One Net: Connect Everyone, Connect as One
Brazil SAMM Transport Network for Lease Line Services

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Bringing Multi-modal Enterprise Collaboration to Your Fingertips

Huawei Full HD Telepresence Video Conferencing System Helps CAAC Improve Service Quality and Productivity

Video Surveillance and Digital Road Management System
Traffic Video Surveillance Project in Guangdong Province

Boundless, Professional Wireless Broadband

Huawei Delivers GSM-R for Sochi High-Speed Railway at Winter Olympics

Huawei GSM-R Helps PRASA Build Advanced High-Speed Railways

Huawei GSM-R Helps Turkmenistan Build a Steel "Silk Road"

Huawei GSM-R Helps Zambia Build Africa's First ETCS L3 Railway

Making a Breakthrough in Turkey Railway Market
Huawei ETCS L2-Compliant Communications Solution for EKB (Eskisehir, Kutahya and Balikesir) Line

Huawei Digital Railway Solution Helps Operate the World's First High-Speed Railway in the North Frigid Zone
GSM-R Project for the Harbin-Dalian High-Speed Railway

Advanced and Green CTCS L3 High Speed Railway Through Hong Kong
Guangzhou–Shenzhen–Hong Kong XRL Project

Developing the World's First Metro LTE Network for Train-Ground Wireless Communications
LTE Train-Ground Wireless Communications Project for Zhengzhou Metro Line 1
Huawei provides a full series of network infrastructure products and solutions such as routers, switches, Wi-Fi, WLAN, network security, optical transmission, microwave, PON, and network management. Through the collaboration between different technologies, such as network and security, wired and wireless networks, datacom and access, DCN and storage, Huawei can help enterprise customers build their network infrastructure platforms covering campus, branch offices, wide area connections, and data centers, to provide comprehensive enterprise network solutions.

One Net: Connect Everyone, Connect as One
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Brazil SAMM Transport Network for Lease Line Services

Background
The CCR (Companhia de Concessões Rodoviárias) Group is one of the largest infrastructure concession companies in the world, with businesses in the areas of road concession, urban mobility and services. CCR is responsible for 2,437 kilometers of highways within the granted national highway system in the states of São Paulo, Rio de Janeiro and Paraná, which has been operating since June 2012. The group also holds 38.25% of the social capital of STP, which operates the electronic payment systems Sem Parar and Via Fácil.

Key Challenges
SAMM has targeted 142 cities into São Paulo, Rio de Janeiro and Paraná state which represents 34% of Brazil demands. Along more than 2,000 kilometers of underground fibers duties, SAMM’s optical backbone has a ring topology supervised by 24*7 days. In addition, SAMM has built a metropolitan network with more than 500 kilometers in São Paulo capital, Rio de Janeiro capital, Campinas and Barueri (cities in São Paulo state). SAMM shall be the first company of the segment in the country to operate a fully subterranean data transmission network, which is an important competitive advantage.

Solution
To match the SAMM’s requirements, Huawei offered a solution based on OSN6800 (DWDM) and OSN3500 (Hybrid MSTP). In the first phase of this network, SAMM deployed 5 DWDM rings with ROADM and OTN, in a total of 34 sites, with the most important site having 5 directions fully ROADM (directionless and colorless). This DWDM network was designed to support 40 wavelengths of 40 Gbit/s, and support transponders of 10 Gbit/s and 40 Gbit/s at the same time. For Hybrid MSTP in the first phase, SAMM deployed 32 sites on 7 rings uplink to the DWDM network, most of these rings use SDH technology with STM-64 interface, and one ring use Ethernet technology with 10GE interface.

At the sites SPO-VQTPT and SPO-VQTPI, for the equipment running on TDM and IP domains, we use a special board called EDQ41 that transforms the data between IP and TDM. Besides this backbone network, SAMM starts to build the metropolitan rings also based on
DWDM and Hybrid MSTP technology, but with small capacities. The OSN1800 (DWDM) equipment supports at most 16*10G interfaces and OSN550 (Hybrid MSTP) supports 10GE interfaces. The metro rings locate in São Paulo, Barueri, Campinas and Rio de Janeiro, which has 41 OSN1800 (DWDM) and 46 OSN550 (Hybrid MSTP) deployed. In phase 2, the constructed network will be expanded to south of Brazil using similar design.

**Customer Benefits**

Huawei's DWDM and Hybrid MSTP solution had been deployed in SAMM's network successfully. Based on the new transmission network, SAMM is able to provide two kinds of new services Data SAMM & IP Corporate SAMM for end users. Data SAMM is the solution that enables the company to link their units through digital circuits for access and transport of voice, data and video with full transparency to data traffic. The Corporate IP SAMM is an IP connectivity service that supports TCP/IP applications and provides Internet access, supporting blocks of IPv4 and IPv6.

After project deployment, SAMM has made some progress compared to the previous network. Here are several highlights:

- Higher bandwidth, easier for expanding.
- Ultra-long distance and cost efficiency.
- High reliability and easy O&M of ROADM + OTN technology.
- Diversified interfaces (GE, 10GE, STM-1, STM-16, STM-64) and a diversity of services.

When Huawei implemented this solution for CCR in 2012, CCR was able to sell the links and bandwidth to carriers and ISPs.
According to Beijing Urban Overall Planning (2004–2020), Beijing will complete 30 metro lines in 2020, with a total length of 1050 kilometers. The metro lines cover the whole main urban district and connect it with the new urban district, which effectively relieve the traffic congestion in Beijing and lays solid foundation for it edging into word-class city.

In the early stage of railway construction in Beijing, there is an underinvestment in secure plan, design, construction, surveillance, and operation. Beijing is in urgent need of enhancing the capability of safety surveillance management, accident prevention and emergency response processing so as to perfect the urban railway transportation and emergency handling system.

Urgent Need for the Railway Safety Surveillance and Emergency Command Center

During the railway construction of Beijing, major accidents should be prevented and information technologies should be utilized to enhance the capabilities of surveillance management, accident prevention, and emergency processing. Beijing Railway Safety Surveillance and Emergency Command Center adopts various intelligent management measures, including construction onsite video surveillance, safety risk elimination, emergency handling video conferencing, scheduling management, and fault statistics collection in pilot running. With these measures, the center can provide...
In recent years, China has experienced significant growth in urban railway transportation. It is estimated that China will complete 89 metro lines, with a total length of 2500 kilometers in 2016. With the rapid development of infrastructure construction, safety accidents occur more frequently in railway transportation and building construction; therefore, facing the large-scale national railway construction, safety technology management is urgently needed.

Dynamic and comprehensive information on safety surveillance, which serves as scientific decision support for management personnel. The Railway Safety Surveillance and Emergency Command Center achieves the routine management, surveillance and warning, and emergency command functions; therefore, it can implement intelligent urban railway management, enhance emergency handling capability during construction, improve safety management capability, and support emergency handling capability. The Railway Safety Surveillance and Emergency Command Center consists of multiple subsystems, such as construction onsite risk surveillance, real-time management for shield construction, construction onsite video surveillance, safety risk eliminate, scheduling management, fault statistics collection during pilot running, emergency handling video conference, fundamental support system (including information security, transport network, emergency database for safety surveillance, Large Screen Display System (LSDS), and power supply system), and emergency command platform for safety surveillance. Each subsystem needs to collect information on construction site and control center and send the information to the safety surveillance and emergency command center through the transport network for processing. The transport network should be of high reliability, scalability, and high performance.

Agile Switches Shoulder the Responsibilities

The Railway Safety Surveillance and Emergency Command Center provides a network platform for the entire emergency command system. The network must be able to safely cope with the burst traffic and a large volume of data. The core layer must provide sufficient bandwidth and adopt backup design, to meet data transport requirements of video and voice services. After careful consideration, the Railway Safety Surveillance and Emergency Command Center chose Huawei as the partner. Considering the multi-service requirement of the Railway Safety Surveillance and Emergency Command Center, Huawei deploys two S12700 agile switches at the core layer. The S12700 agile switches adopt Huawei-developed Cluster Switch System Generation 2 (CSS2) technology to implement 1+N backup of MPUs. Services are not affected as long as one MPU in the entire cluster system works normally. This design significantly reduces transmission delay and ensures stable running of the security surveillance system and real-time data transmission. The S12700 series support high-density line-speed cards, such as 48*10GE and 2*100GE line cards. Each S12700 can provide a maximum of 576 10GE ports or 24 100GE ports. This large port capacity fully meets requirements of bandwidth-consuming applications, for example, multimedia video conferencing and data access.

The S12700 implements 0 packet loss in forwarding and 576*10GE line-speed forwarding. The performance of S12700 has been verified by Ixia and Miercom. In the InterOP conference held in Las Vegas, Miercom presented the PERFORMANCE VERIFIED award to Huawei S12700 agile switches. Huawei S12700 agile switch delivers a high performance to meet the requirements of Railway Safety Surveillance and Emergency Command Center. It transmits real-time data of construction sites and railway operation, reports emergencies, and reduces security risks.

With built-in high-speed, flexible Ethernet Network Processors (ENP), the S12700 have the full programmability to meet customers' requirements and protect customer investment in 10 years. Huawei S12700 agile switches fully meet the requirements of constructing a network platform for Beijing Railway Safety Surveillance and Emergency Command Center. This project sets a good example for other railway construction projects.
Stable and Reliable Network Solution for Airport Terminal Building

T2 Terminal Building Network Project for Chengdu Shuangliu International Airport

Background
Chengdu Shuangliu International Airport, which lies in the southeast China, operates as the airline hub for handling passengers and cargoes and is the 4th largest and busiest airport in mainland China. In 2011, the passenger throughput amounted to over 29 million, ranking first among eastern China airports and 47th among global airports. Cargo traffic ranks 6th among airports in mainland China and 44th among global airports.

Key Challenges
The secure and efficient operation of the airport relied on a stable and reliable information network. The construction command department of Chengdu Shuangliu International Airport posed the following requirements on T2 terminal building network infrastructure.

• Cutting-Edge Network Design and Technology
  The T2 terminal building network is the basis of all services at Chengdu Shuangliu International Airport. The design of this network must ensure network openness, security, and scalability and reserve open, standard interfaces to support future upgrade. The network architecture should be ahead of the competition for at least the next five years. Additionally, enhanced security, as well as easy management and service expansion are also required to ensure secure and stable operation of the airport in a long run.

• Compatible Network Architecture
  A highly compatible network was required to support interoperation between devices and technologies and facilitate network expansion and deployment of new products and features. The network design and devices must use standard technologies and protocols for the interoperability issue and maximizing return on investment.
After a full technical assessment and comprehensive consideration of the requirements from the airport construction headquarter, Huawei proposed an advanced, stable and reliable network solution for Shuangliu Airport Terminal T2. Through the flexible architecture design and unified management platform, the solution meets customer’s business needs in the next five years, realizes the interconnection of the whole network, and makes the maintenance and management become easier.

- **Easy Management**
The network deployed in the T1 and T2 must be designed, constructed, and managed in centralized manner. Simplified network architecture was required to lower operation and maintenance costs, ensure stable network operating, and help in quick fault location and rectification.

