Proposal For a Hybrid L1 Classification Protocol

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Purpose

- The endspan and midspan makers have conflicting desires with regard to the L1 extended classification protocol.

- After much debate at the Knoxville meeting, no compromise was reached, and the two camps both remain unsatisfied.

- The task force can't move forward.

- The purpose of this presentation is to propose a hybrid L1 classification protocol that will hopefully lead to agreement.

The Conflict

- The next two slides are brief summaries of the positions of the two camps.

- I don't claim to have captured the entire arguments (pro or con) for the two protocols: I just tried to state the main points and counter-points succinctly.

Best Protocol for <u>Endspans</u>

- Brief summary of the protocol:
  - The PD requests a low power level via L1.
  - After booting, the PD may negotiate a higher power level via L2 if/when it needs to.
- Reasons why the endspan makers want this:
  - Allows a system with a large number of PD's to start up more rapidly.
  - Lowers PSE cost by allowing a smaller power supply.
- Reason why midspan makers object to this:
  - Creates a category of PD that midspans can't power properly: puts them at a marketing disadvantage.

Best Protocol for <u>Midspans</u>

- Brief summary of the protocol:
  - The PD requests enough power via L1 to satisfy its worst-case maximum load. (Renegotiation after power-up is not possible.)
- Reason why the midspan makers want this:
  - Allows a midspan to do simple power management without the significant expense associated with the hardware/software required to support the L2 protocol.
- Reason why endspan makers object to this:
  - Slows power-up process, or increased cost of PS.

Proposed Hybrid Protocol

The waveform produced by the PSE during classification indicates to the PD if the PSE is capable of L2 power management or not:

- IF the PSE is <u>not</u> capable of L2 power management, then the PD requests MAX power via L1. (This satisfies the desires of the midspan makers.)

