FLUKE networks

Application Note

Verifying Network Service Availability in Moves, Adds and Changes

Certification of installed data cabling has provided network owners and cabling installers with a valuable tool to insure the integrity of the physical network. This has provided a solid foundation for network reliability. With the proliferation of Ethernet communications protocols and additional services such as Power over Ethernet (PoE), it is important to provide an additional level of verification that the necessary network services are available at the Telecommunications Outlet following service activation or Moves, Adds, or Changes (MACs) or after troubleshooting cabling or link connectivity problems. The DTX Network Service Module now provides the ability to verify and document the available services.

The Moves, Adds, and Changes (MACs) environment

While much attention is paid to cabling installation in large new construction projects, many new data cabling installations occur within existing networks. These Moves, Adds, and Changes (MACs) occur when offices are reconfigured to meet the needs of a changing workforce or as networks expand to support a growing business. In a typical new construction project, the cable is pulled, patch panel racks are configured in the telecommunications room, and outlets are terminated in the work areas. The resulting Permanent Links are certified to be compliant with the standards specified in the building contract. The cables then remain unused until the building occupants move in to install their network switches in the telecommunications room and PCs at individual work stations. In this situation, the cabling certification test is the final documentation that the cabling installer completed the job satisfactorily, to standards and customer specifications.

In a MAC environment, cabling is installed within an existing network. Just as in a new construction environment, cable is pulled, and outlets and patch panels are terminated. The cabling is tested with an appropriate certification tester to verify all of the components, together with the installation practices employed, meet the requirements of the appropriate cabling standard. However, the certification in this situation only answers the question, "Was the cabling installed correctly?" The end users in this existing network would also like to know, "Will this work area outlet provide the services I need?"

Certification of installed copper and fiber links

Cabling certification serves two primary purposes. First, it provides an unbiased reference for the installer to demonstrate to the building owner that all of the cabling components meet the specified requirements and were installed with the quality workmanship needed to support the desired network data rates. Secondly, network owners can rely on cabling standards to specify the performance he can expect to obtain in the future as networking equipment continues to increase in speed. Installing higher performance cabling gives the network owner assurance that he can upgrade his network equipment without needing to upgrade the cabling as well. A network owner using a 10/100BASE-T network may choose to install Augmented Category 6 cabling knowing that, over several years, he plans to upgrade all of his equipment to 1000BASE-T with a few connections between servers upgraded to 10GBASE-T.

In order to maintain maximum flexibility in placement of the future servers, he specifies Augmented Cat 6 cable throughout the network. Had he decided a slower protocol would be adequate for his future needs, he may have selected a lesser quality cabling system, as long as it was adequate to support his desired network speed as shown in Table 1.

Data Transmission Protocol	Minimum Cable Classification
10BASE-T	Category 3 / Class C
100BASE-TX	Category 5 (obsolete) / Class D
1000BASE-T	Category 5e / Class D / Cat 6 / Class E
10GBASE-T	Category 6 / Class E (Limited channel length, subject to field test results. Guideline of max 55 m)
	Augmented Category 6 / Class E (Designed for full 100 meters)

Table 1. Minimum twisted pair cabling performance required to support various Ethernet data rates

The OSI model

While network applications communicate using a protocol such as 100BASE-TX, the devices must be connected with a physical media such as twisted pair, fiber optic, or coax cable. The transmitted data passes from the physical media through various layers of processing in order to allow two applications on the network to communicate. The open system interconnection (OSI) model, created by the International Organization for Standardization (ISO), provides a framework to understand the relationships among various network elements in the communications process.

Layer	Name	
7	Application	
6	Presentation	
5	Session	
4	Transport	
3	Network	Internet Protocol (IP) address in software
2	Data link	Media Access Control address in hardware
1	Physical	Signal generation and interface to Twisted-pair, Fiber, Coax, Radio Waves

Figure 2. OSI network communications system model

Cabling certification tests confirm layer 1 of the OSI model – the physical media, twisted pair copper wires or optical fiber – meets the performance requirements needed to support data traffic. In many new construction installations, cabling is installed prior to the network switches and PCs so there is no equipment in place to verify the layer 2 or layer 3 functions of the network. In a MAC environment, the network equipment is likely to be in place and the network owner will need to know if the expected network services are available at the outlet. The network owner may also want to know:

- At what speed can I connect to the network?
- Will this outlet power my Voice Over IP (VoIP) telephone?
- Can I get access to the Internet?
- Can I print to the networked printer?