**Solution**

Huawei performed professional technical evaluations and data collection, leveraged rich network solution design, implementation and optimization experience, ultimately rolled out a cutting-edge, stable, and reliable network solution for the T2 terminal building network project.

The following features highlighted the Huawei solution.

- **Scalable Architecture for building a Leading Network**
A leading network featured reliability, scalability, and security.

  **Reliability:** The core LAN switches set up a cluster with innovating clustering technology and scaled up to 256 Gbit/s cluster bandwidth. This realized redundancy of core nodes and non-blocking transmission. Inter-chassis link aggregation also improved link efficiency and prevented single-point failures.

  **Scalability:** Huawei solution used the high-end S9312 LAN switches as core switches, which enabled the network to stay ahead of competition at least in the next five years and allowed the network to smoothly upgrade and expand.

- **Unified Platform for Central Management of the T1 and T2 Terminal Buildings**
Huawei solution used standard protocols on all nodes for seamless integration between the newly constructed network on the T2 terminal building and the T1 terminal building. The unified network management platform eSight managed LAN switches and routers all over the airport and monitored the status of devices deployed in the surveillance center. This facilitated unified service distribution and increased maintenance efficiency.

**Customer Benefits**

After the implementation of T2 terminal building network, Chengdu Shuangliu International Airport achieves network efficiency, security and reliability, ranks among the top four airports in China regarding network technology.

- **Flexible Network Architecture**
The T2 terminal building network keeps pace with service development and supports efficient, secure, and reliable service operation in the next five years.

- **Easy Maintenance and Management**
Huawei solution enables unified operation and management (O&M) of the networks on the T1 and T2 terminal buildings without employing more assistants.
Improved Railway Communications Network Expedites the Coal Transport in China

Shuohuang Railway Seeks Huawei’s Help for New Transmission Network

Background
Shuohuang Railway, completed in 2012, extends 600 kilometers from Shencheng (a key coal mine base in Shanxi Province) to Huanghua Harbor (one of the busiest export harbors in neighboring Hebei Province). The Shuohuang Railway is the second largest channel for transporting coal resources from west to east, and guarantees sufficient energy supplies in the coastal regions of eastern and southeastern China and increases shipment of coal exports.

Key Challenges
The Shuohuang Railway originally used a Multi-Service Transmission Platform (MSTP) to bear the signaling, monitoring, and voice services. Every service's data bandwidth ranged from 2 Mbit/s up to 100 Mbit/s Fast Ethernet (FE). After railway subsystems had been upgraded and re-constructed, faster and optimized networks, such as Long-Term Evolution (LTE) and video surveillance system, would be needed. These systems required more diversified railway services with advanced network features. The details are as follows:

• Bandwidth
Higher bandwidth requirement imposed heavy loads on the original network. New services also required a more flexible and efficient IP network. However, the traditional MSTP had low transmission efficiency.

• Security
An unstable and increasingly unreliable network affected security. In order to improve its security, all sub-systems should have to be separated so that all services could be
Shuohuang Railway selected Huawei to roll out a reliable and simplified solution by re-constructing its transmission network for enhanced reliability and simplified O&M. The solution implemented a unified platform to carry out all businesses, meets the requirements of railway on reliability and ensures the long-term stable service running on the system.

transmitted efficiently and securely.

- Operations and Maintenance (O&M)
  Spare parts and the maintenance service of the older network were end of life, which negatively impacted the network O&M.

Solution
Huawei rolled out a reliable and simplified solution for re-constructing the railway's transmission network.

- Optimized network
  Huawei deployed a comprehensive transmission network: 10 Gbit/s backbone layer, 2.5 Gbit/s aggregation layer which could easily be upgraded to 10 Gbit/s.

- High efficiency for Ethernet access
  Huawei OptiX OSN 7500 and OptiX OSN 3500, as the widely used intelligent optical transmission switches, provided better performance for crossconnection capability and Ethernet access. In the meantime, 40 percent of the devices’ capacity could be spared for future expansion. The Ethernet access boards in these equipments have higher port density to efficiently save the slot resources, and increase available utilization rate of bandwidth because of the grooming capability base in VC12/ VC3/ VC4 granulation.

- Enhanced reliability
  Huawei provided multiple protection mechanisms to improve system stability and reliability. All of the key boards such as cross-connection boards, main control units, and power supply units were deployed in 1+1 hot standby mode. The secondary power supply for the key boards provided an uninterruptible power system. The network protection ensured that the service in a faulty node could be switched within 50ms. The OSN-series devices also might offer an intelligent optical network platform that could enable the existing live network to evolve into automatically switched optical network, further to improve network reliability.

- Simplified O&M
  The OSN-series equipment shared the same service boards. As a result, fewer spare parts were needed in the whole communication network and maintenance would be more cost-saving. Meanwhile, Huawei’s iManager U2000 could uniformly manage all devices and services in this network.

Customer Benefits

- Large-capacity, scalable network architecture
  Multiple services can be transmitted more flexibly to improve the performance of Shuohuang Railway, and further to expedite the return of customer’s investments.

- Improved reliability
  The system redundancies prevent the failure in single point, and ensure persistent service for line operation.

- Reduced Capex and Opex for customer
  Fewer spare parts and simplified O&M save customer’s OPEX cost obviously, and the long-term supports for smooth evolution will further reduce customer’s CAPEX for network construction.
Stable, Reliable Metro Information Bearer Network

PIS Network Project for Chongqing Metro

Background
Chongqing Rail Transit (Group) Co., Ltd. is a state-owned, large railway transport enterprise for passengers, which was founded in 1992. The group is the only corporation that undertakes the urban railway construction and operation, and resources exploitation along all the lines. Furthermore, the group pays great attention to the construction of information system, and wish to improve the service quality for passengers via advanced information and communication technology.

Key Challenges
Passenger Information System (PIS) is a multimedia and synthesized information system, which is based on the multimedia network technology and the core computer system. It deploys display terminals in station halls, railway platforms and carriages in order to keep informing passengers the train schedule and public media info accurately and timely, it is one of the most important systems in the metro operation.

• Heavy-traffic data transmission
All equipment in the PIS network should meet not only the current needs but also the future demands by adding correspondent modules to satisfy new requirements such as higher bandwidth, more equipment, more applications and more different offices in order to protect the investment made previously.

• Security and reliability of PIS
The bearer network should be able to provide network layer security measures, working together with the entire security system of PIS, to prevent access of unauthorized and external users and avoid operations without permission by operators. Besides, the system required a redundancy design for key equipment and the links, which could avoid single point of failure and ensure a quick recovery when any fault occurred.

Solution
To effectively meet PIS network requirements, Huawei offered a comprehensive solution covering data network, security and storage equipment.
Chongqing Rail Transit (Group) Co., Ltd. wanted to build a Passenger Information System (PIS) to improve the quality of service in the metro system, by adopting advanced information and communication technology. Huawei was chosen to participate in the design and implementation of the bearer network for PIS, which covered Play Control Center (PCC), PIS node of each metro line and central control station. The newly built bearer network helped PIS to be a veritable diversified information platform and ensured its reliability and stability.

Customer Benefits

- **Construct an integrated and large-capacity information platform**
  Constructed on Huawei series LAN switches, The PIS network adopts a three-layer network design including core layer, aggregation layer, and access layer. With the powerful performance of these switches, a truly diversified information platform is built to satisfy the increasing business growth.

- **Secure and reliable network guarantees the service development step by step**
  Redundant equipment configures (dual control boards and dual power modules) and redundant network structure (dual core LAN switches and dual links), with a variety of security policies, guarantee the reliability and diversified development of PIS. It contributes the setup of a multimedia and integrated information system which focuses primarily on users.

High-speed data processing and forwarding
Considering the fact that PCC needs to process the mass amount of information and applications, Huawei used two S9306 LAN switches as the central switches to ensure high-speed and stable data access for users. Huawei’s S9300 series LAN switches are the new-generation and high-end terabit routing switches designed for multilayer convergence.

High-security design to protect PIS effectively
Huawei Unified Service Gateway USG5120 BSR was deployed to achieve high-speed data forwarding and provide security functions such as Reverse Path Forwarding (RPF), which improved network security and avoided various attacks from viruses and Trojans. One Huawei USG5320, serving as the firewall, was also deployed to ensure data access security for internal users. The USG5320 provides functions, as Intrusion Prevention System (IPS) and antivirus technologies, attacks of Distributed Denial of Service (DDoS), Uniform Resource Locator (URL) filtering, and application software restriction.

High reliability network to build a robust PIS system
Huawei deployed S9306s high-end LAN switches at the network core layer and S7703s LAN switches at the aggregation layer. In addition, 1+1 redundancy strategy was adopted for all key equipment to eliminate the network failure caused by single-point failures. Additionally, Huawei’s innovated hardware-level OAM+BFD technology achieves quick network failure detection (within 10 ms) and fast end-to-end network switchover (within 50 ms), thus greatly improves network reliability.
Huawei Helps Safeguard Shenzhen Airport Information Center

Information Security Project for Shenzhen Bao'an International Airport

Background
Shenzhen Bao'an International Airport is a modern international airport with combined transportation from land, sea, and air, and is also the first airport to adopt the pan-regional Transit Transport pact in the territory of China. Since opening to air traffic on October 12, 1991, Shenzhen Bao'an International Airport has enjoyed a fast growing aviation business. By the end of November in 2012, the airport had nine passenger and freight airline bases with over 131 national and international routes to 92 cities at home and abroad. With its fast-growing passenger and cargo throughput, the airport has, for many years, maintained its position as the fourth largest airport in China. In March 2011, it was named “Best Cargo Airport of the Year” by Air Cargo News (the world's top air cargo magazine).

Key Challenges
Shenzhen Bao'an International Airport provides information, offers passenger services, and presents its corporate image through its airport information center. Recently, it planned to deploy E-commerce applications on this center. However, with increased hacking attacks threatening worldwide, Internet security, the airport had concerns over the security of its core applications, key data, and reliable network operations. It urgently needed higher security protection measures for its airport information center to address the following risks:

• Website crashes due to heavy-traffic attacks on outbound Internet

The airport information center did not have devices installed to combat large-scale Distributed Denial of Service (DDoS) attacks on outbound Internet. As a
As the fourth largest airport in China, Shenzhen Bao'an International Airport faced increased network security challenges as its business grew. In response to these urgent needs, Huawei offered a holistic solution that provides security consultation services and network-wide security protection to safeguard this modern international hub and gateway.>>

result, the website crashed periodically, affecting services.
• No protection for cross-regional data exchange
No Intrusion Prevention System (IPS) devices were deployed on the airport intranet to detect and prevent system and application loopholes or attacks. Consequently, it lacked the capability to detect and purge network viruses, or log and query network interactions.
• Lack of efficient control and secure management of terminal devices
Access control and desktop management systems were absent from IT terminals that were connected to the office network. As a result, compromised personal computers often resulted in the breakdown of the entire network, incurring huge maintenance costs and resulting in great financial losses.
• Loopholes and potential risks to the service information system
The airport neither had sufficient classified security levels for its networks nor did it perform detailed risk assessment on its office network. As a result, it urgently needed to run a security evaluation of each system to identify potential risks and eliminate them through system enhancement.

