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Digital Twin Enables Efficient Network Operations

Detailed 3D model enabled China Telecom and China Unicom to achieve a connection rate of 99.82% during the Asian Games, which attracted 600,000 4G/5G users

China Telecom and China Unicom are using a dynamic and detailed 3D model to optimise the performance of their joint network during major events attended by large numbers of people. The digital twin provides the operators with a continuous and very detailed view of the network's performance, enabling them to efficiently optimise the allocation of resources.

中国电信 CHINA TELECOM

China unicom 中国联通

ZTE

Digital Twin Enables Efficient Network Operations

CASE STUDY LEAD: ZTE

CHALLENGE

China Telecom and China Unicom have built a joint network incorporating about 1.2 million 5G sites and two million 4G sites, across the country. During major events, parts of this shared network can see massive demand for connectivity, as a large number of spectators gather in a small area. To effectively manage traffic, China Telecom and China Unicom needed a common tool that enables them to simultaneously monitor the network's performance in near real-time.

SOLUTION

For the Asian Games in Hangzhou in September and October 2023, China Telecom and China Unicom monitored and managed their joint network using a digital twin developed with ZTE. The detailed 3D model was used to monitor the network performance on a 10 by 10 metre gird and predict traffic peaks, so countermeasures could be prepared in advance. In the event of a network issue, the digital twin uses artificial intelligence to identify the optimal solution in a matter of seconds.

IMPACT & STATISTICS

The Asian Games, which encompassed 48 events over 16 days, attracted 600,000 4G/5G users to Hangzhou. During the Games, China Telecom and China Unicom achieved a 4G/5G connection rate of 99.82% and a call drop rate of just 0.05%, despite the peak hourly traffic on their joint network in the home venue reaching 4.2 TB.

During the Asian Games, the 4G average uplink/downlink perception rate was 8.80/17.40 Mbps, and the 5G average uplink/downlink perception rate was 19.38/159.84 Mbps, according to the operators.

WIDER IMPLICATIONS

China Telecom, China Unicom and ZTE plan to employ digital twins to support their shared networks in more cities in China. The technology can be used to improve energy efficiency and reduce costs, as well as to provide service assurance for end-users. The operators also intend to apply the technology to other use cases, such as the construction of new 5G and eventually 6G networks.

STAKEHOLDERS

China Telecom, China Unicom and ZTE

Meeting demand for connectivity during **major events**

China Telecom and China Unicom are using a dynamic and detailed 3D model to improve the performance of their joint network during major events.

- For the 19th Asian Games in Hangzhou, China Telecom, China Unicom and ZTE have jointly applied a digital twin-based solution for full life cycle assurance of the co-construction and sharing network.
- The detailed 3D model was used to monitor the network performance on a 10 by 10-metre gird and predict traffic peaks, so countermeasures could be prepared in advance.
- During the Asian Games, the operators achieved a 4G/5G connection rate of 99.82% and a call drop rate of just 0.05%.
- China Telecom, China Unicom and ZTE plan to employ digital twins to support their shared networks in more cities in China.
- The technology can be used to improve energy efficiency and reduce costs, as well as to provide service assurance for end-users.

China Telecom and China Unicom have built a joint network incorporating about 1.2 million 5G sites and two million 4G sites, across the country. During major events, such as the Asian Games in Hangzhou in September and October 2023, parts of this shared network can see massive demand for connectivity, as a large number of spectators gather in a small area. The Asian Games, which encompassed 48 events over 16 days, attracted 600,000 4G/5G users to Hangzhou.

In the past, the use of bespoke tools by each of the operators to monitor and control the shared network made the joint operation inefficient and opaque. For each tool, the lag in the arrival of network performance information differed, making it difficult for the operators to work together to demarcate and address problems. At the same time, manual decision-making in a complex shared network can be prone to errors, and it can be difficult to efficiently generate an optimal solution that meets the needs of all parties.

To effectively manage traffic during major events, China Telecom and China Unicom need a common tool that enables them to simultaneously monitor the network's performance in near real-time against their own key performance indicators and then reallocate resources as required.

A detailed digital twin provides **continuous transparency**

Ahead of the Asian Games, China Telecom, China Unicom and ZTE built a single digital twin of the network in the Hangzhou area. Designed to provide the operators with a continuous and detailed view of the network's performance, the digital twin processes data in near real-time and uses it to render a three-dimensional model that can then be used to optimise network resources.

The digital twin uses efficient BIM (building information modelling) technology to present the physical environment, cell space topology distribution, and user and network indicators in three dimensions on the 10 by 10 metre grid. To enable the digital twin, many network modules are rebuilt so that they can stream data in near real time simultaneously, thereby aligning the delay and time granularity of all the network indicators.

That enables the operators to synchronise their operations and maintenance (O&M).

Both China Telecom and China Unicom can now view the status of the network and the corresponding user experience in granular detail through the digital twin's dashboard. "The dashboard realises, with five minute latency, monitoring of the user experience to within 10 by 10 metre squares," explains Wang Qiang, vice president of ZTE. In the event of a network issue, the digital twin uses artificial intelligence to identify the optimal solution in a matter of seconds. That means problems can now be resolved in about 10 minutes, rather than a couple of hours, Wang Qiang adds.

