

Secure Inter-Domain Routing Working Group  
Internet-Draft  
Updates: [6485bis](#) (if approved)  
Intended status: BCP  
Expires: May 6, 2016

S. Turner  
IECA, Inc.  
November 3, 2015

**BGPsec Algorithms, Key Formats, & Signature Formats  
draft-ietf-sidr-bgpsec-algs-12**

Abstract

This document specifies the algorithms, algorithms' parameters, asymmetric key formats, asymmetric key size and signature format used in BGPsec (Border Gateway Protocol Security). This document updates the Profile for Algorithms and Key Sizes for use in the Resource Public Key Infrastructure ([draft-ietf-sidr-rfc6485bis](#)).

Status of this Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

Copyright Notice

Copyright (c) 2015 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

- [1.](#) Introduction . . . . . [2](#)
- [1.1.](#) Terminology . . . . . [3](#)
- [2.](#) Algorithms . . . . . [3](#)
- [3.](#) Asymmetric Key Format . . . . . [4](#)
- [3.1.](#) Public Key Format . . . . . [4](#)
- [3.2.](#) Private Key Format . . . . . [4](#)
- [4.](#) Signature Format . . . . . [4](#)
- [5.](#) Additional Requirements . . . . . [4](#)
- [6.](#) Security Considerations . . . . . [5](#)
- [7.](#) IANA Considerations . . . . . [5](#)
- [8.](#) Acknowledgements . . . . . [6](#)
- [9.](#) References . . . . . [6](#)
- [9.1.](#) Normative References . . . . . [6](#)
- [9.2.](#) Informative References . . . . . [7](#)
- Authors' Addresses . . . . . [7](#)

**1. Introduction**

This document specifies:

- o the digital signature algorithm and parameters;
- o the hash algorithm and parameters;
- o the public and private key formats; and,
- o the signature format

used by Resource Public Key Infrastructure (RPKI) Certification Authorities (CA), and BGPsec (Border Gateway Protocol Security) speakers (i.e., routers). CAs use these algorithms when issuing BGPsec Router Certificates [[ID.sidr-bgpsec-pki-profiles](#)] and CRLs [[RFC6487](#)]. BGPsec routers use these when requesting BGPsec certificates [[ID.sidr-bgpsec-pki-profiles](#)], generating BGPsec Update messages [[ID.sidr-bgpsec-protocol](#)], and verifying BGPsec Update messages [[ID.sidr-bgpsec-protocol](#)].

This document is referenced by the BGPsec specification [[ID.sidr-bgpsec-protocol](#)] and the profile for BGPsec Router Certificates and Certification Requests [[ID.sidr-bgpsec-pki-profiles](#)]. Familiarity with these documents is assumed. Implementers are reminded, however, that, as noted in Section 2 of [[ID.sidr-bgpsec-pki-profiles](#)], the algorithms used to sign CA Certificates, BGPsec Router Certificates, and CRLs are found in [[ID.sidr-rfc6485bis](#)].

This document updates [[ID.sidr-rfc6485bis](#)] to add support for a) a different algorithm for BGPsec certificate requests, which are only issued by BGPsec speakers; b) a different Subject Public Key Info format for BGPsec certificates, which is needed for the specified

BGPsec signature algorithm; and, c) a different signature format for BGPsec signatures, which is needed for the specified BGPsec signature algorithm. The BGPsec certificates are differentiated from other RPKI certificates by the use of the BGPsec Extended Key Usage defined in [[ID.sidr-bgpsec-pki-profiles](#)].

### **1.1. Terminology**

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [[RFC2119](#)].

## **2. Algorithms**

Four cryptographic algorithms are used to support BGPsec:

- o The signature algorithm used when issuing BGPsec certificates and CRLs, which would revoke BGPsec certificates, MUST be as specified in [[ID.sidr-rfc6485bis](#)].
- o The signature algorithm used in certification requests and BGPsec Update messages MUST be Elliptic Curve Digital Signature Algorithm (ECDSA) [[RFC6090](#)].
- o The hashing algorithm used when issuing certificates and CRLs MUST be as specified in [[ID.sidr-rfc6485bis](#)].
- o The hashing algorithm used when generating certification requests and BGPsec Update messages MUST be SHA-256 [[SHS](#)]. Hash algorithms are not identified by themselves in certificates, or BGPsec Update messages instead they are combined with the digital signature algorithm (see below).

