Forwarding Commitment BGP Testbed and Deployment Experience

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July 22, 2025

Key Points of FC-BGP

Goals and Challenges

- FC-BGP aims to authenticate BGP route announcements by introducing cryptographic assurances for AS_PATH attributes.
- A significant challenge is ensuring security in scenarios where not all ASes have adopted FC-BGP, necessitating compatibility with existing BGP protocols.

Core Mechanism

- FC-BGP introduces an optional, transitive path attribute called the Forwarding Commitment (FC), which is a cryptographically signed segment certifying an AS's routing intent on its directly connected hops.

Compared to BGPsec

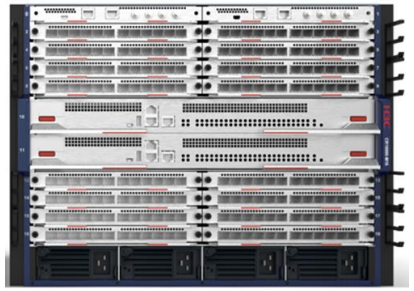
- FC-BGP offers a different security guarantee with transitive Path Attribute, ensuring AS-PATH validation while maintaining compatibility in partial deployment scenarios.

Deployment Motivation

中国电信 CHINA TELECOM

清華大學 Tsinghua University

H3C



CR16000 Router

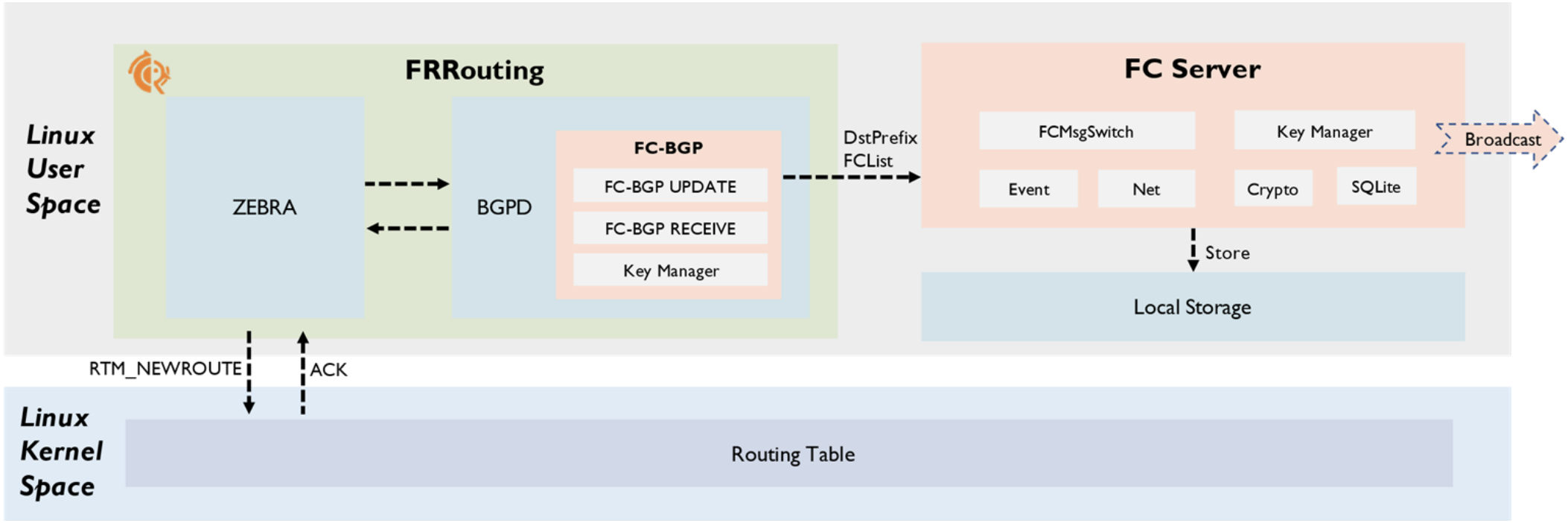
CR19000 Router

Commercial Development and Upgrade

- A real-time warning platform for routing anti-hijacking and anti-leakage, co-developed by China Telecom and Tsinghua University, **has issued alerts on numerous routing hijacking and leakage events**.
- Therefore, H3C, in collaboration with China Telecom and Tsinghua University, **has implemented commercial upgrades to its CR16000 and CR19000 routers to support FC-BGP**. This enhancement is intended to improve inter-domain routing security.

