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Tech Notes

Management of Ethernet Connectivity Options for Cisco ONS 15454

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Contents

[Introduction](#)[Prerequisites](#)[Requirements](#)[Components Used](#)[Conventions](#)[Category 5 Cable Wiring Standards](#)[Ethernet Pinouts](#)[Ethernet Ports on Cisco ONS 15454](#)[Wire-Wrapping on the Backplane](#)[A Wiring Example With the T568B Color Codes](#)[Troubleshoot the Wiring](#)[Summary](#)[Case Study](#)[NetPro Discussion Forums - Featured Conversations](#)[Related Information](#)**Help us help you.****Please rate this document.** Excellent Good Average Fair Poor**This document solved my problem.** Yes No Just browsing**Suggestions for improvement:**

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Introduction

You can manage a Cisco ONS 15454 node over Ethernet and Data Communication Channel (DCC) ports. A variety of options enable you to make the connectivity. This document addresses how the various Ethernet ports relate to each other, and provides cabling instructions. The document also includes a case study to demonstrate a connectivity example.

Prerequisites

Requirements

Cisco recommends that you have knowledge of these topics:

- Cisco ONS 15454

Components Used

The information in this document is based on these software and hardware versions:

- Cisco ONS 15454

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

Refer to [Cisco Technical Tips Conventions](#) for more information on document conventions.

Category 5 Cable Wiring Standards

Three wiring standards are in use today for the Category 5 unshielded twisted copper pairs (see [Table 1](#) for details):

- EIA/TIA 568A
- EIA/TIA 568B or AT&T 258A
- USOC (Universal Service Order Code)

All the three cabling specifications use the same eight cable colors, but their wiring (or cable-to-pin mapping) is different. EIA/TIA 568B (T568B for short) is the most common wiring today.

RJ-45 (where RJ stands for registered jack) is a commonly used connector. USOC defines RJ-45, which was previously called RJ-61X.

Ethernet 10BaseT and 100BaseT use only four wires.

Table 1 – Category 5 UTP Cable Pins for Ethernet

Pin #	EIA/TIA 568A	AT&T 258A, or EIA/TIA 568B	USOC	Ethernet 10BASE-T 100BASE-T
1	White/Green	White/Orange	Brown or Brown/White	X
2	Green/White or Green	Orange/White or Orange	White/Green	X
3	White/Orange	White/Green	White/Orange	X
4	Blue/White or Blue	Blue/White or Blue	Blue or Blue/White	Not used
5	White/Blue	White/Blue	White/Blue	Not used
6	Orange/White or Orange	Green/White or Green	Orange or Orange/White	X
7	White/Brown	White/Brown	Green or Green/White	Not used

8	Brown/White or Brown	Brown/White or Brown	White/Brown	Not used
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Ethernet Pinouts

Ethernet uses *differential signal* to reduce Radio Frequency Interference (RFI). The transmitted signal is sent on two separate lines, one as positive (+), and the other as negative (-). The receiver takes the difference between the two signals to derive the real signal, and therefore eliminates the noise caused by the RFI. In order to ensure that both the signals have the same noise level, you must twist the opposite signals together.

The type of signal for each pin depends on the type of device for which it is wired. There are two types of Ethernet devices:

- Data Terminal Equipment (DTE)—which is a user device, for example, a router or PC.
- Data Communication Equipment (DCE)—which is a network device, for example, a hub, repeater, or switch.

[Table 2](#) lists signal pinouts.

You require a cross-over cable to connect two similar devices (DCE to DCE, or DTE to DTE). You need a straight-through cable to connect dissimilar devices (DTE to DCE or vice versa). You must match transmit pins to receive pins. In addition, you must also match the polarity, i.e., positive to positive and negative to negative because, some devices do not function correctly if there is a polarity mismatch. If the LED is not lit up, the implication is that the wiring is not successful.

Table 2 – Ethernet Pinouts

Pin #	DTE	DCE
1	Transmit+	Receive+
2	Transmit-	Receive-
3	Receive+	Transmit+
4	Receive-	Transmit-

Note: Table 2 includes only usable pins.

