



# Stateless / stateful

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# Stateless management / negotiation

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## 802.3u autonegotiation

- PHY type & capabilities advertised

- Rules define resultant operation

## 802.1AB LLDP Media Endpoint Discovery

- Generic advertisement protocol

- No state change based on received advertisement

- Needs meta rules for negotiation

# Stateless power management

## PD advertises requirements

Peak power  
Average power?  
Power profile?  
Multiple modes



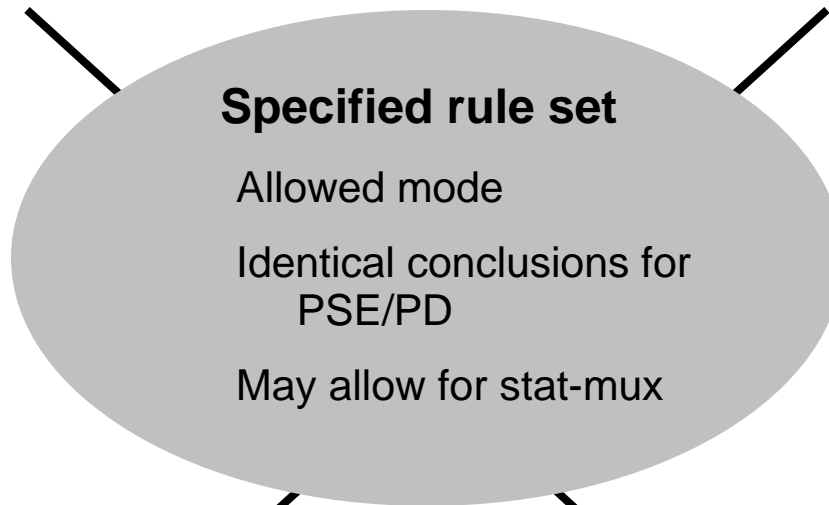
Change of state  
Not in response to allocation

## PSE advertises allocations

Allocated peak  
Other restrictions



Change of state  
Not in response to request



Refer to rules for revised state

# Advantages / disadvantages for stateless

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## Good

Simpler and more robust ++

May use LLDP +

## Bad

Problems with change of state --

Must allocate max mode for flexible PD --

Implementations liable to break stateless rule -  
(hard to enforce – leads to interop issues)

# Problematic situations

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PSE has allocated power to ports

Each PD slot is allocated enough for max power state

Accounting based on current PD power states

Difference represents oversubscription (risk)

PD(s) change to higher power states...

Accounting changes show oversubscription too high

Changing PSE advertisement illegal (not stateless)

Disconnecting some PDs not acceptable

Only recourse is to deny new PDs

# Stateless examples

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## Management objects

PD: max peak power; max average power; current state average power; etc.

PSE: allowed limit peak power; allowed limit average power; remaining power budget (?); etc.

## Rules

PD must not enter a mode that exceeds the PSE's allowed limit

Could apply to peak & average

## Problems

If PSEs & PDs break the “stateless” rule may result in “ratchet”

