

Network Working Group
Internet-Draft
Intended status: Standards Track
Expires: January 12, 2011

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July 11, 2010

Additional New ASN.1 Modules
draft-turner-additional-new-asn-01

Abstract

The Cryptographic Message Syntax (CMS) format, and many associated formats, are expressed using ASN.1. The current ASN.1 modules conform to the 1988 version of ASN.1. This document updates some auxiliary ASN.1 modules to conform to the 2008 version of ASN.1. There are no bits-on-the-wire changes to any of the formats; this is simply a change to the syntax.

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1. Introduction

Some developers would like the IETF to use the latest version of ASN.1 in its standards. Most of the RFCs that relate to security protocols still use ASN.1 from the 1988 standard, which has been deprecated. This is particularly true for the standards that relate to PKIX, CMS, and S/MIME.

In this document we have either change the syntax to use the 2008 ASN.1 standard, or done some updates from previous conversions:

[RFC 3274](#), Compressed Data Content Type for Cryptographic Message Syntax (CMS) [[RFC3274](#)]

[RFC 3379](#), Delegated Path Validation and Delegated Path Discovery Protocol Requirements [[RFC3379](#)]

[RFC 4049](#), BinaryTime: An Alternate Format for Representing Date and Time in ASN.1 [[RFC4049](#)]

[RFC 4073](#), Protecting Multiple Contents with the Cryptographic Message Syntax (CMS) [[RFC4073](#)]

[RFC 4231](#), Identifiers and Test Vectors for HMAC-SHA-224, HMAC-SHA-256, HMAC-SHA-384, and HMAC-SHA-512 [[RFC4231](#)]

[RFC 4334](#), Certificate Extensions and Attributes Supporting Authentication in Point-to-Point Protocol (PPP) and Wireless Local Area Networks (WLAN) [[RFC4334](#)]

[RFC 5752](#), Multiple Signatures in Cryptographic Message Syntax (CMS) [[RFC5752](#)]

[RFC 5652](#), Cryptographic Message Syntax (CMS) [[RFC5652](#)]

[RFC 5083](#), Cryptographic Message Syntax (CMS) Authenticated-

Enveloped-Data Content Type [[RFC5083](#)].

Note that some of the modules in this document get some of their definitions from places different than the modules in the original RFCs. The idea is that these modules, when combined with the modules in [[RFC5912](#)] and [[RFC5911](#)] can stand on their own and do not need to import definitions from anywhere else.

[1.1](#). Requirements Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this

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document are to be interpreted as described in [[RFC2119](#)].

2. ASN.1 Module [RFC 3274](#)

CompressedDataContent

```
{ iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs-9(9)
  smime(16) modules(0) TBD }
```

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

IMPORTS

CMSVersion, EncapsulatedContentInfo,
CONTENT-TYPE

FROM CryptographicMessageSyntax-2009

```
{ iso(1) member-body(2) us(840) rsadsi(113549)
  pkcs(1) pkcs-9(9) smime(16) modules(0) TBD }
```

AlgorithmIdentifier{}, SMIME-CAPS, ParamOptions

FROM AlgorithmInformation-2009

```
{iso(1) identified-organization(3) dod(6) internet(1) security(5)
mechanisms(5) pkix(7) id-mod(0)
id-mod-algorithmInformation-02(58)}
```

```

;

--
--
--

ContentTypes CONTENT-TYPE ::= {ct-compressedData}

SMimeCaps SMIME-CAPS ::= {cpa-zlibCompress.&smimeCaps}

ct-compressedData CONTENT-TYPE ::= {
  CompressedData IDENTIFIED BY id-ct-compressedData
}

CompressedData ::= SEQUENCE {
  version CMSVersion,          -- Always set to 0
  compressionAlgorithm CompressionAlgorithmIdentifier,
  encapContentInfo EncapsulatedContentInfo
}

CompressionAlgorithmIdentifier ::=
  AlgorithmIdentifier{COMPRESS-ALGORITHM, {CompressAlgorithmSet}}

CompressAlgorithmSet COMPRESS-ALGORITHM ::= {
  cpa-zlibCompress, ...
}

```

```

}

-- Algorithm Identifiers

id-alg-zlibCompress OBJECT IDENTIFIER ::= { iso(1) member-body(2)
  us(840) rsadsi(113549) pkcs(1) pkcs-9(9) smime(16) alg(3) 8 }

cpa-zlibCompress COMPRESS-ALGORITHM ::= {
  IDENTIFIER id-alg-zlibCompress
  PARAMS TYPE NULL ARE preferredAbsent
  SMIME-CAPS {IDENTIFIED BY id-alg-zlibCompress}
}

-- Content Type Object Identifiers

```

```

id-ct-compressedData OBJECT IDENTIFIER ::= { iso(1) member-body(2)
    us(840) rsadsi(113549) pkcs(1) pkcs-9(9) smime(16) ct(1) 9 }

--
-- Class defined for compression algorithms
--

COMPRESS-ALGORITHM ::= CLASS {
    &id                OBJECT IDENTIFIER UNIQUE,
    &Params             OPTIONAL,
    &paramPresence     ParamOptions DEFAULT absent,
    &smimeCaps         SMIME-CAPS OPTIONAL
}
WITH SYNTAX {
    IDENTIFIER &id
    [PARAMS [TYPE &Params] ARE &paramPresence]
    [SMIME-CAPS &smimeCaps]
}

END

```

3. ASN.1 Module [RFC 3379](#)

```

IPAddrAndASCertExtn { iso(1) identified-organization(3) dod(6)
    internet(1) security(5) mechanisms(5) pkix(7) mod(0)
    TBD }
DEFINITIONS EXPLICIT TAGS ::=
BEGIN
    EXPORTS ALL;

