

New standards that have led to higher speeds and new cable categories

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Three Realities of Networking

#1 - Networks Never Go Slower

- *Plan for higher speeds, increased throughput, reduced latencies*

#2 - Networks Never Get Smaller

- *Plan for more users, more traffic, more capacity, more complexity*

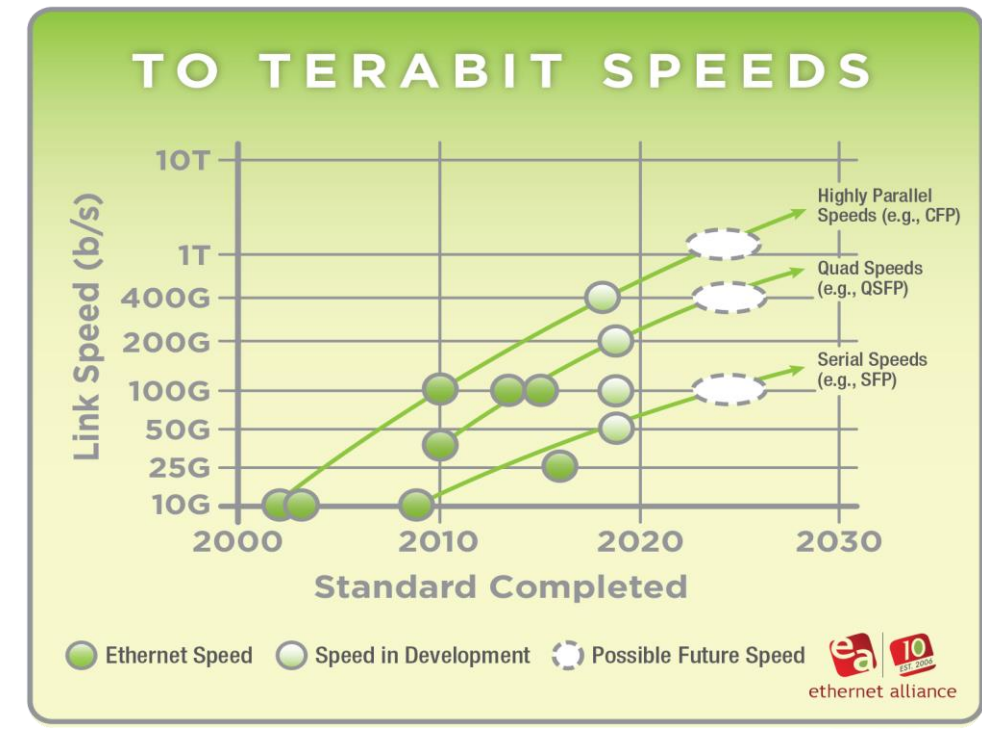
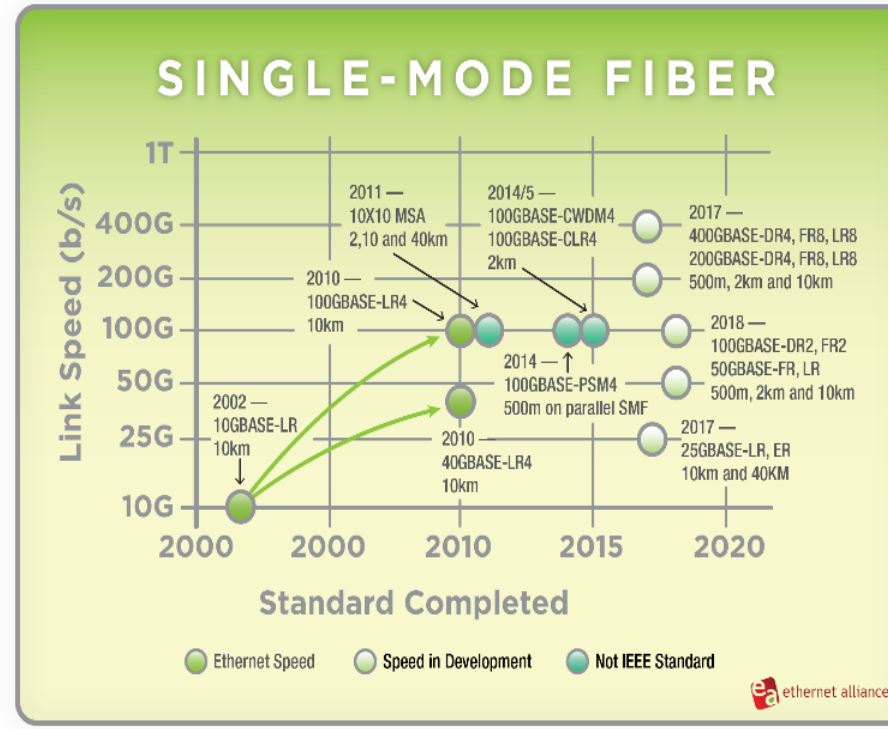
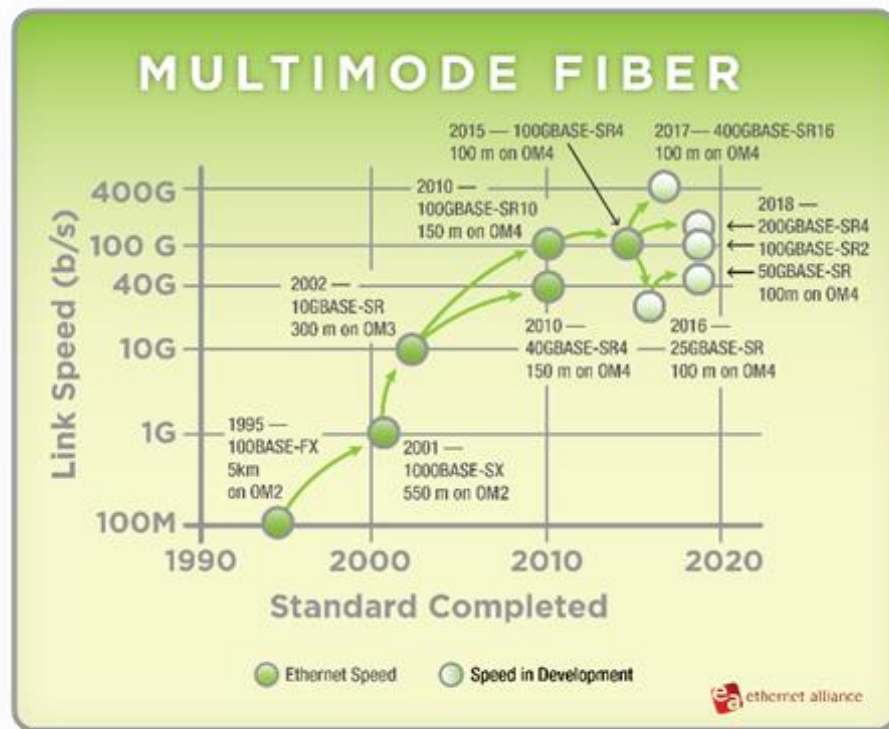
#3 - Networks Never Stay the Same