Link partner cannot know “why” advertisement change occurred

# Stateful management / negotiation

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## SNMP

Manager can interrogate state and request state changes

## 802.3ah EPON

Master keeps state and advertises to slaves

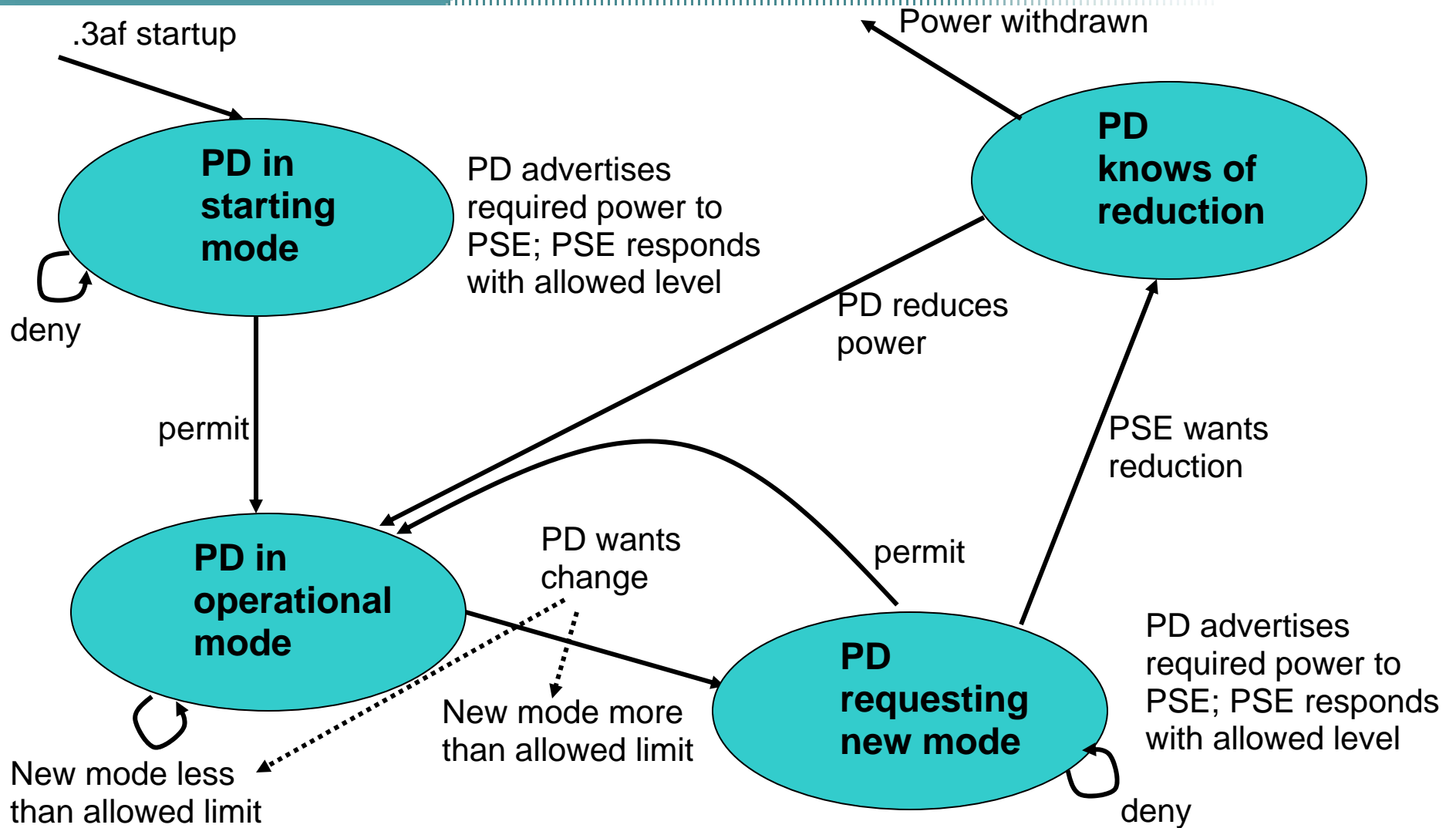
Slave requests cause state change

## Could be used for Power

Request and grant mechanism

Needs state definitions

# Stateful PD operation (summary)





# Advantages / disadvantages for stateful

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## Good

Much more flexible ++

Accommodates controlled changes ++

## Bad

More complex state machines at both ends

Must consider lost packets & robustness

# Stateful examples

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Management objects (some similar to stateless objects)

PD: Current state average and peak power; etc.

PSE: allowed limit peak power; allowed limit average power; remaining power budget (?); etc.

State change requests: PD request increase / PSE request decrease

State machines

PD may be in startup, operational, requesting increase or accommodating decrease

PSE must recognize PD states and changes

# Conclusions

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Stateless will limit scope of solutions

Less flexible power management

Stateless may suffer from interoperability

If implementations (illegally) use state

Stateful offers best flexibility

Self-evident behavior assists with complexity

Stateful definition should be adopted

# Next step

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Stateful operation needs state exchange

Must adopt protocol

802.3ah can be used (802.1AB cannot)

Define objects to transport

Define required protocol support

Appendix for implementation recommendation

Define normative state machines

PD startup, mode change, shutdown

PSE power withdrawal

# Questions...



... or comments