IEEE P802.1ABdh Update to LSVP
(Note: P802.1ABdh == LLDPv2)

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Background - References

- Previous update at IETF-105 with previous background – July 2019
  - https://datatracker.ietf.org/meeting/105/materials/slides-105-lsvr-2-ieee-lldpv2-update
- IEEE 802 approval to start P802.1ABdh – Standard for Local and Metropolitan Area Networks - Station and Media Access Control Connectivity Discovery Amendment: Support for Multiframe Protocol Data Units – September 2019
  - https://standards.ieee.org/project/802_1ABdh.html
- Most recent technical proposal was presented in September 2019
  - http://www.ieee802.org/1/files/public/docs2019/dh-bottorff-alt-0919-v4.pdf
- Draft to define IETF TLVs for LSVR intended to be carried by LLDPv2
  - https://tools.ietf.org/html/draft-congdon-lsvr-lldp-tlvs-00
- Call for Participation press release by IEEE 802 - TBD

Technical changes since IETF-105 update

- Terminology and definitions
- Manifest definition changes to support larger databases
- Review of Shared Media worst case scenarios (see IEEE contribution)

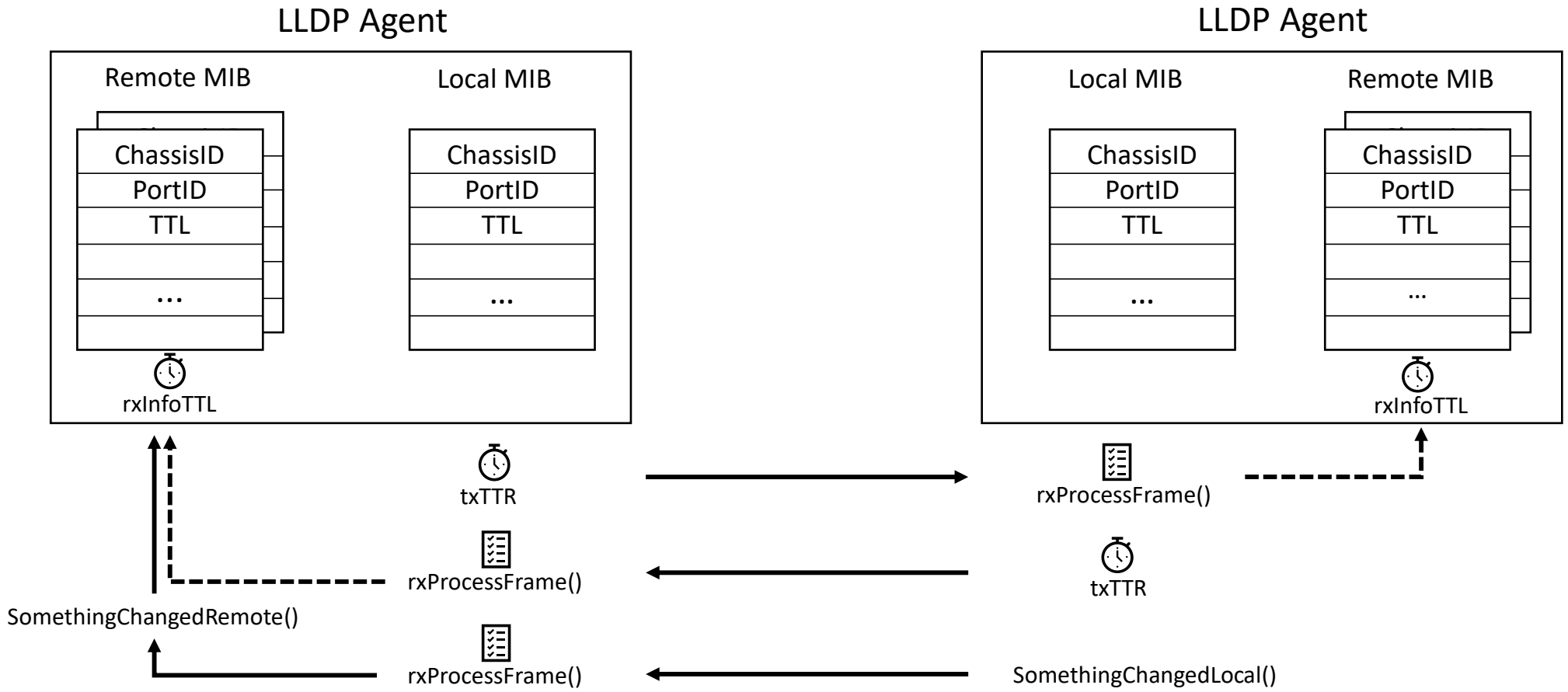
Objectives for New LLDPv2 Method

- Support LLDP databases larger than a single frame
  - Optimize LLDPv2 for databases around 100K bytes
  - For reference IETF currently believes database sizes around 64K bytes are sufficient
- Support the ability to limit the LLDP frame size to meet timing constraints imposed by some TSN applications
  - Do we need to split TLVs over multiple PDUs?
  - How big do these databases need to be?
- Support the ability to communicate with an LLDPv1 implementation
  - Only the LLDPv1 database would be exchanged between and LLDPv1 and LLDPv2 implementation
- Support shared media, optimize for point-to-point though allows shared
  - Duplicate MAC addressing should be handled by the extension protocol
- Ensure the integrity of the full set of TLVs received by partners
  - Do we also need to provide a means to authenticate the LLDP database? The IETF has this requirement.

Objectives for New LLDPv2 Method

