IEEE 802.3 NEA

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25 Gb/s over min. 50m (extended reach)

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Introduction

- The IEEE 802.3bq "Physical Layers and Management Parameters for 25 Gb/s and 40 Gb/s Operation, Types 25GBASE-T and 40GBASE-T" standard published in 2016 specifies transmission rates for 25 Gb/s and 40 Gb/s via balanced four-pair copper cables over 30m.

- Class I (utilising Cat. 8.1 components) and Class II (utilising Cat. 8.2 components) channels specified in ISO/IEC 11801 and EN 50173 support IEEE 802.3bq. They have a frequency range of 2 GHz and are limited to a length of 30m.

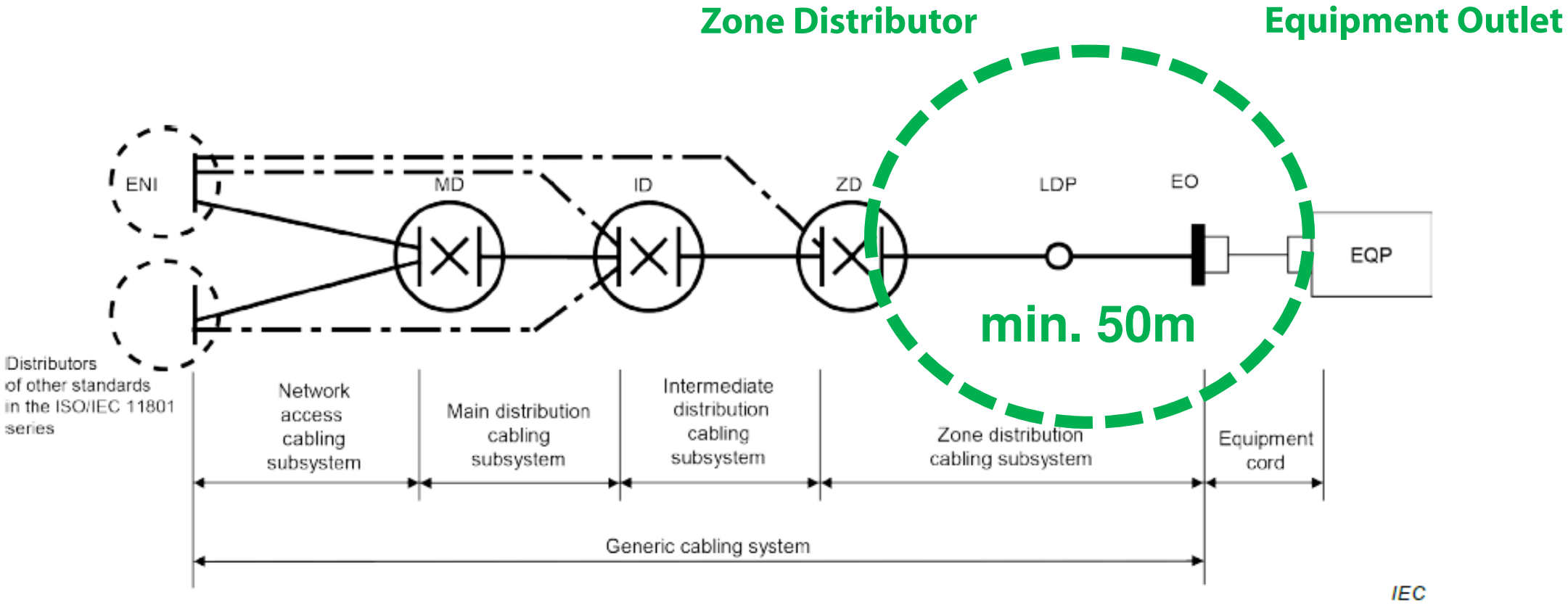
- On the basis of available market information, however, a commercialisation of 40GBASE-T is not intended. Thus, IEEE 802.3bq is reduced de-facto to a potential realisation of 25GBASE-T.

- Because of the fact that 25GBASE-T uses a frequency range of only 1,25 GHz, Class I and Class II channels have margin, which can be used to extend the existing length limitation of 30m.

- An extended reach (e.g., up to min. 50m), could increase the market acceptance for data centre applications and extend the scope of 25 GBASE-T to office and enterprise applications. Thise enhanced attractivity could lead to a win-win situation for all involved parties.

Use Cases

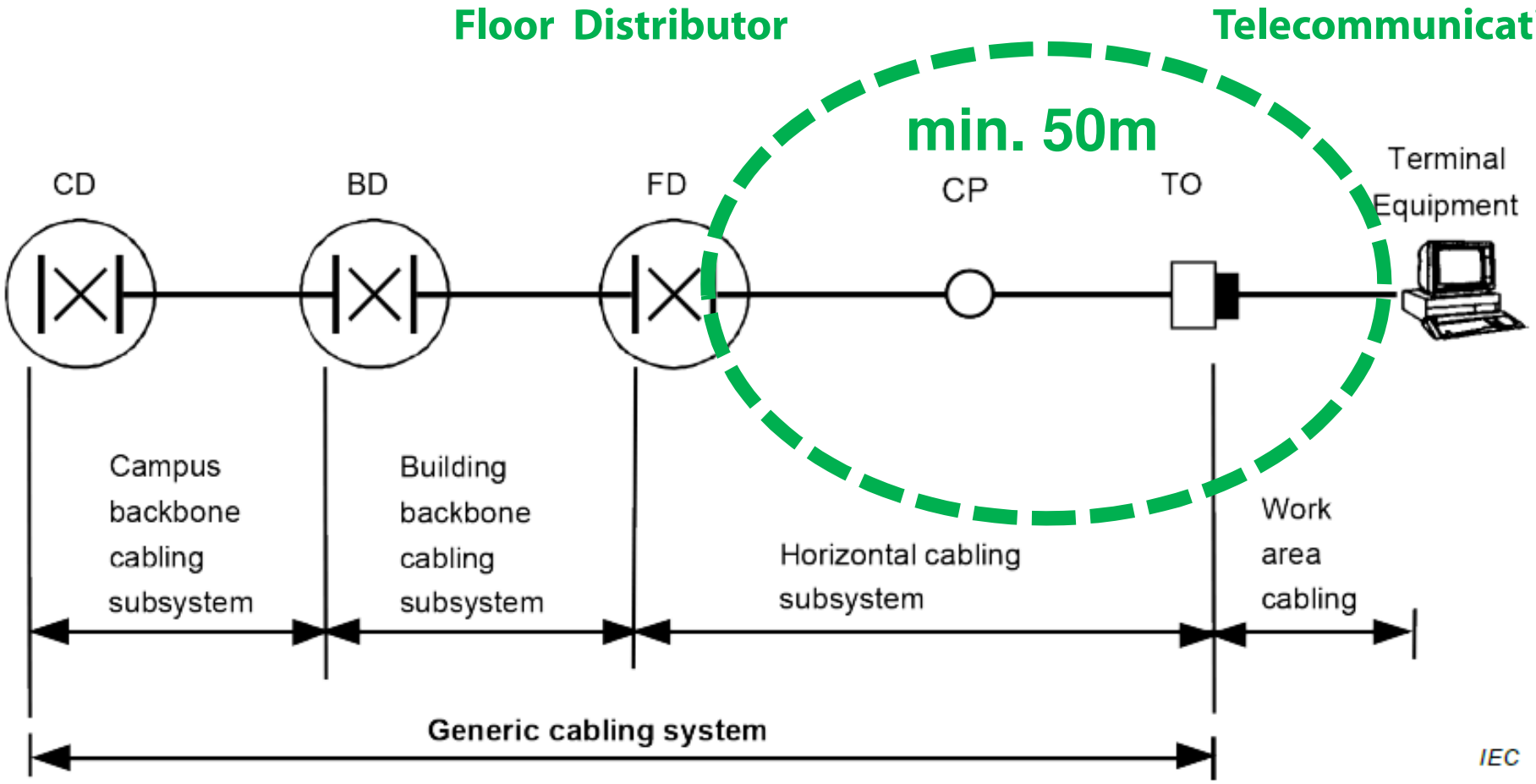
Data Centres: ISO/IEC 11801-5*



***Existing Use Case but with extended reach**
from 30m to min. 50m (from approx. 80% to 90% of Link Lenghts, Flatman)
from 30m to min. 50m (from approx. 40% to 75% of Link Lenghts, Siemon)

