A roadmap for operators in the 5G and cloud era

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In 2018, the curtain rose on 5G commercial adoption. Data from *Huawei Global Industry Vision (GIV)* shows that by 2025, daily communication traffic per capita will hit 4 GB. Cloudification is pervading enterprise and industry digital transformation – 85 percent of enterprise applications will undergo cloudification, driving change in network traffic models.

As we look to the future, what kind of network do operators need to build to support the network requirements of the 5G and cloud?

Three challenges for operators

- How to invest in networks so data traffic can increase tenfold every five years.
- How to support a 10x increase in network size and complexity with simplified network architecture.
- How to improve end-user experience with proactive O&M to move beyond complaints-initiated O&M.

Transforming the structural problems of telecom networks requires innovation in system architecture. Operators' existing network architecture has generally failed to support the development needs of future services. In particular, with service development models increasingly focused on user experience, telecom networks will only be able to meet service needs by fully switching to a future network architecture that's driven by user experience.

In 2018, Huawei released its Intent-Driven Network (IDN) solution based on this goal. The solution enables operators to evolve from legacy networks to a target network architecture that's user-centric by building a digital twin that bridges the physical network and business intentions, and is driven by user business logic and service strategy intentions.

Working with customers

To build networks that are intelligent, simplified, ultra-broadband, open and secure, Huawei launched a series of IDN-based joint innovations with leading global operators and enterprise customers, exploring the solutions using the innovative NetCity model and implementing DevOps. The value of IDN has been gradually verified on live networks, further accelerating the progress of IDN innovation.

NetCity is a joint innovation mechanism based on the IDN concept. In NetCity projects, Huawei collaborates with world-leading operators and enterprises/industry customers to implement fast closed-loop technology innovation and business innovation through joint business design, defining use cases, DevOps iterative development, and local lab verification.

At Mobile World Congress 2018, Swisscom and Huawei jointly signed strategic cooperation MoU for the NetCity project, committing to jointly build a world-leading, highly reliable next-gen network infrastructure to provide new communication network services and the best user experience for Swiss users.

At Huawei Global Analyst Summit 2018 in April, Ping An Technology and Huawei signed a joint innovation agreement to innovate IDN and promote digital transformation in the financial sector.

In May 2018, China Mobile Beijing and Huawei signed a MoU covering big video and a premium network in Shenzhen. China Mobile Beijing will build competitive strengths in future-oriented networks based on Huawei's innovative quality broadband solutions, and gradually evolve towards IDN.

Huawei's Intelligent Transportation solution offers unique competitive strengths in many areas to support road digitalization and vehicle-road synergy.

In October 2018, during HUAWEI CONNECT, Huawei and China Merchants Bank (CMB) announced plans to reconstruct the bank's data plane, operation plane, and O&M plane through joint innovation. This will help CMB carry out digital transformation and drive retail 3.0.

By the end of 2018, Huawei had cooperated with world-leading customers to launch 25 NetCity innovation projects covering multiple application scenarios, including premium broadband, 5G transport, IP metropolitan area, optical transmission, data centers, and enterprise campuses. In total, 61 commercial use cases have been incubated.

During joint innovation with customers, Huawei iteratively upgrades IDN to better support global customers' network development needs. In the operator sphere, Huawei upgraded its telecoms-oriented IDN solution in September 2018, and proposed a two-wheel drive strategy to span the digital and physical worlds and speed up the progress of IDN innovation. The solution has three core benefits:
· Introducing a network brain to build an intelligent network.
· Supporting service model innovation through network-service separation.
· Dealing with the surge in network traffic through Moore's Law for networks.

Intelligent Network Brain

It's crucial to fully consider the end-to-end network as a whole. And building a unified network brain is key. Huawei's IDN solution includes the industry's first network cloud engine (NCE). The innovative NCE integrates management, control, analysis, and AI functions, and consists of four engines: intent, automation, analysis, and intelligence. They form a full-lifecycle complete closed-loop driven by the data on which the intelligent network brain is built. For operator scenarios, NCE has four key benefits.

Achieving user-centric operations by building a digital twin for the physical network. Based on telemetry technology, NCE enables the real-time collection of physical network data, and constructs a digital twin for the end-to-end physical network. This supports real-time perception of the physical network and the playback of physical network historical states, allowing operators to implement user intention-based predictive network operations.

Full-lifecycle closed-loop management using digital twins. NCE harnesses the digital twin to integrate previously fragmented, discrete network data. It enables closed-loop, automated and smart management covering digital planning and design, simulated and visual assessments, automated

physical deployment, and continuous authentication. This supports full-lifecycle closed-loop operations for end-to-end networks.

Exclusive Design Studio forms a programmable platform that accelerates network service innovation and IT integration. As part of NCE, we launched the innovative Design Studio open platform to support network programming. The platform integrates operators' strengths in network operation experience as well as manufacturers' strengths in product innovation, shortening the service innovation cycle. NCE is based on an open north-south interface – it can already connect with seven mainstream cloud platforms and has passed the integration and testing certification of over 40 industry partners.

Building use cases service models based on service scenarios to drive business closed-loops. Aimed at different operator service scenarios, the NCE has a service-centric service model for different business scenarios and use cases. We've also launched a series of scenario solutions through joint innovation and verification incubation with customers.

Network and service separation

Compared to OTT companies' simplified network architecture and

automated service delivery, the problems plaguing traditional carrier networks, such as complex architectures and low service delivery efficiency, are especially striking. The main issue is that carrier networks are coupled with services. Service changes necessitate network changes. This leads to problems such as low network efficiency.

Huawei IDN builds a stable and reliable network bearer layer and an agile network service layer. This helps operators to separate the network from services and innovate system architecture.

The network bearer layer provides capabilities for agile automation and differentiated SLAs for connection services. Constructing an all-optical base and implementing ubiquitous one-hop transmission with OTN technology supports point-to-point, point-to-multipoint, and multi-point to multi-point connection services. The bearer layer automatically establishes connections to the pipe based on service connection intent. Introducing the unified SR/SRv6 network protocol, SR-based differentiated latency guarantees, and bandwidth-capable connection services enable seamless networking for the bearer layer.

The network service layer provides a barbell-type architecture that enables business automation. Layered decoupling of the network improves service agility and unifies cloud and service side access models, creating a foundation for network automation, and drives the on-demand smooth evolution of the service layer BRAS, ultimately enabling full cloudification.

Dealing with traffic surges

Ultra-broadband is still the cornerstone of future network evolution. Huawei continues to promote innovation in physical networks, applying Moore's Law to support cyclical improvements in network equipment capacity and reduce bandwidth cost per bit.

In the access network domain, Huawei has introduced technologies like XGS PON and PON Combo, doubling access network bandwidth every four years. Huawei's next-generation high-capacity distributed intelligent OLT platform MA5800 supports compatibility with six types of PON on the same board, supporting ultra-long-distance coverage that surpasses industry competitors by 10 km.

In optical networks, Huawei has doubled the capacity of optical network equipment every three years using innovative technologies including oDSP chips, silicon photonics, and Super C spectrum. It released the industry's first commercial OXC (all-optical switching) equipment, which has already been widely commercially adopted.

In the IP field, Huawei has doubled the capacity of router equipment every two years with innovative technologies like NP chips, and cable backplanes, reducing the cost per bit.

Developing IDN is a process of continual evolution, and it's the road that must be taken before we arrive at autonomous driving networking. Looking to the future, Huawei will work with global partners to accelerate the progress of IDN innovation, promote the mature rollout of the IDN industry, and jointly build a fully connected, intelligent world. **H**

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