- Support pacing of PDUs to receivers to prevent overloading low level network firmware
  - Historically OSPF and IS-IS have had problems from lack of flow and congestion management
- Reduce network traffic by reducing periodic transmission to the minimum
  - Only update the foundation LLDPv1 PDU periodically
  - Extension PDUs are only transmitted/updated on demand from receivers
  - Update extension PDUs only when they have changed
- Other optimizations and considerations which might be useful
  - Computational load requirements for LLDPv2 receivers to update and validate PDUs
  - Larger TLVs or is using multiple TLVs appears sufficient
  - TLVs spanning multiple extension database PDUs, is this required for TSN
  - Database authentication, is high want for IETF and other applications
    - Part of separate authentication extension
    - Key exchange requirements

Current LLDP operation reminder



NOTE: Think of the Remote and Local MIBs as a database that must fit into a single PDU
Replace all values of the Remote MIB with contents of LLDPDU when something changes

Proposal: Foundation PDU (F-PDU)

- The current LLDPv1 PDU with a Manifest TLV is the foundation PDU (F-PDU)
- The foundation PDU is exchanged using the existing LLDPv1 protocol without modifications
- All databases are created as LLDPv1 databases, no extension PDUs create new databases
- An extended LLDP database is composed of the foundation PDU and n-1 extension PDUs
- A manifest TLV placed in the LLDPv1 foundation PDU identifies all extension PDUs
- If no manifest TLV is present in the foundation PDU then no extension PDUs exist for the LLDP database
- The upper limit to the number of PDUs is determined by the LLDPv1 TLV size limit (512) and the format of the manifest TLV
  - Note: When we have a small max PDU size the manifest TLV size can be further limited resulting in limiting the database size
- The manifest TLV carries an identifier for each extension PDU
- Any change in an extension PDU is reflected as a change in the manifest TLV, therefore any change in an extension PDU will result in a change to the foundation PDU

