MPLS Labels: Upstream/Downstream-Assigned?

Jeffrey Zhang, Juniper Networks

IETF122, Bangkok

Why This Discussion?

- The interpretation of label-assignment mode per RFC5331 is causing some issue/confusion for Domain-wide Common Block (DCB) labels
  - RFC9573
- I will start with similar SRGB labels
  - That people have taken for granted as downstream-assigned
  - But the interpretation per RFC5331 may be ambiguous
- I will then talk about the DCB labels situation
  - And a proposal

RFC 5331 Definition

- Ru: an upstream LSR   Rd: a downstream LSR
- Ru and Rd agreed to bind Label L to a FEC F for packets from Ru to Rd
- Downstream-assignment: the binding was made by Rd and advertised to Ru
- Upstream-assignment:
  - The binding was made by Ru and advertised to Rd, or,
  - The binding was made by a 3rd party, say R3, then advertised to Ru and Rd

Are SRGB Labels Downstream-Assigned?

- Yes, and it conforms to RFC 5331 in this way:

  … Therefore, an
  upstream-assigned label MUST always be looked up in a context-specific label space...

- The SRGB labels are installed and looked up in the default LFIB

But …

- The binding is not made by Rd
  - So it is not exactly covered by RFC5331
  - It is not explicitly stated in RFC8402 either
- It is made by a 3rd party and advertised to Ru and Rd
  - By the FEC (SID) owner
    - RFC5331 does not care the FEC owner though – it only cares about RU and Rd
- Could one argue that an SRGB label is upstream-assigned?
- We are not really worried here though
  - Everybody accepts that they’re downstream-assigned
    - They are installed in the default label table and the lookup is done there

DCB Labels

- A DCB is like an SRGB that is identical on all routers
  - The new name DCB is used to apply to non-SR cases as well
- An operator binds a DCB label to a particular VPN, Broadcast Domain (BD), or Ethernet Segment (ES) consistently on all PEs
  - The RFC9573 use case
- An ingress PE advertises that it uses the DCB label for some multicast flows and sends packets with the label
  - The egress PEs install the label and look it up in the default LFIB
- It is considered as downstream-assigned by RFC9573 co-authors
  - Though not explicitly stated as such
  - Just like the SRGB case

The Problem

- When the packets are encapsulated in a BIER header (followed by the VPN/BD/ES-identifying DCB label), the BIER header’s proto field needs to be set properly – to 1 (for downstream-assigned labels) in this case
  - Per the RFC 9573 design (and RFC8296 specification for BIER-encap)
- RFC9573 does not explicitly state that they’re downstream-assigned
  - It does mention the DCB is carved from the default label space
- Some implementations set it to 2 (in pre-production interop-testing code)
  - And it takes quite some effort to reach consensus

Proposal

- Redefine what is upstream/downstream-assignment
  - Based on the label space from which it is (hence where the lookup is done)
- If a label is from Rd’s default label space and installed in its default LFIB where the lookup is done, it is downstream-assigned. Otherwise, it is upstream-assigned
- This does NOT change the existing semantics and implementations
  - But it does help remove the confusions
- This seems to be the simplest and most definitive rule

Thoughts?

- Or stop using the upstream/downstream-assignment terms?
- But some RFCs do use the terms, and it is important
  - RFC8296 (BIER Encapsulation), "BIER Next Protocol Identifiers“:

    1: MPLS packet with downstream-assigned label at top of stack

    2: MPLS packet with upstream-assigned label at top of stack
  - We could consider updating RFC8296 to say:

    1: MPLS packet with top of stack label to be looked up in the default LFIB

    2: MPLS packet with top of stack label to be looked up in the context-specific LFIB for the BFIR
  - There could be more RFCs like that …