China Mobile customizes AN Methodology to slash 5G OpEx

By John Tanner

Who: China Mobile and Huawei
What: Developed implementation architecture and level-based evaluation system to transform network Operation & Maintenance across its 31 subsidiaries
How: Used TM Forum's Autonomous Networks Project and other Forum assets to introduce autonomous capabilities at 4 levels to form 3 close loops, and conduct evaluation 1-2 times annually to trigger iterative evolution.
Results: O&M efficiency is increased by 10-20%; service opening time shortened by 30-50%; IDC/base station energy consumption reduced by 3-5%; AI innovation vitality activated by 100%.

If deployment of 5G can be considered a race, then China Mobile is arguably at the front of the pack. To date it has deployed the world's largest 5G standalone (SA) core network, along with 500,000 5G base stations. While that earns China Mobile serious bragging rights in terms of rolling out 5G on a larger scale than anyone else, the downside is that a network of that scale is a complex and expensive beast to operate.

Consequently, a key objective for China Mobile's 5G strategy is to find ways to reduce OpEx – but not, however, at the expense of quality of service (QoS.) Indeed, one of China Mobile's biggest challenges is to increase 5G service quality whilst simultaneously lowering operations costs; all of that within the context of the operator's broader goal of achieving a neutral carbon footprint.

Ultimately, the solution for China Mobile was to automate its O&M processes as much as possible. To that end, the operator adopted TM Forum's Autonomous Networks Project as the core concept of its network operations transformation, enabling it to develop an implementation architecture. Moreover, China Mobile tailored the AN model to make it work consistently across a complex network landscape.

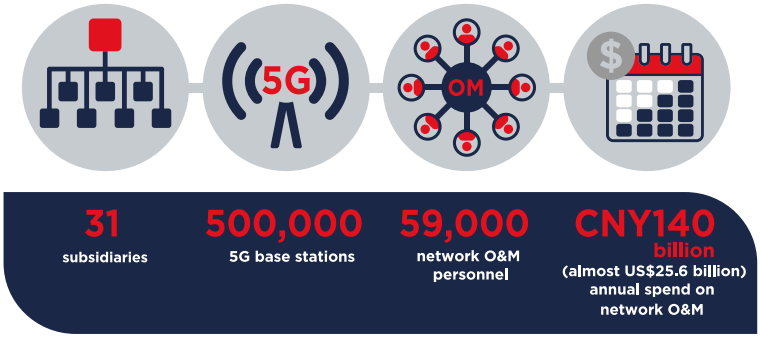
The scale of the challenge

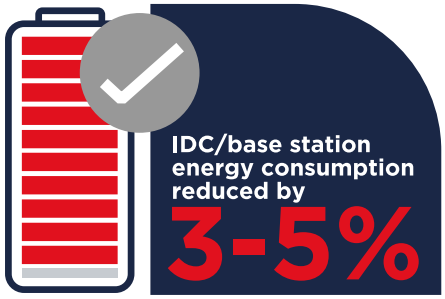
To understand China Mobile's AN strategy, it's important to understand the specific circumstances in which it operates.

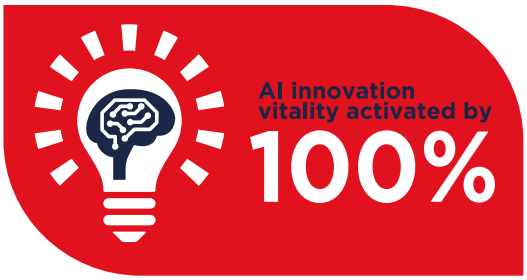
China Mobile Group is an amalgam of 31 independent subsidiaries located in different regions – these subsidiaries are supplied by a wide variety of equipment vendors, and have very different network O&M capabilities due to different customer scales, network architectures and operations processes. Across this complex network structure, China Mobile employs approximately 59,000 network O&M personnel and spends about CNY140 billion (almost $25.6 billion) on network O&M each year.

China Mobile transforms network Operation & Maintenance

Used TM Forum's Autonomous Networks Project, Business Process Framework (eTOM), Digital Maturity Model, AI Maturity Model and other assets.







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With 5G coming into the picture, network O&M must scale significantly to support 5G's capabilities of Enhanced Mobile Broadband, massive Machine Type Communication and Ultra Reliability and Low Latency Communication, whilst also supporting the higher requirements on network quality brought about by the B2B revenue opportunities of 5G services.

"The key for carriers to seize the opportunities of the digital economy is to form a new growth model based on networks and driven by information technology and data elements through digital-intelligent transformation. China Mobile aims to reach Level 4 Autonomous Networks by 2025," says Yang Jie, Chairman of China Mobile.

