Channel, End to End & MPTL: Topologies, Testing Methods & Standards

Presented by:
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Agenda

• About Softing
• Applications
  – Channel Test
  – MPTL
  – End to End (E2E)
• Wrap Up
• Questions
Who We Are

- Headquartered in Haar, Germany.
- Run in accordance with the principles and values of a German medium-sized enterprise.
- Founded in 1979.
- Publicly traded company on the German Stock exchange.
- ~400 employees (annual average).
Disclaimer

• While the standards apply to all testers, adapters and test methods for today's presentation are specific to the Softing WX4500FA running firmware 7.4.
• Check with your tester manufacturer for their proper test methods.
• A proper test reference is assumed before all testing.
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- Ensure to set a proper reference before all testing.
Permanent Link & Channel Link

Test Plane Ends Here

Channel Link Adapter

Patch Cords in the Channel

Test Plane Ends Here

Channel Link 100m max.
Topologies

- Permanent link and channel link have served us well.
- New topologies (MPTL) require higher bandwidth and field installable RJ45.
- E2E provides for multi-segment capability & flexibility.
Higher Bandwidths

What’s prompting the need for MPTL connectors?
• Design recommendation for WAP installations calls for two Cat 6A at each location.
• Additional IoT applications require the increased bandwidth provided by a Cat 6A link.
• Lower costs necessitate these bandwidths rather than traditional biscuit and patch cord.
• Difficulty in crimping a traditional RJ45 onto a Cat 6A cable.
• Component manufacturers have responded with a better mouse trap.
Crimping History

- Cat 3: easiest, small O.D., few twists.
- Cat 5e: easier, smaller O.D., untwisting is still easy.
- Cat 6: harder, larger O.D, twist is tighter.
- Cat 6A: good luck.
The Better Mousetrap

The industry often innovates to meet a need in the marketplace.

Sample MPTL Connectors
Testing Requirements - MPTL Assemblies

Implications for field testers
- Classical channel test setup CANNOT be used.
- Channel tests do NOT include the first and last connector.

![Diagram of testing setup]

- **Failures** due to field termination (other than simple wiremap errors) may not be found using channel mode.
Sample MPTL Report - Passing

Figure 1-A: WireXpert test on 45-foot Cat 6 assembly.
- One end connected to a patch panel.
- Remote end terminated with MPTL RJ-45 connector.
- MPTL test was performed.
- Cable link gets overall pass.
Sample MPTL Report - Fail

Figure 1-B: Cable link immediately re-tested with Patch Cord Adapter & PL Adapter.
• Cable Fails Return Loss test.
How to Test MPTL

The TIA 568-2-D states:

• Tester shall use a PL (Permanent Link) adapter on the patch panel side.
• Tester shall use a patch cord adapter on the field RJ45 side.

Note: patch cord adapters are category specific, you will need to match the adapter to the type of assembly under test.
How to Set Up MPTL

- Permanent link adapter installed on the local side.
- Terra to RJ45 TRC (test reference cord) plugged into the patch panel.
- Proper category rated patch cord adapter installed on remote side.
- Field installed MPTL will plug directly into patch cord adapter.
WireXpert with MPTL Adapters
Advanced Test Set Up

- Tester will give you an error message if you have dissimilar adapters installed.

- Process:
  Advanced Test Option Screen
  Direct Attach – turn on
Select your Test Limits

- Patch cord adapters are category specific. Be sure to install proper adapter for assembly under test.
- Process:
  - Test limit drop down
  - TIA standards
  - Test limit for assembly testing
  - Autotest
  - Save the results
  - Send to Xport software
  - Produce certification reports

(scroll down for Cat 6A MPTL)
WireXpert MPTL Set Up

- Side plugs into the patch panel (simulated with green connector).
- Remote side male MPTL/RJ45 plugs directly into the female patch cord adapter.

