Understanding Power over Ethernet (PoE)

1. Traditional Power System on Remote Ethernet Device

All of electronic devices need power to perform its function including Ethernet devices. In the point of data communication networking topology, the head end equipment (Local Device) can connect more than one remote device, like one 4 ports Ethernet switch can link 4 Wireless Access Point (AP) simultaneously. It means five power source (AC/DC) are needed for operation of this Local Area Network, i.e., five AC outlets are mandatory facility. Sometimes critical positions, like roof, tree or trellis, they are very difficult for AC power outlets layout.

In exited power system, two cables are essential materials, power cable (adaptor) and LAN cable (Cat.5, Cat.5e, even Cat.6). The flexibility of layout for remote device is also limited by AC outlet. It means that is not easy for expansion and reallocation.

2. Benefit of Power over Ethernet (PoE)

– One LAN cable can deliver power and Ethernet data at same time

A. Flexibility for distribution

B. Lower setup cost, running cost and maintenance fee than traditional way

C. Safety mechanism. IEEE 802.3af / IEEE 802.3at can provide short circuit protection, under voltage protection, over current protection, …etc.

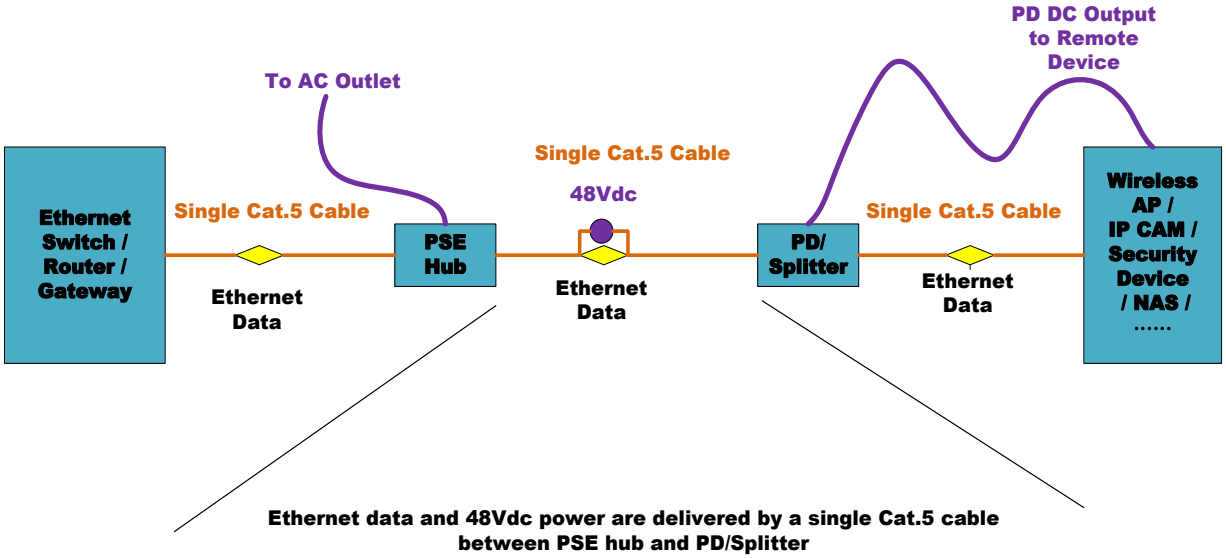
D. Ease of installation. Specially in critical environments, like roof, tree and public area (air port, library and electric poles on street)

E. Central monitoring and control. Some remote devices need to be managed by a server or central controller, like PoE clock, PoE digital signature, PoE digital display, …etc.