- *Plan for flexibility, reconfiguration, manageability*



Standards Changes

- Constant demand for faster data transfer rates!
 - We want more data and we want it NOW!





What is developing

- ANSI/TIA-568.3D Optical Cabling and Components Standard.
 - Defines what fiber optic cabling looks like in a premise or data centre
 - Provides methods for testing the installed cabling.
 - Here is where the trap is set. The link budgets we use for testing have changed. Plus the methods we use have been re-enforced, NO PATCH CORDS for testing!

7.3.4 Use of test cords

Both ANSI/TIA-526-7 and ANSI/TIA-526-14 recommend the use of reference-grade terminations on test cords to reduce uncertainty and improve the reproducibility of measurements. Reference-grade terminations result in lower loss than standard-grade terminations. Table 11 provides the Test Cord Loss Allowance for two different termination combinations.

Table 11 - Test cord loss allowance

Mated termination combination	Multimode (dB/connection)	Single-mode (dB/connection)
Reference-grade to standard-grade	0.3 ¹	0.5 ²
Standard-grade to standard-grade	0.75	0.75

Note 1 – This value is taken from ANSI/TIA-526-14, Table F.1.

Note 2 – This value is taken from ANSI/TIA-526-7, Table G.1.





ANSI/TIA-568.3-D Loss Calculations

- In the context of testing correctly, this guidance changes the way we think of links when calculating Pass / Fail limits.

– *Link Attenuation Allowance (dB) = Cabled Fiber Attenuation Allowance (dB) + Connections Attenuation Allowance (dB) + Fiber Splices Attenuation Allowance (dB) + Test Cord Attenuation Allowance (dB)*

– *Where;*

Cabled Fiber Attenuation Allowance (dB) = Maximum Cabled Fiber Attenuation Coefficient (dB/km) × Length(km)

Connections Attenuation Allowance (dB) = Number of Connections within the link × Connection Loss Allowance (dB/connection)

Fiber Splices Attenuation Allowance (dB) = Number of Splices × Fiber Splice Loss Allowance (dB/splice)

Test Cord Attenuation Allowance for one-cord reference method = 2 × Test Cord Loss Allowance

Test Cord Attenuation Allowance for two-cord reference method = 1 × Test Cord Loss Allowance

Test Cord Attenuation Allowance for three-cord reference method = 0 × Test Cord Loss Allowance

Note: The number of connections within the link excludes the connections on the ends of the link to the test cords that are accounted for subsequently as Test Cord Attenuation Allowance.



The new Category 8 application

- IEEE 802.3bq 25G/40GBASE-T published 8 September 2016
 - Defines minimum transmission characteristics for the application on a twisted pair channel
- ANSI/TIA-568-C.2-1 published 30 June 2016
 - Defines Category 8 Channels and Permanent Links
 - Includes Resistance Unbalance, TCL, ELTCTL
- ANSI/TIA-1152-A published 10 November 2016
 - Defines tester measurement and accuracy requirements for Category 8
- ISO/IEC Standards expected in 2017
 - ISO/IEC 11801-99-1 Class I/II Channels and Permanent Links
 - IEC 61935-1 Ed5.0 tester measurement and accuracy requirements



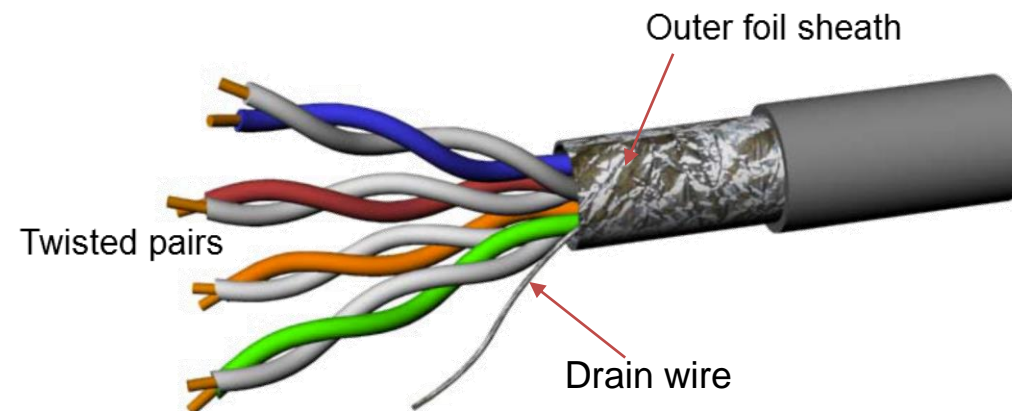
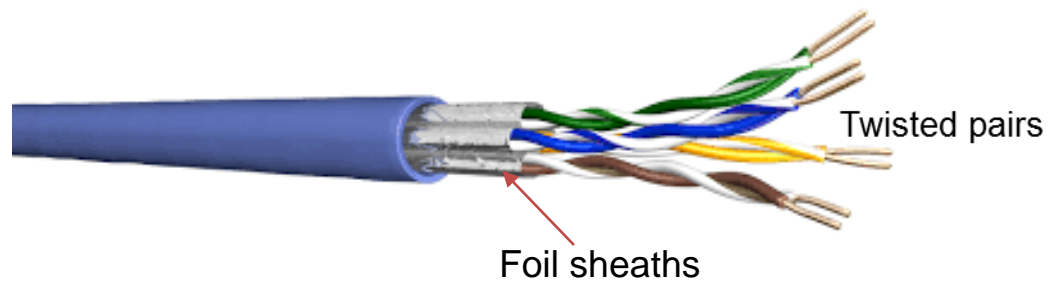
Why 25G/40G on Twisted Pair?