- IF the PSE <u>is</u> capable of L2 power management, then the PD requests a lower power level via L1: enough power to allow the PD to boot. (This satisfies the desires of the endspan makers.)
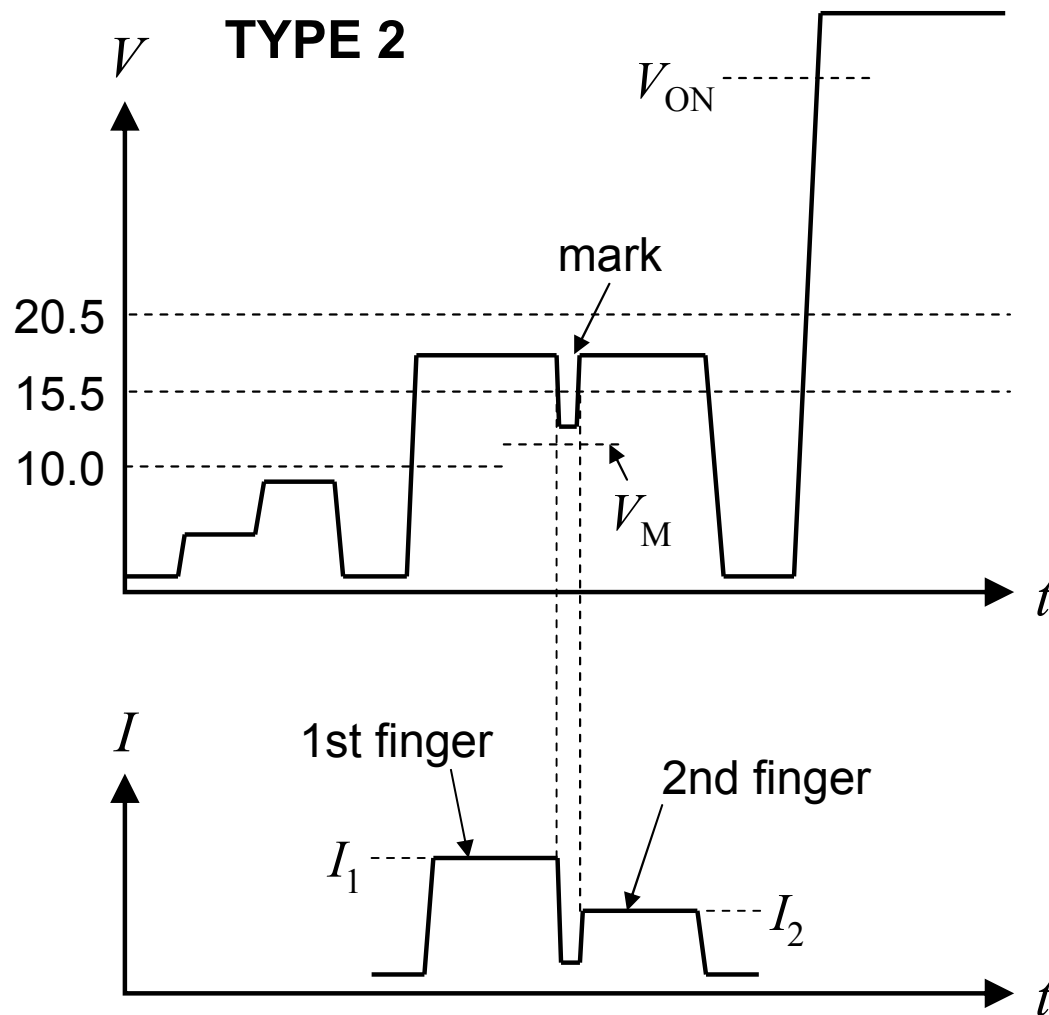
Review of 802.3af Protocol
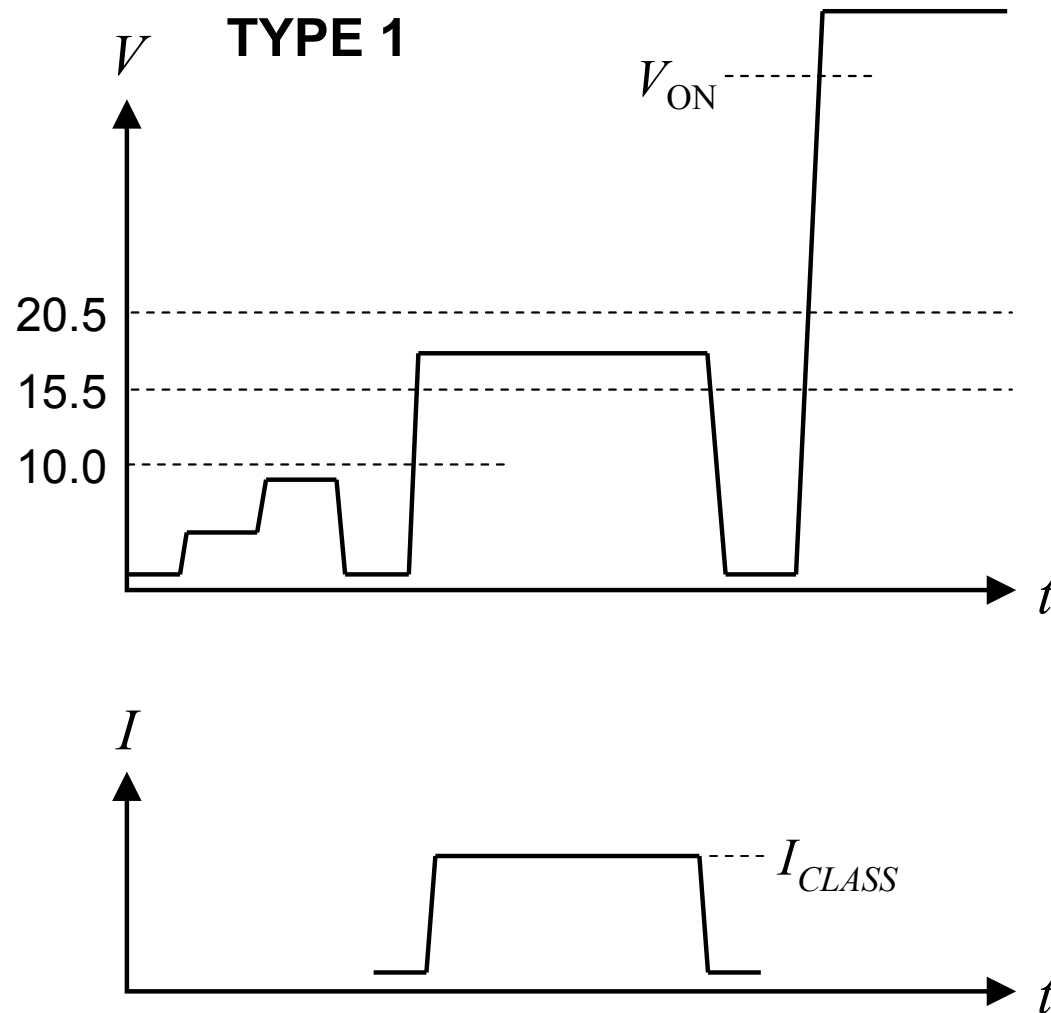
The original classification protocol was stateless: whenever V was within a predetermined range I equaled I_{CLASS}.

