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Resource Public Key Infrastructure (RPKI) Router Implementation Report

Abstract

This document is an implementation report for the Resource Public Key Infrastructure (RPKI) Router protocol as defined in RFC 6810. The authors did not verify the accuracy of the information provided by respondents. The respondents are experts with the implementations they reported on, and their responses are considered authoritative for the implementations for which their responses represent. The respondents were asked to only use the "YES" answer if the feature had at least been tested in the lab.

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1. Introduction

In order to formally validate the origin Autonomous Systems (ASes) of BGP announcements, routers need a simple but reliable mechanism to receive Resource Public Key Infrastructure (RPKI) [RFC6810] prefix origin data from a trusted cache. The RPKI Router protocol defined in [RFC6810] provides a mechanism to deliver validated prefix origin data to routers.

This document provides an implementation report for the RPKI Router protocol as defined in RFC 6810 [RFC6810].

The authors did not verify the accuracy of the information provided by respondents or by any alternative means. The respondents are experts with the implementations they reported on, and their responses are considered authoritative for the implementations for which their responses represent. Respondents were asked to only use the "YES" answer if the feature had at least been tested in the lab.

2. Implementation Forms

Contact and implementation information for person filling out this form:

IOS
Name: Keyur Patel
Email: keyupate@cisco.com
Vendor: Cisco Systems, Inc.
Release: IOS
Protocol Role: Client

XR
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Vendor: Cisco Systems, Inc.
Release: IOS-XR
Protocol Role: Client

JUNOS
Name: Hannes Gredler
Email: hannes@juniper.net
Vendor: Juniper Networks, Inc.
Release: JUNOS
Protocol Role: Client

rpki.net
Name: Rob Austein
Email: sra@hactrn.net
Vendor: rpki.net project
Release: <http://subvert-rpki.hactrn.net/trunk/>
Protocol Role: Client, Server

NCC
Name: Tim Bruijnzeels
Email: tim@ripe.net
Vendor: RIPE NCC
Release: RIPE NCC validator-app 2.0.0 <https://github.com/RIPE-NCC/rpki-validator>
Protocol Role: Server

RTRlib
Name: Fabian Holler, Matthias Waehlisch
Email: waehlisch@ieee.org
Vendor: HAW Hamburg, FU Berlin, RTRlib project
Release: RTRlib 0.2 <http://rpki.realmv6.org/>
Protocol Role: Client

BBN
Name: David Mandelberg, Andrew Chi
Email: dmandelb@bbn.com
Vendor: Raytheon/BBN Technologies
Release: RPSTIR 0.2 <http://sourceforge.net/projects/rpstir/>
Protocol Role: Server

3. Protocol Data Units

Does the implementation support Protocol Data Units (PDUs) as described in Section 5 of [RFC6810]?

P0: Serial Notify

P1: Serial Query

P2: Reset Query

P3: Cache Response

P4: IPv4 Prefix

P6: IPv6 Prefix

P7: End of Data

P8: Cache Reset

P10: Error Report

	IOS	XR	JUNOS	rpki .net clnt	rpki .net srvr	NCC	RTR-lib	BBN
Rcv.P0	YES	YES	YES	YES	---	---	YES	---
Snd.P0	---	---	---	---	YES	YES	---	YES
Rcv.P1	---	---	---	---	YES	YES	---	YES
Snd.P1	YES	YES	YES	YES	---	---	YES	---
Rcv.P2	---	---	---	---	YES	YES	---	YES
Snd.P2	YES	YES	YES	YES	---	---	YES	---
Rcv.P3	YES	YES	YES	YES	---	---	YES	---
Snd.P3	---	---	---	---	YES	YES	---	YES
Rcv.P4	YES	YES	YES	YES	---	---	YES	---
Snd.P4	---	---	---	---	YES	YES	---	YES
Rcv.P6	YES	YES	YES	YES	---	---	YES	---
Snd.P6	---	---	---	---	YES	YES	---	YES
Rcv.P7	YES	YES	YES	YES	---	---	YES	---
Snd.P7	---	---	---	---	YES	YES	---	YES
Rcv.P8	YES	YES	YES	YES	---	---	YES	---
Snd.P8	---	---	---	---	YES	YES	---	YES
Rcv.P10	YES	YES	NO~1	YES	YES	YES	YES	YES
Snd.P10	YES	NO	NO	YES	YES	YES	YES	YES

Note 1: No, Error PDU gets silently ignored.

4. Protocol Sequence

Does the RPKI Router protocol implementation follow the four protocol sequences as outlined in Section 6 of [RFC6810]?

S1: Start or Restart

S2: Typical Exchange

S3: No Incremental Update Available

S4: Cache Has No Data Available

	IOS	XR	JUNOS	rpki .net clnt	rpki .net srvr	NCC	RTRlib	BBN
S1	YES	YES	YES	YES	YES	YES	YES	YES
S2	YES	YES	YES	YES	YES	NO~1	YES	YES
S3	YES	YES	YES	YES	YES	YES	YES	YES
S4	YES	YES	YES	YES	YES	YES	YES	YES~2

Note 1: Does not implement Serial Query, thus Incremental Update is never available, so responds to Serial Query with Cache Reset as described in Section 6.3 of [RFC6810]

Note 2: Sends Cache Reset in response to Serial Query when no data; sends Error Report PDU in response to Reset Query when no data.

