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China Unicom Beijing

Gearing up for the 2022 Winter Olympics with SmartLink

New private lines, new B2B growth

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Awakening the Private Line Market

Over the past decade, the home broadband penetration rate of basic services has been increasing due to the national broadband policies of governments around the world.

While operators have increased the bandwidth access capability of each home by up to 200 times, the enterprise private line market has developed sluggishly. Traditional SDH, MSTP, and MPLS VPN private-line networks face bottlenecks in capacity and coverage, and differentiated requirements from different industries for bandwidth, tariffs, delays, and service provisioning duration haven't been met. Agile, on-demand private-line products for enterprises with a bandwidth of over 10 Mbps are rare and, due to a lack of investment in private lines, many have to lease bandwidth at the same capabilities seen in home broadband 10 years ago and at 10 times the price.

However, enterprise digital transformation has meant that demand for private line services has remained high. For example, banks require highly reliable independent private lines from different carriers. Smart terminals are using new IoT applications like facial recognition and big data analytics. And security cameras have upgraded from 720p to 1080p, with surveillance in real time expected, causing huge traffic increases.

The slow response of telcos has left room for the SD-WAN services offered by OTT players and one-stop subscriptions from cloud service providers.

However, opportunities — and challenges — are abundant for telcos as millions of enterprises move to cloud. Multi-cloud scenarios are inevitable, but the connections oriented for multi-cloud may be unique. China's top three operators all define the private line service as a new growth engine, and have launched differentiated high-quality private line products and networks. All have benchmarked the Internet service experience and quantified service standards, paving the way towards visualized, self-service, and intelligent services. The private line market has delivered quick ROI and is the only area where China's top three operators' revenues have grown in the past two years.

We need to enhance private line services to converge clouds through networks. The burgeoning private line market isn't just a revenue source for operators; it's also a future control point in the cloud era — one that offers unlimited possibilities.

Peng Song
President of Global Carrier Marketing & Solution Sales, Huawei

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Voices from Industry

Wang Chuanbao, Deputy General Manager of China Unicom Beijing, explains how the operator surveyed its key customers to identify requirements for bandwidth, latency, provisioning efficiency, dynamic adjustment, service operating status, and fault demarcation.

Perspectives

Fixed connections are basic business for telcos, making up over 30 percent of their B2B revenues. Huawei Carrier BG President Ryan Ding suggests that operators must quickly respond to changing customer needs and competitors, automate more services, and offer differentiated products.

Ovum analyst Brian Washburn shares insights from Ovum research into which vertical industries buy the highest-capacity network services on average. He also explores how they use high-capacity services in different ways and the impact of network transformation on requirements.

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To better serve government and enterprise customers, China Unicom Beijing identified its key customers' requirements for bandwidth, latency, provisioning efficiency, dynamic adjustment, service operating status, and fault demarcation. "

— Wang Chuanbao, Deputy General Manager of China Unicom Beijing

China Unicom Beijing

Gearing up for the 2022 Winter Olympics with SmartLink

Developing private lines for industries verticals like government, BFSI, healthcare, and education is China Telecom Beijing's current top priority. The telco is consolidating its inherent geographical advantages to offer differentiated services based on its transformational strategies of digitalization, network intelligence, and Internet-based transformation.

By Wang Chuanbao, Deputy General Manager of China Unicom Beijing

China Unicom Beijing Launches SmartLink

n the wake of digital transformation driven by technologies like cloud computing, IoT, and big data, an entirely new B2B private-line market has formed. For China Unicom, its location makes this market ripe for the picking: Beijing connects to nearly 40 percent of China's private line services, presenting a great business opportunity. As a partner of the Beijing 2022 Winter Olympics, for example, China Unicom has positioned private line services as central to its Smart Winter Olympics program.

To better serve government and enterprise

> Compared with traditional private line services, SmartLink offers the qualities of intelligence, transparency, customer self-service, and ultra-low latency, greatly improving user experience and increasing revenues from private line services.

customers, China Unicom Beijing surveyed its key customers to identify their requirements for bandwidth, latency, provisioning efficiency, dynamic adjustment, service operating status, and fault demarcation.

Moreover, the telco has continuously tracked new technologies for transport networks and implemented network upgrades and reconstruction. Applying advanced PeOTN architecture, powerful network capabilities, and Huawei's Network Cloud Engine (NCE), China Unicom Beijing unveiled its SmartLink private line service to a global audience at the end of 2018. Its goal is to provide government and enterprise customers with SMART services — Secure, self-Managing, Agile, Rapid, and Transparent — and, at the same time, build intelligent user networks.

SmartLink is the new private line service developed for the Beijing 2022 Winter Olympics, with intelligent features spanning every phase of government and enterprise private line services. In its pre-sales phase, SmartLink focuses on the customer experience. A self-structured sales model allows users to select the basic package plus value-added services as needed, delivering a one-stop procurement experience. In the sales phase, SmartLink provides a logistics-style service provisioning experience, covering planning, configuring and debugging circuits and installing customer premises equipment (CPE). The entire process is visible and controllable, improving the efficiency of private line service provisioning. In the post-sales phase, SmartLink supports predictive O&M, helping to prevent private line service faults and maximize the availability of private line services. In addition, SmartLink provides self-help services, such as service status visualization and bandwidth on demand (BOD), to deliver better user control and a more flexible and agile service experience.

China Unicom Beijing has now launched the SmartLink private line service for its first batch of customers, including Beijing Supreme People's Court and TouTiao. Compared with traditional private line services, SmartLink offers the qualities of intelligence, transparency, customer self-service, and ultra-low latency, greatly improving user experience and increasing revenues from private line services.

> On China Unicom Beijing's live network, nearly 100,000 private lines mainly carry SDH services. However, existing SDH resources fail to meet requirements for provisioning new private lines. It used Huawei's GNEEC Cloud tool to quickly analyze the legacy SDH network.

Mobilizing resources and reconstructing networks to build SmartLink

China Unicom Beijing has faced a stream of challenges during the development of SmartLink.

It is now adopting legacy SDH network evolution to mobilize resources: On its live network, nearly 100,000 private lines mainly carry SDH services. However, existing SDH resources fail to meet requirements for provisioning new private lines. China Unicom Beijing used Huawei's GNEEC Cloud tool to quickly analyze the legacy SDH network and identify the following problems:

Aging SDH equipment has high risks: 50 percent of the SDH equipment has been running on the live network for more than 10 years and is at the end of its lifecycle. There are no warranties, spare parts, or backup boards.

High O&M costs: The aging SDH equipment is low-capacity and low-density, but requires high levels of fiber resources and equipment room space.

Power consumption is also high.

Insufficient resources: Single fiber capacity is only 10 Gbps, which fails to meet customer requirements for new network construction and network acceleration.

China Unicom Beijing found that the configuration of large-granularity SDH services was unsuitable. Switching resources had become a bottleneck and line resources were wasted.

However, by adopting MS-OTN for migration and reconstruction, an all-optical base could be built for the aggregation-side MS-OTN+OXC, while E2E hard pipes would ensure low latency and high reliability. The access-side OTN was moved downstream towards enterprises, with network bandwidth increased by more than 100 times (N x 10G -> 8T), meeting requirements for at least 30 percent annual growth in private line bandwidth and the rapid increase in the proportion of large-granularity private line services.

China Unicom Beijing also plans to decrease power consumption by gradually replacing equipment room and fiber resources.

> "China Unicom Beijing is most concerned with how to evolve traditional private lines into intelligent private lines to meet requirements for transparent and visible private lines and self-service. This will also help its services stand out from today's homogenized private line market."

After it reconstructed one of its core equipment rooms, the telco mobilized 70 percent of its equipment room and fiber resources and cut power consumption by 30 percent. During network migration, Huawei's GNEEC Cloud tool was used to quickly migrate SDH services to SmartLink, which delivers a better service experience for government and enterprise customers and boosts China Unicom Beijing's revenues.

Network automation and intelligence

It's difficult to deliver the millisecond-level latency and flexible service adjustment that services like securities and real-time synchronization of data centers require. However, China Unicom Beijing constructed its live network based on second-level latency and fixed bandwidth granularity. The telco is most concerned with how to evolve traditional private lines into intelligent private lines to meet requirements for transparent and visible private lines and self-service. This will also help its services stand out from today's homogenized private line market, and ultimately, attract more

customers.

China Unicom Beijing and Huawei deployed Huawei's NCE to achieve intelligent network management and control alongside agile service provisioning. The NCE's latency map function delivers on-demand service bandwidth and latency, increasing the additional value of private line services. During O&M, the NCE can visualize and manage network resources, service status, and performance indicators. Its standard northbound interfaces (NBIs) connect to the upper-layer OSS/BSS to realize online self-service applications, flexible bandwidth adjustment, and self-service queries on service status, providing an E2E all-online experience. AI-based big data analytics enables predictive O&M, which helps to preemptively identify and optimize private line service faults and improve network availability.