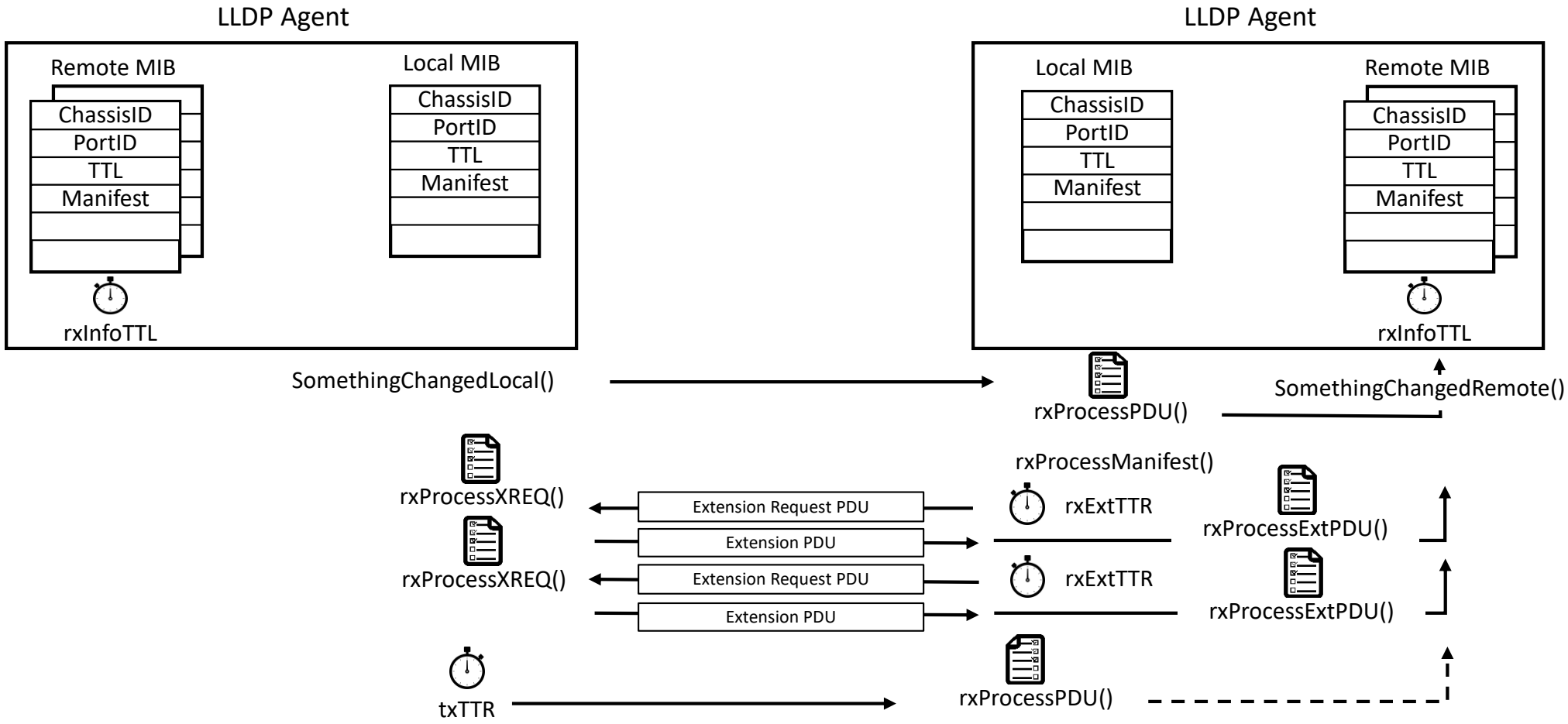
Proposal: Extension PDUs (X-PDUs)

- The extension LLDPDU will be ignored by LLDPv1
  - An alternate Ethertype is used for LLDPv2 PDUs to guarantee PDUs are never directed to LLDPv1
- Each extension PDU has three mandatory TLVs in the beginning of the PDU:
  - Each extension PDU contains the first two mandatory TLVs of a LLDPDUv1 (ChassisID + PortID)
  - Each extension PDU contains a new extension TLV that identifies the PDU
  - Before an extension PDU is added to a database it's {ChassisID, PortID, ExtensionID} must match the manifest TLV
- Each extension PDU is transmitted as a unicast in response to a receiver request
  - Extension PDUs are only transmitted in response to requests
  - The DA of an Extension PDU is the SA of the request
- The TTL in foundation PDU relates to all extension PDUs

Proposal: Extension Request PDU (XREQ-PDU)

- The extension Request PDU will be ignored by LLDPv1
  - An alternate Ethertype is used for LLDPv2 PDUs to guarantee PDUs are never directed to LLDPv1
- Each extension request PDU has three mandatory TLVs in the beginning of the PDU:
  - Each contains the first two mandatory TLVs of a LLDPDU (ChassisID + PortID)
    - However the ChassisID and PortID are for the destination rather than the source
  - Each contains a new extension request TLV that identifies the PDUs a list of extension PDU to be transmitted
- An extension request (XREQ-PDU) is sent between peers to request transmission of an extension PDU
  - The LLDP extension protocol supports multiple peers on a shared media
  - Transmission of X-PDUs is only in response to an XREQ-PDU generated by the receiving system
  - A receivers requests X-PDU transmission when it determines the current X-PDU does not match the manifest TLV
  - Receivers can have only a single XREQ-PDU pending at a time
  - A single XREQ-PDU can request transmission of multiple X-PDUs
  - The receiver controls the transmission rate by controlling the number of X-PDUs requested and the timing between XREQ-PDUs
  - Receivers time out the requested X-PDU responses
  - Transmitters periodically send the foundation F-PDU which can update the manifest TLV in turn resulting XREQs for X-PDUs
- Each extension request PDU is transmitted as a unicast
  - The DA of an extension request PDU is the SA of the foundation PDU