NOTE: Legacy 802.3af devices are now called "Type 1", and devices that include the new L1 classification protocol are now called "Type 2".

Proposed 802.3at Protocol

TYPE 2

V

V_{ON}

mark

20.5

15.5

10.0

V_M

t

I

1st finger

2nd finger

I_1

I_2

t

The extended L1 protocol utilizes two "fingers" (with current levels I_1 and I_2) separated by a "mark" pulse.

This protocol also provides mutual identification:

- The PD knows the PSE is Type 2 because the mark is present.

- The PSE knows the PD is Type 2 because the current changes in response to the mark.

Proposed Hybrid Protocol

TYPE 2

1st mark

V_{M1}

2nd mark

V_{ON}

20.5

15.5

10.0

V_{M2}

V

t

I

1st finger

2nd finger

I_3

I_4

t
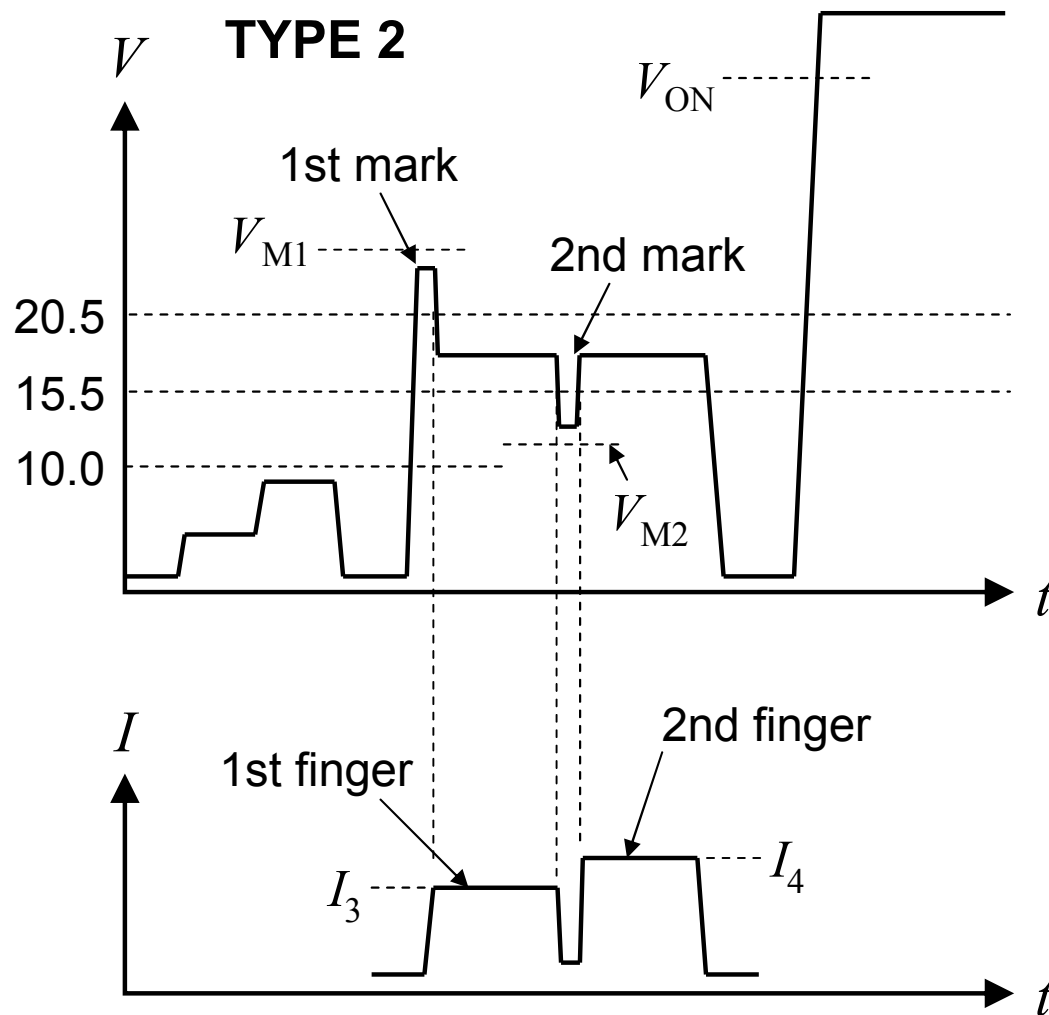
The hybrid protocol includes an additional mark at the beginning of the process:

- The presence of the 1st mark indicates that the PSE is capable of L2 power management: so the PD requests a low power level. (The low-power code consists of I_3 and I_4.)

