4PPoE: Maximizing Interoperability with 802.3-2012 Devices (and other things)

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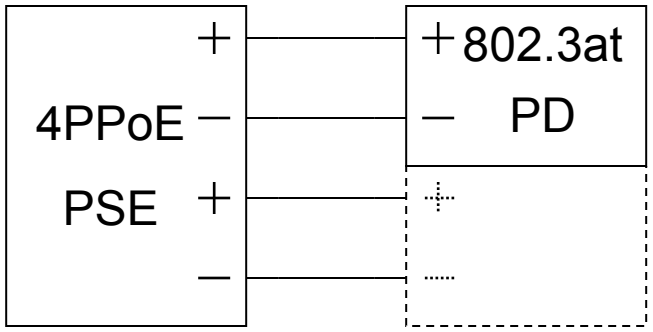
November 2013

Presentation Objective

- Introduce an approach in which 4PPoE PSEs interrogates PDs in order to:
  - increase interoperability with 802.3at PSEs
  - maximize efficiency for all systems
  - avoid powering up pair sets that do not have a valid PoE load.
  - allow both single and dual PD interfaces

4PPoE with 802.3at Use Cases

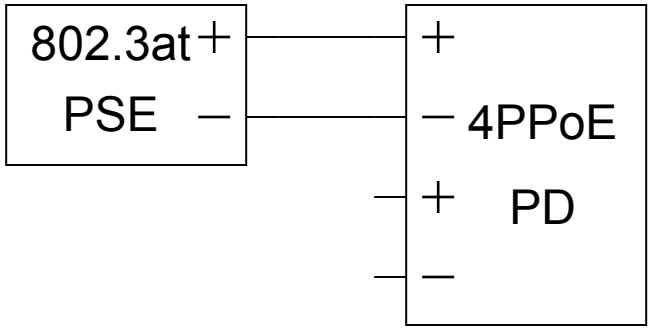
4-Pair to 2-Pair



Objective: 4PPoE PSEs will be backwards compatible with IEEE 802.3-2012 PDs.

- 4PPoE PSE must use same mutual ID protocols as 802.3at in order to identify 802.3at devices.
- 4PPoE PSE should only provide power over pair sets that a valid detection has occurred on.

2-Pair to 4-Pair



Objective: 4PPoE PDs which operate at power levels consistent with IEEE 802.3-2012 PDs will interoperate with IEEE 802.3-2012 PSEs.

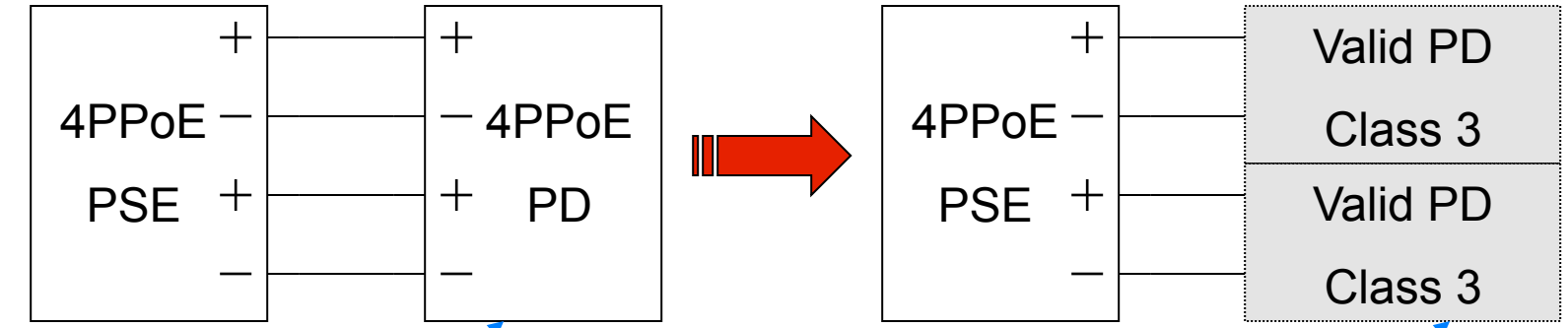
- 4PPoE PD must present itself in the same way as an 802.3at PD if it will be powered.
- 4PPoE PD must ask for all of the power it needs over 2 pairs.

The Resulting Problem

- Assumption: We want 4PPoE PDs operating below 25W to power up when connected to an 802.3at PSE.
  - This means that 4PPoE PDs must present themselves in the same way as 802.3at PDs
- How does a 4PPoE PSE distinguish between these three possible loads?
  - A 4PPoE PD with a single PD interface (connected through a bridge)
  - A 4PPoE PD with 2 PD interfaces
  - 2 PDs connected independently to the alternative pair sets
- Example: A 4PPoE PD that needs 15W (at the output of the PSE), must present a class 3 load over each pair set in case it is connected to an 802.3at PSE. A 4PPoE PSE should not interpret this as 30W when connected.

