BGP Color-Aware Routing (CAR) Problem Statement

draft-dskc-bess-bgp-car-problem-statement

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BGP Color-Aware Routing - Objective

• Define BGP based routing solution to establish end-to-end intent-aware paths across a multi-domain service provider network environment
  – Intent: Example – low-latency
Reminder – Deployed Solution

• SR-TE
  – ietf-spring-segment-routing-policy
  – Mature, widely deployed, multiple implementations
  – Defines notion of Color to represent intent
Colored Service Route Signaling from E3 to E1

- Key point: E1 learns about the “intent” (here for underlay SLA) requested by a route via its color.

- The VPN route is said to be “colored” (<> color-aware).

- Color is widely supported BGP Color Extended-Community.
Automated Steering via SR-TE Color-Aware Path

- When E1 receives a Colored Service route from E3
- E1 requests its SR-PCE1 to compute the inter-domain path
- SR-PCE1 sends the SR Policy to E1 with label/SID stack
- E3, C is a Color-Aware Path in underlay that provides intent-based path to E3
• E3, C is a Color-Aware BGP route in underlay that provides intent-aware path to E3
Focus of Problem Statement Draft

• Clarity on deployment requirements
  – Compatibility, co-existence, interworking with deployed SR-PCE based solution
  – Color to drive automated steering

• Widened problem scope
  – Intent-aware VPN service layer
  – NFV Integration

• Clarity on Scale requirements and constraints
  – Data Plane (MPLS label space / FIB)
  – Control Plane (BGP) Filtering

• Crisp, technical analysis of intent use-cases and protocol requirements
Collaboration

• Collaboration with lead operators, vendors on analysis
  – Acknowledge many contributors in draft

• Recognize prior work
  – Seamless SR/Classful Transport

• Ongoing collaboration effort with SSR co-authors for consensus
  – Reached out through co-authors in Nov/Dec
  – Recognized prior publication on use-cases / illustrations
  – We published problem statement with analytical approach as contribution
  – SSR co-authors acknowledged feedback & split their document
  – Joint discussion progressing well for eventual partnership, new sets of documents
Next Steps

• Request review from Working Group
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New SAFl for BGP CAR

• Need for a new SAFl in BGP
  – Need ability to signal multiple instances of the same prefix for each color (i.e. intent)

• Solution draft describes the following aspects
  – Desired Data Model
  – Multiple encapsulations, their signaling and validation
  – Route resolution & steering mechanisms
  – Scale Characterization
  – Route Filtering
Data Model

- Prefix: IPv4/IPv6 (global scope)
- Color: Distinguishes different instances of a Prefix, per intent
  - Indicates the service/intent associated with the route
- Next Hop: as usual; reachability verified via routing control plane
- Encapsulation:
  - Support for state-of-art: MPLS label(s), SRv6 SID(s), IP etc
  - Support multiple encapsulations
  - AIGP Metric: for accumulation of intent-specific metric
CAR NLRI Proposal

- NLRI Key – E, C
  - E : IPv4 or IPv6 Endpoint Prefix (Network-wide Unique)
  - Color : 32-bit value (SR-TE Policy)

- Color distinguishes per-intent instances of same prefix
- Color also indicates intent provided by route
- Color is consistent across devices within a “color domain”
- Color is same as in BGP Color Extended-Community
- E (Prefix) is unique in inter-domain transport network (e.g., PE)
  - Makes E, C unique even if C is local to a color domain
Multiple Color Domains

• Local-Color-Mapping (LCM) Extended Community
  - Optional, used only if routes go across a color domain boundary
  - Color re-mapped and rewritten into receiving domain’s color at a color domain boundary

• CAR NLRI (E, C) is preserved e2e
Encapsulation

• Variable part in NLRI; rest in Attribute
  – Necessary for packing efficiency of BGP updates
  – Opportunity for clean design that is not constrained by 24-bit MPLS label field in the NLRI

• Validate data-plane availability of encapsulation before using
Scale Considerations

• Hierarchical Design
  – Hierarchical models avoid the need for core BRs to learn routes and install label forwarding entries for (E, C) routes
  – Analyze recursion and data plane complexity at ingress PE/BR

• Filtering
  – Ingress PE/BR only learns (E, C) routes that it needs to install into data plane
Next Steps

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