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M. Richardson  
Sandelman Software Works  
T. Werner  
Siemens  
W. Pan  
Huawei Technologies  
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**Clarification of Enrollment over Secure Transport (EST): transfer  
encodings and ASN.1  
draft-ietf-lamps-rfc7030est-clarify-05**

**Abstract**

This document updates [RFC7030](#): Enrollment over Secure Transport (EST) to resolve some errata that was reported, and which has proven to cause interoperability issues when [RFC7030](#) was extended.

This document deprecates the specification of "Content-Transfer-Encoding" headers for EST endpoints. This document fixes some syntactical errors in ASN.1 that was presented.

**Status of This Memo**

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## [1.](#) Introduction

[RFC7030] defines the Enrollment over Secure Transport, or EST protocol.

This specification defines a number of HTTP end points for certificate enrollment and management. The details of the transaction were defined in terms of MIME headers as defined in [\[RFC2045\]](#), rather than in terms of the HTTP protocol as defined in [\[RFC2616\]](#) and [\[RFC7230\]](#).

[RFC2616] and later [\[RFC7231\]](#) [Appendix A.5](#) has text specifically deprecating Content-Transfer-Encoding. However, [\[RFC7030\]](#) incorrectly uses this header.



Changes to [\[RFC7030\]](#) to bring it inline with typical HTTP processing risk changes the on-wire protocol in a way that is not backwards compatible. However, reports from the implementers suggest that many implementations do not send the Content-Transfer-Encoding, and many of them ignore it. The consequence is that simply deprecating the header would remain compatible with current implementations.

[I-D.ietf-anima-bootstrapping-keyinfra] extends [\[RFC7030\]](#), adding new functionality, and interop testing of the protocol has revealed that unusual processing called out in [\[RFC7030\]](#) causes confusion.

EST is currently specified as part of [\[IEC62351\]](#), and is widely used in Government, Utilities and Financial markets today.

This document therefore revises [\[RFC7030\]](#) to reflect the field reality, deprecating the extraneous field.

This document deals with errata numbers [\[errata4384\]](#), [\[errata5107\]](#), [\[errata5108\]](#), and [\[errata5904\]](#).

## **2. 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 [BCP 14](#) [\[RFC2119\]](#) [\[RFC8174\]](#) when, and only when, they appear in all capitals, as shown here.

## **3. Changes to EST endpoint processing**

The [\[RFC7030\]](#) sections [4.1.3](#) (CA Certificates Response, /cacerts), [4.3.1/4.3.2](#) (Full CMC, /fullcmc), [4.4.2](#) (Server-Side Key Generation, /serverkeygen), and [4.5.2](#) (CSR Attributes, /csrattrs) specify the use of base64 encoding with a Content-Transfer-Encoding for requests and response.

This document updates [\[RFC7030\]](#) to require the POST request and payload response of all endpoints use Base64 encoding as specified in [Section 4 of \[RFC4648\]](#). In both cases, the Distinguished Encoding Rules (DER) [\[X690\]](#) are used to produce the input for the Base64 encoding routine. This format is to be used regardless of any Content-Transfer-Encoding header, and any value in such a header MUST be ignored.



### **3.1. Whitespace processing**

Note that "base64" as used in the HTTP [RFC2616] does not permit CRLF, while the "base64" used in MIME [RFC2045] does. This specification clarifies that despite [RFC2616], that white space including CR, LF, spaces (ASCII 32) and, tabs (ASCII 9) should be tolerated by receivers. Senders are not required to insert any kind of white space.

## **4. Clarification of ASN.1 for Certificate Attribute set.**

[Section 4.5.2 of \[RFC7030\]](#) is to be replaced with the following text:

### **4.1. CSR Attributes Response**

If locally configured policy for an authenticated EST client indicates a CSR Attributes Response is to be provided, the server response MUST include an HTTP 200 response code. An HTTP response code of 204 or 404 indicates that a CSR Attributes Response is not available. Regardless of the response code, the EST server and CA MAY reject any subsequent enrollment requests for any reason, e.g., incomplete CSR attributes in the request.

Responses to attribute request messages MUST be encoded as the content-type of "application/csrattrs", and are to be "base64" [RFC2045] encoded. The syntax for application/csrattrs body is as follows:

CsrAttrs ::= SEQUENCE SIZE (0..MAX) OF AttrOrOID

AttrOrOID ::= CHOICE {  
    oid           OBJECT IDENTIFIER,  
    attribute   Attribute {{AttrSet}} }

AttrSet ATTRIBUTE ::= { aa-asymmDecryptKeyID, ... }

An EST server includes zero or more OIDs or attributes [RFC2986] that it requests the client to use in the certification request. The client MUST ignore any OID or attribute it does not recognize. When the server encodes CSR Attributes as an empty SEQUENCE, it means that the server has no specific additional information it desires in a client certification request (this is functionally equivalent to an HTTP response code of 204 or 404).