Use Cases

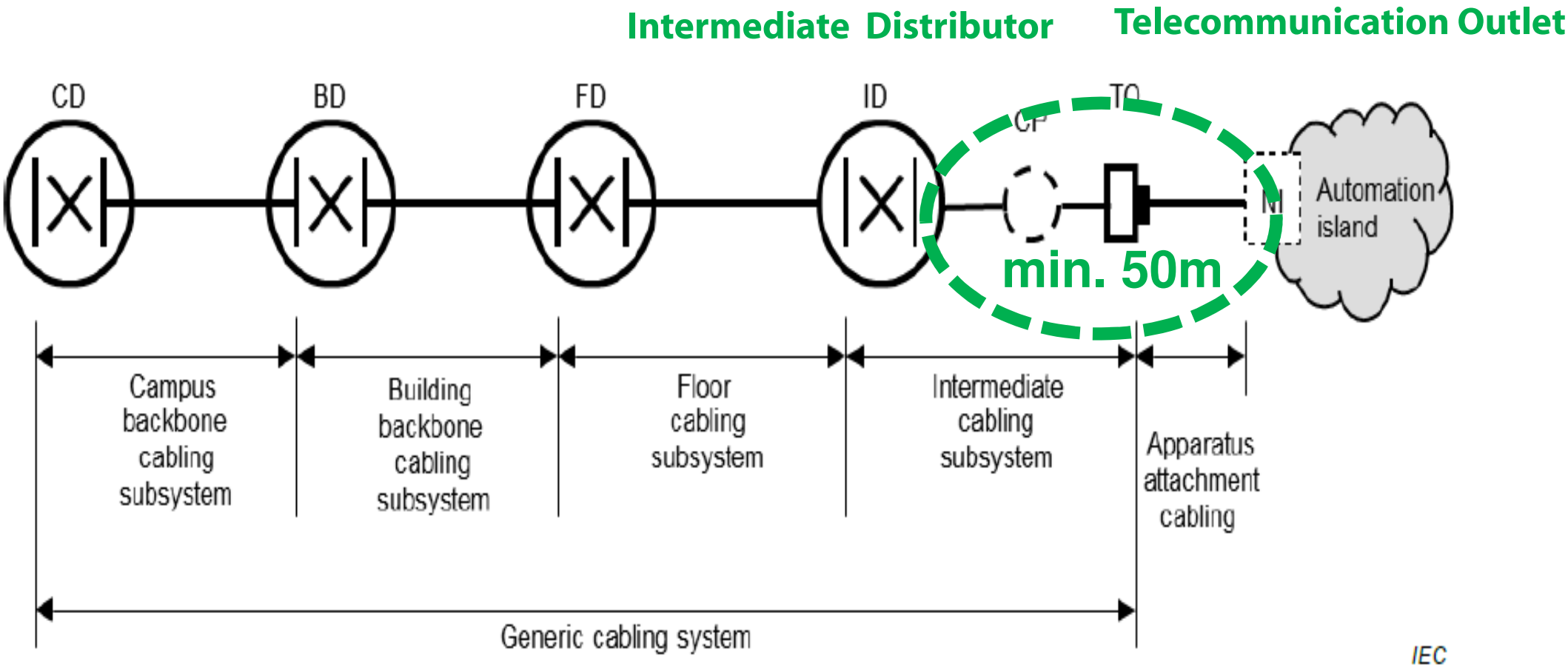
Office Premises: ISO/IEC 11801-2*



*New Use Case with min. 50m (approx. 70% of Link Lenghts)

Use Cases

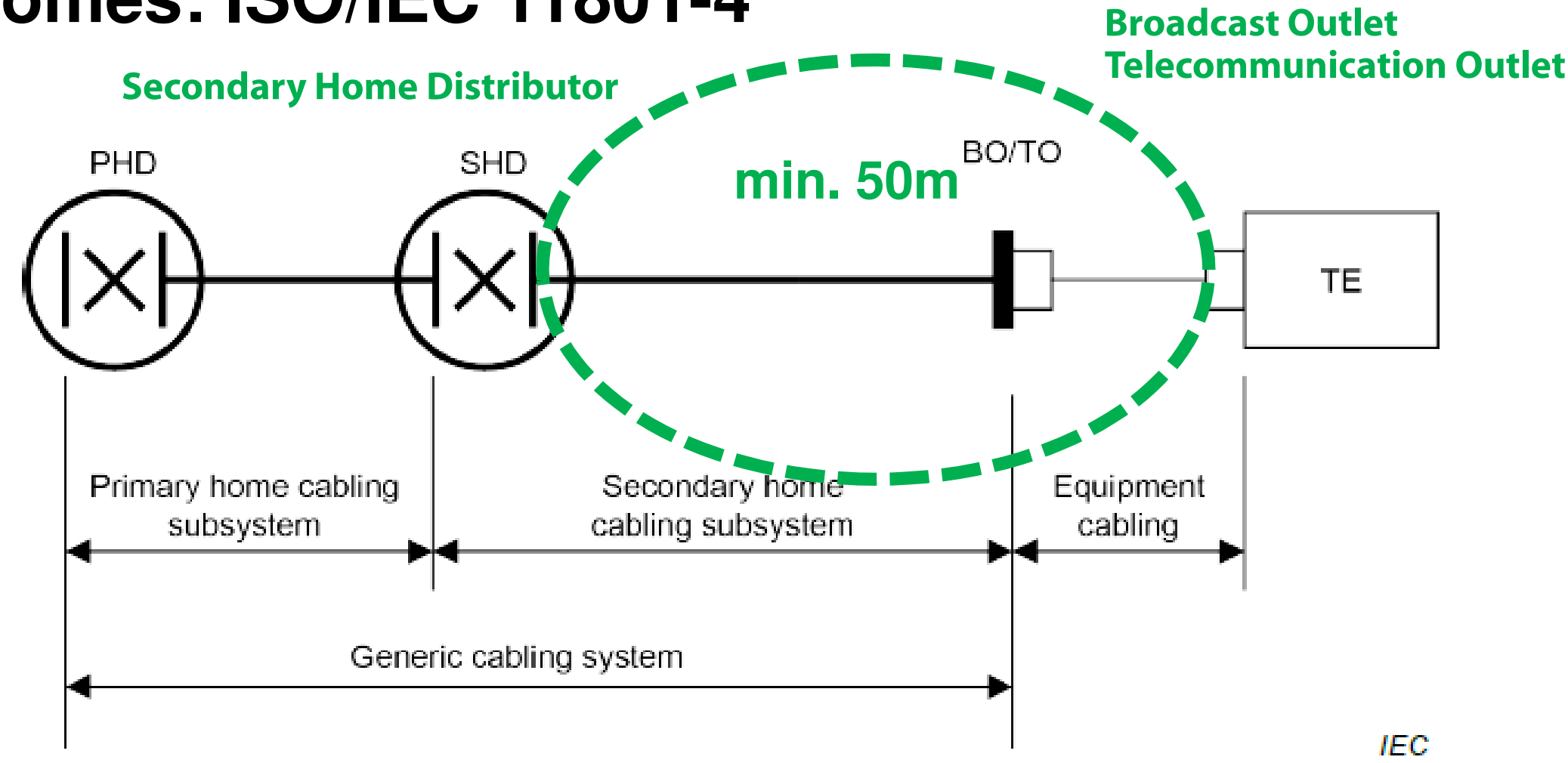
Industrial Premises: ISO/IEC 11801-3*



*New Use Case with min. 50m (approx. 70% of Link Lenghts)

