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Header Protection for Cryptographically Protected Email

Abstract

S/MIME version 3.1 introduced a mechanism to provide end-to-end cryptographic protection of email message headers. However, few implementations generate messages using this mechanism, and several legacy implementations have revealed rendering or security issues when handling such a message.

This document updates the S/MIME specification (RFC 8551) to offer a different mechanism that provides the same cryptographic protections but with fewer downsides when handled by legacy clients. Furthermore, it offers more explicit usability, privacy, and security guidance for clients when generating or handling email messages with cryptographic protection of message headers.

The Header Protection scheme defined here is also applicable to messages with PGP/MIME (Pretty Good Privacy with MIME) cryptographic protections.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at https://www.rfc-editor.org/info/rfc9788.

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1. Introduction

Privacy and security issues regarding email Header Protection in S/MIME and PGP/MIME have been identified for some time. Most current implementations of cryptographically protected email protect only the Body of the message, which leaves significant room for attacks against otherwise-protected messages. For example, lack of Header Protection allows an attacker to substitute the message subject and/or author.

This document describes how to cryptographically protect message headers and provides guidance for the implementer of a Mail User Agent (MUA) that generates, interprets, and replies to such a message. It uses the term "Legacy MUA" to refer to an MUA that does not implement this specification. This document takes particular care to ensure that messages interact reasonably well with Legacy MUAs.

1.1. Update to RFC 8551

An older scheme for Header Protection was specified in S/MIME 3.1 [RFC8551], which involves wrapping a message/rfc822 MIME object with a Cryptographic Envelope around the message to protect it. This document refers to that scheme as "RFC 8551 Header Protection", or "RFC8551HP". Substantial testing has shown that RFC8551HP does not interact well with some Legacy MUAs (see Section 1.1.1).

This specification supersedes RFC8551HP, effectively replacing the final two paragraphs of Section 3.1 of [RFC8551].

In this specification, all Header Fields gain end-to-end cryptographic integrity and authenticity by being copied directly into the Cryptographic Payload without using an intervening message/rfc822 MIME object. In an encrypted message, some Header Fields can also be made confidential by removing or obscuring them from the Outer Header Section.

This specification also offers substantial security, privacy, and usability guidance for composing and rendering MUAs that was not considered in [RFC8551].

1.1.1. Problems with RFC 8551 Header Protection

Several Legacy MUAs have difficulty rendering a message that uses RFC8551HP. These problems can appear on signed-only messages, as well as signed-and-encrypted messages.

In some cases, some MUAs cannot render message/rfc822 message subparts at all, which is in violation of baseline MIME requirements as defined in requirement 6 of Section 2 of [RFC2049]. A message using RFC8551HP is unreadable by any recipient using such an MUA.

In other cases, the user sees an attachment suggesting a forwarded email message that -- in fact -- contains the protected email message that should be rendered directly. In most of these cases, the user can click on the attachment to view the protected message.

However, viewing the protected message as an attachment in isolation

may strip it of any security indications, leaving the user unable to assess the cryptographic properties of the message. Worse, for encrypted messages, interacting with the protected message in isolation may leak contents of the cleartext, for example, if the reply is not also encrypted.

Furthermore, RFC8551HP lacks any discussion of the following points, all of which are provided in this specification:

* Which Header Fields should be given end-to-end cryptographic integrity and authenticity protections (this specification mandates protection of all Header Fields that the composing MUA knows about).

* How to securely indicate the composer’s intent to offer Header Protection and encryption, which lets a rendering MUA detect messages whose cryptographic properties may have been modified in transit (see Section 2.1.1).

* Which Header Fields should be given end-to-end cryptographic confidentiality protections in an encrypted message and how (see Section 3).

* How to securely indicate the composer’s choices about which Header Fields were made confidential, which lets a rendering MUA reply or forward an encrypted message safely without accidentally leaking confidential material (see Section 2.2).

These stumbling blocks with Legacy MUAs, missing mechanisms, and missing guidance create a strong disincentive for existing MUAs to generate messages using RFC8551HP. Because few messages have been produced, there has been little incentive for those MUAs capable of upgrading to bother interpreting them better.

In contrast, the mechanisms defined here are safe to adopt and produce messages with very few problems for Legacy MUAs. And Section 4.10 provides useful guidance for rendering and replying to RFC8551HP messages.

1.2. Risks of Header Protection for Legacy MUA Recipients

Producing a signed-only message using this specification has no additional risks (compared to producing a signed-only message without Header Protection). Such a message will render in the same way on any Legacy MUA as a Legacy Signed Message (that is, a signed message without Header Protection). An MUA conformant to this specification that encounters such a message will be able to gain the benefits of end-to-end cryptographic integrity and authenticity for all Header Fields.

An encrypted message produced according to this specification that has some User-Facing Header Fields removed or obscured may not render as desired in a Legacy MUA. In particular, those Header Fields that were made confidential will not be visible to the user of a Legacy MUA. For example, if the Subject Header Field outside the Cryptographic Envelope is replaced with [...], a Legacy MUA will render the [...] anywhere the Subject is normally seen. This is the only additional risk of producing an encrypted message according to this specification (compared to producing an encrypted message without confidentiality for any Header Field).

A workaround "Legacy Display" mechanism is provided in this specification (see Section 2.1.2). Legacy MUAs will render "Legacy Display Elements" to the user, albeit not in the same location that the Header Fields would normally be rendered.

Alternately, if the composer of an encrypted message is particularly concerned about the experience of a recipient using a Legacy MUA, and they are willing to accept leaking the User-Facing Header Fields, they can simply adopt the No Header Confidentiality Policy (see Section 3.2.3). A signed-and-encrypted message composed using the No Header Confidentiality Policy offers no usability risk for a reader using a Legacy MUA and retains end-to-end cryptographic integrity and authenticity properties for all Header Fields for any reader using a conformant MUA. Of course, such a message has the same (non-existent) confidentiality properties for all Header Fields as a Legacy Encrypted Message (that is, an encrypted message made without Header Protection).

1.3. Motivation

Ordinary Users generally do not understand the distinction between email message Body and Header Section. When an email message has cryptographic protections that cover the message Body but not the Header Fields, several attacks become possible.

For example, a Legacy Signed Message has a signature that covers the Body but not the Header Fields. An attacker can therefore modify the Header Fields (including Subject) without invalidating the signature. Since most readers consider a message Body in the context of the message's Subject, the meaning of the message itself could change drastically (under the attacker's control) while still retaining the same cryptographic indicators of integrity and authenticity.

In another example, a Legacy Encrypted Message has its Body effectively hidden from an adversary that snoops on the message. But if the Header Fields are not also encrypted, significant information about the message (such as the message Subject) will leak to the inspecting adversary.

However, if the composing and rendering MUAs ensure that cryptographic protections cover the message Header Section as well as the message Body, these attacks are defeated.

1.3.1. Backward Compatibility

If the composing MUA is unwilling to generate such a fully protected message due to the potential for rendering, usability, deliverability, or security issues, these defenses cannot be realized.

The composer cannot know what MUA (or MUAs) the recipient will use to handle the message. Thus, an outbound message format that is backward compatible with as many legacy implementations as possible is a more effective vehicle for providing the whole-message cryptographic protections described above.

This document aims for backward compatibility with Legacy MUAs to the extent possible. In some cases, like when a user-visible Header Field like the Subject is cryptographically hidden, a Legacy MUA will not be able to render or reply to the message exactly the same way as a conformant MUA would. But accommodations are described here (in particular, Section 2.1.2) that ensure a rough semantic equivalence for a Legacy MUA even in these cases.

1.3.2. Deliverability

A message with perfect cryptographic protections that cannot be delivered is less useful than a message with imperfect cryptographic protections that can be delivered. Senders want their messages to reach the intended recipients.

Given the current state of the Internet mail ecosystem, encrypted messages in particular cannot shield all of their Header Fields from visibility and still be guaranteed delivery to their intended recipient.

This document accounts for this concern by providing a mechanism (Section 3) that prioritizes initial deliverability (at the cost of some header leakage) while facilitating future message variants that shield more header metadata from casual inspection.

1.4. Other Protocols to Protect Email Header Fields

A separate pair of protocols also provides some cryptographic protection for the email message header integrity: DomainKeys Identified Mail (DKIM) [RFC6376], as used in combination with Domain-based Message Authentication, Reporting, and Conformance (DMARC) [RFC7489]. This pair of protocols provides a domain-based reputation mechanism that can be used to mitigate some forms of unsolicited email (spam).

However, the DKIM+DMARC suite provides cryptographic protection at a different scope, as it is usually applied by and evaluated by a mail transport agent (MTA). DKIM+DMARC typically provide MTA-to-MTA protection, whereas this specification provides MUA-to-MUA protection. This is because DKIM+DMARC are typically applied to messages by (and interpreted by) MTAs, whereas the mechanisms in this document are typically applied and interpreted by MUAs.

A rendering MUA that relies on DKIM+DMARC for sender authenticity should note Section 10.1.

Furthermore, the DKIM+DMARC suite only provides cryptographic integrity and authentication, not encryption. So cryptographic confidentiality is not available from that suite.

The DKIM+DMARC suite can be used on any message, including messages formed as defined in this document. There should be no conflict between DKIM+DMARC and the specification here.

Though not strictly email, similar protections have been in use on Usenet for the signing and verification of message Header Fields for years. See [PGPCONTROL] and [PGPVERIFY-FORMAT] for more details. Like DKIM, these Usenet control protections offer only integrity and authentication, not confidentiality.

1.5. Applicability to PGP/MIME

This document specifies end-to-end cryptographic protections for email messages in reference to S/MIME [RFC8551].

Comparable end-to-end cryptographic protections can also be provided by PGP/MIME [RFC3156].

The mechanisms in this document should be applicable in the PGP/MIME protections as well as S/MIME protections, but analysis and implementation in this document focuses on S/MIME.

To the extent that any divergence from the mechanism defined here is necessary for PGP/MIME, that divergence is out of scope for this document.

1.6. Requirements Language

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.

1.7. Terms

The following terms are defined for the scope of this document:

S/MIME: Secure/Multipurpose Internet Mail Extensions (see [RFC8551])

PGP/MIME: Pretty Good Privacy with MIME (see [RFC3156])

Message: An email message consisting of Header Fields (collectively called "the Header Section of the message") optionally followed by a message Body; see [RFC5322].

Header Field: A Header Field includes a field name, followed by a colon (":"), followed by a field Body (value), and is terminated by CRLF; see Section 2.2 of [RFC5322] for more details.

Header Section: The Header Section is a sequence of lines of characters with special syntax as defined in [RFC5322]. The Header Section of a message contains the Header Fields associated with the message itself. The Header Section of a MIME part (that is, a subpart of a message) typically contains Header Fields associated with that particular MIME part.

Outer Header Section: The unprotected Header Section that MTAs and MUAs unaware of Header Protection treat as the Header Section of the Message.

Inner Header Section: The Header Section at the root of the Cryptographic Payload. An MUA that implements Header Protection renders Header Fields from this section for the user.

Body: The Body is the part of a message that follows the Header Section and is separated from the Header Section by an empty line (that is, a line with nothing preceding the CRLF); see [RFC5322]. It is the (bottom) section of a message containing the payload of a message. Typically, the Body consists of a (possibly multipart) MIME [RFC2045] construct.

Header Protection (HP): The cryptographic protection of email Header Sections (or parts of it) by means of signatures and/or encryption.

Legacy MUA: An MUA that does not understand Header Protection as defined in this document. A Legacy Non-Crypto MUA is incapable of doing any end-to-end cryptographic operations. A Legacy Crypto MUA is capable of doing cryptographic operations but does not understand or generate messages with Header Protection.

Legacy Signed Message: An email message that was signed by a Legacy MUA and therefore has no cryptographic authenticity or integrity protections on its Header Fields.

Legacy Encrypted Message: An email message that was signed and encrypted by a Legacy MUA and therefore has no cryptographic authenticity, integrity, or confidentiality protections on any of its Header Fields.

Header Confidentiality Policy (HCP): A functional specification of which Header Fields should be removed or obscured when composing an encrypted message with Header Protection. An HCP is considered more "conservative" when it removes or obscures fewer Header Fields. When it removes or obscures more Header Fields, it is more "ambitious". See Section 3.

Ordinary User: A user of an MUA who follows a simple and minimal experience, focused on sending and receiving emails. A user who opts into advanced configuration, expert mode, or the like is not an "Ordinary User".

Respond Function: A function found in most MUAs that defines how to pre-populate the Header Fields of a new message in response to another message. See Section 6.1.1.

Additionally, Cryptographic Layer, Cryptographic Payload, Cryptographic Envelope, Cryptographic Summary, Structural Header Fields, Non-Structural Header Fields, Main Body Part, User-Facing Header Fields, and MUA are all used as defined in [RFC9787].

The policies "Specification Required" and "IETF Review" that appear in this document when used to describe namespace allocation are to be interpreted as described in [RFC8126].

Note: To avoid ambiguity, this document avoids using the terms "Header" or "Headers" in isolation, but instead always uses "Header Field" to refer to the individual field and "Header Section" to refer to the entire collection.

1.8. Document Scope

This document describes sensible, simple behavior for a program that generates an email message with standard end-to-end cryptographic protections, following the guidance in [RFC9787]. An implementation conformant to this document will produce messages that have cryptographic protection that covers the message's Header Fields as well as its Body.

1.8.1. In Scope

This document also describes sensible, simple behavior for a program that interprets such a message in a way that can take advantage of these protections covering the Header Fields as well as the Body.

The message generation guidance aims to minimize negative interactions with any Legacy rendering MUA while providing actionable cryptographic properties for modern rendering MUAs.

In particular, this document focuses on two standard types of cryptographic protection that cover the entire message:

* a cleartext message with a single signature and

* an encrypted message that contains a single cryptographic signature.

1.8.2. Out of Scope

The message composition guidance in this document (in Section 5.2) aims to provide minimal disruption for any Legacy MUA that renders such a message. However, by definition, a Legacy MUA does not implement any of the guidance here. Therefore, the document does not attempt to provide guidance for Legacy MUAs directly.

Furthermore, this document does not explicitly contemplate other variants of cryptographic message protections, including any of these:

* encrypted-only message (without a cryptographic signature; see Section 5.3 of [RFC9787])

* triple-wrapped message

* signed message with multiple signatures

* encrypted message with a cryptographic signature outside the encryption

All such messages are out of scope of this document.

1.9. Example

This section provides an example of MIME messages with Header Protection.

Consider the following MIME message:

```
A └┬application/pkcs7-mime; smime-type="enveloped-data"
   (decrypts to)
B  └┬application/pkcs7-mime; smime-type="signed-data"
   ┴ (unwraps to)
C   └┬multipart/alternative; hp="cipher"
D    ├─text/plain; hp-legacy-display="1"
E    └─text/html; hp-legacy-display="1"
```

Observe that:

* Nodes A and B are collectively called the Cryptographic Envelope. Node C (including its subnodes D and E) is called the Cryptographic Payload [RFC9787].

* Node A contains the (unprotected) outer Header Fields. Node C contains the (protected) inner Header Fields.

* The presence of the hp attribute (see Section 2.1.1) on the Content-Type of node C allows the renderer to know that the composer applied Header Protection. Its value allows the renderer to distinguish whether the composer intended for the message to be confidential (hp="cipher") or not (hp="clear"), since encryption may have been added in transit (see Section 10.2).

The Outer Header Section on node A looks as follows:

```
Date: Wed, 11 Jan 2023 16:08:43 -0500
From: Bob <bob@example.net>
To: Alice <alice@example.net>
Subject: [...]
Message-ID: <20230111T210843Z.1234@lhp.example>
Content-Type: application/pkcs7-mime; smime-type="enveloped-data"
MIME-Version: 1.0
```

The Inner Header Section on node C looks as follows:

```
Date: Wed, 11 Jan 2023 16:08:43 -0500
From: Bob <bob@example.net>
To: Alice <alice@example.net>
Subject: Handling the Jones contract
Keywords: Contract, Urgent
Message-ID: <20230111T210843Z.1234@lhp.example>
Content-Type: multipart/alternative; hp="cipher"
MIME-Version: 1.0
HP-Outer: Date: Wed, 11 Jan 2023 16:08:43 -0500
HP-Outer: From: Bob <bob@example.net>
HP-Outer: To: Alice <alice@example.net>
HP-Outer: Subject: [...]
HP-Outer: Message-ID: <20230111T210843Z.1234@lhp.example>
```

Observe that:

* Between node C and node A, some Header Fields are copied as is (Date, From, To, Message-ID), some are obscured (Subject), and some are removed (Keywords).

* The HP-Outer Header Fields (see Section 2.2) of node C contain a protected copy of the Header Fields in node A. The copy allows the renderer to recompute for which Header Fields the composer provided confidentiality by removing or obscuring them.

* The copying/removing/obscuring and the HP-Outer only apply to Non-Structural Header Fields, not to Structural Header Fields like Content-Type or MIME-Version (see Section 1.1.1 of [RFC9787]).

* If the composer intends no confidentiality and doesn't encrypt the message, it doesn't remove or obscure Header Fields. All Non-Structural Header Fields are copied as is. No HP-Outer Header Fields are present.

Node D looks as follows:

```
Content-Type: text/plain; charset="us-ascii"; hp-legacy-display="1";

Subject: Handling the Jones contract
Keywords: Contract, Urgent

Please review and approve or decline by Thursday, it's critical!

Thanks,
Bob

--
Bob Gonzalez
ACME, Inc.
```

Observe that:

* The composer adds the removed and obscured User-Facing Header Fields (see Section 1.1.2 of [RFC9787]) to the main Body (note the empty line after the Content-Type). This is called the Legacy Display Element. It allows a user with a Legacy MUA that doesn't implement this document to understand the message, since the Header Fields will be shown as part of the main Body.

* The hp-legacy-display="1" attribute (see Section 2.1.2) indicates that the composer added a Legacy Display Element. This allows renderers that implement this document to recognize the Legacy Display Element and distinguish it from user-added content. The renderer then hides the Legacy Display Element and doesn't display it to the user.

* hp-legacy-display is added to the node to which it applies, not on any outer nodes (e.g., not to node C).

For more examples, see Appendices D and E.

2. Internet Message Format Extensions

This section describes relevant, backward-compatible extensions to the Internet Message Format [RFC5322]. Subsequent sections offer concrete guidance for an MUA to make use of these mechanisms, including policy decisions and recommended pseudocode.

2.1. Content-Type Parameters

This document introduces two parameters for the Content-Type Header Field, which have distinct semantics and use cases.

2.1.1. Content-Type Parameter: hp

This specification defines a parameter for the Content-Type Header Field named hp (for Header Protection). This parameter is only relevant on the Content-Type Header Field at the root of the Cryptographic Payload. The presence of this parameter at the root of the Cryptographic Payload indicates that the composer intends for this message to have end-to-end cryptographic protections for the Header Fields.

The parameter's defined values describe the composer's cryptographic intent when producing the message:

hp Value	Authenticity	Integrity	Confidentiality	Description
"clear"	yes	yes	no	This message has been signed by the composer, with Header Protection.
"cipher"	yes	yes	yes	This message has been signed by the composer, with Header Protection, and is encrypted to the recipients.

Table 1: hp Parameter for Content-Type Header Field

A composing implementation MUST NOT produce a Cryptographic Payload with parameter hp="cipher" for an unencrypted message (that is, where none of the Cryptographic Layers in the Cryptographic Envelope of the message provide encryption). Likewise, if a composing implementation is constructing an encrypted message with Header Protection, it MUST emit an hp="cipher" parameter, regardless of which Header Fields were made confidential.

Note that hp="cipher" indicates that the message itself has been encrypted by the composer to the recipients but makes no assertions about which Header Fields have been removed or obscured. This can be derived from the Cryptographic Payload itself (see Section 4.2).

A rendering implementation MUST NOT mistake the presence of an hp="cipher" parameter in the Cryptographic Payload for the actual presence of a Cryptographic Layer that provides encryption.

2.1.2. Content-Type Parameter: hp-legacy-display

This specification also defines an hp-legacy-display parameter for the Content-Type Header Field. The only defined value for this parameter is 1.

This parameter is only relevant on a leaf MIME node of Content-Type

text/html or text/plain within a well-formed message with end-to-end cryptographic protections. Its presence indicates that the MIME node it is attached to contains a decorative "Legacy Display Element". The Legacy Display Element itself is used for backward-compatible visibility of any removed or obscured User-Facing Header Field in a Legacy MUA.

Such a Legacy Display Element need not be rendered to the user of an MUA that implements this specification, because the MUA already knows the correct Header Field information and can render it to the user in the appropriate part of the MUA's user interface rather than in the Body of the message.

See Section 5.2.2 for how to insert a Legacy Display Element into a text/plain Main Body Part. See Section 5.2.3 for how to insert a Legacy Display Element into a text/html Main Body Part. See Section 4.5.3 for how to avoid rendering a Legacy Display Element.

2.2. HP-Outer Header Field

This document also specifies a new Header Field: HP-Outer.

This Header Field is used only in the Header Section of the Cryptographic Payload of an encrypted message. It is not relevant for signed-only messages. It documents, with the same cryptographic guarantees shared by the rest of the message, the composer's choices about Header Field confidentiality. It does so by embedding a copy within the Cryptographic Envelope of every Non-Structural Header Field that the composer put outside the Cryptographic Envelope. This Header Field enables the MUA rendering the encrypted message to reliably identify whether the composing MUA intended to make a Header Field confidential (see also Section 11.3).

The HP-Outer Header Fields in a message's Cryptographic Payload are useful for ensuring that any confidential Header Field will not be automatically leaked in the clear if the user replies to or forwards the message. They may also be useful for an MUA that indicates the confidentiality status of any given Header Field to the user.

An implementation that composes encrypted email MUST include a copy of all Non-Structural Header Fields deliberately exposed to the outside of the Cryptographic Envelope using a series of HP-Outer Header Fields within the Cryptographic Payload. These HP-Outer MIME Header Fields should only ever appear directly within the Header Section of the Cryptographic Payload of a Cryptographic Envelope offering confidentiality. They MUST be ignored for the purposes of evaluating the message's Header Protection if they appear in other places.

Each instance of HP-Outer contains a Non-Structural Header Field name and the value that this Header Field was set to within the (unprotected) Outer Header Section. The HP-Outer Header Field can appear multiple times in the Header Section of a Cryptographic Payload.

If a Non-Structural Header Field named Z is present in Header Section of the Cryptographic Payload but doesn't appear in an HP-Outer Header Field value at all, then the composer is effectively asserting that every instance of Z was made confidential by removal from the Outer Header Section. Specifically, it means that no Header Field Z was included on the outside of the message's Cryptographic Envelope by the composer at the time the message was injected into the mail system.

See Section 5.2 for how to insert HP-Outer Header Fields into an encrypted message. See Section 4.3 for how to determine the end-to-

end confidentiality of a given Header Field from an encrypted message with Header Protection using HP-Outer. See Section 6.1 for how an MUA can safely reply to (or forward) an encrypted message without leaking confidential Header Fields by default.

2.2.1. HP-Outer Header Field Definition

The syntax of this Header Field is defined using the following ABNF [RFC5234], where field-name, WSP, VCHAR, and FWS are defined in [RFC5322]:

```
hp-outer     =   "HP-Outer:" [FWS] field-name ": "
                    hp-outer-value CRLF

hp-outer-value  =   (*([FWS] VCHAR) *WSP)
```

Note that hp-outer-value is the same as unstructured from Section 3.2.5 of [RFC5322] but without the obsolete obs-unstruct option.

3. Header Confidentiality Policy

An MUA composing an encrypted message according to this specification may make any given Header Field confidential by removing it from the Header Section outside the Cryptographic Envelope or by obscuring it by rewriting it to a different value in that Outer Header Section. The composing MUA faces a choice for any new message: Which Header Fields should be made confidential, and how?

This section defines the "Header Confidentiality Policy" (or HCP) as a well-defined abstraction to encourage MUA developers to consider, document, and share reasonable policies across the community. It establishes a registry of known HCPs, defines a small number of simple HCPs in that registry, and makes a recommendation for a reasonable default.

Note that such a policy is only needed when the end-to-end protections include encryption (confidentiality). No comparable policy is needed for other end-to-end cryptographic protections (integrity and authenticity), as they are simply uniformly applied so that all Header Fields known by the composer have these protections.

This asymmetry is a consequence of complexities in existing message delivery systems, some of which may reject, drop, or delay messages where all Header Fields are removed from the top-level MIME object.

Note that no representation of the HCP itself ever appears "on the wire". However, the consumer of the encrypted message can see the decisions that were made by the composer’s HCP via the HP-Outer Header Fields (see Section 2.2).

3.1. HCP Definition

In this document, we represent that HCP as a function hcp:

* hcp(name, val_in) -> val_out: This function takes a Non-Structural Header Field identified by name with the initial value val_in as arguments and returns a replacement Header Field value val_out. If val_out is the special value null, it means that the Header Field in question should be removed from the set of Header Fields visible outside the Cryptographic Envelope.

In the pseudocode descriptions of various choices of HCP in this document, any comparison with the name input is done case-insensitively. This is appropriate for Header Field names, as described in [RFC5322].

Note that hcp is only applied to Non-Structural Header Fields. When composing a message, Structural Header Fields are dealt with separately, as described in Section 5.2.

As an example, an MUA that obscures the Subject Header Field by replacing it with the literal string "[...]", hides all Cc'ed recipients, and does not offer confidentiality to any other Header Fields would be represented as (in pseudocode):

```
hcp_example_hide_cc(name, val_in) → val_out:
    if lower(name) is 'subject':
        return '[...]'
    else if lower(name) is 'cc':
        return null
    else:
        return val_in
```

For alignment with common practice as well as the ABNF in Section 2.2.1 for HP-Outer, val_out MUST be one of the following:

* identical to val_in,

* the special value null (meaning that the Header Field will be removed from the outside of the message), or

* a sequence of printable 7-bit clean ASCII characters (of course, non-ASCII text can be encoded as ASCII using the encoded-word construct from [RFC2047]) and ASCII whitespace (specifically, space (0x20) and tab (0x09)).

The HCP can compute val_out using any technique describable in pseudocode, such as copying a fixed string or invocations of other pseudocode functions. If it alters the value, it MUST NOT include control or NUL characters in val_out. val_out SHOULD match the expected ABNF for the Header Field identified by name.

3.1.1. HCP Avoids Changing addr-spec of From Header Field

The From Header Field should also be treated specially by the HCP to enable defense against possible email address spoofing (see Section 10.1). In particular, for hcp("From", val_in), the addr-spec of val_in and the addr-spec of val_out SHOULD match according to Section 4.4.5, unless the composing MUA has additional knowledge coordinated with the rendering MUA about more subtle addr-spec equivalence or certificate validity.

3.2. Initial Registered HCPs

This document formally defines three Header Confidentiality Policies with known and reasonably well-understood characteristics as a way to compare and contrast different possible behavioral choices for a composing MUA. These definitions are not meant to preclude the creation of other HCPs.

The purpose of the registry of HCPs is to facilitate HCP evolution and interoperability discussion among MUA developers and MTA operators.

(The example hypothetical HCP, hcp_example_hide_cc, described in Section 3.1 above is deliberately not formally registered, as it has not been evaluated in practice.)

3.2.1. Baseline Header Confidentiality Policy

The most conservative recommended HCP only provides confidentiality

for Informational Fields, as defined in Section 3.6.5 of [RFC5322]. These fields are "only human-readable content" and thus their content should not be relevant to transport agents. Since most Internet messages today do have a Subject Header Field, and some filtering engines might object to a message without a Subject, this policy is conservative and merely obscures that Header Field by replacing it with a fixed string [...]. By contrast, Comments and Keywords Header Fields are comparatively rare, so these fields are removed entirely from the Outer Header Section.

```
hcp_baseline(name, val_in) → val_out:
    if lower(name) is 'subject':
        return '[...]'
    else if lower(name) is in ['comments', 'keywords']:
        return null
    else:
        return val_in
```

hcp_baseline is the recommended default HCP, as it provides meaningful confidentiality protections and is unlikely to cause deliverability or usability problems.

3.2.2. Shy Header Confidentiality Policy

Alternately, a slightly more ambitious (and therefore more privacy-preserving) HCP might avoid leaking human-interpretable data that MTAs generally don't care about. The additional protected data isn't related to message routing or transport but might reveal sensitive information about the composer or their relationship to the recipients. This "shy" HCP builds on hcp_baseline but also:

* avoids revealing the display-name of each identified email address and

* avoids leaking the composer's locally configured time zone in the Date Header Field.

```
hcp_shy(name, val_in) → val_out:
   if lower(name) is 'from':
      if val_in is an RFC 5322 mailbox:
         return the RFC 5322 addr-spec part of val_in
   if lower(name) in ['to', 'cc']:
      if val_in is an RFC 5322 mailbox-list:
         let val_out be an empty mailbox-list
         for each mailbox in val_in:
            append the RFC 5322 addr-spec part of mailbox to val_out
         return val_out
   if lower(name) is 'date':
      if val_in is an RFC 5322 date-time:
          return the UTC form of val_in
   else if lower(name) is 'subject':
      return '[...]'
   else if lower(name) is in ['comments', 'keywords']:
      return null
   return val_in
```

hcp_shy requires more sophisticated parsing and Header Field manipulation and is not recommended as a default HCP.

3.2.3. No Header Confidentiality Policy

Legacy MUAs can be conceptualized as offering a "No Header Confidentiality" Policy, which offers no confidentiality protection to any Header Field:

```
hcp_no_confidentiality(name, val_in) → val_out:
```

```
    return val_in
```

A conformant MUA that is not modified by local policy or configuration MUST NOT use hcp_no_confidentiality by default.

3.3. Default Header Confidentiality Policy

An MUA MUST have a default HCP that offers confidentiality for the Subject Header Field at least. Local policy and configuration may alter this default, but the MUA SHOULD NOT require the user to select an HCP.

hcp_baseline provides confidentiality for the Subject Header Field by replacing it with the literal string "[...]". It also provides confidentiality for the other less common Informational Header Fields (Comments and Keywords) by removing them entirely from the Outer Header Section. This is a sensible default because most users treat the Informational Fields of a message (particularly the Subject) the same way that they treat the Body, and they are surprised to find that the Subject of an encrypted message is visible.

3.4. HCP Evolution

This document does not mandate any particular HCP, though it offers guidance for MUA implementers in selecting one in Section 3.3. Future documents may recommend or mandate such a policy for an MUA with specific needs. Such a recommendation might be motivated by descriptions of metadata-derived attacks, stem from research about message deliverability, or describe new signaling mechanisms, but these topics are out of scope for this document.

3.4.1. Offering More Ambitious Header Confidentiality

An MUA MAY offer even more ambitious confidentiality for Header Fields of an encrypted message than defined in Section 3.2.2. For example, it might implement an HCP that removes the To and Cc Header Fields entirely, relying on the SMTP envelope to ensure proper routing. Or it might remove References and In-Reply-To so that message threading is not visible to any MTA. Any more ambitious choice might result in deliverability, rendering, or usability issues for the relevant messages, so testing and documentation will be valuable to get this right.

The authors of this document hope that implementers with deployment experience will document their chosen HCP and the rationale behind their choice.

3.4.2. Expert Guidance for Registering Header Confidentiality Policies

There is no formal syntax specified for the HCP, but any attempt to specify an HCP for inclusion in the registry needs to provide:

* a stable reference document clearly indicating the distinct name for the proposed HCP,
* pseudocode that other implementers can clearly and unambiguously interpret,
* a clear explanation of why this HCP is different from all other registered HCPs, and
* any relevant considerations related to deployment of the HCP (for example, known or expected deliverability, rendering, or privacy challenges and possible mitigations).

When the proposed HCP produces any non-null output for a given Header

Field name, val_out SHOULD match the expected ABNF for that Header Field. If the proposed HCP does not match the expected ABNF for that Header Field, the documentation should explicitly identify the relevant circumstances and provide a justification for the deviation.

An entry should not be marked as "Recommended" unless it has been shown to offer confidentiality or privacy improvements over the status quo and have minimal or mitigable negative impact on messages to which it is applied, considering factors such as message deliverability and security. Only one entry in the table (hcp_baseline) is initially marked as "Recommended". In the future, more than one entry may be marked as "Recommended".

4. Rendering Guidance (Receiving Side)

An MUA that receives a cryptographically protected email will render it for the user.

The rendering MUA will render the message Body, render a selected subset of Header Fields, and (as described in Section 3 of [RFC9787]) provide a summary of the cryptographic properties of the message.

Most MUAs only render a subset of Header Fields by default. For example, most MUAs render the From, To, Cc, Date, and Subject Header Fields to the user, but few render Message-Id or Received.

An MUA that knows how to handle a message with Header Protection makes the following four changes to its behavior when rendering a message:

* If the MUA detects that an incoming message has protected Header Fields:

  - For a Header Field that is present in the protected Header Section, the MUA SHOULD render the protected value and ignore any unprotected counterparts that may be present (with a special exception for the From Header Field (see Section 4.4)).

  - For a Header Field that is present only in the Outer Header Section, the MUA SHOULD NOT render that value. If it does render the value, the MUA SHOULD indicate that the rendered value is unprotected. For an exception to this, see Section 7 for a discussion of some specific Header Fields that are known to be added in transit and therefore are not expected to have end-to-end cryptographic protections.

* The MUA SHOULD include information in the message's Cryptographic Summary to indicate the types of protection that applied to each rendered Header Field (if any).

* If any Legacy Display Elements are present in the Body of the message, it does not render them.

* When replying to (or forwarding) a message with confidential Header Fields, the replying (or forwarding) MUA avoids leaking any Header Fields that were confidential in the original into the cleartext of the reply (or forwarded message). It does this even if its own HCP would not have treated those Header Fields as confidential. See Section 6 for more details.

Note that an MUA that handles a message with Header Protection does _not_ need to render any new Header Fields that it did not render before.

4.1. Identifying That a Message Has Header Protection

An incoming message can be identified as having Header Protection using the following test:

* The Cryptographic Payload has parameter hp set to "clear" or "cipher". See Section 4.5 for rendering guidance.

When consuming a message, an MUA MUST ignore the hp parameter to Content-Type when it encounters it anywhere other than the root of the message's Cryptographic Payload.

4.2. Extracting Protected Header Fields From an Encrypted Message

When a message is encrypted and uses Header Protection, the rendering MUA extracts two lists of Header Fields (names and values):

* The list of Header Fields that the composing MUA applied to the protected message.

* Those Header Fields added by the composing MUA to the (unprotected) Outer Header Section of the message, intended for interpretation by MTAs and Legacy MUAs.

The following algorithm takes referenced message refmsg as input, which is encrypted with Header Protection as described in this document (that is, the Cryptographic Envelope includes a Cryptographic Layer that provides encryption, and the hp parameter for the Content-Type Header Field of the Cryptographic Payload is cipher). It produces as output a pair of lists of (h,v) Header Fields.

4.2.1. HeaderSetsFromMessage

Method signature:

HeaderSetsFromMessage(refmsg) -> (refouter, refprotected)

Procedure:

1. Let refheaders be the list of (h,v) protected Header Fields found in the root of the Cryptographic Payload of refmsg.

2. Let refouter be an empty list of Header Field names and values.

3. Let refprotected be an empty list of Header Field names and values.

4. For each (h,v) in refheaders:

    i. If h is HP-Outer:

        a. Split v into (h1,v1) on the first colon (:), followed by any amount of whitespace.

        b. Append (h1,v1) to refouter.

    ii. Else:

        a. Append (h,v) to refprotected.

5. Return refouter, refprotected.

Note that this algorithm is independent of the Outer Header Section. It derives its output only from the normal Header Fields and the HP-Outer Header Fields, both contained inside the Cryptographic Payload.

4.3. Updating the Cryptographic Summary

Regardless of whether a cryptographically protected message has protected Header Fields, the Cryptographic Summary of the message should be modified to indicate what protections the Header Fields have. This field-by-field status is complex and isn't necessarily intended to be presented in full to the user. Rather, it represents the state of the message internally within the MUA and may be used to influence behavior like replying to or forwarding the message (see Section 6.1).

Each Header Field individually has exactly one of the following protection states:

* unprotected (has no Header Protection)

* signed-only (bound into the same validated signature as the enclosing message, but also visible in transit)

* encrypted-only (only appears within the Cryptographic Payload; the corresponding external Header Field was either removed or obscured)

* signed-and-encrypted (same as encrypted-only, but additionally is under a validated signature)

If the message does not have Header Protection (as determined by Section 4.1), then all of the Header Fields are by definition unprotected.

If the message has Header Protection, an MUA SHOULD use the following algorithm to compute the protection state of a protected Header Field (h,v):

4.3.1. HeaderFieldProtection

Method signature:

HeaderFieldProtection(msg, h, v) -> protection_state

Procedure:

1. Let ct be the Content-Type of the root of the Cryptographic Payload of msg.

2. Compute (refouter, refprotected) from HeaderSetsFromMessage(msg).

3. If (h, v) is not in refprotected:

    i. Abort, v is not a valid value for Header Field h.

4. Let is_sig_valid be false.

5. If the message is signed:

    i. Let is_sig_valid be the result of validating the signature.

6. If the message is encrypted, and if ct has a parameter hp="cipher", and if (h,v) is not in refouter:

    i. Return signed-and-encrypted if is_sig_valid, otherwise return encrypted-only.

7. Return signed-only if is_sig_valid, otherwise return unprotected.

Note that:

* This algorithm is independent of the unprotected Header Fields. It derives the protection state only from (h,v) and the set of HP-Outer Header Fields, both of which are inside the Cryptographic Envelope.

* If the signature fails validation, the MUA lowers the affected state to unprotected or encrypted-only without any additional warning to the user (see also Section 3.1 of [RFC9787]).

* Data from signed-and-encrypted and encrypted-only Header Fields may still not be fully private (see Section 11.2).

* Encryption may have been added in transit to an originally signed-only message. Thus, only consider Header Fields to be confidential if the composer indicates it with the hp="cipher" parameter.

* The protection state of a Header Field may be weaker than that of the message Body. For example, a message Body can be signed-and-encrypted, but a Header Field that is copied unmodified to the Outer Header Section is signed-only.

If the message has Header Protection, the Header Fields that are not in refprotected (e.g., because they were added in transit) are unprotected.

Rendering the cryptographic status of each Header Field is likely to be complex and messy -- users may not understand it. It is beyond the scope of this document to suggest any specific graphical affordances or user experience. Future work should include examples of successful rendering of this information.

4.4. Handling Mismatch of From Header Fields

End-to-end (MUA-to-MUA) Header Protection is good for authenticity, integrity, and confidentiality, but it potentially introduces new issues when an MUA depends on its MTA to authenticate parts of the Header Section. The latter is typically the case in modern email systems.

In particular, when an MUA depends on its MTA to ensure that the email address in the (unprotected) From Header Field is authentic, but the MUA renders the email address of the protected From Header Field that differs from the address visible to the MTA, this could create a risk of sender address spoofing (see Section 10.1). This potential risk applies to signed-only messages as well as signed-and-encrypted messages.

4.4.1. Definitions

4.4.1.1. From Header Field Mismatch

"From Header Field Mismatch" is defined as follows:

The addr-spec of the inner From Header Field doesn’t match the addr-spec of the outer From Header Field (see Section 4.4.5).

Note: The unprotected From Header Field used in this comparison is the actual Header Field found in the Outer Header Section (as seen by the MTA), not the value indicated by any potential inner HP-Outer Header Field.

4.4.1.2. No Valid and Correctly Bound Signature

"No Valid and Correctly Bound Signature" is defined as follows:

There is no valid signature made by a certificate for which the MUA has a valid binding to the protected From address. This includes:

* the message has no signature

* the message has a broken signature

* the message has a valid signature, but the rendering MUA does not see any valid binding between the signing certificate and the addr-spec of the inner From Header Field

Note: There are many possible ways that an MUA could choose to validate a certificate-to-address binding. For example, the MUA could ensure the certificate is issued by one of a set of trusted certification authorities, it could rely on the user to do a manual out-of-band comparison, it could rely on a DNSSEC signal ([RFC7929] or [RFC8162]), and so on. It is beyond the scope of this document to describe all possible ways an MUA might validate the certificate-to-address binding or to choose among them.

4.4.2. Warning for From Header Field Mismatch

To mitigate the above described risk of sender address spoofing, an MUA SHOULD warn the user whenever both of the following conditions are met:

* From Header Field Mismatch (as defined in Section 4.4.1.1) and

* No Valid and Correctly Bound Signature (as defined in Section 4.4.1.2)

This warning should be comparable to the MUA's warning about messages that are likely spam or phishing, and it SHOULD show both of the non-matching From Header Fields.

4.4.3. From Header Field Rendering

Furthermore, a rendering MUA that depends on its MTA to authenticate the (unprotected) outer From Header Field SHOULD render the outer From Header Field (as an exception to the guidance in the beginning of Section 4) if both of the following conditions are met:

* From Header Field Mismatch (as defined in Section 4.4.1.1) and

* No Valid and Correctly Bound Signature (as defined in Section 4.4.1.2)

An MUA MAY apply a local preference to render a different display name (e.g., from an address book).

See Section 10.1.1 for a detailed explanation of this rendering guidance.

4.4.4. Handling the Protected From Header Field When Responding

When responding to a message, an MUA has different ways to populate the recipients of the new message. Depending on whether it is a Reply, a Reply All, or a Forward, an MUA may populate the composer view using a combination of the referenced message's From, To, Cc, Reply-To, or Mail-Followup-To Header Fields as well as any other signals.

When responding to a message with Header Protection, an MUA MUST only use the protected Header Fields when populating the recipients of the new message.

This avoids compromise of message confidentiality when a machine-in-the-middle (MITM) attacker modifies the unprotected From address of an encrypted message, attempting to learn the contents through a misdirected reply. Note that with the rendering guidance above, a MITM attacker can cause the unprotected From Header Field to be displayed. Thus, when responding, the populated To address may differ from the rendered From address. However, this change in addresses should not cause more user confusion than the address change caused by a Reply-To in a Legacy Message does.

4.4.5. Matching addr-specs

When generating (Section 3.1.1) or consuming (Section 4.4) a protected From Header Field, the MUA considers the equivalence of two different addr-spec values.

First, the MUA MUST check whether the domain part of an addr-spec being compared contains a U-label [RFC5890]. If it does, it MUST be converted to the A-label form as described in [RFC5891]. We call a domain converted in this way (or the original domain if it didn't contain any U-label) "the ASCII version of the domain part". Second, the MUA MUST compare the ASCII version of the domain part of the two addr-specs by standard DNS comparison: Assume ASCII text and compare alphabetic characters case-insensitively, as described in Section 3.1 of [RFC1035]. If the domain parts match, then the two local-parts are matched against each other. The simplest and most common comparison for the local-part is also an ASCII-based, case-insensitive match. If the MUA has special knowledge about the domain and, when composing, it can reasonably expect the rendering MUAs to have the same information, it MAY match the local-part using a more sophisticated and inclusive matching algorithm.

It is beyond the scope of this document to recommend a more sophisticated and inclusive matching algorithm.

4.5. Rendering a Message with Header Protection

When the Cryptographic Payload's Content-Type has the parameter hp set to "clear" or "cipher", the values of the protected Header Fields are drawn from the Header Fields of the Cryptographic Payload, and the Body that is rendered is the content of the Cryptographic Payload itself.

4.5.1. Example Signed-Only Message

Consider a message with this structure, where the MUA is able to validate the cryptographic signature:

```
A └┬ application/pkcs7-mime; smime-type="signed-data"
  ┴  (unwraps to)
B  └┬ multipart/alternative [Cryptographic Payload + Rendered Body]
C   ├─ text/plain
D   └─ text/html
```

The message Body should be rendered the same way as this message:

```
B └┬ multipart/alternative
C  ├─ text/plain
D  └─ text/html
```

The MUA should render Header Fields taken from part B.

Its Cryptographic Summary should indicate that the message was signed and all rendered Header Fields were included in the signature.

Because this message is signed-only, none of its parts will have a

Legacy Display Element.

The MUA should ignore Header Fields from part A for the purposes of rendering.

4.5.2. Example Signed-and-Encrypted Message

Consider a message with this structure, where the MUA is able to validate the cryptographic signature:

```
E └┬application/pkcs7-mime; smime-type="enveloped-data"
    (decrypts to)
F  └┬application/pkcs7-mime; smime-type="signed-data"
    ┴ (unwraps to)
G   └┬multipart/alternative [Cryptographic Payload + Rendered Body]
H    ├─text/plain
I    └─text/html
```

The message Body should be rendered the same way as this message:

```
G └┬multipart/alternative
H  ├─text/plain
I  └─text/html
```

It should render Header Fields taken from part G.

Its Cryptographic Summary should indicate that the message is signed-and-encrypted.

When rendering the Cryptographic Status of a Header Field and when composing a reply (or forward), each Header Field found in G should be considered against all HP-Outer Header Fields found in G. If an HP-Outer Header Field that matches both the name and value is found, the Header Field's Cryptographic Status is just signed-only, even though the message itself is signed-and-encrypted. If no matching HP-Outer Header Field is found, the Header Field's Cryptographic Status is signed-and-encrypted, like the rest of the message (see Section 4.3).

If any of the User-Facing Header Fields are removed or obscured, the composer of this message may have placed Legacy Display Elements in parts H and I.

The MUA should ignore Header Fields from part E for the purposes of rendering.

4.5.3. Do Not Render Legacy Display Elements

As described in Section 2.1.2, a message with cryptographic confidentiality protection MAY include Legacy Display Elements for backward compatibility with Legacy MUAs. These Legacy Display Elements are strictly decorative and unambiguously identifiable and will be discarded by compliant implementations.

The rendering MUA MUST completely avoid rendering the identified Legacy Display Elements to the user, since it is aware of Header Protection and can render the actual protected Header Fields.

If a text/html or text/plain part within the Cryptographic Envelope is identified as containing Legacy Display Elements, those elements MUST be hidden when rendering and MUST be dropped when generating a draft reply or inline forwarded message. Whenever a message or a MIME subtree is exported, downloaded, or otherwise further processed, if there is no need to retain a valid cryptographic signature, the implementer MAY drop the Legacy Display Elements.

4.5.3.1. Identifying a Part with Legacy Display Elements

A rendering MUA acting on a message that contains an encrypting Cryptographic Layer identifies a MIME subpart within the Cryptographic Payload as containing Legacy Display Elements based on the Content-Type of the subpart. The subpart's Content-Type:

* contains a parameter hp-legacy-display with value set to 1 and

* is either text/plain (see Section 4.5.3.2) or text/html (see Section 4.5.3.3).

Note that the term "subpart" above is used in the general sense: If the Cryptographic Payload is a single part, that part itself may contain a Legacy Display Element if it is marked with the hp-legacy-display="1" parameter.

4.5.3.2. Omitting Legacy Display Elements from text/plain

If a text/plain part within the Cryptographic Payload has the Content-Type parameter hp-legacy-display="1", it should be processed before rendering in the following fashion:

* Discard the leading lines of the content of the MIME part up to and including the first entirely blank line.

Note that implementing this strategy is dependent on the charset used by the MIME part.

See Appendix E.1 for an example.

4.5.3.3. Omitting Legacy Display Elements from text/html

If a text/html part within the Cryptographic Payload has the Content-Type parameter hp-legacy-display="1", it should be processed before rendering in the following fashion:

* If any element of the HTML <body> is a with class attribute header-protection-legacy-display, that entire element should be omitted.

This cleanup could be done, for example, as a custom rule in the MUA's HTML sanitizer, if one exists. Another implementation strategy for an HTML-capable MUA would be to add an entry to the [CSS] style sheet for such a part:

```
body div.header-protection-legacy-display { display: none; }
```

4.6. Implicitly Rendered Header Fields

While the From, To, Cc, Subject, and Date Header Fields are often explicitly rendered to the user, some Header Fields do affect message display without being explicitly rendered.

For example, the Message-Id, References, and In-Reply-To Header Fields may collectively be used to place a message in a "thread" or series of messages.

In another example, Section 6.2 notes that the value of the Reply-To Header Field can influence the draft reply message. So while the user may never see the Reply-To Header Field directly, it is implicitly "rendered" when the user interacts with the message by replying to it.

An MUA that depends on any implicitly rendered Header Field in a message with Header Protection MUST use the value from the protected

Header Field and SHOULD NOT use any value found outside the cryptographic protection unless it is known to be a Header Field added in transit, as specified in Section 7.

4.7. Handling Undecryptable Messages

An MUA might receive an apparently encrypted message that it cannot currently decrypt. For example, when an MUA does not have regular access to the secret key material needed for decryption, it cannot know the cryptographically protected Header Fields or even whether the message has any cryptographically protected Header Fields.

Such an undecrypted message will be rendered by the MUA as a message without any Header Protection. This means that the message summary may well change how it is rendered when the user is finally able to supply the secret key.

For example, the rendering of the Subject Header Field in a mailbox summary might change from [...] to the real message subject when the message is decrypted. Or the message's placement in a message thread might change if, say, References or In-Reply-To have been removed or obscured (see Section 4.6).

Additionally, if the MUA does not retain access to the decrypting secret key, and it drops the decrypted form of a message, the message's rendering may revert to the encrypted form. For example, if an MUA follows this behavior, the Subject Header Field in a mailbox summary might change from the real message subject back to [...]. Or the message might be displayed outside of its current thread if the MUA loses access to a removed References or In-Reply-To Header Field.

These behaviors are likely to surprise the user. However, an MUA has several possible ways of reducing or avoiding all of these surprises, including:

* Ensuring that the MUA always has access to decryption-capable secret key material.

* Rendering undecrypted messages in a special quarantine view until the decryption-capable secret key material is available.

To reduce or avoid the surprises associated with a decrypted message with removed or obscured Header Fields becoming undecryptable, the MUA could also:

* Securely cache metadata from a decrypted message's protected Header Fields so that its rendering doesn't change after the first decryption.

* Securely store the session key associated with a decrypted message so that attempts to read the message when the long-term secret key is unavailable can proceed using only the session key itself. For example, see the discussion about stashing session keys in Section 9.1 of [RFC9787].

4.8. Guidance for Automated Message Handling

Some automated systems have a control channel that is operated by email. For example, an incoming email message could subscribe someone to a mailing list, initiate the purchase of a specific product, approve another message for redistribution, or adjust the state of some shared object.

To the extent that such a system depends on end-to-end cryptographic guarantees about the email control message, Header Protection as

defined in this document should improve the system's security. This section provides some specific guidance for systems that use email messages as a control channel that want to benefit from these security improvements.

4.8.1. Only Interpret Protected Header Fields

Consider the situation where an email-based control channel depends on the message's cryptographic signature and the action taken depends on some Header Field of the message.

In this case, the automated system MUST rely on information from the Header Field that is protected by the mechanism defined in this document. It MUST NOT rely on any Header Field found outside the Cryptographic Payload.

For example, consider an administrative interface for a mailing list manager that only accepts control messages that are signed by one of its administrators. When an inbound message for the list arrives, it is queued (waiting for administrative approval) and the system generates and listens for two distinct email addresses related to the queued message -- one that approves the message and one that rejects it. If an administrator sends a signed control message to the approval address, the mailing list verifies that the protected To Header Field of the signed control message contains the approval address before approving the queued message for redistribution. If the protected To Header Field does not contain that address, or there is no protected To Header Field, then the mailing list logs or reports the error and does not act on that control message.

4.8.2. Ignore Legacy Display Elements

Consider the situation where an email-based control channel expects to receive an end-to-end encrypted message -- for example, where the control messages need confidentiality guarantees -- and where the action taken depends on the contents of some MIME part within the message Body.

In this case, the automated system that decrypts the incoming messages and scans the relevant MIME part MUST identify when the MIME part contains a Legacy Display Element (see Section 4.5.3.1), and it MUST parse the relevant MIME part with the Legacy Display Element removed.

For example, consider an administrative interface of a confidential issue tracking software. An authorized user can confidentially adjust the status of a tracked issue by a specially formatted first line of the message Body (for example, severity #183 serious). When the user's MUA encrypts a plaintext control message to this issue tracker, depending on the MUA's HCP and its choice of legacy value, it may add a Legacy Display Element. If it does so, then the first line of the message Body will contain a decorative copy of the confidential Subject Header Field. The issue tracking software decrypts the incoming control message, identifies that there is a Legacy Display Element in the part (see Section 4.5.3.1), strips the lines comprising the Legacy Display Element (including the first blank line), and only then parses the remaining top line to look for the expected special formatting.

4.9. Affordances for Debugging and Troubleshooting

Note that advanced users of an MUA may need access to the original message, for example, to troubleshoot problems with the rendering MUA itself or problems with the SMTP transport path taken by the message.

An MUA that applies these rendering guidelines SHOULD ensure that the

full original source of the message as it was received remains available to such a user for debugging and troubleshooting.

If a troubleshooting scenario demands information about the cryptographically protected values of Header Fields, and the message is encrypted, the debugging interface SHOULD also provide a "source" view of the Cryptographic Payload itself, alongside the full original source of the message as received.

4.10. Handling RFC8551HP Messages (Backward Compatibility)

Section 1.1.1 describes some drawbacks to the Header Protection scheme defined in [RFC8551], referred to here as RFC8551HP. An MUA MUST NOT generate an RFC8551HP message. However, for backward compatibility, an MUA MAY try to render or respond to such a message as though the message has standard Header Protection.

The following two sections contain guidance for identifying, rendering, replying to, and forwarding RFC8551HP messages. Corresponding test vectors are provided in Appendices C.2.5, C.2.6, and C.3.17.

4.10.1. Identifying an RFC8551HP Message

An RFC8551HP message can be identified by its MIME structure, given that all of the following conditions are met:

* It has a well-formed Cryptographic Envelope consisting of at least one Cryptographic Layer as the outermost MIME object.

* The Cryptographic Payload is a single message/rfc822 object.

* The message that constitutes the Cryptographic Payload does not itself have a well-formed Cryptographic Envelope; that is, its outermost MIME object is not a Cryptographic Layer.

* No Content-Type parameter of hp= is set on either the Cryptographic Payload or its immediate MIME child.

Here is the MIME structure of an example signed-and-encrypted RFC8551HP message:

```
A └┬application/pkcs7-mime; smime-type="enveloped-data"
   (decrypts to)
B  └┬application/pkcs7-mime; smime-type="signed-data"
    ┴ (unwraps to)
C    └┬message/rfc822 [Cryptographic Payload]
D     └┬multipart/alternative [Rendered Body]
E      ├─text/plain
F      └─text/html
```

This meets the definition of an RFC8551HP message because:

* Cryptographic Layers A and B form the Cryptographic Envelope.

* The Cryptographic Payload, rooted in part C, has Content-Type: message/rfc822.

* Part D (the MIME root of the message at C) is itself not a Cryptographic Layer.

* Neither part C nor part D have any hp parameters set on their Content-Type.

4.10.2. Rendering or Responding to an RFC8551HP Message

When an MUA has precisely identified a message as an RFC8551HP message, the MUA MAY render or respond to that message as though it were a message with Header Protection as defined in this document by making the following adjustments:

* Rather than rendering the message Body as the Cryptographic Payload itself (part C in the example above), render the RFC8551HP message's Body as the MIME subtree that is the Cryptographic Payload's immediate child (part D).

* Make a comparable modification to HeaderSetsFromMessage (Section 4.2.1) and HeaderFieldProtection (Section 4.3.1): Both algorithms currently look for the protected Header Fields on the Cryptographic Payload (part C), but they should instead look at the Cryptographic Payload's immediate child (part D).

* If the Cryptographic Envelope is signed-only, behave as though there is an hp="clear" parameter for the Cryptographic Payload; if the Envelope contains encryption, behave as though there is an hp="cipher" parameter. That is, infer the composer's cryptographic intent from the structure of the message.

* If the Cryptographic Envelope contains encryption, further modify HeaderSetsFromMessage to derive refouter from the actual Outer Header Section (those Header Fields found in part A in the example above) rather than looking for HP-Outer Header Fields with the other protected Header Fields. That is, infer Header Field confidentiality based on the unprotected Header Fields.

The inferences in the above modifications are not based on any strong end-to-end guarantees. An intervening MTA may tamper with the message's Outer Header Section or wrap the message in an encryption layer to undetectably change the recipient's understanding of the confidentiality of the message's Header Fields or the message Body itself.

4.11. Rendering Other Schemes

Other MUAs may have generated different structures of messages that aim to offer end-to-end cryptographic protections that include Header Protection. This document is not normative for those schemes, and it is NOT RECOMMENDED to generate these other schemes, as they can either have structural flaws or simply render poorly on Legacy MUAs. A conformant MUA MAY attempt to infer Header Protection when rendering an existing message that appears to use some other scheme not documented here. Pointers to some known other schemes can be found in Appendix F.

5. Composing Guidance (Sending Side)

This section describes the process an MUA should use to apply cryptographic protection to an email message with Header Protection.

When composing a message with end-to-end cryptographic protections, an MUA SHOULD apply Header Protection.

When generating such a message, an MUA MUST add the hp parameter (see Section 2.1.1) only to the Content-Type Header Field at the root of the message's Cryptographic Payload. The value of the parameter MUST indicate whether the Cryptographic Envelope contains a layer that provides encryption.

5.1. Composing a Cryptographically Protected Message Without Header Protection

For contrast, we first consider the typical message composition

process of a Legacy Crypto MUA, which does not provide any Header Protection.

This process is described in Section 5.1 of [RFC9787]. We replicate it here for reference. The inputs to the algorithm are:

* origbody: The unprotected message Body as a well-formed MIME tree (possibly just a single MIME leaf part). As a well-formed MIME tree, origbody already has Structural Header Fields (Content-*) present.

* origheaders: The intended Non-Structural Header Fields for the message, represented here as a list of (h,v) pairs, where h is a Header Field name and v is the associated value. Note that these are Header Fields that the MUA intends to be visible to the recipient of the message. In particular, if the MUA uses the Bcc Header Field during composition but plans to omit it from the message (see Section 3.6.3 of [RFC5322]), it will not be in origheaders.

* crypto: The series of cryptographic protections to apply (for example, "sign with the secret key corresponding to X.509 certificate X, then encrypt to X.509 certificates X and Y"). This is a routine that accepts a MIME tree as input (the Cryptographic Payload), wraps the input in the appropriate Cryptographic Envelope, and returns the resultant MIME tree as output.

The algorithm returns a MIME object that is ready to be injected into the mail system.

5.1.1. ComposeNoHeaderProtection

Method signature:

ComposeNoHeaderProtection(origbody, origheaders, crypto) -> mime_message

Procedure:

1. Apply crypto to MIME part origbody, producing MIME tree output.

2. For each Header Field name and value (h,v) in origheaders:

    i. Add Header Field h to output with value v.

3. Return output.

5.2. Composing a Message with Header Protection

To compose a message using Header Protection, the composing MUA uses the following inputs:

* all the inputs described in Section 5.1

* hcp: an HCP, as defined in Section 3

* respond: if the new message is a response to another message, the MUA’s Respond Function corresponding to the user’s action (see Section 6.1.1), otherwise null

* refmsg: if the new message is a response to another message, the message being responded to, otherwise null

* legacy: a boolean value, indicating whether any recipient of the message is believed to have a Legacy MUA. If all recipients are known to implement this document, legacy should be set to false.

(How an MUA determines the value of legacy is out of scope for this document; an initial implementation can simply set it to true.)

To enable visibility of User-Facing but now removed/obscured Header Fields for decryption-capable Legacy MUAs, the Header Fields are included as a decorative Legacy Display Element in specially marked parts of the message (see Section 2.1.2). This document recommends two mechanisms for such a decorative adjustment: one for a text/plain Main Body Part (see Section 5.2.2) and one for a text/html Main Body Part (see Section 5.2.3) of the email message. This document does not recommend adding a Legacy Display Element to any other part.

Please see Section 7.1 of [RFC9787] for guidance on identifying the parts of a message that are a Main Body Part.

5.2.1. Compose

Method signature:

Compose(origbody, origheaders, crypto, hcp, respond, refmsg, legacy) -> mime_message

Procedure:

1. Let newbody be a copy of origbody.

2. If crypto contains encryption and legacy is true:

    i. Create ldlist, an empty list of (header, value) pairs.

    ii. For each Header Field name and value (h,v) in origheaders:

        a. If h is User-Facing (see Section 1.1.2 of [RFC9787]):

            I. If hcp(h,v) is not v:

                A. Add (h,v) to ldlist.

    iii. If ldlist is not empty:

        a. Identify each leaf MIME part of newbody that represents a "Main Body Part" of the message.

        b. For each "Main Body Part" bodypart of type text/plain or text/html:

            I. Adjust bodypart by inserting a Legacy Display Element Header Field list ldlist into its content and adding a Content-Type parameter hp-legacy-display with value 1 (see Section 5.2.2 for text/plain and Section 5.2.3 for text/html).

3. For each Header Field name and value (h,v) in origheaders:

    i. Add Header Field h to MIME part newbody with value v.

4. If crypto does not contain encryption:

    i. Set the hp parameter on the Content-Type of MIME part newbody to clear.

    ii. Let newheaders be a copy of origheaders.

5. Else (if crypto contains encryption):

i. Set the hp parameter on the Content-Type of MIME part newbody to cipher.

ii. Let response_hcp be an ephemeral HCP, the output of ReferenceHCP(refmsg, respond) (see Section 6.1.2).

iii. Create a new empty list of Header Field names and values newheaders.

iv. For each Header Field name and value (h,v) in origheaders:

a. Let newval be hcp(h,v).

b. If newval is v:

I. Let newval be response_hcp(h,v).

c. If newval is not null:

I. Add (h,newval) to newheaders.

v. For each Header Field name and value (h,v) in newheaders:

a. Let string record be the concatenation of h, a literal ": " (ASCII colon (0x3A) followed by ASCII space (0x20)), and v.

b. Add Header Field "HP-Outer" to MIME part newbody with value record.

6. Apply crypto to MIME part newbody, producing MIME tree output.

7. For each Header Field name and value (h,v) in newheaders:

i. Add Header Field h to output with value v.

8. Return output.

Note that both new parameters (hcp and legacy) are effectively ignored if crypto does not contain encryption. This is by design, because they are irrelevant for signed-only cryptographic protections.

5.2.2. Adding a Legacy Display Element to a text/plain Part

For a list of obscured and removed User-Facing Header Fields represented as (header, value) pairs, concatenate them as a set of lines, with one newline at the end of each pair. Add an additional trailing newline after the resultant text, and prepend the entire list to the content of the text/plain part.

The MUA MUST also add a Content-Type parameter of hp-legacy-display with value 1 to the MIME part to indicate that a Legacy Display Element was added.

For example, if the list of obscured Header Fields was [("Cc", "alice@example.net"), ("Subject", "Thursday’s meeting")], then a text/plain Main Body Part that originally looked like this:

Content-Type: text/plain; charset=UTF-8

I think we should skip the meeting.

would become:

Content-Type: text/plain; charset=UTF-8; hp-legacy-display=1

```
Subject: Thursday’s meeting
Cc: alice@example.net

I think we should skip the meeting.
```

Note that the Legacy Display Element (the lines beginning with Subject: and Cc:) is part of the content of the MIME part in question.

This example assumes that the Main Body Part in question is not the root of the Cryptographic Payload. For instance, it could be a leaf of a multipart/alternative Cryptographic Payload. This is why there are no additional Header Fields in the MIME part of this example.

5.2.3. Adding a Legacy Display Element to a text/html Part

Adding a Legacy Display Element to a text/html part is similar to how it is added to a text/plain part (see Section 5.2.2). Instead of adding the obscured or removed User-Facing Header Fields to a block of text delimited by a blank line, the composing MUA injects them in an HTML element annotated with a class attribute of header-protection-legacy-display.

The content and formatting of this decorative have no strict requirements, but they MUST represent all the obscured and removed User-Facing Header Fields in a readable fashion. A simple approach is to assemble the text in the same way as Section 5.2.2, wrap it in a verbatim <pre> element, and put that element in the annotated .

