

## Approaches to policing and shaping in P802.1av

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### Summary

There has been some discussion in recent teleconference meetings and on the 802.1 email exploder about the requirements for traffic shaping for reserved streams, and how they would be applied to the forwarding and queuing functions in P802.1av. While not attempting to reach a conclusion as to what functions are or are not required (there is probably more work to be done on stream behaviour before such a conclusion can be reached), this paper is an attempt to define some terminology, identify the parts of the forwarding process that may be involved in the process, and summarise the range of views expressed so far in terms of what approach should be taken.

#### 1. Starting assumptions

The reservation mechanisms defined in P802.1at, SRP, are assumed to be in place<sup>1</sup>; these allow stream reservations to be made for streams identified by a MAC address, associated with one of two possible AV traffic classes relating to voice and video data (classes 4 and 5). For any traffic received on either of these traffic classes, AV Bridges will assume that a reservation is required. So far, it is not clear that any hard and fast conclusion has been reached as to what a Bridge will do if a reservation is not present for the stream and outbound Port concerned, but one definite proposal has been made, as follows:

- If the source device is not AV-compliant<sup>2</sup>, the Bridge changes the traffic class to one that is lower and non-AV, and the traffic is then handled as best effort;
- If the source device is AV-compliant, the data is discarded.

The reservation data distributed by SRP identifies reservations per stream<sup>3</sup>; therefore, in principle at least, per-stream reservation information is available to the Forwarding

Process, although for some and possibly all<sup>4</sup> forwarding functions, the per-stream reservation information may need to be aggregated in one way or another.

#### 2. Terminology

There has been a certain amount of confusion in discussions to date, as a consequence of the use of different terms, or understanding different things for the same terms. So, for the purposes of this paper, the following terms and meanings apply<sup>5</sup>:

- **Upstream:** In the direction of the Talker.
- **Inbound stream:** Stream data received through a reception Port of a Bridge for processing prior to queuing on one or more outbound Ports.
- **Outbound stream:** Stream data queued for transmission on, and transmitted through, an outbound Port of a Bridge.
- **(Traffic) policing:** A function imposed on an inbound stream (or set of streams) that enforces the reservation parameters associated with that stream(s) (for example, to detect and handle upstream devices that have exceeded the reservation for a stream), either by discarding frames or by reassigning the traffic class. This function is performed before stream

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<sup>1</sup> Still in draft form, see current draft here: <http://www.ieee802.org/1/files/private/at-drafts/d0/802-1at-d0-3-retaining-mode-cl10.pdf> and also working paper proposing a simpler approach here: <http://www.ieee802.org/1/files/public/docs2007/at-jeffree-srp-simplified-0207-v2-1.pdf>

<sup>2</sup> Determination of whether or not the attached device is an AV device is presumed to be achieved by means of IEEE Std 802.1AB LLDP exchanges.

<sup>3</sup> Worth noting that, as a stream is defined to have a single source (the “Talker”), then a stream is specific to a single reception Port of a Bridge.

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<sup>4</sup> Depending upon which model of the forwarding and queuing

<sup>5</sup> I don’t claim these are necessarily the right definitions

data is queued on an outbound Port of the Bridge.

- **(Traffic) shaping:** A function imposed on an outbound stream (or set of streams) that enforces the reservation parameters associated with the stream(s). This function is performed upon frames that have been assigned to outbound queues by the functions associated with de-queuing and frame transmission.
- **(Traffic) Pacing:** A shaping function that enforces a fixed or bounded interval between consecutive frame transmissions.

### 3. Forwarding process

There are three elements of the forwarding process that will be potentially affected by the need to perform traffic policing and shaping functions:

- Q subclause 8.6.3 – Frame filtering. At present, this function determines the set of potential outbound Ports based on destination address, VID, Filtering Database information (Forward/Filter) for that address and VID, and default group filtering behaviour. This could be extended to include policing functions; however, 8.6.5 may be considered more appropriate.
- Q subclause 8.6.5 – Flow classification and metering. From the existing text of 802.1Q (including 802.1ad), this is probably the most appropriate place to insert policing functions.
- Q subclause 8.6.7 – Queue management and 8.6.8 – Transmission selection. These two subclauses would be the appropriate place to insert shaping functions<sup>6</sup>.

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<sup>6</sup> However, as has been pointed out by David James, depending upon what kind of shaping algorithm is put in place, it may be necessary to perform shaping-related actions before frames are queued, in which case, there may be work to do in 8.6.3 and/or 8.6.5 that is logically shaping, rather than policing.

### 4. Approaches to policing and shaping

There seem to be three approaches that have been discussed so far:

- Those that assume that inbound streams are always well-behaved<sup>7</sup>. If this is the case, then there is no need to employ any policing functions beyond, at most, ensuring that a stream has a reservation associated with it for each candidate outbound Port, and either discarding or demoting the stream to a lower traffic class for that Port if not<sup>8</sup>.
- Those that assume that inbound streams cannot be trusted and must be assumed to be badly-behaved until proved innocent. The extreme of this viewpoint is that there is no alternative but to police inbound streams on a per-stream, per-outbound Port basis, and possibly also perform shaping on a per-stream/port basis too (although that latter requirement is less clear).
- Those that fall somewhere between the two extremes – for example, performing a crude policing function that constrains the aggregate stream traffic through a Port not to exceed the 75% utilisation watermark<sup>9</sup>, or performing policing per inbound/outbound port pair<sup>10</sup>.

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<sup>7</sup> If they are, then all well and good; if they are not, market forces will likely ensure that manufacturers of the badly behaved equipment either don't sell very much product, or fix them so they are well behaved.

<sup>8</sup> In some of our discussions to date, the possibility has been expressed that “partial reservations” may be OK – i.e., on a particular Port, if the available bandwidth is less than required for a particular reservation, the lower bandwidth is nonetheless allocated to the stream and the listener gets to choose whether the degraded stream is acceptable. However, this option disappears if stream sources are assumed to be well-behaved, as having the full stream bandwidth feeding into an under-allocated path looks just the same as a badly-behaved stream. The other two approaches don't have this problem, but have increased complexity in the policing functions.

<sup>9</sup> This potentially results in all inbound streams from all inbound Ports being penalised for any inbound stream's misbehaviour.

<sup>10</sup> This potentially results in all inbound streams from a single inbound Port being penalised for the misbehaviour of one of those streams.