Use Cases

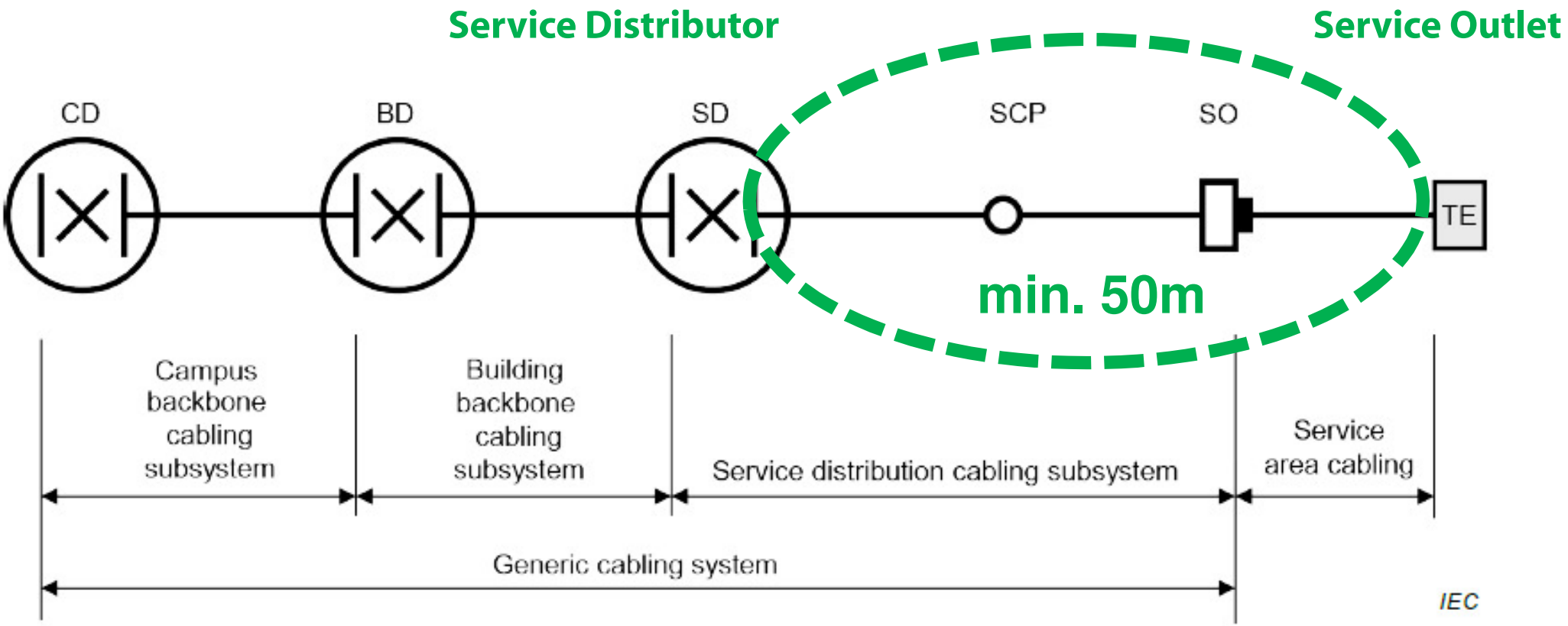
Homes: ISO/IEC 11801-4*



*New Use Case with min. 50m (approx. 90% of Link Lenghts)

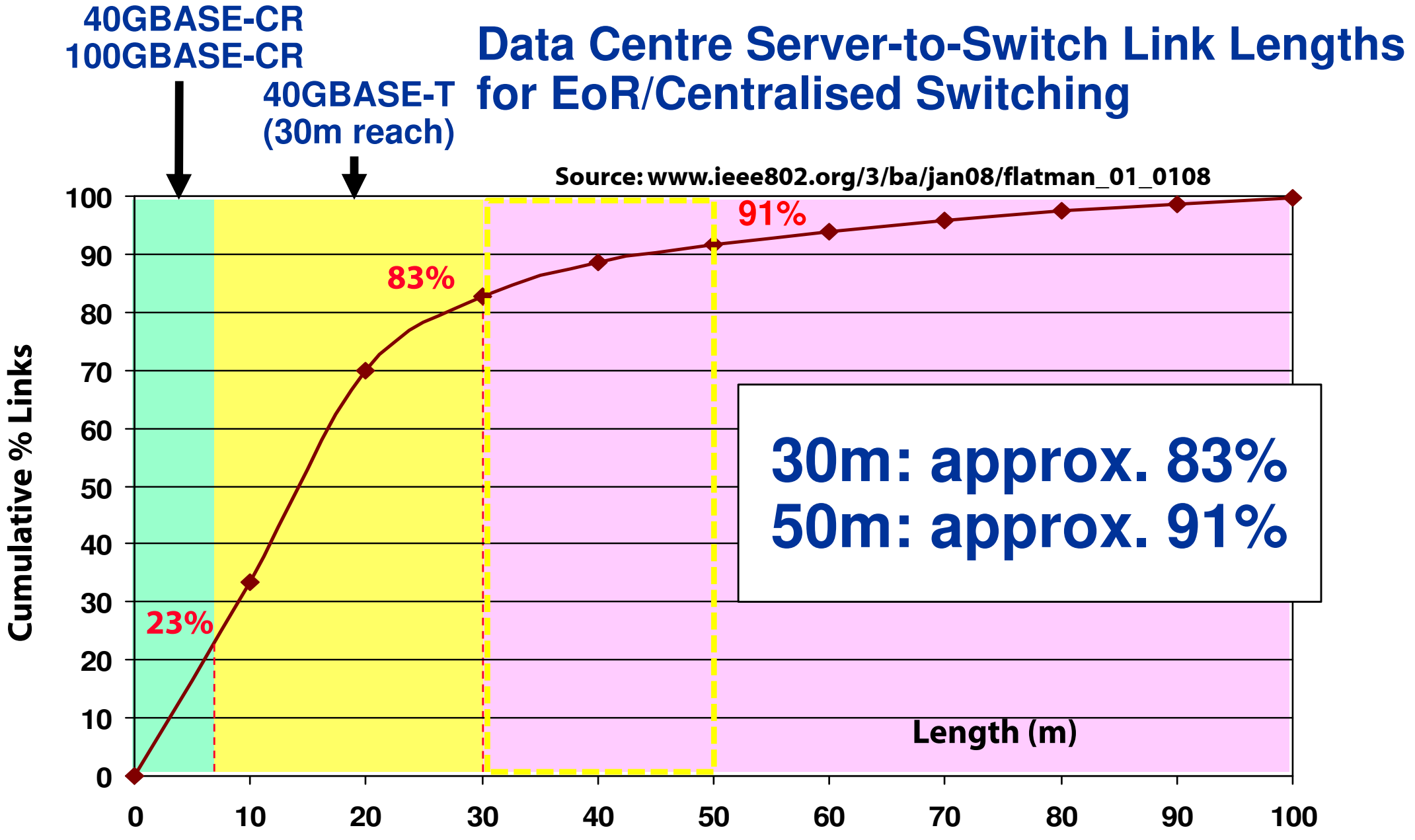
Use Cases

Distributed Building Services: ISO/IEC 11801-6*

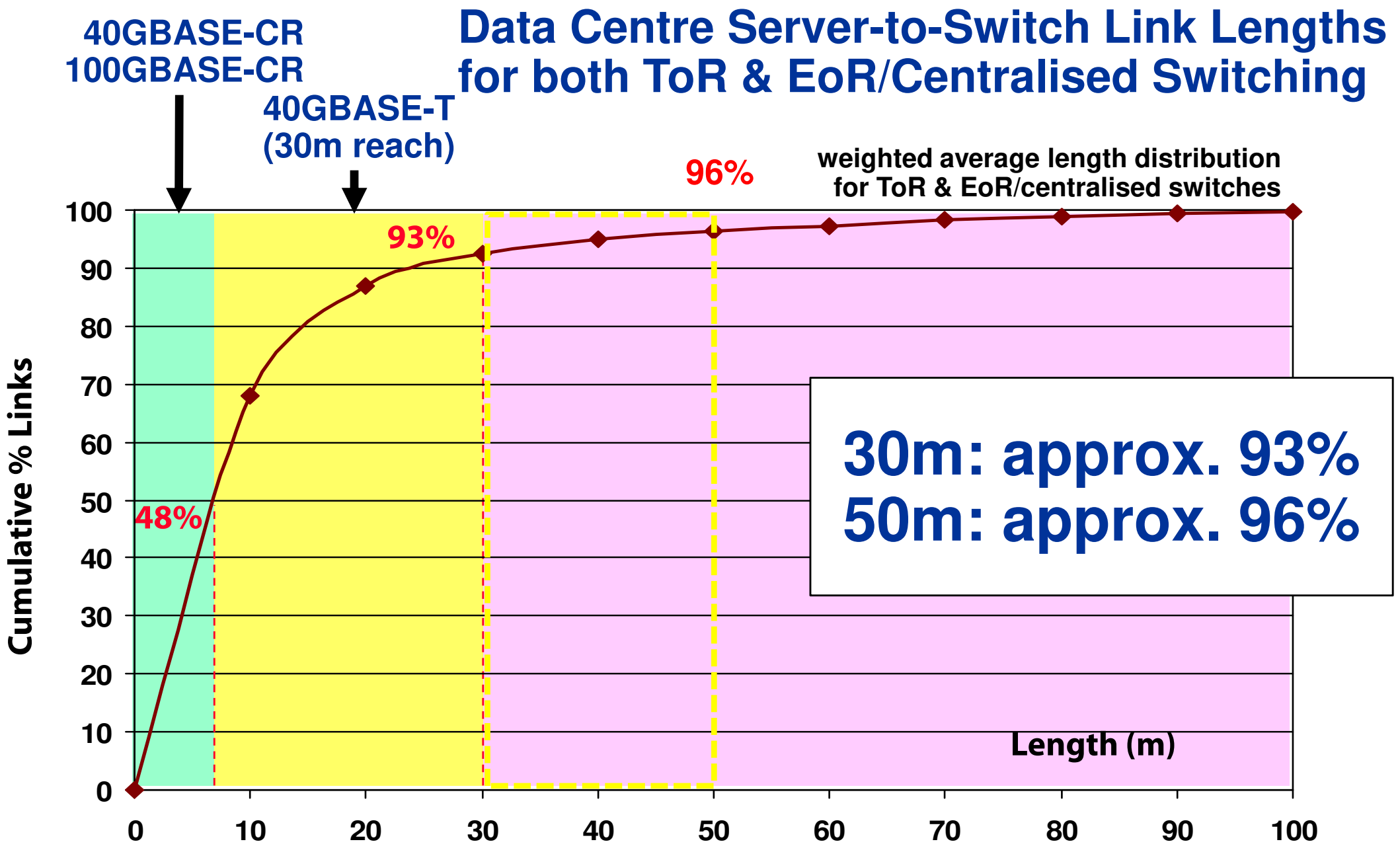


*New Use Case with min. 50m (approx. 70% of Link Lenghts)

