



PEPPOL Deliverable D1.1

Requirements for Use of

Signatures in Public

Procurement Processes



Part 5: XKMS v2 Interface

Specification

Profiling and Extensions Specification



Version 1.2



PEPPOL WP1 2009-04-30

Borderless eProcurement

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1 Summary and Structure of Document

1.1 Scope and Structure of Deliverable D1.1

This document is a part of the multi-part deliverable D1.1 “Requirements for Use of Signatures in the Procurement Processes” issued by the PEPPOL¹ (Pan-European Public Procurement On-Line) project. PEPPOL is a three-year (May 2008 – May 2011) large scale pilot under the CIP (Competitiveness and Innovation Programme) initiative of the European Commission.

D1.1 consists of the following documents:

Part 1: Background and Scope

Part 2: E-tendering Pilot Specifications

Part 3: Signature Policies

Part 4: Architecture and Trust Models

Part 5: XKMS v2 Interface Specification

Part 6: OASIS DSS Interface Specification

Part 7: eID and eSignature Quality Classification

The D1.1 deliverable is the first version of **functional specifications** for cross-border interoperability of e-signatures in Europe. The specifications are specifically targeted at cross-border public procurement, the topic of PEPPOL. However, if the resulting solution is successful it is believed that it will be applicable also to other application areas in need of e-signature interoperability.

Signature interoperability in PEPPOL focuses on verification of e-signatures and their associated eIDs. Interoperability of signing solutions is not handled as it is assumed that all actors are capable of signing documents within their corporate infrastructure.

The specifications guide the implementation, testing, and piloting of e-signature interoperability solutions to be done by PEPPOL. The specifications are publicly available and comments from any interested party are most welcome. Note that since the specifications of D1.1 by necessity will evolve as a result of further work in PEPPOL, any party using or referring to the specifications must ensure that the latest version is used; contact the PEPPOL project for information.

1.2 Scope and Structure of This Document

Cross-border interoperability for verification of e-signatures requires more information than merely an assessment that the signature is valid. Signature validity is just one aspect of signature acceptance, which is governed by the signature policy in force (see D1.1 part 3).

PEPPOL specifies validation services and their interfaces. A validation service must be able to assess and return information related to signature policy adherence, which necessitates a richer interface than merely OCSP or CRL for revocation checking. Two interfaces are specified:

- XKMS v2 for eID certificate validation (this document);
- OASIS DSS for verification of entire, signed documents (part 6 of D1.1).

¹ <http://www.peppol.eu>

The W3C "XML Key Management Specification" [XKMS], part "Key Information Service Specification" (X-KISS) has been chosen as standard interface for the validation process of X509-Certificates used for digital signatures and other purposes in the context of PEPPOL.

XKMS defines a service named "XKMS-Responder", which in the case of X-KISS is able to check the validity of X509-Certificates with regard to a given time instant and appropriate operational model – in case of certificates issued by PKI at least following relevant specifications as defined by the IETF PKIX Working Group². For this scenario, a XKMS-Responder is in the role of kind of a relay

- accepting certificate validation requests on base of the XKMS protocol;
- in case of a unknown certificate issuer mediating request to other XKMS responder instances able to serve the request³;
- checking certificates and certificate chains locally;
- connecting to issuer CAs using the respective served protocols (OCSP, CRL, LDAP...);
- if available at responder instance, including assertions on certificate quality and CSP status as outlined in according Trusted Service List (TSL) entry⁴;
- building up and delivering the validation response with detailed information as defined by the XKMS protocol.

For sake of interoperability, this document defines restrictions made by PEPPOL to the relevant parts XKMS specification in chapter [3].

In addition, the XKMS extension mechanism is used to define sets of optional attributes, which seem to be valuable for already existing implementations of XKMS responders/requestors. As these extensions are seen as MS specific requirements, they should optionally be servable on a profile base. Chapter [4] outlines the extensions defined for PEPPOL. MS may define own extensions in coordination with the PEPPOL WP1 technical subgroup.

It is an assumption of PEPPOL that there will be several XKMS responder instances with different sets of CAs that can be connected directly – one imaginable XKMS Responder landscape could be a model where each member state (MS) operates a XKMS Responder instance covering connectivity to the CAs of this MS. In reality, there might be n specialized instances per MS or even instances covering connectivity to CAs located in different MS.

Another assumption is, a certificate validating client connects to one standard XKMS responder of his choice with trust established to this instance, which – in case of a here unknown issuer of the certificate to be validated – contacts other instances on behalf of the client. This scenario leads to the requirement that XKMS responders must be able to mediate requests to other appropriate instances. In addition, trust relationships must be federated when mediating. Chapter [4] outlines these additional requirements out of scope of the standard XKMS specification in detail.

Chapter [0] describes conventions and XML namespaces used in this document.

Sufficient knowledge of XKMS and other referenced specifications is assumed for the addressed audience of this document.

² Public-Key Infrastructure X.509 Working Group (PKIX-WG) of the [Internet Engineering Task Force](#)

³ This feature is especially defined by PEPPOL with regard to be able to reach any known CA in the EU over the initially contacted XKMS-Responder instance.

⁴ Before TSLs will be available in machine readable format, it is planned to use human readable TSLs as base for according configuration entries of XKMS responders

1.3 Evolution of This Document

The following evolution of this document may be envisaged in future versions:

- Ongoing alignment with D1.1 part 6 (OASIS DSS) in order to optimize structure and semantics of statements about eIDs.
- Further alignment with D1.1 part 7 (quality assessment scheme) should be done in order to incorporate possible quality scheme standardizations in XKMS requests and responses.
- The specification should be promoted as a standard profile. PEPPOL will consider submission and follow up to W3C or OASIS; this process will necessarily lead to changes in specifications.
- Changes due to experience gained in PEPPOL and due to comments from external sources must be expected.

1.4 Version, List of Contributors

Version 1.0	2009/02/11	Complete version for internal quality assurance.
Version 1.1	2009/02/27	Submitted to PEPPOL project management, approved with comments at project management meeting 2009/03/27.
Version 1.2	2009/04/30	For publication, updated according to comments.

The following organizations, in alphabetical order, have contributed to Deliverable D1.1.