```

IMPORTS

-- PKIX specific OIDs and arcs --

id-pe

FROM PKIX1Explicit-2009

{ iso(1) identified-organization(3) dod(6) internet(1)
security(5) mechanisms(5) pkix(7) id-mod(0)
id-mod-pkix1-explicit-02(51)}

EXTENSION

FROM PKIX-CommonTypes-2009

{ iso(1) identified-organization(3) dod(6) internet(1) security(5)
mechanisms(5) pkix(7) id-mod(0) id-mod-pkixCommon-02(57)}

;

-- IP Address Delegation Extension OID --

ext-pe-ipAddrBlocks EXTENSION ::= {
SYNTAX IPAddrBlocks
IDENTIFIED BY id-pe-ipAddrBlocks
}

id-pe-ipAddrBlocks OBJECT IDENTIFIER ::= { id-pe 7 }

-- IP Address Delegation Extension Syntax --

IPAddrBlocks ::= SEQUENCE OF IPAddressFamily

IPAddressFamily ::= SEQUENCE { -- AFI & opt SAFI --
addressFamily OCTET STRING (SIZE (2..3)),
ipAddressChoice IPAddressChoice }

IPAddressChoice ::= CHOICE {
inherit NULL, -- inherit from issuer --
addressesOrRanges SEQUENCE OF IPAddressOrRange }

IPAddressOrRange ::= CHOICE {
addressPrefix IPAddress,
addressRange IPAddressRange }

IPAddressRange ::= SEQUENCE {


```

        min                IPAddress,
        max                IPAddress }

IPAddress                ::= BIT STRING

-- Autonomous System Identifier Delegation Extension OID --

ext-pe-autonomousSysIds EXTENSION ::= {
    SYNTAX ASIdentifiers
    IDENTIFIED BY id-pe-autonomousSysIds
}

id-pe-autonomousSysIds OBJECT IDENTIFIER ::= { id-pe 8 }

-- Autonomous System Identifier Delegation Extension Syntax --

ASIdentifiers           ::= SEQUENCE {
    asnum                [0] ASIdentifierChoice OPTIONAL,
    rdi                  [1] ASIdentifierChoice OPTIONAL }
(WITH COMPONENTS {..., asnum PRESENT} |
 WITH COMPONENTS {..., rdi PRESENT})

ASIdentifierChoice       ::= CHOICE {
    inherit              NULL, -- inherit from issuer --
    asIdsOrRanges        SEQUENCE OF ASIdOrRange }

ASIdOrRange              ::= CHOICE {
    id                   ASId,
    range                ASRange }

ASRange                  ::= SEQUENCE {
    min                  ASId,
    max                  ASId }

ASId                     ::= INTEGER

END

```

4. ASN.1 Module [RFC 4049](#)

```
BinarySigningTimeModule-2009
    { iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1)
      pkcs-9(9) smime(16) modules(0) TBD0 }
DEFINITIONS IMPLICIT TAGS ::=
BEGIN
    IMPORTS

    -- From PKIX-CommonTypes-2009 [RFC5912]

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

    --
    -- BinaryTime Definition
    --
    -- BinaryTime contains the number seconds since
    -- midnight Jan 1, 1970 UTC.
    -- Leap seconds are EXCLUDED from the computation.
    --

    BinaryTime ::= INTEGER (0..MAX)

    --
    -- Signing Binary Time Attribute
    --
    -- The binary signing time should be added to the
    -- SignedAttributeSet and the AuthenticatedAttributeSet
    -- in the CMS modules.
    --

    aa-binarySigningTime ATTRIBUTE ::= {
        TYPE BinarySigningTime
        IDENTIFIED BY id-aa-binarySigningTime }

    id-aa-binarySigningTime OBJECT IDENTIFIER ::= { iso(1)
        member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs9(9)
        smime(16) aa(2) 46 }

    BinarySigningTime ::= BinaryTime
```

END

5. ASN.1 Module [RFC 4073](#)

```
ContentCollectionModule-2009
  { iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1)
    pkcs-9(9) smime(16) modules(0) TBD1 }
DEFINITIONS IMPLICIT TAGS ::=
BEGIN
  IMPORTS

  -- From CryptographicMessageSyntax-2009 [RFC5911]

  CONTENT-TYPE, ContentInfo
  FROM CryptographicMessageSyntax-2009
  { iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1)
    pkcs-9(9) smime(16) modules(0) TBD }

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

--
-- An object set of all content types defined by this module.
-- This is to be added to ContentSet in the CMS module
--

ContentSet CONTENT-TYPE ::= {
  ct-ContentCollection | ct-ContentWithAttributes, ...
}

--
-- Content Collection Content Type and Object Identifier
--

ct-ContentCollection CONTENT TYPE ::= {
  ContentCollection IDENTIFIED BY id-ct-contentCollection }
```

```
id-ct-contentCollection OBJECT IDENTIFIER ::= {
    iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs-9(9)
    smime(16) ct(1) 19 }
```

```
ContentCollection ::= SEQUENCE SIZE (1..MAX) OF ContentInfo
```

```
--
-- Content With Attributes Content Type and Object Identifier
--
```

```
ct-ContentWithAttributes CONTENT TYPE ::= {
    { ContentWithAttributes IDENTIFIED BY id-ct-contentWithAttrs }
```

```
id-ct-contentWithAttrs OBJECT IDENTIFIER ::= {
    iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs-9(9)
    smime(16) ct(1) 20 }
```

```
ContentWithAttributes ::= SEQUENCE {
    content ContentInfo,
    attrs SEQUENCE SIZE (1..MAX) OF AttributeSet
                                           { ContentAttributeSet }
```

```
ContentAttributeSet ATTRIBUTE ::= { ... }
```

