Interdomain Routing (IDR)

IETF-88, Vancouver
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Note Well

This summary is only meant to point you in the right direction, and doesn't have all the nuances. The IETF's IPR Policy is set forth in BCP 79; please read it carefully.

The brief summary:

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- If you are aware that a contribution of yours (something you write, say, or discuss in any IETF context) is covered by patents or patent applications, you need to disclose that fact.
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For further information, talk to a chair, ask an Area Director, or review the following:

- BCP 9 (on the Internet Standards Process)
- BCP 25 (on the Working Group processes)
- BCP 78 (on the IETF Trust)
- BCP 79 (on Intellectual Property Rights in the IETF)
Document Status

• The dog ate my homework
  – Well OK, my laptop has been broken all week
• Thus the chairs will send a document status update to the list next week.
Agenda

• Administrivia (Chair) 10 minutes
• draft-patel-raszuk-bgp-vector-routing-00 (Keyur Patel) 10 minutes
• draft-ietf-idr-aigp-10 last call issues (Eric Rosen) 15 minutes
• draft-ietf-idr-add-paths-09 (Jeff Haas) 10 minutes
• draft-haas-idr-flowspec-redirect-rt-bis-00 (Jeff Haas) 5 minutes
• draft-ietf-idr-sla-exchange (Shitanshu Shah) 5 minutes
• draft-wu-idr-te-pm-bgp-03 (Qin Wu) 5 minutes
• draft-li-idr-cc-bgp-arch-00 (Lizhenbin (Robin)) 10 minutes
BGP Vector Routing

draft-patel-raszuk-bgp-vector-routing-01

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Motivation

- Network Architectures require additional control over the traffic paths (Inter as well as Intra domain)
  - Need to force the traffic to go through one or more Transit Nodes
  - Transit Nodes could be a TE Node
  - Other examples include Service Nodes like: Firewall, NAT, Load Balancers, etc

- Need a **scalable control plane solution** to advertise “information” so that the traffic gets routed through an ordered set of Transit points before it is forwarded to its destination
  - In context of Transit points as Service Nodes it is known as “Service Chaining”. Otherwise it is known as “Traffic Engineering” (TE)
BGP Vector Routing

- BGP based mechanism to create arbitrary forwarding topologies as well as facilitate Service Chaining
  - Does not require changes to the forwarding plane
  - Assumes use of an existing encapsulation/tunneling techniques to forward data
- New BGP attribute known as a Vector Node attribute
- Vector Node attribute consist of one or more TLVs
  - TLVs carry ordered lists of IP Transit Hops that needs to be traversed before the packet is forwarded to its destination
  - TLV information is used to replace the NEXTHOP information when installing the route in RIB/FIB
- Two new TLVs defined as part of this draft
  - Type 1 and Type 2 TLV
- Rules to process and use TLV information of Vector Node Attribute
BGP Vector Routing (Cont’d)

- BGP Vector Node attribute can be applied to any BGP Address Family

- Creation of a BGP Vector Node attribute is outside the scope of the document
  - Assumed to be created using CLI on a router or using an Orchestrated system, or by some automated SDN policy computing engines

- Vector Node attribute is usually inserted at a single point in the network and advertised by BGP to all BGP speakers
BGP Vector Node Attribute TLVs

- **TYPE1 TLV** consists of a Vector Node address
  - Vector Node address is an address of a transit (services) router and is typically announced in an IGP protocol

- **TYPE2 TLV** consists of a Vector Node and a Service Node address
  - Vector Node address is an address of a Transit Services router and is typically announced in an IGP protocol
  - Service Node address is an address of a Service Appliance and is directly connected to Vector Node address and is not announced in an IGP. Alternatively Service Node Address could be a Local ID of a Transit Service Router pointing to an Appliance
  - Vector Nodes and Service Nodes may belong to a different Address Families

- Both the TLVs carry AS Number to facilitate Inter-AS announcements
BGP Vector Node Attribute Rules

- 4 Rules defined to process the BGP Vector Node Attribute
- 1\textsuperscript{st} Rule describes Vector Node attribute and AS Number Validation
  - Missing Attribute or a failing AS Number Validation results in use of a BGP address from BGP MP.REACH attribute or from a NEXT.HOP attribute (if BGP MP.REACH Attribute is NOT present) as a NEXTHOP address when adding a route to RIB/FIB
- 2\textsuperscript{nd} Rule describes a case where an AS Number Validation succeeds but a BGP Speaker Address (loopback or connected) is missing in the Vector Node Attribute
  - In such a case BGP Speaker should use the First TLV Vector Node address as a NEXTHOP address when adding a route to RIB/FIB
- 3\textsuperscript{rd} Rule describes a case where an AS Number Validation succeeds but a BGP Speaker Address (loopback or connected) is present in the Vector Node Attribute TLV
  - In such a case BGP Speaker should use the next eligible Vector Node address as a NEXTHOP address when adding a route to RIB/FIB
4th Rule describes a case where an AS Number Validation succeeds but a BGP Speaker Address (loopback or connected) is present as the Last Vector Node Attribute TLV address

- In such a case BGP Speaker should use the BGP address from BGP MP_REACH attribute or from a NEXT_HOP attribute (if BGP MP_REACH Attribute is NOT present) as a NEXTHOP address when adding a route to RIB/FIB
Questions?