- The absence of the 1st mark (as shown on previous page) indicates that the PSE is not capable of L2 power management: so the PD requests max power. (The max-power code consists of I_1 and I_2 as shown on the previous slide.)
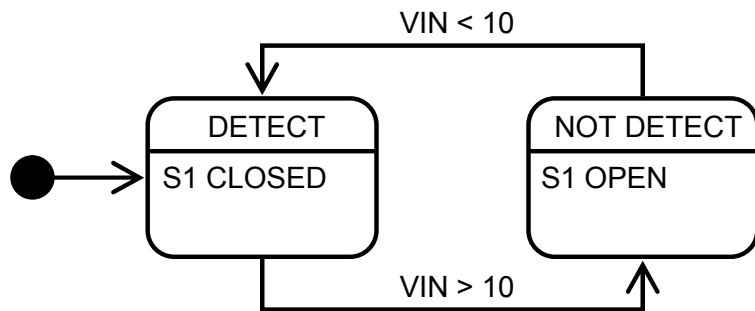
Block Diagram of a Typical PD

NOTE: The purpose of this diagram is to provide a reference for the state diagrams shown on the next two slides. PD's are *not* required to strictly adhere to this diagram.
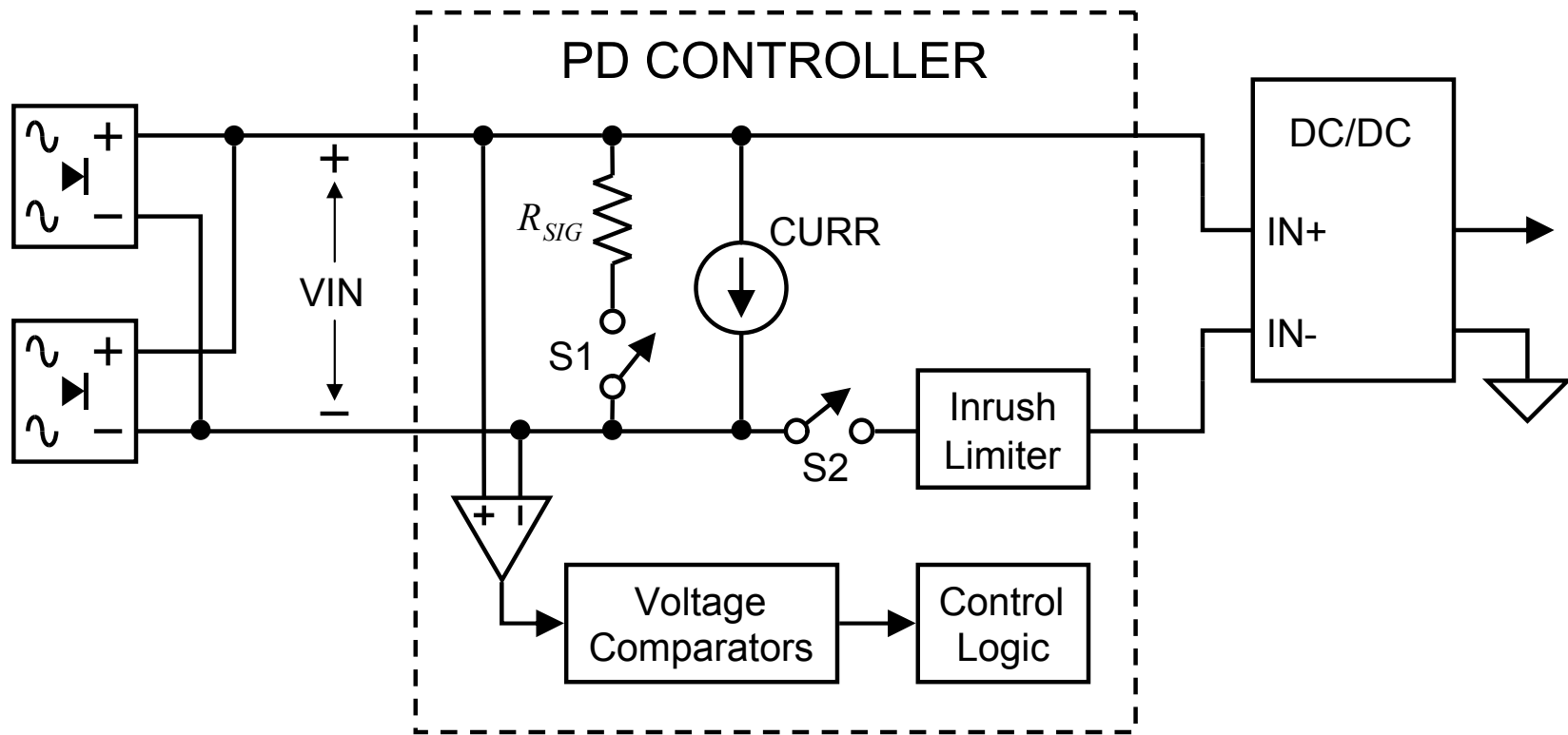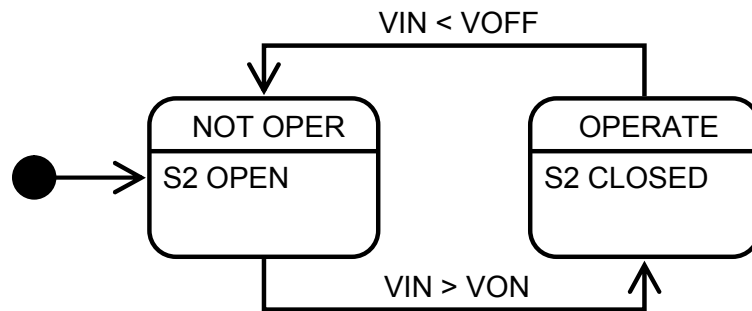

