SPMD

Lessons Learned from PoE

Jason Potterf
Cisco
May 6, 2020

Motivation

- Mission critical SPMD mixing segments will inevitably be hot plugged
- This will occur in live production
- Severe consequences may exist if the segment goes down

Supports Objective 11:

Support addition of a node or set of nodes to a continuously operating powered mixing segment

Note: Objective should also mention removal.

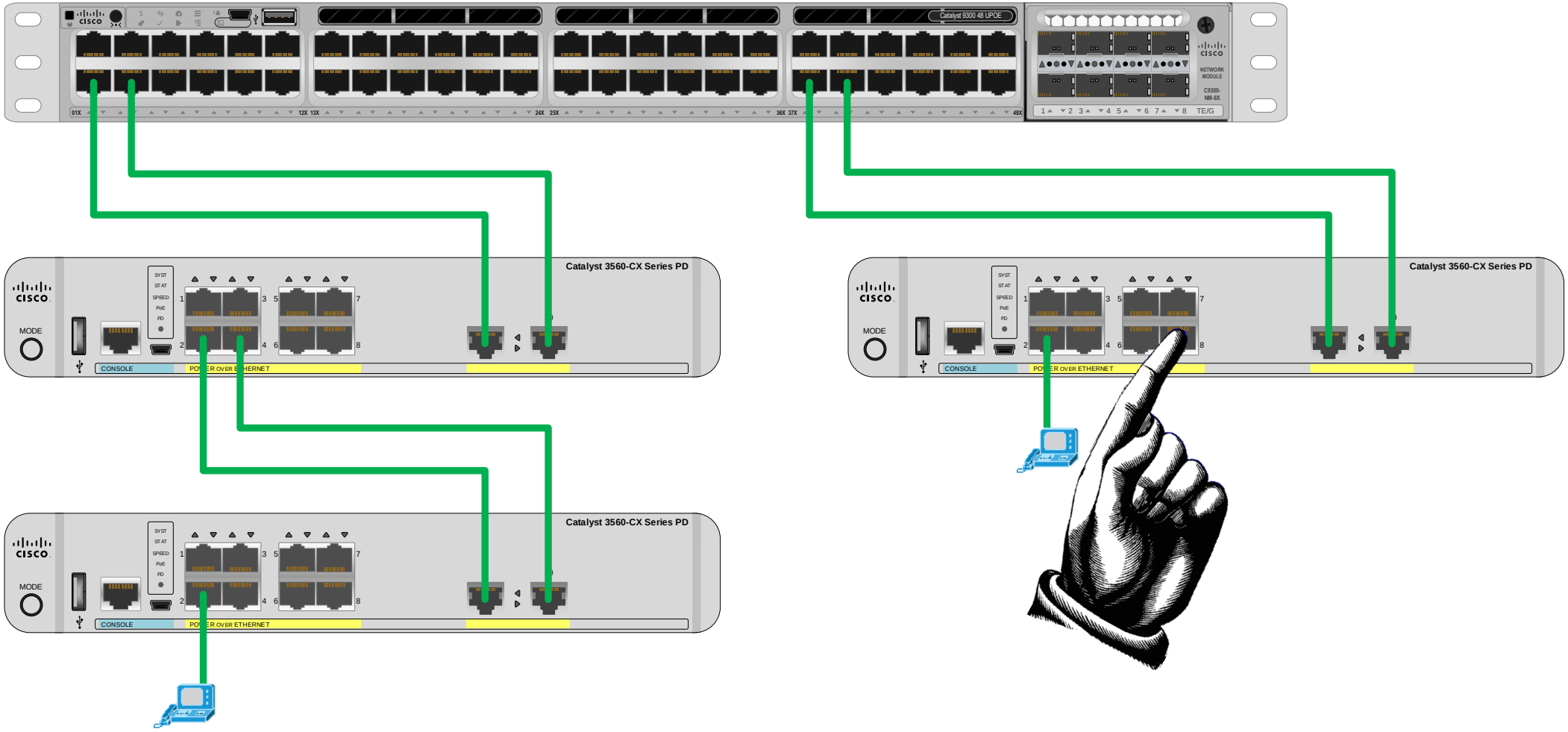
Key Terms

- PoE – 802.3 af/at/bt – Traditional Power over Ethernet
- sPoE (802.3bu PoDL) – Power over Data Lines (not multi-drop)
- mPoE(802.3da PoE) – Power over Single Pair Multi-Drop

