One lane electrical – what do we really mean?

IEEE 802.3 100Gbps Single-lane Electrical Study Group

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Objectives

- Determine what the problem(s) to be solved need:
- Define important attributes for a PHY project
  - Rate?, Reach?, Full/Half Duplex?, Media?, One or Many PHYs, Link Segment performance? Environmental factors?, Other Options?
  - Don't assume – ASK!
- BUT, NOT a product specification
  - Power consumption, Cost/Complexity, Markets
- NOT taking a technical decision on a baseline
- Need to work within the CSDs

History and Traditions - Objectives

(adapted from Howard Frazier "Guidelines for Project Objectives")

- Project objectives are brief statements, usually bullet form that summarize technical objectives for an 802.3 standards project
- They represent high-level technical requirements
- They are created by the study group, but approved and owned by the 802.3 working group, and are fulfilled by the Task Force
  - Working group ballot drafts may be measured on fulfilling these
  - The objectives may be modified in Task Force, but the working group must approve
- They are not a product spec
- They typically address major characteristics: bit rate, media, reach, BER, compatibility, impairments, coexistence
- They do not typically address implementation characteristics (power, cost, integration)

"Lane, Lane, what is Lane?"*

WIKIPEDIA 'the internet's approximate source of truth" (truthiness)

Lane

In the context of traffic control, a **lane** is part of a roadway (carriageway) that is designated for use by a single line of vehicles, to control and guide drivers and reduce traffic conflicts.[1] Most public roads (highways) have at least two lanes, one for traffic in each direction, separated by lane markings. On multilane roadways and busier two-lane roads, lanes are designated with road surface markings. Major highways often have two multi-lane roadways separated by a median.

Some roads and bridges that carry very low volumes of traffic are less than 15 feet (4.6 m) wide, and are only a single lane wide. Vehicles travelling in opposite directions must slow or stop to pass each other. In

Thru lanes indicated by arrows on California CR G4 (Montague Expressway) in Silicon Valley.

Definitions of

single-lane   vocabulary.com

1.

adj   (of roads) having a single lane for traffic in both directions; when vehicles meet one must pull off the road to let the other pass

Common usage is one lane per direction – from what we usually mean

* With apologies to Kara the Eymorg, "Spock's Brain," stardate 5432.3.

IEEE Std 802.3 says…

- 802.3-2015 defines lanes, logical & physical:
  - 1.4.246 lane: A bundle of signals that constitutes a logical subset of a point-to-point interconnect. A lane contains enough signals to communicate a quantum of data and/or control information between the two endpoints.

    (NOTE – there is a comment on the revision project 802.3cj asking to clarify this definition)

  - 1.4.325 PCS lane (PCSL): In 40GBASE-R and 100GBASE-R, the PCS distributes encoded data to multiple <u>logical lanes</u>, these logical lanes are called PCS lanes. One or more PCS lanes can be multiplexed and carried on a <u>physical lane</u> together at the PMA service interface. (See IEEE Std 802.3, Clause 83.)

What we really want

Gary Nicholl – 1/8/18 ad hoc – Nailed it!

> Note, with objectives there needs to be a balance between having enough just detail to support a reasonable response to the PAR and CSD, but not so much detail that we limit the technical solution space when (if) we get into TF.

System view use case – 12/17/17 ad hoc – We are ball-limited

> ## When is 100G electrical I/O required?
> Driven primarily by switch package escape
>
> Practical BGA limit is ~ 256 lanes in a 70 mm package, 1 mm ball pitch

- 1 lane, bidirectional = 4 conductive paths (balls, traces or wires)

Speed per electrical path

- In the beginning…. 1 bit/baud 1 direction
  - Hit a speed bump with the media
- Then there was PAM4, 1 direction
  - Traded signal processing to get double the bits/baud – double the rate for the same media loss
  - To do the same again requires at least PAM16
- Bidirectionality could get the next doubling
  - Same media bandwidth
  - Objectives should not make technical choices or assumptions to preclude this

Language to consider

Replace "single-lane" with "2 differential pairs " in objectives

It's what we mean:

        - board traces are wires

        - copper cable conductors are wires

        - balls are (really small and short) wires

It's unambiguous and general

And, it leaves technical decisions on the table

THANK YOU!