



Example Shelf Configurations and Topologies

The requirements of a particular topology determine what components must be used and how they are interconnected. This chapter provides examples of shelf configurations and optical power budget calculations specific to each of the main types of protection schemes supported by the Cisco ONS 15530, and examples of supported topologies. This chapter contains the following major sections:

- [Shelf Configurations, page 6-1](#)
- [Cisco ONS 15530 Topologies, page 6-25](#)
- [Cisco ONS 15530 and Cisco ONS 15540 Mixed Topologies, page 6-32](#)
- [Cisco ONS 15530 and Cisco ONS 15540 Collocated Topologies, page 6-32](#)

Shelf Configurations

This section describes how to populate a Cisco ONS 15530 shelf for different types of protection configurations.

Unprotected Configurations

This section describes the configuration of the modules and unprotected line cards for unprotected configurations.



Note

You can use splitter line cards for unprotected configurations but they have a higher optical loss.

Figure 6-1 shows an example of a Cisco ONS 15530 shelf in an unprotected configuration using nonsplitter transponder line cards.

Figure 6-1 *Unprotected Configuration Using Nonsplitter Transponder Line Cards*

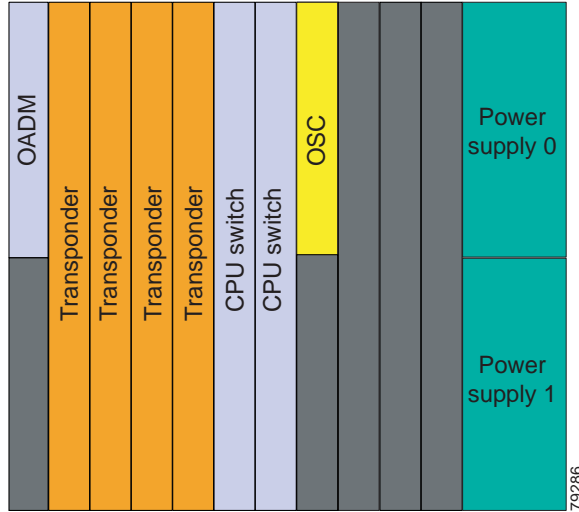


Figure 6-2 shows the optical power budget for an unprotected configuration using nonsplitter transponder line cards.

Figure 6-2 *Optical Power Budget for an Unprotected Configuration Using Nonsplitter Transponder Line Cards*

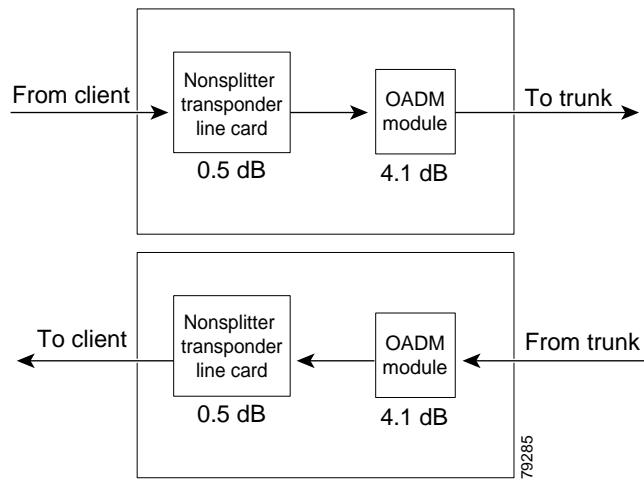


Figure 6-3 shows an example of a Cisco ONS 15530 shelf in an unprotected configuration using ESCON aggregation cards and nonsplitter 2.5-Gbps ITU trunk cards.

Figure 6-3 *Unprotected Configuration Using ESCON Aggregation Cards and a 2.5-Gbps ITU Trunk Card*

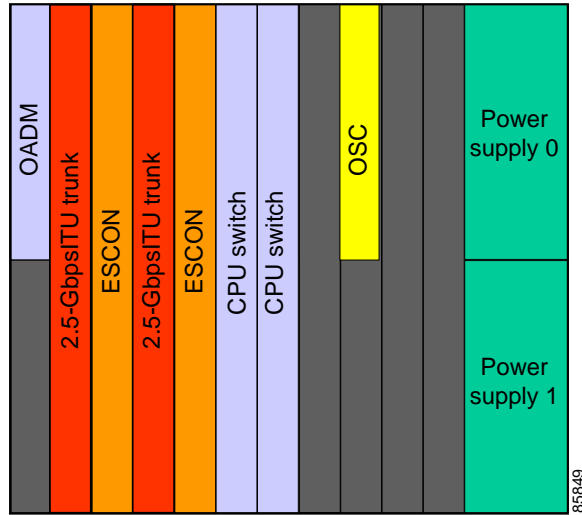


Figure 6-4 shows the optical power budget for an unprotected configuration when using nonsplitter 2.5-Gbps ITU trunk cards.

Figure 6-4 *Optical Power Budget for an Unprotected Configuration Using Nonsplitter 2.5-Gbps ITU Trunk Cards*

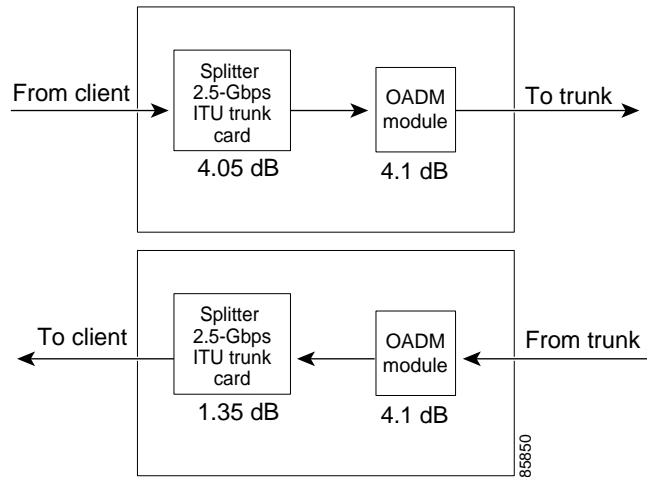


Figure 6-5 shows an example of a Cisco ONS 15530 shelf in an unprotected configuration using 8-port FC/GE aggregation cards and a nonsplitter 10-Gbps ITU trunk card.

Figure 6-5 *Unprotected Configuration Using ESCON Aggregation Cards, 8-Port FC/GE Aggregation Card, and 10-Gbps ITU Trunk Cards*

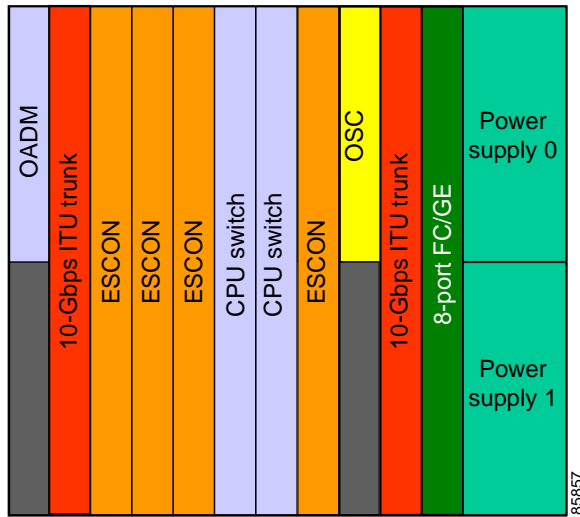


Figure 6-6 shows the optical power budget for an unprotected configuration when using nonsplitter 10-Gbps ITU trunk cards.

Figure 6-6 *Optical Power Budget for an Unprotected Configuration Using Nonsplitter 10-Gbps ITU Trunk Cards*

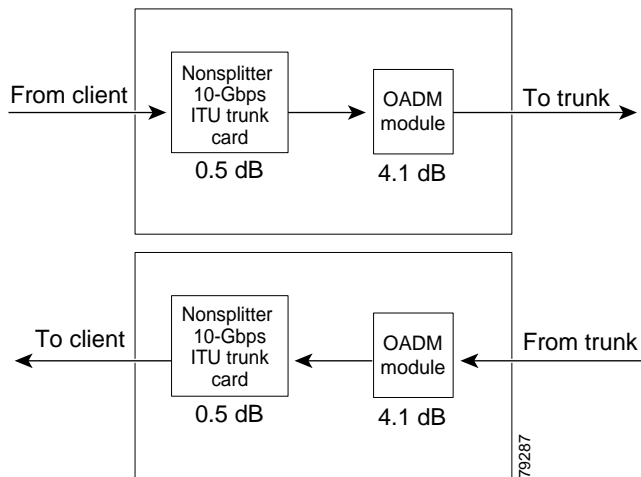


Figure 6-7 shows an example of a Cisco ONS 15530 shelf in an unprotected configuration using ESCON aggregation cards and a 10-Gbps uplink card.

Figure 6-7 *Unprotected Configuration Using ESCON Aggregation Cards and a 10-Gbps Uplink Card*

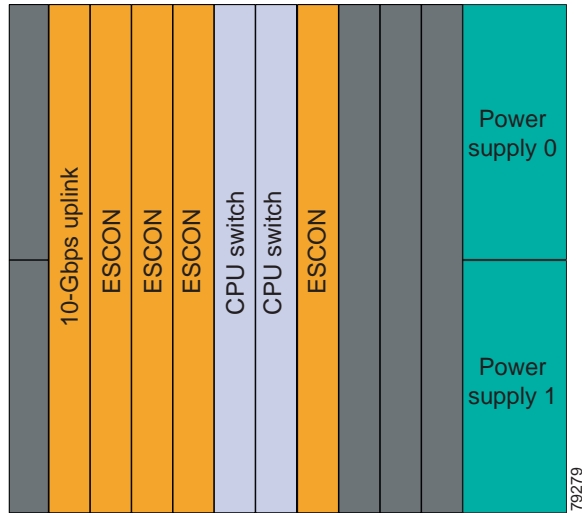


Figure 6-1 shows an example of a Cisco ONS 15530 shelf in an unprotected configuration using nonsplitter 8-port multi-service muxponders.