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- **CNIPA, Italy** <http://www.cnipa.it>
- **DGME, French Ministry of Finance** <http://www.references.modernisation.gouv.fr/>
- **DNV, Norway** <http://www.dnv.com>

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2 Document Conventions

2.1 Notational Conventions

The keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

This specification uses the following syntax to define normative outlines for messages:

- The syntax appears as an XML instance, but values in italics indicate data types instead of values.
- Characters are appended to elements and attributes to indicate cardinality:
 - "?" (0 or 1)
 - "*" (0 or more)
 - "+" (1 or more)
- The character "|" is used to indicate a choice between alternatives.
- The characters "(" and ")" are used to indicate that contained items are to be treated as a group with respect to cardinality or choice.
- An ellipsis (i.e. "...") indicates a point of extensibility that allows other child or attributes content specified in this document. Additional children elements and/or attributes MAY be added at the indicated extension points but they MUST NOT contradict the semantics of the parent and/or owner, respectively. If an extension is not recognized it SHOULD be ignored.
- XML namespace prefixes (see chapter 2.2) are used to indicate the namespace of the element being defined.

Elements and Attributes defined by this specification are referred to in the text of this document using [XPath 1.0] expressions. Extensibility points are referred to using an extended version of this syntax:

- An element extensibility point is referred to using {any} in place of the element name. This indicates that any element name can be used, from any namespace other than the `xkms:` or `xkmsEU:` namespaces.
- An attribute extensibility point is referred to using @{any} in place of the attribute name. This indicates that any attribute name from any namespace can be used.

For those parts of this specification where referenced specifications are profiled, normative statements of requirements are presented in the following manner:

Rnnnn - *Statement text here*

where "nnnn" is replaced by a number that is unique among the requirements in this document, thereby forming a unique requirement identifier.

If needed for clarification, indentation "(gen)" is used, when a software instance is required to support generation of a certain requirement or XML Infoset, indentation "(proc)" if processing is required; "(gen/proc)" if both.

2.2 XML Namespaces

Following XML namespaces are referenced:

Prefix	XML Namespace	Specification
ds	http://www.w3.org/2000/09/xmldsig#	[XMLDSIG]
xkms	http://www.w3.org/2002/03/xkms#	[XKMS]
xkmsEU	http://www.lsp.eu/2009/04/xkmsExt#	This document
xs	http://www.w3.org/2001/XMLSchema	[XMLSchema]

Table 1: Referenced Namespaces

The namespace chosen for the XKMS extension outlined in this document is preliminary. It is intended to align details with other large scale pilot projects which may use outcomes of PEPPOL.

3 XKMS 2.0 Restrictions

For XKMS in general and X-KISS in detail, definitions of [XKMS] apply; only deviations from the standard are outlined here.

3.1 General

- R0100** - For simplification of processing and implementation, conformant XKMS requestors (gen) and responders (proc) MUST use synchronous request/response processing as defined in ([XKMS], chapter 2.4.1). For the PEPPOL pilot, asynchronous processing MUST NOT be used.⁵
- R0110** - For optimization reasons, conformant XKMS requestors (gen/proc) and responders (gen/proc) MUST support compound request/responses as defined in ([XKMS], chapter 3.4).

R0110 applies in conjunction with

- R0120** - Conformant XKMS implementations MUST support the validate service on base of the XML infosets `xkms:ValidateRequest` and `xkms:ValidateResult` ([XKMS], chapters 4.2 and 5.3).

These restrictions lead to the following schemas of XKMS request respective response which MUST be supported:

```
<!-- CompoundRequest -->
<element name="CompoundRequest" type="xkms:CompoundRequestType"/>
<complexType name="CompoundRequestType">
  <complexContent>
    <extension base="xkms:RequestAbstractType">
      <choice maxOccurs="unbounded">
        <element ref="xkms:ValidateRequest"/>
      </choice>
    </extension>
  </complexContent>
</complexType>
<!-- /CompoundRequest -->
```

```
<!-- CompoundResult -->
<element name="CompoundResult" type="xkms:CompoundResultType"/>
<complexType name="CompoundResultType">
  <complexContent>
    <extension base="xkms:ResultType">
      <choice minOccurs="0" maxOccurs="unbounded">
        <element ref="xkms:ValidateResult"/>
      </choice>
    </extension>
  </complexContent>
</complexType>
<!-- /CompoundResult -->
```

⁵ Support of asynchronous processing is foreseen for a future version. For the pilot version, XKMS clients should be aware that XKMS responders used in the PEPPOL infrastructure are not obligated to support asynchronous requests.

3.1.1 Processing Requirements

- R0130** - XKMS responders conformant to this profiling **MUST** try to obtain all missing data needed for the validation process from the underlying PKI service and hence **MUST** provide interfaces to underlying PKIs (both is marked optional in the XKMS specification). The *validation processing* **MUST** at least follow the PKIX-model as outline in [COMMPKI], Part 5: Certificate Path Validation if not otherwise defined by national regulations of the country of the certificate issuing CA.

For CA access, XKMS responders **MUST** support the interfaces as summarized in [COMMPKI], Part 4: Operational Protocols.

3.1.2 XKMS Message Transport

- R0140** - XKMS **MUST** be bound to SOAP 1.2 over https as defined as one option in the XKMS bindings specification [XKMSBIND].

3.1.3 Message Signing Requirements and Processing Recommendations

- R0150** - For integrity protection and authentication reasons, XKMS messages **MUST** be signed by the respective producer. Implementations **MUST** ensure that all the bytes in the XKMS messages be included in hashing and in the resulting signature value of the message (see [XKMS], chapter 3.1.1); message consumers **MUST** validate the signatures. For compound requests and responses, the `/xkms:CompoundRequest/ds:Signature` respective `/xkms:CompoundResponse/ds:Signature` element **MUST** be generated, the inner `.../ds:Signature` elements of the contained `.../xkms:ValidateRequest` respective `.../xkms:ValidateResult` containers **SHOULD NOT** be generated in addition. The latter **MUST** be generated if simple requests/responses are used, which are not enveloped in a compound request respective response.

- R0160** - XKMS signatures **MUST** be generated using X509 certificates, which **MUST** be embedded in the `ds:Signature` elements according to [XMLDSIG].

XKMS responders **MAY** decide service processing or denial on base of known the requestor certificates, which in addition may be taken for accounting issues. Responder instances **MUST** publish their policies concerning the regulations in effect for these issues.

For XKMS requestors, the signing certificate of the used responder is in the role of a trust anchor. Requestors **MUST NOT** consume response messages, for which untrusted or unknown certificates were used for message signing.

3.1.4 Id Attributes, Identifying Requests and Responses

- R0170** - Following [XMLSchema], Id attributes used in a XML Infoset instance **MUST** have unique values. To fulfil this requirement, Id attribute values **SHOULD** be generated according to IETF RFC "A Universally Unique Identifier (UUID) URN Namespace" [RFC4122], whereby this value **SHOULD** be preceded by an underscore ("_") character⁶.

