

Autoclass v100

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Goal of Autoclass

Autoclass is a classification mechanism that allows a PD to communicate its effective maximum power consumption to the PSE. This happens in such a way that the PSE will be able to set the power budget to the effective maximum PD power including the effective channel losses.

Goal: $P_{PSE_BUDGET} = P_{PD} + \text{actual channel loss} + \text{minimal margin}$

This will allow more efficient use of the PSU since only the effectively used power needs to be budgeted. This feature is not offered by the current classification scheme or by LLDP.

Example case

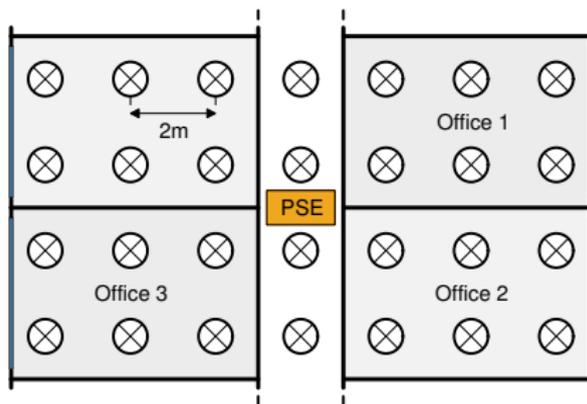
Context:

- Efficiency PoE (PSE+cable+PD) is 96%
- Cable losses are 0.74% (CAT5, awg24, 2pair)
- $V_{PSE} 56V, P_{CPD} 25W$
- PSE budget needs $28 * 30W = 840W$

Simulation results:

Total power delivered by PSE	726.2	W
Total power dissipated in cables	4.5	W
Total power in PD interfaces	17.2	W
Total (constant) power in PDs $28 * 25$	700	W
Total power in PD (load+losses)	717.2	W
Average total PD power	25.6	W
Average current per luminaire	463	mA
Maximum current of all luminaires	464	mA
Lowest current of all luminaires	461	mA

Typical office lighting plan for Europe.
4 rooms & corridor, 2m luminaire spacing, $112m^2$, 3000lm per luminaire (25W) → 28 luminaires.



Example case analysis

With the example on slide 3 we have the following options:

1. Use a **860W PSU** (840W + 20W)

- We follow 802.3at our 860W PSU will only ever see 86.7% load.
- We can use Autoclass to fully power 4 extra ports resulting in +14% more usable ports.
- We can use Extended Power¹ to boost luminaire power to about 29.5W resulting in +18% lumen output.

2. Use a **750W PSU** (730W + 20W)

- Using Autoclass we save cost of $110W / 860W = -13\%$ PSU cost

¹Please see annex for difference between Autoclass and Extended Power

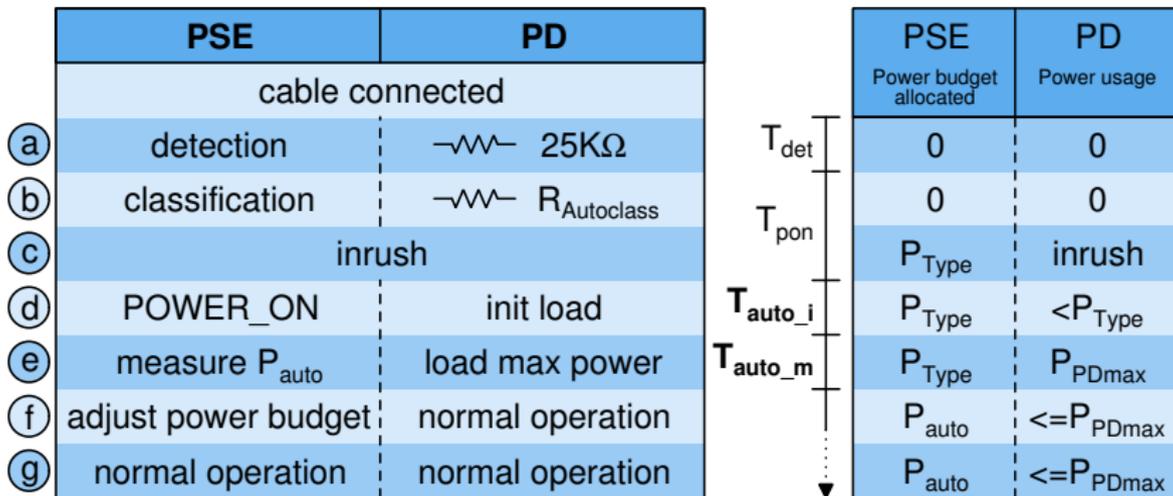
Classification mismatch

If the switch/midspan does not support LLDP, Autoclass can reclaim much more power.