Figure 6-8 *Unprotected Configuration Using Nonsplitter 8-Port Multi-Service Muxponders*

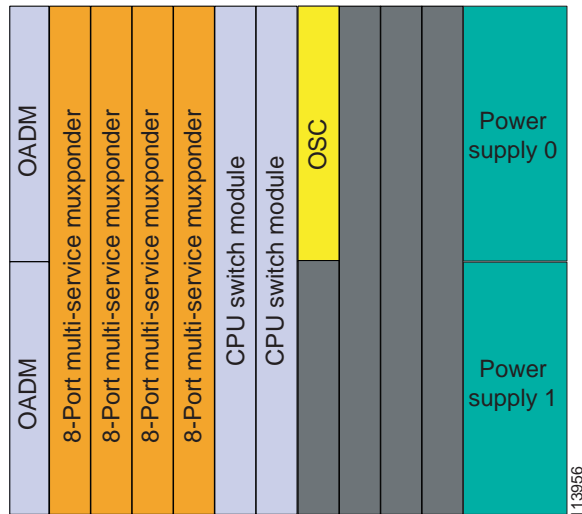
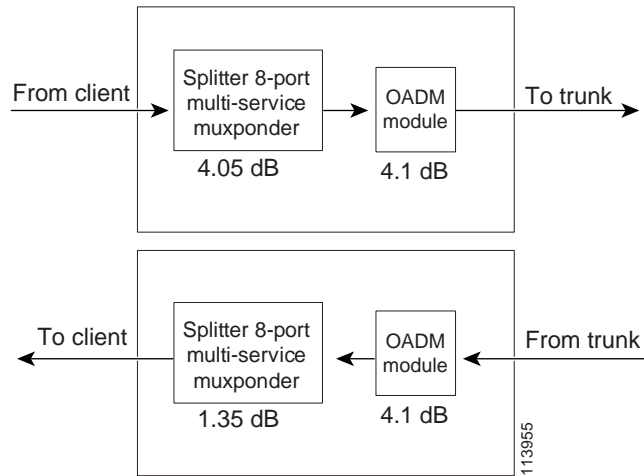


Figure 6-9 shows the optical power budget for an unprotected configuration using nonsplitter 8-port multi-service muxponders.

Figure 6-9 *Optical Power Budget for an Unprotected Configuration Using Nonsplitter 8-Port Multi-Service Muxponders*



Splitter Protected Configurations

This section describes the configuration of the modules and line cards for splitter protected configurations.

Figure 6-10 shows an example of a Cisco ONS 15530 shelf in a splitter protected configuration using transponder line cards.

Figure 6-10 *Splitter Protected Configuration Using Transponder Line Cards*

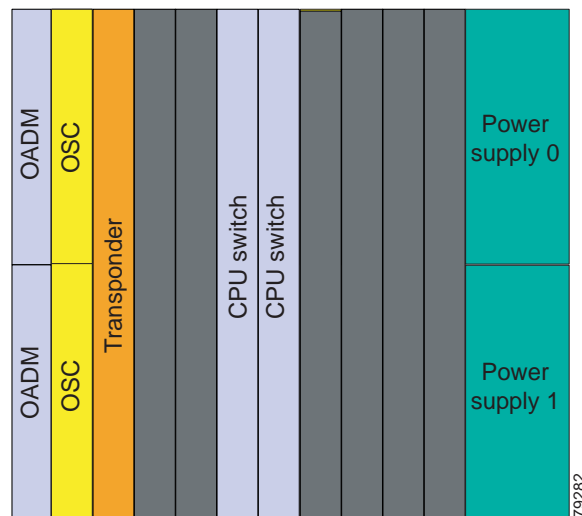


Figure 6-11 shows the optical power budget for a splitter protected configuration.

Figure 6-11 *Optical Power Budget for a Splitter Protected Configuration Using Transponder Line Cards*

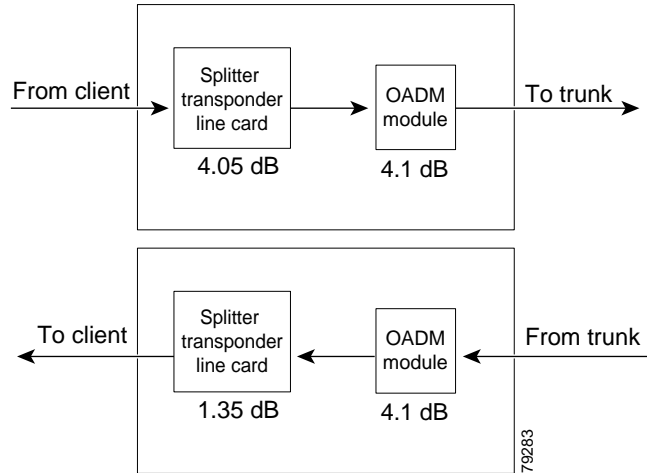


Figure 6-12 shows an example of a Cisco ONS 15530 shelf in a splitter protected configuration using an 8-port FC/GE aggregation cards and 2.5-Gbps ITU trunk cards.

Figure 6-12 *Splitter Protected Configuration Using an 8-Port FC/GE Aggregation Card and Splitter 2.5-Gbps ITU Trunk Cards*

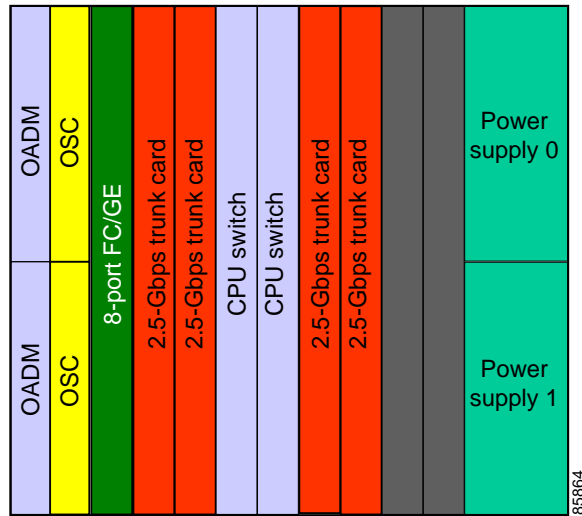


Figure 6-13 shows the optical power budget for a splitter protected configuration.

Figure 6-13 *Optical Power Budget for a Splitter Protected Configuration Using Splitter 2.5-Gbps ITU Trunk Cards*

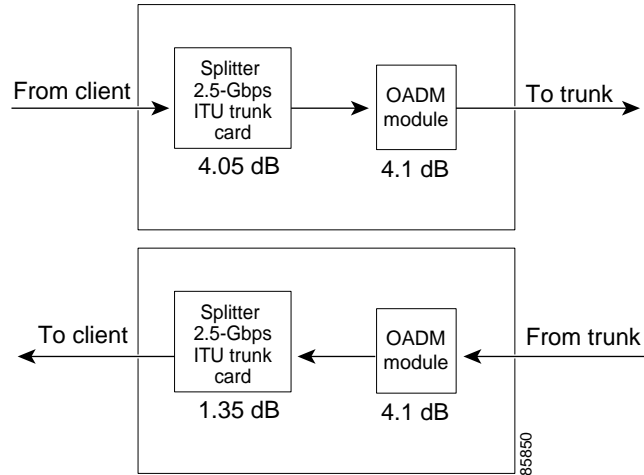


Figure 6-14 shows an example of a Cisco ONS 15530 shelf in a splitter protected configuration using ESCON aggregation cards and 10-Gbps ITU trunk cards.

Figure 6-14 *Splitter Protected Configuration Using ESCON Aggregation Cards and 10-Gbps ITU Trunk Cards*

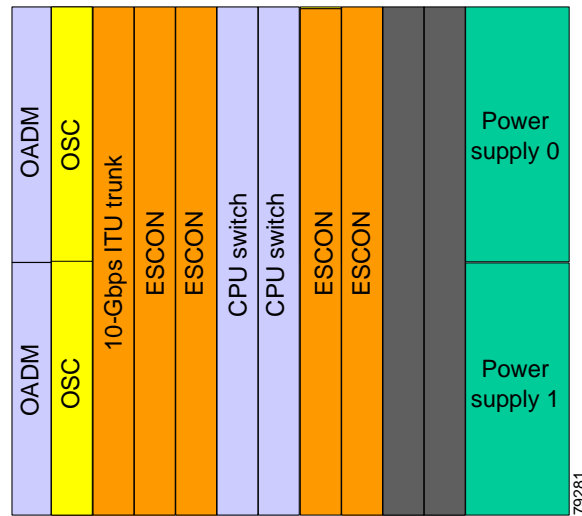


Figure 6-15 shows the optical power budget for a splitter protected configuration.

Figure 6-15 *Optical Power Budget for a Splitter Protected Configuration Using 10-Gbps ITU Trunk Cards*

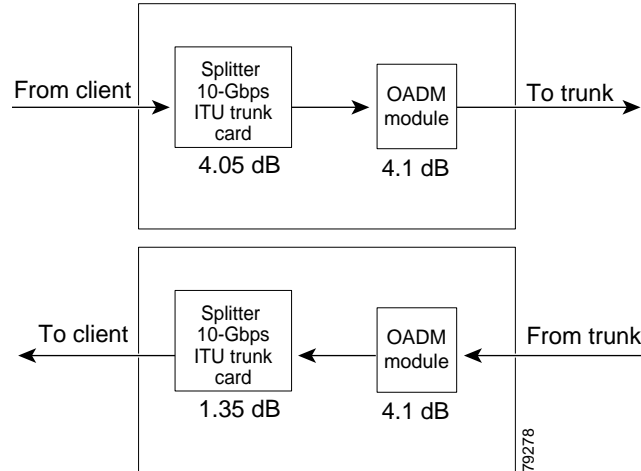


Figure 6-16 shows an example of a Cisco ONS 15530 shelf in a splitter protected configuration using 8-port multi-service muxponders.

