

PoE Plus - IEEE 802.3at

Extended Classification Using Ping-Pong Scheme

November 14, 2005 – Vancouver

Martin Patoka

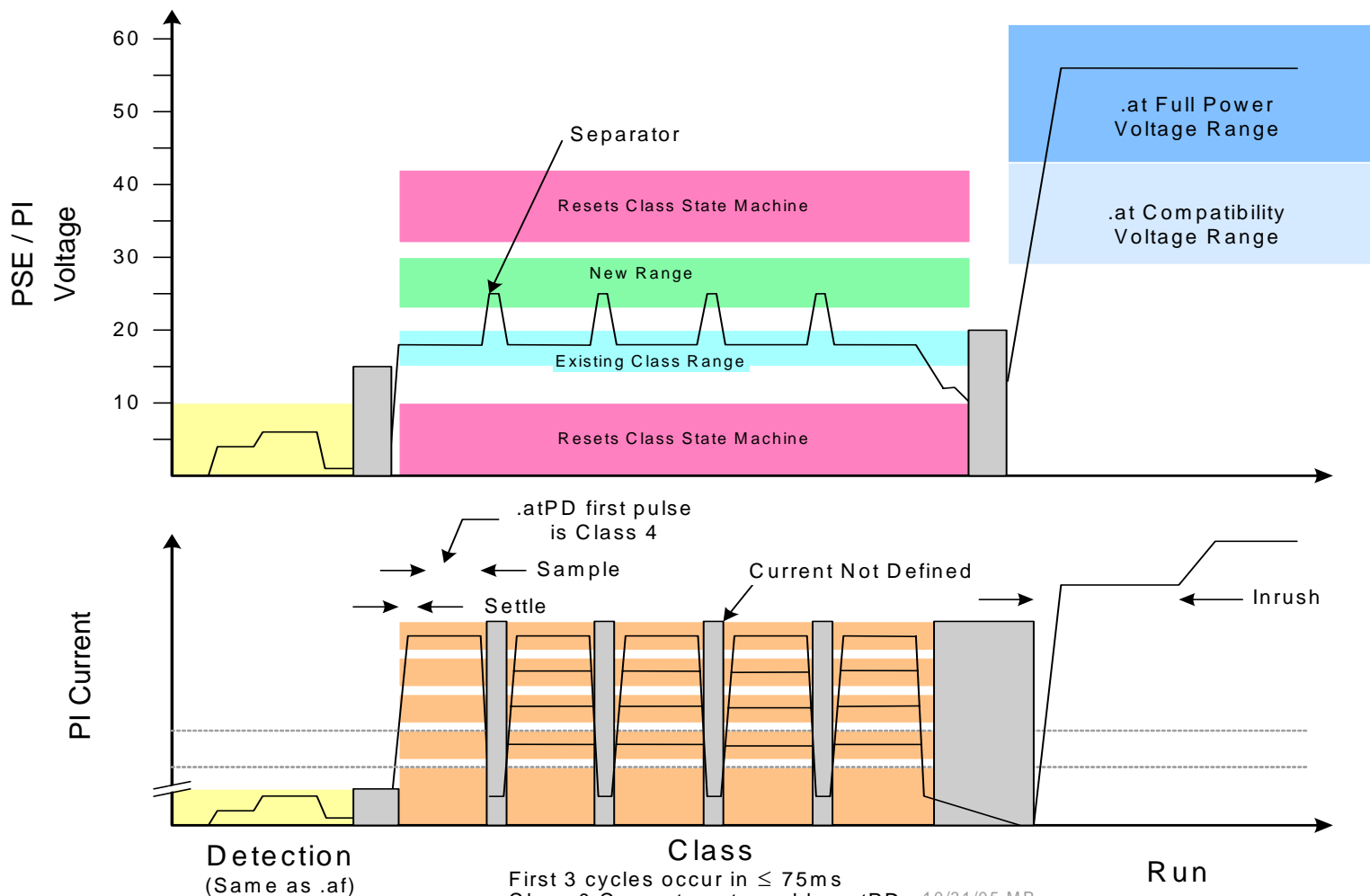
IEEE 802.3at Ping-Pong Classification

- Basic idea is to extend existing Classification to multiple cycles
- Classification method is similar to the existing method
- Handshake system
 - .at PD learns PSE type
 - .at PSE learns PD type
- Misidentification avoided with multi-cycle operation and coding techniques
- Allows for large number of classes by either endpoint or midspan PSE
- The number of classes can be easily increased