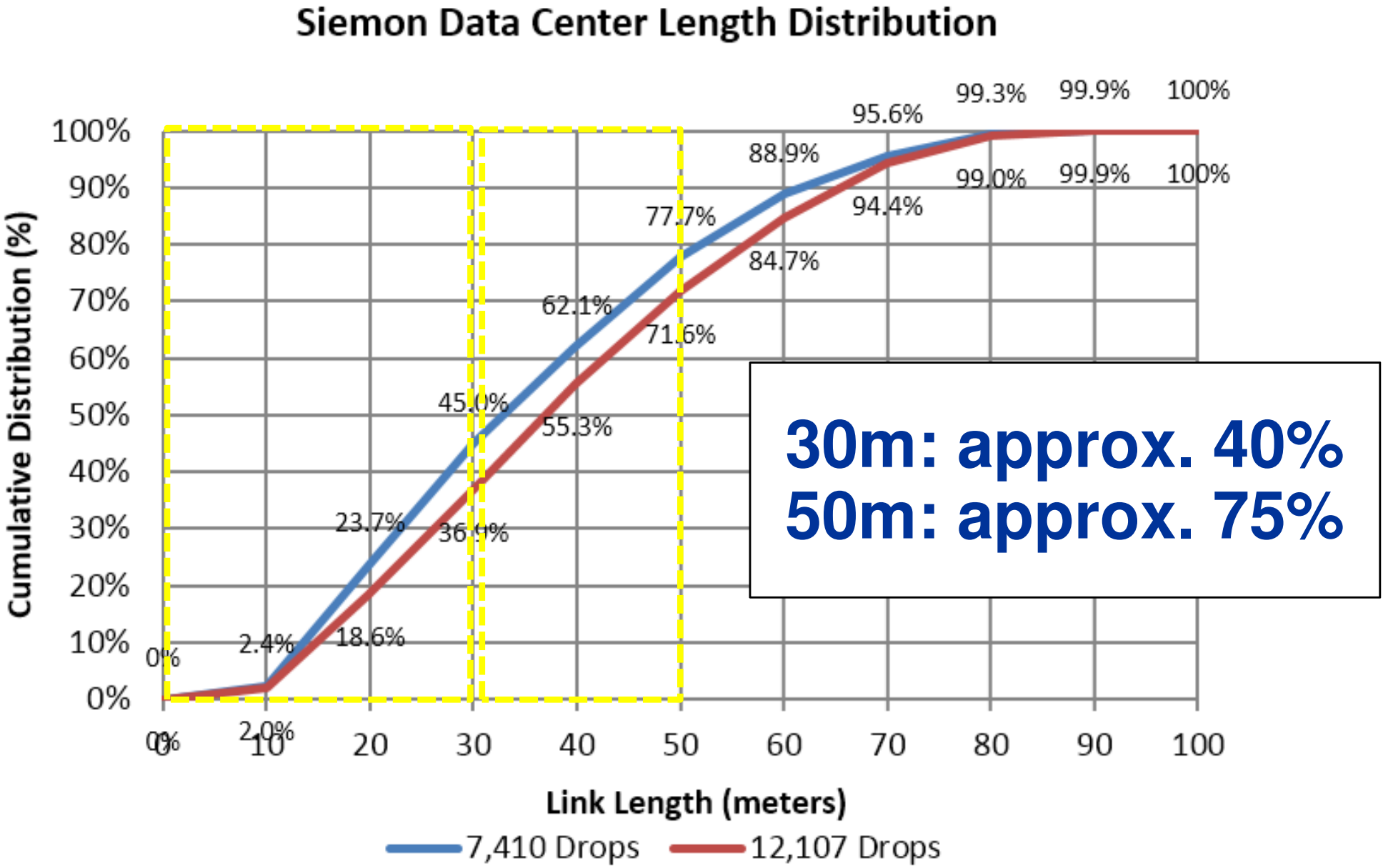
Link Lengths Distribution DC (1)



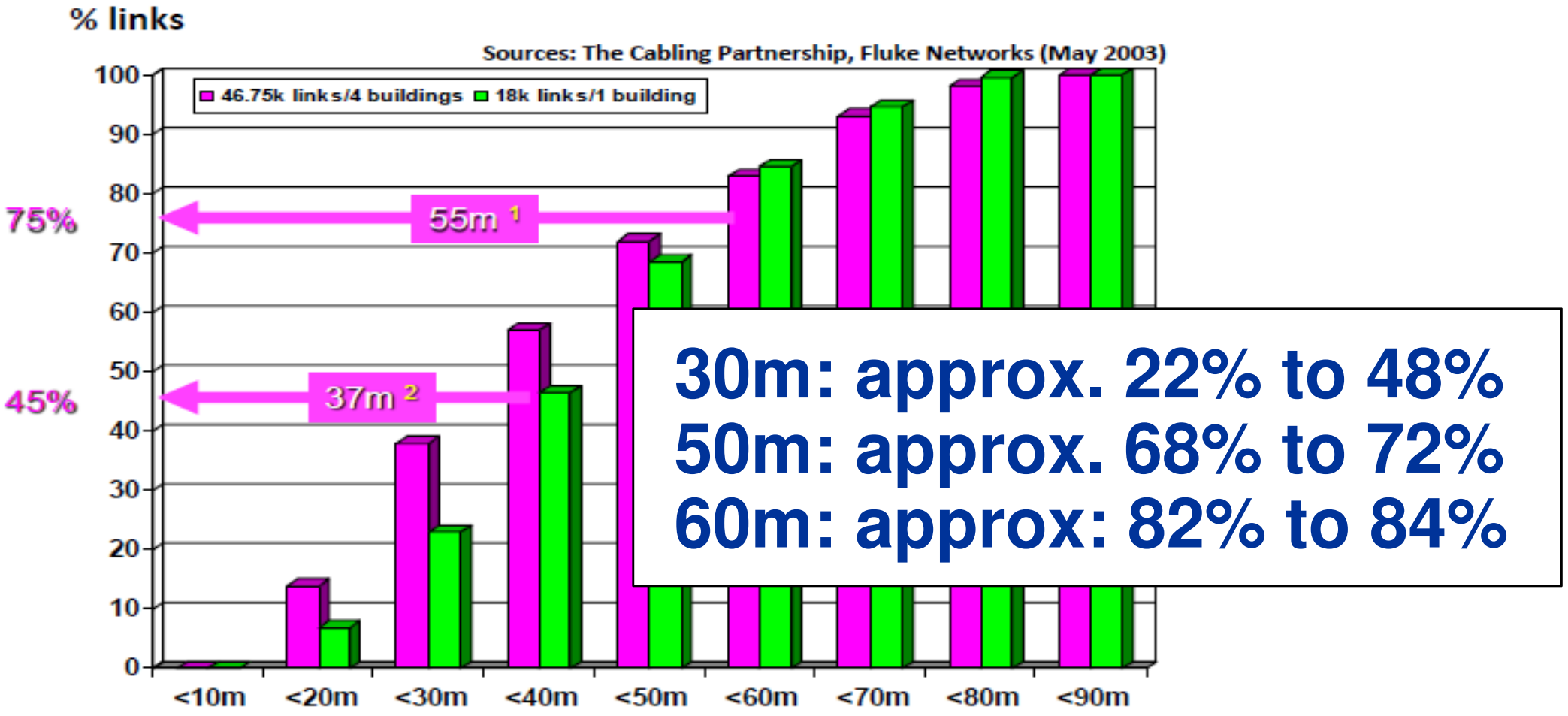
Link Lengths Distribution DC (2)



Link Lengths Distribution DC (3)

