10GBASE-T Cabling Recommendations

presentation to IEEE 802.3an July 2004

by

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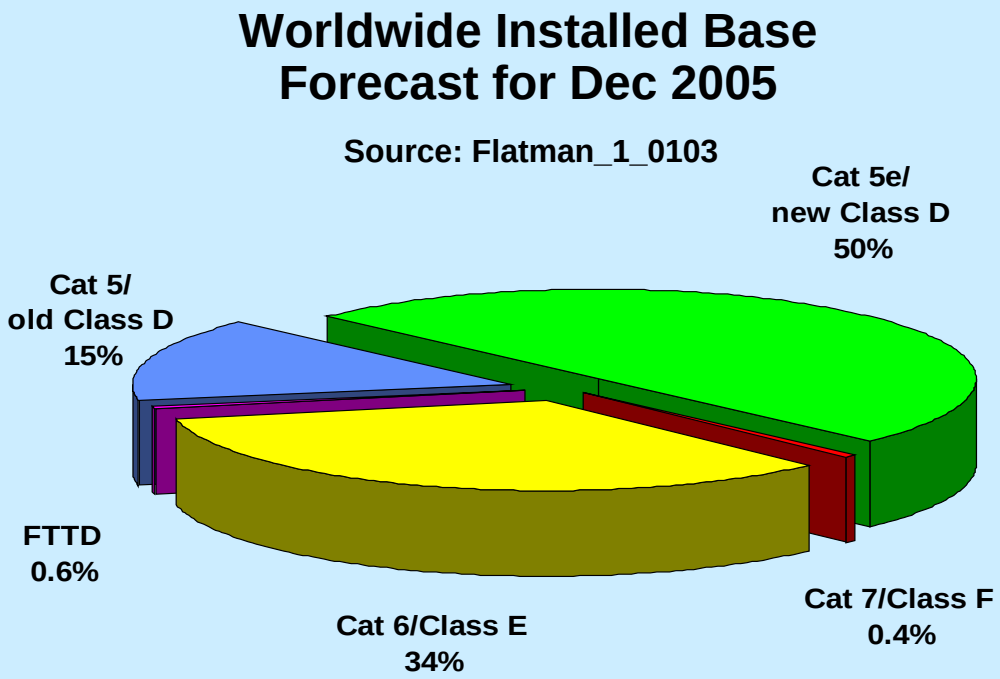
Supporters:

Sterling Vaden,	Superior Modular Products
Shadi Abughazaleh,	Hubbell Premise Cabling
Val Rybinski,	The Siemon Company
Bernie Hammond,	ADC/Krone
Paul Vanderlaan,	Belden
Henricus Koeman,	Fluke Networks
Shimon Muller,	Sun Microsystems
Bruce Tolley,	Cisco Systems
Richard Brand,	Nortel Networks
David Law,	3COM
Mike Bennett,	Lawrence Berkley National Lab

Scope

1. New vs Installed Cabling
2. Channel Insertion Loss
3. Channel NEXT/PSNEXT
4. Upper Frequency Limit
5. Our Cabling Objectives

New vs Installed Cabling



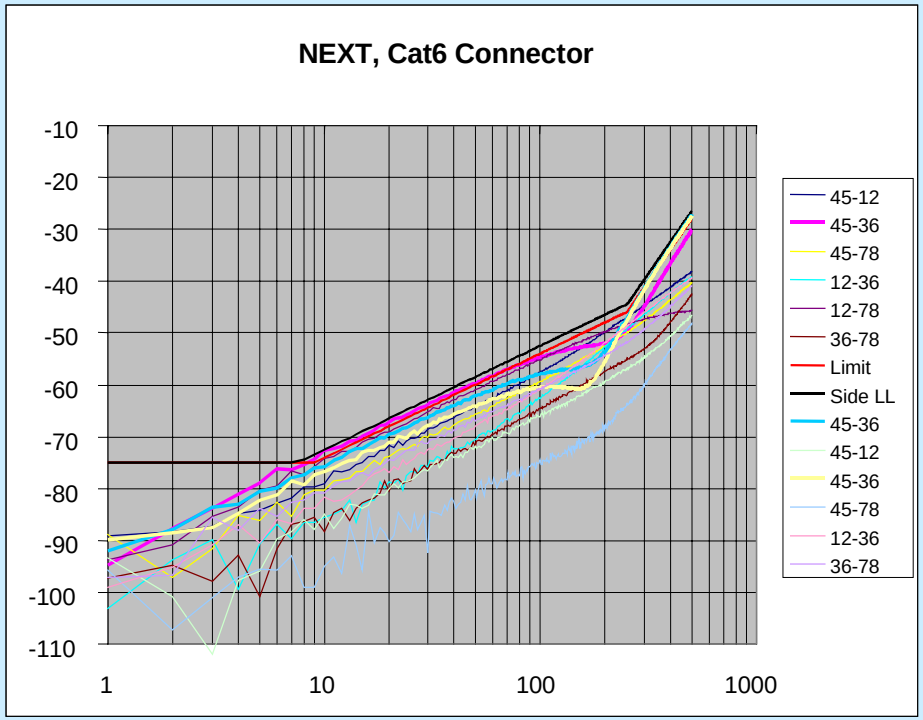
- Class E started shipping in 1998
- Class E ~40% penetration end 06 when 10GBASE-T infant product
- Class E took 6 years to develop (backwards-compatibility, multi-vendor working and testing of connectors were challenging)
- Class E has a life expectancy of at least 10yrs and a general supplier warranty of at least 15yrs
- user resistance to churn cabling should never be underestimated
- standards for *enhanced* Class E/ Cat 6 not expected before 2006
- respectable penetration takes time