In response to insufficient coverage of new users and slow service provisioning, China Unicom Beijing shifted its policy from demand-driven network construction to "network first". It deployed the SmartCapex big data analytics platform to analyze

> SmartLink provides a better user experience for government and enterprise customers. It has improved China Unicom Beijing's O&M automation capabilities and enhanced its competitiveness in the private line service field.

the geographical distribution density of government and enterprise users to identify high-value areas, focus on key commercial buildings, and provide the basis for the advance deployment of private line network resources, supporting precise network planning and construction. Based on the sandbox and visualized platform, China Unicom Beijing anticipated key buildings based on OTN CPE/FO on the access side.

Additionally, China Unicom Beijing used plug-and-play OTN CPEs for client service access, enabling private line services to be provisioned on the same day, greatly shortening service provisioning time and enhancing the competitiveness of private line services.

Continuous exploration and innovation

SmartLink provides a better user experience for government and enterprise customers. It has improved China Unicom Beijing's O&M automation capabilities and enhanced its competitiveness in the private line service field. By serving the Beijing 2022 Winter Olympics, SmartLink will create

greater business and social value and help China Unicom set a new industry benchmark.

China Unicom Beijing is a pioneer in network technologies and continues to innovate digital and intelligent transformation to provide better services for VIP customers like governments, enterprises, and financial customers. ▪

New private lines, new B2B growth

Fixed connections are basic business for telcos, making up over 30 percent of their B2B revenues. However, they must quickly respond to changing customer needs and competitors, maximize the value of business areas where they have an edge, automate more services, and offer differentiated products. This is the only way they can retain customers and produce new revenue streams.

By Ryan Ding, Huawei Executive Director and President of Carrier BG

Private lines are driving new B2B revenue growth

Today's telecom operators are entering a new phase of development. The penetration of broadband services for individuals and households has hit new levels, enabling operators to continue to monetize their large user bases. At the same time, governments have been pushing operators to speed up connections and reduce connection fees, which has meant slugging revenue growth.

In contrast, quite a different trend has appeared in the B2B market. Companies are accelerating digital transformation, and thus the demand for high-quality ICT services is growing. We predict that global corporate spending on ICT will exceed US$3 trillion in 2020, with B2B services set to be a new growth engine for many telecom operators.

Private line services are the gateway to the B2B market. In one real-world example, a telco was doing business with a real estate company. At first, the customer only wanted to order basic commercial

> **Private lines are lucrative, giving operators a "fixed target" and fast ROI. Unlike B2C users, high-value corporate customers have fixed locations. They're often concentrated in downtown office buildings or industrial parks and aren't hard to find on a business register.**

broadband for its 500+ branches. But once they'd established a relationship, the operator was able to offer a package of services that included broadband, desktop cloud, cloud Wi-Fi, and employee SIM cards. It shifted the realtor to a hire-purchase model under which the company could open and close branches faster. What was originally an order worth 500 yuan (US$73) per month per store became a package worth US$550+, reflecting a sevenfold-plus upsell.

Private lines are lucrative, giving operators a "fixed target" and fast ROI. Unlike B2C users, high-value corporate customers have fixed locations. They're often concentrated in downtown office buildings or industrial parks and aren't hard to find on a business register. Operators can easily reach high-value customers and turn the fiber they have laid into a revenue source: Corporate connections produce 10 times as much revenue per bit as home broadband, and contracts are often more than two years.

Thus, operators can recoup their investment in less than three years.

Companies need multiple suppliers, so it's never too late for operators to enter the private line market.

Many large corporate customers procure services from two or more telecom operators to guarantee the resilience of their WAN networks. They want to divide their data traffic between two totally independent networks. For example, many of Huawei's overseas offices lease both a main and a backup private line from two different local operators. Our market insight has found that some major Internet companies lease private lines from three or more suppliers to boost network reliability. Their applications are capable of sharing multiple lines and if a line breaks down, data traffic can switch to other live links.

Private lines are the control point in the cloud era because they represent an operator's core competency. Back in 2013, AT&T realized the opportunities that cloud represented and launched its NetBond product, providing fast, secure, scalable, and low-latency products for corporations to connect to multiple clouds. As a result, AT&T created a strategic position on the chokepoint of cloud data flows and reinforced its position as a leading provider of corporate ICT services. Deutsche Telekom's PLAS products and China Mobile's Cloud Socket products served a similar purpose in their respective markets.

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>
> Operators must learn to adjust their business models, introduce more unique value to their local connections, and win their core business — backbone connections — back from cloud service providers.
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> ❞

Differentiation is necessary given that all telcos are focused on private line services

Private line services are the key to unlocking the B2B market, prompting many new players to appear. Established cloud services providers are starting to build their own undersea cables or lease fiber to build their own high-capacity backbone networks. They also have the ability to synergize cloud and network infrastructure and enable high-speed connections between the Virtual Private Clouds (VPCs) of any two branches of a multinational within minutes. When these cloud and connection services are sold in volume to high-value customers, they will dramatically cut into the ability of operators to profit from international VPN services — a lucrative business. Instead, operators will be forced to subsist on lower-value local connection services. To deal with this threat, operators must learn to adjust their business models, introduce more unique value to their local connections, and win their core business — backbone connections — back from cloud service providers.

As competition intensifies, many telecom operators are still selling their products in the same tiered format, offering customers a list of bandwidths, including protection bandwidths. But B2B customers want TTM within days, self-service bandwidth, latency options, and fully transparent SLAs.

Focusing on the needs of high-value customers and delivering low-latency options

Maintaining a tight focus on the top customers and their priorities can help operators avoid large-scale investments with little return. The highest priority should be maintaining relationships with customers that deliver high profits, so operators can quickly build up their brand for cutting-edge, innovative services.

For example, some of China Telecom Shanghai's major customers are stock exchanges and futures exchanges. In 2018, to boost trades and commissions, a futures brokerage wanted to reduce its private line latency from 4 milliseconds to less than 3 milliseconds by ensuring peak trading speeds, so the brokerage could execute thousands of trades every

> Digital companies want access to services as quickly as possible after subscription. Many operators today are nowhere near able to deliver services fast enough to satisfy their customers.

millisecond. In response, China Shanghai Telecom provided a private line with a latency of just 0.63 milliseconds.

Cloud service providers are another major market for low latency services. Last year, one of China's biggest online gaming companies leased Huawei Cloud's infrastructure-as-a-service (IaaS) solution to help it serve the Chinese market. To ensure a superior countrywide user experience, Huawei Cloud paid a premium of 20 percent above the standard price to an operator and cut the latency of the networks connecting the gaming company's three data centers to less than 25 milliseconds.

Low latency is also important for office applications on the cloud. According to Huawei's own experience, when end-to-end latency exceeds 100 milliseconds, cloud-based communications and conferencing quality declines sharply. In many countries, high network latency is the main barrier to the wide adoption of public cloud services. This also represents a perfect opportunity for operators to enter the market with low-latency products.

Faster TTM, bandwidth on demand,

transparent SLAs

Digital companies want access to services as quickly as possible after subscription. Many operators today are nowhere near able to deliver services fast enough to satisfy their customers.

We analyzed the end-to-end private line service provisioning processes (service subscription, design, installation, product configuration, and acceptance checks) of many global operators, and found that more than 60 percent of their total time was spent on checking the availability of network resources (fiber readiness, equipment capacity, and port availability) and last-mile fiber engineering. The way to reduce the TTM of private line services is to lay fiber in advance for high-value users and to build a constantly-updated IT system that manages passive and active network resources.

For operators, IP RAN networks offer the perfect platform for entering the corporate private line market. There are always mobile base stations around high-value buildings — IP RAN networks provide backhaul services for base stations and are frequently

> To win in a fiercely competitive environment, operators need to clearly recognize the changing needs of their corporate customers in the cloud era and keep refining their network architecture and operational processes.

of bandwidth between 10 Mbps and 100 Mbps, and check the quality of their lines (speed, packet loss, latency, and jitter) on a mobile app 24/7. Within just one year, Unicom had attracted nearly 1,000 new corporate customers thanks to fast service provisioning, flexibility in bandwidth, and SLA transparency.

Optimizing network architecture for differentiated services

expanded. In addition, a mature system that manages all network resources is available, all with updated information for sites, ducts, device ports, and the links needed for private lines.

China Unicom Guangdong laid short fiber optic cables from its mobile stations to buildings nearby. The operator was then able to achieve 100 percent coverage for the 1,000+ most valuable business properties, housing tens of thousands of companies. With these fiber resources in place, China Unicom Guangdong was able to offer a market-beating 2-week TTM for corporate communications services. Unicom customers could select any level

As companies continue to undergo digital and cloud transformation, we predict that their demand for private lines and bandwidth will grow strongly. We expect the global market to be worth over US$170 billion in 2020. To win in a fiercely competitive environment, operators need to clearly recognize the changing needs of their corporate customers in the cloud era, keep refining their network architecture and operational processes, and provide higher-bandwidth, lower-latency, and more agile services with more transparent SLAs. This will put them in the perfect position to lead in the corporate services sector. ▪

Which verticals drive demand for high capacity and services?