- R0180** - To enable requestor-side correlation of requests and responses, the values of the request `@Id` attributes of elements `/xkms:CompoundRequest` and `/xkms:ValidateRequest` **MUST** be copied to the corresponding `@RequestId` attributes of the `/xkms:CompoundResult` and `/xkms:ValidateResult`.⁷

⁶ Values generated following [RFC4122] may have leading characters which violate the production rules of the `xs:ID` type

⁷ [XKMS] outlines the `@RequestId` as an optional attribute

3.2 ValidateRequest

R0200 - `xkms:ValidateRequest` is an extension of `xkms:RequestAbstractType`, which itself is an extension of `xkms:MessageAbstractType`. The extensions defined by `xkms:RequestAbstractType` are defined optional. Following elements and attributes of these extensions MUST NOT be used, as they are meaningful only in the context of asynchronous processing:

@OriginalRequestId, @ResponseLimit, `xkms:ResponseMechanism`,
`xkms:PendingNotification`

R0210 - The `xkms:RespondWith` extension of `xkms:RequestAbstractType` SHOULD be used to indicate the base PKI validation data required in the response. `xkms:RespondWith` is based on the URI enumeration simple type `xkms:RespondWithEnum`. Following table outlines the meaningful choices in this context, which MUST be understood by conformant XKMS responders. Other values MAY be used⁸, for which standard XKMS responders are not obliged to support them:

RespondWith URI	Meaning
<code>http://www.w3.org/2002/03/xkms#X509Cert</code>	Return certificate (default behaviour, if no element <code>xkms:RespondWith</code> present in the request)
<code>http://www.w3.org/2002/03/xkms#X509Chain</code>	Return certificate chain build by responder
<code>http://www.w3.org/2002/03/xkms#X509CRL</code>	Return CRL acquired by responder
<code>http://www.w3.org/2002/03/xkms#OCSP</code> ⁹	Return acquired OCSP response for validated certificate (not multiple OCSPs of the whole chain!)

Table 2: RespondWith URIs of the XKMS standard set to be supported

R0220 - Extended response information can be requested by following additional URIs; XKMS responders used in the PEPPOL context SHOULD support this functionality:

RespondWith URI	Meaning
<code>http://www.lsp.eu/2009/04/xkmsExt#edIDQuality</code>	Return quality of certificate and status of issuing CSP (default behaviour, if no element <code>xkms:RespondWith</code> present in the request)
<code>http://www.lsp.eu/2009/04/xkmsExt#OCSPNoCache</code>	Attention: If not provided, XKMS responder MAY use cached OCSP response for validation ¹⁰

⁸ This is covered by the XKMS schema, as the underlying type is a `xs:union` of defined URI enumerations and `xs:anyURI`

⁹ This enumeration is not defined in [XKMS], but seen as an inevitable extension.

¹⁰ OCSP caching may be an implementation feature to reduce network latencies

RespondWith URI	Meaning
<code>http://www.lsp.eu/2009/04/xkmsExt#ValidationDetails</code>	Details on validation process to be delivered

Table 3: RespondWith URIs that SHOULD be supported for extended responses

If a XKMS responder instance does not understand one of these RespondWith URIs, processing MUST continue and an entry in of `<xkmsEU:ErrorExtension>` MUST be generated:

```
<xkmsEU:ErrorExtension>
  <xkmsEU:Reason>
    http://lsp.eu/2009/04/reason#NotUnderstood
  </xkmsEU:Reason>
  <xkmsEU:Detail>
    copy of RespondWith URI not understood to be placed here
  </xkmsEU:Detail>
</xkmsEU:ErrorExtension>
```

- R0230** - `xkms:ValidateRequest` carries an element `xkms:QueryKeyBinding`, which is an extension of `xkms:KeyBindingAbstractType`, which in case of a `xkms:ValidateRequest` MUST contain at least the `ds:KeyInfo` element.

```
<!-- KeyBindingAbstractType-->
<complexType name="KeyBindingAbstractType" abstract="true">
  <sequence>
    <element ref="ds:KeyInfo" minOccurs="1"/>
    <element ref="xkms:KeyUsage" minOccurs="0" maxOccurs="3"/>
    <element ref="xkms:UseKeyWith" minOccurs="0"
      maxOccurs="unbounded"/>
  </sequence>
  <attribute name="Id" type="ID" use="optional"/>
</complexType>
<!-- /KeyBindingAbstractType-->
```

- R0240** - `ds:KeyInfo` MUST at least carry the certificate to be validated in `ds:X509Data/ds:X509Certificate`. More information – e.g. certificate chains – MAY be supplied by the requestor. One `xkms:ValidateRequest` MUST carry only one end user certificate to be validated; multiple `xkms:ValidateRequest` elements SHOULD be grouped in a `xkms:CompoundRequest`, if validation of more than one certificate is required to be done within one request/response sequence (see R0110 above).

- R0250** - `xkms:QueryKeyBinding` carries an optional element `xkms:TimeInstant`, the value outlined here is the requested time instant for which the requestor wants to check the certificate validity. If available, the requestor SHOULD supply here the time instant the certificate was applied for the cryptographic operation which is about to be verified by the requestor. In case of verifying digital signatures, the value of `xkms:TimeInstant` MUST be derived from the signing time instant, if available in the underlying `ds:Signature` element.

If `xkms:TimeInstant` is not supplied in the request, according to [XKMS] the responder has to validate the certificate on base of the responders actual server time.

3.3 ValidateResult

For the standard part of `xkms:ValidateResult`, no further detailing is made here. [XKMS] applies here without restrictions.

Following applies concerning message extension:

- R0300** - If a request carries an extension with a namespace known by the contacted XKMS responder instance, the request message extension **MUST** be processed according to the rules defined for this extension set. Processing **MAY** lead to a corresponding message extension in the response.

If an extension contained in the request is bound to a namespace not known by the responder instance, processing **MUST** proceed ignoring this request extension; the generated response **MUST** outline this fact by setting the `@ResultMinor` attribute value of the response to

`"http://www.w3.org/2002/03/xkms#OptionalElementNotSupported"`, even if the `@ResultMinor` attribute value may be set to

`"http://www.w3.org/2002/03/xkms#Success"`. In case different values for these attributes should be generated during processing covered by the XKMS standard part, these values dominate.