Figure 6-16 *Splitter Protected Configuration Using 8-Port Multi-Service Muxponders*

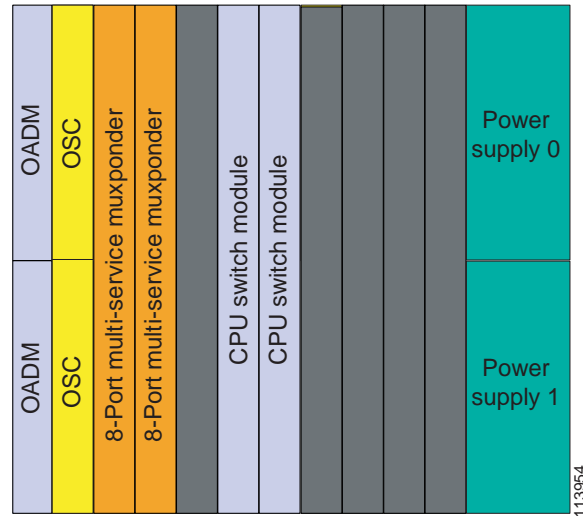
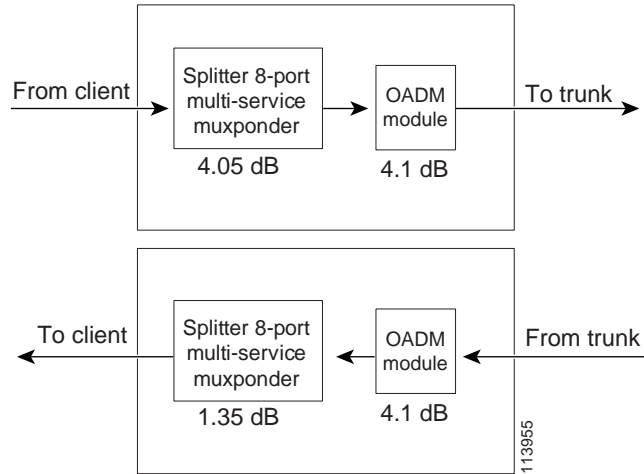


Figure 6-17 shows the optical power budget for a splitter protected configuration using 8-port multi-service muxponders.

Figure 6-17 *Optical Power Budget for a Splitter Protected Configuration Using 8-Port Multi-Service Muxponders*



Line Card Protected Configurations

This section describes the configuration of the modules and line cards for line card protected configurations.

Figure 6-18 shows an example of a Cisco ONS 15530 shelf in a line card protected configuration using transponder line cards.

Figure 6-18 *Line Card Protected Configuration Using Transponder Line Cards*

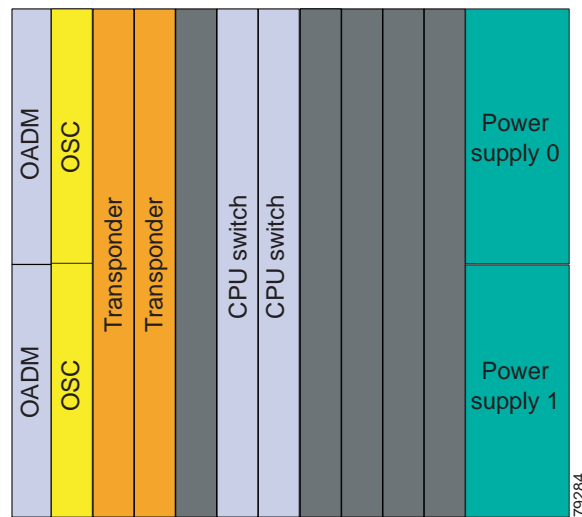


Figure 6-19 shows the optical power budget for a line card protected configuration using nonsplitter transponder line cards.

Figure 6-19 *Optical Power Budget for a Line Card Protected Configuration Using Nonsplitter Transponder Line Cards*

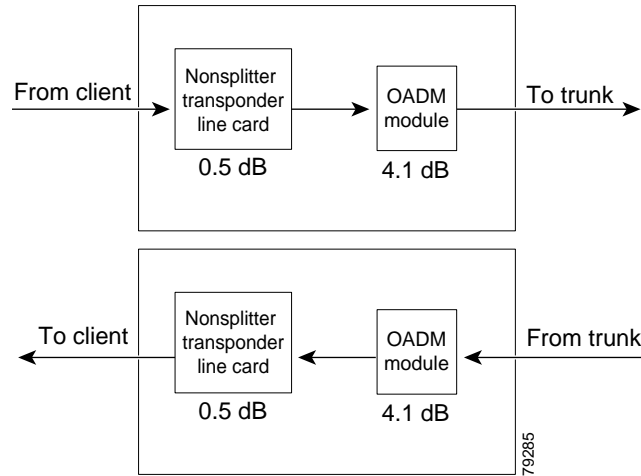


Figure 6-20 shows an example of a Cisco ONS 15530 shelf in a client based line card protected configuration using ESCON aggregation cards and 2.5-Gbps ITU trunk cards.

Figure 6-20 *Client Based Line Card Protected Configuration Using ESCON Aggregation Cards and Nonsplitter 2.5-Gbps ITU Trunk Cards*

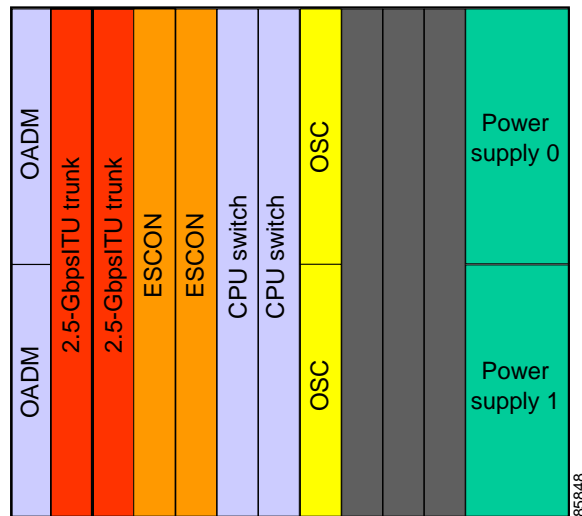


Figure 6-21 shows the optical power budget for a client based line card protected configuration using nonsplitter 2.5-Gbps ITU trunk cards.

Figure 6-21 *Optical Power Budget for a Client Based Line Card Protected Configuration Using Nonsplitter 2.5-Gbps ITU Trunk Cards*

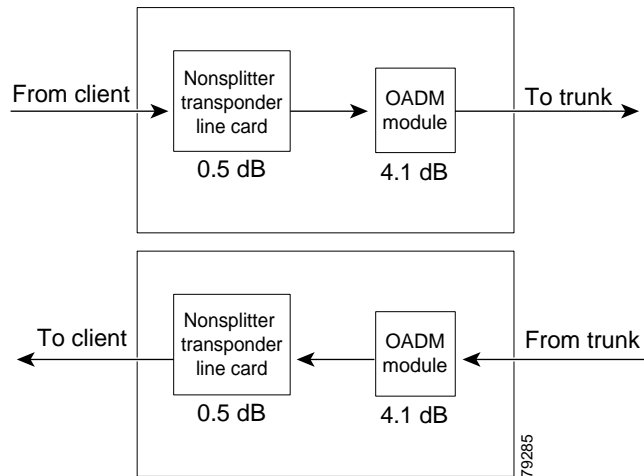


Figure 6-22 shows an example of a Cisco ONS 15530 shelf in a client based line card protected configuration using ESCON aggregation cards and 10-Gbps ITU trunk cards.

Figure 6-22 *Client Based Line Card Protected Configuration Using ESCON Aggregation Cards and 10-Gbps ITU Trunk Cards*

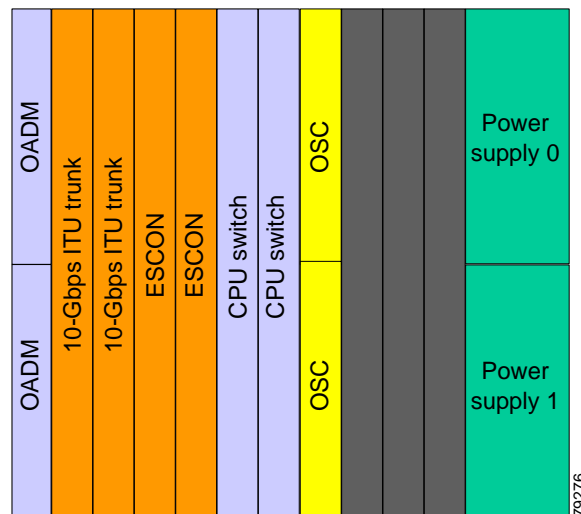


Figure 6-23 shows the optical power budget for a client based line card protected configuration using nonsplitter 10-Gbps ITU trunk cards.

Figure 6-23 *Optical Power Budget for a Client Based Line Card Protected Configuration Using Nonsplitter 10-Gbps ITU Trunk Cards*

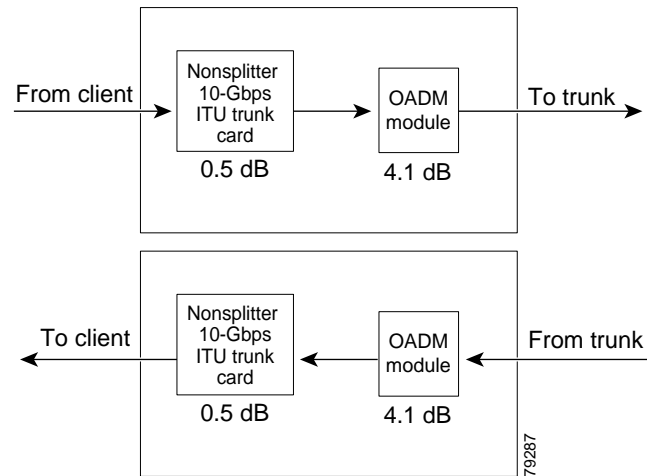


Figure 6-24 shows an example of a Cisco ONS 15530 shelf in a client based line card protected configuration using ESCON aggregation cards and 10-Gbps uplink cards.