Channel Insertion Loss

- **claim that many installed Class E channels will also meet Class F insertion loss limit is indeed correct**
  - » **certainly true when lengths are less than 100m**
  - » **not true near 100m due to ILD @ high frequencies!**
- **agreed that even a slight improvement in IL is valuable**
- **commercially unfair to disallow marginally-compliant products**
  - » **difficult for ISO/IEC to justify a more stringent limit**

Channel NEXT/PSNEXT at Extended Frequencies

Source: Vaden_2_0504



- Cat 6 connector NEXT doesn't extrapolate beyond 250MHz
- 11 connectors measured for NEXT
- channel NEXT to accommodate steeper connector slope >330MHz $31- 50\log_{10}(f/330)$
- channel PSNEXT to accommodate steeper connector slope >330MHz $28- 42\log_{10}(f/330)$
- has negligible effect on channel capacity due to DSP cancellation

Who Else Supports Channel NEXT/PSNEXT Relaxation?

- **11 participating cabling suppliers in abughazaleh_1_0304**
  - **which was denied reaching a vote due to lack of notice**
- **TIA TR-42.7 in TSB-155 D1.0 (Cat 6 cabling for 10GBASE-T)**
  - **adopted by unanimous vote at their June 2004 meeting**
- **ISO/IEC in the NWIP for installed Class E at extended freqs**
  - **contained in the supporting strawman specification**
  - **no opposition at the June 2004 SC25 WG3 meeting**
  - **subject to national review and approval of NWIP**

Channel Upper Frequency

- **05/04 decision to adopt a PAM code with at least 8 levels removes the need for a 625 MHz limit**
- **a channel upper frequency of 500 MHz offers some headroom for the remaining PHY proposals**
- **reducing upper limit to 500 MHz has advantages:**
  - » **it would simplify extended frequency characterisation of channels/cabling components & speed up delivery**
  - » **it would maximise the re-use of installed Class E and Class F cabling and components**
  - » **it would simplify testing**
  - » **it would reduce costs associated with cabling infrastructure (use of existing components, testing, mitigation procedures, etc)**

10GBASE-T Cabling Objectives

1. Support operation over 4-connector structured 4-pair, twisted-pair copper cabling for all supported distances and classes

2. Define a single 10 Gbit/s PHY that would supports links of:
   - » at least 100m on four-pair Class F balanced copper cabling
   - » at least 55m to 100m on four-pair Class E balanced copper cabling

3. Support star-wired local area networks using point-to-point links and structured cabling topologies

4. Select copper media from ISO/IEC 11801:2002, with any appropriate augmentation to be developed through work of 802.3 in conjunction with ISO/IEC SC25 WG3

5. Meet CISPR/FCC Class A EMC limits

6. Support a BER of 10^{-12} on all supported distances and classes

new & installed cabling captured

10GBASE-T Cabling Recommendations

1. Model channel requirements on installed Class E
2. Extrapolate existing Class E IL to max frequency
3. Relax channel NEXT to 31-50log(f/330) >330MHz
   Relax channel PSNEXT to 28-42log(f/330) >330MHz
4. Reduce channel upper frequency to 500 MHz
5. 10GBASE-T cabling objectives cover everything we need and do not require any modification

Final thought:

If we don’t provide a smooth migration path for the deployment of 10GBASE-T, then end users will not find it attractive and it will not be a market success

Nobody wins!