Ethernet Ports on Cisco ONS 15454

An ONS 15454 chassis contains three Ethernet ports:

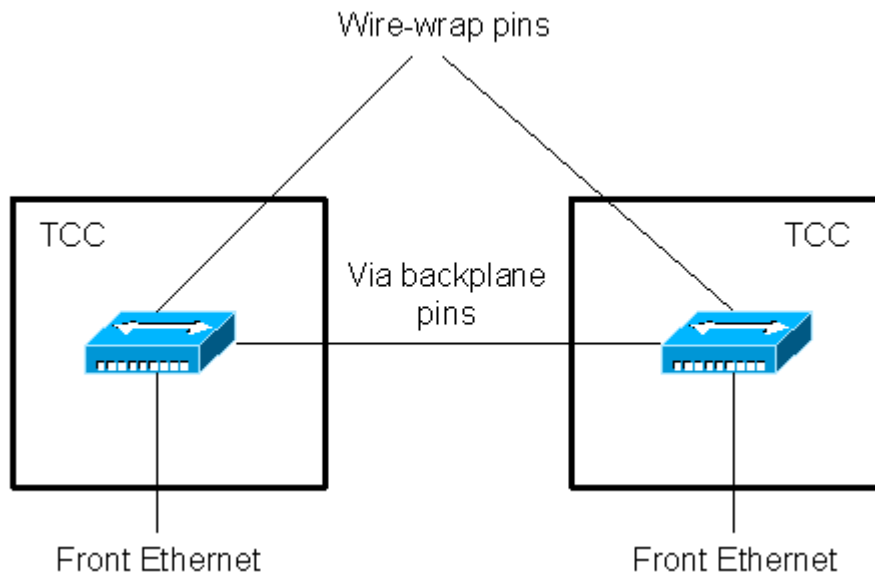
- One Ethernet port on the active TCC. TCC here represents various generations of the card, namely, TCC, TCC+, and TCC2.
- One Ethernet port on the standby TCC.
- Eight wire-wrap pins on the backplane. Only the top four pins are used for LAN connectivity.

All ports are fixed at 10 Mbps with half duplex.

All Ethernet ports on Cisco ONS 15454 are wired as DCE. So, if the external device is a DCE, you need a cross-over cable. If the external device is a DTE, you need a straight-through cable.

The three Ethernet ports (one on each TCC, and one on the backplane) are internally wired to two repeaters (see [Figure 1](#)). On each TCC, one repeater connects all the Ethernet ports together. Also the two repeaters are connected directly through the pins on the backplane.

Figure 1 – Ethernet Port Wiring on ONS 15454



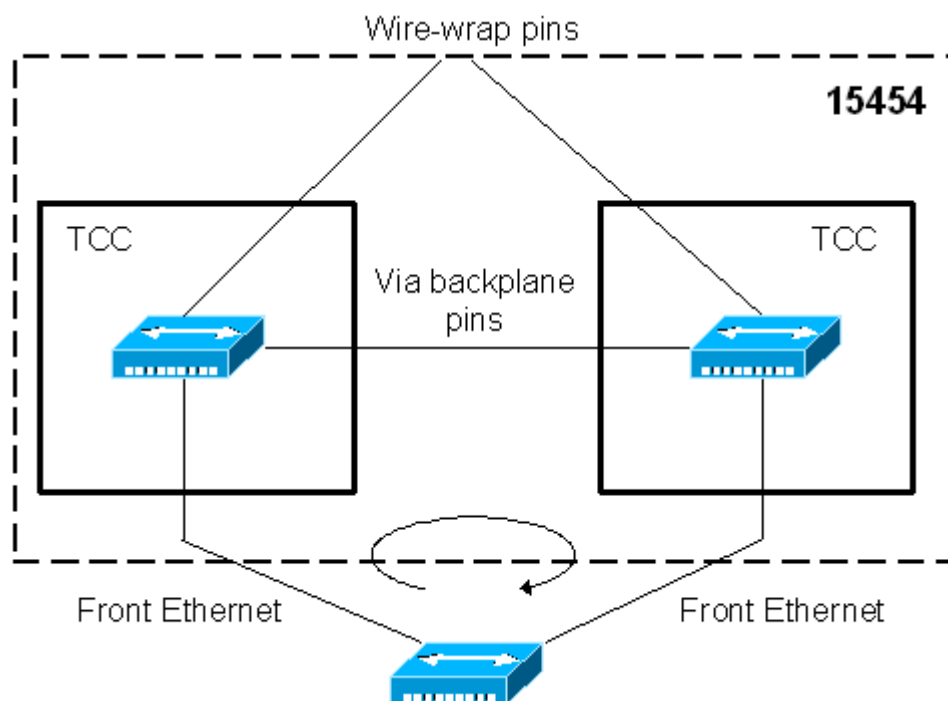
If any two ports or all three ports are connected to the same (external) hub or repeater, a repeater loop is formed. A repeater loop must always be avoided.



