From 1 GB- to 10 GB-Ethernet

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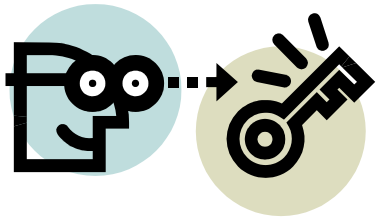
Development and Test Lab

R&M
Convincing cabling solutions

Agenda

- **Introduction**
- **10GBASE-T**
  - Shannon‘s Theory
  - Key Factor PS Alien NEXT
  - Key Factor Alien Common Mode Noise
  - Cabling Influences
- **R&M Position**



Introduction

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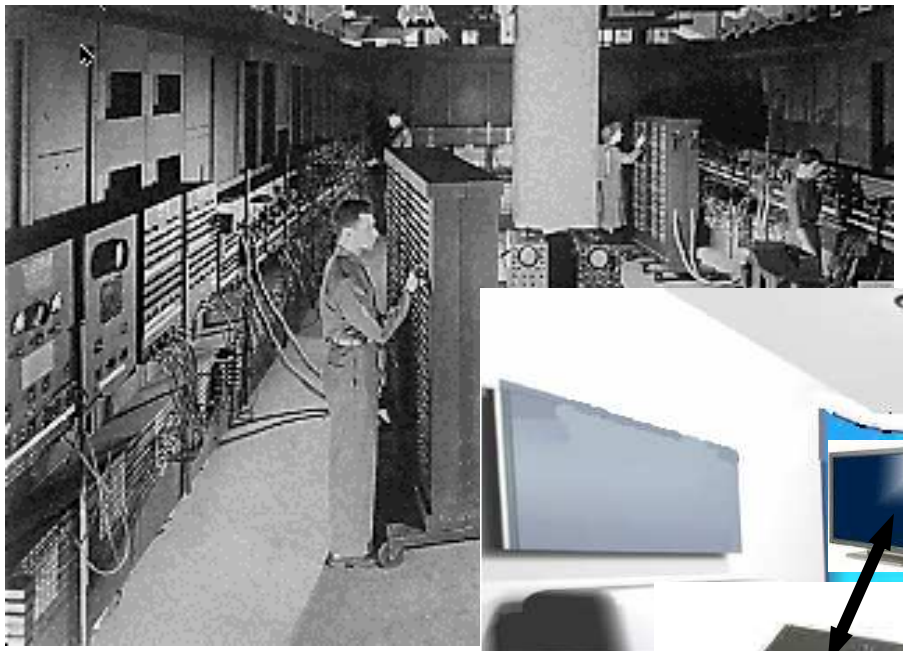
“Years ago computers filled whole rooms...

…….the same is happening today…!!”



Cabling Standards Today

ISO/IEC 11801
2nd Edition

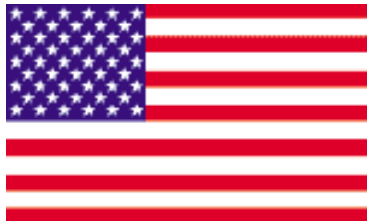
Ratified,
Published in Oct. 2002

Connector standard
ISO/IEC 60603-7-4 & 5 in progress

EN 50173-1
2nd Edition

Ratified,
Published in Nov. 2002

- **Future Idea/project:**
- EN50173-1 General Requirements
- EN50173-2 Office Premises
- EN50173-3 Industrial Premises
- EN50173-4 Homes
- EN50173-4 Data Centers



ANSI/TIA/EIA 568B

Ratified,
Published in July 2002

B1 General Requirements
B2 Twisted Pair Cabling
B3 Optical Fiber Cabling

R&M in Standards Committees

- ISO/IEC SC 25 WG 3 Generic Cabling
- ISO/IEC SC 25 WG 3 Project Team SOHO and Industrial Cabling
- IEC 86 Fiber Optic Connectors and Interfaces
- IEC 48 Copper Connectors **Editor Cat. 6 shielded**
- Cenelec TC 215 Generic Cabling **Editor TR 10GBASE-T**

10GBASE-T

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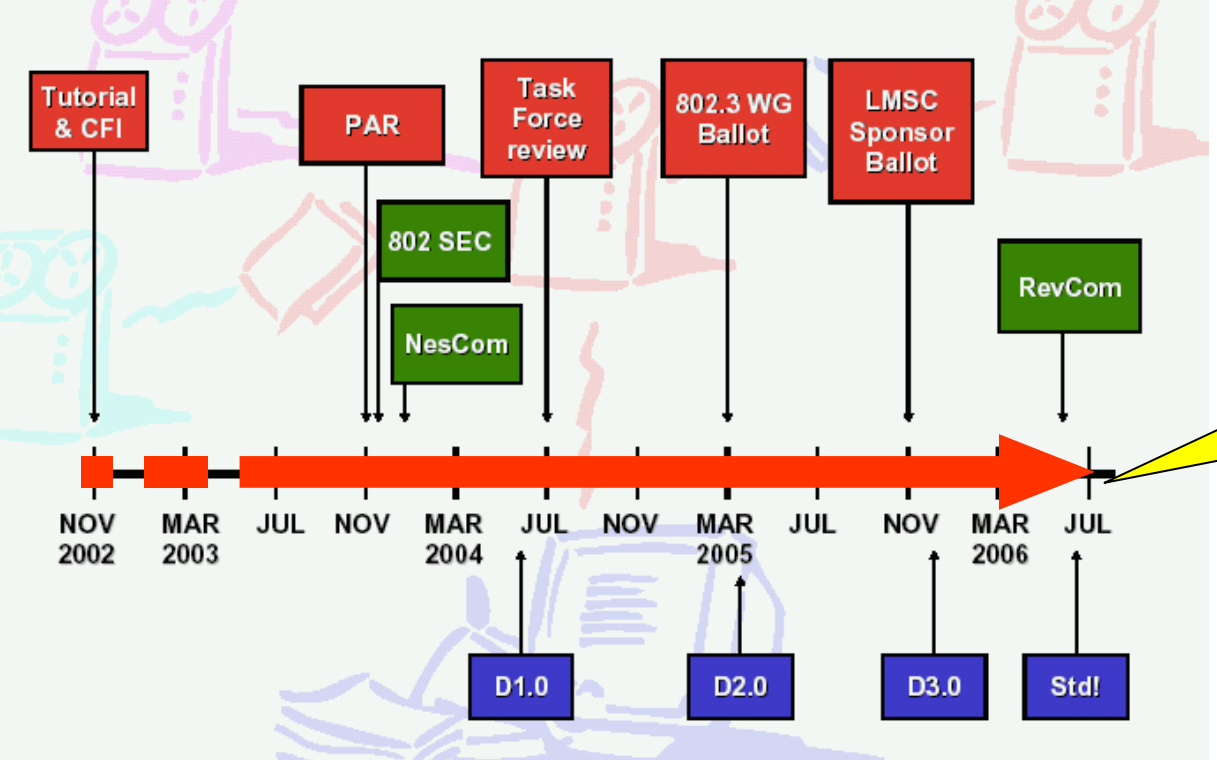
10 Gigabit-Ethernet over TP (10GBASE-T)

