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# INTELLIGENCE EMPOWERS YOUR BUSINESS SUCCESS

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# FOREWORD

## EXPLOITING INTELLIGENCE TO DRIVE 5G SUCCESS

After more than ten years in the lab and multiple levels of testing, 5G arrived in 2019. The number of mobile operators across the world running live networks at end-December rose to 50.

GSMA Intelligence estimates 5G connections reached 9.9 million in the fourth quarter, with 6.8 million in Asia, 1.9 million in North America and about 600,000 in the Middle East.

Rapidly falling handset prices are expected to fuel adoption as network deployments widen. GSMA Intelligence forecasts worldwide 5G connections to reach 1.8 billion by 2025.

The global average monthly data usage is expected to hit nearly 10GB in 2024.

Driving that increase in usage is a raft of new services, covering everything from 4K ultra-HD video and fast gaming to multi-screen viewing and immersive AR and VR. A major 5G market in the future will be enterprise applications.

While the benefits of 5G are many, mobile operators face a range of challenges as they look to launch the next-generation mobile service. These include significant investments, rising network complexity, launching a diverse range of services, network optimisation considerations as well as a number of spectrum limitations.

Deploying 5G is complex and requires coordinated planning and optimisation of services and networks. This starts with service models that analyse and predict usage and focus on evaluating service experience requirements and setting network coverage scope and quality. It also requires investing in AI and big data capabilities to intelligently support new services, applications and user experiences.

The end-game is a faster deployment and an agile network capable of intelligently fixing problems, even before users notice them.

**Joseph Waring**  
Asia editor,  
**Mobile World Live**



# AI-POWERED SERVICES FOR 5G EVOLUTION: AGILE, INTELLIGENT, SMART

**Bill Tang,**  
President of Global Technical Service,  
**Huawei**

The commercial use of 5G is accelerating around the world. The Internet of Everything is drastically increasing the number of connections, and new applications such as cloud-based VR and AR place higher requirements on end-to-end networks.

5G, with its high bandwidth, low latency and wide coverage, makes it possible for operators to provide a wider range of services and solutions for users. With the continuous improvement of networks, the extent of new applications is limited only by our imagination. Network planning, construction, maintenance, optimisation and operations need to evolve intelligently to support new services, applications and user experiences. AI needed to be introduced to increase the accuracy of user experience-based network planning to make it more agile, and to quickly and more intelligently resolve user experience problems.

Huawei Service always aims to improve the way it serves customers and solve their problems. In 2016, Huawei started to apply AI to business processes and technical work involved in serving its customers.

The company has integrated more than 30 years of telecoms industry experience into machine intelligence and machine learning models on its platforms, and overseen its continuous evolution. This technology enables us to provide higher quality, more efficient services and more powerful capabilities to help us find solutions for our customers.



After three years of successful practices, Huawei Service has accumulated a set of man-machine collaboration methods for designing and implementing service solutions and has built a digital platform of knowledge and models, as well as a training and certification system for new talent.

Huawei will continue to work with operators and partners to achieve agile, intelligent and smart services evolution with AI in the 5G era.

## AGILE NETWORK CONSTRUCTION

AI is applied to each phase of 5G network construction to make network planning more accurate and the rollout more efficient. Multiple data points from areas covering the 5G business, users and the evolution of existing technology are used with machine learning and iterative computing to quickly and accurately create plans for different scenarios. Technologies such as photogrammetry, optical character recognition (OCR), voice recognition and computer vision are introduced in the survey, design, commissioning, integration and acceptance phases to continuously improve engineering automation and quality of delivery.

Huawei is also exploring integrated digital delivery equipment to improve the operational efficiency of sites. Its Integrated Service Delivery Platform is shared among customers, equipment vendors and partners for project delivery management. Information and instructions from the operator, equipment vendor and partners are automatically exchanged during project implementation, which makes communication smoother, management smarter and network construction more efficient.

## INTELLIGENT O&M

The co-existence of 2G, 3G, 4G and 5G networks drastically increases the number of connections between people and things, while providing a wide range of services for users. Consequently, the number of service requests and problems faced by operations and maintenance (O&M) personnel also increases. According to data analysis over the past few years, network O&M problems are increasing by 5 per cent annually.

In 2019, Huawei Service provided more than 580,000 cases of technical support on more than 1,700 networks worldwide. Conventional O&M practice cannot be sustained, as people are the main workforce, with just isolated O&M tools for assistance. The introduction of AI for man-machine collaborative IT operations (AIOps) is becoming an inevitable trend.

AIOps O&M will not mean breaking the O&M system and abandoning existing tools. Instead, an O&M knowledge platform using existing models is added, which can drive the evolution of existing domain- and phase-based, human-dominant O&M to man-machine collaborative O&M.

AIOps will not substitute people but will enable them to play a greater role with the assistance of machines. O&M talent will take new positions such as network policy engineers, orchestration engineers and data analysts. People will focus on more important roles in intent design, troubleshooting and key decision-making.

## SMART OPERATIONS

5G is ushering in a new era of communications. It will bring better services, applications and unprecedented experiences to consumers. It will also create an opportunity for operators to break the conventional "pipe" business model, enabling them to develop new digital services, explore new business models and foster new industry partnerships.

Huawei has completed an experience model for the first batch of new 5G services, released new experience and network construction standards, and built an AI-based experience management solution with service-network synergy to provide real-time, dynamic adjustment of a service experience and network policies. With its convergent data service operations platform and intelligent engine, Huawei helps operators accurately and efficiently attract new users, promote user activity, retain users and increase value, transforming their conventional operations into smart operations.

Huawei will increase its investment in its service experience lab and continue to explore the use of digitisation and AI to accelerate the resolution of complex user experience problems, while preparing for more service scenarios in the future.

## OPEN ECOSYSTEMS

We have always adhered to the rule to "simplify things for customers by dealing with complexity ourselves". Huawei Service abstracts rules, models and AI algorithms from a large number of successful practices, encapsulating them in an open, unified technical platform for our customers and partners to use. The company wants to lower the threshold for applying AI technologies, making them more available and easier to use. We will leverage the power of the industry to continuously innovate, solve problems and make AI ubiquitous. Operators and global partners can develop new talent with new methods and skills based on the company's Digital Transformation Practice Centre.

Huawei will continue to invest in and improve the capabilities of AI-powered technical platforms. It will discuss intelligent and agile network construction, intelligent O&M, smart operations and improved user experiences with operators, industry organisations and global partners, cooperating in the 5G era to help customers achieve business success.

"According to data analysis over the past few years, network operations and maintenance problems are increasing by 5 per cent annually."

# MARKET REPORT

## 5G GAINS TRACTION AS OPERATORS SEE ROBUST UPSIDE

by Mobile World Live

The move to 5G is accelerating globally as operators look to the technology to improve network efficiency as data usage soars and search for new revenue streams to invigorate their tepid top-line growth.

Fifty mobile operators in 25 markets offered the next-generation mobile service at the end of 2019. Worldwide, 186 operators in 92 markets have conducted 5G trials, and 76 mobile players announced launch dates for 5G services.

GSMA Intelligence forecasts worldwide 5G connections will reach 1.8 billion by 2025, driven largely by high rates of adoption in China, Europe and the US. Analysts expect 45 per cent of all mobile traffic to run on 5G networks by 2025, when two-thirds of the world's population will have coverage.

Rapidly falling smartphone prices will spur uptake as deployments widen. While consumers currently are paying a premium for the first wave of 5G handsets, Canalys expects prices to fall faster than with 4G device because vendors are more connected to the supply chain and committed to lowering prices to appeal to a wider audience. Prices of some 5G models in China have already dropped to CNY2,000.

The research company predicts 5G, together with new features such as foldable screens and faster chipsets, will fuel a rebound in the smartphone market in 2020, kicking off a three-year era of growth.

As for tariffs, operators in six of the 10 largest 5G markets are not charging a premium on 5G services and fewer than half offer unlimited data plans. In South Korea, LG Uplus in the third quarter reported a second consecutive quarter of gains in mobile service revenue and ARPU during Q3, which it credited to the launch of 5G six months earlier.

Enhanced mobile broadband (eMBB) is the primary use-case for early deployments. Many analysts see video content as a clear 5G sweet spot, particularly as more 4K and 8K content is produced and distributed, as well as mobile gaming.

### CHINA TAKES LEAD

At the end of October, China's three major mobile operators officially launched 5G services in parts of 50 cities, six months after the government issued spectrum licences. As of mid-November, they deployed 113,000 5G base stations.

China Mobile planned to install 50,000 sites by end-December in 50 cities and expand coverage to 300 major cities by the end of 2020. The operator, which already has more 5G subscribers than all three South Korean operators combined, aims to offer network slicing services by the middle of next year when its standalone (SA) 5G network reaches commercial scale.

The world's largest mobile operator set a target of signing up 70 million 5G users by the end of 2020, with a planned investment of CNY20 billion (\$2.85 billion).

China Unicom and China Telecom each targeted about 40,000 base stations by end-2019.