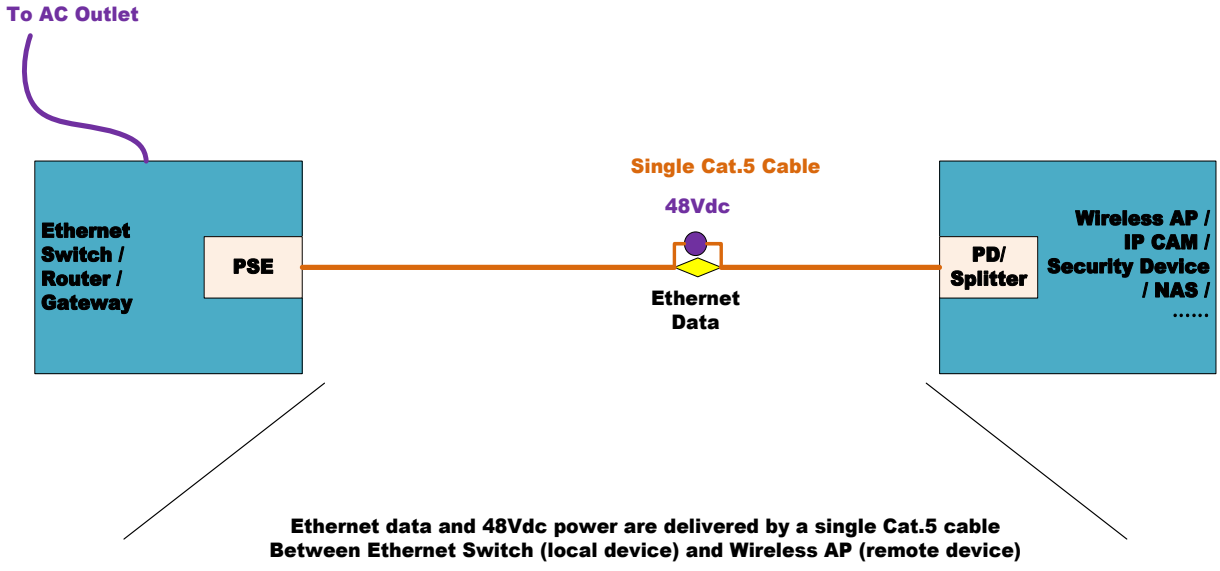
3. Power over Ethernet (PoE)

Power over Ethernet, IEEE802.3af, is constructed by **P**ower **S**ourcing **E**quipment (PSE), Injector and **P**owered **D**evice (PD), Splitter. PD extracts power from PSE via conventional Cat. 5 cable and energizes remote device. The most different with traditional power system is that power and Ethernet data are delivered by a single Cat.5 cable between local device, Ethernet switch, and remote device, wireless access point, IP camera, **N**etwork **A**ttached **S**torage (NAS), ...etc. PoE offers less maintenance fee than traditional method because of no AC outlet and power adaptor on remote side. Two typical connections are as follow.

Mid-Span Mode



End Point Mode



4. Power over Ethernet Introduction For IEEE802.3af Compliant Device

a. PoE Link Detection

PSE shall issue a detection signal to detect PD if PD can pass PD signature detection and then do PD power classification (Class 0 ~ 4) to define the minimum and maximum power requirement for this PD. PSE shall offer 48Vdc to PD when PD signature and power classification is passed and finished. PSE shall always repeat PD detection process when the load is attached on PD side but not IEEE802.3af compliant PD, it means this PD can't pass PD signature detection.

Table 1 PSE Power Classifications

Class	Usage	Minimum Power Levels at Output of PSE
0	Default	15.4W
1	Optional	4.0W
2	Optional	7.0W
3	Optional	15.4W
4	Reserved For Future Use	Treat as Class 0

Table 2 PD Power Classifications

Class	Usage	Range of Max. Power Used By The PD
0	Default	0.44W ~ 12.95W
1	Optional	0.44W ~ 3.84W
2	Optional	3.84W ~ 6.49W
3	Optional	6.49W ~ 12.95W
4	Not Allowed	Reserved For Future Use