Pending EC approval

4 Mediating XKMS Requests and Responses

4.1 Preconditions

- R1000** - If a XKMS responder instance to process a validate request because the issuer of the certificate to be validated is not known here, it **MUST** be able to forward the validate request to another instance able to process the request. It is an implementation detail how the appropriate routing information is made available to the forwarding responder. This information **SHOULD** be gathered on base of Trusted Service Lists (TSL) (D1.1 part 4).
- R1010** - Trust **MUST** been established between the forwarding XKMS responder and validate request destination on base of known signature certificates used for message signing by the involved XKMS responder instances. Again, TSLs **SHOULD** serve as the anchor to establish trust.
- R1020** - For the synchronous processing as restricted for this version (see R0100), all instances involved in a mediation scenario **MUST NOT** close network connections on application level until response delivery is acknowledged by the respective requesting instance.

4.2 Request Forwarding

- R1030** - Before request forwarding, the original request has to be modified:

The `@service` attribute of the request message **MUST** set to the value of the URI to which the XKMS request is directed now.

The `@Id` attribute of the request message **MUST** reset to a newly generated value according to chapter [3.1.4]; the original value **MUST** be retained for further processing.

A new `.../ds:Signature` element **MUST** be provided, the forwarding instance **MUST** resign the request message after eliminating the existing `.../ds:Signature` element.

4.3 Result Delivery

- R1040** - The responder instance the XKMS request has been directed to **MUST** deliver the result message to the mediating responder instance.
- R1050** - The mediating responder instance **MUST** verify the result message signature. In case of fault or missing trust to the result messages signature, this message **MUST** be discarded and a new result messages **MUST** be generated with following fault information attributes:

`@ResultMajor=http://www.w3.org/2002/03/xkms#Receiver`
`@ResultMinor=http://www.lsp.eu/2009/04/xkms#TrustViolation`
`@Service` **MUST** carry the URI of the corresponding request message was directed to.
- R1060** - Before the mediating responder is re-signing the result message (see R1060) and forwarding it to the initial requestor, the result message attribute

`@RequestId` **MUST** be set to the value of the initial request

(which **MUST** have been retained by the mediating instance, see R1030).
- R1070** - To provide trust establishment for the initial requestor, a new `.../ds:Signature` element **MUST** be provided, mediating instance **MUST** resign the result message after eliminating the existing `.../ds:Signature` element.
- R1080** - The mediating responder **MUST NOT** apply any other changes on the result message.

5 XKMS Extensions defined for PEPPOL

For XKMS messages an abstract extension point `xkms:MessageExtension` is foreseen to carry additional information. German regulations require detailed information on certificate quality and validity status as well as the validation process itself. Thus, a `/xkms:ValidateResult` SHOULD contain an extension block `/xkmsEU:ValidateResultExtLSP` as defined here if requested by a message extension in the respective validate request.

5.1 Extension for Validate Request

No special `xkms:MessageExtension` is defined; the only extensions going beyond the standard `xkms:ValidateRequest` are defined above with R0220 for `xkms:RespondWith` URIs.

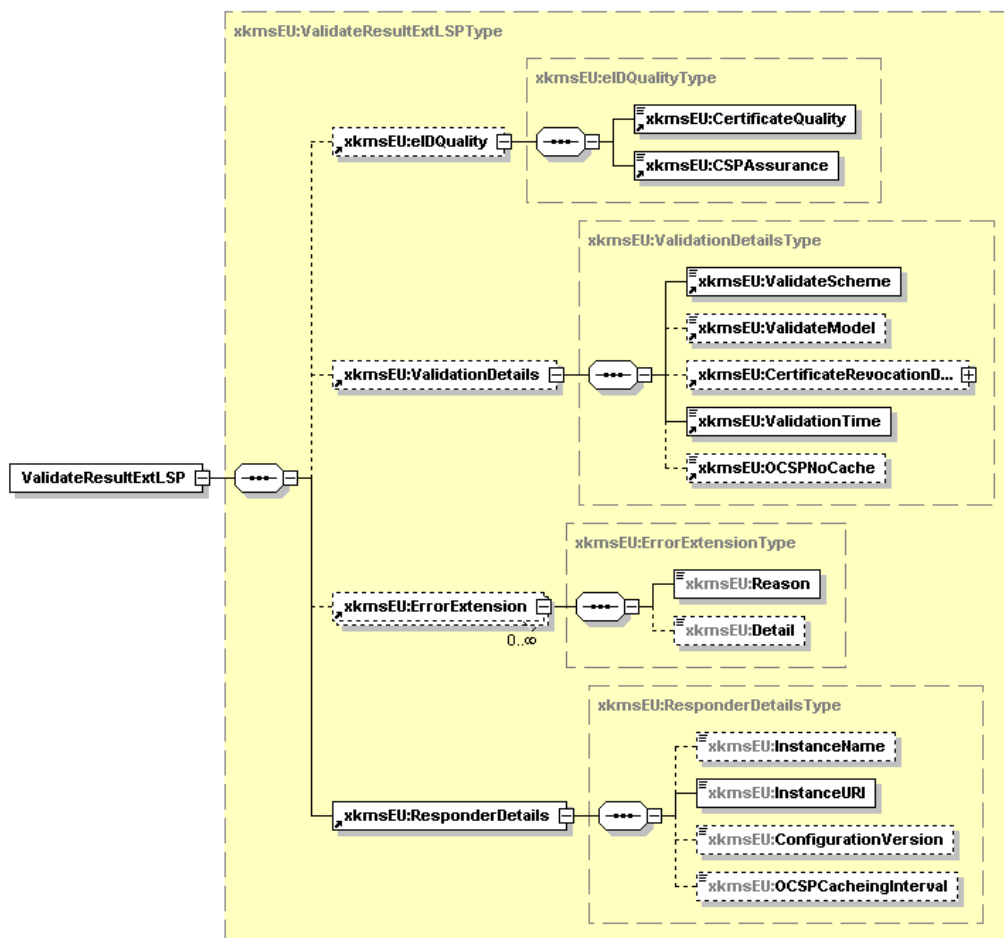
5.2 Extension for Validate Result

Extended validation information is defined for

- the quality of a certificate and the issuing CSP
- details for the validation processing done by a XKMS Responder instance
- details about the Responder itself

complemented by possible fault information concerning the processing of the extensions.