The two operators in September agreed to jointly build and maintain 5G radio access networks (RANs) across the country to accelerate deployment and reduce infrastructure costs. Each company will be responsible for operating its own core networks, but will share spectrum resources and a single RAN. Under the agreement, each will build out the wireless network in specific regions of China.

GSMA Intelligence predicts by 2025 China will be home to roughly 44 per cent of global 5G subscribers. That percentage translates into more than 787 million subs, which will represent 47 per cent of the country's mobile customer base.

Tim Hatt, head of research at GSMA Intelligence, expects the large base to act "as an increasing force of gravity for a domestic supporting ecosystem of handset manufacturers, chip makers, network equipment suppliers and content producers that reduces reliance on foreign companies."

Chinese operators see the move to 5G as an opportunity to improve cost efficiency as data traffic continues to soar.

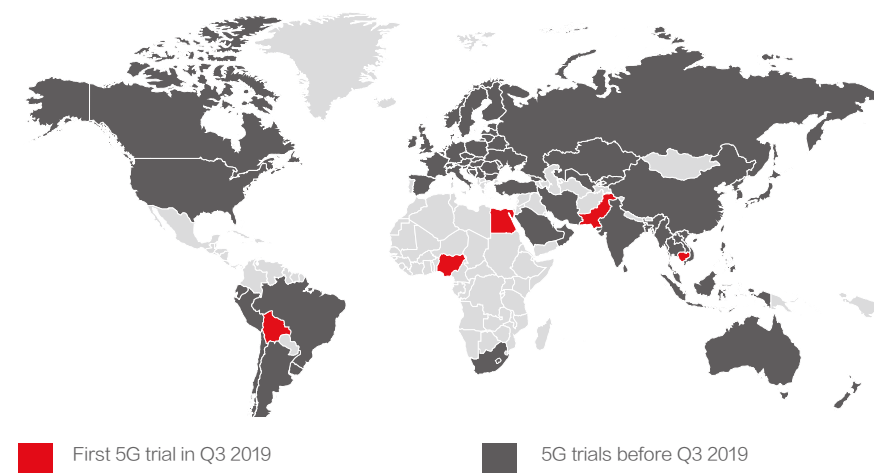
### FIRST WAVE

Operators in South Korea simultaneously launched 5G service in early April 2019 and ended September with a combined total of nearly 3.5 million 5G subscribers.

## 5G trials

GSMA  
Intelligence

- To date, **186** operators across **92** markets have conducted a total of **453** 5G trials.
- In Q3 2019:
- **53** trials were conducted by 48 operators.
- **16** operators conducted their first 5G trials.



The country's Ministry of Science and ICT in December detailed plans to nearly double the allocation of 5G spectrum for mobile operators by end-2026, making an additional 2,640MHz of airwaves available.

South Korea was one of the first to auction 5G spectrum in June 2018 and has ambitions to lead the world in spectrum availability, with a target of 5,320MHz.

Outside of Asia, 5G services are now available in nine countries in Europe, with more than 40 operators detailing plans for launches. Following a number of rollouts in the third quarter, all the operators in the UK now offer 5G services.

After T-Mobile switched on 5G service in early December, all major US operators have deployed some form of the technology in select locations. GSMA Intelligence expects North America to have 345 million 5G subs by 2025.

### OPPORTUNITIES

A survey by GSMA Intelligence found that new revenue generation is the primary goal of network transformation initiatives for two-thirds of operators, helping justify additional network investment.

5G represents the biggest network transformation opportunity (and challenge) for operators in the last decade. Most operators plan to start 5G deployment in non-standalone (NSA) mode. However, more than 70 per cent plan SA launches in three years.

The vast majority of operators expect network investment spend to remain the same or grow over the next 12 months. Some 40 per cent expect spend to be up to 10 per cent higher.

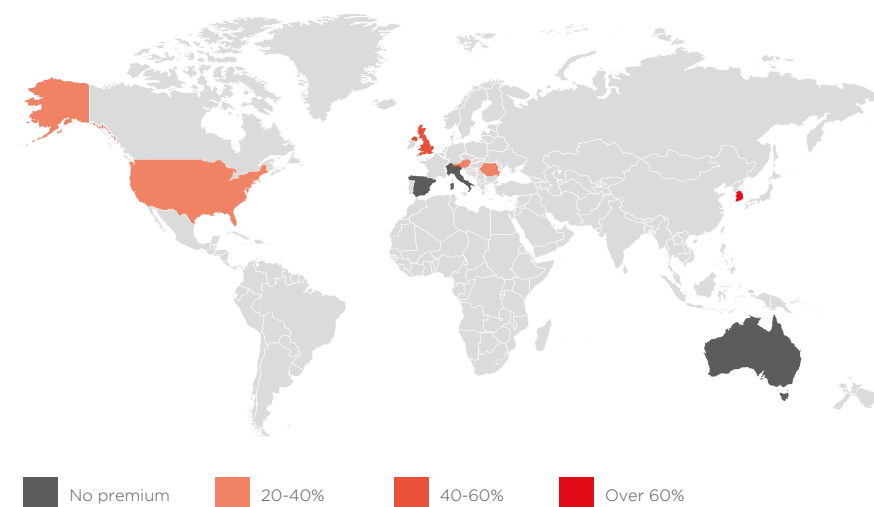
Enterprise revenue is forecast to become increasingly important for operators. While NSA 5G can enable enhanced mobile broadband (eMBB), enterprises require greater network flexibility. This provides impetus for operators to develop 5G SA networks as they look to massive machine-type communications (mMTC) and ultra-reliable low-latency communications (URLLC) services.

This shift is essential as consumer revenue growth from large data bundle sales cannot be sustained in the long term. ARPU levels will eventually decline as data tariffs fall. For example, GSMA Intelligence forecasts annual consumer revenue in China to decrease by more than \$900 million between 2023 and 2025.

## 5G ARPU

GSMA  
Intelligence

5G premium by country, %







Frost & Sullivan believes 5G networks will allow operators to offer new value-added services, which it predicts will become a bigger contributor to the sector's revenues than basic connectivity services, driving the 5G market in the Asia-Pacific region to \$124.8 billion by 2025.

The company said in a research note many mobile operators are aggressively entering the 5G space and to enjoy the full potential of the technology it suggested they focus on industry partnerships and collaborations, which will reduce overall costs and hasten the deployment of the new use-cases enabled by the introduction of 5G.

#### CHALLENGES

While the benefits of 5G are many and far-reaching, operators face a number of challenges, particularly in terms of network implementation. In addition to the significant investment required, key issues to overcome include increased network complexity, providing a diverse range of services, network optimisation considerations as well as a number of spectrum limitations.

As operators look to launch 5G, they need to be prepared to introduce a wide variety of services for both the consumer and

enterprise segments, which complicates network deployments as each use-case has different network requirements.

Once 5G use-cases are selected, operators need to determine the specific network requirements for planning and deploying the network. Different services deliver different experiences, which need new indicators and new ways of evaluation.

The use of new technologies such as Massive MIMO and NSA architecture, where 4G and 5G are closely coupled, will increase the complexity of network planning, construction and optimisation by a hundred-times, which makes AI technology and special services necessary.

Another major issue is mid- and high-band spectrum (i.e. C-Band and mmWave) have more limited coverage and poorer indoor penetration compared with most LTE bands, which means more base stations are often needed. Operators are turning to small cells to provide the dense coverage required for high-capacity networks, particularly in densely populated urban areas.

Higher frequency bands require more accuracy planning of 5G sites to keep costs down, which requires a high-precision propagation model and 3D simulation technology.

The deployment 5G adds yet another network, making maintenance and co-existence with 2G, 3G and 4G infrastructure more difficult. In this case, operations are becoming more complex and costlier. Automated and intelligent operations will be a must. The reactive operational model will evolve to a proactive and autonomous model, with machine learning and prediction capabilities.

Operators are forecast to invest up to \$1 trillion in 5G networks between 2018 and 2025, so expectations are high, with many in the industry believing the technology will transform the sector by not only improving the end-user experience, but creating new business models and services.

Rising competition in most markets continues to erode margins, forcing operators to find additional revenue streams. More and more operators are counting on 5G to spearhead their transformation and drive bottom-line growth.

5G becomes the first generation in the history of mobile to have a bigger impact on enterprise than consumers

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**Intelligence**







# Q&A:

## Tapping AI to ease the path to 5G

**Steven Wu, VP of Huawei's Carrier Business Group and President of Service & Software Marketing & Solution Sales Dept. explains how the company's AI-based intelligent services can help carriers increase revenue, improve efficiency and accelerate the road to 5G.**

**Q:** How does Huawei help operators accelerate their evolution to 5G?

**SW:** Huawei started 5G research as early as 2009 – back when 4G was just starting to see commercial deployments. Over the past ten years, we invested more than \$4 billion, which has enabled us to deliver end-to-end 5G equipment and services to operators.

The next-generation mobile service is important for operators because it offers the potential to help them attract more high-value subscribers and create new business opportunities across a wide variety of industries.

Our global service capabilities allow us to reduce time to market for operators. We have 30 years' experience providing secure and reliable services, deploying sites in more than 170 countries and regions, and supporting stable operations of more than 1,500 network.

