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Mobile Relays for Urban Rail Transportation

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Editorial

The provider faces issues in ensuring an ongoing high Quality of Service (QoS) of railway communications between on-board terminals and base stations. This is explained in part by the carriages' intrinsic movement and substantial penetration loss. A 100 percent compatible LTE/EPC architecture allows for the deployment of mobile relays in public transit. Because QoS on board can be substantially influenced and deteriorated within train vehicles, this effectively guarantees that electromagnetic insulation is maintained to a minimum. However, because all users' traffic is routed over the radio backhaul link, it must account for the extra packet overhead and signalling messages that are typically carried over fixed lines.

Within cities, urban rail transit is the most convenient and safe means of transportation. Its features of low energy usage and excellent efficiency have gained international recognition in recent years. A rising number of countries are developing urban rail transportation and constructing ICT-enabled applications to provide more convenient passenger transportation services in order to maximise the benefits of this mode [1].

However, new economic and technological trends are posing new challenges to ICT construction in the urban rail sector. For example, there are now higher and more diverse requirements on urban rail operational management, train-to-ground wireless communications networks must be more reliable, secure, and have larger transmission bandwidth, and advances in IP-based and broadband networks, as well as the rapid growth of IP services such as CCTV and multimedia advertising, are all posing new challenges to ICT construction in the urban rail sector.

Huawei provides high service dependability, higher operational efficiency, and openness and compatibility in order to allow a multi-line centralised operation, one ICT platform, and quick answers. Huawei's solution provides high reliability, up to 9-level QoS Smooth handover, Easy O&M, and visualised dispatching to facilitate Fully Automatic Operation (FAO), unified responsibility of different services. Huawei provides high service dependability, higher operational efficiency, and openness and compatibility in order to allow a multi-line centralised operation, one ICT platform, and quick answers [2].

IP-based systems and applications require broadband transmission channels and a unified bearer network to save OPEX. This system uses a dedicated-frequency LTE network and features a dependable network, multi-service unified bearer, and forward compatibility. Long-range coverage from a single base station Atomic GPS+1588 V2 clock, as well as a high-reliability design Huawei urban rail solutions are used on more than 100 lines with a total length of over 2,000 kilometres around the world. To carry associated services, a typical wireless communications solution requires four networks in two modes. CBTC, PIS, and CCTV services are carried across public frequency bands via three Wi-Fi networks, although they are susceptible to interference, which could result in unexpected train stops. Meanwhile, restricted Wi-Fi coverage radius necessitates the use of numerous devices, which complicates maintenance, and poor overall network performance during high-speed train travel makes it difficult to speed up the network, stifling transportation innovation. Furthermore, the functions of smart urban rail and intelligent gadgets, including as video calls, task dispatching, and multimedia services, cannot be supported by a narrowband Terrestrial Trunked Radio (TETRA) network, which bears trunking services [3,4].

In 2016, China officially released the LTE-M standard, which defines the capacity requirements for carrying CBTC, trunking, PIS, and CCTV services and addresses the shortcomings of previous wireless communications solutions. The LTE-M technology has three major advantages:

- Dedicated frequency bands prevent interference from public signals, while dual-network redundancy provides backup.
- Convergence: A single point of contact for numerous services; a nine-level Quality of Service (QoS) mechanism that assures CBTC is given top priority.
- Simplification: a single base station can reach up to 1.2 kilometres with ease of deployment and maintenance, and there are no devices required between two urban rail stations.

The TDD 1.8 GHz LTE-M industry chain is quickly evolving, guided by defined spectrum specifications and industry standards. In less than five years, about ten manufacturers, collaborating with dozens of on-board terminal and trunking terminal providers, have been able to supply the TDD 1.8 GHz LTE-M solution. Interoperability Tests (IOTs) with major CBTC, PIS, and CCTV suppliers have been performed with Huawei's solution. According to these testing, the technology can be used for customer train-to-ground communications. The development of broadband urban rail train-to-ground communications is accelerating on the international market. Huawei's TDD 1.8 GHz LTE-M solution has been adopted globally, with urban rail in Australia and light-rail in Ethiopia and Angola adopting it. Construction is still going on in the Southern Pacific, Central Asia, and Africa. Huawei will continue to develop its TDD 1.8 GHz LTE-M solution for urban rail to offer ubiquitous connectivity and support the industry's rapid growth around the world [5].

Traditional distributed architecture faces challenges

The ISCS is a large-scale system that connects multiple computers and electromechanical devices. The system includes multiple subsystems, including central integrated monitoring, equipment maintenance and network management, station integrated monitoring, depot/stabling yard integrated monitoring, as well as simulation and training systems, by using the traditional three-level control and two-level management architecture. The ISCS has a large hardware cost because it requires 40-50 real-time servers, history servers, station servers, and other equipment to be deployed independently at the OCC, station, and depots. Furthermore, server and computing resource utilisation has stayed below 5% for a long time, resulting in significant waste.

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Conflict of Interest

The author shows no conflict of interest towards this manuscript.

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