Bridging networks and business intent to activate intelligence

As the digital transformation of global industries continues to pick up pace, enterprise networks need to not only provide basic connectivity, but also better serve future business needs of enterprises and industries. There are three major ways this can be achieved.

(1) Fully understanding enterprise business needs and being able to respond quickly; (2) Solving issues predictively to deliver five-nines reliability for industries such as finance; and (3) Developing programmability to enable the integration of enterprise digital systems with more third-party vendors. All pose a huge challenge on existing enterprise networks, making transformation of the entire enterprise network imperative.

Learning from the best

We've witnessed a number of pioneers in manufacturing, transportation, and finance making very successful forays into digital transformation. Their explorations provide a valuable reference for enterprise network transformation.

Leading manufacturers have introduced automation, allowing them to coordinate the management of administration and production with second-level precision. Harley-Davidson, for example, can now complete the assembly of a motorcycle (all 1,200 parts) in just 89 seconds, slashing the time from customer order to delivery

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from 21 days to six hours. Through open, automated, and efficient coordination, Harley has achieved customized production.

The transportation giant GE was the first to propose the Digital Twin concept. GE implanted sensors into aircraft landing gear, so that the parameters of its equipment could be instantly acquired and digital twins built. This enabled predictive maintenance in aircraft overhaul based on the indicators, shortening aircraft maintenance time from six to one hours and greatly enhancing production efficiency and quality.

And in the financial sector, innovative banks are applying technologies such as artificial intelligence (AI) and big data. Harnessing the sheer volume of data provided by big data, they're able to continuously train and enhance AI financial analysis capabilities, and provide sustainable online production and services using AI. This allows them to provide financial services for people anytime, anywhere.

These examples demonstrate the key roles automation, digital twins, AI, and big data play in the digital transformation of leading industries. The application of these technological innovations in enterprise networks will spark new synergies.

IDN: Bridging physical networks and business intent

Today's enterprise networks are entirely network-centric, with no perception of user experience. System optimization relies on passive responses, and in many networks O&M is driven by user complaints. Network O&M is increasingly complex, and budget limitations have made human-based O&M unable to adapt to the sheer scale of business growth. It has thus become difficult for closed network architecture to support service flexibility.

Looking to the future, Huawei believes that networks will evolve towards self-driving networks, and the path from today's software-defined networks (SDNs) to self-driving networks will possibly take five to ten years. During this process of evolution, we will go through the era of the Intent-Driven Network (IDN).

As Huawei sees it, the fundamental challenge facing enterprise networks is that existing networks are unable to match the business intent of enterprises, which means a big gap exists between physical networks and business intent.

That's why Huawei has developed IDN. The IDN builds a digital twin between the physical network and business intent using AI, big data, and the cloud, and establishes a communication mechanism between the physical network and business intent, enabling enterprises to achieve business success.

Based on digital twins, the network system can translate the business intent of an enterprise into a network language and directly drive the automatic operation to network equipment. Combined with real-time data collection and analysis, it can present the status of services running on the

network in digital form. This enables enterprises to incorporate business intent into their network design and accurately capture the state of business intent over the network and in real-world applications, helping them accelerate business innovation and boost operating efficiency.

Digital twins can also help enterprises quickly detect and solve network problems. By leveraging AI algorithms and upgrading the experience library, digital twins can predict future network status, helping enterprises deal with network risks in advance and enhance network reliability. As they continue to evolve, digital twins will produce more new business models and business scenarios, helping companies develop more innovative solutions.

Importantly, Huawei's IDN also supports northbound and southbound open APIs and is compatible with various third-party platforms. Northbound APIs adopt the RESTful standard to communicate with upper-layer applications. In data center scenarios, Huawei IDN supports interworking with over 20 multi-vendor cloud platforms. Southbound APIs use the NETCONF/YANG standard to connect to third-party controllers or network equipment.