Request WG to adopt the draft as a WG document.
AIGP Last Call Issues

• After almost 5 years, 5 implementations, and significant deployment, draft finally reaches WG last call

• So folks not directly involved read the draft for the first time

• Some interesting issues raised during LC, some controversy about how to address those issues

• Some F2F discussion seems worthwhile before finalizing

• Note: no objections raised during LC to “meat” of draft, i.e. to rules for computing and using the value of the AIGP attribute (semantics)

• Objections raised to error handling, encoding, “leakage protection” at admin boundaries, i.e., stuff that might impact “somebody else”

• Want to focus discussion on LC issues …
AIGP

- BGP Path Attribute: Accumulated IGP Metric of path to prefix
- Allows IGP metric to be major determinant of bestpath selection for BGP-distributed internal routes
  - Provisioning determines the set of prefixes to which AIGP gets attached
  - BGP becomes a sort of IGP for those prefixes
- **Must not leak** out past administrative boundary
  - **Not** an inter-provider metric
  - AIGP is non-transitive attribute, discarded when not recognized
  - By default, even if recognized, AIGP treated as unrecognized (discarded) on EBGP sessions
    - All admin boundaries are EBGP sessions (converse not true)
- For possible future expansion, attribute coded as list of TLVs, but only type 1 (*IGP distance*) defined
Error Handling for Malformed AIGP Attribute

• Not clearly specified in draft

• What’s best: *treat as withdraw*, or *discard attribute*?

• *Treat as withdraw* is default for attributes affecting bestpath selection
  - But AIGP is only to be used in scenarios where there is tunneling to the next hop; complete consistency not needed

• *Discard attribute* is therefore less disruptive way to handle malformed attribute

• *Discard attribute* is also very like what is done with an unrecognized transitive attribute

• Proposed resolution: use *discard attribute* as error handling method
Can the Non-Transitivity Break?

- R1---(ibgp)---ASBR1----(ebgp)----ASBR2
- AS containing ASBR2 uses AIGP
  - ASBR2 mistakenly sets the transitive bit on the AIGP attribute
  - ASBR2 mistakenly sends AIGP attribute to ASBR1
- ASBR1 does not understand attribute, sees transitive bit, forwards to R1 when really the attribute ought to be discarded
- R1 understands AIGP attribute and is provisioned to use it.
  - But now it mistakenly has received the attribute from across an admin boundary
  - Should R1:
    - Clear the transitive bit and forward the attribute (local repair)? Or
    - Discard attribute as malformed
  - Proposed resolution: discard attribute as malformed
    - Attribute isn’t supposed to be processed by R1 or forwarded any further
    - Restores the proper non-transitive behavior
TLV Encoding Issues

• Length field not specified “correctly”, shouldn’t include length of type and length fields
  • Too late
  • Sorry 😞

• What if attribute contains multiple type 1 TLVs?
  • Is this malformed, or should one of the type 1 TLVs be used and the others ignored?
  • Proposed resolution: do not treat as malformed, use the first one.
  • Other TLV types to be ignored if not recognized, of course.
Disabled By Default

• Default per-session settings:
  • Do not originate routes with AIGP
  • On EBGP sessions, discard attribute if received
  • So:
    • On EBGP sessions, attribute shouldn’t pass unless enabled on both sides
    • On IBGP sessions, attribute will pass if enabled on one side
  • Enough protection against leakage?
    • Think so; but controversial on mailing list.
  • Enough protection against errors?
    • Can’t protect against all errors
Capability Needed?

• Capability needed?
  • No, shouldn’t need a capability for every new (optional) attribute
Advancing add-path

Jeffrey Haas, et seq.
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add-path current status

• The base BGP add-path feature is well deployed and interoperable at this point:
  – Alcatel-Lucent
  – Cisco
  – Juniper
  – (and probably others...)

add*path)current)status
add-path concerns

• During the development of the add-path feature, there were a number of concerns about how the feature would behave from a route-selection standpoint.

• Those issues are much better understood these days. Many are documented in draft-ietf-idr-add-paths-guidelines.
eBGP and add-path

• draft-pmohapat-idr-fast-conn-restore is currently a NORMATIVE reference in the base add-path document.