The annotated should be placed as close to the start of the <body> as possible, where it will be visible when viewed with a standard HTML renderer.

The MUA MUST also add a Content-Type parameter of hp-legacy-display with value 1 to the MIME part to indicate that a Legacy Display Element was added.

For example, if the list of obscured Header Fields was [("Cc", "alice@example.net"), ("Subject", "Thursday’s meeting")], then a text/html Main Body Part that originally looked like this:

```
Content-Type: text/html; charset=UTF-8

<html><head><title></title></head><body>
<p>I think we should skip the meeting.</p>
</body></html>
```

would become:

```
Content-Type: text/html; charset=UTF-8; hp-legacy-display=1

<html><head><title></title></head><body>
<div class="header-protection-legacy-display">
<pre>Subject: Thursday’s meeting
Cc: alice@example.net</pre></div>
<p>I think we should skip the meeting.</p>
</body></html>
```

This example assumes that the Main Body Part in question is not the root of the Cryptographic Payload. For instance, it could be a leaf of a multipart/alternative Cryptographic Payload. This is why there are no additional Header Fields in the MIME part of this example.

5.2.3.1. Step-by-Step Example for Inserting a Legacy Display Element

into text/html

A composing MUA MAY insert the Legacy Display Element anywhere reasonable within the message as long as it prioritizes visibility for the reader using a Legacy MUA that is capable of decryption. This decision may take into account special message-specific HTML formatting expectations if the MUA is aware of them. However, some MUAs may not have any special insight into the user's preferred HTML formatting and still want to insert a Legacy Display Element. This section offers a non-normative, simple, and minimal step-by-step approach for a composing MUA that has no other information or preferences to fall back on.

The process below assumes that the MUA already has the full HTML object that it intends to send, including all of the text supplied by the user.

1. Assemble the text exactly as specified for text/plain (see Section 5.2.2).

2. Wrap that text in a verbatim <pre> element.

3. Wrap that <pre> element in a element annotated with the class header-protection-legacy-display.

4. Find the <body> element of the full HTML object.

5. Insert the element as the first child of the <body> element.

5.2.4. Only Add a Legacy Display Element to Main Body Parts

Some messages may contain a text/plain or text/html subpart that is _not_ a Main Body Part. For example, an email message might contain an attached text file or a downloaded web page. Attached documents need to be preserved as intended in the transmission, without modification.

The composing MUA MUST NOT add a Legacy Display Element to any part of the message that is not a Main Body Part. In particular, if a part is annotated with Content-Disposition: attachment, or if it does not descend via the first child of any of its multipart/mixed or multipart/related ancestors, it is not a Main Body Part and MUST NOT be modified.

See Section 7.1 of [RFC9787] for more guidance about common ways to distinguish Main Body Parts from other MIME parts in a message.

5.2.5. Do Not Add a Legacy Display Element to Other Content-Types

The purpose of injecting a Legacy Display Element into each Main Body Part is to enable rendering of otherwise obscured Header Fields in Legacy MUAs that are capable of message decryption but don't know how to follow the rest of the guidance in this document.

The authors are unaware of any Legacy MUA that would render any MIME part type other than text/plain and text/html as the Main Body. A generating MUA SHOULD NOT add a Legacy Display Element to any MIME part with any other Content-Type.

6. Replying and Forwarding Guidance

An MUA might create a new message in response to another message, thus acting both as a rendering MUA and as a composing MUA. For example, the user of an MUA viewing any given message might take an action like "Reply", "Reply All", "Forward", or some comparable

action to start the composition of a new message. The new message created this way effectively references the original message that was viewed at the time.

For encrypted messages, special guidance applies, because information can leak in at least two ways: leaking previously confidential Header Fields and leaking the entire message by sending the reply or forward to the wrong party.

6.1. Avoid Leaking Encrypted Header Fields in Replies and Forwards

As noted in Section 5.4 of [RFC9787], an MUA in this position MUST NOT leak previously encrypted content in the clear in a follow-up message. The same is true for protected Header Fields.

Values from any Header Field that was identified as either encrypted-only or signed-and-encrypted based on the steps outlined in Section 4.3 MUST NOT be sent in cleartext in a reply or forwarded message.

For example, if Subject was encrypted, and it is copied into the draft encrypted reply's Subject, the replying MUA will automatically obscure the reply's Subject Header Field.

When crafting the Header Fields for a reply or forwarded message, the composing MUA SHOULD make use of the HP-Outer Header Fields from within the Cryptographic Envelope of the referenced message to ensure that Header Fields derived from the referenced message do not leak in the reply or forwarded message.

On a high level, this can be achieved as follows: Consider a Header Field in a reply message that is generated by derivation from a Header Field in the referenced message. For example, the To Header Field is typically derived from the referenced message's Reply-To or From Header Fields. When generating this Header Field for the Outer Header Section, the composing MUA first applies its own HCP. If the Header Field's value is changed by that HCP, then the resulting value is used for the Outer Header Section. If the Header Field's value is unchanged, the composing MUA re-generates the Header Field using the Header Fields that had been in the Outer Header Section of the original message at composition time. These are inferred from the HP-Outer Header Fields located within the Cryptographic Payload of the referenced message. If the value is itself different than the protected value, then it is applied to the Outer Header Section. If the value is the same as the protected value, then it is simply copied to the Outer Header Section directly. As long as the resulting value is not null, it is noted (whether identical to the protected value or not) in the protected Header Section using HP-Outer, as described in Section 2.2.1.

See Appendix D.2 for a simple worked example of this process.

Below we describe a supporting algorithm to handle this. It produces a list of Header Fields that should be obscured or removed in the new message even if the composer's choice of HCP wouldn't normally remove or obscure the Header Field in question. This is effectively a single-use HCP. The normal composing guidance in Section 5.2 applies this single-use HCP to implement the high-level guidance above.

6.1.1. The Respond Function

The mechanism described below depends on an abstraction referred to in this document as a Respond Function.

The Respond Function takes a list of Header Fields from a referenced message as input and generates a list of initial candidate message

Header Field names and values that are used to populate the message composition interface.

Something like this function already exists in most MUAs, though it may differ across responsive actions. For example, the Respond Function that implements "Reply All" is likely to be different from the Respond Function that implements "Reply", which is in turn different from the Respond Function that implements "Forward".

6.1.2. ReferenceHCP

The algorithm takes two inputs:

* refmsg: a single referenced message

* respond: the MUA’s Respond Function associated with the user’s action (see Section 6.1.1)

As an output, it produces an ephemeral single-use HCP, specific to this kind of response to this specific message.

Method signature:

ReferenceHCP(refmsg, respond) -> response_hcp

Procedure:

1. If respond is null, refmsg is null, or refmsg is not encrypted with Header Protection:

    i. Return hcp_no_confidentiality (there is no header confidentiality in any referenced message that needs protection).

2. Extract refouter, refprotected from refmsg as described in Section 4.2.

3. Let genprotected be a list of (h,v) pairs generated by respond(refprotected).

4. Let genouter be a list of (h,v) pairs generated by respond(refouter).

5. For each (h,v) in genprotected:

    i. If (h,v) is in genouter:

        a. Remove (h,v) from both genprotected and genouter (this Header Field does not need additional confidentiality).

6. Let confmap be a mapping from a Header Field name and value (h,v) to either a string or the special value null (this mapping is initially empty).

7. For each (h,v) remaining in genprotected:

    i. Set result to the special value null.

    ii. For each (h1,v1) in genouter:

        a. If h1 is h:

            I. Set result to v1.

    iii. Insert (h,v) -> result into confmap.

8. Return a new HCP from confmap that tests whether the (name,val_in) tuple is in confmap; if so, return confmap[(name,val_in)]; otherwise, return val_in.

Note that the key idea here is to reuse the MUA's existing Respond Function. The algorithm simulates how the MUA would pre-populate a reply to (or forward of) two messages whose Header Fields have the values refouter and refprotected, respectively (independent of any cryptographic protections). Then, it uses the difference to derive a one-time HCP. This HCP takes into account both the referenced message's composer's preferences and the derivations that can happen to Header Field values when responding. Note that while some of these derivations are straightforward (e.g., In-Reply-To is usually derived from Message-ID), others are non-trivial. For example, the From address may be derived from To, Cc, or the MUA's local address preference (especially when the MUA received the referenced message via Bcc). Similarly, To may be derived from To, From, and/or Cc Header Fields depending on the MUA implementation and depending on whether the user clicked "Reply", "Reply All", "Forward", or any other action that generates a response to a message. Reusing the MUA's existing Respond Function incorporates these nuances without requiring any extra configuration choices or additional maintenance burden.

6.2. Avoid Misdirected Replies

When replying to a message, the composing MUA typically decides who to send the reply to based on:

* the Reply-To, Mail-Followup-To, or From Header Fields

* optionally, the other To or Cc Header Fields (if the user chose to "Reply All")

When a message has Header Protection, the replying MUA MUST populate the destination fields of the draft message using the protected Header Fields and ignore any unprotected Header Fields.

This mitigates against an attack where Mallory gets a copy of an encrypted message from Alice to Bob and then replays the message to Bob with an additional Cc to Mallory's own email address in the message's (unprotected) Outer Header Section.

If Bob knows Mallory's certificate already, and he replies to such a message without following the guidance in this section, it's likely that his MUA will encrypt the cleartext of the message directly to Mallory.

7. Unprotected Header Fields Added in Transit

Some Header Fields are legitimately added in transit and could not have been known to the composer at message composition time.

The most common of these Header Fields are Received and DKIM-Signature, neither of which are typically rendered, either explicitly or implicitly.

If a rendering MUA has specific knowledge about a given Header Field, including that:

* the Header Field would not have been known to the original composer and

* the Header Field might be rendered explicitly or implicitly,

then the MUA MAY decide to operate on the value of that Header Field

from the Outer Header Section, even though the message has Header Protection.

The MUA MAY prefer to verify that the Header Fields in question have additional transit-derived cryptographic protections before rendering or acting on them. For example, the MUA could verify whether these Header Fields are covered by an appropriate and valid ARC-Authentication-Results (see [RFC8617]) or DKIM-Signature (see [RFC6376]) Header Field.

Specific examples of Header Fields added in transit that are meaningful to the user can be found in the following section.

7.1. Mailing List Header Fields: List-* and Archived-At

If the message arrives through a mailing list, the list manager itself may inject Header Fields (most have a List- prefix) in the message. Header Fields commonly added by list managers include:

* List-Archive
* List-Subscribe
* List-Unsubscribe
* List-Id
* List-Help
* List-Post
* Archived-At

Some MUAs render these Header Fields implicitly by providing buttons for actions like "Subscribe", "View Archived Version", "Reply List", "List Info", etc.

An MUA rendering a message with Header Protection that contains any of these Header Fields in the Outer Header Section and that has reason to believe the message arrived through a mailing list MAY decide to render them to the user (explicitly or implicitly) even though they are not protected.

8. Email Ecosystem Evolution

The email ecosystem is the set of client-side and server-side software and policies that are used in the creation, transmission, storage, rendering, and indexing of email over the Internet.

This document is intended to offer tooling needed to improve the state of the email ecosystem in a way that can be deployed without significant disruption. Some elements of this specification are present for transitional purposes but would not exist if the system were designed from scratch.

This section describes these transitional mechanisms, as well as some suggestions for how they might eventually be phased out.

8.1. Dropping Legacy Display Elements

Any decorative Legacy Display Element added to an encrypted message that uses Header Protection is present strictly for enabling Header Field visibility (most importantly, the Subject Header Field) when the message is viewed with a decryption-capable Legacy MUA.

Eventually, the hope is that most decryption-capable MUAs will

conform to this specification and there will be no need for injection of Legacy Display Elements in the message Body. A survey of widely used decryption-capable MUAs might be able to establish when most of them do support this specification.

At that point, a composing MUA could set the legacy parameter defined in Section 5.2 to false by default or could even hard-code it to false, yielding a much simpler message construction set.

Until that point, an end user might want to signal that their rendering MUAs are conformant to this document so that a peer composing a message to them can set legacy to false. A signal indicating capability of handling messages with Header Protection might be placed in the user's cryptographic certificate or in outbound messages.

This document does not attempt to define the syntax or semantics of such a signal.

8.2. More Ambitious Default HCP

This document defines a few different forms of HCP. An MUA implementing an HCP for the first time SHOULD deploy hcp_baseline as recommended in Section 3.3. This HCP offers the most commonly expected protection (obscuring the Subject Header Field) without risking deliverability or rendering issues.

The HCPs proposed in this document are relatively conservative and still leak a significant amount of metadata for encrypted messages. This is largely done to ensure deliverability (see Section 1.3.2) and usability (see Section 2 of [RFC9787] and Section 9), as messages without some critical Header Fields are more likely to not reach their intended recipient.

In the future, some mail transport systems may accept and deliver messages with even less publicly visible metadata. Many MTA operators today would ask for additional guarantees about such a message to limit the risks associated with abusive or spam mail.

This specification offers the HCP formalism itself as a way for MUA developers and MTA operators to describe their expectations around message deliverability. MUA developers can propose a more ambitious default HCP and ask MTA operators (or simply test) whether their MTAs would be likely to deliver or reject encrypted mail with that HCP applied. Proponents of a more ambitious HCP should explicitly document the HCP and name it clearly and unambiguously to facilitate this kind of interoperability discussion.

Reaching widespread consensus around a more ambitious global default HCP is a challenging problem of coordinating many different actors. A piecemeal approach might be more feasible, where some signaling mechanism allows a message recipient, MTA operator, or third-party clearinghouse to announce what kinds of HCPs are likely to be deliverable for a given recipient. In such a situation, the default HCP for an MUA might involve consulting the signaled acceptable HCPs for all recipients and combining them (along with a default for when no signal is present) in some way.

If such a signal were to reach widespread use, it could also be used to guide reasonable statistical default HCP choices for recipients with no signal.

This document does not attempt to define the syntax or semantics of such a signal.

8.3. Deprecation of Messages Without Header Protection

At some point, when the majority of MUA clients that can generate cryptographically protected messages can do so with Header Protection, it should be possible to deprecate any cryptographically protected message that does not have Header Protection.

For example, as noted in Section 9.1, it's possible for an MUA to render a signed-only message that has no Header Protection the same as an unprotected message. And a signed-and-encrypted message without Header Protection could likewise be marked as not fully protected.

These stricter rules could be adopted immediately for all messages. Or an MUA developer could roll them out immediately for any new message but still treat an old message (based on the Date Header Field and cryptographic signature timestamp) more leniently.

A decision like this by any popular rendering MUA could drive adoption of this standard for composing MUAs.

9. Usability Considerations

This section describes concerns for MUAs that are interested in easy adoption of Header Protection by normal users.

While they are not protocol-level artifacts, these concerns motivate the protocol features described in this document.

See also the usability commentary in Section 2 of [RFC9787].

9.1. Mixed Protections Within a Message Are Hard to Understand

When rendering a message to the user, the ideal circumstance is to present a single cryptographic status for any given message. However, when message Header Fields are present, some message Header Fields do not have the same cryptographic protections as the main message.

Representing such a mixed set of protection statuses is very difficult to do in a way that an Ordinary User can understand. There are at least three scenarios that are likely to be common and poorly understood:

* A signed message with no Header Protection.

* A signed-and-encrypted message with no Header Protection.

* A signed-and-encrypted message with Header Protection as defined in this document, where some User-Facing Header Fields have confidentiality but some do not.

An MUA should have a reasonable strategy for clearly communicating each of these scenarios to the user. For example, an MUA operating in an environment where it expects most cryptographically protected messages to have Header Protection could use the following rendering strategy:

* When rendering a message with a signed-only cryptographic status but no Header Protection, an MUA may decline to indicate a positive security status overall and only indicate the cryptographic status to a user in a message properties or diagnostic view. That is, the message may appear identical to an unsigned message except if a user verifies the properties through a menu option.

* When rendering a message with a signed-and-encrypted or encrypted-

only cryptographic status but no Header Protection, overlay a warning flag on the typical cryptographic status indicator. That is, if a typical signed-and-encrypted message displays a lock icon, display a lock icon with a warning sign (e.g., an exclamation point in a triangle) overlaid. For example, see the graphics in [chrome-indicators].

* When rendering a message with a signed-and-encrypted or encrypted-only cryptographic status with Header Protection but where the Subject Header Field has not been removed or obscured, place a warning sign on the Subject line.

Other simple rendering strategies could also be reasonable.

9.2. Users Should Not Have to Choose a Header Confidentiality Policy

This document defines the abstraction of an HCP object for the sake of communication between implementers and deployments.

Most email users are unlikely to understand the trade-offs between different policies. In particular, the potential negative side effects (e.g., poor deliverability) may not be easily attributable by a normal user to a particular HCP.

Therefore, MUA implementers should be conservative in their choice of default HCP and should not require the Ordinary User to make an incomprehensible choice that could cause unfixable, undiagnosable problems. The safest option is for the MUA developer to select a known, stable HCP (this document recommends hcp_baseline in Section 3.3) on the user's behalf. An MUA should not expose the Ordinary User to a configuration option where they are expected to manually select (let alone define) an HCP.

10. Security Considerations

Header Protection improves the security of cryptographically protected email messages. Following the guidance in this document improves security for users by more directly aligning the underlying messages with user expectations about confidentiality, authenticity, and integrity.

Nevertheless, helping the user distinguish between cryptographic protections of various messages remains a security challenge for MUAs. This is exacerbated by the fact that many existing messages with cryptographic protections do not employ Header Protection. MUAs encountering these messages (e.g., in an archive) will need to handle older forms (without Header Protection) for quite some time, possibly forever.

For any MUA that offers S/MIME cryptographic protections, the security considerations from Section 6 of [RFC8551] (S/MIME), Section 3 of [RFC5083] (Authenticated-Enveloped-Data in Cryptographic Message Syntax (CMS)), and Section 14 of [RFC5652] (CMS more broadly) continue to apply. Likewise, for any MUA that offers PGP/MIME cryptographic protections, the security considerations from Section 8 of [RFC3156] (PGP with MIME) as well as Section 13 of [RFC9580] (OpenPGP itself) continue to apply. In addition, these underlying security considerations are now also applicable to the contents of the message Header Section, not just the message Body.

10.1. From Address Spoofing

For a rendering MUA that depends on its MTA to authenticate the origin of the message, applying this specification could enable sender address spoofing.

To prevent sender spoofing, many rendering MUAs implicitly rely on their receiving MTA to inspect the Outer Header Section and verify that the From Header Field is authentic. If a rendering MUA displays a From address (from the protected part) that doesn't match the From address the MTA used to authenticate and/or filter (see also Section 4.4.1.1), the MUA may be vulnerable to spoofing.

Consider a malicious MUA that sets the following Header Fields on an encrypted message with Header Protection:

* Outer: From: <alice@example.com>

* Inner: HP-Outer: From: <alice@example.com>

* Inner: From: <bob@example.org>

During sending, the MTA of example.com validates that the sending MUA is authorized to send from alice@example.com. Since the message is encrypted, the sending and receiving MTAs cannot see the protected Header Fields. A naive rendering MUA might follow the algorithms in this document without special consideration for the From Header Field. Such an MUA might display the email as coming from bob@example.org to the user, resulting in a spoofed address.

This problem applies both between domains and within a domain.

This problem always applies to signed-and-encrypted messages. This problem also applies to signed-only messages because MTAs typically do not look at the protected Header Fields when confirming From address authenticity.

Sender address spoofing is relevant for two distinct security properties:

* Sender authenticity: relevant for rendering the message (which address to show the user?)

* Message confidentiality: relevant when replying to a message (a reply to the wrong address can leak the message contents)

10.1.1. From Rendering Reasoning

Section 4.4.3 provides guidance for rendering the From Header Field. It recommends a rendering MUA that depends on its MTA to authenticate the (unprotected) outer From Header Field to render the outer From Header Field if both of the following conditions are met:

* From Header Field Mismatch (as defined in Section 4.4.1.1) and

* No Valid and Correctly Bound Signature (as defined in Section 4.4.1.2)

Note: The second condition effectively means that the inner (expected to be protected) From Header Field appears to have insufficient protection.

This may seem surprising since it causes the MUA to render a mix of both protected and unprotected values. This section provides an argument as to why this guidance makes sense.

We proceed by case distinction:

* Case 1: Malicious composing MUA.

  - Attack situation: The composing MUA puts a different inner From Header Field to spoof the sender address.

- In this case, it is "better" to fall back and render the outer From Header Field because this is what the receiving MTA can validate. Otherwise, this document would introduce a new way for senders to spoof the From address of the message.

- This does not preclude a future document from updating this document to specify a protocol for legitimate sender address hiding.

* Case 2: Malicious sending/transiting/receiving MTA (or anyone meddling between MTAs).

  - Attack situation: An on-path attacker changes the outer From Header Field (possibly with other meddling to invalidate the signature; see below). Their goal is to get the rendering MUA to show a different From address than the composing MUA intended (breaking MUA-to-MUA sender authenticity).

  - Case 2.a: The composing MUA submitted an unsigned or encrypted-only message to the email system. In this case, there can be no sender authenticity anyway.

  - Case 2.b: The composing MUA submitted a signed-only message to the email system.

    o Case 2.b.i: The attacker removes or invalidates the signature. In this case, the attacker can also modify the inner From Header Field to their liking.

    o Case 2.b.ii: The signature is valid, but the rendering MUA does not see any valid binding between the signing certificate and the addr-spec of the inner From Header Field. In this case, there can be no sender authenticity anyways (the certificate could have been generated by the on-path attacker). This case is indistinguishable from a malicious composing MUA; hence, it is "better" to fall back to the outer From Header Field that the MTA can validate. Note that once the binding is validated (e.g., after an out-of-band comparison), the rendering may change from showing the outer From address (and a warning) to showing the inner, now validated From address. In some cases, the binding may be instantly validated even for previously unseen certificates (e.g., if the certificate is issued by a trusted certification authority).

  - Case 2.c: The composing MUA submitted a signed-and-encrypted message to the email system.

    o Case 2.c.i: The attacker removes or invalidates the signature. Note that the signature is inside the ciphertext (see Section 5.2 of [RFC9787]). Thus, assuming the encryption is non-malleable, any on-path attacker cannot invalidate the signature while ensuring that the message still decrypts successfully.

    o Case 2.c.ii: The signature is valid, but the rendering MUA does not see any valid binding between the signing certificate and the addr-spec of the inner From Header Field. See case 2.b.ii.

As the case distinction shows, the outer From Header Field is either the preferred fallback (in particular, to avoid introducing a new spoofing channel) or just as good (because just as modifiable) as the inner From Header Field.

Rendering the outer From Header Field does carry the risk of a "temporary downgrade attack" in cases 2.b.ii and 2.c.ii, where a malicious MTA keeps the signature intact but modifies the outer From Header Field. The MUA can resolve this temporary downgrade by validating the certificate-to-addr-spec binding. If the MUA never does this validation, the entire message could be fake.

If there were a signaling channel where the MTA can tell the MUA whether it authenticated the From Header Field, an MUA could use this in its rendering decision. In the absence of such a signal, and when end-to-end authenticity is unavailable, this document prefers to fall back to the outer From Header Field. This default is based on the assumption that most MTAs apply some filtering based on the outer From Header Field (whether the MTA can authenticate it or not). Rendering the unprotected outer From Header Field (instead of the protected inner one) in case of a mismatch retains this ability for MTAs.

If the MUA decides not to rely on the MTA to authenticate the outer From Header Field, it may prefer the inner From Header Field.

10.2. Avoid Cryptographic Summary Confusion from the hp Parameter

When parsing a message, the recipient MUA infers the message's Cryptographic Status from the Cryptographic Layers, as described in Section 4.6 of [RFC9787].

The Cryptographic Layers that make up the Cryptographic Envelope describe an ordered list of cryptographic properties as present in the message after it has been delivered. By contrast, the hp parameter to the Content-Type Header Field contains a simpler indication: whether the composer originally tried to encrypt the message or not (see Section 2.1.1). In particular, for a message with Header Protection, the Cryptographic Payload MUST have a hp parameter of cipher if the message is encrypted (in addition to signed) and clear if no encryption is present (that is, the message is signed-only).

As noted in Section 2.1.1, the rendering implementation MUST NOT inflate its estimation of the confidentiality of the message or its Header Fields based on the composer's intent if it can see that the message was not actually encrypted. A signed-only message that happens to have an hp parameter of cipher is still signed-only.

Conversely, since the encrypting Cryptographic Layer is typically outside the signature layer (see Section 5.2 of [RFC9787]), an originally signed-only message could have been wrapped in an encryption layer by an intervening party before receipt to appear encrypted.

If a message appears to be wrapped in an encryption layer, and the hp parameter is present but is not set to cipher, then it is likely that the encryption layer was not added by the original composer. For such a message, the lack of any HP-Outer Header Field (see Section 2.2) in the Header Section of the Cryptographic Payload MUST NOT be used to infer that all Header Fields were removed from the Outer Header Section by the original composer. In such a case, the rendering MUA SHOULD treat every Header Field as though it was not confidential.

10.3. Caution About Composing with Legacy Display Elements

When composing a message, it's possible for a Legacy Display Element (see Section 2.1.2) to contain risky data that could trigger errors in a rendering client.

For example, if the value for a Header Field to be included in a Legacy Display Element within a given Body part contains folding whitespace, it SHOULD be "unfolded" before generating the Legacy Display Element: All contiguous folding whitespace SHOULD be replaced with a single space character. Likewise, if the Header Field value was originally encoded per [RFC2047], it SHOULD be decoded first to a standard string and re-encoded using the charset appropriate to the target part.

When including a Legacy Display Element in a text/plain part (see Section 5.2.2), if the decoded Subject Header Field contains a pair of newlines (e.g., if it is broken across multiple lines by encoded newlines), the composing MUA MUST strip any newline from the Legacy Display Element. If the pair of newlines is not stripped, a rendering MUA that follows the guidance in Section 4.5.3.2 might leave the later part of the Legacy Display Element in the rendered message.

When including a Legacy Display Element in a text/html part (see Section 5.2.3), any material in the Header Field values MUST be explicitly HTML escaped to avoid being rendered as part of the HTML. At a minimum, the characters <, >, ', ", and & MUST be escaped to <, >, ', ", and &, respectively (for example, see [HTML-ESCAPES]). If unescaped characters from removed or obscured Header Field values end up in the Legacy Display Element, a rendering MUA that follows the guidance in Section 4.5.3.3 might fail to identify the boundaries of the Legacy Display Element, cutting out more than it should or leaving remnants visible. And a Legacy MUA parsing such a message might misrender the entire HTML stream, depending on the content of the removed or obscured Header Field values.

The Legacy Display Element is a decorative addition solely to enable visibility of obscured or removed Header Fields in decryption-capable Legacy MUAs. When it is produced, it should be generated minimally and strictly, as described above, to avoid damaging the rest of the message.

10.4. Plaintext Attacks

An encrypted email message using S/MIME or PGP/MIME tends to have some amount of predictable plaintext. For example, the standard MIME Header Fields of the Cryptographic Payload of a message are often a predictable sequence of bytes, even without Header Protection, when they only include the Structural Header Fields MIME-Version and Content-Type. This is a potential risk for known-plaintext attacks.

Including protected Header Fields as defined in this document increases the amount of known plaintext. Since some of those Header Fields in a reply will be derived from the message being replied to, this also creates a potential risk for chosen-plaintext attacks, in addition to known-plaintext attacks. This potential risk also applies in a similar manner to forwarded messages.

Modern message encryption mechanisms are expected to be secure against both known-plaintext attacks and chosen-plaintext attacks. An MUA composing an encrypted message should ensure that it is using such a mechanism, regardless of whether it does Header Protection.

11. Privacy Considerations

11.1. Leaks When Replying

The encrypted Header Fields of a message may accidentally leak when replying to the message. See the guidance in Section 6.

11.2. Encrypted Header Fields Are Not Always Private

For encrypted messages, depending on the composer's HCP, some Header Fields may appear both within the Cryptographic Envelope and on the outside of the message (e.g., Date might exist identically in both places). Section 4.3 identifies such a Header Field as signed-only. These Header Fields are clearly _not_ private at all, despite a copy being inside the Cryptographic Envelope.

A Header Field whose name and value are not matched verbatim by any HP-Outer Header Field from the same part will have an encrypted-only or signed-and-encrypted status. But even Header Fields with these stronger levels of cryptographic confidentiality protection might not be as private as the user would like.

See the examples below.

This concern is true for any encrypted data, including the Body of the message, not just the Header Fields: If the composer isn't careful, the message contents or session keys can leak in many ways that are beyond the scope of this document. The message recipient has no way in principle to tell whether the apparent confidentiality of any given piece of encrypted content has been broken via channels that they cannot perceive. Additionally, an active intermediary aware of the recipient's public key can always encrypt a cleartext message in transit to give the recipient a false sense of security (see also Section 10.2).

11.2.1. Encrypted Header Fields Can Leak Unwanted Information to the Recipient

For an encrypted message, even with an ambitious HCP that successfully obscures most Header Fields from all transport agents, Header Fields will be ultimately visible to each intended recipient. This can be especially problematic for a Header Field that is not User-Facing; the composer may not expect such a Header Field to be injected by their MUA. Consider the three following examples:

* The MUA may inject a User-Agent Header Field that describes itself to every recipient, even though the composer may not want a recipient to know the exact version of their OS, hardware platform, or MUA.

* The MUA may have an idiosyncratic way of generating a Message-ID Header Field, which could embed the choice of MUA, time zone, hostname, or other subtle information to a knowledgeable recipient.

* The MUA may erroneously include a Bcc Header Field in the origheaders of a copy of a message sent to a named recipient, defeating the purpose of using Bcc instead of Cc (see Section 11.4 for more details about risks related to Bcc).

Clearly, no end-to-end cryptographic protection of any Header Field as defined in this document will hide such a sensitive field from an intended recipient. Instead, the composing MUA MUST populate the origheaders list for any outbound message with only information each recipient should have access to. This is true for any message without any cryptographic protection as well, of course, and it is even worse there: Such a leak is exposed to the transport agents as well as all recipients. An encrypted message with Header Protection and a more ambitious HCP avoids these leaks that expose information to the transport agents, but it cannot defend against such a leak to a recipient.

11.2.2. Encrypted Header Fields Can Be Inferred from External or

For example, if the To and Cc Header Fields are removed from the Outer Header Section, the values in those fields might still be inferred with high probability by an adversary who looks at the message either in transit or at rest. For example, if the message is found in a mailbox, or being delivered to a mailbox, and the mailbox is known to be associated with the email address bob@example.org, it's likely that Bob was in either To or Cc. Furthermore, encrypted message ciphertext may hint at the recipients: For S/MIME messages, the RecipientInfo, and for PGP/MIME messages, the key ID in the Public Key Encrypted Session Key (PKESK) packets will all hint at a specific set of recipients. Additionally, an MTA that handles the message may add a Received Header Field (or some other custom Header Field) that leaks some information about the nature of the delivery.

11.2.3. Encrypted Header Fields May Not Be Fully Masked by HCP

In another example, if the HCP modifies the Date Header Field to mask out high-resolution timestamps (e.g., rounding to the most recent hour), some information about the date of delivery will still be attached to the email. At the very least, the low-resolution, global version of the date will be present on the message. Additionally, Header Fields like Received that are added during message delivery might include higher-resolution timestamps. And if the message lands in a mailbox that is ordered by time of receipt, even its placement in the mailbox and the unobscured Date Header Fields of the surrounding messages could leak this information.

Some Header Fields like From may be impossible to fully obscure, as many modern message delivery systems depend on at least domain information in the From Header Field for determining whether a message is coming from a domain with "good reputation" (that is, from a domain that is not known for leaking spam). So even if an ambitious HCP opts to remove the human-readable part from any From Header Field and to standardize/genericize the local part of the From address, the domain will still leak.

11.3. A Naive Recipient May Overestimate the Cryptographic Status of a Header Field in an Encrypted Message

When an encrypted (or signed-and-encrypted) message is in transit, an active intermediary can strip or tamper with any Header Field that appears outside the Cryptographic Envelope. A rendering MUA that naively infers cryptographic status from differences between the external Header Fields and those found in the Cryptographic Envelope could be tricked into overestimating the protections afforded to some Header Fields.

For example, if the original composer's HCP passes through the Cc Header Field unchanged, a cleanly delivered message would indicate that the Cc Header Field has a cryptographic status of signed. But if an intermediary attacker simply removes the Header Field from the Outer Header Section before forwarding the message, then the naive recipient might believe that the field has a cryptographic status of signed-and-encrypted.

This document offers protection against such an attack by way of the HP-Outer Header Fields (see Section 2.2) that can be found on the Cryptographic Payload. If a Header Field appears to have been obscured by inspection of the Outer Header Section but an HP-Outer Header Field matches it exactly, then the rendering MUA can indicate to the user that the Header Field in question may not have been confidential.

In such a case, a cautious MUA may render the Header Field in

question as signed (because the composer did not hide it) but still treat it as signed-and-encrypted during reply to avoid accidental leakage of the cleartext value in the reply message, as described in Section 6.1.

11.4. Privacy and Deliverability Risks with Bcc and Encrypted Messages

As noted in Section 9.3 of [RFC9787], handling Bcc when generating an encrypted email message can be particularly tricky. With Header Protection, there is an additional wrinkle. When an encrypted email message with Header Protection has a Bcc'ed recipient, and the composing MUA explicitly includes the Bcc'ed recipient's address in their copy of the message (see the "second method" in Section 3.6.3 of [RFC5322]), that Bcc Header Field will always be visible to the Bcc'ed recipient.

In this scenario, though, the composing MUA has one additional choice: whether or not to hide the Bcc Header Field from intervening message transport agents by returning null when the HCP is invoked for Bcc. If the composing MUA's rationale for including an explicit Bcc in the copy of the message sent to the Bcc recipient is to ensure deliverability via a message transport agent that inspects message Header Fields, then stripping the Bcc field during encryption may cause the intervening transport agent to drop the message entirely. This is why Bcc is not explicitly stripped in hcp_baseline.

On the other hand, if deliverability to a Bcc'ed recipient is not a concern, the most privacy-preserving option is to simply omit the Bcc Header Field from the protected Header Section in the first place. An MUA that is capable of receiving and processing such a message can infer that since their user's address was not mentioned in any To or Cc Header Field, they were likely a Bcc recipient.

Please also see Section 9.4 of [RFC9787] for more discussion about Bcc and encrypted messages.

12. IANA Considerations

This document registers an email Header Field, describes parameters for the Content-Type Header Field, and establishes a registry for Header Confidentiality Policies to facilitate HCP evolution.

12.1. Registration of the HP-Outer Header Field

IANA has registered the following Header Field in the "Permanent Message Header Field Names" registry within the "Message Headers" registry group <https://www.iana.org/assignments/message-headers> in accordance with [RFC3864].

Header Field Name	Protocol	Status	Reference
HP-Outer	mail	standard	Section 2.2.1 of RFC 9788

Table 2: Addition to the Permanent Message Header Field Names Registry

Note that the Template and Trace columns are empty and therefore not included in the table.

The Author/Change Controller (Section 4.5 of [RFC3864]) for this entry is the IETF.

12.2. Reference Update for the Content-Type Header Field

This document defines the Content-Type parameters known as hp (in Section 2.1.1) and hp-legacy-display (in Section 2.1.2). Consequently, IANA has added this document as a reference for Content-Type in the "Permanent Message Header Field Names" registry as shown below.

Header Field Name	Protocol	Reference
Content-Type	MIME	[RFC4021] and RFC 9788

Table 3: Permanent Message Header Field Names Registry

Note that the Template and Trace columns are empty and therefore not included in the table.

12.3. New Mail Header Confidentiality Policies Registry

IANA has created a new registry titled "Mail Header Confidentiality Policies" within the "MAIL Parameters" registry group <https://www.iana.org/assignments/mail-parameters/> with the following content:

Header Confidentiality Policy Name	Description	Recommended	Reference
hcp_no_confidentiality	No header confidentiality	N	Section 3.2.3 of RFC 9788
hcp_baseline	Confidentiality for Informational Header Fields: Subject Header Field is obscured, Keywords and Comments are removed	Y	Section 3.2.1 of RFC 9788
hcp_shy	Obscure Subject, remove Keywords and Comments, remove the time zone from Date, and remove display-names from From, To, and Cc	N	Section 3.2.2 of RFC 9788

Table 4: Mail Header Confidentiality Policies Registry

Note that hcp_example_hide_cc is offered as an example in Section 3.1 but is not formally registered by this document.

The following textual note has been added to this registry:

> Adding an entry to this registry with an N in the "Recommended" column follows the registration policy of Specification Required. Adding an entry to this registry with a Y in the "Recommended"

| column or changing the "Recommended" column in an existing entry
| (from N to Y or vice versa) requires IETF Review.

Note that during IETF Review, the designated expert must be consulted. Guidance for the designated expert can be found in Section 3.4.2.

Additionally, this textual note has been added to the registry:

| The Header Confidentiality Policy Name never appears on the wire.
| This registry merely tracks stable references to implementable
| descriptions of distinct policies. Any addition to this registry
| should be governed by guidance in Section 3.4.2 of RFC 9788.

13. References

13.1. Normative References

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Appendix A. Table of Pseudocode Listings

This document contains guidance with pseudocode descriptions. Each algorithm is listed here for easy reference.

Method Name	Description	Reference
HeaderSetsFromMessage	Derive "outer" and "protected" sets of Header Fields from a given message	Section 4.2.1
HeaderFieldProtection	Calculate cryptographic protections for a Header Field in a given message	Section 4.3.1
ReferenceHCP	Produce an ephemeral HCP to use when responding to a given message	Section 6.1.2
ComposeNoHeaderProtection	Legacy Message composition with end-to-end cryptographic protections (but no Header Protection)	Section 5.1.1
Compose	Compose a message with end-to-end cryptographic protections including Header Protection	Section 5.2.1

Table 5: Table of Pseudocode Listings

Appendix B. Possible Problems with Legacy MUAs

When an email message with end-to-end cryptographic protection is rendered by an MUA, the user might experience many different possible problematic interactions. A message with Header Protection may introduce new forms of user experience failure.

In this section, the authors enumerate different kinds of failures we have observed when reviewing, rendering, and replying to messages with different forms of Header Protection in different Legacy MUAs. Different Legacy MUAs demonstrate different subsets of these problems.

A conformant MUA would not exhibit any of these problems. An implementer updating their Legacy MUA to be compliant with this specification should consider these concerns and try to avoid them.

Recall that "protected" refers to the values of the inner Header Fields, e.g., the real Subject, and "unprotected" refers to the values of the outer Header Fields, e.g., the replacement Subject.

B.1. Problems Viewing Messages in a List View

* Unprotected Subject, Date, From, and To Header Fields are visible (instead of being replaced by protected values)

* Threading is not visible

B.2. Problems When Rendering a Message

* Unprotected Subject is visible

* Protected Subject (on its own) is visible in the Body

* Protected Subject, Date, From, and To Header Fields are visible in the Body

* User interaction needed to view the whole message

* User interaction needed to view the message Body

* User interaction needed to view the protected Subject

* Impossible to view the protected Subject

* Nuisance alarms during user interaction

* Impossible to view the message Body

* Appears as a forwarded message

* Appears as an attachment

* Security indicators not visible

* Security indicators do not identify the protection status of Header Fields

* User has multiple different methods to reply (e.g., reply to outer, reply to inner)

* User sees English "Subject:" in Body despite message itself being in non-English

* Security indicators do not identify the protection status of Header Fields

* Header Fields in the Body render with local Header Field names (e.g., showing "Betreff" instead of "Subject") and dates (TZ, locale)

B.3. Problems When Replying to a Message

Note that the use case here is:

* User views a message, to the point where they can read it

* User then replies to the message, and they are shown a message composition window, which has some UI elements

* If the MUA has multiple different methods to reply to a message, each way may need to be evaluated separately

This section also uses the shorthand UI:x to mean "the UI element that the user can edit that they think of as x".

* Unprotected Subject is in UI:subject (instead of the protected Subject)

* Protected Subject is quoted in UI:body (from Legacy Display Element)

* Protected Subject leaks when the reply is serialized into MIME

* Protected Subject is not anywhere in UI

* Message Body is _not_ visible/quoted in UI:body

* User cannot reply while viewing protected message

* Reply is not encrypted by default (but is for legacy signed-and-encrypted messages without Header Protection)

* Unprotected From or Reply-To Header Field is in UI:To (instead of the protected From or Reply-To Header Field)

* User’s locale (lang, TZ) leaks in quoted Body

* Header Fields not protected (and in particular, Subject is not obscured) by default

Appendix C. Test Vectors

This section contains sample messages using the specification defined above. Each sample contains a MIME object, a textual and diagrammatic view of its structure, and examples of how an MUA might render it.

The cryptographic protections used in this document use the S/MIME standard, and keying material and certificates come from [RFC9216].

These messages should be accessible to any IMAP client at imap://bob@header-protection.cmrg.net/ (any password should authenticate to this read-only IMAP mailbox).

Copies of these test vectors can also be downloaded separately at <https://header-protection.cmrg.net>.

If any of the messages downloaded differ from those offered here, this document is the canonical source.

C.1. Baseline Messages

These messages offer no Header Protection at all and can be used as a baseline. They are provided in this document as a counterexample. An MUA implementer can use these Messages to verify that the reported Cryptographic Summary of the Message indicates no Header Protection.

C.1.1. No Cryptographic Protections over a Simple Message

This message uses no cryptographic protection at all. Its Body is a text/plain message.

It has the following structure:

```
└─ text/plain 152 bytes
```

Its contents are:

```
MIME-Version: 1.0
Content-Type: text/plain; charset="utf-8"
Content-Transfer-Encoding: 7bit
Subject: no-crypto
Message-ID: <no-crypto@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:00:02 -0500
User-Agent: Sample MUA Version 1.0

This is the
no-crypto
message.
```

This message uses no cryptographic protection at all. Its Body is a text/plain message.

```
--
Alice
alice@smime.example
```

C.1.2. S/MIME Signed-Only signedData over a Simple Message, No Header Protection

This is a signed-only S/MIME message via PKCS#7 signedData. The payload is a text/plain message. It uses no Header Protection.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 3856 bytes
  └─ (unwraps to)
    └── text/plain 206 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"
Subject: smime-one-part
Message-ID: <smime-one-part@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:01:02 -0500
User-Agent: Sample MUA Version 1.0

MIILGQYJKoZIhvcNAQcCoIILCjCCCwYCAQExDTALBglghkgBZQMEAgEwggFCBgkq
hkiG9w0BBwGgggEzBIIBL01JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVR5cGU6
IHRleHQvcGxhaW47IGNoYXJzZXQ9InV0Zi04Ig0KQ29udGVudC1UcmFuc2Zlci1F
bmNvZGluZzogN2JpdA0KDQpUaGlzIGlzIHRoZQ0Kc21pbWUtb25lLXBhcnQNCm1l
c3NhZ2UuDQoNClRoaXMgaXMgYSBzaWduZWQtb25seSBTL01JTUUgbWVzc2FnZSB2
aWEgUEtDUyM3IHNpZ25lZERhdGEuICBUaGUNCnBheWxvYWQgaXMgYSB0ZXh0L3Bs
YWluIG1lc3NhZ2UuIEl0IHVzZXMgbm8gSGVhZGVyIFByb3RlY3Rpb24uDQoNCi0t
IA0KQWxpY2UNCmFsaWNlQHNtaW1lLmV4YW1wbGUNCqCCB6YwggPPMIICt6ADAgEC
AhMPLSW9ETmXSs5CVIeh7j00Boq0MA0GCSqGSIb3DQEBDQUAMFUxDTALBgNVBAoT
BElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMg
UlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQxOFoYDzIw
NTIwOTI3MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBX
RzEXMBUGA1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEBAQUAA4IB
DwAwggEKAoIBAQCalSn6i8Gi44/oAVAn5GnCk4PHHNjrSfWUnnelN41KImVaTC3D
9zFCrS3i4Pa9ZgHyA5Qf8JW3ZmnVz5q7M8onZm7mZjqQeb6FUH4i2GMt4jse2Dqs
165ernT9O5NLFflHUjURca3ynqEBBV4DmhnZp8eDhv3t6dXyCjNHT82S6DgCReZu
TtMc1zy++MxQlqdn9WZLhOAOpeNZKGmVwjeVy+8FkyzC3jX/Qcm+ZLCqlLqhBwDH
dZ5qDTII2PVX1X3K7/cONxhvBbaUl/k1swdszUtjhflyFZ80RuQ3qFC6vL/PGeWy
6SCf58duq/AOEksCAWlb+MD8QH9Yj7CFSmq1AgMBAAGjga8wgawwDAYDVR0TAQH/
BAIwADAXBgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYETYWxpY2VA
c21pbWUuZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8BAf8EBAMC
BSAwHQYDVR0OBBYEFKJTQdVEPIApFXwBI/Dnjq/N83cPMB8GA1UdIwQYMBaAFJEw
jnwHFwyn8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQCBSXignLEynBak
DKU68ro0RsyXWAPkfXgQLgy7GrW7SrZeBc5IEcjoN9f/gsOx/Ht9Ii6zyBZVjdao
x644DsiLOQEP4YMS7y4q94RFFdmdzEbDLYx9sfUhvdTxDNOOoHz53PYDBh4zE4Na
r2inC0D+VM6RGDy66K9l+D+bl8Wj9CyGUc1ppMNURexTg+z3web/eDOdu+F2MVtl
uLihne0Bp1GUTkr0mJBolg6dSYal8Hw8/ANHpyExl56BJABb744gqoeuD9YSHjKK
49+qYC9faFmQ+mK80lh1M9RdNI7srjn0LKpuob6w06jaRzWdNeXzlEc2tUpAr4vR
hZjVD6FYMIIDzzCCAregAwIBAgITN0EFee11f0Kpolw69PhqzpqP1zANBgkqhkiG
9w0BAQ0FADBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzExMC8G
A1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhvcml0eTAg
Fw0xOTExMjAwNjU0MThaGA8yMDUyMDkyNzA2NTQxOFowOzENMAsGA1UEChMESUVU
RjERMA8GA1UECxMITEFNUFMgV0cxFzAVBgNVBAMTDkFsaWNlIExvdmVsYWNlMIIB
IjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAtPSJ6Fg4Fj5Nmn9PkrYo0jTk
```

```
fCv4TfA/pdO/KLpZbJOAEr0sI7AjaO7B1GuMUFJeSTulamNfCwDcDkY63PQWl+DI
Ls7GxVwXurhYdZlaV5hcUqVAckPvedDBc/3rz4D/esFfs+E7QMFtmd+K04s+A8TC
NO12DRVBDpbP4JFD9hsc8prDtpGmFk7rd0q8gqnhxBW2RZAeLqzJOMayCQtws1q7
ktkNBR2wZX5ICjecF1YJFhX4jrnHwp/iELGqqaNXd3/Y0pG7QFecN7836IPPdfTM
SiPR+peCrhJZwLSewbWXLJe3VMvbvQjoBMpEYlaJBUIKkO1zQ1Pq90njlsJLOwID
AQABo4GvMIGsMAwGA1UdEwEB/wQCMAAwFwYDVR0gBBAwDjAMBgpghkgBZQMCATAB
MB4GA1UdEQQXMBWBE2FsaWNlQHNtaW1lLmV4YW1wbGUwEwYDVR0lBAwwCgYIKwYB
BQUHAwQwDgYDVR0PAQH/BAQDAgbAMB0GA1UdDgQWBBS79syyLR0GEhyXrilqkBDT
IGZmczAfBgNVHSMEGDAWgBSRMI58BxcMp/EJKGU2GmccaHb0WTANBgkqhkiG9w0B
AQ0FAAOCAQEAc4miNqfOqaBpI3f+CpJDhxtuZ2P9HjQEQ+v6BdP7GKJ19naIs3Bj
JOd64roAKHAp+c284VvyVXWJ99FMX8q2ZUQMxH+xh6oAfzcozmnd6XaVWHg4eHIj
So27PmhKE1oAJKKhDbdbEcZXL2+x1V+duGymWtaD01DZZukKYr7agyHahiXRn/C9
cy31wbqNsy9x0fjPQg6+DqatiQpMz9EIae6aCHHBhOiPU7IPkazgPYgkLD59fk4P
GHnYxs1FhdO6zZk9E8zwlc1ALgZa/iSbczisqckN3qGehD2s16jMhwFXLJtBiN+u
CDgNG/D0qyTbY4fgKieUHx/tHuzUszZxJjGCAgAwggH8AgEBMGwwVTENMAsGA1UE
ChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1Q
UyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzdBBXntdX9CqaJcOvT4as6a
qdcwCwYJYIZIAWUDBAIBoGkwGAYJKoZIhvcNAQkDMQsGCSqGSIb3DQEHATAcBgkq
hkiG9w0BCQUxDxcNMjEwMjIwMTUwMTAyWjAvBgkqhkiG9w0BCQQxIgQg+APzZJl4
pcksifU3FOYwAUqexbFmtbnUdg8eCFIklg8wDQYJKoZIhvcNAQEBBQAEggEARlZH
lulQA7h4AzGUznSRv1TB3w2u4oXQBgxTTaUFXvezPsEacndc16K4ESz8IpjsLEqC
lhFU6haOKz3OZnab6A8sCqozqAoCpJI35L3D0XwlqucqRDMQoNDZf1AZw1/2rvhl
BA4+YVc1vNjwbFF7T8bz6ttkXBdseesPV8zy01tsPVBSEr9A8QtVGTPw/BLEV/sV
d6QtbPMCqdVDjRAa5onUPyZvXkt+Qkt5Wcqxfwbotg/u7ecLhqnK0rC2SZkGDjtZ
a6BuLu88DxA9T90G+L3hhL5VPdEdkdRCounTb9McyGWWmnK0PYind/sKBATP5ouF
jj3rLaMfllxGB0xn3A==
```

C.1.2.1. S/MIME Signed-Only signedData over a Simple Message, No Header Protection, Unwrapped

The S/MIME signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Type: text/plain; charset="utf-8"
Content-Transfer-Encoding: 7bit

This is the
smime-one-part
message.

This is a signed-only S/MIME message via PKCS#7 signedData.  The
payload is a text/plain message. It uses no Header Protection.

--
Alice
alice@smime.example
```

C.1.3. S/MIME Signed-Only multipart/signed over a Simple Message, No Header Protection

This is a signed-only S/MIME message via PKCS#7 detached signature (multipart/signed). The payload is a text/plain message. It uses no Header Protection.

It has the following structure:

```
└─┬ multipart/signed 4187 bytes
  ├── text/plain 224 bytes
  └── application/pkcs7-signature [smime.p7s] 3429 bytes
```

Its contents are:

```
MIME-Version: 1.0
Content-Type: multipart/signed;
 protocol="application/pkcs7-signature"; boundary="e19";
 micalg="sha-256"
```

```
Subject: smime-multipart
Message-ID: <smime-multipart@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:02:02 -0500
User-Agent: Sample MUA Version 1.0

--e19
MIME-Version: 1.0
Content-Type: text/plain; charset="utf-8"
Content-Transfer-Encoding: 7bit

This is the
smime-multipart
message.

This is a signed-only S/MIME message via PKCS#7 detached
signature (multipart/signed).  The payload is a text/plain
message. It uses no Header Protection.

--
Alice
alice@smime.example

--e19
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-signature; name="smime.p7s"

MIIJ4AYJKoZIhvcNAQcCoIIJ0TCCCc0CAQExDTALBglghkgBZQMEAgEwCwYJKoZI
hvcNAQcBoIIHpjCCA88wggK3oAMCAQICEw8tJb0ROZdKzkJUh6HuPTQGirQwDQYJ
KoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cx
MTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3Jp
dHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5MjcwNjU0MThaMDsxDTALBgNVBAoT
BElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYDVQQDEw5BbGljZSBMb3ZlbGFj
ZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBAJqVKfqLwaLjj+gBUCfk
acKTg8cc2OtJ9ZSed6U3jUoiZVpMLcP3MUKtLeLg9r1mAfIDlB/wlbdmadXPmrsz
yidmbuZmOpB5voVQfiLYYy3iOx7YOqzXrl6udP07k0sV+UdSNRFxrfKeoQEFXgOa
Gdmnx4OG/e3p1fIKM0dPzZLoOAJF5m5O0xzXPL74zFCWp2f1ZkuE4A6l41koaZXC
N5XL7wWTLMLeNf9Byb5ksKqUuqEHAMd1nmoNMgjY9VfVfcrv9w43GG8FtpSX+TWz
B2zNS2OF+XIVnzRG5DeoULq8v88Z5bLpIJ/nx26r8A4SSwIBaVv4wPxAf1iPsIVK
arUCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQMA4wDAYKYIZIAWUD
AgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5leGFtcGxlMBMGA1UdJQQMMAoG
CCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIFIDAdBgNVHQ4EFgQUolNB1UQ8gCkVfAEj
8OeOr83zdw8wHwYDVR0jBBgwFoAUkTCOfAcXDKfxCShlNhpnHGh29FkwDQYJKoZI
hvcNAQENBQADggEBAIFJeKCcsTKcFqQMpTryujRGzJdYA+R9eBAuDLsatbtKtl4F
zkgRyOg31/+Cw7H8e30iLrPIFlWN1qjHrjgOyIs5AQ/hgxLvLir3hEUV2Z3MRsMt
jH2x9SG91PEM046gfPnc9gMGHjMTg1qvaKcLQP5UzpEYPLror2X4P5uXxaP0LIZR
zWmkw1RF7FOD7PfB5v94M5274XYxW2W4uKGd7QGnUZROSvSYkGiWDp1JhqXwfDz8
A0enITGXnoEkAFvvjiCqh64P1hIeMorj36pgL19oWZD6YrzSWHUz1F00juyuOfQs
qm6hvrDTqNpHNZ015fOURza1SkCvi9GFmNUPoVgwggPPMIICt6ADAgECAhM3QQV5
7XV/QqmiXDr0+GrOmqnXMA0GCSqGSIb3DQEBDQUAMFUxDTALBgNVBAoTBElFVEYx
ETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMgUlNBIENl
cnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQxOFoYDzIwNTIwOTI3
MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzEXMBUG
A1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEK
AoIBAQC09InoWDgWPk2af0+StijSNOR8K/hN8D+l078oullsk4ASvSwjsCNo7sHU
a4xQUl5JO6VqY18LANwORjrc9BaX4MguzsbFXBe6uFh1mVpXmFxSpUByQ+950MFz
/evPgP96wV+z4TtAwW2Z34rTiz4DxMI07XYNFUEOls/gkUP2GxzymsO2kaYWTut3
SryCqeHEFbZFkB4urMk4xrIJC3CzWruS2Q0FHbBlfkgKN5wXVgkWFfiOucfCn+IQ
saqpo1d3f9jSkbtAV5w3vzfog8919MxKI9H6l4KuElnAtJ7BtZcsl7dUy9u9COgE
ykRiVokFQgqQ7XNDU+r3SeOWwks7AgMBAAGjga8wgawwDAYDVR0TAQH/BAIwADAX
BgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYETYWxpY2VAc21pbWUu
ZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8BAf8EBAMCBsAwHQYD
VR0OBBYEFLv2zLItHQYSHJeuKWqQENMgZmZzMB8GA1UdIwQYMBaAFJEwjnwHFwyn
8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQBziaI2p86poGkjd/4KkkOH
G25nY/0eNARD6/oF0/sYonX2doizcGMk53riugAocCn5zbzhW/JVdYn30UxfyrZl
```

```
RAzEf7GHqgB/NyjOad3pdpVYeDh4ciNKjbs+aEoTWgAkoqENt1sRxlcvb7HVX524
bKZa1oPTUNlm6QpivtqDIdqGJdGf8L1zLfXBuo2zL3HR+M9CDr4Opq2JCkzP0Qhp
7poIccGE6I9Tsg+RrOA9iCQsPn1+Tg8YedjGzUWF07rNmT0TzPCVzUAuBlr+JJtz
OKypyQ3eoZ6EPazXqMyHAVcsm0GI364IOA0b8PSrJNtjh+AqJ5QfH+0e7NSzNnEm
MYICADCCAfwCAQEwbDBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBX
RzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhv
cml0eQITN0EFee11f0Kpolw69Phqzpqp1zALBglghkgBZQMEAgGgaTAYBgkqhkiG
9w0BCQMxCwYJKoZIhvcNAQcBMBwGCSqGSIb3DQEJBTEPFw0yMTAyMjAxNTAyMDJa
MC8GCSqGSIb3DQEJBDEiBCAokSzA71kmvoyy0h+lrO2jw3pvGhvgRnv/zTDC9IxD
UzANBgkqhkiG9w0BAQEFAASCAQBWL6C/VCYFv6ZiQR6JYBbLWiQJyAmNFrRhAbfi
w5bPndhDbJNSv3DXoUfCKd87pvD5Qr1PsH4WXDZ/IY95h3dD7k6oIIFXhPBTYYW7
Np+vrVtS0sDklr03+ebMBY6J0rEtNf5ZXCkQULTmvwmmuKcg4S+5piNqhTnnE0en
IvICii8NgjP3VVPZmNpFmxwmztGWd04omYHbY4JY9C7yvuQ6SNEQm47bxnSIS5yH
sowWnDYqs2cMDLxZ7zy0cEyOpSy8oDfVde4TyOifqMT3VzSmlttdG1uDNE90ek3t
xJn9E+hE02sw0Mv1lLjNdRXviRsaMw33DxGbtoUSo2mOkpYb

--e19--
```

C.1.4. S/MIME Signed-and-Encrypted over a Simple Message, No Header Protection

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a text/plain message. It uses no Header Protection.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 6720 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 3960 bytes
    └ (unwraps to)
    └── text/plain 241 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: smime-signed-enc
Message-ID: <smime-signed-enc@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:03:02 -0500
User-Agent: Sample MUA Version 1.0

MIITXAYJKoZIhvcNAQcDoIITTTCCE0kCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBAFxh1OX2qKJrCxk4NBNVX/kprtR6yjMWM/1n
tepVdA0A/uf69sMzbyZhd8wFl1eapv05Xp6+1DuOZfqYgkbCJwD+ZtSL4MB7EBPM
ytxB42LTEC9f8Z/80L96/+nnDotKHxFSVZPXfmi+FKLLDlddH7bswV3GH/nozzYl
4wjesm/nvakHEv2CNJ2mh5XHq0gqNPDx5/2OmxaU+x0biLPcGNzFob39ok+1rTbN
/9fIGDLKr1ENzQXW0vixcyAS/RBlHw6WGby51EvV7FObcdxsXkTI+vvHTcTGbPhi
54ShTTEocIj7mrXzHodVEy0pysuYCl2hOkqre9HSspAqw7s+/3wwggGEAgEAMGww
VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
HGLS64MvlsDXhpQwDQYJKoZIhvcNAQEBBQAEggEAbrhe4bg9I4GbmhF5qnO5kJXw
JTfpgB3iK+K+bIxH/gsZbLAOx2UR2OHESrW2dqojynuxZ+QE571NXQN7X7THoOaB
mhUPuBRPycw/orR2GR0KCYx4taATw9o2fK3KssO+IAnNP1OM7yUsgABZHT6BfvtC
qH7ZPBJaj73A9AyrxTNPtJJHwueE3X5CPTODViasPRZrqiGB/WO/siuApdk0MPik
tp29bVqzQuD1tpDFb+aQyfggEnqGQn1ReZYhfBvub+AUr+O0lNOh57mob+eJwc0F
Snq9mljS3kgoXbh1DrV9S/seSdYZ7ieCiS3FYEi8h7RsZTGCVMn/STxiq13X0DCC
EC4GCSqGSIb3DQEHATAdBglghkgBZQMEAQIEEP3eQZI7xmdgaoarujEjNYuAghAA
mXWuV/HZ+MiCJTgt1RWzuHw8hnhLDxcY444IeB0M44fryhiuSkUKDdnvy6GDRiUF
ThwVs2iGHdCgvh/tJNaXmF9fa/Vi/aHq/oL3wJi+cS0qkeeq2kpGSMm82mNBlmgt
uhcwozIru+2n+L0xspYIUx0+dG59NlfB1alRQJd7JmCUWF9AY/wVkGPkj5Vym+Vt
```

dRqGqcnJPM4Nq572bhxgLwDOCuoU+2rN5pdW1AT31odSdPtHoux3ysK+aMLcw3ch
mL+en9j/euqO40Xr3Re0J/suSzHobI5I0bDtQwaEoXooz6aQIZrFE4TtZLCDzG7o
ZbMf3rkJ1CIelKpbVhjRAjj4X+MvktiOfxVV4K3GYAagHI5jp+4+MWz2yaQcAnRE
7SpHFxuFdmSYYYAq0yTgxkS9opoAwxPytKefqnnY62wAbug26ZCpSM03172cKopA
gkBqljwFEl+YeauN6206vZKuOhNuyQFbPeO+00qKeHw2bPM+PiKWdzAkQKz9N4CO
kFqzOgEHG5HnH8jx9PPuU57g8TmJccDFuUrZ4kZVcfWogH7gsNyW+A06BSu9Do/S
I7VxMwenuQLv1+W/tm+zLqBLpksKOh81HVNVQ+4zEXx/jQBqM/Tv9BcetVdzGTIq
vCNn7KDLwLceNF7hgbNM4SfZZhg5hfV/xxeNpZx0tn86hHntN54FKymO/kXaFebr
W5yoXwvGHukCJJyI87NN7WIM12g5IHC829NIICAGIuZ/kxPb/A51WB8yr8748XXv
QcXKg7OxTzkVgiACGDyS3ye+fZCncBZgfQ0jcipQU7jVYu7+UiUZDAvuQwae/RUd
CSOhdjwtBzMlIazVfbIaHPM5QKvB+MzbAKUMWza+XRpjLrDVdaSFR06V4r4SUMsi
AvKdd/1RFvSTEhtNj1QOUKEa1DvnuRLvYsdjWLDF2TsBCjP4jdGKGG+PtfB4vcSU
NFJSJ5epaUIDxbFkgSolRF+lM8790NdlgkhY6RbW3kXkA0T1CmKIYrN6poYxCSwU
Q+RzGurGDMQTGvfDgZrObvdE0haaNEdti/ci2EbcasYa3um7HCpt/bKDw5sivnh6
9P9E1WMvdAfEinppCZO8yRrkS1l6b9Jgk6ohJWftQMA2OmpKGw6tRbblH0tJ33JR
8ghApEJpSvtoKGc46NTelR6hBgxoaJCebRpxJ9wrNp4EETj0/PbZDiDzNETWDZ4E
Bn74vJ2I3wCltkk16SmnEJadZovBlyqKYB6bmFvX9S00hOBv8TZ4o//mY4nH57f0
5CmUM42ePRS0HMk9SrBjpouTIkw/tbDieZNb4tA09B/c3/s3qpZ2Bo0Bz7RVRI79
D2P8hnp+/7y74rqyUdRdqW6mFXjNojo1A+hsbXWqTfuMcSikbENC59pmhMDxdS4L
GxJCIVoZmhbnjeEhIMqKwa0NtyLLG8uRlzdTF8g/IOI6UwCeFXl/dO3tvLoEB/KA
D/n27IyDILDldYa1Em7I8jQmQghJ1IdMrUlr1n/mRB+sql2IDVlI95+r96IrFdmj
AWVMX+vbq6n/QNcaxfS5nL7ICgV9kQHO9AtzJ4zXxLDj62nkIdoCRupF+IlHXL9G
OmgJJFj0uhgXO67/2G0cT2JME1siW7/F6JHzlGAyeVSoPs2FAJKYMQvvkR6jbn3y
Huw3s9RS31co6D+nvxJHLvr/REVwiLklxPqimC+2pmkUjRYyL/aXRV9pDuNJLtMu
XJxqwrYgwPw9mBXXaYLgo8G+SSUfeBKvwuKa2kd0prB3cWwfIWlZBgZvVGc7Uudz
QzxyMaDt8R7eVG6/CXUeGOMSWKbjzoZwkbB/QCgZetVO3YM7FqhEfvmg0tv1pS0c
nprxkkMurw1NGearPv+faBo09YSswF38ol44A8hdpYIGc3LL4jj4wSPdS+lMVp84
nKWnZJ/asIS74bEH7TK3JK6tgOPEvh+GDMODoXALsnH157oDi0GeN0kwcB7CeUT7
6zYaQT07QcgOUyWMEOlScOi9zibws0ZKL3uNTwmF8p1Jv2TEvepZQiL2/xbENTmf
H+47tdIPUlJOePdjUGo6QTAaqSH5of0e/T/QENueeJOJboPgbaV0OqTFOVVAMMhA
upadP8ROG6TalcPC7X0gV9Yi60vd/WWVTJPPLDf4+FJm7HmkzT5l5fOAuA+mYJUO
F+BPTUCKyeY9VypoXDV0VnTTpiB9jfyOlPJjBnZ/85Bvfkt0eCW5rV7xeq7tgSJT
+LOkTfwDBqlOZt1hlvKe3SFHnsW9hdojlJz/sXw5FcFCxbxqfageVJ60uamENOhB
j4Q2ZRvslLXxpVME0ifG1CxpfAr2ZQsEormIu0zJeZjkDguwNlBInFKHFzvtSEJp
rP4hAqknbSvOqUdAFp9rlII2dYXI4xh3kV3ECvhvwFt39PfVpGL97R92cTK9JCgq
p9IOJZv32FdhEsaHqQIRklw5xy96fTwbrho+LQSZIMUhTQ+hcqtcRX9cDPA+VZO/
0vLgkF1R8rAWOTCxu3pHELjDq9nKKIzvX7tmyKapFgC38uotkvvKzpUzoA2xPoVH
ybrM09g9ujruzT/Oz02cDa9NWh2eYsiTWJvekeNftvakr6U9r7VYzUkmPCtfDDKC
oWSZHgwnU50Psl6UoTFaw1GuVnlC3cOREOUvFNbtV6R9Jdn3y0XJ0T4uZapFHPJf
naojAoE5iu3VXRMxVZB+4vZWhFJoe4QNvc5t0kwUZVmE1nQWNkHuRyVnpfoLqaG1
1+5IpR6yIZDHlWm75oc8hchG9PxrE0O2WWUqf+QSEdsT74cGTJVOZDl6d4x/G5g4
97v1JaCSCgB/J9yrm4olsqgoYfWAbTcIBe0cUHnoNMAstKqH26jAf0Hz1l3V9D7M
zt3POMck+f3lLNUCqyNLcSASWc7jmB170/oF4vNP1EkgwWaz7yBluTLS8sJCIViV
YYyZvj4du48h7lKaxeairWjcen+qeIS+Tn8VHqoJD6+QJinH5bXMKtxX0Orvf69p
r0WjUctKikcjJFRbc6sQyMP6Y44+6/LyFmWILTaV1WPoWLX5MYKOwP1s5GRneGWS
mZRztWt/CL/8DWjpPEG2siCSaS+lBc1u/C5HkD1UVDjPmZTnvuFTHukaTKfteGz1
z0Bxuz9gQMyAgU0OMyl+cGldHeR3HvIC9zUZ0qRj/d/20M8aQ+8NtVodadiMt29p
THvkrioxuW6MVKXs0gZgdL72swDHtG3lKW1rrbufgjSr0UvSc8/MDgBPJVP2d6QX
P1IJvvBcr766DZ26j9/X0Is5cJjCN7Y0fIrS4RGu5aQR0w+dOulK6v8q8reYZy0K
198CRs3prXRKRPiU0oM16oQdsV9T9LhfOnhWeliL/HzetEltcOSiKgGKVYcArkZU
bzxsxUHF7q7qEzF2fVzWYBnM3qn8Shj3HHlPWYxW6uh5kI6O+mV3Hs56KJjD9zsZ
ZIzTE/5agYXKpliVrGScTUUGeDqrPPyEtOGRTmiQDLISHfW+nviZZcjC4XDxp04b
v6BH3EsSbXN4wJAXypDCY2kfL8wzqMh7qh/8Pk2AuodDtCJQJGsQPkgGwX21lSR2
4C1J1WJqDEaNhvmMf7B9nUu8unXYwwFe7FQN22CYZJOQloj04T1Ukg7wRITeWwc6
xArdNOTn+XQuXfkxVEbiQRhiFt/47qAzoAjPRVr9r4P89Hz3wkTIxirpAjTnKA5v
osv/7+28rRuYRYGu2yPwNeUPmO0YHy3IeTVKcJ/UcmO3cXAe+Q+9ckmZ/MmxaxA1
zvj2pH+INf3eBsQK77PxwsaGUFHqKWS1Wvk/FPsZkGEMX6QcD56sbGRbtsRRryXy
4L0Ul3Jc1P1jwMjHldGEqQohVfKYvHwdOdMaExZh/hhlpfxw1Cwh/d+xuuPlLko5
HTHxwlzQvRgzTlIdX78XItFIYo+eMOb84xr8kAaXwHWpuZ06tymA59kD7LpvWVC6
r/OmqcnvAVDg/eiNh6Kru4BkIiTMtBs313ruZtSe8Hphvm80fYcelpfHs8Y1qrsS
EVohhfxL7073Td6jScN54FZU3dg0EfFg97wyn+2DKeckNr5E/CgdD/FqhkH1IaEO
8wTbc9T/6XC+n27q/kQAMXzFnhn4Ec5E6uQb2MkCJEpW91eg9ZTDRYsZW1/r8yz+
QzbrSDSjVRvZ61FkGdh6m4i024ZtfCUV08AXoOhGKCh8fG/PKmCMzHvqQezO7I8I
DFLTBhWBag9kcNljVFnBYFl0e/hGnAZ6aDc6AQA0HdIZiAF49kEBhCLtOTsa4UHT
npIjhKR6fi1RuiVnFkTqfCMgZawLlZOkaQX2BdH1bsz2Q8wbu/DiNoyXdB/1k3Y2
9yLcVvGRCnyXODjehyoLF/iJUzewsu8fzlTJfV/CCo07cDge2PdnDPVdEl2nM+BH

