

## CARRY OUT PROPRIETARY RESEARCH AND DEVELOPMENT

### Promote technological innovation

China Unicom is among the first batch of innovative enterprises recognised by the Ministry of Science and Technology, State-owned Assets Supervision and Administration Commission and All-China Federation of Trade Unions. It has always focused on technological innovation in its development, and has established strong technological innovation bases and sound technological innovation mechanism, and has launched into applications a series of technological innovation achievements.

### Improve technological innovation system

The Technology Department of the Group takes charge of technology management, and is responsible for setting technology development strategy and network evolution plan for the Company. It centrally manages standards of communication technology, new technology development, and communication network resources. Research and development institutions include three main R&D bases, namely China Unicom Research Institute, Network Technology Research Institute and Software Research Institute, one post-doctoral workstation, as well as various professional subsidiaries and provincial branches such as the system integration company, the broadband online company, the cloud data company and Small Waugh Technology Co., Ltd.

China Unicom Post-doctoral Workstation has recruited and cultivated over 40 post-doctoral researchers up to now. In the comprehensive appraisal of post-doctoral work stations carried out by the Ministry of Human Resources and Social Security and National Post-doctor Regulatory Commission, China Unicom Post-doctoral Workstation is ranked “Excellent”, becoming the only “national level excellent” post-doctoral workstation in the communication industry.

China Unicom attached high importance to building up its IT talent pool. Currently, two experts recruited by “Recruitment Program of Global Experts” are working and conducting researches in relevant professional positions, and have made certain achievements in the fields of big data, cloud computing and wireless network, and have made their contributions to the promotion of technological business transformation of the Company and supporting sustainable and healthy development of enterprises.

In 2016, China Unicom revised six technological management measures including “Incentive Measures for Technological Innovation”, “Enterprise Standards Management Measures” and “Radio Frequency Management Measures”, to further standardise the workflow of technology management and stimulate vitality for technological innovation.

### Apply technological innovation achievements

The “SIM-based and password-free one-point security certification system and scale application” is a convenient and secure certification service provided to mobile Internet users. It can effectively solve problems such as corporate information thefts and leakage of user privacy. Currently, the service has 2 million users. This project won the 2016 second prize of science and technology award granted by China Institute of Communications, and the GSMA Vision 2020 best innovation award of 2016 Mobile World Congress.

The project of “Research on Key Technology and Large-scale Application of TD-LTE and LTE FDD Integrated Networking” solved a number of key technical difficulties about TD-LTE and LTE FDD network application and deployment, proposed a systematic solution for integration of networks, and provided guidance for China Unicom to build the largest TD-LTE/LTE FDD integrated networking in the world.

### Develop network in a looking-forward way

China Unicom, in line with technological development trend and business demands of the Company, has carried out technical research in a looking-forward way with priorities, and gradually drove forward technology pre-research, technical tests and pilot commercial use.

### Research and develop 5G network

China Unicom has actively carried out R&D on 5G network architecture and relevant key technologies and services. We have cooperated with a number of manufacturers on equipment R&D, and participated in the formulation of 3GPP international standard, the promotion of national IMT-2020 and 5G frequency spectrum planning.

China Unicom has actively conducted SDN/NFV research, carried out tests and trial runs in different fields, and actively participated in activities of standard organisations and open-source organisations.

### Promote IPv6

China Unicom has completed IPv6 upgrade in the China169 backbone, and has carried out four-star and five-star IDC machine room upgrade in pilot cities. As a result, 13 platforms including WO store and central music platform can support IPv6, and IPv6 upgrades in the backend support systems of Metropolitan Area Networks in pilot cities have been completed. LTE core network equipment can support IPv6, and small scale tests on existing networks have been conducted.

### Make achievements in technology research

In 2016, China Unicom made arrangements to undertake 51 national technology research projects, including “New Generation Wireless Broadband Mobile Communication Network 03 Project” of MIIT, “863 Project” of the Ministry of Science and Technology, national key research and development plan, “New Materials R&D and Industrialisation Project” and “TD-LTE Project” of National Development and Reform Commission, involving such fields as 5G, cloud computing and big data, mobile Internet service and smart mobile terminals. China Unicom also took the lead to complete the national SDN/NFV industry alliance project, and displayed a series of important achievements such as 5G network structure, 5G air interface technology, 5G virtual base stations and 5G Internet of Things business applications at the 2016 Mobile World Congress.