



**Electronic Signatures and Infrastructures (ESI);
Procedures for Creation and Validation
of AdES Digital Signatures;
Part 1: Creation and Validation**

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Electronic Signatures and Infrastructures (ESI).

The present document is part 1 of a multi-part deliverable covering Procedures for Creation and Validation of AdES Digital Signatures, as identified below:

- **Part 1: "Creation and Validation"**;
- Part 2: "Signature Validation Report".

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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Introduction

The present document aims to meet the general requirements of the international community to provide trust and confidence in electronic transactions, including, amongst other, applicable requirements from Regulation (EU) No 910/2014 [i.15].

1 Scope

The present document specifies procedures for:

- the creation of AdES digital signatures (specified in ETSI EN 319 122-1 [i.2], ETSI EN 319 132-1 [i.4], ETSI EN 319 142-1 [i.6] respectively);
- establishing whether an AdES digital signature is technically valid;

whenever the AdES digital signature is based on public key cryptography and supported by public key certificates. To improve readability of the present document, *AdES digital signatures* are meant when the term *signature* is being used.

NOTE 1: Regulation (EU) No 910/2014 [i.15] defines the terms electronic signature, advanced electronic signature, electronic seals and advanced electronic seal. These signatures and seals are usually created using digital signature technology. The present document aims at supporting the Regulation (EU) No 910/2014 [i.15] for creation and validation of advanced electronic signatures and seals when they are implemented as AdES digital signatures.

The present document introduces general principles, objects and functions relevant when creating or validating signatures based on signature creation and validation constraints and defines general classes of signatures that allow for verifiability over long periods.

The following aspects are considered to be out of scope:

- generation and distribution of Signature Creation Data (keys, etc.), and the selection and use of cryptographic algorithms;
- format, syntax or encoding of data objects involved, specifically format or encoding for documents to be signed or signatures created; and
- the legal interpretation of any signature, especially the legal validity of a signature.

NOTE 2: The signature creation and validation procedures specified in the present document provide several options and possibilities. The selection of these options is driven by a signature creation policy, a signature augmentation policy or a signature validation policy respectively. Note that legal requirements can be provided through specific policies, e.g. in the context of qualified electronic signatures as defined in the Regulation (EU) 910/2014 [i.15].

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

- [1] IETF RFC 5280: "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile".
- [2] ISO/IEC 9594-8:2014: "Information technology -- Open Systems Interconnection -- The Directory -- Part 8: Public-key and attribute certificate frameworks".
- [3] IETF RFC 3161: "Internet X.509 Public Key Infrastructure; Time Stamp Protocol (TSP)".

- [4] ETSI TS 119 172-1: "Electronic Signatures and Infrastructures (ESI); Signature Policies; Part 1: Building blocks and table of contents for human readable signature policy documents".
- [5] T7 & Teletrust: "Common PKI Specifications for Interoperable Applications", Specification Part 9 SigG-Profile, Version 2.0, 20 January 2009.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] IETF RFC 4158: "Internet X.509 Public Key Infrastructure: Certification Path Building".
- [i.2] ETSI EN 319 122-1: "Electronic Signatures and Infrastructures (ESI); CAAdES digital signatures; Part 1: Building blocks and CAAdES baseline signatures".
- [i.3] ETSI EN 319 122-2: "Electronic Signatures and Infrastructures (ESI); CAAdES digital signatures; Part 2: Extended CAAdES signatures".
- [i.4] ETSI EN 319 132-1: "Electronic Signatures and Infrastructures (ESI); XAdES digital signatures; Part 1: Building blocks and XAdES baseline signatures".
- [i.5] ETSI EN 319 132-2: "Electronic Signatures and Infrastructures (ESI); XAdES digital signatures; Part 2: Extended XAdES signatures".
- [i.6] ETSI EN 319 142-1: "Electronic Signatures and Infrastructures (ESI); PAdES digital signatures; Part 1: Building blocks and PAdES baseline signatures".
- [i.7] ETSI EN 319 142-2: "Electronic Signatures and Infrastructures (ESI); PAdES digital signatures; Part 2: Additional PAdES signatures profiles".
- [i.8] IETF RFC 5652: "Cryptographic Message Syntax (CMS)".
- [i.9] IETF RFC 4998: "Evidence Record Syntax (ERS)".
- [i.10] IETF RFC 6283: "Extensible Markup Language Evidence Record Syntax (XMLERS)".
- [i.11] Void.
- [i.12] IETF RFC 6960: "X.509 Internet Public Key Infrastructure Online Certificate Status Protocol - OCSP".
- [i.13] ETSI EN 319 422: "Electronic Signatures and Infrastructures (ESI); Time-stamping protocol and time-stamp token profiles".
- [i.14] ETSI TS 119 312: "Electronic Signatures and Infrastructures (ESI); Cryptographic Suites".
- [i.15] Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on electronic identification and trust services for electronic transactions in the internal market and repealing Directive 1999/93/EC.
- [i.16] IETF RFC 3852: "Cryptographic Message Syntax (CMS)".
- [i.17] ETSI TS 119 442: "Electronic Signatures and Infrastructures (ESI); Protocol profiles for trust service providers providing AdES digital signature validation services".
- [i.18] ETSI TS 119 102-2: "Electronic Signatures and Infrastructures (ESI); Procedures for Creation and Validation of AdES Digital Signatures; Part 2: Signature Validation Report".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