• The Edge_Discriminator Path Attribute documented in that I-D is required for BGP to perform consistent path selection for eBGP routes distributed in Add-Path.

• There are no implementations of this feature?
Advancing add-path

• Operators are clearly seeing benefit from the add-path feature, even without the Edge_Discriminator feature.
• Introducing that feature has the usual incremental BGP deployment pain points.
• Should the feature be removed as a normative reference so the add-path feature can advance and get published as an RFC?
Discussion
draft-haas-idr-flowspec-redirect-rt-bis

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RFC 5575 Redirect Extended Community

“Redirect: The redirect extended community allows the traffic to be redirected to a VRF routing instance that lists the specified route-target in its import policy. If several local instances match this criteria, the choice between them is a local matter (for example, the instance with the lowest Route Distinguisher value can be elected). This extended community uses the same encoding as the Route Target extended community [RFC4360].”
The Issue

• A Route Target is not only the 6 bytes of Value field but uses the Type-high octet as a “format specifier”.

• The Flowspec RFC only shows a single type/sub-type allocated: 0x8008

• This has lead several implementers to the conclusion that you simply try out all RT types using the Value field.

• *This is not how the feature is deployed.*
The fix

• A small draft updating RFC 5575 noting that the type field for the Redirect Extended Community is used the same as the Route Target extended Community, just ORed with 0x80.

• IANA is requested to update its registry to make the appropriate allocations.
Inter-domain SLA Exchange

http://www.ietf.org/id/draft-ietf-idr-sla-exchange-02.txt

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Topics

- Take-away from IETF 86 (including feedback from tsvwg)
- Changes since IETF 86
- Implementation Report
- Next Steps
Evaluate re-use of existing IANA types
(This slide was presented at the IETF 86)

- RFC 5102 - IPFIX Information Element ids to represent Traffic Class (IANA Type = IPFIX Information Element Identifiers)
  Re-use only Element Id + Abstract data-type

- RFC5575 – BGP Flow Specification (IANA Type = Flow Spec Component Types)
  Limited set of traffic class

- RFC5975 – QSPEC Template (ref. QSPEC parameters)
  Parameter ID IANA type
  Limited set of traffic class
  Some of the parameters are irrelevant to SLA

  Feed-back from tsvwg: look at RFC2212 as a reference (RFC5975 inherits from)
Changes since IETF 86

- Re-use of IPFIX Element identifiers for Traffic Classifier Element [RFC5102]

- Rate profile using exactly same format as Tspec [RFC2212]

- Modification for proper and consistent use of Terminology
  Eg.,
  SLA parameter exchange is not same as establishing SLA
  Generalize terminology to support more use-case applicability
Implementation Report

- Implementation on multiple Cisco OS
  Supports use-cases (section “Deployment Considerations”) described in the draft

- Details of implementation report and inter-operability at

- Looking for more implementations
Next Steps?
BGP attribute for North-Bound Distribution of Traffic Engineering (TE) performance Metric
draft-wu-idr-te-pm-bgp-03

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Recap.

- TE performance related information is required by some external components (e.g., ALTO server, PCE server)
  - TE Performance information includes network delay, jitter, packet loss, bandwidths.
  - PCE Server can use network performance info as constraint for end to end path computation
  - ALTO server can gather and aggregate these dynamic network performance information and use these info to decide which endpoint to connect.

- TE performance can be hard to gather via ISIS or OSPF or need to gather using other means in some cases
  - Inter-AS PCE computation
  - Hierarchy of PCE
  - BGP
  - NMS/OSS
  ......

- A new general mechanism is needed to collect and distribute TE performance information
  - draft-ietf-idr-ls-distribution describes a mechanism to distribute link state and TE information using BGP
  - This draft uses BGP to share additional TE performance related information to external components beyond linkstate and TE information contained in [I-D.ietf-idr-ls-distribution]
New BGP TLV attribute for TE performance info

- [I-D.ietf-idr-ls-distribution] defines new BGP path attribute (BGP-LS attribute) to carry link, node, prefix properties.
- This draft reuses existing BGP-LS attribute and defines 7 new TLVs that can be announced as BGP-LS attribute used with link NLRI.
- These BGP TLVs populate the following network performance information:
  - Unidirectional Link Delay
  - Min/Max Unidirectional Link Delay
  - Unidirectional Delay Variation
  - Unidirectional Packet Loss
  - Available bandwidth
  - Unidirectional Residual Bandwidth
  - Unidirectional Available Bandwidth
  - Unidirectional Utilized Bandwidth
- These network performance information carried in BGP TLV is same as one in IS-IS Extended Reachability TLV [I.D-ietf-isis-te-metric-extensions-00]
- The format and semantics of the 'value' fields in these BGP TLVs is same as one defined as sub TLV of IS-IS Extended Reachability TLV.
Update after IETF 87

