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Privacy Enhancement for Internet Electronic Mail: Part IV: Key Certification and Related Services

STATUS OF THIS MEMO

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1. Executive Summary

This document describes three types of service in support of Internet Privacy-Enhanced Mail (PEM) [1-3]: key certification, certificate-

revocation list (CRL) storage, and CRL retrieval. Such services are among those required of an RFC [1114+] certification authority. Other services such as certificate revocation and certificate retrieval are left to the certification authority to define, although they may be based on the services described in this document.

Each service involves an electronic-mail request and an electronic-mail reply. The request is either an RFC [1113+] privacy-enhanced message or a message with a new syntax defined in this document. The new syntax follows the general RFC [1113+] syntax but has a different process type, thereby distinguishing it from ordinary privacy-enhanced messages. The reply is either an RFC [1113+] privacy-enhanced message, or an ordinary unstructured message.

Replies that are privacy-enhanced messages can be processed like any other privacy-enhanced message, so that the new certificate or the retrieved CRLs can be inserted into the requestor's database during normal privacy-enhanced mail processing.

Certification authorities may also require non-electronic forms of request and may return non-electronic replies. It is expected that descriptions of such forms, which are outside the scope of this document, will be available through a certification authority's "information" service.

2. Overview of Services

This section describes the three services in general terms.

The electronic-mail address to which requests are sent is left to the certification authority to specify. It is expected that certification authorities will advertise their addresses as part of an "information" service. Replies are sent to the address in the "Reply-To:" field of the request, and if that field is omitted, to the address in the "From:" field.

2.1 Key Certification

The key-certification service signs a certificate containing a specified subject name and public key. The service takes a certification request (see Section 3.1), signs a certificate

constructed from the request, and returns a certification reply (see Section 3.2) containing the new certificate.

The certification request specifies the requestor's subject name and public key in the form of a self-signed certificate. The

certification request contains two signatures, both computed with the requestor's private key:

1. The signature on the self-signed certificate, having the cryptographic purpose of preventing a requestor from requesting a certificate with another party's public key. (See Section 4.)

2. A signature on some encapsulated text, having the practical purpose of allowing the certification authority to construct an ordinary RFC [1113+] privacy-enhanced message as a reply, with user-friendly encapsulated text. (RFC [1113+] does not provide for messages with certificates but no encapsulated text; and the self-signed certificate is not "user friendly" text.) The text should be something innocuous like "Hello world!"

A requestor would typically send a certification request after generating a public-key/private-key pair, but may also do so after a change in the requestor's distinguished name.

A certification authority signs a certificate only if both signatures in the certification request are valid.

The new certificate contains the subject name and public key from the self-signed certificate, and an issuer name, serial number, validity period, and signature algorithm of the certification authority's choice. (The validity period may be derived from the self-signed certificate.) Following RFC [1114+], the issuer may be any whose distinguished name is superior to the subject's distinguished name, typically the one closest to the subject. The certification authority signs the certificate with the issuer's private key, then transforms the request into a reply containing the new certificate (see Section 3.2 for details).

The certification reply includes a certification path from the new

certificate to the RFC [1114+] Internet certification authority. It may also include other certificates such as cross-certificates that the certification authority considers helpful to the requestor.

2.2 CRL Storage

The CRL storage service stores CRLs. The service takes a CRL-storage request (see Section 3.3) specifying the CRLs to be stored, stores the CRLs, and returns a CRL-storage reply (see Section 3.4) acknowledging the request.

The certification authority stores a CRL only if its signature and certification path are valid, following concepts in RFC [1114+]. (Although a certification path is not required in a CRL-storage request, it may help the certification authority validate the CRL.)

2.3 CRL Retrieval

The CRL retrieval service retrieves the latest CRLs of specified certificate issuers. The service takes a CRL-retrieval request (see Section 3.5), retrieves the latest CRLs the request specifies, and returns a CRL-retrieval reply (see Section 3.6) containing the CRLs.

There may be more than one "latest" CRL for a given issuer, if that issuer has more than one public key (see RFC [1114+] for details).

The CRL-retrieval reply includes a certification path from each retrieved CRL to the RFC [1114+] Internet certification authority. It may also include other certificates such as cross-certificates that the certification authority considers helpful to the requestor.

3. Syntax

This section describes the syntax of requests and replies for the three services, giving simple examples.

3.1 Certification request

A certification request is an RFC [1113+] MIC-ONLY or MIC-CLEAR privacy-enhanced message containing a self-signed certificate. There is only one signer.

The fields of the self-signed certificate (which has type Certificate, as in RFC [1114+]) are as follows:

version is 0

serialNumber is arbitrary; the value 0 is suggested unless the certification authority specifies otherwise

signature is the algorithm by which the self-signed certificate is signed; it need not be the same as the algorithm by which the requested certificate is to be signed

issuer is the requestor's distinguished name

validity is arbitrary; the value with start and end both at 12:00am GMT, January 1, 1970, is suggested unless the certification authority specifies otherwise

subject is the requestor's distinguished name

subjectPublicKeyInfo is the requestor's public key

The requestor's MIC encryption algorithm must be asymmetric (e.g., RSA) and the MIC algorithm must be keyless (e.g., RSA-MD2, not MAC), so that anyone can verify the signature.