Ovum finds that vertical industries use high-capacity services in different ways. The public sector, healthcare industry, and utilities sector operate more local, regional, and national networks. These networks are kept contained, and prioritize data privacy and security. In contrast, finance and logistics verticals tend to operate far-reaching, highly interconnected global networks. Security is important in these networks, but does not take priority over consistent performance and low latency, which are equally important.

By Brian Washburn, Practice Leader of Ovum

Network transformation requires a more agile network and greater capacity

Enterprises are on a path to transform their networks. For example, most companies have already attached cloud services to their network. When enterprises adopt digital transformation, they build their business on data, which needs higher-speed circuits and larger ports. As shown in Figure 1, Ovum's enterprise research finds vertical industries that buy the highest-capacity network services on average include logistics and transport (shipping and fulfillment), public sector (large government agencies), and major utilities.

Enterprises also need security and network performance. Ovum enterprise research on service level agreement (SLA) requirements finds that transport & logistics has the most performance

Figure 1 Enterprise verticals and their average highest-speed WAN ports in service

Vertical	Speed
Transport & Logistics	1 Gbps
Public Sector	835 Mbps
Energy, Utilities & Mining	775 Mbps
Finance & Insurance	660 Mbps
Healthcare	650 Mbps
Business Services	640 Mbps
Manufacturing & Construction	635 Mbps
Media & Communications	550 Mbps
Education	520 Mbps
Retail, Wholesale & Accomodation	500 Mbps
Agriculture, Forestry & Fishing	320 Mbps
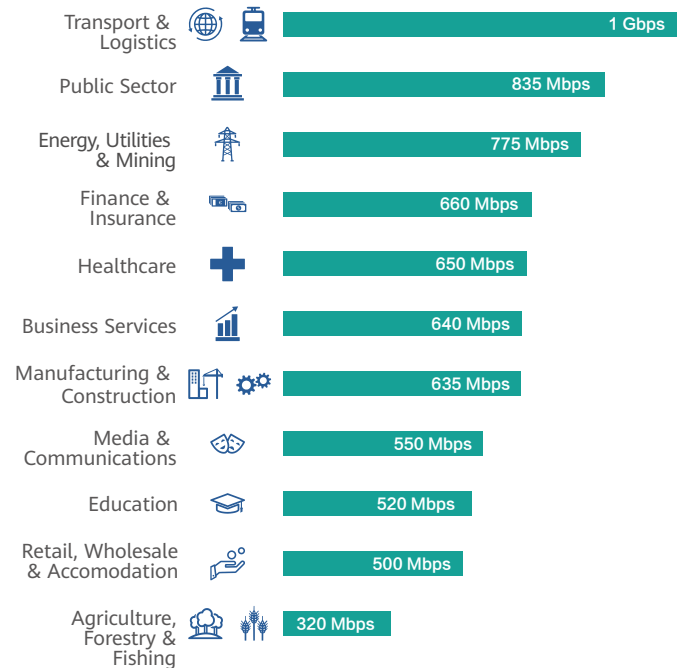
Source: Ovum Enterprise Network Services survey

Figure 2 Lead enterprise verticals that adopt flexible bandwidth billing plans

Variable "Burst" Billing Plans

Transport & Logistics	46%
Public Sector	37%
Finance and Insurance	36%

0% 10% 20% 30% 40% 50%

Dynamic Connectivity to Cloud

Business Services	54%
Public Sector	52%
Manufacturing and Construction	50%

0% 10% 20% 30% 40% 50% 60%

Flexible Monthly Port Changes

Finance and Insurance	46%
Energy and Utilities	41%
Transport and Logistics	39%

0% 10% 20% 30% 40% 50%

Expandable/Upgradeable Ports

Retail and Wholesale	54%
Energy and Utilities	52%
Manufacturing and Construction	45%

0% 10% 20% 30% 40% 50% 60%

Source: Ovum Enterprise Network Services survey

demands, followed by finance and business services. Across all verticals, 45 percent of enterprises rank secure data SLA as very important to their business.

Vertical industries use high-capacity services in different ways. Ovum's research finds public sector, healthcare, and utilities operate more local, regional, and national networks. Their networks are kept contained, and place a high priority on data privacy and security. Finance and logistics verticals tend to operate far-reaching, highly interconnected global networks. Security is important, but consistent performance and low latency are just as important.

Demand for flexible capacity services is limited but growing

While enterprise appetite for capacity and cloud services is growing, Ovum has found that IT executives have been slower to accept flexible network plans. Figure 2 shows some key verticals that lead adoption across a range of dynamic billing plans,

based on Ovum's enterprise survey research. Ovum's survey research shows a near-even split: 52 percent of enterprises still favor static bandwidth contracts over flexible plans; the other 48 percent mix plans or prefer dynamic network pricing.

From its conversations with enterprise IT executives, Ovum found that finance, public sector, and logistics are more likely to use dynamic network services somewhere in the company just because they're large bandwidth consumers. Manufacturing and retail IT executives shared with Ovum that they use open, easily expanded contracts because they need to be flexible to set up new locations and grow capacity. The business services vertical includes software and professional services companies. In its interviews with IT executives Ovum finds that these companies increasingly use cloud for their project-based work. They're more willing to buy dynamic network services for their dynamic cloud workloads.

Applications shape and drive enterprise network plans

Figure 3 Top enterprise applications by vertical

Transport and Logistics	IT Operations-83%	IoT & Digital & Transformation-78%	Internet & Access-74%
Public Sector	Custom Applications-75%	UC and & Collaboration-71%	Internet & Access-71%
Energy and Utilities	Enterprise Software-70%	Custom & Applications-67%	Data Storage & Retrieval-63%
Finance and Insurance	Custom Applications-83%	IoT & Digital & Transformation-74%	Enterprise Software-72%
Healthcare	Enterprise Software-81%	IoT & Digital & Transformation-74%	Custom & Applications-67%
Business Services	Custom Applications-80%	Applications & Development-80%	[Multi-way tie: UC, IoT/digital, and storage-62%]
Manufacturing & Construction	Enterprise Software-63%	IoT & Digital & Transformation-60%	Custom Applications-60%
Media & Communications	Enterprise Software-86%	Internet & Access-81%	Custom Applications-74%
Education	Internet Access-81%	IT & Operations-69%	Data Storage & Retrieval-69%
Retail, Wholesale & Accommodation	Enterprise Software-77%	IT & Operations-69%	Custom Applications-67%
Agriculture, Forestry & Fishing	IoT & Digital Transformation-70%	[Multi-way tie: Internet access, UC, and enterprise software-65%]	

Enterprises buy private network ports to get capacity services that support their companies' wide range of applications. Figure 3 shows the top applications that influence network purchase decisions across vertical industries. Enterprises most commonly rank the following applications as priorities: Enterprise software such as enterprise resource planning/supply chain management and customer relationship management; in-house, custom-built applications; and new digital applications, including the Internet of Things (IoT).

In its discussions with enterprise IT executives, Ovum found that applications increasingly drive other ICT buying decisions. For example, IoT and digital transformation are built to be cloud-native, one of many factors pushing enterprises to be more cloud-centric. In its survey research, Ovum found that 90 percent of enterprises list cloud-enablement among their network-related IT priorities.

Ovum's interviews with enterprise IT executives found that there are big differences in software and data for each vertical industry. IT managers in manufacturing shared with Ovum that resource planning and supply chain management are critical. Supply chain management is also important in the logistics and transport sector, but logistics and transport companies also have other priorities, such as managing complex IT environments and supporting a large interconnected ecosystem of partners. In contrast, Ovum's discussions with IT executives in healthcare covers electronic health records, digitalizing and automating patient processes, collecting data from medical devices, and tracking the location of on-site equipment. For key applications, types of enterprise software, and digital transformation, Ovum recommends the following for telcos:

Enterprise software: Enterprise software is a wide category that includes very demanding applications.

> Telcos need to show both high performance and a consistent track record. SAP HANA can be very demanding: Data replication requires a 10 Gbps connection and <2ms round-trip latency.

To sell in this space effectively, telcos need to show both high performance and a consistent track record. SAP HANA can be very demanding: Data replication requires a 10 Gbps connection and <2ms round-trip latency. Enterprise resource planning such as SAP Cloud recommends <100 ms round-trip latency, and <250ms global round-trip latency between client and data center. Microsoft Dynamics 365 for customer relationship management (CRM) recommends <150 ms round-trip latency for a good user experience. Virtual desktop infrastructure (VDI) such as Citrix similarly recommends <150ms round-trip latency. Telcos will need to meet application performance levels to keep customers satisfied.

