



Huawei Power Transmission and Transformation Communication Solution



HUAWEI ENTERPRISE ICT SOLUTIONS **A BETTER WAY**





Foreword

Transmission networks are undergoing a modernization in order to be prepared for the next decades on the changing environment. These can be described by the integration of renewable and distributed energy sources, the appearance of the electrical mobility and the continuing cost pressure. The role of the communication systems being deployed in energy networks is significantly raised. To meet the demand for grid-connection of large-scale cross-region power transmission and new energy power generation, the advantages of the information and communications technology (ICT) should support end-to-end data collection, information communications, and smart dispatching to ensure stable and secure operations of power grids.

As a leading global ICT solutions provider, Huawei has a proven track record in the ICT field. We are committed to providing comprehensive and efficient ICT solutions for global customers in industries such as utilities, the government, the public sector, finance, transportation, energy, and corporations, and to help industry customers enhance their core competitiveness through ICT technologies. Huawei has launched its power transmission and transformation (T&T) communications solution to help power companies realize smart management of their T&T communication system with cost-effective operations.

Huawei's T&T communications solution includes a backbone network solution to target the wear parts of network infrastructure and a multi-service solution to help operators to migrate to smarter operations. Huawei's solutions help power companies manage the operations of T&T lines, providing a real-time support and guarantee the highest level of communications security .

Challenges



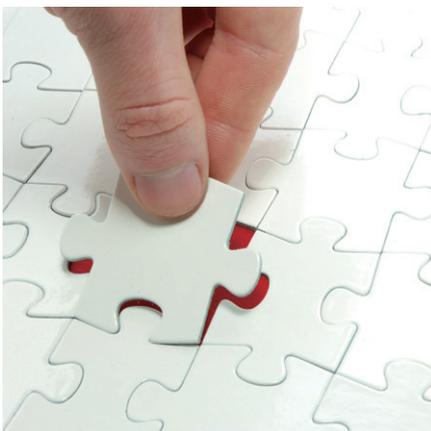
As the artery in the power system, the power transmission lines have the important function of transmitting long-distance high-capacity power with a high operational availability and security. Power companies rely on dispatcher telephones, teleprotection, supervisory control and data acquisition (SCADA) and energy management system (EMS) to monitor and control the transmission lines. The requirements for T&T communication networks are even higher because they support the aforementioned functions

First, some traditional power grids still employ power line carriers (PLCs) and copper cables as the transmission communications backbone network. This network is vulnerable to electromagnetic disruption, can only support short-distance transmission and carry few services. Insufficient bandwidth and low response time have significant impact on such services as dispatcher calls, teleprotection and SCADA, and can delay the detection of possible accidents or instable states. At least this can cause tremendous losses. Therefore, these power companies have increasingly high demands for resolving accidents in time, improving power quality, and increasing operational efficiency.

The traditional T&T communication network that carries voice, teleprotection and other time-division multiplexing (TDM) services is sometimes not prepared to support new IP services, such as telepresence, video surveillance, office automation (OA), and Enterprise Resource Planning (ERP). Today, power companies require more secure, reliable and flexible communications networks with higher bandwidths to support their new services.

A secure and efficient T&T communications network plays an irreplaceable role in the service system of the transmission line.

Huawei Power Transmission and Transformation Communication Solution



Accompanying the phases of development of transmission line, Huawei provides the corresponding T&T communications solutions, i.e. the backbone communication solution for power transmission improving the basic communications networks and the intelligent power T&T communication evolution solution that target multi-service needs.

Backbone Communication Solution for Power Transmission

Huawei backbone communication solution for power transmission uses optical fiber composite overhead ground wire (OPGW) and all-dielectric self-supporting optical fiber cable (ADSS), combined with high bandwidth and high reliability of multi-service transport platforms ("Hybrid MSTPs") to ensure an upgradability with investment saving from TDM to IP service.

Application scenarios

Huawei backbone communication solution for power transmission is used in dispatching centers, substations, power plants, corporate headquarters and branches. It is designed to support substation automation, dispatcher telephones, teleprotection, and other basic services.

Solution description

This solution focuses on cabling in T&T communications networks and enables these networks to carry basic services such as real-time operational control, dispatcher calls, teleprotection and non-real-time management information. It helps power companies to move from buried optical fiber cables to more cost-effective ones such as OPGW /ADSS cabling. It consist of "Hybrid MSTP" equipment and OPGW /ADSS cables to connect substations, power plants and dispatch centers (control centers) to each other and run the relevant services. (See Figure 1.)