END

6. ASN.1 Module [RFC 4231](#)

```
HMAC { TBD }
DEFINITIONS EXPLICIT TAGS ::=
BEGIN
  EXPORTS ALL;

  IMPORTS

  MAC-ALGORITHM, SMIME-CAPS
  FROM AlgorithmInformation-2009
    { iso(1) identified-organization(3) dod(6) internet(1) security(5)
      mechanisms(5) pkix(7) id-mod(0)
      id-mod-algorithmInformation-02(58)};

  --
  -- This object set contains all of the MAC algorithms that are
  -- defined in this module.
  -- One would add it to a constraining set of objects such as the
  -- MessageAuthenticationCodeAlgorithmSet in [RFC5652]
  --

  MessageAuthAlgs MAC-ALGORITHM ::= {
    maca-hMAC-SHA224 |
    maca-hMAC-SHA256 |
```

```

    maca-hMAC-SHA384 |
    maca-hMAC-SHA512
}

--
-- This object set contains all of the S/MIME capabilities that
-- have been defined for all the MAC algorithms in this module.
-- One would add this to an object set that is used to restrict
-- smime capabilities such as the SMimeCapsSet variable in
-- the S/MIME message draft
--

SMimeCaps SMIME-CAPS ::= {
    maca-hMAC-SHA224.&smimeCaps      |
    maca-hMAC-SHA256.&smimeCaps      |
    maca-hMAC-SHA384.&smimeCaps      |
    maca-hMAC-SHA512.&smimeCaps
}

--
-- Define the base OID for the algorithm identifiers
--

```

```

rsadsi OBJECT IDENTIFIER ::=
    {iso(1) member-body(2) us(840) rsadsi(113549)}

digestAlgorithm OBJECT IDENTIFIER ::= {rsadsi 2}

--
-- Define the necessary algorithm identifiers
--

id-hmacWithSHA224 OBJECT IDENTIFIER ::= {digestAlgorithm 8}
id-hmacWithSHA256 OBJECT IDENTIFIER ::= {digestAlgorithm 9}
id-hmacWithSHA384 OBJECT IDENTIFIER ::= {digestAlgorithm 10}
id-hmacWithSHA512 OBJECT IDENTIFIER ::= {digestAlgorithm 11}

--
-- Define each of the MAC-ALGORITHM objects to describe the
-- algorithms defined
--

```

```
maca-hMAC-SHA224 MAC-ALGORITHM ::= {  
    IDENTIFIER id-hmacWithSHA224  
    PARAMS TYPE NULL ARE preferredPresent  
    IS-KEYED-MAC TRUE  
    SMIME-CAPS {IDENTIFIED BY id-hmacWithSHA224}  
}
```

```
maca-hMAC-SHA256 MAC-ALGORITHM ::= {  
    IDENTIFIER id-hmacWithSHA256  
    PARAMS TYPE NULL ARE preferredPresent  
    IS-KEYED-MAC TRUE  
    SMIME-CAPS {IDENTIFIED BY id-hmacWithSHA256}  
}
```

```
maca-hMAC-SHA384 MAC-ALGORITHM ::= {  
    IDENTIFIER id-hmacWithSHA384  
    PARAMS TYPE NULL ARE preferredPresent  
    IS-KEYED-MAC TRUE  
    SMIME-CAPS {IDENTIFIED BY id-hmacWithSHA384}  
}
```

```
maca-hMAC-SHA512 MAC-ALGORITHM ::= {  
    IDENTIFIER id-hmacWithSHA512  
    PARAMS TYPE NULL ARE preferredPresent  
    IS-KEYED-MAC TRUE  
    SMIME-CAPS {IDENTIFIED BY id-hmacWithSHA512}
```

```
}
```

END

7. ASN.1 Module [RFC 4334](#)

WLANCertExtn

{ iso(1) identified-organization(3) dod(6) internet(1)


```

    security(5) mechanisms(5) pkix(7) id-mod(0)
    TBD }

DEFINITIONS IMPLICIT TAGS ::=
BEGIN
    EXPORTS ALL;

    IMPORTS

    EXTENSION, ATTRIBUTE
    FROM PKIX-CommonTypes-2009
        {iso(1) identified-organization(3) dod(6) internet(1) security(5)
        mechanisms(5) pkix(7) id-mod(0) id-mod-pkixCommon-02(57)}

    id-pe, id-kp
    FROM PKIX1Explicit-2009
        { iso(1) identified-organization(3) dod(6) internet(1) security(5)
        mechanisms(5) pkix(7) id-mod(0) id-mod-pkix1-explicit-02(51)}

    id-aca
    FROM PKIXAttributeCertificate-2009
        { iso(1) identified-organization(3) dod(6) internet(1) security(5)
        mechanisms(5) pkix(7) id-mod(0) id-mod-attribute-cert-02(47)}

    ;

    -- Extended Key Usage Values

    KeyUsageValues OBJECT IDENTIFIER ::= {
        id-kp-eapOverPPP | id-kp-eapOverLAN
    }

    id-kp-eapOverPPP OBJECT IDENTIFIER ::= { id-kp 13 }

    id-kp-eapOverLAN OBJECT IDENTIFIER ::= { id-kp 14 }

    -- Wireless LAN SSID Extension

    ext-pe-wlanSSID EXTENSION ::= {
        SYNTAX SSIDList
        IDENTIFIED BY id-pe-wlanSSID
    }

```

```
    CRITICALITY {FALSE}
  }

id-pe-wlanSSID  OBJECT IDENTIFIER ::= { id-pe 13 }

SSIDList  ::=  SEQUENCE SIZE (1..MAX) OF SSID

SSID  ::=  OCTET STRING (SIZE (1..32))

-- Wireless LAN SSID Attribute Certificate Attribute
-- Uses same syntax as the certificate extension: SSIDList

at-aca-wlanSSID ATTRIBUTE ::= {
    TYPE SSIDList
    IDENTIFIED BY id-aca-wlanSSID
}

id-aca-wlanSSID  OBJECT IDENTIFIER ::= { id-aca 7 }

END
```

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8. ASN.1 Module [RFC 5752](#)

MultipleSignatures-2009

```
{ iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs9(9)
  smime(16) modules(0) TBD2 }
```

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

-- EXPORTS All

-- The types and values defined in this module are exported for use
-- in the other ASN.1 modules. Other applications may use them for
-- their own purposes.