Warning: A repeater loop can result in traffic storms. All ports on the hubs or repeaters in the loop can lose connectivity.

[Figure 2](#) represents a scenario where two TCC ports are connected to the same hub. A repeater loop is formed between the two TCC Ethernet ports and the hub. Traffic circulates until all ports saturate. The same problem occurs when you connect the backplane Ethernet port and any TCC port(s) to the same hub.

Figure 2 – An Example of A Repeater Loop



You can connect multiple ports to a switch without a loop formation, because Spanning Tree Protocol (STP) allows only one port to be in the forwarding state. However, you experience a temporary loss of connectivity (for about 30 seconds) during each STP convergence.

Wire-Wrapping on the Backplane

The backplane of Cisco ONS 15454 ANSI systems contains eight LAN pins, marked as A1 through A4 and B1 through B4. You can use only A1, A2, B1, and B2 (which connect to LAN1), but you cannot use the other 4 pins (which connect to LAN2).

[Table 3](#) and [Table 4](#) list the RJ-45 pin association for the ANSI and SDH systems.

Table 3 – LAN Pin Assignments for ONS 15454 ANSI on the Backplane

Pin Field	Backplane Pin	RJ-45 Pin
LAN 1 that connects to DCE	B2	1
	A2	2
	B1	3
	A1	6
LAN 1 that connects to DTE	B1	1
	A1	2
	B2	3
	A2	6

Table 4 – LAN Pin Assignments for 15454 SDH on MIC-C/T/P

Pin Field	Backplane Pin	RJ-45 Pin
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Pin Field	RJ-45 Pin	RJ-45 Pin	Function
LAN 1 that connects to DCE	1	3	PNMSRX+, white / green
	2	6	PNMSRX-, green
	3	1	PNMSTX+ white / orange
	6	2	PNMSTX- orange
LAN 1 that connects to DTE	1	1	PNMSRX+, white / green
	2	2	PNMSRX-, green
	3	3	PNMSTX+ white / orange
	6	6	PNMSTX- orange

A Wiring Example With the T568B Color Codes

[Table 5](#) provides an example of common wiring color codes for T568B standard.

Table 5 – An Example of the T568B Color Codes

Pin #	DCE Signal	AT&T 258A, or EIA/TIA 568B
1	Receive+	White/Orange
2	Receive1	Orange
3	Transmit+	White/Green
6	Transmit-	Green

Note: This example includes only usable pins.

The most common configuration is to connect the backplane Ethernet pins to a DCE device, such as, a LAN switch or a hub. In such a case, the color codes listed in [Table 6](#) are applicable:

Table 6 – An Example of Wiring for DCE on 15454 ANSI

Backplane LAN Pin #	A	B
1	Green	White/Green
2	Orange	White/Orange

Troubleshoot the Wiring

The wiring is successful if the LED for the port on the LAN switch/hub or router/PC is lit up, and there is no specific condition reported on the ONS. If the wiring is flipped between pin 1 and pin 2, the LED does not light up. If the wiring is flipped between A and B, LED can light up, but a

condition can also be reported in CTC and on the LED panel on the ONS, based on the type of controller card. This condition is called "LAN Connection Polarity Reverse Detected (COND-LAN-POL-REV)". [Table 7](#) lists the support for this feature in three types of controller cards for software releases 4.x.