An overview is given in the following picture:



Picture 1: Extension scheme overview

Syntax for the `xkmsEU:ValidateResultExtLSP` element:

```
<xkmsEU:ValidateResultExtLSP>
```

```

<xkmsEU:eIDQuality>
  <xkmsEU:CertificateQuality>
    http://lsp.eu/2009/04/certquality#unknown |
    http://lsp.eu/2009/04/certquality#low |
    http://lsp.eu/2009/04/certquality#lcp |
    http://lsp.eu/2009/04/certquality#ncp |
    http://lsp.eu/2009/04/certquality#ncpplus |
    http://lsp.eu/2009/04/certquality#qcp |
    http://lsp.eu/2009/04/certquality#qcpplus
  </xkmsEU:CertificateQuality>

  <xkmsEU:CSPAssurance>
    http://lsp.eu/2009/04/CSPAssurance#none |
    http://lsp.eu/2009/04/CSPAssurance#IndependentDocumentReview |
    http://lsp.eu/2009/04/CSPAssurance#InternalComplianceAudit |
    http://lsp.eu/2009/04/CSPAssurance#SupervisionWithComplianceAudit |
    http://lsp.eu/2009/04/CSPAssurance#ExternalComplianceAudit |
    http://lsp.eu/2009/04/CSPAssurance#ExternalComplianceAuditCertified |
    http://lsp.eu/2009/04/CSPAssurance#SupervisionWithExternalCompliance
      Audit
    http://lsp.eu/2009/04/CSPAssurance#AccreditationWithExternal
      ComplianceAudit
  </xkmsEU:CSPAssurance>
</xkmsEU:eIDQuality> ?

```



```

<xkmsEU:ValidationDetails>
  <xkmsEU:ValidateScheme>
    http://www.lsp.eu/2009/04/valScheme#LOCAL |
    http://www.lsp.eu/2009/04/valScheme#OCSP |
    http://www.lsp.eu/2009/04/valScheme#CRL |
    http://www.lsp.eu/2009/04/valScheme#CRL_LDAP |
    http://www.lsp.eu/2009/04/valScheme#LDAP
  </xkmsEU:ValidateScheme>

  <xkmsEU:ValidateModel>
    http://www.lsp.eu/2009/04/valModel#PKIX |
    http://www.lsp.eu/2009/04/valModel#chain |
    http://www.lsp.eu/2009/04/valModel#escapeRoute |
  </xkmsEU:ValidateModel>      ?

  <xkmsEU:CertificateRevocationDetails>
    <xkmsEU:RevocationTimeInstant> xs:dateTime
  </xkmsEU:RevocationTimeInstant>
    <xkmsEU:RevocationReason>
      http://www.lsp.eu/2009/04/reason#unspecified |
      http://www.lsp.eu/2009/04/reason#KeyCompromise |
      http://www.lsp.eu/2009/04/reason#CACompromise |
      http://www.lsp.eu/2009/04/reason#AffiliationChanged |
      http://www.lsp.eu/2009/04/reason#Superseded |
      http://www.lsp.eu/2009/04/reason#CessationOfOperation |
      http://www.lsp.eu/2009/04/reason#CertificateHold |
      http://www.lsp.eu/2009/04/reason#RemoveFromCRL |
      http://www.lsp.eu/2009/04/reason#PrivilegeWithdrawn |
      http://www.lsp.eu/2009/04/reason#AACompromise |
      http://www.lsp.eu/2009/04/reason#none
    </xkmsEU:RevocationReason>
  </xkmsEU:CertificateRevocationDetails>      ?
  <xkmsEU:ValidationTime> xs:dateTime </xkmsEU:ValidationTime>
</xkmsEU:ValidationDetails> ?

<xkmsEU:ResponderDetails>
  <xkmsEU:InstanceName> xs:string </xkmsEU:InstanceName> ?
  <xkmsEU:InstanceUri> xs:anyUri </xkmsEU:InstanceUri>
  <xkmsEU:ConfigurationVersion> xs:string
    </xkmsEU:ConfigurationVersion> ?
  <xkmsEU:OCSPCacheInterval> xs:duration
    </xkmsEU:OCSPCacheInterval> ?
  <xkmsEU:OCSPNoCache> xs:boolean </xkmsEU:OCSPNoCache> ?
</xkmsEU:ResponderDetails>

<xkmsEU:ErrorExtension
  <xkmsEU:Reason=
    http://www.lsp.eu/2009/04/reason#OpaqueClientDataTooLong |
    http://www.lsp.eu/2009/04/reason#TrustCenterNotReachable |
    http://www.lsp.eu/2009/04/reason#WrongCertificateFormat |
    http://www.lsp.eu/2009/04/reason#WrongTimeInstant |
    http://www.lsp.eu/2009/04/reason#UnkownCA |
    http://www.lsp.eu/2009/04/reason#SignatureKeyTooShort
    http://www.lsp.eu/2009/04/reason#Unknown
    http://www.lsp.eu/2009/04/reason#NotUnderstood
  </xkmsEU:Reason>
  <xkmsEU:Detail> xs:string </xkmsEU:Details>
</xkmsEU:ErrorExtension>      *

</xkmsEU:ValidateResultExtLSP> ?

```

Description of elements and attributes in the schema overview above:

`/xkmsEU:ValidateResultExtLSP ?`

Container element carrying all items explained below.

.../xkmsEU:eIDQuality ?

Optional container element carrying assurances on certificate quality and issuing CSP status. MUST be present if certificate validation could be processed. Explicitly requested by a `xkms:RespondWith` value of

`http://www.lsp.eu/2009/04/xkmsExt#edIDQuality`

.../xkmsEU:eIDQuality/xkmsEU:CertificateQuality

Element of type `xs:anyURI` indicating the certificate quality. All values in the table below carry the prefix `http://lsp.eu/2009/04/certquality#`, which is omitted here for readability. This table corresponds to D1.1 Part 7, "eID and eSignature Quality Classification", chapter 3.2.1. For further details, see ETSI specification [ETSI101456], [ETSI102042] referenced in this table.

CertificateQuality URI ending	Meaning
unknown	Certificate quality can't be determined
low	Low confidence in certificate but certificate policy exists or quality assessment is possible by other means
lcp	Certificate governed by a Certificate Policy in compliance with the ETSI TS 102 042 standard for LCP or a similar standard
ncp	Certificate governed by a Certificate Policy in compliance with the ETSI TS 102 042 standard for NCP or a similar standard
ncpplus	Certificates governed by a Certificate Policy in compliance with the ETSI TS 102 042 standard for NCP+ or a similar standard (Use of a SSCD is mandated in the CP)
qcp	Certificates governed by a Certificate Policy in compliance with the ETSI TS 101 456 standard for QCP or a similar standard
qcpplus	Certificates governed by a Certificate Policy in compliance with the ETSI TS 101 456 standard for QCP+ or a similar standard. (Use of a SSCD is mandated in the CP)

Table 4: Quality of Certificate

.../xkmsEU:eIDQuality/xkmsEU:CSPAssurance

Element of type `xs:anyURI` indicating the certificate issuing CSP status according to D1.1 Part 7, "eID and eSignature Quality Classification", chapter 3.2.3. All values in the table below carry the prefix `http://lsp.eu/2009/04/CSPAssurance#`, which is omitted here for readability.