IoT and digital transformation: New digital applications are deployed cloud-native. Many of these applications are streamlined and latency tolerant. A few areas are under development, such as autonomous cars and augmented/virtual reality, will have extreme performance needs someday. Today, telcos can address most enterprise digital applications by offering secure connectivity to cloud with basic performance and traffic delivery guarantees.

Network providers need to adjust delivery to vertical industry needs

Based on enterprise survey research and IT executive interviews, Ovum has the following observations and recommendations for network providers targeting specific vertical industries.

Transport and logistics: These enterprises tend to be large and decentralized. Telcos targeting this sector need to support far-reaching global or regional networks. These enterprises buy high-capacity services to operate sophisticated networks emphasizing IT operations, mixing private WAN and public Internet. Successful telcos will combine private line needs with secure Internet and with support for IT applications such as cargo tracking, fleet management, and asset management. UAE-based Etisalat is an example of an operator committed to supply chain management across freight, fleet, inventory, warehousing, materials management, and enterprise resource planning. Etisalat capitalizes on the fact that the world's major logistics companies have headquarters or large regional hubs in the Middle East.

Energy and utilities: Energy and utilities companies are mostly national organizations. Most behave like commercial companies. This sector often wrestles with managing large amounts of customer and operations data. Successful telcos in this vertical

> Ovum found that the diverse business services vertical contains many mid-range, regional enterprises. These businesses are often project-based, and therefore likelier to embrace dynamic network connectivity to cloud.

show how network solutions help address big data challenges.

Finance and insurance: This sector includes the world's largest, most globally distributed enterprises. The sector also has a diverse collection of companies by size and geographic coverage. Finance is a network-hungry and innovation-hungry business, but it faces strong regulatory and compliance restrictions. Successful telcos build a dedicated practice just for the finance vertical that understands industry compliance. In the past, BT (with Radianz) and CenturyLink (with Savvis) were effective in bundling financial extranet services with network services. Newer operators such as GTT win financial customers because the telco owns key low-latency routes between major global trading exchanges.

Business services: Ovum found that diverse business services vertical contains many mid-range, regional enterprises. These businesses are often project-based, and therefore likelier to embrace dynamic network connectivity to cloud. The vertical sector is diverse and has many different applications priorities. Successful telcos target business services by subtype — such as legal services or software developers — for the right mix of network offers.

Manufacturing and construction: This vertical segment concentrates around mid-range, regional enterprises. Successful telcos in this vertical offer open-ended contracts that let companies add new network sites and more capacity when and where they need it. Successful telcos also support the sector's commonly used supply chain/fulfillment applications, and support their new digital applications. Tata Communications is an example of an operator that targets the manufacturing vertical. The operator is tracking the "Industrie 4.0" movement as well as industrial IoT on the factory floor. Tata Communications supports supply chain management, and sells flexible bandwidth plans that let manufacturing companies add new sites and capacity easily.

Retail, wholesale, and accommodation: These companies tend to be smaller, and national or regional. The retail industry is especially cost-sensitive, and is more likely to want flexible contracts that add network sites and bandwidth as they are needed. Successful telcos need to find ways to keep down network prices, and show how they save costs in other ways such as reducing downtime or increasing productivity. They can offer value-adds such as guest Internet and support for e-commerce. ▪▪▪

Carrier-Enterprise synergy: From telco to tech partner

The enterprise segment is a potential growth engine for telcos across the globe. Digital disruption requires enterprises to adjust their business models, become more flexible, and focus on customer experience, with next-gen networking technologies underpinning many of the digital solutions needed to achieve these goals. Carriers themselves are experiencing disruption and are going through internal transformation. There are opportunities for carriers to offset their own disruption by investing in the enterprise segment.

By Malcolm Rogers, Analyst of Global Data

> According to GlobalData, mobile voice revenues declined by 11 percent worldwide in 2018, mobile messaging revenues by 10 percent, and fixed voice revenues by 5 percent.

Threats to carrier business

The telecommunications industry is in a period of transition and disruption. Today's carriers are well aware of the threat posed to traditional voice and messaging services by OTT players such as WhatsApp, WeChat, and Facebook Messenger. Core carrier businesses like voice and messaging are no longer achieving the same levels of revenue they used to. However, there's little operators can do about it, and both fixed and mobile voice revenues are continuing to decline. According to GlobalData, mobile voice revenues declined by 11 percent worldwide in 2018, mobile messaging revenues by 10 percent, and fixed voice revenues by 5 percent. And this income is gone forever, with GlobalData estimating that by 2023 mobile voice, mobile messaging, and fixed voice revenues will drop to 22 percent, 43 percent, and 23 percent below 2018 levels, respectively.

Web companies like Amazon, Google, Facebook, and Alibaba are expanding their reach across a host of industries to encompass services like cloud computing, storage, AI, and Blockchain. Many enterprises today rely on cloud services provided by these Internet giants. So far, this situation has largely

Malcolm Rogers

> DT offers Ethernet connections to cloud with over 40 Ethernet clusters across Europe, North America, Asia, Africa, and the Middle East. The company's focus on cloud has proven to be a good bet with cloud-related revenues.

benefited carriers, as data needs to be channeled from enterprise premises to data centers from cloud providers. However, many web players are investing in their own data transport capabilities, with Facebook, Google, Alibaba, Amazon, and Microsoft all building out data centers, connecting them with their own fiber, and developing virtual networking products.

Why carriers still matter

Despite OTT players' investment in data centers and cables, telcos still dominate the networking space. Enterprises (and consumers) will continue to rely on the networks owned and operated by traditional telcos. Today's enterprise customers are hyper-focused on customer experience, while enterprise employees expect great experiences from their company's technology. A dynamic network can enable businesses to scale bandwidth in real time, provision new branches quickly, enable employees to work securely from anywhere, and reduce pressure on internal IT teams to ensure that everything runs smoothly on the back-end. Analytics can be deployed for predictive monitoring and automated provisioning to minimize downtimes and network failures and enhance user experience. A telco that can provide a next-generation network that achieves solid business outcomes will be in a good position to remain a

trusted technology partner in the enterprise segment.

While OTT players can offer services on top of a connection, they cannot ensure end-to-end network performance. While carriers cannot compete with web companies for cloud services, it can be an enabler for enterprises to leverage cloud technology to drive transformation. Leading carriers already offer more agile networking solutions with SDN/NFV technologies, direct cloud connectivity, and managed security services.

Opportunities in the enterprise space

Bountiful opportunities remain for carriers to grow their revenue from the enterprise segment. These extend beyond simple Internet and voice plans to more advanced networking solutions like MPLS, Ethernet, and fiber, and pairing them with services like managed networks, cloud services, security, and data analytics. GlobalData expects that global Ethernet WAN revenues will reach US$70 billion by 2022, optical networks US$57 billion, and IP/MPLS VPN US$47 billion. These revenues will also be supplemented by newer network technologies like NFV and SD-WAN that can make enterprise networks even more dynamic. The most successful carriers

will be the ones who can expand beyond core telecommunications to become technology partners.

Direct cloud connections

Cloud services are increasingly important to enterprises around the world. According to a GlobalData survey of over 3,200 enterprise IT buyers, cloud services accounted for 11.1 percent of total ICT spend in 2018 on average, up from 6.7 percent in 2017. Application performance, data security, and connection speeds are all major concerns for enterprises when connecting to cloud. Offering direct private connections to cloud through IP/VPN or Ethernet can help enterprise customers better achieve business outcomes, especially if they're operating in a hybrid (private/public) cloud environment.

Germany-based Deutsche Telekom (DT) has won business by offering its "Secure Cloud Connect" service, which allows enterprises to use a private Ethernet line to connect its premises to more than 40 cloud providers in Europe and America. The service offers simplicity and security to enterprises with cloud needs. DT offers Ethernet connections to cloud with over 40 Ethernet clusters across Europe, North America, Asia, Africa, and the Middle East. The company's focus on cloud has proven to be a good bet with cloud-related revenues, which grew 29 percent year on year in fiscal year 2018. Several major carriers have also adopted a similar approach.

Managed security

Today many enterprises are increasing spending on managed security services like network data filtering, network access authentication, security breach detection, and response services. Evolving security threats make businesses more likely to face IT security vulnerabilities. Further business digitalization and increasing digital touch points make business critical IT systems more susceptible to threats. As such GlobalData expects global enterprise spending

on managed security services to reach US$123 billion by 2022. Carriers can offer the security of private lines alongside managed security services to add more value for enterprises concerned about security. This may be particularly attractive for industry verticals like finance, government, and healthcare which deal with very sensitive data and applications, and which are subject to regulation.

For example, the US carrier AT&T offers network filtering, firewalls, virus scanning, secure Internet gateways, and more, which it delivers on cloud. The carrier has been successful in winning customers based on simplifying security for enterprises. AT&T's success comes on the strength of its network, which offers the company the ability to scan massive amounts of data traversing its global network for threats. It uses AI and analytics to continually refine threat detection. AT&T provides managed security services to over 100 markets, having deployed eight security operation centers (SOCs) to provide 24/7 coverage for managed security clients when threats are detected and a response is needed. Due to these strengths, AT&T has won managed security contracts with key organizations, including the US Department of Homeland Security, the US Federal Trade Commission, and the retailer Aeropostale.