- Lower power and lower costs
 - Can be built into switch and server motherboards
 - No SFP Transceiver required as with fiber
 - Lower cost and more flexible than TwinAx Direct Attach cables
 - Can Auto-Negotiate at different rates
 - Expected to be a data center application only
 - 24m Permanent Link, 2 * 3m Patch cords max to create the channel of 30m
 - Top of Rack and End of Row Switch data center architectures
- Category 6A and 10GBASE-T followed similar path



Three types of Category 8 to deal with!

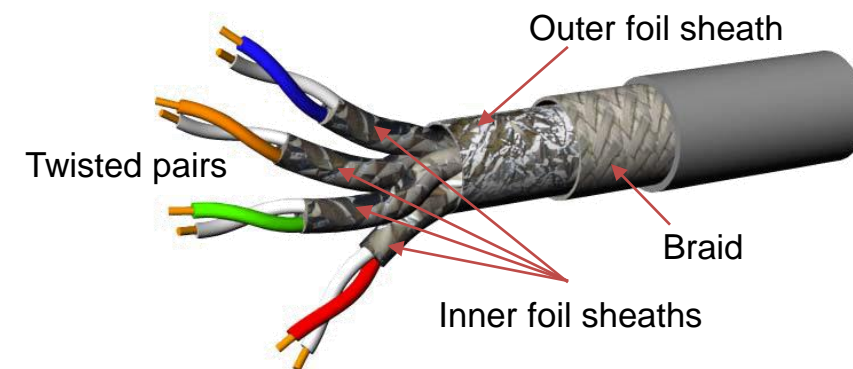
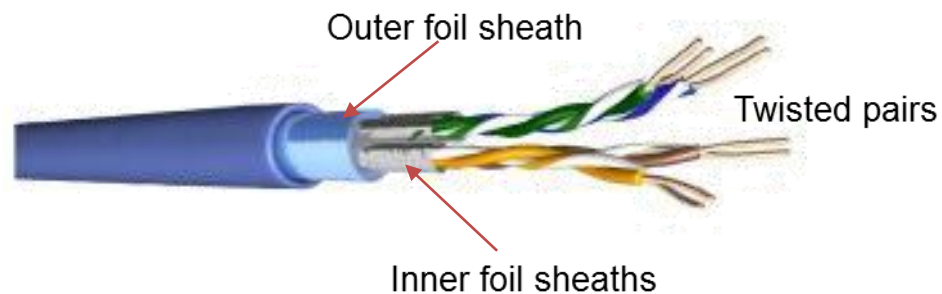
- The ANSI/TIA standardization body specifies Category 8 cabling components. They are backwards-compatible with the RJ45 jacks of Categories 6A, 6 and 5e according to ANSI/TIA-568-C.2.
- ISO/IEC specify two valid variants: Categories 8.1 and 8.2.
 - ISO/IEC Category 8.1 components are used to build Class I links. They are backward-compatible with the RJ45 connector interface for Categories 6A, 6 and 5e specified in ISO/IEC 11801.
 - Minimum cable type is U/FTP or F/UTP





Three types of Category 8 to deal with!