Figure 6-24 Client Based Line Card Protected Configuration Using ESCON Aggregation Cards and 10-Gbps Uplink Cards

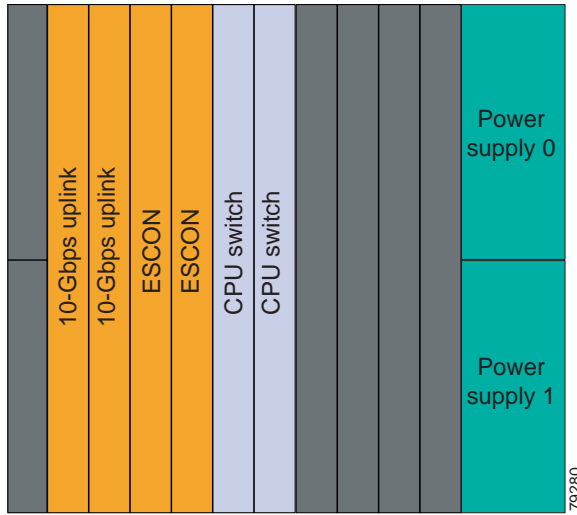


Figure 6-25 shows an example of a Cisco ONS 15530 shelf in a line card protected configuration using nonsplitter 8-port multi-service muxponders.

Figure 6-25 Line Card Protected Configuration Using Nonsplitter 8-Port Multi-Service Muxponders

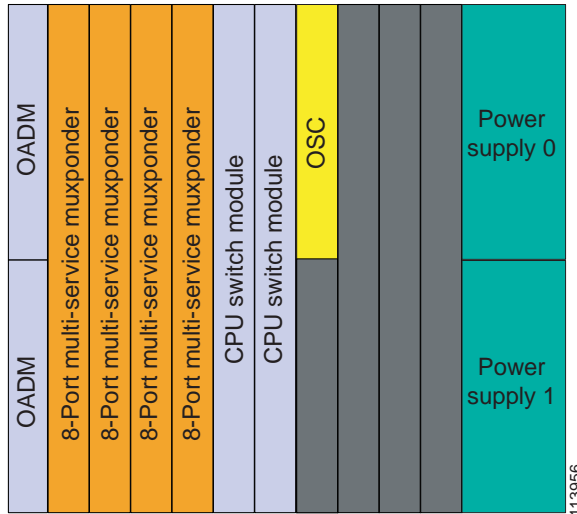
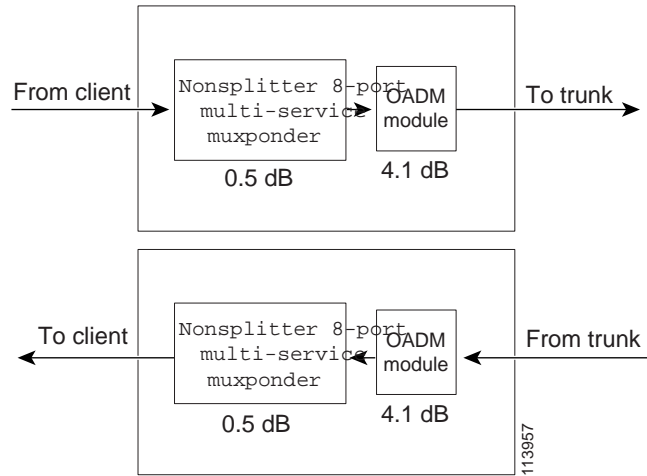


Figure 6-26 shows the optical power budget for a line card protected configuration using nonsplitter 8-port multi-service muxponders.

Figure 6-26 *Optical Power Budget for a Line Card Protected Configuration Using Nonsplitter 8-Port Multi-Service Muxponders*



Switch Fabric Based Line Card Protection Configurations

This section describes the configuration of line cards for switch fabric protected configurations.

Figure 6-27 shows an example of a Cisco ONS 15530 shelf in a switch fabric protected configuration with an ESCON aggregation card and two 2.5-Gbps ITU trunk cards.

Figure 6-27 *Switch Fabric Protected Configuration Using Nonsplitter 2.5-Gbps ITU Trunk Cards*

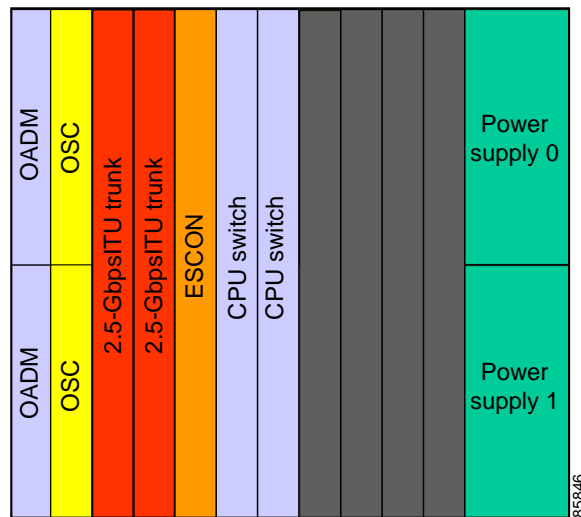


Figure 6-28 shows the optical power budget for a switch fabric based line card protected configuration.

Figure 6-28 *Optical Power Budget for Switch Fabric Protected Configurations Using Nonsplitter 2.5-Gbps ITU Trunk Cards*

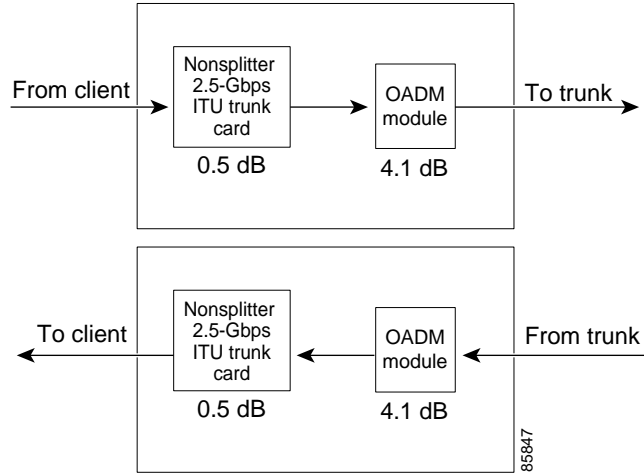


Figure 6-29 shows an example of a Cisco ONS 15530 shelf in a switch fabric protected configuration with an ESCON aggregation card and two 10-Gbps ITU trunk cards.

Figure 6-29 *Switch Fabric Protected Configuration Using Nonsplitter 10-Gbps ITU Trunk Cards*

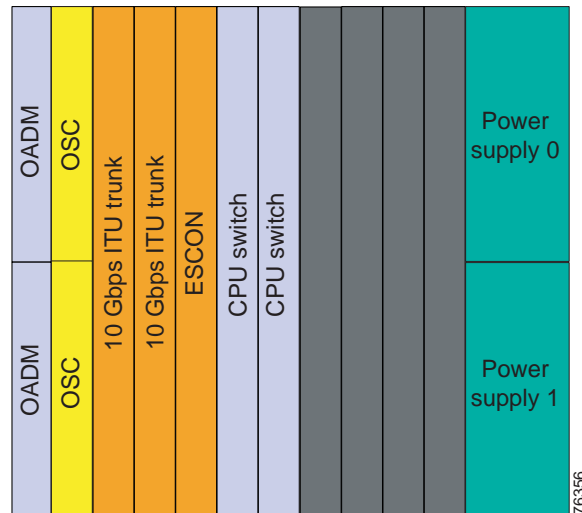


Figure 6-30 shows the optical power budget for a switch fabric based line card protected configuration.

Figure 6-30 *Optical Power Budget for Switch Fabric Protected Configurations Using Nonsplitter 10-Gbps ITU Trunk Cards*

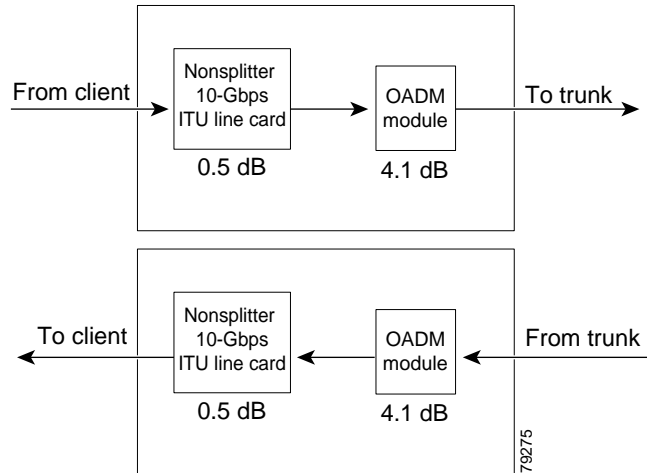
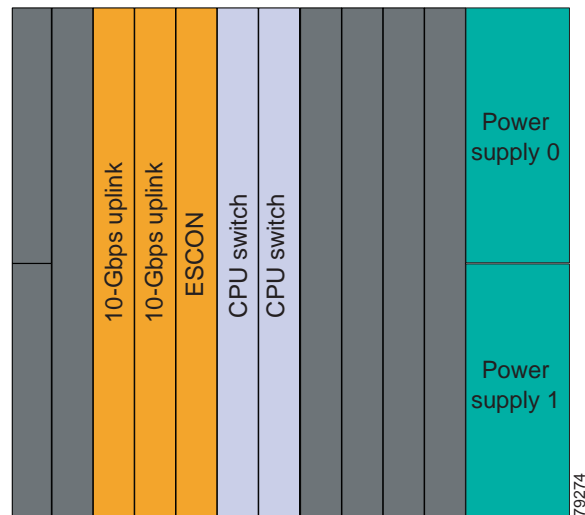


Figure 6-31 shows an example of a Cisco ONS 15530 shelf in a switch fabric based line card protected configuration with an ESCON aggregation card and two 10-Gbps uplink cards.

Figure 6-31 *Switch Fabric Based Protected Configuration Using 10-Gbps Uplink Cards*



Trunk Fiber Based Protection Configurations

This section describes the configuration of line cards for trunk fiber protected configurations.

Figure 6-32 shows an example of a Cisco ONS 15530 shelf in a trunk fiber protected configuration with transponder line cards.