According to IEEE 802.3an

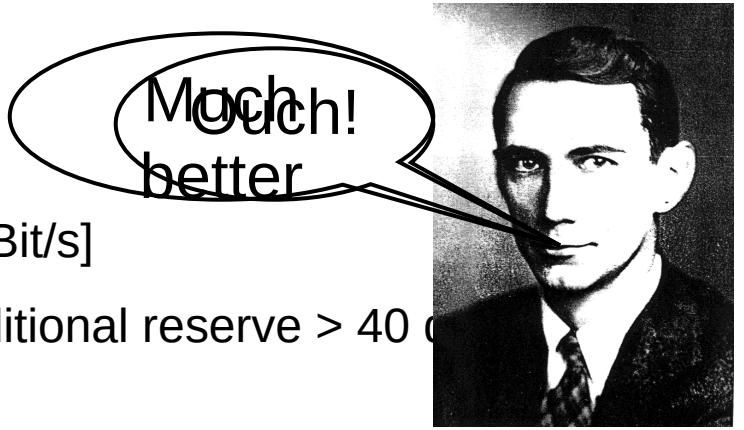


Standard ready:
Mid 2006

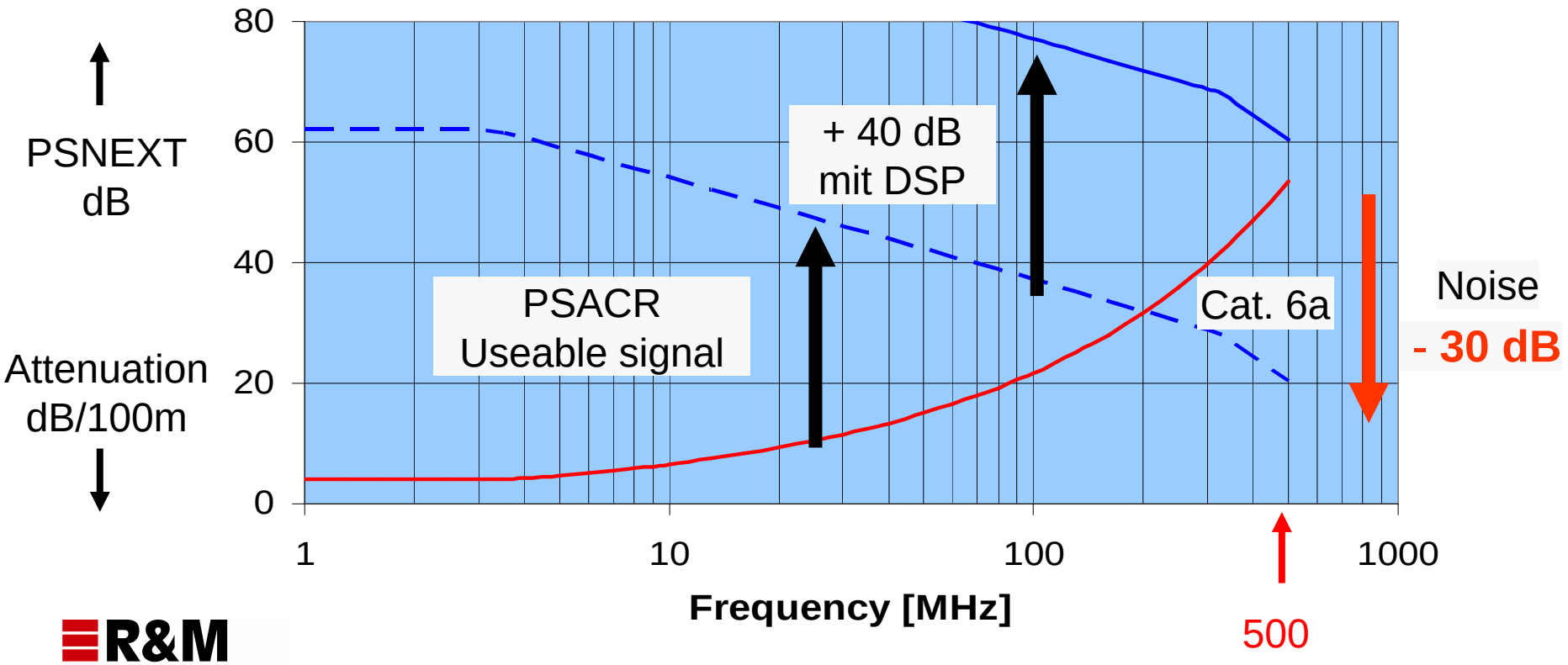
Goal: 10 Gb/s over ISO/IEC 11801: 2002 Class E and Class F

- At least 100m with shielded Class E or F cabling
- At least 55m with unshielded Class E cabling