```
Qo4scmT4cm1YYNGoecy9wGSgHE4fvhk0Szv0V2Fbt5HpJqsJvKH573AlCxROpumw
rOttrdRvke2vTw2nlw5iW1lPhcIpUQAEZfpxQ2lhJfRvJiWDBvimAjVlHipTd0xA
oNZ383NE4SLWvNmjryk/uSvqoMXvof0Hatm67So0KMVDmBA5AMMq+9TBNBxaN1WW
FIuWMzmMWZYCMYm2Lmz2nUOdqVz95Y6rEsaMqQoft/UitEYyJdqawyMXYKmwtYzN
7yES4hRc3ee3JTyogrEtirg87pJ+RB7wOuI9FVjkKhjgVppGQVZAKcpeTRyrqjNU
oSycr2PbV3RPwzDRXX12PigHgX3suLehccOWAMFvpQvgixXU/Ik5ScDcuLC4o/bs
juzOjy5ENDOjQldvC1bgfPfYUSZAvd/g0SYDc0xzC0Dm7dudNhuwSNDT7R39qh9t
eBZSOEI+1TKIxThFhHjKnWqxAJP9LJZbk7/L9QaKfQnDxQkPgwaFgskPTBflzgXd
4inGVpCfaO3dHbhcb2EdF3jiIzHH84S0w5L1ZmXGgYUfNZHNkFf55VYZoTxNCIuA
Duc6jWMI+BXIxXM1hJ0YYY9OYljhT1vpv0VS6rj8zrr9y4xkH8dIfDdVZh+OIqI5
jGMcCDFrCk03zHtLeYTWzQge5p2UPRRQWoxjKsjDHehxWdtHzfUsAAhx3f9USH3b
+nt2vLL2FuSjJMtqS9ACRFncGCQAPsdXjozm85raGnn8p4j9EbN2MFzQ1/mRA3XM
3mNpZ2/qT2GUOB2d49WLHJvesgKGbrIQBb0eM6//hH84BonFrSR6Sf0uUjTGiu2L
PXWkcsTORuAaaTzM33OVOzQTAhBS27vhMr/kxMZSdTx/14phEaJ4zkYzzPb+T92G
CpiDpwEfU2akyZNalZ9jTo28zq1gZENDRu6tYRsjRvPsDI3JN4702HZf80KFhdO/
ZgQ8egO79JS5iJASxu78DbC8Lo28DzDN7etUTCLKxBmz/IQFIHDDkxmzNgoF399J
BiD2T2KmI8jOgLaSmuAnyw==
```

C.1.4.1. S/MIME Signed-and-Encrypted over a Simple Message, No Header Protection, Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

MIILPAYJKoZIhvcNAQcCoIILLTCCCykCAQExDTALBglghkgBZQMEAgEwggFlBgkq
hkiG9w0BBwGgggFWBIIBUk1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVR5cGU6
IHRleHQvcGxhaW47IGNoYXJzZXQ9InV0Zi04Ig0KQ29udGVudC1UcmFuc2Zlci1F
bmNvZGluZzogN2JpdA0KDQpUaGlzIGlzIHRoZQ0Kc21pbWUtc2lnbmVkLWVuYw0K
bWVzc2FnZS4NCg0KVGhpcyBpcyBhIHNpZ25lZC1hbmQtZW5jcnlwdGVkIFMvTUlN
RSBtZXNzYWdlIHVzaW5nIFBLQ1MjNw0KZW52ZWxvcGVkRGF0YSBhcm91bmQgc2ln
bmVkRGF0YS4gIFRoZSBwYXlsb2FkIGlzIGEgdGV4dC9wbGFpbg0KbWVzc2FnZS4g
SXQgdXNlcyBubyBIZWFkZXIgUHJvdGVjdGlvbi4NCg0KLS0gDQpBbGljZQ0KYWxp
Y2VAc21pbWUuZXhhbXBsZQ0KoIIHpjCCA88wggK3oAMCAQICEw8tJb0ROZdKzkJU
h6HuPTQGirQwDQYJKoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjERMA8GA1UE
CxMITEFNUFMgV0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNh
dGlvbiBBdXRob3JpdHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5MjcwNjU0MTha
MDsxDTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYDVQQDEw5B
bGljZSBMb3ZlbGFjZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBAJqV
KfqLwaLjj+gBUCfkacKTg8cc2OtJ9ZSed6U3jUoiZVpMLcP3MUKtLeLg9r1mAfID
lB/wlbdmadXPmrszyidmbuZmOpB5voVQfiLYYy3iOx7YOqzXrl6udP07k0sV+UdS
NRFxrfKeoQEFXgOaGdmnx4OG/e3p1fIKM0dPzZLoOAJF5m5O0xzXPL74zFCWp2f1
ZkuE4A6l41koaZXCN5XL7wWTLMLeNf9Byb5ksKqUuqEHAMd1nmoNMgjY9VfVfcrv
9w43GG8FtpSX+TWzB2zNS2OF+XIVnzRG5DeoULq8v88Z5bLpIJ/nx26r8A4SSwIB
aVv4wPxAf1iPsIVKarUCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQ
MA4wDAYKYIZIAWUDAgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5leGFtcGxl
MBMGA1UdJQQMMAoGCCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIFIDAdBgNVHQ4EFgQU
olNB1UQ8gCkVfAEj8OeOr83zdw8wHwYDVR0jBBgwFoAUkTCOfAcXDKfxCShlNhpn
HGh29FkwDQYJKoZIhvcNAQENBQADggEBAIFJeKCcsTKcFqQMpTryujRGzJdYA+R9
eBAuDLsatbtKtl4FzkgRyOg31/+Cw7H8e30iLrPIFlWN1qjHrjgOyIs5AQ/hgxLv
Lir3hEUV2Z3MRsMtjH2x9SG91PEM046gfPnc9gMGHjMTg1qvaKcLQP5UzpEYPLro
r2X4P5uXxaP0LIZRzWmkw1RF7FOD7PfB5v94M5274XYxW2W4uKGd7QGnUZROSvSY
kGiWDp1JhqXwfDz8A0enITGXnoEkAFvvjiCqh64P1hIeMorj36pgL19oWZD6YrzS
WHUz1F00juyuOfQsqm6hvrDTqNpHNZ015fOURza1SkCvi9GFmNUPoVgwggPPMIIC
t6ADAgECAhM3QQV57XV/QqmiXDr0+GrOmqnXMA0GCSqGSIb3DQEBDQUAMFUxDTAL
BgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUg
TEFNUFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQx
OFoYDzIwNTIwOTI3MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhM
QU1QUyBXRzEXMBUGA1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEB
AQUAA4IBDwAwggEKAoIBAQC09InoWDgWPk2af0+StijSNOR8K/hN8D+l078oulls
k4ASvSwjsCNo7sHUa4xQUl5JO6VqY18LANwORjrc9BaX4MguzsbFXBe6uFh1mVpX
mFxSpUByQ+950MFz/evPgP96wV+z4TtAwW2Z34rTiz4DxMI07XYNFUEOls/gkUP2
GxzymsO2kaYWTut3SryCqeHEFbZFkB4urMk4xrIJC3CzWruS2Q0FHbBlfkgKN5wX
VgkWFfiOucfCn+IQsaqpo1d3f9jSkbtAV5w3vzfog8919MxKI9H6l4KuElnAtJ7B
```

```
tZcsl7dUy9u9COgEykRiVokFQgqQ7XNDU+r3SeOWwks7AgMBAAGjga8wgawwDAYD
VR0TAQH/BAIwADAXBgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYET
YWxpY2VAc21pbWUuZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8B
Af8EBAMCBsAwHQYDVR0OBBYEFLv2zLItHQYSHJeuKWqQENMgZmZzMB8GA1UdIwQY
MBaAFJEwjnwHFwyn8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQBziaI2
p86poGkjd/4KkkOHG25nY/0eNARD6/oF0/sYonX2doizcGMk53riugAocCn5zbzh
W/JVdYn30UxfyrZlRAzEf7GHqgB/NyjOad3pdpVYeDh4ciNKjbs+aEoTWgAkoqEN
t1sRxlcvb7HVX524bKZa1oPTUNlm6QpivtqDIdqGJdGf8L1zLfXBuo2zL3HR+M9C
Dr4Opq2JCkzP0Qhp7poIccGE6I9Tsg+RrOA9iCQsPn1+Tg8YedjGzUWF07rNmT0T
zPCVzUAuBlr+JJtzOKypyQ3eoZ6EPazXqMyHAVcsm0GI364IOA0b8PSrJNtjh+Aq
J5QfH+0e7NSzNnEmMYICADCCAfwCAQEwbDBVMQ0wCwYDVQQKEwRJRVRGMREwDwYD
VQQLEwhMQU1QUyBXRzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZp
Y2F0aW9uIEF1dGhvcml0eQITN0EFee11f0Kpolw69Phqzpqp1zALBglghkgBZQME
AgGgaTAYBgkqhkiG9w0BCQMxCwYJKoZIhvcNAQcBMBwGCSqGSIb3DQEJBTEPFw0y
MTAyMjAxNTAzMDJaMC8GCSqGSIb3DQEJBDEiBCCb47LkqJUmFpzt9bQAPoWpk+vy
9sGfzpOuEZflV+goizANBgkqhkiG9w0BAQEFAASCAQCd+I+Tr7hDMV3VFvFGduS9
4ysR9dceBgPloLOH71fsoJUl508WspagFkqjkUGPipKfYVrssRi8IHQM682HQqUk
jkB0UYx0hfEBVbsDvhYejzOYfyLRQD6TYI3HTVFJIJIKVk3JQUuQWzx+A5i14oHI
mCeHl1FgRq6D1B3hjpWFFWI35pRZ1gSZ3tPryQwq1Y0bMkiF4CeuUYEKWIdFHZdo
u/IMfLJoJeYpy8cyv6FznuJzkAR9AlUIUw58zXCD0ipCfKH2w6vwqdoCo4V0+cZd
5cZlYQSFab3fduU44viKaXf4VOpWK49oDeR/tV5i1LfM3ZYeH2V1r+pmnjyt8CcW
```

C.1.4.2. S/MIME Signed-and-Encrypted over a Simple Message, No Header Protection, Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Type: text/plain; charset="utf-8"
Content-Transfer-Encoding: 7bit

This is the
smime-signed-enc
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a text/plain
message. It uses no Header Protection.

--
Alice
alice@smime.example
```

C.1.5. No Cryptographic Protections over a Complex Message

This message uses no cryptographic protection at all. Its Body is a multipart/alternative message with an inline image/png attachment.

It has the following structure:

```
└─┬ multipart/mixed 1402 bytes
  ├─┬ multipart/alternative 794 bytes
  │ ├── text/plain 206 bytes
  │ └── text/html 304 bytes
  └── image/png inline 232 bytes
```

Its contents are:

```
MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="0cf"
Subject: no-crypto-complex
Message-ID: <no-crypto-complex@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:00:02 -0500
User-Agent: Sample MUA Version 1.0
```

```
--0cf
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="6e6"

--6e6
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
no-crypto-complex
message.

This message uses no cryptographic protection at all.  Its Body
is a multipart/alternative message with an inline image/png
attachment.

--
Alice
alice@smime.example
--6e6
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>no-crypto-complex</b>
message.</p>
<p>This message uses no cryptographic protection at all.  Its Body
is a multipart/alternative message with an inline image/png
attachment.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--6e6--

--0cf
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--0cf--
```

C.1.6. S/MIME Signed-Only signedData over a Complex Message, No Header Protection

This is a signed-only S/MIME message via PKCS#7 signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses no Header Protection.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 5253 bytes
  └─ (unwraps to)
    └─┬ multipart/mixed 1288 bytes
      ├─┬ multipart/alternative 882 bytes
      │ ├── text/plain 260 bytes
      │ └── text/html 355 bytes
      └── image/png inline 236 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"
Subject: smime-one-part-complex
Message-ID: <smime-one-part-complex@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:01:02 -0500
User-Agent: Sample MUA Version 1.0

MIIPIwYJKoZIhvcNAQcCoIIPFDCCDxACAQExDTALBglghkgBZQMEAgEwggVMBgkq
hkiG9w0BBwGgggU9BIIFOU1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVR5cGU6
IG11bHRpcGFydC9taXhlZDsgYm91bmRhcnk9ImRiMCINCg0KLS1kYjANCk1JTUUt
VmVyc2lvbjogMS4wDQpDb250ZW50LVR5cGU6IG11bHRpcGFydC9hbHRlcm5hdGl2
ZTsgYm91bmRhcnk9IjUxZCINCg0KLS01MWQNCkNvbnRlbnQtVHlwZTogdGV4dC9w
bGFpbjsgY2hhcnNldD0idXMtYXNjaWkiDQpNSU1FLVZlcnNpb246IDEuMA0KQ29u
dGVudC1UcmFuc2Zlci1FbmNvZGluZzogN2JpdA0KDQpUaGlzIGlzIHRoZQ0Kc21p
bWUtb25lLXBhcnQtY29tcGxleA0KbWVzc2FnZS4NCg0KVGhpcyBpcyBhIHNpZ25l
ZC1vbmx5IFMvTUlNRSBtZXNzYWdlIHZpYSBQS0NTIzcgc2lnbmVkRGF0YS4gIFRo
ZQ0KcGF5bG9hZCBpcyBhIG11bHRpcGFydC9hbHRlcm5hdGl2ZSBtZXNzYWdlIHdp
dGggYW4gaW5saW5lDQppbWFnZS9wbmcgYXR0YWNobWVudC4gSXQgdXNlcyBubyBI
ZWFkZXIgUHJvdGVjdGlvbi4NCg0KLS0gDQpBbGljZQ0KYWxpY2VAc21pbWUuZXhh
bXBsZQ0KLS01MWQNCkNvbnRlbnQtVHlwZTogdGV4dC9odG1sOyBjaGFyc2V0PSJ1
cy1hc2NpaSINCk1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVRyYW5zZmVyLUVu
Y29kaW5nOiA3Yml0DQoNCjxodG1sPjxoZWFkPjx0aXRsZT48L3RpdGxlPjwvaGVh
ZD48Ym9keT4NCjxwPlRoaXMgaXMgdGhlDQo8odG1sOyBjaGFyc2V0PSJ1cy1hc2Np
bWxpbmUNCmltYWdlL3BuZyBhdHRhY2htZW50LiBJdCB1c2VzIG5vIEhlYWRlciBQ
cm90ZWN0aW9uLjwvcD4NCjxwPjx0dD4tLSA8YnIvPkFsaWNlPGJyLz5hbGljZUBz
bWltZS5leGFtcGxlPC90dD48L3A+PC9ib2R5PjwvaHRtbD4NCi0tNTFkLS0NCg0K
LS1kYjANCkNvbnRlbnQtVHlwZTogaW1hZ2UvcG5nDQpDb250ZW50LVRyYW5zZmVy
LUVuY29kaW5nOiBiYXNlNjQNCkNvbnRlbnQtRGlzcG9zaXRpb246IGlubGluZQ0K
DQppVkJPUncwS0dnb0FBQUFOU1VoRVVnQUFBQlFBQUFBVUNBWUFBQUNOaVIwTkFB
QUFjRWxFUVZSNDJ1VlRPeGJBDQpNQWdTNzM5bk8zVHBSdzIwZHFwYmZBUlFFak95
d2l3WW5DdGtES25iY0xrNjZzcWxUK3p0OWNpZGtFKzZLd2taDQpzZ3J6ZmNxVk1w
TDJqbzA0NDdnWURwZUFyaytPbkpIa0loQWZUUFJpY2loQWY1WUpydzd2anYwWldS
V00vdWxpDQp2ZFBmMVFaMmtERDl4cHBkOHdBQUFBQkpSVTVFcmtKZ2dnPT0NCg0K
LS1kYjAtLQ0KoIIHpjCCA88wggK3oAMCAQICEw8tJb0ROZdKzkJUh6HuPTQGirQw
DQYJKoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMg
V0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRo
b3JpdHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5MjcwNjU0MThaMDsxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYDVQQDEw5BbGljZSBMb3Zl
bGFjZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBAJqVKfqLwaLjj+gB
UCfkacKTg8cc2OtJ9ZSed6U3jUoiZVpMLcP3MUKtLeLg9r1mAfIDlB/wlbdmadXP
mrszyidmbuZmOpB5voVQfiLYYy3iOx7YOqzXrl6udP07k0sV+UdSNRFxrfKeoQEF
XgOaGdmnx4OG/e3p1fIKM0dPzZLoOAJF5m5O0xzXPL74zFCWp2f1ZkuE4A6l41ko
aZXCN5XL7wWTLMLeNf9Byb5ksKqUuqEHAMd1nmoNMgjY9VfVfcrv9w43GG8FtpSX
+TWzB2zNS2OF+XIVnzRG5DeoULq8v88Z5bLpIJ/nx26r8A4SSwIBaVv4wPxAf1iP
sIVKarUCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQMA4wDAYKYIZI
AWUDAgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5leGFtcGxlMBMGA1UdJQQM
MAoGCCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIFIDAdBgNVHQ4EFgQUolNB1UQ8gCkV
fAEj8OeOr83zdw8wHwYDVR0jBBgwFoAUkTCOfAcXDKfxCShlNhpnHGh29FkwDQYJ
KoZIhvcNAQENBQADggEBAIFJeKCcsTKcFqQMpTryujRGzJdYA+R9eBAuDLsatbtK
tl4FzkgRyOg31/+Cw7H8e30iLrPIFlWN1qjHrjgOyIs5AQ/hgxLvLir3hEUV2Z3M
RsMtjH2x9SG91PEM046gfPnc9gMGHjMTg1qvaKcLQP5UzpEYPLror2X4P5uXxaP0
LIZRzWmkw1RF7FOD7PfB5v94M5274XYxW2W4uKGd7QGnUZROSvSYkGiWDp1JhqXw
fDz8A0enITGXnoEkAFvvjiCqh64P1hIeMorj36pgL19oWZD6YrzSWHUz1F00juyu
OfQsqm6hvrDTqNpHNZ015fOURza1SkCvi9GFmNUPoVgwggPPMIICt6ADAgECAhM3
QQV57XV/QqmiXDr0+GrOmqnXMA0GCSqGSIb3DQEBDQUAMFUxDTALBgNVBAoTBElF
VEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMgUlNB
IENlcnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQxOFoYDzIwNTIw
OTI3MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzEX
MBUGA1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAw
```

```
ggEKAoIBAQC09InoWDgWPk2af0+StijSNOR8K/hN8D+l078oullsk4ASvSwjsCNo
7sHUa4xQUl5JO6VqY18LANwORjrc9BaX4MguzsbFXBe6uFh1mVpXmFxSpUByQ+95
0MFz/evPgP96wV+z4TtAwW2Z34rTiz4DxMI07XYNFUEOls/gkUP2GxzymsO2kaYW
Tut3SryCqeHEFbZFkB4urMk4xrIJC3CzWruS2Q0FHbBlfkgKN5wXVgkWFfiOucfC
n+IQsaqpo1d3f9jSkbtAV5w3vzfog8919MxKI9H6l4KuElnAtJ7BtZcsl7dUy9u9
COgEykRiVokFQgqQ7XNDU+r3SeOWwks7AgMBAAGjga8wgawwDAYDVR0TAQH/BAIw
ADAXBgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYETYWxpY2VAc21p
bWUuZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8BAf8EBAMCBsAw
HQYDVR0OBBYEFLv2zLItHQYSHJeuKWqQENMgZmZzMB8GA1UdIwQYMBaAFJEwjnwH
Fwyn8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQBziaI2p86poGkjd/4K
kkOHG25nY/0eNARD6/oF0/sYonX2doizcGMk53riugAocCn5zbzhW/JVdYn30Uxf
yrZlRAzEf7GHqgB/NyjOad3pdpVYeDh4ciNKjbs+aEoTWgAkoqENt1sRxlcvb7HV
X524bKZa1oPTUNlm6QpivtqDIdqGJdGf8L1zLfXBuo2zL3HR+M9CDr4Opq2JCkzP
0Qhp7poIccGE6I9Tsg+RrOA9iCQsPn1+Tg8YedjGzUWF07rNmT0TzPCVzUAuBlr+
JJtzOKypyQ3eoZ6EPazXqMyHAVcsm0GI364IOA0b8PSrJNtjh+AqJ5QfH+0e7NSz
NnEmMYICADCCAfwCAQEwbDBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1Q
UyBXRzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1
dGhvcml0eQITN0EFee11f0Kpolw69Phqzpqp1zALBglghkgBZQMEAgGgaTAYBgkq
hkiG9w0BCQMxCwYJKoZIhvcNAQcBMBwGCSqGSIb3DQEJBTEPFw0yMTAyMjAxNzAx
MDJaMC8GCSqGSIb3DQEJBDEiBCBkEM75wgxSOKXxqQLSNadhQ5kDl0ABIYw030cj
kP4nsDANBgkqhkiG9w0BAQEFAASCAQA9zet9PbdeBOdT0TVjIwCXvUjnq1/UN22d
GV2Ql//QcTN3Z7wMvLilhcYHrL8Sl9lIm2XYCV9r2yqvVyiB+qN+69y18HIzZ7ok
rgqQ8TDPt4IW2UXxyXrBOItFirLKklntf4SafPq73ipeZLMc3x3jr84lr7psIknp
EEmNM+okG6FHduKq8nSvbAKlahOE9qvDGcBJBYXtn+/ijqA6Fxu+mJDshCz0Vvq4
uVXp0ZS3pyO+Gg0JJnLD+z5+MPqO8TrSTBhZYQauVQFji9Kjb2A8KZpLjEXvw/JV
NqgxW8weaEV03KYp+fbsIdTSDwrz5w9rmSH1b+ReoY5kMa50eu9w
```

C.1.6.1. S/MIME Signed-Only signedData over a Complex Message, No Header Protection, Unwrapped

The S/MIME signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="db0"

--db0
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="51d"

--51d
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
smime-one-part-complex
message.

This is a signed-only S/MIME message via PKCS#7 signedData.  The
payload is a multipart/alternative message with an inline
image/png attachment. It uses no Header Protection.

--
Alice
alice@smime.example
--51d
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-one-part-complex</b>
message.</p>
<p>This is a signed-only S/MIME message via PKCS#7 signedData.  The
payload is a multipart/alternative message with an inline
```

```
image/png attachment. It uses no Header Protection.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--51d--

--db0
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--db0--
```

C.1.7. S/MIME Signed-Only multipart/signed over a Complex Message, No Header Protection

This is a signed-only S/MIME message via PKCS#7 detached signature (multipart/signed). The payload is a multipart/alternative message with an inline image/png attachment. It uses no Header Protection.

It has the following structure:

```
└─┬ multipart/signed 5230 bytes
  ├─┬ multipart/mixed 1344 bytes
  │ ├─┬ multipart/alternative 938 bytes
  │ │ ├── text/plain 278 bytes
  │ │ └── text/html 376 bytes
  │ └── image/png inline 232 bytes
  └── application/pkcs7-signature [smime.p7s] 3429 bytes
```

Its contents are:

```
MIME-Version: 1.0
Content-Type: multipart/signed;
 protocol="application/pkcs7-signature"; boundary="872";
 micalg="sha-256"
Subject: smime-multipart-complex
Message-ID: <smime-multipart-complex@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:02:02 -0500
User-Agent: Sample MUA Version 1.0

--872
MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="757"

--757
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="3ff"

--3ff
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
smime-multipart-complex
message.

This is a signed-only S/MIME message via PKCS#7 detached
signature (multipart/signed).  The payload is a
multipart/alternative message with an inline image/png
```

```
attachment. It uses no Header Protection.

--
Alice
alice@smime.example
--3ff
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-multipart-complex</b>
message.</p>
<p>This is a signed-only S/MIME message via PKCS#7 detached
signature (multipart/signed).  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses no Header Protection.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--3ff--

--757
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--757--

--872
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-signature; name="smime.p7s"

MIIJ4AYJKoZIhvcNAQcCoIIJ0TCCCc0CAQExDTALBglghkgBZQMEAgEwCwYJKoZI
hvcNAQcBoIIHpjCCA88wggK3oAMCAQICEw8tJb0ROZdKzkJUh6HuPTQGirQwDQYJ
KoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cx
MTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3Jp
dHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5MjcwNjU0MThaMDsxDTALBgNVBAoT
BElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYDVQQDEw5BbGljZSBMb3ZlbGFj
ZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBAJqVKfqLwaLjj+gBUCfk
acKTg8cc2OtJ9ZSed6U3jUoiZVpMLcP3MUKtLeLg9r1mAfIDlB/wlbdmadXPmrsz
yidmbuZmOpB5voVQfiLYYy3iOx7YOqzXrl6udP07k0sV+UdSNRFxrfKeoQEFXgOa
Gdmnx4OG/e3p1fIKM0dPzZLoOAJF5m5O0xzXPL74zFCWp2f1ZkuE4A6l41koaZXC
N5XL7wWTLMLeNf9Byb5ksKqUuqEHAMd1nmoNMgjY9VfVfcrv9w43GG8FtpSX+TWz
B2zNS2OF+XIVnzRG5DeoULq8v88Z5bLpIJ/nx26r8A4SSwIBaVv4wPxAf1iPsIVK
arUCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQMA4wDAYKYIZIAWUD
AgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5leGFtcGxlMBMGA1UdJQQMMAoG
CCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIFIDAdBgNVHQ4EFgQUolNB1UQ8gCkVfAEj
8OeOr83zdw8wHwYDVR0jBBgwFoAUkTCOfAcXDKfxCShlNhpnHGh29FkwDQYJKoZI
hvcNAQENBQADggEBAIFJeKCcsTKcFqQMpTryujRGzJdYA+R9eBAuDLsatbtKtl4F
zkgRyOg31/+Cw7H8e30iLrPIFlWN1qjHrjgOyIs5AQ/hgxLvLir3hEUV2Z3MRsMt
jH2x9SG91PEM046gfPnc9gMGHjMTg1qvaKcLQP5UzpEYPLror2X4P5uXxaP0LIZR
zWmkw1RF7FOD7PfB5v94M5274XYxW2W4uKGd7QGnUZROSvSYkGiWDp1JhqXwfDz8
A0enITGXnoEkAFvvjiCqh64P1hIeMorj36pgL19oWZD6YrzSWHUz1F00juyuOfQs
qm6hvrDTqNpHNZ015fOURza1SkCvi9GFmNUPoVgwggPPMIICt6ADAgECAhM3QQV5
7XV/QqmiXDr0+GrOmqnXMA0GCSqGSIb3DQEBDQUAMFUxDTALBgNVBAoTBElfVEYx
ETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMgUlNBIENl
cnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQxOFoYDzIwNTIwOTI3
MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzEXMBUG
A1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEK
AoIBAQC09InoWDgWPk2af0+StijSNOR8K/hN8D+l078oullsk4ASvSwjsCNo7sHU
a4xQUl5JO6VqY18LANwORjrc9BaX4MguzsbFXBe6uFh1mVpXmFxSpUByQ+950MFz
```

```
/evPgP96wV+z4TtAwW2Z34rTiz4DxMI07XYNFUEOls/gkUP2GxzymsO2kaYWTut3
SryCqeHEFbZFkB4urMk4xrIJC3CzWruS2Q0FHbBlfkgKN5wXVgkWFfiOucfCn+IQ
saqpo1d3f9jSkbtAV5w3vzfog8919MxKI9H6l4KuElnAtJ7BtZcsl7dUy9u9COgE
ykRiVokFQgqQ7XNDU+r3SeOWwks7AgMBAAGjga8wgawwDAYDVR0TAQH/BAIwADAX
BgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYETYWxpY2VAc21pbWUu
ZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8BAf8EBAMCBsAwHQYD
VR0OBBYEFLv2zLItHQYSHJeuKWqQENMgZmZzMB8GA1UdIwQYMBaAFJEwjnwHFwyn
8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQBziaI2p86poGkjd/4KkkOH
G25nY/0eNARD6/oF0/sYonX2doizcGMk53riugAocCn5zbzhW/JVdYn30UxfyrZl
RAzEf7GHqgB/NyjOad3pdpVYeDh4ciNKjbs+aEoTWgAkoqENt1sRxlcvb7HVX524
bKZa1oPTUNlm6QpivtqDIdqGJdGf8L1zLfXBuo2zL3HR+M9CDr4Opq2JCkzP0Qhp
7poIccGE6I9Tsg+RrOA9iCQsPn1+Tg8YedjGzUWF07rNmT0TzPCVzUAuBlr+JJtz
OKypyQ3eoZ6EPazXqMyHAVcsm0GI364IOA0b8PSrJNtjh+AqJ5QfH+0e7NSzNnEm
MYICADCCAfwCAQEwbDBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBX
RzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhv
cml0eQITN0EFee11f0Kpolw69Phqzpqp1zALBglghkgBZQMEAgGgaTAYBgkqhkiG
9w0BCQMxCwYJKoZIhvcNAQcBMBwGCSqGSIb3DQEJBTEPFw0yMTAyMjAxNzAyMDJa
MC8GCSqGSIb3DQEJBDEiBCC5KpxWrqp9lc/at0VVROdHn83fXt5r6VC1EPizN3pz
YDANBgkqhkiG9w0BAQEFAASCAQCVWFu4+5JFFOLMcfSgjQsyxsRKPplmT35MrYT1
rZKzBqdb7BgsgtavL6xHs/GKGjbqHwrrPADgsnyeXwotOBZoFzxLxw9fQI7z7wH5
QbGLEj6hRHvrSdYzhlptTnTqc4hXdYwh3jjNJlIf1D01EP9KySaLt3M/aGcNUKDO
z2ngLLtpOQULqGm/IxkIG+Rj9YHlktQVEiPxtT+TQ8qO0eiHZVukT88BpGOBBpCs
9aLUH2JuEF6v6wKp9S+sWj4sxO9bzYmNPOmi8WWyGYx5NVldgzeZxhISConuiji7
e3Wyda9wa7pqiFz0nsY+/mqILYTxBYMcsjN8uZ8yCaPdcfpU
```

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C.1.8. S/MIME Signed-and-Encrypted over a Complex Message, No Header Protection

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses no Header Protection.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 8710 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 5434 bytes
    └ (unwraps to)
    └─┬ multipart/mixed 1356 bytes
      ├─┬ multipart/alternative 950 bytes
      │ ├── text/plain 295 bytes
      │ └── text/html 390 bytes
      └── image/png inline 236 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: smime-signed-enc-complex
Message-ID: <smime-signed-enc-complex@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:03:02 -0500
User-Agent: Sample MUA Version 1.0

MIIZHAYJKoZIhvcNAQcDoIIZDTCCGQkCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBAGaxvLw0XDiDHlLUZffbDPPnrxQvEqUfaDKF
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fdEjeihEluJrK171PW04zgCUajmHpT0QFkstBnP8sI631tIKutQ1tn7f7NbXFSkI
```

```
gnfZnpO9osQpUI1hfDbKsPE4Lsv0p3R60Bhy3xK27qS53KMH4bzQrIN86FiGRgYL
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VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
HGLS64MvlsDXhpQwDQYJKoZIhvcNAQEBBQAEggEAjofQnu1xr50wncKoCmExvdj5
eIbwYUuUrpfriURfX3dhMTAQ5jnQghbIi+zmTuraElTk6Vi65/rpDBz7a4YBAaeQ
jz3GH4ua8j5wrYe44ipXaZnHd2QkS5zYCER/lBD/lgCrgewhy7Ef4QI03drzT3zF
rc2YozxaViKZ/KUaBn27BlIPZoXWtahlSa8TnoZkCl4to5mI5K6vLuxAR7WgFC84
5vpnELyyiXcET0cjDnnvfx2wfUpBPo4gx1S+VTzcCn9i/b35LiLoVWSlWabY62Zt
RRlNH2gTIqNKjw3X6XvSM63e6qilg7vxWf1wv6tS+mlgsVzxc58u1g0zCxKuUjCC
Fe4GCSqGSIb3DQEHATAdBglghkgBZQMEAQIEEL40oVxNKumsqJAgvAxYpoaAghXA
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BLdn9VFjENNYqszWxUmTxMoGE9bMFAOQny4FrMCyuFLVcu2ktQg6L2q8CSw98Eod
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KJcgdsmUv8GeIs0fkihsABdUMZn/kdFdDOQIx4w9K5hmxWXeR37ancwRloBgC2Ke
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kBmFWvaD45247R1ubkERejEd05zl/K+93KhzVDeoMow/Q0GGEEQ/SZ5als5NpyzJ
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```

```
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c4a5Q0+R9fw4Acs/QtDoX5ZMgMoSpdN8x7AdBtxolicWe/iQECurAnRYcrwKXo7+
WVURy5/cq6Z3STIHqdCcGBBJLX9OsGIyBK80mgmhNDjbRe4fdeVXOSWQOcdNQSXT
KFg5G75UuCkukly7e31XNbhhRQy58jbuhM4bptnxqM7cz++uC1Xfl+zm8TX+1gRM
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101qRGC8/O7/I4L45Sb8diZaPsNIl/3kuqjGMASYtnEFYcrurCGlC1UweIShOrtS
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RVGOKJv4fxqOgAt99XeXQvgfWWM/Kix/hI+zP5gOrzKW0i/T7wdJBQDBIOwqbauP
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lOZDtmjZAGQIHnzXTl8kAOuHRlx2mkBpRwNYGUTQZzdGGJAUnrwBotPfx6310aKb
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rkvilUvkZg3QCNNoCtuAb4/sfTN/pqXpcdW7Cte6kHPbxtzoGkR2P+Lu6lJdxrG0
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qa1t27+4JaC2w5maC49s6cd/hRi7AGCyy8dMhUfNz+xs8m0BrdKACkQm8i3u817v
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fHVB/KkHgCQnEiEYshhHmYpHjiTbTYfT6S9HkA2yugwbdFHpxFjLRaS2AVZ/mZPc
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Cn0pGXHB13LsLt2EXxmb0gEZhZnWTdhkzzEXyvZjXeZDDeU4h7ilvJqWJ2CBpWtH
w/CDpK5lffK0VMX62Dce+3QefqFVifhmXQfYRxgJGSh/qGYeLLdiOWrdeZrFrvD
```

C.1.8.1. S/MIME Signed-and-Encrypted over a Complex Message, No Header Protection, Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

MIIPaQYJKoZIhvcNAQcCoIIPWjCCD1YCAQExDTALBglghkgBZQMEAgEwggWSBgkq
hkiG9w0BBwGgggWDBIIFf01JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVR5cGU6
IG11bHRpcGFydC9taXhlZDsgYm91bmRhcnk9IjM2MyINCg0KLS0zNjMNCk1JTUUt
VmVyc2lvbjogMS4wDQpDb250ZW50LVR5cGU6IG11bHRpcGFydC9hbHRlcm5hdGl2
ZTsgYm91bmRhcnk9ImYyNyINCg0KLS1mMjcNCkNvbnRlbnQtVHlwZTogdGV4dC9w
bGFpbjsgY2hhcnNldD0idXMtYXNjaWkiDQpNSU1FLVZlcnNpb246IDEuMA0KQ29u
dGVudC1UcmFuc2Zlci1FbmNvZGluZzogN2JpdA0KDQpUaGlzIGlzIHRoZQ0Kc21p
bWUtc2lnbmVkLWVuYy1jb21wbGV4DQptZXNzYWdlLg0KDQpUaGlzIGlzIGEgc2ln
bmVkLWFuZC1lbmNyeXB0ZWQgUy9NSU1FIG1lc3NhZ2UgdXNpbmcgUEtDUyM3DQpl
bnZlbG9wZWREYXRhIGFyb3VuZCBzaWduZWREYXRhLiAgVGhlIHBheWxvYWQgaXMg
YQ0KbXVsdGlwYXJ0L2FsdGVybmF0aXZlIG1lc3NhZ2Ugd2l0aCBhbiBpbmxpbmUg
aW1hZ2UvcG5nDQphdHRhY2htZW50LiBJdCB1c2VzIG5vIEhlYWRlciBQcm90ZWN0
aW9uLg0KDQotLSANCkFsaWNlDQphbGljZUBzbWltZS5leGFtcGxlDQotLWYyNw0K
Q29udGVudC1UeXBlOiB0ZXh0L2h0bWw7IGNoYXJzZXQ9InVzLWFzY2lpIg0KTUlN
RS1WZXJzaW9uOiAxLjANCkNvbnRlbnQtVHJhbnNmZXItRW5jb2Rpbmc6IDdiaXQN
Cg0KPGh0bWw+PGhlYWQ+PHRpdGxlPjwvdGl0bGU+PC9oZWFkPjxib2R5Pg0KPHA+
VGhpcyBpcyB0aGUNCjxiPnNtaW1lLXNpZ25lZC1lbmMtY29tcGxleDwvYj4NCm1l
c3NhZ2UuPC9wPg0KPHA+VGhpcyBpcyBhIHNpZ25lZC1hbmQtZW5jcnlwdGVkIFMv
TUlNRSBtZXNzYWdlIHVzaW5nIFBLQ1MjNw0KZW52ZWxvcGVkRGF0YSBhcm91bmQg
c2lnbmVkRGF0YS4gIFRoZSBwYXlsb2FkIGlzIGENCm11bHRpcGFydC9hbHRlcm5h
dGl2ZSBtZXNzYWdlIHdpdGggYW4gaW5saW5lIGltYWdlL3BuZw0KYXR0YWNobWVu
dC4gSXQgdXNlcyBubyBIZWFkZXIgUHJvdGVjdGlvbi48L3A+DQo8cD48dHQ+LS0g
PGJyLz5BbGljZTxici8+YWxpY2VAc21pbWUuZXhhbXBsZTwvdHQ+PC9wPjwvYm9k
eT48L2h0bWw+DQotLWYyNy0tDQoNCi0tMzYzDQpDb250ZW50LVR5cGU6IGltYWdl
L3BuZw0KQ29udGVudC1UcmFuc2Zlci1FbmNvZGluZzogYmFzZTY0DQpDb250ZW50
LURpc3Bvc2l0aW9uOiBpbmxpbmUNCg0KaVZCT1J3MEtHZ29BQUFBTlNVaEVVZ0FB
QUJRQUFBQVVDQVlBQUFDTmlSME5BQUFBY0VsRVFWUjQydVZUT3hiQQ0KTUFnUzcz
OW5PM1RwUncyMGRxcGJmQVJRRWpPeXdpd1luQ3RrREtuYmNMazY2c3FsVCt6dDlj
aWRrRSs2S3drWg0Kc2dyemZjcVZNcEwyam8wNDQ3Z1lEcGVBcmsrT25KSGtJaEFm
VFBSaWNpaEFmNVlKcnc3dmp2MFpXUldNL3VsaQ0KdmRQZjFRWjJrREQ5eHBwZDh3
QUFBQUJKUlU1RXJrSmdnZz09DQoNCi0tMzYzLS0NCqCCB6YwggPPMIICt6ADAgEC
AhMPLSW9ETmXSs5CVIeh7j00Boq0MA0GCSqGSIb3DQEBDQUAMFUxDTALBgNVBAoT
BElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMg
UlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQxOFoYDzIw
NTIwOTI3MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBX
RzEXMBUGA1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEBAQUAA4IB
DwAwggEKAoIBAQCalSn6i8Gi44/oAVAn5GnCk4PHHNjrSfWUnnelN41KImVaTC3D
9zFCrS3i4Pa9ZgHyA5Qf8JW3ZmnVz5q7M8onZm7mZjqQeb6FUH4i2GMt4jse2Dqs
165ernT9O5NLFflHUjURca3ynqEBBV4DmhnZp8eDhv3t6dXyCjNHT82S6DgCReZu
TtMc1zy++MxQlqdn9WZLhOAOpeNZKGmVwjeVy+8FkyzC3jX/Qcm+ZLCqlLqhBwDH
dZ5qDTII2PVX1X3K7/cONxhvBbaUl/k1swdszUtjhflyFZ80RuQ3qFC6vL/PGeWy
6SCf58duq/AOEksCAWlb+MD8QH9Yj7CFSmq1AgMBAAGjga8wgawwDAYDVR0TAQH/
BAIwADAXBgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYETYWxpY2VA
c21pbWUuZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8BAf8EBAMC
BSAwHQYDVR0OBBYEFKJTQdVEPIApFXwBI/Dnjq/N83cPMB8GA1UdIwQYMBaAFJEw
jnwHFwyn8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQCBSXignLEynBak
DKU68ro0RsyXWAPkfXgQLgy7GrW7SrZeBc5IEcjoN9f/gsOx/Ht9Ii6zyBZVjdao
x644DsiLOQEP4YMS7y4q94RFFdmdzEbDLYx9sfUhvdTxDNOOoHz53PYDBh4zE4Na
r2inC0D+VM6RGDy66K9l+D+bl8Wj9CyGUc1ppMNURexTg+z3web/eDOdu+F2MVtl
uLihne0Bp1GUTkr0mJBolg6dSYal8Hw8/ANHpyExl56BJABb744gqoeuD9YSHjKK
49+qYC9faFmQ+mK80lh1M9RdNI7srjn0LKpuob6w06jaRzWdNeXzlEc2tUpAr4vR
hZjVD6FYMIIDzzCCAregAwIBAgITN0EFee11f0Kpolw69Phqzpqp1zANBgkqhkiG
9w0BAQ0FADBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzExMC8G
A1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhvcml0eTAg
Fw0xOTExMjAwNjU0MThaGA8yMDUyMDkyNzA2NTQxOFowOzENMAsGA1UEChMESUVU
RjERMA8GA1UECxMITEFNUFMgV0cxFzAVBgNVBAMTDkFsaWNlIExvdmVsYWNlMIIB
IjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAtPSJ6Fg4Fj5Nmn9PkrYo0jTk
fCv4TfA/pdO/KLpZbJOAEr0sI7AjaO7B1GuMUFJeSTulamNfCwDcDkY63PQWl+DI
Ls7GxVwXurhYdZlaV5hcUqVAckPvedDBc/3rz4D/esFfs+E7QMFtmd+K04s+A8TC
NO12DRVBDpbP4JFD9hsc8prDtpGmFk7rd0q8gqnhxBW2RZAeLqzJOMayCQtws1q7
ktkNBR2wZX5ICjecF1YJFhX4jrnHwp/iELGqqaNXd3/Y0pG7QFecN7836IPPdfTM

```
SiPR+peCrhJZwLSewbWXLJe3VMvbvQjoBMpEYlaJBUIKkO1zQ1Pq90njlsJLOwID
AQABo4GvMIGsMAwGA1UdEwEB/wQCMAAwFwYDVR0gBBAwDjAMBgpghkgBZQMCATAB
MB4GA1UdEQQXMBWBE2FsaWNlQHNtaW1lLmV4YW1wbGUwEwYDVR0lBAwwCgYIKwYB
BQUHAwQwDgYDVR0PAQH/BAQDAgbAMB0GA1UdDgQWBBS79syyLR0GEhyXrilqkBDT
IGZmczAfBgNVHSMEGDAWgBSRMI58BxcMp/EJKGU2GmccaHb0WTANBgkqhkiG9w0B
AQ0FAAOCAQEAc4miNqfOqaBpI3f+CpJDhxtuZ2P9HjQEQ+v6BdP7GKJ19naIs3Bj
JOd64roAKHAp+c284VvyVXWJ99FMX8q2ZUQMxH+xh6oAfzcozmnd6XaVWHg4eHIj
So27PmhKE1oAJKKhDbdbEcZXL2+x1V+duGymWtaD01DZZukKYr7agyHahiXRn/C9
cy31wbqNsy9x0fjPQg6+DqatiQpMz9EIae6aCHHBhOiPU7IPkazgPYgkLD59fk4P
GHnYxs1FhdO6zZk9E8zwlc1ALgZa/iSbczisqckN3qGehD2s16jMhwFXLJtBiN+u
CDgNG/D0qyTbY4fgKieUHx/tHuzUszZxJjGCAgAwggH8AgEBMGwwVTENMAsGA1UE
ChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1Q
UyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzdBBXntdX9CqaJcOvT4as6a
qdcwCwYJYIZIAWUDBAIBoGkwGAYJKoZIhvcNAQkDMQsGCSqGSIb3DQEHATAcBgkq
hkiG9w0BCQUxDxcNMjEwMjIwMTcwMzAyWjAvBgkqhkiG9w0BCQQxIgQgup+VC4mf
BVNHPJS0b9oKX/dVMKiR3JOz5AXfqv/YG0AwDQYJKoZIhvcNAQEBBQAEggEAJ2XX
xojAdRnBTCRahPos057TnArr1wju76pnJSWXK1flGWjEsSpHVro2t9LRKALqwTnX
YLM1PbrPoMyivqfhFik1h1dR9J2aXisS4FfZB3jj1c8XkD1yZb8qTBBRQ4v17MFS
1bEKW4ecopbd67f73QhUvk3NGJ8Aq8JPY8yxKGgGH9bucecSGYAHC1745wosTs81
aaY3k5UwyHNxRjFkkQAsnMe7HAiVnwsDLYCDOXACbg/DOwOCFK9vzDYkD5HjnqK2
wrhkTs1R4OZW+gWXPhFYClf3fMvrGZvr9rCwgjnwMvrpQjugZi5QGoi/sEdHO5T5
edT2/t+0u3oJtCflrQ==
```

C.1.8.2. S/MIME Signed-and-Encrypted over a Complex Message, No Header Protection, Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="363"

--363
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="f27"

--f27
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
smime-signed-enc-complex
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses no Header Protection.

--
Alice
alice@smime.example
--f27
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-signed-enc-complex</b>
message.</p>
<p>This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses no Header Protection.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
```

```
--f27--

--363
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--363--
```

C.2. Signed-Only Messages

These messages are signed-only, using different schemes of Header Protection and different S/MIME structures. They use no HCP because the HCP is only relevant when a message is encrypted.

C.2.1. S/MIME Signed-Only signedData over a Simple Message, Header Protection

This is a signed-only S/MIME message via PKCS#7 signedData. The payload is a text/plain message. It uses the Header Protection scheme from RFC 9788.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 4189 bytes
  └ (unwraps to)
    └── text/plain 232 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"
Subject: smime-one-part-hp
Message-ID: <smime-one-part-hp@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:06:02 -0500
User-Agent: Sample MUA Version 1.0

MIIMDwYJKoZIhvcNAQcCoIIMADCCC/wCAQExDTALBglghkgBZQMEAgEwggI4Bgkq
hkiG9w0BBwGgggIpBIICJU1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVRyYW5z
ZmVyLUVuY29kaW5nOiA3Yml0DQpTdWJqZWN0OiBzbWltZS1vbmUtcGFydC1ocA0K
TWVzc2FnZS1JRDogPHNtaW1lLW9uZS1wYXJ0LWhwQGV4YW1wbGU+DQpGcm9tOiBB
bGljZSA8YWxpY2VAc21pbWUuZXhhbXBsZT4NClRvOiBCb2IgPGJvYkBzbWltZS5l
eGFtcGxlPg0KRGF0ZTogU2F0LCAyMCBGZWIgMjAyMSAxMDowNjowMiAtMDUwMA0K
VXNlci1BZ2VudDogU2FtcGxlIE1VQSBWZXJzaW9uIDEuMA0KQ29udGVudC1UeXBl
OiB0ZXh0L3BsYWluOyBjaGFyc2V0PSJ1dGYtOCI7IGhwPSJjbGVhciINCg0KVGhp
cyBpcyB0aGUNCnNtaW1lLW9uZS1wYXJ0LWhwDQptZXNzYWdlLg0KDQpUaGlzIGlz
IGEgc2lnbmVkLW9ubHkgUy9NSU1FIG1lc3NhZ2UgdmlhIFBLQ1MjNyBzaWduZWRE
YXRhLiAgVGhlDQpwYXlsb2FkIGlzIGEgdGV4dC9wbGFpbiBtZXNzYWdlLiBJdCB1
c2VzIHRoZSBIZWFkZXIgUHJvdGVjdGlvbg0Kc2NoZW1lIGZyb20gUkZDIDk3ODgu
DQoNCi0tIA0KQWxpY2UNCmFsaWNlQHNtaW1lLmV4YW1wbGUNCqCCB6YwggPPMIIC
t6ADAgECAhMPLSW9ETmXSs5CVIeh7j00Boq0MA0GCSqGSIb3DQEBDQUAMFUxDTAL
BgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUg
TEFNUFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQx
OFoYDzIwNTIwOTI3MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhM
QU1QUyBXRzEXMBUGA1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEB
AQUAA4IBDwAwggEKAoIBAQCalSn6i8Gi44/oAVAn5GnCk4PHHNjrSfWUnnelN41K
ImVaTC3D9zFCrS3i4Pa9ZgHyA5Qf8JW3ZmnVz5q7M8onZm7mZjqQeb6FUH4i2GMt
4jse2Dqs165ernT9O5NLFflHUjURca3ynqEBBV4DmhnZp8eDhv3t6dXyCjNHT82S
```

```
6DgCReZuTtMc1zy++MxQlqdn9WZLhOAOpeNZKGmVwjeVy+8FkyzC3jX/Qcm+ZLCq
lLqhBwDHdZ5qDTII2PVX1X3K7/cONxhvBbaUl/k1swdszUtjhflyFZ80RuQ3qFC6
vL/PGeWy6SCf58duq/AOEksCAWlb+MD8QH9Yj7CFSmq1AgMBAAGjga8wgawwDAYD
VR0TAQH/BAIwADAXBgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYET
YWxpY2VAc21pbWUuZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8B
Af8EBAMCBSAwHQYDVR0OBBYEFKJTQdVEPIApFXwBI/Dnjq/N83cPMB8GA1UdIwQY
MBaAFJEwjnwHFwyn8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQCBSXig
nLEynBakDKU68ro0RsyXWAPkfXgQLgy7GrW7SrZeBc5IEcjoN9f/gsOx/Ht9Ii6z
yBZVjdaox644DsiLOQEP4YMS7y4q94RFFdmdzEbDLYx9sfUhvdTxDNOOoHz53PYD
Bh4zE4Nar2inC0D+VM6RGDy66K9l+D+bl8Wj9CyGUc1ppMNURexTg+z3web/eDOd
u+F2MVtluLihne0Bp1GUTkr0mJBolg6dSYal8Hw8/ANHpyExl56BJABb744gqoeu
D9YSHjKK49+qYC9faFmQ+mK80lh1M9RdNI7srjn0LKpuob6w06jaRzWdNeXzlEc2
tUpAr4vRhZjVD6FYMIIDzzCCAregAwIBAgITN0EFee11f0Kpolw69Phqzpqp1zAN
BgkqhkiG9w0BAQ0FADBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBX
RzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhv
cml0eTAgFw0xOTExMjAwNjU0MThaGA8yMDUyMDkyNzA2NTQxOFowOzENMAsGA1UE
ChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxFzAVBgNVBAMTDkFsaWNlIExvdmVs
YWNlMIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAtPSJ6Fg4Fj5Nmn9P
krYo0jTkfCv4TfA/pdO/KLpZbJOAEr0sI7AjaO7B1GuMUFJeSTulamNfCwDcDkY6
3PQWl+DILs7GxVwXurhYdZlaV5hcUqVAckPvedDBc/3rz4D/esFfs+E7QMFtmd+K
04s+A8TCNO12DRVBDpbP4JFD9hsc8prDtpGmFk7rd0q8gqnhxBW2RZAeLqzJOMay
CQtws1q7ktkNBR2wZX5ICjecF1YJFhX4jrnHwp/iELGqqaNXd3/Y0pG7QFecN783
6IPPdfTMSiPR+peCrhJZwLSewbWXLJe3VMvbvQjoBMpEYlaJBUIKkO1zQ1Pq90nj
lsJLOwIDAQABo4GvMIGsMAwGA1UdEwEB/wQCMAAwFwYDVR0gBBAwDjAMBgpghkgB
ZQMCATABMB4GA1UdEQQXMBWBE2FsaWNlQHNtaW1lLmV4YW1wbGUwEwYDVR0lBAww
CgYIKwYBBQUHAwQwDgYDVR0PAQH/BAQDAgbAMB0GA1UdDgQWBBS79syyLR0GEhyX
rilqkBDTIGZmczAfBgNVHSMEGDAWgBSRMI58BxcMp/EJKGU2GmccaHb0WTANBgkq
hkiG9w0BAQ0FAAOCAQEAc4miNqfOqaBpI3f+CpJDhxtuZ2P9HjQEQ+v6BdP7GKJ1
9naIs3BjJOd64roAKHAp+c284VvyVXWJ99FMX8q2ZUQMxH+xh6oAfzcozmnd6XaV
WHg4eHIjSo27PmhKE1oAJKKhDbdbEcZXL2+x1V+duGymWtaD01DZZukKYr7agyHa
hiXRn/C9cy31wbqNsy9x0fjPQg6+DqatiQpMz9EIae6aCHHBhOiPU7IPkazgPYgk
LD59fk4PGHnYxs1FhdO6zZk9E8zwlc1ALgZa/iSbczisqckN3qGehD2s16jMhwFX
LJtBiN+uCDgNG/D0qyTbY4fgKieUHx/tHuzUszZxJjGCAgAwggH8AgEBMGwwVTEN
MAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNhbXBs
ZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzdBBXntdX9CqaJc
OvT4as6aqdcwCwYJYIZIAWUDBAIBoGkwGAYJKoZIhvcNAQkDMQsGCSqGSIb3DQEH
ATAcBgkqhkiG9w0BCQUxDxcNMjEwMjIwMTUwNjAyWjAvBgkqhkiG9w0BCQQxIgQg
K3lOLqVxzkFzTCjC4/0WD1uiOJZ/y8y2mKLDM5P/bj0wDQYJKoZIhvcNAQEBBQAE
ggEAiWwxPK/j2eujuwSbftm7fHd+LZyXyhUhfrZghxdPZyunkZmQ+N4ARXGv0zqr
yOgKhBdbd0pFO8sIfqRGvU2eQdvfFWTKz1Nt1UMGMUtTTA2Iua4+QcPdjX6At6k/
pp/OdEIuSLQHW89UkUfNEqYc8SjnhOaTMz7glWEM9jIXuWcmhtRqqsg+yYItvSbd
eXktWzBWuVCzvrsO4Q3oR4B0Aohdf+qCeTOwP5grdU4oIadD4eq1o+OEZfmliN2N
3dNYgd65gF0IXek3a1MMFh6AQF9aJz6451GqO1fwwwX2TtRnjXBY0ucY2Rn6h3PB
GEyYkGT7mRMuLMxmHktDjUBiIA==
```

C.2.1.1. S/MIME Signed-Only signedData over a Simple Message, Header Protection, Unwrapped

The S/MIME signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Subject: smime-one-part-hp
Message-ID: <smime-one-part-hp@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:06:02 -0500
User-Agent: Sample MUA Version 1.0
Content-Type: text/plain; charset="utf-8"; hp="clear"

This is the
smime-one-part-hp
message.
```

This is a signed-only S/MIME message via PKCS#7 signedData. The payload is a text/plain message. It uses the Header Protection

scheme from RFC 9788.

--
Alice
alice@smime.example

C.2.2. S/MIME Signed-Only multipart/signed over a Simple Message, Header Protection

This is a signed-only S/MIME message via PKCS#7 detached signature (multipart/signed). The payload is a text/plain message. It uses the Header Protection scheme from RFC 9788.