IEEE 802.3at Ping-Pong Classification

Example of Ping-Pong 802.3at Classification Plan

Note: Waveforms Uncontrolled in Gray Areas



11/14/2005 MP

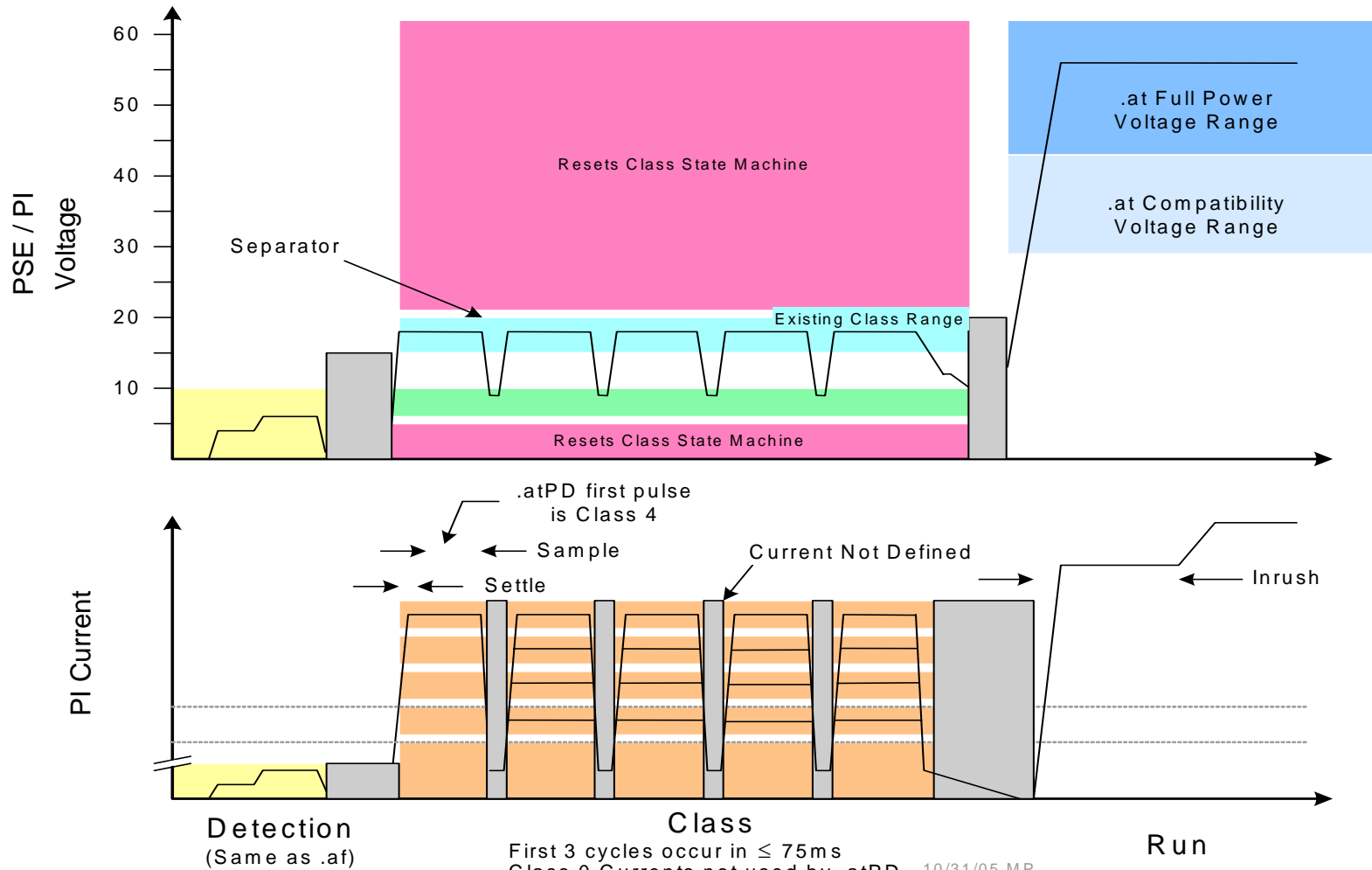
First 3 cycles occur in ≤ 75 ms
 Class 0 Currents not used by .atPD
 Code 444XX not used by .atPD