Shannon’s Theory

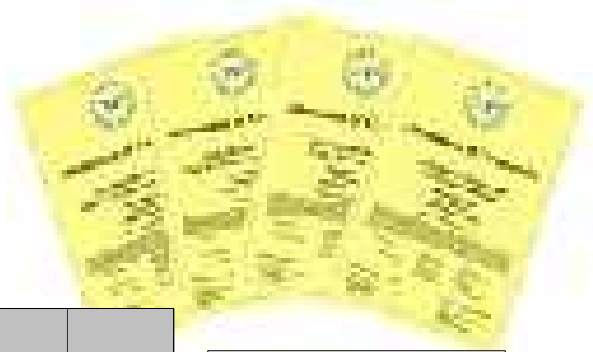


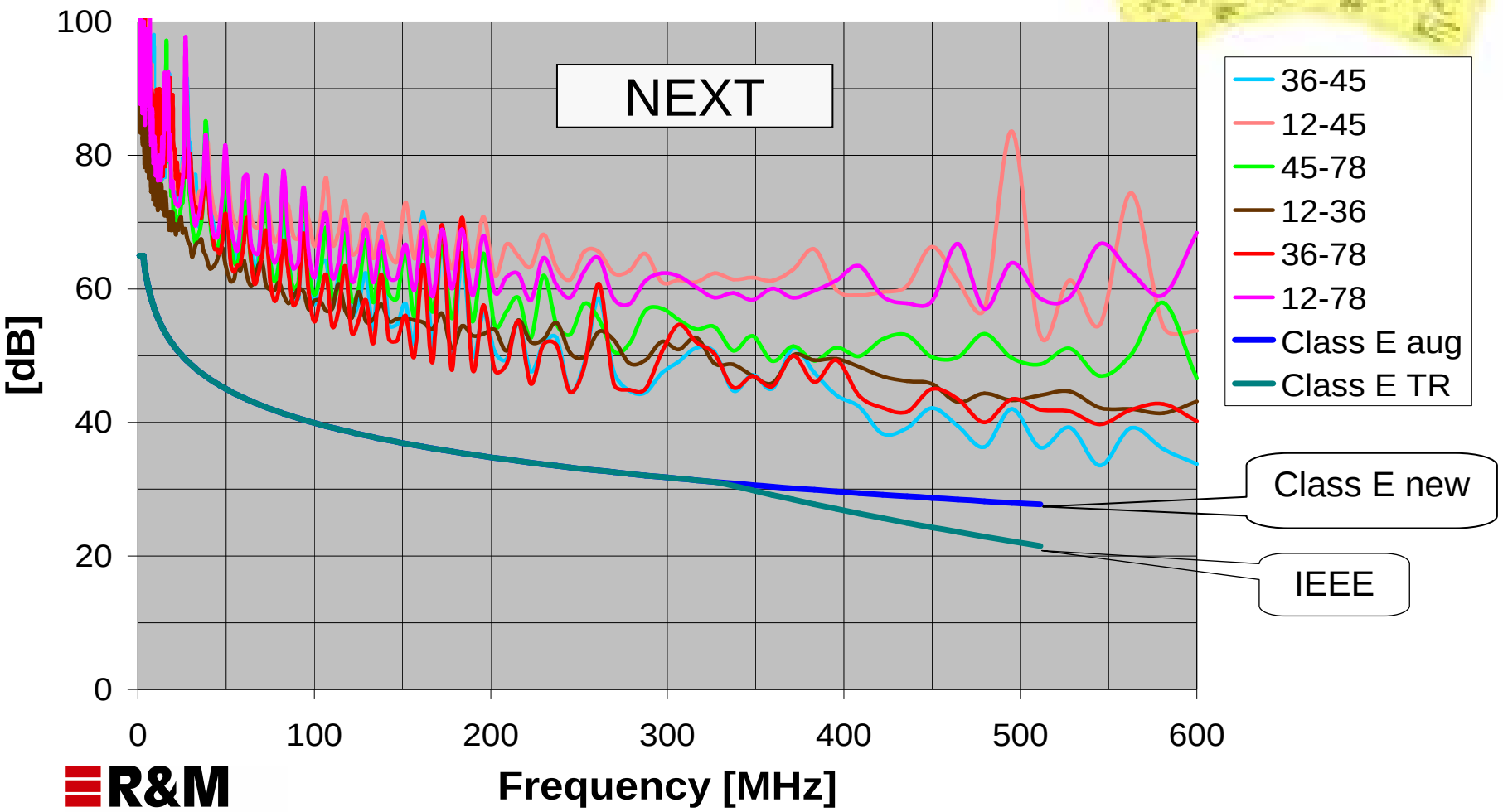
- Channel capacity = Bandwidth*log2(1+SNR) [Bit/s]
- Active NEXT Reduction with DSP provides additional reserve > 40 d
- 7 dB positive PSACR at 500 MHz



