Overview of the Transport Network

Overview

An optical transport network (OTN) is the basis of the communications networks. With the rapid development of the communications networks, ever-increasing requirements are imposed on the OTN:

- Large capacity
- Low capital expenditure (CapEx) and operation expenditure (OpEx)
- Fast and flexible service deployment and scheduling
- Strong scalability
- High reliability
- Complete operation, administration, and maintenance (OAM) functions

Since the release of its first optical transceiver in the 1990s, Huawei has made continuous technical breakthroughs, gradually shaping the development trend of OTN technologies. In addition, Huawei has always been dedicated to providing operators with a unified and complete intelligent transport network solution featuring high bandwidth, service flexibility, and security.

OTN networking

Solution Features

The unified and complete transport network solution is used to continuously make breakthroughs in solving the bottlenecks of limited bandwidth and transmission distance. On the Metropolitan Area Networks (MANs), backbone networks, and marine networks, this solution provides ultra high-speed, block-free, highly reliable, and fully intelligent connections, as well as huge bandwidth and immediate service access.

Huawei’s OTN strategy is focused on four areas:

- Unified transport: covering areas on land, in water, and air by bandwidth clouds
- Embracing core technologies and enhancing the leading position
- Optimizing product combination; providing huge bandwidth and supporting immediate service access
- Continuously making breakthroughs, shaping the development trend of transport technologies
OTN Series Products

Overview

Services, such as high-speed Internet, video, and media streams constantly become more demanding as they evolve. Accordingly, traffic on the MANs and backbone networks increases sharply. Based on the persistent and thorough research and development of the service and transport networks, Huawei offers the OTN bandwidth cloud solution to meet increasing bandwidth requirements. This solution integrates multiple leading technologies such as long distance transmission at 40 Gbit/s or 100 Gbit/s, optical and electrical cross connections on the large capacity–based OTN, photonic integrated device (PID), and automatically switched optical network (ASON). Like cloud computing, this solution is used to form an intelligent and reliable network featuring ultra-large capacity, dynamic sharing, and fast access, truly implementing “0 wait, 0 waste, 0 downtime”. This solution helps operators easily address the challenges of traffic fluctuations, network planning, construction, and operation and maintenance.

Product Appearance

Product appearance of OTN series products.
Product Features

The following describes the product features:

- Long distance transmission at 40 Gbit/s or 100 Gbit/s; 100% utilization of bandwidth resources using the ODUk or ODUflex full service matrix, achieving "0 waste" in bandwidth

- OTN/PID optical and electrical convergence scheduling, not only supporting free connections between huge optical and electrical services, but also achieving "0 wait" for customers using the highly effective PID technology to implement rapid network deployment

- Intelligent and reliable ASON, capable of circumventing multiple network faults, quick fault locating, and leading commercial use, achieving "0 downtime" for customers

Comparison Between OTN Series Products

<table>
<thead>
<tr>
<th>Performance Parameter</th>
<th>Technical Counters of OptiX OSN 8800 T32</th>
<th>Technical Counters of OptiX OSN 8800 T16</th>
<th>Technical Counters of OptiX OSN 1800 I and II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (H x W x D)</td>
<td>900 mm x 498 mm x 295 mm</td>
<td>450 mm x 447 mm x 295 mm</td>
<td>44 mm x 435 mm x 220 mm</td>
</tr>
</tbody>
</table>

Transport technology
- Linear rate: 2.5 Gbit/s, 5 Gbit/s, 10 Gbit/s, 40 Gbit/s, and 100 Gbit/s
- Amplifier: erbium doped fiber application amplifier (EDFA) and Raman
- Transmission: 10 Gbit/s 5000 km without electronic regeneration, 40 Gbit/s or 100 Gbit/s 2000 km without electronic regeneration
- Maximum transmission distance is 140km (39dB).

Maximum wavelength and capacity
- 80 wavelength; a maximum single-channel rate of 100 Gbit/s
- 80 dense wavelength division multiplexing (DWDM) or 16 coarse wavelength division multiplexing (CWDM)
- CWDM: eight waves (the maximum); DWDM: 40 waves (the maximum); maximum single-channel rate: 10 Gbit/s (OUT-2)

Cross granule
- ODU0, ODU1, ODU2, ODU2e, ODU3, and ODUflex
- ODU0, ODU1, ODU2, ODU2e, ODU3, ODUflex, and any service
- When the LQM2 boards are inserted in paired slots, any service can be cross-connected.