Solution
Through its security consulting services, Huawei was able to provide a holistic security solution that covered security consultation services as well as ensure network-wide security protection. Key features of the solution include the following:
• Comprehensive security consultation services
Huawei's highly skilled security consultation team inspected the security status of the aviation service portal, call center, e-card, access control system, Office Automation (OA) network, mobile office system, and official website. The team also performed a comprehensive security assessment of all service systems. From the assessment results, the team identified system loopholes and closed them to provide strong systems information security.
In addition, Huawei assigned dedicated engineers to periodically inspect the security of specific airport systems and, during the holidays, designated two engineers to monitor (24/7) security performance on-site and solve unexpected problems.
• Anti-DDOS devices were deployed on the outbound network
Huawei's Anti-DDOS solution uses the Access Control List (ACL)-based packet capturing method to obtain attack evidence for subsequent security audits. The solution also supports one-click automatic
attack evidence collection, including automatic packet capturing, automatic extraction, and automatic storage of attack signatures, which further facilitates later audits.

- **Accurate detection and intelligent obstruction of threats**
  Huawei's Network Intelligent Police (NIP) system provides a full lineup of security functions, including virtual patches, Web application protection, client protection, malicious software control, network application control, and infrastructure protection. These help manage network security issues in new IT environments (for example, Web 2.0 and virtualization), and prevent terminals and Web applications from network attacks. By leveraging Huawei's global loophole tracking capabilities, the NIP system can promptly detect attacks and provide timely updates to the network attack signature library and intercept the attacks by default. Additionally, the NIP system accurately finds attacks using state-of-the-art loophole detection technologies.

- **Access control and security management of terminals**
  Huawei's SecoSpace Terminal Security Management (TSM) solution offers customer-friendly access control using a carrier-class hardware security access control gateway. With this TSM solution, the customer can build a function-rich intranet security management platform that features high adaptability, easy management, flexible scalability, and high reliability. All this is possible without changing the existing network architecture, replacing equipment, or
compromising network performance and reliability. Terminal user identities are authenticated based on user roles, to prevent unauthorized access and fortify airport intranet security. To enhance terminal security control and management, a full array of functions are combined, including terminal security reinforcement, online behavior management, network protection, mobile storage device management, and information leakage prevention. Asset management, software deployment, remote assistance, and bulletin posting functions are also available to improve desktop service management. All these features and functions fully satisfy customer requirements for terminal security protection.

**Customer Benefits**

Huawei's comprehensive security solution safeguards information security for Shenzhen Bao'an International Airport and Huawei's professional and timely security services help the airport cope efficiently with bursts of traffic during holidays. Deployment of this solution is a key step in Shenzhen Bao'an International Airport safeguarding its information-led platforms. The airport is now able to formulate comprehensive security protection policies through the combination of state-of-the-art technologies and management methods. Also, security for business operations is ensured for terminal and service systems.
With the development of cloud computing, Huawei offers customers storage, servers, cloud computing and data centers, and ICT products and solutions. Huawei also cooperates with more than 400 partners such as Intel, SAP, and CA, to provide IT industry solutions. These solutions enable customers to build advanced, efficient IT platforms which help them adapt to changes in enterprise business.

Make IT Simple,
Make Business Agile
Make IT Simple,
Make Business Agile
Lucerne Public Transport Authority Chooses Huawei Storage Solutions

VBL Lucerne Successfully Increased Performance and Reliability Using Huawei's OceanStor S5500T Storage Solution

Background

The Lucerne Public Transport Authority (VBL), of Lucerne, Switzerland is an independent transport company owned by the city of Lucerne. The job of VBL is to provide coordinated public transportation services (primarily bus and trolleybus) to approximately 200,000 citizens in the Lucerne area, not to mention numerous tourists and visitors. VBL operates 32 bus and trolleybus lines with over 300,000 route kilometers.

Key Challenges

The ICT infrastructure of VBL was processing an increasingly large amount of data. Day after day, the system was oversubscribed, which prevented smooth operation of the network. During the evening, batch processing jobs had to be run. Due to these challenges, the system was becoming increasingly unmanageable. The demands on the performance and availability of the VDL system grew rapidly in recent years. While the consistent growth of networking, Internet and mobility provides key support for passengers, employees and vehicles, these demands also stressed the network. On top of that, VDL added the ability to sell tickets and maintain the tariff structure to their network. Franz Theiler, director of ICT at VBL Lucerne, decided to replace the company's five-year old infrastructure with a new solution. He defined the exact requirements, considered various vendors, and turned to their trusted ICT consultant and service provider Infoniq SQL AG: "Infoniq is a long-time partner for storage management software at VBL. Therefore, we asked their experts how they would improve our situation."
In general, VBL required 5 years of 7x24 Support plus a scalable system to account for data growth. VBL also requested a cost-effective backup solution via Fibre Channel. Based on these requirements, the only solution that would meet all of VBL’s requirements was a pair OceanStor S5550T storage solutions from Huawei. The strong Huawei hardware allows for the integration of leading technologies such as Turbo Module, Turbo Boost and energy-saving processes.

Solution
The head of Infoniqa's Huawei Enterprise team, responsible for the storage solutions, with his engineering team analyzed the initial situation at VBL by conducting numerous detailed discussions throughout the company. In various workshops, they determined the needs of VBL as follows:

- Optimize time-critical batch runs
- Significantly improve server performance in the VMware environment
- Eliminate (or reduce) the I/O bursts of mission-critical applications such as Oracle
- Commitment of at least 5000 IOPS (write and read-operations per second) without ground noise
- Smooth implementation and migration of all applications and databases (VMware/Oracle)
- A completely redundant system (two-room concept with fail-safedisk arrays)
- Easy and clear configuration management platform

In general, VBL required 5 years of 24/7 support plus a scalable system to account for data growth. VBL also requested a cost-effective backup solution via Fibre Channel. Based on these requirements, the only solution that would meet all of VBL’s requirements was a pair OceanStor S5550T storage solutions from Huawei. The strong Huawei hardware integrates leading technologies such as Turbo Module, Turbo Boost and energy-saving processes. The Huawei OceanStor S5500T is designed for large databases with online transaction processing/online analysis processing, highperformance computing, digital media and similar scenarios. The Huawei solution is scalable, highly energy efficient, provides high uptime and is reliable. There are also simple expansion and management options.

Customer Benefits
After a detailed evaluation, Franz Theiler was convinced:
"In terms of quality, performance and priceperformance ratio, Huawei gave us the best deal. We have only had positive experiences with the solutions offered by Infoniqa, and we know we can always fall back on their courteous support team. Also, the newly formed Storage Solutions team at Huawei upholds these principles. We experienced swift and targeted installation and configuration of our new storage infrastructure. High-quality products and the great expertise of Infoniqa secured a smooth progress."

Franz Theiler-Director of ICT at VBL

Today the storage problems of the VBL have been solved. According to Franz Theiler:
"Basically, the all time-critical Batch processing jobs run faster and we have a lot of capacity." The overall server performance in the current VMware environment is much better. The daily peaks are handled through smart cache. Particularly VDL likes simple and clear Configuration Platform.

"At the beginning we relied on the promises of a high-quality product from our partners," says Theiler. "This promise was kept. We have left the performance issues of the past behind us."
Huawei Desktop Cloud Solution: Helping HKA Develop a Digital Airline System

Background
Founded in 2006, HKA is a world-renowned airline company. In recognition of its personable services and high-quality onboard offerings, HKA was recently awarded the highly esteemed four-star rating from Skytrax. As one of the world's leading airline companies, HKA strives to feature industry-leading digital technologies and top-level services. Yang Jianhong, HKA CEO, explained that the rapid development of information technologies compels airlines to innovate in order to cope with fierce business competition. HKA is now actively developing a digital service system and using business and technical innovations to enable refined management and accurate decision making.

Key Challenges
The rapid development of the aviation industry was continually increasing HKA's service scope, customer traffic, and workforce; however, most of the airline's IT systems were monolithic, or "stovepipe" style, with each application deployed on an independent platform. This architecture created many challenges, such as low resource usage, limited maintenance efficiency, decentralized management, a lack of hardware and software resource sharing, and difficult IT system maintenance. HKA's IT systems yielded the following disadvantages:

• Complicated and time-consuming deployment
   To deploy a Personal Computer (PC), HKA's IT personnel had to deploy the hardware, install the operating system and required applications, and perform system commissioning — an arduous process.

• Difficult management and maintenance
   A large number of PCs were provided by different vendors. The high device fault-rate and frequent software upgrades inconvenienced users with diversified requirements for desktop environments. The lack of unified management required IT personnel to manually maintain each PC, separately.

• Inefficient data security protection
   Data stored on PCs was prone to cyber attacks and...
Hong Kong Airlines (HKA) needed a comprehensive information security protection solution to encompass terminal security, access control, network security, cloud platform security, data transmission, and desktop security management. In response, Huawei provided a secure desktop cloud solution for HKA, leveraging an advanced cloud computing architecture and "cloud-pipeline-client" strategy. The signing of the ICT Strategic Cooperation Frame Agreement ensured extensive and long-term cooperation between Huawei and HKA.

Vulnerable to information leakage.

• Low resource usage
  PCs were deployed in decentralized mode, resulting in low resource usage rates (less than 5 percent) and high operating costs.

• High energy consumption and operating costs
  Matched power supply and cooling systems consumed considerable power, and management and maintenance required the presence of IT personnel in the equipment room, which raised system operation costs.

Like many other companies, HKA needed to transform from a traditional IT architecture to an advanced, cloud-based architecture to meet the demands of increasingly popular cloud technologies.

Solution

Huawei impressed the customer with a "cloud-pipeline-client" development strategy, collaborative Information Communications Technology (ICT) solution, and customer-centric services.

Huawei provided end-to-end services to build up a unified cloud desktop platform to complete the IT architecture transformation and help HKA implement a "Digital Aviation" development strategy. The Huawei cloud desktop platform features high efficiency, flexible services, enhanced security protection, and a full project delivery experience. The platform services cover cloud clients, hardware, software, in addition to network and information security, technical consultation, and integrated design. Resource sharing and centralized data management facilitate swift HKA service development.

Huawei deployed relevant hardware in HKA’s central equipment room.

HKA’s service departments were connected to the central equipment room using Thin Clients (TCs) through the transmission network. In addition to TCs, users can also use other network devices to access desktops and applications. The solution has substantially enhanced HKA’s information security, improved system operation and maintenance efficiency, facilitated office services, and enhanced service continuity. It offers the following advantages:

• End-to-end security protection
  Service data is processed and stored in background systems, while terminals provide only security protection (such as access control) and encrypted transmission services. By separating service data from terminals, the solution substantially improves HKA information security.

• Centralized application management and quick service deployment
  Huawei commissioned and optimized HKA’s Office Automation (OA) software without impacting user experience. Users can perform quick service deployment.
and centrally manage services via the data center.

- **Intelligent service management and high system maintenance efficiency**
  Automatic resource management and control have simplified system maintenance and lowered HKA’s investment costs. With the convenient maintenance tool, users can perform self-service terminal maintenance through simple mouse clicks, greatly increasing operating efficiency.

- **Elastic resource distribution and sharing**
  The data center manages, controls, shares, and distributes resources in a unified and flexible manner, significantly improving HKA’s resource usage.