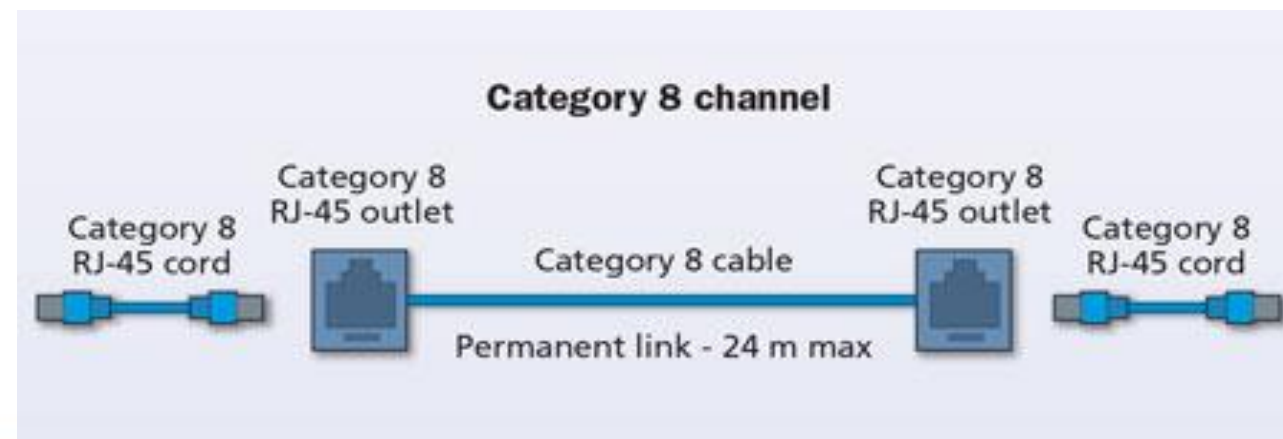
- The ANSI/TIA standardization body specifies Category 8 cabling components. They are backwards-compatible with the RJ45 jacks of Categories 6A, 6 and 5e according to ANSI/TIA-568-C.2.
- ISO/IEC specify two valid variants: Categories 8.1 and 8.2.
 - ISO/IEC Category 8.2 components are used to build Class II links. The standard defines different connector interfaces that are not compatible with one another. Category 8.2 components are backward-compatible with Category 7A and 7 components with the appropriate plug. Category 8.2 connector interfaces are not backward-compatible with the RJ45 jacks of existing cabling.
 - Minimum cable type is F/FTP or S/FTP.





Category 8.1

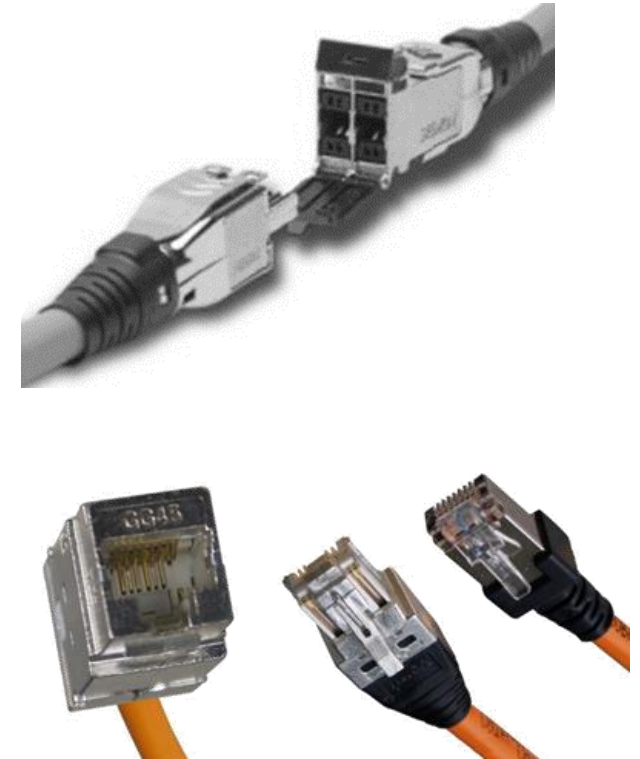
- The manufacturers of active equipment have asked for an RJ45-compatible plug configuration, and therefore for the international use of Category 8.1. This solution is backward-compatible with the billions of RJ45 connections installed worldwide.
 - This is a key issue! Active equipment manufacturers will be using RJ 45 jacks within their products.
 - Connection is either via a traditional channel model or via direct connect.
 - To field test you need Cat 8 Channel Adapters with RJ45 jacks and Permanent Link leads.