Transmission fiber
- G.652, G.653, G.654, and G.655
OSN Intelligent Optical Transmission Series Products

Overview

With the rapid increase in services such as voice, data, video, and dedicated lines, transport networks are bound to bear a variety of services. The multi-service transfer platform (MSTP) supports the access and transport of multiple time division multiplexing (TDM), IP, and asynchronous transfer mode (ATM) services. Additionally, the platform converges with technologies such as link capacity adjustment scheme (LCAS), resilient packet ring (RPR), and multi-protocol label switch (MPLS), to provide superior quality of service (QoS) at different levels of services. Furthermore, an intelligent feature control plane is introduced to the optical network to further mitigate the challenges which face service development, such as low network security, scalability, bandwidth utility, and service response speed. The control plane enables resource allocation to be implemented in dynamic mode, rather than static mode, the control plane also optimizes resource configuration, lowers the network construction cost, and extends the service time of networks.

To meet existing service requirements and prepare for future network development, Huawei has launched the OptiX OSN 3500 series intelligent optical transmission system (OptiX OSN 3500). This system forms the end-to-end intelligent optical network solution, extending coverage from the backbone networks to the access layers.

Product Appearance

Product appearance of the OptiX OSN 3500.
Product Features

The product characteristics provide a comprehensive solution:

- Cutting-edge device structure with high cross-connection scheduling capability and integrity
- Unified platform design which implements complete compatibility between service boards and software
- Complete intelligent features which facilitate customer-oriented intelligent networks
- Comprehensive MSTP features which implement highly effective access and bearing of multiple services
- Built-in wavelength division and microwave functions designed to access and protect diverse networks

Comparison Between OSN Intelligent Optical Transmission Series Products

<table>
<thead>
<tr>
<th>Performance Parameter</th>
<th>Technical Counters of OptiX OSN 3500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device rate</td>
<td>STM-64/16</td>
</tr>
<tr>
<td>Cross-connections capability</td>
<td>Packet: 100 Gbit/s; TDM: 1280 x 1280 VC-4 high order cross-connections; 8064 x 8064, 16128 x 16128, or 48384 x 48384 VC-12 or equivalent VC-3 low order cross-connections</td>
</tr>
<tr>
<td>Service access capacity (the maximum access capability)</td>
<td>12 x STM-64 standard or concatenated services; 60 x STM-16 standard or concatenated services; or 156 x STM-4 standard or concatenated services; or 224 x STM-1 standard service or 132 x STM-1 electrical services; or 32 x E4 services; or 504 x E1/T1 services; or 117 x E3/T3 services; 56 x GE, 16 x 10 GE, or 180 x FE services</td>
</tr>
<tr>
<td>Dimensions (W x D x H)</td>
<td>497 mm x 295 mm x 722 mm</td>
</tr>
</tbody>
</table>
Hybrid MSTP Series Products

Overview

In response to the increasing development of IP-based customer services, Huawei has launched a packet transport solution called Hybrid MSTP. This solution is compatible with TDM and designed to integrate with live networks while laying the foundation for future networks. Based on a universal switch architecture, Hybrid MSTP is capable of full packet transport and completely compatible with the existing networks. This solution meets the requirements for packet-based transformation of bearer networks underpinned by optimal performance and the lowest costs.

Product Appearance

Product appearance of the OptiX OSN 550 and OptiX OSN 3500.

- **OSN 550**
  - PKT: 60G
  - TDM: 20G/5G

- **OSN 3500**
  - PKT: 100G
  - TDM: 200G/20G

Product Features

The product has three primary features:

- Based on the universal switch architecture, the Hybrid MSTP series products implement the smooth conversion between the TDM mode, packet mode, and hybrid mode after the extension at the service board level. Therefore, these products ease the selection of technologies and always meet the requirements for service and network development in the most suitable mode.

- Designed around advanced packet architecture, these products have complete packet clock features, fine QoS capability, and synchronous digital hierarchy (SDH)-like management capability. They provide strong pseudo wire emulation edge-to-edge (PWE3) functions which ensure a reliable packet bearer network.

- These products inherit the powerful MSTP features, required to implement and bear TDM services in an optimal manner.
Comparison Between Hybrid MSTP Series Products

<table>
<thead>
<tr>
<th>Performance Parameter</th>
<th>Technical Counters of OptiX OSN 550</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (H x W x D)</td>
<td>88 mm x 442 mm x 220 mm</td>
</tr>
<tr>
<td>Device rate</td>
<td>STM-4/STM-1</td>
</tr>
<tr>
<td>Switching capacity</td>
<td>Packet: 60 Gbit/s; TDM: 20 Gbit/s (high order) and 5 Gbit/s (low order)</td>
</tr>
<tr>
<td>Service access capacity</td>
<td>None</td>
</tr>
</tbody>
</table>
Microwave Series Products

Overview

Despite the rapid increase in the fiber coverage rate, fiber coverage is still absent at terminal nodes and in harsh environments. Additionally, frequent natural disasters in the recent years have introduced wire transport to the increasing risk of large-scale faults. Microwave products mitigate the adverse effects of disaster; this has increased demand. The real-time transport network (RTN) microwave series products launched by Huawei form a unique IP-based microwave transmission system integrating TDM, Hybrid, and packet solutions. The microwave series products do not share the limitations inherent in fiber transmission, and are highly effective in facilitating multiple services bearing through improved microwave transport performance.