Managed Network Services

Carriers can offer more than just basic connectivity when building networks for enterprises, including

> "Carriers can offer the security of private lines alongside managed security services to add more value for enterprises concerned about security. This may be particularly attractive for industry verticals like finance, government, and healthcare."

managed WAN and LAN services, which combine a mix of technologies (Ethernet, MPLS, IP VPN, Internet, and so on). They can also offer features that optimize network performance and flexibility based on enterprise customer needs. Managed network services encompass a range of key functions, including carrier-built predictive analytics capabilities that reduce downtime. Managed network services can contribute significantly to revenue growth for carriers. GlobalData expects enterprises worldwide to spend US$43.7 billion on managed network services in 2019, which will increase to US$63.0 billion in 2022.

Australia-based Telstra has grown revenue from the enterprise segment with its managed network services. The company offers end-to-end management across all aspects of the enterprise network, including advisory services around network design, managing network elements like WAN and LAN switches and routers, and VAS like bandwidth optimization and 24/7 service desk and monitoring. Telstra is using these services to help drive growth for business, and so far it has been successful. In 2018, the operator reported A$660m (US$500m) in managed network services, deriving from the Telstra Programmable Network solution. The solution offers a simple management platform that enables fast provisioning, dynamic bandwidth on-demand, NFV

deployment, WAN optimization and more, all from a single pane-of-glass view.

Ultimately it's the combination of providing next-generation networks alongside managed services in key growth areas that can unlock future growth for carriers. Managed services can be even more lucrative than the networks themselves. GlobalData expects managed security services revenue to reach US$123 billion by 2022, managed cloud services to reach US$79 billion, and managed network services to reach US$63 billion.

Despite pressures from digital disruption and changing consumer preferences, growing opportunities exist in the business segment. Next-generation networks will enable businesses to operate much more flexibly, and IT will move from a cost center to a business enabler. Carriers have an opportunity to guide their enterprise customers through this transition while simultaneously moving up the value chain from access provider to technology enabler. Operators who invest in the enterprise segment can see tremendous revenue growth over the coming years. Offering managed LAN, WAN, cloud and security are promising areas for operators across the globe. Ensuring that their products and services are capable of meeting enterprises' next-gen demands is the first step.

Managed Wi-Fi revamps STC's B2B services

Drawing inspiration from Saudi Arabia's Saudi Vision 2030, Saudi Telecom Company (STC) started shifting its strategic focus towards government and enterprise services in 2016 – a move that's proved advantageous both as a response to increasing competition and also to STC's long-term interests. STC currently has more than 50,000 government and enterprise customers, a lucrative market and huge customer base that's helping us with our digital transformation journey.

By Talal Albakr, Vice President-Digital Solutions at STC Solutions

As government and enterprise customers carry out digital transformation, more businesses are rapidly migrating from fixed-access/LAN offices to wireless/Wi-Fi offices. After migrating to a wireless office, B2B customers are more likely to purchase managed Wi-Fi network services than continue to run and maintain their own network model. They can then focus more on their own services, control corporate IT spending, and implement a light-asset operation.

In view of this, STC launched a new managed Wi-Fi network service at the right time, expanding its conventional leased line services for government and enterprises and extending the pipe from enterprises' customer premises equipment (CPE) to the customer's LAN Network. Initial estimates reveal that this service will lift enterprise business revenues by over 5 percent.

Cloud management and local platforms enable campus Wi-Fi

Like most operators, STC was reluctant to sell its enterprise customers onto a cloud service provider (CSP). Instead, it opted to provide more services, including delivery, maintenance, and industry value-added services, to meet enterprises' needs, with the aim of gradually building up its own B2B service ecosystem and increasing its enterprise application business revenue while improving customer loyalty. STC carried out extensive research to select a suitable operating model for campus Wi-Fi services.

Our enterprise business team analyzed how to best approach the three stages involved in offering managed Wi-Fi network services: network planning,

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deployment, and operations and maintenance (O&M).

Conventionally, network planning requires site surveys to gain a clear understanding of how many access points (APs) and switches are required, how to install cabling, and other such information. Service deployment requires hardware installation and software commissioning engineers to work on-site at the same time. Hardware needs to be installed and then commissioning engineers must complete network commissioning before the service can be launched. Subsequent O&M is even more troublesome. The local network management center must solve all issues. Each O&M personnel can only deal with a very limited network scope, and a common fault at the customer site may require two to three days to resolve on-site. A major problem with the conventional process is high cost and low efficiency, which is also the main reason most carriers don't provide managed Wi-Fi services.

Therefore, the key to enabling managed Wi-Fi management services is centralized multi-tenant management in the cloud through a series of cloud tools that increase efficiency. First, cloud network

planning is essential. Enterprise customers just need to upload a map to the platform, and the O&M center can complete planning for future project installation. The ZTP model of deployment and acceptance is also important. Only hardware installation engineers are required at the project site to complete service provisioning and project acceptance. Supported by a series of cloud tools, subsequent O&M is the most important task. In fact, 80 percent of network problems are solved in the remote network management center.

An open cloud platform can help enterprises with data operations, which are a value-added service for enterprise customers through add-on sales. This is where the value and advantage of managed services lie, helping STC retain enterprise customers. To make this work, local deployment of the cloud platform is the key. That's why STC decided to build its own cloud platform to provide high-quality, manageable Wi-Fi services for enterprise customers.

Huawei CloudCampus

STC carried out performance testing and

competitions over 10 months, trialing various industry-leading cloud platforms, evaluating their functions, usability, and how well they matched STC's requirements. We ultimately selected Huawei's CloudCampus solution. Two years ago, we deployed the solution in our data centers and officially launched our managed Wi-Fi network services.

STC discovered that the O&M mobile app and the wide range of products offered by the CloudCampus solution are advantageous in terms of campus Wi-Fi network managed services.

With the mobile app, enterprise customers and STC's O&M center engineers can carry out network O&M anytime, anywhere. Self-service O&M by enterprise customers helps to filter out at least 30 percent of the O&M workload, significantly reducing pressure on the O&M center. Meanwhile, the cloud management platform enables real-time visibility on customer network performance and application performance. The platform uses AI to accurately predict network performance trends and automatically repair common faults, such as spectrum interference and Wi-Fi experience

deterioration, directly targeting the root causes of faults for each user and service, guaranteeing a high-quality Wi-Fi experience. Crucially, since enabling the service, STC has been able to keep its O&M team the same size as it was two years ago, despite adding a raft of government and enterprise customer network management tasks.

STC also requires a series of products for different Wi-Fi coverage scenarios as well as indoor office scenarios, including high-traffic outdoor scenarios and high-density coverage scenarios such as classrooms, stadiums, hospitals, and student dorms. The ability to cover a range of scenarios has helped STC win more government and enterprise customer projects.

An example of one of these is the Saudi Arabia Ministry of Health (MOH) project. The MOH encompasses 15 sub-departments, including healthcare and drug supervision, healthcare institutions nationwide, more than 2,000 primary health care clinics, and over 250 large hospitals. The MOH sought an operator that could manage its nationwide hospital and clinic networks using a

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> Boosted by the CloudCampus solution and STC's large government and enterprise customer base, STC has successfully packaged managed Wi-Fi services and leased lines into a competitive offering.
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> **"**

unified platform and also provide network-hosting services.

To ensure the security of medical information in the country, the MOH demanded the cloud storage of healthcare and network management data could not cross borders.

Harnessing the CloudCampus platform deployed in STC's data centers, STC successfully completed network deployment and acceptance of more than 250 clinics in the first phase of the MOH project in only four months, without having to increase the number of O&M personnel.

In one Riyadh clinic, O&M center engineers were able to complete network planning and pre-configuration work on the cloud platform in five minutes, based on the indoor blueprints of the clinic and detailed project designs provided by the MOH. After configuration was completed, installation engineers brought APs and LAN switches to the clinic. They completed all their work in three hours, including cabling based on the blueprints, installing and powering on equipment, and scanning device MAC addresses and serial numbers using a cloud management app. All

told, STC was able to cut the cost of end-to-end network delivery by at least 30 percent.

Thanks to the smooth delivery of the first phase of the project and the cost-saving benefits of the platform, STC succeeded in winning managed Wi-Fi network services projects for over 800 clinics and hospitals in the second phase, which accounted for more than 50 percent of the overall project. To date, these projects have been successfully delivered and commercially deployed.

Managed Wi-Fi network services + leased lines drive new growth

Boosted by the CloudCampus solution and STC's large government and enterprise customer base, STC has successfully sold managed Wi-Fi services and leased lines into a competitive offering. More importantly, our own cloud management platform lays the physical foundation for offering more value-added services and add-on sales to fully cultivate value from enterprise customers. Today, STC is well prepared to provide high-quality managed Wi-Fi networks for more enterprise customers.

