

Multidrop Considerations

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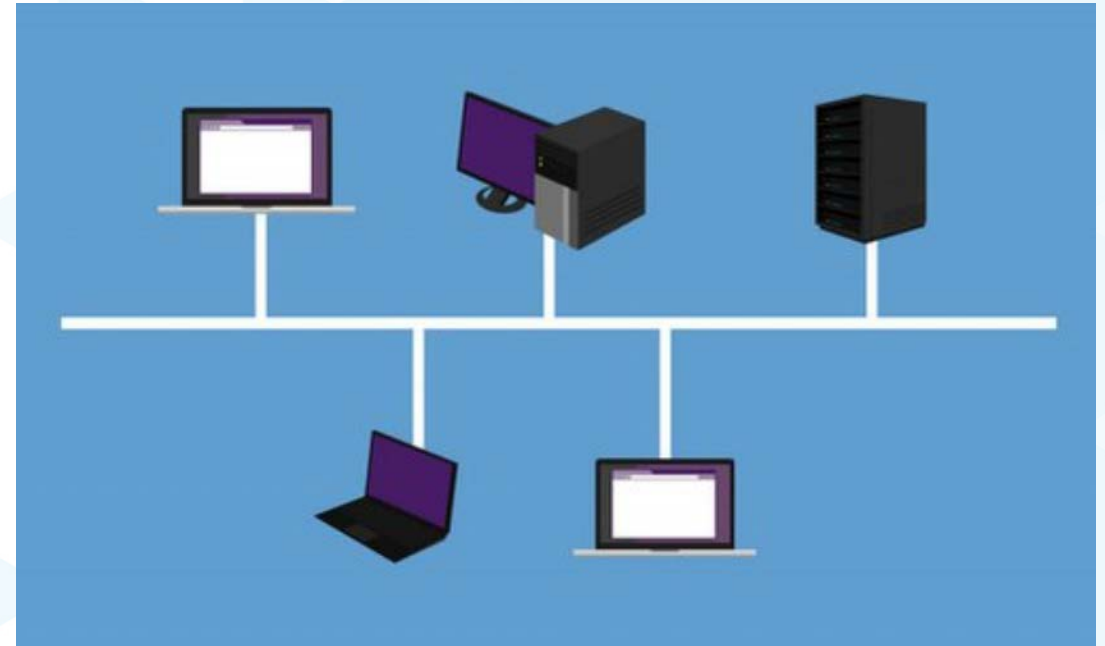
Multidrop Architecture

► Advantages

- Cost-effective to install
 - Less cable required to connect the nodes (vs. Star)
- Provides an easy feasibility to extend or to reduce a network
- Ideal for small network setups

► Disadvantages

- More expensive to maintain
- Hot adds may disturb network
- Ideal only for small network setups
- If the backbone (primary) cable fails, the entire network fails
- If the uplink PHY fails, the network becomes isolated
- Bandwidth and power are shared
 - Power overconsumption can bring down network



Sources:

<http://techgenix.com/network-topology/>

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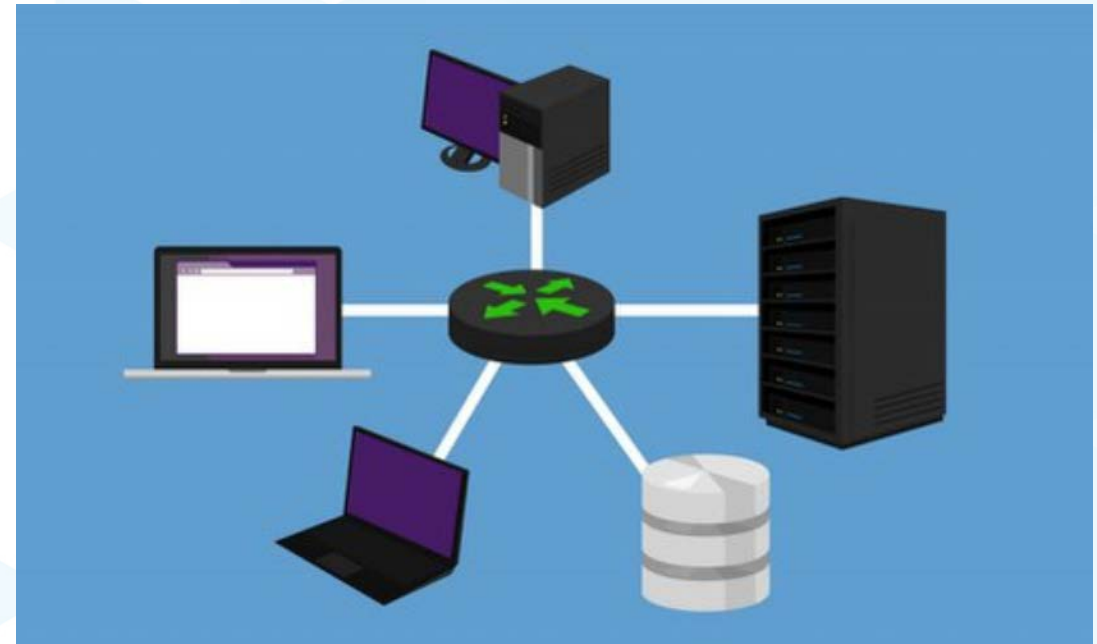
Switched Star Architecture