CSPAssurance URI ending	Meaning
none	Self assessment only

CSPAssurance URI ending	Meaning
IndependentDocument Review	Statement of compliance issued by an independent, external unit based on document review only
InternalCompliance Audit	Internal audit carried out periodically concludes compliance to applicable requirements
SupervisionWithout ComplianceAudit	CA is supervised by a public, national or international authority according to applicable law to the CA
ExternalCompliance Audit	Audit carried out periodically by external, independent auditor concludes compliance to applicable requirements
ExternalCompliance AuditCertified	Audit carried out periodically by external, independent auditor concludes compliance to applicable requirements. CA operations are certified in accordance with a relevant standard; OR cross certification with a relevant bridge CA has been made; OR the CA has obtained membership in a PKI hierarchy as a result of appropriate assessment
SupervisionWith ExternalCompliance Audit	Audit carried out periodically by external, independent auditor concludes compliance to applicable requirements. CA is supervised by a public, national or international authority according to applicable law to the CA
AccreditationWith ExternalCompliance Audit	Audit carried out periodically by external, independent auditor concludes compliance to applicable requirements. CA is accredited by a public, national or international authority according to applicable law to the CA

Table 5: CA Independent Assurance

.../xkmsEU:ValidationDetails ?

Optional container element carrying details on the certificate validation. MUST be present if certificate validation could be processed. Explicitly requested by a **xkms:RespondWith** value of **http://www.lsp.eu/2009/04/xkmsExt#ValidationDetails**.

.../xkmsEU:ValidationDetails/xkmsEU:ValidateScheme

Element of type **xs:anyURI** indicating the mechanism respective the protocol a certificate was validated. All values in the table below carry the prefix **http://lsp.eu/2009/04/valScheme#**, which is omitted here for readability.

ValidateScheme URI ending	Meaning
---------------------------	---------

ValidateScheme URI ending	Meaning
LOCAL	Only local checked by responder instance
OCSP	Request to CA OCSP responder
CRL	CRL used
CRL_LDAP	CRL and LDAP used
LDAP	Request to CA LDAP certificate directory

Table 6: Certificate Validation Schemes

.../xkmsEU:ValidationDetails/xkmsEU:ValidateModel ?

Element of type **xs:anyURI** indicating the validation scheme used. All values in the table below carry the prefix `http://lsp.eu/2009/04/valModel#`, which is omitted here for readability.

ValidateModel URI ending	Validation Process
PKIX	Validation PKIX-conformant (shell-model)
chain	Strict certificate chain validation processing
escapeRoute	Mix of both above as described in [COMMPKI], part 9

Table 7: Certificate Validation Models

.../xkmsEU:ValidationDetails/xkmsEU:CertificateRevocationDetails ?

Container holding details in case of a certificate revoked status.

.../xkmsEU:ValidationDetails/xkmsEU:CertificateRevocationDetails/
xkmsEU:RevocationTimeInstant

Time of revocation; type is **xs:dateTime**.

.../xkmsEU:ValidationDetails/xkmsEU:CertificateRevocationDetails/
xkmsEU:RevocationReason

Element of type **xs:anyURI** indicating one of the following revocation reasons outlines in the table below. All values carry the prefix `http://lsp.eu/2009/04/reason#`, which is omitted here for readability.

RevocationReason URI ending	Meaning
unspecific	No specific revocation reason specified
KeyCompromise	User certificate is compromised

RevocationReason URI ending	Meaning
CACompromise	Issuer certificate is compromised
AffiliationChanged	Name or other attributes of certificate owner changed; certificate is not compromised
Superseded	Certificate marked as superseded; certificate is not compromised
CessationOfOperation	Certificate marked as no longer needed; certificate is not compromised
CertificateHold	Certificate withdrawn temporarily; certificate is not compromised
RemoveFromCRL	Certificate is withdrawn from CRL, reusable again
PrivilegeWithdrawn	A privilege documented in certificate is withdrawn
AACompromise	The private key of an Attribute Authority could be or is compromised
None	No revocation reason available

Table 8: Certificate Revocation Reasons

.../xkmsEU:ValidationDetails/xkmsEU:ValidationTime

Time of validation processing; element of type **xs:dateTime**.

.../xkmsEU:ValidationDetails/xkmsEU:OCSPNoCache ?

Optional element of type **xs:boolean**. MUST be reported as true, if the OSCP response was not taken from the cache.

.../xkmsEU:ResponderDetails

This container MUST be present, indicating details to the XKMS responder used, otherwise corresponding attributes of the node generating this validation result.

.../xkmsEU:ResponderDetails/xkmsEU:InstanceName ?

Optional element of type **xs:string** carrying a responder name.

.../xkmsEU:ResponderDetails/xkmsEU:InstanceUri

Mandatory element of type **xs:anyURI** carrying the responder URI.

.../xkmsEU:ResponderDetails/xkmsEU:ConfigurationVersion ?

Optional element of type **xs:string** carrying information about the responders configuration version.¹¹

.../**xkmsEU:ResponderDetails/xkmsEU:OCSPCacheInterval** ?

Optional element of type **xs:duration**. If a responder uses cacheing for OSCP responses, the cacheing interval time SHOULD be reported here.

.../**xkmsEU:ErrorExtension** *

This optional element is used to report errors concerning the validation process in the attribute:

.../**xkmsEU:ErrorExtension/Reason**

Element of type **xs:anyURI** with following possible values; all values carry the prefix **http://lsp.eu/2009/04/reason#**, which is omitted here for readability.

ErrorExtension/Reason URI ending	Semantics
OpaqueClientData TooLong	Length of value of /xkms:OpaqueClientData exceeds 256 byte
TrustCenter NotReachable	Responder of certificate issuer CA not reached - time-out limit reached or other technical reasons
WrongCertificateFormat	Certificate defect or wrong coded
WrongTimeInstant	Validation time instant not recognizable or in future
UnknownCA	Certificate issuer not known
SignatureKeyTooShort	Key length of signature certificate is too short
Unknown	Error reason could not be determined
NotUnderstood	A request parameter could not be understood, but processing was (partially) possible. The indicated parameter SHOULD be outlined in the xkmsEU:Details element of this xkmsEU:ErrorExtension entry.