- Process:
  Autotest
eXport Reporting Software
Sample MPTL Test Report

Limit Type is Cat 6A MPTL
Adapters are PL (Permeant Link) and Cat 6A Patch Cord
End to End

- End-2-End (E2E) is well-known in industrial settings, particularly in Europe.
- US growth as industrial ethernet replaces proprietary networks.
- Industrial ethernet takes advantage of the reliability and efficiency of an End-to-End network topology, a number of point-to-point segments in a series.
- This topology is becoming more common in enterprise networks with Power over Ethernet devices as information points with unique IP addresses.
- End-to-End allows these additional points to be linked serially for signal efficiency and with patch cord (segments) for ease of installation.
- The segments can be linked by adapters, hubs, switches, and gateways. Increasingly, E2E links support widely varying requirements in bandwidth, PoE and reliability.
End to End Applications

• **LED Lighting**: Many new systems run on PoE and are segment-based topologies.
• **Healthcare**: Many nurse call and patient room applications are segment-based.
• **Data Center**
  • Direct connection between devices, i.e. servers in the same row.
    (Note: E2E not yet standardized for CAT6A / Class E_A)
• **Professional Entertainment**: Cabling “on the fly” for stage equipment
End to End Installation

A Power over Ethernet installation reduces material and labor cost by using a single Cat5e/6 connection for power and communication. This plug-and-play, low-voltage cabling approach greatly simplifies the installation process, saving time, minimizing safety risk and helps to alleviate resourcing constraints for skilled labor.

From Hubbel’s website
What’s Different About End to End

• E2E is a segment-based topology.
• You can have multiple segments between the end point connecting devices.
• Quantity of RJ45 connectors will vary.
• Number of segments & connectors will determine the loss limit.
• WireXpert is already programmed with these loss limits.
Segments

1 Segment (S); 2 Connections (v)

2 Segments; 3 Connections

3 Segments; 4 Conn.
(Coupler as 1 Conn)

3 Segments; 3 Conn.
(Coupler as 2 Conn)

4 Segments; 5 Conn.

5 Segments; 6 Conn.
Testing Requirements – End to End Assemblies

Implications for field testers

• Classical channel test setup CANNOT be used
• Channel tests does NOT include the first and last connector
End to End Practical Guidelines

• Make sure your tester supports E2E links.
• WireXpert software 7.3 or higher supports E2E link testing.
• Standards only define measurement up to CAT6 / Class E₆.
• Max Ethernet supported speed is 1000MBit/s.
  • If 10GBit/s performance is required, Softing recommends using hybrid cables and CAT6A / Class E₆ permanent link limits.
• Hybrid cords can help to access tight or exposed locations.
  • Make sure the device can handle measurement using hybrid cords.
Cabling Requirements for IoT

E2E link configuration

- Up to 100m on solid wires, ~80m on stranded (depends on brand).
- Permanent link – E2E has plugs at the end.
- Direct connect equipment plugs into patch cables.
- Field installed plugs need to be included in test because they have been terminated.
Testing End to End

Currently E2E is governed by the IS0 11801

• WireXpert should be fitted with M12 (Industrial Ethernet) or End to End adapters.
• When testing RJ45’s on both ends, terra to female RJ45 TRC’s (test reference cords) will be used.
Category vs. Class D & E

- Class A: link/channel up to 100 kHz using [Category 1](#) cable/connector
- Class B: link/channel up to 1 MHz using [Category 2](#) cable/connector
- Class C: link/channel up to 16 MHz using [Category 3](#) cable/connector
- Class D: link/channel up to 100 MHz using [Category 5e](#) cable/connector
- Class E: link/channel up to 250 MHz using [Category 6](#) cable/connector
- Class E_A: link/channel up to 500 MHz using [Category 6A](#) cable/connector

(Amendment 1 and 2 to ISO/IEC 11801, 2nd Ed.)
How to Set Up End to End

- Adapters are hot-swappable and interchangeable.
- With Terra connectors, the TRC (test reference cords) will be a Terra to female RJ45.
- Process:
  Install M12 (Industrial Ethernet) adapters on local and remote units.
WireXpert with End to End Adapters
Select your Test Limits

- Process:
  - ISO standards from test limit.
  - Select test limit for number of segments and connectors.
  - Autotest
  - Save the result
  - Send to Xport software
  - Produce certification reports
WireXpert End to End Set Up

- Process:
  Terra to Female RJ45’s on Local & Remote Yellow Cable simulating a 2 connector, 1 segment E2E link
  Save the result
  Send to Xport software
End to End Test Results
Wrap Up

• Channel adapters as a one size fits all solution is not recommended.

• TIA 568-2-D allows you to certify MPTL assemblies with the proper WireXpert adapters and test reference cords.

• ISO 11801 allows you to certify E2E assemblies with the WireXpert M12 adapters and Terra to female RJ45 test reference cords.
Questions?
Thank You

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