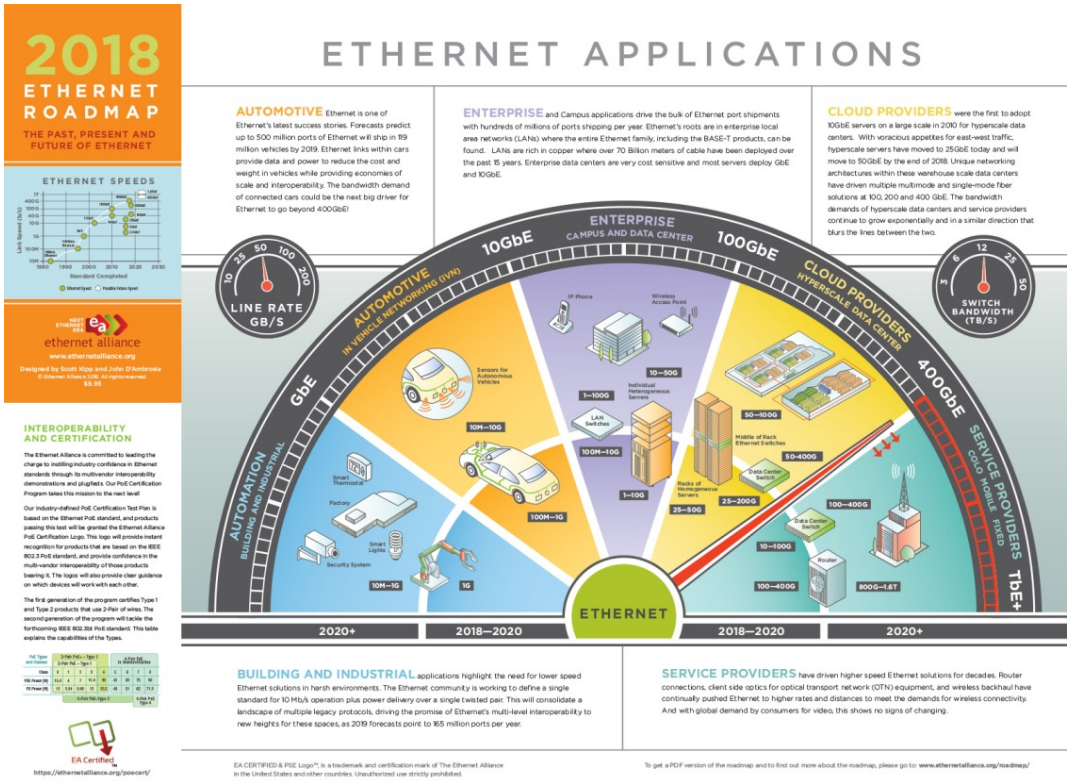


Channel Lengths Distribution Enterprise



Future Applications

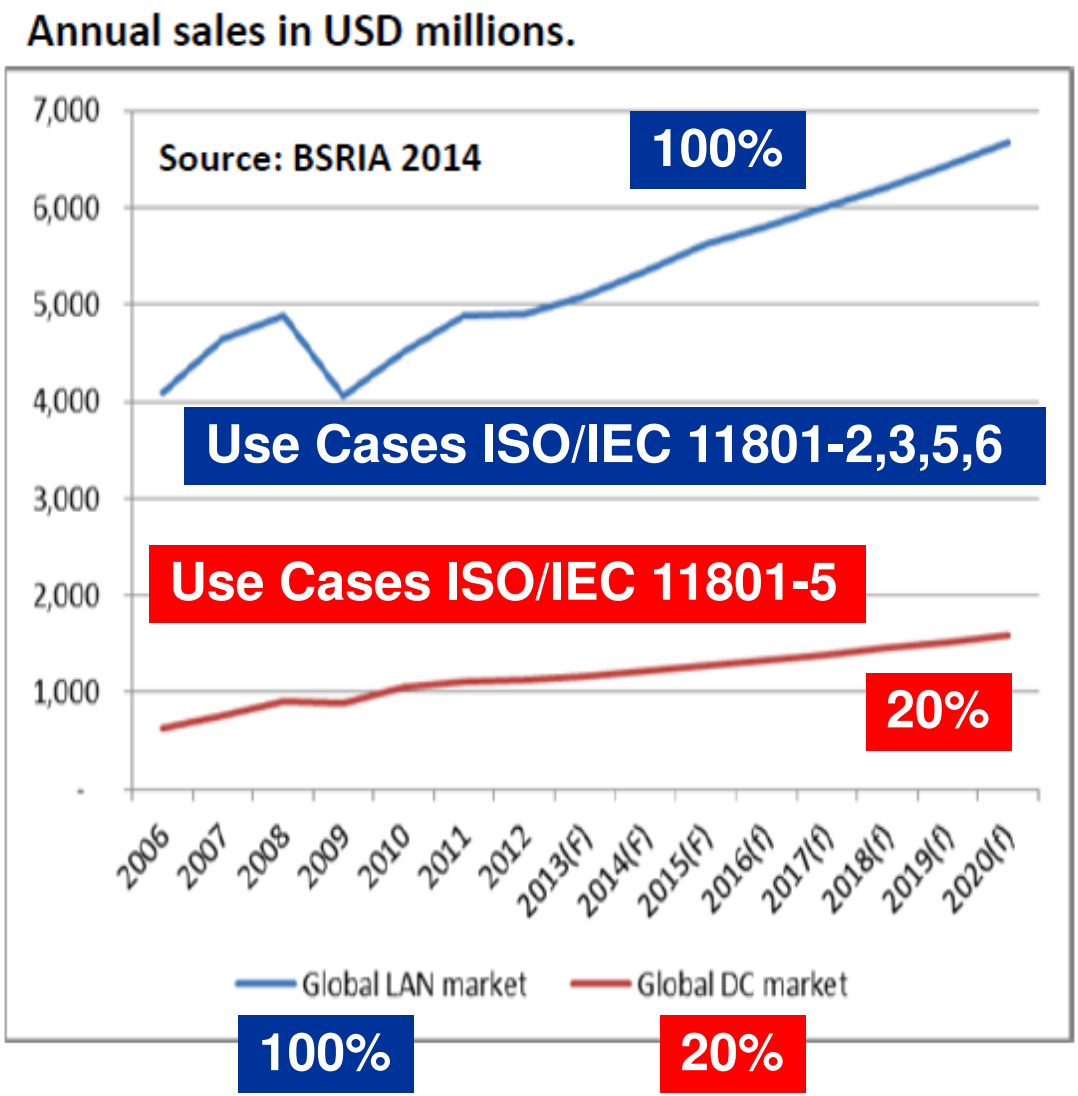
- **Backbone and Consolidation Point Cabling for Single Pair Ethernet Applications driven by IoT and Industry 4.0***
- **High Data rate connections for high performance work stations**
- **Fronthaul Connections of Next Generation WLAN Access Points**



* Up to 4 SPE Channels in one 4 pair balanced cabling

Market Potential

Cabling volume DC versus Enterprise/Global



- DC ≈ 19% total 2014 market
  - 57% value FO components
  - 43% value Cu components
- Cu links ≈ 8% total value or ≈ 5% total volume
- DC will take higher share of Cat 6_A, Cat 7_A (& all Cat 8) but BSRIA data is dominated by office/enterprise cabling

Feasibility

Requirements for Channel I and II (30m)

according to ISO/IEC 11801-1 edition 2018

Frequency	IL		RL		PSNEXT	
(MHz)	Class I	Class II	Class I	Class II	Class I	Class II
1	3	3	19	19	62	62
16	3	3	18	18	50,9	62
100	6,5	6,3	16	16	37,5	62
250	10,4	10,1	13,4	13,4	30,6	56,1
500	15	14,6	10,7	10,7	25,4	50,6
600	16,6	16,1	10	10	23,2	49,1
1.000	22	21,1	8	8	16,6	44,9
1.250	25	23,8	8	8	13,5	38
1.600	28,8	27,2	8	8	9,9	28,5
2.000	32,8	30,8	6,2	6,2	6,6	24,7

Table: excerpt for IL, RL and PSNEXT (highlighted frequency range for 25 Gb/s).

Feasibility

Adjusted IL requirements for 50m channels …compared to 30m channels

Frequency (MHz)	IL Class I	50m 8.1	IL Class II	50m 8.2
1	3	3	3	3
16	3	3	3	3
100	6,5	10,1	6,3	10,0
250	10,4	16,2	10,1	16,1
500	15	23,5	14,6	23,1
600	16,6	26,0	16,1	25,5
1.000	22	34,4	21,1	33,5
1.250	25	39,0	23,8	37,8