LLDP Extension Operation Proposal: Receiver Pacing



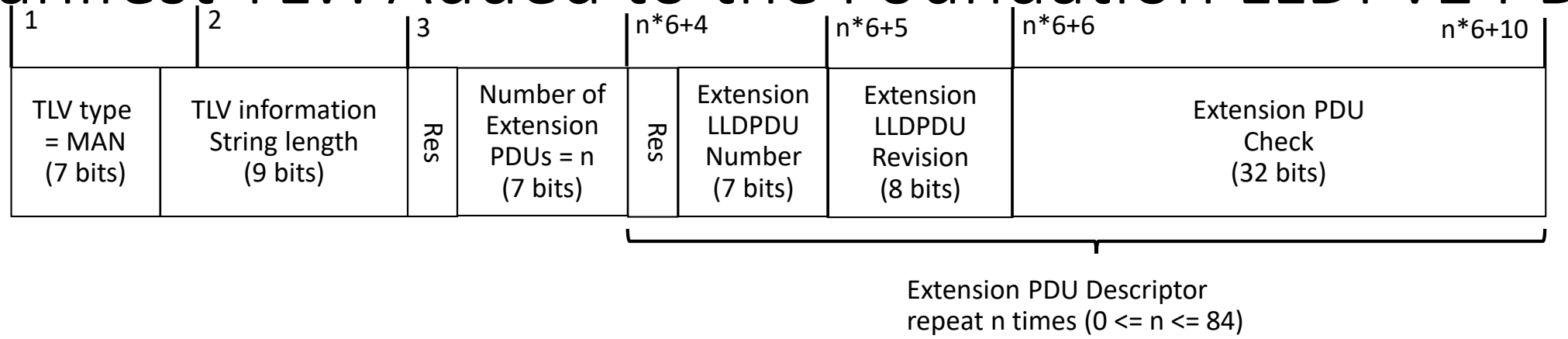
NOTE: Send LLDPDU as specified by LLDPv1 when something changes and periodically
Only send extension LLDPDU when explicitly requested by a XREQ
Only issue XREQ when manifest shows the local copy is out of date

LLDPv2 Project (P802.1ABdh) Next Steps

- Continued technical contributions
  - Would love to have an Open Source implementation for evaluation
- Review areas of change to IEEE Std IEEE 802.1AB-2016 (aka LLDP)
- Initial draft by an individual contributor
- Assign editor in 802.1 Working Group