This experience is vital for accelerating end-to-end 5G implementations, which cover everything from planning and optimisation to network deployment and integration. Our professional services help operators maximise ROI and develop new services. Supporting our robust technologies, 22,000 frontline employees and more than 2,400 service suppliers are responsible for deploying solutions and providing support worldwide.

Huawei's Digital Transformation Practice Centre is an incubator for third-party partners, providing them with a simulated 5G environment to develop, test and mature their business ideas.

**Q:** How can operators make use of existing 4G infrastructure to optimise 5G deployment?

**SW:** Huawei developed a tool to evaluate existing site facilities, tracking things like load capacity, to identify which sites can be reused for 5G. For sites that cannot be reused, Huawei has an innovative approach for fast and flexible deployment. For example, if a tower has insufficient load capacity, the approach improves installation efficiency 40 per cent by eliminating the need to drill and weld when upgrading the facility.

When deploying new 5G AAUs, Huawei considers the use of existing sites on the new network, then creates an antenna convergence reconstruction plan, which combines 2G, 3G and 4G antennas into one system. It then installs 5G AAUs in the space vacated, optimising the reconstructed network. The convergence plan ensures the original network performance does not deteriorate. In addition, more space is opened up for 5G AAU installation, reducing costs as less new space is required.

**Q:** What are the main challenges in 5G network planning?

**SW:** The high frequency of 5G spectrum delivers more limited coverage and weaker penetration compared with 4G bands. Huawei uses a special propagation model and 3D Massive MIMO simulation to improve planning accuracy. With the AI-based model, the simulation results in 10 per cent to 20 per cent better propagation. Huawei's 3D simulation model can accurately position equipment not just to the outside of buildings, as most models can, but also inside facilities.

Different 5G services have different network requirements. In addition to providing a network simulation environment, Huawei also tests and pre-verifies specific use-cases in its OpenLab before commercial deployment, which can reduce the duration and risks of commercial delivery. In a rollout in South Korea we detected 90 per cent of key issues before commercial delivery.

**Q:** What is Huawei's solution for reaching the best 5G throughout?

**SW:** Massive MIMO needs to perform 3D simulation and optimisation across as many as 10,000 patterns. This makes 5G optimisation about 100 times more complex than 4G. Huawei uses AI technology and algorithms to select the best site parameters in different scenarios.

Currently, most 5G networks are non-standalone. Huawei provides 4G and 5G synergetic optimisation to guarantee the end-user's experience and maximise operators' network value.

**Q:** Why is AI so important for implementing intelligent network operations?

**SW:** In the 5G era, new services, networks and technologies bring new challenges to operations. End-users have higher expectations. At the same time, services and networks become more complex and difficult to guarantee. Operations need to change from best-effort to offering clear and differentiated service level agreement (SLA) assurance.

This complexity has resulted in more outages caused by human error and rising operating costs. More than 70 per cent of network problems are caused by humans. It is necessary to shift operations using AI from reactive to predictive to improve the current low-quality and low-efficiency situation.

**Q:** Can you share some insight into Huawei's progress in making systems proactive using learning-based tools?

**SW:** Huawei's AUTIN (automation and intelligent) operations solution supports more than 20 predictive maintenance projects globally. Potential faults and risks can be predicted up to 30 days in advance, giving operators ample time to make the necessary corrective measures.

We leverage our assets and experience to offer a robust predictive maintenance service. Our vision is to ultimately reach close to zero network outages. We have achieved prediction capabilities addressing use-cases on service and hardware faults in specific scenarios. In the coming years we will be adding more use-cases as well as extending it to 5G networks.

**Q:** What do you see as the biggest obstacle in slowing operators' efforts to improve their network operations?

**SW:** With the launch of 5G, operators operate in a complex environment with 2G, 3G, 4G and 5G networks co-existing. The number of managed objects will increase significantly, which will generate more alarms and work orders each day. The requirements for SLA and customer experience assurance will change as well, with even higher demands on capacity, availability and quality. Although operators have 21st century technology across 4G and 5G networks, many of them are still using the traditional way to manage in this complicated environment.

The AUTIN solution has accumulated a large number of operation assets which enabled us to improve operation quality and efficiency. Since early 2019, we have focused on forecasting and preventing potential problems in wireless devices using AI algorithms and developing commercial assurance solutions for network slicing. In future, we will look to develop self-healing, self-optimisation capabilities for 5G networks and further improve the assurance capability of the network slicing service.

**Q:** How can operators speed up 5G site rollouts?

**SW:** Time to market is important for operators as an early start can help them attract high-value subscribers. However, building a 5G network is not easy work. To speed up the deployment of a high-quality 5G network, Huawei offers an AI-based digital solution for site installation.

The first step is to create a 3D digital twin of an actual site after engineers complete a detailed site survey. This speeds up site design as measurements can first be done on the digital twin, with engineers correcting site faults online and eliminating the need for frequent site visits. Huawei is able to reduce rollout times by 30 per cent. For example, 3,000 sites were deployed in South Korea within a month.

**Q:** Why is there so much talk about 5G energy usage with 5G?

**SW:** The power consumption of 5G per bit is about 1/50 of 4G. That's a huge reduction. However, 5G uses much more spectrum, resulting in energy consumption significantly increasing to achieve the same coverage. Energy savings has become an important consideration for operators.

Through continuous improvement in chips, power amplifiers and algorithms, Huawei 5G gear uses 20 per cent less energy than the industry average. In addition, with AI online energy savings, Huawei's PowerStar can significantly reduce the power consumption of telecoms equipment.

“Although operators have 21st century technology across 4G and 5G networks, many of them are still using the traditional way to manage in this complicated environment.”



# Q&A:

## Jiangsu Mobile pushes automation to prepare for 5G

Chen Ying, chief engineer of the network department at China Mobile (Jiangsu), outlined the operator's roadmap for streamlining operations and maintenance tasks to prepare for the 5G era with increased network scale and complexity.

**Q.** What prompted the move to transform China Mobile's operations and maintenance (O&M) in Jiangsu province?

**Chen Ying (CY):** There are two main factors. The first is workload driven. The expected increase in the number of users and business traffic will boost network maintenance work. This problem needs to be solved by improving the efficiency of operation and maintenance. The second aspect is driven by new technologies. The evolution of 5G network architecture to cloudification requires operation and maintenance personnel to deploy and maintain network services through resource orchestration.

**Q.** What are your main objectives? What is your timeframe?

**CY:** The goal of China Mobile Jiangsu is to increase the level of automation and intelligence in network operations by comprehensively using various technical methods so that the machines can do more repetitive and basic work, while maintaining operational expenditure and improving operational efficiency. Our goal is to double the automation rate of network O&M within three to five years.

**Q.** What specific areas are you focused on in the beginning?

**CY:** Network O&M involves many aspects, covering different areas such as mobile broadband, fixed broadband, NFV and 5G network operations. Our intelligent operation transformation started with the less mature automation areas of O&M.

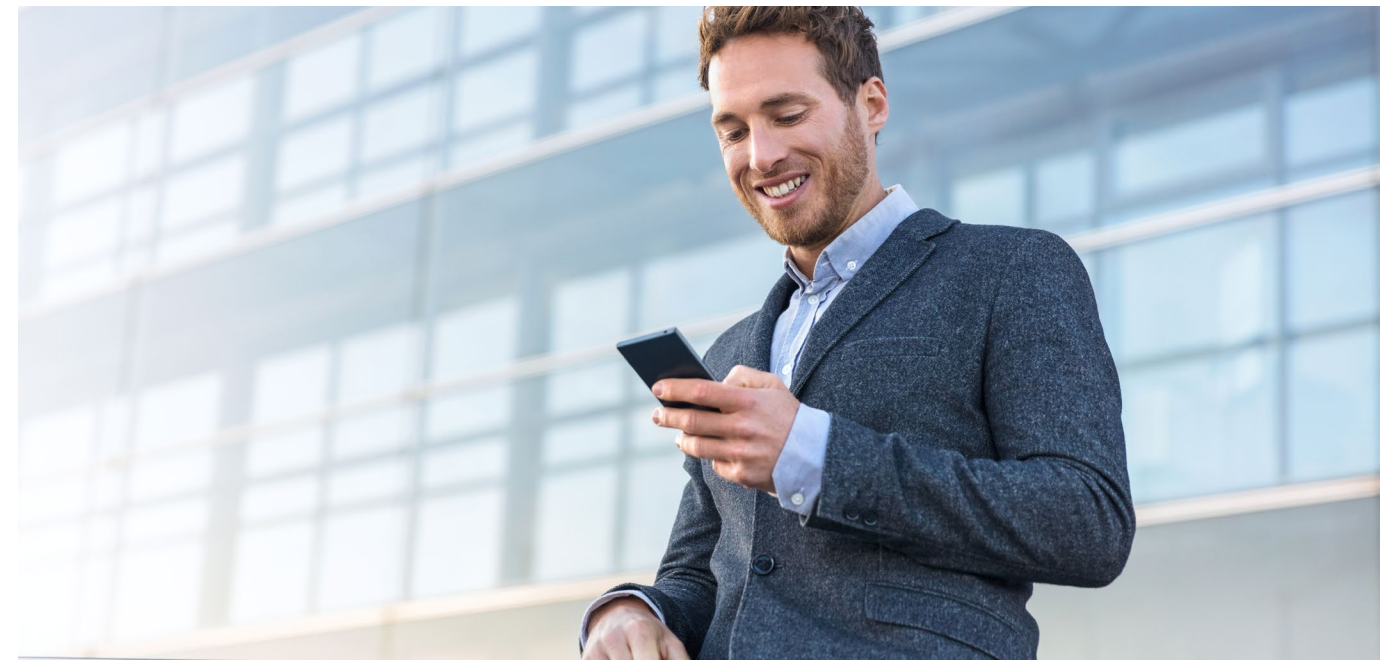
For example, wireless network resources allocation, transmission maintenance and checking of trouble tickets for fault alarm handling.

