Trivial TLV Transport (T3P)
Proposed T3PDU and State Machines

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Trivial TLV Transport Protocol (T3P) Goals
(From 11/09 “bg-hudson-tlvtransport-1109-v02.pdf” presentation)

• What should stay the same
  – TLV format (but allow multiple of the same TLV type)
  – Addressing
  – Strong push to minimize traffic
• Very simple
• Meets needs of VSI Discovery Protocol
• Minimizes traffic for new protocols
• Easy to learn (re-uses LLDP knowledge)
• Could carry other client protocols
  – Example: LLDP TLVs
    • LLDP ‘client protocol’ holds inventory of LLDP TLVs
    • Use TLV transmit timers to match LLDP intervals
    • Add timers for each TLV received (to clear if no longer sent)
Trivial TLV Transport Protocol (T3P) Lower-level Transport Overview

1. Client protocols pass outgoing TLVs to lower-level transport. TLVs are queued until frame is ready to be sent.

2. Frame with TLVs is transmitted but the frame is not yet deleted from the transmit buffer. A L-ACK timer is set.

3. Arriving frame is received into a receive 'buffer', where it is held until it is removed by frame/TLV processing to pass TLVs to the upper level protocols.

4. When the receive buffer is emptied, a low-level acknowledge (L-ACK) is sent to the sender.

5. If the L-ACK is received before the timer expires, then the transmit buffer is cleared and the next TLV can be transmitted from the queue.

If the L-ACK timer expires before the L-ACK is received, then the frame in the transmit buffer is resent (some preset number of times).

T3P-R has symmetric behavior, but only a single direction shown here.
Trivial TLV Transport Protocol (T3P) Lower-level Transport Overview

1. **Transmit Side - Enqueue State Machine**
   Places TLVs received from ULP into a T3P queue.

2. **Transmit Side - Transmit State Machine**
   Transmits one or more TLVs from T3P queue.

3. **Receive Side - Receive & Enqueue TLV State Machine**
   Receives a T3PDU and enqueues TLVs to ULPs.

T3P-R has symmetric behavior, but only a single direction shown here.
T3P PDU Overview

<table>
<thead>
<tr>
<th>Ethertype = TBD</th>
<th>Chassis ID TLV</th>
<th>Port ID TLV</th>
<th>T3P TLV</th>
<th>Optional TLV</th>
<th>..</th>
<th>Optional TLV</th>
<th>End of T3PDU TLV</th>
</tr>
</thead>
<tbody>
<tr>
<td>← 2 Octets →</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td>M</td>
<td></td>
<td>M</td>
<td></td>
</tr>
</tbody>
</table>

Where M = Mandatory TLV

- The destination address of the Ethernet frame that contains a T3PDU has the following semantics:
  - Nearest bridge (01-80-C2-00-00-0E)
  - Nearest Customer Bridge (01-80-C2-00-00-00)
- The source address shall be the sending station or port individual MAC address.
- A new Ethertype will be needed for T3P.
- If T3P is performed over Multi-channel, then the STAG for the channel shall precede the T3PDU.
- Each T3PDU contains 3 mandatory TLVs and can contain optional TLVs, in the order shown below:
  - A Chassis ID TLV*
  - A Port ID TLV*
  - A T3P TLV
  - Zero or more optional TLVs, as allowed by the maximum size of the T3PDU.
  - An End Of T3PDU TLV*

*Note: These TLVs shall use the same format as defined in the LLDP specification, given the transport semantics of T3P, the LLDP TTL TLV is not used.
T3P TLV Overview

- **Mode** – Identifies whether the operation is a:
  - T3P request (0x00)
  - T3P acknowledgement (0x01)

- **Sequence number** – identifies the sequential order of the TLV, with respect to other T3PDUs. The sequence number for the first T3PDU is x0000, each subsequent new T3PDU is incremented by 1.
**Transmit Side - Enqueue State Machine**

```
initQueue
---
totalBytes = 0
immediateTLVs = 0

enqueueTLV
---
totalBytes += sizeof(TLV)
If (typeof(TLV) == TLV_IMMEDIATE)
immediateTLVs++
```

- **Client TLV Received**
- **Client TLV Received**
Transmit Side
Transmit State Machine

- **initTransmit**
  - **Sequence = 0**

  - `watchQueue`
    - `frameSize = 0`
    - `bytesToSend += totalBytes`
    - `if (bytesToSend) start QTimer;`
    - `Start healthTimer;`

  - `bytesToSend >= maxT3PDU || QTimer expired || immediateTLVs`

  - `createT3PDU`
    - `if (frameSize + sizeof(TLV)) <= maxT3PDU)`
      - `Dequeue TLV; Retries = 0;`
      - `if (typeof(TLV) == IMMEDIATE_TLV))`
        - `immediateTLVs --`
      - `Append TLV in PDU;`
      - `frameSize += sizeof(TLV); Get next TLV;`
      - `bytesToSend -= sizeof(TLV)}`

  - `(frameSize + sizeof(TLV) > maxT3PDU) || !bytesToSend`

  - `transmitT3PDU`
    - `frameSize = 0; If (Retries=0) Sequence++; Transmit T3PDU; Start ackTimer`

  - `!bytesToSend`

  - `bytesToSend && (ackReceived || Retries >= maxRetries)`

- `healthTimer expired`

- `transmitT3HealthPDU**`
  - `Store healthTLV in PDU`
  - `Sequence++`
  - `Transmit T3PDU`

  - `(Retries < maxRetries) && (!ackReceived) && ackTimer`

** What should we do if the health check dies?
**Receive Side**

**Receive & Enqueue TLV State Machine**

1. **initReceive**
   - lastSequence = 0;

2. **T3PDU received**
   - seqT3PDU = sequenceOf(T3PDU);
   - seqT3PDU > lastSequence
     - sendACK
     - if (!healthT3PDU)**{ enqueuteLVsToApps(T3PDU) sendAcknowledgement(seqT3PDU) }
     - lastSequence = seqT3PDU

3. **seqT3PDU <= lastSequence**
   - resendACK
   - UCT

4. **UCT**
   - sendAcknowledgement(seqT3PDU)