802.3da
Power Classes

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ANALOG DEVICES

AHEAD OF WHAT'S POSSIBLE™

Critical Power Parameters

- Coupling Inductance (L_{PD}) needs to be resolved to move power specification forward
  - **L_{PD} – Affects economic feasibility and classification timing**
  - **N (num PDs) – Affects Inductor Size L_{PD}**
  - **Droop (V_{DROOP}, T_{DROOP})– Determines L_{PD}**
  - **Bit Rate - Determines L_{PD}**

- Optimize L_{PD} to minimize cost and size

- Make L_{PD} inversely proportional to PD current
 - Allow high-power PDs to use lower L_{PD} since fewer high-power devices can be connected

Choosing Power Classes

- Set 90W maximum guaranteed PSE output

- Assume each mixing segment can support maximum of 16 PDs

- Divide 90W into 16 Classes

- Classes are linearly distributed
  - 90W / 16 Classes = 5.625W / Class

- Classes are 'Tokens'
  - Each mixing segment has 16 tokens
    - Tokens use power budget
      - 1 x Class 16 (90W)
      - 1 x Class 15, 1 x Class 1 (84.375W + 5.625W = 90W)
      - 16 x Class 1 (16 x 5.625W = 90W)
      - 8 x Class 2 (8 x 11.25W = 90W)
      - 4 x Class 4 (4 x 22.5W = 90W)
      - 1 x Class 8, 1 x Class 4, 1 x Class 3, 1 x Class 1 (90W)
      - Etc...

- Sum of PD classes on a mixing segment <=16
  - Customer can add the classes of attached devices to determine if another device can be added

Class	PSE Power	PSE Power
1	1 x 5.625W	5.625W
2	2 x 5.625W	11.25W
…	…	…
15	15 x 5.625W	84.375
16	16 x 5.625W	90W

Choose Coupling Inductance By Class

- Set 80uH as minimum lumped inductance for all PDs

- 80uH x 16 Classes = 1280uH
  - Class 1 coupling inductance = 1280uH
  - Class 16 coupling inductance = 80uH

- Classes are 'Tokens'
  - Each mixing segment has 16 tokens
    - Tokens use inductance budget
      - 1 x Class 16 (80 uH)
      - 16 x Class 1 (1280uH / 16 = 80uH)
      - 1 x Class 15, 1 x Class 1 (85.3uH || 1280uH = 80uH)
      - 8 x Class 2 (640uH / 8 = 80uH)
      - 4 x Class 4 (320 / 4 = 80uH)
      - 1 x Class 8, 1 x Class 4, 1 x Class 3, 1 x Class 1 (80uH)
      - Etc...
  - Sum of PD classes on a mixing segment <=16
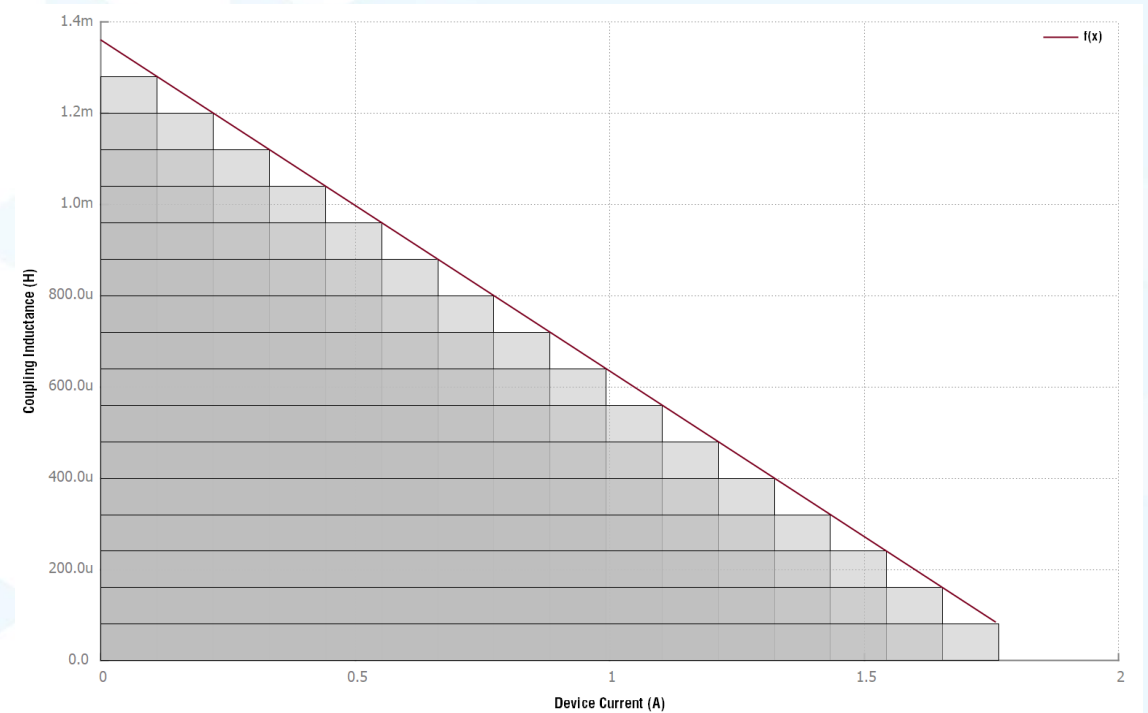
Continuing work

- Agree on minimum total inductance for the system (40uH?)
  - Trade off inductor size/cost with PHY complexity
    - Work on SCCP Timing

- Calculate delivered power
  - Cable thickness
  - Cable length
  - Device Separation

- Determine SCCP (detection) timing

- Verify C_{NODE} Estimation

- Update Models