help desk

Ethernet cables, pt. 3 | By Wayne Howell

"Solid conductor Ethernet cable should only be used for permanent installations and never for touring, on reels, or for patching . . ."

→ In the first two parts of this article, I looked at the structure of Ethernet cables and their failure modes. In this final part, I'll discuss testing. Testing can be broken down into four categories:
• Wiring Check
• Network Test
• Certification
• Data Analysis

The first three relate to the actual wiring of the cable infrastructure. The fourth is about the data carried by the cable.

WIRING CHECK

Wiring check, as the name suggests, is a simple check that each conductor in the cable is connected to the correct pin in the RJ45. The pins in the RJ45 connector are rarely labelled, but looking into a female connector, the numbers are as follows:
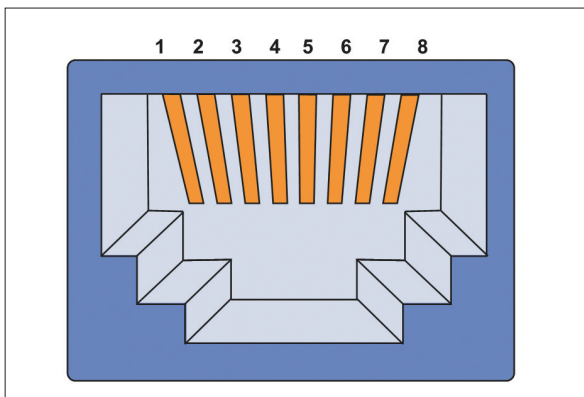
Before testing whether the wiring is correct, we need to understand the correct wiring. There are actually two sets of correct wiring, designated EIA / TIA 568A and EIA / TIA 568B (often just referred to as 'A' or 'B' wiring). The detail is shown in the charts below:

Pin	Colour	Pair
1	White/Green	3
2	Green	3
3	White/Orange	2
4	Blue	1
5	White/Blue	1
6	Orange	2
7	White/Brown	4
8	Brown	4

↑ TIA568-A

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The two wiring systems have the pairs 2 and 3 swapped relative to each other. In the early days of Ethernet, it was necessary to use either "straight wired" or "cross-over" cables between different types of equipment. Thankfully most modern equipment incorporates a system called Auto-MDI which means that the equipment switches pairs 2 and 3 automatically.

Modern Ethernet cables will be straight wired, which means the same wiring system at both ends of the cable. The choice of TIA568-A or TIA568-B is not really important, so long as you use the same at both ends! In Europe TIA568-B is most common.

A wiring checker is an invaluable piece of equipment and costs very little (around £10 from Screwfix). These products have a base station and a remote which allows both ends of the cable to be connected. The test provides a simple pass/fail on the correct cable wiring. Some of the more advanced wiring checkers such as the Easy Check (FT-68MLT £20 from Rapid Electronics) can test both straight and cross-over cables.

NETWORK TEST

A Wiring Check tool is invaluable and every cable you make or purchase should be tested with one. However, these simple tools only tell you about very basic errors - miswiring or a broken conductor.

They will not tell you if the conductors in a twisted pair have been mis-connected at both ends of the cable. Ethernet, particularly modern high speed Ethernet, is very unforgiving of this type of wiring error - called a split pair.

To test at this level, a more sophisticated tool is needed. There are a number of test equipment manufacturers, but my favourite is Fluke. The MicroScanner (MS-POE £800 from NetworkTesters) is an excellent example.

The product includes all the basic cable tests but adds detection of the following:
• Overall cable length: Ethernet cables cannot exceed 100m.

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• High Impedance: Checks whether each pair is of
a reasonable impedance. High impedance faults are usually
caused by a bad crimp connection.
• Split pair detection: As I described above, a cable can
appear to be made correctly, if the same fault is duplicated at
both ends.
• Distance to fault: Gives an approximate distance to the fault.
This is incredibly useful when trying to locate cable damage.
• Pair length: If there is a significant difference in length of the
pairs, data degradation can occur. This fault occurs when one
pair was cut back further than the others when terminating.

In addition, the product has a number of features for
detecting the state of an Ethernet switch connected to the far
end of the cable and whether it is capable of supplying PoE
(Power-over-Ethernet).

CERTIFICATION
The Network Tester described above has an extensive range of
features, but is not able to fully certify that
a cable complies with every aspect of the standards - for
example, if gives a simple High Impedance warning rather
than testing the actual loop impedance. This is usually fine for
an engineer who is fault finding (I've used the predecessor to
this model many times on site), but when new infrastructure is
installed the client will (should) expect it to be fully certified.

This requires a yet more sophisticated tester with
a higher price tag. Again, Fluke largely own this product space
with the recently launched DSX range which has superseded
the DTX range. These products are able to test cables up
to Cat8 with speeds of up to 40 Gigabit. The cost is around
£11,000 (Cable Monkey) although weekly hire can be more
cost effective.

Next month we'll look at data analysis, with particular
emphasis on using Wireshark - the free network analysis
software. ⊗