Stateless / stateful

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Stateless management / negotiation

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

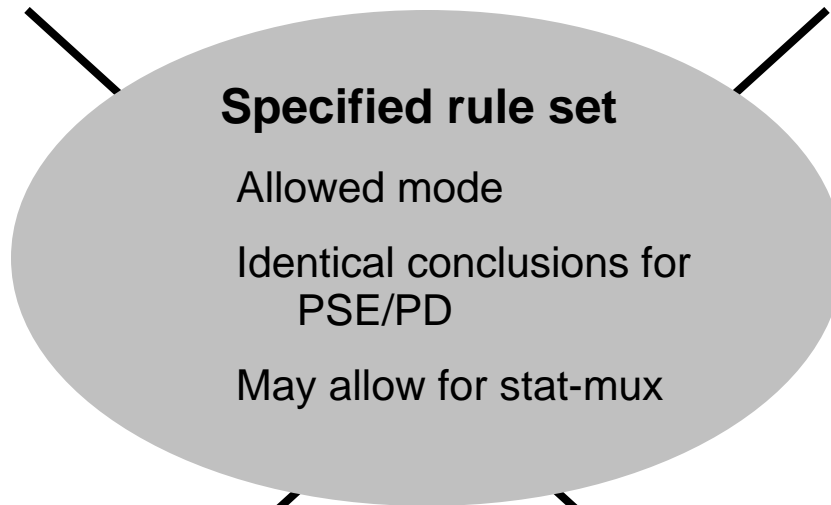Peak power

Average power?

Power profile?

Multiple modes

PSE advertises allocations

Allocated peak

Other restrictions

Specified rule set

Allowed mode

Identical conclusions for PSE/PD

May allow for stat-mux

Change of state

Not in response to allocation

Refer to rules for revised state

Change of state

Not in response to request

Advantages / disadvantages for stateless

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

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

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

SNMP

Manager can interrogate state and request state changes

802.3ah EPON

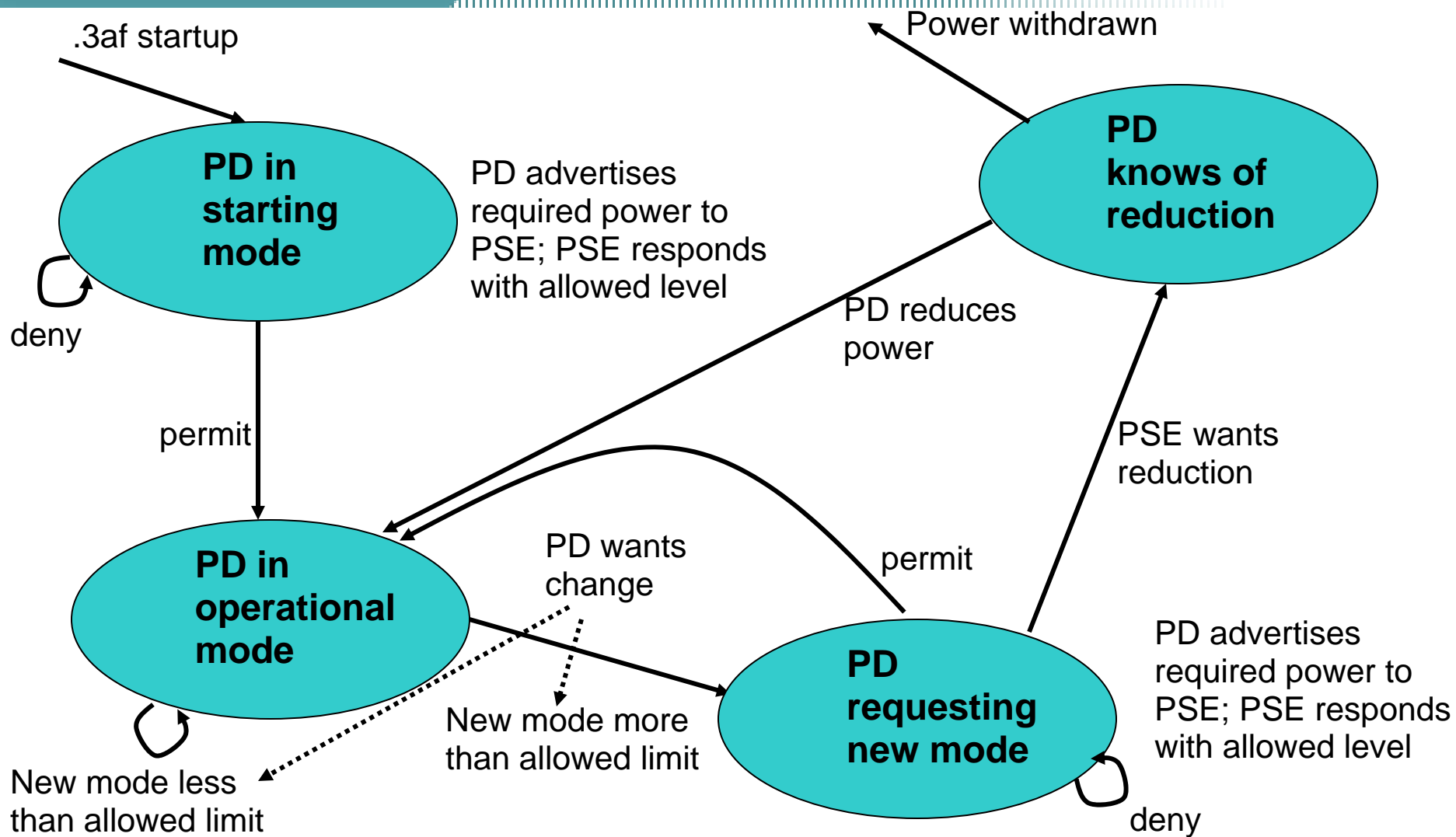Master keeps state and advertises to slaves

Slave requests cause state change

Could be used for Power

Request and grant mechanism

Needs state definitions

Stateful PD operation (summary)

.3af startup

Power withdrawn

PD in starting mode

PD advertises required power to PSE; PSE responds with allowed level

PD knows of reduction

deny

PD reduces power

permit

PSE wants reduction

PD in operational mode

PD wants change

permit

New mode more than allowed limit

PD requesting new mode

PD advertises required power to PSE; PSE responds with allowed level

New mode less than allowed limit

deny

Advantages / disadvantages for stateful

Good

Much more flexible ++

Accommodates controlled changes ++

Bad

More complex state machines at both ends

Must consider lost packets & robustness

Stateful examples

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

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

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