R&M Solutions

4 Connector Channels certified by 3P to 600MHz





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Key Factors: 3 Aliens

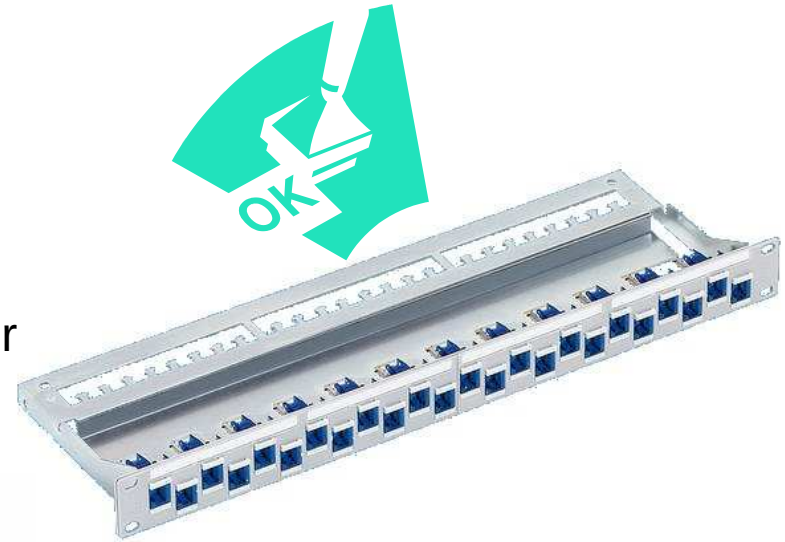
Alien crosstalk in connectors

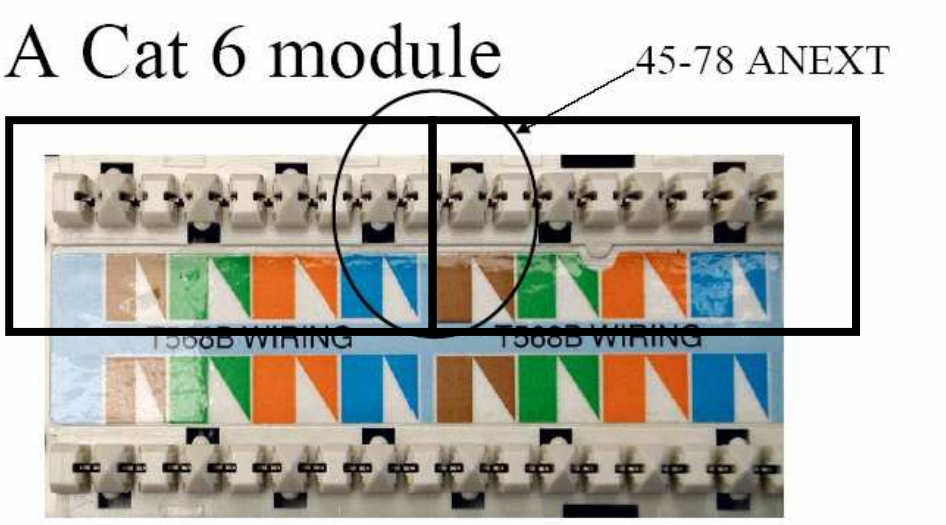
Alien crosstalk in cable

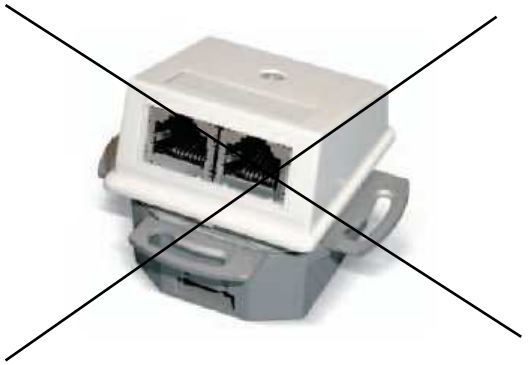
Alien common mode noise

ANEXT in Panels or Outlets

- ANEXT in UTP modules can reach the level of ANEXT in cables
- UTP outlets need a larger spacing
- In STP outlets the shield must completely cover each individual module