**Q.** What benefits will the move bring in terms of reducing costs, improving efficiency and enhancing quality?

**CY:** Intelligent operation transformation can reduce costs, improve efficiency and enhance quality. For example, part of wireless network resources can now be dynamically allocated throughout the entire province using software.

**Q.** Why did you select Huawei as a partner - what can it deliver that other vendors are not able to?

**CY:** The main consideration is that Huawei has rich experience in telecoms networks. The company has the largest market share of ICT operation and maintenance services in the global market and manages hundreds of networks. Currently, thousands of dev-ops and a large number of partners have launched more than 1,000 O&M applications on Huawei's Operation Web Services (OWS) platform to continuously enrich the capabilities.



**Q.** Why is having a next-generation OSS architecture in place so important?

**CY:** The main direction of future telecoms network evolution is the cloudification of the network architecture. In the new cloudified network era, the next-generation OSS is a must to enable better control, operation and maintenance of networks.

For example, the OSS is essential to support the functions such as control, allocation, self-healing and scaling of cloud network elements. Besides, the requirements, application, allocation, installation, configuration and start-up of the resource pool of the next-generation network will be managed by the OSS.

**Q.** How will the platform allow you to evolve towards an intelligent O&M model?

**CY:** Huawei's OWS is a cloud-based operation platform, offering four modules: perception, analysis, decision-making and execution. It implements unified data service, automation as well as open orchestration capabilities. In addition, the platform can separate design and running status, and achieve layered decoupling and on-demand deployment to enable agile transformation.

**Q.** Can you explain how the open platform, using specific models and algorithms, can be programmed to enable operators to transform their O&M activities?

**CY:** Huawei's OWS uses a microservice architecture to decouple capabilities for the future OSS architecture. It is able to implement full-stack network monitoring and automatic and intelligent operation through a unified platform and breaks down O&M information silos caused by traditional siloed OSS. It also supports visualised orchestration of multiple service scenarios, and flexible multi-vendor integration and interconnection.

**Q.** What are the key capabilities in terms of troubleshooting and predicting interruptions?

**CY:** The OWS platform implements automatic rule deployment and intelligent application in the fields of fault management, change management and preventive maintenance to realise automatic alarm correlation compression, automatic fault diagnosis and recovery, and work-order automation. In addition, the platform uses machines to replace repetitive tasks done by humans, achieving operation acceleration and improving the standardisation and quality of operations.

**Q.** How are you preparing for a future-oriented 5G era?

**CY:** In the 5G era, the network scale will become very large and complex. Efficient and agile intelligent operation mode is critical. Automation and intelligence are significant for improving 5G service quality and to facilitate O&M personnel skillset transformation. For example, service provisioning and recovery and end-user service quality awareness can be realised with more intelligence embedded in O&M systems.

"In the new cloudified network era, the next-generation OSS is a must to enable better control, operation and maintenance of networks."



# AI-ENABLED INTELLIGENT 5G NETWORK OPERATIONS AND MAINTENANCE

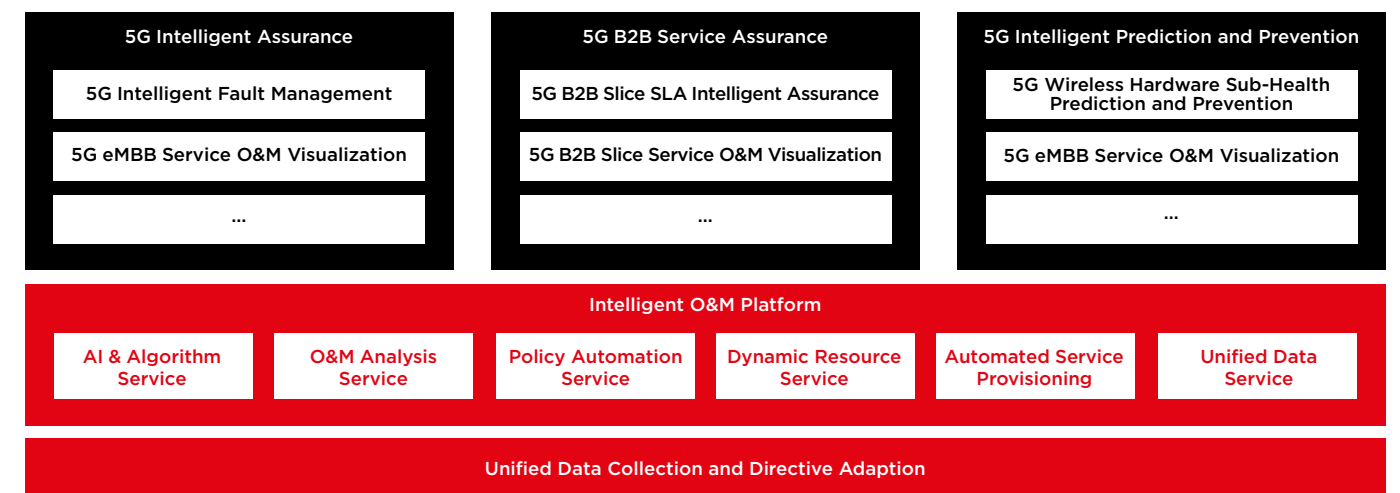
**Fred Zhao,**  
Director of Assurance & Managed Services Dept.  
**Huawei**

A new round of scientific, technological and industrial innovation is sweeping the world. The digital economy has become a vital engine for sustainable economic growth. As a key enabling technology and infrastructure in the digital economy era, 5G networks provides ultra-high bandwidth, ultra-low latency and massive connections, which will help pave the path to the Internet of Everything and lay the foundation for the digital transformation of the global economy and society.

5G will accelerate operators' transformation from the pipe economy to the platform economy, not only connecting people but connecting almost everything. It will help operators cope with the ever-changing business environment and promote the expansion of a digital society. The introduction of new 5G technology architecture and service diversity bring about two challenges to the network's operations and maintenance (O&M)

- 5G services on 5G come with different QoS requirements and differentiated service assurance, which places new requirements on O&M tools, processes and capabilities, as well as new challenges to traditional O&M modes. The introduction of new architectures and technologies greatly increases the difficulty of 5G network O&M.
- The co-existence of 2G, 3G, 4G and 5G multi-mode network elements has caused a structural dilemma in the telecoms industry: namely increasing opex due to growing network scale. This subsequently poses challenges to O&M efficiency and operators' overall costs.

## Intelligent 5G Operation Solution



5G network O&M faces complex structural problems and challenges, which cannot be addressed by traditional O&M methods. The telecoms industry is in urgent need of automated intelligent network O&M. In the face of this, and after years of innovation and research, Huawei launched the Intelligent 5G Operation Solution. Featuring all-online capabilities, full automation and intelligence, the solution aims to promote 5G intelligent O&M which helps operators handle new challenges in network O&M.

Based on the unified O&M capability of Huawei's intelligent O&M platform, the solution provides centralised monitoring, fault root cause analysis, performance data analysis, automatic O&M and closed-loop control to effectively address operators' challenges, improve fault handling efficiency and reduce O&M costs. In the early stages of 5G network O&M, the Intelligent 5G Operation Solution focuses on the construction of basic 5G network assurance capabilities, implements basic network visualisation, supports fault demarcation and quickly implements fault self-diagnosis. With increasing the number of service models and fault data, the risk prediction and prevention capabilities of the solution will be enhanced to gradually achieve highly autonomous networks.

In terms of fault diagnosis, the Intelligent 5G Operation Solution supports automatic demarcation and locating of typical 5G network faults. The solution implements automated service assurance and builds an intelligent 5G fault management mode by introducing AI training to improve a network's self-healing capability.

Making use of the vendor's intelligent O&M platform, the solution monitors 5G service data in real time and establishes a fault prediction model for 5G devices running on the network. It can identify service risks and faults in advance, improve network risk prediction and prevention capabilities, and shorten the fault recovery duration.

The 5G Intelligent Operation Solution implements end-to-end visualisation of network slice monitoring and detects SLA deterioration of network slices in minutes. Based on the AI-trained prediction model and Huawei's experience in handling typical B2B service SLA problems, the intelligent solution can automatically diagnose slice SLA problems.