5. Protocol Transport

Does the RPKI Router protocol implementation support the different protocol transport mechanisms outlined in Section 7 of [RFC6810]?

	IOS	XR	JUNOS	rpki .net clnt	rpki .net srvr	NCC	RTRlib	BBN
SSH	NO	YES	NO	YES	YES	NO	YES	YES
TLS	NO	NO	NO	NO	NO	NO	NO	NO
TCP	YES	YES	YES	YES	YES	YES	YES	YES
TCP-MD5	NO	NO	NO	NO	NO	NO	NO	NO
TCP-AO	NO	NO	NO	NO	NO	NO	NO	NO
IPsec	NO	NO	NO	NO	NO	NO	NO	NO

6. Error Codes

Does the RPKI Router protocol implementation support the different protocol error codes outlined in Section 10 of [RFC6810]?

	IOS	XR	JUNOS	rpki .net clnt	rpki .net srvr	NCC	RTRlib	BBN
Rcv.0	YES	YES	NO	YES	YES	YES	YES	YES
Snd.0	YES	YES	NO	YES	YES	YES	YES	YES
Rcv.1	YES	YES	NO	YES	YES	YES	YES	YES
Snd.1	YES	YES	NO	YES	YES	YES	YES	YES
Rcv.2	YES	YES	NO	YES	---	---	YES	---
Snd.2	---	---	---	---	YES	YES	---	YES
Rcv.3	YES	YES	NO	YES	---	---	YES	---
Snd.3	---	---	---	---	YES	YES	---	YES
Rcv.4	YES	YES	NO	YES	YES	YES	YES	YES
Snd.4	YES	YES	NO	YES	YES	YES	YES	YES
Rcv.5	YES	YES	NO	YES	YES	YES	YES	YES
Snd.5	YES	YES	NO	YES	YES	YES	YES	YES
Rcv.6	---	---	---	---	YES	YES~1	---	YES
Snd.6	YES	YES	NO	NO	---	---	YES	---
Rcv.7	---	---	---	---	YES	YES~1	---	YES
Snd.7	YES	YES	NO	NO	---	---	YES	---

Note 1: YES, but... fatal, so connection is dropped, but cache does not conclude it's inconsistent.

7. Incremental Updates Support

Does the RPKI Router implementation support Incremental Updates as defined in Section 4 of [RFC6810]?

IOS	XR	JUNOS	rpki.net clnt	rpki.net srvr	NCC	RTRlib	BBN
NO	NO	YES	YES	YES	NO	YES	YES

8. Session ID Support

Session ID is used to indicate that the cache server may have restarted and that the incremental restart may not be possible.

Does the RPKI Router protocol implementation support the Session ID procedures outlined in Section 5.1 of [RFC6810]?

IOS	XR	JUNOS	rpki.net clnt	rpki.net srvr	NCC	RTRlib	BBN
YES	YES	YES	YES	YES	NO~1	YES	YES

Note 1: NO, using random, but will FIX

9. Incremental Session Startup Support

Does the RPKI Router protocol implementation support Incremental session startups with Serial Number and Session ID as defined in Section 5.3 of [RFC6810]?

IOS	XR	JUNOS	rpki.net clnt	rpki.net srvr	NCC	RTRlib	BBN
YES	YES	YES	YES	YES	NO	YES	YES

10. Interoperable Implementations

List other implementations with which you have tested the interoperability of the RPKI Router implementation.

10.1. Cisco Implementation

Cisco: The Cisco IOS and IOS-XR implementation should be interoperable with other vendor RPKI Router Protocol implementations. In particular, we have tested our interoperability with rpki.net's RPKI Router implementation.

10.2. Juniper Implementation

Juniper: The Juniper Networks, Inc. JUNOS implementation should be interoperable with other vendor RPKI Router Protocol implementations. In particular, we have tested our interoperability with rpki.net's and NCC's RPKI Router Cache implementation.

10.3. rpki.net Implementation

rpki.net: The rpki.net implementation should operate with other rpki-rtr implementations. In particular, we have tested our rpki-rtr server's interoperability with Cisco IOS, Cisco IOS-XR, and Juniper.

10.4. RIPE NCC Implementation

RIPE NCC: The RIPE NCC validator has been tested by us with other rpki-rtr implementations. In particular, we have tested with RTRlib and CISCO IOS. We received positive feedback from close contacts who tested our validator with JUNOS and Quagga.

10.5. RTRlib Implementation

RTRlib: The RTRlib has been tested by us with other rpki-rtr implementations. In particular, we have tested with rtr-origin from rpki.net and RIPE NCC Validator.

10.6. BBN RPSTIR Implementation

BBN RPSTIR: We have not yet tested with any other implementations.

11. Security Considerations

No new security issues are introduced to the RPKI Router protocol defined in [RFC6810].

12. Acknowledgements

The authors would like to thank Andrew Chi, David Mandelberg, Fabian Holler, Forhad Ahmed, and Tim Bruijnzeels for their contributions to this document.

13. Normative References

[RFC6810] Bush, R. and R. Austein, "The Resource Public Key Infrastructure (RPKI) to Router Protocol", RFC 6810, January 2013.

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