NOTE: The exception to the above hashing algorithm is the use of SHA-1 [[SHS](#)] when CAs generate authority and subject key identifiers [[RFC6487](#)].

To support BGPsec, the algorithms are identified as follows:

- o In certificates and CRLs, an Object Identifier (OID) is used. The value and locations are as specified in section 2 of [[ID.sidr-rfc6485bis](#)].
- o In certification request, an OID is used. The `ecdsa-with-SHA256` OID [[RFC5480](#)] MUST appear in the PKCS #10 signatureAlgorithm field [[RFC2986](#)] or in Certificate Request Message Format (CRMF) `POPSigningKey` algorithm field [[RFC4211](#)].

- o In BGPsec Update messages, the ECDSA with SHA-256 Algorithm Suite Identifier from [Section 7](#) is included in the Signature-Block List's Algorithm Suite Identifier field.

### **3. Asymmetric Key Format**

The RSA key pairs used to compute signatures on CA certificates, BGPsec Router Certificates, and CRLs are as specified in Section 3 of [\[ID.sidr-rfc6485bis\]](#). The remainder of this section addresses key formats found in the BGPsec router certificate requests and in BGPsec Router Certificates.

The ECDSA key pairs used to compute signatures for certificate requests and BGPsec Update messages MUST come from the P-256 curve [\[RFC5480\]](#). The public key pair MUST use the uncompressed form.

#### **3.1. Public Key Format**

The Subject's public key is included in subjectPublicKeyInfo [\[RFC5280\]](#). It has two sub-fields: algorithm and subjectPublicKey. The values for the structures and their sub-structures follow:

- o algorithm (which is an AlgorithmIdentifier type): The id-ecPublicKey OID MUST be used in the algorithm field, as specified in [Section 2.1.1 of \[RFC5480\]](#). The value for the associated parameters MUST be secp256r1, as specified in [Section 2.1.1.1 of \[RFC5480\]](#).
- o subjectPublicKey: ECPoint MUST be used to encode the certificate's subjectPublicKey field, as specified in [Section 2.2 of \[RFC5480\]](#).

#### **3.2. Private Key Format**

Local Policy determines private key format.

### **4. Signature Format**

The structure for the certificate's and CRL's signature field MUST be as specified in Section 4 of [\[ID.sidr-rfc6485bis\]](#). The structure for the certification request's and BGPsec Update message's signature field MUST be as specified in [Section 2.2.3 of \[RFC3279\]](#).

### **5. Additional Requirements**

It is anticipated that BGPsec will require the adoption of updated key sizes and a different set of signature and hash algorithms over time, in order to maintain an acceptable level of cryptographic

security to protect the integrity of BGPsec. This profile should be updated to specify such future requirements, when appropriate.

CAs and RPs SHOULD be capable of supporting a transition to allow for the phased introduction of additional encryption algorithms and key specifications, and also accommodate the orderly deprecation of previously specified algorithms and keys. Accordingly, CAs and RPs SHOULD be capable of supporting multiple RPKI algorithm and key profiles simultaneously within the scope of such anticipated transitions. The recommended procedures to implement such a transition of key sizes and algorithms are not specified in this document, see Section 6 in [[ID.sidr-bgpsec-protocol](#)] for more information.

**6. Security Considerations**

The Security Considerations of [[RFC3279](#)], [[RFC5480](#)], [[RFC6090](#)], [[ID.sidr-rfc6485bis](#)], and [[ID.sidr-bgpsec-pki-profiles](#)] apply to certificates. The security considerations of [[RFC3279](#)], [[RFC6090](#)], [[ID.sidr-rfc6485bis](#)], [[ID.sidr-bgpsec-pki-profiles](#)] apply to certification requests. The security considerations of [[RFC3279](#)], [[ID.sidr-bgpsec-protocol](#)], and [[RFC6090](#)] apply to BGPsec Update messages. No new security considerations are introduced as a result of this specification.

**7. IANA Considerations**

The Internet Assigned Numbers Authority (IANA) is requested to define the "BGPsec Algorithm Suite Registry" described below.

