



“The State of IEEE 802.3ap Backplane Ethernet”

John D’Ambrosia
Scientist, Components Technology
Secretary, IEEE 802.3ap



1



At lectures, symposia, seminars, or educational courses, an individual presenting information on IEEE standards shall make it clear that his or her views should be considered the personal views of that individual rather than the formal position, explanation, or interpretation of the IEEE.

Currently, IEEE P802.3ap is under review per the IEEE 802.3 Working Group ballot process and is subject to change. The work in this presentation is per IEEE802.3ap Draft 2.3.

The author would like to thank the following individuals for their input and support -

- Adam Healey, Agere Systems
- Blaine Kohl, Tehuti Networks

- **Introduction**
- Backplane Architecture and Issues
- Overview of Specification
- Closing Thoughts

- “Ethernet in a box”
- Target Applications
 - Wireline and wireless access equipment
 - Blade servers
 - Enterprise switching
- Leverages field proven Ethernet controller and switching IP
- Reduces solution cost and complexity

Example Application 14 Slot Dual Star Fabric

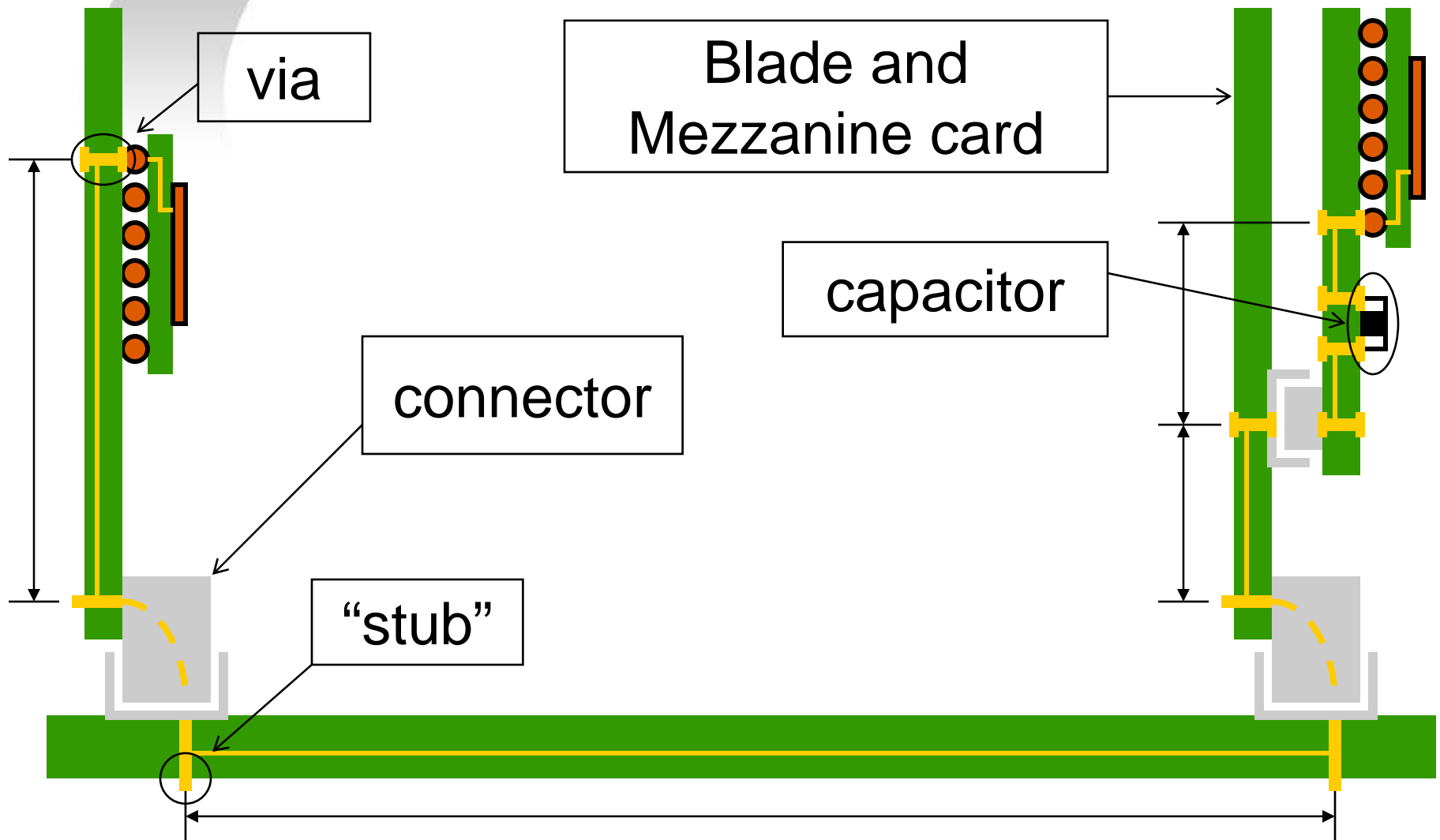


Photo provided by Tyco Electronics

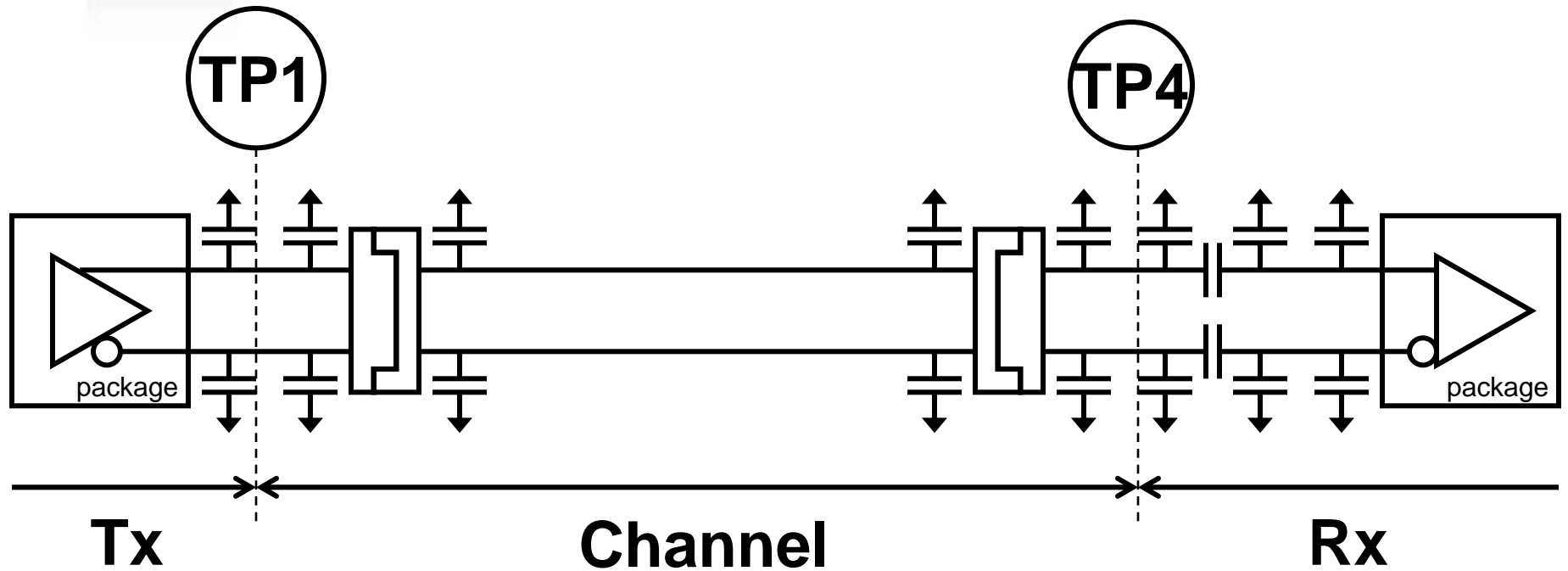
- Preserves the Ethernet frame at the MAC
- Supports existing media independent interfaces.
- Operates over improved FR-4 up to 1m.
 - Serial 1 Gb/s PHY
 - 4-lane 10 Gb/s PHY
 - Serial 10 Gb/s PHY
- Supports auto-negotiation.
- Supports BER of 10^{-12} or better.

- Introduction
- **Backplane Architecture and Issues**
- Overview of Specification
- Closing Thoughts

- Supply a PHY specification
 - Not a backplane specification
 - A PHY is not just a SERDES
- Be application agnostic
- Supply informative recommendations for backplane channels



- Line Cards – 178 to 305 mm maximum
- Backplanes – 244 to 559 mm maximum
- Total – 447 to 1016 mm maximum
- 2 or 3 connectors
- Problem is highly application dependent



Definition of *Improved* FR-4

<i>f</i> (GHz)	<i>Dk</i>	<i>Df</i>
0.1	3.60	0.010
1.0	3.57	0.010
2.0	3.50	0.011
