Power Grid Network Solution Overview
Huawei Electric Power Industry Solutions

"ONE NET" Smart Power Grid Integrated Network Solution

This network is dedicated for power dispatch communication, totally isolated from other networks. It has strict requirements for reliability, stability, security and real-time dispatch. This network needs large-scaled and long-distance transmission.

How to provide reliable ultra-long-distance transmission?
How to ensure network-wide reliability and uninterrupted system running despite a node failure?
How to utilize optical fiber resources to improve network coverage?
How to provide sufficient bandwidth for new dispatch services such as graphical terminals?

This network carries enterprise-wide data services like OA/ERP, providing network connectivity for electricity production, management, marketing agencies and institutions. It requires flexible scalability and high bandwidth, quality, and reliability.

How to ensure reliable and quality of enterprise-wide communication?
How to design a highly flexible network that allows different terminals and services?
How to ensure the quality and security of services not affected by each other?
How to simplify management and maintenance of a huge number of network devices?

This network facilitates network communication of DA system and connects DA main stations, substations, and terminals. The backbone network requires low latency and high reliability, and the access network requires flexibility and auto-adaptation.

How to utilize limited optical fiber resources in MANs to improve network coverage?
How to design a highly flexible network to accommodate new electric facilities?
How to enable network access equipment adaptable to harsh environment?
How to ensure security and reliability of the backbone network?
Smart Dispatch Integrated Network Solution

For Power Dispatch Services

Solution Overview

- For requirement of safety and reliability, power dispatch system usually needs the dedicated network carrying services, divided into real-time, non-real-time and emergency services. Services VPN division is used with QoS scheduling parameters configured individually to ensure critical business low latency and packet zero loss. The network ensures its reliability by full redundancy and fast switch-over.

- Power dispatch network is usually divided into 3 layers as following
  - Core layer, in dispatch center and backup dispatch center, to terminal all the substations and plants' dispatch VPN services. The nodes in core layer are fully redundantly configured to ensure dispatch business non-stop. The source timer can be deployed in this layer, to provide standard synchronized signal.
  - Backbone layer, is in big substations and other control stations. The backbone routers, connected by STP/WDM and MPLS/IP network, to implement long distance and high reliability forwarding, ensures safety isolation and high quality for key services.
  - Access layer, is in substations and power plants. The access routers aggregate site’s services and uplink to remote dispatch center. MPLS VPN is used for service isolation. As big and important substations/plants, dual access routers can be used, and for other sites, single router with dual engines can be used, to ensure dispatch service reliability.

Solution Highlights

Huawei’s smart integrated solutions for power dispatch network are dedicated to solve the power dispatch business concerns, through the network, equipment and overall reliability design, to provide non-stop power dispatch service. The refinement of service deployment with MPLS VPN and MPLS HQoS technology, more in line with real-time scheduling business needs, achieves dispatch business proprietary quality assurance. MSTP/WDM transmission and router combination solution based on IP & optical transmission provides super-long distance high reliability. Program based on 1588v2 solution can effectively achieve high-precision time synchronization between different power plants and substations.
**Challenge:** SGCC (State Grid Corporation of China) is the biggest Power Grid company in the world, serving 26 provinces and more than one billion population of China. To achieve the goal of strong & smart grid, SGCC needed to build a national grid network backbone with very high reliability. The whole network must eliminate single failure, and failure of any node must cause services switched to backup routing within 500ms.

**Solution:** Huawei relies on its 10-years large-scale network construction experience, to build the national backbone network based on dual-plane transformation. NE40E routers are used in backbone of two planes, involved in the nodes in headquarters, 5 regions and 25 provinces. This program used the topology of two identical flat network architecture, running two separate IGP routing planes with L3 VPN MPLS BGP, to achieve safe isolation of services.

**Benefits:** Dual-plane construction of the backbone network greatly enhanced the reliability and stability of the whole network, to support the strong, efficient and self-healing smart grid. Huawei’s E2E high reliability ensured entire network 200ms protection switch-over; Huawei complete MPLS H-QoS provided a safe business service quality isolation and low latency. In addition, Huawei routers support 1588v2, to provide precise clock synchronization function for future evolution.
Smart Integrated Data Network Solution
For Power Information Services

Solution Overview

- 2-levels network architecture is proposed to adopted in integrated data network. Substations or other enterprise units are managed by regional center, which is in charge of corresponding regional office, including management and communication services. The core layer in HQ center aggregates the entire services by MPLS VPN. Due to differentiation existing in each region, nested VPN is adopted, as the regional center combines local VPNs into a big VPN and then uploads to HQ.
- Power integrated data network is usually divided into 3 layers as following:

Solution Highlights

Huawei smart integrated data network solution focuses on power multi-services deployment based on unified intelligent network platform, which provides powerful performance, smart services scheduling, high reliability and intelligent management.
**Challenge:** SGCC aimed at the highly efficient, integrated, reliable and green power integrated data service bearer network, to carry enterprise informational services as OA/ERP, including video, voice and other new business. The network provided the conditions for carrying on the smart grid to provide informational services with high security.

**Solutions:** Three layers structure is adopted, involving Beijing HQ, 5 regional and 25 provinces nodes. Huawei set up national grid network by NE40E/20E series routers, to build integrated data network backbone. The entire network adopted mesh/half-mesh topology with MPLS VPN technology. The full redundancy was designed to eliminate single point of failure. High-speed BFD was used to detect failure in very short time. MPLS QoS solution are used to ensure data, voice and video services keeping high quality.