Detection

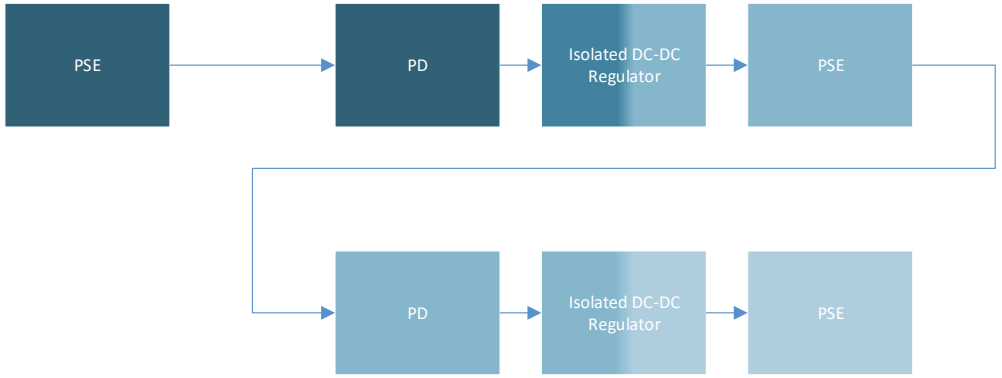
- In PoE systems, there is no power present until a PD is detected
  - Allows PoE to exceed safety standard requirements – “lickable”
  - Allows hot plugging without any cause for safety concerns
- Current SPMD thinking supports detection only on the first PD
  - Second PD, not so much – no longer “lickable”
- How can enhance SPMD in hot-plugging environments to have safety equivalent to PoE?

PoE PD-PSE Chain



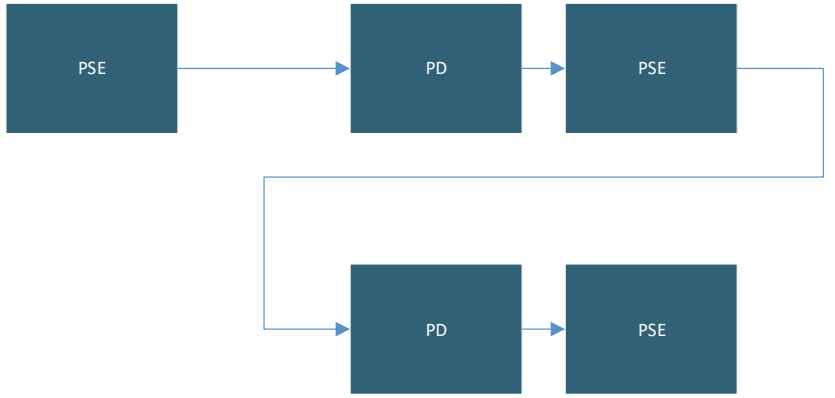
PoE PD-PSE Chain

- PD-PSE chains provide enhanced safety and network stability by controlling PD admission to the chain
- Due to isolation requirements, 802.3 af/at/bt PD-PSE chains are lossy
- SPMD should strike a balance



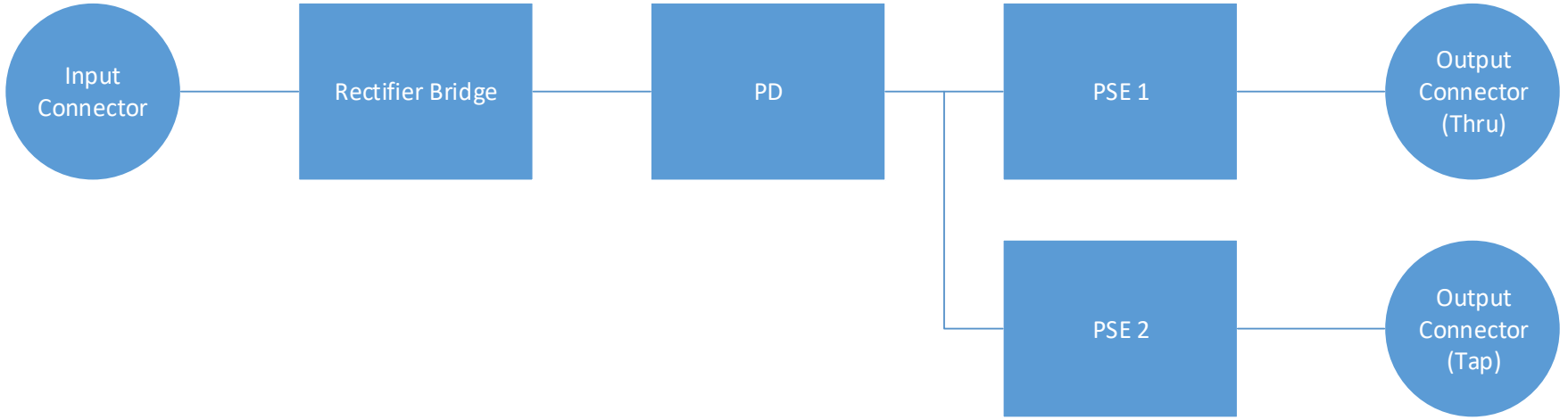
PoE PD-PSE Chain

- Removing isolation requirement reduces loss considerably
- Retaining requirement for PSE on the pass-through port helps safeguard upstream devices