How the PSE Sees the World

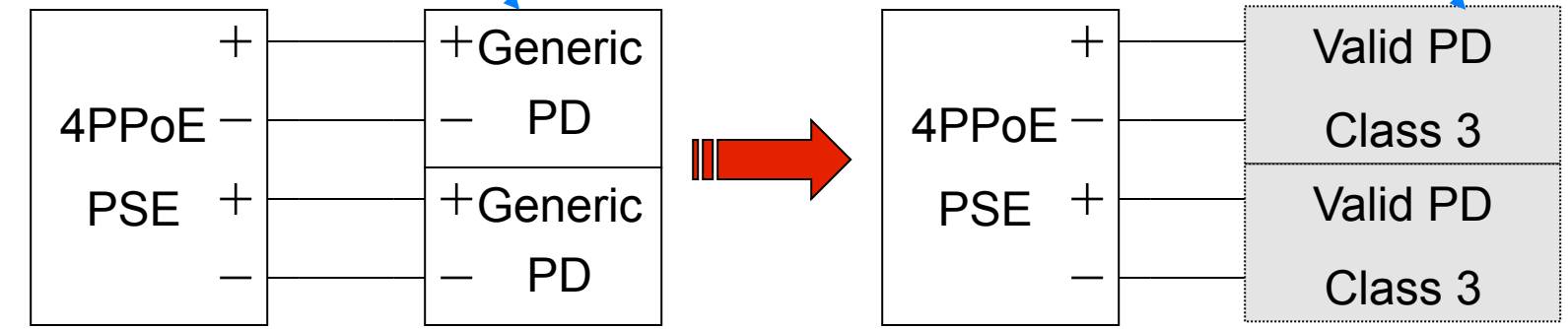
A 4PPoE PD Requiring Class 3 (15W) Total Power



Different Loads

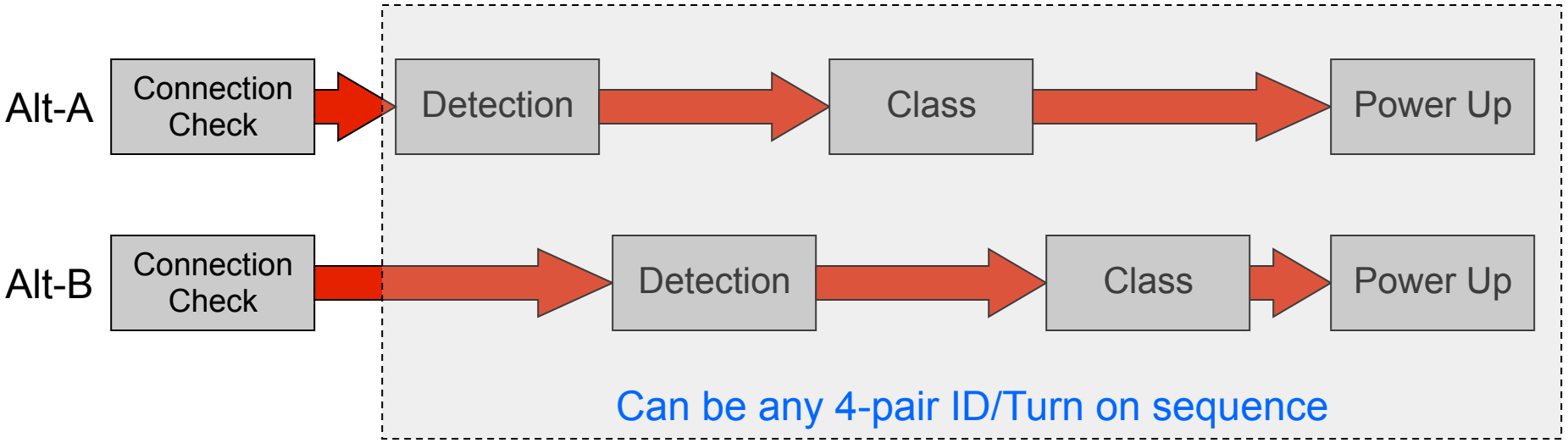
Same Appearance

(2) PDs Requiring each requiring Class 3 (15W) Power



Is there a way to know if all 4 pairs are connected to the same PD interface?