IMPORTS

-- Imports from PKIX-Common-Types-2009 [[RFC5912](#)]

ATTRIBUTE

FROM PKIX-CommonTypes-2009

```
{ iso(1) identified-organization(3) dod(6) internet(1)
  security(5) mechanisms(5) pkix(7) id-mod(0)
  id-mod-pkixCommon-02(57) }
```

-- Imports from CryptographicMessageSyntax-2009 [[RFC5911](#)]

DigestAlgorithmIdentifier, SignatureAlgorithmIdentifier

FROM CryptographicMessageSyntax-2009

```
{ iso(1) member-body(2) us(840) rsadsi(113549)
  pkcs(1) pkcs-9(9) smime(16) modules(0) TBD }
```

-- Imports from ExtendedSecurityServices-2009 [[RFC5911](#)]

ESSCertIDv2

FROM ExtendedSecurityServices-2009

```
{ iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs-9(9)
  smime(16) modules(0) id-mod-ess-2006-02(42) }
```

;

--

-- [Section 3.0](#)

--

```
-- at-multipleSignatures should be added ONLY to the
--   SignedAttributesSet defined in [RFC5652]
--
```

```
at-multipleSignatures ATTRIBUTE ::= {
  TYPE MultipleSignatures
  IDENTIFIED BY id-aa-multipleSignatures
}
```

```
id-aa-multipleSignatures OBJECT IDENTIFIER ::= {
  iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs9(9)
  id-aa(2) 51 }
```

```
MultipleSignatures ::= SEQUENCE {
  bodyHashAlg      DigestAlgorithmIdentifier,
  signAlg          SignatureAlgorithmIdentifier,
  signAttrsHash    SignAttrsHash,
  cert             ESSCertIDv2 OPTIONAL
}
```

```
SignAttrsHash ::= SEQUENCE {
  algID            DigestAlgorithmIdentifier,
  hash             OCTET STRING
}
```

END

9. ASN.1 Module [RFC 5652](#)

This module is updated from [RFC 5911](#) [[RFC5911](#)] by defining separate attribute sets for the protected and unprotected attribute sets. By using different attribute sets for EncryptedData and EnvelopedData as well as for AuthenticatedData and AuthEnvelopedData, protocol designers can make use of the '02 ASN.1 constraints to define different sets of attributes for EncryptedData and EnvelopedData and for AuthenticatedData and AuthEnvelopedData. Previously, attributes could only be constrained based on whether they were in the clear or unauthenticated not on the encapsulating content type.

CryptographicMessageSyntax-2009

```
{ iso(1) member-body(2) us(840) rsadsi(113549)
  pkcs(1) pkcs-9(9) smime(16) modules(0) TBD }
```

DEFINITIONS IMPLICIT TAGS ::=

BEGIN

IMPORTS

```
ParamOptions, DIGEST-ALGORITHM, SIGNATURE-ALGORITHM,
PUBLIC-KEY, KEY-DERIVATION, KEY-WRAP, MAC-ALGORITHM,
KEY-AGREE, KEY-TRANSPORT, CONTENT-ENCRYPTION, ALGORITHM,
AlgorithmIdentifier
```

FROM AlgorithmInformation-2009

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

```

id-mod-algorithmInformation-02(58)}

SignatureAlgs, MessageDigestAlgs, KeyAgreementAlgs,
    MessageAuthAlgs, KeyWrapAlgs, ContentEncryptionAlgs,
    KeyTransportAlgs, KeyDerivationAlgs, KeyAgreePublicKeys
FROM CryptographicMessageSyntaxAlgorithms-2009
    { iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs-9(9)
      smime(16) modules(0) id-mod-cmsalg-2001-02(37) }

Certificate, CertificateList, CertificateSerialNumber,
    Name, ATTRIBUTE
FROM PKIX1Explicit-2009
    { iso(1) identified-organization(3) dod(6) internet(1)
      security(5) mechanisms(5) pkix(7) id-mod(0)
      id-mod-pkix1-explicit-02(51) }

AttributeCertificate
FROM PKIXAttributeCertificate-2009
    { iso(1) identified-organization(3) dod(6) internet(1)
      security(5) mechanisms(5) pkix(7) id-mod(0)
      id-mod-attribute-cert-02(47) }

```

```

AttributeCertificateV1
FROM AttributeCertificateVersion1-2009
    { iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs-9(9)
      smime(16) modules(0) id-mod-v1AttrCert-02(49) } ;

-- Cryptographic Message Syntax

-- The following are used for version numbers using the ASN.1
-- idiom "[[n:"
-- Version 1 = PKCS #7
-- Version 2 = S/MIME V2
-- Version 3 = RFC 2630
-- Version 4 = RFC 3369
-- Version 5 = RFC 3852

CONTENT-TYPE ::= TYPE-IDENTIFIER
ContentType ::= CONTENT-TYPE.&id

ContentInfo ::= SEQUENCE {

```

```

contentType      CONTENT-TYPE.
                  &id({ContentSet}),
content          [0] EXPLICIT CONTENT-TYPE.
                  &Type({ContentSet}{@contentType})}

