Multicast for Package A

Glen Kramer, Broadcom
Why do we need this change?

- Multicast specifications in DPoE 2.0 and in SIEPON-A have diverged.

- Several issues were discovered with DPoE Multicast specification.
  - Refer to presentation “Motivation For Changes to Package A (and DPoE) Multicast” by Curtis Knittle to understand problems with current multicast provisioning

- This MR will fix the technical issues and restore the alignment between DPoE 2.0 and in SIEPON-A.
Many Levels of Multicast in EPON

Inter-ONU multicast
- Uses multicast LLID to deliver a copy of a frame to multiple ONUs
- Has no impact on what happens to the frame within ONU
- Managed by EPON eOAM

Intra-ONU multicast
- ONU replicates a frame to multiple UNIs
- Frames may be classified by any fields (L1, L2, L3, L4,...)
- Frames may arrive on unicast or multicast LLID
- Managed by EPON eOAM

IP multicast
- RGW replicates IP packets to multiple ports
- RGW may be an IGMP client or may act as IGMP proxy
- Managed by TR-069 (?)

Multicast management of RGW is out of scope for this presentation
Multicast LLID configuration currently uses two messages:
- Multicast LLID Registration (Opcode = 0x06) OAMPDU assigns a multicast LLID to a D-ONU or deletes it from a D-ONU.
- Multicast LLID Registration Response (Opcode = 0x07) is sent by the ONU to confirm the operation.

These messages are sufficient, however they provide no mechanism for the host to query what multicast LLIDs are currently configured in a given ONU. In current spec, an ONU can be queried re. the unicast LLIDs, but not the multicast LLIDs.

Proposal: It would be a much better approach to define a multicast LLID attribute (amulticastLLID) and a TLV and use it with the generic GetRequest and SetRequest OAMPDUs.
- Consistent with how other parameters are configured.
- Allows querying the ONU to determine which multicast LLIDs are already set.
Intra-ONU Multicast Configuration

Proposal:
Use existing Ingress Rule attribute (0xD7/0x05-01) to configure Intra-ONU Multicast Forwarding

1. Ingress Rule attribute allows chaining of multiple ‘results’, including the directive to forward to specific port/queue.

   IF
   
   Clause 1 and
   
   Clause 2 and
   
   Clause 3
   
   THEN
   
   Result: QUEUE {object type, object instance, queue number} and
   
   Result: QUEUE {object type, object instance, queue number}

2. Ingress Rule attribute allows matching of a frame against many field types.

   • 0x00: LINK_INDEX field
   • 0x01: DA field
   • 0x02: SA field
   • 0x03: ETHER_TYPE_LEN field
   • 0x04: B_DA field
   • 0x05: B_SA field
   • 0x06: I_TAG field
   • 0x07: S_TAG field
   • 0x08: C_TAG field
   • 0x09: MPLS_LSE field
   • 0x0A: IP_TOS_TC field
   • 0x0B: IP_TTL_HL field
   • 0x0C: IP_PT field
   • 0x0D: IPv4_DA field
   • 0x0E: IPv6_DA field
   • 0x0F: IPv4_SA field
   • 0x10: IPv6_SA field
   • 0x11: IPv6_NEXT_HEADER field
   • 0x12: IPv6_FLOWLABEL field
   • 0x13: TCP_UDP_SP field
   • 0x14: TCP_UDP_DP field
   • 0x15: B_TAG field
Ingress Rules can match a frame based on many fields, including “**LLID Index**”. LLID Index represents the local index of the logical link instantiated on the ONU. For example, for an ONU supporting 8 LLIDs, the value of LLID Index would range from 0 to 7.

But multicast LLIDs are assigned to ONUs by value. The same multicast LLID would have different indices in different ONUs.

To match multicast traffic against the multicast LLID value, a new field code should be added to Table 14-220 to represent “**LLID Value**”
Intra-ONU Multicast Options

- Port-based Intra-ONU multicast control
  - If the OLT knows to which UNIs the multicast clients are connected, it can configure an ONU to forward multicast traffic to these exact ports.

- MAC-based Intra-ONU Multicast Control
  - If the OLT knows only multicast clients’ MAC addresses, it needs the ONU to map these addresses to specific UNIs.

- Different UNIs may have different numbers of egress queues. OLT should be able to specify which queue to use at each UNI for the given multicast group.
  - This is easy to accomplish in Port-based multicast control because the OLT knows queue configurations for each UNI and it knows which UNIs are part of a given multicast group.
  - But in case of MAC-based Multicast Control, the OLT does not know apriori which UNIs are part of a given multicast group, so it cannot specify the proper queues.
Define an attribute *aLearnedMacPort* that will allow the OLT to query the port number on which a specific MAC address was learned.

When the OLT receives a request to add MAC address X to a multicast group, it first queries the ONU to find out on which port MAC address X was learned and then uses Port-Based Multicast Control method (Ingress rule TLV).

These sequences are identical.
Modify Multicast specifications in SIEPON-A as follows:

1. Replace *Multicast LLID Registration* and *Multicast LLID Registration Response* messages with a `aMulticastLLID` attribute that is to be used with the generic `GetRequest` and `SetRequest` messages (see slide 5).

2. Remove *Static IP Multicast Control* message. Specify the implementation of port-based intra-ONU multicast using the existing `Ingress Rule (0xD7/0x05-01)` and a new field code for “LLID Value” (see slides 6 and 7).

3. Specify the implementation of NAC-based intra-ONU multicast control as a 2-step process using a new read-only attribute `aLearnedMacPort` and the existing `Ingress Rule (0xD7/0x05-01)` (see slide 9).
Thank You