- **Eco-friendly office with low noise and energy consumption**
  The energy-saving and noise-reducing TC simplifies noise control in offices, enables requirement-based resource distribution, and reduces heat dissipation and energy consumption.

- **Flexible access and mobile office**
  The system supports multiple terminal types, allowing convenient mobile access anytime, anywhere.

**Customer Benefits**

The Huawei cloud desktop solution provides the following benefits for HKA:

- **Cloud system operating experience**
  In the first stage of construction, Huawei deployed the cloud desktop system in
HKA’s internal office system. This pilot system facilitates deployment of cloud systems in the travel service, contact center, and mobile office systems.

- **Promoting cloud platform development**
  Airport services will gradually migrate to the cloud platform. Huawei’s cloud desktop platform supports information sharing, quick service deployment, flexible resource distribution, and data center transformation (from traditional to cloud-based). The platform will enable construction of HKSS’s IT systems, allowing the airline to fully implement the “Digital Aviation” development strategy.

- **Comprehensive IT system**
  Huawei, as HKSS’s ICT solution provider and preferred business partner, provided a comprehensive end-to-end solution that covers data-center design, virtualization, cloud computing, servers, storage devices, IP backbone networks, and unified communication and collaboration systems. The solution ensures all-around support for HKA’s global market expansion.

“*This contract signing marks the cooperation between two strong enterprises. HKA purchased Huawei’s mature cloud desktop technologies to reduce operating costs, improve work efficiency, and accelerate the implementation of the “Digital Aviation” development strategy. In the future, HKA will open more international airlines to provide better services and strive to become an international airline company that features industry-leading digital technologies and top-level services.*”

*Yang Jianhong, CEO of Hong Kong Airlines*
Huawei Storage Ships Out to Londonderry Port

Background
The city of Londonderry was established and defined by Royal Charter of James I on the 29th March 1613. During the 17th and 18th centuries Londonderry Corporation was responsible for the upkeep and development of the port, which saw a huge increase in trade with the opening of the UK and US markets. Today Londonderry Port imports over £500M worth of goods annually and offers port and marine services to both tourists and cargo customers.

Key Challenges
During 2010, Londonderry Port found that the amount of electronic data being generated by its business was growing exponentially and their existing IT infrastructure was unable to cope with the growth. In addition, the port had to deal with higher volumes of payment and maintenance transactions within its expanding supply chain. In an effort to deal with this, the IT team set out to research a new data storage solution and address the challenges being faced. During this exercise Londonderry Port laid out the requirement to provide a solution that would not only address the immediate needs but also provide future scalability with increased performance at a competitive price.

Solution
Huawei's OceanStor S2600 is ideal for Small and Medium-sized Businesses (SMBs). Based on an innovative architecture design, the S2600 offers a complete storage solution with five E-features – Evolutionary, Easy, Enhanced, Energy-saving, and Economical. Evolutionary because of the seamless convergence of FC SAN and IP SAN and a complete set of features, including remote replication (HyperMirror), power failure protection, and disk pre-copy. Easy due to the ease with which installation, operation and maintenance can be performed. Huawei's ISM storage management software supports automatic installation and provides a configuration wizard to help users complete all configurations within five minutes. ISM also handles alarm to alert users via SMS, email, sound, and on the display. System modules such as controllers, power supplies, and hard disks are hot-swappable, simplifying parts replacement and the Huawei global service network provides customers with quick and high-quality services. Enhanced as a result of expanded data protection, disk protection, scalability and carrier-class availability. Extensive value-added features such as HyperImage, HyperCopy, HyperClone, and...
As the range of services and the expectations of port users grew, the amount of data to be stored exceeded their current system. With economic pressures and widely varying estimates of future needs, the exact size and configuration of storage system was unknown. To address the current needs and ensure simple future expansion, regardless of size, Huawei provided the OceanStor S2600 SAN storage system. This system is simple, reliable and very expandable, precisely what the port needed.

HyperMirror ensure overall data integrity. System backup technology combines disk snapshot with backup software to achieve rapid and effective data backup. The S2600 supports background initialization of RAID and online expansion up to 96 disks and 256 hosts, meeting customer needs for capacity expansion. The S2600 system availability is 99.999%

Energy-saving due to energy-saving disks, components and power supplies. Industry-leading disk spin-down technology reduces power consumption in data backup and archiving by more than 40%. AC and DC power supplies are available for various application scenarios.

Economical is the result of supporting a broad range of host interfaces and being able to mix SAS, SSD, and SATA disks in the highly compact enclosure. Up to eight host interfaces are provided to reduce the investment in switches. SAS, SSD, and SATA disks can be flexibly configured in an S2600 enclosure and data can be saved to various combinations of SSD, SAS and SATA disks according to its importance and security level, thus maximizing space utilization and minimizing customer investment. The enclosure takes only 2U, making it easy to install.

Customer Benefits
The S2600 provided the Port with a perfect solution to their current problems and prepared them for future expansion. This solution, delivered by Loughtec, Huawei's partner, not only met the needs of the Port, but also proved to be the right product for Loughtec. The Huawei solution has delivered on all counts." Said Sean McDermott, Director at Loughtec, adding: "Loughtec has put a considerable amount of time and effort into finding a reliable and cost-effective SAN solution for our customer base. The successful installation in the port has proven to us that we have found that solution in the Huawei SAN."

"We are extremely happy with our decision to adopt a new brand technology from the market place. The Huawei solution has delivered on all counts."

IT Director of Londonderry Port, Mark Doherty

IT Simple,
Make Business Agile
Huawei Storage Solution Keeps Trafficmaster in the Driver's Seat

Background
The Trafficmaster group offers a range of driving-related services which use a common telematics technology platform. Services include: delivering fleet tracking and management, Smartnav real-time navigation, vehicle tracking, and the latest pay-as-you-drive insurance monitoring solutions.

Key Challenges
The company was looking for a new SAN storage solution because their legacy system had reached the end of its life and was no longer supported by the provider. In addition, the existing storage capacity was not able to meet the company's rapidly growing needs. Although Trafficmaster's technical requirements were not complex, they needed high performance storage that could deliver large volumes of information to the database quickly. In addition, one of their key concerns was migration down-time during the installation of a new solution. Given the real-time nature of Trafficmaster's solutions, any complications in the migration could pose significant difficulties for the company to operate its business.

After assessing a number of providers and evaluating cost, performance, facilities, and features, Trafficmaster chose Huawei because of its scalable and customer-focused approach.

Solution
Trafficmaster needed a solution that would not only deliver high performance, but also help the company prepare for future growth requirements, ideally over the next five years. Huawei's OceanStor S2600 is an entry-level solution with a big-company capacity; designed for Small and Medium-sized Businesses (SMBs), it is an ideal solution for companies who anticipate significant future growth. The OceanStor S2600 is packed with energy-saving features, including industry-leading disk spin-down technology to reduce power consumption by more than 40% during data back-up. Trafficmaster also took the opportunity to leverage the migration period to develop the role of storage in the IT infrastructure. With the increased capacity they were gaining from their new solution, Trafficmaster made the decision to expand the

In Transportation
Running fleets of vehicles has moved from a seat-of-the-pants business to a highly automated, data-intensive set of activities. Trafficmaster Ltd., a leader in providing solutions to fleet operators, was running out of space to store the increasing amount of data needed to successfully run their business and needed to quickly find a solution that could meet today's requirements, but also easily grow to meet tomorrow's. Huawei's S2600 scalable SAN solution provided the perfect mix of capacity, features and support to allow Trafficmaster to drive into the future.

Customer Benefits
Trafficmaster is very pleased with the business results it has achieved by implementing Huawei storage technology. In addition to delivering high performance, the OceanStor S2600 also proved to be an extremely energy-efficient and cost-effective option that will protect Trafficmaster's IT investments today and into the future.

"The performance of the Huawei OceanStor S2600 has had a dramatic impact on our ability to process information," said Derek Arnold, Head of IT, Trafficmaster. "Not only is our system now running faster than ever, but we can also see that for a very affordable price we've been able to build in enough capacity to account for future growth in the company. This made the solution a very effective investment to help us remain competitive and continue to grow."

Mr. Arnold added: "The difference in performance has been dramatic. As soon as the migration was complete, we saw a significant improvement in the speed and performance of our database. What has been particularly helpful is our ability to manage the solution in a way that allows us to see a future growth path and where we still have provision for the future as we increase capacity."

"The difference in performance has been dramatic"

Another key benefit for Trafficmaster was the customer-focused approach. The Huawei support team was helpful both during the sales process, implementation stage, and while migration was underway. The team continued to provide expert support and guidance for a smooth process that delivered fast results. ■
Huawei Helps CCCC Shanghai Dredging Co., Ltd. Reinvent Its Data Center

Background
Shanghai Dredging Co., Ltd. of China Communications Construction Company (CCCC) is the largest dredging company in China. It is responsible for waterway dredging, exploration, design, and measuring; shipbuilding; dredging software development; and dredging equipment and navigation mark manufacturing.

Key Challenges
To accommodate quick business growth, CCCC Shanghai Dredging Co., Ltd planned to build a data center to provide 24/7 data services. While building the data center, the customer faced the following challenges:
• Leading technologies
  The customer expected the data center to be leading and practical over the next ten years.
• Reliability
  The data center must provide redundancy design to deliver high reliability.
• Scalability
  The customer wanted to build the data center in phases. The first phase, the data center must meet immediate business needs and future smooth capacity expansion.
• Energy efficiency
  The data center must be energy efficient to reduce energy consumption costs.

Solution
Because the service volume did not reach 100 kW, CCCC Shanghai Dredging Co., Ltd decided to deploy Huawei's next-generation efficient modular data center solution. The All-in-Room IDS 2000 solution delivers high integration, security, and reliability, while reducing noise, footprint, and energy consumption. With a compatible architecture, the solution can be easily and flexibly installed, which fully met the customer's requirements for small and medium data centers.
• The solution neatly combines the modular uninterruptible power supply (UPS), energy-efficient precision air-conditioner, integrated power
"Huawei's data center solution helps us enhance data center efficiency and simplify operation and maintenance. It has set a benchmark for future data center projects at CCCC."

- CCCC Shanghai Dredging Co., Ltd. >>

distribution unit (PDU), fire control system, confined cold aisle, and modular capacity expansion technology to remain competitive over the next ten years.

- The solution deploys two UPS5000-E 80kVA modules in parallel redundant mode to deliver 96% energy efficiency and uses the N+X redundancy to achieve reliability higher than 1+1 redundancy.

- The solution also deploys carrier-grade 50 kW precision air-conditioners in 3+1 mode and reserves expansion pipelines and interfaces for the second phase, which facilitates future capacity expansion. The precision air-conditioners use the R410A refrigerant to reduce energy consumption.

- In the first phase, the solution deploys two data center modules, each with 16 cabinets, including integrate network cabling cabinets and power distribution cabinets. The solution offers emergency ventilation to automatically open skylights in case of an air-conditioner fault and ensure temperatures within the normal range.

- The solution deploys an industry-leading intelligent management system to centrally manage data center infrastructures, intelligent link L1 and L3, simplify operation and maintenance (O&M), and reduce energy consumption by about 10%. The solution also offers open interface protocols to interoperate with third-party devices.