Leveraging TM Forum's AN framework

TM Forum's AN concept proposes to define standard levels of autonomous operations for operators, similar to how car manufacturers determine the autonomous capabilities of self-driving vehicles.

China Mobile decided to embrace this AN concept to implement the required intelligent automation at different levels in different domains. The key challenge was how to implement the AN model across the entire group.

Luckily, China Mobile had more than a passing familiarity with TM Forum's AN concept – it actually helped develop the concept. In 2020, China Mobile contributed the proposed methodology for application introduction to TM Forum AN white papers. The operator also led an AN Catalyst project that won the Catalyst Digital Showcase Award and Outstanding Contribution to TM Forum Assets Award.

In addition to the Forum's AN framework, China Mobile's O&M transformation plan incorporates additional TM Forum assets such as:

- TM Forum Business Process Framework (eTOM)
- TM Forum Digital Maturity Model (DMM)
- AI Maturity Model
- AN Business Architecture (IG1218)
- AN Technical Architecture (IG1230)

The path to rollout

China Mobile collaborated with Huawei and other partners to explore the path to achieve its goal of Level 4 AN by 2025:

- Developed a **"234" implementation architecture** with dual goals of business expansion and increased efficiency, to introduce autonomous capabilities at foyr levels to form three close loops, and conduct capability evaluation 1-2 times annually to trigger iterative evolution
- An **autonomous capability evaluation model** was developed and used in the preliminary evaluation for all 31 branches – 1,100 capability shortcomings were identified
- Formulated a new "**25N" OSS blueprint** with eight technical specifications to guide the practice of all branches in introducing over 3,000 autonomous capabilities.
- Promoted AI-driven OAM applications nation-wide based on over 100 AI capabilities hosted on its in-house "**Jiutian" AI platform**, with over 100 million API calls annually.

Reaping the benefits

The operator launched its Practice on Autonomous Network White Paper (2021) in July. Li Huidi, Vice President of China Mobile, says China Mobile has been developing its "Jiutian" AI platform to quickly bridge capability gaps and facilitate AI innovation and R&D. Also, Li adds, this system has resulted in implementation of L4 cases in at least half a dozen key domains so far in 2021, including:

Provisioning of cloud-network convergence services within seconds: Agile service orchestration and automatic network configuration are implemented based on dynamic scheduling policies to provide high-quality cloud-network private line services for various industries and facilitate digital transformation for the entire society.

Automatic 5G fault handling: Based on expert rules, experience, and AI algorithms, an average of 100 million device alarms per day can be automatically handled, compressed, demarcated, and located. “The alarm ticket dispatch ratio can reach 1,000:1,” says Li. “Main faults can be cleared within 30 minutes, which has improved network efficiency by 40%, thus ensuring 5G network quality.”

Intelligent optimization of 5G base station parameters: AI algorithms are used to analyze sector coverage characteristics, quickly mine optimal beam parameter combinations, and automatically deliver base station parameters. This increases the outdoor download rate by 13% and the indoor download rate by 30%, which significantly improves the user experience.

Intelligent shutdown of 5G base stations: AI algorithms analyze the characteristics of historical base station traffic changes, predict traffic changes, and dynamically shut down cells in different periods. As a result, energy consumption of base stations has been reduced from 8% to 11%, which not only greatly reduces carbon emissions, but also saves on network operations costs.

Intelligent scheduling of Internet data center (IDC) air conditioners: AI algorithms analyze indoor and outdoor environments, IT service loads and other characteristics. Air conditioner parameters are dynamically optimized based on scenarios, reducing power usage by 8% for an equipment room per day on average. China Mobile estimates it can achieve power savings of about 220 million kWh every year after applying this to the whole network.

Hours-level opening and recovering of home broadband services: China Mobile has been able to deliver new promises to activate new services within 24 hours via intelligent design of the setup scheme, automatic processing of anomalies, automatic network resources allocation and automatic system level network data production. After application, more than 10 million new home broadband service users have been added each month. Network problems are dealt with ahead of customer complaints.

Overall, China Mobile says its AN project has increased OAM efficiency by 10-20%; shortened service opening time by 30-50%; reduced IDC/base station energy consumption by 3-5%; and activated AI innovation vitality by 100%.

Meanwhile, the automation journey continues – all of this is part of China Mobile’s five-year development plan to roll out AN across its subsidiaries, says Li: “Our plan calls for full L2 and partial L3 O&M capabilities from 2021 to 2022 and progressing to full L4 by 2025.”