b. Isolated And Non-isolated PDs

b1. Isolated PD

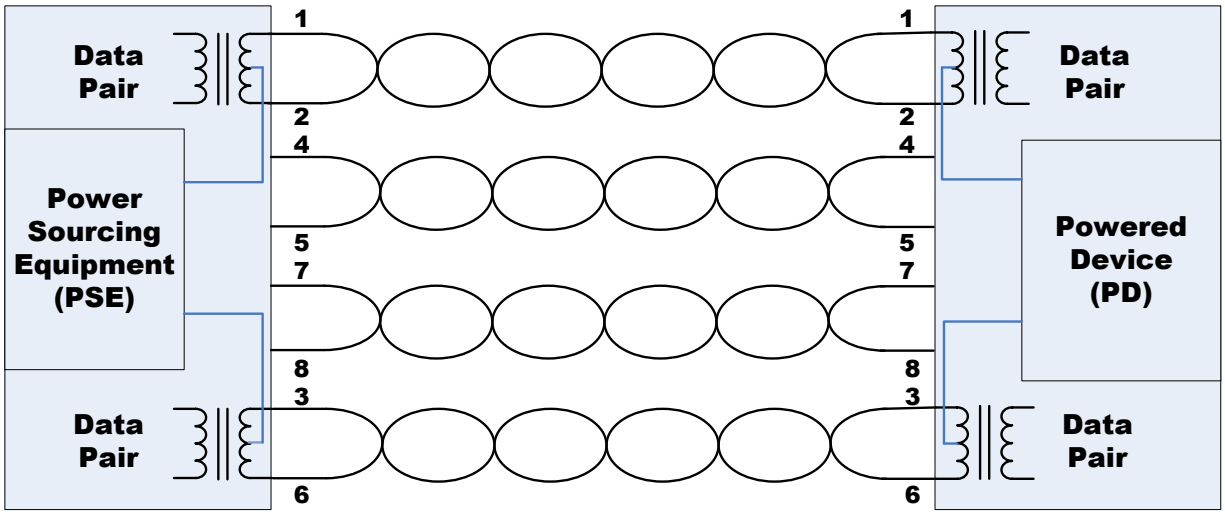
It can provide a 1500V isolation protection from PD input to PD output. This isolation protection can efficiently enhance short circuit protection whatever short circuit is happened in PSE side or PD side.

b2. Non-isolated PD

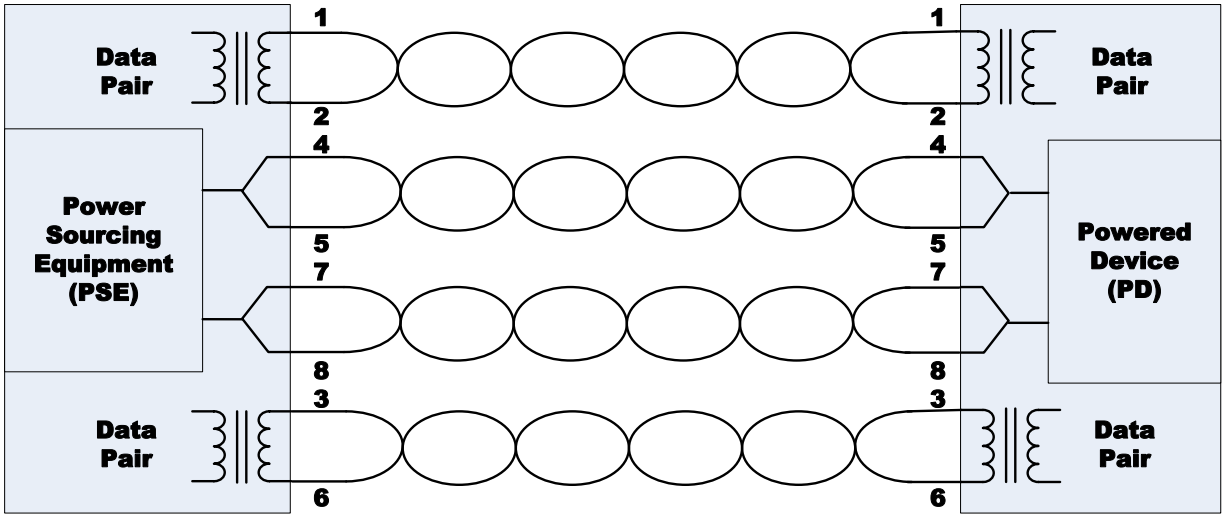
It is weak than isolated PD for short circuit condition. Short circuit condition is possible to damage both of PSE side and PD side because of PSE and PD power output side sharing same power ground, return path.

5. Mid-span & End-point Connection

a. End point Connection



b. Mid-span Connection



6. IEEE802.3AT - PoE+ System

- IEEE802.3AT is the advanced high power PoE solution, so it is called PoE+. It supports PSE output power up to 25.5W and 4 pairs deliver 48Vdc to PD. PoE+ can provide up to 50W at the output of PSE when uses two PSE channels on a single RJ45 and applies 48Vdc on 4 pairs simultaneously.