```

```

ContentSet CONTENT-TYPE ::= {
  -- Define the set of content types to be recognized.
  ct-Data | ct-SignedData | ct-EncryptedData | ct-EnvelopedData |
  ct-AuthenticatedData | ct-DigestedData, ... }

```

```

SignedData ::= SEQUENCE {
  version CMSVersion,
  digestAlgorithms SET OF DigestAlgorithmIdentifier,
  encapContentInfo EncapsulatedContentInfo,
  certificates [0] IMPLICIT CertificateSet OPTIONAL,
  crls [1] IMPLICIT RevocationInfoChoices OPTIONAL,
  signerInfos SignerInfos }

```

```

SignerInfos ::= SET OF SignerInfo

```

```

EncapsulatedContentInfo ::= SEQUENCE {
  eContentType      CONTENT-TYPE.&id({ContentSet}),
  eContent          [0] EXPLICIT OCTET STRING
                    ( CONTAINING CONTENT-TYPE.
                      &Type({ContentSet}{@eContentType})) OPTIONAL }

```

```

SignerInfo ::= SEQUENCE {
  version CMSVersion,
  sid SignerIdentifier,

```

```

  digestAlgorithm DigestAlgorithmIdentifier,
  signedAttrs [0] IMPLICIT SignedAttributes OPTIONAL,
  signatureAlgorithm SignatureAlgorithmIdentifier,
  signature SignatureValue,
  unsignedAttrs [1] IMPLICIT Attributes
    {{UnsignedAttributes}} OPTIONAL }

```

```

SignedAttributes ::= Attributes {{ SignedAttributesSet }}

```

```

SignerIdentifier ::= CHOICE {
  issuerAndSerialNumber IssuerAndSerialNumber,
  ...,

```

```

    [[3: subjectKeyIdentifier [0] SubjectKeyIdentifier ]] }

SignedAttributesSet ATTRIBUTE ::=
    { aa-signingTime | aa-messageDigest | aa-contentType, ... }

UnsignedAttributes ATTRIBUTE ::= { aa-countersignature, ... }

SignatureValue ::= OCTET STRING

EnvelopedData ::= SEQUENCE {
    version CMSVersion,
    originatorInfo [0] IMPLICIT OriginatorInfo OPTIONAL,
    recipientInfos RecipientInfos,
    encryptedContentInfo EncryptedContentInfo,
    ...,
    [[2: unprotectedAttrs [1] IMPLICIT Attributes
        {{ UnprotectedEnvAttributes }} OPTIONAL ]] }

OriginatorInfo ::= SEQUENCE {
    certs [0] IMPLICIT CertificateSet OPTIONAL,
    crls [1] IMPLICIT RevocationInfoChoices OPTIONAL }

RecipientInfos ::= SET SIZE (1..MAX) OF RecipientInfo

EncryptedContentInfo ::= SEQUENCE {
    contentType          CONTENT-TYPE.&id({ContentSet}),
    contentEncryptionAlgorithm ContentEncryptionAlgorithmIdentifier,
    encryptedContent      [0] IMPLICIT OCTET STRING OPTIONAL }

-- If you want to do constraints, you might use:
-- EncryptedContentInfo ::= SEQUENCE {
--     contentType          CONTENT-TYPE.&id({ContentSet}),
--     contentEncryptionAlgorithm ContentEncryptionAlgorithmIdentifier,
--     encryptedContent      [0] IMPLICIT ENCRYPTED {CONTENT-TYPE.
--         &Type({ContentSet}){@contentType}} OPTIONAL }
-- ENCRYPTED {ToBeEncrypted} ::= OCTET STRING ( CONSTRAINED BY

```

```

--         { ToBeEncrypted } )

UnprotectedEnvAttributes ATTRIBUTE ::= { ... }
UnprotectedEncAttributes ATTRIBUTE ::= { ... }

```



```

RecipientInfo ::= CHOICE {
    ktri          KeyTransRecipientInfo,
    ...,
    [[3: kari    [1] KeyAgreeRecipientInfo ]],
    [[4: kekri   [2] KEKRecipientInfo]],
    [[5: pwri    [3] PasswordRecipientInfo,
        ori     [4] OtherRecipientInfo ]] }

```

```

EncryptedKey ::= OCTET STRING

```

```

KeyTransRecipientInfo ::= SEQUENCE {
    version CMSVersion, -- always set to 0 or 2
    rid RecipientIdentifier,
    keyEncryptionAlgorithm AlgorithmIdentifier
        {KEY-TRANSPORT, {KeyTransportAlgorithmSet}},
    encryptedKey EncryptedKey }

```

```

KeyTransportAlgorithmSet KEY-TRANSPORT ::= { KeyTransportAlgs, ... }

```

```

RecipientIdentifier ::= CHOICE {
    issuerAndSerialNumber IssuerAndSerialNumber,
    ...,
    [[2: subjectKeyIdentifier [0] SubjectKeyIdentifier ]] }

```

```

KeyAgreeRecipientInfo ::= SEQUENCE {
    version CMSVersion, -- always set to 3
    originator [0] EXPLICIT OriginatorIdentifierOrKey,
    ukm [1] EXPLICIT UserKeyingMaterial OPTIONAL,
    keyEncryptionAlgorithm AlgorithmIdentifier
        {KEY-AGREE, {KeyAgreementAlgorithmSet}},
    recipientEncryptedKeys RecipientEncryptedKeys }

```

```

KeyAgreementAlgorithmSet KEY-AGREE ::= { KeyAgreementAlgs, ... }

```

```

OriginatorIdentifierOrKey ::= CHOICE {
    issuerAndSerialNumber IssuerAndSerialNumber,
    subjectKeyIdentifier [0] SubjectKeyIdentifier,
    originatorKey [1] OriginatorPublicKey }