The Network Brain: Four key capabilities of the NCE

At the heart of the IDN lies the Network Cloud Engine (NCE), which consists of the Intent Engine, Automation Engine, Analytics Engine, and Intelligence Engine. The NCE has four key capabilities: digital twins, full-lifecycle management, Design Studio, and a use case-driven closed-loop business.

The digital twin network is built on telemetry technology and OPM 3D data models. First, the NCE uses telemetry to collect and aggregate massive amounts of network data in real time, enabling real-time situational awareness of the entire enterprise network. The NCE employs OPM 3D data models to collect, label, model, and maintain network data from five different layers: equipment, network, service, user, and application. It then builds digital twins for each of the enterprise network scenarios. Huawei has now built over 110 network data models.

Digital twins for the physical network enable closed-loop network management across the entire lifecycle. The NCE leverages digital twins to correlate discrete data and share it online, transforming data from open-loop management to closed-loop management. This helps build digital O&M capabilities across the entire lifecycle, from digital deployment and simulation, to visualized assessment, physical deployment, and continuous verification. In doing so, enterprise customers are able to achieve network-wide insights, precise planning, and rapid deployment in multiple areas, including networks, services, users, and applications.

The Design Studio open platform enables service application customization and one-click provisioning. To meet enterprises' changing business needs, the NCE offers the Design Studio design operation mode as an upgrade of the traditional online operation mode. Network service design and definition functionalities are opened to customers through Design Studio's programmable platform, so that customers can define and design their own network services, data analysis algorithms, and APIs based on their business needs. The NCE can provide over 400 microservices as atomic services. After service design is completed through Design Studio, enterprise customers can dynamically activate the services in NCE running state, and launch new services instantly. This completely frees traditional software platforms from the restrictions of service provisioning cycles, enabling one-click service provisioning.

Innovative use case service models are developed based on service scenarios to drive closed-loop business. To meet the business needs of enterprise

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customers in specific scenarios, the NCE builds service models that are customer service-centric and oriented to each use case scenario. The service models are app-based, so that enterprise customers don't need to repeatedly switch between and call multiple functions. They just need to use the app for a one-stop solution to network problems under a specific use case scenario.

To date, the NCE has provided app services for over 50 use cases, including intelligent troubleshooting, congestion prediction, health analysis, service simulation, and ZTP deployment in scenarios such as enterprise campuses, data centers, and wide area networks (WANs). With the NCE, the dream of real closed-loop business has become reality.

Dealing with the traffic explosion with Moore's Law for networks

To adapt to changes in the digital world, physical network architecture needs to change. Huawei applied the concept of Moore's Law to enterprise networks, improving network equipment capacity in different fields through continuous technological innovation.

In the field of campus Wi-Fi, Huawei introduces smart antennas, dual 5G filtering, radio resource management algorithms, and tri-network integration technology to double campus Wi-Fi speeds every three years. The Huawei AP7060DN is the first sixth-generation 10G Wi-Fi product based on the 802.11ax standard. In the field of routers, Huawei focuses on WANs and has doubled router capacity every 24 months, reducing cost per bit.

In optical networks, which are used mainly in the ISP industry, Huawei doubles optical network equipment capacity every three years by leveraging leading oDSP chips and photoelectric hybrid technology. Huawei's new OXC platform is the industry's first commercial product with all-optical switching capabilities.

Huawei has innovated at the hardware level by referencing Moore's Law for networks. But at the same time, we also need to consider innovations in network architecture. Huawei advocates separating the services from network through the unified Fabric architecture, on which network traffic is switched in a large network switch matrix. The Fabric architecture is also more flexible and can meet enterprise customer needs for network expansion.

Huawei has partnered with pioneering customers in finance, transportation, retail, and over-the-top (OTT) through the NetCity joint innovation mechanism, and launched 25 IDN business innovations. By quickly applying the innovative solutions through DevOps, we've helped customers enhance their service operating efficiency and create more business value.

In the future, Huawei will work with partners to drive the digital transformation of industry customers and embrace the fully connected, intelligent world.