Figure 6-32 Trunk Fiber Protected Configuration Using Nonsplitter Transponder Line Cards

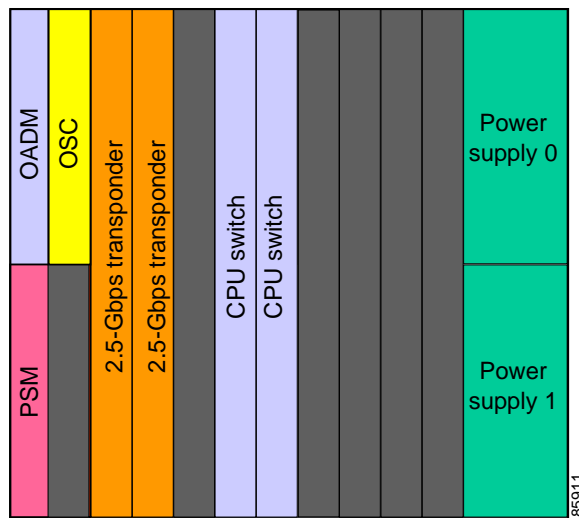


Figure 6-33 shows the optical power budget for a trunk fiber protected configuration with nonsplitter transponder line cards.

Figure 6-33 Optical Power Budget for Trunk Fiber Protected Configurations Using Nonsplitter Transponder Line Cards

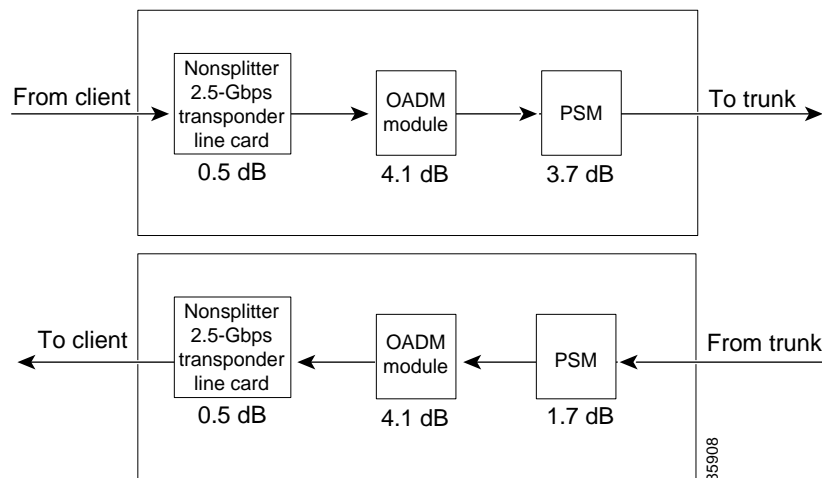


Figure 6-34 shows an example of a Cisco ONS 15530 shelf in a trunk fiber protected configuration with 8-port multi-service muxponders.

Figure 6-34 *Trunk Fiber Protected Configuration Using Nonsplitter 8-Port Multi-Service Muxponders*

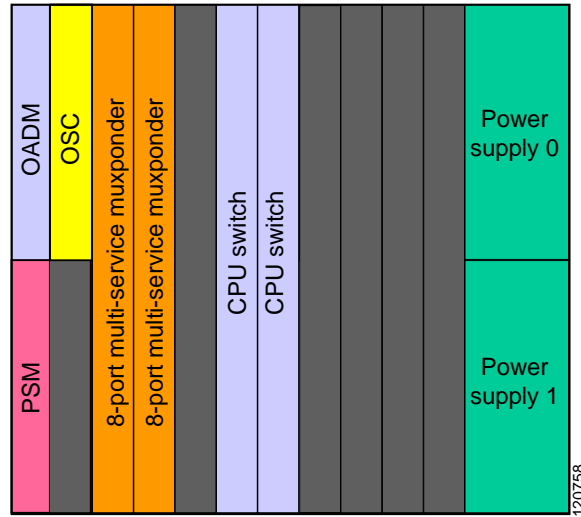


Figure 6-35 shows the optical power budget for a trunk fiber protected configuration with nonsplitter 8-port multi-service muxponders.

Figure 6-35 *Optical Power Budget for Trunk Fiber Protected Configurations Using Nonsplitter 8-Port Multi-Service Muxponders*

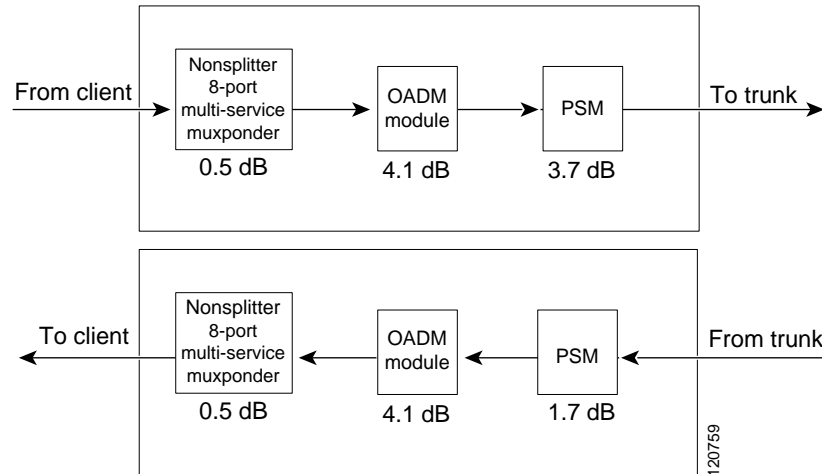


Figure 6-36 shows an example of a Cisco ONS 15530 shelf in a trunk fiber protected configuration with an ESCON aggregation card and two nonsplitter 2.5-Gbps ITU trunk cards.

Figure 6-36 Trunk Fiber Protected Configuration Using a Nonsplitter 2.5-Gbps ITU Trunk Card

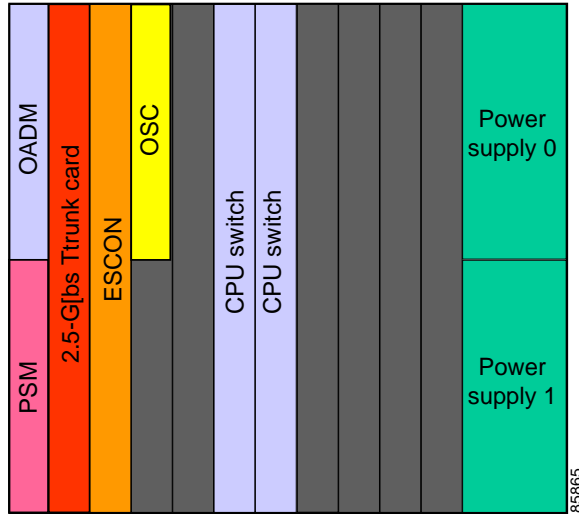


Figure 6-37 shows the optical power budget for a trunk fiber protected configuration.

Figure 6-37 Optical Power Budget for Trunk Fiber Protected Configurations Using Nonsplitter 2.5-Gbps ITU Trunk Cards

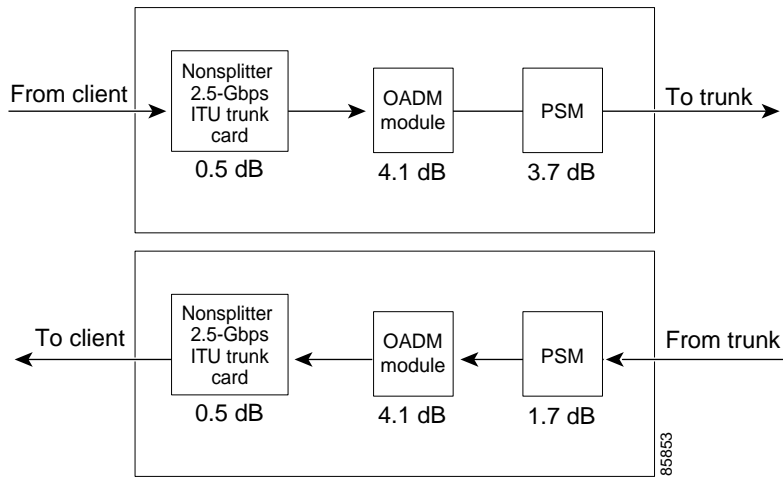


Figure 6-38 shows an example of a Cisco ONS 15530 shelf in a trunk fiber protected configuration with an ESCON aggregation card and two 10-Gbps ITU trunk cards.

Figure 6-38 Trunk Fiber Protected Configuration Using Nonsplitter a 10-Gbps ITU Trunk Card

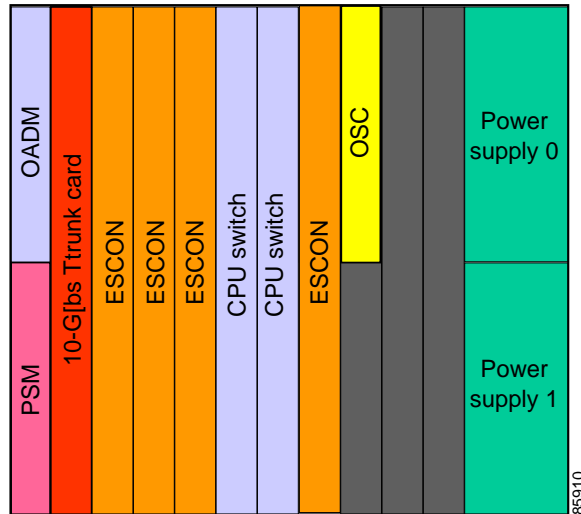
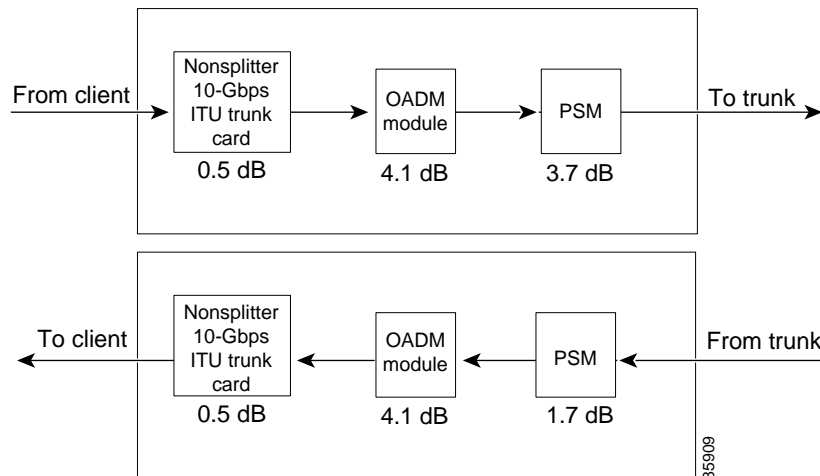


Figure 6-39 shows the optical power budget for a trunk fiber protected configuration.