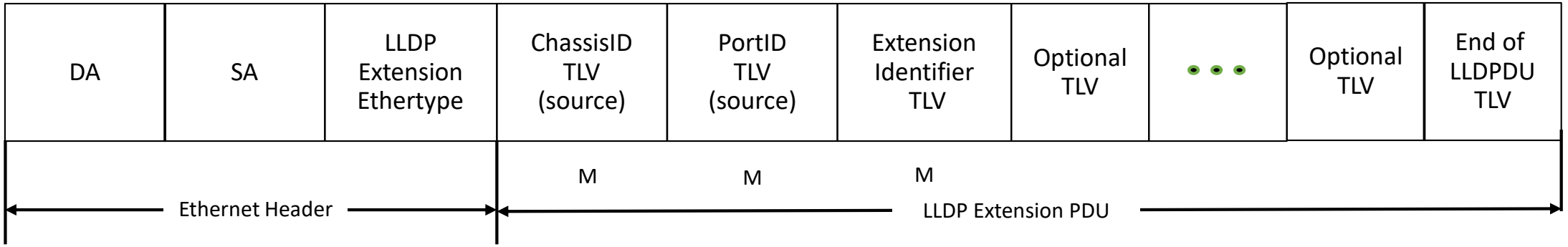
Backup - Details

Manifest TLV: Added to the Foundation LLDPv1 PDU



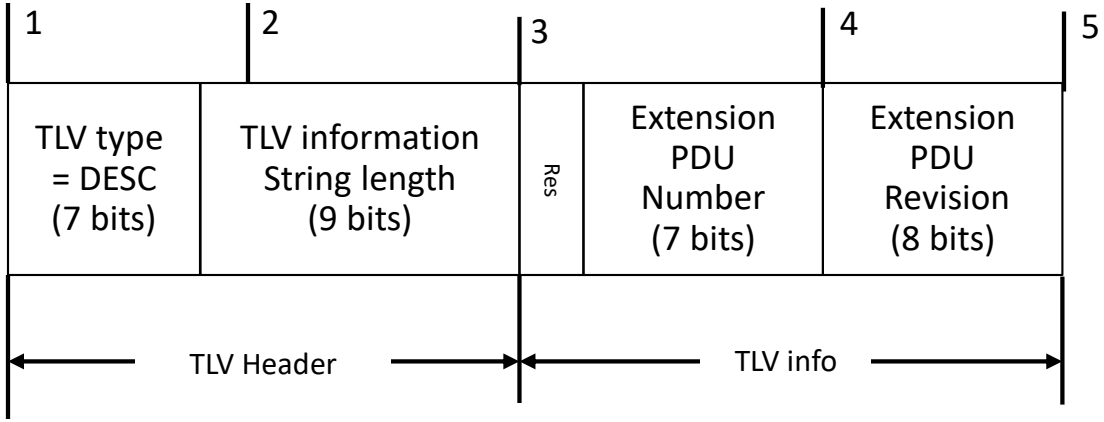
- Number of extension PDUs indicates the number of valid PDU descriptors in the manifest
  - Some implementations may fix the manifest TLV size however load it with a variable number of PDUs
  - If we don't need to hold the manifest TLV size constant, then the TLV length is sufficient to determine the number of manifest entries
- Each Extension PDU is identified by a:
  - Extension LLDPDU number, this number is included in the manifest to facilitate PDU deletion and insertion
  - Extension LLDPDU revision, updated modulo 256 on every change to the extension LLDPDU
  - Extension LLDPDU check: for example 32 bits of MD5

Format for LLDP Extension PDUs (X-PDU)



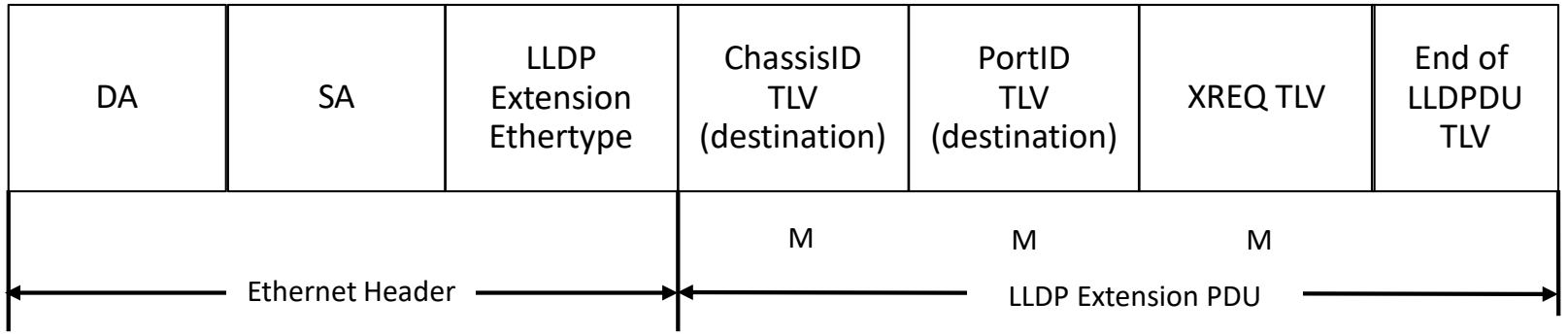
- LLDPv2 Ethertype
  - New LLDPv2 Ethertype for Extension PDUs prevents conflict with LLDPv1
  - Extension PDUs are identified by the presence of the Extension Desc TLV
  - Since extensions are not multicast and only delivered on request no new Ethertype is required, though one could be used if desired
- Chassis ID + Port ID are mandatory
  - The Chassid ID and Port ID of the PDU source
  - Note TTL from 1st PDU should apply and is not needed here
- Extension Identifier TLV is mandatory and must be the third TLV
  - Identifies this Extension PDU, the PDU revision