**Benefits:** Integrated data network for SGCC provided high quality, security and reliability of WAN connectivity services for the national grid SG-ERP information system, and built up a solid foundation for the realization of reunification of a strong intelligence network.

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**Power Integrated Data Network Products**

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<thead>
<tr>
<th>NE40E-X3</th>
<th>NE40E-X8</th>
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<tbody>
<tr>
<td><strong>Features</strong></td>
<td><strong>Features</strong></td>
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<tr>
<td>Core, backbone and access routers</td>
<td>The 3-rd generation intellectual multi-service routers, used in substation access gateway.</td>
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<tr>
<td>100G platform with high capacity</td>
<td>Multi-core technology, with hot-swap service card</td>
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<tr>
<td>Maximum 16 × 10G, 48 × GE ports per slot</td>
<td>Full interface type, including GE optical/electrical, FE RJ45, RS232, FXS, xPON, etc.</td>
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<tr>
<td>MPLS HQoS to support multi-service high quality</td>
<td>Integrated switch and router, to reduce TCO</td>
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<tr>
<td>Dual power modules and engines</td>
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<tr>
<td>Power Enterprise core switch, designed with high capacity and non-block switch, to reach 2T</td>
<td>Aggregation and access switches, high capacity non-blocking forwarding</td>
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<tr>
<td>Multiple reliability technology</td>
<td>Auto configuration, one stop deployment</td>
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<tr>
<td>Advanced QoS mechanism, to ensure service quality.</td>
<td>Advanced NAC security mechanism</td>
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<tr>
<td>Integrated FW and NetStream, to reduce TCO</td>
<td>Perfect SLA and OAM/Y.1731 technology to ease E2E network maintenance</td>
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<tr>
<th>S9300</th>
<th>WA603DN</th>
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<tr>
<td><strong>Features</strong></td>
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<tr>
<td>Suitable for indoor/outdoor wireless access</td>
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<tr>
<td>Supports 802.11a/b/g/n, maximum support 600Mbpsx2.4GHz/5GHz dual-band support, providing flexible deployment options</td>
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<tr>
<td>Intelligent network, support for power-adaptive, self-channel selection, automatic power adjustment and load balancing</td>
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</tr>
<tr>
<td>High performance enterprise FW, with maximum 6Gbps capacity and 1500Kpps forwarding</td>
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</tr>
<tr>
<td>Multi-service interface, supporting ADSL, 3G, E1/JCE1, G.SHDSL, Wi-Fi, SA, FE, GE etc.</td>
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Smart Distribution Network Solution
For Power ADO Services

Solution Overview

- Distribution main station is deployed in dispatch center, and sub-stations are deployed in 110kv/35kv substation, responsible for their areas of DTU/TTU/FTU communication terminal equipment, the master station is responsible for communication with the various sub-stations. OLT is placed in the substation communication room, and ONU is placed in the outdoor ring main units and other electrical equipments, through the RJ45 Ethernet ports or RS485 line connection terminals. The metro backbone adopts either SEP L2 ring protocol or IS-IS/OSPF IGP routing protocols, to achieve high reliability.

Solution Highlights

Huawei’s intelligent power distribution solution fully considers the needs of adaptation to the environment, with the ONU equipment specially designed of lightning protection, waterproof, and anti-magnetic properties. Huawei’s xPON technology enables a single fiber pull away to 20 km, that effectively improves the utilization of fiber resources.
**Challenge:** Zhejiang Power Company was committed to develop real-time monitoring of remote control electric power running operation, to ensure that the distribution system switch from passive response to active maintenance with fast fault. The ADO network covering the entire city’s power distribution network was established, with the requirement of very high reliability and environment adaptability.

**Solution:** After complete tests, GPON solution was used. OLT was placed in 110KV or 35KV substations and other communication rooms, communications cable extending along the power line distribution network of electrical equipment. ONU ring was placed in the cabinets and other outdoor power equipment. Design by ODN significantly enhanced the user experience.

**Benefits:** GPON solution saved fiber resources, to enhance network coverage, and to save significant cost. ONU devices have a good environment for tolerance, high temperature, anti-magnetic anti-lightning. Network in real time and high reliability enhanced customer experience.

### Power Distribution Network Products

- **S9312**
  - Backplane capacity 12T, and switch capacity 2T
  - Less than 20 μs latency, ensure real-time forwarding
  - Maximum 576GE/FE ports, meet 10-years expansion
  - Comprehensive L2/L3 IP/MPLS forwarding capacity, suitable for a variety of metro network
  - Dedicated hardware supports BFD for everything, to ensure fast switchover
  - SEP fast L2 reliance technology, to ensure 50ms switchover.

- **S9306**
  - Backplane capacity 6T, and switch capacity 2T
  - Less than 20 μs latency, ensure real-time forwarding
  - Maximum 288GE/FE ports, meet 10-years expansion

- **MA5600T**
  - Dual engines, 16 service slots and 2 uplink cards
  - 4/8 ports GPON card, uplink 2×2 GE/10GE/STM-1
  - 40Gbps per slots, to support 10G PON expansion
  - Supports MPLS to adapt flexible network
  - Global shipments of the first, mature and reliable equipment

- **MA5621**
  - Uplink: 2×GPON/2×GE (optical) or 1×GE (optical) +1×GPON
  - Downlink: 4×GE/FE+4×RS485/RS232
  - Support IEC60870-5-101, IEC60870-5-104/61850, CDT, DNP
  - Dedicated design for power industry to meet harsh environment requirement, tolerant high temperature, rain, lightning, and electromagnetic, working in 40°C ~ 70°C (7×24)
  - Hand-in-hand protection to meet high reliability requirement