It has the following structure:

```
└─┬ multipart/signed 4434 bytes
  ├── text/plain 249 bytes
  └── application/pkcs7-signature [smime.p7s] 3429 bytes
```

Its contents are:

```
MIME-Version: 1.0
Content-Type: multipart/signed;
 protocol="application/pkcs7-signature"; boundary="54f";
 micalg="sha-256"
Subject: smime-multipart-hp
Message-ID: <smime-multipart-hp@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:07:02 -0500
User-Agent: Sample MUA Version 1.0

--54f
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Subject: smime-multipart-hp
Message-ID: <smime-multipart-hp@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:07:02 -0500
User-Agent: Sample MUA Version 1.0
Content-Type: text/plain; charset="utf-8"; hp="clear"

This is the
smime-multipart-hp
message.

This is a signed-only S/MIME message via PKCS#7 detached
signature (multipart/signed). The payload is a text/plain
message. It uses the Header Protection scheme from RFC 9788.

--
Alice
alice@smime.example

--54f
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-signature; name="smime.p7s"

MIIJ4AYJKoZIhvcNAQcCoIIJ0TCCCc0CAQExDTALBglghkgBZQMEAgEwCwYJKoZI
hvcNAQcBoIIHpjCCA88wggK3oAMCAQICEw8tJb0ROZdKzkJUh6HuPTQGirQwDQYJ
KoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cx
MTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3Jp
dHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5MjcwNjU0MThaMDsxDTALBgNVBAoT
BElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYDVQQDEw5BbGljZSBMb3ZlbGFj
ZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBAJqVKfqLwaLjj+gBUCfk
```

```
acKTg8cc2OtJ9ZSed6U3jUoiZVpMLcP3MUKtLeLg9r1mAfIDlB/wlbdmadXPmrsz
yidmbuZmOpB5voVQfiLYYy3iOx7YOqzXrl6udP07k0sV+UdSNRFxrfKeoQEFXgOa
Gdmnx4OG/e3p1fIKM0dPzZLoOAJF5m5O0xzXPL74zFCWp2f1ZkuE4A6l41koaZXC
N5XL7wWTLMLeNf9Byb5ksKqUuqEHAMd1nmoNMgjY9VfVfcrv9w43GG8FtpSX+TWz
B2zNS2OF+XIVnzRG5DeoULq8v88Z5bLpIJ/nx26r8A4SSwIBaVv4wPxAf1iPsIVK
arUCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQMA4wDAYKYIZIAWUD
AgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5leGFtcGxlMBMGA1UdJQQMMAoG
CCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIFIDAdBgNVHQ4EFgQUolNB1UQ8gCkVfAEj
8OeOr83zdw8wHwYDVR0jBBgwFoAUkTCOfAcXDKfxCShlNhpnHGh29FkwDQYJKoZI
hvcNAQENBQADggEBAIFJeKCcsTKcFqQMpTryujRGzJdYA+R9eBAuDLsatbtKtl4F
zkgRyOg31/+Cw7H8e30iLrPIFlWN1qjHrjgOyIs5AQ/hgxLvLir3hEUV2Z3MRsMt
jH2x9SG91PEM046gfPnc9gMGHjMTg1qvaKcLQP5UzpEYPLror2X4P5uXxaP0LIZR
zWmkw1RF7FOD7PfB5v94M5274XYxW2W4uKGd7QGnUZROSvSYkGiWDp1JhqXwfDz8
A0enITGXnoEkAFvvjiCqh64P1hIeMorj36pgL19oWZD6YrzSWHUz1F00juyuOfQs
qm6hvrDTqNpHNZ015fOURza1SkCvi9GFmNUPoVgwggPPMIICt6ADAgECAhM3QQV5
7XV/QqmiXDr0+GrOmqnXMA0GCSqGSIb3DQEBDQUAMFUxDTALBgNVBAoTBElFVEYx
ETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMgUlNBIENl
cnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQxOFoYDzIwNTIwOTI3
MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzEXMBUG
A1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEK
AoIBAQC09InoWDgWPk2af0+StijSNOR8K/hN8D+l078oullsk4ASvSwjsCNo7sHU
a4xQUl5JO6VqY18LANwORjrc9BaX4MguzsbFXBe6uFh1mVpXmFxSpUByQ+950MFz
/evPgP96wV+z4TtAwW2Z34rTiz4DxMI07XYNFUEOls/gkUP2GxzymsO2kaYWTut3
SryCqeHEFbZFkB4urMk4xrIJC3CzWruS2Q0FHbBlfkgKN5wXVgkWFfiOucfCn+IQ
saqpo1d3f9jSkbtAV5w3vzfog8919MxKI9H6l4KuElnAtJ7BtZcsl7dUy9u9COgE
ykRiVokFQgqQ7XNDU+r3SeOWwks7AgMBAAGjga8wgawwDAYDVR0TAQH/BAIwADAX
BgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYETYWxpY2VAc21pbWUu
ZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8BAf8EBAMCBsAwHQYD
VR0OBBYEFLv2zLItHQYSHJeuKWqQENMgZmZzMB8GA1UdIwQYMBaAFJEwjnwHFwyn
8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQBziaI2p86poGkjd/4KkkOH
G25nY/0eNARD6/oF0/sYonX2doizcGMk53riugAocCn5zbzhW/JVdYn30UxfyrZl
RAzEf7GHqgB/NyjOad3pdpVYeDh4ciNKjbs+aEoTWgAkoqENt1sRxlcvb7HVX524
bKZa1oPTUNlm6QpivtqDIdqGJdGf8L1zLfXBuo2zL3HR+M9CDr4Opq2JCkzP0Qhp
7poIccGE6I9Tsg+RrOA9iCQsPn1+Tg8YedjGzUWF07rNmT0TzPCVzUAuBlr+JJtz
OKypyQ3eoZ6EPazXqMyHAVcsm0GI364IOA0b8PSrJNtjh+AqJ5QfH+0e7NSzNnEm
MYICADCCAfwCAQEwbDBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBX
RzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhv
cml0eQITN0EFee11f0Kpolw69Phqzpqp1zALBglghkgBZQMEAgGgaTAYBgkqhkiG
9w0BCQMxCwYJKoZIhvcNAQcBMBwGCSqGSIb3DQEJBTEPFw0yMTAyMjAxNTA3MDJa
MC8GCSqGSIb3DQEJBDEiBCAfybSsej+1D6r16hb18FcqV4ucPU0CgwMlVVH7gTaP
3TANBgkqhkiG9w0BAQEFAASCAQBwlRSGR8OZHFa+8cUc5th58+DiNkwKWqz4pWWX
0QP9uuxRZjE8Dtg7b88d0HtZWL98qAp+bjFK8ElktpuBiS5Nuiy+Zm3XnMU5GhCM
ywIPUAPJA6jvibT5fzYvMGV11RBmrTFNBZxxrJOAWfGfqf96vx9VajBVbyXdXnV7
hnQCx8wsbIOrbRUUVJHBGqpx+j+bIoUmg3uKxOYkZFz9IShmq8fzsW/CVTBMLfoT
qle2y+4H+RlGioqz8Mvs+XXbL5MG1r5PGjgpa9hHxPKdbFQCoWIJMA6xJNKgeuoN
rA3kHbrX/5Gn9eK8vE5eI6rpEurDGYkws6A9Z/tvsR7Gm9Ia
```

--54f--

C.2.3. S/MIME Signed-Only signedData over a Complex Message, Header Protection

This is a signed-only S/MIME message via PKCS#7 signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses the Header Protection scheme from RFC 9788.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 5643 bytes
  └ (unwraps to)
    └─┬ multipart/mixed 1568 bytes
      ├─┬ multipart/alternative 932 bytes
      │ ├── text/plain 286 bytes
      │ └── text/html 381 bytes
      └── image/png inline 236 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"
Subject: smime-one-part-complex-hp
Message-ID: <smime-one-part-complex-hp@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:06:02 -0500
User-Agent: Sample MUA Version 1.0

MIIQQwYJKoZIhvcNAQcCoIIQNDCCEDACAQExDTALBglghkgBZQMEAgEwggZsBgkq
hkiG9w0BBwGgggZdBIIGWU1JTUUtVmVyc2lvbjogMS4wDQpTdWJqZWN0OiBzbWlt
ZS1vbmUtcGFydC1jb21wbGV4LWhwDQpNZXNzYWdlLUlEOiA8c21pbWUtb25lLXBh
cnQtY29tcGxleC1ocEBleGFtcGxlPg0KRnJvbTogQWxpY2UgPGFsaWNlQHNtaW1l
LmV4YW1wbGU+DQpUbzogQm9iIDxib2JAc21pbWUuZXhhbXBsZT4NCkRhdGU6IFNh
dCwgMjAgRmViIDIwMjEgMTI6MDY6MDIgLTA1MDANClVzZXItQWdlbnQ6IFNhbXBs
ZSBNVUEgVmVyc2lvbiAxLjANCkNvbnRlbnQtVHlwZTogbXVsdGlwYXJ0L21peGVk
OyBib3VuZGFyeT0iYWI4IjsgaHA9ImNsZWFyIg0KDQotLWFiOA0KTUlNRS1WZXJz
aW9uOiAxLjANCkNvbnRlbnQtVHlwZTogbXVsdGlwYXJ0L2FsdGVybmF0aXZlOyBi
b3VuZGFyeT0iMGY0Ig0KDQotLTBmNA0KQ29udGVudC1UeXBlOiB0ZXh0L3BsYWlu
OyBjaGFyc2V0PSJ1cy1hc2NpaSINCk1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50
LVRyYW5zZmVyLUVuY29kaW5nOiA3Yml0DQoNClRoaXMgaXMgdGhlDQpzbWltZS1v
bmUtcGFydC1jb21wbGV4LWhwDQptZXNzYWdlLg0KDQpUaGlzIGlzIGEgc2lnbmVk
aCBhbiBpbmxpbmUNCmltYWdlL3BuZyBhdHRhY2htZW50LiBJdCB1c2VzIHRoZSBI
ZWFkZXIgUHJvdGVjdGlvbiBzY2hlbWUgZnJvbQ0KUkZDIDk3ODguDQoNCi0tIA0K
QWxpY2UNCmFsaWNlQHNtaW1lLmV4YW1wbGUNCi0tMGY0DQpDb250ZW50LVR5cGU6
IHRleHQvaHRtbDsgY2hhcnNldD0idXMtYXNjaWkiDQpNSU1FLVZlcnNpb246IDEu
MA0KQ29udGVudC1UcmFuc2Zlci1FbmNvZGluZzogN2JpdA0KDQo8aHRtbD48aGVh
ZD48dGl0bGU+PC90aXRsZT48L2hlYWQ+PGJvZHk+DQoNCi0tIA0K
PGI+c21pbWUtb25lLXBhcnQtY29tcGxleC1ocDwvYj4NCm1lc3NhZ2UuPC9wPg0K
PHA+VGhpcyBpcyBhIHNpZ25lZC1vbmx5IFMvTUlNRSBtZXNzYWdlIHZpYSBQS0NT
Izcgc2lnbmVkRGF0YS4gIFRoZQ0KcGF5bG9hZCBpcyBhIG11bHRpcGFydC9hbHRl
cm5hdGl2ZSBtZXNzYWdlIHdpdGggYW4gaW5saW5lDQppbWFnZS9wbmcgYXR0YWNo
bWVudC4gSXQgdXNlcyB0aGUgSGVhZGVyIFByb3RlY3Rpb24gc2NoZW1lIGZyb20N
ClJGQyA5Nzg4LjwvcD4NCjxwPjx0dD4tLSA8YnIvPkFsaWNlPGJyLz5hbGljZUBz
bWltZS5leGFtcGxlPC90dD48L3A+PC9ib2R5PjwvaHRtbD4NCg0K
LS1hYjgNCkNvbnRlbnQtVHlwZTogaW1hZ2UvcG5nDQpDb250ZW50LVRyYW5zZmVy
LUVuY29kaW5nOiBiYXNlNjQNCkNvbnRlbnQtRGlzcG9zaXRpb246IGlubGluZQ0K
DQppVkJPUncwS0dnb0FBQUFOU1VoRVVnQUFBQlFBQUFBVUNBWUFBQUNOaVIwTkFB
QUFjRWxFUVZSNDJ1VlRPeGJBDQpNQWdTNzM5bk8zVHBSdzIwZHFwYmZBUlFFak95
d2l3WW5DdGtES25iY0xrNjZzcWxUK3p0OWNpZGtFKzZLd2taDQpzZ3J6ZmNxVk1w
TDJqbzA0NDdnWURwZUFyaytPbkpIa0loQWZUUFJpY2loQWY1WUpydzd2anYwWldS
V00vdWxpDQp2ZFBmMVFaMmtERDl4cHBkOHdBQUFBQkpSVTVFcmtKZ2dnPT0NCg0K
LS1hYjgtLQ0KoIIHpjCCA88wggK3oAMCAQICEw8tJb0ROZdKzkJUh6HuPTQGirQw
DQYJKoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMg
V0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRo
b3JpdHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5MjcwNjU0MThaMDsxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYDVQQDEw5BbGljZSBMb3Zl
bGFjZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBAJqVKfqLwaLjj+gB
UCfkacKTg8cc2OtJ9ZSed6U3jUoiZVpMLcP3MUKtLeLg9r1mAfIDlB/wlbdmadXP
mrszyidmbuZmOpB5voVQfiLYYy3iOx7YOqzXrl6udP07k0sV+UdSNRFxrfKeoQEF
XgOaGdmnx4OG/e3p1fIKM0dPzZLoOAJF5m5O0xzXPL74zFCWp2f1ZkuE4A6l41ko
aZXCN5XL7wWTLMLeNf9Byb5ksKqUuqEHAMd1nmoNMgjY9VfVfcrv9w43GG8FtpSX
+TWzB2zNS2OF+XIVnzRG5DeoULq8v88Z5bLpIJ/nx26r8A4SSwIBaVv4wPxAf1iP
sIVKarUCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQMA4wDAYKYIZI
AWUDAgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5leGFtcGxlMBMGA1UdJQQM
MAoGCCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIFIDAdBgNVHQ4EFgQUolNB1UQ8gCkV
fAEj8OeOr83zdw8wHwYDVR0jBBgwFoAUkTCOfAcXDKfxCShlNhpnHGh29FkwDQYJ
KoZIhvcNAQENBQADggEBAIFJeKCcsTKcFqQMpTryujRGzJdYA+R9eBAuDLsatbtK
tl4FzkgRyOg31/+Cw7H8e30iLrPIFlWN1qjHrjgOyIs5AQ/hgxLvLir3hEUV2Z3M
RsMtjH2x9SG91PEM046gfPnc9gMGHjMTg1qvaKcLQP5UzpEYPLror2X4P5uXxaP0
LIZRzWmkw1RF7FOD7PfB5v94M5274XYxW2W4uKGd7QGnUZROSvSYkGiWDp1JhqXw
```

```
fDz8A0enITGXnoEkAFvvjiCqh64P1hIeMorj36pgL19oWZD6YrzSWHUz1F00juyu
OfQsqm6hvrDTqNpHNZ015fOURza1SkCvi9GFmNUPoVgwggPPMIICt6ADAgECAhM3
QQV57XV/QqmiXDr0+GrOmqnXMA0GCSqGSIb3DQEBDQUAMFUxDTALBgNVBAoTBElF
VEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMgUlNB
IENlcnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQxOFoYDzIwNTIw
OTI3MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzEX
MBUGA1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAw
ggEKAoIBAQC09InoWDgWPk2af0+StijSNOR8K/hN8D+l078oullsk4ASvSwjsCNo
7sHUa4xQUl5JO6VqY18LANwORjrc9BaX4MguzsbFXBe6uFh1mVpXmFxSpUByQ+95
0MFz/evPgP96wV+z4TtAwW2Z34rTiz4DxMI07XYNFUEOls/gkUP2GxzymsO2kaYW
Tut3SryCqeHEFbZFkB4urMk4xrIJC3CzWruS2Q0FHbBlfkgKN5wXVgkWFfiOucfC
n+IQsaqpo1d3f9jSkbtAV5w3vzfog8919MxKI9H6l4KuElnAtJ7BtZcsl7dUy9u9
COgEykRiVokFQgqQ7XNDU+r3SeOWwks7AgMBAAGjga8wgawwDAYDVR0TAQH/BAIw
ADAXBgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYETYWxpY2VAc21p
bWUuZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8BAf8EBAMCBsAw
HQYDVR0OBBYEFLv2zLItHQYSHJeuKWqQENMgZmZzMB8GA1UdIwQYMBaAFJEwjnwH
Fwyn8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQBziaI2p86poGkjd/4K
kkOHG25nY/0eNARD6/oF0/sYonX2doizcGMk53riugAocCn5zbzhW/JVdYn30Uxf
yrZlRAzEf7GHqgB/NyjOad3pdpVYeDh4ciNKjbs+aEoTWgAkoqENt1sRxlcvb7HV
X524bKZa1oPTUNlm6QpivtqDIdqGJdGf8L1zLfXBuo2zL3HR+M9CDr4Opq2JCkzP
0Qhp7poIccGE6I9Tsg+RrOA9iCQsPn1+Tg8YedjGzUWF07rNmT0TzPCVzUAuBlr+
JJtzOKypyQ3eoZ6EPazXqMyHAVcsm0GI364IOA0b8PSrJNtjh+AqJ5QfH+0e7NSz
NnEmMYICADCCAfwCAQEwbDBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1Q
UyBXRzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1
dGhvcml0eQITN0EFee11f0Kpolw69Phqzpqp1zALBglghkgBZQMEAgGgaTAYBgkq
hkiG9w0BCQMxCwYJKoZIhvcNAQcBMBwGCSqGSIb3DQEJBTEPFw0yMTAyMjAxNzA2
MDJaMC8GCSqGSIb3DQEJBDEiBCAXURNXz0Mn7lPPDM1oQHdl876V7RbyfNsR/srF
sVvmLDANBgkqhkiG9w0BAQEFAASCAQAjKgdecJe4TqYBPZ1hQzaeCGP+Y8kB5byd
wtkUDh91bAPCGiA7YzRjyWG/Yq4soSb/bRSpPRr3Jyzubwq5oBsnH9k1L2hVDinF
Yeot2E1Aga5OZTjfS8URVY4IEKKI9hNNUpdnqoehQqm54D4LFnJiujiVrS2COHSj
Z3Nr9SjeZ7ymKzThhsHaZTRJaloCxauGkf8EpeNJeoeNzae2PvcgomrO1aLW3M1o
Q3VqlsOfVsLElmS8hL0Mo08XXVs9KRWuBiuXR+fsXlODlVHwqWJVBR/5wOGLgfn9
bPh7G4quw8SDQNHb/qTjsWYfAfE1K2edTz5z1u0GPm9ElCiFUPsc
```

C.2.3.1. S/MIME Signed-Only signedData over a Complex Message, Header Protection, Unwrapped

The S/MIME signed-data layer unwraps to:

```
MIME-Version: 1.0
Subject: smime-one-part-complex-hp
Message-ID: <smime-one-part-complex-hp@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:06:02 -0500
User-Agent: Sample MUA Version 1.0
Content-Type: multipart/mixed; boundary="ab8"; hp="clear"

--ab8
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="0f4"

--0f4
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
smime-one-part-complex-hp
message.

This is a signed-only S/MIME message via PKCS#7 signedData.  The
payload is a multipart/alternative message with an inline
image/png attachment. It uses the Header Protection scheme from
RFC 9788.
```

```
--
Alice
alice@smime.example
--0f4
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-one-part-complex-hp</b>
message.</p>
<p>This is a signed-only S/MIME message via PKCS#7 signedData.  The
payload is a multipart/alternative message with an inline
image/png attachment. It uses the Header Protection scheme from
RFC 9788.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--0f4--

--ab8
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--ab8--
```

C.2.4. S/MIME Signed-Only multipart/signed over a Complex Message, Header Protection

This is a signed-only S/MIME message via PKCS#7 detached signature (multipart/signed). The payload is a multipart/alternative message with an inline image/png attachment. It uses the Header Protection scheme from RFC 9788.

It has the following structure:

```
└─┬ multipart/signed 5518 bytes
  ├─┬ multipart/mixed 1626 bytes
  │ ├─┬ multipart/alternative 988 bytes
  │ │ ├── text/plain 303 bytes
  │ │ └── text/html 401 bytes
  │ └── image/png inline 232 bytes
  └── application/pkcs7-signature [smime.p7s] 3429 bytes
```

Its contents are:

```
MIME-Version: 1.0
Content-Type: multipart/signed;
 protocol="application/pkcs7-signature"; boundary="a64";
 micalg="sha-256"
Subject: smime-multipart-complex-hp
Message-ID: <smime-multipart-complex-hp@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:07:02 -0500
User-Agent: Sample MUA Version 1.0

--a64
MIME-Version: 1.0
Subject: smime-multipart-complex-hp
Message-ID: <smime-multipart-complex-hp@example>
```

```
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:07:02 -0500
User-Agent: Sample MUA Version 1.0
Content-Type: multipart/mixed; boundary="550"; hp="clear"

--550
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="fcd"

--fcd
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
smime-multipart-complex-hp
message.

This is a signed-only S/MIME message via PKCS#7 detached
signature (multipart/signed).  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788.

--
Alice
alice@smime.example
--fcd
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-multipart-complex-hp</b>
message.</p>
<p>This is a signed-only S/MIME message via PKCS#7 detached
signature (multipart/signed).  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--fcd--

--550
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--550--

--a64
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-signature; name="smime.p7s"

MIIJ4AYJKoZIhvcNAQcCoIIJ0TCCCc0CAQExDTALBglghkgBZQMEAgEwCwYJKoZI
hvcNAQcBoIIHpjCCA88wggK3oAMCAQICEw8tJb0ROZdKzkJUh6HuPTQGirQwDQYJ
KoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cx
MTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3Jp
dHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5MjcwNjU0MThaMDsxDTALBgNVBAoT
BElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYDVQQDEw5BbGljZSBMb3ZlbGFj
ZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBAJqVKfqLwaLjj+gBUCfk
```

```
acKTg8cc2OtJ9ZSed6U3jUoiZVpMLcP3MUKtLeLg9r1mAfIDlB/wlbdmadXPmrsz
yidmbuZmOpB5voVQfiLYYy3iOx7YOqzXrl6udP07k0sV+UdSNRFxrfKeoQEFXgOa
Gdmnx4OG/e3p1fIKM0dPzZLoOAJF5m5O0xzXPL74zFCWp2f1ZkuE4A6l41koaZXC
N5XL7wWTLMLeNf9Byb5ksKqUuqEHAMd1nmoNMgjY9VfVfcrv9w43GG8FtpSX+TWz
B2zNS2OF+XIVnzRG5DeoULq8v88Z5bLpIJ/nx26r8A4SSwIBaVv4wPxAf1iPsIVK
arUCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQMA4wDAYKYIZIAWUD
AgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5leGFtcGxlMBMGA1UdJQQMMAoG
CCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIFIDAdBgNVHQ4EFgQUolNB1UQ8gCkVfAEj
8OeOr83zdw8wHwYDVR0jBBgwFoAUkTCOfAcXDKfxCShlNhpnHGh29FkwDQYJKoZI
hvcNAQENBQADggEBAIFJeKCcsTKcFqQMpTryujRGzJdYA+R9eBAuDLsatbtKtl4F
zkgRyOg31/+Cw7H8e30iLrPIFlWN1qjHrjgOyIs5AQ/hgxLvLir3hEUV2Z3MRsMt
jH2x9SG91PEM046gfPnc9gMGHjMTg1qvaKcLQP5UzpEYPLror2X4P5uXxaP0LIZR
zWmkw1RF7FOD7PfB5v94M5274XYxW2W4uKGd7QGnUZROSvSYkGiWDp1JhqXwfDz8
A0enITGXnoEkAFvvjiCqh64P1hIeMorj36pgL19oWZD6YrzSWHUz1F00juyuOfQs
qm6hvrDTqNpHNZ015fOURza1SkCvi9GFmNUPoVgwggPPMIICt6ADAgECAhM3QQV5
7XV/QqmiXDr0+GrOmqnXMA0GCSqGSIb3DQEBDQUAMFUxDTALBgNVBAoTBElFVEYx
ETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMgUlNBIENl
cnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQxOFoYDzIwNTIwOTI3
MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzEXMBUG
A1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEK
AoIBAQC09InoWDgWPk2af0+StijSNOR8K/hN8D+l078oullsk4ASvSwjsCNo7sHU
a4xQUl5JO6VqY18LANwORjrc9BaX4MguzsbFXBe6uFh1mVpXmFxSpUByQ+950MFz
/evPgP96wV+z4TtAwW2Z34rTiz4DxMI07XYNFUEOls/gkUP2GxzymsO2kaYWTut3
SryCqeHEFbZFkB4urMk4xrIJC3CzWruS2Q0FHbBlfkgKN5wXVgkWFfiOucfCn+IQ
saqpo1d3f9jSkbtAV5w3vzfog8919MxKI9H6l4KuElnAtJ7BtZcsl7dUy9u9COgE
ykRiVokFQgqQ7XNDU+r3SeOWwks7AgMBAAGjga8wgawwDAYDVR0TAQH/BAIwADAX
BgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYETYWxpY2VAc21pbWUu
ZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8BAf8EBAMCBsAwHQYD
VR0OBBYEFLv2zLItHQYSHJeuKWqQENMgZmZzMB8GA1UdIwQYMBaAFJEwjnwHFwyn
8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQBziaI2p86poGkjd/4KkkOH
G25nY/0eNARD6/oF0/sYonX2doizcGMk53riugAocCn5zbzhW/JVdYn30UxfyrZl
RAzEf7GHqgB/NyjOad3pdpVYeDh4ciNKjbs+aEoTWgAkoqENt1sRxlcvb7HVX524
bKZa1oPTUNlm6QpivtqDIdqGJdGf8L1zLfXBuo2zL3HR+M9CDr4Opq2JCkzP0Qhp
7poIccGE6I9Tsg+RrOA9iCQsPn1+Tg8YedjGzUWF07rNmT0TzPCVzUAuBlr+JJtz
OKypyQ3eoZ6EPazXqMyHAVcsm0GI364IOA0b8PSrJNtjh+AqJ5QfH+0e7NSzNnEm
MYICADCCAfwCAQEwbDBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBX
RzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhv
cml0eQITN0EFee11f0Kpolw69Phqzpqp1zALBglghkgBZQMEAgGgaTAYBgkqhkiG
9w0BCQMxCwYJKoZIhvcNAQcBMBwGCSqGSIb3DQEJBTEPFw0yMTAyMjAxNzA3MDJa
MC8GCSqGSIb3DQEJBDEiBCAHedgXF/1PPCnjTbv4CNkHl6SU0FJSW9ykndUZcVnS
czANBgkqhkiG9w0BAQEFAASCAQCYePlJ3K4FtJC/4snTsO8l+p0qEkpFh4swjQTG
WUhZHrdzb4kvHTCaoH5ShpVxZ4FOp1InabzulsB1P9m5xDvZveUMaCiC/qgSS+st
KdklsWANoTgTlAAGs9og6Wp5Nq/evf8XIYdQV0ZXavzASl/yylz2uHTpW1ETxTlZ
fkgSqb8X/zRaVGoai20aVbmsIJFrVPIlkpgh+r8tbJOm4791cCU/8lIdreynoUKq
Bsa2Y/uhoez/pldX/5A7Rv+JX2vdt71C2BZAk4166wvDhhlHf9pVCWXdKXSh99c6
Do1TzpnakOm4bKSzPMXTrz1p5GcfDzO94kbNImkcdr8yAdcB
```

--a64--

C.2.5. S/MIME Signed-Only signedData over a Complex Message, Legacy RFC 8551 Header Protection

This is a signed-only S/MIME message via PKCS#7 signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses the legacy RFC 8551 Header Protection (RFC8551HP) scheme.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 5696 bytes
  │  (unwraps to)
  └─┬ message/rfc822 1660 bytes
    └─┬ multipart/mixed 1612 bytes
      ├─┬ multipart/alternative 974 bytes
      │ ├── text/plain 296 bytes
      │ └── text/html 394 bytes
```

└──image/png inline 232 bytes

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"
Subject: smime-one-part-complex-rfc8551hp
Message-ID: <smime-one-part-complex-rfc8551hp@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:26:02 -0500
User-Agent: Sample MUA Version 1.0
```

MIIQaQYJKoZIhvcNAQcCoIIQWjCCEFYCAQExDTALBglghkgBZQMEAgEwggaSBgkq
hkiG9w0BBwGgggaDBIIGf01JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVR5cGU6
IG1lc3NhZ2UvcmZjODIyDQoNCk1JTUUtVmVyc2lvbjogMS4wCkNvbnRlbnQtVHlw
ZTogbXVsdGlwYXJ0L21peGVkOyBib3VuZGFyeT0iZmNjIgpTdWJqZWN0OiBzbWlt
ZS1vbmUtcGFydC1jb21wbGV4LXJmYzg1NTFocApNZXNzYWdlLUlEOiA8c21pbWUt
b25lLXBhcnQtY29tcGxleC1yZmM4NTUxaHBAZXhhbXBsZT4KRnJvbTogQWxpY2Ug
PGFsaWNlQHNtaW1lLmV4YW1wbGU+ClRvOiBCb2IgPGJvYkBzbWltZS5leGFtcGxl
PgpEYXRlOiBTYXQsIDIwIEZlYiAyMDIxIDEyOjI2OjAyIC0wNTAwClVzZXItQWdl
bnQ6IFNhbXBsZSBNVUEgVmVyc2lvbiAxLjAKCi0tZmNjCk1JTUUtVmVyc2lvbjog
MS4wCkNvbnRlbnQtVHlwZTogbXVsdGlwYXJ0L2FsdGVybmF0aXZlOyBib3VuZGFy
eT0iMGY4IgoKLS0wZjgKQ29udGVudC1UeXBlOiB0ZXh0L3BsYWluOyBjaGFyc2V0
PSJ1cy1hc2NpaSIKTUlNRS1WZXJzaW9uOiAxLjAKQ29udGVudC1UcmFuc2Zlci1F
bmNvZGluZzogN2JpdAoKVGhpcyBpcyB0aGUKc21pbWUtb25lLXBhcnQtY29tcGxl
eC1yZmM4NTUxaHAKbWVzc2FnZS4KClRoaXMgaXMgYSBzaWduZWQtb25seeSBTL01J
TUUgbWVzc2FnZSB2aWEgUEtDUyM3IHNpZ25lZERhdGEuICBUaGUKcGF5bG9hZCBp
cyBhIG11bHRpcGFydC9hbHRlcm5hdGl2ZSBtZXNzYWdlIHdpdGggYW4gaW5saW5l
CmltYWdlL3BuZyBhdHRhY2htZW50LiBJdCB1c2VzIHRoZSBsZWdhY3kgUkZDIDg1
NTEgSGVhZGVyClByb3RlY3Rpb24gKFJGQzg1NTFIUCkgc2NoZW1lLgoKLS0gCkFs
aWNlCmFsaWNlQHNtaW1lLmV4YW1wbGUKLS0wZjgKQ29udGVudC1UeXBlOiB0ZXh0
L2h0bWw7IGNoYXJzZXQ9InVzLWFzY2lpIgpNSU1FLVZlcnNpb246IDEuMApDb250
ZW50LVRyYW5zZmVyLUVuY29kaW5nOiA3Yml0Cgo8aHRtbD48aGVhZD48dGl0bGU+
PC90aXRsZT48L2hlYWQ+PGJvZHk+CjxwPlRoaXMgaXMgdGhlCjxiPnNtaW1lLW9u
ZS1wYXJ0LWNvbXBsZXgtcmZjODU1MWhwPC9iPgptZXNzYWdlLjwvcD4KPHA+VGhp
cyBpcyBhIHNpZ25lZC1vbmx5IFMvTUlNRSBtZXNzYWdlIHZpYSBQS0NTIzcgc2ln
bmVkRGF0YS4gIFRoZQpwYXlsb2FkIGlzIGEgbXVsdGlwYXJ0L2FsdGVybmF0aXZl
IG1lc3NhZ2Ugd2l0aCBhbiBpbmxpbmUKaW1hZ2UvcG5nIGF0dGFjaG1lbnQuIEl0
IHVzZXMgdGhlIGxlZ2FjeSBSRkMgODU1MSBIZWFkZXIKUHJvdGVjdGlvbiAoUkZD
ODU1MUhQKSBzY2hlbWUuPC9wPgo8cD48dD48dHQ+LS0gPGJyLz5BbGljZTxici8+YWxp
Y2VAc21pbWUuZXhhbXBsZTwvdHQ+PC9wPjwvYm9keT48L2h0bWw+Ci0tMGY4LS0K
Ci0tZmNjCkNvbnRlbnQtVHlwZTogaW1hZ2UvcG5nCkNvbnRlbnQtVHJhbnNmZXIt
RW5jb2Rpbmc6IGJhc2U2NApDb250ZW50LURpc3Bvc2l0aW9uOiBpbmxpbmUKCmlW
Qk9SdzBLR2dvQUFBQU5TVWhFVWdBQUFCUUFBQUFVQ0FZQUFBQ05pUjBOQUFBQWNF
bEVRVlI0MnVWVE94YkEKTUFnUzczOW5PM1RwUncyMGRxcGJmQVJRRWpPeXdpd1lu
Q3RrREtuYmNMazY2c3FsVCt6dDljaWRrRSs2S3drWgpzZ3J6ZmNxVk1wTDJqbzA0
NDdnWURwZUFyaytPbkpIa0lqQWZUUFJjJpY2loQWY1WUpydzd2anYwWldlSV00vdWxp
CnZkUGYxUVoya0REOXhwcGQ4d0FBQUFCSlJVNUVya0pnZ2c9PQoKLS1mY2MtLQqg
ggemMIIDzzCCAregAwIBAgITDy0lvRE5l0rOQlSHoe49NAaKtDANBgkqhkiG9w0B
AQ0FADBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzExMC8GA1UE
AxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhvcml0eTAgFw0x
OTExMjAwNjU0MThaGA8yMDUyMDkyNzA2NTQxOFowOzENMAsGA1UEChMESUVURjER
MA8GA1UECxMITEFNUFMgV0cxFzAVBgNVBAMTDkFsaWNlIExvdmVsYWNlMIIBIjAN
BgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAmpUp+ovBouOP6AFQJ+RpwpODxxzY
60n1lJ53pTeNSiJlWkwtw/cxQq0t4uD2vWYB8gOUH/CVt2Zp1c+auzPKJ2Zu5mY6
kHm+hVB+IthjLeI7Htg6rNeuXq50/TuTSxX5R1I1EXGt8p6hAQVeA5oZ2afHg4b9
7enV8gozR0/Nkug4AkXmbk7THNc8vvjMUJanZ/VmS4TgDqXjWShplcI3lcvvBZMs
wt41/0HJvmSwqpS6oQcAx3Weag0yCNj1V9V9yu/3DjcYbwW2lJf5NbMHbM1LY4X5
chWfNEbkN6hQury/zxnlsukgn+fHbqvwDhJLAgFpW/jA/EB/WI+whUpqtQIDAQAB
o4GvMIGsMAwGA1UdEwEB/wQCMAAwFwYDVR0gBBAwDjAMBgpghkgBZQMCATABMB4G
A1UdEQQXMBWBE2FsaWNlQHNtaW1lLmV4YW1wbGUwEwYDVR0lBAwwCgYIKwYBBQUH
AwQwDgYDVR0PAQH/BAQDAgUgMB0GA1UdDgQWBBSiU0HVRDyAKRV8ASPw546vzfN3
DzAfBgNVHSMEGDAWgBSRMI58BxcMp/EJKGU2GmccaHb0WTANBgkqhkiG9w0BAQ0F
AAOCAQEAgUl4oJyxMpwWpAylOvK6NEbMl1gD5H14EC4Muxq1u0q2XgXOSBHI6DfX

```
/4LDsfx7fSIus8gWVY3WqMeuOA7IizkBD+GDEu8uKveERRXZncxGwy2MfbH1Ib3U
8QzTjqB8+dz2AwYeMxODWq9opwtA/lTOkRg8uuivZfg/m5fFo/QshlHNaaTDVEXs
U4Ps98Hm/3gznbvhdjFbZbi4oZ3tAadRlE5K9JiQaJYOnUmGpfB8PPwDR6chMZee
gSQAW++OIKqHrg/WEh4yiuPfqmAvX2hZkPpivNJYdTPUXTSO7K459CyqbqG+sNOo
2kc1nTXl85RHNrVKQK+L0YWY1Q+hWDCCA88wggK3oAMCAQICEzdBBXntdX9CqaJc
OvT4as6aqdcwDQYJKoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjERMA8GA1UE
CxMITEFNUFMgV0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNh
dGlvbiBBdXRob3JpdHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5MjcwNjU0MTha
MDsxDTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYDVQQDEw5B
bGljZSBMb3ZlbGFjZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBALT0
iehYOBY+TZp/T5K2KNI05Hwr+E3wP6XTvyi6WWyTgBK9LCOwI2juwdRrjFBSXkk7
pWpjXwsA3A5GOtz0FpfgyC7OxsVcF7q4WHWZWleYXFKlQHJD73nQwXP968+A/3rB
X7PhO0DBbZnfitOLPgPEwjTtdg0VQQ6Wz+CRQ/YbHPKaw7aRphZO63dKvIKp4cQV
tkWQHi6syTjGsgkLcLNau5LZDQUdsGV+SAo3nBdWCRYV+I65x8Kf4hCxqqmjV3d/
2NKRu0BXnDe/N+iDz3X0zEoj0fqXgq4SWcC0nsG1lyyXt1TL270I6ATKRGJWiQVC
CpDtc0NT6vdJ45bCSzsCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQ
MA4wDAYKYIZIAWUDAgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5leGFtcGxl
MBMGA1UdJQQMMAoGCCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIGwDAdBgNVHQ4EFgQU
u/bMsi0dBhIcl64papAQ0yBmZnMwHwYDVR0jBBgwFoAUkTCOfAcXDKfxCShlNhpn
HGh29FkwDQYJKoZIhvcNAQENBQADggEBAHOJojanzqmgaSN3/gqSQ4cbbmdj/R40
BEPr+gXT+xiidfZ2iLNwYyTneuK6AChwKfnNvOFb8lV1iffRTF/KtmVEDMR/sYeq
AH83KM5p3el2lVh4OHhyI0qNuz5oShNaACSioQ23WxHGVy9vsdVfnbhsplrWg9NQ
2WbpCmK+2oMh2oYl0Z/wvXMt9cG6jbMvcdH4z0IOvg6mrYkKTM/RCGnumghxwYTo
j1OyD5Gs4D2IJCw+fX5ODxh52MbNRYXTus2ZPRPM8JXNQC4GWv4km3M4rKnJDd6h
noQ9rNeozIcBVyybQYjfrgg4DRvw9Ksk22OH4ConlB8f7R7s1LM2cSYxggIAMIIB
/AIBATBsMFUxDTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYD
VQQDEyhTYW1wbGUgTEFNUFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhM3
QQV57XV/QqmiXDr0+GrOmqnXMAsGCWCGSAFlAwQCAaBpMBgGCSqGSIb3DQEJAzEL
BgkqhkiG9w0BBwEwHAYJKoZIhvcNAQkFMQ8XDTIxMDIyMDE3MjYwMlowLwYJKoZI
hvcNAQkEMSIEIJaCe/AYALXLZ8GDGBxF2yvHB9b3uwnKNIvWM0h3y2s3MA0GCSqG
SIb3DQEBAQUABIIBADrTK0kKM1vxG/qmdbFxdKDBjyUXGDaOWqjCmq81OfRF88aY
37JerJhyUUsUPVCd73rlsjskMrxsA53c6ojOcSqj5PM7ZDhXCnGdEg4CiKjOAn1l
C84LXG485qDGcJiQ0hMF/p/V2UguVdfVzPrCLPP2SCDP5BWfCLMII3k4sRVayUt4
FwlYLvsXcRUbTlLZBoJrYvfN6sNOAfcbNwAMTu0rx1A8ZAoNBTbhAbpn/UiTd6Av
YFcisTSEIuZ+oGRyvU3n/wBHp9bUonKVHuNYGYKgycuXowwVx3D3j6+h+XEBOFJE
KTaTKY4sz4qH+3UWjytqrEisWQW0JkuzVOa0dg4=
```

C.2.5.1. S/MIME Signed-Only signedData over a Complex Message, Legacy RFC 8551 Header Protection, Unwrapped

The S/MIME signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Type: message/rfc822

MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="fcc"
Subject: smime-one-part-complex-rfc8551hp
Message-ID: <smime-one-part-complex-rfc8551hp@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:26:02 -0500
User-Agent: Sample MUA Version 1.0

--fcc
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="0f8"

--0f8
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
smime-one-part-complex-rfc8551hp
message.
```

```
This is a signed-only S/MIME message via PKCS#7 signedData.  The
payload is a multipart/alternative message with an inline
image/png attachment. It uses the legacy RFC 8551 Header
Protection (RFC8551HP) scheme.

--
Alice
alice@smime.example
--0f8
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-one-part-complex-rfc8551hp</b>
message.</p>
<p>This is a signed-only S/MIME message via PKCS#7 signedData.  The
payload is a multipart/alternative message with an inline
image/png attachment. It uses the legacy RFC 8551 Header
Protection (RFC8551HP) scheme.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--0f8--

--fcc
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--fcc--
```

C.2.6. S/MIME Signed-Only multipart/signed over a Complex Message, Legacy RFC 8551 Header Protection

This is a signed-only S/MIME message via PKCS#7 detached signature (multipart/signed). The payload is a multipart/alternative message with an inline image/png attachment. It uses the legacy RFC 8551 Header Protection (RFC8551HP) scheme.

It has the following structure:

```
└─┬ multipart/signed 5624 bytes
  ├─┬ message/rfc822 1718 bytes
  │ └─┬ multipart/mixed 1670 bytes
  │   ├─┬ multipart/alternative 1030 bytes
  │   │ ├── text/plain 324 bytes
  │   │ └── text/html 422 bytes
  │   └── image/png inline 232 bytes
  └── application/pkcs7-signature [smime.p7s] 3429 bytes
```

Its contents are:

```
MIME-Version: 1.0
Content-Type: multipart/signed;
 protocol="application/pkcs7-signature"; boundary="740";
 micalg="sha-256"
Subject: smime-multipart-complex-rfc8551hp
Message-ID: <smime-multipart-complex-rfc8551hp@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
```

```
Date: Sat, 20 Feb 2021 12:27:02 -0500
User-Agent: Sample MUA Version 1.0

--740
MIME-Version: 1.0
Content-Type: message/rfc822

MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="cf8"
Subject: smime-multipart-complex-rfc8551hp
Message-ID: <smime-multipart-complex-rfc8551hp@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:27:02 -0500
User-Agent: Sample MUA Version 1.0

--cf8
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="e8a"

--e8a
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
smime-multipart-complex-rfc8551hp
message.

This is a signed-only S/MIME message via PKCS#7 detached
signature (multipart/signed).  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the legacy RFC 8551 Header Protection
(RFC8551HP) scheme.

--
Alice
alice@smime.example
--e8a
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-multipart-complex-rfc8551hp</b>
message.</p>
<p>This is a signed-only S/MIME message via PKCS#7 detached
signature (multipart/signed).  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the legacy RFC 8551 Header Protection
(RFC8551HP) scheme.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--e8a--

--cf8
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--cf8--
```

```
--740
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-signature; name="smime.p7s"

MIIJ4AYJKoZIhvcNAQcCoIIJ0TCCCc0CAQExDTALBglghkgBZQMEAgEwCwYJKoZI
hvcNAQcBoIIHpjCCA88wggK3oAMCAQICEw8tJb0ROZdKzkJUh6HuPTQGirQwDQYJ
KoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cx
MTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3Jp
dHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5MjcwNjU0MThaMDsxDTALBgNVBAoT
BElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYDVQQDEw5BbGljZSBMb3ZlbGFj
ZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBAJqVKfqLwaLjj+gBUCfk
acKTg8cc2OtJ9ZSed6U3jUoiZVpMLcP3MUKtLeLg9r1mAfIDlB/wlbdmadXPmrsz
yidmbuZmOpB5voVQfiLYYy3iOx7YOqzXrl6udP07k0sV+UdSNRFxrfKeoQEFXgOa
Gdmnx4OG/e3p1fIKM0dPzZLoOAJF5m5O0xzXPL74zFCWp2f1ZkuE4A6l41koaZXC
N5XL7wWTLMLeNf9Byb5ksKqUuqEHAMd1nmoNMgjY9VfVfcrv9w43GG8FtpSX+TWz
B2zNS2OF+XIVnzRG5DeoULq8v88Z5bLpIJ/nx26r8A4SSwIBaVv4wPxAf1iPsIVK
arUCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQMA4wDAYKYIZIAWUD
AgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5leGFtcGxlMBMGA1UdJQQMMAoG
CCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIFIDAdBgNVHQ4EFgQUolNB1UQ8gCkVfAEj
8OeOr83zdw8wHwYDVR0jBBgwFoAUkTCOfAcXDKfxCShlNhpnHGh29FkwDQYJKoZI
hvcNAQENBQADggEBAIFJeKCcsTKcFqQMpTryujRGzJdYA+R9eBAuDLsatbtKtl4F
zkgRyOg31/+Cw7H8e30iLrPIFlWN1qjHrjgOyIs5AQ/hgxLvLir3hEUV2Z3MRsMt
jH2x9SG91PEM046gfPnc9gMGHjMTg1qvaKcLQP5UzpEYPLror2X4P5uXxaP0LIZR
zWmkw1RF7FOD7PfB5v94M5274XYxW2W4uKGd7QGnUZROSvSYkGiWDp1JhqXwfDz8
A0enITGXnoEkAFvvjiCqh64P1hIeMorj36pgL19oWZD6YrzSWHUz1F00juyuOfQs
qm6hvrDTqNpHNZ015fOURza1SkCvi9GFmNUPoVgwggPPMIICt6ADAgECAhM3QQV5
7XV/QqmiXDr0+GrOmqnXMA0GCSqGSIb3DQEBDQUAMFUxDTALBgNVBAoTBElFVEYx
ETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMgUlNBIENl
cnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQxOFoYDzIwNTIwOTI3
MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzEXMBUG
A1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEK
AoIBAQC09InoWDgWPk2af0+StijSNOR8K/hN8D+l078oullsk4ASvSwjsCNo7sHU
a4xQUl5JO6VqY18LANwORjrc9BaX4MguzsbFXBe6uFh1mVpXmFxSpUByQ+950MFz
/evPgP96wV+z4TtAwW2Z34rTiz4DxMI07XYNFUEOls/gkUP2GxzymsO2kaYWTut3
SryCqeHEFbZFkB4urMk4xrIJC3CzWruS2Q0FHbBlfkgKN5wXVgkWFfiOucfCn+IQ
saqpo1d3f9jSkbtAV5w3vzfog8919MxKI9H6l4KuElnAtJ7BtZcsl7dUy9u9COgE
ykRiVokFQgqQ7XNDU+r3SeOWwks7AgMBAAGjga8wgawwDAYDVR0TAQH/BAIwADAX
BgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYETYWxpY2VAc21pbWUu
ZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8BAf8EBAMCBsAwHQYD
VR0OBBYEFLv2zLItHQYSHJeuKWqQENMgZmZzMB8GA1UdIwQYMBaAFJEwjnwHFwyn
8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQBziaI2p86poGkjd/4KkkOH
G25nY/0eNARD6/oF0/sYonX2doizcGMk53riugAocCn5zbzhW/JVdYn30UxfyrZl
RAzEf7GHqgB/NyjOad3pdpVYeDh4ciNKjbs+aEoTWgAkoqENt1sRxlcvb7HVX524
bKZa1oPTUNlm6QpivtqDIdqGJdGf8L1zLfXBuo2zL3HR+M9CDr4Opq2JCkzP0Qhp
7poIccGE6I9Tsg+RrOA9iCQsPn1+Tg8YedjGzUWF07rNmT0TzPCVzUAuBlr+JJtz
OKypyQ3eoZ6EPazXqMyHAVcsm0GI364IOA0b8PSrJNtjh+AqJ5QfH+0e7NSzNnEm
MYICADCCAfwCAQEwbDBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBX
RzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhv
cml0eQITN0EFee11f0Kpolw69Phqzpqp1zALBglghkgBZQMEAgGgaTAYBgkqhkiG
9w0BCQMxCwYJKoZIhvcNAQcBMBwGCSqGSIb3DQEJBTEPFw0yMTAyMjAxNzI3MDJa
MC8GCSqGSIb3DQEJBDEiBCA9qnCv8hrAl02HDXOOfVNCH7ucDtJ3vYdKv0vdCnWz
SDANBgkqhkiG9w0BAQEFAASCAQBp4hNammJHK5hpd7ha6lzKahf9hoZZS6TPNUCD
plGKSjV4XN7pLxDu3wXAuzon2zV0FxeA1MG6gZgdSBy/5nGivTc/NBOmXJtlNOUV
6b+IiQ1ZgJcWG6R2Pi0bE+NfadPhxvekgmCNTNl0jHQkXn+ABstolOZ+0QnY7TPe
6JoT6HHamKbV0L1/gkEEQtSvOkaDaZllA+if+Qkb6xus1QA3FGzScPpcryTvupsO
wNIlNwiRTT1Kvk7uMxJkWTvfZnWh2UOh7lJAkXbRfMwXwmnVnVooCFHWWpUBVPnn
URqYcZhz+4DJc9iim5CqXRZzIF6t6fioS8lCBalaWRy4AaEJ

--740--
```

C.3. Signed-and-Encrypted Messages

These messages are signed and encrypted. They use PKCS#7 signedData inside envelopedData, with different Header Protection schemes and different Header Confidentiality Policies.

C.3.1. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_baseline

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a text/plain message. It uses the Header Protection scheme from RFC 9788 with the hcp_baseline Header Confidentiality Policy.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 7825 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 4786 bytes
    └ (unwraps to)
    └── text/plain 330 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-hp-baseline@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:09:02 -0500
User-Agent: Sample MUA Version 1.0

MIIWjAYJKoZIhvcNAQcDoIIWfTCCFnkCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBAERACKkMFfCQBEXqsSFRAOfaa0UcrVI6fcuB
nsfnksstYg/+DabeHHBueVpIuTr5Zqtj8kQMK8hWRoA+yVhA85aZaRadcywsEn3O
oTc5vD6m9DBVOIpK2vhT+aYWJr67cfzlxJgVdRi6Pf+8g3c0oi05fMA17pPCUHYe
//VSeW3cdaMGgaqFamqL+pOi222Hp19p+3Q6zYRUJ5Y1cvD4aOKzaxw0RcWvFg//
KYuy1q6Fn0utZAhoEfnBtEp71fSI5LugUdj3tx3NDfrG1MLJHbBsELqawuWrcvmv
BbewMWR5BYcl1/DQgbGFSbB/yoqBPkpC54A7PP2MXfb97SEquY0wggGEAgEAMGww
VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
HGLS64MvlsDXhpQwDQYJKoZIhvcNAQEBBQAEggEAL7PO1rb8J7CwZ+vEvIROxpiZ
on8lc1VRHaE2tthLu8WOekoAyQtPv11edZgydCRbXr++xY2CvOiaE3+jdWrn11am
khzFkHpfEna4o91BHoNoipvl4vuLp7B+s2Dxymwctv1sZYkcHjVC8Eh1SH/43JMY
0TJkBtkO1nLDWTVfVePC/ydbFaXqtgN69SiN03GjaczhHUTuZbKJX41SbGqk3XhH
iscSIrS/QIdK9arBEP7Vlr7WdvVdfAfPEYZvRRrogzZJ5TE95Aes78+kaQO5wJRq
xSCdSgw1M9jcHUrUtZ0kk/pGvs2aa3oNtkKj/7OMDi64SsWwEdiTVsHob5foyjCC
E14GCSqGSIb3DQEHATAdBglghkgBZQMEAQIEEGYCTS4JhiRx+ufWgp0alQiAghMw
GgBNjWrIh5GY9ElDx5GWJxbUaCM77I6Q/NAYPVQaM73L5yCBHNEekbAFMFmZF8k2
bYgLyBCp2PcL6BhSAQiFAvDUN8KYTKHYqaz0cwK2C9EgUi1dBtQ7VB+xPvTXZwSx
0sPOiv6keO2FYeIDEnT56jnD2b+JkW4/dwsgBVju3dtPsVR6bIRHICTrk0thCphg
0kUPnjefdDmQh0kCkp8XuN6M9ZTwamzR1gn4ZLXw5LArZ9h7P1yNKZvdoR6D+510
qo6IhBR1fmi+uF60m8blLN8TBJ9y8dt+UPQE3XD2d/r8YHvrItCJD1hse56J3WqG
AAU3dlks76PcxUzECQPmVgdzfWYmQ+ygCnxqIWanRbDsOY9DG0FoozWLbRG0yTsT
awwlH8si81FJPUyqiKRSdhufVMHIQT/rySSmfB2o6r6Z5p60x2sqY5csYemPrFq2
YWp5wCv/nLTkcAbvuCohR22XSlz9n0ihuTQbH3d2vDsUQzbX/7RrPNPOKYLPNZXu
O0XEklYC0IwMMJ4CUGtjgOMalOEpeePuURmXzQHg3704w4ESSiCnmVEVQCLEwgQu
8A1r9P97aQaVV4vvKEtLv2/RpRr5BXY28Kcer/2HQFUJ9nBpkJf+ItZBicO2cab5
o0JelZdoPL6aDwy4eDLVS+SMajO5bQLYMKaTYfcP+nUdYZ5gLU9qBcqRtIjQ5qdB
WH8XhEEiBPZYYHhvBidaK9EovTOJ4touEgOG0iaWoRa8crQgryKR/cnInZ1pWpfd
kmeJ0+NJSfstOLaHhk2x1fiq0KklryMAF9ORN2iZvtbOdr6zv2iR548O1XuN0Q52
ZmLQnWdqj2CSXvXi2kPHz+/1dn/iQl4oXAnDMbvm0QcJxvflFg1zQzRsTwvoyiRn
RBUdbsbGBziZGqg/vMaVnZF8yUl6ADxzqIf5rM/iV76g7sscLhX5Ewcj618QKOgq
n3nGxBd2xuEuX0pv9tS0mRi81qElRUboHV3/HhRnlTLs699fLFOAJMcke43a0jHF
NOECszVjwdXfn9JwlS6ZwWGqtDuCB4qPGjVttiPMn3iWIbWC6y5mtgaJBBAcGMaT
DXcojNrR3mUEwFmWFZKb/3cn2mzmB26JU9qbfyZrFxvXFPF0EYzqReHSkQLvwnqu
IqWm1ILBuIsLICSUrJw64e+k+qBgqg7lKhTywECC/0D1bjKntE7R7eeUn5IGs4Xd
```

dLdr0f/UkDhIqIAkn67CnIZi+miCszlk+l8uzIAIM6Vux3a7rXYVcJdSQg59tWFN
mmqdx9BT/bZok1Ijo2qG6JI2EIIjuvD8ufW9LYl2QCNuZ+Qn8S5b4gbRDKZGf9fG
vD2G96t0C8QpnUmVn4dI5B4plXYo77SrvMAY85GOtzha6HCJdIA+5SMxxIF/Qpba
TBinO2Z+4dxTJvbIJpQzZfMUQP4DCJxphpaALMiBxgVMM7FxPn4hpwUUAiu8juQP
GRh/PRKTB+ZjdzysiCYBPUlvd5BO/aM8uhu0CqOal9oA7bOXznd5PyJOBrkac94x
qXCwhwu72jYrt0YFmL9RbpXMZSh/fTGq68NY7j7NOMdlFS8P7Si1Tdfc7Q8fh4MW
w/ODenQPXTRKJ8NTYk7LntGM2NKrUS+e1kjaAwCk/F5fRieF6AkbVkP/vFDQYTui
oQM9LlGW85TIihO/WDWJYzRQCoigVVErwppjuwSDztFtQrtfCFbOVx4sAfbYoEt7
NTVg9V/elgTgAwrzowT9jMmZIDnkAzQ1Y46sD20BhjgxU1YwWSIhKyo7EP0xszPX
DTo9fY5ybayhkYQ59gQcb0mrwZ8q9C95FFxxpA0S9Yee5++j5+RCSosvYIHw5Piv
Rge1Wm1U3SG0BYQENLqYB+G39va0T5yy9lusVMiFnJ6CVGGNufLXNjpCXaNQLfRX
shYBUoUMwt0R9kpBDDg1tOwqHWoh0iG4X8Iy+cLvna2thFv8u94/Riq5pUn1sbC6
wxyu6y0vBdMLx0fm0fP8xyPnBCiG/5WeziARqdAaH8sGp3Q7qc/YApnlIQevCU2b
OlIz6t7dLve9HyYlvIv4pClPWi6AZg/un4Rtas2HuLAndrNV7s55sOFH4BvdGP58
3fR/M9ITOVjyiT3bUit+5qE7MvpUqdxfsdC3SUaPxFJ17khGiimV0gC+x+8YTicE
JebKrihVAosyVVWZpjCIa4hjdMpVgUutyEgVNov9XFoWcNxMb8f5IAgXvNKMsvpN
FMoAfeT1MSj3tM5jdWliV0P5tU8WtlFj3hxixZPaz+w2SykOrHoyoDjCWpXifZ3K
CVgGghueWgLglwuja0FSkvZbq1AiVy6ebtbkx/q5o/jh91oTa0SM2MupcHrHg3Z6
SB6ujw7BlBXWqcNlMMJQS6npXCWsleg8iHQRdTuDGabxuBJmVf6I2mg8Ev+Ki7C1
KAHfAAhHp1E13DXf+E8eHVEPIemv3YeY3ldBVI93+T5V823yYwqwk5PfWZ+fPo+7
lBoq8IuHDu0fpwh21b6iNKEODvokXOPwkixLB7KpMpl9niCkdVwtj8CJJzLD6CSR
ctVnGtFua77wOMEu1wvlXWuWz2IT9a3aKGyciLrgz/CsTmJKWSIoc/f+u6EnPf23
hYMpMxLI46I9VQVcxaX5YD20ywMxTmN2fkGQdoyxa5pAhN75+iBeYH9J0+B+bYHo
HJX9UiEs5Ja6vu37SVje6RqchkLrrXLyock/uTB0pCqsqJaZoFaVC8M1T+jTw8ro
+mioqKVi0JeH/Wn3yhCEHQ5AY5n5dB2OMdPe9BZQ9zzr/WdNx1/xs/FpRj+ggpql
1nEerBbzG9uJQOneKqRLYActvZ3zhe9X7Sl/jS9+pFLLtO2tnRNe/edOunZHrJVt
pb19s+WtaDVez/eRUbjkgdjlBFtfYtFtcldKJBjLO9KiIkLecj49cfZHr2pcXeZS
pnMu3vv1mjapHAbqIvnEnf/jGxGFIiWKP3jeKjgjv7580R3YpNQ62upOe2MP+HAw
3nhYYNrLxD1eFT/TTiFwOfVpvrVuL3vFfJBXVFWyaokM4/sLN4E2EfJ9kdgBVS2Y
RmgXH3/EBYjJzicoVcvb799rXkbfu5LymXGteMZ+XeTDeYkLrx490E4FYmnQFlQX
Grx2cqtzLPe4aVFekZndq0zDenNibLpv2PGL1cJy3mL/FEM85phjxe16wXM/aPcD
2ScKzC7eSfUj01K27nswJ0FogQQv4Q81apSQaVt3884uQfpz8j07NxR7ZfknpnwF
AR208udTix02yEQc0lYEI+vTo48DiI7bHVOXbA4lM7hSCaFyqAMuyb9JXyZGVvdc
v9+mxvNg6ObXhOkLwPxBVfQ+TraGKGvxMBI29/Lzfgssb6k8JoxiBy/qQnBcLZfs
bCqggRM2WDy0mApeyAHBwmybYS1l1nosIGHntnpaPgsRMIcMENNzEpVdWLZOcmwh
fEX++diQFQ9AwzW3zygnYAk/tZSXVe2wUL9ojMRr7kLwUz9n3OZLF3u/4UEra7bD
XRMtTO/UmuN/d16EqBN10gKY96buiRcgAAigMzj+D5VRqXzgj0I0Qq+gu/eXkzr0
tONfZfuoVNDl+q6H//f2kDRHbj0SXz9OSWHOtxaJ6SJbDX60MQFb6mEWJm8kno/e
UpEXjHzTU2xyum8qoN8XdaRBevrBhyPXFPb8QEVD1BXR6ehFockfbnaRqHVaStva
Df6/nos9E7ViCGW8R3YoJ+2qfWTk7RXjmq1ykrdbQxMycOXyRTbLB5ur0ynIif15
oQyz3SiQGSLOaSD1Z501Yty3zTEn8jMlpBOr9KXFkgbbxNY1X6nn3vZ5ZumAl1M/
iwtaPgThkj2RnM0ATEWG9SQva8FaH8zUv3fGepJ37VMPlQ43eWhZavwZi1/fs5vG
UYCyqxjhNXtwSnhEGHI2F4LaffYeim20Wt9HiXZON15vRpSeTWvTGOUGVZWROzx7
OgIeKe/ksjcIlJuzy9fKQlJjsmURWQfuKM2vfRFGAoM3jxKBNDDFzinkL2/kVpoz
rn8LpukkEOZNB++ALIGVOB8L4zNDluePDTYlojthvjJUN0+oU6OB/iYvcnHOKXin
PKmeDe7g5Ywjx0Uj0nuZEwa4L7ALCG2WpmnpMOT1RkHVpqn+29PPQ/Cx+JpGmXO+
uFiHQN+L3uk74rQwJ+LUQBGDrRE94GobEN/sWgk4l6bQrf7Sl3Af0QaXDCN9d2Nn
ebzYvxhxEkpqVnvjvd1Vr3ZT7ECzOFEA2hjK8L12oJz/zF8DXUhSlXxXAER3Nf5n
VzM+OfCpigIUezk5QN3r0sHD1mWEmOe6JgXnDu8BIbBN6NnxFXE+rbRV71vd0APE
q5F0T9a0o95/cVYBcLvhW3QQcp6yP1Xhulaq1zZc/N1482qDNddYDPtUDaa+g7/X
m1+3tK1myLIBhxv8ORgdyVQiXmHmvjWVk8qqSmwrNM7rZNkWo4FZFOYALreVHxHZ
T1bgmQ2Q/OydwRhfpWTlHK1AH4UzUTWKjFDH0j1pZGqtDuc+ghEboZxHdAI/xrvy
ypU3OnP5a9Dvdx4B2GuKHbPpN/yY+jbvjDbb1DX0NROcVqC7JU+mMXYFRkKg6yga
L2KDhI0VChXtzGUGSR7wnfvCPBWOpmi959NSoSRdVnVI6hrCqNopVPvRh9bAtdor
+MoGi2gxmKCLhxY0A9/6VjZnBF498RxRKSAh9EkHZp3Wtiy5T5779j8gHRLwIpeL
YnORqbfW0gcWhjKwL8BoXT95S7rvHWuJbwFXMmZFD7fVJqDl1auaeS8QNFPxEOIW
91Z+2yidE0MdkfTWWS3WTFy3N4DBYP6JJRIzHV9bYk18ASxvNR7sGjKTsaioRble
3WaKwI7eszBNvgEsrNtJP9PYD3leXc0XXbsZZmUgbu+Q0zIYfrmJwoOwA/4pOjtM
VpF0dAWOvwOMygwsljdOH8MFBBwVMsu95DiM5Qx7JTXNaPAkxKSVrvmPCPi1yH6s
82Tkf9D7MC91TyOV5g5wqR/aNXfHFk31+8tRi/jhDAGcyY+s1AUONPaNCImOjfe1
oRPRpw6noLVW+0X6JuZ+hFoIvOv5oY4mhvXmtm0rxG1/bI+5WFHRfqD3rQNX/RW0
WMepPlKnRq1yNCzwKNrdPf7sus1MHSDCYCuGFUUawRBZnPtd0wM7G4kPiVh6rm0W
EQji3yT1bDp61yVbw6TN0SAhcAzkDwrBNiGyDCDa5naYnnYRNE2j5KkAcFtZv32Q
KFVEAld8dP3+qeuGiNJVpiTNaQMtMT+Zm4IwgHHn7aHKW6su/jjc48gxLU+IHSR6
iW9IwZxRvCWkHLKmUutBN/WkNMgpt/Wmc3waY7LZiFhK+LCXHK1dLbyrkCdSD8DB
iYxV6+MFG9huPj1JtuonFt6DX/PE2S7pgLeTFWDwKxaeNSd6WGVU6KiEpeEgDPmJ