Customer Benefits
Huawei has helped Shanghai Dredging Co., Ltd build the first modular data center at CCCC. Huawei’s solution has brought the following compelling benefits for the customer:

- The All-in-Room data center uses redundancy design to deliver Tier-5 reliability.
- Intelligent L1-L3 linkage improves management efficiency and reduces energy consumption by about 10%.
- The intelligent monitoring system displays and monitors the running status of devices in real-time and 3D manner, which greatly facilitates O&M while reducing maintenance costs.
Chongqing Rail Sees Clearly with Huawei Servers and Storage

CRT Line 6 Phase I Project

Background
Chongqing Rail Transit (Group) Co., Ltd. (CRT) constructs and operates urban rail systems and develops resources along the railway lines in the city of Chongqing. CRT planned seven railway lines with an estimated length of 513 kilometers. As of 2013, CRT had completed four lines (Lines 1, 2, 3, and 6), with a total track length of 197 kilometers. The four operating lines carry up to 1.5 million passengers daily, and form the basic backbone network of the Chongqing rail transit system.

Line 6 runs southeast to northwest for 65 kilometers, with 28 stations planned. The project consists of three phases. Phase I is 23.684 kilometers and is configured with 13 underground stations and three elevated stations. Phase I opened on September 28, 2012, and Phase II is planned to open by 2014.

Key Challenges
The existing system in Line 6 Phase I has three subsystems: communication, integrated video surveillance, and Automatic Fare Collection (AFC). In the communication subsystem, IT infrastructure for the Closed-Circuit Television (CCTV) system is of great importance.

The 16 stations and one depot in Phase I required more than one thousand analog cameras and one hundred High-Definition (HD) IP cameras. High performance server and storage systems were required to address the following challenges:

- **Capacity**
  One surveillance site must be equipped with an average of 80 cameras. Traditional Digital Video Recorders (DVRs), and common storage servers were incapable of saving HD surveillance videos at a 4 to 6 Mbit/s rate for 30 days.

- **Bandwidth**
  Cameras must capture videos and send them to storage through servers in real time, demanding high quality and high reliability of the servers and storage systems.
Building a new rail line in steep terrain is difficult, but add in the challenge of having complete CCTV coverage and normal computing and storage systems run into problems. When Chongqing Rail faced this challenge, they turned to high-performance servers and storage from Huawei.

**Performance**
The servers and storage systems must support real-time playback of all HD surveillance videos.

**Solution**
Huawei deployed RH2285 servers and S2600T unified storage systems in the CCTV system for Line 6 to deliver an end-to-end computing and storage infrastructure for CRT. Huawei’s solution has the following advantages:

- **Separated architecture**
  Computing and storage are separated to allow HD video access and to support high capacity data storage. This helps record, forward, and store HD video streams.

- **High bandwidth**
  Built-in network adapters, plus optional Peripheral Component Interconnect (PCI) network adapters, on RH2285 servers provide increased outbound network bandwidth to support analog and HD video data sent from cameras. These PCI-compliant network adapters double the original outbound bandwidth, and enhance the capability of RH2285 servers to support dual-link computing, which improves bandwidth utilization.

- **Massive storage**
  Compared to traditional DVRs and common storage servers, Huawei S2600T IP SAN storage system supports massive data storage. The IP SAN storage system is configured with dual controllers and supports storage capacity expansion to 200 hard disks by adding disk enclosures. For example, if 4 Terabyte (TB) hard disks are used, the IP SAN storage system provides up to 1 Petabyte (PB) storage capacity.

**Customer Benefits**
Huawei’s end-to-end computing and storage infrastructure provides the following benefits to CRT in its Line 6 Phase I project:

- **HD video surveillance**
  Huawei’s dual-controller S26000T IP SAN storage system and large-bandwidth RH2285 servers enable smooth reading and writing of surveillance videos at a high bit rate. This overcomes performance defects of traditional DVRs and eliminates problems such as blurred images and choppy video processing.

- **Enhanced scalability**
  Industry-leading scalability of RH2285 servers and S2600T storage systems addresses current computing and storage requirements and can be easily expanded to meet future demands. This feature also reduces the equipment room footprint for the customer.

- **7*24 video surveillance**
  Redundant configuration for key storage and server components enables the customer to access and use data anytime, while ensuring high reliability of the surveillance system and improving the customer’s capacity to handle emergencies.
Huawei's five core products – unified communications, contact centers, converged conference, telepresence, and video surveillance – provide solutions that free industrial customers from geographical and space limitations and help to build unified and efficient teams. Familiar applications include remote education, banking, offices, consultation, court sessions, and transportation monitoring.
Bringing Multi-modal Enterprise Collaboration to Your Fingertips
Huawei Full HD Telepresence Video Conferencing System Helps CAAC Improve Service Quality and Productivity

Background
The Civil Aviation Administration of China (CAAC), directly affiliated to the State Council of the People's Republic of China, is in charge of civil aviation affairs for the entire country. The CAAC manages seven regional authorities and forty-one airports. To deliver secure and quality aviation services, the CAAC was planning to adopt the latest Telepresence and videoconferencing solution to link its agencies at all levels throughout the country. The solution was required to meet the current needs such as to support emergency response, governmental affairs, service delivery, consultation, and training programs. In the mean time, it should be scalable and resilient so that the services can be smoothly expand to cover additional locations.

Key Challenges
Along with the booming Chinese economy, the air traffic has been growing significantly for years in China, setting an increasing pressure on CAAC in terms of management, coordination, monitoring and control. The CAAC adopted a videoconferencing solution in 2003 to link some of its agencies in response to these challenges, but it seems that after years of operation, the legacy standard-definition solution became outdated with the following weaknesses and defects, hindering its ability to make quick decision and take actions:
• The video quality was poor and became unacceptable
The legacy SD videoconferencing system provided video in CIF (352*288) resolution, which was becoming unacceptable for CAAC and its seven regional authorities. The videoconferencing room was filled with codex, microphones, cameras, TV and messy cables, which was very frustrating to the participants.
• The operation was complicated with very high maintenance costs
The legacy SD system needed a conference secretary to set up the system one day before the conference call to ensure it was working in the right manner. Audio and video devices in the room were difficult to manage since these devices were standalone alone
To deliver secure and quality aviation services, the Civil Aviation Administration of China CAAC was planning to adopt the latest Telepresence and videoconferencing solution to link its agencies at all levels throughout the country. Huawei delivered a full HD solution that combines Telepresence suite, HD videoconferencing system and HD MCU to renew the CAAC’s legacy solution.

Solution

Huawei delivered a full HD solution that combines Telepresence suite, HD videoconferencing system and HD MCU to renew the CAAC’s legacy solution.

To support executive virtual meetings, Huawei deployed TP3118S Telepresence product in the CAAC headquarters and 7 sets of TP3106 Telepresence product in the regional authorities. Taking the physical condition of the CAAC’s meeting rooms into consideration, Huawei customized some parts of the Telepresence products so that it can fit into the CAAC’s environment perfectly with superb audiovisual experience. For the average virtual meetings, Huawei deployed HD videoconferencing system in the seven regional authorities and forty-one airports. Both Telepresence and videoconferencing systems are being connected to the same Huawei Multipoint Control Unit (MCU). The Huawei solution delivers the following benefits:

• Customized Telepresence
  Huawei customized the Telepresence system by making the best use of existing meeting rooms to satisfy customer requirements in terms of dimension, quality, comfort and security.

• Ease of use
  The Huawei Telepresence solution uses a touch panel with an intuitive graphical user interface (GUI) as the videoconferencing room control device. It takes only several minutes for an average people to understand the videoconferencing operation. The CAAC executives now are able to convene and control video conferences by themselves with ease, thus removing the need of a secretary or technician.

• High system stability
  To improve system stability and ensure superb experience, Huawei employs multiple backup mechanisms for the MCU shared by Telepresence and videoconferencing systems. In addition, the core management system, switching system, and terminals are also designed with redundancies to ensure high availability. For example, the core switching system supports two-node clusters in backup mode.

• Improved O&M efficiency and reduced operation costs
  One MCU is being used for both Telepresence and videoconferencing systems, and the users can do mixed Telepresence and videoconferencing call when they need it, which dramatically improves O&M efficiency, resulting in operation cost reduction.

Customer Benefits

• Faster decision making due to effective video communication
  The Telepresence and videoconferencing system provides true-to-life video communication experience, and the participants just feel like "being there" due to the 1080p full HD video, directional sound and live content sharing. This makes the communication much more effective between CAAC HQ and its branch agencies, resulting in faster decision making process.

• Cost saving due to better usage on videoconferencing facilities
  Instead of using a videoconferencing technician, the intelligent control and SiteCall functions enable every participant to convene Telepresence and video calls by itself at any time. More and more CAAC staff is turning to use Telepresence and videoconference to carry out business meetings, resulting in productivity improvement and cost reduction.

• Reliable video service thanks to carrier-grade stability
  The carrier-grade MCU ensures non-stop videoconferencing service, 24 hours a day and 7 days a week. The CAAC staff can do Telepresence and videoconferencing call at any time when they need it without worrying about service availability.
Video Surveillance and Digital Road Management System

Traffic Video Surveillance Project in Guangdong Province

Background

The Road Management Bureau in Guangdong Province is responsible for the inspection and maintenance of all provincial highways and national highways in the entire province. Guangdong now boasts the most extensive highway network in all of China, with a total length of 190,143 kilometers. Being a model in the industry, the Guangdong Road Management Bureau wishes to set a good example in "road inspection and maintenance" through new technologies. In 2012, the Guangdong Road Management Bureau assigned Qingyuan Municipal Road Management Bureau to reform road inspection, laying the foundation for road management throughout the entire province.

Key Challenges

Guangdong Province has a large area of highway mileage, and faces the following major challenges:

• Inconvenient evidence-gathering with traditional digital cameras

In traditional work models, traffic inspectors use digital cameras to photograph and document roadside scenes, which is feasible for such problems as traffic accidents, vehicle breakdowns, road construction, and broken roads, but not for other incidents, such as illegal driving behavior, scattered cargo, and severe weather conditions. The customer is in dire need of HD vehicle-mounted surveillance systems to improve work efficiency.

• Difficult access to road information in vital transportation areas

When a natural disaster occurs or when adverse weather conditions (such as heavy fog, rain, snow, ice, wind, and flooding) are present on a stretch of road, it is important to obtain real-time information about road conditions in such vital transportation areas as tunnels, bridges, and hillsides; publish road information; and execute contingency plans. However, information and images of these vital areas are difficult to obtain, for adequate power cannot be supplied to all of these areas.
Solution
To meet the customer's demands for establishing a digital vehicle-mounted road inspection system, Huawei actively provides end-to-end video surveillance products and an integrated video surveillance solution to build a vehicle-mounted system to provide surveillance over these areas.

The Huawei-provided video surveillance solution incorporates the following features:

• **Digital vehicle-mounted inspection**: The vehicle-mounted surveillance system records the entire inspection process. The recorded videos can be stored for a long time as evidence for law enforcement, which greatly improves the customer's inspection efficiency in evidence-gathering.