► Advantages

- Electrical failure of one node will not affect the entire network
- Devices can be added, removed, reconfigured, or modified without disturbing the network
- Moderate cabling requirements
- Easy to set up and modify
- Easy to troubleshoot
- Wiring fault effects are isolated

► Disadvantages

- The entire network is dependent on the central switch:
 - If the switch fails, then the whole network will be down
- More expensive to install



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Multidrop Issues We Should Address #1

▶ **#1 Power Up is a Deliberate Action**

- ▶ The act of applying power is a deliberate action performed by the PSE
 - Power on is a behavior described by the standard
- ▶ In traditional PoE, the PSE does not apply power until the PD is positively identified
 - Non-compliant PoE devices exist which do not perform detection
 - These are known as “Power over Scary”

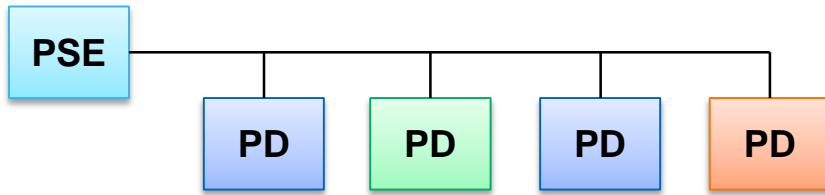
▶ **So...Check Link Prior to Power On**

- ▶ Do not take the deliberate action of power on without verifying at least one PD is present
 - Multi-drop PoE derivatives must determine at least one valid PD load is present prior to the application of power
- ▶ A lack of PD verification is an explicit omission of the standard
 - A simple classification procedure, as proposed in earlier slides, meets this verification requirement

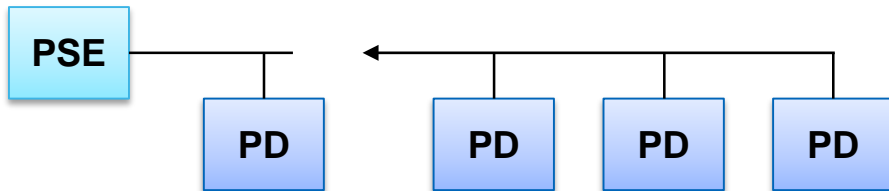
Multidrop Issues We Should Address #2

▶ #2 Expensive to maintain / debug

- Device population issues can be difficult to debug
 - eg debugging a *very long* Christmas light strand