PD power	PSE class	% overbudget
50W	50W	0%
40W	50W	20%
30W	38W	21%
25W	30W	17%
20W	30W	33%
15W	30W	50%
10W	15W	33%

Using Autoclass it is possible to reduce the mismatch between PSE budget allocation and PD power requirements to 2% - 4% (some headroom is required), at any power level, without resorting to large numbers of power classes.

Autoclass - how it works(1)



See explanation of items a-g on slide 7

Autoclass - how it works(2)

If a PD classifies as Autoclass, it must consume the maximum amount of power it will ever need for a duration of T_{auto_m} after inrush. During this time the PSE measures the consumed power at the PSE PI. After T_{auto_m} the PSE may reduce the allocated power budget of that PD to the value it measured. This method takes into account all DC losses in the PSE, PD and channel.

- a: Detection as usual.
- b: PSE performs classification, PD is configured for Autoclass.
- c: Inrush as usual.
- d: PSE is in POWER_ON condition for T_{auto_i} . The PD initializes the load.
- e: PD consumes maximum power, PSE measures power consumption.
This period lasts T_{auto_m} .
- f: PSE may now reduce allocated power to the maximum it measured during T_{auto_m} . PD enters normal operation.
- g: PSE and PD are now both operating in POWER_ON condition.

New parameters

- T_{auto_i} Amount of time after inrush during which the PD can initialize the load (with possibly a second inrush event). During this time the power consumption of the PD is not taken into account to calculate P_{auto} .
- T_{auto_m} Amount of time during which the PD should consume the maximum amount of power it will ever need (P_{PDmax}). During this time the PSE measures the power delivered to the port and keeps track of the maximum. This maximum is stored as P_{auto} .
- P_{PDmax} Maximum amount of power the PD consumes as measured at the PD PI (in Autoclass context).
- P_{auto} Highest amount of power measured during T_{auto_m} at the PSE PI.

Interoperability

	PD Type 1+2	PD Type 3+4
PSE Type 1+2	N/A	PD must limit power consumption to T1/T2 levels. No Autoclass.
PSE Type 3+4	N/A	Autoclass possible

A PSE may treat Autoclass as the highest power class of the mutually identified Type and not implement the measurement and budget re-allocation.

Summary

Autoclass is a simple & cost-effective means to match system PSU power with actual PD consumed power.

It is a PD choice to make use of 'normal' classes, LLDP, or Autoclass, depending on the nature of the device.

It will only cost us the use of a class for Autoclass and a software implementation at the PSE side. A PSE is not required to implement Autoclass, it may also treat the Autoclass as regular power class.

Autoclass is ideally suited for PDs that can control their power consumption reliably (like LED drivers and heaters).

For typical PoE systems it means less power is allocated but never used.

For Lighting PoE systems it means lower rated power PSUs can be used.

Straw poll 1

The .bt project should support Autoclass.
Do you agree with this statement ?

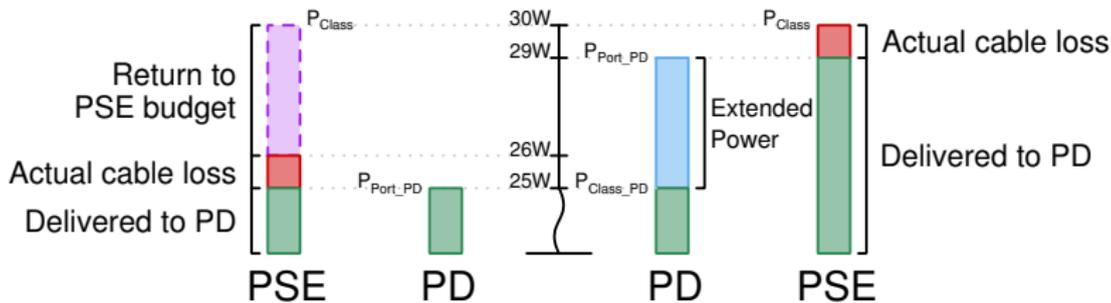
Yes:

Abstain:

No:



Autoclass vs Extended Power (1)



Autoclass

Autoclass returns $P_{Class} - P_{Port_PD}$ to the PSE budget.

This classification feature must be supported by PSE and PD to work

Extended Power

Extended Power allows the PD to consume up to $P_{Class} - P_{Class_PD}$ - (actual channel loss) above the P_{Class_PD} guaranteed power.

Invisible to the PSE

Autoclass vs Extended Power (2)

Autoclass: Main goal is to optimally make use of the PSE power supply by reducing the amount of power reserved (at the PSE) for channel losses to the actual channel losses with minimal margin.

Extended power: Main goal is to allow a PD to consume more power than the amount that can be guaranteed under worst case conditions. The PD may consume the cable reserves allocated in excess of actual channel losses.