attribute authority: authority which assigns privileges by issuing attribute certificates

attribute certificate: data structure, digitally signed by an attribute authority, that binds some attribute values with identification information about its holder

certificate: See public key certificate.

certificate identifier: unambiguous identifier of a certificate

certificate path (chain) validation: process of verifying and confirming that a certificate path (chain) is valid

certificate revocation list: signed list indicating a set of certificates that are no longer considered valid by the certificate issuer

certificate validation: process of verifying and confirming that a certificate is valid

certification authority: authority trusted by one or more users to create and assign public-key certificates

chain model: model for validation of X.509 certificate chains where all CA certificates have to be valid at the time they were used for issuing a certificate and the end-entity certificate was valid when creating the signature

claimed signing time: time of signing claimed by the signer which on its own does not provide independent evidence of the actual signing time

(signature) commitment type: signer-selected indication of the exact implication of a digital signature

(signature) creation constraint: criteria used when creating a digital signature

cryptographic suite: combination of a signature scheme with a padding method and a cryptographic hash function

detached (digital) signature: digital signature that, with respect to the signed data object, is neither enveloping nor enveloped

digital signature: data appended to, or a cryptographic transformation of a data unit that allows a recipient of the data unit to prove the source and integrity of the data unit and protect against forgery e.g. by the recipient

digital signature value: result of the cryptographic transformation of a data unit that allows a recipient of the data unit to prove the source and integrity of the data unit and protect against forgery e.g. by the recipient

driving application: application that uses a signature creation system to create a signature or a signature validation application in order to validate digital signatures or a signature augmentation application to augment digital signatures

electronic document: any content stored in electronic form, in particular text or sound, visual or audiovisual recording

enveloped (digital) signature: digital signature embedded within the signed data object

enveloping (digital) signature: digital signature embedding the signed data object

evidence: information that can be used to resolve a dispute about various aspects of authenticity of archived data objects

evidence record: unit of data, which can be used to prove the existence of an archived data object or an archived data object group at a certain time

NOTE: See IETF RFC 4998 [i.9] and IETF RFC 6283 [i.10].

proof of existence: evidence that proves that an object existed at a specific date/time

prospective certificate chain: sequence of n certificates which satisfies the conditions (a) to (c) in IETF RFC 5280 [1] clause 6.1, and the trust anchor is trusted according to the signature validation policy in use

public key certificate: public key of an entity, together with some other information, rendered unforgeable by digital signature with the private key of the certification authority which issued it

shell model: model for validation of X.509 certificate chains where all certificates have to be valid at a given time

NOTE: The given time is an input parameter to the validation.

signature acceptance: technical verification to be performed on the signature itself or on the attributes of the signature (i.e. the "signature elements constraints")

signature attribute: signature property

signature augmentation: process of incorporating to a digital signature information aiming to maintain the validity of that signature over the near term and/or the long term

NOTE 1: Augmenting signatures is the process by which certain material (e.g. time stamps, validation data and even archival-related material) is incorporated to the signatures for making them more resilient to change or for enlarging their longevity.

NOTE 2: This covers collection of information and creation of new structures that allows performing, on the long term, validations of a signature.

signature augmentation constraint: technical criteria used when augmenting a signature to a specific signature class

signature augmentation policy: set of signature augmentation constraints

NOTE 1: An augmentation policy can be uniquely identified by an OID / URI.

NOTE 2: The present document does not further specify the content of such a policy.

signature augmentation report: information about the augmentation provided by the Signature Augmentation Application to the Driving Application

NOTE: The present document does not further specify the content of such a report.

signature augmentation result: either the augmented signature or an error message that augmentation did not succeed, and optionally a **signature augmentation report**

NOTE: ETSI TS 119 442 [i.17] specifies how to convey such signature augmentation result.

signature class: set of signatures achieving a given functionality

EXAMPLE: Signature with time, signature with long term validation material, Signature providing Long Term Availability and Integrity of Validation Material are possible signature classes.

