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Generic 1-pair Topology considerations

Masood Shariff

Engineer Senior Principal
Systems Engineering

Supporters

NAME	COMPANY
Matthias Fritsche	HARTING Electronics GmbH
Dieter Schiketanz	Reutlingen University
Alan Flatman	LAN Technologies
Bryan Moffitt	CommScope
Andy Jimenez	ANIXTER

NAME	COMPANY

Background

There are several single pair applications from IEEE 802.3 with different reach objectives as shown below:

Application	IEEE 802.3 TF	Data rate	Distance	No of Conn	Frequency	DOP
10SPE	802.3cg	10 Mb/s	1000 m	10	0.1-20 MHz	June 2019
100BASE-T1	802.3bw	100 Mb/s	15 m	4	1-100 MHz	2015
1000BASE-T1 type A	802.3bp	1000 Mb/s	15 m	4	1-600 MHz	2016
1000BASE-T1 type B	802.3bp	1000 Mb/s	40 m	4	1-600 MHz	2016
PoDL	802.3bu	50 W	15 m (extendable)			2016
NGAUTO	SG	2.5, 5, 10 Gb/s	15 m	4	1-2000 MHz	TBD

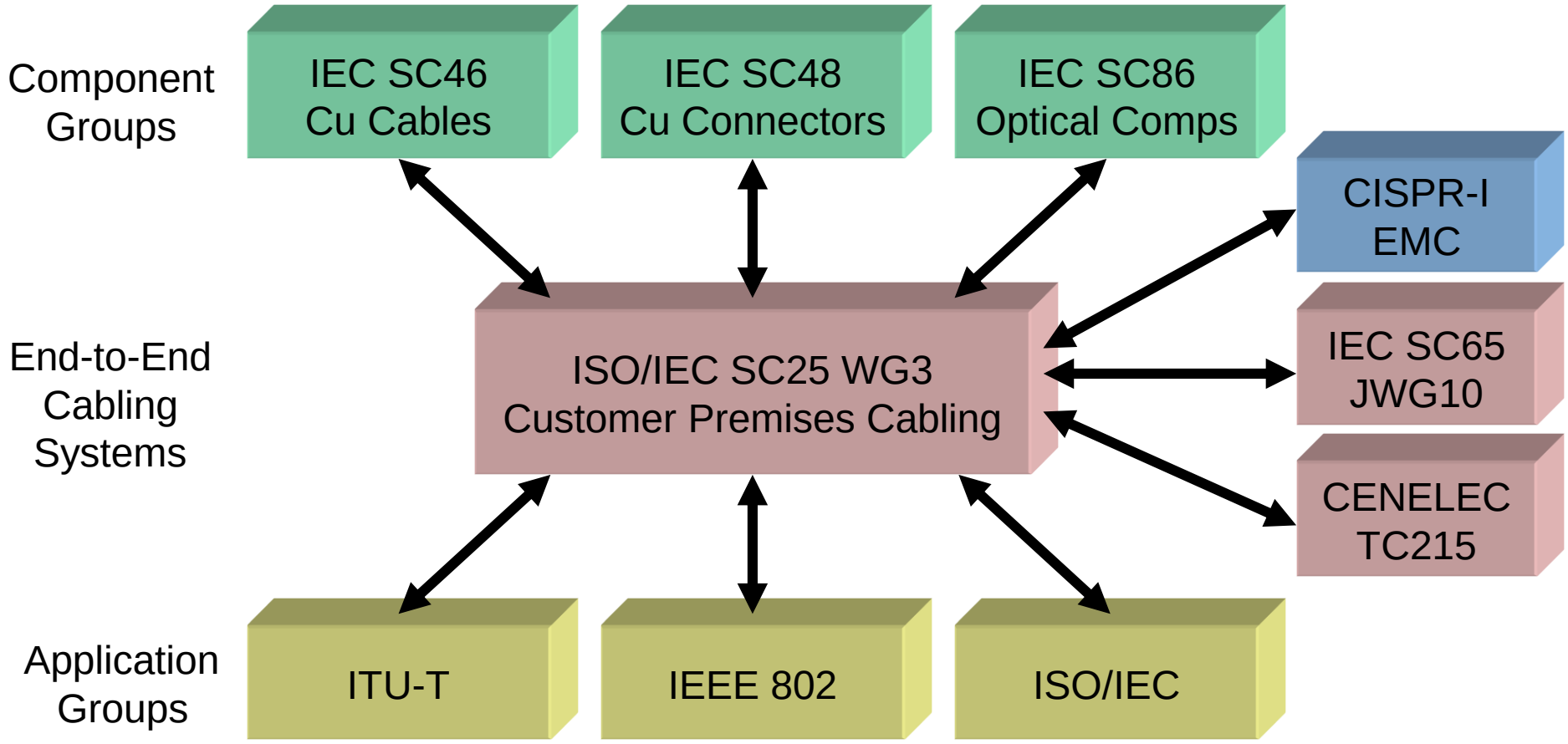
*NGAUTO Study Group Objectives not yet adopted by 802.3. frequency range based on presentations for technical feasibility

