China Unicom has launched an "Internet+ manufacturing" servicing model leveraging its expertise in informatisation and network resources advantage, helping to resolve critical issues in the value chain faced by the manufacturing sector and driving the optimisation and transformation of enterprises.

China Unicom Jiangxi has linked up various sections in the value chain and created the "Mass Service Link", China's first complete S2B2C ecological platform for the apparel industry, based on the current characteristics and critical issues of the sector and the current application scenario, with a view to helping enterprises in the textile and apparel industry to realise customisation, flexible production and intelligent manufacturing, thereby achieving Internet-oriented transformation.

#### ◎ Smart agriculture

China Unicom has been actively building a targeted poverty alleviation big data platform and the WO land "Internet+ agriculture" cloud platform to promote agriculture-related informatisation application products such as agricultural tracking, home security protection, the Snow Bright Project, and others, to improve the production work of agriculture, rural and farmers, enhance the efficiency of agricultural production, and upgrade the standard of modernised management in rural villages.

China Unicom Miyang of Henan has built a number of information platform in an intensive implementation of the "e-commerce + industry + poverty aid" model on the back of its strengths in e-commerce platform. The e-commerce operations centre currently hosts 21 e-commerce companies and 9 business venture teams; while www.pangu1688.cn is hosting 689 companies with sales exceeding RMB30 million; the Miyang county specialty agricultural products tracking administration platform provides source tracking for 36 specialty products in Miyang County.



Miyang County e-Commerce Poverty Alleviation Rural Service Station

#### ◎ Smart finance

China Unicom is committed to financial platform development, new-generation upgrades of financial products and enhancement of users' operating capability. In addition to serving users and partners well, China Unicom has also vigorously explored industrial customers and scenarios of different businesses to facilitate innovation and breakthrough in new value for the communication + payment/financial industry. In 2018, further communication with clearing institutions such as China Nets Union, UnionPay and the Clearing Centre actively provided access to various payment services, the number of banks China Unicom supported increased to 543. Meanwhile, the Company continued to drive innovative services such as channeling through types II and III accounts and credit cards, while building new systems such as cross-border payment, IVR payment and POS acquiring to support cross-border services. Financial service products such as WO Instalment, staff service, CPC fee assistance and poverty alleviation e-mall have been launched to provide more convenient and efficient financial services for internal and external customers.

## 🌱 DEVELOPING SMART FUTURISTIC TECHNOLOGIES

China Unicom has persisted an innovation-driven approach and has actively explored opportunities to deploy in key frontier areas, while enhancing proprietary innovation in an intensive effort to integrate the development of new technologies and mobile communications, driving ability enhancement in product and service supply.

## Embracing Artificial Intelligence (AI)

Backed by ongoing research of AI technologies, China Unicom has been actively exploring and implementing AI applications in network, service and management.

- Use of AI to enhance network intelligentisation and active investigation in frontier sectors such as automated-driving network.
- Active use of AI to empower industry applications, providing solutions in areas such as smart city and smart medical care and facilitating the development of the real economy.
- Use of AI in intelligent customer service which drove solid results in customer service quality improvement, cost reduction and efficiency enhancement.
- Use of AI to enhance the intelligentisation level in human resources, finance and legal matters, achieving the intelligentisation of management.

In active implementation of the national AI strategy, China Unicom has led and participated in the formulation of a number of AI international standards and held numerous positions with international standards associations. The Company has participated in a number of AI-related source development projects under the Linux Foundation, and also served as the deputy general secretary unit of China Artificial Intelligence Industry Alliance.

## Tracking blockchain technologies

With a strong focus on the research of core blockchain technologies and its innovative applications, China Unicom has actively explored and implementing applications of blockchain in network, service, operation and management, driving the development and scenario implementation of blockchain technologies to assist industrial transformation and upgrade. Study is made to apply blockchain technologies in the enhancement of network capability, adopting the decentralised coordination model of blockchain as an important supplement to the traditional coordination model for production, operation and management, in an active use of blockchain to combine with industry Internet.

China Unicom has led and participated in the formulation of a number of blockchain-related international standards. In 2018, there were 113 blockchain patents, ranking 6th globally and 2nd in China.



## Expediting technology research

In 2018, China Unicom continued to drive technology research and built an innovative technology system consisting of four components, namely the organisational system, operating system, assessment system and incentive system, while at the same time a technological innovation informatisation platform was also built to solidify the foundation in technological innovation.

- In connection with international standards, China Unicom holds more than 100 incumbent positions at a number of important international standards associations and resource development organisations, among which more than 20 positions are important management roles, basically covering important communication and IT sectors in the international market.

- In connection with industry standards, China Unicom has led and participated in the formulation of 285 industry standards, ranking 3rd among members of China Communications Standards Association (CCSA) based on number of standards formulated, while many of China Unicom's staff hold important positions with CCSA.

- "Bidirectional ceiling antenna used in distribution system in mobile communication network room" was accredited with a silver award at 20th WIPO-CNIPA Award (China Patent Award), while numerous projects garnered industrial science and technology awards.

### Accelerating 5G research and development

In 2018, China Unicom engaged in full efforts to drive the development of the entire 5G value chain in service, network, terminal and application, as large-scale 5G networking tests were conducted and construction plans were being deployed.

- Completion of three 3GPP international standards, including the China Unicom-led "4G/5G close coupling network structure", as well as the formulation of the 5G NR series corporate standards, while progress was made in the formulation of 5G NR related industry standards.

- Completion of 5G base station equipment features and technical requirements, internal and external field testing standards, and deployment plans and guides for the test of new technologies.

- 737 base stations were constructed in 17 cities to run outdoor field tests and service trials, among which five outfield sites have allocated to large scale network testing, driving the maturity in the 5G value chain.

- With persistence in the simultaneous synergy of the terminal and network, China Unicom issued China Unicom 5G Terminal White Paper to clearly specify the technical requirements of China Unicom's 5G terminals, in vigorous drive of the development of the 5G terminal value chain.

- China Unicom's 5G Innovation Lab officially established to focus on work including the innovation of 5G industry applications.

**545** essays written on international standards submitted

**285** leading industry standards and participation in formation in 2018

**1121** patent applications made

**441** patents granted

On 29 September, in midst of the PT Expo China, China Unicom joined hands with Huawei in performing China's first 5G off-site ensemble concert from different locations. During the concert, "China Unicom Song" was played simultaneously at three locations in Beijing in an ensemble of different instruments. The grandeur of the performance was broadcast live at the venue of the launching ceremony. The harmonious combination of Chinese and Western instruments was brought to the audience in millisecond-grade transmission, bringing to all an experience of a bright future 5G network would lead to.