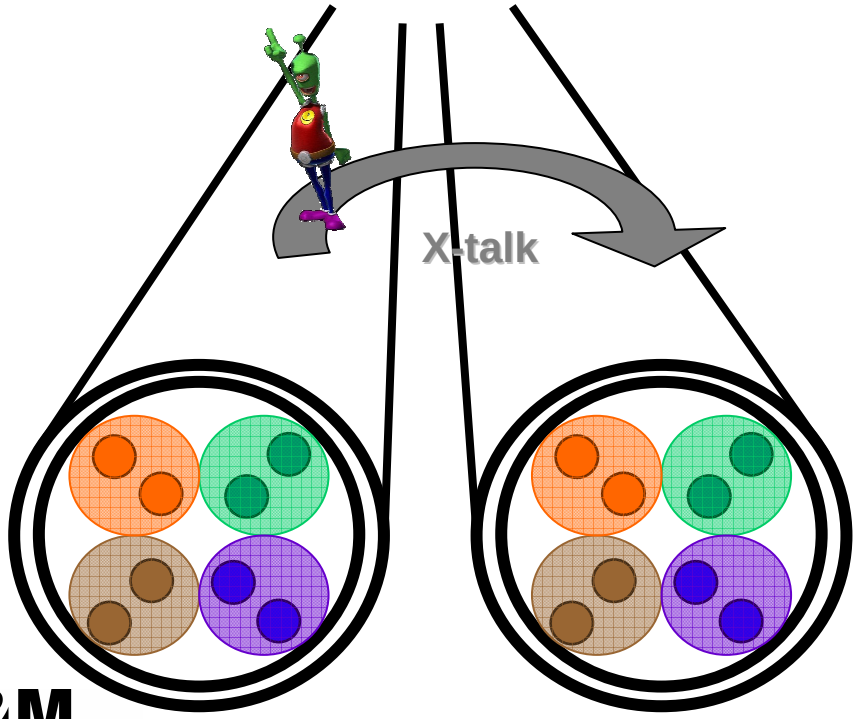


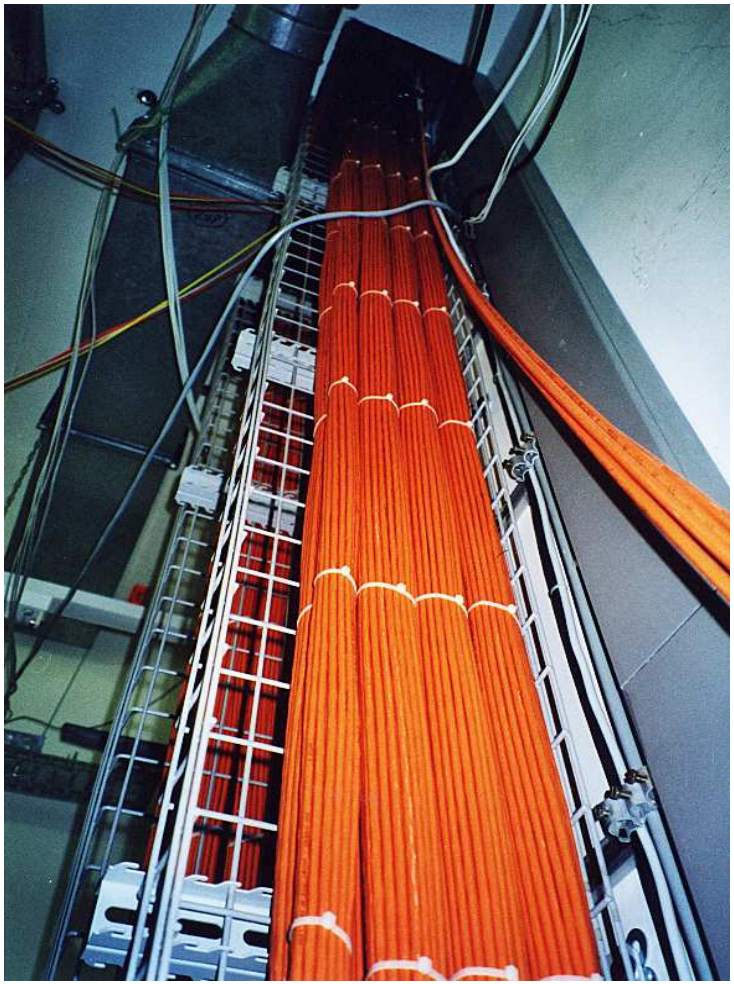


Source: Larry Cohen, Solarflare Communications

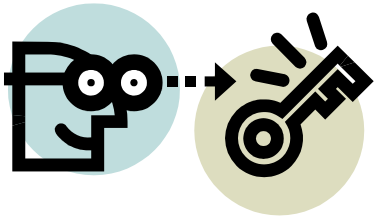
Alien crosstalk between cables

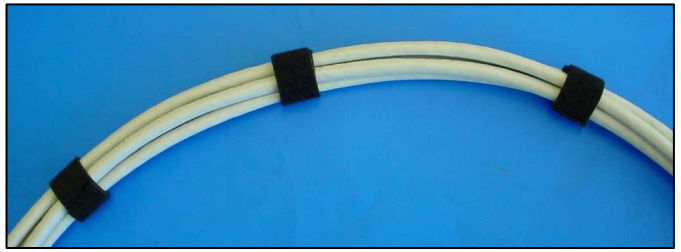
- Crosstalk due to the same lay length of the equal coloured pairs between different cables.
- Cannot be measured with traditional field testers.