Table 9: XKMS Error Extension: Reasons

¹¹ Capabilities of a XKMS responder – i.e. OSCP-responders known by a responder instance - may depend on a concrete configuration version; this information may be helpful when checking for reasons of errors reported by a XKMS responder.

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6.3 References

- [COMMPKI] Common PKI Specifications for interoperable Applications, Version 2.0, 20 January 2009; http://www.common-pki.org/uploads/media/Common-PKI_v2.0.pdf
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- [RFC2119] S. Bradner, Key words for use in RFCs to Indicate Requirement Levels, RFC 2119, Harvard University, March 1997, <http://www.ietf.org/rfc/rfc2119.txt>
- [RFC4122] A Universally Unique Identifier (UUID) URN Namespace, The Internet Engineering Task Force July 2005, <http://www.ietf.org/rfc/rfc4122.txt>
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- [XKMSBIND] XML Key Management Specification (XKMS 2.0) Bindings Version 2.0, W3C Recommendation, 28 June 2005, <http://www.w3.org/TR/2005/REC-xkms2-bindings-20050628/>
- [XMLDSIG] World Wide Web Consortium. XML-Signature Syntax and Processing (Second Edition), W3C Recommendation, 10 June 2008; <http://www.w3.org/TR/xmlsig-core/>
- [XMLSchema] World Wide Web Consortium. XML Schema, Parts 0, 1, and 2 (Second Edition). W3C Recommendation, 28 October 2004; <http://www.w3.org/TR/xmlschema-0/>, <http://www.w3.org/TR/xmlschema-1/>, and <http://www.w3.org/TR/xmlschema-2/>
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February 1998, revised 16 August 2006; <http://www.w3.org/TR/2006/REC-xml-20060816/>

[XPath 1.0] W3C Recommendation, "[XML Path Language \(XPath\) Version 1.0](http://www.w3.org/TR/xpath)," 16 November 1999; <http://www.w3.org/TR/xpath>

Appendix A. Extension Schema

Schema of PEPPOL XKMS Extensions

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xkms="http://www.w3.org/2002/03/xkms#"
xmlns:xkmsEU="http://www.lsp.eu/2009/04/xkmsExt#"
targetNamespace="http://www.lsp.eu/2009/04/xkmsExt#" elementFormDefault="qualified"
attributeFormDefault="unqualified" xml:lang="en">
  <xs:annotation>
    <xs:documentation xml:lang="en">This schema serves the requirements of EU
Large Scale Pilot Projects regarding certificate validation as an extension to
XKMS2 XKISS ValidateResult</xs:documentation>
    <xs:documentation xml:lang="en">1.0 by Apitzsch/bos as of 2009-04-
28</xs:documentation>
  </xs:annotation>
  <xs:import namespace="http://www.w3.org/2002/03/xkms#" schemaLocation=
"http://www.w3.org/TR/2005/REC-xkms2-20050628/Schemas/xkms.xsd"/>
  <!--ValidateResult EU LSP Extension-->
  <xs:element name="ValidateResultExtLSP" substitutionGroup=
"Xkms:MessageExtension" type="XkmsEU:ValidateResultExtLSPTYPE"/>
  <xs:complexType name="ValidateResultExtLSPTYPE">
    <xs:complexContent>
      <xs:extension base="Xkms:MessageExtensionAbstractType">
        <xs:sequence>
          <xs:element ref="XkmsEU:eIDQuality" minOccurs="0"/>
          <xs:element ref="XkmsEU:ValidationDetails" minOccurs="0"/>
          <xs:element ref="XkmsEU:ErrorExtension" minOccurs="0"
maxOccurs="unbounded"/>
          <xs:element ref="XkmsEU:ResponderDetails"/>
        </xs:sequence>
      </xs:extension>
    </xs:complexContent>
  </xs:complexType>
  <!-- /ValidateResulttext EU LSP Extension-->
  <!-- ValidationDetails -->
  <xs:element name="ValidationDetails" type="XkmsEU:ValidationDetailsType"/>
  <xs:complexType name="ValidationDetailsType">
    <xs:sequence>
      <xs:element ref="XkmsEU:ValidateScheme"/>
      <xs:element ref="XkmsEU:ValidateModel" minOccurs="0"/>
      <xs:element ref="XkmsEU:CertificateRevocationDetails" minOccurs="0"/>
      <xs:element ref="XkmsEU:ValidationTime"/>
      <xs:element ref="XkmsEU:OCSPNoCache" minOccurs="0"/>
    </xs:sequence>
  </xs:complexType>
  <!-- /ValidationDetails -->
  <!-- ValidateScheme -->
  <xs:element name="ValidateScheme" type="XkmsEU:ValidateSchemeType"/>
  <xs:simpleType name="ValidateSchemeType">
    <xs:restriction base="xs:anyURI">
      <xs:enumeration value="http://lsp.eu/2009/04/valScheme#LOCAL"/>
      <xs:enumeration value="http://lsp.eu/2009/04/valScheme#OCSP"/>
      <xs:enumeration value="http://lsp.eu/2009/04/valScheme#CRL"/>
      <xs:enumeration value="http://lsp.eu/2009/04/valScheme#CRL_LDAP"/>
    </xs:restriction>
  </xs:simpleType>
</xs:schema>
```