The private line services that industries really need

By Sun Zhenya

Changes are prompting new demand

The acceleration of enterprise digital transformation and massive cloud deployment have changed requirements on enterprise networks in various ways:

Network connections: In 2019, enterprises globally spent 24 percent more on cloud than in 2018. Hybrid cloud is the main scenario where applications and data are distributed on different clouds. The new architecture requires connections between enterprise branches and multiple clouds and between different clouds.

Changes in operations model: Products providing 10 ms latency and OTN high-quality private lines are popular in the market as soon as they're launched. The performance factors of traditional business models, such as bandwidth and latency, are gradually changing to a fine-grained traffic operations model that's flexible and on-demand and features time-division and slicing characteristics.

Changes in requirements on value-added network value: In areas such as fast OAM response and proactive fault diagnosis, value isn't determined by importance, but by scarcity. Cloud makes IT simpler, but this is at the cost of complex network connections. This scarcity is about network maintenance instead of network resources.

Discussions on private line requirements in typical industries

In the first half of 2019, we interviewed leading enterprises in various industries to understand the differentiated requirements that various industries have for private lines. Thus, we could determine whether a new business model is available for enterprise private lines.

Commercial banks: High requirements on security, latency, and after-sales support

Banks are undergoing two changes: (1) online banking and (2) digitalized, intelligent business halls. By 2019, about 90 percent of business halls in China had been converted from counter services to robot services, and the service offload rate of online banking had reached 50 percent.

- **Security and reliability is still the first rule**

Online banking has greatly improved the business transaction efficiency of traditional banks. It also makes complete physical isolation between the bank intranet and Internet impossible. If users roaming internationally don't want their data to be transferred abroad, logical isolation based on services and network layers is a challenge.

- **Direct relationship between network latency and customer experience**

> To cope with the exclusive demands of building a dedicated network, operators should be able to build a media-specific network with managed construction and maintenance capabilities.

ATMs are replacing counter staff, cutting delays in service completion due to face-to-face interaction. However, if an ATM's operating system or machine interface isn't updated when required, business transaction efficiency is affected and customers may lose trust in service security.

- **Higher private line bandwidth due to camera deployment**

An ATM has a standard configuration for real-time images. A conventional 2M private line can support the data transmission of the service system from a business hall. Currently, 2M is the minimum requirement for a camera to provide image flows. But now, small business halls need to provide service bandwidth of tens of Mbps and large business halls need to provide hundreds of Mbps.

- **Rapid coverage of branches**

Banks have many branches and ATMs. They require that operators provide fast service provisioning and maintenance to guarantee a good customer experience.

Therefore, when operators are planning their private line bank connections, they must provide super-low latency and sufficient bandwidth to ensure no more than 1-second latency during a transaction to meet the new requirements of banking services. Operators

in China are moving to construct independent low-latency financial networks, with an OTN backbone network established between major cities dealing with core financial transactions to provide high-security and low-latency private lines for enterprises. In addition, developed provinces can establish regional OTN financial networks to interconnect with the nationwide backbone network to provide high-value services.

Media industry: On-demand ultra-high bandwidth and DCI requirements at different locations

The media industry has felt the greatest impact of the Internet. In a shift away from the traditional model of shooting, production, and broadcasting, the emergence of a multitude of dispersed, micro, and finely divided media companies has completely separated content shooting, production, and broadcasting . A program may be shot by a company in an remote city in China, transferred to another city thousands of kilometers away for production, and then transferred to a third city for broadcasting.

We found that leading media enterprises in China are building a media industry cloud and deploying data centers in major cities to provide network, cloud, and application capabilities for small companies in the industry. Under this design, new private line requirements are as follows:

- **Anytime, anywhere access to services with elephant flows**

There are two challenges when rapidly transmitting footage from remote cities to the closest data center. First, the shooting location isn't always known in advance, and so video companies are unlikely to rent private lines at a remote location for an extended period of time. Second, the program source typically takes up more than 100 GB. So, how can transmission time for content be kept to within hours?

- **DCI requirements for video cloud**

There are many small players in the media industry. Media giants need to build a public cloud to provide small players with capabilities, including studios, program orchestration, and editing. This creates DCI requirements. The media giant we interviewed runs clear and stable services, but has typical demands for using a specific network for the media industry, including help from operators to construct a nationwide DCI network.

To cope with the exclusive demands of building a dedicated network, operators should be able to build a media-specific network with managed construction and maintenance capabilities. And it should be possible to transfer elephant flows to the media-specific network anytime, anywhere. In response, operators should design appropriate services with a unified account for users to quickly access networks nationwide. The network should provide ultra-large upstream and downstream bandwidth on demand to complete video transmission.

Large ICT enterprises: Requirements for private line performance and fast fault detection

Large ICT enterprises typically have complex networks and high requirements on network maintenance personnel. Based on our interviews, a typical large ICT enterprise has more than 30 R&D and sales

branches across the country, with tens of thousands of employees performing two or three remote videoconferences and data access operations every day. Currently, the information flow between nodes runs on the MPLS VPN network provided by the operator for low-latency interconnections between all nodes. The enterprise, however, receives hundreds of complaints about the unsatisfactory quality of its internal IT service every month, which include freezing during videoconferencing and audio delays. What's behind these complaints is a lack of real-time network quality information. Instead, IT personnel have to provide feedback to operators for fault location, which lowers efficiency and affects user experience. After the public cloud is introduced, increasing enterprise connections makes network architecture more complex, intensifying IP application problems.

Fast fault location and in-time network optimization are major challenges to enterprise network management. Large ICT enterprises responded that they want operators to provide self-service queries on private line performance (such as packet loss rate and latency), so that they can obtain WAN performance data during a specific period with minute- or even second-level precision for better analysis and fault location.

However, the current situation is that network performance is queried periodically. Generally, operators provide enterprises with network quality data on a monthly or weekly basis. A lack of effective solutions exist for real-time performance queries, a problem that's only to some extent mitigated by new software architecture, algorithms, cloud architecture, and network management systems. The latest network management system, for example, can automatically trigger network recovery upon discovery of network quality deterioration and send the latest system data to enterprises on demand.

Internet industry: High-bandwidth redundancy between multiple operators

> " The enterprises we interviewed selected three lines from different operators, all lacking an SLA covering high-reliability. By optimizing their software and networks, they can evenly balance services among the three links. "

The network requirements of the Internet industry reflects its operations principles: fast, efficient, and iterative. The Internet industry has the highest network requirements, underpinned by a "broad-based" concept in terms of reliability and bandwidth. This concept balances techniques and costs to achieve the most cost-effective route. The enterprises we interviewed selected three lines from different operators, all lacking an SLA covering high-reliability. By optimizing their software and networks, they can evenly balance services among the three links. As long as the bandwidth utilization of each private line is less than 30 percent, services aren't interrupted even if two out of the three links are compromised. Therefore, three data links, each with 99.9 percent availability, can be joined together to achieve 99.999 percen availability to create a "broad-based reliability design."

This decentralized process requires Internet companies to have strong network design and management capabilities and be able to communicate network requirements to different operators. ISPs in the existing market can sell operator networks to enterprises with unified interfaces, which responds well to the network demands of Internet companies. Traffic optimization and hosted management on the integrated network can further meet demands for startup Internet companies that want to focus on service development or are experiencing fast growth.

Large stores: Wi-Fi + video surveillance + one-stop broadband requirements

To provide a better shopping experience and thus retain customers, large stores typically provide indoor Wi-Fi to combat weak phone signals.

The outlet we interviewed is in a campus with over 200 customers, many of which run their own Wi-Fi networks. Due to a lack of technical skills, the outlet finds it challenging to manage these Wi-Fi networks — in one case, it took a month to resolve signal interference between customers using the 2.4 GHz frequency band. The outlet hopes that operators can provide a one-stop solution for Wi-Fi management, video surveillance, and broadband Internet access.

The new business model requires seamless online and offline working modes, unified goods delivery, and an efficient supply chain. In response, employees and customers need to connect to the same network, inventory management system, and data interaction platform between the payment system and headquarters, so that vendors can adjust how they run their stores. Vendors require trained technicians to provide IT and network support for public Wi-Fi networks and vendor Wi-Fi networks. In addition to providing traditional network solutions, network service providers can leverage the latest software technologies

to introduce customer flow analysis and advertisement push services that match the new business model.

Chain restaurant industry

Fast service provisioning and stable and reliable cloud service connections

The catering industry is the fastest-growing industry when it comes to cloudifying IT systems. The company we interviewed has reduced its on-site servers from 11 cabinets to 2. By 2020, the enterprise will be fully cloud-based, with no cabinets.