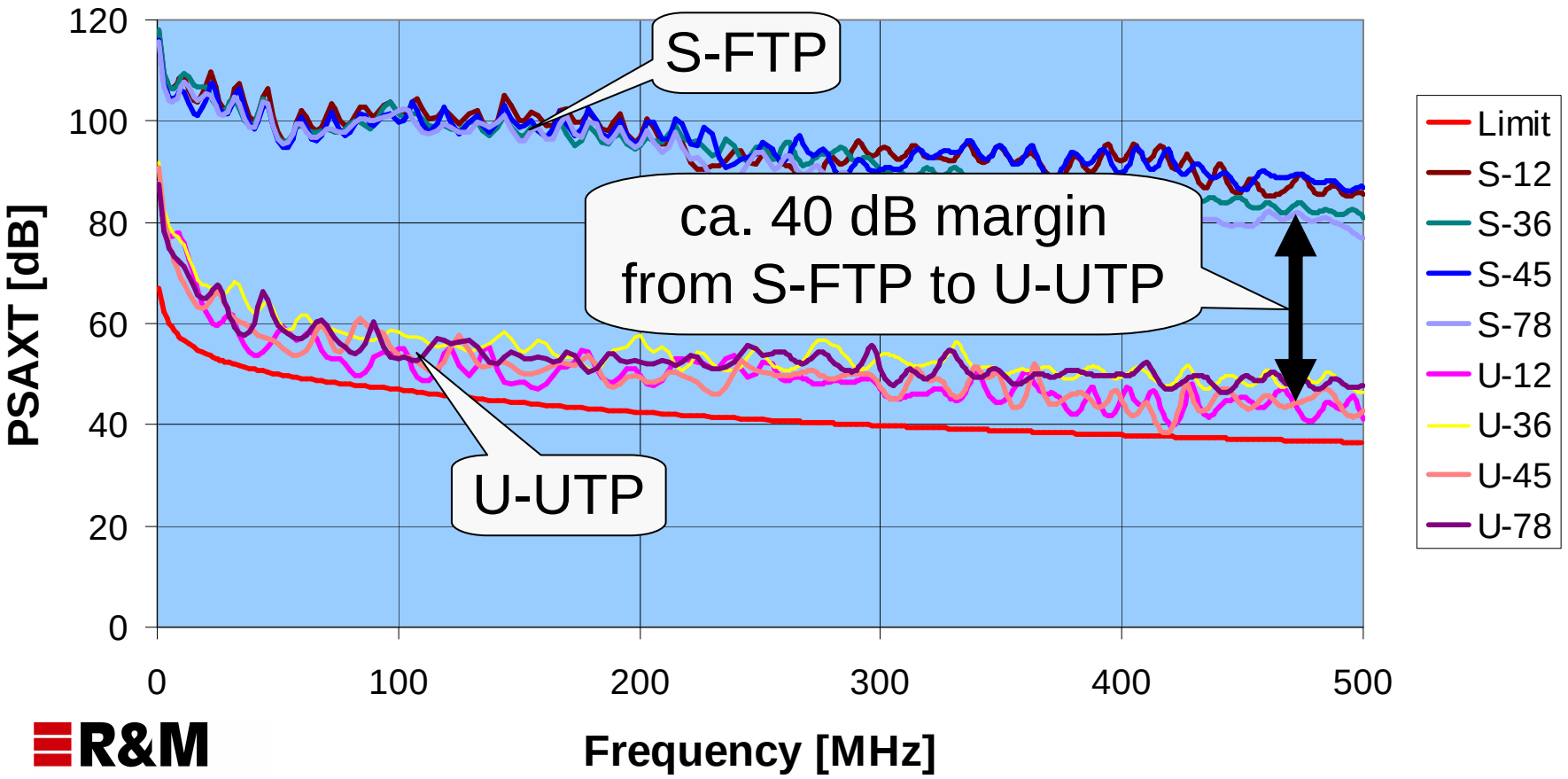




Key Factor PS Alien NEXT in Cables







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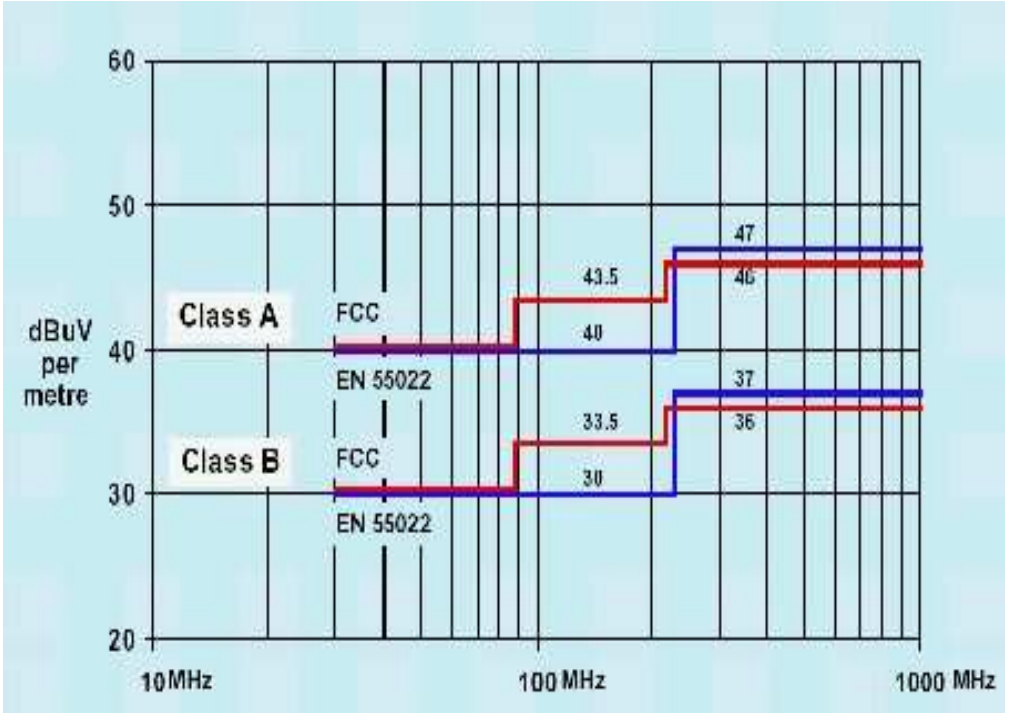
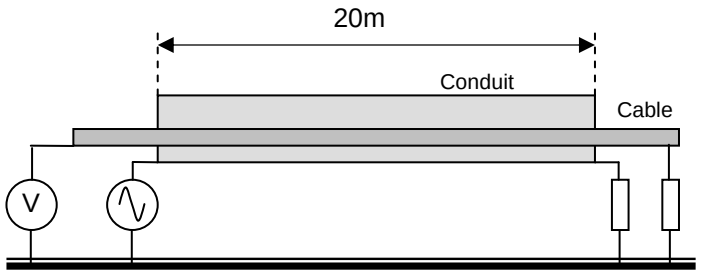
Key Factor Alien Common Mode Noise

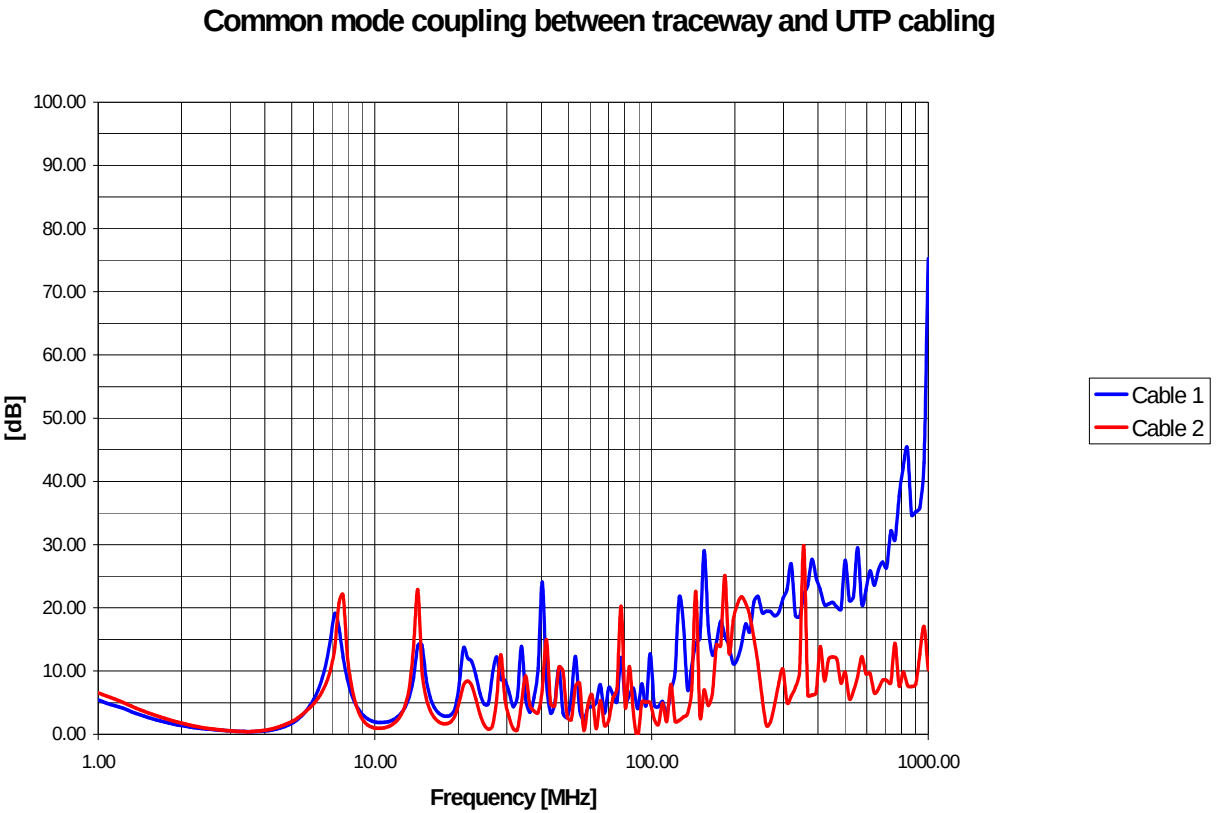


- The importance of EMC/EMV is continually growing due to more and more “electro smog”

Crosstalk between Conduit and Cable



- Dependent on the conduit construction (and its grounding) there is practically no attenuation between the conduit system and the cabling –
- which means the residual current on the conduit is also in the UTP cable!



Grounding is very important …also for UTP!!??...