Table 7 – LAN Polarity Detection for Different Controller Cards

Controller Card	Detect LAN Polarity	Ethernet Still Functions even if Polarity Reversed
TCC+ or TCC	Yes	Yes
TCC2	No	No

Summary

A Cisco ONS 15454 node has three Ethernet ports; one on the active TCC, one on the standby TCC, and one on the backplane. These ports are internally wired with repeaters. When you connect two or all three ports into a hub or repeater, a repeater forms, and can result in loss of connectivity.

If a hub or repeater is the uplink device, you must connect only one of the three ports to it. There is essentially no difference as to which one of the three ports to use, with software releases 2.0.1 and later. However, when you use the backplane port, an advantage is that you do not need to change the cable when you replace a TCC.

If you want two or more simultaneous connections, use a switch that supports STP. STP puts only one port in the forwarding state, and the rest of the port(s) in the blocking state. Cisco recommends you to test the switch in the lab before you deploy the switch in production. When you work with STP, be aware of the convergence outage. See the [Case Study](#) section for more details on this option.

Each of the three Ethernet ports is wired as a DCE. Therefore, you must ensure that the cabling is based on the device to which you want to connect. Cisco recommends a Category 5 UTP cable. Besides the Ethernet ports, you can manage ONS 15454 nodes through SONET DCC ports, with proper configurations (which is not discussed here, because that is beyond the scope of this document).

Case Study

This case study shows how to connect 15454 nodes to a layer 2 switch that supports spanning tree protocol (STP). As indicated previously in this document, two TCC ports and the backplane port form repeated Ethernet segments. When you connect any two of the three ports to a hub, all segments can be saturated due to broadcast storms and collisions. So you must always avoid such a connection. If you require two simultaneous connections, use a switch that supports STP. This case study demonstrates the setup.

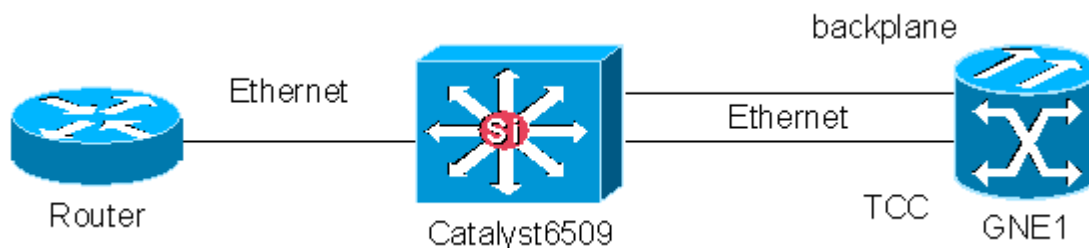
[Figure 3](#) represents a Cisco ONS 15454 node (GNE1) connected to a Catalyst 6509 switch through two Ethernet ports:

- One Ethernet port is connected through the backplane port.
- The other Ethernet port is connected through the front Ethernet port on the standby or active

TCC.

A router is also connected to the switch. All three Ethernet ports on the Catalyst switch are in the same VLAN.

Figure 3 – Two Ethernet Ports Connected to a Switch



When both ports to GNE1 are connected, each port goes through the various stages of STP. One of the ports goes through the **Not-connected, Listening, Learning, and Forwarding** stages, while the other port goes through the **Not-connected, Listening, and Blocking** stages. In effect, only one port is in the Forwarding state. This eliminates the saturation problem that occurs in a hub environment. If you disconnect the Forwarding port, the other port goes through the **Blocking, Listening, Learning, and Forwarding** stages.

During each STP convergence, there are about 30-second periods with no traffic movement. In other words, there is no connectivity to the node during such periods.

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