Example:

```
To: cert-service@ca.domain
From: requestor@host.domain

-----BEGIN PRIVACY-ENHANCED MESSAGE-----
Proc-Type: 4,MIC-ONLY
Content-Domain: RFC822
Originator-Certificate: <requestor's self-signed certificate>
MIC-Info: RSA,RSA-MD2,<requestor's signature on text>
```

```
<text>
-----END PRIVACY-ENHANCED MESSAGE-----
```

3.2 Certification reply

A certification reply is an RFC [1113+] MIC-ONLY or MIC-CLEAR privacy-enhanced message containing a new certificate, its certification path to the RFC [1114+] Internet certification authority, and possibly other certificates. There is only one signer. The "MIC-Info:" field and encapsulated text are taken directly from the certification request. The reply has the same process type (MIC-ONLY or MIC-CLEAR) as the request.

Since the reply is an ordinary privacy-enhanced message, the new certificate can be inserted into the requestor's database during normal privacy-enhanced mail processing. The requestor can forward the reply to other requestors to disseminate the certificate.

Example:

```
To: requestor@host.domain
From: cert-service@ca.domain

-----BEGIN PRIVACY-ENHANCED MESSAGE-----
Proc-Type: 4,MIC-ONLY
```



```
Content-Domain: RFC822
Originator-Certificate: <requestor's new certificate>
Issuer-Certificate: <issuer's certificate>
MIC-Info: RSA,RSA-MD2,<requestor's signature on text>

<text>
-----END PRIVACY-ENHANCED MESSAGE-----
```

3.3 CRL-storage request

A CRL-storage request is an RFC [1113+] CRL-type privacy-enhanced message containing the CRLs to be stored and optionally their certification paths to the RFC [1114+] Internet certification authority.

Example:

To: cert-service@ca.domain
From: requestor@host.domain

-----BEGIN PRIVACY-ENHANCED MESSAGE-----
Proc-Type: 4,CRL
CRL: <CRL to be stored>
Originator-Certificate: <CRL issuer's certificate>
CRL: <another CRL to be stored>
Originator-Certificate: <other CRL issuer's certificate>
-----END PRIVACY-ENHANCED MESSAGE-----

3.4 CRL-storage reply

A CRL-storage reply is an ordinary message acknowledging the storage of CRLs. No particular syntax is specified.

3.5 CRL-retrieval request

A CRL-retrieval request is a new type of privacy-enhanced message, distinguished from RFC [1113+] privacy-enhanced messages by the process type CRL-RETRIEVAL-REQUEST.

The request has two or more encapsulated header fields: the required "Proc-Type:" field and one or more "Issuer:" fields. The fields must appear in the order just described. There is no encapsulated text, so there is no blank line separating the fields from encapsulated text.

Each "Issuer:" field specifies an issuer whose latest CRL is to be retrieved. The field contains a value of type Name specifying the

issuer's distinguished name. The value is encoded as in an RFC [1113+] "Originator-ID-Asymmetric:" field (i.e., according to the Basic Encoding Rules, then in ASCII).

Example:

To: cert-service@ca.domain
From: requestor@host.domain

```
-----BEGIN PRIVACY-ENHANCED MESSAGE-----
Proc-Type: 4,CRL-RETRIEVAL-REQUEST
Issuer: <issuer whose latest CRL is to be retrieved>
Issuer: <another issuer whose latest CRL is to be retrieved>
-----END PRIVACY-ENHANCED MESSAGE-----
```

3.6 CRL-retrieval reply

A CRL-retrieval reply is an RFC [1113+] CRL-type privacy-enhanced message containing retrieved CRLs, their certification paths to the RFC [1114+] Internet certification authority, and possibly other certificates.

Since the reply is an ordinary privacy-enhanced message, the retrieved CRLs can be inserted into the requestor's database during normal privacy-enhanced mail processing. The requestor can forward the reply to other requestors to disseminate the CRLs.

Example:

```
To: requestor@host.domain
From: cert-service@ca.domain

-----BEGIN PRIVACY-ENHANCED MESSAGE-----
Proc-Type: 4,CRL
CRL: <issuer's latest CRL>
Originator-Certificate: <issuer's certificate>
CRL: <other issuer's latest CRL>
Originator-Certificate: <other issuer's certificate>
-----END PRIVACY-ENHANCED MESSAGE-----
```

4. Security Considerations

The self-signed certificate (Section 3.1) prevents a requestor from requesting a certificate with another party's public key. Such an attack would give the requestor the minor ability to pretend to be the originator of any message signed by the other party. This attack is significant only if the requestor does not know the message being

signed, and the signed part of the message does not identify the signer. The requestor would still not be able to decrypt messages

intended for the other party, of course.

References

[1] RFC [1113+], Privacy Enhancement for Internet Electronic Mail: Part I: Message Encryption and Authentication Procedures, J. Linn, ?, 1992.

[2] RFC [1114+], Privacy Enhancement for Internet Electronic Mail: Part II: Certificate-Based Key Management, S. Kent, ?, 1992.

[3] RFC [1115+], Privacy Enhancement for Internet Electronic Mail: Part III: Algorithms, Modes, and Identifiers, D. Balenson, ?, 1992.

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