

# Integrating “Power via Media Dependent Interface” and “Power over Data Line” support to the Linux kernel

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# Patch v7: Add generic support for the PSE

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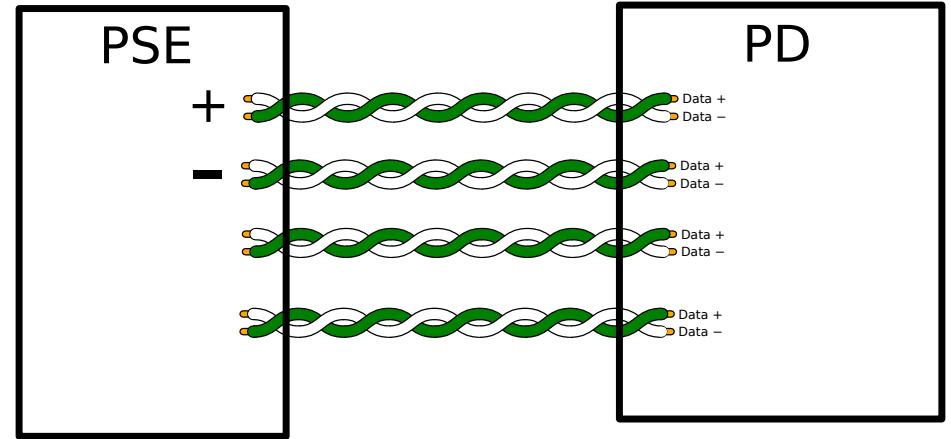


- <https://lore.kernel.org/all/20220926112500.990705-1-o.rempel@pengutronix.de/>



# What is Power via MDI?

- Power via Media Dependent Interface (MDI) aka Power over Ethernet (PoE)
- Added with 802.3af-2003 and modified with 802.3at-2009
- PSE – power source equipment
- PD – powered device