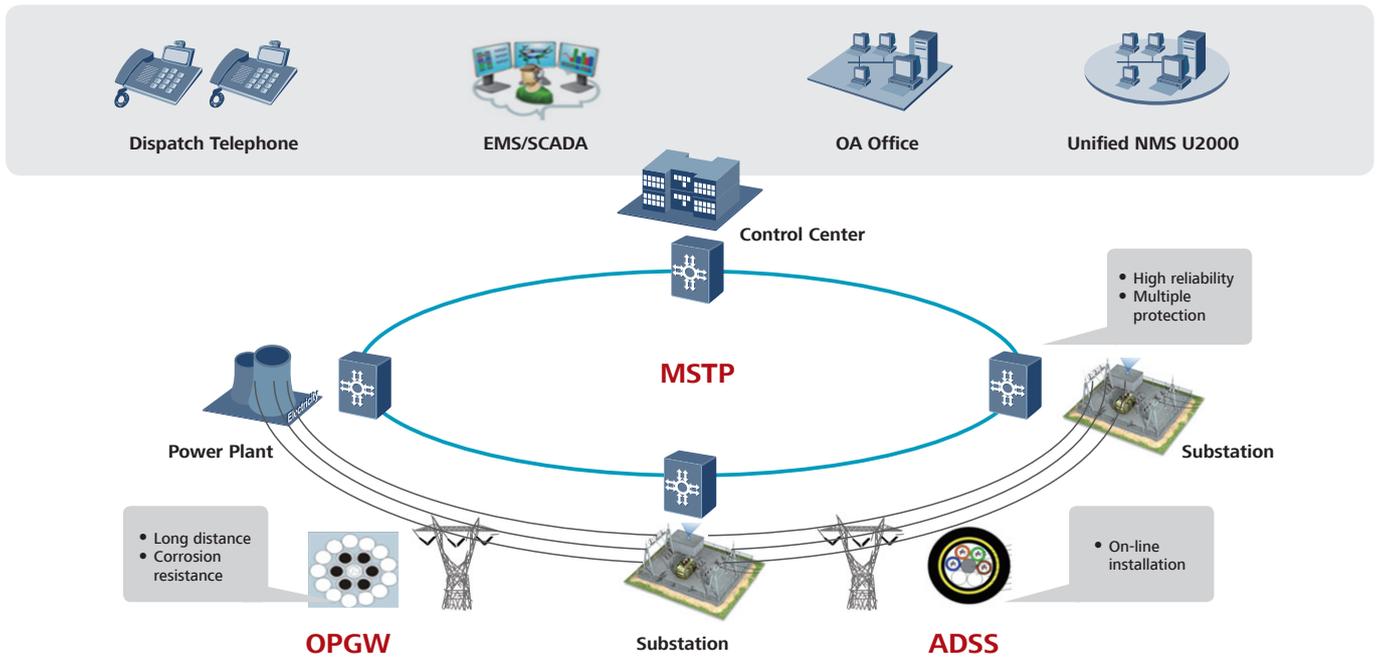


Figure 1 Backbone Communication Solution for Power Transmission

←Solution highlights

- Highly interference-resistant.
- Wide spans of aerial optical cable.
- All-directional protection.
- Ultra-long-distance transmission with a maximum of 380 km per span.
- High capacity of 8 Tbps over a single fiber.
- Upgrade capability from 10G TDM services to 10G IP services.
- Unified network management, visualized and remote operations and maintenance.

Intelligent Power T&T Communication Evolution Solution

Huawei offers an intelligent power T&T communication evolution solution that can meet electrical power enterprises' demand for high bandwidths and a safe, reliable communications network.

Application scenarios

The solution mainly applies in dispatch centers, substations, power plant, corporate headquarters and branches that offer not only TDM services, but also IP services such as telepresence conference, video surveillance, OA, and ERP.

Solution description

The solution includes two networking models, namely Hybrid MSTP + IP and optical transport networks (OTN) or wavelength division multiplexing (WDM) + IP. Both models support the function of automatically switched optical networks (ASONs).

Hybrid MSTP + IP networking model

The Huawei solution uses the mature Hybrid MSTP optical transmission equipment and takes the innovative technologies of partition, classification, and layering to build a T&T communication network. In consideration of the power grid structure, the voltage levels, and regional interconnection, this communications network adapts to the whole power grid. Huawei provides a full portfolio of transmission equipment which is adaptable to the access layer, the convergence layer, and the core layer. These offerings can support different networking models depending on traffic and network planning. In Figure 2, "Hybrid MSTP" is used to form a single ring, multi-ring, or mesh network to converge IP and multi-service access while carrying TDM services. ASONs can be introduced into mesh networking to improve network reliability. Use case: basic energy operations!

