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BGPsec Algorithms, Key Formats, & Signature Formats
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Abstract

This document specifies the algorithms, algorithm 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 (ID.sidr-rfc6485bis).

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1. Introduction

This document specifies:

- the digital signature algorithm and parameters;
- the hash algorithm and parameters;
- the public and private key formats; and,
- 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 processing requests for BGPsec Router Certificates [ID.sidr-bgpsec-pki-profiles]. BGPsec routers use these algorithms when requesting BGPsec certificates [ID.sidr-bgpsec-pki-profiles], signing 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 issued only 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 certificate 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

The algorithms used to compute signatures on CA certificates, BGPsec Router Certificates, and CRLs are as specified in Section 2 of [ID.sidr-rfc6485bis]. The remainder of this section addresses algorithms used when BGPsec routers request certificates, RPKI CAs verify BGPsec certification requests, BGPsec routers generate BGPsec Update messages, and when BGPsec routers verify BGPsec Update messages:

- The signature algorithm used MUST be the Elliptic Curve Digital Signature Algorithm (ECDSA) with curve P-256 [RFC6090][FIPS186].

- The hash algorithm used MUST be SHA-256 [SHS].

Hash algorithms are not identified by themselves in certificates or BGPsec Update messages. They are represented by an OID that combines the hash algorithm with the digital signature algorithm as follows:

- The ecdsa-with-SHA256 OID [RFC5480] MUST appear in the PKCS #10 signatureAlgorithm field [RFC2986] or in Certificate Request Message Format (CRMF) POPOSigningKey algorithm field [RFC4211], which location depends on the certificate request format generated.

- 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 Pair Formats

The key formats 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 private keys 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:

- algorithm (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].

- 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], which is the same format used by other RPKI certificates. 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. 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 [RFC6919]. 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	RFC 5480
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

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9. References

9.1. Normative References

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

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9.2. Informative References

None.

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