Figure 6-39 Optical Power Budget for Trunk Fiber Protected Configurations Using Nonsplitter 10-Gbps ITU Trunk Cards



Note

The PSM can also connect directly to a transponder line card or an ITU trunk card. That configuration would not include the loss for the OADM modules.

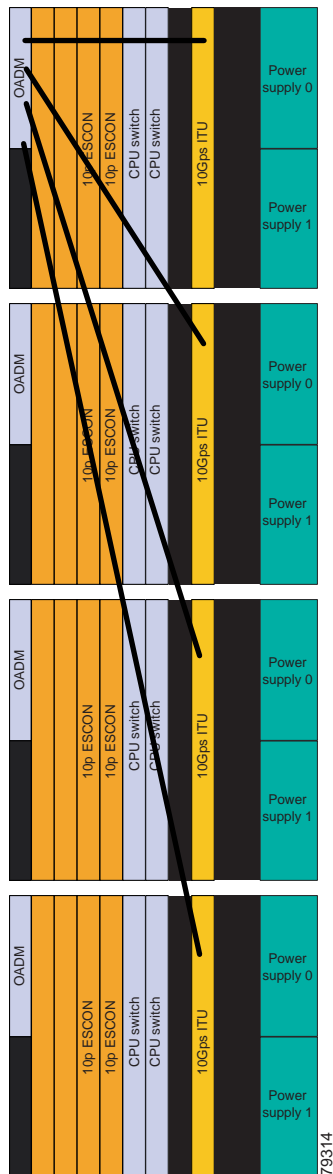
Multiple Shelf Node Configurations

This section describes multiple shelf nodes consisting of only Cisco ONS 15530 shelves and multiple shelf nodes consisting of Cisco ONS 15530, Cisco ONS 15540 ESP, and Cisco ONS 15540 ESPx shelves.

ITU Linked Configuration

Figure 6-40 shows a multiple shelf node with three Cisco ONS 15530 shelves linked to the OADM modules on a fourth Cisco ONS 15530 shelf.

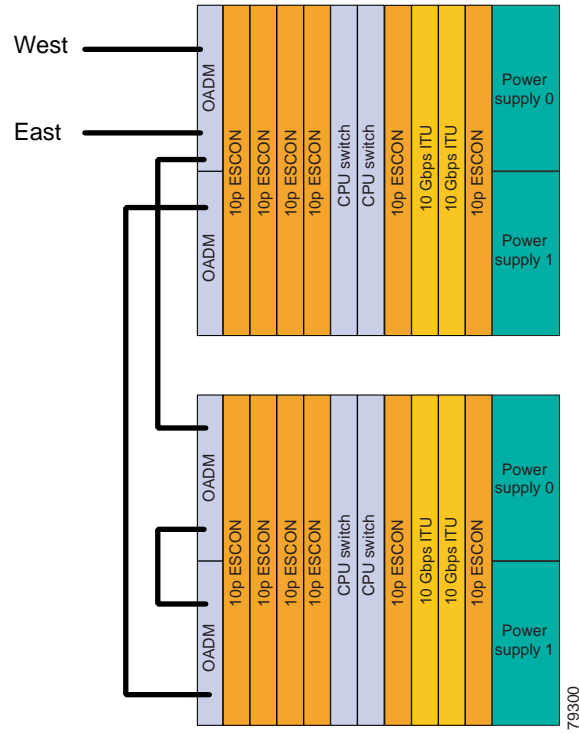
Figure 6-40 Cisco ONS 15530 Multiple Shelf Node with ITU Uplinking



DWDM Linked Configuration

Figure 6-41 shows an example of DWDM linking with two Cisco ONS 15530 shelves linked together via the OADM modules to form a single logical node.

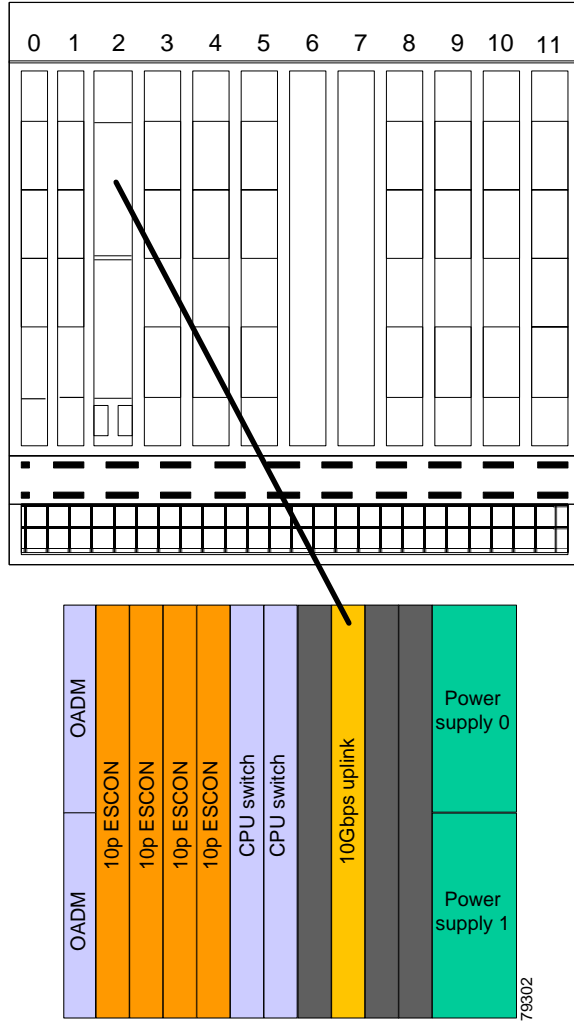
Figure 6-41 DWDM Linking With Two Cisco ONS 15530 Shelves



10-GE Client Signal Uplink Configuration

Figure 6-42 shows an example of an unprotected 10-GE client signal linking a Cisco ONS 15530 shelf and a Cisco ONS 15540 ESPx or Cisco ONS 15540 ESP shelf.

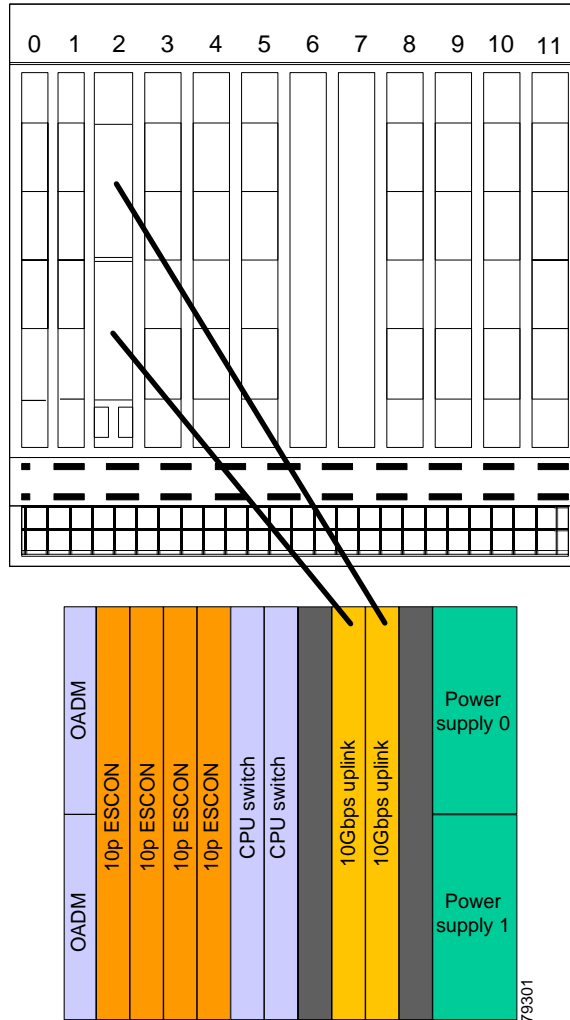
Figure 6-42 Unprotected 10-GE Client Signal Linking



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Figure 6-43 shows an example of protected 10-GE client signal linking between a Cisco ONS 15530 shelf and a Cisco ONS 15540 ESPx or Cisco ONS 15540 ESP shelf.

Figure 6-43 Protected 10-GE Client Signal Linking



Cisco ONS 15530 Topologies

The section describes network topologies consisting only of Cisco ONS 15530 shelves. The Cisco ONS 15530 can be configured in the following types of topologies:

- Point-to-point
- Meshed ring
- Hubbed ring with a multiple shelf hub

Point-to-Point Topologies

The Cisco ONS 15530 supports point-to-point topologies, with or without signal protection. A single shelf supports up to four protected channels and up to eight unprotected channels. To support more channels, multiple shelf nodes can be used.