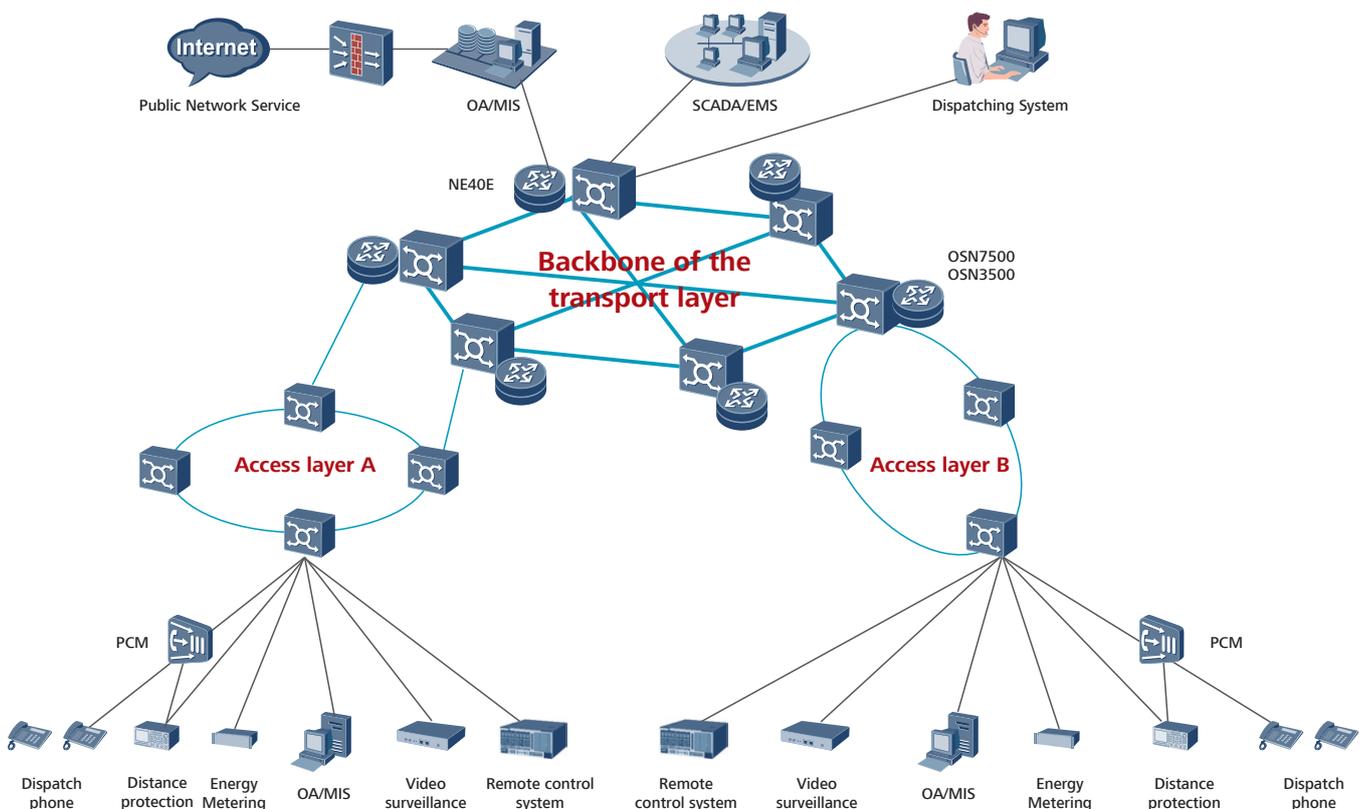


Figure 2 Hybrid MSTP + IP networking model

OTN/WDM + IP networking model

In consideration of huge coverage, multi-services and huge traffic of the transmission network, this model uses Huawei's OTN/WDM equipments to support long-distance and huge-capacity transmission. The OTN/WDM equipment can not only save a lot of optical cables, but also provide huge bandwidth capacity, thus satisfying the needs for long-term service development.

This solution uses the OTN/WDM+IP networking model. IP or MSTP is used in the access networks and OTN/WDM are used in the backbone networks that can provide ASON for meshed networking, thus improving network reliability (meshed protection). (See Figure 3.)