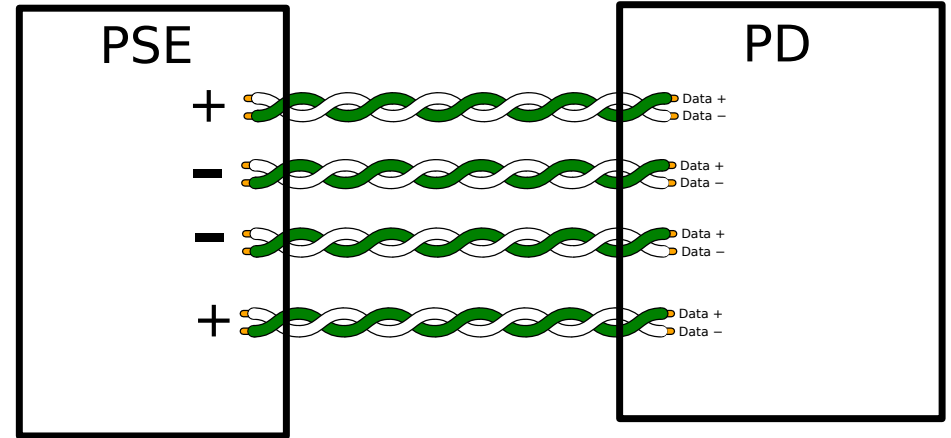


- Power delivered over two pairs. One pair +, other pair -



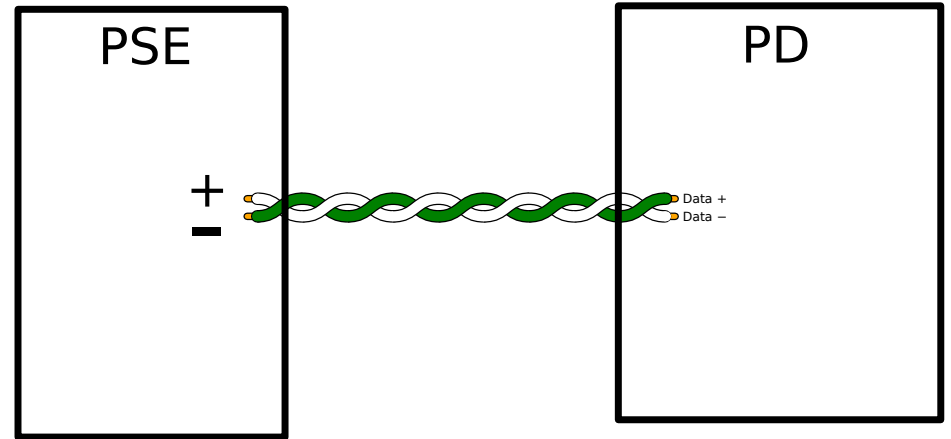
# Extended to 4 pairs by 802.3bt

- Same as PoE but more power
- For power delivery are used all 4 pairs



# What is PoDL?

- Power over Data Line
- For 10/100/1000Base-T1/L/S
- Same as PoE, except power is delivered over one twisted pair
- PoDL needs different filter implementation compared to PoE\* variants



# Detection

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- Optional functionality
- PSE provides a constant current on the line and measures the voltage drop if PD is connected



# Classification

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- Optional functionality
- PoE and PoDL have different way for classification.
- PoDL is using SCCP – simple, digital, one-wire communication serial classification protocol.
- PoE uses a constant voltage from the PSE and a current sink on the PD to signal the power class



# Challenges of kernel implementation

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- How to name framework?
  - “Power over Ethernet” (PoE) is not used by the 802.3-2018 specification. Instead we have “Power via Media Dependent Interface” (PvMDI)
  - Power over Data Line (PoDL) is used by 802.3-2018 but not compatible with PvMDI
  - Amendment names (802.3af, 802.3at) do not scale and actual changes history is not preserved in finale spec.
  - PSE and PD are only common names which can be found in 802.3 specification for PvMDI and PoDL, and IC datasheets.





# Challenges of kernel implementation

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- How to name UAPI?
  - IEEE 802.3-2018 describes two types of PSE:
    - “PSE” for PvMDI/PoE\*
    - “PoDL PSE” for PoDL
  - PSE and PoDL PSE have similar objects but different values and different standardization paths. Even if there are similarities now, they may become not compatible in the future.



# IEEE 802.3-2018 to Kernel UAPI mapping

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- aPoDLPSEAdminState  
→ ETHHTOOL\_A\_PODL\_PSE\_ADMIN\_STATE
- aPoDLPSEPowerDetectionStatus  
→ ETHHTOOL\_A\_PODL\_PSE\_PW\_D\_STATUS
- acPoDLPSEAdminControl  
→ ETHHTOOL\_A\_PODL\_PSE\_ADMIN\_CONTROL



# Current kernel implementation

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- Keep initial implementation minimal. Implement only what I really use and able to test.
- For now only PoDL PSE support
- PSE support on each network interface
- Can be detected from user space
- Provides ethtool interface
- Currently it can:
  - control admin state of PSE per port independent of link admin state
  - Read admin state and status of PSE



# WIP: ethtool implementation

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```
$ ip l
```

```
...
```

```
5: t111@eth0: <BROADCAST,MULTICAST> ..
```

```
...
```

```
$ ethtool --show-pse t111
```

```
PSE attributes for t111:
```

```
PoDL PSE Admin State: disabled
```

```
PoDL PSE Power Detection Status: disabled
```

```
$ ethtool --set-pse t111 podl-pse-admin-control enable
```

```
$ ethtool --show-pse t111
```

```
PSE attributes for t111:
```

```
PoDL PSE Admin State: enabled
```

```
PoDL PSE Power Detection Status: delivering power
```



# What is next?

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- Classification support.
  - Potential conflict with autoneg or manual master clock role (SCCP vs FLP)
- Components affecting maximal power delivery to the PD: Power supply, Board, Ethernet cable.
  - We need interfaces to set: max class, max load limit, load balancing, port prioritization
- Reuse existing frameworks where possible: regulator, power delivery, etc.



# What is next?

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- PD Support
  - get classification result from PD controller
  - Report available power budget to related system components or to the user space
  - Possible use case: surveillance camera has enough power for CPU but no budget for the motor. Administrator will be able to get needed information for troubleshooting.



Thank you!

Questions?

