Chapter 8
Miscellaneous Features
NET3011 - 17W

Miscellaneous Features - Basics

We'll focus on the two genuinely new topics from the following list:

- Discovery protocols: CDP & LLDP (**new**)
- Unidirectional Link Detection: UDLD
- Power over Ethernet: PoE (**new**)
- SDM templates
- Traffic monitoring: SPAN + RSPAN
- Service Level Agreements (IP SLA)

The remaining material has already been covered in this course (lectures, labs) or other courses.

Discovery Protocols – Basics

- You're familiar with Cisco Discovery Protocol (CDP)
  - basic purpose is to identify & map neighbours, and advertise simple configuration info (Voice VLAN)
  - runs at L2 (even router ports *without an IP*, will send & receive CDP frames!), but still processed by the Control Plane
  - implemented on almost *all* Cisco equipment
  - now implemented by many (most?) other vendors (aka ISDP: "Industry Standard Discovery Protocol")
  - quasi-standard due to widespread acceptance
  - but proprietary nonetheless, so no source code and possibly no way to turn **off** sensitive information
- Link Layer Discover Protocol is very, very similar but is standards-based: 802.1AB

Discovery Protocols – LLDP

- LLDP:
  - like CDP, uses multicast MAC addresses as the destination (0*1*:80:c2:00:00:**00** or :**03** or :**0e**)
  - like CDP, stateless advertising of info
  - like CDP, uses TLVs which make it possible to add or remove particular information

    https://wiki.wireshark.org/LinkLayerDiscoveryProtocol
    https://www.cisco.com/c/en/us/td/docs/ios/12_2/configfun/configuration/guide/ffun_c/fcf015.html#wp1003035

  - CLI commands are almost identical to CDP
- Use with caution: DoS attacks exist for CDP and thus probably for LLDP (overflow neighbour tables by spoofing 1000's of CDP frames; can result in dropped frames and unresponsive CLI)

  https://en.wikipedia.org/wiki/CDP_Spoofing

Discovery Protocols – Config & Verify

- Enable, customize, list neighbours, get details

```
Dev(config)# [no] cdp run
Dev(config)# [no] lldp run

Dev(config)# lldp tlv-select ?
  mac-phy-cfg           IEEE 802.3 MAC/Phy Configuration/status TLV
  management-address    Management Address TLV
  port-description      Port Description TLV
  port-vlan             Port VLAN ID TLV
  power-management      IEEE 802.3 DTE Power via MDI TLV
  system-capabilities   System Capabilities TLV
  system-description    System Description TLV
  system-name           System Name TLV

Dev# show cdp neighbor
Dev# show lldp neighbor

Dev# show cdp neighbor fa0/7 detail
Dev# show lldp neighbor fa0/7 detail
```

Power over Ethernet – Basics

- Simple idea: provide power over the same wires as the Ethernet signals
  - different frequencies, so no interference
    power is DC = 0 Hz;
    Ethernet freq = 10's, 100's, or 1000's of MHz
- Saves cost & management hassle of extra cabling
- Safe: uses ~48-50V DC at 1/3 or 2/3 Amps max
- Need a method to detect whether attached device needs power, how much, and limits to prevent overloads

