Draft Update: FC-BGP Protocol Specification

https://datatracker.ietf.org/doc/draft-sidrops-wang-fcbgp-protocol/00/

https://datatracker.ietf.org/doc/draft-wang-sidrops-fcbgp-protocol/01/

Zhuotao Liu

Authors: K. Xu, X. Wang, Z. Liu, Q. Li, J. Wu, and Y. Guo

SIDROPS WG
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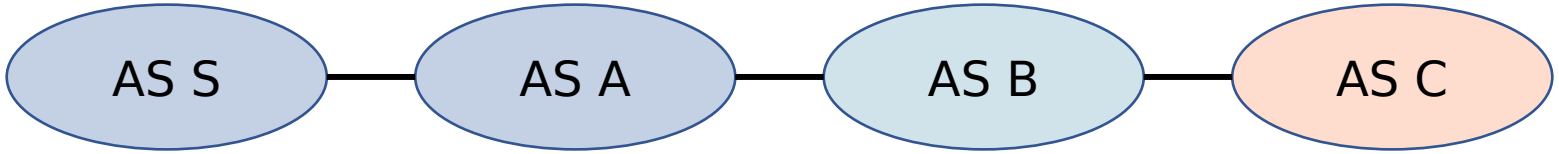
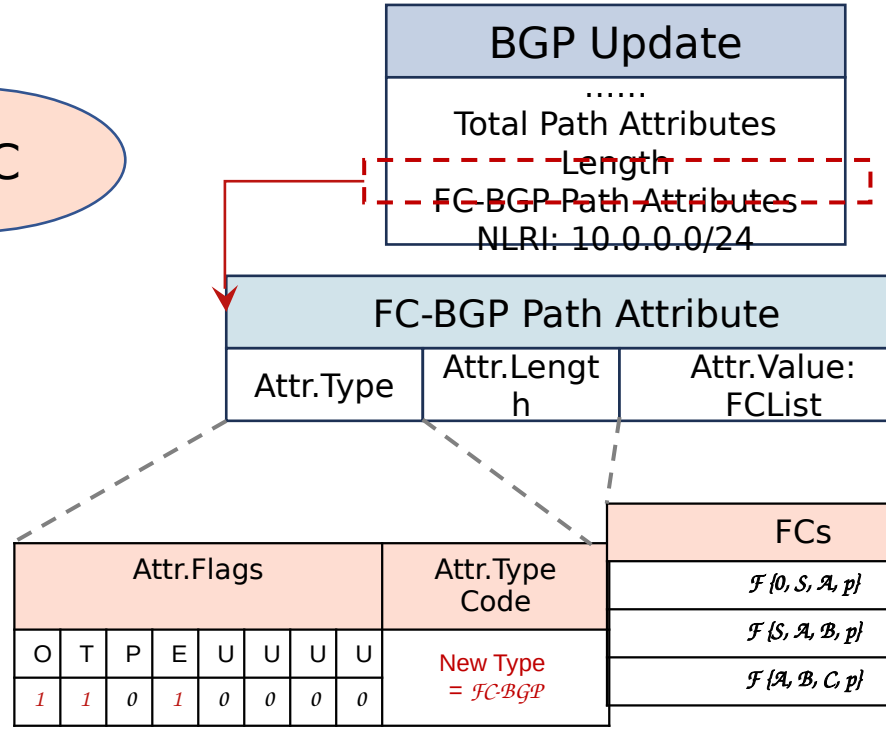
Outline of the Talk

- Recap on FC-BGP Basics
- Comments/Suggestions since IETF 119
- Main Changes from v-00 to v-01
- Implementation Status
- Next Steps

Recap on FC-BGP





Suppose AS B receives a BGP update P:$S \leftarrow A \leftarrow$ B, AS B uses the following Forwarding Commitment to publicly certify its routing intent over the next hop to AS C

$$\mathcal{F}_{\{A,B,C,\mathcal{P}\}} = \left\{ \mathcal{H}(A,B,C,\mathcal{P})_{\mathrm{Sig}_B} \,||\, \mathsf{A} \,||\, \mathsf{B} \,||\, \mathsf{C} \right\},$$