• Complimentary to [I-D.ietf-idr-ls-distribution]
• Changes compared to (v-01)
  – Remove new metric ‘channel throughput’ from this draft based on discussion with ISIS-TE-extension draft authors
  – Move new metric ‘link utilization’ to [I.D-ietf-isis-te-metric-extensions-01] and define it as ‘unidirectional utilized bandwidth’ Sub TLV of IS-IS Extended Reachability TLV
  – Change metric name and add “Min/Max Unidirectional Link Delay” as a new metric to get inline with [I.D-ietf-isis-te-metric-extensions-00 ].
  – Add ‘unidirectional utilized bandwidth’ as seventh metric carried in new BGP TLV.
  – Add 'Anomalous' bit in the BGP TE performance TLV to indicate whether performance is in steady state.

• Thanks Hannes for arranging an offline discussion after Berlin meeting with ISIS-TE-extension authors on why two additional attributes should be added into IGP draft.

• New coauthors
  – Stefano Previdi
  – Hannes Gredler
  – Saikat Ray
Next Step

• Any comments?
• Request WG adoption
An Architecture of Central Controlled Border Gateway Protocol (BGP)
draft-li-idr-cc-bgp-arch-00

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IETF 88, Vancouver, BC, Canada
Introduction

- As the Software Defined Networks (SDN) solution develops, BGP is extended to support central control.
- This document introduces an architecture of using BGP for central control.
- Some use cases under this new framework are also discussed. For specific use cases, making necessary extensions in BGP are required.
Architecture -- Reference Model

Figure 1: An Architecture of Central Controlled BGP

- BGP Controller controls all the BGP Clients within its administrative domain by communicating with them.
- BGP sessions are also set up between multiple BGP controllers.
BGP Controller and BGP Client can run on a general-purpose server or a network device.

It is more meaningful to decouple control plane and forwarding functionality on BGP Client because this manner enables network devices focusing on forwarding functionality.
Architecture -- Protocol Extensions

• Building Connectivity:
  – Connectivity between BGP Controller and BGP Clients in an AS can be built by extending IGP protocol.
  – In order to simplify network operations, such connectivity SHOULD be automatically established.

• Roles Auto-Discovery:
  – BGP Controller and BGP Client roles can be auto-discovered by extending IGP protocol to flooding the role information within an AS.
  – When IGP has finished the flooding process of role information, BGP Controller and BGP Client can establish a BGP session on demand.

• Capability Negotiation:
  – In order for BGP Controller and BGP Client to support BGP-based Central Controlled framework in a friendly way, this document suggests to defines a new BGP Central Control Capability.

• High Availability:
  – To void one-point-failure of BGP Controller, it is possible to run redundant BGP Controllers for high availability.

• Security
Use Cases

In BGP-based Central Controlled framework, new use cases are emerging:

• Network Topology Acquisition
  – BGP has been extended to distribute link-state and traffic engineering information.

• Simplifying Network Operation and Maintenance
  – By using I2RS APIs, it would allow network operator to setup BGP policy configuration and apply route policy easily from an central point.
  – In the new Central Controlled framework, VPN Service can be deployed rapidly according to business requirements. More detailed description could be found in [draft-li-l3vpn-instant-vpn-arch-00].
Use Cases (Cont.)

• **MPLS Global Label Allocation**
  - MPLS Global Label should be allocated in a central point to guarantee all distributed network nodes can understand meaning of a specific global label in same.
  - The new BGP-based Central Controlled framework is particularly suitable to allocate MPLS Global Label for services deployed on the network edge nodes.
  - [draft-li-mpls-global-label-usecases-00] proposes the use cases: 1) Identification of MVPN/VPLS, 2) Local Protection of PE Node, 3) Segment-Based EVPN, etc.

• **RR-Based Traffic Steering**
  - RR-based Traffic Steering (RRTS) defined in [draft-chen-idr-rr-based-traffic-steering-usecase-00], is an idea that leverages the BGP route reflection mechanism to realize traffic steering in the network.
  - Therefore the operators can conduct specific traffic to traverse specific path, domains and/or planes as demand.
Use Cases (Cont.)

- **Inter-Controller Applications**
  - The service set up between the nodes is proxied by the BGP Controllers.
  - More detailed description could be found in [draft-li-l2vpn-ccvpn-arch-00]

![Diagram](image)

Figure 3: Removing BGP Session between Controller and NODE
Next Steps

- Solicit more comments & feedbacks
- Revise the draft