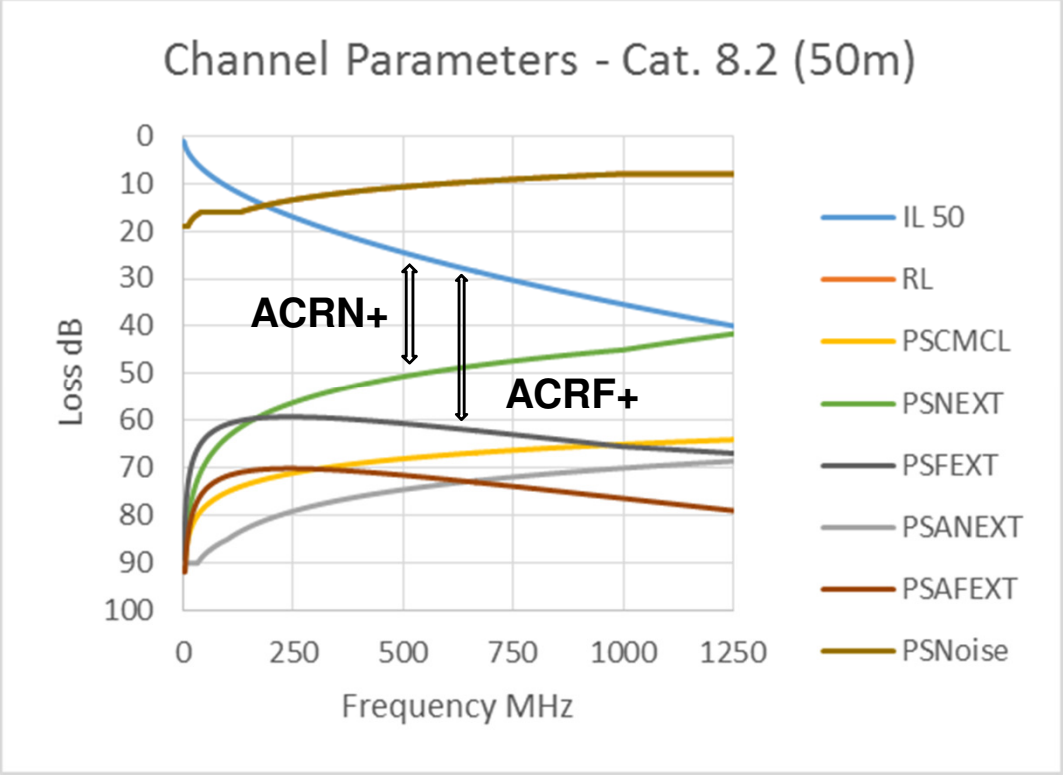
Feasibility

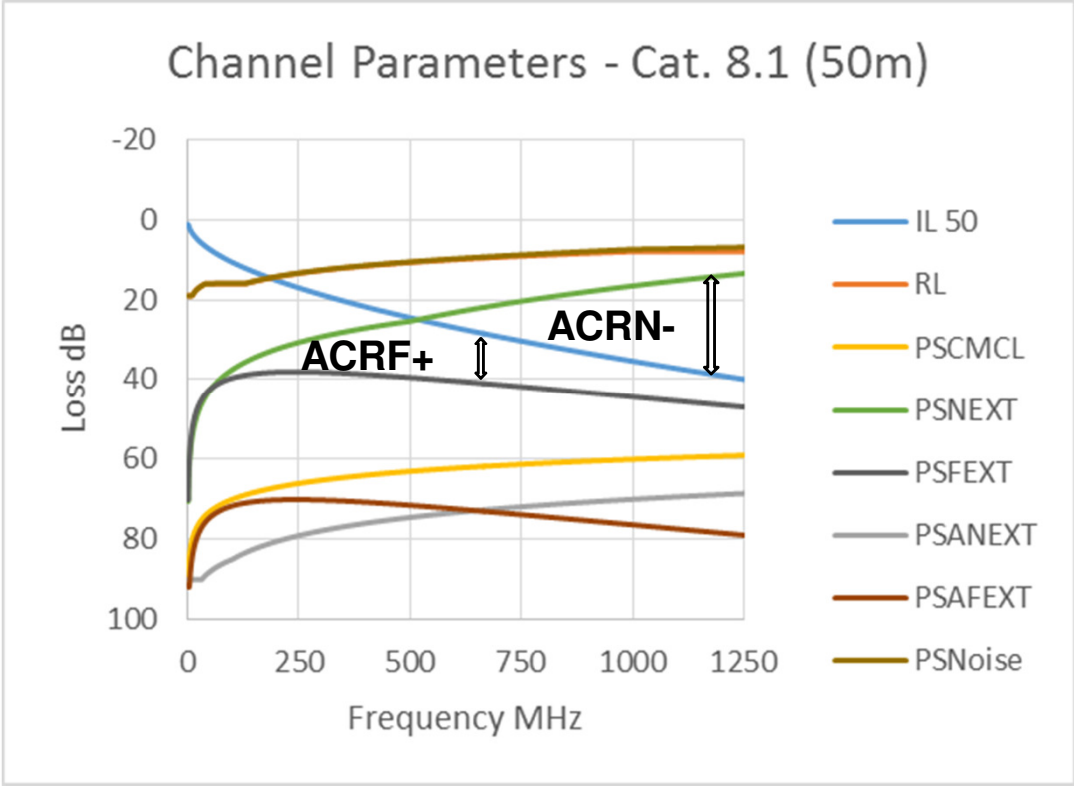
Adjusted delay requirements for 50m channels …compared to 30m channels

Frequency (MHz)	Delay Class I/II	50m 8.1/8.2
1	0,176	0,294
16	0,168	0,281
100	0,166	0,277
250	0,166	0,277
500	0,166	0,277
600	0,166	0,277
1.000	0,166	0,277
1.250	0,166	0,277
	in microseconds	