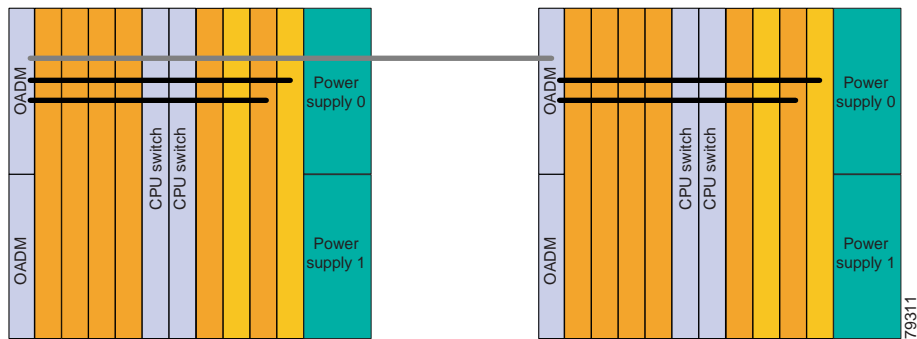
Use following criteria to determine the equipment needed for a point-to-point topology:

- Distance between nodes
- Potential topology changes in the future (such as migration to a ring)
- Presence of OSC

Unprotected Point-to-Point Topology

Figure 6-44 shows an example of an unprotected point-to-point topology between two Cisco ONS 15530 shelves.

Figure 6-44 Unprotected Point-to-Point Topology



Protected Point-to-Point Topology

Figure 6-45 shows an example of a splitter protected point-to-point topology between two Cisco ONS 15530 shelves.

Figure 6-45 Protected Point-to-Point Topology

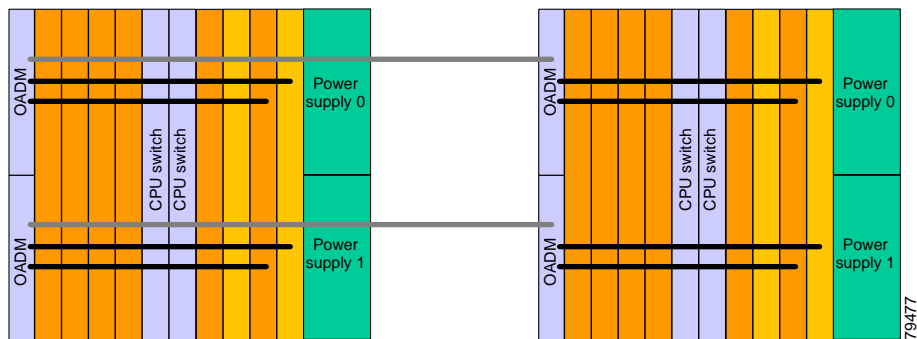
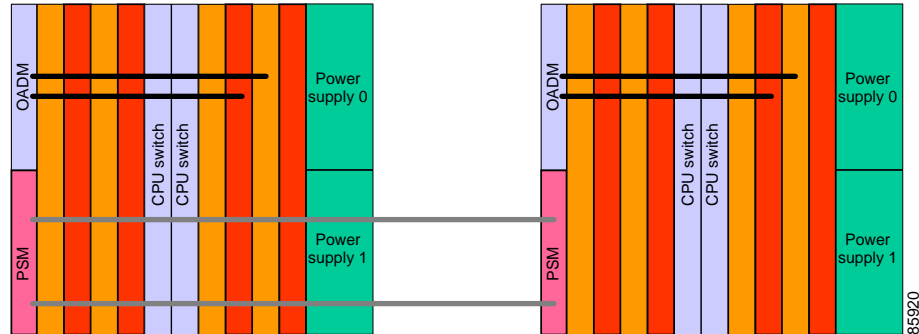


Figure 6-46 shows an example of a trunk fiber protected point-to-point topology between two Cisco ONS 15530 shelves.

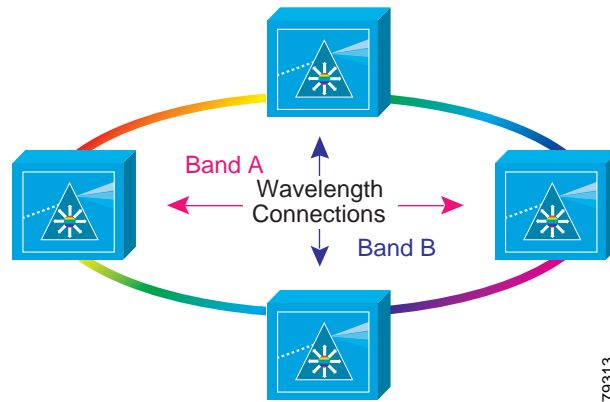
Figure 6-46 Protected Point-to-Point Topology



Meshed Ring Topologies

Figure 6-47 shows a logical view of a meshed ring topology consisting of only Cisco ONS 15530 shelves.

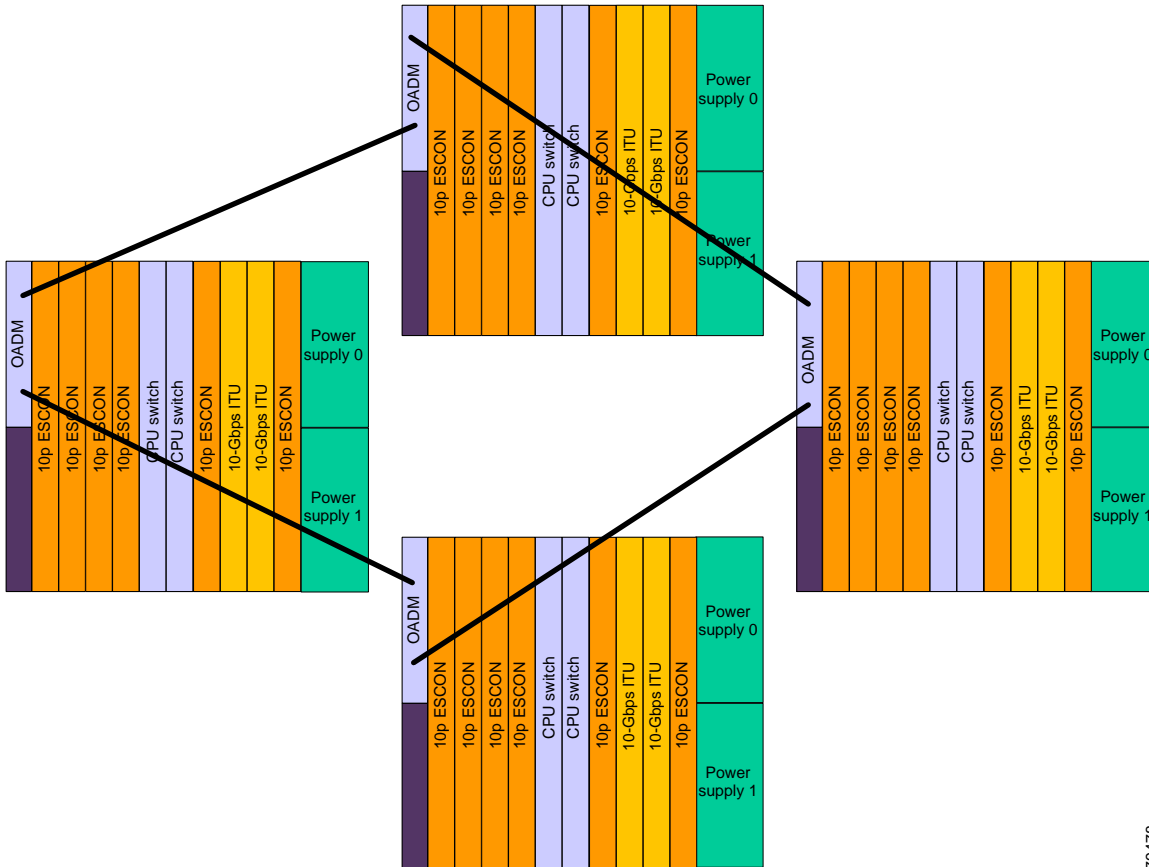
Figure 6-47 Meshed Topology



Unprotected Meshed Ring Topology

Figure 6-48 shows an example of an unprotected meshed ring topology consisting of only Cisco ONS 15530 shelves and supporting on four channels.

Figure 6-48 Unprotected Meshed Ring Topology

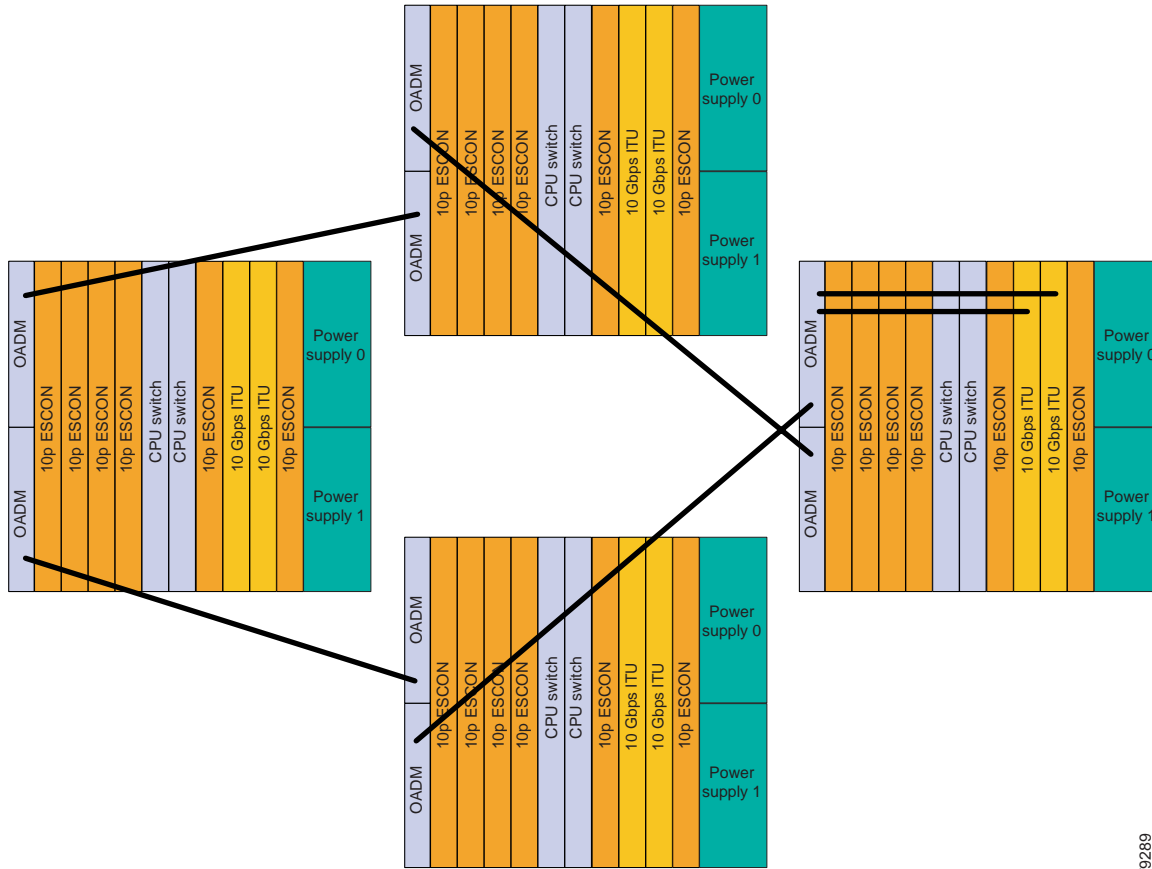


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Protected Meshed Ring Topology

Figure 6-49 shows an example of a protected meshed ring topology consisting of only Cisco ONS 15530 shelves.