5.0	3.50	0.011
10.0	3.40	0.012
20.0	3.20	0.0125

Refers to the effective dielectric properties of the fabricated board

Temperature and Humidity Tolerance (0-55°C, 10-90% non-condensing): *Dk* ±0.04, *Df* ±0.0010

Resin Tolerance: *Dk* ±0.02, *Df* ±0.0005

- Introduction
- Backplane Architecture and Issues
- **Overview of Specification**
- Closing Thoughts

- Serial 1 Gb/s connection
 - 8B10B encoding
 - Signaling Speed 1.25 Gbaud
- No transmitter or receiver-based equalization
- Auto-negotiation
- No Forward Error Correction

- 10 Gb/s connection
 - Four lanes for transmit, four lanes for receive
 - 8B10B encoding
 - Signaling speed is 3.125 Gbaud per lane
- Fixed transmit pre-emphasis
- Some receiver equalization
- Auto-negotiation
- No Forward Error Correction

- 10 Gb/s connection
 - 64B/66B encoding
 - Scrambled
 - Signaling speed is 10.3125 Gbaud
- Transmitter equalization
- Adaptive receiver equalization
- Auto-negotiation
- Optional Forward Error Correction

Example Application

14 Slot Dual Star Fabric



1000BASE-KX \Rightarrow 10GBASE-KX4 \Rightarrow 10GBASE-KR
4Gb/s=48Gb/s 10Gb/s=120Gb/s 40 Gb/s=480Gb/s

Photo provided by Tyco Electronics

- A migration path for Backplane Ethernet devices
- Provisions for interoperability with legacy devices
- Automated link selection
 - Speed
 - Features

- Tradeoffs to consider during implementation-
 - Required BER
 - Required latency
 - Complexity
- Not required to meet objectives
- Suitable for DFE-based receiver architecture
 - Counter-acts error propagation
- Signaling speed is not altered

- Introduction
- Backplane Architecture and Issues
- Overview of Specification
- **Closing Thoughts**

- Not just a PHY solution
- Part of an Ethernet Backplane Fabric solution
- Backplane channels are not cable channels
- Total length misleading metric
 - Channel loss
 - Crosstalk
 - Reflections
- The lab is not the “Real World”

Thank You

FORCE ™

- D'Ambrosia, Healey, "The State of IEEE 802.3ap Backplane Ethernet," DesignCon 2006.
- Goergen, "Channel Model and Material Characteristics," Feb 2006.