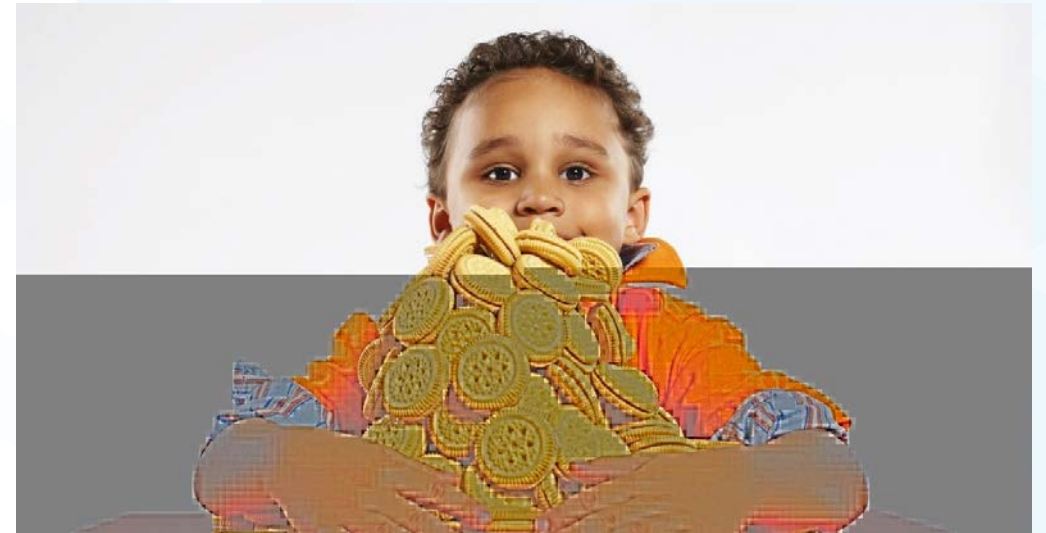


- Hot adds can add multiple PDs at once
 - eg a strand of PDs is added to bus all at once



▶ #3 Power is shared

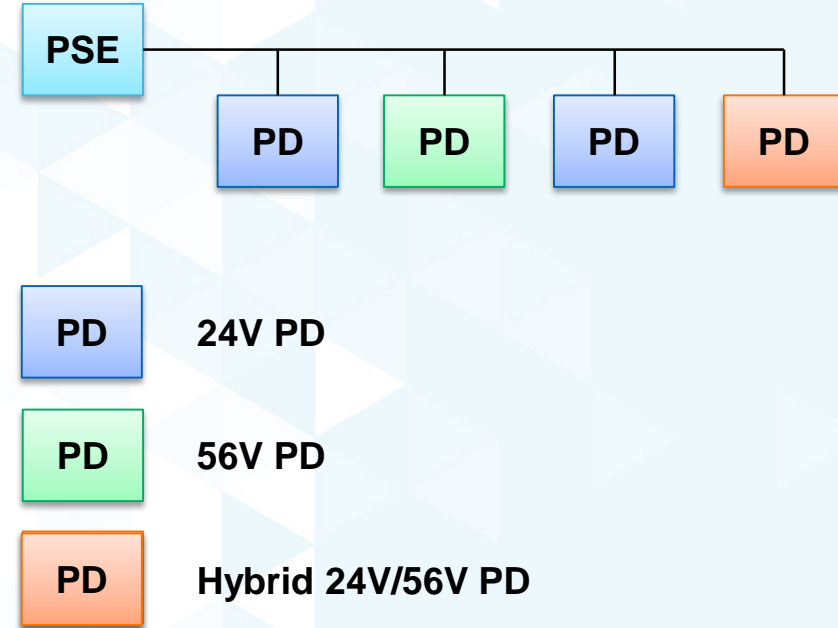
- Overconsumption can bring down network
- Rational limit to PD max power budget preserves network integrity



Source: <https://www.crosswalk.com/>

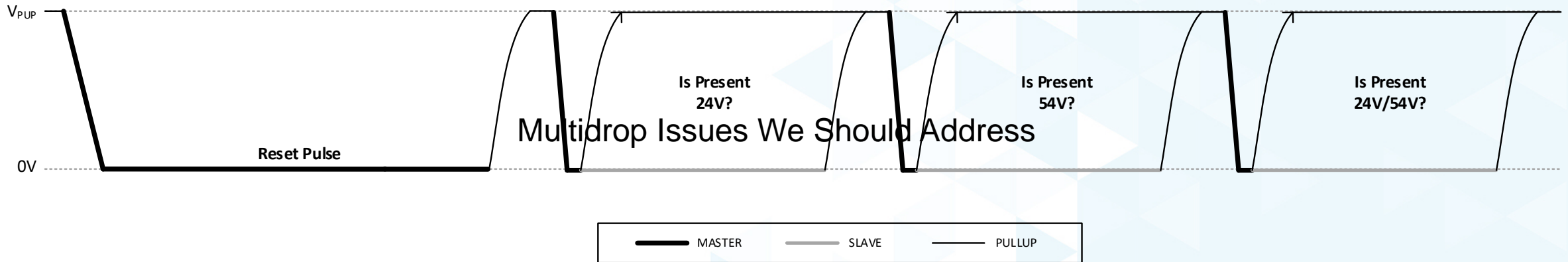
Device Population and “Classification as Detection”

