SPMD Power Up Procedure, part 2

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This is a revision of the presentation showed on Aug 26, 2020

New text/concepts are denoted by red text or a red box around the text

In presentation observations from 082620

- ~~Exit strategy – how do we sense that PDs have left and reclaim that allocated power~~
- ~~PSE hands out back off time to denied PD.~~
- ~~Time limit for negotiation and back off time between retries~~
- ~~Use LLDP to also relax power budget~~
- ~~A 1W or less PD never needs to negotiate? (how does PSE maintain power budget in this case)~~
- What is the power penalty of LLDP
- ~~How much power to reserve for negotiation?~~
- Current noise spec

Propose a power up scheme for SPMD

Objectives to satisfy:

- Specify optional plug-and-play power distribution over the mixing segment
- PSE shall only energize the mixing segment when at least one PD is connected
- Support addition and removal of a node or set of nodes to a continuously operating powered mixing segment

Objective 9

- Specify **OPTIONAL** plug-and-play power distribution over the mixing segment
- Implies support for PDs that don't require power
- Implies PDs that don't require power need to 'tolerate' PSE voltage

This is covered in 147.9.3:

The DTE shall withstand without damage the application of any voltages between 0 V dc and 60 V dc with the source current limited to 2000 mA, applied across BI_DA+ and BI_DA–, in either polarity, under all operating conditions, for an indefinite period of time.

- This text will also need to be included in P802.3da

Objective 10

- PSE shall only energize the mixing segment when at least one PD is connected
- Implies a detection scheme.
- Heath Stewart proposed a simplified version of the method in clause 104 (https://www.ieee802.org/3/da/public/jul20/stewart_01_0720%20Classification.pdf)
- After detection, PSE applies power.
- PD still required to perform ‘negotiation’ (details to come)

Objective 11

- Support addition and removal of a node or set of nodes to a continuously operating powered mixing segment
- Implies that one can plug in a string of PDs
- Need method to allow multi-PD detection (stewart_01_0720)
- PDs would still need to perform negotiation

Negotiation

- This happens after a PSE has applied power to the initial PD, or after a PD is added to an already energized mixing segment (i.e. after power is applied at the PD PI)
- Negotiation is the method for the PD to request power from the PSE and for the PSE to grant or deny the request
- Need requirements for the PD for negotiation power draw and for the denied power state
- Need a process for negotiation that minimizes the reserve power budget

Allowed Power

- Propose that P802.3da adopt 1W as power allowed to PD for negotiation
- Propose that P802.3da adopt 0.1W as the power allocated for the denied power state

Allowed Power

- *Propose that P802.3da adopt 1W as power allowed to PD for negotiation*
  - This leads one to assume we need to reserve (n-1) watts for negotiation where n is the number of devices allowed on a mixing segment, and to maintain (n-1-x) watts in reserve where n is the number of devices allowed on the mixing segment and x is the current number of devices on the mixing segment.
  - If n=32, this is a large waste of reserve power
- Propose that P802.3da adopt 0.1W as the power allocated for the denied power state

More reasonable reserve power

- A better idea is to limit the reserve power to something that can be hidden in the margins
- Assuming we end up with 90W as the maximum PSE power (like IEEE 802.3bt), we need something less than ~5W of reserve power
- If we allow 32 nodes on a mixing segment (the biggest number I recall thinking was reasonable), 0.1W at power up would mean only 3.1W of reserve power

Removal Detection

- The previous scheme did not include a method to detect PD removal.
- PD removal detection is crucial so the PSE can maintain an accurate PSE power budget.
- Ideally, negotiation and removal detection are covered by the same process.

Steps for Negotiation

- Power is applied at the PI (i.e. PD is connected to a mixing segment)
- PD powers up in a limited power mode and signals to the PSE that it is ready to negotiate
- PD goes to sleep (but monitors data)
- PSE signals uniquely to PD that it is ready to negotiate
- PD powers up in a LOW power mode and uses LLDP to request power from PSE

  Two possible results:

  PSE replies ‘YES’: PD fully powers up

  PSE replies ‘NO’: PD moves to denied power state

Allowed Power

- Propose that limited power for signaling PSE is 0.1W.
  - Implies this is embedded in the PHY
- Propose that low power for negotiation is 1W
  - An MCU is likely required for this part, hence more power
- This means reserve PSE power is 1W + (n-1)*0.1W
  - 4.1W for 32 nodes.

Removal

- A polling scheme is required to detect PD removal
- PSE periodically pings each PD
- Three successive missed ‘pings’ equates to a removed PD and the PSE can reallocate the removed PD’s power.
- It has been suggested that a scheme similar to an EEE LPI request can be used.

Summary

- This text needs included in P802.3da: The DTE shall withstand without damage the application of any voltages between 0 V dc and 60 V dc with the source current limited to 2000 mA, applied across BI_DA+ and BI_DA−, in either polarity, under all operating conditions, for an indefinite period of time.
- PSE does not apply voltage to the PI until a PD is attached.
- PD is detected via the method in stewart_01_0720
- PSE applies voltage after detecting at least one PD

Summary pt 2

- PD powers up at 0.1W, signals to PSE ready to negotiate
- PSE signals uniquely to PD that it is ready to negotiate
- PD powers up to 1W for negotiation
- PD uses LLDP to request a power draw
- If PSE grants the requested power, PD moves to full power
- If denied power by PSE, PD enters power back off, limits power draw to 0.1W. PSE provides back off time before PD can request a new negotiation.

Summary pt 3

- PSE periodically polls PDs
- A PD that misses three successive polls is assumed removed
- This power is reallocated to the PSE budget

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