Do We Need an Intermediate Link Segment?

IEEE P802.3cg 10 Mbps Single Pair Ethernet Task Force

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Our Objectives: two link segments, possibly a PHY per link segment

11. Define the performance characteristics of a link segment and a PHY to support operation over this link segment with single twisted pair supporting up to four inline connectors using balanced cabling for up to at least 15 m reach
12. Define the performance characteristics of a link segment and a PHY to support point-to-point operation over this link segment with single twisted pair supporting up to 10 inline connectors using balanced cabling for up to at least 1 km reach

What about 200m?

- Graber_3cg_01a_0317.pdf got me thinking….

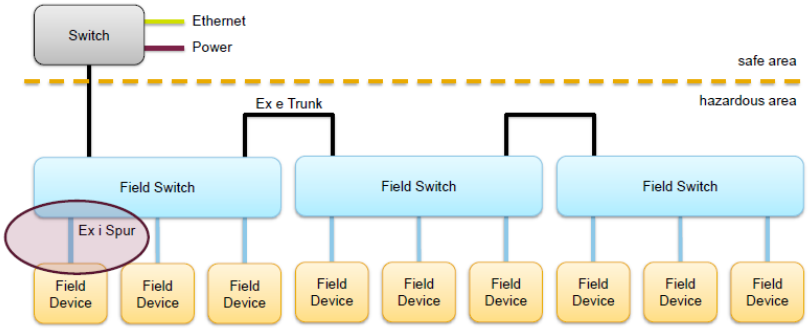
Insertion Loss for 200 m Link Segments

- Worst-Case Model: IL [dB] = 2 * (1.23 * SQRT(f/MHz) + 0.01 * f/MHz + 0.2 / SQRT(f/MHz))
  + 4 * 0.015 * SQRT(f/MHz)

- For a short distance link segment (200 m), the resulting insertion loss is much lower (only about 5.2 dB for a worst-case link segment with 4 inline connectors).
- Even, if the signal amplitude is reduced to 1 V_{pp} (-0.5 V, 0 V, +0.5 V) due to intrinsic safety requirements, the remaining signal amplitude at the receive side is still about 14.3 dB (5 times) higher than for a worst-case long distance 1000 m link segment.
- This will allow for a significantly higher noise immunity.

Varied use cases

- In-cabinet, chassis
  - Short (0.1m? to 15m)
  - Narrow wire (28 AWG?), 0-4 connectors
- Cars
  - 4 conn, 15m
- Industrial pods
  - Pods 5-40m, 0-4 connectors
  - Wiring gauge?
- Trunks
  - Trunks to 1km, 10 conn
  - Thicker wire (14,18 AWG)
- Spurs / In bldg. distribution
  - To 200m (in bldg. ~100m), to 4 connectors
  - Gauge likely based on power, 16-18AWG, but also could be smaller



Intermediate reach doesn't look long or short reach

- RL is determined by near-in connectors
- IL even of narrow gauge cable is far less than long-reach
- IL of medium gauge cable is more than short-reach
- Powering may ultimately determine gauge

AWG	Length @ IL limit(m)	Length @ ohms loop R 6.5	12	25	4M IL @15m 4 conn	IL @ 100m 4 conn	IL @ 200m 4 conn	IL @ 1km 10 conn
14	1589	353	652	1359	0.4	1.5	3.4	16.5
16	1261	221	408	850	0.5	1.8	4.2	20.7
18	1000	139	258	536	0.5	2.3	5.3	25.9
20	793	88	162	337	0.6	2.8	6.6	32.6
22	629	55	102	212	0.8	3.5	8.3	41.0
24	499	35	64	133	0.9	4.4	10.4	51.6
26	395	22	40	84	1.1	5.5	13.1	65.0
28	314	14	25	53	1.4	6.9	16.5	81.9

Recommendation

- Define a nominal model for intermediate link segments:
  - Powered spur
  - Unpowered spur
  - In-building distribution
- These go along with the 1000m link segment (baselined in March), and the 15m point-to-point link segment (to be baselined)
- Evaluate PHY suitability & complexity for intermediate link for both long & short reach proposals