Figure 6-49 Protected Meshed Ring Topology



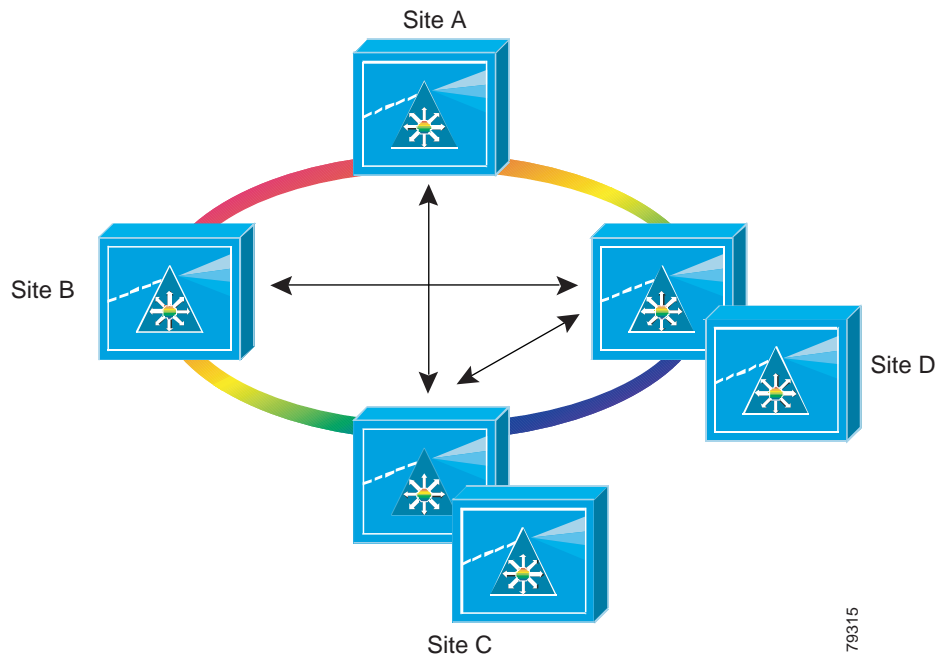
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Meshed Ring Topology Using Multiple Cisco ONS 15530 Shelf Nodes

You can configure the Cisco ONS 15530 shelves in a meshed ring topology. The most common application for this configuration is when multiple bands are supported on a node.

Figure 6-50 shows a logical view of a meshed ring topology consisting of Cisco ONS 15530 shelves with multiple shelf nodes.

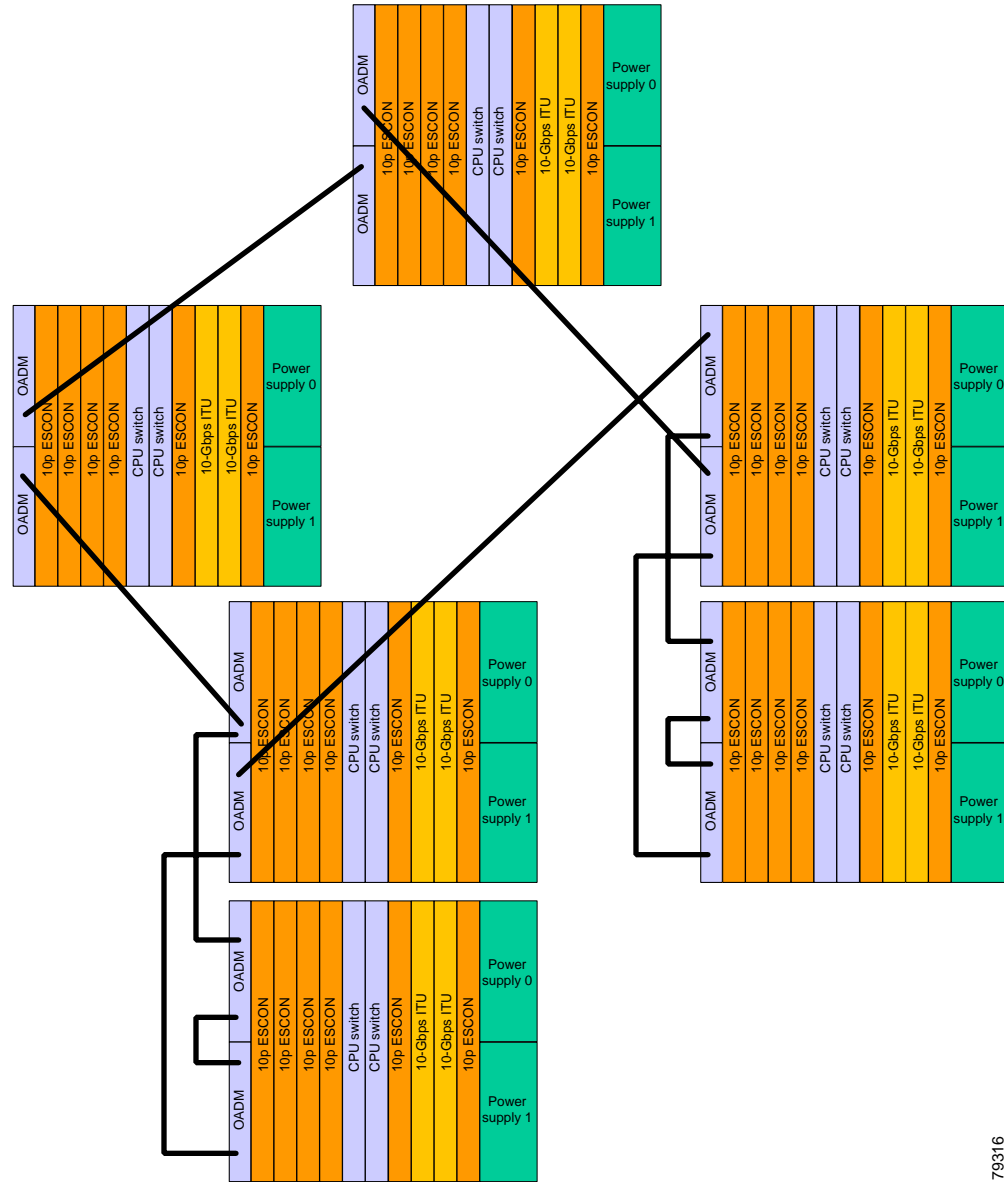
Figure 6-50 Meshed Ring Topology with Multiple Shelf Nodes



Protected Meshed Ring Topology

Figure 6-51 shows a protected meshed ring topology consisting of Cisco ONS 15530 shelves with multiple shelf nodes.

Figure 6-51 Protected Meshed Ring Topology with Multiple Shelf Nodes



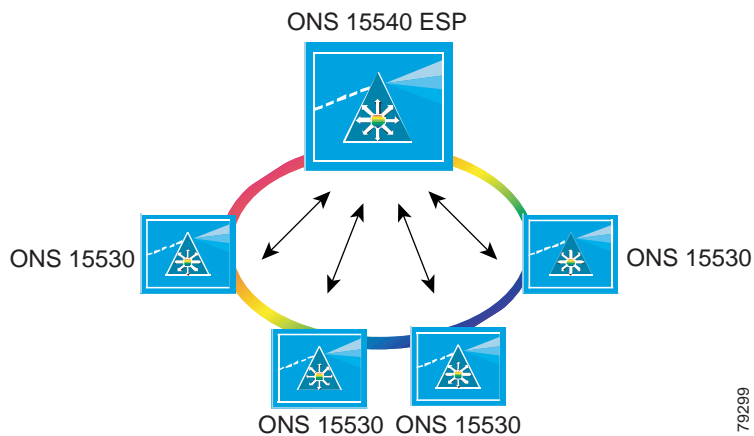
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Cisco ONS 15530 and Cisco ONS 15540 Mixed Topologies

The Cisco ONS 15530, Cisco ONS 15540 ESP, and Cisco ONS 15540 ESPx systems can be used in the same network topology. The most common application is using a Cisco ONS 15540 ESP or Cisco ONS 15540 ESPx as the hub node in a hubbed ring topology.

Figure 6-52 shows a logical view of an hubbed ring topology consisting of a Cisco ONS 15540 ESP as the hub node and Cisco ONS 15530 shelves as the spoke nodes. The configuration supports transparent services.

Figure 6-52 Hubbed Ring Topology With a Cisco ONS 15540 ESP Hub



Cisco ONS 15530 and Cisco ONS 15540 Collocated Topologies

The Cisco ONS 15530 can be combined with a Cisco ONS 15540 ESP or Cisco ONS 15540 ESPx system in the same network node. The most common application is using a Cisco ONS 15540 ESP or Cisco ONS 15540 ESPx as the hub node in a hubbed ring topology where aggregated services are required.

Figure 6-53 shows a logical view of an hubbed ring topology consisting of collocated Cisco ONS 15540 ESPx and Cisco ONS 15530 shelves as the hub node and Cisco ONS 15530 shelves as the spoke nodes. This configuration can support transparent and aggregated services.

Figure 6-53 Hubbed Ring Topology With Collocated Cisco ONS 15540 ESP and Cisco ONS 15530 Hub