While each is a specialized application, TIA/ISO cabling standards generally attempt to specify generic cabling using a common topology

Structured Cabling History

- Structured cabling came into being in 1991 around the same time as the first IEEE 10BASE-T Ethernet application
- Balanced cabling has evolved with the applications to develop Categories 5, 5e, 6, 6A, and 8 to keep up to the demands of higher speed applications
- Standardized generic cabling has proved to be a popular stable platform for applications and customers with several billion meters installed around the globe

Cabling Centric Standards Process Model



Courtesey: Alan Flatman from ISO WG3 report to IEEE 802.3, Vancouver BC

Desired specifications for Single-Pair

- Transmission Specifications
  - Insertion Loss
  - Return Loss
- EMC-related
  - Balance (TCTL, ELTCTL)
  - Coupling Attenuation
- Crosstalk-related
  - Alien PSANEXT
  - Alien PSAACRF (alien FEXT)

Reach break-down by standard and Category

15m:

- 802.3bw will work with < 100 MHz performance specified
- 802.3bp drives Category 6a-like specifications (~500 MHz specified)
- Multi-gig applications likely to drive from Category 6a (500MHz) to Category 8-like (2 GHz) specifications

40m: 802.3bp “Type B” drives Category 6a-like + enhanced alien crosstalk specs

- Category 6a specifications for alien crosstalk are sufficient
- Shielding likely in harsh environments

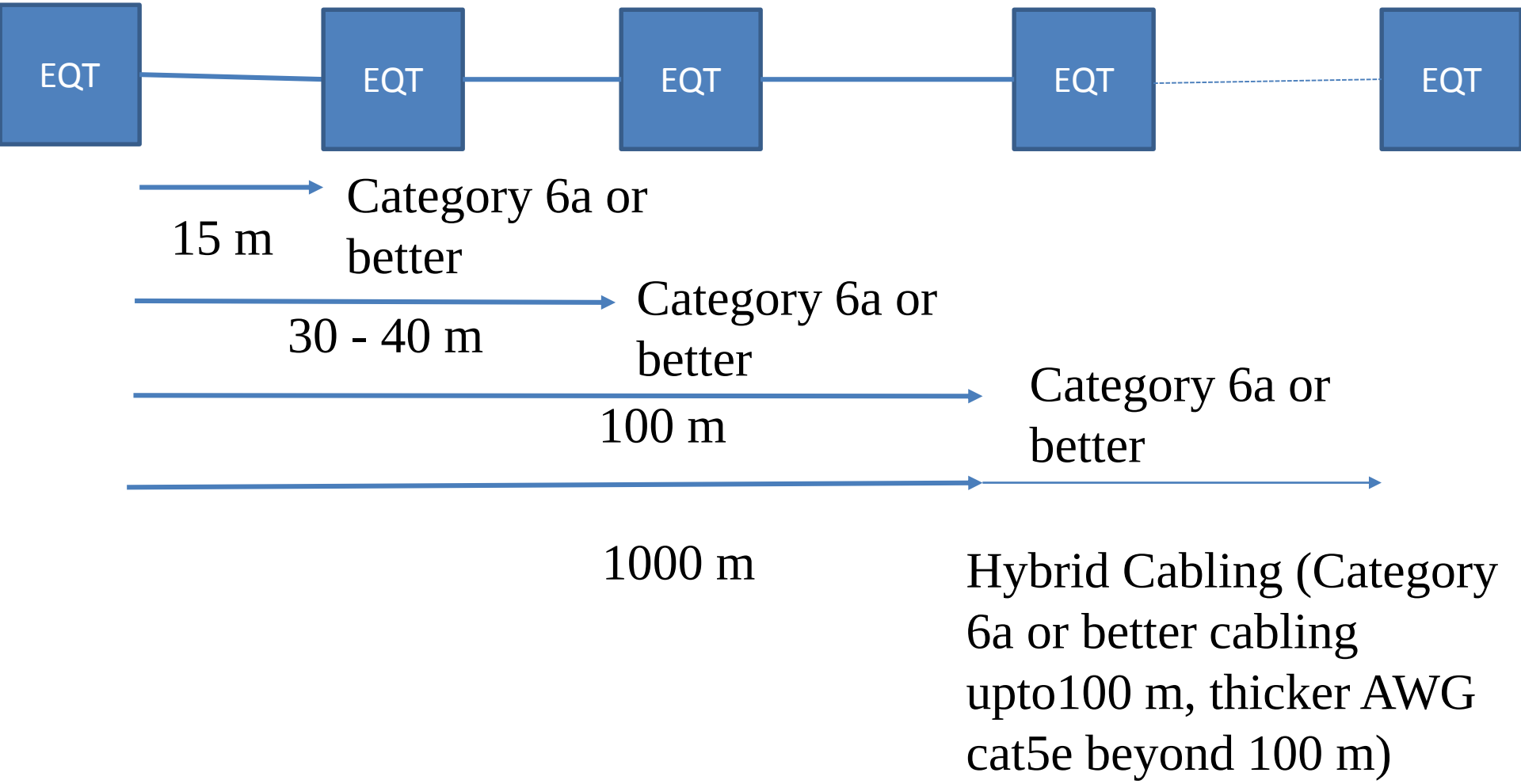
100m: No IEEE single pair applications yet