Maximum noise level on cable: 0.005 V

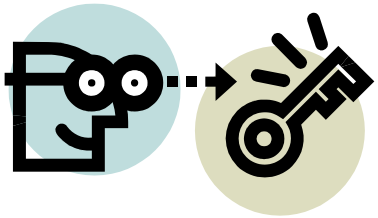
STP: Maximum noise level on screen or grounding system:
0.5V (with 40 dB screen efficiency)

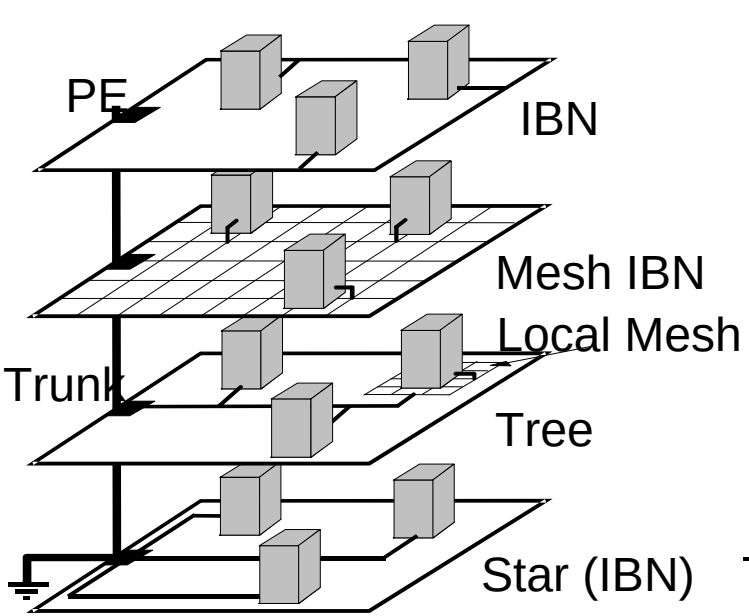
UTP: Maximum allowed noise level on grounding system (conduit):
0.015 V
(with 10 dB coupling between cable and grounding system)

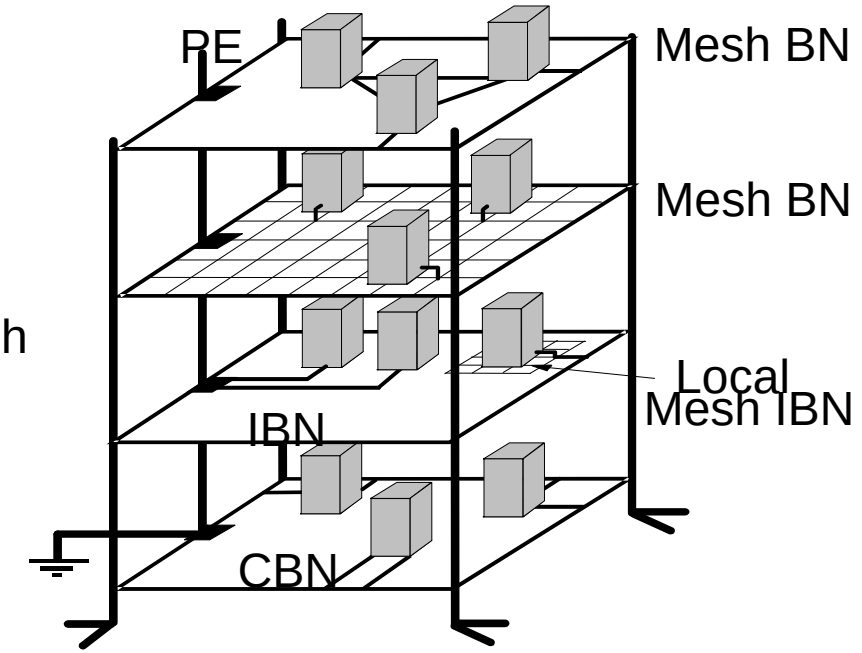
STP allows for a 30x (~30 dB) higher noise level on the grounding system than UTP!!

Grounding will be a key factor for 10 GBit/s!

Cenelec: EN 50174-2 and EN 50310







For UTP systems the right grounding will be more important than with STP systems.

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Cabling Influences

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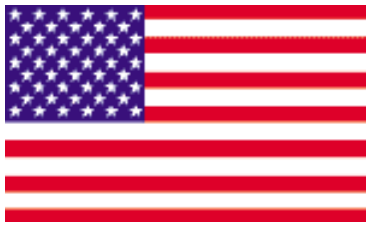
Cooperation between IEEE – Cabling Committees

ISO / IEC SC 25 WG3

- Technical Report in process (based on Cenelec Draft 1.0)
- Preparation of addendum to ISO/IEC 11801 Amendment 2.1 10G Cabling-Performance and possible new classes (Ex, Fx)
- Started basic research on external influences on the cable, (EMC, etc.)