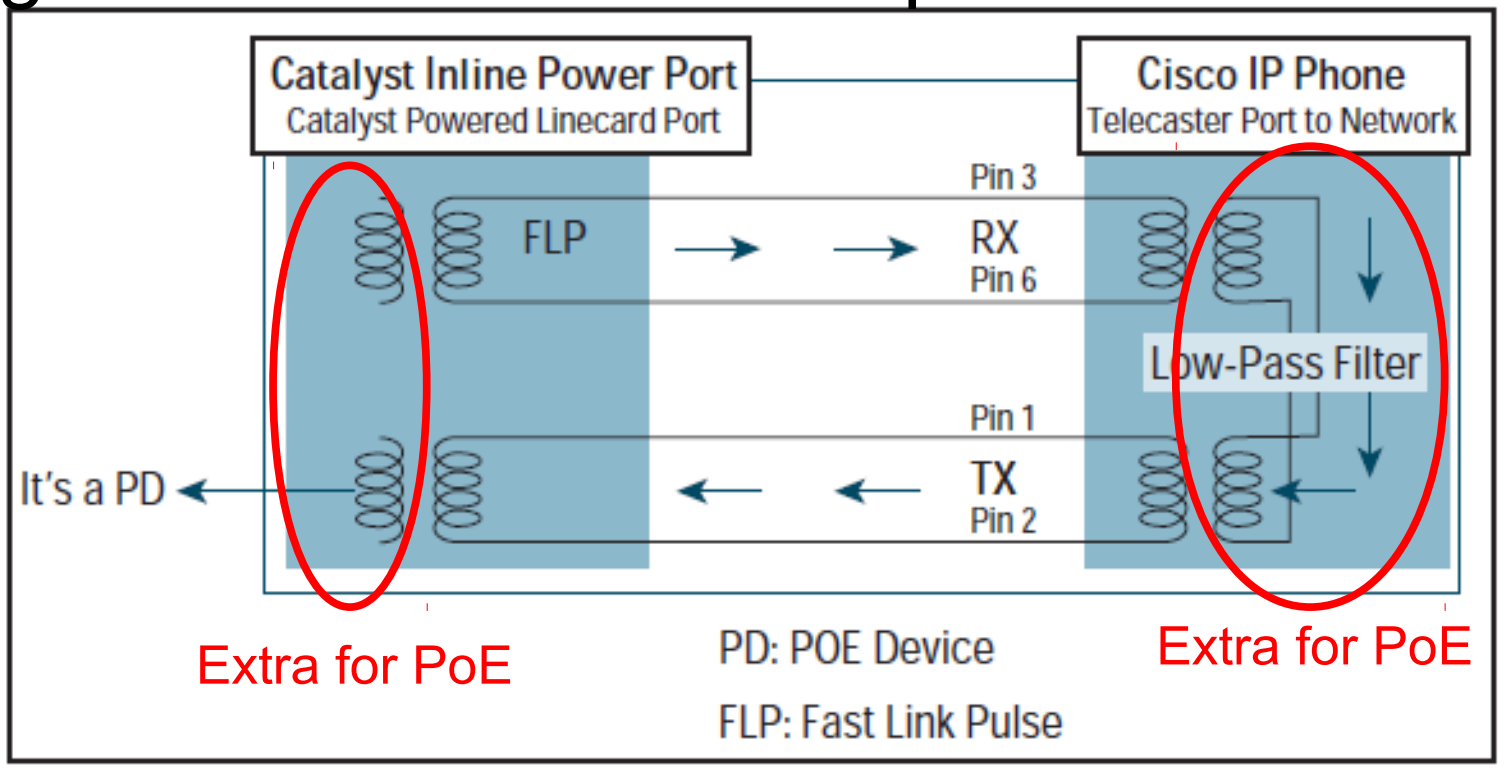
Power over Ethernet – Standards

- PoE specs have evolved over time, so different implementations exist:
  - Cisco proprietary ILP (lapsing into obscurity)
  - IEEE 802.3**af**-2003 → 15.4 Watts max
  - IEEE 802.3**at**-2009 → 25.5 Watts max
  - IEEE 802.3-2012 → aggregated spec
  - IEEE 802.3**bt**-(~Oct 2017) → 100 Watts max

    http://www.ieee802.org/3/bt/P802d3bt_PAR.pdf
- Catch-22? How can device tell the switch it needs power, but it can only negotiate after it's powered up and booted?
  - two methods exist to detect a device needs power, even without it being powered up