```

```

OriginatorPublicKey ::= SEQUENCE {
    algorithm AlgorithmIdentifier {PUBLIC-KEY, {OriginatorKeySet}},
    publicKey BIT STRING }

```

```

OriginatorKeySet PUBLIC-KEY ::= { KeyAgreePublicKeys, ... }

```

RecipientEncryptedKeys ::= SEQUENCE OF RecipientEncryptedKey

RecipientEncryptedKey ::= SEQUENCE {
 rid KeyAgreeRecipientIdentifier,
 encryptedKey EncryptedKey }

KeyAgreeRecipientIdentifier ::= CHOICE {
 issuerAndSerialNumber IssuerAndSerialNumber,
 rKeyId [0] IMPLICIT RecipientKeyIdentifier }

RecipientKeyIdentifier ::= SEQUENCE {
 subjectKeyIdentifier SubjectKeyIdentifier,
 date GeneralizedTime OPTIONAL,
 other OtherKeyAttribute OPTIONAL }

SubjectKeyIdentifier ::= OCTET STRING

KEKRecipientInfo ::= SEQUENCE {
 version CMSVersion, -- always set to 4
 kekid KEKIdentifier,
 keyEncryptionAlgorithm KeyEncryptionAlgorithmIdentifier,
 encryptedKey EncryptedKey }

KEKIdentifier ::= SEQUENCE {
 keyIdentifier OCTET STRING,
 date GeneralizedTime OPTIONAL,
 other OtherKeyAttribute OPTIONAL }

PasswordRecipientInfo ::= SEQUENCE {
 version CMSVersion, -- always set to 0
 keyDerivationAlgorithm [0] KeyDerivationAlgorithmIdentifier
 OPTIONAL,
 keyEncryptionAlgorithm KeyEncryptionAlgorithmIdentifier,
 encryptedKey EncryptedKey }

OTHER-RECIPIENT ::= TYPE-IDENTIFIER

OtherRecipientInfo ::= SEQUENCE {
 oriType OTHER-RECIPIENT.
 &id({SupportedOtherRecipInfo}),
 oriValue OTHER-RECIPIENT.
 &Type({SupportedOtherRecipInfo}{@oriType})}

SupportedOtherRecipInfo OTHER-RECIPIENT ::= { ... }

DigestedData ::= SEQUENCE {
 version CMSVersion,
 digestAlgorithm DigestAlgorithmIdentifier,
 encapContentInfo EncapsulatedContentInfo,

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```
    digest Digest, ... }
```

```
Digest ::= OCTET STRING
```

```
EncryptedData ::= SEQUENCE {  
    version CMSVersion,  
    encryptedContentInfo EncryptedContentInfo,  
    ...,  
    [[2: unprotectedAttrs [1] IMPLICIT Attributes  
        {{UnprotectedEncAttributes}} OPTIONAL ]] }
```

```
AuthenticatedData ::= SEQUENCE {  
    version CMSVersion,  
    originatorInfo [0] IMPLICIT OriginatorInfo OPTIONAL,  
    recipientInfos RecipientInfos,  
    macAlgorithm MessageAuthenticationCodeAlgorithm,  
    digestAlgorithm [1] DigestAlgorithmIdentifier OPTIONAL,  
    encapContentInfo EncapsulatedContentInfo,  
    authAttrs [2] IMPLICIT AuthAttributes OPTIONAL,  
    mac MessageAuthenticationCode,  
    unauthAttrs [3] IMPLICIT UnauthAttributes OPTIONAL }
```

```
AuthAttributes ::= SET SIZE (1..MAX) OF Attribute  
    {{AuthAttributeSet}}
```

```
AuthAttributeSet ATTRIBUTE ::= { aa-contentType | aa-messageDigest  
                                   | aa-signingTime, ... }
```

```
MessageAuthenticationCode ::= OCTET STRING
```

```
UnauthAttributes ::= SET SIZE (1..MAX) OF Attribute  
    {{UnauthAttributeSet}}
```

```
UnauthAttributeSet ATTRIBUTE ::= {...}
```

```
--  
-- General algorithm definitions  
--
```

```
DigestAlgorithmIdentifier ::= AlgorithmIdentifier  
    {DIGEST-ALGORITHM, {DigestAlgorithmSet}}
```