The DTX-NSM Network Service Module can provide the answers.

At what speed can I connect to the network?

In a MAC, the new link is connected to an appropriate switch port following the completion of the cabling certification test. At this point, all of the services required by the end user should be available at the work area outlet. The DTX Network Service Module (DTX-NSM) provides the ability to verify these services and document they were in place at completion of the MAC.

Insert the DTX-NSM Network Service Module into the back of the DTX CableAnalyzer main unit, turn the knob position to "MONITOR." Simply connect a patch cord between the work area outlet and the RJ45 outlet on the DTX-NSM. These functions are also available on fiber optic networks using an optional Small Form-factor pluggable [SFP] fiber optic transceiver installed in the DTX-NSM. Select "Network Connectivity" and press the TEST button and DTX will generate a result display similar to that in Figure 3.

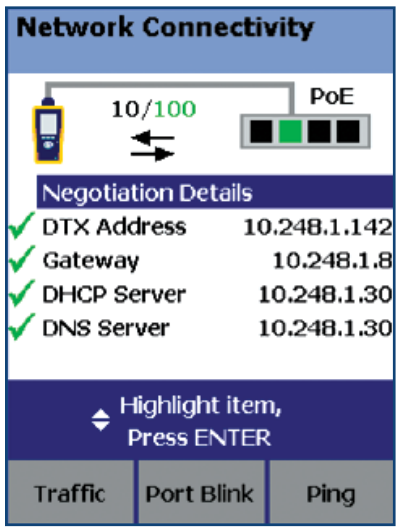

Figure 3. Network connectivity test result display

The graphic at the top of the display shows us this outlet is capable of supporting 10BASE-T or 100BASE-TX communication and that it is currently communicating at 100BASE-TX (green highlighted value) and full duplex mode (solid arrows).

DTX-NSM will report the 10/100/1000BASE-T(X) and full/half duplex capabilities of the outlet. Selecting "Negotiation Details" provides the information regarding the connection in Figure 4.

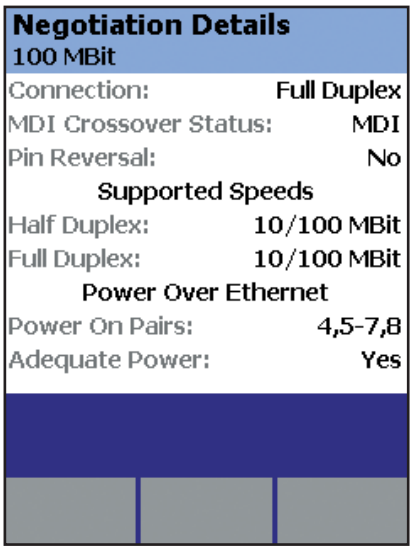

Figure 4. Negotiation details

In addition to the connection speed information, two types of information are available on the "Negotiations Details" screen – connection status and Power over Ethernet availability. First, the connection status provides pin reversal and crossover information. If the transmit and receive pairs have been reversed at some point in the channel, many switches can detect this condition and compensate for it. In that case, it will be reported as "MDI-X" in the MDI Crossover Status. Similarly, if individual wires have been reversed within the channel (tip/ring reversal), the switch may compensate by reversing its polarity, in which case it will be reported as a pin reversal by the DTX-NSM. In both cases, the switch has compensated for an error in a patch cord (assuming the Permanent Link was properly certified).

Second, when present, Power over Ethernet (PoE) status shows which pairs are carrying the DC power and whether adequate voltage was maintained under load. This provides assurance that VoIP telephones, wireless access points, or other Ethernet-powered devices will function properly on this outlet.

Returning to the display in Figure 3, four additional lines are preceded by green check marks indicating successful connection. The four items are DTX Address, Gateway, DHCP Server, and DNS Server. Each green check mark indicates successful connection and is followed by the IP address for that device. We can select a particular device such as the Gateway and review its details as shown in Figure 5. The statistics show the number of ping requests made and the number of responses received. The remaining statistics provide a measure of the reliability and consistency of the connection. Reliable connection to the Gateway indicates the end user has access out of the LAN – such as to the Internet.