Extension PDU Identifier TLV (XID TLV):



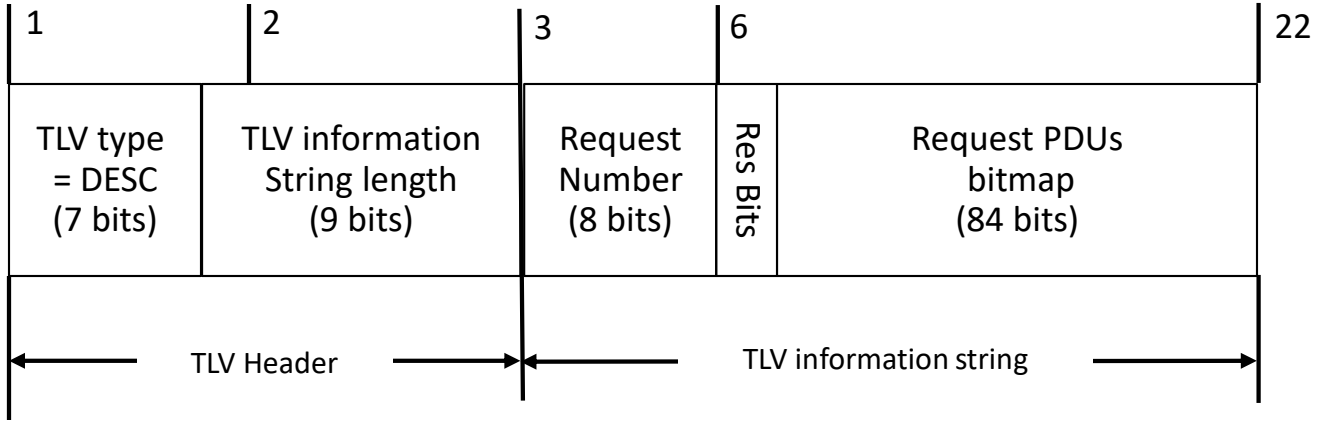
- Extension PDU Number is the designation number for this PDU
  - The PDU number is in the range from 1 – 84
  - Matched to the manifest extension PDU number
- Extension PDU revision number
  - Incremented modulo 256 whenever the extension LLDPDU is changed
  - Matched to the manifest to guarantee the extension LLDPDU is the one represented in the manifest
- Note the extension PDU check code is not carried in the Extension TLV and so must be calculated to match the manifest check code

Request For Extension PDUs (XREQ-PDU)



- LLDP Extension Ethertype
  - New LLDP Ethertype for Extension PDUs to prevent conflict with LLDPv1 implementations
- ChasssisID and PortID TLVs are mandatory in a Request for Extension PDU
  - ChassisID is the first and PortID is the second TLV in the PDU
  - Unlike a standard LLDPDU the ChassisID and PortID identify the destination not the source
- Extension Request TLV is mandatory in a Request for Extension PDU
  - The Extension Request TLV is the third TLV in the PDU
  - Request PDUs are identified by the presence of the Request for Extension TLV

Extension Request PDUs TLV (XREQ TLV)



- Extension Request PDUs
  - A given chassis/port may only have a single XREQ TLV pending at a time
  - Multiple XREQs PDUs may be used to pace the PDUs at the receiver by withholding XREQs
  - A single XREQ PDU may request multiple Extension PDUs if the receiver has sufficient buffer for them
  - The bit map is used to identify the list of Extension LLDPDUs by number
    - The index to the bit map identifies the Extension LLDPDU number
- Extension LLDPDUs are not multicast, instead they are unicast
  - The extension LLDPDUs are sent to the SA address within the foundation LLDPDU
  - On a shared media each individual LLDP Agent must provide independent requests for extension frames
  - This allows the individual receivers to pace PDUs at rates that match their ability to handle the reception