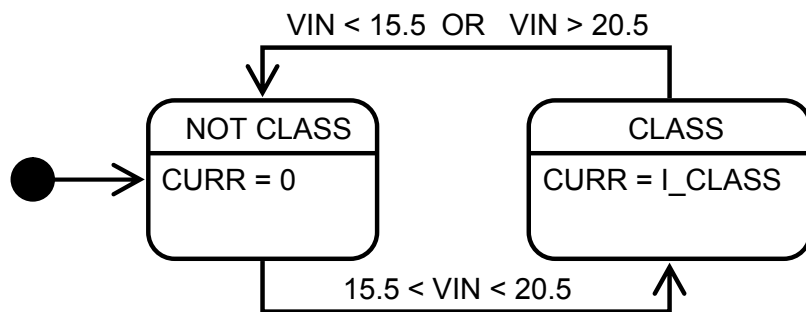**PD State Variables:** S1, S2, and CURR.

PD State Diagrams

TYPES 1 AND 2 PD

```
                    VIN < 10
        ┌──────────────────────────────┐
        │                              │
        ▼                              │
   ┌──────────┐                  ┌──────────────┐
   │  DETECT  │                  │  NOT DETECT  │
●──▶├──────────┤                  ├──────────────┤
   │ S1 CLOSED│                  │   S1 OPEN    │
   └──────────┘                  └──────────────┘
        │            VIN > 10           ▲
        └──────────────────────────────┘
```

TYPES 1 AND 2 PD

```
                    VIN < VOFF
        ┌──────────────────────────────┐
        │                              │
        ▼                              │
   ┌──────────┐                  ┌──────────────┐
   │ NOT OPER │                  │   OPERATE    │
●──▶├──────────┤                  ├──────────────┤
   │ S2 OPEN  │                  │  S2 CLOSED   │
   └──────────┘                  └──────────────┘
        │           VIN > VON           ▲
        └──────────────────────────────┘
```

TYPE 1 PD ONLY

```
              VIN < 15.5  OR   VIN > 20.5
        ┌──────────────────────────────┐
        │                              │
        ▼                              │
   ┌──────────┐                  ┌──────────────┐
   │ NOT CLASS│                  │    CLASS     │
●──▶├──────────┤                  ├──────────────┤
   │ CURR = 0 │                  │CURR = I_CLASS│
   └──────────┘                  └──────────────┘
        │       15.5 < VIN < 20.5       ▲
        └──────────────────────────────┘
```