(i) FC-BGP adopts a per-pathlet validation scheme for validating BGP updates, instead of the per-path validation scheme used in BPGsec, which has two benefits

1) Same security guarantees as BGPsec in full-deployment, but with much lower path validation overhead in dynamic networks, like the Internet
2) (Strictly) more security benefits than BGPsec in case of partial

Comments/Suggestions since IETF 119

- The draft is somewhat light, lacking necessary materials
- Showing FC-BGP is equivalently secure as BGPsec.
- The impacts to FIB or RIB size, memory consumption and convergence time, etc.
- Should not modify the priority of route selection.
- Where do you implement FC-BGP?
- Clarify certificate and keys for signature signing and what happens when keys refreshed.
- Add considerations of AS Confederation and transparent Route Server
- Comparability: co-existence of FC-BGP with BGP/BGPsec.
- Security Consideration about insertion of ASN 0
- Focusing on only the control plane security

Key Changes from v-00 to v-01

1. We removing the data-plane related content in this version
2. In Sec.1, we add **the key differentiator of FC-BGP** (stressing the partial deployment scenario), describe explicitly that FC-BGP **depends on RPKI,** and cite RPKI's RFCs.
3. In Sec. 2, we explicitly states that negotiating **new capability is unnecessary.**
4. In Sec.4 and Sec.5, we add additional **the protocol descriptions regarding** sending/receiving BGP-UPDATE messages, including AS Confederation, ISP Router Server, etc.
5. In Sec.6, Sec.7, and Sec.8, we further add more **operational considerations, security considerations, and IANA considerations**.

Change No.1: Key Differentiaor with BGPsec

- Text in this v-01

1. Introduction

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FC-BGP and BGPsec offer different levels of security benefits in the case of partial deployment, even though they achieve the same security benefits when fully deployed.

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In contrast to BGPsec, FC-BGP treats **partial deployability** as a first-class citizen. It adopts a pathlet-driven authentication paradigm, in which the authenticity of an AS-path can be incrementally built based on authenticated pathlets. This design ensures that downstream FC-BGP-aware ASes can use the authenticated pathlets provided by upstream upgraded ASes, even if the full AS-path traverses legacy ASes that do not support FC-BGP.

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Change No. 2: RPKI / BGPsec Certificate/Key

- FC-BGP relies on RPKI. It uses BGPsec keys to sign/verify FCs.
- Text in this v-01

  Similar to BGPsec, FC-BGP relies on RPKI to **perform route origin validation** [RFC6483].

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  This certificate is associated with its AS number. The **router key generation** here follows [RFC8208] and [RFC8635].

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  it MUST match the **AS number in the Subject field of the RPKI router certificate** that will be used to verify the FC segment constructed by this FC-BGP speaker (see Section 3.1.1 of [RFC8209] and [RFC6487])

  ……

  FC-BGP only supports one **algorithm suite** in this document as **BGPsec Algorithm** defined in [RFC8208].

Change No.3: Processing BGP UPDATE

- Sending
  - Text in this v-01

4. FC-BGP UPDATE Messages
   4.1. Generation
   4.2. Propagation
   4.3. Processing Instructions for AS Confederation Members

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- Receiving
  - Text in this v-01

5. Processing a Received FC-BGP UPDATE Message
   5.1. Overview
   5.2. Validation
      5.2.1. Validation Algorithm

Change No.4: Route Selection

- We do not modify the priority of BGP route selection in FC-BGP. Instead, we leave route section to local policy.
- Text in this v-01

6.4. BGP Route Selection

While FC-BGP does modify the BGP route selection result, it is not the primary intention of FC-BGP to modify the BGP route selection process itself. Instead, FC-BGP focuses on providing an additional layer of validation and verification for BGP UPDATE messages.