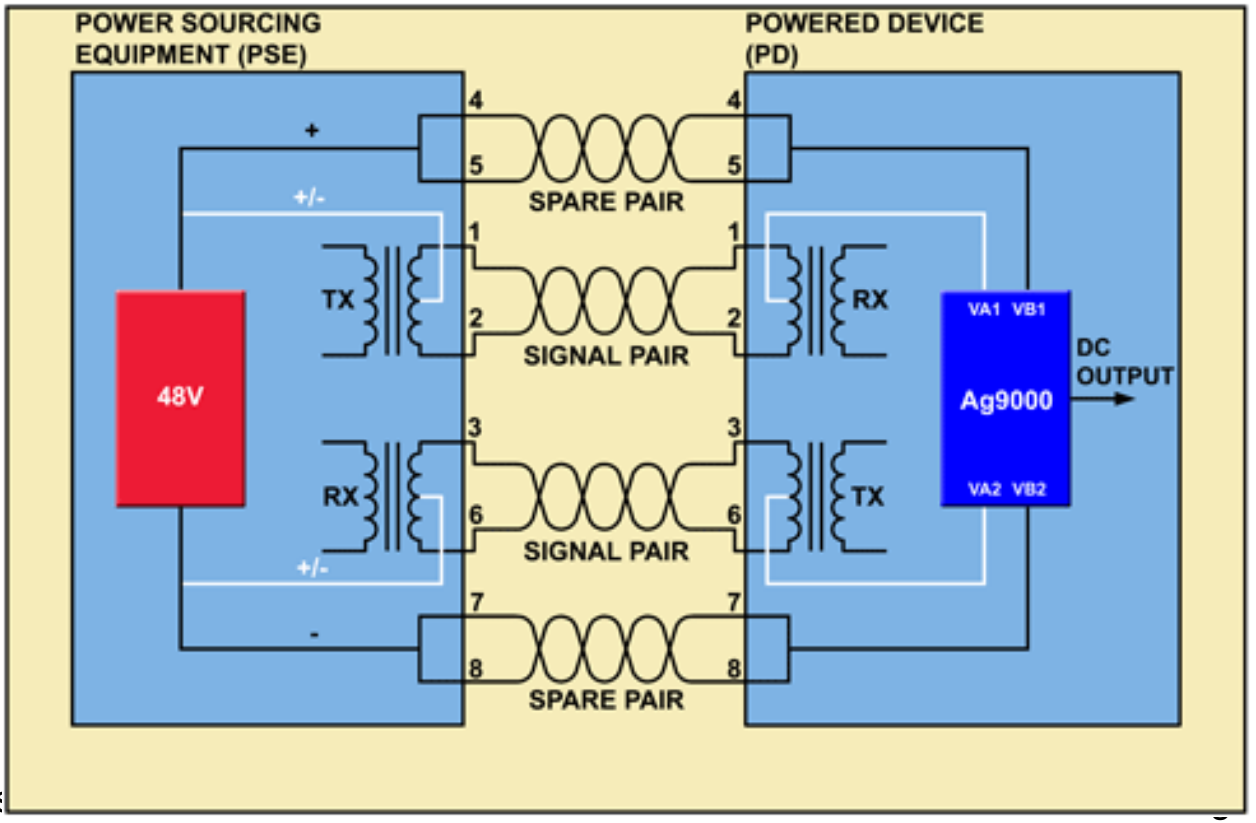
Power over Ethernet – Detection (1)

- Cisco's **In**Line **P**ower (ILP) scheme
  - the switch supply transmits a low frequency tone
  - PoE device has an extra circuit which couples Rx and Tx pairs
  - supply detects tone echo, turns on power
  - *not* for GigE links which use all 4 pairs



Power over Ethernet – Detection (2)