• **Key road information connection through multiple technologies**: By integrating wind and solar energy power supply, 3G video surveillance, and on-site weather data collection technologies, Huawei's video surveillance solution enables live video surveillance in remote areas or in the event of severe natural disasters, which offers precious first-hand on-site materials for emergency handling.

• **Open platform that complies with standard protocols**: By complying with standard protocols, the road management system can connect to the platforms in the traffic surveillance center, such as the Traffic Guidance Information System (TGIS), public information service, and electronic map system, which ensures collaboration management and improves work efficiency.

Customer Benefits

• Qingyuan has become the first city to use the digital vehicle-mounted road inspection system. Huawei's digital traffic surveillance products help the customer enhance law enforcement methods and improve work efficiency by approximately 20% to 30%. The system also reduces the rate of false alarms.

• The solution improves inspectors' response time to emergencies and natural disasters by providing road information about vital transportation areas in real time.

• By integrating multiple systems, the solution achieves collaborated road management, including obtaining real-time information, executing contingency plans, notifying related departments, and informing the public — all of which largely improve the public sector's capacity to protect people's lives and property.
Utilizing its solid background in LTE, CDMA, and GSM mobile communication technologies, Huawei offers enterprise customers broadband trunking, video surveillance, long-distance coverage, E2E encryption, Location-Based Service (LBS), SMB solution LitePTT, GSM-R railway wireless dispatch, and high-speed train control infrastructure solutions.

Boundless, Professional Wireless Broadband
Boundless, Professional Wireless Broadband
Huawei GSM-R Improves Municipal Administration and Traffic Conditions for Sochi

Background
To improve livelihood and traffic condition, the Russian government invested heavily in the construction of new facilities. The Sochi railway was a top priority because it is 1st GSM-R line in Russia Railway, and also connects the main station in Sochi. The railway needed to be put into operation before the end of 2013.

The Sochi railway was constructed by the Joint Stock Company Russian Railways (JSC RZD). Founded in 1992, JSC RZD is the largest transport company in Russia. The government-owned company oversees a network of about 85,500 kilometers of railroads spanning 11 time zones, the second largest in the world, behind that only of the United States. JSC RZD has more than 8000 dispatching stations and 17 trunk lines. It carries over 1.3 billion passengers and 1.3 billion tons of freight every year.

Key Challenges
The Sochi railway leverages an advanced train control system that transmits train-ground information based on GSM-R. The railway was expected to serve millions of athletes and tourists after railway official operation. The railway faced challenges from low temperatures because trains would shuttle between Sochi and the snow-capped mountains in Krasnaya Polyana. Stability is a priority for communications devices running in low temperatures.

The trains were designed to run at an average speed of 180 km/h and a maximum speed of 400 km/h, posing high requirements for network security and reliability. Because the railway had to be put into operation before the end of 2013, the project also required a short construction period.

Multi-site co-cell: ensuring network security and reliability
After a month of stringent interoperation testing, Huawei's GSM-R solution was eventually chosen by JSC RZD.

Based on digital modeling of the live network environment, network architecture, and device capabilities, the solution uses Huawei's mature GSM-R technology and in-depth security and reliability assessment to deliver five-nines reliability (99.999%).
To improve traffic condition and municipal administration, Huawei help Russia to build 1st GSM-R line in Sochi, a Russian city located on the Black Sea coast. To provide long-term security and allow the Sochi railway to operate efficiently, Huawei offered a superb Global System for Mobile Communications - Railway (GSM-R) network with hot-standby features for all network elements (NEs).
Digitalization: an inevitable trend for railway networks

South Africa, located at the southern tip of Africa, has the largest economy on the continent and plays a leading role in the region’s economic development. Its GDP accounts for about one-third of the total GDP of the sub-Saharan African countries. With the most developed railway network in Africa, South Africa has a total railway length of approximately 34,100 kilometers (including 18,200 kilometers of electric railways) and 2,000 electric locomotives. However, railway passenger volume has decreased due to the large number of passengers who have shifted to transport by road. To attract more railway passengers with faster, more comfortable and convenient services, the South African Department of Transport has attached great importance to the digitalization of railway networks and has taken appropriate actions.

Founded in 2009 and administered by the Department of Transport, PRASA is the largest passenger railway company in South Africa with 2300 kilometers of railways. But PRASA’s railway network is outdated and urgently in need of upgrading. To build Africa’s most advanced passenger railway network with improved transport efficiency and service quality, PRASA has earmarked USD15 billion since 2011 to reinvent its existing networks. The plan involves 7724 new locomotives, signal systems in four regions, and wireless communication systems in three regions. The first new locomotive is scheduled to be put into operation in 2015.

PRASA also plans to reinvent its wireless communication systems for the railways connecting major cities, including Cape Town, Durban, and Gauteng. Existing wireless communication systems use the outdated Ministry of Posts and Telegraph 1327 standard (MPT 1327 is a signaling protocol standard for analog radio).

High security and efficiency requirements for ultra-long distance

As the first GSM-R system in South Africa, the new system will cover Cape Town, Durban, and Gauteng along 1200-km railways with a total of 196 stations. Due to the current unbalanced distribution of backbone transmission resources among different regions, the new system must also take appropriate measures to save optical fiber resources. The
The Passenger Rail Agency of South Africa (PRASA) is a state-owned company responsible for most passenger railway services in South Africa. Huawei is helping PRASA deploy a Global System for Mobile Communications - Railway (GSM-R) system along its 1200-km railway. The GSM-R system will allow the South African railway network to enter the cutting-edge digital age and to play a primary role in planning and building future railway networks for South Africa and its neighboring countries.

Existing network structures are complex because the networks were constructed in phases over many years. The new system must seamlessly interconnect three signal systems from different vendors and offer adequate geographical redundancy to ensure smooth and secure railway operations. At the same time, the new system must meet the European Train Control System Level 2 (ETCS L2) standard. To meet these conditions, PRASA needed a GSM-R vendor with extensive ETCS L2 delivery experience as well as localized delivery and training capabilities.

Reliable bearer network tailored to individual needs
Huawei is the GSM-R vendor that PRASA has been looking for. Huawei offers a customized wireless communication solution to reliably build railway scheduling and data communication systems before the end of 2015. The solution includes GSM-R core networks and scheduling and transmission systems. The solution leverages an impressive array of technologies, including all-NE hot standby, intra-frequency co-site and dual-network coverage, and Synchronous Digital Hierarchy (SDH) to ensure service continuity and maximize frequency utilization.

In addition, the solution leverages distributed base station technology to implement quick and flexible network coverage in diverse scenarios (such as tunnels and crossing lines) along the Cape Town, Durban, and Gauteng railways. Cutting edge softswitch core network products dramatically improve data transmission efficiency, simplify network management, reduce operating costs, and support smooth evolution from the old to the new system. Also, the multi-RRU (remote radio unit) co-cell technology expands cell coverage, reduces cell switchovers, increases quality of service (QoS), and saves a large amount of optical fiber resources.

Thanks to its rich network design, delivery, and maintenance experience from more than a decade in the communications industry, Huawei deeply understands PRASA's needs and offers quality services to help improve South Africa's rail efficiency and service.

Cutting-edge digital age
This project marks the first application of ETCS L2-compliant train control systems in Africa. With Huawei’s end-to-end GSM-R system, PRASA will achieve a secure and efficient operation and improve rail transport efficiency. The GSM-R system will help not only the South African railway network enter the cutting-edge digital age, it will also play a pivotal role in planning and building future railway networks across South Africa and its neighboring countries.
Huawei GSM-R Helps Turkmenistan Build a Steel "Silk Road"

**Economic development needs efficient operation of the railway**

As the second largest country in Central Asia, Turkmenistan is located at the center of the Eurasian continent and has been an important transport hub since ancient times. Due to Turkmenistan's continuous economic growth in recent years, rail has become an essential means of transportation between Europe and Asia. As such, upgrading its railway network has become inevitable.

With a North-South and East-West railway network layout, Turkmenistan has a total railway length of approximately 3000 kilometers, which passes through 696 bridges and tunnels and includes 169.3 kilometers of dedicated lines.

Turkmenistan's Ministry of Railway Transportation is responsible for railway services in the country. To improve railway transport efficiency and boost economic growth, the Ministry plans to deploy cutting-edge communications technologies and spread over seven phases to modernize its existing railway network within ten years.

**Multi-dimensional challenges**

constraint railway upgrade

Turkmenistan's current railway network has been operational since the former Soviet Union period. The outdated communication systems have lowered the operational efficiency of major lines. For example, traveling from end to end on the Ashgabat-Karakum-Dashoguz railway, one of the major lines stretching 540 kilometers, takes more than 20 hours because trains can drive at a maximum speed of only 60 km/h. Low railway operational efficiency has hindered the country's economic growth and caused great concern for the government.

Moreover, trains in Turkmenistan must traverse a large number of bridges and tunnels. Existing communication technologies cannot enable full network coverage over railway sections, particularly in tunnels where trains drive "blindly" due to train-ground communication disconnection. As a result, environmental complexities have posed immense security challenges.

Upgrading the network will modernize the communication systems for the 590 kilometer-long East-West railway, improve the railway operational efficiency, and play an important role in future railway network construction.
To modernize communication systems for North-South and East-West railways in Turkmenistan, Huawei has offered a cutting-edge Global System for Mobile Communications - Railway (GSM-R) solution. This solution allows the Turkmenistan government to leverage steel and modern technologies to build a new "silk road", which will become an important transport hub connecting Europe and Asia. >>

**GSM-R: high security and efficiency**

Outdated analog train control technologies are used in the current railway network. Such technologies do not apply to large-scale networking and are a bottleneck in improving the railway's efficiency. To help customers address the challenges, Huawei offers a mature GSM-R solution tailored for customer needs.

Huawei's end-to-end GSM-R solution includes core, wireless, and transmission networks. Working with signal devices along the railway, the solution offers full network coverage over all railway sections. The solution leverages high-speed adaptive algorithms and cell priority features to seamlessly interconnect railway communications systems in various regions. The solution also uses a unified platform that supports smooth evolution to a Long Term Evolution (LTE) network, offering more reliable and diverse applications for railway systems.

In addition, the solution leverages distributed base station technology to implement quick and flexible network coverage in diverse scenarios (such as bridges and tunnels). Wireless communication is extremely complex in tunnels. To resolve technical difficulties, such as high call drop rate, the solution uses the multi-RRU (remote radio unit) co-cell technology to cover a single tunnel with the same cell, ensuring high signal quality, communication continuity, and operational security.

Turkmenistan’s Ministry of Railway Transportation has planned to modernize the entire railway network in seven phases. Based on its rich experience in the railway industry, Huawei has also offered a unified scheme for the seven phases to maximize the value of existing devices and guarantee the compatibility among various railway lines.

**Vibrant steel "silk road"**

Huawei's GSM-R solution is expected to significantly improve railway efficiency and service quality in Turkmenistan. The steel "silk road" will help the country boost economic growth, increase interactions with neighboring countries, and enhance its position in the region.
Huawei GSM-R Helps Zambia Build Africa's First ETCS L3 Railway

**Economic diversification: promoting a railway network**

Zambia is a landlocked country in Southern Africa. ZRL is Zambia's national railway operator and manages two major railway lines with a total length of 2166 km, including the Zambia Railway (1280 km) and the Tanzania-Zambia Railway (Tanzam Railway, 886 km in Zambia). However, railways only handle about 20% of the total freight in Zambia as a result of high rail transport costs and an aging infrastructure in need of repair.