With all services moving to cloud, this chain restaurant enterprise plans to move all traditional private line services from its outlets distributed to HQ and change the subscription to public cloud-centric private line services. In response to this strategy, the enterprise wants new network products and new network architecture.

Fast access to cloud. After services move to cloud, the IT SaaS of a new outlet takes only two days from subscription to service provisioning. By contrast, it took several weeks or even a month if the restaurant enterprise engaged with an operator for a private line that was connected to the public cloud, which slowed down service development.

Flexibility. During busy hours, Wi-Fi access volumes are huge. In this case, bandwidth adjustment can improve customers' Internet access experience and enhance their brand image. This also applies to the hotel industry.

Stable and reliable bandwidth. After services are moved to the cloud, catering outlets depend on cloud services to fulfill their orders and payments. Stable and reliable services are critical. Daily bills, procurement data, and financial data from outlets will be uploaded to the cloud for processing, which requires more from upstream network bandwidth.

The cloud private lines of enterprises must provide subscribe-and-play and flexible features, and ensure basic reliability. In addition to meeting the requirements of new features for traditional private lines, cloud private lines require traditional networks to be reconstructed into software-defined networks (SDN). Operators need to construct flexible SDNs and support one network for multi-cloud. Currently, there are nearly 100 operators in the world that can provide secure and direct-connect-to-cloud private lines.

Given the momentum of IT cloudification and the Internet, enterprise development cannot exist without network support. Different industries have different network requirements due to their service characteristics, but there are still common requirements.

Security: Regardless of high-quality, network-wide private lines in the bank industry or the broad-based reliability design of Internet enterprises, the essence of different solutions is to enhance network security.

High network speed: High bandwidth and low latency are the two factors that ensure fast network response, especially in the era of image content floods.

The solutions vary from industry to industry. For example, Wi-Fi monitoring in the retail industry, multi-line hosted management in the Internet industry, and the cloud-network association of the catering industry, all have their own characteristics.

In the enterprise private line field, operators need to consider how to support "soft" features over hard pipes. On the one hand, soft indicates the fast response of private lines, fast fault location, and flexibility. On the other, it means rethinking the market and marketing portfolio. Differentiated soft features allow us to build differentiated competitiveness.

China Telecom

## How China Telecom Sichuan delivered the impossible

China Telecom Sichuan overcame extremely demanding requirements to construct a dedicated video cloud network for a high-value customer, deploying an industry-first solution to form a cloud pool that linked multiple city video platforms with the provincial capital's video platform – all within an impossible timeframe.

By Yan Hao, Liang Junsheng, China Telecom Sichuan

> ## "According to our experience, it's extremely difficult to provision three 20 Gbps cross-domain private lines within one month."
>
> — Yan Hao, China Telecom Sichuan
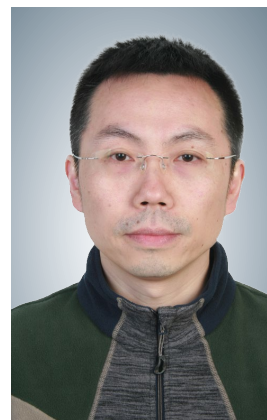
Dedicated networks for video

China Telecom Sichuan has enjoyed considerable business success by integrating IPTV, fixed broadband, and mobile broadband services and providing bundled packages for home users. From 2015 to 2018, China Telecom Sichuan doubled its home broadband and mobile service subscribers. After achieving stable growth in consumer and home services, China Telecom Sichuan gravitated to the enterprise market, hoping to exploit new business growth points in the B2B market.

In 2018, a high-value customer invited a bid to construct a dedicated video cloud network in Sichuan. The bid required a video platform of the provincial capital to connect to the video platforms of major cities in the province to form a cloud pool, with access possible through both the provincial and municipal video platforms. To serve Sichuan Province, which has a population

of about 90 million, the customer's video cloud network has huge requirements on computing and storage resources, network access, and data center interconnection (DCI). With its wide optical network coverage, rich video platform operation experience, and strong construction capability, we were determined to win the project.

The customer required the data on the city video platform to be backed up on the provincial capital's video platform, with authorized personnel in the provincial center able to access and manage data on the city's video platform. Quick delivery was also a precondition; for example, in the first phase of the project, the customer asked the provider to connect the municipal video platforms with the video platform of the provincial capital within four months, so that the video platform of the provincial capital could uniformly manage the video data of all covered cities.

Given that IT system commissioning alone

> SRv6 Overlay enables fast provisioning by establishing an IPv6-based overlay service path that traverses the backbone network between the two end nodes, in the municipal and provincial DCs, of a private line.

can take at least three months, this left just one month to provide high-bandwidth private lines – 20 Gbps bandwidth in the first phase – for cross-city interconnections between three video platforms: an almost impossible task.

Our cross-city MPLS private line services traverse two metro networks and one backbone network, spanning three cities. This required multiple teams to cooperate to complete service pre-handling and provisioning.

To complete service pre-handling, one provincial planning team and two municipal planning teams from China Telecom Sichuan needed to separately survey live network resources; check the availability and sufficiency of resources like transmission links, interfaces, and bandwidth; and manually design service paths and quality of service (QoS) metrics segment by segment.

To complete service provisioning, three O&M teams from China Telecom Sichuan had to run commands to operate each device hop by hop based on the planned service paths, and coordinate to implement E2E service testing and acceptance.

According to our experience, provisioning a cross-city 20 Gbps private line could be bottlenecked by insufficient bandwidth and take at least two months. It's extremely difficult to provision three 20 Gbps cross-domain private lines within one month.

How SRv6 Overlay works

To address these challenges, we required a lightweight cross-domain private-line solution that could achieve fast deployment and deliver reasonable returns. Therefore, China Telecom Sichuan and Huawei set up a joint innovation project team to explore new private line solutions. And we soon found one: SRv6 Overlay.

SRv6 Overlay enables fast provisioning by establishing an IPv6-based overlay service path that traverses the backbone network between the two end nodes, in the municipal and provincial DCs, of a private line. To do so requires just two PEs in each of the two DCs.

IPv6/IPv4 dual stack was enabled for all the routers on the metro and backbone networks, with more than 1 Tbps bandwidth reserved between the provincial metro network and

backbone network. Service provisioning can be completed by simply configuring the two end nodes, without the need to re-plan or modify the configurations on transit nodes. As a result, the private line provisioning period was shortened to just 1 to 2 weeks. Moreover, the deployment and O&M costs were much lower than those required for provisioning MPLS private lines, fully meeting customer requirements.

At the end of January 2019, China Telecom Sichuan had successfully deployed the industry's first commercial SRv6 site, realizing cross-city video service interworking.

SLA based on best-effort forwarding

Another concern was how this solution could provide a guaranteed SLA for customers based on best-effort forwarding without any reliable fast protection switching or bandwidth reservation mechanism.

To achieve this, we used Huawei's Network Cloud Engine (NCE) for online quality monitoring on the two end nodes of private lines. For several weeks, the NCE was configured to measure various metrics, including latency, packet loss rate, jitter, and availability. Because of the backbone network's high bandwidth, light load, and reserved bandwidth of higher than 1 Tbps, the latency, jitter, and packet loss rate of the private line were able to fully support video platform interconnection.

If the network becomes heavily loaded in the future, China Telecom Sichuan can simply upgrade a few key transit nodes and enable SRv6 Traffic Engineering (TE). If performance

deterioration due to, for example, congestion on certain service paths on the intermediate network, the given private line service can automatically select a non-congested service path through SRv6 TE. In addition, Huawei NCE provides latency mapping for users to collect segment-by-segment latency information about network-wide devices in real time, achieving latency-based path selection and traffic optimization under a committed SLA.

SRv6 in the full-service transport field

After several months of trialing commercial use, China Telecom Sichuan's proposed solution to construct a dedicated network for video was accepted by the customer and then expanded to multiple cities. SRv6 Overlay can provide fast, cost-effective, and committed services in scenarios that require rapid cross-city service provisioning and elastic real-time bandwidth adjustments, for example, cross-city cloud DC or IDC interconnections and cross-city, enterprise private line access to cloud. Featuring flexible deployment and a committed SLA, SRv6 supports various service scenarios, including government and enterprise private line, 5G transport, and home broadband scenarios.

SRv6 has now proven its value as a basic transport protocol for future fixed mobile convergence (FMC) networks. ▄▄▄

China Mobile

Safe Cities are smart business for operators

China Mobile Hefei has emerged as a key solution provider thanks to its advantages in technical and delivery capabilities, O&M assurance, and competitive construction costs. The operator's success at expanding its B2B market presence by providing video surveillance solutions on its backhaul network is reflected in remarkable business results.

By He Dawei, General Manager of China Mobile Hefei

> The project involved constructing a backhaul network with 12,000 cameras and service availability of more than 99 percent delivered within a six-month timeframe. China Mobile Hefei took over the construction and maintenance of all backhaul lines.