Category 8.2

- In Europe, many of the installed links are terminated in other connectors, like the Siemon TERA and Nexans GG45.
 - To maintain compatibility with these systems, manufacturers created Cat 8 components using these connector types.
 - Typically Cat 8.2 components provide more headroom than Cat 8.1 components.
- TIA and ISO/IEC are currently discussing harmonizing their specifications on both ends, as well as including Category 8.2 components in the TIA standard.





To summarise the Cat 8 types

- We will need to be able to field test three types of Category 8 solution.
 - All have a maximum frequency of 2GHz
 - All require the need for Channel Testing
 - All require the need for Permanent Link Testing

Component Category	Link Class	Max. Frequency	Responsible Standards Body	Usage	25GBASE-T	40GBASE-T	Compatible with RJ 45
Cat 8	Cat 8 Link	2GHz	ANSI/TIA	North America	Yes	Yes	Yes
Cat 8.1	Class I	2GHz	ISO/IEC	International	Yes	Yes	Yes
Cat 8.2	Class II	2GHz	ISO/IEC	International	Yes	Yes	No



Field testing Cat 8 solutions

- ANSI/TIA-1152-A published last November and supports the testing of installed Category 8 solutions plus all the preceding categories of cabling, 5e, 6 & 6A.
 - Defines the levels of tester.
 - Level IIe accuracy covers Category 5e
 - Level III accuracy covers Category 6
 - Level IIIe accuracy covers Category 6A
 - Level 2G accuracy covers Category 8
 - ISO/IEC will publish 61935-1 Ed 5
 - Adds Class I and Class II link testing
 - ISO will have a Level VI accuracy for Class I & II testers.

Field Tester Accuracy Levels		
Cabling Standard	Frequency Range (MHz)	Accuracy Level
CAT 5e	100	Level II
CAT 6	250	Level III
CAT 6A	500	Level IIIe
CAT 8	2,000	Level 2G
ISO-only Accuracy Levels (ISO 61935-1)		
Cabling Standard	Frequency Range (MHz)	Accuracy Level
CLASS F	600	Level IV
CLASS FA	1000	Level V



ANSI/TIA field test requirements

- With the new ANSI/TIA-1152-A we also get some changes in field testing.
 - We carry out all the usual parametric tests but now up to 2GHz, if testing Cat 8.
 - New requirement for wiremap test; when testing Cat 8 installations, must test the shield continuity along the path of the cabling.
 - Prevents the field tester being fooled by ground paths via racking and the earth connections.
 - Optional tests added to support the emerging IEEE 802.3bt PoE++ standard.
 - Channel dc loop resistance is to be below 25Ω
 - Current imbalance between pairs is to be minimized. This is achieved with Resistance Unbalance measurements within the pair and between pairs.