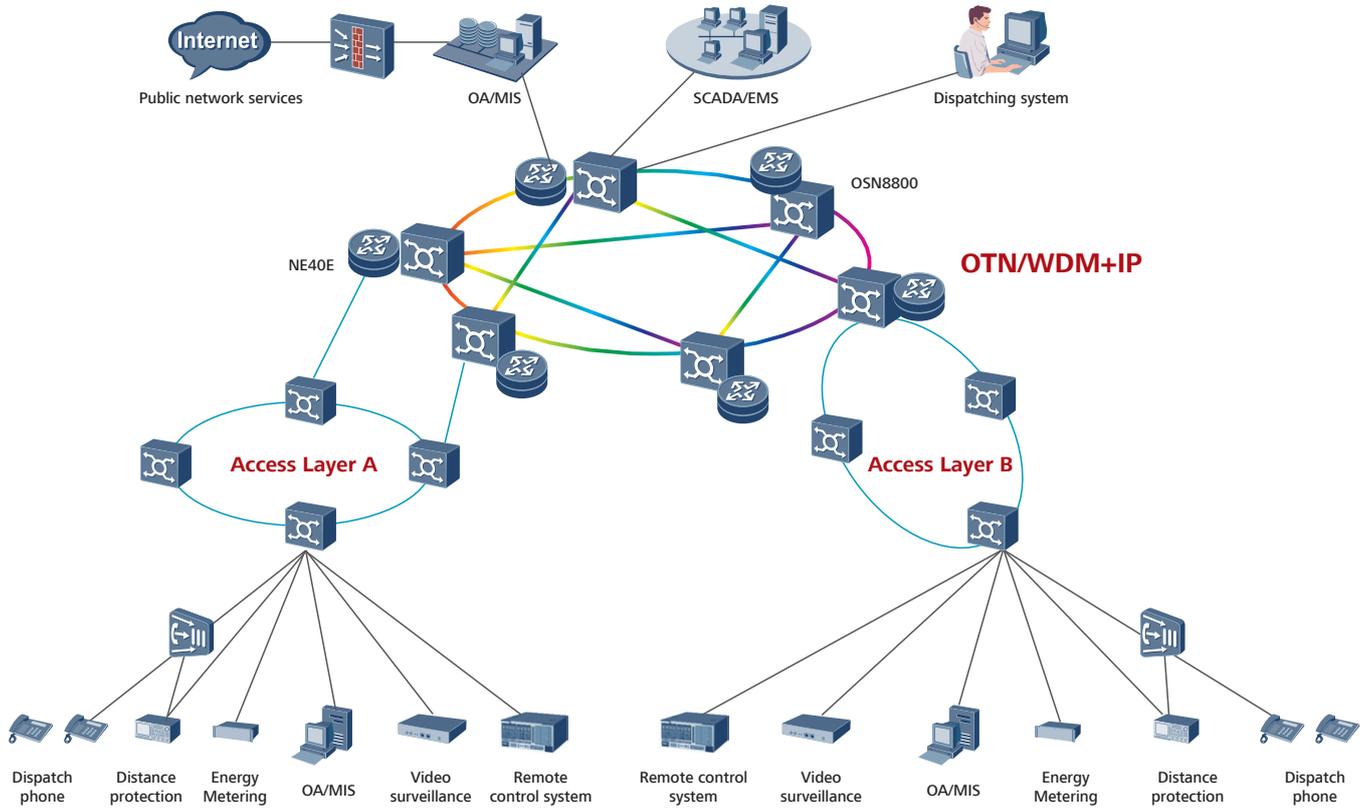


Figure 3 OTN/WDM + IP networking model

←Solution highlights

- Resist strikes in harsh conditions by ASON.
- Ultra-long-distance transmission with a maximum of 380 km per span.
- High bandwidth capacity with 8 Tbps over a single fiber, and the cross-connection capacity can reach 6.4 Tbps.
- Unified network management, visualized and remote operation and maintenance.

Huawei power T&T communications solution has unique technological advantages:

- Reliable operations of distance protection services that have a communication delay of less than 50 ms.
- Reliability of 99.999%, ensuring uninterrupted services.
- 8 Tbps bandwidth capacity over a single fiber enables the network to support growing services. Moreover, the surplus bandwidth can be leased to create new growth points.

The Huawei solution greatly supports the continuous evolution of the information and control system of the transmission network, which includes dispatcher calls, teleprotection, substation automation, and energy management system (EMS). The solution also greatly enhances the security of the transmission network and avoids wide-area power failure, thus minimizing losses to power companies. At the same time, this solution improve the efficiency of power services and greatly helps power companies to increase the security of power grids and lower operational costs. With the high capacity and high number of client interfaces it supports tertiary business.