To promote economic diversification (agriculture, tourism, and mining) in North Western and Southern provinces and to strengthen economic cooperation with neighboring countries, Zambia has increased its investment in optimizing railway infrastructure and building new railway lines.

Upgrading the communication system for the 950 km-long Livingstone – Chingola railway is now on the agenda. ZRL wants to improve the annual freight capacity of the railway by more than 50%.

**Multidimensional challenges before upgrading**

The existing communication system uses ultra high frequency (UHF) and very high frequency (VHF) wireless networks, resulting in poor voice quality, low operational efficiency, and co-channel interference. To address these problems, ZRL wants to upgrade the existing communication system with mature and reliable GSM-R.

Another significant challenge is how to smoothly upgrade the communication system with limited funds. The new GSM-R solution must maximize existing communication resources and offer a customized upgrade without compromising system reliability.

Because the Zambia IT staff has a limited technical background, ZRL needs a vendor with robust project implementation, delivery, service, and training capabilities to ensure efficient system operation and maintenance (O&M).
Huawei is offering a cutting-edge Global System for Mobile Communications - Railway (GSM-R) solution for Zambia Railways Limited (ZRL) to build Africa's first railway that complies with the European Train Control System Level 3 (ETCS L3) standard. Huawei's GSM-R solution is expected to significantly improve railway operational efficiency and boost economic diversification.

Seamless interconnection and integration
Huawei is the GSM-R vendor that ZRL has been looking for. To interconnect the existing communication system and ensure system reliability and availability, Huawei offers a GSM-R solution that complies with the industry's leading ETCS L3 standard. Compared to ETCS L1 and L2, ETCS L3 features fewer trackside devices, lower total cost of ownership (TCO), and increased dependability.

Huawei's GSM-R solution enables full wireless coverage over the railway. The solution enables hot standby for all NEs, including core network devices, by using a variety of approaches, such as mobile switching center (MSC) server dual homing and controller (BSC) geographical redundancy, and transceiver redundancy. To address the considerable distance between railway stations, GSM-R leverages industry-leading power boost technology (PBT) and "soft-splitter" technology to expand base station coverage by more than 25%. Dual-channel microwave transmission replaces optical fiber transmission, reducing customer construction costs while ensuring system availability.

More importantly, the solution seamlessly integrates UHF and VHF wireless networks and makes full use of existing communication resources, such as towers, equipment rooms, and power supply systems. End-to-end resource migration dramatically improves migration efficiency.

Huawei has strong service capabilities in Zambia. Huawei has deployed several 2G and 3G networks in Zambia and has a proven track record in delivering a full range of railway projects worldwide, ensuring successful project implementation. During project delivery, Huawei will host a series of training courses for ZRL technicians to improve technical skills and ensure smooth system O&M.

Modernizing the railway network
Upon completion of this project, Huawei's GSM-R solution will enhance transport capabilities for the Livingstone – Chingola railway and promote economic diversity along the line. The ETCS L3-compliant GSM-R project will set a positive example for future projects across Zambia and its neighboring countries, and improve Zambia's international profile.
Making a Breakthrough in Turkey Railway Market

Huawei ETCS L2-Compliant Communications Solution for EKB (Eskisehir, Kutahya and Balıkesir) Line

Background

TCDD is a government-owned national railway carrier in the Republic of Turkey, headquartered in Ankara. TCDD now controls approximately 12,000 km of railways and owns eight passenger transportation lines and seven freight transportation ports, with a workforce of more than 32,000 employees. Each year, TCDD carries over 25 million tons of freight and more than 90 million passengers. Up to date, TCDD has taken up 72% of Turkey’s railway market share.

Key Challenges

When constructing the EKB line, the main challenges are faced in:

- Radio coverage
  Turkey has a complex topography, with predominantly plateaus and mountains. The EKB line is 484 km in total, along which there are 42 tunnels. Under such geographic environments, TCDD was very concerned about how to ensure radio coverage in tunnels and how to flexibly deploy sites.

- Interoperability
  The EKB line is Turkey’s first Train Control System Level 2 (ETCS L2)-compliant high speed railway constructed by Huawei. Because TCDD’s current core network was provided by other vendor, TCDD required the new vendor for the EKB line to offer devices that can interoperate with core network, thereby ensuring the train control security. Further, TCDD hoped that the vendor could provide peripherals except for the signaling system devices, and that their devices could easily integrate with these peripherals.

- Network security
  Turkey’s high speed railway projects are essential to Central Asian railway network, and some of Turkey’s railway lines are connected to Turkey’s neighbors, such as Turkmenistan and Azerbaijan. To ensure the efficiency and security of crosscountry transportation, TCDD asked high requirements for network security.
The EKB (Eskisehir, Kutahya and Bafıkesir) line is an integral part of the "Nine-Year Plan for High-Speed Railway" launched by the Turkish State Railways (TCDD). Once the EKB line is put into operation, it will greatly decrease the travel time between major cities Eskisehir, Kutahya, Afyon, and Bafıkesir. The EKB line, together with other high speed lines, will better bridge Turkey and Central Asian countries.

Solution

In response to TCDD’s stringent requirements for network security, Huawei offered an ETCS L2-compliant communications solution. Huawei's solution has the following key features:

• **DBSs ensure radio coverage in tunnels and simplify site deployment**

  To resolve the radio coverage and site deployment problems, Huawei introduced an industry-unique Distributed Base Station (DBS) solution. This solution uses Remote Radio Unit (RRU) multi-site cell technology to ensure improved Quality of Service (QoS) and to simplify site deployments, highly praised by TCDD.

• **ETCS L2-compliant Huawei devices successfully interconnect with other vendor devices**

  Huawei's solution ensures good inter-operability with the devices from other vendor. This has been proven during the ETCS L2 and CTCS L3-based Inter-Operability Testing (IOT) with devices provided by other vendors in DB-Systel labs and also on the Beijing - Guangzhou – Shenzhen – Hongkong Express Railway Link (XRL) project.

• **Huawei devices are easy to integrate with third-party devices and enhance collaboration capabilities**

  Railway applications are backed by the collaboration of multiple communications units. Therefore, a vendor's communications solution must consider the inter-operability with third-party peripherals and signaling systems. In this project, Huawei's Global System for Mobile Communications – Railway (GSM-R) solution efficiently interoperates with third-party peripherals and signaling systems from European and local well-established vendors (for example, with Frequentis' railway dispatch and telephony systems, with Funkwerk's vehicle-mounted stations, and with Sierra Wireless' handheld devices). Those interoperability cases prove that Huawei is able to provide an end-to-end solution.

• **BTS ring network enhances network security**

  In Huawei's solution, a maximum of five Base Transceiver Stations (BTSs) form a ring. Therefore, two links (active and standby) are set up between BTSs and a Base Station Controller (BCS), preventing transmission links from the Single Point of Failure (SPOF).

Customer Benefits

When the project completes, the EKB line will significantly reduce the travel time from Istanbul to Ankara via Eskisehir to approximately 3 hours and 10 minutes from the current 6 or 7 hours. Also, this line will better bridge Turkey's several major cities and helps fuel local economic development. Actually it's not only a safe, affordable, green transportation for everyone, but also a new congestion-relieved mobility while congestion happens on highways and runways. The investment in EKB line infrastructure can make fuel efficient, requiring less than 20% of the fuel used by commercial trucks to move the same quantity of cargo over the same distance. This reduces operating costs and drastically reduces CO2 emissions and other air pollutions.
Huawei Digital Railway Solution Helps Operate the World's First High-Speed Railway in the North Frigid Zone

GSM-R Project for the Harbin-Dalian High-Speed Railway

**Background**
The Harbin-Dalian high-speed railway is the high-speed passenger transportation line that connects Harbin, China's Heilongjiang province and Dalian, China's Liaoning province. It is 921 km long in total, with a designed speed of 350 km/h. As an important part of China's "Four Vertical and Four Horizontal" railway development strategy, the Harbin-Dalian high-speed railway will better bridge major cities along this line and also enhance ties between major cities in China's northeast region and pivotal cities such as Beijing, Shanghai, and Tianjin.

**Key Challenges**
The Harbin-Dalian high-speed railway adopted the Chinese Train Control System Level 3 (CTCS L3) control system which is equivalent to the European Train Control System Level 2 (ETCS L2), and used GSM-R technologies for communications between trains and stations. The construction of the railway faced the following challenges:

- **Stable running of equipment under extreme weathers**
  China's northeast region has long winters and low temperatures that can be lower than -40°C. Devices must therefore be stable for a long time at low temperatures.

- **Support for fast design speed**
  Trains on the railway are designed with a speed of 350 km/h and use the trainmounted control system to communicate with stations, which requires highly...
The Harbin-Dalian high-speed railway is the world’s first high-speed rail in the North Frigid Zone that has been put into commercial use. Huawei offered a field-proven GSM-R solution to this project, which has been used in many other high-speed railway projects. Huawei now owns over 48% of the railway communications solution market in China, and has become a trusted partner for China’s railway projects.>

The Chinese railway industry is experiencing leapfrogging growth. Without compromising construction quality, a short construction period can significantly ease transportation pressures and promote economic development along the railway.

The system frequency planning and design faced great challenges in intersection regions due to limited resources for radio frequency. Radio interference may result in network quality deterioration and even communications interruption.

Solution
In response, Huawei offered a field-proven GSM-R solution to this project. This solution has been used in many other high-speed railway projects, such as in the Dalian-Qinhuangdao, Beijing-Jiulong, Guangzhou-Zhuhai, and Guangzhou-Shenzhen high-speed passenger and freight transportation lines. Huawei now owns over 48% of the railway communications solution market in China, and has become a trusted partner for China’s railway projects.

Based on the site requirements of the Harbin-Dalian high-speed railway, Huawei provided an end-to-end, highly reliable GSM-R solution with the following features:

- The solution uses the MSC dual-homing, BSC geographical redundancy, and carrier backup technologies to enable hot-backup for all network elements (NEs) and core networks.
- Based on the communications conditions on high-speed trains, Huawei developed dedicated features and algorithms to ensure service continuity.

To solve problems in frequency design and cell hand-off control in intersection regions, Huawei used the industryleading distributed base station technologies to:

- Simplify frequency design.
- Enlarge the coverage area of cells.
- Reduce cell hand-off frequencies.
- Ensure capacity support for intersection regions.
- Ensure smooth network switching.
- Provide security assurance for train control signals.

To ensure that the high-speed railway can be put into commercial use in 2012, Huawei co-operated with the signal system provider, Bombardier, and the two parties completed a series of Inter-Operability Testing (IOT) examinations. This move ensured normal operation of system services and shortened the project construction period.

Customer Benefits
Upon completion, the Harbin-Dalian high-speed railway has its minimum departure interval reduced to three minutes. As a result, passengers can travel from Harbin to Dalian in only three hours, and the passenger transportation efficiency is significantly improved.