- 4-pair technology path suggests bandwidth to 500 MHz is useful at this reach

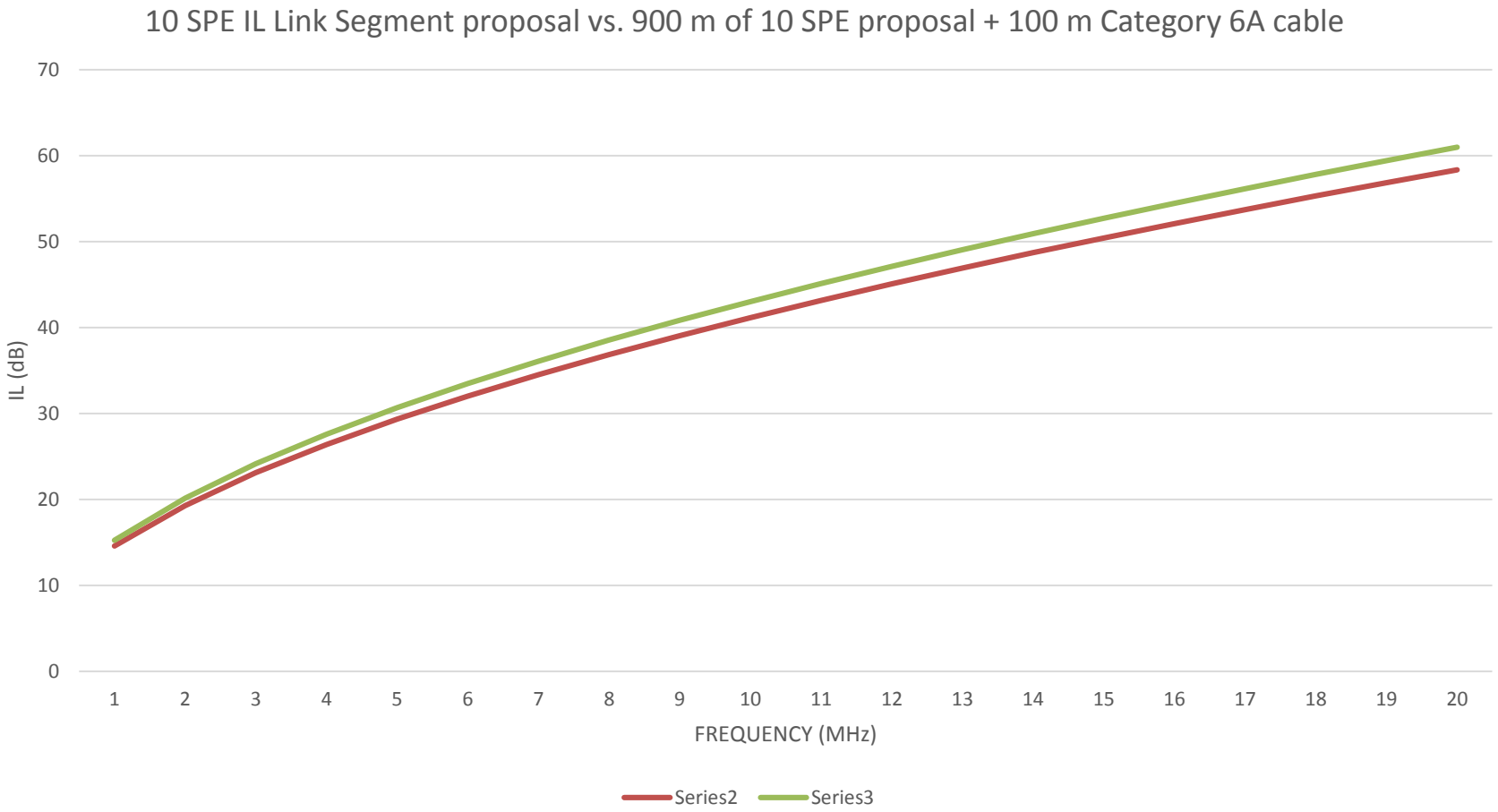
1000m: 802.3cg likely to drive hybrid cabling due to application

- Bandwidth unclear
- High EMI environment drives good balance and/or shielding

Reach Zone Approach



IL comparison of current 10SPE proposal vs. using 100 m of Cat6A for the first 100 m



Impact on IEEE 802.3cg link segment

- Transmission performance of first 100 m inside a building will be improved to Category 6A or better
- The cable will be typical 23 AWG with higher (worse) IL to allow for dense and compact installation inside buildings
- The rest of the 900m link segment will support the current proposal in the task force and improve transmission parameters to Category 5e
- RL of the combined 1000 m link segment will be compliant to current 802.3cg link segment