Success Case

Continuing Success, Step Further

-High-performance, flexible MPLS/IP network of Brazil Copel



Background

Established in 1954, Copel is the largest state-owned power grid operator in Parana, Brazil. It is engaged in power generation, transmission, distribution, and telecommunications services and has a workforce of 9400 employees. The company operates 18 power plants, 17 of which are hydroelectric plants. Copel has a total installed power capacity of 4550 Mw, accounting for approximately 7% of the total electricity consumption in Brazil. Remote automatic control is enabled in 12 power plants. Transmission lines have a length of 2028 kilometers and cover 31 substations. Distribution lines have a length of 184,418 kilometers and cover 357 substations, all of which are automated. Copel has 14,306 kilometers of optical cables, including 7510 kilometers of Optical Fiber Composite Overhead Ground Wire (OPGW). The optical cables cover 302 cities in Parana and another two cities in Santa Catarina.

Challenges

The legacy network of Copel used Internet Protocol (IP) and Multi-Protocol Label Switch (MPLS) technologies to construct a network for Parana by leveraging optical cables. This network is primarily used to provide IP-based voice, video conferencing, multimedia, and other telecom services for the municipal hall, municipal public service organizations, schools, and enterprises in Parana.

With the increase of services, the live network cannot continue to carry the existing services stably and faces the following problems:

1. With the increase of services, Medium Access Control (MAC) addressing within the local area network (LAN) faces a heavy broadcast storm.
2. The network has convergence issues in case of link failures.
3. The network bandwidth is insufficient, resulting in low communications efficiency.
4. Many switches are only on one ring network and there is no redundancy.
5. The network structure is complicated. The equipment is from different vendors, which causes operation and maintenance (O&M) difficulties and communication interruption.

Huawei solution

Considering the customers' requirements in short and long run, Huawei mainly uses the NE40-X3 and NE40-X8 routers for networking in this project. The NE40-X3 is deployed at network borders for service access and the NE40-X8 is used on the core backbone network. The networking diagram is as follows:

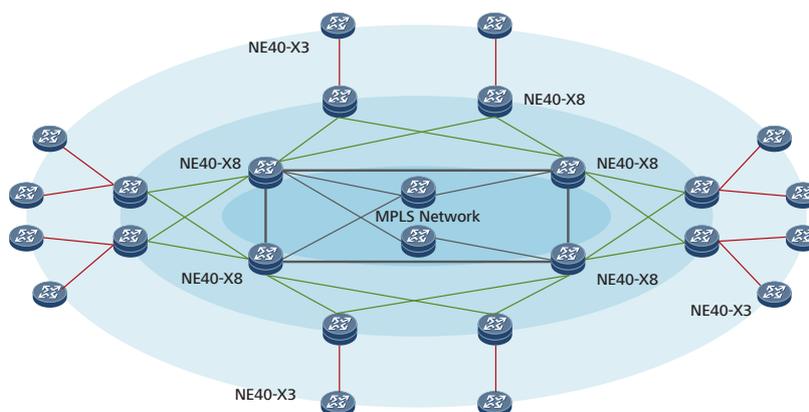


Figure 4 COPEL MPLS IP Networking Illustration

Customer Benefits

Huawei's solution simplifies network structure, and reduces O&M costs. By comprehensively using MPLS VPN (MPLS L3/L2 and VLL/PWE3) and QoS technologies, Huawei's solution enables millisecond-level protection and ensures reliable service operations. It offers strong compatibility and interoperability, and enables smooth interconnection with the legacy networks and systems.

In addition, Huawei provides a sophisticated 400G platform. Each slot can be upgraded to 400G smoothly. This platform is compatible with the existing low-speed line cards and also supports the new 40G and 100G line cards and ports. With these technologies, all services are carried on one network.

Meanwhile, a unified network management system (NMS) – T2000 is adopted in this project, it provides the capabilities to monitor and manage entire network in real-time and efficiently. Through dynamic detection and failure prevention functionalities, Copel's network transforms from an unmanageable, low-controllable to a reliable, efficient and easy-maintenance one, thereby the O&M cost is reduced and efficiency is improved.

After deployment, the high-performance network equipment covers all the services across the network, meets the bandwidth requirements of these services, ensures that the entire network is stable and guarantee that the communications faults all year long do not last more than three minutes. It promotes customer satisfaction and cut down the TCO significantly.



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