- ▶ Proposals for multiple voltage classes are under consideration
- ▶ If “hot added”, an incompatible PD will silently not power on
- ▶ However
 - During subsequent “debug” PSE reboot and prior to power application
 - PD population can be queried at *extremely low effort* to determine
 - if *_any_* 24V PDs are on bus
 - if *_any_* 48V PDs are on bus
 - if *_any_* hybrid PDs are on bus
 - The important question is “are there *any* PDs of Class X” rather than “how many PDs of Class X are there”



- ▶ **Solution:** Simple class one-hot “vote” allows PSE to determine if one (or more) of a voltage class is present

Sample One-hot Device Population Classification



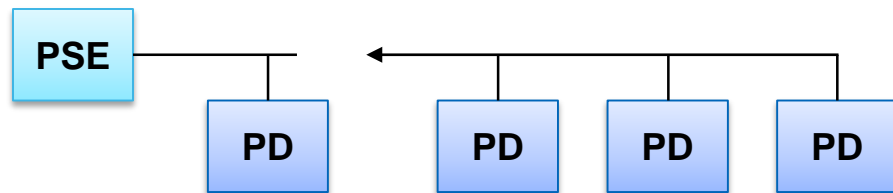
Proposed Objective:

Research voltage compatibility classification prior to Power On

Multidrop Issues We Should Address #3

▶ #3 Power is shared

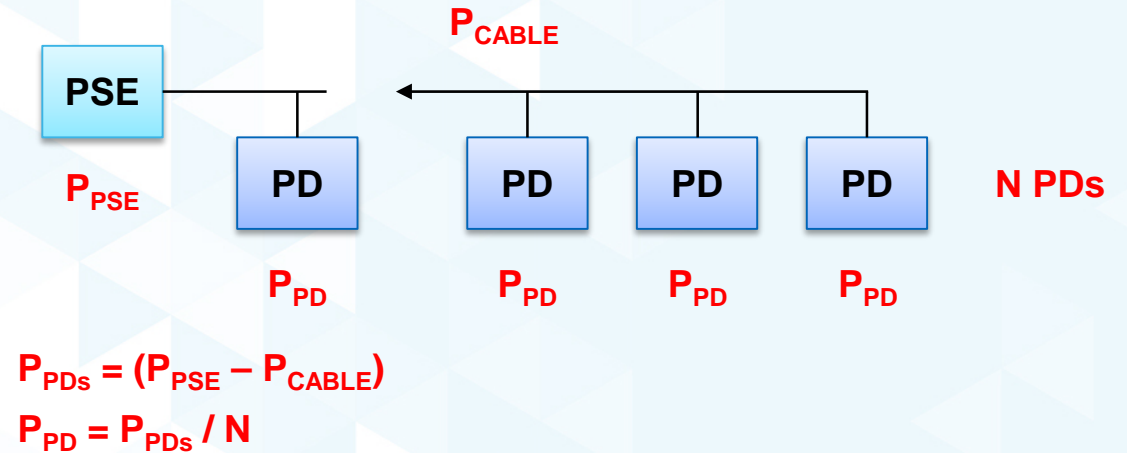
- Overconsumption can bring down network
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Hot Adds and Shared Power Budget

- ▶ The number of PD nodes is N
 - N is TBD
- ▶ Traditionally, PSE output power is limited to 100W or less
 - Limited Power Source
- ▶ Risks of overallocation
 - Even if a single PD(1) is present, PD(1) should be limited to $1/N^{\text{th}}$ of P_{PDS}
 - If PD(1) can claim $> 1/N^{\text{th}}$ of P_{PDS} , then the strand will fail when additional PDs (or strands of PDs) are added
 - Any number above $1/N^{\text{th}}$ of P_{PDS} decreases reliability of strand during hot adds
 - P_{INRUSH} should be limited to $1/N^{\text{th}}$ of P_{PDS} (or less)



- ▶ **Solution:** Limit P_{PD} to $P_{\text{PDS}/N}$ at all times
- ▶ **Solution:** Limit P_{INRUSH} to $P_{\text{PDS}/N}$ at all times