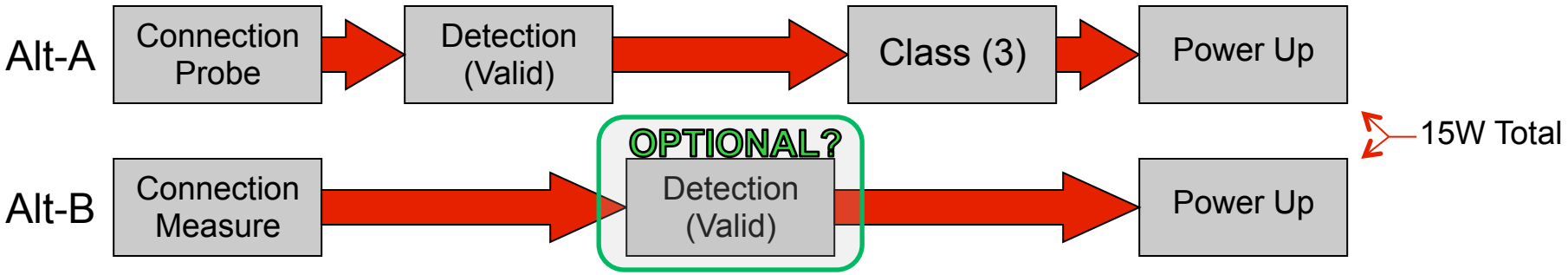
One Way to Solve the Problem



- Connection check is used to determine if the PSE is probing the same PD interface (through a bridge).
- If PSE determines that it is a single PD interface, the power requested by the PD during class is assumed to be the total power for all 4 pairs.
- If PSE determines that it is connected to 2 separate PD interfaces, the power requested by each PD during class applies only to each PDs pair set respectively.
- Connection check can be done using circuitry and methods already used in PSEs.

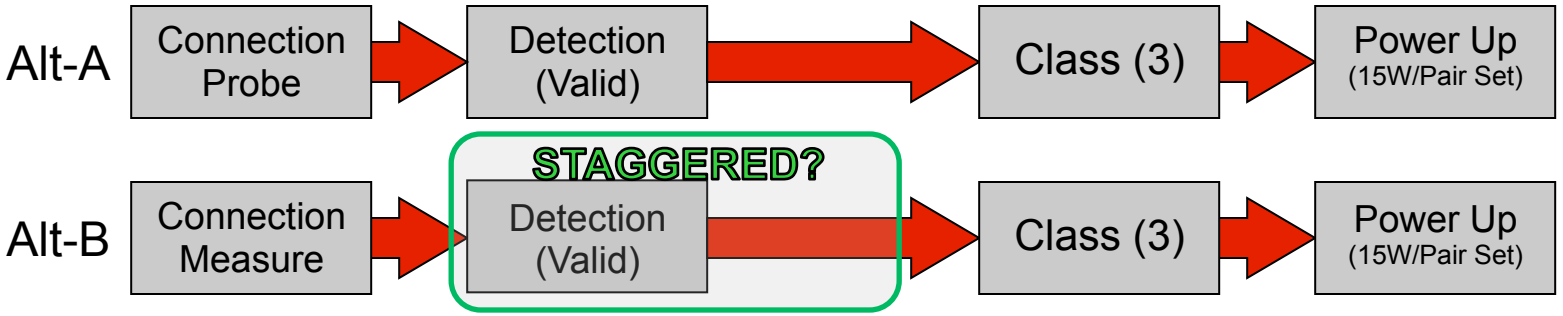
Connection Check: An Example

4PPoE PSE Connected to 4PPoE PD with Single PD Interface



Connection Check indicates (possible) 1 PD interface

4PPoE PSE Connected to 4PPoE PD with Dual Interface PD (or 2 Separate PDs)



Connection Check indicates (possible) 2 PD interfaces

Practical Implementations of a Connection Check

- One pair set can be used to corrupt detection on the 2nd pair set.
  - Simply enabling detection on both pair sets simultaneously would probably work for most existing silicon.
    - Current probe approaches would read 2x the detection resistance.
    - Voltage probe approaches would read 2x the detection resistance if balancing was perfect.
      - May need to force non-measured port to a higher voltage in order to corrupt the measured port.
      - Could measure both ports to ensure seeing a corrupt measurement.
- Could use existing circuitry in a new way to create a dedicated check.
  - A probe would be provided on one pair set, while the other pair set is measured in order to determine if they are connected through any kind of bridge

Advantages of a Connection Check

- Increases interoperability with 802.3at PSEs
  - Allows 4PPoE PDs with a single PD interface to request full power over a single pair set.
  - Allows 4PPoE PDs with a dual PD interface to request power independently for each pair set.
- Maximizes efficiency for all systems
  - Allows 4PPoE PSEs to power both 4PPoE PDs and 802.3at PDs over 4 pairs.
  - In fact, a 4PPoE PSE and an 802.3at PD is all that is needed for a 4-pair system operating at 25W or below.
- Simple to implement
  - Would only require a new algorithm for 4-pair PSEs. No new circuitry would be required as the check could be implemented using circuitry that currently exists in the PSE.
  - No change would be required for the PD (Could use 802.3at PDs).
- Extremely flexible
  - Allows for both single and dual PD interface 4-pair systems to be used with 4PPoE PSEs.
- Robust system detection
  - Removes concerns about Y-cables.
  - Will not power ports that have not produced a valid detection.