In 2019, Huawei and China Unicom benchmarked the industry's best practices, applied AI technology into the industry and was the first to deploy an intelligent 5G O&M platform in Guangdong province. After six months, the operator's 5G networks are now capable of quick fault identification, demarcation and recovery. With the help of Huawei, the operator has improved both 5G network quality and O&M efficiency. In the future, the two parties will continue to cooperate in building intelligent O&M capabilities with the vision of an automated 5G network.

With the increasing spread of commercial 5G networks and the use of AI in network operations, the solution enhanced the capacity of our intelligent operation solution AUTIN (an operations consulting and software-as-a-service offering) which will continue to help operators improve operation quality and efficiency and achieve 5G service innovation and success. Huawei is ready to cooperate with global operators to actively invest in 5G innovation. Together, we can achieve autonomous networks and build a fully connected, intelligent world.

“With increasing the number of service models and fault data, the risk prediction and prevention capabilities of the solution will be enhanced to gradually achieve highly autonomous networks.”



# ANALYST REPORT

## MODERNISING CHINA UNICOM NETWORK OPERATIONS WITH TIANSHU



**James Crawshaw**, Senior Analyst, Intelligent Networks and Automation, **Heavy Reading**

With the advent of 5G, operators are entering a new capex cycle and must make careful decisions about where to invest in network capacity. Yet, many operators lack the tools to optimise these decisions.

For many operators, network construction and operations are still performed offline and manually. This leads to long network construction times and low operational efficiency. Various tools are required to manually collect data from different departments and teams. This data is analysed manually, and an offline network evaluation and planning exercise is undertaken. The proposed network plan must then be approved by the marketing, network optimisation and network construction departments.

The approval process is typically conducted through emails and offline reports, and the process is iterative due to changing business priorities. After the plan's approval, the procurement process begins and ultimately the infrastructure is delivered, installed and commissioned. Throughout this long, complex process, there is a lack of transparency and visibility.

One of the key problems that operators face during network construction and operations is trying to match information from disparate operations and business support systems (OSSs and BSSs). What is needed is a converged or holistic view to enable accurate traffic prediction and a network plan that is focused on user experience. By moving from an uncoordinated set of processes to a more joined-up approach, an operator could substantially reduce the time

to market for a new network. Such an approach could also enable the operator to make more focused investments in its network that deliver the strongest return on investment.

China Unicom selected Huawei as a partner to help with the digital transformation of its network planning, construction, and operations. Together they developed a system called TianShu, based on Huawei's Collaboration Workspace Realisation (CWR) solution. TianShu enables stronger collaboration between marketing, sales, planning, network planning, procurement, network construction and ongoing operations.

The TianShu system taps into the operator's OSS and BSS data as well as detailed information from network management systems. It incorporates several new capabilities, such as precise planning and performance management, and combines these with existing systems to provide comprehensive data that facilitates current network construction and operations and maintenance (O&M) processes. By introducing the valued site selection, precise planning, and digitised delivery capabilities, TianShu has improved the productivity and cost savings of network planning and construction at China Unicom.

As a result of its process streamlining and use of the TianShu system, China Unicom was able to reduce its network building time by 50 per cent. The company also used the TianShu system to conduct a market segmentation analysis to identify which users it should focus on retaining and which it should focus on upselling new packages. It then organised an

outbound sales call campaign supported by in-store selling. This enabled the operator to accelerate growth among its high value users.

To date, China Unicom's TianShu system has been rolled out across all 31 provinces in China. The company has found that, on average, areas where it has deployed have seen a 7 per cent increase in high value users.

Liu Hongbo, general manager of China Unicom's Intelligence Network Centre, explained the benefits of the TianShu system: "TianShu helps China Unicom greatly shorten the 5G network construction period, improve planning accuracy, and support integrated and collaborative operation of 4G network planning, deployment, maintenance and optimisation. In the future, we hope that the TianShu system can develop end-to-end capabilities for customers and continuously improve government and enterprise customers' ease of ordering and service experience."

He added that AI enables the development of intelligent operational capabilities, noting "TianShu integrates and streamlines data sources from various dimensions, builds an intelligent support platform integrating planning, construction, maintenance and optimisation, and implements value-based digital sandbox operational capabilities".

**Source:** Heavy Reading



## Q&A: Digital transformation starts with customer centric vision

**Miguel Fernandez, CTO of Telecom Argentina Group, highlights the many benefits its new service operations centre promises to deliver as it expands the platform across the country and all business lines.**

**Q:** What are the key objectives of your transformational programme plan?

**Miguel Fernandez (MF):** Fernandez: With the ongoing development of the industry, digital transformation is becoming paramount to Telecom Argentina. Actually, we're in the middle of this transformation journey; our organisation has just been shaped to address new customer demands.

From the company's point of view, we must adapt to satisfy the ever-changing demands of our digital clients: this is our transformation objective. We believe that the change from a network technology focus to a customer-centric vision will allow us to improve our brand in the country.

**Q:** How is transforming to customer-centric operations changing the way you operate?

**MF:** We believe transformation from network technology centric operations to customer-centric operations will require a lot of changes from the way we've been functioning up until now. The key elements are technologies, process, people and culture.

It is necessary to develop customer-centric strategies and criteria, and add customer experience to the company's goals. The customer lifecycle model defined by the TM Forum is applicable for us.

To achieve this, we established a service operations centre (SOC) and work side-by-side with our network operations centre to focus on the customer service experience. Huawei's SmartCare platform allows us to see and manage things we couldn't before.

Of course, for a SOC to work properly we must create a customer-focused culture in the company, which is mainly people and process driven. We are working on that in all areas of the company. For example, re-defining the scope of technology, new career planning and new functions inside the organisation.

**Q:** How is that investment and effort translating into business value?

**MF:** The SOC has contributed a lot so far, even at this early stage.

In our VoLTE provisioning phase, we were able to improve efficiency 30 per cent by using a more precise marketing campaign. In addition, we've seen a visible improvement in the customer experience, with our net promotor score (NPS) improving 40 per cent after the SOC was implemented.

We can be more precise on our optimisation activities, measuring and improving customer satisfaction after every action we take. Roaming assurance for customers traveling to the 2019 Copa America event was successfully secured because of SOC.

We operationally launched the SOC in August 2019 and just completed the phase 2 expansion covering mobile operations countrywide. We still have work to do and also are simplifying the network, getting rid of legacy technology. I think SOC can be of great value to us in the near future.

For our mobile SOC operations, we are trying to monetize the benefits of our operations whenever possible, and we think this is where SOC will shine.

**Q:** How is Huawei supporting your goals?

**MF:** Huawei is an important strategic partner in this transformation. It has rich global experience as an industry leader and a professional team made of up of local and expatriate talent to help us set up our SOC. It also enables the development of our team, giving us the skills and knowledge to make the transformation possible. We expect continued cooperation to make innovative use-cases with a joint Telecom Argentina-Huawei operations team.

**Q:** What are the next steps on that journey?

**MF:** As you know, this is a continuous journey. We are doing many things and there's still more to do. We need to continue growing our big data and analytics capabilities to support our data driven operations to be more proactive in addressing our customers' needs with the collaboration of other departments.

We also are working to deploy the service operations platform across the country and to take advantage of the new capabilities to implement our new set of customer-centric processes. This is key to leveraging our cultural transformation to succeed in these challenges.

We also expect to implement an SOC in our international operations in Paraguay. Another part of the journey is in the near future to replicate the SOC model, which now only covers our mobile business, to the other two verticals of the company: fixed, which includes our DOCSIS/HFC network, and content platform called Flow.



# CREATING THE ULTIMATE EXPERIENCE TO DRIVE GROWTH

**Simon Liang,**  
Director of Service Experience Consulting & System Integration Dept,  
**Huawei**

New services and experiences made possible by 5G can promote industry upgrades, with new business models and scenarios driving operators' business growth.

At the end of 2019, 5G networks were commercially deployed in 25 countries and regions by 50 carriers, with that number predicted to climb to more than 170 by end-2020.

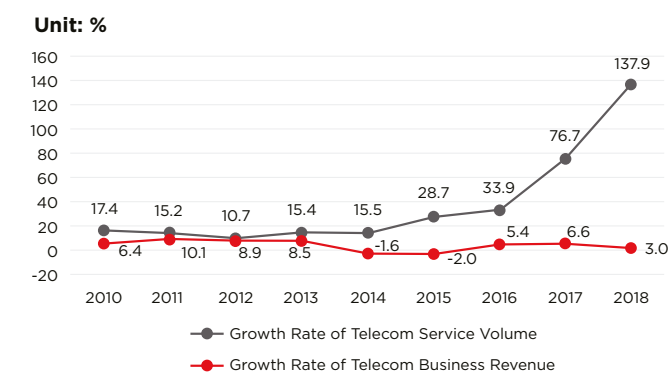
The era of mass 5G deployment and commercialisation is expected to usher in a new era of mobile communications. The International Telecommunication Union outlined three broad application scenarios for 5G: enhanced mobile broadband, massive machine-type communications and ultra-reliable low-latency communication. 5G will not only bring more diverse service applications and unprecedented user experiences to consumers, it will also spawn new application scenarios for hundreds of industries, accelerate industry digitisation, improve industry efficiency and reduce operational costs.