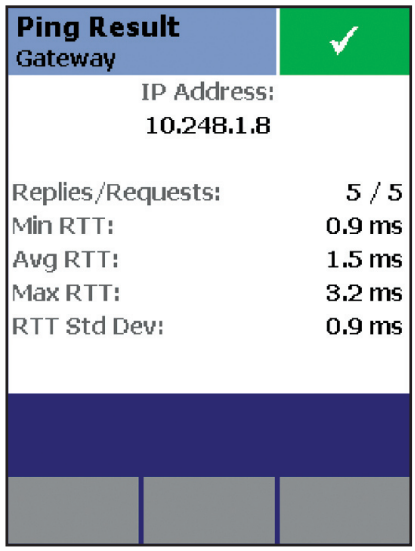

Figure 5. Ping result for Gateway

Successful access to the Gateway then provides the ability to verify connection to other devices outside the Local Area Network (LAN). In situations where the end user needs access to specific locations on a Wide Area Network or other Internet addresses, specific IP Addresses for these devices can be stored in a list of commonly used devices which might include local servers, printers, or satellite offices as illustrated in Figure 6.

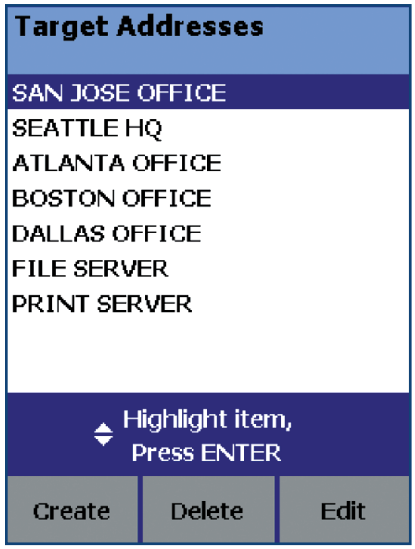

Figure 6. Ping list

Any device may be selected from this list. We will then obtain the same statistics that we observed for the Gateway. In the example shown in Figure 7, we chose to Ping the San Jose office. Note the average Round Trip Time (RTT) for the Ping Request/Reply is significantly greater than for the Gateway, indicating the time required for the Ping to travel the Internet to San Jose and return. The average RTT and the consistency of the RTT, reflected in its Standard Deviation (RTT Std Dev), may be critical for some time-sensitive applications such Voice over IP or IP Video streaming.

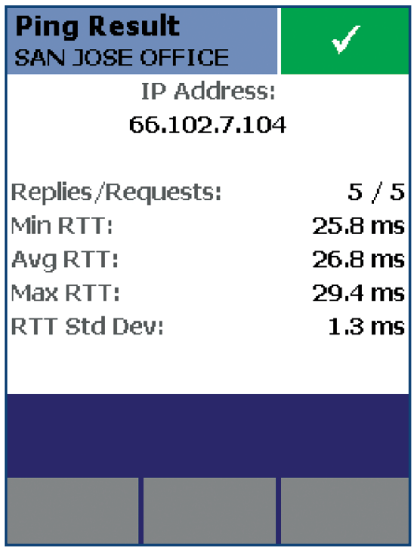

Figure 7. Ping results

Conclusion

While cable certification remains a critical step in the installation of any new link, we have seen that the DTX-NSM allows another level of visibility into the network. In a Move, Add, or Change environment, the link can be immediately put into service and the network capability of the outlet can be documented. This provides the cable installer and the network owner with an additional level of assurance that the network will perform to its maximum potential. To learn more about the unique test capabilities of the DTX CableAnalyzer, visit **www.flukenetworks.com/dtx** and take a virtual test drive.

NETWORKSUPERVISION

Fluke Networks
P.O. Box 777, Everett, WA USA 98206-0777

Fluke Networks operates in more than 50 countries worldwide. To find your local office contact details, go to **www.flukenetworks.com/contact**.

Printed in U.S.A. 8/2006 2561573 A-ENG-N Rev B