However, the handling of FC-BGP validation states, as well as the integration of FC-BGP with the BGP route selection, **is indeed a matter of local policy.** FC-BGP implementations SHOULD provide mechanisms that allow operators to define and configure their own local policies on a **per-session basis.**

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Change No.5: AS Confederation

- The leftmost bit of the Flags field: Confed_Segment flag (Flags-CS)
- Text in this v-01

3. FC Path Attribute

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The leftmost bit of the Flags field in Figure 2 is the **Confed_Segment flag (Flags-CS).** The Flags-CS flag is **set to 1** to indicate that the FC-BGP speaker that constructed this FC segment is sending the UPDATE message to a peer AS within the same AS confederation [RFC5065]. (That is, a sequence of consecutive Confed_Segment flags are set in an FC-BGP UPDATE message whenever, in a non-FC-BGP UPDATE message, an AS_PATH segment of type AS_CONFED_SEQUENCE occurs.) In all other cases, the Flags-CS flag is **set to 0**.

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4.3. Processing Instructions for AS Confederation Members

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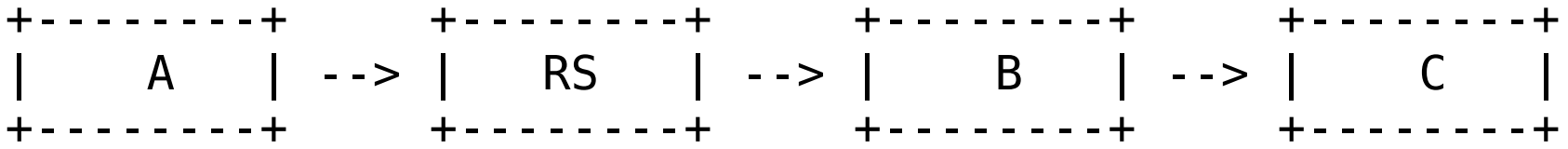
Change No.6: Route Server

- The second leftmost bit (i.e., the second highest) of the Flags field is the Route_Server flag (Flags-RS).
- Text in [4.1. Generation; 5.2.1. Validation Algorithm; 7. Security Considerations]



RS inserts ASN into AS path.

1. FC(0, A, RS) by AS A
2. FC(A, RS, B) by RS
3. FC(RS, B, C) by AS B

RS acts like a typical FC-BGP-enabled AS.

RS does not insert ASN into AS path.

1. RS populates its FC segment into FCList.
   1. FC(0, A, RS) by AS A
   2. FC(A, RS, B, **Flags-RS**) by RS
   3. FC(RS, B, C) by AS B
2. RS fails to populate FC segment.
   1. FC(0, A, RS) by AS A
   2. FC(RS, B, C) by AS B

A typical partial deployment case

Change No. 7: Inserting ASN 0

- Text in this v-01

7.3.1. Three AS Numbers

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In the context of BGP [RFC4271], to detect an AS routing loop, it scans the full AS path (as specified in the AS_PATH attribute) and checks that the autonomous system number of the local system does not appear in the AS path. As outlined in [RFC7607], Autonomous System 0 was listed in the IANA Autonomous System Number Registry as "Reserved - May be used to identify non-routed networks". So, **there should be no AS 0 in the AS_PATH attribute of the BGP UPDATE message**. **Therefore, AS 0 could be used to populate the PASN field when no previous AS hops in the AS path.**

Implementation Status

- FRR: based on FRR 9.0.1
  - FC Path Attribute
    - SIG = ECDSA(SHA256(PASN, CASN, NASN, Address, Prefixlen))
    - Sign FC with ECDSA-SHA256 when sending BGP UPDATE
    - FC Verification when receiving BGP UPDATE
  - Keys: Loading from files
  - TODO:
    - AS Confederation, Route Server, AS Path Prepending, etc.
    - RPKI Keys
- Dev. and Test Env.
  - OS: Ubuntu 22.04
  - OpenSSL 3.0.2
- H3C: commercial release, in testing
  - Device: CR19000 Series
  - FC Path Attribute
    - SIG = ECDSA(SHA256(PASN, CASN, NASN, Address, Prefixlen))
    - Sign FC with ECDSA-SHA256 when sending BGP UPDATE
    - FC Verification when receiving BGP UPDATE
  - Keys: Generates within the router

Next Steps

- We are looking forward to WG Adoption.

Questions? Feedback?

Comments are welcomed.

https://datatracker.ietf.org/doc/draft-wang-sidrops-fcbgp-protocol/01/

Please email feedback to

draft-wang-sidrops-fcbgp-protocol@ietf.org

or, open issues at

https://github.com/FCBGP/fcbgp-protocol