As the digital twin gives the operators a complete picture on a single unified screen, they have been able to reduce the time it takes to analyse the root cause of quality problems by 73%, they can also be used to dynamically predict traffic peaks, and hence prepare countermeasures in advance to assure the end users' experience. In a similar vein, the digital twin modelling technology can also be used to quantitatively pre-evaluate the impact of any changes to the network parameters on the user perception indicators employed by both operators. The digital twin takes a "white box" approach, so that both operators can see the potential impact, thereby avoiding unexpected network faults caused by configuration changes. ZTE estimates the digital twin has reduced the operators' communication costs and operational collaboration costs by 78%. The system uses heuristic learning and reinforcement learning algorithms to identify the optimal solution for both operators in a matter of seconds, improving the coordination optimisation efficiency by 93%, according to ZTE.

High quality service maintained throughout the Asian Games

The digital twin network system guaranteed high quality communications for the spectators 24 hours a day for the duration of the Asian Games, according to the O&M reports of China Telecom and China Unicom. As well as meeting spectators' expectations, reliable connectivity was important to ensure the security teams at the events could accurately control the movement of crowds and deploy security resources in real time to ensure public safety.

The peak hourly traffic of both parties in the home venue was 4.2 TB, while the 4G/5G connection rate was 99.82%, according to the operators, while the call drop rate was just 0.05%. The 4G average uplink/downlink perception rate was 8.80/17.40 Mbps, and the 5G average uplink/downlink perception rate was 19.38/159.84 Mbps. The difference in the average user throughput between the two operators was just 1.6%, suggesting the shared network performed equitably.

For both operators, maintaining a high quality of service (QoS) through the 16-day event was important. If a major issue happens that make dozens of thousands or even hundreds of thousands people lose contact during a match, because the system meltdowns, or a couple of sites meltdown, it will become a critical issue. They are trying to avoid that.

The digital twin reduced the time it took to locate QoS problems in the shared network fourfold to about one minute, according to China Telecom, which also says the efficiency of response was improved by 72%, thereby enabling the efficiency of the optimization policy generation to improve by 93%.

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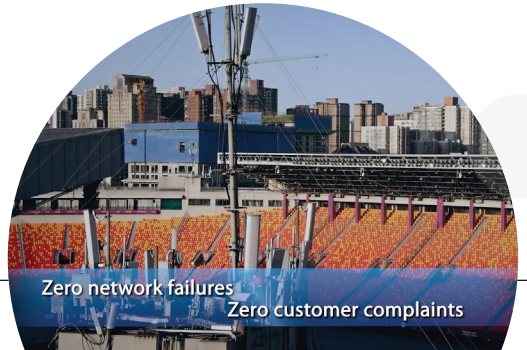

Digital twins could be **deployed more widely**

China Telecom and China Unicom believe digital twins can enable their shared networks to maximise resource allocation efficiency, achieving the more flexible operations. And the technology can be used to improve energy efficiency and reduce costs, as well as to provide service assurance for end-users. China Telecom, China Unicom, and ZTE plan to employ digital twins to support their shared networks in more cities in China. They also intend to apply the technology to other use cases, such as the construction of new 5G and eventually 6G networks, and the collaborative removal and planning of base stations in the 4G intermediate frequency network.

According to China Telecom, the application of digital twin in the network assurance for Hangzhou Asian Game has been successful, to some extent, it is highly replicable and extensible, providing valuable reference and strong technical support for the transformation of other operators.

ZTE anticipates that operators outside of China will increasingly turn to digital twin technologies to help run their networks. “They will probably start on one part of it. Rather than realise the whole system, they may just focus on network policy,” says Wang Qiang. “You can start in one small area, achieve the benefit, and then expand from there.”

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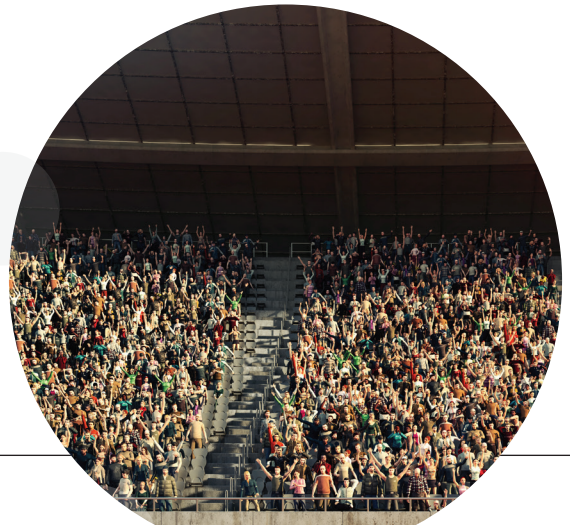
Wang Qiang - Vice president of ZTE



About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

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GSMA 5G Transformation Hub

The GSMA 5G Transformation Hub is a source of information on some of the most innovative 5G solutions in the world. This portal contains case studies detailing design, benefits, key players, measured value and the future impact of scaling up these 5G solutions worldwide. The 5G Era is now firmly established and this family of standardised GSM technologies, including mmWave, are being rolled out successfully across the globe. The GSMA 5G Transformation Hub, launched at MWC Barcelona in 2022, provides details of how 5G is best placed to deliver real value for a range of key sectors including manufacturing, energy, transportation, media and live entertainment, smart cities and construction. Many more case studies will be added, in the coming months, covering even more industries and the GSMA is asking Members to nominate innovative 5G case studies to add to this global digital showcase. The 5G Transformation Hub and this particular Case Study are both sponsored by Qualcomm.

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