	Copper Certification	
	ANSI/TIA-568-C.2 & C.2-1 Cabling System Requirements	ANSI/TIA-1152-A Field Test Requirements
Wire Map *	✓	✓
Length	✓	✓
Propagation Delay	✓	✓
Delay Skew	✓	✓
dc Loop Resistance **	✓	Optional
Resistance Unbalance **	✓	Optional
Insertion Loss	✓	✓
NEXT, PS NEXT	✓	✓
Return Loss	✓	✓
ACR-F, PS ACR-F	✓	✓
TCL, ELTCTL	✓	
PS ANEXT, PS AACR-F	✓	✓

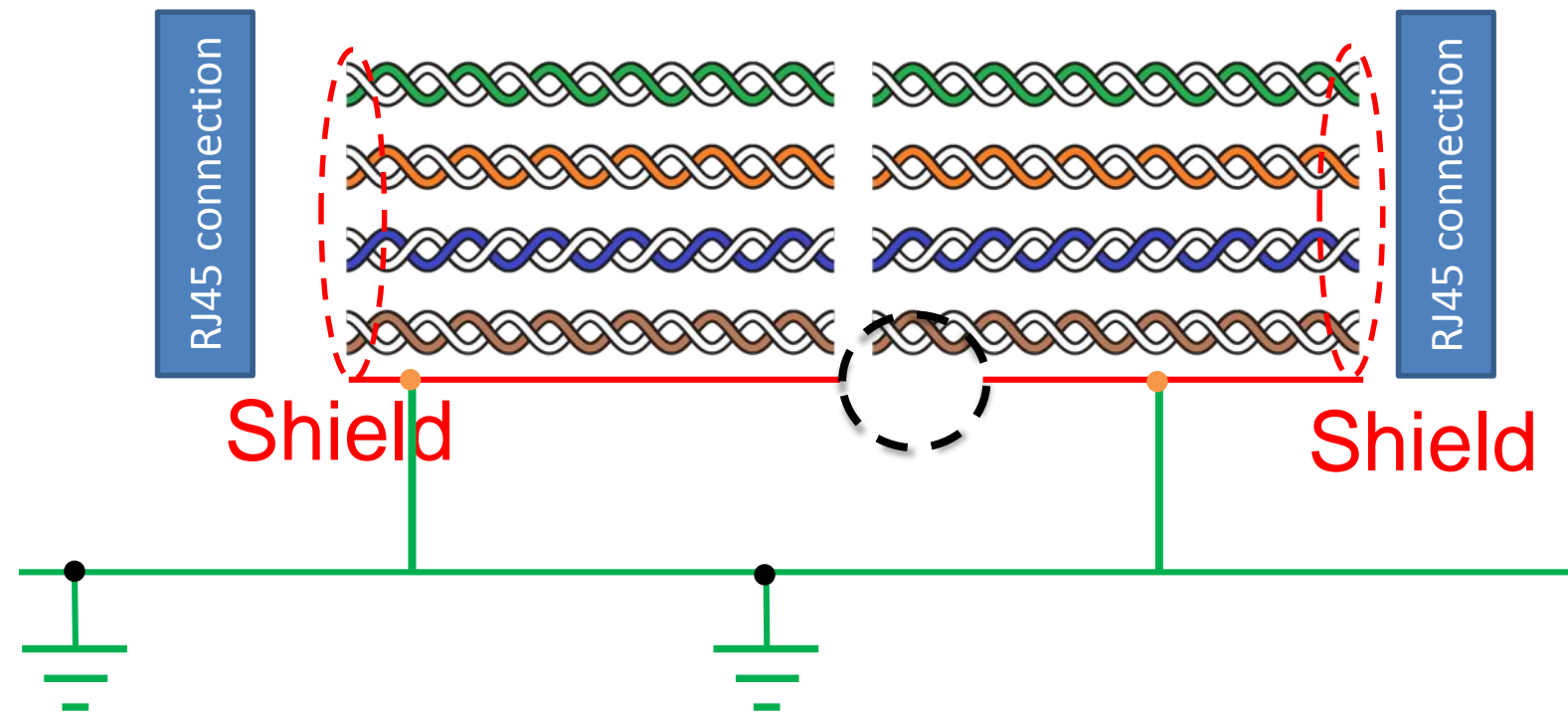
* For Level 2G testers screen continuity is tested along the path of the cabling.