```

        <xs:enumeration value="http://lsp.eu/2009/04/valScheme#LDAP"/>
    </xs:restriction>
</xs:simpleType>
<!-- /ValidateScheme -->
<!-- ValidateModel -->
<xs:element name="ValidateModel" type="xkmsEU:ValidateModelType"/>
<xs:simpleType name="ValidateModelType">
    <xs:restriction base="xs:anyURI">
        <xs:enumeration value="http://lsp.eu/2009/04/valModel#PKIX"/>
        <xs:enumeration value="http://lsp.eu/2009/04/valModel#chain"/>
        <xs:enumeration value="http://lsp.eu/2009/04/valModel#escapeRoute"/>
    </xs:restriction>
</xs:simpleType>
<!-- /ValidateModel -->
<!-- ValidationTime -->
<xs:element name="ValidationTime" type="xs:dateTime"/>
<!-- /ValidationTime -->
<!-- OCSPNoCache -->
<xs:element name="OCSPNoCache" type="xs:boolean"/>
<!-- /OCSPNoCache -->
<!-- CertificateRevocationDetail -->
<xs:element name="CertificateRevocationDetails">
    <xs:complexType>
        <xs:sequence>
            <xs:element name="RevocationTimeInstant" type="xs:dateTime"/>
            <xs:element ref="xkmsEU:RevocationReason"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>
<xs:element name="RevocationReason" type="xkmsEU:RevocationReasonType"/>
<xs:simpleType name="RevocationReasonType">
    <xs:restriction base="xs:anyURI">
        <xs:enumeration value="http://lsp.eu/2009/04/xkmsextLSP#unspecified"/>
        <xs:enumeration value="http://lsp.eu/2009/04/xkmsextLSP#KeyCompromise"/>
        <xs:enumeration value="http://lsp.eu/2009/04/xkmsextLSP#CACompromise"/>
        <xs:enumeration value="
            http://lsp.eu/2009/04/xkmsextLSP#AffiliationChanged"/>
        <xs:enumeration value="http://lsp.eu/2009/04/xkmsextLSP#Superseded"/>
        <xs:enumeration value="
            http://lsp.eu/2009/04/xkmsextLSP#CessationOfOperation"/>
        <xs:enumeration value="http://lsp.eu/2009/04/xkmsextLSP#CertificateHold"/>
        <xs:enumeration value="http://lsp.eu/2009/04/xkmsextLSP#RremoveFromCRL"/>
        <xs:enumeration value="
            http://lsp.eu/2009/04/xkmsextLSP#PrivilegeWithdrawn"/>
        <xs:enumeration value="http://lsp.eu/2009/04/xkmsextLSP#AACompromise"/>
        <xs:enumeration value="http://lsp.eu/2009/04/xkmsextLSP#none"/>
    </xs:restriction>
</xs:simpleType>
<!-- /CertificateRevocationDetail -->
<!-- CertificateQuality -->
<xs:element name="CertificateQuality" type="xkmsEU:CertificateQualityType"/>
<xs:simpleType name="CertificateQualityType">
    <xs:restriction base="xs:anyURI">
        <xs:enumeration value="http://lsp.eu/2009/04/certquality#unknown"/>
        <xs:enumeration value="http://lsp.eu/2009/04/certquality#low"/>
        <xs:enumeration value="http://lsp.eu/2009/04/certquality#lcp"/>
        <xs:enumeration value="http://lsp.eu/2009/04/certquality#ncp"/>
        <xs:enumeration value="http://lsp.eu/2009/04/certquality#ncpplus"/>
        <xs:enumeration value="http://lsp.eu/2009/04/certquality#qcp"/>
        <xs:enumeration value="http://lsp.eu/2009/04/certquality#qcpplus"/>
    </xs:restriction>
</xs:simpleType>
<!-- /CertificateQuality -->
<!-- CSP independent assurance -->
<xs:element name="CSPAssurance" type="xkmsEU:CSPAssuranceType"/>
<xs:simpleType name="CSPAssuranceType">

```



```

<xs:restriction base="xs:anyURI">
  <xs:enumeration value="http://lsp.eu/2009/04/CSPAssurance#none"/>
  <xs:enumeration value="http://lsp.eu/2009/04/CSPAssurance#IndependentDocument_Review"/>
  <xs:enumeration value="http://lsp.eu/2009/04/CSPAssurance#InternalComplianceAudit"/>
  <xs:enumeration value="http://lsp.eu/2009/04/CSPAssurance#SupervisionWithoutComplianceAudit:"/>
  <xs:enumeration value="http://lsp.eu/2009/04/CSPAssurance#ExternalComplianceAudit"/>
  <xs:enumeration value="http://lsp.eu/2009/04/CSPAssurance#ExternalComplianceAuditCertified"/>
  <xs:enumeration value="http://lsp.eu/2009/04/CSPAssurance#SupervisionWithExternalComplianceAudit"/>
  <xs:enumeration value="http://lsp.eu/2009/04/CSPAssurance#AccreditationWithExternalComplianceAudit"/>
</xs:restriction>
</xs:simpleType>
<!-- /CertificateQuality -->
<xs:element name="eIDQuality" type="xkmsEU:eIDQualityType"/>
<xs:complexType name="eIDQualityType">
  <xs:sequence>
    <xs:element ref="xkmsEU:CertificateQuality"/>
    <xs:element ref="xkmsEU:CSPAssurance"/>
  </xs:sequence>
</xs:complexType>
<!--ResponderDetails-->
<xs:element name="ResponderDetails" type="xkmsEU:ResponderDetailsType"/>
<xs:complexType name="ResponderDetailsType">
  <xs:sequence>
    <xs:element name="InstanceName" type="xs:string" minOccurs="0"/>
    <xs:element name="InstanceURI" type="xs:anyURI"/>
    <xs:element name="ConfigurationVersion" type="xs:string" minOccurs="0"/>
    <xs:element name="OCSPCacheingInterval" type="xs:duration" minOccurs="0"/>
  </xs:sequence>
</xs:complexType>
<!--ResponderDetails-->
<!-- ErrorExtension -->
<xs:element name="ErrorExtension" type="xkmsEU:ErrorExtensionType"/>
<xs:complexType name="ErrorExtensionType">
  <xs:sequence>
    <xs:element name="Reason" type="xkmsEU:ReasonType"/>
    <xs:element name="Detail" type="xs:string" minOccurs="0"/>
  </xs:sequence>
</xs:complexType>
<xs:simpleType name="ReasonType">
  <xs:restriction base="xs:anyURI">
    <xs:enumeration value="http://lsp.eu/2009/04/reason#OpaqueClientDataTooLong"/>
    <xs:enumeration value="http://lsp.eu/2009/04/reason#TrustCenterNotReachable"/>
    <xs:enumeration value="http://lsp.eu/2009/04/reason#WrongCertificateFormat"/>
    <xs:enumeration value="http://lsp.eu/2009/04/reason#UnknownCA"/>
    <xs:enumeration value="http://lsp.eu/2009/04/reason#WrongTimeInstant"/>
    <xs:enumeration value="http://lsp.eu/2009/04/reason#SignatureKeyTooShort"/>
    <xs:enumeration value="http://lsp.eu/2009/04/reason#Unknown"/>
    <xs:enumeration value="http://lsp.eu/2009/04/reason#NotUnderstood"/>
    <xs:enumeration value=""/>
  </xs:restriction>
</xs:simpleType>
<!-- /errorExtension -->
<!-- /XKISS EU LSP Extension End Schema -->
</xs:schema>

```