Feasibility

Channel I and channel II parameters for 50m

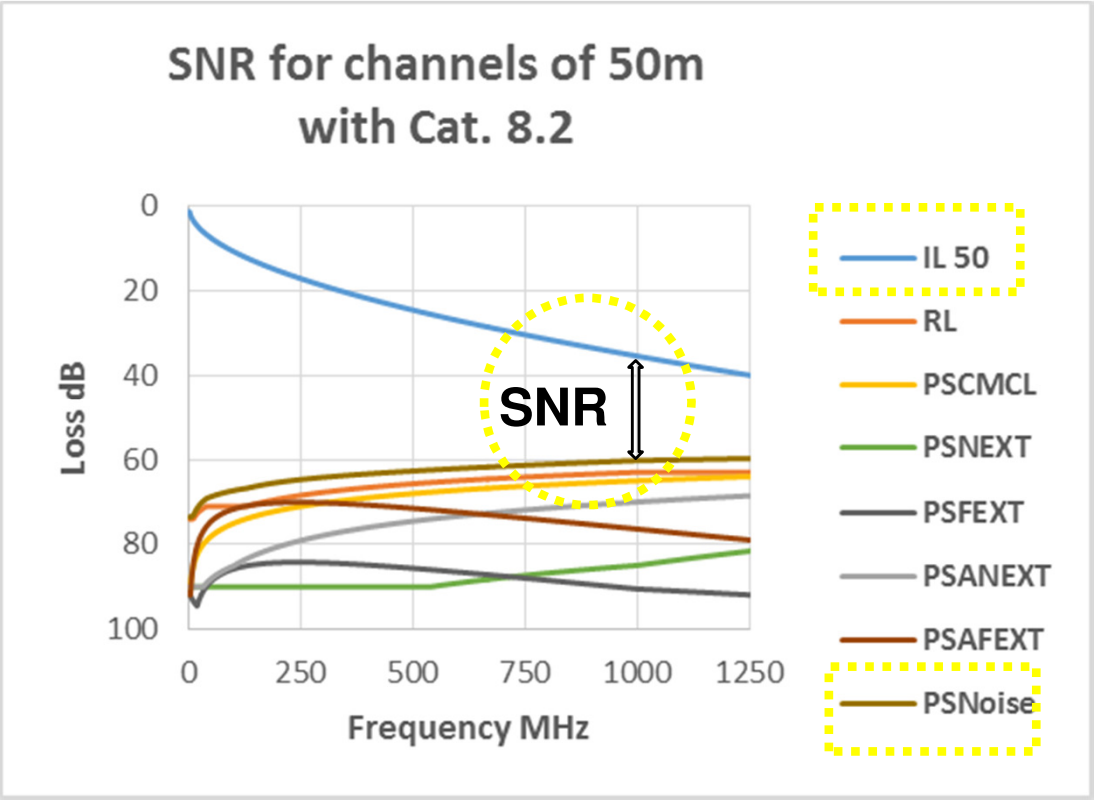


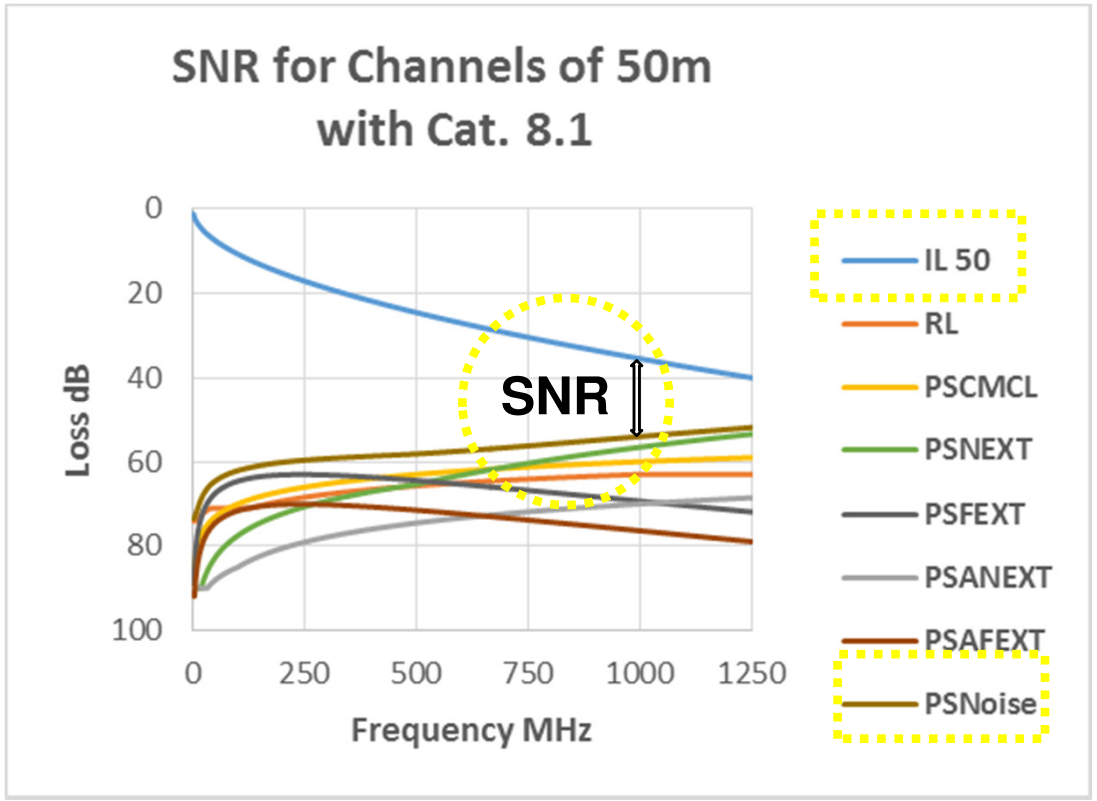


Internal transmission parameters: (near-end) Return loss (RL) and (far-end) Insertion loss (IL)
Internal crosstalk parameters: Near-end crosstalk loss (NEXT) and Far-end crosstalk loss (FEXT & ACRF)
External crosstalk parameters: Near-end alien-crosstalk loss (ANEXT) and Far-end alien-crosstalk loss (AFEXT & AACRF)
External mode-conversion parameters: Coupling attenuation (CA). The basic noise term, integrated common-mode-coupling-loss (PSCMCL), comprises near-end and far-end CA.

Feasibility

Simulation of SNR for channels of 50m

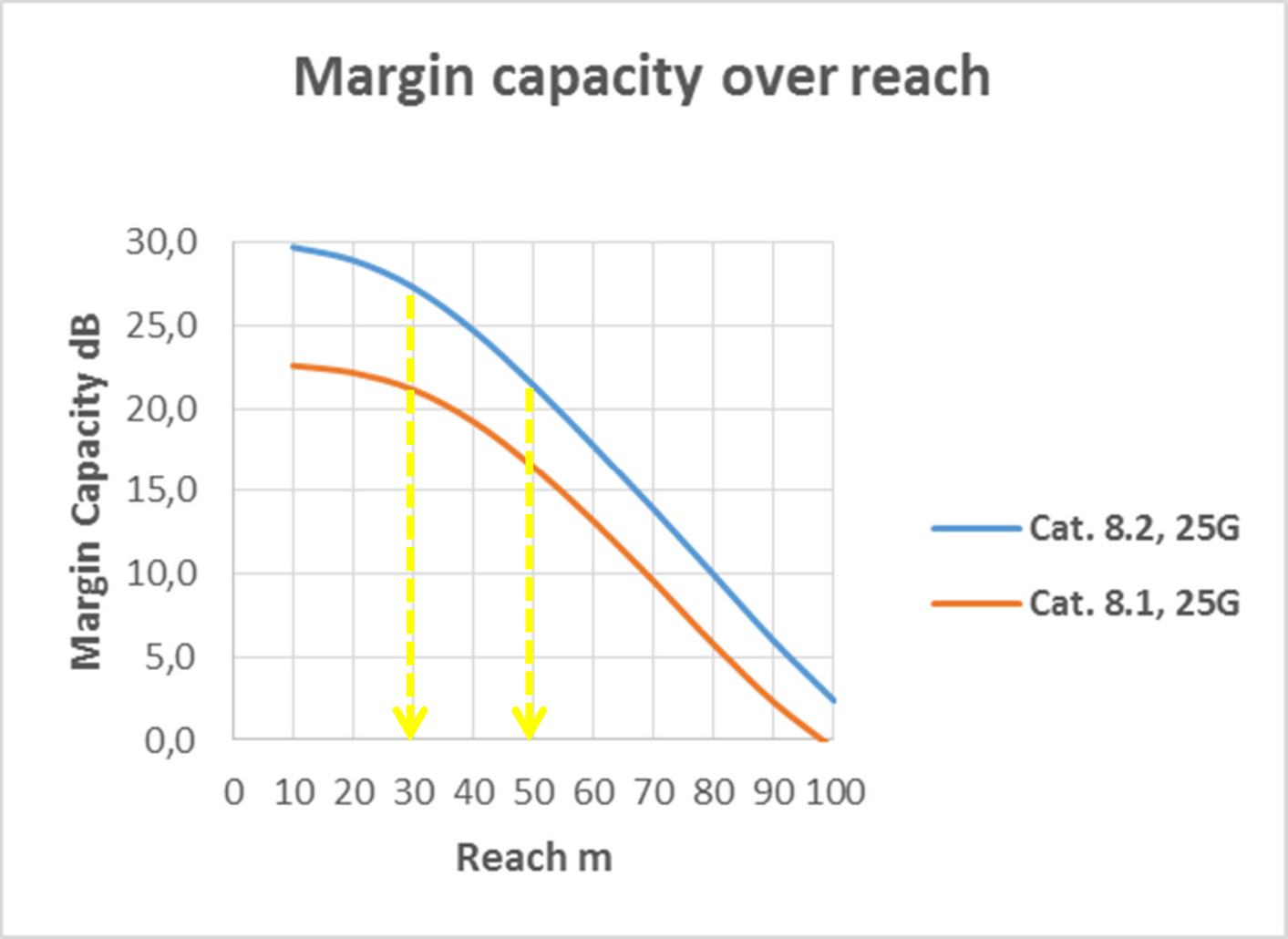




SNR with cancelation of:
RL: 55dB
PSNEXT: 40dB
PSFEXT: 25dB

Feasibility

Calculation margin capacity over reach



Measurements @ University Reutlingen have confirmed the simulation…

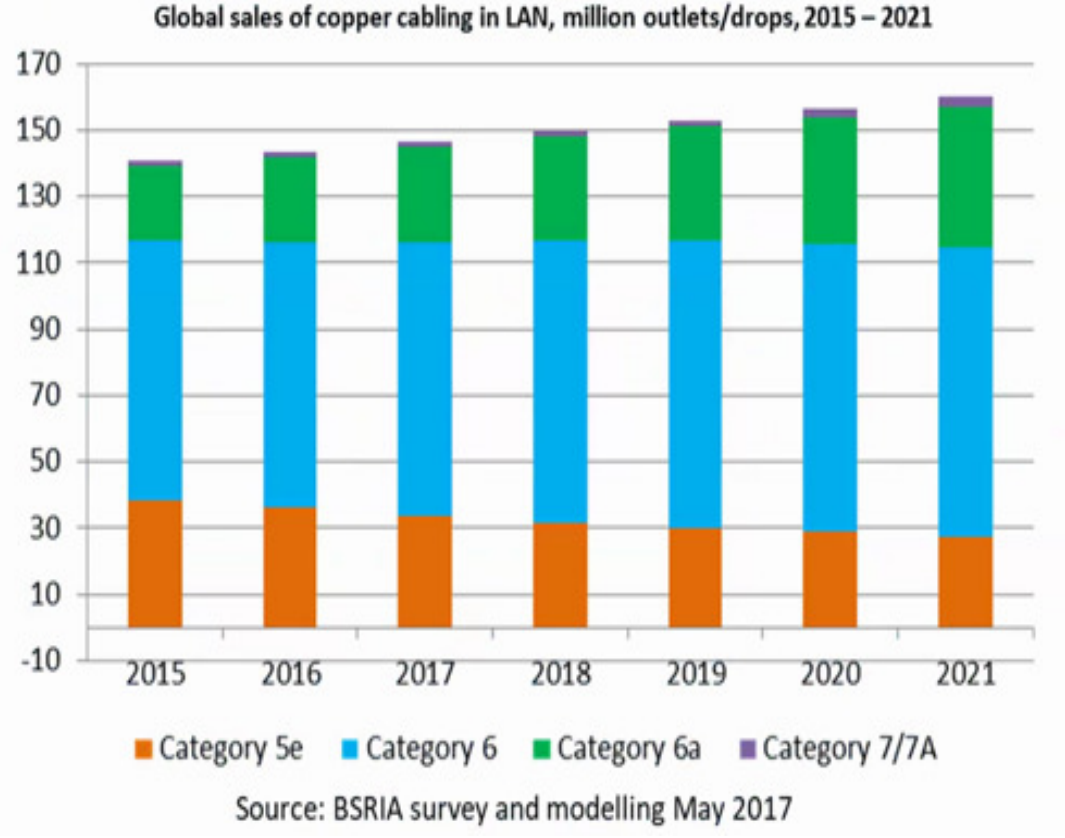
Related Projects (1)

ISO/IEC TR 11801: Part 9905 (2018): Guidelines for the use of installed cabling to support 25GBASE-T application

Table 20 – Risk of 25GBASE-T operation over installed cabling channels

Channel type	Channel length [a]		
Component category	< 10 m	10 m to 20 m	20 m to 30 m
7_A	Low	Low	Low
7	Medium	High	High
6_A	Medium	High	High

[a] Risk level is based on meeting performance requirements of 4.1.