Serving as a unified platform integrating TDM, Hybrid, and packet solutions, the OptiX RTN 900 series products include OptiX RTN 910 and OptiX RTN 950. With the height of 1 U (44.45 mm) and two RF directions, the OptiX RTN 910 is used to connect to the access layer. With the height of 2 U (88.90 mm) and multiple RF directions, the OptiX RTN 950 is used to connect to the convergence layer. The OptiX RTN series microwave products use the general outdoor devices (such as outdoor units [ODUs] and antennas).

Product Appearance

Product appearance of the OptiX RTN 910

Product appearance of the OptiX RTN 950

Product Features

The product characteristics provide several advantages:

- Support of full service bearing, Institute of Electrical and Electronics Engineers (IEEE) 1588v2 and synchronous Ethernet, and smooth network evolution
- Implementation of lossless adaptive modulation (AM) technology to dynamically adjust bandwidth
- Use of cross-polarization interference cancellation (XPIC) and highly effective header compression technologies, which greatly increases single-carrier transmission capacity
- Support for air link aggregation, and implementation of load sharing on multiple carriers for Ethernet services
- Sharing of the network management system (NMS) with optical network products to simplify operation and maintenance
Comparison Between Microwave Series Products

<table>
<thead>
<tr>
<th>Performance Parameter</th>
<th>Technical Counters of OptiX RTN 910</th>
<th>Technical Counters of OptiX RTN 950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency band</td>
<td>6 GHz, 7 GHz, 8 GHz, 10 GHz/10.5 GHz, 11 GHz, 13 GHz, 15 GHz, 18 GHz, 23 GHz, 26 GHz, 28 GHz, 32 GHz, 38 GHz, or 42 GHz</td>
<td>6 GHz, 7 GHz, 8 GHz, 10 GHz/10.5 GHz, 11 GHz, 13 GHz, 15 GHz, 18 GHz, 23 GHz, 26 GHz, 28 GHz, 32 GHz, 38 GHz, or 42 GHz</td>
</tr>
<tr>
<td>Channel spacing (MHz)</td>
<td>3.5, 7, 14, 28, 40, and 56</td>
<td>3.5, 7, 14, 28, 40, and 56</td>
</tr>
<tr>
<td>Modulation mode</td>
<td>QPSK, 16QAM, 32 QAM, 64QAM, 128QAM, 256QAM, 512QAM*, or 1024QAM*</td>
<td>QPSK, 16QAM, 32 QAM, 64QAM, 128QAM, 256QAM, 512QAM*, or 1024QAM*</td>
</tr>
<tr>
<td>Maximum interface</td>
<td>Plesiochronous digital hierarchy (PDH) interface: 96 x E1</td>
<td>PDH interface: 192 x E1</td>
</tr>
<tr>
<td></td>
<td>SDH interface: 6 x STM-1 and 4 x STM-4*</td>
<td>SDH interface: 12 x STM-1 and 12 x STM-4*</td>
</tr>
<tr>
<td></td>
<td>Ethernet interface: 20 x FE and 6 x GE</td>
<td>Ethernet interface: 48 x FE and 12 x GE</td>
</tr>
<tr>
<td>Radio frequency (RF) direction</td>
<td>A maximum of two directions</td>
<td>A maximum of six RF directions</td>
</tr>
<tr>
<td>Device capacity</td>
<td>TDM cross connection capacity: 8 x 8 VC-4, full timeslot cross-connections at the VC-12/VC-3/VC-4 level</td>
<td>TDM cross connection capacity: 32 x 32 VC-4, full timeslot cross-connections at the VC-12/VC-3/VC-4 level</td>
</tr>
<tr>
<td></td>
<td>Packet switching capacity: 4.4 Gbit/s</td>
<td>Packet switching capacity: 10 Gbit/s</td>
</tr>
<tr>
<td>Dimensions (W x D x H) and weight</td>
<td>Dimensions: 442 mm x 220 mm x 44 mm, Weight: 4.1 kg</td>
<td>Dimensions: 442 mm x 220 mm x 88 mm, Weight: 5.5 kg</td>
</tr>
</tbody>
</table>