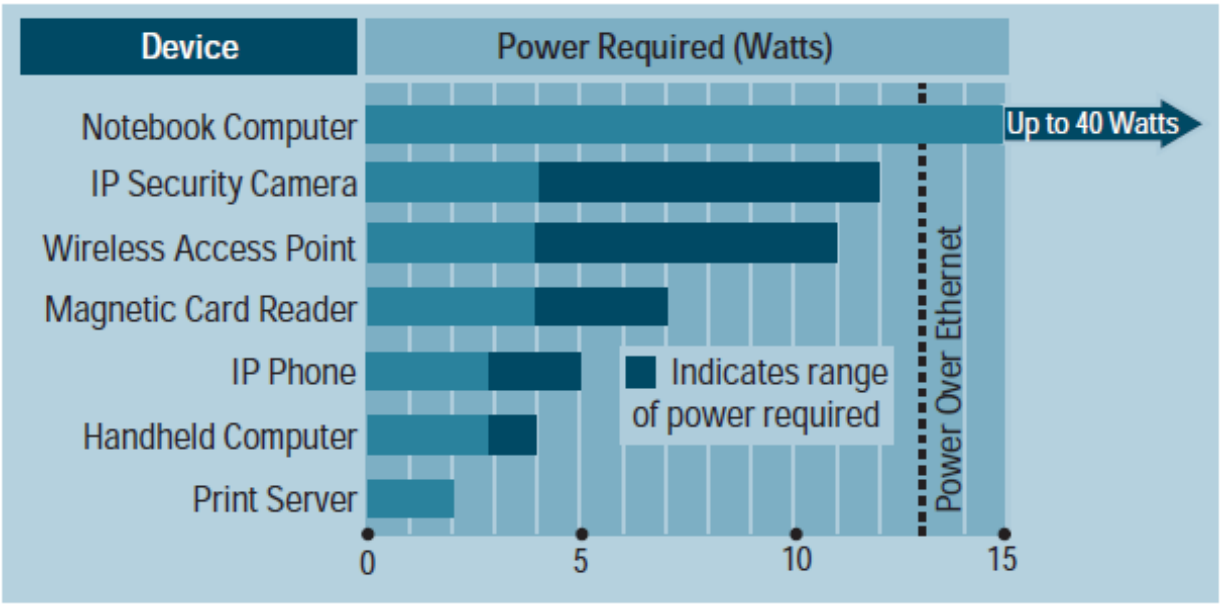
- IEEE 802.3af/at method:
  - the switch supplies a small voltage across the transmit pair and the receive pair of the cable
  - PoE device has a resistance which allows a measurable current to flow
  - switch decides device presence by current flow
- Most important: two methods are **not** compatible!



Power over Ethernet – Coming Soon!

- You will likely see more PoE for laptops, IoT, etc

  https://en.wikipedia.org/wiki/IEEE_802.3#Communication_standards



IEEE 802.3af

Power levels available

Class	Usage	Classification current [mA]	Power range [Watt]	Class description
0	Default	0 - 4	0.44 - 12.94	Classification unimplemented
1	Optional	9 - 12	0.44 - 3.84	Very Low power
2	Optional	17 - 20	3.84 - 6.49	Low power
3	Optional	26 - 30	6.49 - 12.95	Mid power
4	Reserved	36 - 44	12.95 - 25.50	High power

Power over Ethernet – Config & Verify

- Cisco allows you to configure three different power limits:
  - **auto** (default)
    - device and power requirements are auto discovered
    - default power budget for a switch port is 15.4W
    - can be changed with max milli-watts
  - **static**
    - configures a static power budget for a switch port
    - for devices that cannot use either discovery method
  - **never**: power completely disabled; never offered

```
Sw(config)# interface {i/f}
Sw(config-if)# power inline {auto [max milli-watts]
                | never | static [max milli-watts]}

Sw# show power inline {i/f}
```

Reminder

- You are responsible for *reading* the textbook to gain the knowledge (memorization) and understanding (apply the knowledge)
- These slides omitted material from Ch 8 that you *should* already know; check the end-of-chapter questions in textbook to confirm that you still remember it all