For global operators, 5G looks to offer a chance to break out of the traditional pipe-centred business model, develop new digital services and foster new industry applications.

## PROMOTE TRANSFORMATION

In the post-4G age, global operators all face similar challenges, including increasing telecoms services without a corresponding rise in revenue and difficulty making profits from new services. According to a report on the economic performance of the communications industry in 2018, published by China's Ministry of Industry and Information Technology (MIIT), the growth rate of telecoms business volume is 45.9 times that of business revenues. This is a record high for the industry.

### Telecom service volume and revenue growth rate in China



Source: Ministry of Industry and Information Technology website

Demographic and traffic dividends are fast disappearing, with traditional service increases unable to drive business growth. New self-operating services, such as video and gaming activities, can be developed to expand the home market as well as the government and enterprise sectors. Now, the inevitable choice for operators is to transform from infrastructure operators into digital service providers and accelerate revenue structure optimisation.

The development of digital services may be restricted by factors including government policies, industry environment and operators' strategic determination and capabilities.

In the past few years, practices by some leading companies show that digital services are benefitting from a wider user base, highly flexible tariff packages, more data and marketing channels, and better user experiences. 5G will create a range of digital service applications, including cloud VR, AR and gaming, which will place higher demands on operators' network experience. For example, the end-to-end delay for cloud VR cannot exceed 70ms.

Operators also have unique strengths in terms of technological leadership and fast service provisioning.

These factors give operators the option to develop new digital services through top-down strategies, to drive their digital transformation and achieve long-term business success.

## EXPLORING NEW SCENARIOS

5G will be widely applied to the B2B sector, where the services will expand across dozens of industry vertical industries, such as healthcare, electricity, mining and logistics. Through the influence of network slicing, mobile edge computing, big data and cloud, operators can provide enterprises with deterministic network resource assurance and scenario-based 5G services, driving industry digitisation and creating a sizable market for themselves.

As they deploy 5G networks, operators will face new obstacles to efficiently plan network resources for B2B industry applications and provide enterprise-level service quality assurance and self-service solutions.

5G offers a historical opportunity for an industry upgrade and a huge market for the long-term advancement of new services, experiences, business models and application scenarios. However, it also poses a series of challenges on topics ranging from network experience to operational transformation.

With deep understanding of operators' challenges in the 5G era, Huawei launched the SmartCare solution based on a unified digital platform to assist operators in their digitisation journey and sustained development in terms of the network, services and business. Empowered by these solutions, operators will be able to deliver the ultimate network user experience, create new digital services and continue to grow in the 5G era.

## NEW EXPERIENCES AND MODELS

Although 5G creates the opportunity for new digital services, relevant business models are required for business monetisation. New 5G technology has the potential to allow operators to break the traditional voice and traffic charging dimensions, explore differentiated experiences, such as speed and latency, and explore the multi-dimension monetisation mode of content rights. New models will be the key to maximising network value and achieving business success. Commercial 5G packages released by global operators show that they are enhancing their content value with video, VR and music by providing differentiated speeds.

In the 5G era, the change from traffic monetisation to experience monetisation and content monetisation will become inevitable. For now, global operators must solve the problem of how to move from KPI-driven network operations to experience-centred service operations. They also need to deliver differentiated experiences and devise a multi-dimensional monetisation model.

“5G will create a range of digital service applications, including cloud VR, AR and gaming, which will place higher demands on operators' network experience.”







# Q&A:

## MTN turns to CEM to deliver best-in-class experience

**Zoltan Miklos, general manager for engineering at MTN South Africa, shares how the operator transformed from focusing on network operations to putting services and the user experience at the centre of everything it does.**

**Q.** How has Huawei's Customer Experience Management (CEM) solution enabled MTN to improve its business objectives?

**Zoltan Miklos (ZM):** MTN SA uses end-to-end proactive and reactive processes to focus on customer experience improvements across three business areas.

First, digital operation has been enabled through Huawei's CEM platform, enabling supporting staff to deliver the best digital experience to our subscriber base (for voice and data service experience). Processes have also been enhanced to be more service driven. For example, using experience driven planning and optimisation to prioritise cells in poor experience areas.

Second, customer care has been enhanced by providing end-to-end customer experience visibility to customer care agents to respond to customer complaints efficiently. Finally, MTN commercial sales and marketing teams are empowered with relevant network and customer experience data to personalise offers to customers to improve their overall price and service experience.

**Q.** How does it allow you to be more responsive to customers' needs?

**ZM:** With the CEM enabling platform, we can perform faster and more precise end-to-end customer experience problem analytics. Moreover, we have enhanced our net promoter score (NPS) and churn predictive models, giving MTN an enhanced proactive and reactive care view. The insights data obtained also can be used to enhance our marketing, network planning and operation team capability to achieve capex and opex benefits.

**Q.** What is required to transform from a traditional network-centric company to a user service-centric operations company?

**ZM:** MTN has transformed from a traditional network operations centric model to a user-service operations centric (SOC) model, with the SOC being an important engine to improve revenue, customer retention and operational efficiency.

In addition, as part of the customer experience platform deployed, MTN uses a geolocation capability which allows for service-based coverage maps to be produced from customer devices, thereby assisting in planning and optimisation activities.

The SOC focuses on services and customers, and this transformation requires a service-centric operating model that introduces and monitors new data and service KQIs; uses predictive models to correlate usage patterns with customer needs, and new skills and competencies.

**Q.** What business and operation performance metrics do you monitor and why?

**ZM:** MTN SA uses business and operation performance metrics to ensure customer experience benchmarking, increase NPS, reduce the number of customer complaints, reduce churn, increase service usage, migrate user traffic from 2G and 3G technologies to 4G, and improve ROI.

On the experience level, first-call resolution improved 10 per cent and the mean time to correct and detect trouble tickets improved at least 30 per cent.

**Q.** How does the CEM help improve the customer experience?

**ZM:** MTN SA's customer experience management is a closed-loop platform for measuring the customer lifecycle experience and taking those insights to action. We make use of powerful PSPU (per service per user) big data analytics, powered by Huawei's SmartCare CEM platform, which allows for the capture, measure and analysis of the customer journey and touch points in near real time.

CEM introduces the capabilities to build prediction algorithms to predict perceived customer experience and proactively manage reasons for bad experiences.

We also use a customer experience index and key quality indicators to effectively monitor, interpret, analyse and act on customer experience issues.

# ANALYST REPORT

## MAXIMISING VALUE FROM 5G THROUGH EFFECTIVE NETWORK PLANNING AND OPTIMISATION

**Adaora Okeleke, Senior Analyst, Telecoms Operations and IT, Ovum**



Network planning and optimisation are critical to the efficient use of communications service provider (CSP) networks. These functions will ensure that CSPs obtain maximum ROI, manage the cost of operations and deliver optimal quality of experience to customers. However, the migration to a new network technology brings new challenges to these functions. This will be the case with the current migration of networks to 5G.

The arrival of 5G promises to provide new opportunities for CSPs to increase service revenue and achieve cost efficiencies. By using advanced capabilities such as Massive MIMO, network slicing, edge computing and network function virtualisation, CSPs can offer new services including smart home, autonomous driving, drone operations and remote healthcare services. CSPs can also see the cost of operating networks fall in the long term. Implementing these features and technologies, however, present challenges to CSPs' planning and optimisation operations. These challenges include fulfilling the diverse set of network requirements needed for each service, limitations associated with spectrum bands supporting 5G, the co-existence of 4G and 5G cells, and the complexities that come with implementing Massive MIMO.

Lessons from existing 5G deployments provide insight into ways CSPs can address these 5G network planning and optimisation challenges. These include taking a service-oriented approach to planning 5G networks, using 3D modeling to plan and optimise 5G networks, and prioritising 4G network optimisation.

**• Taking a service-oriented approach:** Given the broad portfolio of services that 5G will enable, 5G network planning should begin with assessing the services the CSP plans to deliver. This assessment will include identifying the location of the target customers, determining the consumption pattern of these services relative to time and the network requirements for each service. With this assessment, network planning teams can determine the baseline service performance indicators for these services, which can then be mapped to the corresponding network performance indicators that must be achieved. The network planning team can then create a network plan that fulfills these KPIs.

**• Leveraging 3D modeling:** 3D-site modeling will be relevant to 5G network planning and optimization. It will enable CSPs to take into consideration the beam-based coverage and transmission patterns of the Massive MIMO antennas used in 5G sites. It can also address the fact that target 5G users (devices and humans) will be indoors and at varying heights above ground level. These capabilities can be achieved by taking the 3D characteristics of the antennas and the surrounding environment to ensure site plans are accurate.

**• Prioritising the optimisation of 4G networks:** With current 5G deployments based on 5G non-standalone architecture, the performance of the 4G anchor network will be critical to the performance of the 5G network as it caters for its coverage needs.