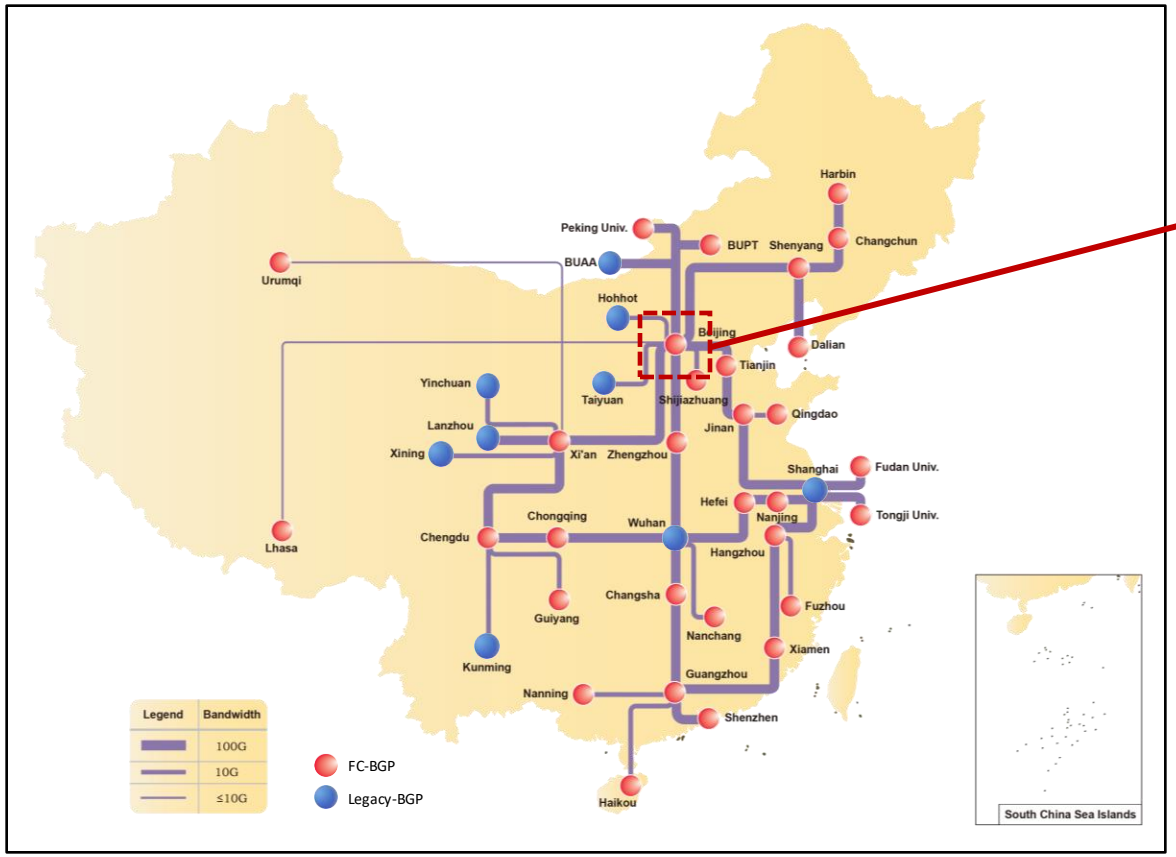
Open source

- https://github.com/fcbgp/fcbgp-implementation



- We have presented our work at the IETF 122 Hackathon meeting.
- We will continue to maintain and optimize FC-BGP in the future.

Progress in Deployment



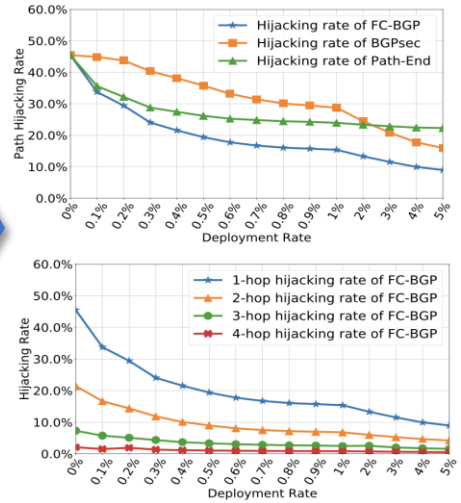
FITI Backbone Node Device

H3C CR16000/19000

FITI holds **4096** ASN assigned by APNIC, along with a **/20** IPv6 address block. With sites distributed across China, it features a genuine internet environment suitable for large-scale network experimentation, with a maximum bandwidth of up to **1.2T**.

Future Internet Technology Infrastructure, **FITI**

Progress in Deployment



BGP Topology and Announcement Dataset

Testbed for FC-BGP (FITI and IXPs)

Security Benefits in Partial Deployment

Utilizing public datasets from RouteViews, we performed Internet BGP topology reconstruction and BGP announcement replay on the Testbed. Simultaneously, we adjusted the deployment ratio of FC-BGP to calculate the network-wide route hijackability rate under partial deployment scenarios as the deployment rate increases.

Test Experience and Results

Functional Test

The FC-BGP prototype fully implements the protocol specification, supports both IPv4 and IPv6, operates as a route reflector and client.

Compatibility Test

FC-BGP works reliably in mixed environments. Legacy routers (Huawei, Ruijie, etc.) transparently forward UPDATEs with FC attributes, preserving message integrity.

Partial Deployment Test

Incremental deployment is a key design principle that was used in the experiment. The results indicate that, even with partial deployment, FC-BGP provides significant security benefits in protecting routing information. With a deployment rate of only 10%, over 70% of Internet BGP paths can be protected.

Thank You!

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https://datatracker.ietf.org/doc/draft-li-sidrops-fcbgp-experiment/

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IETF 123 SIDROPS

July 22, 2025