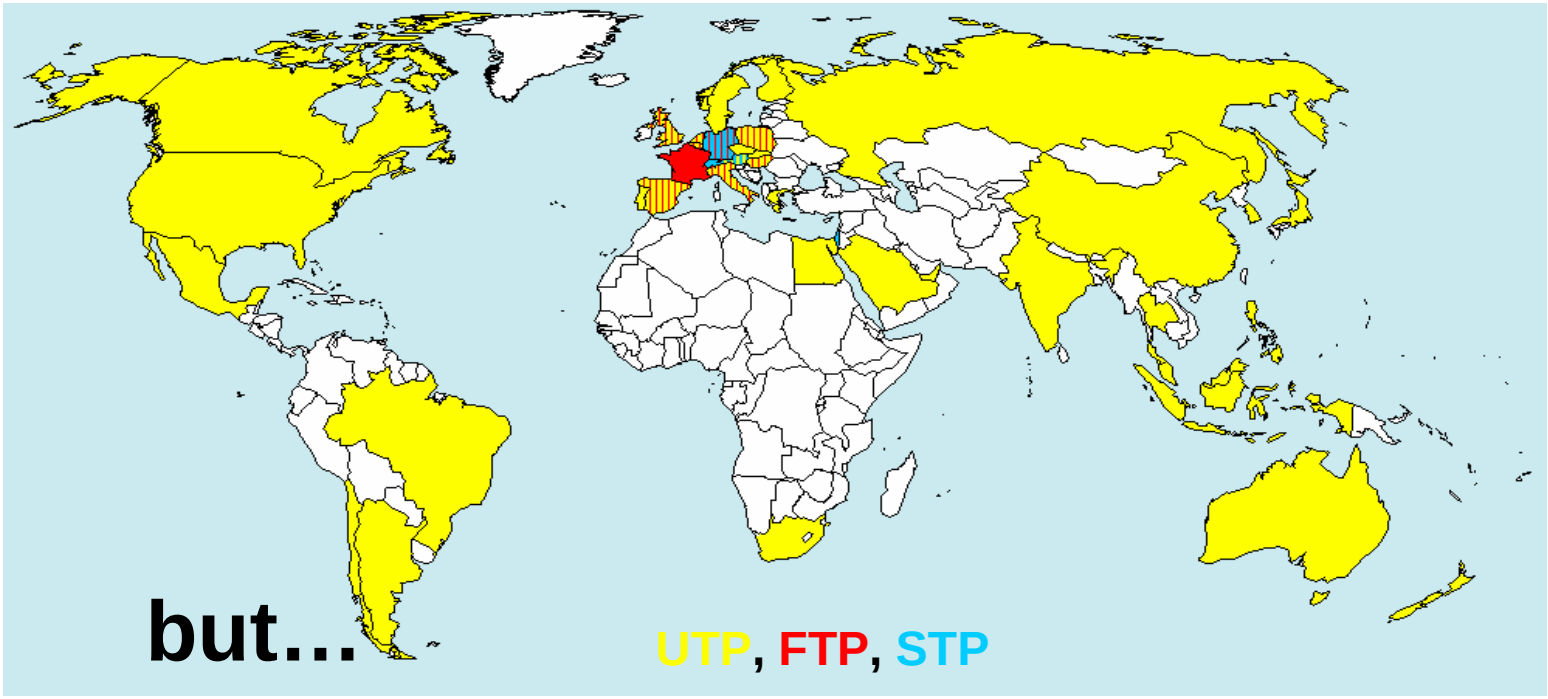


EIA / TIA TR 42

- ANSI/TIA-TSB-155 Draft 1.3
- Preparation of Addendum 10 to ANSI/TIA/EIA-568-B, Draft 1.4 for 10G support
- ANEXT specification and measurement techniques

It‘s time to think shielded !!

- A sufficiently screened system solves the problems caused by alien influences.
- The screening and grounding system will become as important as the traditional transmission parameters.

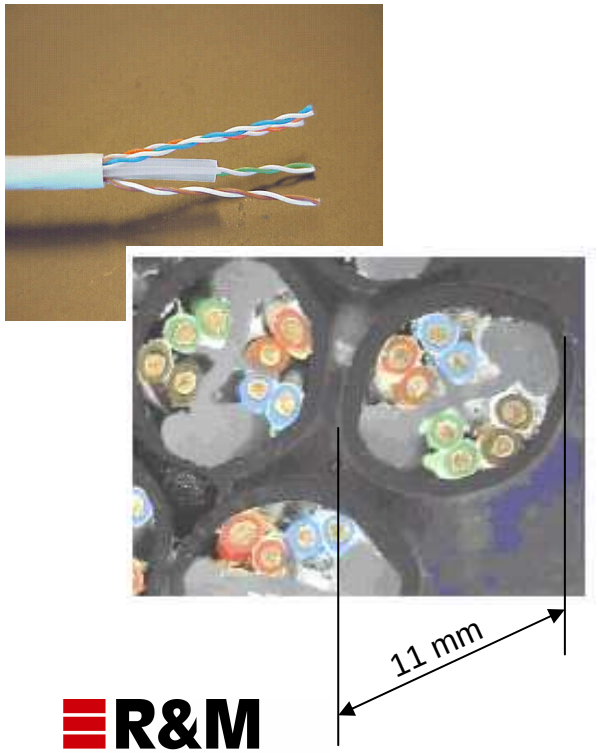


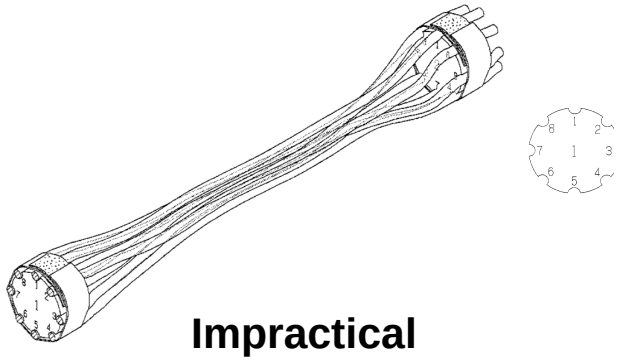
….. and UTP?

First cables with improved ANEXT performance are available.

Installation practices for reduced ANEXT will emerge (spaghetti cabling)

Spacing between modules will increase again.
Port density decreases.





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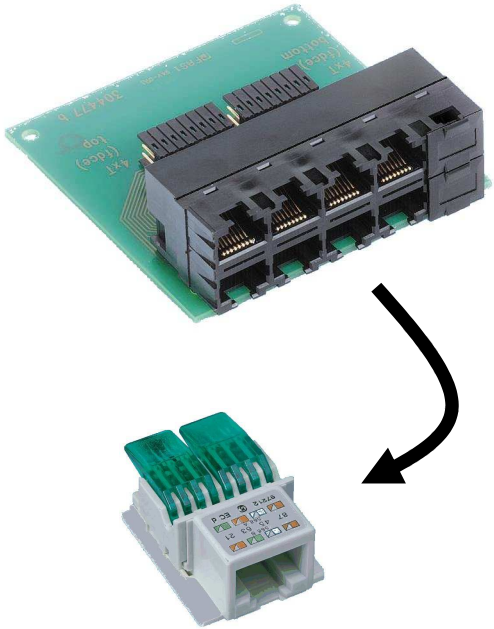

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R&M Positioning

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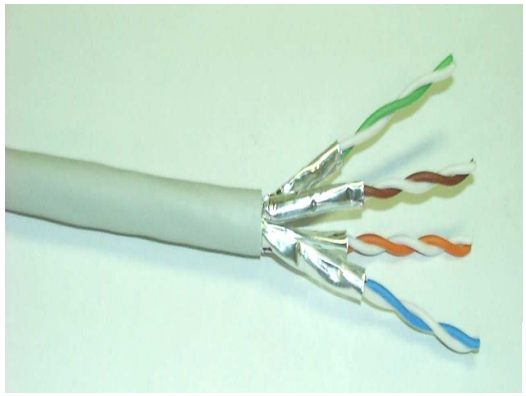
The solution is R&M‘s shielded STARsystem “The reasonable approach to 10GBASE-T“



- No problems with noise
- Proven passive components available
- RJ45 is the most prevalent connector system
- Compatible with existing active technology

Get more @ R&M

We will keep our partners continuously updated on future developments in standardisation and IEEE.

10GBASE-T @ R&M

Screened Star System channels meet all current requirements for 10G support

As the UTP standards become more stable we plan to release a complete solution in 3Q05 with a focus on ease of handling and investment protection.

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