An algorithm suite consists of a digest algorithm and a signature algorithm. This specification creates an IANA registry of one-octet BGPsec algorithm suite identifiers. Additionally, this document registers a single algorithm suite which uses the digest algorithm SHA-256 and the signature algorithm ECDSA on the P-256 curve [[RFC5480](#)].

BGPsec Algorithm Suites Registry

| Digest Algorithm | Signature Algorithm | Algorithm Suite Identifier | Specification Pointer    |
|------------------|---------------------|----------------------------|--------------------------|
| Reserved         | Reserved            | 0x0                        | This draft               |
| SHA-256          | ECDSA P-256         | TBD                        | <a href="#">RFC 5480</a> |

|                                 |            |          |            |  |
|---------------------------------|------------|----------|------------|--|
| Unassigned                      | Unassigned | TBD..0xF | This draft |  |
| +-----+-----+-----+-----+-----+ |            |          |            |  |
| Reserved                        | Reserved   | 0xF      | This draft |  |
| +-----+-----+-----+-----+-----+ |            |          |            |  |

Future assignments are to be made using either the Standards Action process defined in [RFC5226], or the Early IANA Allocation process defined in [RFC7120]. Assignments consist of a digest algorithm name, signature algorithm name, and the algorithm suite identifier value.

**8. Acknowledgements**

The author wishes to thank Geoff Huston for producing [ID.sidr-rfc6485bis], which this document is heavily based on. I'd also like to thank Roque Gagliano, David Mandelberg, and Sam Weiller for their review and comments.

**9. References**

**9.1. Normative References**

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.

[RFC2986] Nystrom, M. and B. Kaliski, "PKCS #10: Certification Request Syntax Specification Version 1.7", [RFC 2986](#), November 2000.

[RFC3279] Bassham, L., Polk, W., and R. Housley, "Algorithms and Identifiers for the Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile", [RFC 3279](#), April 2002.

[RFC4211] Schaad, J., "Internet X.509 Public Key Infrastructure Certificate Request Message Format (CRMF)", [RFC 4211](#), September 2005.

[RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", [BCP 26](#), [RFC 5226](#), May 2008.

[RFC5280] Cooper, D., Santesson, S., Farrell, S., Boeyen, S., Housley, R., and W. Polk, "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile", [RFC 5280](#), May 2008.

[RFC5480] Turner, S., Brown, D., Yiu, K., Housley, R., and T. Polk,

"Elliptic Curve Cryptography Subject Public Key Information", [RFC 5480](#), March 2009.

- [RFC6090] McGrew, D., Igoe, K., and M. Salter, "Fundamental Elliptic Curve Cryptography Algorithms", [RFC 6090](#), February 2011.
- [RFC6487] Huston, G., Michaelson, G., and R. Loomans, "A Profile for X.509 PKIX Resource Certificates", [RFC 6487](#), February 2012.
- [RFC7120] Cotton, M., "Early IANA Allocation of Standards Track Code Points", [BCP 100](#), [RFC 7120](#), January 2014.
- [SHS] National Institute of Standards and Technology (NIST), "FIPS Publication 180-3: Secure Hash Standard", FIPS Publication 180-3, October 2008.
- [ID.sidr-rfc6485bis] Huston, G., and G. Michaelson, "The Profile for Algorithms and Key Sizes for use in the Resource Public Key Infrastructure", [draft-ietf-sidr-rfc6485bis](#), work-in-progress.
- [ID.sidr-bgpsec-protocol] Lepinski, M., "BGPsec Protocol Specification", [draft-ietf-sidr-bgpsec-protocol](#), work-in-progress.
- [ID.sidr-bgpsec-pki-profiles] Reynolds, M. and S. Turner, "A Profile for BGPSEC Router Certificates, Certificate Revocation Lists, and Certification Requests", [draft-ietf-sidr-bgpsec-pki-profiles](#), work-in-progress.

## **9.2. Informative References**

None.

### Authors' Addresses

Sean Turner  
IECA, Inc.  
3057 Nutley Street, Suite 106  
Fairfax, VA 22031  
USA

EMail: [turners@ieca.com](mailto:turners@ieca.com)