— He Dawei, General Manager of China Mobile Hefei

With a greater commitment from governments to build safe cities, the demand for high-quality video surveillance networks is increasing.

Located in Anhui province, Hefei is a major hub both in China's Belt and Road Initiative and in the Yangtze River Delta Economic Zone. Since the inception of China Mobile Hefei's video surveillance project in September 2017, Hefei city has seen the deployment of nine video platforms and 12,000 cameras covering more than 1,000 communities and streets, helping local law enforcement departments achieve a safer city environment.

Video surveillance systems need to be deployed by operators that possess sufficient network resources and strong investment capabilities. They also involve corresponding maintenance departments and personnel that are familiar with video surveillance technology. Telcos have strong sales capabilities and

large-scale network infrastructures that span regions and even countries, making them able to deliver carrier-grade service quality for users.

GPON: The best choice for public camera backhaul

The market applications of video surveillance address strict requirements.

The Hefei video surveillance project involved constructing a backhaul network with 12,000 cameras, service availability of more than 99 percent, and MTTR of less than 2 hours — all delivered within a six-month timeframe. China Mobile Hefei took over the construction and maintenance of all backhaul lines.

The project team initially studied the camera deployment scenario, environment, and traffic models. They came up with two feasible camera backhaul solutions: LAN switch access and passive optical network (PON) access.

> Optical network units (ONUs) can operate in relatively harsh environments as they're resistant to high temperatures and high humidity, and they offer protection from lightning.

In enterprise campus scenarios, the LAN switch access solution is already commonly deployed for video backhaul scenarios featuring between 100 and 200 cameras. Although this solution has multiple suppliers and is cost-effective, it has obvious disadvantages in backhaul scenarios with more than 500 cameras in public areas.

First, there are hundreds of access and aggregation switches, and network designs are very complex. Any design or construction error can cause a logical loop on the network, resulting in a Layer 2 broadcast storm that can cause a large number of cameras to disconnect.

Second, the P2P networking design of switches occupies many end fibers and requires fiber re-deployment in 50 percent of areas, which fails to meet fast service provisioning requirements. Unlike the switch access solution, PON technology was designed for massive access scenarios such as home broadband.

As a fixed-mobile convergence (FMC) operator, China Mobile Hefei serves 1.4 million home broadband subscribers and owns 5 million lines of local fiber resources. Its research found that

the average distance between these cameras and the PON optical access points was relatively short at 50 to 80 meters. With reuse by the fiber to the home (FTTH) installation and maintenance team, a single camera can be set up and operational within one day.

The major challenges

As public security cameras tend to be deployed outdoors, optical network units (ONUs) should operate in relatively harsh environments, as they're resistant to high temperatures and high humidity, and they offer protection from lightning. Additionally, requirements for data network security are high. Common home broadband FTTH solutions fail to meet any of these requirements. After comprehensive evaluation, Huawei's PON private line backhaul solution proved to be the best choice.

Outdoor ONUs are deployed next to cameras. They can adapt to wide temperatures ranging from -40°C to 55°C with 6 kV surge protection, guaranteeing high reliability and a low failure rate. AES-128 encryption is supported for data security, while MAC address binding is supported to prevent unauthorized access and improve network security.

Distributed optical line terminals (OLTs) are deployed inside base stations. They reuse the backhaul fibers of base stations, which greatly reduces service provisioning time. In addition, distributed OLTs can support network slicing to isolate the traffic of all public surveillance cameras from home broadband traffic on the same fiber network. This ensures that the network is free from congestion and packet loss 24/7, and provides clear surveillance images at all times.

Additionally, the intelligent ODN management and warning solution of Huawei's network cloud engine (NCE)-FAN allows China Mobile Hefei to predict fiber quality deterioration in advance and quickly locate faults to meet strict SLA requirements. The NCE-FAN supports quick fault management on network-wide cameras, achieving 99.9 percent availability and an MTTR of less than 2 hours.

Expanding the backhaul boundary

Video surveillance has expanded from the traditional security domain to other verticals, with digital and network-based video surveillance systems becoming increasingly mainstream. Enterprise users hope to improve their management efficiency and service quality. Applications include remote loss estimation in insurance, customs clearance in logistics, and remote outlet management in supply chains. The sharp increase in video surveillance requirements makes video surveillance based on fixed broadband another major opportunity for operators to increase their revenues.

Based on the video backhaul solution

developed for the project, China Mobile Hefei is also considering packaging its video cloud platform to expand video surveillance services for SME customers like Safe Campus and Smart Store. In actual application, the distributed OLT + intelligent gateway + Hemu camera + cloud storage solution has so far been well received by micro and small enterprises.

Outstanding business solutions also provide other added value. For example, "Sunshine Kitchen" facilitates interaction and trust between merchants and consumers. "Happy Family" helps guarantee real-time home security with nursing applications, alarms, and cloud storage playback. In addition, O2O takeaway vendors can use the video cloud storage function to share information with customers and ensure a better ordering experience.

In 2019, China Mobile Hefei will continue expanding the Safe City project and explore the market presence of value-added broadband services in campuses, hotels, and industrial parks.

China Mobile Hefei will work with Huawei to explore more business solutions for enterprise services based on the application of PON private line video surveillance. ∎

Turkcell

boosts its B2B business with converged transport and cloud network synergy

Turkey's leading mobile carrier Turkcell operates powerful FMC-based IP transport networks. Its early investment in public cloud services has paid off, resulting in a penetration rate in the enterprise service market of 25 percent by 2018. Now, Turkcell's strategy will focus on eight sub-industries and continue to develop private line services.

By OZGUR GENC, Director of Core & Transport Network, Turkcell

Since 2016, the B2B market in Turkey has grown by 10 percent year on year. In 2018, the B2B market space in Turkey was worth US$4 billion, with private line services comprising 60 percent of the total value. In the same year, the Turkish Regulation allowed mobile operators to use mobile network assets to develop private line services, bringing huge market opportunities.

The selling points in Turkcell's favor

Brand effect: Turkcell has inherent advantages in developing private line services, evidenced by their track record of building many long-term customer relationships through value-added individual applications such as music box and net disk storage. These relationships and accumulated goodwill power the sale of private line services.

Value-add for enterprise services: Turkcell began developing cloud services as early as 2016. Turkcell's existing B2C cloud value-added services allowed the company to quickly provide new B2B services. The network + cloud business model promotes the rapid growth of ARPU and revenues.

Five-step plan for private line services

Step 1: Build the teams

Turkcell's sales team and our existing powerful O&M and service planning teams form an E2E organization that covers sales, planning, construction, operations, installation, and maintenance. This end-to-end organization has developed many new private lines in the 2018 B2B market.

Step 2: Upgrade network capacity with base station fiber resources

When planning site location and fiber construction, Turkcell sought to preferentially cover vital business districts and technology parks. This allowed the company to catch up the main incumbent in terms of the fiber coverage rate in these districts, paving the way for Turkcell to develop private line services. Using existing base station resources to develop B2B services has helped Turkcell reduce equipment room and power supply requirements and O&M costs. The payback period for B2B services is less than two years.

> Turkcell upgraded its transport network to meet the surging traffic requirements of 5G services and cloud-based B2B services, using base station fibers as the main solution for developing B2B and mobile services on the same transport network.

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Step 3: Quickly provision private line services with differentiated SLAs

The emergence of the digital economy in Turkey means that many small and medium Internet companies have set up in science parks and business districts, with high demands on the fast provisioning of private line services. Turkcell reused IP RAN to quickly deploy fiber to enterprises and provision services for target customers, shortening TTM from months to weeks.

In addition, all private line services are connected using typical ring networking, ensuring service path redundancy, end-to-end network faults recovery within 200 ms, and service availability at over 99.99 percent. Providing highly reliable services via base stations is another important point for Turkcell's service differentiation and brand reputation.

Step 4: Provide one-stop integrated cloud and private line services

In 2016, Turkcell and Huawei jointly developed a plan to provide public cloud services for B2C customers in Turkey. Turkcell provides these customers with IaaS (such as computing and storage resource leasing) and SaaS (such as cloud Wi-Fi, office communication, cloud storage, and online cloud conferencing).

These public cloud-based VAS allow Turkcell to provide enterprises with a one-stop ICT service portfolio. When a customer selects Turkcell's public cloud service, the private line service is recommended. Binding these services together is helping Turkcell to quickly and efficiently sell private line services. The package sale of binding these services enables enterprises to quickly obtain cost-effective B2B services.

Step 5: Improve SLA private line services and encourage new B2B service growth with fully automated SDN

We believe that B2B ICT services will soon be fully automated and cloudified. Given this blue ocean market, Turkcell should provide a one-stop subscription service experience for enterprises coupled with an industry-leading SLA standard. For example, to provide services more quickly, Turkcell is exploring the deployment of fully automated SDN to shorten the cloud service and private line provisioning period from weeks to hours, which will allow us to support various services such as flexible charging, bandwidth on-demand, and optional latency. ▬▬

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