BGP -CAR/-CT
Interoperability Proposal

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What’s covered/not-covered

Covered:
- Forwarding behaviors, except for -CT SRv6 procedures that are undergoing update.
- Mapping NLRI keys.

Not Covered:
- Filtering. (-CAR procedure remains TBD, -CT is RT-Constrain vs. Transport Class Extended Community)
- VPN-CAR - -CT doesn’t have a similar procedure.
Forwarding Behaviors

• Both proposals cover three forwarding behaviors:
  • Label Stack, comparable to BGP-LU
  • SR Label Index
  • SRv6

• BGP-CT utilizes same procedures as BGP-LU for each of these.

• BGP-CAR covers the same, but with their optimizations to carry a portion of the forwarding behavior information in the non-key portion of the NLRI.

• These cleanly map and will not be further discussed in this presentation. The details are in the draft.
NLRI Keys

- In BGP-CAR, the NLRI key is Endpoint (IP Prefix) + 32-bit Color.
- In BGP-CT, the NLRI key is Route Distinguisher + Endpoint (IP Prefix)
Where’s the Color?

**BGP-CAR:**

- The NLRI key contains the color and is the *original intent*.
- When the Local Color-Mapping Extended Community (LCM) is present, the *effective color* is the LCM. Absent the LCM, the NLRI key contains the *effective color*.

**BGP-CT:**

- The Transport Class Extended Community contains the color.
What does interoperability mean?

• Question: For a given protocol’s BGP Route (Endpoint, Color, Forwarding Behavior, Path Attributes), can we create from the foreign protocol create routes representing this same state?

  Will route selection consistently work for native and foreign routes within a given RIB?

• Answer: Yes. The foreign protocol can be *mapped* into the native protocol.

  This mapping operation behaves with similar functionality to BGP VPNs where CE routes are carried as VPN routes, and vice-versa.
What needs to be mapped?

• Each protocol has a sense of *original intent* that is to be carried end-to-end. That intent is largely an operational construct:
  • BGP-CAR carries a color as its original intent. Effective color may be the color carried in the NLRI, or the LCM when that is present.
  • BGP-CT’s Route Distinguisher doesn’t have a strong “original intent” sense as BGP-CAR, but it is what needs to be preserved as original intent across mapping/unmapping operations.
• Put a different way, it’s what you do route selection on in your RIB on a hop-by-hop basis.
An example interop topology

CT Domain 1 --- CAR Domain 1 --- CT-Domain 2 --- CAR Domain 2

Domain boundaries are likely (but not required to be) ASBRs.

Mapping can happen on send, or on receive and will work regardless of direction.
Mapping nomenclature

• When a BGP-CAR route carries BGP-CT original intent, it is a “CAR-mapped-CT route”.
• When a BGP-CT route carries BGP-CAR original intent, it is a “CT-mapped-CAR route”.
Mapping Machinery

• **RD-Color Route Distinguisher Format:**
  Used by BGP-CT to carry the BGP-CAR route’s original intent (NLRI color)

• **Classful Transport Original RD Extended Community (CTORD):**
  Used by BGP-CAR to carry the BGP-CT route’s Route Distinguisher.

• **Classful Transport Original Intent Extended Community (CTOI):**
  Used by BGP-CAR to carry the BGP-CT route’s original Transport Class, and preserves it no matter how many times it is rewritten.

The two pieces of state encoded as Extended Communities could go into a new Path Attribute as a different option. (Compare vs. RFC 6368 ATTR_SET.) This machinery is envisioned to be run by the software, not from operator policy.
Mapping CT routes into CAR (CAR-Mapped-CT routes)

CAR, as the native protocol, receives a foreign CT route.

1. If there is no Classful Transport Original Intent Extended Community, add one containing the Transport Class. If one already exists, preserve it in its current state since it’s gone through a mapping at least once.

2. Set the Classful Transport Original RD Extended Community from the CT route’s Route Distinguisher.

3. The CAR NLRI color is set to the Transport Class value.

4. The CAR NLRI endpoint is set to the CT NLRI endpoint.

5. The Transport Class Extended Community is deleted.
Unmapping CAR-Mapped-CT routes into CT

CT as the native protocol receives a CAR-MAP-CT route

1. The CT route’s Route Distinguisher is set to the Transport Class Original RD Extended Community, and that Extended Community is then deleted.

2. The CT route’s Transport Class Extended Community is set to received CAR route’s effective color. (Note: Error in I-D.)

3. The Transport Class Original Intent Extended Community is preserved. This permits subsequent CAR mapping operations to always use the same NLRI color value across the deployment.
Mapping CAR routes into CT (CT-Mapped-CAR routes)

CT, as the native protocol, receives a CAR route

1. The CT routes Route Distinguisher is the RD-Color encoding of the CAR NLRI color. (Preserve the original intent.)

2. The CT Transport Class is set to the CAR route effective color. (Carry the effective color.)

3. Delete the LCM Extended Community, if present.
Unmapping CT-Mapped-CAR routes into CAR

CAR as the native protocol receives a CT-MAP-CAR route

1. The CAR NLRI color is set to the RD-Color value.

2. If the color value contained in RD-Color is different from the Transport Color, an LCM Extended Community is created with the Transport Color value.

3. Delete the Transport Color Extended Community
Consistency of Route Selection

• On a given BGP Speaker, the “native” mode needs to be selected; e.g. BGP-CAR/BGP-CT.

• The native RIB for that protocol is where all routing state is absorbed and where route selection occurs.

• The best path from that RIB is used to populate the route resolution tables. (CAR and CT follow same resolution procedure.)

• This best path also needs to be the best path in the foreign protocol’s RIB for propagation purposes.
Thoughts on a merged solution

• The RD-Color Route Distinguisher format can carry a color as “original intent”.

• If the NLRI key were RD + Endpoint (in either order), -CAR and -CT style “original intents” can be carried end-to-end with no need for mappings.

• The only interesting differentiator is what to do about how to encode the forwarding behaviors
Carrying the Forwarding Behaviors

- CT has the issue that a mandatory Label may be inappropriate for some styles of encoding for SRv6.
- CAR optional NLRI keys put additional data between the key portion and the non-key. RFC 7606 wisdom tells us we want this as boring as possible.
- Allowing per-NLRI information can be helpful for packing, but not universally.
Carrying the Forwarding Behaviors

• Stick with CAR encoding?
• A new nexthop type since these are nexthop behaviors?
• Carry the per-NLRI attributes in a new BGP Update format? Compare vs. draft-ietf-grow-bmp-tlv “NLRI index” proposal.
Questions?