```
GpLAv1ow/G3Vmv0GhM/oxKd76uY61CosCHlEV6KqSX/c2YA1IVcxu6v8kaPXd2B9
mbafIPVDfEr8ZOD8SswA9jxaf3ZCmrYHhwyV9FSuQn8BNBpYqaa1++YOeOWPJ9tA
7qTDNUJNgc0vKa/nVWPuSVogfaVn5gw/byuNlPHmdLEdHUMyOcal4UyJ28nQrvYR
23WPQKmRT9OASsEMm2UZzB4+yf4/lzt3p2auEks2s3GMlfdyUm7PHu6tz/Kvpvy3
xE6G04qV/cEK9600jwfonvNgf+LV/06GV262QvbVj6eKnNVoE/7qws+QJNuwjqmE
xyOt/dRjTFLomTXFAKWpnXNTPNzUTyM4GG31We+aOkOzvjhC4dAL7lf4JKYqP6WW
wKxjK46KQuew81k08Wwk1VHW+D4DlN2ynIbDM+q8rkrlJNNvIHXw5BA5CSWpsxnu
oYR/fpw6kSbCPGO7b2tWVGmTw3S/Vwy96OLwunw4oYyaaBgenFFBgDzicgiyExtP
K0OPIr3LjEXyol31cLwSBjCNUMt7FwPiB5/TFQwVmtGq5t3uYL3ei5IgTaozbk7p
04bVa2QJQxK4bHHbsgZ8/Vd2JXJJdQ+I1rfC0F6PKFqrfhDeujsF8QzZhvn8M2qJ
y1NPENK9Q4zb77dYvDUXBss4+erFM0wPesScHEbQPh9yyu2zqskpYQMrOqMPCjb6
y7yKppG1pOIrMzpJQkt7WP6n68nhZAlkEoCu7XchopEq1TmlzFVJ0F48ijIXWHMJ
PjsMWj2eh6goyFaAl2tovcyHl14j8vY3JO9ACyLytyns+PzdrqjuZxJQt8wZMd84
axs1klGO2AEuAehpsf7ypMKCBO32kirOMQSYZc4QridRDU5J5TTxMsxz8vXtc748
8fDkhFFq5Bqf6Weo8YiFvspF/Vvow6xjGpcNK6DMgxwwvUb92bxHwhdlyVa90lho
B1fxiQkaA+Oiy4bdYXuDoLHd5p+T8SipMorXJrHe/blq0OwNaHrbGSCje2SXQBqB
+cMVUyvTtEsA+hpI6hIlAZutTZ7qrvIMGafd5CO078+8okboTHysqAIH8WAdDwkv
aXylZnqk5kEiwW3eNjoh0Q==
```

C.3.1.1. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_baseline, Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

MIINkwYJKoZIhvcNAQcCoIINhDCCDYACAQExDTALBglghkgBZQMEAgEwggO8Bgkq
hkiG9w0BBwGgggOtBIIDqU1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVRyYW5z
ZmVyLUVuY29kaW5nOiA3Yml0DQpTdWJqZWN0OiBzbWltZS1zaWduZWQtZW5jLWhw
LWJhc2VsaW5lDQpNZXNzYWdlLUlEOiA8c21pbWUtc2lnbmVkLWVuYy1ocC1iYXNl
bGluZUBleGFtcGxlPg0KRnJvbTogQWxpY2UgPGFsaWNlaW1lLmV4YW1wbGU+
DQpUbzogQm9iIDxib2JAc21pbWUuZXhhbXBsZT4NCkRhdGU6IFNhdCwgMjAgRmVi
IDIwMjEgMTA6MDk6MDIgLTA1MDANClVzZXItQWdlbnQ6IFNhbXBsZSBNVUEgVmVy
c2lvbiAxLjANCkhQLU91dGVyOiBTdWJqZWN0OiBbLi4uXQ0KSFAtT3V0ZXI6IE1l
c3NhZ2UtSUQ6IDxzbWltZS1zaWduZWQtZW5jLWhwLWJhc2VsaW5lQGV4YW1wbGU+
DQpIUC1PdXRlcjogRnJvbTogQWxpY2UgPGFsaWNlaW1lLmV4YW1wbGU+DQpI
UC1PdXRlcjogVG86IEJvYiA8Ym9iQHNtaW1lLmV4YW1wbGU+DQpIUC1PdXRlcjog
RGF0ZTogU2F0LCAyMCBGZWIgMjAyMSAxMDowOTowMiAtMDUwMA0KSFAtT3V0ZXI6
IFVzZXItQWdlbnQ6IFNhbXBsZSBNVUEgVmVyc2lvbiAxLjANCkNvbnRlbnQtVHlw
ZTogdGV4dC9wbGFpbjsgY2hhcnNldD0idXRmLTgiOyBocD0iY2lwaGVyIg0KDQpU
aGlzIGlzIHRoZQ0Kc21pbWUtc2lnbmVkLWVuYy1ocC1iYXNlbGluZQ0KbWVzc2Fn
ZS4NCg0KVGhpcyBpcyBhIHNpZ25lZC1hbmQtZW5jcnlwdGVkIFMvTUlNRSBtZXNz
YWdlIHVzaW5nIFBLQ1MjNw0KZW52ZWxvcGVkRGF0YSBhcm91bmQgc2lnbmVkRGF0
YS4gIFRoZSBwYXlsb2FkIGlzIGEgdGV4dC9wbGFpbg0KbWVzc2FnZS4gSXQgdXNl
cyB0aGUgSGVhZGVyIFByb3RlY3Rpb24gc2NoZW1lIGZyb20gUkZDIDk3ODggd2l0
aA0KdGhlIGBoY3BfYmFzZWxpbmVgIEhlYWRlciBDb25maWRlbnRpYWxpdHkgUG9s
aWN5Lg0KDQotLSANCkFsaWNlDQphbGljZUBzbWltZS5leGFtcGxlDQqgggemMIID
zzCCAregAwIBAgITDy0lvRE5l0rOQlSHoe49NAaKtDANBgkqhkiG9w0BAQ0FADBV
MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzExMC8GA1UEAxMoU2Ft
cGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhvcml0eTAgFw0xOTExMjAw
NjU0MThaGA8yMDUyMDkyNzA2NTQxOFowOzENMAsGA1UEChMESUVURjERMA8GA1UE
CxMITEFNUFMgV0cxFzAVBgNVBAMTDkFsaWNlIExvdmVsYWNlMIIBIjANBgkqhkiG
9w0BAQEFAAOCAQ8AMIIBCgKCAQEAmpUp+ovBouOP6AFQJ+RpwpODxxzY60n1lJ53
pTeNSiJlWkwtw/cxQq0t4uD2vWYB8gOUH/CVt2Zp1c+auzPKJ2Zu5mY6kHm+hVB+
IthjLeI7Htg6rNeuXq50/TuTSxX5R1I1EXGt8p6hAQVeA5oZ2afHg4b97enV8goz
R0/Nkug4AkXmbk7THNc8vvjMUJanZ/VmS4TgDqXjWShplcI3lcvvBZMswt41/0HJ
vmSwqpS6oQcAx3Weag0yCNj1V9V9yu/3DjcYbwW2lJf5NbMHbM1LY4X5chWfNEbk
N6hQury/zxnlsukgn+fHbqvwDhJLAgFpW/jA/EB/WI+whUpqtQIDAQABo4GvMIGs
MAwGA1UdEwEB/wQCMAAwFwYDVR0gBBAwDjAMBgpghkgBZQMCATABMB4GA1UdEQQX
MBWBE2FsaWNlQHNtaW1lLmV4YW1wbGUwEwYDVR0lBAwwCgYIKwYBBQUHAwQwDgYD
VR0PAQH/BAQDAgUgMB0GA1UdDgQWBBSiU0HVRDyAKRV8ASPw546vzfN3DzAfBgNV
HSMEGDAWgBSRMI58BxcMp/EJKGU2GmccaHb0WTANBgkqhkiG9w0BAQ0FAAOCAQEA
gUl4oJyxMpwWpAylOvK6NEbMl1gD5H14EC4Muxq1u0q2XgXOSBHI6DfX/4LDsfx7
fSIus8gWVY3WqMeuOA7IizkBD+GDEu8uKveERRXZncxGwy2MfbH1Ib3U8QzTjqB8
```

```
+dz2AwYeMxODWq9opwtA/lTOkRg8uuivZfg/m5fFo/QshlHNaaTDVEXsU4Ps98Hm
/3gznbvhdjFbZbi4oZ3tAadRlE5K9JiQaJYOnUmGpfB8PPwDR6chMZeegSQAW++O
IKqHrg/WEh4yiuPfqmAvX2hZkPpivNJYdTPUXTSO7K459CyqbqG+sNOo2kc1nTXl
85RHNrVKQK+L0YWY1Q+hWDCCA88wggK3oAMCAQICEzdBBXntdX9CqaJcOvT4as6a
qdcwDQYJKoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFN
UFMgV0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBB
dXRob3JpdHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5MjcwNjU0MThaMDsxDTAL
BgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYDVQQDEw5BbGljZSBM
b3ZlbGFjZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBALT0iehYOBY+
TZp/T5K2KNI05Hwr+E3wP6XTvyi6WWyTgBK9LCOwI2juwdRrjFBSXkk7pWpjXwsA
3A5GOtz0FpfgyC7OxsVcF7q4WHWZWleYXFKlQHJD73nQwXP968+A/3rBX7PhO0DB
bZnfitOLPgPEwjTtdg0VQQ6Wz+CRQ/YbHPKaw7aRphZO63dKvIKp4cQVtkWQHi6s
yTjGsgkLcLNau5LZDQUdsGV+SAo3nBdWCRYV+I65x8Kf4hCxqqmjV3d/2NKRu0BX
nDe/N+iDz3X0zEoj0fqXgq4SWcC0nsG1lyyXt1TL270I6ATKRGJWiQVCCpDtc0NT
6vdJ45bCSzsCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQMA4wDAYK
YIZIAWUDAgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5leGFtcGxlMBMGA1Ud
JQQMMAoGCCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIGwDAdBgNVHQ4EFgQUu/bMsi0d
BhIcl64papAQ0yBmZnMwHwYDVR0jBBgwFoAUkTCOfAcXDKfxCShlNhpnHGh29Fkw
DQYJKoZIhvcNAQENBQADggEBAHOJojanzqmgaSN3/gqSQ4cbbmdj/R40BEPr+gXT
+xiidfZ2iLNwYyTneuK6AChwKfnNvOFb8lV1iffRTF/KtmVEDMR/sYeqAH83KM5p
3el2lVh4OHhyI0qNuz5oShNaACSioQ23WxHGVy9vsdVfnbhsplrWg9NQ2WbpCmK+
2oMh2oYl0Z/wvXMt9cG6jbMvcdH4z0IOvg6mrYkKTM/RCGnumghxwYToj1OyD5Gs
4D2IJCw+fX5ODxh52MbNRYXTus2ZPRPM8JXNQC4GWv4km3M4rKnJDd6hnoQ9rNeo
zIcBVyybQYjfrgg4DRvw9Ksk22OH4ConlB8f7R7s1LM2cSYxggIAMIIB/AIBATBs
MFUxDTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhT
YW1wbGUgTEFNUFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhM3QQV57XV/
QqmiXDr0+GrOmqnXMAsGCWCGSAFlAwQCAaBpMBgGCSqGSIb3DQEJAzELBgkqhkiG
9w0BBwEwHAYJKoZIhvcNAQkFMQ8XDTIxMDIyMDE1MDkwMlowLwYJKoZIhvcNAQkE
MSIEIPc7Pk9KNPXyMYThSPlPWV2Qm8CR4vwcxnqIoOjkdUtMMA0GCSqGSIb3DQEB
AQUABIIBAA4QYIyZPmQpKWNUhU2nJc7Fr1Oh66z992rzH2OTpxSHehRBo5dJYSqm
9p/EOWB0XLOuJ8s97cVbdYl1EqEjx9zvp1kdLtvosuonNGHmQlCPVKSFfpBvq4DV
L7YcZkAQgXujN2Z1F+MDlUTYo6reDa2K21zPqa6CJX75zersFb1xS3raFRaNAspW
URatTpJpgf2E7F39o78kRGsbUxurtzm5QTNHIVAqjv4LudNSGVOH++VTmkMR5gLJ
3Xm2E7tz/TLDlGDi+l67tYni3f+sMgyW39dA4/ImkVV3LCjT6TXuKRwvDnLdik1u
eh0Hs/LLI6jCJ82HDBCfgGfbJ8Lfqdk=
```

C.3.1.2. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_baseline, Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Subject: smime-signed-enc-hp-baseline
Message-ID: <smime-signed-enc-hp-baseline@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:09:02 -0500
User-Agent: Sample MUA Version 1.0
HP-Outer: Subject: [...]
HP-Outer: Message-ID: <smime-signed-enc-hp-baseline@example>
HP-Outer: From: Alice <alice@smime.example>
HP-Outer: To: Bob <bob@smime.example>
HP-Outer: Date: Sat, 20 Feb 2021 10:09:02 -0500
HP-Outer: User-Agent: Sample MUA Version 1.0
Content-Type: text/plain; charset="utf-8"; hp="cipher"

This is the
smime-signed-enc-hp-baseline
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a text/plain
message. It uses the Header Protection scheme from RFC 9788 with
the ‘hcp_baseline‘ Header Confidentiality Policy.
```

```
--
Alice
alice@smime.example
```

C.3.2. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_baseline (+ Legacy Display)

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a text/plain message. It uses the Header Protection scheme from RFC 9788 with the hcp_baseline Header Confidentiality Policy with a "Legacy Display" element.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 8085 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 4972 bytes
    └─ (unwraps to)
      └── text/plain 418 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-hp-baseline-legacy@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:10:02 -0500
User-Agent: Sample MUA Version 1.0

MIIXTAYJKoZIhvcNAQcDoIIXPTCCFzkCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBAHafgwK5Dq1Mk+/BfVcTHIE/bWksOCdgOuo1
ppl3Qdi238REiGsONqPHaLjiK9xhjvTS4pSV3NHEbKTVZpQurzaUqIXL/sA12kkn
TQgbJiemZq2HXKI1feGM86z13FYWPe4g42nffZNi5kErmPI/IZX4CuJ2+6Wy8IoO
tZ3C1vLg6z4V9mialF6IyVDYw2VZUIb/r3I4SKINANa1t6wKHeHTX6TEJxOv3P6W
kWUwpPHGzYXPNVKX+NSLxGqX68vTYOhg86Q+FeKLNHkutnQD1fNU/ZBn/iidZt3u
aUbDpByaxv79j8QpvCHUXbygTIYENNc11+RcJ3WmkCKVkwXG2fswggGEAgEAMGww
VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
HGLS64MvlsDXhpQwDQYJKoZIhvcNAQEBBQAEggEARW1p7eiEdi69X6DKW+FXzEoc
E8KIzTvIpU++vNLVzq+29VTzdjvBVcg/8F8L4BNCIpWSgz5i7Z0o9LjMCw/mHo20
XL074me2zAv3HeGZ85i7gIiA/lsdgIb3f2Qw/+8gQVAIkoYOlBmpocBf6EGyEciU
SWfwp1qJE6/YWhiFbjcTIZYj6UqGy72AkiqGKgCZ/tFWhMJ2KKzbm8t5rG8oC8bD
dgjT2PYo5by8brJohF/zTS5CucfLqqWpA7QtHLHcAeU3NXqVc5tHyGZy89KDpEii
xVCxdE9Rs2AurTjT2/98WF5tTEFOR6LeEdG3svOzmMd0xWEdwP47BA/ePsS53jCC
FB4GCSqGSIb3DQEHATAdBglghkgBZQMEAQIEEILWJEheEd6fWe0TTJf9JzOAghPw
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```

C.3.2.1. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_baseline (+ Legacy Display), Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

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Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

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MAEwHgYDVR0RBBcwFYETYWxpY2VAc21pbWUuZXhhbXBsZTATBgNVHSUEDDAKBggr
BgEFBQcDBDAOBgNVHQ8BAf8EBAMCBsAwHQYDVR0OBBYEFLv2zLItHQYSHJeuKWqQ
ENMgZmZzMB8GA1UdIwQYMBaAFJEwjnwHFwyn8QkoZTYaZxxodvRZMA0GCSqGSIb3
DQEBDQUAA4IBAQBziaI2p86poGkjd/4KkkOHG25nY/0eNARD6/oF0/sYonX2doiz
cGMk53riugAocCn5zbzhW/JVdYn30UxfyrZlRAzEf7GHqgB/NyjOad3pdpVYeDh4
ciNKjbs+aEoTWgAkoqENt1sRxlcvb7HVX524bKZa1oPTUNlm6QpivtqDIdqGJdGf
8L1zLfXBuo2zL3HR+M9CDr4Opq2JCkzP0Qhp7poIccGE6I9Tsg+RrOA9iCQsPn1+
Tg8YedjGzUWF07rNmT0TzPCVzUAuBlr+JJtzOKypyQ3eoZ6EPazXqMyHAVcsm0GI
364IOA0b8PSrJNtjh+AqJ5QfH+0e7NSzNnEmMYICADCCAfwCAQEwbDBVMQ0wCwYD
VQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzExMC8GA1UEAxMoU2FtcGxlIExB
TVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhvcml0eQITN0EFee11f0Kpolw69Phq
zpqp1zALBglghkgBZQMEAgGgaTAYBgkqhkiG9w0BCQMxCwYJKoZIhvcNAQcBMBwG
CSqGSIb3DQEJBTEPFw0yMTAyMjAxNTEwMDJaMC8GCSqGSIb3DQEJBDEiBCBARlG4
9zozFh95Jb3qN55AtQaDyR811KUu+Kt9v5+b9zANBgkqhkiG9w0BAQEFAASCAQAv
syHys6sl5UEThDVuQ8xBKoZOktYzIMuwy9TPtVJ0rX1vG4iXMBE+px8wWoyqlypv
KkM+bN307AfxMENsBsWfm9vEzPAC3WjgXl/6T5vhgxWb+Cb0Zn+uaYGkxa43vsS6
fUonAiKB2QTuG4LgHxD1lxsKOYvUx8DcNcS/I4y9Xw+rm74LTjyrGISWmq7qec+s
duAWjkLU5025Opkh86yjSI0L89x0XEqcKeKoxp4O7lxt3LZ6rHC3pr2zHhgGo3uc
xI/5nTWN98HT9N8w/jNkZSskHXbnCxNgLz/CFHXA41Qq0Wd7wrk9vdHammCjdc2U
4RtIRPzk8ehj5ko6LULT
```

C.3.2.2. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_baseline (+ Legacy Display), Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Subject: smime-signed-enc-hp-baseline-legacy
Message-ID: <smime-signed-enc-hp-baseline-legacy@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:10:02 -0500
User-Agent: Sample MUA Version 1.0
HP-Outer: Subject: [...]
HP-Outer:
 Message-ID: <smime-signed-enc-hp-baseline-legacy@example>
HP-Outer: From: Alice <alice@smime.example>
HP-Outer: To: Bob <bob@smime.example>
```

```
HP-Outer: Date: Sat, 20 Feb 2021 10:10:02 -0500
HP-Outer: User-Agent: Sample MUA Version 1.0
Content-Type: text/plain; charset="utf-8";
 hp-legacy-display="1"; hp="cipher"

Subject: smime-signed-enc-hp-baseline-legacy

This is the
smime-signed-enc-hp-baseline-legacy
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a text/plain
message. It uses the Header Protection scheme from RFC 9788 with
the ‘hcp_baseline‘ Header Confidentiality Policy with a "Legacy
Display" element.

--
Alice
alice@smime.example
```

C.3.3. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_shy

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a text/plain message. It uses the Header Protection scheme from RFC 9788 with the hcp_shy Header Confidentiality Policy.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 7760 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 4732 bytes
    └ (unwraps to)
    └── text/plain 320 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-hp-shy@example>
From: alice@smime.example
To: bob@smime.example
Date: Sat, 20 Feb 2021 15:12:02 +0000
User-Agent: Sample MUA Version 1.0

MIIWXAYJKoZIhvcNAQcDoIIWTTCCFkkCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBAC7eDC6qLlW6dni6TljfOJWAP5P9RzVjPRjs
gJJeEWxC4ddrf6UUR/HNSIEz0R+QFrbuzM45aZZdGpq8WEyRdhfho9R6hHdaDhbL
FWpH5K5KNWVaUbmZkzvhbXAS6/ac9p9prd+0D7lPZySQv7sL43jFS72bx1jTF7O4
Zfd+IoGg5mjroPVQBpP3K6oG/lOQydggNimBy5ISWRYtsHizfrFawjO7V6I8f7sa
eOf6jFB9t1SVbjNzuGSZ8R9hg3nVHjNsQ2x9YTHDzaJoMlvGwDFPOouo2MHEirAK
It62HCddq0tB6fGTUoxztrqPoNNTiZIN1Zb4eXp0JtpnXKMC5nQwggGEAgEAMGww
VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
HGLS64MvlsDXhpQwDQYJKoZIhvcNAQEBBQAEggEAWMK/5bj6qVYBipvgvm/QXOqT
7iH7R7z8RC0jlU/k/G2Vgcl+9Lk83z46Las0vnk7xgUJCwbFhw+hgd/rBZOuDJPt
Zhrx0G2rI0UaR8dH2YjitHPi12yNGWgxddaGAFD07GU5Sbi2Q/R1jDoVXuYRGIZW
EGoatToIrQLmfKMoF0d2EbSOI6ic+jHNUD0NSzstRdsoqIDKM0PWcb7ap+uNsi2h
eJemWXQ5xwQuMCDNxicYwCzV9TjfaiXZV2EaJjtgSB0YbTxSu3AlpYRIx+Ao1+58
TlK0bdv8EUqxb3ehR7B/yl5GoM7PtF1MbKF5m08JQCLUVULY41BLMEs6JTijijCC
```

```
Ey4GCSqGSIb3DQEHATAdBglghkgBZQMEAQIEEFcKhjcQbc7Lfa9Sm6HsEHOAghMA
Xv//vkE9RSpsfziFKfS2N/SASzpEdcNE1ByKrDHpehYSwXT3s/V+JqxyfxW0dBgR
hrdQ/dw74DBv/Yk/q5auISAwC3ChtX0sgA5p2oMNOcDw1z+ZtniVHSYoDRRq5fnj
lYLZ8yNrziZW2XF6gVLnsCE7mIjuCzliUXpSr3PSlVLTXRgqeXvrzEijprArIh8P
SyoZ4Kd8js+N85yl1Lrh+EERevf184tTeRTjVdP4c6G2b5yPIwPqABM7B4EP5DLR
AWaqEXr4g7xWkiuZLYjJVdTfh0I6oiKVKVoP7X8hMiOE0M4Sx9UG6FGUz7mvuraR
az3wcYWNKhf80XoLZM64on9t2700RT16NOPMi7Ik8nM/Soo9lPm7RxHGN0bzNba3
eVgBV6iDn5bZgMxwocdY/A2b/kM0WReApCXNhcKJo3O1qORrCaTIfKAMDX6lyUI5
bpE+3Bj+S7WYEblQvXs3iAcDqEtA6zLy/A8eCJdgy86i8QS2PKRb81+3496ogtRQ
a3cNoxBQ1nzxSOjnzgvIPi9wTSysSVbtSAZJxeGoDUk3T/pyTki9ODL4GsINGTew
WDUuEHNulCYyj7RN6cDU/IV3ucww4WWvxos/npcQar994ycE+qCob3FEd5GUmQ5t
ESNOrYoHkKhqlc/eNJs4HmICbJnqk3YbXYsa3y0QHYrCAMvtXW4zuwng6nh9tM5f
YseP0Az9tik1y9PWdRUfp1pZBPwYIN+RnDRsj3JGIjPy5Eu+vPyELGzSSm4iMD9f
7LUwuSQAchF2ffKJZNiTmT/HKXB8MIRnowdBfhLIyNy+hv8JX7B78ixpsvsjTsFD
DsqCOIV01Zf+/M/h7+RmV4tozT52KvU8jr1jOIo1PCBvp7QSj0L9M0u/M+2gXd0B
4kB9zNLlByy9zlalHiIEuu1LVZ4zmwx19RtzCB0sgeAquCDBta3Qg1/pMhL9jQRw
wEQTBgoH5Ibs819g/R6LKy7hHvl4Ea/a+b+LVT8Lz9/dCjY6orXgu/8ePcoiAKmY
MFPXLoSHnH9LF81O4UB/Lejo3M4VUFtZzZFs/bVQK8pmzx9bbOMFoKlM5LsgE+RJ
W/oeLsJfF3iVWnvHMVgDTZ6S7OlhfL6ZJtnziwkq3Ub3MjhlhgiuaS1dzihWXv+m
k/U8mMu7t7033YW999w9R8G2jpxU5Sp2GzEuAzzqfEL7eKnbRQJD93dOrwUmY6RY
HzUGJbfm56J8+Uc4GpGmgRqnx96aodf/McUB/NCLD5DVJ3aPvktHrhyB3M2V4jq4
RT/xXUvq+FLqK0nR3XwQicLcc1YREa3jbrf5zHJmcITdQTuZmgPXL2UAPzbdzm/e
sRK6o7b3TQIhwgyEWOAVrf91aDuBiOcw9/IaLDUOwy9moQJHb8g5HH1+XVhYwqfJ
pV0LNGSSxSu7abtgmmD02QC9mTXxh99lcE+z7SJXYjkNevf/SRzIyUIwtxD/Se0M
2LYYArUntyOQmBVzUREV9wkZXCR5cRYS9az+nBjUEmLL0CBcPPl/ar8m/qzoWm9s
Jnn1NQOVP7F8EVoUXyPDchk820ZVJ/WcLpGPoPWQlCfKbGwKOftL8DQPFnZssBeQ
cNxihr1y2iDFGib8vt9vr10hR0XP0zMruXz2CukMILTV1je+UPV1uh41YVKJOsS4
tFyWCvQXxfUZtCELQlaPu00FVvpzLqOmzRTd6os/zCGCo8lJ5VXeuQdEo9lPMebu
FygtuUJBh4WchNieVjoAafg3+51+IY5Ft5qpHUFBQOWQwskA2Ly4KGVKu9XFrUS0
rAPLk3CkPYxKA0AJlwdoc5CI3jE3IWWQf2DTFyQQzDE4/omkFCB3j7uIQVRYXD3I
lncWsYa+0Ih7r6kLdEWWXBHSAZcMCAwBNK8+7JYtb3tQj0aUaOid6OTO2R0ozwuG
9OAKLcYfI6z/z8ETf4UNQ2UxgoXGEmR2puKx+3+R1BZiIdk8VHbOZQDcW6qNEHdN
5Aq841xFokdjg0AGt3WmUPXI4at4gxLMDYdqK+KTl+JuBBjqaR2ctC6Lpd3VC9jw
io+WNCfLvvbhw2MtFmsOvGjBDUxnNkyhmNochTMsVv2IkxqJofjaGJ3cjFmU3Qi4
ARyuB6tFgtw5pMqw72Hci63gv8pRrmlyEIL6iOXhHvaqc/xzlPPrb5z/o9X3iv3N
etY4PhNF3FKaTmeFGPwGd9czdUUvBphb/zph+xzzA8rE1ItCHwNyv7JlX3veIlUj
dyeKEDqSp1CIx9+HqYhZkCE9XiRfp5UgGJ2uFKgiP3gKHHn1eeLotKASZbaz02fw
M9k5xIom9wHVHnnnPvTzOCI7iswvP7am7moWkMwAzmxEUhVyWTSCvE7Pdnp+XbNA
wcMSf4AzEIlXMSuX0C876naz6LBZDdMQAaSRRjDab3YilCrVEMj4BMDmniPJ/r7I
IBiNCtOJjSCr0IpTL9ASJqsBf/HbvQo5LVieTwVZUGZrCViT6LbLmT8/tBV3Y8Vw
9Y9LbombG3TXMWEgtylKxYDvJ2zOBx1pspXnsGzB2QKxduinTDb6N3PBWR8Yb1ul
lcWEyzx16n9g9DqNOpi8cmVrd5f5bBMOD8CnPK4mWKkvpoQ0IXlNIDOQpjDZGgPl
eYQBlnT0jOqJG1Om4X/qv+1yzTltsYnjWzER/teKsjGXUvMHzNwx6iFdU0KQ/JjV
A419ox0SIwS0N2/1ZgAosqw/N3oDuPEgfFYKsoCMFjn/WCX8LBdd3CsznKhvfsRN
qgNHEVGzQoVT70qWhnNb5F/8tGuQZ3aX2PirqT/S8+e4sPdgtO0e4AZrmCC02wmw
kWytPNtflN4GCmZmPJcAIqirm7ohaTdUSLfDKb2qBL/8OUFQqyL7loJnYnIEguLa
/tNLfWUamgZOEts4ebaa559S6UbINlhwKDpuvuoh+XgloNRfxtLsszAmQJUfC2GM
dWnOeKWMaIntPz5YucKa7nUYQHxzU93Ot9d15WhoqnEi4Fqgo15gJJq9AmODHDXr
+SsBc7mpuE/sJBCIrn9XIvU3QxXniAXx8agQHwaKc4YYXu1EB+pium01HqXtqcCG
iE9NDZRYTb3l5an7cPnC+674y3A3X6EIvFJAQ7yabMIXG7IZc+gdk4CwkG+XoG9R
5zSOjFGt+x6FaWLOs0AbcZtX7htR6R4fnB5thsJ0u5UOOjvj3Ub7cSF4I2Gqf2ul
HA19GZ5cC49or6jABUxQBhexoaI+ywQOXVRYcQ2CGrZkjy1yC/EmHOw+sAmrn95f
wWDdz6izTOOVNsazPzKTSuLV6R+alEjiLqh6AgsYSqzCRTum8dRRflS6KxA6gKAA
6c+XVZje9A2szgblxHFcs/FC3hs7veBPSbgCeA5nSHTk2LjmExQX5n6qsavHqUba
gi01+X0792Ji/dPMNi1UOdN1PJ/LIHPioNcG7oBmF+AjVE64fe8G7Rxpum8JebfT
sv1Pgq/aUsLb2adv/GlYe7vbuLQOyeUJFgcNHCEWxffh+wejHXilxxxZr5wjIkee
2+yK7sHFJoY0VT+dFFdg2MU11hjz5VhE9vQRcwF142XKJqI842xdCvjiAexGDWC8
BIqhNJDL85nJT6RddqoAylblR2AqmebZ78E1LVsfUJ2MBUcWH260Ky1oWp7RUdwz
rKwxbHjoadueEom2DhdBsCl+AiaOW2S6iq7bBffqZTFdM3OXsXsdy6nNaWSviOoX
DgXLK0Kq4uh6SRDl7tKFPoa7rIb0B5n7r82vWKYAcd6FcHTQGU2f/lXXnQuoycDM
HssIDRpSxzMB56ecSBQrApjWS/NXUpAunJr0zW4FNWQiEd143VTFJEg7tgk2/0ln
PG6fzKOiuJdqyCLXhxOsfy/64JAXbAIexyp9B++ZUq6pMZFewPpkqRH17L8EJ2NJ
62jYABnH4S1uiyY5rfTeY+Sz6gwlD+fshZSWFla6D6wqKBT83I7gpvhbGgzctRpB
Uycd/IRV9NGOzF8RjpPtNOYUKV4C6/5cTMnT1NKOJ7qvYdEQRSRLCDVDpd7Zlptw
FjtH5QEXqDA8w/B1UzdVKhvefN5ZQ33bs43/4A42USlEMFsPlntMQa5gibVLVaMj
fZofDE/NoQUUjC8zpqoHXrPnLvnmZQoijSrv08/HEfBBo7NlTQXNmAdfVbVv7L/w
```

```
MJziZBEE9ux2rTilRpINcNbGlTTMkaTZMkv9EbiHHQwbujiDjyQ8/3/rgmsigjKc
UpcUX8vL/R6BcRjau9v52ISAMIRuOv2yeiyUT5PyjUdbSABZ4ApgHPjkIusTtGzE
KNut5dmX+YsLQofapHwh84xvr0xBGfFNTpnEHnj+sIYjEiHVxWXbeFPnk/Arshq7
UjOu57IQwtaBl8tO020l7HRxYO+PnjH1qLrvWSYVa4FX7BErCdzQsGDXoBeHdcmM
sLiri6xgXET27TkSculjVYQKMZ6fTXhf+MJUYWlWatAgoW6YegwnfCw5zZgLdSxs
f79eYUy7eePwko6a8jgFucRHrWCjmpCiCarLTbpIeMGMqlIBMl5D1gKKDVmmwmS+
gM4n2XZ4dyrqzJMJHaSGX23gXq1S82rx2B9O82uWKOTrHAgUhDd5qfp63rGZJ/KX
RwfPdjHy4ITGCPsi9sVo/Gt40+PhaH/F+156N6+YlmZ4NemtfxWRotBRla3BObLA
CTw2+T+Nus171wJu3q0nW2aSfHrf8laYCnkKUMqQ4Ju7Yf3c12B8a0EXYamiAvD1
EijcTPQe9VexCXX8zSzK+A20dSxtAr9QhRAAao9ewV0oDbsO7G9dBGqjnAph3OLy
0DY0a9ylz1DwJWeSAZvsQYJ4dCGJloBXHHB8VWjkdKe675lF7eDcvaN882M1jqpb
edoV2QrdqKjITiw+jSMKalldsvM1f/WaIZ7CB+aqOmupKUdK75NJ0GiUBRB7L3zT
Ja9ryWZ05VVTVypRWPsD4m1wLS64GT0ZpSPNWa8FHeKYif3lVPoA6CpDvcL5AtEx
WpwsE4+rSGqMFFvk2MtJswUFVoJYKMxEVHDqYUz9c3Xati/wDDpmUuSeZ+V5yujj
BmWTLKH5jX8gCyhHDWZpRWStMxxIo8KHtcR/q9yf6Fgp3OcN188Tx4hVqDFbDeJo
iEqy27D1SK6zBtSRLaFeZ+t5E9degiG24xufCyXwg5o/Zoh9+J3opef4Hr9qfBk8
GVsg169pNQsvqeAyI4pwlqvNLzl/B72TyRk/O/PibKICikUI/UrOkSKsyNBCj8Ns
N6PN0+KxNIsoCuHdPc7MKnMU4W5d5lRES3SmQI2wKBiq++VO2zz7G5Toi+69YuXE
eTWn3a6+7MxG2NDsxu/YaR2ghqm+a7PN++WtpyLSw2rsdHRlTrOQ6FZBBuuLrR7z
Ll7pEtN4k2p43DURAWr3jQL9/iRdqYaBXMxdL3HKMiD4XTvaNw7vXs/rR77skc7h
lFbOvFIk8FahdGHaXY2/uJUuI/RA9dKD7IizDtuVel9n8gsxfPE68Pm7y2ZT9fBe
FXeoN1SnRCXwKPaBc/C+cErJbSx6/FOaWpraenLxA6bdKnA0dznNotzxZj1J5eky
SVakMlhLBDCiIZhWQsbdNQPCLWv41XQ3uSdNWgOvWCkX6jxfr0+kq2fF3Ecy4x0o
SU4QTi60lYKIpZmwS7vhyovQmR6h04KUFeagDDMQ31qxT0j+D95XHPRmTLflEpJS
VdOwWXajTs8hOe7dtzfaIqgetdqSqoRIfx+WO7BEux9bD+KIznUWnHsuyaNwfnXE
Ve8+EcR3I9TlBzfpAdXeK8xnWJOIOBrCxN55xhuZGOExt//vaaWXPZb+KP0mvN+G
aXrg1u3wQaEW5v4wai1URgFhCilXa3K+AyfYxSaBYCmKVUafF4tPOUkYUVjLGqLP
TwPIS+PHnZtVtbEjT7vKEbVDz1s8c1mWEAaxVbfxAt5qfI3hTTKvW3y6CyaBWlXM
lwmOFZSx0Q0ss7JKkYlTweuUygsnH4C0tj7tDHNxLDVkyDQoZEi3cgU9tl9xXu3L
A6T0OC2i1Zp82p1CJy8sg42WDjw8af1Xf+KnyzbuZ2GKmCf/5Z8AGn8FBs04SG0P
damoK80/butLsVv2z6HNEdNzkJNkQTQsDfWc0EuLkQTQbHGwtekMr9aRLLEEFkmS
eW+/OJwYC2hcuM2BjNY0oxVR868E3UXgr1evQ5IPsMAr6BlvSi5tFJfOkUuE44Ty
nX/7qhBcsx4ieWZtGO87PRwjdTIFEynhISWn+S5iu27xBVHslSk+8LVHxT5zEQR2
H+J5/ZEwKNN6vV0TfcJXCvGEgdaZSCP9mnLvwpGQL17cROU58KPVpHF/uaFFSmWd
cwHhSD56dLJFog0Kc0phn6Vf6FFJ7lgDVJHj/2igEqEzxJjrnCtaGM32tX6yvytq
CQwIInshpVWWsajcninsn3yCzDuQdiRTW5FnHqEqAi8k9LFDoF06QIvCHxWrg7Zd
oJQBOTOwY6Cl1c77GnYyjg==
```

C.3.3.1. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_shy, Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

MIINbAYJKoZIhvcNAQcCoIINXTCCDVkCAQExDTALBglghkgBZQMEAgEwggOVBgkq
hkiG9w0BBwGgggOGBIIDgk1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVRyYW5z
ZmVyLUVuY29kaW5nOiA3Yml0DQpTdWJqZWN0OiBzbWltZS1zaWduZWQtZW5jLWhw
LXNoeQ0KTWVzc2FnZS1JRDogPHNtaW1lLXNpZ25lZC1lbmMtaHAtc2h5QGV4YW1w
bGU+DQpGcm9tOiBBbGljZSA8YWxpY2VAc21pbWUuZXhhbXBsZT4NClRvOiBCb2Ig
PGJvYkBzbWltZS5leGFtcGxlPg0KRGF0ZTogU2F0LCAyMCBGZWIgMjAyMSAxMDox
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```

```
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```

C.3.3.2. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_shy, Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Subject: smime-signed-enc-hp-shy
Message-ID: <smime-signed-enc-hp-shy@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:12:02 -0500
```

```
User-Agent: Sample MUA Version 1.0
HP-Outer: Subject: [...]
HP-Outer: Message-ID: <smime-signed-enc-hp-shy@example>
HP-Outer: From: alice@smime.example
HP-Outer: To: bob@smime.example
HP-Outer: Date: Sat, 20 Feb 2021 15:12:02 +0000
HP-Outer: User-Agent: Sample MUA Version 1.0
Content-Type: text/plain; charset="utf-8"; hp="cipher"

This is the
smime-signed-enc-hp-shy
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a text/plain
message. It uses the Header Protection scheme from RFC 9788 with
the ‘hcp_shy‘ Header Confidentiality Policy.

--
Alice
alice@smime.example
```

C.3.4. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_shy (+ Legacy Display)

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a text/plain message. It uses the Header Protection scheme from RFC 9788 with the hcp_shy Header Confidentiality Policy with a "Legacy Display" element.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 8190 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 5050 bytes
    ┴ (unwraps to)
    └── text/plain 506 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-hp-shy-legacy@example>
From: alice@smime.example
To: bob@smime.example
Date: Sat, 20 Feb 2021 15:13:02 +0000
User-Agent: Sample MUA Version 1.0

MIIXnAYJKoZIhvcNAQcDoIIXjTCCF4kCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
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Boq0MA0GCSqGSIb3DQEBAQUABIIBACAU9OH5PSuN9tLWwz3pZCIjfuhDPvElwIWM
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```

```
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```

```
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smdYByOOxrQ11yeBNb1yV5/ehfRdAY2dRhOgv9ZQtutFdLopZAai7MZkh63P8PSy
PvBVlpXrx1ZxCRuBeafxJfU+rWSS2x2Bep3rDKtdBLM/816NUvMprDeR75QiESZu
byynANxocATJEkPOh2uGQ1RMlBlFz8dFLgVIRQ7MloIEiEyzdkta2XDKZ67X0F6u
warivnsUCeT/h9SeIg3C3tpxgBpb9NppMY+UVb46HB7XpzjHQObDAwC3VEizrKVm
a/6SynuNH5n/zNU0/MSY5M3GQL4xSfXq8AEId5UhuPiFwmD+sQ+G4VVm7d2HbXbL
9D/NkDep0zvdqbnB1ygTnlnRf/Nl5uFsdu+/1iKOMP5guzqCj0bKh+52lQTBHPDO
nZVM6Xvr+hWZPEZ7auSUqgeBR3DBXiwvRL5sxNysL6wRu/TXVV1ZIew+EiJJ9uZa
f0f+vvd6CeF72Syt7ceE5vs0i7M7z7dHMxiBsskpgQbx/AtTxGQyMU3Ki4DtmmnJ
gYBnIR7n6Ywu33dIeivQwZVywdnwHo6/SujaAX0bEBcPAlQqczLouNtFB+OKbdQt
jG8wMLs8eV/cdGiniwDXtSTp4VZw8lQNIdiGtgWAt/k11zFfn7A/YF0QfC8e1k9s
oLhZTic6SY33HLDJX5/Iq2b3Iw6ijzH8kkgTRCdtoJx+EqRIiV6ybT040cRgVCKp
FSZyuTeJXKDGWFDpbhz/PD4Np+dzp0tVUWw0M8pFy3erWmKPqu5Q4lbwinZPwtUD
PpP8CBKRWXanaqy558CIyJKzhkgGXR2z6OrOXSQtVDbcbQtxixdjV9lGP2qP25t8
PCsHvbNGSvBlmIUWPFn4iQ9T7wnDMtxPDzBb0k6KXWi1IxxC97pfFwt7kVjGT7St
6amDshEfCqLLcwCN6Aa3lKfP58FewuEoHoG5xFaT1+lOW/U6n9F6T2+CUM/3YOxN
kq1oI9e2dCDvz9ND813U9YS8HGHqGQqjSQteWt49xRXqvMi7gurrNz6i2feOmCvI
GMIsnp2rCDyIfmadJam0ElyYnSHbL+PyjhMt8883j+N3m5IKUfA1wo3KbI2zWa2w
mP6rImkJ2WemM2Z5gIQWJ1DOKt3M9fUxwcoX8W8XEXiRVJgOTp00xn+fqXqItZDJ
qkdgt7h7bVnhQbV6fvOCSSwU1ta+bjVGFgHPE1C6+Z6UrHQwn3iM9ZE7A+ytZz2D
CikVVFZANawbp9M5mM7PVPEY69n3WQ3VqpB0rZbCYFgNB0IyUu2yg06sH2wrKYE4
pfMbmLOUyFTbfs8ChQiOVcmtZHux/wOL52MGFyBJkupHwhZ1bBSjZocuXx7pxe5L
5EFMWtj6IQvQtE6XB7Nm5xcKty9EW/eIkd1aUXXRnzRKOZb7eWnRnqe21iVwL3el
R26HfqfCDntOCSSkYdOmeOu/mD4oZoqT/PRcR5i9b6jQUtZyfmbFBG7ZdIuavn5a
orjJCN2i02T7v2zN0aYTnMX+3fue/Ekgdvw7EfuBp73JaySDVByciSQkzDyJnWEb
fw5dEF/Zxl7KhnMud0ZIOZkdaAWyF36jVUgj2znIA2cjVqd9P+CfH9YI6vXPefgE
rWUbg1ijrufE26Yd40Hj7hMVXdeIwDuhZe8AdSmovaqK06N0eBRiyCzznmmaO9ae
VVdLoHyY5l/95Pc4cOZoeFWJ83agzcOrtSHWgAkVsycW9xg+g/oHBu3VoA8rlcs8
Djv73l84caZKdwiQ9sHvsvBBMIT5Ozz9uts+STb4e/h3ElAAkddL7eFowqlVOGIN
X3zSdDv1sT4D82oAeMDxeCAxG18Bn03Vd8dt/zA8FxVluUuLmcBHVVgy6pPqdiit
buR6Saa08RusmygTIjzbc10ZUD/bLB7YlCWS6mWwriviXBg2ThitwQJL3vXfEWHF
mHiGR5uc8dVhU9CmzqwQiiFFA9WOE8wgOudV419m6RbmW3grmVC8xskOYK7EzX7s
Mhv6dvIIY6in5dYp6hEcQYOsdxekSlltHUVIaijO+z9zxORP4XA2tkyU0ndXuWkg
kivonLqcBXiaO7nICbpwLKDK/N1JE+nKZLUZg51OXig3obIe5C6oALyC5o56zw9q
5opiXEKZBhjcEBdzTfBeYRE60zfqbacTyDS9wBzHo/84wY7fhNQsR3Y8t8bZZJcA
STWQVzhjszD1i+WRnJJO9fc9htipj7I7Sec9nMvrWh+sCeF1/QY+rEqbhQWajyUi
NTnIwHeuYIqtP8xi0vxqmBFe/t/WPrd+r53YOlObp6lJWPk8bnxA+5v76gjHAIHt
utp3kvykjCbJizw0WFU6du/jgCXzaYFWK88smgM1xAJ9dXUkkMekx/kJwUr/5Dfd
eWMKT42eG/JxFMeauuRsOwMIxAuj+AJU3IHej9oYBZWuEMqid5ZvL05ZYO7IaDoO
O/pfhG0YQ1mE8mCwlvqggUYfgVnfxBpAi5yikLMkTKP1YmKqfdDC3PvpDrqlp9Pc
rSMAnsydjO3K3JGoFDvv4RxCuIhn65Lqz1s9YepmHNfFlAZxEPhC5MJlwIXAT3VV
imEMYLUHbb4HsqWX/KR/FuZO0zpHGZhPIdtiS6TdiRm4D9ywPfV7J36zDVFEP6mm
kE7FrgI4Wo5aizOFA4GZFXN6h9IlsFiV9izXUoMjFJwR6Kp/QF1ikD0Pf/aPiUqu
```

C.3.4.1. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_shy (+ Legacy Display), Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

MIIOVAYJKoZIhvcNAQcCoIIORTCCDkECAQExDTALBglghkgBZQMEAgEwggR9Bgkq
hkiG9w0BBwGgggRuBIIEak1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVRyYW5z
ZmVyLUVuY29kaW5nOiA3Yml0DQpTdWJqZWN0OiBzbWltZS1zaWduZWQtZW5jLWhw
LXNoeS1sZWdhY3kNCk1lc3NhZ2UtSUQ6IDxzbWltZS1zaWduZWQtZW5jLWhwLXNo
eS1sZWdhY3lAZXhhbXBsZT4NCkZyb206IEFsaWNlIDxhbGljZUBzbWltZS5leGFt
cGxlPg0KVG86IEJvYiA8Ym9iQHNtaW1lLmV4YW1wbGU+DQpEYXRlOiBTYXQsIDIw
IEZlYiAyMDIxIDEwOjEzOjAyIC0wNTAwDQpVc2VyLUFnZW50OiBTVVB
IFZlcnNpb24gMS4wDQpIUC1PdXRlcjogU3ViamVjdDogWy4uLl0NCkhQLU91dGVy
OiBNZXNzYWdlLUlEOiA8c21pbWUtc2lnbmVkLWVuYy1ocC1zaHktbGVnYWN5QGV4
YW1wbGU+DQpIUC1PdXRlcjogRnJvbTogYWxpY2VAc21pbWUuZXhhbXBsZQ0KSFAt
T3V0ZXI6IFRvOiBib2JAc21pbWUuZXhhbXBsZQ0KSFAtT3V0ZXI6IERhdGU6IFNh
```

dCwgMjAgRmViIDIwMjEgMTU6MTM6MDIgKzAwMDANCkhQLU91dGVyOiBVc2VyLUFn
ZW50OiBTYW1wbGUgTVVBIFZlcnNpb24gMS4wDQpDb250ZW50LVR5cGU6IHRleHQv
cGxhaW47IGNoYXJzZXQ9InV0Zi04IjsNCiBocC1sZWdhY3ktZGlzcGxheT0iMSI7
IGhwPSJjaXBoZXIiDQoNClN1YmplY3Q6IHNtaW1lLXNpZ25lZC1lbmMtaHAtc2h5
LWxlZ2FjeQ0KRnJvbTogQWxpY2UgPGFsaWNlQHNtaW1lLmV4YW1wbGU+DQpUbzog
Qm9iIDxib2JAc21pbWUuZXhhbXBsZT4NCkRhdGU6IFNhdCwgMjAgRmViIDIwMjEg
MTA6MTM6MDIgLTA1MDANCg0KVGhpcyBpcyB0aGUNCnNtaW1lLXNpZ25lZC1lbmMt
aHAtc2h5LWxlZ2FjeQ0KbWVzc2FnZS4NCg0KVGhpcyBpcyBhIHNpZ25lZC1hbmQt
ZW5jcnlwdGVkIFMvTUlNRSBtZXNzYWdlIHVzaW5nIFBLQ1MjNw0KZW52ZWxvcGVk
RGF0YSBhcm91bmQgc2lnbmVkRGF0YS4gIFRoZSBwYXlsb2FkIGlzIGEgdGV4dC9w
bGFpbg0KbWVzc2FnZS4gSXQgdXNlcyB0aGUgSGVhZGVyIFByb3RlY3Rpb24gc2No
ZW1lIGZyb20gUkZDIDk3ODggd2l0aA0KdGhlIGBoY3Bfc2h5YCBIZWFkZXIgQ29u
ZmlkZW50aWFsaXR5IFBvbGljeSB3aXRoIGEgIkxlZ2FjeQ0KRGlzcGxheSIgZWxl
bWVudC4NCg0KLS0gDQpBbGljZQ0KYWxpY2VAc21pbWUuZXhhbXBsZQ0KoII HpjCC
A88wggK3oAMCAQICEw8tJb0ROZdKzkJUh6HuPTQGirQwDQYJKoZIhvcNAQENBQAw
VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkwIBcNMTkxMTIw
MDY1NDE4WhgPMjA1MjA5MjcwNjU0MThaMDsxDTALBgNVBAoTBElFVEYxETAPBgNV
BAsTCExBTVBTIFdHMRcwFQYDVQQDEw5BbGljZSBMb3ZlbGFjZTCCASIwDQYJKoZI
hvcNAQEBBQADggEPADCCAQoCggEBAJqVKfqLwaLjj+gBUCfkacKTg8cc2OtJ9ZSe
d6U3jUoiZVpMLcP3MUKtLeLg9r1mAfIDlB/wlbdmadXPmrszyidmbuZmOpB5voVQ
fiLYYy3iOx7YOqzXrl6udP07k0sV+UdSNRFxrfKeoQEFXgOaGdmnx4OG/e3p1fIK
M0dPzZLoOAJF5m5O0xzXPL74zFCWp2f1ZkuE4A6l41koaZXCN5XL7wWTLMLeNf9B
yb5ksKqUuqEHAMd1nmoNMgjY9VfVfcrv9w43GG8FtpSX+TWzB2zNS2OF+XIVnzRG
5DeoULq8v88Z5bLpIJ/nx26r8A4SSwIBaVv4wPxAf1iPsIVKarUCAwEAAaOBrzCB
rDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQMA4wDAYKYIZIAWUDAgEwATAeBgNVHREE
FzAVgRNhbGljZUBzbWltZS5leGFtcGxlMBMGA1UdJQQMMAoGCCsGAQUFBwMEMA4G
A1UdDwEB/wQEAwIFIDAdBgNVHQ4EFgQUolNB1UQ8gCkVfAEj8OeOr83zdw8wHwYD
VR0jBBgwFoAUkTCOfAcXDKfxCShlNhpnHGh29FkwDQYJKoZIhvcNAQENBQADggEB
AIFJeKCcsTKcFqQMpTryujRGzJdYA+R9eBAuDLsatbtKtl4FzkgRyOg31/+Cw7H8
e30iLrPIFlWN1qjHrjgOyIs5AQ/hgxLvLir3hEUV2Z3MRsMtjH2x9SG91PEM046g
fPnc9gMGHjMTg1qvaKcLQP5UzpEYPLror2X4P5uXxaP0LIZRzWmkw1RF7FOD7PfB
5v94M5274XYxW2W4uKGd7QGnUZROSvSYkGiWDp1JhqXwfDz8A0enITGXnoEkAFvv
jiCqh64P1hIeMorj36pgL19oWZD6YrzSWHUz1F00juyuOfQsqm6hvrDTqNpHNZ01
5fOURza1SkCvi9GFmNUPoVgwggPPMIICt6ADAgECAhM3QQV57XV/QqmiXDr0+GrO
mqnXMA0GCSqGSIb3DQEBDQUAMFUxDTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExB
TVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMgUlNBIENlcnRpZmljYXRpb24g
QXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQxOFoYDzIwNTIwOTI3MDY1NDE4WjA7MQ0w
CwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzEXMBUGA1UEAxMOQWxpY2Ug
TG92ZWxhY2UwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEKAoIBAQC09InoWDgW
Pk2af0+StijSNOR8K/hN8D+l078oullsk4ASvSwjsCNo7sHUa4xQUl5JO6VqY18L
ANwORjrc9BaX4MguzsbFXBe6uFh1mVpXmFxSpUByQ+950MFz/evPgP96wV+z4TtA
wW2Z34rTiz4DxMI07XYNFUEOls/gkUP2GxzymsO2kaYWTut3SryCqeHEFbZFkB4u
rMk4xrIJC3CzWruS2Q0FHbBlfkgKN5wXVgkWFfiOucfCn+IQsaqpo1d3f9jSkbtA
V5w3vzfog8919MxKI9H6l4KuElnAtJ7BtZcsl7dUy9u9COgEykRiVokFQgqQ7XND
U+r3SeOWwks7AgMBAAGjga8wgawwDAYDVR0TAQH/BAIwADAXBgNVHSAEEDAOMAwG
CmCGSAFlAwIBMAEwHgYDVR0RBBcwFYETYWxpY2VAc21pbWUuZXhhbXBsZTATBgNV
HSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8BAf8EBAMCBsAwHQYDVR0OBBYEFLv2zLIt
HQYSHJeuKWqQENMgZmZzMB8GA1UdIwQYMBaAFJEwjnwHFwyn8QkoZTYaZxxodvRZ
MA0GCSqGSIb3DQEBDQUAA4IBAQBziaI2p86poGkjd/4KkkOHG25nY/0eNARD6/oF
0/sYonX2doizcGMk53riugAocCn5zbzhW/JVdYn30UxfyrZlRAzEf7GHqgB/NyjO
ad3pdpVYeDh4ciNKjbs+aEoTWgAkoqENt1sRxlcvb7HVX524bKZa1oPTUNlm6Qpi
vtqDIdqGJdGf8L1zLfXBuo2zL3HR+M9CDr4Opq2JCkzP0Qhp7poIccGE6I9Tsg+R
rOA9iCQsPn1+Tg8YedjGzUWF07rNmT0TzPCVzUAuBlr+JJtzOKypyQ3eoZ6EPazX
qMyHAVcsm0GI364IOA0b8PSrJNtjh+AqJ5QfH+0e7NSzNnEmMYICADCCAfwCAQEw
bDBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzExMC8GA1UEAxMo
U2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhvcml0eQITN0EFee11
f0Kpolw69Phqzpqp1zALBglghkgBZQMEAgGgaTAYBgkqhkiG9w0BCQMxCwYJKoZI
hvcNAQcBMBwGCSqGSIb3DQEJBTEPFw0yMTAyMjAxNTEzMDJaMC8GCSqGSIb3DQEJ
BDEiBCCSH/VshGTecXJjFa7ucaLu5N5h+XWZDoRRFzjPTfPjqTANBgkqhkiG9w0B
AQEFAASCAQCmZj3YztDO1jbNLEaAm/3QumEiuQzGfQctHOakbQxvEdazDFQuz4XY
tnXnadpjedB8CrzjKdgP8A3ls1mzTSrobnZ4hEd9uhuMDgVRUXaEy+0rx+XCfBek
2fvCIwuVDT5dZ5k2X95CTtcAhBu4VcXo/WJEiPKAu1/p+iZtRiZeV4jZQBfquGT9
sVqKEXkhfyAjl8pynl3yOMoX3AEnPOuFhEDm5Sx383zfzF9jvoaK5wOne/PzZ559
tzHJBnv+nQN7UpC4O6LCCIyjzI+hoEV+GP0m0LpClvUcRaplG5vgwshhHJRyjeOt
veiRr2vhYuXwo3pR+NzQGx3eaqOnksSP

C.3.4.2. S/MIME Signed-and-Encrypted over a Simple Message, Header Protection with hcp_shy (+ Legacy Display), Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Subject: smime-signed-enc-hp-shy-legacy
Message-ID: <smime-signed-enc-hp-shy-legacy@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:13:02 -0500
User-Agent: Sample MUA Version 1.0
HP-Outer: Subject: [...]
HP-Outer: Message-ID: <smime-signed-enc-hp-shy-legacy@example>
HP-Outer: From: alice@smime.example
HP-Outer: To: bob@smime.example
HP-Outer: Date: Sat, 20 Feb 2021 15:13:02 +0000
HP-Outer: User-Agent: Sample MUA Version 1.0
Content-Type: text/plain; charset="utf-8";
 hp-legacy-display="1"; hp="cipher"

Subject: smime-signed-enc-hp-shy-legacy
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:13:02 -0500

This is the
smime-signed-enc-hp-shy-legacy
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a text/plain
message. It uses the Header Protection scheme from RFC 9788 with
the ‘hcp_shy‘ Header Confidentiality Policy with a "Legacy
Display" element.