```
DigestAlgorithmSet DIGEST-ALGORITHM ::= {
```

CryptographicMessageSyntaxAlgorithms-2009.MessageDigestAlgs, ... }

SignatureAlgorithmIdentifier ::= AlgorithmIdentifier
{SIGNATURE-ALGORITHM, {SignatureAlgorithmSet}}

SignatureAlgorithmSet SIGNATURE-ALGORITHM ::=

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{ SignatureAlgs, ... }

KeyEncryptionAlgorithmIdentifier ::= AlgorithmIdentifier
{KEY-WRAP, {KeyEncryptionAlgorithmSet}}

KeyEncryptionAlgorithmSet KEY-WRAP ::= { KeyWrapAlgs, ... }

ContentEncryptionAlgorithmIdentifier ::= AlgorithmIdentifier
{CONTENT-ENCRYPTION, {ContentEncryptionAlgorithmSet}}

ContentEncryptionAlgorithmSet CONTENT-ENCRYPTION ::=
{ ContentEncryptionAlgs, ... }

MessageAuthenticationCodeAlgorithm ::= AlgorithmIdentifier
{MAC-ALGORITHM, {MessageAuthenticationCodeAlgorithmSet}}

MessageAuthenticationCodeAlgorithmSet MAC-ALGORITHM ::=
{ MessageAuthAlgs, ... }

KeyDerivationAlgorithmIdentifier ::= AlgorithmIdentifier
{KEY-DERIVATION, {KeyDerivationAlgs, ...}}

RevocationInfoChoices ::= SET OF RevocationInfoChoice

RevocationInfoChoice ::= CHOICE {
 crl CertificateList,
 ...,
 [[5: other [1] IMPLICIT OtherRevocationInfoFormat]] }

OTHER-REVOK-INFO ::= TYPE-IDENTIFIER

OtherRevocationInfoFormat ::= SEQUENCE {
 otherRevInfoFormat OTHER-REVOK-INFO.
 &id({SupportedOtherRevokInfo}),
 otherRevInfo OTHER-REVOK-INFO.

&Type({SupportedOtherRevokInfo}{@otherRevInfoFormat}))}

SupportedOtherRevokInfo OTHER-REVOK-INFO ::= { ... }

CertificateChoices ::= CHOICE {
 certificate Certificate,
 extendedCertificate [0] IMPLICIT ExtendedCertificate,
 -- Obsolete
 ...,
 [[3: v1AttrCert [1] IMPLICIT AttributeCertificateV1]],
 -- Obsolete
 [[4: v2AttrCert [2] IMPLICIT AttributeCertificateV2]],
 [[5: other [3] IMPLICIT OtherCertificateFormat]] }

AttributeCertificateV2 ::= AttributeCertificate

OTHER-CERT-FMT ::= TYPE-IDENTIFIER

OtherCertificateFormat ::= SEQUENCE {
 otherCertFormat OTHER-CERT-FMT.
 &id({SupportedCertFormats}),
 otherCert OTHER-CERT-FMT.
 &Type({SupportedCertFormats}{@otherCertFormat})}

SupportedCertFormats OTHER-CERT-FMT ::= { ... }

CertificateSet ::= SET OF CertificateChoices

IssuerAndSerialNumber ::= SEQUENCE {
 issuer Name,
 serialNumber CertificateSerialNumber }

CMSVersion ::= INTEGER { v0(0), v1(1), v2(2), v3(3), v4(4), v5(5) }

UserKeyingMaterial ::= OCTET STRING

KEY-ATTRIBUTE ::= TYPE-IDENTIFIER

OtherKeyAttribute ::= SEQUENCE {
 keyAttrId KEY-ATTRIBUTE.
 &id({SupportedKeyAttributes}),
 keyAttr KEY-ATTRIBUTE.

&Type({SupportedKeyAttributes}{@keyAttrId}))}

SupportedKeyAttributes KEY-ATTRIBUTE ::= { ... }

-- Content Type Object Identifiers

id-ct-contentInfo OBJECT IDENTIFIER ::= { iso(1) member-body(2)
us(840) rsadsi(113549) pkcs(1) pkcs9(9) smime(16) ct(1) 6 }

ct-Data CONTENT-TYPE ::= {OCTET STRING IDENTIFIED BY id-data}

id-data OBJECT IDENTIFIER ::= { iso(1) member-body(2)
us(840) rsadsi(113549) pkcs(1) pkcs7(7) 1 }

ct-SignedData CONTENT-TYPE ::=
{ SignedData IDENTIFIED BY id-signedData}

id-signedData OBJECT IDENTIFIER ::= { iso(1) member-body(2)
us(840) rsadsi(113549) pkcs(1) pkcs7(7) 2 }

ct-EnvelopedData CONTENT-TYPE ::=
{ EnvelopedData IDENTIFIED BY id-envelopedData}

id-envelopedData OBJECT IDENTIFIER ::= { iso(1) member-body(2)
us(840) rsadsi(113549) pkcs(1) pkcs7(7) 3 }

ct-DigestedData CONTENT-TYPE ::=
{ DigestedData IDENTIFIED BY id-digestedData}

id-digestedData OBJECT IDENTIFIER ::= { iso(1) member-body(2)
us(840) rsadsi(113549) pkcs(1) pkcs7(7) 5 }

ct-EncryptedData CONTENT-TYPE ::=
{ EncryptedData IDENTIFIED BY id-encryptedData}

id-encryptedData OBJECT IDENTIFIER ::= { iso(1) member-body(2)
us(840) rsadsi(113549) pkcs(1) pkcs7(7) 6 }

ct-AuthenticatedData CONTENT-TYPE ::=
{ AuthenticatedData IDENTIFIED BY id-ct-authData}

```

id-ct-authData OBJECT IDENTIFIER ::= { iso(1) member-body(2)
    us(840) rsadsi(113549) pkcs(1) pkcs-9(9) smime(16) ct(1) 2 }

--
-- The CMS Attributes
--

MessageDigest ::= OCTET STRING

SigningTime ::= Time

Time ::= CHOICE {
    utcTime UTCTime,
    generalTime GeneralizedTime }

Countersignature ::= SignerInfo

-- Attribute Object Identifiers

aa-contentType ATTRIBUTE ::=
    { TYPE ContentType IDENTIFIED BY id-contentType }
id-contentType OBJECT IDENTIFIER ::= { iso(1) member-body(2)
    us(840) rsadsi(113549) pkcs(1) pkcs9(9) 3 }

aa-messageDigest ATTRIBUTE ::=
    { TYPE MessageDigest IDENTIFIED BY id-messageDigest }
id-messageDigest OBJECT IDENTIFIER ::= { iso(1) member-body(2)

```

```

    us(840) rsadsi(113549) pkcs(1) pkcs9(9) 4 }

aa-signingTime ATTRIBUTE ::=
    { TYPE SigningTime IDENTIFIED BY id-signingTime }
id-signingTime OBJECT IDENTIFIER ::= { iso(1) member-body(2)
    us(840) rsadsi(113549) pkcs(1) pkcs9(9) 5 }

aa-countersignature ATTRIBUTE ::=
    { TYPE Countersignature IDENTIFIED BY id-countersignature }
id-countersignature OBJECT IDENTIFIER ::= { iso(1) member-body(2)
    us(840) rsadsi(113549) pkcs(1) pkcs9(9) 6 }

