BASE-T AND THE RATE DEBATE

George A. Zimmerman, Ph.D.

CME Consulting

Experts in Advanced PHYsical Communications Technology

WHO AM I?

- George A. Zimmerman, Ph.D.
  - 20 years in advanced development and standardization of advanced wireline PHYs including, DSL & Ethernet
  - Founder / CTO of Solarflare Communications, Inc.
  - Kicked off 10GBASE-T CFI, major contributor to IEEE Std. 802.3an
  - Contributor to IEEE Std. 802.3az
  - Contributor, Chief Editor for IEEE P802.3bq 40GBASE-T
  - Member TIA TR42.7
  - Independent consultant and PHY expert on PHY technology capabilities, cabling issues and PoE

WHAT MAKES BASE-T UNIQUE IN THE RATE-DEBATE

- BASE-T implementations have thrived by being consistent and compatible across speeds:
- Multi-speed ports are the norm, enabled by Auto Negotiation protocols (so much so, people think multiple speeds are required by the standard)
- Consistent backwards-compatible media
- Consistent connector usage makes BASE-T familiar
- Power over Ethernet with RJ45 as universal power connector

- The keys to success – make it work like it used to, plus, give an upgrade
  - "Give someone something better, that they already know how to use…"

WHAT WE USED TO THINK (2002)

- Ethernet was one big market
- Ethernet moved in order-of-magnitude rate steps 100M -> 1Gig -> 10Gig -> 100Gig?
- Media upgrades happened as network speeds increased
  - Needs emerged first in the core / "data center" and migrated out to the enterprise floor
  - 1000 BASE-T leveraged this with rapid expansion from the core to the floor
  - 10GBASE-T was built for this world, expecting qualification or an upgrade in the floor wiring, and driving applications

- And then…
  - Everything changed.
  - 10GBASE-T took a long time and is finally emerging as a data center workhorse, not in the ubiquitous enterprise

A FUNNY THING HAPPENED ON THE WAY TO 10 GIG…

- Today's Enterprise Data Center is a Differentiated Segment
  - Rack-optimized solutions, blade servers, top-of-rack switching, pods, high density, extreme bandwidths
  - Flexible, more easily upgraded infrastructure
  - Aggregated & virtualized applications drive speed needs
  - 10GBASE-T is taking hold here
- The Enterprise "Floor" is Mature & Wireless First Hop is Here
  - Slow rate of upgrades for horizontal connections to desktops & distributed devices (Installed base is Cat 5e and Cat 6)
  - Single-user applications on the floor are not driving needs for 10G speed
  - Incursion of gigabit & greater rate wireless technologies dominant in laptop/mobile access - stealing the port growth
- The BASE-T world offers both solutions, but they are drifting apart in speeds
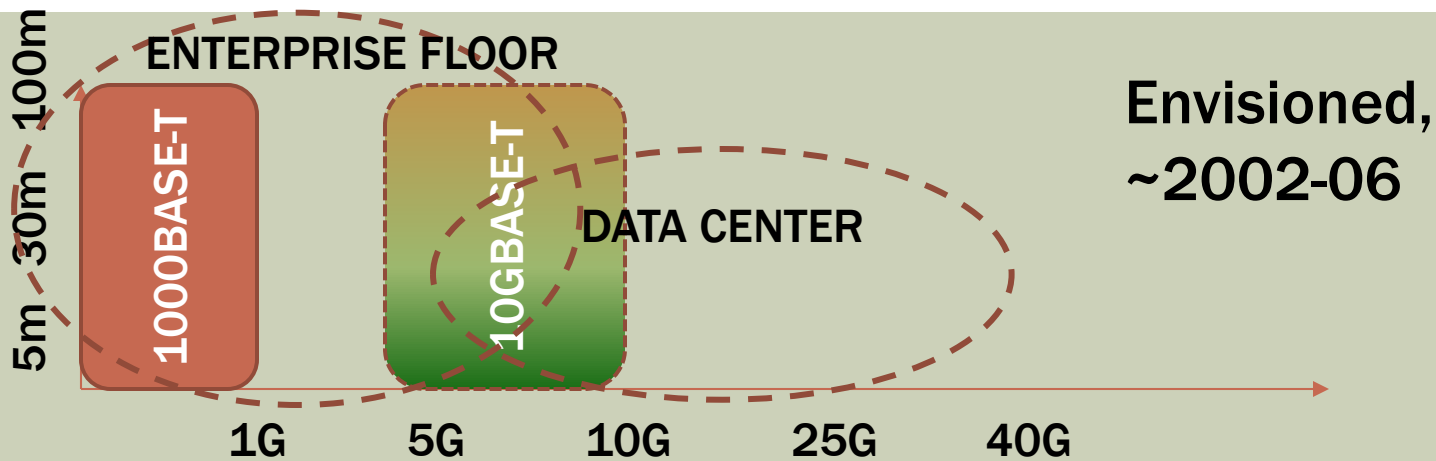
25/40GBASE-T – FOR THE DATA CENTER