Related Projects (2)

ISO/IEC TR 11801-9909 (Draft 2019): Balanced Cabling in support of 25 Gb/s, extended reach over greater than 30m

Table 1 – Enhancement considerations for 25GBAST-T extended reach

	Channel length (L), m			
Reach range	30 < L ≤ 40	40 < L ≤ 50	50 < L ≤ 67	68 < L ≤ 100
Application supported	25GBASE-T	25 Gb/s	25 Gb/s	25 Gb/s
	Recommended channel enhancement			
CHANNEL COMPONENT CATEGORY 8.1	Reduced delay	Reduced delay, & 40 Gb/s capacity	Not recommended	Not recommended
CHANNEL COMPONENT CATEGORY 8.2	Reduced delay	Reduced delay, & Enhanced 40 Gb/s capacity	Reduced delay, & Enhanced 40 Gb/s capacity	Reduced delay, Enhanced 40 Gb/s capacity, & Enhanced MDI

Related Projects (3)

Liaison letter IEEE 802.3 to ISO/IEC JTC1/SC25 WG3

From: David Law — Chair, IEEE 802.3 Ethernet Working Group
dlaw@hpe.com

Subject: Further information regarding ISO/IEC TR 11801—9909 (Balanced cabling in support of 25 Gb/s, extended reach over greater than 30 m)

Approval: Agreed to at IEEE 802.3 plenary meeting, Bangkok, Thailand, 15th November 2018

Dear Mr Oehler,

IEEE 802.3 would like to thank ISO/IEC JTC 1/SC 25/WG 3 for their work in developing document(s) related to 25 Gb/s balanced cabling extended reach over greater than 30 m. To keep both committees up to date, we ask if it would be possible to share major developments in this process. We also ask if it would be possible, when appropriate, to provide drafts of these documents for information and review in the context of the published IEEE 802.3 standard.

Draft documents would be posted in a private password protected area accessible only to IEEE 802.3 participants.

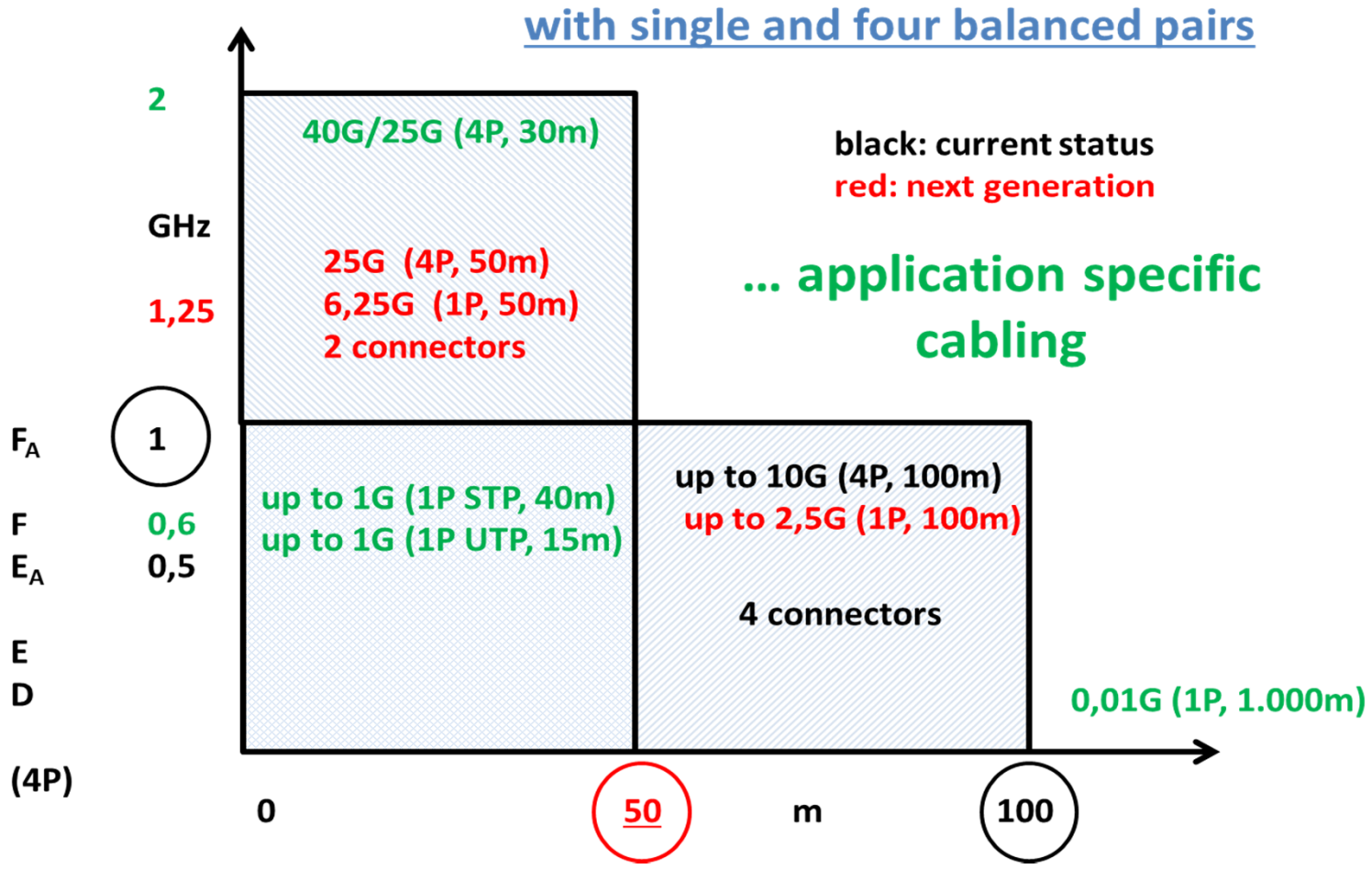
We look forward to continued cooperation,

Sincerely,
David Law
Chair, IEEE 802.3 Ethernet Working Group

Related Projects (4)

Application specific cabling versus generic cabling (1&4 pairs)

Next&New Generation Generic Cabling



Summary

- Extended channel/link lengths of min. 50m increases the market acceptance for data center applications and opens the market for office, industry, (home) and distributed building services regarding 25Gb/s over balanced cabling.
- Additional driver for the new use cases: PoE
- Expected market potential for the global LAN market is 10 to 20 greater than the DC market
- Feasibility based on cabling data has been proved by calculation and measurements
- ISO/IEC TR 11801-9909: “Balanced cabling in support of 25 Gb/s, extended reach, up to at least 50 m”: project approved at the last ISO/IEC Meeting in Falls Church (09.2018)

Questions?

- Request to ISO/IEC WG3 for analysis regarding Channel & Link Lenghts greater 50m, e.g. 55m, 60m, 65m…?
- Extended reach technology based on IEEE 802.3bq?
  - Maintenance request?
  - Revision?
- Extended reach technology based on 100Gbs with 4 lanes of 25 Gbs?
- Next Steps?

Sources:

IEEE 802.3bq „Physical Layers and Management Parameters for 25 Gb/s and 40 Gb/s Operation, Types 25GBASE-T and 40GBASE-T”

ISO/IEC TR 11801-9901
Information technology - Generic cabling for customer premises - Part 9901: Guidance for balanced cabling in support of at least 40 Gbit/s data transmission

ISO/IEC TR 11801-9905
Information technology - Generic cabling for customer premises - Part 9905: Guidelines for the use of installed cabling to support 25GBASE-T application

ISO/IEC TR 11801-9909 (Draft)
Information technology - Generic cabling for customer premises - Part 9909: Balanced Cabling in support of 25 Gbit/s, extended reach over greater than 30m

Implications of Higher Data-Rate Ethernet Over Prior Standard Twisted-Pair Data Cabling 65th IWCS Conference
David C. Hess

Analoge and Digital Measurements @ University Reutlingen
Katharina Seitz
Dieter Schicketanz

Supporters:

- Dieter Schicketanz/University Reutlingen
- Rainer Schmidt/Harting
- Matthias Fritsche/Harting
- Hans Lackner/QosCom
- Dave Hess/Cord Data