--
Alice
alice@smime.example
```

C.3.5. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header Protection with hcp_baseline

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a text/plain message. It uses the Header Protection scheme from RFC 9788 with the hcp_baseline Header Confidentiality Policy.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 8300 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 5136 bytes
    └ (unwraps to)
     └── text/plain 336 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-hp-baseline-reply@example>
```

From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:15:02 -0500
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-hp-baseline@example>
References: <smime-signed-enc-hp-baseline@example>

MIIX7AYJKoZIhvcNAQcDoIIX3TCCF9kCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBACsFMztj9S2Us6fsAlVzAPVWpbjptMkEGnAZ
b+17E/dDNLBf1K4WiN2WVycsvg58WSEIUfRBxZ6BHePpS3+4Tg4PlmzBV41gGZuO
4eXWbrkGAwBOsckyRgpDLTmRpnN4lczjVx4gSfkEOXeDTU5FCoed4i1jnIHdP1Uw
v7WWq/SnDrwVfBZZKya0RPn58V299JxTjDKL1VKsCK5NV+weQo16deS9d3deg48n
dv/C9Gme0jUoOUilZCngEytRsGhJSoummFm2sieZ+ypP1zl8uZUHfnJXPqPiK2Sn
Ji3nypkjx1BJXO8M3wsaifNGmk/Rj9mz8mXWkAL2RrhP7ViISsswggGEAgEAMGww
VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
HGLS64MvlsDXhpQwDQYJKoZIhvcNAQEBBQAEggEAf7w9j/+bUK8AFDQHC69/A/xG
/IygoRihTfsSINKsaezVLHmVvJXqOiPDavHRvHLMQNE0lqLy5edKD9tndyLCkOTy
xa8kQWwzxfRJHBq++paJMNTgdSLWpSMVxxPO7FghXbJoHPRq5T1m4q6V0Hjixfeq
lvtnWcGTFhwDiW09beFZhZInMGJOmRcgqHjToye2RkN8Vna0ySczcoWl5yFqW61J
bW1bHVun8Rn8OyEtw6XDDbnUgiVB3MYa5daDcVUe09npf+04M3gPQrDe27SBbmFm
LD3KfuLs8Be4TBRVaNkiruULjidQ0akI4gEaSpAX3y+ALHPDFH4UbwQrr7wdizCC
FL4GCSqGSIb3DQEHATAdBglghkgBZQMEAQIEEGKhwDGWZa/xZkxt86e1AK2AghSQ
hTHm2t4nNf1Tgo2kzG18BqDLWQNlUJVQdHShktmLMyXbJ3/qgZIm7wnh+lZecrR2
aJ8yXfgWs8Po3atCKApsxA6eqUJN72NsrLIKiLSASXbsQHbRCtr+uJcs3M4z607H
UHpLSej8FRWJ7iRY1d4wJM5K0TKS+VzbMgo6MzSnhlZKZtqOokDCVgfg7t0fZKEd
mD7fn4qCeMCw3nkorWSBHnTkxaPC2vjPAMaFbxuRgbdEtEOK1DEvn4k1q0ig961i
2b31Ne0VDTFyJLna+3a466wj4I9nnwaQsH/F3p5GAJl1tVBLQXi4VVYrDsn4Xiza
gJMNmNBD4wXm2jKq7oT8KFTWy9vt9noH2qBgXYBvEkT0GDVx3gC5wCZ1YzUzUVS8
X0fA4xsz3nb+YpP2ir6fXPOt7JvyRHV1LA9Gf18cQO9izQR4IebBu05xnn+XAp8/
p7aFpcIJgJtrgUeE96cvO59lGCNb4pIgYTYYZaHyb7xNwbTWqGVhC+DQgNB8xiUT
/jS6QmOvXUMjSWULEaAeMGlB2NdxBPW2tyZxBpAhlOwn1k0yPgxYBa0r0EVoK7o9
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```

C.3.5.1. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header Protection with hcp_baseline, Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

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kkOHG25nY/0eNARD6/oF0/sYonX2doizcGMk53riugAocCn5zbzhW/JVdYn30Uxf
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X524bKZa1oPTUNlm6QpivtqDIdqGJdGf8L1zLfXBuo2zL3HR+M9CDr4Opq2JCkzP
0Qhp7poIccGE6I9Tsg+RrOA9iCQsPn1+Tg8YedjGzUWF07rNmT0TzPCVzUAuBlr+
JJtzOKypyQ3eoZ6EPazXqMyHAVcsm0GI364IOA0b8PSrJNtjh+AqJ5QfH+0e7NSz
NnEmMYICADCCAfwCAQEwbDBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1Q
UyBXRzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1
dGhvcml0eQITN0EFee11f0Kpolw69Phqzpqp1zALBglghkgBZQMEAgGgaTAYBgkq
hkiG9w0BCQMxCwYJKoZIhvcNAQcBMBwGCSqGSIb3DQEJBTEPFw0yMTAyMjAxNTE1
MDJaMC8GCSqGSIb3DQEJBDEiBCAn/5Euey54zEPMTWTi6D1FzMPXZyPmKLehwiHU
u97UIzANBgkqhkiG9w0BAQEFAASCAQCldWAb1Y3QmHJaNLnrFOVTdBYsVLQoKmle
oajirYCQ8fv1D9dknCPl2tRdshOMtV+c7sR4wW6XNQNBdbLh/+zw9aV32quYp1m5
LmvWZJnmbVCuFqZwG/frYlk46SXkggJZCFNuTKRNiBMERuYtyROlQUX3VlchX3NX
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VCjMvXymn4aygpSkiZT35CjFhZmAoEaFUilfl354sl21RjXMZZ/2fLho2SzWXCR4
qwji+i7VzeP6sQ1Jyt4vpv4R2p9stcSEUpFMRQhqNfHiJd0kZLYo
```

C.3.5.2. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header Protection with hcp_baseline, Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Subject: smime-signed-enc-hp-baseline-reply
Message-ID: <smime-signed-enc-hp-baseline-reply@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:15:02 -0500
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-hp-baseline@example>
References: <smime-signed-enc-hp-baseline@example>
HP-Outer: Subject: [...]
HP-Outer:
 Message-ID: <smime-signed-enc-hp-baseline-reply@example>
HP-Outer: From: Alice <alice@smime.example>
HP-Outer: To: Bob <bob@smime.example>
HP-Outer: Date: Sat, 20 Feb 2021 10:15:02 -0500
HP-Outer: User-Agent: Sample MUA Version 1.0
HP-Outer: In-Reply-To: <smime-signed-enc-hp-baseline@example>
HP-Outer: References: <smime-signed-enc-hp-baseline@example>
Content-Type: text/plain; charset="utf-8"; hp="cipher"

This is the
smime-signed-enc-hp-baseline-reply
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a text/plain
message. It uses the Header Protection scheme from RFC 9788 with
the ‘hcp_baseline‘ Header Confidentiality Policy.

--
Alice
alice@smime.example
```

C.3.6. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header

Protection with hcp_baseline (+ Legacy Display)

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a text/plain message. It uses the Header Protection scheme from RFC 9788 with the hcp_baseline Header Confidentiality Policy with a "Legacy Display" element.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 8625 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 5376 bytes
  ┴  (unwraps to)
   └── text/plain 430 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-hp-baseline-legacy-reply@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:16:02 -0500
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-hp-baseline-legacy@example>
References: <smime-signed-enc-hp-baseline-legacy@example>

MIIY3AYJKoZIhvcNAQcDoIIYzTCCGMkCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBABcSvh6m3bqMqug7JtspPDcpNnbUKLh0maZf
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eDNEsIoFnkJJHiOW+TI6ecod4Gdyku4qQKjULEzI35mhJhbofl/IrffWdG8CAdgf
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RfDkeAWxLf3A3P1aK8gBxVGEO3hFyWjmdw+hOJoK/AEk+0q2ctSfyc0bmkz8TiHR
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```

```
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GjWlJuHSy23yzQ3x8kaZLkw0tNWVOtWzlHdjBq5TXOGU/IBjOfRbnsSxC8btiIFS
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8dvr2dAYkITswQNQtSO7FJlvp3ugNNW33BJs2LGmaLhvosBh0YngJx10fr7Fbkyb
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```

```
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ygZqKCwHiR8wvDjppzTiuvQegN/K6MIwjgKRcfoPmBxI4KryoKK83Xs7rA+z6spK
zJpUtlGSV24ooyVcWy03RQ85Gc/HMMwP+zOg37J/YZASBpqjvlSWxDaK8ZzR+dEJ
1EAhJ3uCRenTRURzMyrysBdLayLFW+gHUDFC5F+INKPGMertJqtYdfOs0tqG2uPU
JX8U3mubey4B4G3j58ok7ZBD4rOll+h/8Z2Nahs8udVMMfSB0xx8bmf7rwaJKf/K
yg/AjedixIkUNA5CfMErF/h1EV+zEux7jyQGdVQ7xJI=
```

C.3.6.1. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header Protection with hcp_baseline (+ Legacy Display), Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

MIIPPwYJKoZIhvcNAQcCoIIPMDCCDywCAQExDTALBglghkgBZQMEAgEwggVoBgkq
hkiG9w0BBwGgggVZBIIFVU1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVRyYW5z
ZmVyLUVuY29kaW5nOiA3Yml0DQpTdWJqZWN0OiBzbWltZS1zaWduZWQtZW5jLWhw
LWJhc2VsaW5lLWxlZ2FjeS1yZXBseQ0KTWVzc2FnZS1JRDogPHNtaW1lLXNpZ25l
ZC1lbmMtaHAtYmFzZWxpbmUtbGVnYWN5LXJlcGx5QGV4YW1wbGU+DQpGcm9tOiBB
bGljZSA8YWxpY2VAc21pbWUuZXhhbXBsZT4NClRvOiBCb2IgPGJvYkBzbWltZS5l
eGFtcGxlPg0KRGF0ZTogU2F0LCAyMCBGZWIgMjAyMSAxMDoxNjowMiAtMDUwMA0K
VXNlci1BZ2VudDogU2FtcGxlIE1VQSBWZXJzaW9uIDEuMA0KSW4tUmVwbHktVG86
IDxzbWltZS1zaWduZWQtZW5jLWhwLWJhc2VsaW5lLWxlZ2FjeUBleGFtcGxlPg0K
UmVmZXJlbmNlczogPHNtaW1lLXNpZ25lZC1lbmMtaHAtYmFzZWxpbmUtbGVnYWN5
QGV4YW1wbGU+DQpIUC1PdXRlcjogU3ViamVjdDogWy4uLl0NCkhQLU91dGVyOg0K
IE1lc3NhZ2UtSUQ6IDxzbWltZS1zaWduZWQtZW5jLWhwLWJhc2VsaW5lLWxlZ2Fj
eS1yZXBseUBleGFtcGxlPg0KSFAtT3V0ZXI6IEZyb206IEFsaWNlIDxhbGljZUBz
bWltZS5leGFtcGxlPg0KSFAtT3V0ZXI6IFRvOiBCb2IgPGJvYkBzbWltZS5leGFt
cGxlPg0KSFAtT3V0ZXI6IERhdGU6IFNhdCwgMjAgRmViIDIwMjEgMTA6MTY6MDIg
LTA1MDANCkhQLU91dGVyOiBVc2VyLUFnZW50OiBTVVBIFZlcnNpb24g
MS4wDQpIUC1PdXRlcjoNCiBJbi1SZXBseS1UbzogPHNtaW1lLXNpZ25lZC1lbmMt
aHAtYmFzZWxpbmUtbGVnYWN5QGV4YW1wbGU+DQpIUC1PdXRlcjoNCiBSZWZlcmVu
Y2VzOiA8c21pbWUtc2lnbmVkLWVuYy1ocC1iYXNlbGluZS1sZWdhY3lAZXhhbXBs
ZT4NCkNvbnRlbnQtVHlwZTogdGV4dC9wbGFpbjsgY2hhcnNldD0idXRmLTgiOw0K
IGhwLWxlZ2FjeS1kaXNwbGF5PSIxIjsgaHA9ImNpcGhlciINCg0KU3ViamVjdDog
c21pbWUtc2lnbmVkLWVuYy1ocC1iYXNlbGluZS1sZWdhY3ktcmVwbHkNCg0KVGhp
cyBpcyB0aGUNCnNtaW1lLXNpZ25lZC1lbmMtaHAtYmFzZWxpbmUtbGVnYWN5LXJl
cGx5DQptZXNzYWdlLg0KDQpUaGlzIGlzIGEgc2lnbmVkLWFuZC1lbmNyeXB0ZWQg
```

```
Uy9NSU1FIG1lc3NhZ2UgdXNpbmcgUEtDUyM3DQplbnZlbG9wZWREYXRhIGFyb3Vu
ZCBzaWduZWREYXRhLiAgVGhlIHBheWxvYWQgaXMgYSB0ZXh0L3BsYWluDQptZXNz
YWdlLiBJdCB1c2VzIHRoZSBIZWFkZXIgUHJvdGVjdGlvbiBzY2hlbWUgZnJvbSBS
RkMgOTc4OCB3aXRoDQp0aGUgYGhjcF9iYXNlbGluZWAgSGVhZGVyIENvbmZpZGVu
dGlhbGl0eSBQb2xpY3kgd2l0aCBhICJMZWdhY3kNCkRpc3BsYXkiIGVsZW1lbnQu
DQoNCi0tIA0KQWxpY2UNCmFsaWNlQHNtaW1lLmV4YW1wbGUNCqCCB6YwggPPMIIC
t6ADAgECAhMPLSW9ETmXSs5CVIeh7j00Boq0MA0GCSqGSIb3DQEBDQUAMFUxDTAL
BgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUg
TEFNUFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQx
OFoYDzIwNTIwOTI3MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhM
QU1QUyBXRzEXMBUGA1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEB
AQUAA4IBDwAwggEKAoIBAQCalSn6i8Gi44/oAVAn5GnCk4PHHNjrSfWUnnelN41K
ImVaTC3D9zFCrS3i4Pa9ZgHyA5Qf8JW3ZmnVz5q7M8onZm7mZjqQeb6FUH4i2GMt
4jse2Dqs165ernT9O5NLFflHUjURca3ynqEBBV4DmhnZp8eDhv3t6dXyCjNHT82S
6DgCReZuTtMc1zy++MxQlqdn9WZLhOAOpeNZKGmVwjeVy+8FkyzC3jX/Qcm+ZLCq
lLqhBwDHdZ5qDTII2PVX1X3K7/cONxhvBbaUl/k1swdszUtjhflyFZ80RuQ3qFC6
vL/PGeWy6SCf58duq/AOEksCAWlb+MD8QH9Yj7CFSmq1AgMBAAGjga8wgawwDAYD
VR0TAQH/BAIwADAXBgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYET
YWxpY2VAc21pbWUuZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8B
Af8EBAMCBSAwHQYDVR0OBBYEFKJTQdVEPIApFXwBI/Dnjq/N83cPMB8GA1UdIwQY
MBaAFJEwjnwHFwyn8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQCBSXig
nLEynBakDKU68ro0RsyXWAPkfXgQLgy7GrW7SrZeBc5IEcjoN9f/gsOx/Ht9Ii6z
yBZVjdaox644DsiLOQEP4YMS7y4q94RFFdmdzEbDLYx9sfUhvdTxDNOOoHz53PYD
Bh4zE4Nar2inC0D+VM6RGDy66K9l+D+bl8Wj9CyGUc1ppMNURexTg+z3web/eDOd
u+F2MVtluLihne0Bp1GUTkr0mJBolg6dSYal8Hw8/ANHpyExl56BJABb744gqoeu
D9YSHjKK49+qYC9faFmQ+mK80lh1M9RdNI7srjn0LKpuob6w06jaRzWdNeXzlEc2
tUpAr4vRhZjVD6FYMIIDzzCCAregAwIBAgITN0EFee11f0Kpolw69Phqzpqp1zAN
BgkqhkiG9w0BAQ0FADBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBX
RzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhv
cml0eTAgFw0xOTExMjAwNjU0MThaGA8yMDUyMDkyNzA2NTQxOFowOzENMAsGA1UE
ChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxFzAVBgNVBAMTDkFsaWNlIExvdmVs
YWNlMIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAtPSJ6Fg4Fj5Nmn9P
krYo0jTkfCv4TfA/pdO/KLpZbJOAEr0sI7AjaO7B1GuMUFJeSTulamNfCwDcDkY6
3PQWl+DILs7GxVwXurhYdZlaV5hcUqVAckPvedDBc/3rz4D/esFfs+E7QMFtmd+K
04s+A8TCNO12DRVBDpbP4JFD9hsc8prDtpGmFk7rd0q8gqnhxBW2RZAeLqzJOMay
CQtws1q7ktkNBR2wZX5ICjecF1YJFhX4jrnHwp/iELGqqaNXd3/Y0pG7QFecN783
6IPPdfTMSiPR+peCrhJZwLSewbWXLJe3VMvbvQjoBMpEYlaJBUIKkO1zQ1Pq90nj
lsJLOwIDAQABo4GvMIGsMAwGA1UdEwEB/wQCMAAwFwYDVR0gBBAwDjAMBgpghkgB
ZQMCATABMB4GA1UdEQQXMBWBE2FsaWNlQHNtaW1lLmV4YW1wbGUwEwYDVR0lBAww
CgYIKwYBBQUHAwQwDgYDVR0PAQH/BAQDAgbAMB0GA1UdDgQWBBS79syyLR0GEhyX
rilqkBDTIGZmczAfBgNVHSMEGDAWgBSRMI58BxcMp/EJKGU2GmccaHb0WTANBgkq
hkiG9w0BAQ0FAAOCAQEAc4miNqfOqaBpI3f+CpJDhxtuZ2P9HjQEQ+v6BdP7GKJ1
9naIs3BjJOd64roAKHAp+c284VvyVXWJ99FMX8q2ZUQMxH+xh6oAfzcozmnd6XaV
WHg4eHIjSo27PmhKE1oAJKKhDbdbEcZXL2+x1V+duGymWtaD01DZZukKYr7agyHa
hiXRn/C9cy31wbqNsy9x0fjPQg6+DqatiQpMz9EIae6aCHHBhOiPU7IPkazgPYgk
LD59fk4PGHnYxs1FhdO6zZk9E8zwlc1ALgZa/iSbczisqckN3qGehD2s16jMhwFX
LJtBiN+uCDgNG/D0qyTbY4fgKieUHx/tHuzUszZxJjGCAgAwggH8AgEBMGwwVTEN
MAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNhbXBs
ZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzdBBXntdX9CqaJc
OvT4as6aqdcwCwYJYIZIAWUDBAIBoGkwGAYJKoZIhvcNAQkDMQsGCSqGSIb3DQEH
ATAcBgkqhkiG9w0BCQUxDxcNMjEwMjIwMTUxNjAyWjAvBgkqhkiG9w0BCQQxIgQg
48aQJVg4Ai/QpEFw8rsxq2fGKjdKAo7F9AiyJ9AcdQswDQYJKoZIhvcNAQEBBQAE
ggEAVvcWqGsebWjsEhsQlER/C5Pib2KPH+9KhVGFbCjDFZvBmNklEI2YomGPyrXq
OoPdQEQpVKLXB3M2VfV9BotUyXNQRR48gRU/P2kRGclOnaKOkzJVnBQjuNkcTTDF
+CHduHMFTcBHNmvWn9TsxhzIksqIWWqTS2ugc4JGJ+Oh9IGX5HBpFcuXU3ouznUt
RQDZNZuiqo7MFcw4z8uJXHXiZM4lWici8jlSs7LNtlUX01Wd/K8rTJZZZ01zpEtD
vjVftz2p54sEevwkS++c3eM9MUyNYT+GC/Hm2m3japmH8E7grmssDeo3d4a1aKy9
wd7sRi7PdwAgwUXiOuso3yAoqQ==
```

C.3.6.2. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header Protection with hcp_baseline (+ Legacy Display), Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
```

```
Content-Transfer-Encoding: 7bit
Subject: smime-signed-enc-hp-baseline-legacy-reply
Message-ID: <smime-signed-enc-hp-baseline-legacy-reply@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:16:02 -0500
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-hp-baseline-legacy@example>
References: <smime-signed-enc-hp-baseline-legacy@example>
HP-Outer: Subject: [...]
HP-Outer:
 Message-ID: <smime-signed-enc-hp-baseline-legacy-reply@example>
HP-Outer: From: Alice <alice@smime.example>
HP-Outer: To: Bob <bob@smime.example>
HP-Outer: Date: Sat, 20 Feb 2021 10:16:02 -0500
HP-Outer: User-Agent: Sample MUA Version 1.0
HP-Outer:
 In-Reply-To: <smime-signed-enc-hp-baseline-legacy@example>
HP-Outer:
 References: <smime-signed-enc-hp-baseline-legacy@example>
Content-Type: text/plain; charset="utf-8";
 hp-legacy-display="1"; hp="cipher"

Subject: smime-signed-enc-hp-baseline-legacy-reply

This is the
smime-signed-enc-hp-baseline-legacy-reply
message.

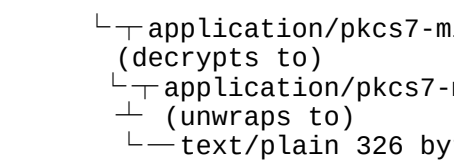
This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a text/plain
message. It uses the Header Protection scheme from RFC 9788 with
the ‘hcp_baseline‘ Header Confidentiality Policy with a "Legacy
Display" element.

--
Alice
alice@smime.example
```

C.3.7. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header Protection with hcp_shy

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a text/plain message. It uses the Header Protection scheme from RFC 9788 with the hcp_shy Header Confidentiality Policy.

It has the following structure:



Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-hp-shy-reply@example>
From: alice@smime.example
To: bob@smime.example
Date: Sat, 20 Feb 2021 15:18:02 +0000
User-Agent: Sample MUA Version 1.0
```

In-Reply-To: <smime-signed-enc-hp-shy@example>
References: <smime-signed-enc-hp-shy@example>

MIIXnAYJKoZIhvcNAQcDoIIXjTCCF4kCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBAEY/MQAP8JUkxGJr2+gL9fUy/gTYqzyKkkZF
GQqKBR98jCom6wtry9FqxMqirqkIXmy6QgPsFh9nf6QmP62K3QjP/aGDI2VLeKJk
beQfZRQRCLqqsP0MRQLT2d8lAJAHCO57N8tdm3jXavSWxaZkEqWF1rtcVCz2QQRg
iKJ99BPNEjwLLK81VCjxTkQOcxRgUNUK21pMQVFoltXE7SGVjV8jeEiEHj9q65nb
ITmfNgmTP9oNk8gojEj/cmTy+hHGPVFjDJZxAHtd4tjU4k/LP46NRAW3tmaxOKMP
v/WkGMcYQGy+qdaXn3n2Fp5VCTfJjFW1bZHdSHwW63kTGr+uOQMwggGEAgEAMGww
VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
HGLS64MvlsDXhpQwDQYJKoZIhvcNAQEBBQAEggEAk75ys1csbLhA8HayfcCB6yPP
70oO/9hlsazxTzL8NcP/f3vzlVEdaCXKGzQSWRSMgf5RoxQvUrFCTaq/F+rbGM7g
S03e1DfxGb8wUgE2ZeZB1o0GvSd6eNB6gjayEJ9AEHwpT4bEJeh7TQ/Mi3PDwelF
kbmA056B7R7529w55YeQF7ZgsJxicJFp00ADPw8iYGd1bOj3wGt3Kz5uycUqsc+4
Q8VWlU5N+8jeJRDVPtEQJwa+S2HyuaPLUZcyZWkuGtVAOPRyCqSjtgSwenLmRTGU
YtwAFvQ6K5E+vCRPyIAg/HYwaYNeUJn5Cr++YkpNBofnrofxaV8zKRIx96IoxTCC
FG4GCSqGSIb3DQEHATAdBglghkgBZQMEAQIEEHawOvd97z0NJQe7ccQnSR2AghRA
lqu1gwka8gwMldV4laK3pICEOTa0bvJGWO7wrvSEAgZUObXjd3ekfVtDGWgXhWbB
8uaam5ssV4WViD4h3iZ8HTRPiczbSsJ2lf8CKOwqOYp8VKQ/wy87yVB6Mna3ZHCT
PqyEOTYYsc6nrf9vQIxrE6I0Roa6FJ33+PpS312CglFyMyhs5bS3TTt2xwnBvLJX
HoPF8JwGxe5xkD9xqOC8jjkMdBcUM8y+DRf9vcDYLAONiuJzpaixkEVG8lFdsXtz
95b3Uedf7XdXe9p/gnqfeVvDLvTjUoxWa98KUM+ZC0bm4gHhTwdP2itiUGMiGYZf
yl7WICIW2jVPVZ6GGrcE9fYwqsG6O+5vygpte2juAQUkwQ74PIcVY6sSWMVbFmfu
iWCQ07OXmNDOtcSHd8Uhz1uqUGQxNElzFQJoKc9RzO4O+jSgSRenVvfwR0AtZy24
WnvbnyUHESgmcn94eHBYow7fqmC7N63kTwtr4NXuMAEH1MvW1iVkJNyB9ZI/DOCr
0fv+/yPfLr3Jobx94CYnP/FRqir1h6dO1M9RonpK5wj+YEl2zNUmegCDizVCcuvP
md2nj91RGccyWgmQ4LPrNdMk2+nQvKNm9Jrv2iHNseyuwGJrc9cczvl/E3Xf0cnu
mS8Y4iMPY/wRnIBN5+D8IzgWXvhMEGumwtT58XFL9KwrLjOKRvai4iNIW6K1fh8J
hh0D7HrdneBas9x0QV7yP2TMuOO9LBln0M9OAlIJAa2LNBoMLlaaeJvv4/AzTIEm
GEYbVIxD3ovj0jm9GCEn1XNgktaTJZt1g+u1v3bsUOIZZcNGdsiUpMXY5a4xnO9N
7KGyn0K/ALBt4dsfY4V0hfQ7HrgAlOs/pO/6bgfGfAul207nzGUV05C2gvn0HApq
tU0RpW7F59q5rr/EMlMU4RIE4RtsKFv/jjLVMqwyQ8c6SAVsdCUNCqWPPN5KPKne
B7NQ397Wfrpd5+f0IiQ/g6GQpSpiQjjfZW/tKq+EGxVpHqrM/wtM9W8phh+rRas9
meavNl9EuB8aJ2gjansk/IezbZkUuN8GUzhFxEQHzSQNADeWjt4rnPaBzPrKzDlh
MqRk1j2LrH8Oh4xBzimpEz4Z+MzEY13pbdu7g1ZWyTCiewHeyZbIoRZNLFtYG6rY
uGjEX1MHkY8HarcAqii4Uk5KTi/cEoH6bOYj8zIlcGxqiA9Xha6jsaG/BkRQS0Mm
/YqBxllLNoyiTV/VC53MoHfA4Ro2/4YrdaykBZEPoAn0mM99EUdgm0vqQeiKLd3j
IePb2udTgpPlHIR6Nw9XNlqiUxFyD5PcBIz/JNY4FbZQ8xWB5OpiQNm8zL4Q7Sim
6RH13Wpl1MIU6FhS1K9966Pjkh/nMnS7hPtsH/rBXxrgFVBv75Kn1gmccadIXvQh
fgZTXjXDgw+7ilNxJn7c0tCgZpuGM37TmjIXANDwBCSJHfeVG4WdJTKsM2NXJrzH
9uFOUnhwY8LLmy0MJ4BgYMqe7cCHBZ+Els7bbUCA3la4tYXQKQY5Z9XtE3bst8rO
2fxWkwF0qncK/giXEhSURyiMr9yc1T0lGfF3jSxMahSohnBA3cKHBww0Y5Kj9n4l
kemATIjN88n7IazxyAztz9n7/I2FXmPAtu0W8FG5QBoIhfBw4cunuHkzAU7yTSNl
MNCjYW7FL/ouvnb/MY5I1LySF0XqfJ5JEdgfk1gXsQKG5g4350i1T3I4XWsK6h5j
dJxTS9v6U2efWIDWYtAKqi0tNnvcbJjQBNx4zt/sPqqU6dCTSz3tn9QdYm40EuiF
aEBcna52jUCncF1EETp2S+yv2ZudNOUysRGAfy7maNGcqrUuLtXRfa1xdJ/TBYhs
wlAwdMKtakFv6dqu/h3kMBDEqcu3y6pWnB7mFlcso2CUkv7/CEl0cg6KNOtPz5k2
WAin1RylzYjBkR+OoMexQXQNSXk1Zf8PKZ9QBTfFOiuifAfAizyAGao3CebY6WNT
1ewkZBAMoyM3iFjvCXjR203l2bkKSIZopA0FFIsDsGWn3ILZmPWq/9TcrNvqPTKI
WzyIKlml2VUse6OtvGShW18wW7BNBlsZeAi8naGvMe/9JmOShIJj/neKxgoivxrV
oM9B8a5k/qB7W9tecEHAyohQPOy11+1HfDTeClJmdhui/uhqFJW6zQv5+qCdx/sl
KRXR2uxdmpFex7u6EfaDUmKyO1PZg7a81808fTaBX+LL8N2LpNrpeoO8feH6nnKE
vvUl4wH1fabHsqUcOr+WADC1Uxsi54HmUszrdK95byESEjaVLJwL8LXj2APu7cx6
tZ/8qsDqz5x3CgsCTS1QXv74GwvnJdzs/O7vE0mG7c1v7ukn9qxd99wPg9vHwkEf
+d/45beotS4F5kBnxL+wXmlPBJ3+k1BgnFYuYodvXaDMUNZDnpPPQuKoC6RRVqYR
pjaOpmi9tuIjURYQMuSuiBUt28OfzhBK+kte8rZIZ+ZwykY/BIVEWbobOZMXEZyG
+3kPPrPxcV5omNiPdE7qjo0Skj8QPAEx4IcT1KBIS9vL6OXgH1tDbz5IYrX5eF3A
jFE38ykxMAJ4Z4NRFzHddZmqiPBWSPcR6+aYSGjiw4T4ywP1ZwKaPtB/2AXDz88b
lViai4VNsa1feH2UIMKY3BPpWRf6ADfWI1n+jIByAc0UkNynB/gL/UOfUOCLaRm0
QUchsCqO6vou+/Yil/czE9VxrW/ARBTw+mmOh7Hn+7aW3jsPxZLdTMaia9exM2VF
rBcyA/1iv+7zEPhlWJv6rVQHR6/goDQsaVfuyeumZRouazmKXpwVRu5i0pV8Ie/n
QQ2UXU7JytaLkeSqqsnLXo2K+NdIp0MXOBCu1TIz7fOZs/iUZphAxhZ+9qZCzHR+

```
j1X74Pu2lzGDWi9ElfIH5xrb0H9jYnqYWzM2Od5nLG9KB2oGluR8pgVSZ/c6FWaf
7o+2X0QpBdX53Ggpp4LqE/Mi6HbePQyt3c2ldkpOy/IFlg0WvyTWH/G3CBYPLldb
iPv//0yVozh8ZOKRpbNLUAjguDd6+m7cSNloIECRjeZ9VwDU6YFnRwraFDOeTbkZ
/5jjwrKVj+bCX+h6puLsBh+KZDFnw/T5Jlt5Z4CbMv5sPdwMBLjB9AmMCmEHwLVr
E+pWoT7lTl6kfqBd3Kyb8e5WeqqtvOQbYaVuxArxEFsKfzg6T+iN7F3jElfcBG3v
XRIgBkA7MhyMs4ymwjSH3GMKCE72nQ5w//F5L/Pv9kpMzB/t6SJ08TfnYvzqWbp8
HuSnYYYtoyys6+DdmWlPNWESYX4sGYkov2vHbnRojo4qGSqfsf7hmZ4lWKKcbyRp
NcZX8s76oWYpBfGDfRQS0MxOwnuh6B3TL6dD1Xy+HPhNePF+yp6eIDIo/pfji8pz
F0WZMKN+DGqNgF/EZw2m2hZGY2EyWXuDvSRe6C7d7jbbbLE2ydfxCpWjNWwQ6lD/
SKqCgpiyLmLG36Ml7MIDy7xpfra9pqadnoAMzfkzMnjky9pS+Torv+Yn4pP5H3ml
7dE0M43sLRx1ypkBSjd5S7sHYvlmqf1aWYQ5KveElT1Um1UtPz9j3qFyeJMYhBd0
/yBU7AZEHzaM0/Bwjz1fZQTw+5IdfM3CNPhxNC6O+zEgFwXDKlFBGQ8Ys1ygryH6
vXU2Vkg6Int5TWUJw2JPvBznnkqv4eQxK8WoGCeIHCaFryS49nTpa2YL+BAOC3Ct
Du7wF+FEEGr17xsJq6ok4IzqoA5LtTa21lde5PssaeEeJT6kqXyw8XjZ6aOPn76v
0P60mu2Bbp3xC/yU/SbVrAvkekX7Ah9ZTeGlLEG7ZxW+oZg/wnOc7eMkdz8xj+OX
X3an+SsHkf8xuIs/ryPyR1UU877yD9J/eV+1xgP3x7xwnWUrGigan/qK/TGe2WM3
FdzAFloPaq+jAjzItnZ59+RYOBCGiGMzUu7XDN0t15yXL3CeAP42YIi2exVQdj/u
jC27PzoF6+diNsenHt95jedzYB9FjY53++B7jzhqPTmv0QL+pt4O45Rbqtk+whgd
MuSFTsFXvL9L5BkBfM3fg2yYwJTAmyra8516c8TQj9PNtua0weCTf9WYfcmH+j6u
W2Dfhc6Zuu+OcXFXWhew50PqlfdeYJvxGGOqLP8hSBMN5zhyj8Q5z4MxiyOa0QVH
+4N+pAqiKw9rbrg5JOfMZjI9FgmcVJAbxZpxXk1oDpCgYMp1RcgkMJhaZOl1x959
bpfcbgL6HqyP1T8iQxDJt3wpRAinPVccScBEOJcJcaPXk1pVRfGTfwUtH+PI546h
uKdJF63tGZPIExodinaerZBiqkbP4jxPB4rGbrSJBi928QX5InN+pz3MQ8uJmyND
uGus9+FNgJ7a4j6mvdOz8lfcRn+U3YE1jLIEE0R/VtIg6jgezyt7/Z4J7rbf1pJC
ZHJQ6x6UR1VA53pQKoFVF9bsPl3ZvsvHWT8yblfKL3U3EJm0Yl+GHbVqaZR2XF8a
knL2/j4tpd/73jOvlb7eAR+eFgjh0HQdR/aEQ46eF0gYZTPDoXHB+9lxjtikAO6L
HgAQ6y1OnxuQWRaburXeyXYEoPVLUrYfdueBBRn8lTZY4esZNCAaCeqsICN2eKEl
wbF0oNH9Hn7vuIkdPCbSLMQxs9JBelIjgv1X/V0VVG8xiA3F18Jwf6XZl7AwpWBa
MBD7iBxovI0XAClxcWrB6ZlRYxwMujdIw2Dm98kaAeGpr9vXvkjxpLdcsSZF25cg
iSBoXR8KAbAvO8X0EciO/Or1qptyUgu6tUL+jFox7pC9Byaa4BW9/Dr4biwelUFD
IT3M7OhrYJDEwoF6UIjlcMpymnJYmqGasG59Ah4uaEieQxYk01RRFiytF+N6oc2U
39qNFtxzMs14dQr/+zuLdbugVge7v6DgC65iQl9ontT/lH/EX3hChmY6daUmz4kS
2VmwdoEhuO6H7yeoIhBTZ2v4+vkGihgQTo8xm+6rw/t55+nQfgQYTC/ZZ+9MuAN3
uKSvTsrorp1I6kK5zI8s6rOY+YaqS10ckNrYXmyq9TSIwyBzk/btb/mDvZMF/TpK
QIaHsSVlkIdmfq5YmTr+iNlwK1fcOZjseesYAhehpPJUzuP4KdGWr8Jc/pC0QNYd
iGL23ieFbTHKgPyGCmRdYgEMqpe/THE65H7pGuINigDEgkG4m0Eq7xDVbvy1SVJC
jc7o/O8cONg3kbHyYbGUlaIKBBap285GWNSotQSChkaDo3hT6S6cjPVsrPoqMN8j
PQNPARqKYRriyI3ej8msK311VRTjAGKWwEVgxn4nF02bvg9HBqv/TiFrTrFLSsd8
6g4HpglcnewxmVWjAeCsruK3IJv79JWRNPxOX9+tnd3k28E1QqwuEA02uNuHZLbB
TvlHswfi9xmPwZG1bytwrSB+kv/oE0cVLI9fPCKpe3I9N+oL8xLrlqG7vNqwaZAK
MTd1VoPxWmlvj/z2NahU05eC12yx29sJN9Oqz4DB2juUaLFSA45+rJMQc9Vj8fFr
/Qrq91UVuXQJIJXCWfC598YJ/p4VwL/glK4ofs9ssl5MZbj3IesHFEwN5BQm2BJB
khO/s2kG3dJ5jSHSFcB/EDexFZtdLCyEwjiMNQqniOUwQjaZCKf4U3QYV2vxTL9r
jA7KfBOgAdwgXX+tKRWv0VgIOz6gITE21u9envfZ1eqOfexlfGT1xv/E+iGauIST
qgVKh0ciZMPqhRgaBHrtrjtTyifweXbSKo4AFVNHN3K+swDmXW/XHQ6Y7UAjseZS
ZFtjurmHB+uYz+O4kxAct4fJW7d2e5iU6tEGKseCnBZ//PGgzkLbwigdNhopou/Z
s53h4I2Z0rxJFz33NHwTx2wquT7MLwCZwD/Thttujx6uI2JXMa0zudluK7S+lj2y
d3DBHNGszistpi7cUoOgYVMvFwuTSPgvLfyb3CiyUHlK3TIEqox2BJun3tXL2P9s
7tFBjgqVRqm8AYDRzSpkw5jKL2xWBCI0j9hd2PDOQbhw/EgLNqlHmLK7Yqy5TK/v
CMk2aLkVAORtQlryJ2M8WlObq3RPjwfc/zB9NWKTpX/EuY03nYXQLG951Oajvodu
sNZB4JyeNKbIn9LPNZ+8mfaxHE8Zmqd3A8XSN/KfSGOj5k1wkh2qrWWlhbZQGBnU
ocpwedKqvxKxun/nGsfRmDvMzSMqRfXYxATneXH5IhmCLsBx3qeGLiYoRkLd0434
3Z4937SMWwtg+oZYcd+ndW1OnEVyGqTmWB2UKhJhfIhL1YzpkS6444tdlIV2LKeK
GwhG/6RzVZ+qnNzeEFlJjwUsMTd+4Xa3k2bkMBJQZggOtFxCeiANkVsBzrT6DTLa
L9xJqDPD7SROKHubosXhFwx/cDcFveWL+mbkfQc9/edehffeCvdgXO1CIxPmxXHY
y5vETDTiJqDd6+wjQHRrjoTv17Zz2ZblhhvdxLnoE9IMABvmd8H6fF3L4jIn2k3K
Kc0CAy20FA9K2eMgCOW1+JeYcgA1Sh5Y8x1Fg6Ah0FFH62SMn33B9rMYOB++Sjg0
vh/1cfHXaZPwpMb1gNU9hipbThL+2MH0irtzQ7sn7X9FQqvkQwA57OaXXpUId2Nu
U0rjXrw8AxmaUtFpN43rCk9t58eP+vosfCsG/uA80ptkEqb0Gz3FM9B6Be4crw2O
3Oivl7+0dpJ/rAD1lG3Vq6VAvpAQNT0g0/TmrHJ2rnhX5UUxZB7YPF/eufDDtLF+
BZNXMT9+snguEJHRifIxhFXIsE/MFti9ROSsbT90u4k9WxY0PI5hp95dkvX/PfUO
lNsNQvN/OjVFx860ZCY2UR+l8VhYwUkTL6qlBAeVca2QvdZ8BIhr/GNHfXyge0yo
cIbqf3WQnU/05jV6v1YOq2TJZaN8tLaf+rJait129WW48fCv/oxW00xUeRwB6Fnp
```

C.3.7.1. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header Protection with hcp_shy, Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

MIIOVgYJKoZIhvcNAQcCoIIORzCCDkMCAQExDTALBglghkgBZQMEAgEwggR/Bgkq
hkiG9w0BBwGgggRwBIIEbE1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVRyYW5z
ZmVyLUVuY29kaW5nOiA3Yml0DQpTdWJqZWN0OiBzbWltZS1zaWduZWQtZW5jLWhw
LXNoeS1yZXBseQ0KTWVzc2FnZS1JRDogPHNtaW1lLXNpZ25lZC1lbmMtaHAtc2h5
LXJlcGx5QGV4YW1wbGU+DQpGcm9tOiBBbGljZSA8YWxpY2VAc21pbWUuZXhhbXBs
ZT4NClRvOiBCb2IgPGJvYkBzbWltZS5leGFtcGxlPg0KRGF0ZTogU2F0LCAyMCBG
ZWIgMjAyMSAxMDoxODowMiAtMDUwMA0KVXNlci1BZ2VudDogU2FtcGxlIE1VQSBW
ZXJzaW9uIDEuMA0KSW4tUmVwbHktVG86IDxzbWltZS1zaWduZWQtZW5jLWhwLXNo
eUBleGFtcGxlPg0KUmVmZXJlbmNlczogPHNtaW1lLXNpZ25lZC1lbmMtaHAtc2h5
QGV4YW1wbGU+DQpIUC1PdXRlcjogU3ViamVjdDogWy4uLl0NCkhQLU91dGVyOiBN
ZXNzYWdlLUlEOiA8c21pbWUtc2lnbmVkLWVuYy1ocC1zaHktcmVwbHlAZXhhbXBs
ZT4NCkhQLU91dGVyOiBGcm9tOiBhbGljZUBzbWltZS5leGFtcGxlDQpIUC1PdXRl
cjogVG86IGJvYkBzbWltZS5leGFtcGxlDQpIUC1PdXRlcjogRGF0ZTogU2F0LCAy
MCBGZWIgMjAyMSAxNToxODowMiArMDAwMA0KSFAtT3V0ZXI6IFVzZXItQWdlbnQ6
IFNhbXBsZSBNVUEgVmVyc2lvbiAxLjANCkhQLU91dGVyOiBJbi1SZXBseS1Ubzog
PHNtaW1lLXNpZ25lZC1lbmMtaHAtc2h5QGV4YW1wbGU+DQpIUC1PdXRlcjogUmVm
ZXJlbmNlczogPHNtaW1lLXNpZ25lZC1lbmMtaHAtc2h5QGV4YW1wbGU+DQpDb250
ZW50LVR5cGU6IHRleHQvcGxhaW47IGNoYXJzZXQ9InV0Zi04IjsgaHA9ImNpcGhl
ciINCg0KVGhpcyBpcyB0aGUNCnNtaW1lLXNpZ25lZC1lbmMtaHAtc2h5LXJlcGx5
DQptZXNzYWdlLg0KDQpUaGlzIGlzIGEgc2lnbmVkLWFuZC1lbmNyeXB0ZWQgUy9N
SU1FIG1lc3NhZ2UgdXNpbmcgUEtDUyM3DQplbnZlbG9wZWREYXRhIGFyb3VuZCBz
aWduZWREYXRhLiAgVGhlIHBheWxvYWQgaXMgYSB0ZXh0L3BsYWluDQptZXNzYWdl
LiBJdCB1c2VzIHRoZSBIZWFkZXIgUHJvdGVjdGlvbiBzY2hlbWUgZnJvbSBSRkMg
OTc4OCB3aXRoDQp0aGUgYGhjcF9zaHlgIEhlYWRlciBDb25maWRlbnRpYWxpdHkg
UG9saWN5Lg0KDQotLSANCkFsaWNlDQphbGljZUBzbWltZS5leGFtcGxlDQqgggem
MIIDzzCCAregAwIBAgITDy0lvRE5l0rOQlSHoe49NAaKtDANBgkqhkiG9w0BAQ0F
ADBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzExMC8GA1UEAxMo
U2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhvcml0eTAgFw0xOTEx
MjAwNjU0MThaGA8yMDUyMDkyNzA2NTQxOFowOzENMAsGA1UEChMESUVURjERMA8G
A1UECxMITEFNUFMgV0cxFzAVBgNVBAMTDkFsaWNlIExvdmVsYWNlMIIBIjANBgkq
hkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAmpUp+ovBouOP6AFQJ+RpwpODxxzY60n1
lJ53pTeNSiJlWkwtw/cxQq0t4uD2vWYB8gOUH/CVt2Zp1c+auzPKJ2Zu5mY6kHm+
hVB+IthjLeI7Htg6rNeuXq50/TuTSxX5R1I1EXGt8p6hAQVeA5oZ2afHg4b97enV
8gozR0/Nkug4AkXmbk7THNc8vvjMUJanZ/VmS4TgDqXjWShplcI3lcvvBZMswt41
/0HJvmSwqpS6oQcAx3Weag0yCNj1V9V9yu/3DjcYbwW2lJf5NbMHbM1LY4X5chWf
NEbkN6hQury/zxnlsukgn+fHbqvwDhJLAgFpW/jA/EB/WI+whUpqtQIDAQABo4Gv
MIGsMAwGA1UdEwEB/wQCMAAwFwYDVR0gBBAwDjAMBgpghkgBZQMCATABMB4GA1Ud
EQQXMBWBE2FsaWNlQHNtaW1lLmV4YW1wbGUwEwYDVR0lBAwwCgYIKwYBBQUHAwQw
DgYDVR0PAQH/BAQDAgUgMB0GA1UdDgQWBBSiU0HVRDyAKRV8ASPw546vzfN3DzAf
BgNVHSMEGDAWgBSRMI58BxcMp/EJKGU2GmccaHb0WTANBgkqhkiG9w0BAQ0FAAOC
AQEAgUl4oJyxMpwWpAylOvK6NEbMl1gD5H14EC4Muxq1u0q2XgXOSBHI6DfX/4LD
sfx7fSIus8gWVY3WqMeuOA7IizkBD+GDEu8uKveERRXZncxGwy2MfbH1Ib3U8QzT
jqB8+dz2AwYeMxODWq9opwtA/lTOkRg8uuivZfg/m5fFo/QshlHNaaTDVEXsU4Ps
98Hm/3gznbvhdjFbZbi4oZ3tAadRlE5K9JiQaJYOnUmGpfB8PPwDR6chMZeegSQA
W++OIKqHrg/WEh4yiuPfqmAvX2hZkPpivNJYdTPUXTSO7K459CyqbqG+sNOo2kc1
nTXl85RHNrVKQK+L0YWY1Q+hWDCCA88wggK3oAMCAQICEzdBBXntdX9CqaJcOvT4
as6aqdcwDQYJKoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjERMA8GA1UECxMI
TEFNUFMgV0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlv
biBBdXRob3JpdHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5MjcwNjU0MThaMDsx
DTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYDVQQDEw5BbGlj
ZSBMb3ZlbGFjZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBALT0iehY
OBY+TZp/T5K2KNI05Hwr+E3wP6XTvyi6WWyTgBK9LCOwI2juwdRrjFBSXkk7pWpj
XwsA3A5GOtz0FpfgyC7OxsVcF7q4WHWZWleYXFKlQHJD73nQwXP968+A/3rBX7Ph
O0DBbZnfitOLPgPEwjTtdg0VQQ6Wz+CRQ/YbHPKaw7aRphZO63dKvIKp4cQVtkWQ
Hi6syTjGsgkLcLNau5LZDQUdsGV+SAo3nBdWCRYV+I65x8Kf4hCxqqmjV3d/2NKR
u0BXnDe/N+iDz3X0zEoj0fqXgq4SWcC0nsG1lyyXt1TL270I6ATKRGJWiQVCCpDt
c0NT6vdJ45bCSzsCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcGA1UdIAQQMA4w
DAYKYIZIAWUDAgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5leGFtcGxlMBMG
A1UdJQQMMAoGCCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIGwDAdBgNVHQ4EFgQUu/bM

```
si0dBhIcl64papAQ0yBmZnMwHwYDVR0jBBgwFoAUkTCOfAcXDKfxCShlNhpnHGh2
9FkwDQYJKoZIhvcNAQENBQADggEBAHOJojanzqmgaSN3/gqSQ4cbbmdj/R40BEPr
+gXT+xiidfZ2iLNwYyTneuK6AChwKfnNvOFb8lV1iffRTF/KtmVEDMR/sYeqAH83
KM5p3el2lVh4OHhyI0qNuz5oShNaACSioQ23WxHGVy9vsdVfnbhsplrWg9NQ2Wbp
CmK+2oMh2oYl0Z/wvXMt9cG6jbMvcdH4z0IOvg6mrYkKTM/RCGnumghxwYToj1Oy
D5Gs4D2IJCw+fX5ODxh52MbNRYXTus2ZPRPM8JXNQC4GWv4km3M4rKnJDd6hnoQ9
rNeozIcBVyybQYjfrgg4DRvw9Ksk22OH4ConlB8f7R7s1LM2cSYxggIAMIIB/AIB
ATBsMFUxDTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQD
EyhTYW1wbGUgTEFNUFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhM3QQV5
7XV/QqmiXDr0+GrOmqnXMAsGCWCGSAFlAwQCAaBpMBgGCSqGSIb3DQEJAzELBgkq
hkiG9w0BBwEwHAYJKoZIhvcNAQkFMQ8XDTIxMDIyMDE1MTgwMlowLwYJKoZIhvcN
AQkEMSIEIAsnTrJmG9vhEDGPGAIiq3jNFKAZg/b5qnb8K8AAVkcfMA0GCSqGSIb3
DQEBAQUABIIBAH/7j5oqF/rfVNLmPNfU3UFn3oHiaWt3+y8+fLX1e4uMgFOshe5Y
Iz5rkMeHmP0HHtnqfbPjyktjTR/wlmHazGcasD5/KT2/1/HXOJJdaM/YQ4g5RiBi
h7TDwAfDsNMMeEfYII+gDXrVeTc0BvtrWetxrGYhbMUNLtM5tskMhuUMVYrQBcUh
vkYBamQMVmiZMBOFHhhA9hEay6QFIlAC1v3WtJvyiJCShld1Qetd+NuDbaCr6vZt
+C8LsBh8hQO+TIT8AnV8yBhQnqFGj61JQjwGBRRwQHbvAEG4uxaWr2OwCa0VWOh5
237SKEh0m/haavxKarioAGkbzlAGbNElyX0=
```

C.3.7.2. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header Protection with hcp_shy, Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Subject: smime-signed-enc-hp-shy-reply
Message-ID: <smime-signed-enc-hp-shy-reply@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:18:02 -0500
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-hp-shy@example>
References: <smime-signed-enc-hp-shy@example>
HP-Outer: Subject: [...]
HP-Outer: Message-ID: <smime-signed-enc-hp-shy-reply@example>
HP-Outer: From: alice@smime.example
HP-Outer: To: bob@smime.example
HP-Outer: Date: Sat, 20 Feb 2021 15:18:02 +0000
HP-Outer: User-Agent: Sample MUA Version 1.0
HP-Outer: In-Reply-To: <smime-signed-enc-hp-shy@example>
HP-Outer: References: <smime-signed-enc-hp-shy@example>
Content-Type: text/plain; charset="utf-8"; hp="cipher"

This is the
smime-signed-enc-hp-shy-reply
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a text/plain
message. It uses the Header Protection scheme from RFC 9788 with
the ‘hcp_shy‘ Header Confidentiality Policy.

--
Alice
alice@smime.example
```

C.3.8. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header Protection with hcp_shy (+ Legacy Display)

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a text/plain message. It uses the Header Protection scheme from RFC 9788 with the hcp_shy Header Confidentiality Policy with a "Legacy Display" element.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 8690 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 5422 bytes
  ──┴ (unwraps to)
    └── text/plain 518 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-hp-shy-legacy-reply@example>
From: alice@smime.example
To: bob@smime.example
Date: Sat, 20 Feb 2021 15:19:02 +0000
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-hp-shy-legacy@example>
References: <smime-signed-enc-hp-shy-legacy@example>

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C.3.8.1. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header Protection with hcp_shy (+ Legacy Display), Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

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```

```
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```

C.3.8.2. S/MIME Signed-and-Encrypted Reply over a Simple Message, Header Protection with hcp_shy (+ Legacy Display), Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Subject: smime-signed-enc-hp-shy-legacy-reply
Message-ID: <smime-signed-enc-hp-shy-legacy-reply@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:19:02 -0500
User-Agent: Sample MUA Version 1.0
```

```
In-Reply-To: <smime-signed-enc-hp-shy-legacy@example>
References: <smime-signed-enc-hp-shy-legacy@example>
HP-Outer: Subject: [...]
HP-Outer:
 Message-ID: <smime-signed-enc-hp-shy-legacy-reply@example>
HP-Outer: From: alice@smime.example
HP-Outer: To: bob@smime.example
HP-Outer: Date: Sat, 20 Feb 2021 15:19:02 +0000
HP-Outer: User-Agent: Sample MUA Version 1.0
HP-Outer: In-Reply-To: <smime-signed-enc-hp-shy-legacy@example>
HP-Outer: References: <smime-signed-enc-hp-shy-legacy@example>
Content-Type: text/plain; charset="utf-8";
 hp-legacy-display="1"; hp="cipher"

Subject: smime-signed-enc-hp-shy-legacy-reply
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 10:19:02 -0500

This is the
smime-signed-enc-hp-shy-legacy-reply
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a text/plain
message. It uses the Header Protection scheme from RFC 9788 with
the ‘hcp_shy‘ Header Confidentiality Policy with a "Legacy
Display" element.

--
Alice
alice@smime.example
```

C.3.9. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_baseline

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses the Header Protection scheme from RFC 9788 with the hcp_baseline Header Confidentiality Policy.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 10035 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 6416 bytes
  ┴─  (unwraps to)
    └─┬ multipart/mixed 2054 bytes
      ├─┬ multipart/alternative 1126 bytes
      │ ├── text/plain 384 bytes
      │ └── text/html 479 bytes
      └── image/png inline 236 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-complex-hp-baseline@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:09:02 -0500
User-Agent: Sample MUA Version 1.0
```

MIIc7AYJKoZIhvcNAQcDoIIc3TCCHNkCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
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C.3.9.1. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_baseline, Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

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Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"
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ybK5q4kRvQ==

C.3.9.2. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_baseline, Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Subject: smime-signed-enc-complex-hp-baseline
Message-ID: <smime-signed-enc-complex-hp-baseline@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:09:02 -0500
User-Agent: Sample MUA Version 1.0
HP-Outer: Subject: [...]
HP-Outer:
 Message-ID: <smime-signed-enc-complex-hp-baseline@example>
HP-Outer: From: Alice <alice@smime.example>
HP-Outer: To: Bob <bob@smime.example>
HP-Outer: Date: Sat, 20 Feb 2021 12:09:02 -0500
HP-Outer: User-Agent: Sample MUA Version 1.0
Content-Type: multipart/mixed; boundary="3a3"; hp="cipher"

--3a3
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="f31"

--f31
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
smime-signed-enc-complex-hp-baseline
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_baseline‘ Header Confidentiality Policy.

--
Alice
alice@smime.example
--f31
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-signed-enc-complex-hp-baseline</b>
message.</p>
<p>This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_baseline‘ Header Confidentiality Policy.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--f31--

--3a3
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
```

```
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--3a3--
```

C.3.10. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_baseline (+ Legacy Display)

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses the Header Protection scheme from RFC 9788 with the hcp_baseline Header Confidentiality Policy with a "Legacy Display" element.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 10640 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 6870 bytes
    └  (unwraps to)
    └─┬ multipart/mixed 2373 bytes
      ├─┬ multipart/alternative 1423 bytes
      │ ├── text/plain 480 bytes
      │ └── text/html 640 bytes
      └── image/png inline 236 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID:
 <smime-signed-enc-complex-hp-baseline-legacy@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:10:02 -0500
User-Agent: Sample MUA Version 1.0

MIIerAYJKoZIhvcNAQcDoIIenTCCHpkCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBAFzRRJ4ae2Mk8l1B7yZRDGmCK9wJNrPFJTno
34WR+wNG0/sDCZCYzBvpNXScUVbk/+Y90xyCKLXZYvP89rkPvPPEDjm0faAKPw7r
9CodT58+Zxc+mW50t1G/ERj0yLlMFa+yAvWjuAXuQ25+mZ1fB2TkMQ6pZPg38smk
Gtl3Dzqx31lCmB3JSYfBJQ3SCNOeRQzZENp9dpo0o4+wfxBCukVTGPexmnX9GIkL
9bfoTfqcOt9gPQBXKnOG/hg6vmEQN0avXjI71fCMUwj6nUr7Jmd5e5P9Js01/4Qa
jScrAk/JdFNixNiVarqYWEWiIeTRu8NidcW3L941Fb/3CSfcgR4wggGEAgEAMGww
VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
HGLS64MvlsDXhpQwDQYJKoZIhvcNAQEBBQAEggEABb5CqsgXnqKOQb8V12/4362F
J3hgPcMNbwO/59c8Fmn1ETL5R85beGapoHKD9hlejMVgyVPJucrSzVX458JBx7F8
Q2gcINWqe4i1Vul4vGwFPQVsyK5ufH7VnNYJ3rwaig1mc+3zb2NaF8rS41xnCHVD
0Fcl9lpsN3iQ4hqzUNKTupjVKmZJfIVvjdwwrTnqdSbovmCAFYe4b5h+lIPfGJ9p
RZNDWB4mZk+adxhK6qYxoAqzJE1HmF4NwJz0BKaknBPr9jWPa6Y6A+ap3Fn4OfYV
NXqRS0LSsqkT8D31CoSDbWsBH2SlVWHmOtSZvQfNh1jXDRfQFssgg4dOXiL+LDCC
G34GCSqGSIb3DQEHATAdBglghkgBZQMEAQIEEMGuYxUySDVL/ohXx2NMvHaAghtQ
poigIUJ21hyg0R0MwSilmOnxXu6RlAVjlj9LiS9iEfWStaxj1wv7I03AnTJDMpEn
4JUC6w+ZKkG1N7KF0viOCi1l/dIBCmBrUIBH6GTb1AVVlUI8NwnIR0Edv/RqlNSj
dViDiZerCe6EJeD0oirYPPjzofrD56glnYCetuDXFnMas2ECP7pu6YaB3MiuLO1G
McK9B5G5ior0BiAigYPpMW1dmufoOJFYX6F7v5+1ZrIlTOYvGGYU0WeOvM3mY1Js
49qkzg8l/6qc89+vlAMDa3f6P5Iv0g10/s37Yz3N8roT78C9ZegPC/85RgA2KY6t
U6wgGDllqgPUfg0Fd9yVd/konoBN4Nxik2YmM6mJTj73Ii3H2LFSWD9HRJjXwpda
JZqkCjWHOjbugF+z1wpLSFLznRxdgje5Q4BkQDSw7BJsm9a04EgRg/4IDZTXsY6e
zncUIslIJvf2dKCMzLzNA/KNBoSZPxvZo3MDIBr4z9Mp07I2jbtdM5OAQCbWwNGz
```

```
oUuu4p1NvUJDJoLae/w2j8v2RDpI7rss5hWLqmwEnJJNPMmR7PtqU5tL7kbonPjs
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4XXLgm8JYgu1znbsil+FSJtVIrsasEtHny5xJAHAlCwFCr10Wt9gqCv/t8tji5Xl
gKoxdtM2mp4zsXurP7BsKDXSA27QGVyuL2l6Oq7VHrwg2ex/7AB31qCP0hZni86K
Fk3O3ZxjjN3aZo7iXeN/IjaQDhmKEg4qaZ/Kfs+gGA31alBopZKL4UyFehX5Le/J
BbXPCFaXCxU1eztGqLA4BPSNSuDoUXzHMnvm/nRsuUF/d0YHsNp7iVORUVMj9JQP
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DGYIWjd59fN26eSbB8Eh0R72L/K8ziXIObxLd1pLy7F0ae/WyDKl5fykSTd581MB
UqRflyAiTn8lojH9b1svp2XXNVBNRDuCtJCjqd2VT5NqO0UNN5Hy9ojVyCyqTFZa
pwbyx3V5MCZfnZMtEr9A4y8e37ogWC6zm2Hg/3/mgapslPJsWBZHRqPaIhnytKDq
J3WlegHY6f4WF1XyTVOKZ98mjTytcwRZ+D5QwrNdULT3EYOeFGdBJ6Ao11+2EDZh
0vMVjdxfLAXxIyZ3srdqf1jFoLnAqsmJMolWBT4eX1379SQK4UULoGVIUOrjsCd1
YK7vKED3e502hQc1IKHFD79OTg2VssER5QTLXkxHvoLXzL35fif9gZN0K5WEin6K
aBHSMcFzT2sFtESHpzs3Kl2FlEUBnxA4QfvmiFcvH212yUAvnwczoH69w3+xaaqW
mmOqMpNRMxMap1j1lLI9lzGG4bp4sHNPd/t4uN/RPjq71+f6HNjbJsu+My0bNTIc
zfmwTlsg8zN8L1biu0U1Nfn79XY01xsLpJqFYGoYUiTuY0SBPz77LT3BE6j2OsLp
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6e4vEwamNB36hEtHZuTL7tPuv9mSZD4wzK+sPHxrVyw7Qvnln0PDmzS8Bs2l1dQI
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ULCIyQqAY0CAzjO70EeI96JOZHh9Yh06ZOdh2iNGaZmQ6QRCIzlEiikKPKK6euhf
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qzH1ko+s4NbuyZJbyiXvEVmD5bNQ7w2VrvOtZMekQa4CtDusF0zjStqHSZTJ16J7
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rBxtsKJs/e3zmKqi7siJ/GvAIVGrVQzMOT1iZvJyQ/OUZMFh1vUbvBTFAY8e7LjA
wbVB9PD4VdtwjPZdeXkGylCjskNUmlTGi4hO4mKnOFbuLxOFMTDrU73RE58tsdqk
MI1Z7AnhyyTRWUj6s+jBoXtRXwWZgvGb1Ro4CZ6EC1c5Z6DFFcy5ICgI52r+Pz6x
cdINTvTgPedoDqDXv+5kPy1+EyT5/pFzRfp+eIzZmfnzXvrUzXSK2UEyxVxvJe+t
eS+jmBFNhvkzZQ10UcCsdKjhgDc42dR+N1gNUem5UXvsMV8JGv6rcK+AoXgIA6lB
Aby/E5dXc1YT5CJLs9NRGidWXW6ltJgoYORM/97GVNJeQRa758t+7A0rV/CaHJlg
HR8pjTnelOCQT99BmYknS2NhG0XrZsT4/rtCsUvJRrR3bPyd6M868jWmW443w0Fx
AYkvOQW2J7GDHjJRwJqhK2tDhTpl9Mtuv1Uv75UuPSP+sxcncjz4mGYR/A4vkjFD
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FsoN3/w71djAYPJtNhHPqB+TICv7rs2JhhHbHvrHU16L6118UgSM2TUtxZEQ5CXd
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AW6jwfvYaAa9bjX+B+QZYKjYZiKXbdu55h1WMGXng9yDhQONyQMPbCMprfu4tLr7
Tv/bFEak1TOahNORfVzioWE/Flig3JotDqB6wJE2EmXtjH426cn4orFNyai0fF47
PsoiGdUJvjKfWVe1X+71AD9+xe46JyJyrnvLY2y1gjYljVKFe4rhLfrCwU91xFoD
svrzv7LMSSJhuCdvcPq9OS6fw97upSYVlUWt4KIRtDOi1vxJpeR49VppMY4EXNpS
6+6mv2g4SWIfPCSw8C42q+sO6KUmqmCMcdXx37mrBy9DT1EjAbrq17WyVPmMQz9v
ehaCSiAAOZCXC2sX3pC6N6o2d56Z6tdFbPSgMBOFW1vuHUlMUtOkCXuxIjtucF/v
/vZVmtSATOv+tpDqcB2tWg5a6vq1/EHXV29XsSZ/Hty/1j/Gt4oirtmmajAVMevu
Upk9+WaDwWtJ44cWEOLnw5d1aiSupG1Xt2Qpo+QtSLFtYSoalZRenOvZcdEqMEMg
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jq58X2QVYE0MsHeCgUS+dWAaSsvi01YpeuWkf9LSH30jqrclgCM9cbrkpodCSrYr
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GOCcWlmhJfxwIKK2ddAasxiZ5h9+rOjE4YDxXOSFCUoTtHZvOAES+5MT5g0ZwMjK
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```

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0S3o/nQVSEukU1z1aZUB70lnejzvGC5EEvnTHeohRrjHP88R0oz6K7HgsCw2GVS9
XT0XTjwIwmX7Q3rifjVxrju6sdmyTywLlwPWPMHFZbNWZMoaZdr1f2p6HoUJrIkK
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Yp1Jp7HKxw3owdFmB41P2FBHT/eehbfgLozSG/bhVj7pEuaY0XozKDu+0OqRxg+i
UJCfcngZP4nP5D6pG2ll3sFM+i37A2tGrGlGescgQk/SgWrnkDm+FZjIG9vLJMG4
/wBjVRqF639bUrc8qrhx/jRPxkgg4Ly7+UW3mwUnr3Erf3p6ZL1//Nd7f5BC8Rcc
YXY3dR+gAMpAFE62akhotTGVqUxcVU76KxI9geFg3e8pMHJ1ycygoM1b9Gt98IvB
59nId0bbvOm4iLuzs3cSsdboDlS/tWMqcETzrpIOqaqydrbTkwxGGv0/3vAV19+v
lFy9IQ8Z2mUF+S2CgJ9bTzTXh2QqIIugoBYT3TpUlq+Tbl9oFH3FBej1J3EKaxW8
s0mKvro8GmNxR2sbhBL1LnzLWs6vAstngAZmPlj1mYcbgNU998+27/+5Iln9IZ6X
/jrQhWtuKg2QgQV0gtraDqz6/lMGKeUidjg2C1IKXo/m87hJWFSj9TMr+/2K2OMr
XReM5ER2YFKsGqCNFkiTkl+T3SPw6qynf3S7lxtxmys8zOu7f/JFILKZarfWRyIE
2qyOWmBfu6/sEuVMGOWLpHbpGevp+SMT8J6187NH1NGO29jmGO9rjh4f0B8ZSmJW
FFnwQm1PalAzCPGxlgVbbERuRZ6tnPTFIBCpE4I/9d/lNbHeKgZRjhK9jsk2Fc7v
QCdpedO1qwysKFmC0otrromr6mTzEZepedKYuB1TDuZMBTwIQNWf4oGiBZlQ03z+
VuXgWhgWZJxspGZ8CgYBi9CoTgsu/fkjq0n+rd9LrlRhoLPR/iVdhtSvHp1u/BYf
OL9a2cqXRQfIze+cJfD2Ler8h627aW59SA8g566CSxPVw/GvO2Rk2mm/PCwep6lX
gpWu81riycD6VFUnSCDrw0aqpNfhNOBnx4bNqvGM2msMTJ46BgGv7gMHoUzjracz
tsP5Y8qS17FsxptAmPjP5GpFihHQv3JO2XgbaAudsKGMAf/bUZf5djDhmzZxWqrr
TW+abp6gKjktu1Ug2zYl9JYanABpb8/9oYI1AattVoAokUjlWca02bGqeMRpBtwj
oo5E22qyEkRIhfoHrWLoUg/bt2vEjKAdbe/Xp7zb1Mf6MDksa5/IIMhB1l6y0yV4
JKeRvxji3t7bNaYzTCtAcLMQRAoqrp/B97emRVQSx21ALE7puVLezZHTPDscyz7c
hijAssGK+6cb180XGxtM3VSZg3R8tGiETu6nFhTB4ojh7CG+szqAkWKupBPxOUkO
l5zIkutYJLpFhCbQ4cj6cF1faug6POMcww7iBkqRCU2Y0c4QcQ9z706+t67Sj3oy
g62KUvdvEiA+lm3MSTJASj76mi1hi1rdTNU2pdfT4JIzPAMI6RDN0Jike6Y/Vr7z
wuHcGe8inCjn0+14A5sdgRouC0v5tkId04pRewc3eUixnVvzsXTp1jvbMcCxTHYG
rM1GsyxHiB3j47De343GLJo3JUxt+X8e/Xfs/dwDbTppYa8J67/w74YRRvgGq/A2
/c/lyk/JOkuZcbnKGJa8UsflyXfEhbFDnA6ogWRxBHYTsOs27Du95SvrZwk4GL3j
pW4KkX80gGTY857dMJm8OEuxZbVDjhAyBgnC+pq4m4AyfIOzFcXKHSb6e581n0jE
Z07Agv5hPcO9phCHyn3pIE9snR0Jwn7vlGaMrv6uv6DDwWIx52yNrucgYCi3WRxc

XIwOTYWaGhkFJ/HDHd2gCmVbSsZPTEaU9IXxmvScOpfCl7sUe5baRYR5X4VS5Oh3
jNpFO5YYLwvN5CAnPRXa6vlKWZzyq34vgQhsHHiJJq40GdyKV0ODlWE6ZoyGenxE
rV0yLodGch/JAzig28oODwnw4D3IsCbu5hCVQLy6unZsxwWRjMT0onfFrnoO5ttl
XYq5LHaxkJKF9aBzSi/AcNWao3wEXVyKTT1P2DQcGCmVz+6fsR1AE22e094tULy4
mSAC10R8byELoQs+W4i8GdND86fG+mRQKoR8fYsrOF1CZpLXDFG4AnmiaBF5Ro7C
X20oNkEZ4yhYoiSOTp/yfWOphJ9iDxfXO0RVHSrO2Aw=

C.3.10.1. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_baseline (+ Legacy Display), Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"
```