If the CA requires a particular cryptographic algorithm or use of a particular signature scheme (e.g., certification of a public key based on a certain elliptic curve, or signing using a certain hash algorithm) it MUST provide that information in the CSR Attribute



Response. If an EST server requires the linking of identity and POP information (see [Section 3.5](#)), it MUST include the challengePassword OID in the CSR Attributes Response.

The structure of the CSR Attributes Response SHOULD, to the greatest extent possible, reflect the structure of the CSR it is requesting. Requests to use a particular signature scheme (e.g. using a particular hash function) are represented as an OID to be reflected in the SignatureAlgorithm of the CSR. Requests to use a particular cryptographic algorithm (e.g., certification of a public key based on a certain elliptic curve) are represented as an attribute, to be reflected as the AlgorithmIdentifier of the SubjectPublicKeyInfo, with a type indicating the algorithm and the values indicating the particular parameters specific to the algorithm. Requests for descriptive information from the client are made by an attribute, to be represented as Attributes of the CSR, with a type indicating the [\[RFC2985\]](#) extensionRequest and the values indicating the particular attributes desired to be included in the resulting certificate's extensions.

The sequence is Distinguished Encoding Rules (DER) encoded [\[X690\]](#) and then base64 encoded ([Section 4 of \[RFC4648\]](#)). The resulting text forms the application/csrattr body, without headers.

For example, if a CA requests a client to submit a certification request containing the challengePassword (indicating that linking of identity and POP information is requested; see [Section 3.5](#)), an extensionRequest with the Media Access Control (MAC) address ([\[RFC2307\]](#)) of the client, and to use the secp384r1 elliptic curve and to sign with the SHA384 hash function. Then, it takes the following:

```
OID:          challengePassword (1.2.840.113549.1.9.7)

Attribute:    type = extensionRequest (1.2.840.113549.1.9.14)
              value = macAddress (1.3.6.1.1.1.1.22)

Attribute:    type = id-ecPublicKey (1.2.840.10045.2.1)
              value = secp384r1 (1.3.132.0.34)

OID:          ecdsaWithSHA384 (1.2.840.10045.4.3.3)
```

and encodes them into an ASN.1 SEQUENCE to produce:

```
30 41 06 09 2a 86 48 86 f7 0d 01 09 07 30 12 06 07 2a 86 48 ce 3d
02 01 31 07 06 05 2b 81 04 00 22 30 16 06 09 2a 86 48 86 f7 0d 01
09 0e 31 09 06 07 2b 06 01 01 01 01 16 06 08 2a 86 48 ce 3d 04 03
03
```





and then base64 encodes the resulting ASN.1 SEQUENCE to produce:

```
MEEGCSqGSib3DQEJBzASBgqhkhjOPQIBMQcGBSuBBAAiMBYGCSqGSib3DQEJDjEJ
BgcrBgEBAQEWBggqhkhjOPQQDAW==
```

## **5. Clarification of error messages for certificate enrollment operations**

[errata5108] clarifies what format the error messages are to be in. Previously a client might be confused into believing that an error returned with type text/plain was not intended to be an error.

### **5.1. Updating [section 4.2.3](#): Simple Enroll and Re-enroll Response**

Replace:

If the content-type is not set, the response data MUST be a plaintext human-readable error message containing explanatory information describing why the request was rejected (for example, indicating that CSR attributes are incomplete).

with:

If the content-type is not set, the response data must be a plaintext human-readable error message containing explanatory information describing why the request was rejected (for example, indicating that CSR attributes are incomplete). Servers MAY use the "text/plain" content-type [[RFC2046](#)] for human-readable errors.

### **5.2. Updating [section 4.4.2](#): Server-Side Key Generation Response**

Replace:

If the content-type is not set, the response data MUST be a plaintext human-readable error message.

with:

If the content-type is not set, the response data must be a plaintext human-readable error message. Servers MAY use the "text/plain" content-type [[RFC2046](#)] for human-readable errors.



## **6. Privacy Considerations**

This document does not disclose any additional identifies to either active or passive observer would see with [[RFC7030](#)].

## **7. Security Considerations**

This document clarifies an existing security mechanism. It does not create any new protocol mechanism.

## **8. IANA Considerations**

The ASN.1 module in [Appendix A](#) of this document makes use of object identifiers (OIDs). This document requests that IANA register an OID in the SMI Security for PKIX Arc in the Module identifiers subarc (1.3.6.1.5.5.7.0) for the ASN.1 module. The OID for the Asymmetric Decryption Key Identifier (1.2.840.113549.1.9.16.2.54) was previously defined in [[RFC7030](#)].