- Evolving 10GBASE-T signaling to fix the issues for the data center
- Ease the PHY problem!
  - Data centers are planned today around racks and rows
  - Flexible rack- or row-oriented topologies -> 30m distances
  - New Category 8 cabling provides more frequency spectrum
  - Target similar power levels (1 to 2x) to 10GBASE-T today
- Ease the systems problems!
  - Offer PHYs optimized for the switch silicon interfaces (25G first)
- Ease the infrastructure problems!
  - 10G/25G/40G all should work on the same Cat 8, 30m infrastructure
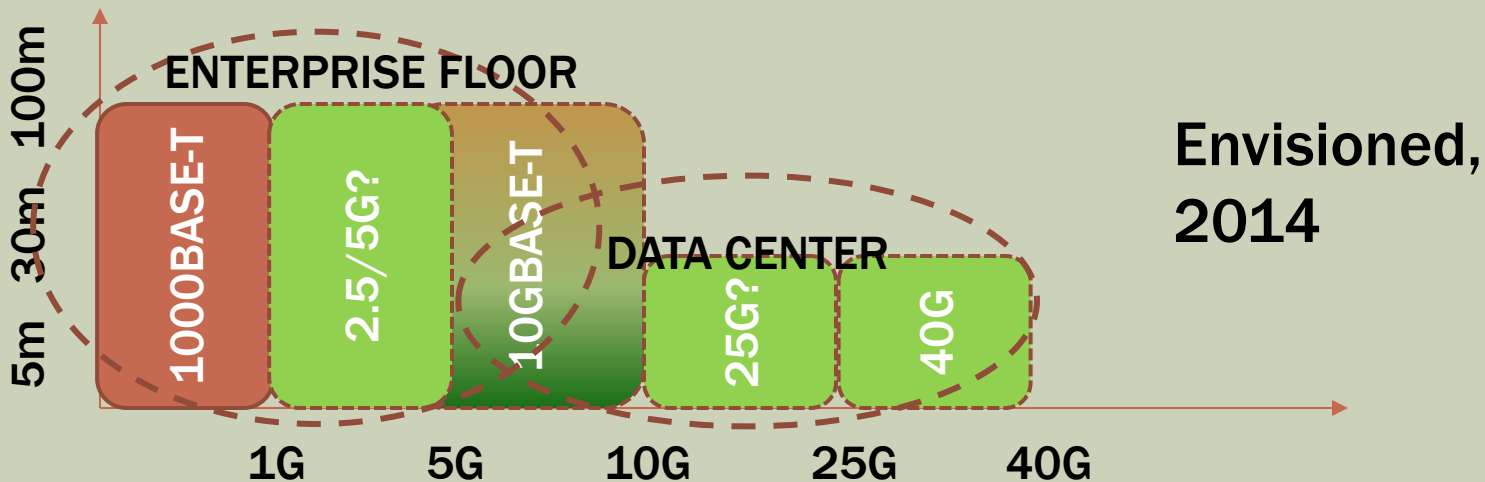 - But - Is 30 the new 100?

2.5/5GBASE-T – FOR THE FLOOR

- "Technology changes about every 18 months, yet an office design typically lasts a decade; a building, about 40 years." – Southwest Airlines Magazine, October 2014
  - As a result – the wiring to the floor, a building infrastructure element isn't changing fast enough
  - Predominantly Cat 5e & 6 *[DATA BEING GATHERED]*
- More and more connection paths go to wireless access points, and these are increasing beyond 1 Gbps rates
  - WAPS wired up across the floor, powered by PoE
- Buildings aren't getting smaller – so the 100m stays for home-run connections
  - So, the 100m stays, along with installed Cat5e and Cat6 cabling
  - Cat6 likely emerges as a triple-speed gigabit cabling infrastructure

- 10GBASE-T sits with a foot in both camps
  - Cat 6a emerges as a quad-speed gigabit cabling infrastructure