MIITfQYJKoZIhvcNAQcCoIITbjCCE2oCAQExDTALBglghkgBZQMEAgEwggmmBgkq
hkiG9w0BBwGgggmXBIIJk01JTUUtVmVyc2lvbjogMS4wDQpTdWJqZWN0OiBzbWlt
ZS1zaWduZWQtZW5jLWNvbXBsZXgtaHAtYmFzZWxpbmUtbGVnYWN5DQpNZXNzYWdl
LUlEOg0KIDxzbWltZS1zaWduZWQtZW5jLWNvbXBsZXgtaHAtYmFzZWxpbmUtbGVn
YWN5QGV4YW1wbGU+DQpGcm9tOiBBbGljZSA8YWxpY2VAc21pbWUuZXhhbXBsZT4N
ClRvOiBCb2IgPGJvYkBzbWltZS5leGFtcGxlPg0KRGF0ZTogU2F0LCAyMCBGZWIg
MjAyMSAxMjoxMDowMiAtMDUwMA0KVXNlci1BZ2VudDogU2FtcGxlIE1VQSBWZXJz
aW9uIDEuMA0KSFAtT3V0ZXI6IFN1YmplY3Q6IFsuLi5dDQpIUC1PdXRlcjogTWVz
c2FnZS1JRDoNCiA8c21pbWUtc2lnbmVkLWVuYy1jb21wbGV4LWhwLWJhc2VsaW5l
LWxlZ2FjeUBleGFtcGxlPg0KSFAtT3V0ZXI6IEZyb206IEFsaWNlIDxhbGljZUBz
bWltZS5leGFtcGxlPg0KSFAtT3V0ZXI6IFRvOiBCb2IgPGJvYkBzbWltZS5leGFt
cGxlPg0KSFAtT3V0ZXI6IERhdGU6IFNhdCwgMjAgRmViIDIwMjEgMTI6MTA6MDIg
LTA1MDANCkhQLU91dGVyOiBVc2VyLUFnZW50OiBTYW1wbGUgTVVBIFZlcnNpb24g
MS4wDQpDb250ZW50LVR5cGU6IG11bHRpcGFydC9taXhlZDsgYm91bmRhcnk9IjNj
NSI7IGhwPSJjaXBoZXIiDQoNCi0tM2M1DQpNSU1FLVZlcnNpb246IDEuMA0KQ29u
dGVudC1UeXBlOiBtdWx0aXBhcnQvYWx0ZXJuYXRpdmU7IGJvdW5kYXJ5PSJhZjMi
DQoNCi0tYWYzDQpNSU1FLVZlcnNpb246IDEuMA0KQ29udGVudC1UcmFuc2Zlci1F
bmNvZGluZzogN2JpdA0KQ29udGVudC1UeXBlOiB0ZXh0L3BsYWluOyBjaGFyc2V0
PSJ1cy1hc2NpaSI7DQogaHAtbGVnYWN5LWRpc3BsYXk9IjEiDQoNClN1YmplY3Q6
IHNtaW1lLXNpZ25lZC1lbmMtY29tcGxleC1ocC1iYXNlbGluZS1sZWdhY3kNCg0K
VGhpcyBpcyB0aGUNCnNtaW1lLXNpZ25lZC1lbmMtY29tcGxleC1ocC1iYXNlbGlu
ZS1sZWdhY3kNCm1lc3NhZ2UuDQoNClRoaXMgaXMgYSBzaWduZWQtYW5kLWVuY3J5
cHRlZCBTL01JTUUgbWVzc2FnZSB1c2luZyBQS0NTIzcNCmVudmVsb3BlZERhdGEg
YXJvdW5kIHNpZ25lZERhdGEuICBUaGUgcGF5bG9hZCBpcyBhDQptdWx0aXBhcnQv
YWx0ZXJuYXRpdmUgbWVzc2FnZSB3aXRoIGFuIGlubGluZSBpbWFnZS9wbmcNCmF0
dGFjaG1lbnQuIEl0IHVzZXMgdGhlIEhlYWRlciBQcm90ZWN0aW9uIHNjaGVtZSBm
cm9tIFJGQyA5Nzg4DQp3aXRoIHRoZSBgaGNwX2Jhc2VsaW5lYCBIZWFkZXIgQ29u
ZmlkZW50aWFsaXR5IFBvbGljeSB3aXRoIGENCiJMZWdhY3kgRGlzcGxheSIgZWxl
bWVudC4NCg0KLS0gDQpBbGljZQ0KYWxpY2VAc21pbWUuZXhhbXBsZQ0KLS1hZjMN
Ck1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVRyYW5zZmVyLUVuY29kaW5nOiA3
Yml0DQpDb250ZW50LVR5cGU6IHRleHQvaHRtbDsgY2hhcnNldD0idXMtYXNjaWki
Ow0KIGhwLWxlZ2FjeS1kaXNwbGF5PSIxIg0KDQo8aHRtbD48aGVhZD48dGl0bGU+
PC90aXRsZT48L2hlYWQ+PGJvZHk+DQo8ZGl2IGNsYXNzPSJoZWFkZXItcHJvdGVj
dGlvbi1sZWdhY3ktZGlzcGxheSI+DQo8cHJlPg0KU3ViamVjdDogc21pbWUtc2ln
bmVkLWVuYy1jb21wbGV4LWhwLWJhc2VsaW5lLWxlZ2FjeQ0KPC9wcmU+DQo8L2Rp
dj48cD5UaGlzIGlzIHRoZQ0KPGI+c21pbWUtc2lnbmVkLWVuYy1jb21wbGV4LWhw
LWJhc2VsaW5lLWxlZ2FjeTwvYj4NCm1lc3NhZ2UuPC9wPg0KPHA+VGhpcyBpcyBh
IHNpZ25lZC1hbmQtZW5jcnlwdGVkIFMvTUlNRSBtZXNzYWdlIHVzaW5nIFBLQ1Mj
Nw0KZW52ZWxvcGVkRGF0YSBhcm91bmQgc2lnbmVkRGF0YS4gIFRoZSBwYXlsb2Fk
IGlzIGENCm11bHRpcGFydC9hbHRlcm5hdGl2ZSBtZXNzYWdlIHdpdGggYW4gaW5s
aW5lIGltYWdlL3BuZw0KYXR0YWNobWVudC4gSXQgdXNlcyB0aGUgSGVhZGVyIFBy
b3RlY3Rpb24gc2NoZW1lIGZyb20gUkZDIDk3ODgNCndpdGggdGhlIGBoY3BfYmFz
ZWxpbmVgIEhlYWRlciBDb25maWRlbnRpYWxpdHkgUG9saWN5IHdpdGggYQ0KIkxl
Z2FjeSBEaXNwbGF5IiBlbGVtZW50LjwvcD4NCjxwPi0tIDxici8+QWxpY2U8YnI+
YnI+YWxpY2VAc21pbWUuZXhhbXBsZTwvcD48L2JvZHk+PC9odG1sPg0KDQot
LWFmMy0tDQoNCi0tM2M1DQpDb250ZW50LVR5cGU6IGltYWdlL3BuZw0KQ29udGVu
dC1UcmFuc2Zlci1FbmNvZGluZzogYmFzZTY0DQpDb250ZW50LURpc3Bvc2l0aW9u
OiBpbmxpbmUNCg0KaVZCT1J3MEtHZ29BQUFBTlNVaEVVZ0FBQUJRQUFBQVVDQVlB
QUFDTmlSME5BQUFBY0VsRVFWUjQydVZUT3hiQQ0KTUFnUzczOW5PM1RwUncyMGRx
cGJmQVJRWpPeXdd1luQ3RrREtuYmNMMazY2c3FsVCt6dDljaWRRrRSs2S3drWg0K

```
c2dyemZjcVZNcEwyam8wNDQ3Z1lEcGVBcmsrT25KSGtJaEFmVFBSaWNpaEFmNVlK
cnc3dmp2MFpXUldNL3VsaQ0KdmRQZjFRWjJrREQ5eHBwZDh3QUFBQUJKUlU1RXJr
SmdnZz09DQoNCi0tM2M1LS0NCqCCB6YwggPPMIICt6ADAgECAhMPLSW9ETmXSs5C
VIeh7j00Boq0MA0GCSqGSIb3DQEBDQUAMFUxDTALBgNVBAoTBElFVEYxETAPBgNV
BAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMgUlNBIENlcnRpZmlj
YXRpb24gQXV0aG9yaXR5MCAXDTE5MTEyMDA2NTQxOFoYDzIwNTIwOTI3MDY1NDE4
WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzEXMBUGA1UEAxMO
QWxpY2UgTG92ZWxhY2UwggEiMA0GCSqGSIb3DQEBAQUAA4IBDwAwggEKAoIBAQCa
lSn6i8Gi44/oAVAn5GnCk4PHHNjrSfWUnnelN41KImVaTC3D9zFCrS3i4Pa9ZgHy
A5Qf8JW3ZmnVz5q7M8onZm7mZjqQeb6FUH4i2GMt4jse2Dqs165ernT9O5NLFflH
UjURca3ynqEBBV4DmhnZp8eDhv3t6dXyCjNHT82S6DgCReZuTtMc1zy++MxQlqdn
9WZLhOAOpeNZKGmVwjeVy+8FkyzC3jX/Qcm+ZLCqlLqhBwDHdZ5qDTII2PVX1X3K
7/cONxhvBbaUl/k1swdszUtjhflyFZ80RuQ3qFC6vL/PGeWy6SCf58duq/AOEksC
AWlb+MD8QH9Yj7CFSmq1AgMBAAGjga8wgawwDAYDVR0TAQH/BAIwADAXBgNVHSAE
EDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0RBBcwFYETYWxpY2VAc21pbWUuZXhhbXBs
ZTATBgNVHSUEDDAKBggrBgEFBQcDBDAOBgNVHQ8BAf8EBAMCBSAwHQYDVR0OBBYE
FKJTQdVEPIApFXwBI/Dnjq/N83cPMB8GA1UdIwQYMBaAFJEwjnwHFwyn8QkoZTYa
ZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IBAQCBSXignLEynBakDKU68ro0RsyXWAPk
fXgQLgy7GrW7SrZeBc5IEcjoN9f/gsOx/Ht9Ii6zyBZVjdaox644DsiLOQEP4YMS
7y4q94RFFdmdzEbDLYx9sfUhvdTxDNOOoHz53PYDBh4zE4Nar2inC0D+VM6RGDy6
6K9l+D+bl8Wj9CyGUc1ppMNURexTg+z3web/eDOdu+F2MVtluLihne0Bp1GUTkr0
mJBolg6dSYal8Hw8/ANHpyExl56BJABb744gqoeuD9YSHjKK49+qYC9faFmQ+mK8
0lh1M9RdNI7srjn0LKpuob6w06jaRzWdNeXzlEc2tUpAr4vRhZjVD6FYMIIDzzCC
AregAwIBAgITN0EFee11f0Kpolw69Phqzpqp1zANBgkqhkiG9w0BAQ0FADBVMQ0w
CwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzExMC8GA1UEAxMoU2FtcGxl
IExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhvcml0eTAgFw0xOTExMjAwNjU0
MThaGA8yMDUyMDkyNzA2NTQxOFowOzENMAsGA1UEChMESUVURjERMA8GA1UECxMI
TEFNUFMgV0cxFzAVBgNVBAMTDkFsaWNlIExvdmVsYWNlMIIBIjANBgkqhkiG9w0B
AQEFAAOCAQ8AMIIBCgKCAQEAtPSJ6Fg4Fj5Nmn9PkrYo0jTkfCv4TfA/pdO/KLpZ
bJOAEr0sI7AjaO7B1GuMUFJeSTulamNfCwDcDkY63PQWl+DILs7GxVwXurhYdZla
V5hcUqVAckPvedDBc/3rz4D/esFfs+E7QMFtmd+K04s+A8TCNO12DRVBDpbP4JFD
9hsc8prDtpGmFk7rd0q8gqnhxBW2RZAeLqzJOMayCQtws1q7ktkNBR2wZX5ICjec
F1YJFhX4jrnHwp/iELGqqaNXd3/Y0pG7QFecN7836IPPdfTMSiPR+peCrhJZwLSe
wbWXLJe3VMvbvQjoBMpEYlaJBUIKkO1zQ1Pq90njlsJLOwIDAQABo4GvMIGsMAwG
A1UdEwEB/wQCMAAwFwYDVR0gBBAwDjAMBgpghkgBZQMCATABMB4GA1UdEQQXMBWB
E2FsaWNlQHNtaW1lLmV4YW1wbGUwEwYDVR0lBAwwCgYIKwYBBQUHAwQwDgYDVR0P
AQH/BAQDAgbAMB0GA1UdDgQWBBS79syyLR0GEhyXrilqkBDTIGZmczAfBgNVHSME
GDAWgBSRMI58BxcMp/EJKGU2GmccaHb0WTANBgkqhkiG9w0BAQ0FAAOCAQEAc4mi
NqfOqaBpI3f+CpJDhxtuZ2P9HjQEQ+v6BdP7GKJ19naIs3BjJOd64roAKHAp+c28
4VvyVXWJ99FMX8q2ZUQMxH+xh6oAfzcozmnd6XaVWHg4eHIjSo27PmhKE1oAJKKh
DbdbEcZXL2+x1V+duGymWtaD01DZZukKYr7agyHahiXRn/C9cy31wbqNsy9x0fjP
Qg6+DqatiQpMz9EIae6aCHHBhOiPU7IPkazgPYgkLD59fk4PGHnYxs1FhdO6zZk9
E8zwlc1ALgZa/iSbczisqckN3qGehD2s16jMhwFXLJtBiN+uCDgNG/D0qyTbY4fg
KieUHx/tHuzUszZxJjGCAgAwggH8AgEBMGwwVTENMAsGA1UEChMESUVURjERMA8G
A1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2VydGlm
aWNhdGlvbiBBdXRob3JpdHkCEzdBBXntdX9CqaJcOvT4as6aqdcwCwYJYIZIAWUD
BAIBoGkwGAYJKoZIhvcNAQkDMQsGCSqGSIb3DQEHATAcBgkqhkiG9w0BCQUxDxcN
MjEwMjIwMTcxMDAyWjAvBgkqhkiG9w0BCQQxIgQgFPMLhnhgVYfwoQAWNtNbXfp6
/cWw0vajQObfIM2N1+0wDQYJKoZIhvcNAQEBBQAEggEADBKPOlAhmQvuL9r8u9eh
4V7q50gjztxHMFw2kcppxXNAEoy6iQ9LeHjSXSmVNIsNyD34OfqIWUOztwbva/xC
+qOC/4GwaG4nvqCmyT2FfN19X+2XHgaLtlgUSE5JhYifHm2cfFGH4YObujre1NS+
tZubVHdqf/Stlr1vFhpBYcsu0ZInwbeVbUJBMYd2iqG5sE702eQpMPeSdh4C1CB8
W+1n0eMlPiea/V2SZC3WCTpErF7llbYdc6jLAWsOeT8tlJ+DhfgBccCppbsCw2nlW
yAxju5U8wojwW5qTVdVdlerenMLyzVmaxnVKZU5b5PPq8WV27JVzEZtG9YUTZV3T
8g==
```

C.3.10.2. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_baseline (+ Legacy Display), Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Subject: smime-signed-enc-complex-hp-baseline-legacy
Message-ID:
 <smime-signed-enc-complex-hp-baseline-legacy@example>
```

```
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:10:02 -0500
User-Agent: Sample MUA Version 1.0
HP-Outer: Subject: [...]
HP-Outer: Message-ID:
 <smime-signed-enc-complex-hp-baseline-legacy@example>
HP-Outer: From: Alice <alice@smime.example>
HP-Outer: To: Bob <bob@smime.example>
HP-Outer: Date: Sat, 20 Feb 2021 12:10:02 -0500
HP-Outer: User-Agent: Sample MUA Version 1.0
Content-Type: multipart/mixed; boundary="3c5"; hp="cipher"

--3c5
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="af3"

--af3
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Content-Type: text/plain; charset="us-ascii";
 hp-legacy-display="1"

Subject: smime-signed-enc-complex-hp-baseline-legacy

This is the
smime-signed-enc-complex-hp-baseline-legacy
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_baseline‘ Header Confidentiality Policy with a
"Legacy Display" element.

--
Alice
alice@smime.example
--af3
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Content-Type: text/html; charset="us-ascii";
 hp-legacy-display="1"

<html><head><title></title></head><body>
<div class="header-protection-legacy-display">
<pre>
Subject: smime-signed-enc-complex-hp-baseline-legacy
</pre>
</div><p>This is the
<b>smime-signed-enc-complex-hp-baseline-legacy</b>
message.</p>
<p>This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_baseline‘ Header Confidentiality Policy with a
"Legacy Display" element.</p>
<p><tt>-- <br>Alice<br>alice@smime.example</tt></p></body></html>
--af3--

--3c5
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline
```

```
iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--3c5--
```

C.3.11. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_shy

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses the Header Protection scheme from RFC 9788 with the hcp_shy Header Confidentiality Policy.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 9945 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 6346 bytes
    └  (unwraps to)
    └─┬ multipart/mixed 2005 bytes
      ├─┬ multipart/alternative 1106 bytes
      │ ├── text/plain 374 bytes
      │ └── text/html 469 bytes
      └── image/png inline 236 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-complex-hp-shy@example>
From: alice@smime.example
To: bob@smime.example
Date: Sat, 20 Feb 2021 17:12:02 +0000
User-Agent: Sample MUA Version 1.0

MIIcrAYJKoZIhvcNAQcDoIIcnTCCHJkCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
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C.3.11.1. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_shy, Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
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SFAtT3V0ZXI6IERhdGU6IFNhdCwgMjAgRmViIDIwMjEgMTc6MTI6MDIgKzAwMDAN
CkhQLU91dGVyOiBVc2VyLUFnZW50OiBTYW1wbGUgTVVBIFZlcnNpb24gMS4wDQpD
b250ZW50LVR5cGU6IG11bHRpcGFydC9taXhlZDsgYm91bmRhcnk9ImViNCI7IGhw
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YWFiDQpDb250ZW50LVR5cGU6IHRleHQvcGxhaW47IGNoYXJzZXQ9InVzLWFzY2lp
Ig0KTUlNRS1WZXJzaW9uOiAxLjANCkNvbnRlbnQtVHJhbnNmZXItRW5jb2Rpbmc6
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dW5kIHNpZ25lZERhdGEuICBUaGUgcGF5bG9hZCBpcyBhDQptdWx0aXBhcnQvYWx0
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IFJGQyA5Nzg4DQp3aXRoIHRoZSBgaGNwX3NoeWAgSGVhZGVyIENvbmZpZGVudGlh
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```
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AWUDBAIBoGkwGAYJKoZIhvcNAQkDMQsGCSqGSIb3DQEHATAcBgkqhkiG9w0BCQUx
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WM5HN/DtOsBA0zgDBSymieKaXbzfFAzNcgm441xlPMWCWH1ceqgzrq20KHTts6yv
pm6/ag==
```

C.3.11.2. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_shy, Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Subject: smime-signed-enc-complex-hp-shy
Message-ID: <smime-signed-enc-complex-hp-shy@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:12:02 -0500
User-Agent: Sample MUA Version 1.0
HP-Outer: Subject: [...]
HP-Outer: Message-ID: <smime-signed-enc-complex-hp-shy@example>
HP-Outer: From: alice@smime.example
HP-Outer: To: bob@smime.example
HP-Outer: Date: Sat, 20 Feb 2021 17:12:02 +0000
HP-Outer: User-Agent: Sample MUA Version 1.0
Content-Type: multipart/mixed; boundary="eb4"; hp="cipher"

--eb4
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="aab"

--aab
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
```

```
This is the
smime-signed-enc-complex-hp-shy
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_shy‘ Header Confidentiality Policy.

--
Alice
alice@smime.example
--aab
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-signed-enc-complex-hp-shy</b>
message.</p>
<p>This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_shy‘ Header Confidentiality Policy.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--aab--

--eb4
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--eb4--
```

C.3.12. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_shy (+ Legacy Display)

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses the Header Protection scheme from RFC 9788 with the hcp_shy Header Confidentiality Policy with a "Legacy Display" element.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 10945 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 7084 bytes
  ┴  (unwraps to)
    └─┬ multipart/mixed 2525 bytes
      ├─┬ multipart/alternative 1605 bytes
      │ ├── text/plain 568 bytes
      │ └── text/html 740 bytes
      └── image/png inline 236 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-complex-hp-shy-legacy@example>
From: alice@smime.example
To: bob@smime.example
Date: Sat, 20 Feb 2021 17:13:02 +0000
User-Agent: Sample MUA Version 1.0

MIIfjAYJKoZIhvcNAQcDoIIffTCCH3kCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
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UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
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XdALRlUG2vgMLUGld8Ztvztz4idD1ixj3Gebv2YwOcPPNxT8jLe+L0XvNtRqAdHs
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VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
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ar3ZQQEGRO976398AdChG9t+8tlGPAWeR9QWnoS3IBZQtqLiHzZAWobHgYz+iKSf
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6yI9K5QPEcFa9AErInwKFQ==
```

C.3.12.1. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_shy (+ Legacy Display), Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

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```

```
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RzEIRwi/BymNcaR2Bac=
```

C.3.12.2. S/MIME Signed-and-Encrypted over a Complex Message, Header Protection with hcp_shy (+ Legacy Display), Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Subject: smime-signed-enc-complex-hp-shy-legacy
Message-ID: <smime-signed-enc-complex-hp-shy-legacy@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:13:02 -0500
User-Agent: Sample MUA Version 1.0
HP-Outer: Subject: [...]
HP-Outer:
 Message-ID: <smime-signed-enc-complex-hp-shy-legacy@example>
HP-Outer: From: alice@smime.example
HP-Outer: To: bob@smime.example
HP-Outer: Date: Sat, 20 Feb 2021 17:13:02 +0000
HP-Outer: User-Agent: Sample MUA Version 1.0
Content-Type: multipart/mixed; boundary="88b"; hp="cipher"

--88b
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="6bd"

--6bd
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Content-Type: text/plain; charset="us-ascii";
 hp-legacy-display="1"
```

```
Subject: smime-signed-enc-complex-hp-shy-legacy
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:13:02 -0500

This is the
smime-signed-enc-complex-hp-shy-legacy
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_shy‘ Header Confidentiality Policy with a "Legacy
Display" element.

--
Alice
alice@smime.example
--6bd
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Content-Type: text/html; charset="us-ascii";
 hp-legacy-display="1"

<html><head><title></title></head><body>
<div class="header-protection-legacy-display">
<pre>
Subject: smime-signed-enc-complex-hp-shy-legacy
From: Alice &lt;alice@smime.example&gt;
To: Bob &lt;bob@smime.example&gt;
Date: Sat, 20 Feb 2021 12:13:02 -0500
</pre>
</div><p>This is the
<b>smime-signed-enc-complex-hp-shy-legacy</b>
message.</p>
<p>This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_shy‘ Header Confidentiality Policy with a "Legacy
Display" element.</p>
<p><tt>-- <br>Alice<br>alice@smime.example</tt></p></body></html>
--6bd--

--88b
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--88b--
```

C.3.13. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_baseline

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses the Header Protection scheme from RFC 9788 with the hcp_baseline Header Confidentiality Policy.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 10575 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 6820 bytes
  ──┴ (unwraps to)
    └─┬ multipart/mixed 2343 bytes
      ├─┬ multipart/alternative 1138 bytes
      │ ├── text/plain 390 bytes
      │ └── text/html 485 bytes
      └── image/png inline 236 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-complex-hp-baseline-reply@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:15:02 -0500
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-complex-hp-baseline@example>
References: <smime-signed-enc-complex-hp-baseline@example>

MIIefAYJKoZIhvcNAQcDoIIebTCCHmkCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
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Q2YcvCrj56tjKGHnKCKNhEyQaBIJwa586dT87MAlhCgSAOlPRWInWkH8yjHkxgF5
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```

```
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C.3.13.1. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_baseline, Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

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Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"
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AgMBAAGjga8wgawwDAYDVR0TAQH/BAIwADAXBgNVHSAEEDAOMAwGCmCGSAFlAwIB
MAEwHgYDVR0RBBcwFYETYWxpY2VAc21pbWUuZXhhbXBsZTATBgNVHSUEDDAKBggr
BgEFBQcDBDAOBgNVHQ8BAf8EBAMCBsAwHQYDVR0OBBYEFLv2zLItHQYSHJeuKWqQ
ENMgZmZzMB8GA1UdIwQYMBaAFJEwjnwHFwyn8QkoZTYaZxxodvRZMA0GCSqGSIb3
DQEBDQUAA4IBAQBziaI2p86poGkjd/4KkkOHG25nY/0eNARD6/oF0/sYonX2doiz
cGMk53riugAocCn5zbzhW/JVdYn30UxfyrZlRAzEf7GHqgB/NyjOad3pdpVYeDh4
ciNKjbs+aEoTWgAkoqENt1sRxlcvb7HVX524bKZa1oPTUNlm6QpivtqDIdqGJdGf
8L1zLfXBuo2zL3HR+M9CDr4Opq2JCkzP0Qhp7poIccGE6I9Tsg+RrOA9iCQsPn1+
Tg8YedjGzUWF07rNmT0TzPCVzUAuBlr+JJtzOKypyQ3eoZ6EPazXqMyHAVcsm0GI
364IOA0b8PSrJNtjh+AqJ5QfH+0e7NSzNnEmMYICADCCAfwCAQEwbDBVMQ0wCwYD
VQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBXRzExMC8GA1UEAxMoU2FtcGxlIExB
TVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhvcml0eQITN0EFee11f0Kpolw69Phq
zpqp1zALBglghkgBZQMEAgGgaTAYBgkqhkiG9w0BCQMxCwYJKoZIhvcNAQcBMBwG
CSqGSIb3DQEJBTEPFw0yMTAyMjAxNzE1MDJaMC8GCSqGSIb3DQEJBDEiBCDqxAGg
S+1eHkWHxwhKH54BovlMmxx6FJnth3m1aP2z+DANBgkqhkiG9w0BAQEFAASCAQAF
sIpGZtBsgrjVl9N6sQu/kUOdnbGSU9JKm6bXL+1vef+4jDckomzjYI5A1sKXxfsK
nBWwgEsEv9V03839X1gMAUc09cx1wwcg4LAUEDWgscC/iNJQo6Xm8fTs8yBMiM/+
0yMrreXIgeXR2ikTG5ub9mPrnxOxaefdnx6HMTh6jGmIodN2BAPIW2KahYYS0BQZ
g74NYeBJX1euT3/ZUqLmupQ0bephgj14pNcslj0qPSRmBf8pZv/9tzYOuSj5CwK4
pzvzfqRN6Lsz3AgFpXd0m7RiYCEwcAkgLLgJ4brnvtASUAmKuSRJaePB7Qcbewy3
4DJRpBBHfebD7Zg7DtDN
```

C.3.13.2. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_baseline, Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Subject: smime-signed-enc-complex-hp-baseline-reply
Message-ID: <smime-signed-enc-complex-hp-baseline-reply@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:15:02 -0500
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-complex-hp-baseline@example>
References: <smime-signed-enc-complex-hp-baseline@example>
HP-Outer: Subject: [...]
HP-Outer: Message-ID:
 <smime-signed-enc-complex-hp-baseline-reply@example>
HP-Outer: From: Alice <alice@smime.example>
HP-Outer: To: Bob <bob@smime.example>
HP-Outer: Date: Sat, 20 Feb 2021 12:15:02 -0500
HP-Outer: User-Agent: Sample MUA Version 1.0
HP-Outer:
 In-Reply-To: <smime-signed-enc-complex-hp-baseline@example>
HP-Outer:
 References: <smime-signed-enc-complex-hp-baseline@example>
Content-Type: multipart/mixed; boundary="8ec"; hp="cipher"
```

```
--8ec
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="bce"

--bce
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
smime-signed-enc-complex-hp-baseline-reply
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_baseline‘ Header Confidentiality Policy.

--
Alice
alice@smime.example
--bce
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-signed-enc-complex-hp-baseline-reply</b>
message.</p>
<p>This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_baseline‘ Header Confidentiality Policy.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--bce--

--8ec
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--8ec--
```

C.3.14. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_baseline (+ Legacy Display)

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses the Header Protection scheme from RFC 9788 with the hcp_baseline Header Confidentiality Policy with a "Legacy Display" element.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 11205 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 7286 bytes
```

```
  ┴ (unwraps to)
   └┬multipart/mixed 2668 bytes
    ├┬multipart/alternative 1427 bytes
    │ ├─text/plain 482 bytes
    │ └─text/html 642 bytes
    └─image/png inline 236 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID:
 <smime-signed-enc-complex-hp-baseline-lgc-rpl@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:16:02 -0500
User-Agent: Sample MUA Version 1.0
In-Reply-To:
 <smime-signed-enc-complex-hp-baseline-legacy@example>
References:
 <smime-signed-enc-complex-hp-baseline-legacy@example>

MIIgTAYJKoZIhvcNAQcDoIIgPTCCIDkCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBADQPkIuGlBhlGBvHWV+5XhSHz6YEXDsOGhxo
lwaqsHHut09RMi+VovM7fasvln4F4tpKCfYbV5kAkFrNFB7fY2thHH58YpkABzF4
oA0kDcWHqVho/AVV1n0Kf7kplDCR0uPfibSgWjJQcsRARuwB0aRAkUMJKl9EcZgX
KWz54wcwkZkcKGn2SxhWSea6HqhB1no0Q0Iexgzl4LdEWlcZWkQYfWZ6VAY8r5tp
h0txgujzFUFuYLebbKS8LC2G2jurs+ktsSGDwnLzOqSeQyN17rlDnEC+aQMmTsRI
S0DMwKAb/P3z5u6jk3Ryu2HRBIZsTsJhIhgkuoZqEFG5/ZS91I0wggGEAgEAMGww
VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
HGLS64MvlsDXhpQwDQYJKoZIhvcNAQEBBQAEggEAR0Pqih31TIW6ROhwnDGcMz2i
5f9z+HpFsjLj6EJ5LU3DXhsdT+6XcF2fqtCJUjvIgqVBj/5ixRYR1wPzypgz/QI5
MYBi2hrr6ch/tWyUDSV5R2FKLD58u5ZLlt5KKW6oyW3L30zB+hl1NEaIjUFyMSJm
Up6/JEPDeJwg3fAygH9XHUxE1ocTgWuVyVqFsjyzAja3S2cvUOvm6smEGdPYcBxc
Lr1zALPmct3Dikn/pTZizIDA1zQR78mwbPYJ2mJsLYxGAjoPhEh5X8y9PrzJNGsO
gQW1UtLI9dDSjrijLV1vKWWaV2coMcsXxQiLAVoVWDJxjEDM2UoY2ymQAX39HzCC
HR4GCSqGSIb3DQEHATAdBglghkgBZQMEAQIEEGhYozFbuzK33IcI4CwfeAuAghzw
eiwNUm6ghKAi3x/wM+7u99irte7m5KiQwuC/6W88BVZk+Xu8rGHeHgl8Py8Sdfxx
e0MvM1Bdc8NwsUAJK4PphSZkK8FPKczvKF7kV1+XzBTQRflesQido0IOKfLHDBMS
NKbvK8haTRiB/4EBAPh2C7evfTYfKeN6Wd7GKkzphO58dB8t9ABpJP+mCG+hvuhv
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DXSy4eyDDI85wWQIsLQ2fh599Vhag0tXk4+ElCzdSy+UqXwmX8hMBHZoWU0j65No
PgWcZQ4IT7qctJd9NDBi3a3R6OFYJSPjNEu1TmW6kEQlE+I0PtlxiqTDDJu9odKt
uQzHsQBEG+kDFTvtPIu3OcZniFN1Xhm4cc1iZMdc+fvwom9SXl8R3fiK3zFbOZbT
C+/DQWjxrjsbCdukOfXqI1o72SQwgLuHDpfs2Kmz0bHrMlORN/RAhKKem2Kb7s7g
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/HVEe6BNkxhD6q9ti7Lg3dDODkh8meLgkaXirmSC/IDwY4IzVepKWnENn5iMemf3
8/nZ6g8m7xph0riq9NLXLqecLqQrhJfUEvBtxw0bm+OxZGkPel/5ib941dSNKexk
DZ2cq4gAifNoAWu9q9S9bz7+ODD68hRdoQQuUvDyV2FzB6cyOBeoB2tWLnknl3FN
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2RUVtRA5FmXizcTRi2rdY38uIEvBOj7jNLzGErG6F/li4OEm7SiwovzvuUsVSSON
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FcrmPDisDWYS3WN67eyXyWtM2aM7LnoUl5kPNYlwBe7qIaxwch8i9k0KBVcU52gY
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```

```
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TbmljK7/zCwzGoBjQrJxykFGD1xHZwWY3TEhpQoewduLE1nX3lZtHBHvV6bt2CMD
ld639Jczp5QSAq4yGtZjZYUqHqYGIgNqov8GyLfiNaLUhneojo2V41SL1kRIsF5U
EYfjDYXv/MSorcMCI0x8/B+0qxtyd0R05QE1RZnSftQ+appE8XKLVPcFzQ8x+P9g
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fOkeN7ArJmiZIUevxsgQe1mCFGp6+L4/XPalGV6LzIUY7kS4HNW7gpn8lDYw6Jwv
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11q0rwhWavVshkk07DPjpcZP6FOvsEJNLfmw+Ob9RcOpaQUJh9xpw7avQSkeQ/hk
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```

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C.3.14.1. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_baseline (+ Legacy Display), Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:


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MBwGCSqGSIb3DQEJBTEPFw0yMTAyMjAxNzE2MDJaMC8GCSqGSIb3DQEJBDEiBCCY
UuDiqUQkX8Y6z7GoBK5oZgbF9o0kqfOxpi4tDaKThTANBgkqhkiG9w0BAQEFAASC
AQAPvlBItCWJNdtkeHveM0hBpLsosoAUG3bMHg0JNi89kzV02YK9YDjFSG2nX2Wj
pYuKJVi7UH1aGCmyA0D20umbcIuBqtWXX+W4SRhzNGR3P+lxlVKMe//qPlTgdZTR
t9Eg+vmJwrIuJVcZk6+tagnOinCl5watJ0BDEnCQcgywe+5EvT7+kRrIV8eZWj1f
7e2ut4xOMYVOKwWBOpBFtY27rlu8rMjqf6JT1wpvGvaXllsTsBPqxfOPe0x321ma
HGAO/tnCcM7FXtFChgFR6rfpRDvTBvFtR81lDbK/vPYo/PevKjR8mX5lgO0GcFwg
30JDp0rABngu4wItcNYBsHNP
```

C.3.14.2. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_baseline (+ Legacy Display), Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Subject: smime-signed-enc-complex-hp-baseline-lgc-rpl
Message-ID:
 <smime-signed-enc-complex-hp-baseline-lgc-rpl@example>
```

```
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:16:02 -0500
User-Agent: Sample MUA Version 1.0
In-Reply-To:
 <smime-signed-enc-complex-hp-baseline-legacy@example>
References:
 <smime-signed-enc-complex-hp-baseline-legacy@example>
HP-Outer: Subject: [...]
HP-Outer: Message-ID:
 <smime-signed-enc-complex-hp-baseline-lgc-rpl@example>
HP-Outer: From: Alice <alice@smime.example>
HP-Outer: To: Bob <bob@smime.example>
HP-Outer: Date: Sat, 20 Feb 2021 12:16:02 -0500
HP-Outer: User-Agent: Sample MUA Version 1.0
HP-Outer: In-Reply-To:
 <smime-signed-enc-complex-hp-baseline-legacy@example>
HP-Outer: References:
 <smime-signed-enc-complex-hp-baseline-legacy@example>
Content-Type: multipart/mixed; boundary="bed"; hp="cipher"

--bed
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="828"

--828
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Content-Type: text/plain; charset="us-ascii";
 hp-legacy-display="1"

Subject: smime-signed-enc-complex-hp-baseline-lgc-rpl

This is the
smime-signed-enc-complex-hp-baseline-lgc-rpl
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_baseline‘ Header Confidentiality Policy with a
"Legacy Display" element.

--
Alice
alice@smime.example
--828
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Content-Type: text/html; charset="us-ascii";
 hp-legacy-display="1"

<html><head><title></title></head><body>
<div class="header-protection-legacy-display">
<pre>
Subject: smime-signed-enc-complex-hp-baseline-lgc-rpl
</pre>
</div><p>This is the
<b>smime-signed-enc-complex-hp-baseline-lgc-rpl</b>
message.</p>
<p>This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_baseline‘ Header Confidentiality Policy with a
```

```
"Legacy Display" element.</p>
<p><tt>-- <br>Alice<br>alice@smime.example</tt></p></body></html>
--828--

--bed
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--bed--
```

C.3.15. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_shy

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses the Header Protection scheme from RFC 9788 with the hcp_shy Header Confidentiality Policy.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 10445 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 6720 bytes
    └ (unwraps to)
    └─┬ multipart/mixed 2273 bytes
      ├─┬ multipart/alternative 1118 bytes
      │ ├── text/plain 380 bytes
      │ └── text/html 475 bytes
      └── image/png inline 236 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID: <smime-signed-enc-complex-hp-shy-reply@example>
From: alice@smime.example
To: bob@smime.example
Date: Sat, 20 Feb 2021 17:18:02 +0000
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-complex-hp-shy@example>
References: <smime-signed-enc-complex-hp-shy@example>

MIIeHAYJKoZIhvcNAQcDoIIeDTCCHgkCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBAI9iPH5/b2KLsDbl+Gv6Q/yOjrEsmu76WuOA
rQu6BKFkeKtgemTUgvvcbc//DMQLqFXrciCBw2LNPzq6pxpgaaS8xFcvHttAtd4j
pci1n9SJvAggSTzU+vaHUEdgf/PTP5mBDy82PbZx4cZbuIM4prBq6/haUnmxARs4
xSEbfQliaYCSFRt+3GAhXLSI2y+6odiA/0DxltHq+PiTc2SGn1BVyNyxeNpxbAkm
G38L96SPP3lgeb1oV2F6aEmwBKUeMoHoFPfGz3L7aCKCcbaXgp+phC+8qlMPJxol
sPgSToVMCakQBk/OaveXL5HaMHYd63p2G5vBUcjvUsEsyP5N0j4wggGEAgEAMGww
VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
HGLS64MvlsDXhpQwDQYJKoZIhvcNAQEBBQAEggEAnQrNiuXf9Kn9FiuopsfQYQT0
L6euHqh4ENdEQeBLZUsvmaO98nqF0Sc6Pe9QKlIJbnFFBHLGD/52Sv5vZH5aLUgh
BCeM5YiBg6J5Di8EmE207ltptn1+mDColCceMsCpiBiSohczFNY4ME0Yd30NsYcY
qEr1TbT8/CqmSBtJrkVVNAi+XCYPYo4yQTlRjneBR066DaPvMsR4G1YZSb/xcKih
```

```
5w49gwQO4qf7N7CH3t79Fo+OPRwRDF1MwVMTK3L4BAZzH//M4+h3w3u8XzM2djUK
/4YQ9EyFfhoTGrbi1o7KsZV/fMlmGxaIdtdQ+zny1ZzGijJG0GjKbJ7fxjCHkzCC
Gu4GCSqGSIb3DQEHATAdBglghkgBZQMEAQIEECpxXzqAYIhfW/zQN9X1OhiAghrA
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GxVYDWVflW5ofL+YdOiW5/OYwJ/6Q1i8gEmfl3JTnjSA3vIx9wP1bu8K5hS4eyd8
dNbb2AwprX/Fwd1hSiTsnJ0eov9RcdmmTLhyD7yG6VVMZ85ZhJE7i6IygHxq8MlF
Cef4x0QJf7XHmd02Hi4t/7yjSf/HsaSNct2jp+XB43tNtYpl1r3acsibOvP4lAp/
XZuR3tvUNeXL/NTp5ulMqfIQlLKC9Ah0znPX8H7g9ccTPig09nm8qWeaOMyiJ9Vm
/jPJPN6xPTJT3jxEMXj9V0DmlkG4aHhkf74vfQKPNt/lx5Tl79Cit73Sw0ajCqgF
IOPeyvUww7u4kGXhTxlv+CirX6W7wPGPdQku7PXwl5r2I8iBWFaOiqPhuoluaWnK
CRN9QQOA0PAScDZxyHB+Z0E4JMgzt7rwDiGChcZn/OwYMYEgZW75N6kA2Ptc2pfw
+9l9AXkRIJcU0t3p3Kk9JiFC/AinLP2XfseuQYvtEUviBlD6snMquAkdkvlsI1po
SjJNHyPqC1+x/0jVqquEpDVhHQ7JYci4CfzTaEGxvtpGMtAYgHXOlTe34+xqvg7/
Vwjs+NJOQVT1Oj+bQAu1IbtAdg1hE6PHcWy2Sl2Ej5wWvbrtoyi/9b8hBoGGnLIi
mRDKj2PiA0dGKiOq0d4tIzmKnzRUPugVwjLEpW9BBP6p0BcNYBbBKdOQvmOdhlkb
V2rggBQdIUeDvb9bgM7O9oCZIokmJqUDVrD75VTWPel1hPv4ab8XM09y8lC/+4R2
8X8NJyLf2RLGmRhvvAYi4LYRaP4db7pEDCK3cEZ+hB0MG20Lfuzoe1RmOtU5Eu+4
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JUhpTgaycis/SAHAPdomO2aS6tDMYSlhv9hLTCrsTnyFB04AOV+j8R834An3VRZV
S+Qw8M3jlWD1TurHPGpQAdmvRUjKzXOnXA/Ior2MdEvkOObluFHTvCqC3HRx1+eV
IwuHNTcWedC5EYfIzIfKgjkKf3gq6MRd5wfjqPCCN/WVDIHGCMs3BZJVAX+1aXqU
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n+nCqncj9Z+k0c9y58Sg61ice7iiBgsjFzh49HH04h4ft19xtySOLmIXpCVR+cY+
SIAqgRgXNnx+jMPCKf0DQMqAE0C5XmztiSG7XWlE3ufS0Gw9zSWxoHFbPinbU8nc
8vokU2Jk7rJujoNjwNeLc6UgnsixtpQlUlNhC9apAZo/6QzUiVkyZh30I7E3GNZp
IlvBhD1pGbbxBkewC7L3rfA5TbAci7tNNX46beoEfbI73HqtN7+EnAkxCVsE6mH6
JUNSPJI7RJu3/sFyq8KyV2EzYfwhb+ww9tPYhKCaokeluvmEqzb1qMw4atpSBWU0
lnyku3ffndauOW0MVpMmbtlVMqz2NFJcfAm132PQdHSs5Hxc4XiStJBZ6/EeGn/a
lbhjdpYf5Df73zb1icUxU/El5Gkws+S2oloCa2d0XbjY0ngr/9l28xJJLEyBQDV9
GxlsULqjM+ipoQb1PfhH9UQOH3HGTdd7Ko3YcoiGhN2Fx/mddOvbROJWbx1OsV49
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9gasdKFk7m3etaqc6Vd0XOdeV0AAl6AvGv0/cXymmyN9Xdw1+Aet4StR12YzlmuR
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/qyQZ459RU0A1brtE9//7aBqhXAUzzgZ5COu0OPgFeNikBhlUJNeCceypG7kFDn5
EynDYo7WAGhOOEaurGB0F+Zb6QBWMGIYQpaueSEl8BZcXMwVKGeGdVA9oW/X5pvP
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uQPaEXqLhqfRsXkw4m4ZD3YJQbVNQ3ICal34CqA7bwjfpOQrosgzpx67QG9+ksTH
Wyd4hk8GfceC0MiB8vPNcg4j9vBliOxw5Ip1WFBy6TL4PUAx1RnUQeUDlv5lXbt/
EzviUnnBaPsnZsMrMYZmj3PRsCKLr118BAXgWgZjrS4b7wsahkTZiVKRc+/bXMv7
7Ta16UYQ2mTLM9qPGOv9gJFZtQEs+HQdJ0HG3on47coqxudJclPSLvK4Gvlux0iO
0GyIagZXndQkWaXGy4KHcyM8nqmwhAbmhLtTX70egiI88pkj3i1dOX3Gi3KEXL7D
6zHlQUYQ6bVeq2NB6byFKGiSZz+9i4J3vgfW2l/lMwu26fukAslL7cBsXyREjTLw
tYGbw5EWoHOxr8Mgj7HrhGPLXX/gmjYmg7YRds9WWte+9FsRYnUTc9oVEGoIcE9b
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```

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/gn72roI+uT/gYH8Lc2SYNR7gOQqEUmZ79MzziePg8fyvxd8IiOSpUHMlkLbQdjC
YislsKmjjSWQYJrsSXKB/jomZuv4V8Ix68odD6nAlT2/FLxH7hq7YFfdFaTeUaU9
vCEugvwN5Z1+VdXAWp3egdU3fY3yDgrIDqTfkH8mlk/Sk8XEhhMnYFeYPQ8sDmkT
8ZwI+P8D5RfP0fMRAAg11rCPm9woeXA9JEGNfBtKpEMEez2am99nKfIbkL0xvj+e
yZTOEkjDVXtugIbUf7RMmGoFj4oHQa69cDWDfMXPJoXtF99LUI62Dr4rDGrSPVUt
dgVwS8IWPahbRPn09NixO1rb+Q1+3UyUcovJuNwia8RT8jH5z11SL4s5CwC77jLb
PCzez5nGqm6tuFLQ48togUaMbkwmGxhxE3mLVDlOh/rQ2cndcvHNwkhUJpo3A9Dc
mn5wb5OYXknZBjqv9Zi+6xufiTKUpoFXG7YvyKp2Wj3xNSBDDLi2ovA6BVCNsRnl
jjWeVtjcCg2cmm8nKEix2KXb7VbiYkzV6selYCZC2LTprlJxIwzRH8oKM5mmR0UE
0mXtEhiUbSPrIYEJKgBS9x/541nFj6zPR8VDWPBC/z+Jz/+pQGjO1tn8Cw3yaZoH
aNAg6NWu9Z94WdiOras+rAXsrccFofWL7NDC8YhQO7a4o4cLz9Y+sG99CxMrdOOG
L6iachPXuUyjpTxqE1g5U9bIGqoZkrmDkv9ZjGxidFA/ofjXZ/kV0zfQ0R1TZ8g7
/EMhFMLtcWu+SCPl7IxBgGK14wEUN4gJdBvWbNvXItyOSSngCEBwlG+cqZxtzHvO
S+lrIEtuFP1ziPKXisDekRlJ2n9ySsGz3ff4SQYHvv2f5OJpjK3niOtzXrhzjqQR
E7LXJlAYxc/SdKkB2N8ajOG7vld5ydA5dDZM1cbdNkeGgxaCZd6hDb08Lc52Hlj6
B9NQgygtF0INFnEUvrVsI3SJKSrQAeafppe7/RrC9FsuwDe2582BKbX9NnCXQamI
ND3HDvVFLi7tnaJ7luGtQvqV4BHsF6WNbJTisWxTJtuhqQ3N7LvyBGO8DJnwzUFj
D0vaWHTdeMmsvkQz8JO/fMxq1GxGnHkjjg8BmmkymS2sA/RXLPJ4FIGgPg1eNymY
6IphFEpTwyoW1IYFIROIW6KiVArA4N8lYpoMeprzO08I8MA5Gf9XoRJRpLMo2zOf
hJ6UCYO2rgunUaa4kMbpSW+l+7wUPEgbxM47UQKZ6FRjU0lMnmYNxHnoJIOCHJ4R
0nPO2O0dEYk8qYe+YSGsVa6d/dGskOBK5YrZeXmSiTHiZemAyahE38rZJIZrwC6n
Kjm1MDaTiS0QhtNSVctjNYqJzkesSJr7ihxP7M8uvBONV9hs3dpiJr7oXFKPR3gU
mE/Jj6gtBe+xcuhluqPvwLPRiM6rZEHisjct8KYVzSFhXMZ/LqM/r4SAnDTHoMlp
PJOQzqUqUSDrZp6FefbzrHMKvmh/BjCPYVYrtRhnCyeq90h6D7pUjsdKV81MzX40
TeIfRAlpv5VVJlN9A7QItE9sCvT63b9M19YIHltZLrZI6oAuRLVux0TphgJnuH9Q
nrDVlhFYzmcIIz5zeHcSRLAnE4xhHY9eNbBkfr+0kSmzYO1lj/z0kWs82ZxFsCv/
X8m9r88mMAO8UjvSSdaXaU4QMpgyjQjdIDYp8bzX/sySZsSwue6Xfz8+HV18Km0/

aurM5Cnt4pPCyecHh6d3ktp0atLFfAgkvXRy1qeB/HQ2FpH6WbZTxdq0AKKsPHpJ
Q9E9KwXmooTajSKyLamS/eO72pQ5G715KDaEkaG/O7LRXS/gmKhk+yrfULj2uMAF
3Z1f/irjt2aDlYOOfpQtkO396ZjRlpTb5Z0YwA9Z/h8nDiKils7wm7aOr4MFU863
64FshXZDst8UhD2fg+FErcxLn0cBsgBAwoQ/dVyAThn5yg2/RdQUXb+lbUdoWQsa
KjA2/fCE+MWIvNI/7kVOJu1oF/kIhKb2GMS4qP+mL7iyGRexfKuXg9t2ZPcrzDVQ
DJ+U8ShhTwbwxKow+MYEa6tyNr5n//R3X0PqWEh2Nm4i3RHsHAiyT5y4XAFV4bqw
8A+j/IsOYb6YOnXSmPcAqapvfpBkmFYVmKeKEnX0qvurU9WnWIPUVex2lZORXWpm
Z0rJpkGeJ0Qzl+lUTlyzDv3F0OYfu2YM087UwDjusFXkZx4q0us0RRlHOivRhsSm
fVPvCEJpPP+IkbKC9rnTNDRYHZXe0fwL0BayXeP5vzu0xhTPj2scw7xGGQXSV/K7
rXZIyp21dUgWPvtC6GsnaqqB60ulY7Z4RyGIROF+dpIqGPa7cT5DWaxFZxA28zCe
my2SjL2+P8CiOO0cynhFSW+RkxwemTxUIcorFeRbwY/QGJPxOt3zYd8Ac3xMUpl6
5e8lO5xVK4nonot1XfxBEb3KLU5szkNM1KzoXNFxjvnfiwrSX8UNGWAvmDWiGWut
7D7b2mazbiAoTMEOmX43as1FHeco3oDjeoEiYyc8b/6nLj9/SMSkxzgncrxvEEAG
amhJ49wnRgOUWYkZzyOOaCQqA4xnGl84Dj3tQy0afpE=

C.3.15.1. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_shy, Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"
```

MIITEgYJKoZIhvcNAQcCoIITAzCCEv8CAQExDTALBglghkgBZQMEAgEwggk7Bgkq
hkiG9w0BBwGgggksBIIJKE1JTUUtVmVyc2lvbjogMS4wDQpTdWJqZWN0OiBzbWlt
ZS1zaWduZWQtZW5jLWNvbXBsZXgtaHAtc2h5LXJlcGx5DQpNZXNzYWdlLUlEOiA8
c21pbWUtc2lnbmVkLWVuYy1jb21wbGV4LWhwLXNoeS1yZXBseUBleGFtcGxlPg0K
RnJvbTogQWxpY2UgPGFsaWNlQHNtaW1lLmV4YW1wbGU+DQpUbzogQm9iIDxib2JA
c21pbWUuZXhhbXBsZT4NCkRhdGU6IFNhdCwgMjAgRmViIDIwMjEgMTI6MTg6MDIg
LTA1MDANClVzZXItQWdlbnQ6IFNhbXBsZSBNVUEgVmVyc2lvbiAxLjANCkluLVJl
cGx5LVRvOiA8c21pbWUtc2lnbmVkLWVuYy1jb21wbGV4LWhwLXNoeUBleGFtcGxl
Pg0KUmVmZXJlbmNlczogPHNtaW1lLXNpZ25lZC1lbmMtY29tcGxleC1ocC1zaHlA
ZXhhbXBsZT4NCkhQLU91dGVyOiBTdWJqZWN0OiBBLi4uXQ0KSFAtT3V0ZXI6DQog
TWVzc2FnZS1JRDogPHNtaW1lLXNpZ25lZC1lbmMtY29tcGxleC1ocC1zaHktcmVw
bHlAZXhhbXBsZT4NCkhQLU91dGVyOiBGcm9tOiBhbGljZUBzbWltZS5leGFtcGxl
DQpIUC1PdXRlcjogVG86IGJvYkBzbWltZS5leGFtcGxlDQpIUC1PdXRlcjogRGF0
ZTogU2F0LCAyMCBGZWIgMjAyMSAxNzoxODowMiArMDAwMA0KSFAtT3V0ZXI6IFVz
ZXItQWdlbnQ6IFNhbXBsZSBNVUEgVmVyc2lvbiAxLjANCkhQLU91dGVyOiBJbi1S
ZXBseS1UbzogPHNtaW1lLXNpZ25lZC1lbmMtY29tcGxleC1ocC1zaHlAZXhhbXBs
ZT4NCkhQLU91dGVyOiBSZWZlcmVuY2VzOiA8c21pbWUtc2lnbmVkLWVuYy1jb21w
bGV4LWhwLXNoeUBleGFtcGxlPg0KQ29udGVudC1UeXBlOiBtdWx0aXBhcnQvbWl4
ZWQ7IGJvdW5kYXJ5PSIyMzAiOyBocD0iY2lwaGVyIg0KDQotLTIzMA0KTUlNRS1W
ZXJzaW9uOiAxLjANCkNvbnRlbnQtVHlwZTogbXVsdGlwYXJ0L2FsdGVybmF0aXZl
OyBib3VuZGFyeT0iNGM4Ig0KDQotLTRjOA0KQ29udGVudC1UeXBlOiB0ZXh0L3Bs
YWluOyBjaGFyc2V0PSJ1cy1hc2NpaSINCk1JTUUtVmVyc2lvbjogMS4wDQpDb250
ZW50LVRyYW5zZmVyLUVuY29kaW5nOiA3Yml0DQoNClRoaXMgaXMgdGhlDQpzbWlt
ZS1zaWduZWQtZW5jLWNvbXBsZXgtaHAtc2h5LXJlcGx5DQptZXNzYWdlLg0KDQpU
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bmcgUEtDUyM3DQplbnZlbG9wZWREYXRhIGFyb3VuZCBzaWduZWREYXRhLiAgVGhl
IHBheWxvYWQgaXMgYQ0KbXVsdGlwYXJ0L2FsdGVybmF0aXZlIG1lc3NhZ2Ugd2l0
aCBhbiBpbmxpbmUgaW1hZ2UvcG5nDQphdHRhY2htZW50LiBJdCB1c2VzIHRoZSBI
ZWFkZXIgUHJvdGVjdGlvbiBzY2hlbWUgZnJvbSBSRkMgOTc4OA0Kd2l0aCB0aGUg
YGhjcF9zaHlgIEhlYWRlciBDb25maWRlbnRpYWxpdHkgUG9saWN5Lg0KDQotLSAN
CkFsaWNlDQphbGljZUBzbWltZS5leGFtcGxlDQotLTRjOA0KQ29udGVudC1UeXBl
OiB0ZXh0L2h0bWw7IGNoYXJzZXQ9InVzLWFzY2lpIg0KTUlNRS1WZXJzaW9uOiAx
LjANCkNvbnRlbnQtVHJhbnNmZXItRW5jb2Rpbmc6IDdiaXQNCg0KPGh0bWw+PGhl
YWQ+PHRpdGxlPjwvdGl0bGU+PC9oZWFkPjxib2R5Pg0KPHA+VGhpcyBpcyB0aGUN
CjxiPnNtaW1lLXNpZ25lZC1lbmMtY29tcGxleC1ocC1zaHktcmVwbHk8L2I+DQpt
ZXNzYWdlLjwvcD4NCjxwPlRoaXMgaXMgYSBzaWduZWQtYW5kLWVuY3J5cHRlZCBT
L01JTUUgbWVzc2FnZSB1c2luZyBQS0NTIzcNCmVudmVsb3BlZERhdGEgYXJvdW5k
IHNpZ25lZERhdGEuICBUaGUgcGF5bG9hZCBpcyBhDQptdWx0aXBhcnQvYWx0ZXJu
YXRpdmUgbWVzc2FnZSB3aXRoIGFuIGlubGluZSBpbWFnZS9wbmcNCmF0dGFjaG1l
bnQuIEl0IHVzZXMgdGhlIEhlYWRlciBQcm90ZWN0aW9uIHNjaGVtZSBmcm9tIFJG
QyA5Nzg4DQp3aXRoIHRoZSBgaGNwX3NoeWAgSGVhZGVyIENvbmZpZGVudGlhbGl0
eSBQb2xpY3kuPC9wPg0KPHA+PHR0Pi0tIDxici8+QWxpY2U8YnIvPmFsaWNlQHNt

```
aW1lLmV4YW1wbGU8L3R0PjwvcD48L2JvZHk+PC9odG1sPg0KLS00YzgtLQ0KDQot
LTIzMA0KQ29udGVudC1UeXBlOiBpbWFnZS9wbmcNCkNvbnRlbnQtVHJhbnNmZXIt
RW5jb2Rpbmc6IGJhc2U2NA0KQ29udGVudC1EaXNwb3NpdGlvbjogaW5saW5lDQoN
CmlWQk9SdzBLR2dvQUFBQU5TVWhFVWdBQUFCUUFBQUFVQ0FZQUFBQ05pUjBOQUFB
QWNFbEVRVlI0MnVWVE94YkENCk1BZ1M3MzluTzNUcFJ3MjBkcXBiZkFSUUVqT3l3
aXdZbkN0a0RLbmJjTGs2NnNxbFQrenQ5Y2lka0UrNkt3a1oNCnNncnpmY3FWTXBM
MmpvMDQ0N2dZRHBlQXJrK09uSkhrSWhBZlRQUmljaWhBZjVZSnJ3N3ZqdjBaV1JX
TS91bGkNCnZkUGYxUVoya0REOXhwcGQ4d0FBQUFCSlJVNUVya0pnZ2c9PQ0KDQot
LTIzMC0tDQqgggemMIIDzzCCAregAwIBAgITDy0lvRE5l0rOQlSHoe49NAaKtDAN
BgkqhkiG9w0BAQ0FADBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhMQU1QUyBX
RzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9uIEF1dGhv
cml0eTAgFw0xOTExMjAwNjU0MThaGA8yMDUyMDkyNzA2NTQxOFowOzENMAsGA1UE
ChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxFzAVBgNVBAMTDkFsaWNlIExvdmVs
YWNlMIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAmpUp+ovBouOP6AFQ
J+RpwpODxxzY60n1lJ53pTeNSiJlWkwtw/cxQq0t4uD2vWYB8gOUH/CVt2Zp1c+a
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A5oZ2afHg4b97enV8gozR0/Nkug4AkXmbk7THNc8vvjMUJanZ/VmS4TgDqXjWShp
lcI3lcvvBZMswt41/0HJvmSwqpS6oQcAx3Weag0yCNj1V9V9yu/3DjcYbwW2lJf5
NbMHbM1LY4X5chWfNEbkN6hQury/zxnlsukgn+fHbqvwDhJLAgFpW/jA/EB/WI+w
hUpqtQIDAQABo4GvMIGsMAwGA1UdEwEB/wQCMAAwFwYDVR0gBBAwDjAMBgpghkgB
ZQMCATABMB4GA1UdEQQXMBWBE2FsaWNlQHNtaW1lLmV4YW1wbGUwEwYDVR0lBAww
CgYIKwYBBQUHAwQwDgYDVR0PAQH/BAQDAgUgMB0GA1UdDgQWBBSiU0HVRDyAKRV8
ASPw546vzfN3DzAfBgNVHSMEGDAWgBSRMI58BxcMp/EJKGU2GmccaHb0WTANBgkq
hkiG9w0BAQ0FAAOCAQEAgUl4oJyxMpwWpAylOvK6NEbMl1gD5H14EC4Muxq1u0q2
XgXOSBHI6DfX/4LDsfx7fSIus8gWVY3WqMeuOA7IizkBD+GDEu8uKveERRXZncxG
wy2MfbH1Ib3U8QzTjqB8+dz2AwYeMxODWq9opwtA/lTOkRg8uuivZfg/m5fFo/Qs
hlHNaaTDVEXsU4Ps98Hm/3gznbvhdjFbZbi4oZ3tAadRlE5K9JiQaJYOnUmGpfB8
PPwDR6chMZeegSQAW++OIKqHrg/WEh4yiuPfqmAvX2hZkPpivNJYdTPUXTSO7K45
9CyqbqG+sNOo2kc1nTXl85RHNrVKQK+L0YWY1Q+hWDCCA88wggK3oAMCAQICEzdB
BXntdX9CqaJcOvT4as6aqdcwDQYJKoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVU
RjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0Eg
Q2VydGlmaWNhdGlvbiBBdXRob3JpdHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5
MjcwNjU0MThaMDsxDTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcw
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wdRrjFBSXkk7pWpjXwsA3A5GOtz0FpfgyC7OxsVcF7q4WHWZWleYXFKlQHJD73nQ
wXP968+A/3rBX7PhO0DBbZnfitOLPgPEwjTtdg0VQQ6Wz+CRQ/YbHPKaw7aRphZO
63dKvIKp4cQVtkWQHi6syTjGsgkLcLNau5LZDQUdsGV+SAo3nBdWCRYV+I65x8Kf
4hCxqqmjV3d/2NKRu0BXnDe/N+iDz3X0zEoj0fqXgq4SWcC0nsG1lyyXt1TL270I
6ATKRGJWiQVCCpDtc0NT6vdJ45bCSzsCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAA
MBcGA1UdIAQQMA4wDAYKYIZIAWUDAgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWlt
ZS5leGFtcGxlMBMGA1UdJQQMMAoGCCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIGwDAd
BgNVHQ4EFgQUu/bMsi0dBhIcl64papAQ0yBmZnMwHwYDVR0jBBgwFoAUkTCOfAcX
DKfxCShlNhpnHGh29FkwDQYJKoZIhvcNAQENBQADggEBAHOJojanzqmgaSN3/gqS
Q4cbbmdj/R40BEPr+gXT+xiidfZ2iLNwYyTneuK6AChwKfnNvOFb8lV1iffRTF/K
tmVEDMR/sYeqAH83KM5p3el2lVh4OHhyI0qNuz5oShNaACSioQ23WxHGVy9vsdVf
nbhsplrWg9NQ2WbpCmK+2oMh2oYl0Z/wvXMt9cG6jbMvcdH4z0IOvg6mrYkKTM/R
CGnumghxwYToj1OyD5Gs4D2IJCw+fX5ODxh52MbNRYXTus2ZPRPM8JXNQC4GWv4k
m3M4rKnJDd6hnoQ9rNeozIcBVyybQYjfrgg4DRvw9Ksk22OH4ConlB8f7R7s1LM2
cSYxggIAMIIB/AIBATBsMFUxDTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBT
IFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMgUlNBIENlcnRpZmljYXRpb24gQXV0
aG9yaXR5AhM3QQV57XV/QqmiXDr0+GrOmqnXMAsGCWCGSAFlAwQCAaBpMBgGCSqG
SIb3DQEJAzELBgkqhkiG9w0BBwEwHAYJKoZIhvcNAQkFMQ8XDTIxMDIyMDE3MTgw
MlowLwYJKoZIhvcNAQkEMSIEIJqUXzqD6DHL5QxaWDH8cjQd+BnWEDsqfNBB2TB1
TAOkMA0GCSqGSIb3DQEBAQUABIIBACXiU0FE8dQ6qbdByg97uCGlmOthKkgEMr5O
RkpoX6ntzZW8Bzj3xOt6fe6wwhxExszASuxN0STebics6GRcN/EzXV/SUDEOW7Y6
gK8c4LiuNfD76ZQLHbPhIMYDidhYb5lDO4MZCJosGPFCgGitf5V089h6WjZMY26F
YpL5lQfXgVAP0A4Y+2f8RaEP4Fsh8SLcV/EzniT2xCNCEuZwsETA65OnGJ6A6ktM
ljaEywaYkm0bVFuJ2ml4x0YDd/pZpr7CIgDtzh/97x39apqnNOnzTGnGgZi2T6yK
4flYxBHvYI53lUd/ub1SQMH/+X4zL0sbfb5+idTt10u1pN0Qcb8=
```

C.3.15.2. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_shy, Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Subject: smime-signed-enc-complex-hp-shy-reply
Message-ID: <smime-signed-enc-complex-hp-shy-reply@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:18:02 -0500
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-complex-hp-shy@example>
References: <smime-signed-enc-complex-hp-shy@example>
HP-Outer: Subject: [...]
HP-Outer:
 Message-ID: <smime-signed-enc-complex-hp-shy-reply@example>
HP-Outer: From: alice@smime.example
HP-Outer: To: bob@smime.example
HP-Outer: Date: Sat, 20 Feb 2021 17:18:02 +0000
HP-Outer: User-Agent: Sample MUA Version 1.0
HP-Outer: In-Reply-To: <smime-signed-enc-complex-hp-shy@example>
HP-Outer: References: <smime-signed-enc-complex-hp-shy@example>
Content-Type: multipart/mixed; boundary="230"; hp="cipher"

--230
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="4c8"

--4c8
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
smime-signed-enc-complex-hp-shy-reply
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_shy‘ Header Confidentiality Policy.