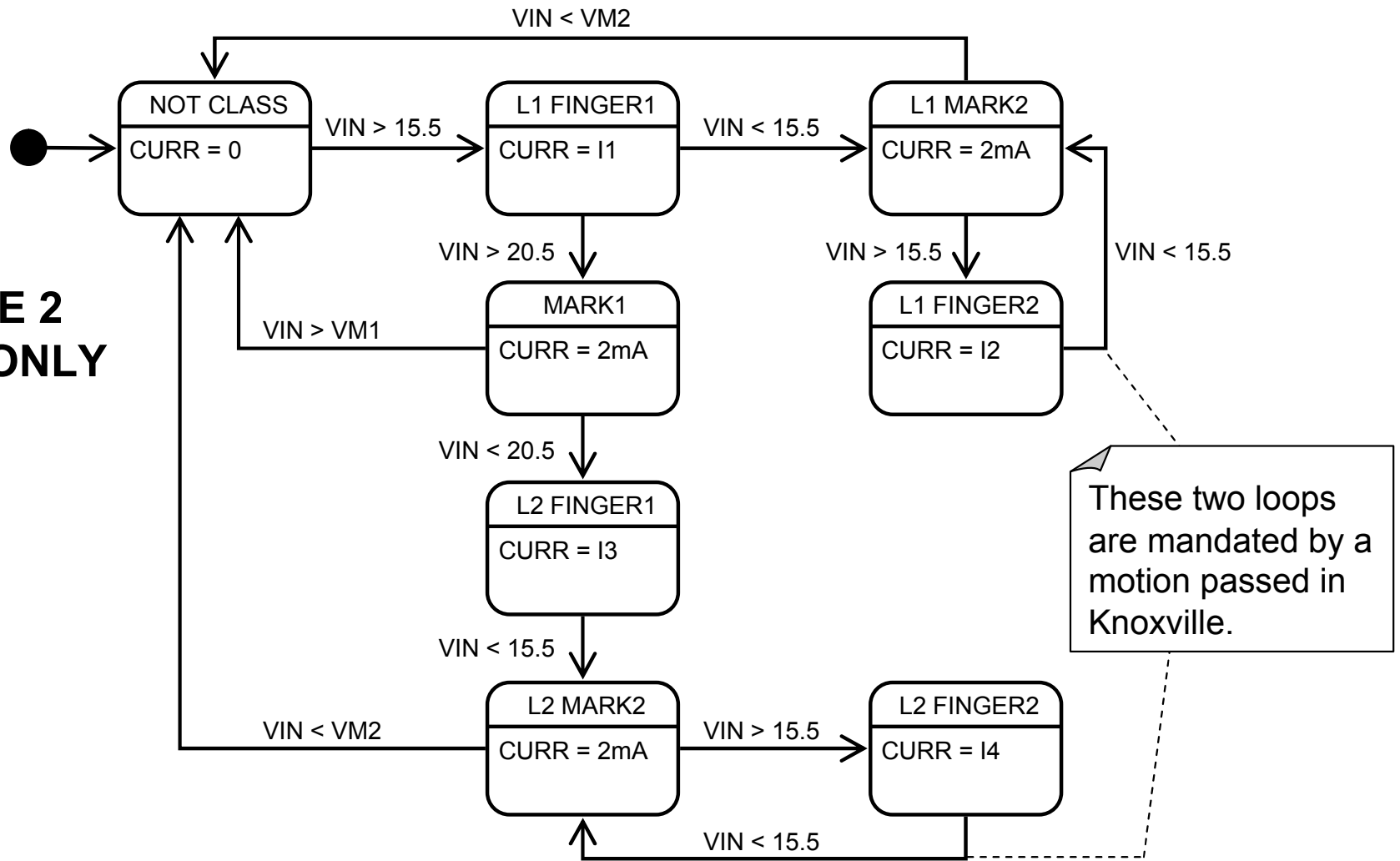**NOTE:** The PD behaviors defined by these simple state diagrams are already defined in the text of 802.3af: we don't need to add these, but it may make the standard clearer.

PD State Diagrams (Continued)

**TYPE 2
PD ONLY**

Conclusions

- The proposed hybrid protocol has advantages:
  - Satisfies the desire of midspan makers for PD's to request max power via L1.
  - Satisfies the desire of endspan makers for PD's to request low power via L1.
- But it's not perfect:
  - It doesn't allow existing hardware that is noncompliant with 802.3af to be made compliant with 802.3at simply by a software upgrade.
  - Minor increase in complexity of PD and PSE control logic.