--
-- Obsolete Extended Certificate syntax from PKCS#6

```

--

```
ExtendedCertificateOrCertificate ::= CHOICE {  
    certificate Certificate,  
    extendedCertificate [0] IMPLICIT ExtendedCertificate }
```

```
ExtendedCertificate ::= SEQUENCE {  
    extendedCertificateInfo ExtendedCertificateInfo,  
    signatureAlgorithm SignatureAlgorithmIdentifier,  
    signature Signature }
```

```
ExtendedCertificateInfo ::= SEQUENCE {  
    version CMSVersion,  
    certificate Certificate,  
    attributes UnauthAttributes }
```

```
Signature ::= BIT STRING
```

```
Attribute{ ATTRIBUTE:AttrList } ::= SEQUENCE {  
    attrType          ATTRIBUTE.  
        &id({AttrList}),  
    attrValues        SET OF ATTRIBUTE.  
        &Type({AttrList}{@attrType}) }
```

```
Attributes { ATTRIBUTE:AttrList } ::=  
    SET SIZE (1..MAX) OF Attribute [{ AttrList }]
```

```
END
```

10. ASN.1 Module [RFC 5083](#)

This module is updated from [RFC 5911](#) [[RFC5911](#)] by defining separate attribute sets for the protected and unprotected attribute sets. By using different attribute sets for AuthenticatedData and AuthEnvelopedData, protocol designers can make use of the '02 ASN.1 constraints to define different sets of attributes for

AuthenticatedData and AuthEnvelopedData. Previously, attributes could only be constrained based on whether they were unauthenticated not on the content type.

```

CMS-AuthEnvelopedData-2009
    {iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs-9(9)
    smime(16) modules(0) TBD}
DEFINITIONS IMPLICIT TAGS ::=
BEGIN
IMPORTS

CMSVersion, EncryptedContentInfo,
    MessageAuthenticationCode, OriginatorInfo, RecipientInfos,
    CONTENT-TYPE, Attributes{}
FROM CryptographicMessageSyntax-2009
    {iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs-9(9)
    smime(16) modules(0) id-mod-cms-2004-02(41)} ;

ContentTypes CONTENT-TYPE ::= {ct-authEnvelopedData, ... }

ct-authEnvelopedData CONTENT-TYPE ::= {
    AuthEnvelopedData IDENTIFIED BY id-ct-authEnvelopedData
}

id-ct-authEnvelopedData OBJECT IDENTIFIER ::=
    {iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1) pkcs-9(9)
    smime(16) ct(1) 23}

AuthEnvelopedData ::= SEQUENCE {
    version CMSVersion,
    originatorInfo [0] IMPLICIT OriginatorInfo OPTIONAL,
    recipientInfos RecipientInfos,
    authEncryptedContentInfo EncryptedContentInfo,
    authAttrs [1] IMPLICIT AuthAttributes OPTIONAL,
    mac MessageAuthenticationCode,
    unauthAttrs [2] IMPLICIT UnauthAttributes OPTIONAL
}

AuthAttributes ::= Attributes{{AuthEnvDataAttributeSet}}

UnauthAttributes ::= Attributes{{UnauthEnvDataAttributeSet}}

AuthEnvDataAttributeSet ::= {aa-contentType | aa-messageDigest |
    aa-signedTime, ... }

UnauthEnvDataAttributeSet ::= {...}

END

```

[11.](#) Module Identifiers in ASN.1

One potential issue that can occur when updating modules is the fact that a large number of modules may need to be updated if they import from a newly updated module. This section addresses one method that can be used to deal with this problem, but the modules in this document don't currently implement the solution discussed here.

When looking at an import statement, there are three portions: The list of items imported, a textual name for the module and an object identifier for the module. Full implementations of ASN.1 do module matching using first the object identifier and if that is not present the textual name of the module. Note however that some older implementations used the textual name of the module for the purposes of matching. In a full implementation the name assigned to the module is scoped to the ASN.1 module that it appears in (and thus need to match the module it is importing from).

One can create a module that contains only the module number assignments and import the module assignments from the new module. This means that when a module is replaced, one can replace the previous module, update the module number assignment module and recompile without having to modify any other modules.

A sample module assignment module would be:

```
ModuleNumbers
DEFINITIONS TAGS ::=
BEGIN
    id-mod-CMS ::= { iso(1) member-body(2) us(840) rsadsi(113549)
        pkcs(1) pkcs-9(9) smime(16) modules(0) TBD }

    id-mod-AlgInfo ::=
        {iso(1) identified-organization(3) dod(6) internet(1) security(5)
            mechanisms(5) pkix(7) id-mod(0)
            id-mod-algorithmInformation-02(58)}
END
```

This would be used in the following import statement:

IMPORTS

```
id-mod-CMS, id-mod-AlgInfo
FROM ModuleNumber    -- Note it will match on the name since no
                     -- OID is provided
```

```
CMSVersion, EncapsulatedContentInfo, CONTENT-TYPE
FROM CryptographicMessageSyntax-2009
    id-mod-CMS
```

```
AlgorithmIdentifier{}, SMIME-CAPS, ParamOptions
FROM AlgorithmInformation-2009 id-mod-AlgInfo
;
```

[12.](#) Security Considerations

This document itself does not have any security considerations. The ASN.1 modules keep the same bits-on-the-wire as the modules that they replace.

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[13.](#) IANA Considerations

None.

14. Normative References

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