Since starting its commercial use in December 2012, the Harbin-Dalian high-speed railway has run stably with Huawei’s GSM-R equipment despite 15 snowfalls. The stable operations help realize the goal of secure and efficient transportation and promote the economic development in the northeast region of China.
Advanced and Green CTCS L3 High Speed Railway Through Hong Kong

Guangzhou–Shenzhen–Hong Kong XRL Project

**Background**
Carrying an average of 4.9 million passengers every weekday, the MTR is regarded as one of the world's leading railways for safety, reliability, customer service, and cost-efficiency. To perfect China's high speed railway link network and enhance communication between Hong Kong and the Chinese mainland, Guangzhou-Shenzhen-Hong Kong XRL is a strategic railway project that must align with the Chinese Train Control System Level-3 (CTCS L3) (equal to European Train Control System Level-2 (ETCS L2) standards). This XRL consists of two sections: the Guangshen and Hong Kong sections. The 102 km Guangshen section opened on December 26, 2011. Trains on the Guangshen section will run at speeds as high as 350 km/h. The entire Guangzhou – Shenzhen – Hong Kong XRL is scheduled to open in 2015. Now, this XRL is the Pearl River Delta cross-boundary transport infrastructures.

**Key Challenges**
Trains will run on the Hong Kong section at high speeds and must negotiate a complex geographic environment. In view of the requirements, Guangzhou Railway and MTR were concerned about ensuring railway security, reliability, and efficiency. For the communications system, Guangzhou Railway and MTR were facing the following challenges:

- **Tunnel**
The Shiziyang Tunnel was the most important tunnel in the Guangshen section. This tunnel crosses the Pearl River estuary with a length of 10.8 kilometers. It is designed for speeds up to 350 km/h - the fastest underwater tunnel in the world.
The 142 km Guangzhou – Shenzhen – Hong Kong Express Rail Link (XRL) connects Hong Kong, Shenzhen and Guangzhou. Huawei offered a Global System for Mobile Communications – Railway (GSM-R) wireless dispatching solution for Guangzhou Railway (Group) Corporation (Guangzhou Railway) and Mass Transit Railway (MTR) to address their high technology requirements under complex operating scenarios.

• Operator
Two railway operators manage the Guangshen and Hong Kong sections — Guangzhou Railway and MTR. This raised the challenge of how Guangzhou Railway and MTR would co-operate in constructing and operating a cross-border XRL under secure, fast, and efficient mode.
• Inter-operability
The Base Station System (BSS) layer in the Hong Kong section must inter-connect with the Network SubSystem (NSS) layer in the Guangshen section. Signalling of the two sections were provided by different vendors, which increased requirements on device interoperability and interface openness.
• Coverage and interference
Multiple interference factors exist along the railway, including radio signals from UMTS 900M cellular systems, which increased difficulties of signal coverage and network planning.

Solution
The Guangshen runs on a bridge across the Pearl River while the Hong Kong section connects Shenzhen and Hong Kong through tunnels. Both sections carry high-speed rail traffic and run through complex geographic environments, and demand wireless dispatch systems with 99.999% reliability along the entire network. Huawei offered a solution tailored to the customers' high network security and reliability requirements. Huawei's solution has the following key features:
• System-level redundancy
Because of multi-underwater tunnels, especially Shiziyang Tunnel, both sections required class-leading signal coverage. After field surveys and precise network planning, Huawei offers a solution that uses system-level redundancy backup to improve the security and reliability of the communications system.
• Joint operation of Guangzhou Railway and MTR
The Guangshen and Hong Kong sections are operated by two railway operators. However, the core networking equipment of the Guangzhou-Shenzhen-Hong Kong XRL was designed to reside in Guangzhou. To both connect and isolate the networks of the Guangshen and Hong Kong sections, Huawei deployed one Base Station Controller (BSC) for the Guangshen section and another for the Hong Kong section. The two BSCs helped the cross-border BTSs better manage edge network planning and reduce interference. Additionally, in Huawei's solution the MTR's BBS layer connects to the Operations Support System (OSS) in Guangzhou Railway, while MTR's Fiber Access System (FAS) directly connects to the FAS in Guangzhou Railway. Therefore, Guangzhou Railway and MTR can collaborate with each other efficiently, achieving synchronous dispatching and operation.

**Field-proven device interoperability**

Railway communications is founded on collaboration among multiple communications units. The GSM-R solution must ensure interoperability with all third-party devices, including railway signaling system. The communications part of this project also involved a large number of third-party devices, such as third-party dispatch systems and hand-held devices. Huawei GSM-R devices had solved these challenges well.

**Coverage and interference**

Railway communications system must be immune to interference. Huawei's solution uses guard space at the edge of the band and leaves
a 2.7-MHz space between the center frequencies of UTMS and GSM-R networks. Huawei’s solution reduces interferences from sites located away from railway tracks by decreasing their UMTS900M transmit power.

Customer Benefits
The Guangzhou – Shenzhen – Hong Kong XRL project connects Pearl River Delta (PRD) 1-hour, and Beijing 10-hour economic and living circles, and reaches 16 cities of China’s mainland. This project will promote Hong Kong up to HK$87 billion in economic development over the next 50 years and further consolidate Hong Kong’s position as a regional center.

Additionally, this project brings new railway operation and technology innovation values to MTR and upgrades the reliability of wireless communications.

- Railway operation
  Huawei’s comprehensive end-to-end wireless solution lays a solid groundwork for MTR’s secure, efficient, and green railway operation

- Technology innovation
  This project breaks through conventional system-level communications redundancy and signal coverage technologies, enhances the modernization of the railway communications equipment, and paves the way for standard railway communications in both Hong Kong and China’s mainland.
Developing the World's First Metro LTE Network for Train-Ground Wireless Communications

LTE Train-Ground Wireless Communications Project for Zhengzhou Metro Line 1

Background
Zhengzhou is a major city and transportation hub in the central region of China. Zhengzhou municipal government has decided to speed up the development of the urban railway transportation system to improve traffic conditions and support the city's sustainable development. The government expected the metros to take 60% of the public transportation loads in the central business district of the city.

Six metro lines will be constructed in Zhengzhou as per layout of metro network, including three east-west lines, two north-south lines, and one ring-shaped line. The total length will be 202.53 km. Metro line 1 is the first metro line in Zhengzhou, 26.2 km will be constructed in Phase 1 project. The operation of Metro line 1 will relieve the city's east-west direction traffic pressure and enhances the connection between new and old towns in Zhengzhou.

Key Challenges
The train-ground wireless transmission is a bottleneck of urban railway transportation services. The Zhengzhou municipal government faced the following challenges in determining an appropriate wireless communications system:
- Slow and unstable data transmission in the Passenger Information System (PIS)
- Traditional PIS systems use local data recording solution or using the wireless local area network (WLAN) for real-time data transmission. The data recording solution does not support real-time information services, which cannot realize the
As one of the megacities in the central region of China, Zhengzhou urgently needed an advanced metro communications system to improve the quality of the city’s public transportation services. Huawei’s Long Term Evolution (LTE) train-ground wireless communications solution has provided highly reliable and stable communications services for Zhengzhou’s metro line 1 to improve service quality, enhance operation security, and raise transportation efficiency.

- Problems for vehicle-mounted devices to upload live videos to operation center
    Due to the low uplink data transmission capacity, train-mounted communications devices cannot efficiently upload live video surveillance data to operation center, which cannot meet the requirements of public security protection.

- High fault rate and difficult maintenance
    The WLAN solution uses access points (APs) to provide communications services. A single AP covers a maximum of 200 meters and has low reliability. To ensure full coverage and high reliability, a large number of devices that require power supply units must be deployed, which results in the high fault rate and difficult operation and maintenance (O&M).

Solution

Based on the rich experience in developing LTE end-to-end solutions and the customer’s service requirements, Huawei has provided an all-in-one LTE wireless communications solution to provide data transmission services for the PIS and train-mounted video surveillance system.

The solution is based on professional Huawei network planning and leverages LTE’s advantages in access performance and service bandwidth in fast moving scenarios. This solution provides approximately 20 Mbit/s downlink bandwidth, which has set a good example for the live and HD PIS in the urban railway transportation industry in China.

The Huawei LTE system works in Time Division Duplex (TDD) mode, which enables the system to provide large-bandwidth uplink data transmission services with limited frequency resources, meeting the requirements of the wireless transmission of live HD surveillance videos.

The system also uses a comprehensive Quality of Service (QoS) mechanism to perform refined service priority management. When the network is not congested, the system has low delay, minimized packet loss rate, and high QoS. When the network is congested, the system ensures that key services have the required bandwidth resources. The network bears the service data of the PIS and video surveillance system, which lowers the network development costs and lays a solid foundation for future wireless service expansion.

The LTE is a future-proof mobile communications technologies and mainstream technology that facilitates the evolution from 3G to 4G. The stability of the LTE technology has been tested in global markets. The mean time between failures (MTBF) of LTE remote radio units (RRUs) is not less than 150,000 hours, which is much higher than that of the WLAN APs (50,000 hours).

With the boundless, professional wireless broadband...
industry-leading 20 W single-channel transmission power and LTE's first-class service switching performance, each RRU covers a distance of 1200 meters, which dramatically decreases the number of power supply units, significantly reduces the deployment costs, and simplifies the O&M over the customer's wireless network

Customer Benefits
The metro LTE train-ground wireless communications solution ensures the stable and efficient operation of PIS in Metro Line 1, which has brought the following social and economic benefits:

- Better brand image for Zhengzhou's urban railway system
  With the world's first metro LTE system for train-ground wireless communications, the project provides a high-speed, stable, and reliable train-ground wireless data transmission network. It has made metro line1 in Zhengzhou as an excellent example in the industry of urban railway transportation.

- Optimizing user experience and service quality
  Traditional WLAN train-ground wireless communications systems suffer frequent signal interruption and blurry videos, while Huawei's LTE train-ground wireless communications network provides high QoS and uninterrupted data transmission channels. The latter can ensure that trains can obtain continuous information and perform real-time communications with the station and OCC, which substantially improves the metro service quality.

- Enhancing security protection and emergency response
  Metro line 1 in Zhengzhou uses the LTE train-ground wireless communications system to perform live video surveillance and data monitoring for carriages, which enables the management personnel to obtain real-time information about trains and enhances the security protection and emergency response capability.

- Improved O&M efficiency and cost-effectiveness
  The traditional WLAN solution suffers the high fault rate, massive device deployment, and difficult O&M. The LTE train-ground wireless data transmission system leverages Huawei's highly reliable and secure design of wireless communications devices in the railway transportation, which improves the O&M efficiency by more than tenfold.
Huawei Enterprise Business Group ("Huawei Enterprise") is one of the three business groups of Huawei, a leading global information and communications technology (ICT) solutions provider. By leveraging our strong R&D capabilities and comprehensive technical expertise, Huawei’s strategy in the enterprise domain focuses on close cooperation and integration with partners to deliver a wide range of highly efficient customer-centric ICT solutions and services that are based on a deep understanding of customer needs. In line with our strategy, we offer a broad portfolio of innovative ICT solutions that cater to global vertical industry and enterprise customers across government and public sector, finance, transportation, energy, large enterprises, communications and multiservice operators (MSOs), and small and midsize enterprises (SMEs). Our portfolio covers enterprise networking, unified communications & collaboration (UC&C), cloud computing & data center, enterprise wireless, network energy and infrastructure services.