--
Alice
alice@smime.example
--4c8
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-signed-enc-complex-hp-shy-reply</b>
message.</p>
<p>This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_shy‘ Header Confidentiality Policy.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--4c8--

--230
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
```

```
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--230--
```

C.3.16. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_shy (+ Legacy Display)

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses the Header Protection scheme from RFC 9788 with the hcp_shy Header Confidentiality Policy with a "Legacy Display" element.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 11530 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 7520 bytes
  ┴   (unwraps to)
    └─┬ multipart/mixed 2834 bytes
      ├─┬ multipart/alternative 1629 bytes
      │ ├── text/plain 580 bytes
      │ └── text/html 752 bytes
      └── image/png inline 236 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID:
 <smime-signed-enc-complex-hp-shy-legacy-reply@example>
From: alice@smime.example
To: bob@smime.example
Date: Sat, 20 Feb 2021 17:19:02 +0000
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-complex-hp-shy-legacy@example>
References: <smime-signed-enc-complex-hp-shy-legacy@example>

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```

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9ioY7srsLj4QbHLLCfTqh0+MVvifbizFmNDuR29KuATR1391X9OenKKpIm0S9ipH
aLaY41RR7PDA+qjtypnNr0N0ramUOP7MeAaEPPczIarmrz1K5KbJrcUzOqiEDLoA
ZggjdwIpYYlAbpCY3FYksI8l8Wo75sPSo7scdUTIfl6FwhwIJ6nqLIG3QG28ovpN
```

```
XCBdcdSvc3Ixt4wsoCJxguuUA7twFZHfoGDu7f7Dc7bdwm9UBJ38QL7frr8/UYQQ
Ltb2xTiZKsMFEc7q3KiH8y2Z1pjRUf+0ylkb5XI/5mClpr96L/ldErMb6nn221qg
PldLvNA47EWriCXnvbCuf4ikKoh+h7F7LpmDpEmEj7JPgLjDE8X3ShdTzZOBNOeW
1JucBZVnMsVseOlddvc30X+BqiizXsNQ9c3atc9A0avuhslocANQoH9x08VRkZky
m2iHfeL1HbjRw+PchbdVfXxwlgO/+AfiOCEVKMHkB03mbbmFa9oFh9e8zQ0Uia9L
43TQolX67p6s6KpI9o1r5/bUzNYtNrO2jVd8TjCmg7m6JkusTBXktJDs/iwCJWCn
ZQI/ghEtYaBtDGHfal8xiY/B/g6v8YkezPf8VXxlIUOrGTfzk3zk/PD3TnbRLy3N
ot49sr1uKpYYdofnGfleclXBVbvAVZsm3I58MpjdOCQsLCxYNgxVPIhFkptUUjKf
/4nQ/X8kdmH5gSs97JF7P2+pw6EimubVOvHTX+gKbp1rHzWUEUtH4JQLssH+8v+H
hoJtKrmhoEPysT+tjPJtbWMsptslap14bwHCfNrtlQnhsE6jrrPFIUB7a7DNL7D8
FDfRazcq1w0JGs4un6GaJ7d1CYzHrOVKR0c1T201uIwzJOyXU3+YgMYfWqIYViW1
AGwZj1PPXM8aICmdOyVpWomBq2tUa0fCSHSD//lltDpr3sTGahPvbV8clhQZhHkF
jyYq5D83dsNKFbcSnsctx4SP71LMaKZw9ttsEzHRRU0duUI149uKpRU0ciGPsSEc
gHhBEgKruGdxX9zWeGEFuBzrgpu3C3LXRbhlGNS7RbFlIIR8WZoD0cMPEVrOt4Y9
pOGMl1/8LiwQFeznZhQVIjLbjWcjDcqzqxscBh1TJKrjl26Le1tFMmHaY147SfiO
PORZOLmnvQxdAaFeN4c+U9pU8DZPMZFa3f3EmoMgi/t16vnw0F/eFywz4GjNLqEt
d27PzhPuqYPupgCu95ZLVo3727BMwF0+Z+Noqv/X5RFA8W3wXX6Cw0JsSYBp6Xn0
/HP6a5LoHU3yku+sC2C9EvVuPVEY/51uk7oIyTO0pC6T83oa/mQ7xMMSfuzVcsKK
YLvHwwvXZK6kbkyNS0ryODE0wwXoC1UnJ5PEX7V+0ondyRxe0D5SnIGAIR/SyllM
qzSYcMRUGBmK56IirKZ0XmoM34Gv92Z7TNMUZLReIAO1qUHMiOIfaZ1Tp7gbgBZq
5P6nHYB/zZ7qHM/LPSZdWA==
```

C.3.16.1. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_shy (+ Legacy Display), Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

MIIVWAYJKoZIhvcNAQcCoIIVSTCCFUUCAQExDTALBglghkgBZQMEAgEwgguBBgkq
hkiG9w0BBwGgggtyBIILbk1JTUUtVmVyc2lvbjogMS4wDQpTdWJqZWN0OiBzbWlt
ZS1zaWduZWQtZW5jLWNvbXBsZXgtaHAtc2h5LWxlZ2FjeS1yZXBseQ0KTWVzc2Fn
ZS1JRDoNCiA8c21pbWUtc2lnbmVkLWVuYy1jb21wbGV4LWhwLXNoeS1sZWdhY3kt
cmVwbHlAZXhhbXBsZT4NCkZyb206IEFsaWNlIDxhbGljZUBzbWltZS5leGFtcGxl
Pg0KVG86IEJvYiA8Ym9iQHNtaW1lLmV4YW1wbGU+DQpEYXRlOiBTYXQsIDIwIEZl
YiAyMDIxIDEyOjE5OjAyIC0wNTAwDQpVc2VyLUFnZW50OiBTYW1wbGUgTVVBIFZl
cnNpb24gMS4wDQpJbi1SZXBseS1UbzogPHNtaW1lLXNpZ25lZC1lbmMtY29tcGxl
eC1ocC1zaHktbGVnYWN5QGV4YW1wbGU+DQpSZWZlcmVuY2VzOiA8c21pbWUtc2ln
bmVkLWVuYy1jb21wbGV4LWhwLXNoeS1sZWdhY3lAZXhhbXBsZT4NCkNvbnRlbnQtVHlwZTogbXVsdGlw
YXJ0L21peGVkOyBib3VuZGFyeT0iMjQyIjsgaHA9ImNpcGhlciINCg0KLS0yNDIN
Ck1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVR5cGU6IG11bHRpcGFydC9hbHRl
cm5hdGl2ZTsgYm91bmRhcnk9ImRhNyINCg0KLS1kYTcNCk1JTUUtVmVyc2lvbjog
MS4wDQpDb250ZW50LVRyYW5zZmVyLUVuY29kaW5nOiA3Yml0DQpDb250ZW50LVR5
cGU6IHRleHQvcGxhaW47IGNoYXJzZXQ9InVzLWFzY2lpIjsNCiBocC1sZWdhY3kt
ZGlzcGxheTsiMSINCg0KU3ViamVjdDogc21pbWUtc2lnbmVkLWVuYy1jb21wbGV4
LWhwLXNoeS1sZWdhY3ktcmVwbHkNCkZyb206IEFsaWNlIDxhbGljZUBzbWltZS5l
eGFtcGxlPg0KVG86IEJvYiA8Ym9iQHNtaW1lLmV4YW1wbGU+DQpEYXRlOiBTYXQs
IDIwIEZlYiAyMDIxIDEyOjE5OjAyIC0wNTAwDQoNClRoaXMgaXMgdGhlIDQpzbWlt
ZS1zaWduZWQtZW5jLWNvbXBsZXgtaHAtc2h5LWxlZ2FjeS1yZXBseQ0KbWVzc2Fn
ZS4NCg0KVGhpcyBpcyBhIHNpZ25lZC1hbmQtZW5jcnlwdGVkIFMvTUlNRSBtZXNz
YWdlIHVzaW5nIFBLQ1MjNw0KZW52ZWxvcGVkRGF0YSBhcm91bmQgc2lnbmVkRGF0
YS4gIFRoZSBwYXlsb2FkIGlzIGENCm11bHRpcGFydC9hbHRlcm5hdGl2ZSBtZXNz
YWdlIHdpdGggYW4gaW5saW5lIGltYWdlL3BuZw0KYXR0YWNobWVudC4gSXQgdXNl
cyB0aGUgSGVhZGVyIFByb3RlY3Rpb24gc2NoZW1lIGZyb20gUkZDIDk3ODgNCndp
dGggdGhlIGBoY3Bfc2h5YCBIZWFkZXIgQ29uZmlkZW50aWFsaXR5IFBvbGljeSB3
```

C.3.16.2. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_shy (+ Legacy Display), Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

MIIVWAYJKoZIhvcNAQcCoIIVSTCCFUUCAQExDTALBglghkgBZQMEAgEwgguBBgkq
hkiG9w0BBwGgggtyBIILbk1JTUUtVmVyc2lvbjogMS4wDQpTdWJqZWN0OiBzbWlt
ZS1zaWduZWQtZW5jLWNvbXBsZXgtaHAtc2h5LWxlZ2FjeS1yZXBseQ0KTWVzc2Fn
ZS1JRDoNCiA8c21pbWUtc2lnbmVkLWVuYy1jb21wbGV4LWhwLXNoeS1sZWdhY3kt
cmVwbHlAZXhhbXBsZT4NCkZyb206IEFsaWNlIDxhbGljZUBzbWltZS5leGFtcGxl
Pg0KVG86IEJvYiA8Ym9iQHNtaW1lLmV4YW1wbGU+DQpEYXRlOiBTYXQsIDIwIEZl
YiAyMDIxIDEyOjE5OjAyIC0wNTAwDQpVc2VyLUFnZW50OiBTYW1wbGUgTVVBIFZl
cnNpb24gMS4wDQpJbi1SZXBseS1UbzogPHNtaW1lLXNpZ25lZC1lbmMtY29tcGxl
eC1ocC1zaHktbGVnYWN5QGV4YW1wbGU+DQpSZWZlcmVuY2VzOiA8c21pbWUtc2ln
bmVkLWVuYy1jb21wbGV4LWhwLXNoeS1sZWdhY3lAZXhhbXBsZT4NCkNvbnRlbnQt
```

aXRoIGEgIkxlZ2FjeQ0KRGlzcGxheSIgZWxlbWVudC4NCg0KLS0gDQpBbGljZQ0K
YWxpY2VAc21pbWUuZXhhbXBsZQ0KLS1kYTcNCk1JTUUtVmVyc2lvbjogMS4wDQpD
b250ZW50LVRyYW5zZmVyLUVuY29kaW5nOiA3Yml0DQpDb250ZW50LVR5cGU6IHRl
eHQvaHRtbDsgY2hhcnNldD0idXMtYXNjaWkiOw0KIGhwLWxlZ2FjeS1kaXNwbGF5
PSIxIg0KDQo8aHRtbD48aGVhZD48dGl0bGU+PC90aXRsZT48L2hlYWQ+PGJvZHk+
DQo8ZGl2IGNsYXNzPSJoZWFkZXItcHJvdGVjdGlvbi1sZWdhY3ktZGlzcGxheSI+
DQo8cHJlPg0KU3ViamVjdDogc21pbWUtc2lnbmVkLWVuYy1jb21wbGV4LWhwLXNo
eS1sZWdhY3ktcmVwbHkNCkZyb206IEFsaWNlICZsdDthbGljZUBzbWltZS5leGFt
cGxlJmd0Ow0KVG86IEJvYiAmbHQ7Ym9iQHNtaW1lLmV4YW1wbGUmZ3Q7DQpEYXRl
OiBTYXQsIDIwIEZlYiAyMDIxIDEyOjE5OjAyIC0wNTAwDQo8L3ByZT4NCjwvZGl2
PjxwPlRoaXMgaXMgdGhlDQo8Yj5zbWltZS1zaWduZWQtZW5jLWNvbXBsZXgtaHAt
c2h5LWxlZ2FjeS1yZXBseTwvYj4NCm1lc3NhZ2UuPC9wPg0KPHA+VGhpcyBpcyBh
IHNpZ25lZC1hbmQtZW5jcnlwdGVkIFMvTUlNRSBtZXNzYWdlIHVzaW5nIFBLQ1Mj
Nw0KZW52ZWxvcGVkRGF0YSBhcm91bmQgc2lnbmVkRGF0YS4gIFRoZSBwYXlsb2Fk
IGlzIGENCm11bHRpcGFydC9hbHRlcm5hdGl2ZSBtZXNzYWdlIHdpdGggYW4gaW5s
aW5lIGltYWdlL3BuZw0KYXR0YWNobWVudC4gSXQgdXNlcyB0aGUgSGVhZGVyIFBy
b3RlY3Rpb24gc2NoZW1lIGZyb20gUkZDIDk3ODgNCndpdGggdGhlIGBoY3Bfc2h5
YCBIZWFkZXIgQ29uZmlkZW50aWFsaXR5IFBvbGljeSB3aXRoIGEgIkxlZ2FjeQ0K
RGlzcGxheSIgZWxlbWVudC48L3A+DQo8cD48dHQ+LS0gPGJyPkFsaWNlPGJyPmFs
aWNlQHNtaW1lLmV4YW1wbGU8L3R0PjwvcD4KLS1kYTct
LQ0KDQotLTI0Mg0KQ29udGVudC1UeXBlOiBpbWFnZS9wbmcNCkNvbnRlbnQtVHJh
bnNmZXItRW5jb2Rpbmc6IGJhc2U2NA0KQ29udGVudC1EaXNwb3NpdGlvbjogaW5s
aW5lDQoNCmlWQk9SdzBLR2dvQUFBQU5TVWhFVWdBQUFCUUFBQUFVQ0FZQUFBQ05p
UjBOQUFBQWNFbEVRVlI0MnVWVE94YkENCk1BZ1M3MzluTzNUcFJ3MjBkcXBiZkFS
UUVqT3l3aXdZbkN0a0RLbmJjTGs2NnNxbFQrenQ5Y2lka0UrNkt3a1oNCnNncnpm
Y3FWTXBMMmpvMDQ0N2dZRHBlQXJrK09uSkhrSWhBZlRQUmljaWhBZjVZSnJ3N3Zq
djBaV1JXTS91bGkNCnZkUGYxUVoya0REOXhwcGQ4d0FBQUFCSlJVNUVya0pnZ2c9
PQ0KDQotLTI0Mi0tDQqgggemMIIDzzCCAregAwIBAgITDy0lvRE5l0rOQlSHoe49
NAaKtDANBgkqhkiG9w0BAQ0FADBVMQ0wCwYDVQQKEwRJRVRGMREwDwYDVQQLEwhM
QU1QUyBXRzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBDZXJ0aWZpY2F0aW9u
IEF1dGhvcml0eTAgFw0xOTExMjAwNjU0MThaGA8yMDUyMDkyNzA2NTQxOFowOzEN
MAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxFzAVBgNVBAMTDkFsaWNl
IExvdmVsYWNlMIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAmpUp+ovB
ouOP6AFQJ+RpwpODxxzY60n1lJ53pTeNSiJlWkwtw/cxQq0t4uD2vWYB8gOUH/CV
t2Zp1c+auzPKJ2Zu5mY6kHm+hVB+IthjLeI7Htg6rNeuXq50/TuTSxX5R1I1EXGt
8p6hAQVeA5oZ2afHg4b97enV8gozR0/Nkug4AkXmbk7THNc8vvjMUJanZ/VmS4Tg
DqXjWShplcI3lcvvBZMswt41/0HJvmSwqpS6oQcAx3Weag0yCNj1V9V9yu/3DjcY
bwW2lJf5NbMHbM1LY4X5chWfNEbkN6hQury/zxnlsukgn+fHbqvwDhJLAgFpW/jA
/EB/WI+whUpqtQIDAQABo4GvMIGsMAwGA1UdEwEB/wQCMAAwFwYDVR0gBBAwDjAM
BgpghkgBZQMCATABMB4GA1UdEQQXMBWBE2FsaWNlQHNtaW1lLmV4YW1wbGUwEwYD
VR0lBAwwCgYIKwYBBQUHAwQwDgYDVR0PAQH/BAQDAgUgMB0GA1UdDgQWBBSiU0HV
RDyAKRV8ASPw546vzfN3DzAfBgNVHSMEGDAWgBSRMI58BxcMp/EJKGU2GmccaHb0
WTANBgkqhkiG9w0BAQ0FAAOCAQEAgUl4oJyxMpwWpAylOvK6NEbMl1gD5H14EC4M
uxq1u0q2XgXOSBHI6DfX/4LDsfx7fSIus8gWVY3WqMeuOA7IizkBD+GDEu8uKveE
RRXZncxGwy2MfbH1Ib3U8QzTjqB8+dz2AwYeMxODWq9opwtA/lTOkRg8uuivZfg/
m5fFo/QshlHNaaTDVEXsU4Ps98Hm/3gznbvhdjFbZbi4oZ3tAadRlE5K9JiQaJYO
nUmGpfB8PPwDR6chMZeegSQAW++OIKqHrg/WEh4yiuPfqmAvX2hZkPpivNJYdTPU
XTSO7K459CyqbqG+sNOo2kc1nTXl85RHNrVKQK+L0YWY1Q+hWDCCA88wggK3oAMC
AQICEzdBBXntdX9CqaJcOvT4as6aqdcwDQYJKoZIhvcNAQENBQAwVTENMAsGA1UE
ChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1Q
UyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkwIBcNMTkxMTIwMDY1NDE4WhgP
MjA1MjA5MjcwNjU0MThaMDsxDTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBT
IFdHMRcwFQYDVQQDEw5BbGljZSBMb3ZlbGFjZTCCASIwDQYJKoZIhvcNAQEBBQAD
ggEPADCCAQoCggEBALT0iehYOBY+TZp/T5K2KNI05Hwr+E3wP6XTvyi6WWyTgBK9
LCOwI2juwdRrjFBSXkk7pWpjXwsA3A5GOtz0FpfgyC7OxsVcF7q4WHWZWleYXFKl
QHJD73nQwXP968+A/3rBX7PhO0DBbZnfitOLPgPEwjTtdg0VQQ6Wz+CRQ/YbHPKa
w7aRphZO63dKvIKp4cQVtkWQHi6syTjGsgkLcLNau5LZDQUdsGV+SAo3nBdWCRYV
+I65x8Kf4hCxqqmjV3d/2NKRu0BXnDe/N+iDz3X0zEoj0fqXgq4SWcC0nsG1lyyX
t1TL270I6ATKRGJWiQVCCpDtc0NT6vdJ45bCSzsCAwEAAaOBrzCBrDAMBgNVHRMB
Af8EAjAAMBcGA1UdIAQQMA4wDAYKYIZIAWUDAgEwATAeBgNVHREEFzAVgRNhbGlj
ZUBzbWltZS5leGFtcGxlMBMGA1UdJQQMMAoGCCsGAQUFBwMEMA4GA1UdDwEB/wQE
AwIGwDAdBgNVHQ4EFgQUu/bMsi0dBhIcl64papAQ0yBmZnMwHwYDVR0jBBgwFoAU
kTCOfAcXDKfxCShlNhpnHGh29FkwDQYJKoZIhvcNAQENBQADggEBAHOJojanzqmg
aSN3/gqSQ4cbbmdj/R40BEPr+gXT+xiidfZ2iLNwYyTneuK6AChwKfnNvOFb8lV1
iffRTF/KtmVEDMR/sYeqAH83KM5p3el2lVh4OHhyI0qNuz5oShNaACSioQ23WxHG
Vy9vsdVfnbhsplrWg9NQ2WbpCmK+2oMh2oYl0Z/wvXMt9cG6jbMvcdH4z0IOvg6m

```
rYkKTM/RCGnumghxwYToj1OyD5Gs4D2IJCw+fX5ODxh52MbNRYXTus2ZPRPM8JXN
QC4GWv4km3M4rKnJDd6hnoQ9rNeozIcBVyybQYjfrgg4DRvw9Ksk22OH4ConlB8f
7R7s1LM2cSYxggIAMIIB/AIBATBsMFUxDTALBgNVBAoTBElFVEYxETAPBgNVBAsT
CExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFNUFMgUlNBIENlcnRpZmljYXRp
b24gQXV0aG9yaXR5AhM3QQV57XV/QqmiXDr0+GrOmqnXMAsGCWCGSAFlAwQCAaBp
MBgGCSqGSIb3DQEJAzELBgkqhkiG9w0BBwEwHAYJKoZIhvcNAQkFMQ8XDTIxMDIy
MDE3MTkwMlowLwYJKoZIhvcNAQkEMSIEIEUN8MCE/gE8VaUWOZYNyiuSDKZahJOb
CB59LQgqpUl1MA0GCSqGSIb3DQEBAQUABIIBAEk7y6K+3YZB+tri+EVQFLmb1N5K
CUsnwbyLwl9bH3bv+8MFEYqYmiATHzimOxdQNBl8c6HR7GqnMQVJIZ+OEYiL1fz/
Ej7Up3VQzyR1KvblL4Xt1W7+ITh/6iAx1j1W48US9pMR+05Rz+cfVATn77voVNs3
fN0B8EsjPoVM708f/xKD5lwHv/72Mg1fUTs3YMaqabplXdABkdp1lQhZ6za+N3/k
yEYSmxz0Owd4JRKuAIdbzdFIC57BIGFICQX0Nr1c3aZ/wHvNvH2xOAp1cQ7M6Nu3
KImZs86OBQmc0Kdk8AzE4s0o8mtf3uhU+eJ/23FWjMYpGdgHaUu90GMnKnM=
```

C.3.16.2. S/MIME Signed-and-Encrypted Reply over a Complex Message, Header Protection with hcp_shy (+ Legacy Display), Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Subject: smime-signed-enc-complex-hp-shy-legacy-reply
Message-ID:
 <smime-signed-enc-complex-hp-shy-legacy-reply@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:19:02 -0500
User-Agent: Sample MUA Version 1.0
In-Reply-To: <smime-signed-enc-complex-hp-shy-legacy@example>
References: <smime-signed-enc-complex-hp-shy-legacy@example>
HP-Outer: Subject: [...]
HP-Outer: Message-ID:
 <smime-signed-enc-complex-hp-shy-legacy-reply@example>
HP-Outer: From: alice@smime.example
HP-Outer: To: bob@smime.example
HP-Outer: Date: Sat, 20 Feb 2021 17:19:02 +0000
HP-Outer: User-Agent: Sample MUA Version 1.0
HP-Outer:
 In-Reply-To: <smime-signed-enc-complex-hp-shy-legacy@example>
HP-Outer:
 References: <smime-signed-enc-complex-hp-shy-legacy@example>
Content-Type: multipart/mixed; boundary="242"; hp="cipher"

--242
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="da7"

--da7
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Content-Type: text/plain; charset="us-ascii";
 hp-legacy-display="1"

Subject: smime-signed-enc-complex-hp-shy-legacy-reply
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:19:02 -0500

This is the
smime-signed-enc-complex-hp-shy-legacy-reply
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
```

```
with the ‘hcp_shy‘ Header Confidentiality Policy with a "Legacy
Display" element.

--
Alice
alice@smime.example
--da7
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit
Content-Type: text/html; charset="us-ascii";
 hp-legacy-display="1"

<html><head><title></title></head><body>
<div class="header-protection-legacy-display">
<pre>
Subject: smime-signed-enc-complex-hp-shy-legacy-reply
From: Alice &lt;alice@smime.example&gt;
To: Bob &lt;bob@smime.example&gt;
Date: Sat, 20 Feb 2021 12:19:02 -0500
</pre>
</div><p>This is the
<b>smime-signed-enc-complex-hp-shy-legacy-reply</b>
message.</p>
<p>This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the Header Protection scheme from RFC 9788
with the ‘hcp_shy‘ Header Confidentiality Policy with a "Legacy
Display" element.</p>
<p><tt>-- <br>Alice<br>alice@smime.example</tt></p></body></html>
--da7--

--242
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline

iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--242--
```

C.3.17. S/MIME Signed-and-Encrypted over a Complex Message, Legacy RFC 8551 Header Protection with hcp_baseline

This is a signed-and-encrypted S/MIME message using PKCS#7 envelopedData around signedData. The payload is a multipart/alternative message with an inline image/png attachment. It uses the legacy RFC 8551 Header Protection (RFC8551HP) scheme with the hcp_baseline Header Confidentiality Policy.

It has the following structure:

```
└─┬ application/pkcs7-mime [smime.p7m] 9580 bytes
  (decrypts to)
  └─┬ application/pkcs7-mime [smime.p7m] 6082 bytes
  ┴  (unwraps to)
    └─┬ message/rfc822 1876 bytes
      └─┬ multipart/mixed 1828 bytes
        ├─┬ multipart/alternative 1168 bytes
        │ ├── text/plain 393 bytes
        │ └── text/html 491 bytes
        └── image/png inline 232 bytes
```

Its contents are:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
Subject: [...]
Message-ID:
 <smime-enc-signed-complex-rfc8551hp-baseline@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:28:02 -0500
User-Agent: Sample MUA Version 1.0

MIIbnAYJKoZIhvcNAQcDoIIbjTCCG4kCAQAxggMQMIIBhAIBADBsMFUxDTALBgNV
BAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhTYW1wbGUgTEFN
UFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5AhMPLSW9ETmXSs5CVIeh7j00
Boq0MA0GCSqGSIb3DQEBAQUABIIBAANFe+QhN1IuF/acKoQk/CrT7s6ncIXk72bZ
yqANUj5IWD/YQPJMczB4khaPZRacFIWSbcn3RHR8H9kaincGgB0F3pw+Ju1CaD5x
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RRABOCiNe+lRF7L+X/kqJL0oALwBWLn1OsfK5AwCg3Vao4uyRUtRbC8P4Q7v+KPi
6qYEwXAe6gz1LCwD/EPyiDnMBlbNBid0g8nC8pt2Ymbz+SljAW9FDv9Xyv8iJuXT
+OXOgl8pfBA1a4zKGiRZrKN0PDf0NUh13p/0h7Wd/322eR+FTuwwggGEAgEAMGww
VTENMAsGA1UEChMESUVURjERMA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNh
bXBsZSBMQU1QUyBSU0EgQ2VydGlmaWNhdGlvbiBBdXRob3JpdHkCEzB8R0APhiY6
HGLS64MvlsDXhpQwDQYJKoZIhvcNAQEBBQAEggEAHNOf6aUb4tfH2tb0OWz678eY
tSslVolgGLYIrJcX3Xz0ZVEg7EHJfwMMrfzuvaXtMu3VR26TZpJxJrUQy5bplIKf
rb4ZF95XeC1KMC5E88kpOX3qb+ALpsnRbUvldPfaG17GQl1LXRML16Xvw2BdQ/p3
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0JgsFeUSjBLtIqGVGPwKRAreug/2rcRWDBlW4QTZ0Yuw7Zu/xVPkAevp8Hn6v0C2
rxEpaXnhzITeCsS0qLN+G+vuQAzDxz4SlpWxx6HajBToje79ZtuF/YzAZfJTWsKO
MzxO8hOCxEl/7z355AmXrKF0ubZj+/Y9UTXlSqUUXV/5b0L98xU5NoAaAhzssysb
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FjsmhyKMUeEmlUXbJ2omjDnnYmYzogYXTs5XSmrZrjvoIbQAKtmxSKywQRNfHjei
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MxUxTVa3uc+Dk7ZY4jzZbGoRVLsUFvCnJklk64GbzydMGplEPH2gR2fjecRbFknq
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```

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VDIkJo74MDUSn1osHHojKd13lqdAH7Am2UjoIVogx8cE9cSEnmZfwZBf2Pb2TxwF
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KTBJIqXP57aNaW/BG6eIiaSxVoLnsbgW57P0mpP5JxK4f6cvMPihO9rNItSqESuK
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```
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if3rUpGk+50tx2RWBlWvzVJtF5HEB+1xbaaEaMCqS8OexHWQUcZApzhnQC9NeniN
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A7hG5SUmKYqajYlDwPqFJmX72sOofNh8qdn4K1P7zzfOjzi0Zs9mBqmAzG6U+Ciu
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+0uS/NB34PyjK+ZX0ouEo+fSvM/TFWNBHVlbiFZZL58/+F7Jk2f+ojtViMTrgHZt
j+vEd4UwxKLV/jgAT5ktM3WYSGDzlqLxVXgFAST6TYzGhGaxNkLUWBXfuNP0klNz
PwSS2ychxCl+jUgjtHtenhfVfQtyG/NzKnx0s5vazdSRe4bnVBmqm8i+dsUqyPCd
FYDZOpfnljZ1ywCw30yaeA==
```

C.3.17.1. S/MIME Signed-and-Encrypted over a Complex Message, Legacy RFC 8551 Header Protection with hcp_baseline, Decrypted

The S/MIME enveloped-data layer unwraps to this signed-data part:

```
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="signed-data"

MIIRQgYJKoZIhvcNAQcCoIIRMzCCES8CAQExDTALBglghkgBZQMEAgEwggdrBgkq
hkiG9w0BBwGgggdcBIIHWE1JTUUtVmVyc2lvbjogMS4wDQpDb250ZW50LVR5cGU6
IG1lc3NhZ2UvcmZjODIyDQoNCk1JTUUtVmVyc2lvbjogMS4wCkNvbnRlbnQtVHlw
ZTogbXVsdGlwYXJ0L21peGVkOyBib3VuZGFyeT0iMTQ0IgpTdWJqZWN0OiBzbWlt
ZS1lbmMtc2lnbmVkLWNvbXBsZXgtcmZjODU1MWhwLWJhc2VsaW5lCk1lc3NhZ2Ut
SUQ6CiA8c21pbWUtZW5jLXNpZ25lZC1jb21wbGV4LXJmYzg1NTFocC1iYXNlbGlu
ZUBleGFtcGxlPgpGcm9tOiBBbGljZSA8YWxpY2VAc21pbWUuZXhhbXBsZT4KVG86
IEJvYiA8Ym9iQHNtaW1lLmV4YW1wbGU+CkRhdGU6IFNhdCwgMjAgRmViIDIwMjEg
MTI6Mjg6MDIgLTA1MDAKVXNlci1BZ2VudDogU2FtcGxlIE1VQSBWZXJzaW9uIDEu
MAoKLS0xNDQKTUlNRS1WZXJzaW9uOiAxLjAKQ29udGVudC1UeXBlOiBtdWx0aXBh
cnQvYWx0ZXJuYXRpdmU7IGJvdW5kYXJ5PSI1NzkiCgotLTU3OQpDb250ZW50LVR5
cGU6IHRleHQvcGxhaW47IGNoYXJzZXQ9InVzLWFzY2lpIgpNSU1FLVZlcnNpb246
IDEuMApDb250ZW50LVRyYW5zZmVyLUVuY29kaW5nOiA3Yml0CgpUaGlzIGlzIHRo
ZQpzbWltZS1lbmMtc2lnbmVkLWNvbXBsZXgtcmZjODU1MWhwLWJhc2VsaW5lCm1l
c3NhZ2UuCgpUaGlzIGlsIEgc2lnbmVkLWFuZC1lbmNyeXB0ZWQgUy9NSU1FIG1l
c3NhZ2UgdXNpbmcgUEtDUyM3CmVudmVsb3BlZERhdGEgYXJvdW5kIHNpZ25lZERh
dGEuICBUaGUgcGF5bG9hZCBpcyBhCm11bHRpcGFydC9hbHRlcm5hdGl2ZSBtZXNz
YWdlIHdpdGggYW4gaW5saW5lIGltYWdlL3BuZwphdHRhY2htZW50LiBJdCB1c2Vz
IHRoZSBsZWdhY3kgUkZDIDg1NTEgSGVhZGVyIFByb3RlY3Rpb24KKFJGQzg1NTFI
UCkgc2NoZW1lIHdpdGggdGhlIGBoY3BfYmFzZWxpbmVgIEhlYWRlcgpDb25maWRl
bnRpYWxpdHkgUG9saWN5LgoKLS0gCkFsaWNlCmFsaWNlQHNtaW1lLmV4YW1wbGUK
LS01NzkKQ29udGVudC1UeXBlOiB0ZXh0L2h0bWw7IGNoYXJzZXQ9InVzLWFzY2lp
IgpNSU1FLVZlcnNpb246IDEuMApDb250ZW50LVRyYW5zZmVyLUVuY29kaW5nOiA3
Yml0Cgo8aHRtbD48aGVhZD48dGl0bGU+PC90aXRsZT48L2hlYWQ+PGJvZHk+Cjxw
PlRoaXMgaXMgdGhlCjxiPnNtaW1lLWVuYy1zaWduZWQtY29tcGxleC1yZmM4NTUx
aHAtYmFzZWxpbmU8L2I+Cm1lc3NhZ2UuPC9wPgo8cD5UaGlzIGlzIGEgc2lnbmVk
LWFuZC1lbmNyeXB0ZWQgUy9NSU1FIG1lc3NhZ2UgdXNpbmcgUEtDUyM3CmVudmVs
```

b3BlZERhdGEgYXJvdW5kIHNpZ25lZERhdGEuICBUaGUgcGF5bG9hZCBpcyBhCm11
bHRpcGFydC9hbHRlcm5hdGl2ZSBtZXNzYWdlIHdpdGggYW4gaW5saW5lIGltYWdl
L3BuZwphdHRhY2htZW50LiBJdCB1c2VzIHRoZSBsZWdhY3kgUkZDIDg1NTEgSGVh
ZGVyIFByb3RlY3Rpb24KKFJGQzg1NTFIUCkgc2NoZW1lIHdpdGggdGhlIGBoY3Bf
YmFzZWxpbmVgIEhlYWRlcgpDb25maWRlbnRpYWxpdHkgUG9saWN5LjwvcD4KPHA+
PHR0Pi0tIDxici8+QWxpY2U8YnIvPmFsaWNlQHNtaW1lLmV4YW1wbGU8L3R0Pjwv
cD48L2JvZHk+PC9odG1sPgotLTU3OS0tCgotLTE0NApDb250ZW50LVR5cGU6IGlt
YWdlL3BuZwpDb250ZW50LVRyYW5zZmVyLUVuY29kaW5nOiBiYXNlNjQKQ29udGVu
dC1EaXNwb3NpdGlvbjogaW5saW5lCgppVkJPUncwS0dnb0FBQUFOU1VoRVVnQUFB
QlFBQUFBVUNBWUFBQUNOaVIwTkFBQUFjRWxFUVZSNDJ1VlRPeGJBCk1BZ1M3Mzlu
TzNUcFJ3MjBkcXBiZkFSUUVqT3l3aXdZbkN0a0RLbmJjTGs2NnNxbFQrenQ5Y2lk
a0UrNkt3a1oKc2dyemZjcVZNcEwyam8wNDQ3Z1lEcGVBcmsrT25KSGtJaEFmVFBS
aWNpaEFmNVlKcnc3dmp2MFpXUldNL3VsaQp2ZFBmMVFaMmtERDl4cHBkOHdBQUFB
QkpSVTVFcmtKZ2dnPT0KCi0tMTQ0LS0KoIIHpjCCA88wggK3oAMCAQICEw8tJb0R
OZdKzkJUh6HuPTQGirQwDQYJKoZIhvcNAQENBQAwVTENMAsGA1UEChMESUVURjER
MA8GA1UECxMITEFNUFMgV0cxMTAvBgNVBAMTKFNhbXBsZSBMQU1QUyBSU0EgQ2Vy
dGlmaWNhdGlvbiBBdXRob3JpdHkwIBcNMTkxMTIwMDY1NDE4WhgPMjA1MjA5Mjcw
NjU0MThaMDsxDTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMRcwFQYD
VQQDEw5BbGljZSBMb3ZlbGFjZTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoC
ggEBAJqVKfqLwaLjj+gBUCfkacKTg8cc2OtJ9ZSed6U3jUoiZVpMLcP3MUKtLeLg
9r1mAfIDlB/wlbdmadXPmrszyidmbuZmOpB5voVQfiLYYy3iOx7YOqzXrl6udP07
k0sV+UdSNRFxrfKeoQEFXgOaGdmnx4OG/e3p1fIKM0dPzZLoOAJF5m5O0xzXPL74
zFCWp2f1ZkuE4A6l41koaZXCN5XL7wWTLMLeNf9Byb5ksKqUuqEHAMd1nmoNMgjY
9VfVfcrv9w43GG8FtpSX+TWzB2zNS2OF+XIVnzRG5DeoULq8v88Z5bLpIJ/nx26r
8A4SSwIBaVv4wPxAf1iPsIVKarUCAwEAAaOBrzCBrDAMBgNVHRMBAf8EAjAAMBcG
A1UdIAQQMA4wDAYKYIZIAWUDAgEwATAeBgNVHREEFzAVgRNhbGljZUBzbWltZS5l
eGFtcGxlMBMGA1UdJQQMMAoGCCsGAQUFBwMEMA4GA1UdDwEB/wQEAwIFIDAdBgNV
HQ4EFgQUolNB1UQ8gCkVfAEj8OeOr83zdw8wHwYDVR0jBBgwFoAUkTCOfAcXDKfx
CShlNhpnHGh29FkwDQYJKoZIhvcNAQENBQADggEBAIFJeKCcsTKcFqQMpTryujRG
zJdYA+R9eBAuDLsatbtKtl4FzkgRyOg31/+Cw7H8e30iLrPIFlWN1qjHrjgOyIs5
AQ/hgxLvLir3hEUV2Z3MRsMtjH2x9SG91PEM046gfPnc9gMGHjMTg1qvaKcLQP5U
zpEYPLror2X4P5uXxaP0LIZRzWmkw1RF7FOD7PfB5v94M5274XYxW2W4uKGd7QGn
UZROSvSYkGiWDp1JhqXwfDz8A0enITGXnoEkAFvvjiCqh64P1hIeMorj36pgL19o
WZD6YrzSWHUz1F00juyuOfQsqm6hvrDTqNpHNZ015fOURza1SkCvi9GFmNUPoVgw
ggPPMIICt6ADAgECAhM3QQV57XV/QqmiXDr0+GrOmqnXMA0GCSqGSIb3DQEBDQUA
MFUxDTALBgNVBAoTBElFVEYxETAPBgNVBAsTCExBTVBTIFdHMTEwLwYDVQQDEyhT
YW1wbGUgTEFNUFMgUlNBIENlcnRpZmljYXRpb24gQXV0aG9yaXR5MCAXDTE5MTEy
MDA2NTQxOFoYDzIwNTIwOTI3MDY1NDE4WjA7MQ0wCwYDVQQKEwRJRVRGMREwDwYD
VQQLEwhMQU1QUyBXRzEXMBUGA1UEAxMOQWxpY2UgTG92ZWxhY2UwggEiMA0GCSqG
SIb3DQEBAQUAA4IBDwAwggEKAoIBAQC09InoWDgWPk2af0+StijSNOR8K/hN8D+l
078oullsk4ASvSwjsCNo7sHUa4xQUl5JO6VqY18LANwORjrc9BaX4MguzsbFXBe6
uFh1mVpXmFxSpUByQ+950MFz/evPgP96wV+z4TtAwW2Z34rTiz4DxMI07XYNFUEO
ls/gkUP2GxzymsO2kaYWTut3SryCqeHEFbZFkB4urMk4xrIJC3CzWruS2Q0FHbBl
fkgKN5wXVgkWFfiOucfCn+IQsaqpo1d3f9jSkbtAV5w3vzfog8919MxKI9H6l4Ku
ElnAtJ7BtZcsl7dUy9u9COgEykRiVokFQgqQ7XNDU+r3SeOWwks7AgMBAAGjga8w
gawwDAYDVR0TAQH/BAIwADAXBgNVHSAEEDAOMAwGCmCGSAFlAwIBMAEwHgYDVR0R
BBcwFYETYWxpY2VAc21pbWUuZXhhbXBsZTATBgNVHSUEDDAKBggrBgEFBQcDBDAO
BgNVHQ8BAf8EBAMCBsAwHQYDVR0OBBYEFLv2zLItHQYSHJeuKWqQENMgZmZzMB8G
A1UdIwQYMBaAFJEwjnwHFwyn8QkoZTYaZxxodvRZMA0GCSqGSIb3DQEBDQUAA4IB
AQBziaI2p86poGkjd/4KkkOHG25nY/0eNARD6/oF0/sYonX2doizcGMk53riugAo
cCn5zbzhW/JVdYn30UxfyrZlRAzEf7GHqgB/NyjOad3pdpVYeDh4ciNKjbs+aEoT
WgAkoqENt1sRxlcvb7HVX524bKZa1oPTUNlm6QpivtqDIdqGJdGf8L1zLfXBuo2z
L3HR+M9CDr4Opq2JCkzP0Qhp7poIccGE6I9Tsg+RrOA9iCQsPn1+Tg8YedjGzUWF
07rNmT0TzPCVzUAuBlr+JJtzOKypyQ3eoZ6EPazXqMyHAVcsm0GI364IOA0b8PSr
JNtjh+AqJ5QfH+0e7NSzNnEmMYICADCCAfwCAQEwbDBVMQ0wCwYDVQQKEwRJRVRG
MREwDwYDVQQLEwhMQU1QUyBXRzExMC8GA1UEAxMoU2FtcGxlIExBTVBTIFJTQSBD
ZXJ0aWZpY2F0aW9uIEF1dGhvcml0eQITN0EFee11f0Kpolw69Phqzpqp1zALBglg
hkgBZQMEAgGgaTAYBgkqhkiG9w0BCQMxCwYJKoZIhvcNAQcBMBwGCSqGSIb3DQEJ
BTEPFw0yMTAyMjAxNzI4MDJaMC8GCSqGSIb3DQEJBDEiBCBeode6D2+XFP+H82l3
4jEbYjlqU5Tgru11NftjsHf5ojANBgkqhkiG9w0BAQEFAASCAQCPddNTo2dMep9S
Ux9R61FJylyqjA4n22MbI3haUrxVOgk1+FAacmva+eo8weKDd+FR3fYuy4C+PkIj
woclAH4Hb7QkNHQgv5DSuvqN1/QoIHpGvF0atF0NXKOirYFGIZmeytKJJ9WR67A1
Myuh/Yi8aaUDheliEIPsD+59pFRHDZIcM1MkNuSJGw6LHMCHSA9p7WggrLrD8trC
rR/xL2ZWbswb5sr3Y6NucbZS51e0UAy2fKzxK/CUFG/M4VhFQF1UgUZU/6hwXHMg
ffr7xEDPeco1Tq7/fCLCVYz5Ixf+RfCOid7Gps07qsQlMIV/awPSekvMyg93nqDv
ES1xMiED

C.3.17.2. S/MIME Signed-and-Encrypted over a Complex Message, Legacy RFC 8551 Header Protection with hcp_baseline, Decrypted and Unwrapped

The inner signed-data layer unwraps to:

```
MIME-Version: 1.0
Content-Type: message/rfc822

MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="144"
Subject: smime-enc-signed-complex-rfc8551hp-baseline
Message-ID:
 <smime-enc-signed-complex-rfc8551hp-baseline@example>
From: Alice <alice@smime.example>
To: Bob <bob@smime.example>
Date: Sat, 20 Feb 2021 12:28:02 -0500
User-Agent: Sample MUA Version 1.0

--144
MIME-Version: 1.0
Content-Type: multipart/alternative; boundary="579"

--579
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

This is the
smime-enc-signed-complex-rfc8551hp-baseline
message.

This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the legacy RFC 8551 Header Protection
(RFC8551HP) scheme with the ‘hcp_baseline‘ Header
Confidentiality Policy.

--
Alice
alice@smime.example
--579
Content-Type: text/html; charset="us-ascii"
MIME-Version: 1.0
Content-Transfer-Encoding: 7bit

<html><head><title></title></head><body>
<p>This is the
<b>smime-enc-signed-complex-rfc8551hp-baseline</b>
message.</p>
<p>This is a signed-and-encrypted S/MIME message using PKCS#7
envelopedData around signedData.  The payload is a
multipart/alternative message with an inline image/png
attachment. It uses the legacy RFC 8551 Header Protection
(RFC8551HP) scheme with the ‘hcp_baseline‘ Header
Confidentiality Policy.</p>
<p><tt>-- <br/>Alice<br/>alice@smime.example</tt></p></body></html>
--579--

--144
Content-Type: image/png
Content-Transfer-Encoding: base64
Content-Disposition: inline
```

```
iVBORw0KGgoAAAANSUhEUgAAABQAAAAUCAYAAACNiR0NAAAAcElEQVR42uVTOxbA
MAgS739nO3TpRw20dqpbfARQEjOywiwYnCtkDKnbcLk66sqlT+zt9cidkE+6KwkZ
sgrzfcqVMpL2jo0447gYDpeArk+OnJHkIhAfTPRicihAf5YJrw7vjv0ZWRWM/uli
vdPf1QZ2kDD9xppd8wAAAABJRU5ErkJggg==

--144--
```

Appendix D. Composition Examples

This section offers step-by-step examples of message composition.

D.1. New Message Composition

A typical MUA composition interface offers the user a place to indicate the message recipients, subject, and content of the message. Consider a composition window filled out by the user like so:

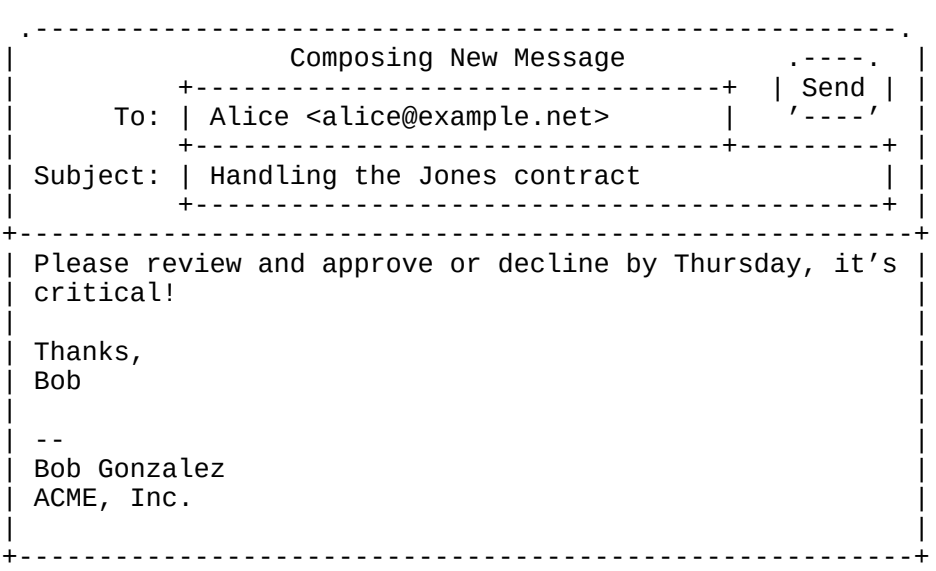

Figure 1: Example Message Composition Interface

When Bob clicks "Send", his MUA generates values for the Message-ID, From, and Date Header Fields and converts the message content into the appropriate format.

D.1.1. Unprotected Message

The resulting message would look something like this if it was sent without cryptographic protections:

```
Date: Wed, 11 Jan 2023 16:08:43 -0500
From: Bob <bob@example.net>
To: Alice <alice@example.net>
Subject: Handling the Jones contract
Message-ID: <20230111T210843Z.1234@lhp.example>
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0

Please review and approve or decline by Thursday, it’s critical!

Thanks,
Bob

--
Bob Gonzalez
ACME, Inc.
```

D.1.2. Encrypted with hcp_baseline and Legacy Display

Now consider the message to be generated if it is to be cryptographically signed and encrypted, using HCP hcp_baseline, and the legacy variable is set.

For each Header Field, Bob's MUA passes its name and value through hcp_baseline. This returns the same value for every Header Field, except that:

hcp_baseline("Subject", "Handling the Jones contract") yields "[...]".

D.1.2.1. Cryptographic Payload

The Cryptographic Payload that will be signed and then encrypted is very similar to the unprotected message in Appendix D.1.1. Note the addition of:

* the hp="cipher" parameter for the Content-Type
* the appropriate HP-Outer Header Field for Subject
* the hp-legacy-display="1" parameter for the Content-Type
* the Legacy Display Element (the simple pseudo-header and its trailing newline) in the Main Body Part

```
Date: Wed, 11 Jan 2023 16:08:43 -0500
From: Bob <bob@example.net>
To: Alice <alice@example.net>
Subject: Handling the Jones contract
Message-ID: <20230111T210843Z.1234@lhp.example>
Content-Type: text/plain; charset="us-ascii"; hp-legacy-display="1";
 hp="cipher"
MIME-Version: 1.0
HP-Outer: Date: Wed, 11 Jan 2023 16:08:43 -0500
HP-Outer: From: Bob <bob@example.net>
HP-Outer: To: Alice <alice@example.net>
HP-Outer: Subject: [...]
HP-Outer: Message-ID: <20230111T210843Z.1234@lhp.example>

Subject: Handling the Jones contract

Please review and approve or decline by Thursday, it's critical!

Thanks,
Bob

--
Bob Gonzalez
ACME, Inc.
```

D.1.2.2. Outer Header Section

The Cryptographic Payload from Appendix D.1.2.1 is then wrapped in the appropriate Cryptographic Layers. For this example using S/MIME, it is wrapped in an application/pkcs7-mime; smime-type="signed-data" layer, which is in turn wrapped in an application/pkcs7-mime; smime-type="enveloped-data" layer.

Then, an Outer Header Section is applied to the outer MIME object, which looks like this:

```
Date: Wed, 11 Jan 2023 16:08:43 -0500
From: Bob <bob@example.net>
To: Alice <alice@example.net>
```

```
Subject: [...]
Message-ID: <20230111T210843Z.1234@lhp.example>
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
MIME-Version: 1.0
```

Note that the Subject Header Field has been obscured appropriately by hcp_baseline. The output of the CMS enveloping operation is base64 encoded and forms the Body of the message.

D.2. Composing a Reply

Next, we consider a typical MUA reply interface, where we see Alice replying to Bob's message from Appendix D.1.

When Alice clicks "Reply" to Bob's signed-and-encrypted message with Header Protection, she might see something like this:

```
 .-------------------------------------------------------.
|  Replying to Bob ("Handling the Jones Contract") .----.  |
|          +-----------------------------------+  | Send | |
|      To: | Bob <bob@example.net>             |  '----'  |
|          +-----------------------------------+---------+ |
| Subject: | Re: Handling the Jones contract             | |
|          +---------------------------------------------+ |
+-----------------------------------------------------------+
| On Wed, 11 Jan 2023 16:08:43 -0500, Bob wrote:            |
|                                                           |
| > Please review and approve or decline by Thursday,       |
| > it's critical!                                          |
| >                                                         |
| > Thanks,                                                 |
| > Bob                                                     |
| >                                                         |
| > --                                                      |
| > Bob Gonzalez                                            |
| > ACME, Inc.                                              |
|                                                           |
| --                                                        |
| Alice Jenkins                                             |
| ACME, Inc.                                                |
|                                                           |
+-----------------------------------------------------------+
```

Figure 2: Example Message Reply Interface (Unedited)

Note that because Alice's MUA is aware of Header Protection, it knows what the correct Subject Header Field is, even though it was obscured. It also knows to avoid including the Legacy Display Element in the quoted/attributed text that it includes in the draft reply.

Once Alice has edited the reply message, it might look something like this:

```
 .-------------------------------------------------------.
|  Replying to Bob ("Handling the Jones Contract") .----.  |
|          +-----------------------------------+  | Send | |
|      To: | Bob <bob@example.net>             |  '----'  |
|          +-----------------------------------+---------+ |
| Subject: | Re: Handling the Jones contract             | |
|          +---------------------------------------------+ |
+-----------------------------------------------------------+
| On Wed, 11 Jan 2023 16:08:43 -0500, Bob wrote:            |
|                                                           |
```

```
| > Please review and approve or decline by Thursday,      |
| > it’s critical!                                         |
|                                                          |
| I’ll get right on it, Bob!                               |
|                                                          |
| Regards,                                                 |
| Alice                                                    |
|                                                          |
| --                                                       |
| Alice Jenkins                                            |
| ACME, Inc.                                               |
|                                                          |
+----------------------------------------------------------+
```

Figure 3: Example Message Reply Interface (Edited)

When Alice clicks "Send", the MUA generates values for the Message-ID, From, and Date Header Fields, populates the In-Reply-To and References Header Fields, and also converts the reply content into the appropriate format.

D.2.1. Unprotected Message

The resulting message would look something like this if it were to be sent without any cryptographic protections:

```
Date: Wed, 11 Jan 2023 16:48:22 -0500
From: Alice <alice@example.net>
To: Bob <bob@example.net>
Subject: Re: Handling the Jones contract
Message-ID: <20230111T214822Z.5678@lhp.example>
In-Reply-To: <20230111T210843Z.1234@lhp.example>
References: <20230111T210843Z.1234@lhp.example>
Content-Type: text/plain; charset="us-ascii"
MIME-Version: 1.0

On Wed, 11 Jan 2023 16:08:43 -0500, Bob wrote:

> Please review and approve or decline by Thursday,
> it’s critical!

I’ll get right on it, Bob!

Regards,
Alice

--
Alice Jenkins
ACME, Inc.
```

Of course, this would leak not only the contents of Alice’s message but also the contents of Bob’s initial message, as well as the Subject Header Field! So Alice’s MUA won’t do that; it is going to create a signed-and-encrypted message to submit to the network.

D.2.2. Encrypted with hcp_no_confidentiality and Legacy Display

This example assumes that Alice’s MUA uses hcp_no_confidentiality, not hcp_baseline. That is, by default, it does not obscure or remove any Header Fields, even when encrypting.

However, it follows the guidance in Section 6.1 and will make use of the HP-Outer field in the Cryptographic Payload of Bob’s original message (Appendix D.1.2.1) to determine what to obscure.

When crafting the Cryptographic Payload, its baseline HCP

(hcp_no_confidentiality) leaves each field untouched. To uphold the confidentiality of the composer's values when replying, the MUA executes the following steps (for brevity, only Subject and Message-ID/In-Reply-To are shown):

* Extract the referenced Header Fields (see Section 4.2):
  - refouter contains:
    - Date: Wed, 11 Jan 2023 16:08:43 -0500
    - From: Bob <bob@example.net>
    - To: Alice <alice@example.net>
    - Subject: [...]
    - Message-ID: <20230111T210843Z.1234@lhp.example>
  - refprotected contains:
    - Date: Wed, 11 Jan 2023 16:08:43 -0500
    - From: Bob <bob@example.net>
    - To: Alice <alice@example.net>
    - Subject: Handling the Jones contract
    - Message-ID: <20230111T210843Z.1234@lhp.example>
* Apply the response function:
  - respond(refouter) contains:
    - From: Alice <alice@example.net>
    - To: Bob <bob@example.net>
    - Subject: Re: [...]
    - In-Reply-To: <20230111T210843Z.1234@lhp.example>
    - References: <20230111T210843Z.1234@lhp.example>
  - respond(refprotected) contains:
    - From: Alice <alice@example.net>
    - To: Bob <bob@example.net>
    - Subject: Re: Handling the Jones contract
    - In-Reply-To: <20230111T210843Z.1234@lhp.example>
    - References: <20230111T210843Z.1234@lhp.example>
* Compute the ephemeral response_hcp (see Section 6.1):
  - Note that all Header Fields except Subject are the same.
  - confmap contains only ("Subject", "Re: Handling the Jones contract") -> "Re: [...]"

Thus, all Header Fields that were signed are passed through untouched. The reply's Subject is obscured as Subject: Re: [...] if

and only if the user does not edit the Subject line from that initially proposed by the MUA's reply interface. If the user edits the Subject line, e.g., to Subject: Re: Handling the Jones contract ASAP, the response_hcp will _not_ obscure it and instead pass it through in the clear.

For stronger header confidentiality, the replying MUA should use a reasonable HCP (not hcp_no_confidentiality). Also recall that the local HCP is applied first and that response_hcp is only applied to what is left unchanged by the local HCP.

D.2.2.1. Cryptographic Payload

Consequently, the Cryptographic Payload for Alice's reply looks like this:

```
Date: Wed, 11 Jan 2023 16:48:22 -0500
From: Alice <alice@example.net>
To: Bob <bob@example.net>
Subject: Re: Handling the Jones contract
Message-ID: <20230111T214822Z.5678@lhp.example>
In-Reply-To: <20230111T210843Z.1234@lhp.example>
References: <20230111T210843Z.1234@lhp.example>
Content-Type: text/plain; charset="us-ascii"; hp-legacy-display="1";
 hp="cipher"
MIME-Version: 1.0
HP-Outer: Date: Wed, 11 Jan 2023 16:48:22 -0500
HP-Outer: From: Alice <alice@example.net>
HP-Outer: To: Bob <bob@example.net>
HP-Outer: Subject: Re: [...]
HP-Outer: Message-ID: <20230111T214822Z.5678@lhp.example>
HP-Outer: In-Reply-To: <20230111T210843Z.1234@lhp.example>
HP-Outer: References: <20230111T210843Z.1234@lhp.example>

Subject: Re: Handling the Jones contract

On Wed, 11 Jan 2023 16:08:43 -0500, Bob wrote:

> Please review and approve or decline by Thursday,
> it's critical!

I'll get right on it, Bob!

Regards,
Alice

--
Alice Jenkins
ACME, Inc.
```

Note the following features:

* the hp="cipher" parameter to Content-Type

* the appropriate HP-Outer Header Field for Subject

* the hp-legacy-display="1" parameter for the Content-Type

* the Legacy Display Element (the simple pseudo-header and its trailing newline) in the Main Body Part

D.2.2.2. Outer Header Section

The Cryptographic Payload from Appendix D.2.2.1 is then wrapped in the appropriate Cryptographic Layers. For this example using S/MIME, it is wrapped in an application/pkcs7-mime; smime-type="signed-data"

layer, which is in turn wrapped in an application/pkcs7-mime; smime-type="enveloped-data" layer.

Then, an Outer Header Section is applied to the outer MIME object, which looks like this:

```
Date: Wed, 11 Jan 2023 16:48:22 -0500
From: Alice <alice@example.net>
To: Bob <bob@example.net>
Subject: Re: [...]
Message-ID: <20230111T214822Z.5678@lhp.example>
In-Reply-To: <20230111T210843Z.1234@lhp.example>
References: <20230111T210843Z.1234@lhp.example>
Content-Transfer-Encoding: base64
Content-Type: application/pkcs7-mime; name="smime.p7m";
 smime-type="enveloped-data"
MIME-Version: 1.0
```

Note that the Subject Header Field has been obscured appropriately even though hcp_no_confidentiality would not have touched it by default. The output of the CMS enveloping operation is base64 encoded and forms the Body of the message.

Appendix E. Rendering Examples

This section offers example Cryptographic Payloads (the content within the Cryptographic Envelope) that contain Legacy Display Elements.

E.1. Example text/plain Cryptographic Payload with Legacy Display Elements

Here is a simple one-part Cryptographic Payload (Header Section and Body) of a message that includes Legacy Display Elements:

```
Date: Fri, 21 Jan 2022 20:40:48 -0500
From: Alice <alice@example.net>
To: Bob <bob@example.net>
Subject: Dinner plans
Message-ID: <text-plain-legacy-display@lhp.example>
MIME-Version: 1.0
Content-Type: text/plain; charset="us-ascii"; hp-legacy-display="1";
 hp="cipher"
HP-Outer: Date: Fri, 21 Jan 2022 20:40:48 -0500
HP-Outer: From: Alice <alice@example.net>
HP-Outer: To: Bob <bob@example.net>
HP-Outer: Subject: [...]
HP-Outer: Message-ID: <text-plain-legacy-display@lhp.example>

Subject: Dinner plans

Let’s meet at Rama’s Roti Shop at 8pm and go to the park
from there.
```

A compatible MUA will recognize the hp-legacy-display="1" parameter and render the Body of the message as:

```
Let’s meet at Rama’s Roti Shop at 8pm and go to the park
from there.
```

A legacy decryption-capable MUA that is unaware of this mechanism will ignore the hp-legacy-display="1" parameter and instead render the Body including the Legacy Display Elements:

```
Subject: Dinner plans
```

Let’s meet at Rama’s Roti Shop at 8pm and go to the park
from there.

E.2. Example text/html Cryptographic Payload with Legacy Display Elements

Here is a modern one-part Cryptographic Payload (Header Section and Body) of a message that includes Legacy Display Elements:

```
Date: Fri, 21 Jan 2022 20:40:48 -0500
From: Alice <alice@example.net>
To: Bob <bob@example.net>
Subject: Dinner plans
Message-ID: <text-html-legacy-display@lhp.example>
MIME-Version: 1.0
Content-Type: text/html; charset="us-ascii"; hp-legacy-display="1";
 hp="cipher"
HP-Outer: Date: Fri, 21 Jan 2022 20:40:48 -0500
HP-Outer: From: Alice <alice@example.net>
HP-Outer: To: Bob <bob@example.net>
HP-Outer: Subject: [...]
HP-Outer: Message-ID: <text-html-legacy-display@lhp.example>

<html><head><title></title></head><body>
<div class="header-protection-legacy-display">
<pre>Subject: Dinner plans</pre>
</div>
<p>
Let’s meet at Rama’s Roti Shop at 8pm and go to the park
from there.
</p>
</body>
</html>
```

A compatible MUA will recognize the hp-legacy-display="1" parameter and mask out the Legacy Display div, rendering the Body of the message as a simple paragraph:

Let’s meet at Rama’s Roti Shop at 8pm and go to the park
from there.

A legacy decryption-capable MUA that is unaware of this mechanism will ignore the hp-legacy-display="1" parameter and instead render the Body including the Legacy Display Elements:

Subject: Dinner plans

Let’s meet at Rama’s Roti Shop at 8pm and go to the park
from there.

Appendix F. Other Header Protection Schemes

Other Header Protection schemes have been proposed in the past. However, those typically have drawbacks such as sparse implementation, known problems with legacy interoperability (in particular with rendering), lack of clear signaling of composer intent, and/or incomplete cryptographic protections. This section lists such schemes known at the time of the publication of this document out of historical interest.

F.1. Original RFC 8551 Header Protection

S/MIME [RFC8551] (as well as its predecessors [RFC5751] and [RFC3851]) defined a form of cryptographic Header Protection that has never reached wide adoption and has significant drawbacks compared to the mechanism in this document. See Section 1.1.1 for more

discussion of the differences and Section 4.10 for guidance on how to handle such a message.

F.2. Pretty Easy Privacy (pEp)

The pretty Easy privacy (pEp) [PEP-GENERAL] project specifies two different MIME schemes that include Header Protection for Signed-and-Encrypted email messages in [PEP-EMAIL]: One scheme -- referred as pEp Email Format 1 (PEF-1) -- is generated towards MUAs not known to be pEp-capable, while the other scheme -- referred as PEF-2 -- is used between MUAs discovered to be compatible with pEp. Signed-only messages are not recommended in pEp.

Although the PEF-2 scheme is only meant to be used between MUAs compatible with PEF-2, a PEF-2 message may end up at an MUA unaware of PEF-2 (in which case, it typically renders badly). This is due to signaling mechanism limitations.

As the PEF-2 scheme is an enhanced variant of the RFC8551HP scheme (with an additional MIME Layer), it is similar to the RFC8551HP scheme (see Section 4.10). The basic PEF-2 MIME structure looks as follows:

```
A └┬multipart/encrypted [Outer Message]
B  ├──application/pgp-encrypted
C  └┬application/octet-stream inline [Cryptographic Payload]
D   (decrypts to)
E    └┬multipart/mixed
F     ├──text/plain
G     ├┬message/rfc822
H     │└──[Inner Message]
I     └──application/pgp-keys
```

The MIME structure at part H contains the Inner Message to be rendered to the user.

It is possible for a normal MUA to accidentally produce a message that happens to have the same MIME structure as used for PEF-2 messages. Therefore, a PEF-2 message cannot be identified by the MIME structure alone.

The lack of a mechanism comparable to HP-Outer (see Section 2.2) makes it impossible for the recipient of a PEF-2 message to safely determine which Header Fields are confidential or not while forwarding or replying to a message (see Section 6).

Note: As this document is not normative for PEF-2 messages, it does not provide any guidance for handling them. Please see [PEP-EMAIL] for more guidance.

F.3. "draft-autocrypt" Protected Headers

[PROTECTED-HEADERS] describes a scheme similar to the Header Protection scheme specified in this document. However, instead of adding Legacy Display Elements to existing MIME parts (see Section 5.2.2), [PROTECTED-HEADERS] suggests injecting a new MIME element "Legacy Display Part", thus modifying the MIME structure of the Cryptographic Payload. These modified Cryptographic Payloads cause significant rendering problems on some common Legacy MUAs.

The lack of a mechanism comparable to hp="cipher" and hp="clear" (see Section 2.1.1) means the recipient of an encrypted message as described in [PROTECTED-HEADERS] cannot be cryptographically certain whether the composer intended for the message to be confidential or not. The lack of a mechanism comparable to HP-Outer (see Section 2.2) makes it impossible for the recipient of an encrypted

message as described in [PROTECTED-HEADERS] to safely determine which Header Fields are confidential or not while forwarding or replying to a message (see Section 6).

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