10/31/05 MP

IEEE 802.3at Ping-Pong Classification

Example of Ping-Pong 802.3at Classification Plan

Note: Waveforms Uncontrolled in Gray Areas



11/14/2005 MP

First 3 cycles occur in ≤ 75 ms
 Class 0 Currents not used by .atPD
 Code 444XX not used by .atPD

10/31/05 MP

IEEE 802.3at Ping-Pong Classification

- **System Rules**

- First 3 Class periods complete within 75ms (.af requirement)
- .at Class Duration is limited; example 150ms
- .at separator pulse is something like 5ms
- Only one Class cycle if first value is not a “4”
- PSE applies current-limited voltage to loop (like .af)
- PD signals via current (like .af)
- Existing Class current definitions are used (0 – 4)
- Not all codes are used to avoid accepting non-.at PD devices
- Class 0 is not used for .at PDs because this system requires some pull-down load

IEEE 802.3at Ping-Pong Classification

- **PD Rules**

- .at PD first Class must be “4” to signal PoE+
- .at PD does not use 444xx code (eliminate Class 4 .af PD)
 - Other codes eliminated that could be caused by non-.at devices
- .at PD is required to pull Class 1 current to discharge the internal capacitor, and perhaps link capacitance
 - Input diode bridge might prevent identification of separator
- .at PD state machine reset when port voltage enters reset or operational range
- .at PD indicates wrong PSE type if there are not 5 Class cycles before powering
- .at PD signals as Class 0 if too many cycles occur

- **PSE Rules**

- .at PSE does only one Class if first value is not a “4”
- .at PSE interprets Class “444” as .af PD (\Rightarrow Class 0)
- .at PSE stops after receiving code “444”
- Class coding scheme may render other codes invalid
- .at PSE has same privileges to power PD or not
- .at PSE may do multiple Detection-Class-Detection cycles
 - Must assure that a reset is applied before reclassifying
- Power devices with invalid class as .af PD

IEEE 802.3at Ping-Pong Classification

- Some number of .at class codes need to be avoided
- Example of number of Classes that can be realized
 - .af Class + 3 additional cycles $\Rightarrow 4^3 - 4^1 = 64 - 4 = 60$
 - .af Class + 4 additional cycles $\Rightarrow 4^4 - 4^2 = 256 - 16 = 240$
 - .af Class + 5 additional cycles $\Rightarrow 4^5 - 4^3 = 1024 - 64 = 960$
- Class power coverage should go to 100W to “future proof”
 - Covers this class method if a larger wire diameter is used and the allowed wiring current is increased

- **Advantages**
 - PSE detects presence of .af or .at PD
 - PD detects presence of .af or .at PSE
 - .at PD may choose to operate at reduced functionality
 - .at PD has the ability to signal presence of inadequate PSE once powered
 - Adequate number of new classes for reasonable power utilization
 - Simple technique uses existing practice
 - Works for both end-point and midspan
 - A .at PD that is not powered up after classification can attempt to reclass at a lower power
- **Disadvantage**
 - Dynamic reclassification cannot be done at this signaling layer
 - The door is open to reclassification via Ethernet