Therefore, resolving as quickly as possible any coverage or network performance issues in the 4G anchor network will assure the performance, throughput and other quality indicators of the 5G cells. One of the ways this can be achieved is by creating multiple anchor-point frequencies within the frequency bands that the 4G network relies on to ensure that 5G users remain connected to these frequencies.

To implement these approaches successfully, operators must be ready to adopt best practices that will enable effective 5G network planning and optimisation. These include standardising processes involved in optimising networks and keeping site plans updated.

Investing in big data and AI and in the accompanying infrastructure to support the increased computation workloads for these technologies will be required. For example, the use of machine learning can support the analysis of current and future consumption patterns of AR- and VR-based services. These technologies can also support the forecasting of 5G network coverage and capacity and identify the optimal parameter combinations required to achieve high spectral efficiency and optimal network performance in Massive MIMO antenna systems.

Finally, CSPs should invest in the skills that align with the relevant technologies and practices discussed. How a CSP decides to build up these skills will vary depending on their level of maturity when it comes to deploying 5G networks and implementing technologies such as AI and big data. CSPs can consider working with peers already running 5G networks or work with vendor partners that have built experience in planning and operating 5G networks using the methodologies discussed.

Source: Ovum



# A CONVERGENT BILLING SYSTEM FOR THE 5G ERA

**Rockred Zhang,**  
President of Software Business Unit,  
**Huawei**

Huawei contributed 45 per cent of the technical reports submitted to the billing working group in the formulation of 3GPP Release 15 standards. We are committed to tackling the many challenges of convergent billing in the 5G era.

The three major issues encountered in the process are dealing with changes in the convergent billing architecture, creating enterprise capabilities and introducing monetisation capabilities.

## CHANGES IN CONVERGENT BILLING ARCHITECTURE

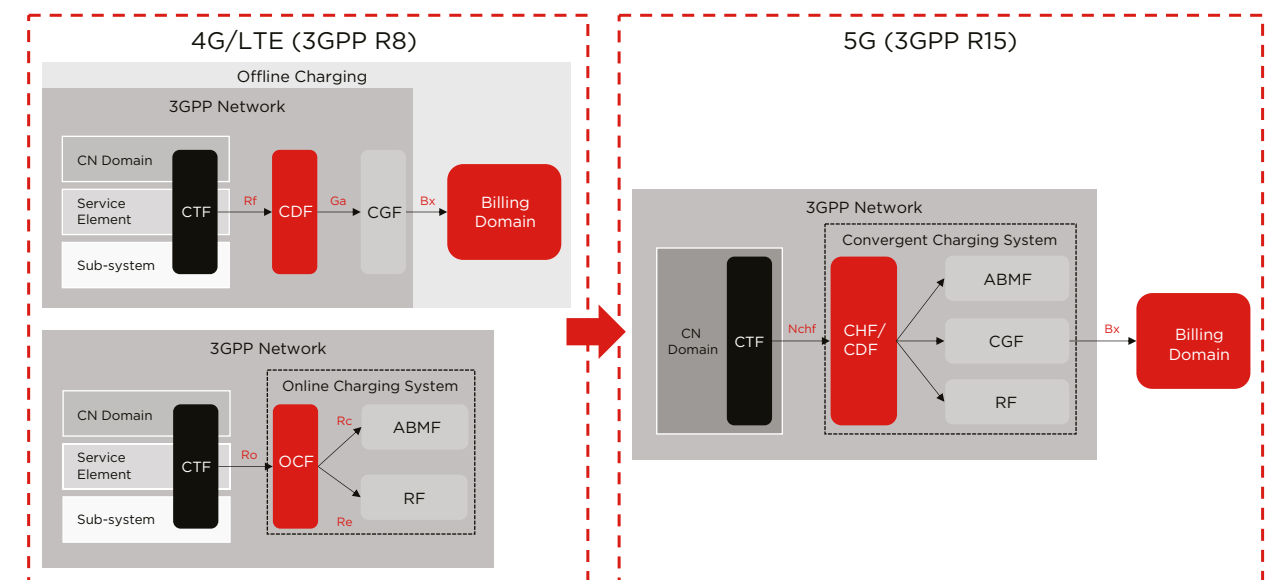
4G networks adopted different convergent billing architectures

for online and offline modes. Users are required to choose prepaid or post-paid mode.

With 5G networks, the 3GPP introduced the convergent billing architecture, with the core network adopting convergent architecture for both online and offline billing mode. This billing system can choose online or offline billing modes according to the service needs, bringing more flexibility. As an advocate of convergent billing architecture, Huawei launched its Convergent Billing System (CBS) in 2007.

In the 3GPP Release 15 specifications, the Charging Data

Figure 1: Convergent charging architecture



Source: 3GPP

Function (CDF) and Charging Gateway Function (CGF) have been integrated into the Convergent Charging System (CCS) to simplify the network structure. Huawei's Convergent Charging Gateway, released in 2019, complies with the Release 15 specifications and is responsible for producing 5G service call detail records.

## ENTERPRISE SERVICE CAPABILITY

Huawei's CBS provides various enterprise service capabilities to support 5G applications like autonomous driving and industrial automation.

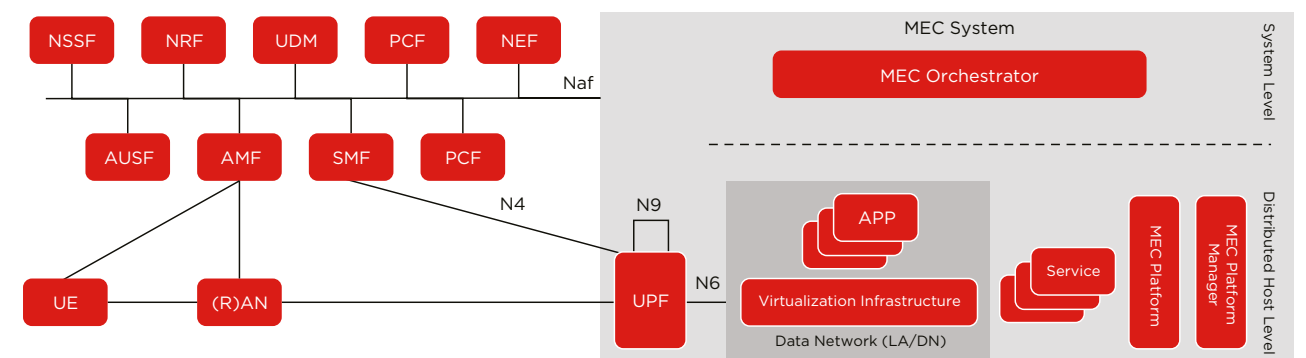
After subscribing to a service, users can leverage the user plane function (UPF) at the edge and access the applications and content deployed on the mobile edge computing (MEC) server

to experience low-latency services. Huawei's CBS allows OTTs to use open APIs to sign up new users, for example, to cloud gaming services deployed on the edge by a gaming vendor.

Huawei's CBS also can use various billing criteria of cloud computing, such as CPUs and memory, to charge OTTs usage on the edge computing server.

Its CBS supports billing for 5G slices according to the quality of service. The Huawei CBS R20, which will be released in 2020 and complies with 3GPP Release 16 specifications, can manage 5G slices and support service quality assurance billing. For example, if the actual service quality does not meet the standard of the service level agreement, the corresponding compensation can be applied for the user.

Figure 2: 5G UPF and MEC



Source: ETSI



MONETISATION CAPABILITY

In the 5G era, leading operators will build their core business model based on service experience monetisation. Huawei's CBS offers more than 100 service experience related billing dimensions, including uplink or downlink access speed, service latency, traffic destination and flexible combinations of these elements. This enables operators to provide an optimal charging experience for users in the 5G era, such as online subscription in real time. Therefore, operators can generate revenue from the key benefits of 5G: larger bandwidth and lower latency.

Huawei's CBS has made contributions on three key areas:

1. Cloud-native architecture

The CBS has applied the micro-services architecture in the 5G billing field. It complies with the principles of stateless micro-services and separation of data and applications. The balanced design of micro-services enables flexibility and high performance at the same time.

The 5G billing micro-services deployed in containers (e.g.docker) enables not only flexible scaling and self-healing, but also allows different versions of micro-services to be deployed in a 'gray zone', where pilot users can test new capabilities before they are released to general users.

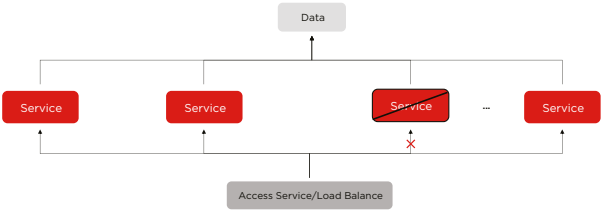
The benefit of stateless micro-services and data and application separation, all key applications of the CBS, is a distributed architecture. Multiple instances of a single service can be simultaneously deployed and access to any service instance is identical.

Applications can be flexibly scaled or upgraded by adding or stopping service instances, with service continuity not affected. Moreover, the traditional active-standby pair, as well as disaster recovery pairs, are no longer required.