** Proposed Measurement requirement to support IEEE 802.3bt DTE Power over MDI



Shield Continuity (RF)

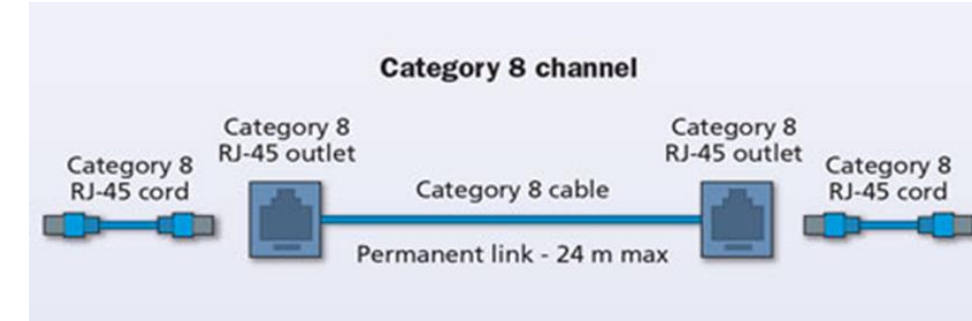
An ordinary continuity test would show this as connected.





Critical requirements for testing

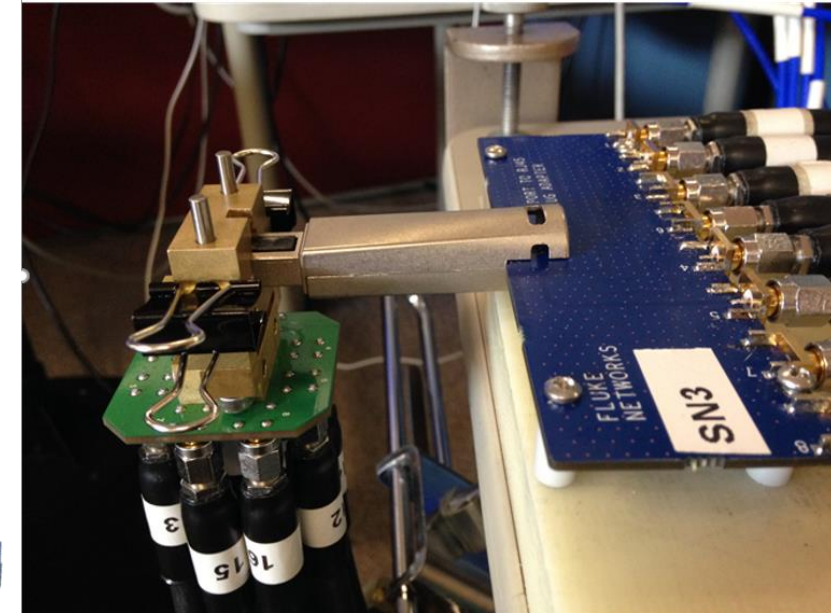
- For field testing we have two test models to work with, Channel and Permanent Link.
 - The installer usually installs and tests a Permanent Link.
 - However, the application requires proper Channel performance, which includes PL and the patch cords.
- To test a Permanent Link you need reference grade RJ45 Plugs
- To test a Channel you need a correctly performing RJ45 jack that is perfectly centred.





Creating the field test interfaces

- ANSI/TIA-1183-1 gave us the test methodology to enable us to produce components and verify their performance.
 - The Cat 8 reference plug came first.
 - With a reference plug you can then produce a Permanent Link interface.
 - With a reference plug you can then make test jacks.
 - With test jacks, you can make Channel interfaces for testing.





To summarize

- International structured cabling standards will continue to evolve and change
 - These new standards bring to us more bandwidth and higher speeds to meet our ever growing data demands.
- Your testing solution must also evolve to meet the challenges of these new cabling categories, both copper and fiber, that are being introduced.



Thank You!
Questions?