Introducing the Active T

- Passive T – glorified Y-cable
- Active T – contains circuitry and is a PD/PSE combo
  - No isolation requirement means greatly reduced loss
- Block Diagram:



Problems the Active T solves

- Uniformity to PoE, sPoE where no port has power without a PD
- Power up/inrush on Multi-PD addition
- Faults
- Standby PSE
- Polarity Swaps

Inrush on Multi-PD addition

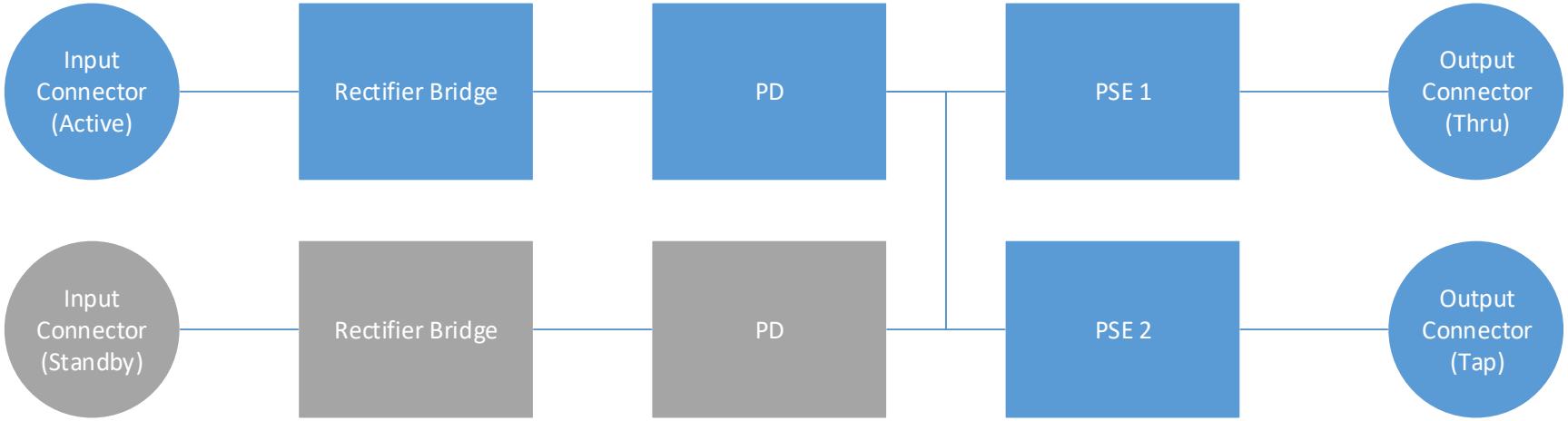
- What happens when you add a string of PDs?
  - Common use case when swapping out a switch
  - Answer: Inrush on all nodes at once!
- The Active T can prioritize and sequence outputs
- Active T allows the PDs to power up in a deterministic manner starting with the PD(s) closest to the PSE
  - Supports PSE in the middle topology via Active T in the middle
    - Worst case limited to 2 PDs max inrushing simultaneously
- This is also helps to protect against data corruption

Faults

- Inrush is not the only concern with connecting an existing string
- A fault in any node of that string can bring down the whole segment
- Active T isolates faults, protecting the rest of the mixing segment
- Can be designed to detect and protect against flapping due to marginal or contaminated connectors
- The PSE in the active T can also foldback to enforce inrush for downstream devices

Redundancy

- Active T architecture enables advanced redundant topologies
- A “cross-tap” could be constructed to provide redundant power and data feeds to one or more PDs



Polarity swaps

- Possible to architect these such that it fixes wire swap between T's
- Experience shows the wires will get swapped
- Data doesn't care about the polarity…
  - not true for power with only a passive T
- Alternately can leave rectification to the individual PDs

Downsides and Benefits

- Simplifications made possible by SPMD should allow COGS below a traditional PoE PD/PSE chain
- Still, could raise the passive T connector COGS significantly (4-5x)
- Benefits
  - Significant gains in robustness for hot-plugged networks
  - Resolves some previous concerns around mPoE
  - Greatly increases ease of use for the customer
  - Maintains the PoE safety stance of detection before powering


CISCO