IANA is requested to update the "Reference" column for the Asymmetric Decryption Key Identifier attribute to also include a reference to this document.

## **9. Acknowledgements**

This work was supported by Huawei Technologies.

The ASN.1 Module was assembled by Russ Housley and formatted by Sean Turner. Russ Housley provided editorial review.

## **10. References**

### **10.1. Normative References**

[errata4384]

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[errata5107]

"EST errata 5107: use Content-Transfer-Encoding", n.d.,  
<<https://www.rfc-editor.org/errata/eid5107>>.

[errata5108]

"EST errata 5108: use of Content-Type for error message",  
n.d., <<https://www.rfc-editor.org/errata/eid5108>>.



## [errata5904]

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<<https://www.rfc-editor.org/errata/eid5904>>.

## [IEC62351]

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- [X680] ITU-T, "Information technology - Abstract Syntax Notation One.", ISO/IEC 8824-1:2002, 2002.
- [X681] ITU-T, "Information technology - Abstract Syntax Notation One: Information Object Specification.", ISO/IEC 8824-2:2002, 2002.
- [X682] ITU-T, "Information technology - Abstract Syntax Notation One: Constraint Specification.", ISO/IEC 8824-2:2002, 2002.
- [X683] ITU-T, "Information technology - Abstract Syntax Notation One: Parameterization of ASN.1 Specifications.", ISO/IEC 8824-2:2002, 2002.
- [X690] ITU-T, "Information technology - ASN.1 encoding Rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER).", ISO/IEC 8825-1:2002, 2002.

## **[10.2.](#) Informative References**

- [I-D.ietf-anima-bootstrapping-keyinfra] Pritikin, M., Richardson, M., Eckert, T., Behringer, M., and K. Watsen, "Bootstrapping Remote Secure Key Infrastructures (BRSKI)", [draft-ietf-anima-bootstrapping-keyinfra-41](#) (work in progress), April 2020.
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## **[Appendix A](#). ASN.1 Module**

This annex provides the normative ASN.1 definitions for the structures described in this specification using ASN.1 as defined in [\[X680\]](#) through [\[X683\]](#).

There is no ASN.1 Module in [RFC 7030](#). This module has been created by combining the lines that are contained in the document body.



PKIXEST-2019

```
{ iso(1) identified-organization(3) dod(6)
  internet(1) security(5) mechanisms(5) pkix(7) id-mod(0)
  id-mod-est-2019(TBD) }
```

DEFINITIONS IMPLICIT TAGS ::=
BEGIN

-- EXPORTS ALL --

IMPORTS

Attribute

FROM CryptographicMessageSyntax-2010 -- [[RFC6268](#)]  
 { iso(1) member-body(2) us(840) rsadsi(113549)  
 pkcs(1) pkcs-9(9) smime(16) modules(0)  
 id-mod-cms-2009(58) }

ATTRIBUTE

FROM PKIX-CommonTypes-2009 -- [[RFC5912](#)]  
 { iso(1) identified-organization(3) dod(6) internet(1) security(5)  
 mechanisms(5) pkix(7) id-mod(0) id-mod-pkixCommon-02(57) } ;

-- CSR Attributes

CsrAttrs ::= SEQUENCE SIZE (0..MAX) OF AttrOrOID

AttrOrOID ::= CHOICE {  
 oid OBJECT IDENTIFIER,  
 attribute Attribute {{AttrSet}} }

AttrSet ATTRIBUTE ::= { aa-asymmDecryptKeyID, ... }

-- Asymmetric Decrypt Key Identifier Attribute

aa-asymmDecryptKeyID ATTRIBUTE ::=  
 { TYPE AsymmetricDecryptKeyIdentifier  
 IDENTIFIED BY id-aa-asymmDecryptKeyID }

id-aa-asymmDecryptKeyID OBJECT IDENTIFIER ::= { iso(1) member-body(2)  
 us(840) rsadsi(113549) pkcs(1) pkcs9(9) smime(16) aa(2) 54 }

AsymmetricDecryptKeyIdentifier ::= OCTET STRING

END



**Appendix B. FAKE REFERENCES**

RFC-EDITOR: please remove this section. It exists just to reference [[RFC6268](#)] and [[RFC5912](#)].

**Authors' Addresses**

Michael Richardson  
Sandelman Software Works

Email: [mcr+ietf@sandelman.ca](mailto:mcr+ietf@sandelman.ca)

Thomas Werner  
Siemens

Email: [thomas-werner@siemens.com](mailto:thomas-werner@siemens.com)

Wei Pan  
Huawei Technologies

Email: [william.panwei@huawei.com](mailto:william.panwei@huawei.com)