signature creation application: application within the signature creation system, complementing the signature creation device, that creates a signature data object

signature creation data: unique data, such as codes or private cryptographic keys, which are used by the signer to create a digital signature value

signature creation device: configured software or hardware used to implement the signature creation data and to create a digital signature value

signature creation environment: physical, geographical and computational environment of the signature creation system

signature creation policy: set of rules, applicable to one or more digital signatures, that defines the technical and procedural requirements for their creation, in order to meet a particular business need, and under which the digital signature(s) can be determined to be conformant

signature creation system: overall system, consisting of the signature creation application and the signature creation device, that creates a digital signature

signature invocation: non-trivial interaction between the signer and the SCA or SCDev that is necessary to invoke the start of the signing process

NOTE: It is the 'Wilful Act' of the signer.

signature policy: signature creation policy, signature augmentation policy, signature validation policy or any combination thereof, applicable to the same signature or set of signatures

signature scheme: triplet of algorithms composed of a signature creation algorithm, a signature verification algorithm and a key generation algorithm

signature validation: process of verifying and confirming that a digital signature is technically valid

signature validation application: application that validates a signature against a signature validation policy, and that outputs a status indication (i.e. the signature validation status) and a signature validation report

(signature) validation constraint: technical criteria against which a digital signature can be validated

EXAMPLE: Criteria can be expressed as an abstract formulation of rule, value, parameter, range and computation result.

NOTE: Validation constraints can be defined in a formal signature validation policy, can be given in configuration parameter files or implied by the behaviour of the signature validation application.

signature validation policy: set of **signature validation constraints** processed or to be processed by the Signature Validation Application

NOTE 1: A signature validation policy is a purely technical concept. It is one of the inputs of a validation process (other inputs include the signed data and the signature) that determine the validation result (PASSED, FAILED or INDETERMINED).

NOTE 2: A signature validation policy can be imposed by **signature applicability rules**.

signature validation report: comprehensive report of the validation provided by the Signature Validation Application to the Driving Application and allowing the Driving Application and any party beyond the DA, to inspect details of the decisions made during validation and investigate the detailed causes for the status indication provided by the Signature Validation Application

EXAMPLE: Clause 5.1.3 specifies minimum requirements for the content of such a report and ETSI TS 119 102-2 [i.18] specifies such a report.

signature validation status: one of the following indications: TOTAL-PASSED, TOTAL-FAILED or INDETERMINATE

signature verification: process of checking the cryptographic value of a signature using signature verification data

signature verification data: data, such as codes or public cryptographic keys, used for the purpose of verifying a signature

signed data object: data structure containing the signature value, signature attributes and other information (see clause 4.2.10)

signer: entity being the creator of a digital signature

time-assertion: time-stamp token or evidence record

time-stamp token: data object defined in IETF RFC 3161 [3], representing a time-stamp

trust anchor: entity that is trusted by a relying party and used for validating certificates in certification paths

trust service: electronic service which enhances trust and confidence in electronic transactions

trust service status list: form of a signed list as the basis for presentation of trust service status information

validation: process of verifying and confirming that a certificate or a digital signature is valid

validation data: data that is used to validate a digital signature

verifier: entity that wants to validate or verify a digital signature

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BES	Basic Electronic Signature
CA	Certification Authority
CMS	Cryptographic Message Syntax
CRL	Certificate Revocation List
DA	Driving Application
DTBS	Data To Be Signed
DTBSF	Data To Be Signed (Formatted)
DTBSR	Data To Be Signed Representation
EPES	Explicit Policy based Electronic Signature
ER	Evidence Record
ERS	Evidence Record Syntax
HTML	HyperText Markup Language
LDAP	Lightweight Directory Access Protocol
LT	Long Term
LTV	Long Term Validation
OCSP	Online Certificate Status Protocol
ODA	Office Document Architecture
OID	Object Identifier
PC	Personal Computer
PKC	Public Key Certificate
PKI	Public Key Infrastructure
PKIX	Public Key Infrastructure X. 509
POE	Proof Of Existence
RSA	Rivest, Shamir and Adleman algorithm
SAV	Signature Acceptance Validation
SCA	Signature Creation Application
SCDev	Signature Creation Device
SCE	Signature Creation Environment
SCS	Signature Creation System
SD	Signer's Document
SDO	Signed Data Object
SDR	Signer's Document Representation
SGML	Standard Generalized Markup Language
SVA	Signature Validation Application
TSA	Time-Stamping Authority
TSL	Trust-service Status List
TSP	Trust Service Provider
URI	Uniform Resource Identifier
XML	eXtensible Mark-up Language
XSL	eXtensible Stylesheet Language

4 Signature creation

4.1 Signature creation model

The objective of signature creation is to generate a signature covering the Signer's Document (SD), the signing certificate or a reference to it, as well as signature attributes supporting the signature and its interpretation and purpose.

The present document uses the functional model of a Signature Creation Environment (SCE) consisting of:

- a signer that wants to create a signature;