Huawei's CBS adopts smaller containers to deploy its micro-services, and these can be directly deployed on bare metal servers. Container-level fault isolation, zero-touch healing and active system health checks are provided to make the system more reliable and easier to maintain.

Benefitting from self-developed high-performance codec algorithms, as well as high-performance HTTP stacks, the

Figure 3: Distributed architecture



Source: Huawei

end-to-end billing response time was reduced by 30 per cent. The throughput of the 5G service-based billing interface is also more than 30 per cent higher than the traditional 4G billing interface, and can withstand 10-times the surge traffic.

2. Smooth migration

As the largest telecoms equipment vendor, Huawei's CBS has more than 200 customers around the world and provides billing services to 2.2 billion customers. It designed a smooth migration path from the traditional physical machine or virtual machine deployment architecture to the cloud native architecture, protecting an operator's investment.

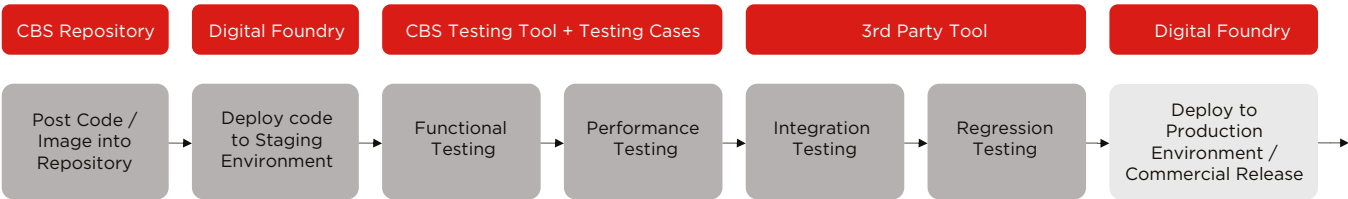
3. Continuous development and delivery

The faster and improved service experience brought by 5G requires more agile IT systems to support monetisation. Huawei, as an industry pioneer, continuously develops the technologies. Various new tools have been applied in the development and delivery processes, significantly reducing implementation times, from four to six months to one month or less.

In addition, the process shown in chart 4 (above/below) can be integrated with an operator's own delivery processes, enabling it to quickly reap the benefits of a new version of the software.

As most countries will deploy 5G services commercially before 2021, and considering billing system upgrades can take nine to 18 months, 2020 will be a crucial year for reconstruction of the 5G billing system.

Figure 4: Improved development and delivery



Source: Huawei

# 5G INDOOR NETWORK CONSTRUCTION GUIDELINES

Duan Xuepeng,  
General Manager of MBB Domain,  
Huawei

Compared with LTE networks, 5G technology provides abundant new services and has the potential to continuously expand the capabilities of almost all industries. Not only does 5G provide high-speed data services, it also can deliver compelling applications for consumers, enterprises and industries, making life and work more convenient, productive and enjoyable.

People can now view immersive sports events and entertainment programmes, while businesses can streamline production systems and governments can make social services more acceptable.

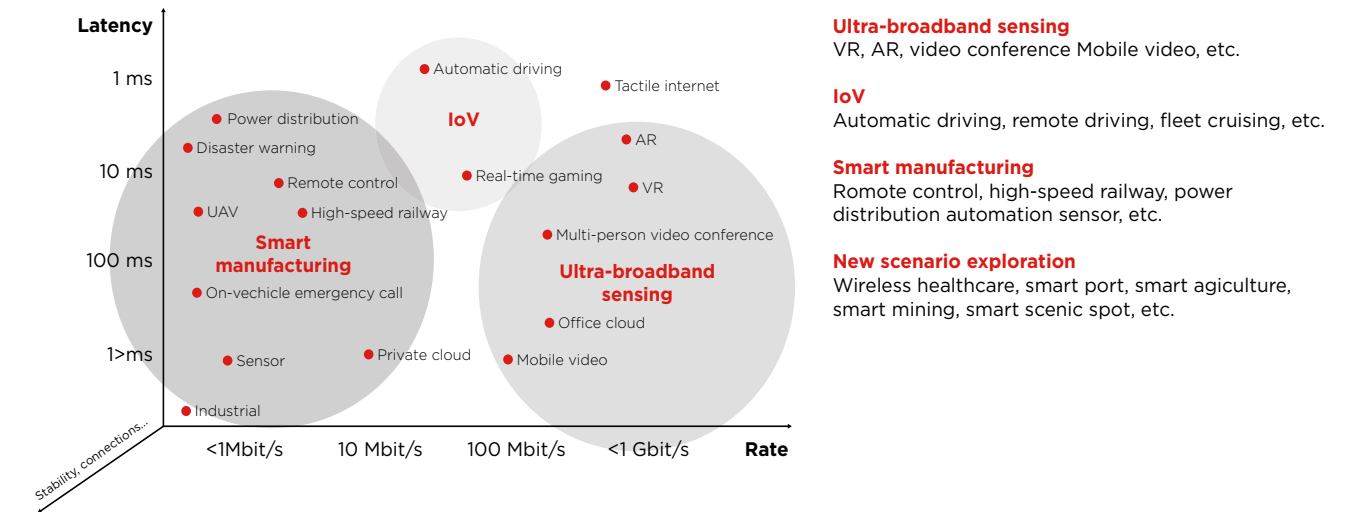
5G will connect diverse vertical industries, making use of the same technology standard to simplify installation and maintenance.

For example, a 5G network can support a smart building system with video surveillance equipment and sensors, which were originally connected to a fixed network, providing more flexible deployment, capacity expansion and reconfiguration.

5G will emerge as the core of the smart city evolution, becoming as essential as water, electricity and gas.

Most of these services will be used indoor, with more than 80 per cent of data services expected to be consumed within buildings in the near future.

5G network scenarios and performance requirements



Source: GSMA & Huawei Wireless X-Labs



**INDOOR CONSIDERATIONS**

The objective of indoor 5G network construction should be to improve the user experience and introduce new business models. 5G indoor network buildouts should follow the principle of on-demand network construction to cultivate a new ecosystem, which not only allows operators to make an attractive profit, but also facilitates industry partners in profiting as well.

During the construction of the 5G network, operators will undergo two major changes:

- New business models: Operators will shift from operations focused solely on connectivity towards traffic value monetisation, with connections at the core. Multiple network features, such as throughput, latency and slicing, will allow operators to move beyond simple pipe services. They will expand to provide an intelligent platform and many associated network services.
- Vertical networking architecture: Driven by new business models, the network architecture will be integrated with vertical industries. In addition to providing wireless connectivity, networks will also integrate with the smart units in the industry to form a cloud-pipe-device architecture.

In the 5G era, the amount of traffic will skyrocket. Unlimited data packages will become standard, business value will be reshaped. Operators will be required to strengthen their operations to realise sustainable business growth with differentiated monetisation methods using multiple network features.

Different indoor services need to be supported by diverse network construction requirements. Based on past deployments in various scenarios such as stadiums, hospitals, transportation hubs and commercial buildings, Huawei is able to analyse factors such as capacity planning, network reliability and network O&M to develop an appropriate indoor 5G network construction strategy.

In the indoor 5G network planning process, different functional areas in a building will have different features. A 5G network must also be designed to meet consumer and business service requirements.

During the construction of the indoor 5G network, using all-scenario digital products is recommended to meet the large-capacity, low-latency, high-performance requirements. The products have a unified digital integrated deployment

platform, which can implement process-based operations, data streamlining, visualised progress and quality management, improving end-to-end deployment efficiency and quality.

With 5G network operations and maintenance (O&M) and optimisation, the digital integrated deployment platform can provide the location of faulty devices, provide grid-based indoor coverage, and offer a “black box” for indoor site maintenance to improve indoor O&M efficiency. Moreover, the platform can also reduce indoor energy consumption.

Indoor traffic on HKT’s network has soared and already reached 80 per cent of total traffic in 2019. With the rise of 5G, the proportion of indoor traffic consumption will only increase. Traditional passive indoor distributed systems will struggle to meet the requirements and challenges of indoor network capacity and evolution in the 5G era.

To provide the optimal user experience, smart O&M and highly efficient operations, it is necessary for an indoor digital network to be constructed based on an all-optical architecture. HKT in Hong Kong will provide more abundant digital services and applications for individual consumers and home users to improve convenience. In addition, the operator will continuously build out a high-quality, highly reliable indoor digital network for enterprises, enabling more applications and creating more business value.

Indoor coverage has become a highly valued fundamental of 5G networks, and indoor digitisation is now a major industry trend. Huawei is an end-to-end 5G indoor coverage provider, with extensive capabilities in indoor network consulting and planning, 5G scenario-based solutions, 5G digital products and integration, and industry ecosystems. In addition, we have accumulated vast experience and have actively promoted 5G indoor coverage around the globe.

Huawei has helped 140 operators in 85 nations deploy more than 60,000 hotspot networks. In the future, the company will continue to collaborate with industries to increase investment in indoor coverage solutions, deepen cooperation with operators and other industry partners, jointly explore new business models and construct a new industry ecosystem. Together, we can build a smarter, more efficient indoor 5G network to create more value.

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