Federal Office
for Information Security

BSI Technical Guideline 03125 Preservation of Evidence of Cryptographically Signed Documents

Annex TR-ESOR-VR:
Verification Reports for Selected Data Structures

Designation	Verification Reports for Selected Data Structures
Abbreviation	BSI TR-ESOR-VR
Version	1.3 (on base of the eIDAS-Regulation and the ETSI Preservation Standards with a new certification scheme)
Date	31.03.2022

Document history

Version	*Date*	*Editor*	*Description*
V1.3	31.03.2022	BSI	TR-ESOR-VR V1.3

Table 1: Document History

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1 Introduction

The goal of the Technical Guideline “Preservation of Evidence of Cryptographically Signed Documents” is to specify technical security requirements for the long-term preservation of evidence of cryptographically signed electronic documents and data along with associated electronic administrative data (meta data).

A Middleware defined for this purpose (TR-ESOR-Middleware) in the sense of this Guideline includes all of the modules (**M**) and interfaces (**S**) [for the German ”*Schnittstellen*“] used for securing and preserving the authenticity and proving the integrity of the stored documents and data.

The Reference Architecture introduced in the Main Document of this Technical Guideline consists of the functions and logical units described in the following:

- the input interfaces TR-S.4 or TS 119512-Interface TR-S.512 in the profiling **[TR-ESOR-TRANS]** of the TR-ESOR-Middleware serves to embed the TR-ESOR-Middleware in the existing IT and infrastructure landscape;
- the “ArchiSafe”-Module (see **[TR-ESOR-M.1]**), which regulates the flow of information in the Middleware, that implements the security requirements for the interfaces with the IT applications and which ensures that the application systems are decoupled from the ECM-/Long-Term Storage;
- the “Cryptographic” module (see **[TR-ESOR-M.2]**) and the associated interfaces TR-S.1 and TR-S.3 that provide the functions for creating hash values, verifying electronic signatures or seals or time-stamps, verifying electronic certificates and for obtaining qualified time-stamps or (optional) of electronic signatures or seals for the Middleware. Furthermore, it can provide the functions for the encryption and decryption of data and documents;
- the “ArchiSig” module (see **[TR-ESOR-M.3]**) with the interface TR-S.6 that provides the functions needed for the preservation of evidence of the digitally signed documents;
- an ECM-/Long-Term Storage with the interfaces TR-S.2 and TR-S.5 that assumes the physical archiving/storage and also the storage of the meta data that preserve evidence.
  This ECM-/Long-Term Storage is no longer directly a part of the Technical Guideline, but requirements may be induced through the two interfaces that are still part of the TR-ESOR-Middleware.
  The application layer that can include an XML-adapter is not a direct part of this Technical Guideline, either, even though this XML-adapter can be implemented as part of a Middleware.

The IT Reference Architecture depicted in Figure 1 and Figure 2 is based on the ArchiSafe Reference Architecture and is supposed to enable and support the logical (functional) interoperability of future products with the objectives and requirements of the Technical Guideline. In principle, the upper interface of the TR-ESOR-Middleware is either the TR-S.4-Interface pursuant to **[TR-ESOR-E],** according to Figure 1, or the TR-S.512-Interface pursuant to **[ETSI TS 119 512]** in the profiling **[TR-ESOR-TRANS]**, according to Figure 2.

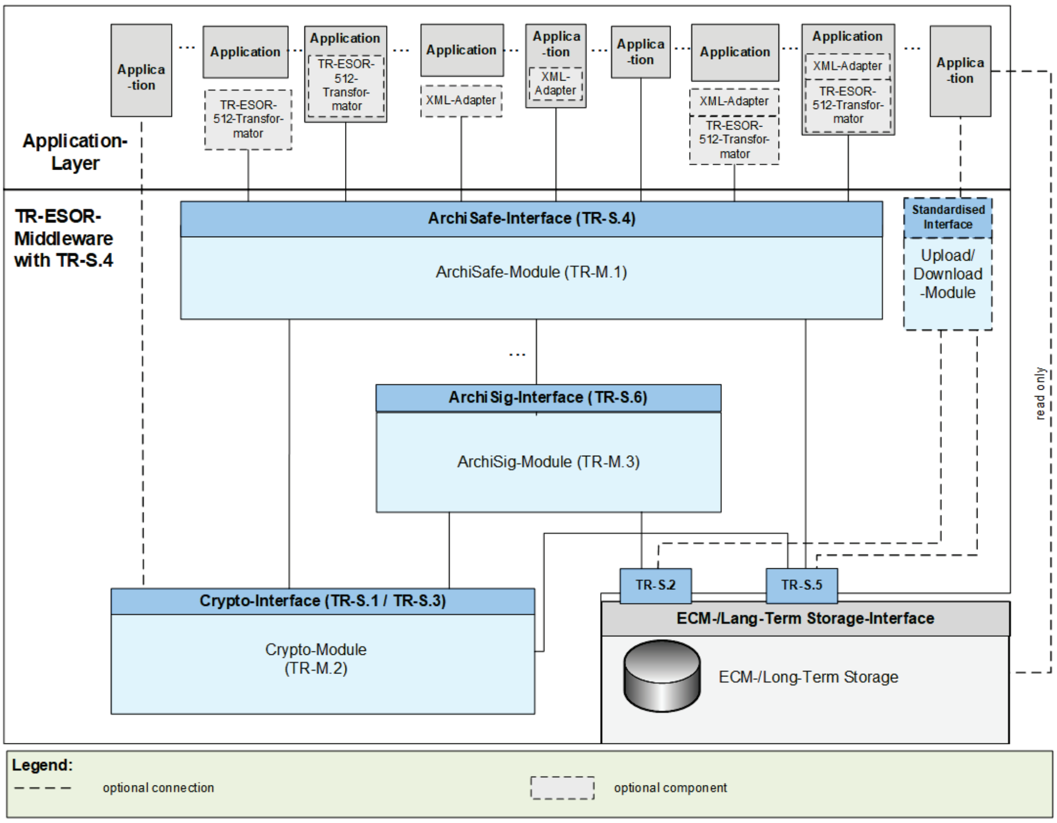


Figure 1: Schematic Depiction of the IT Reference Architecture with TR-S.4

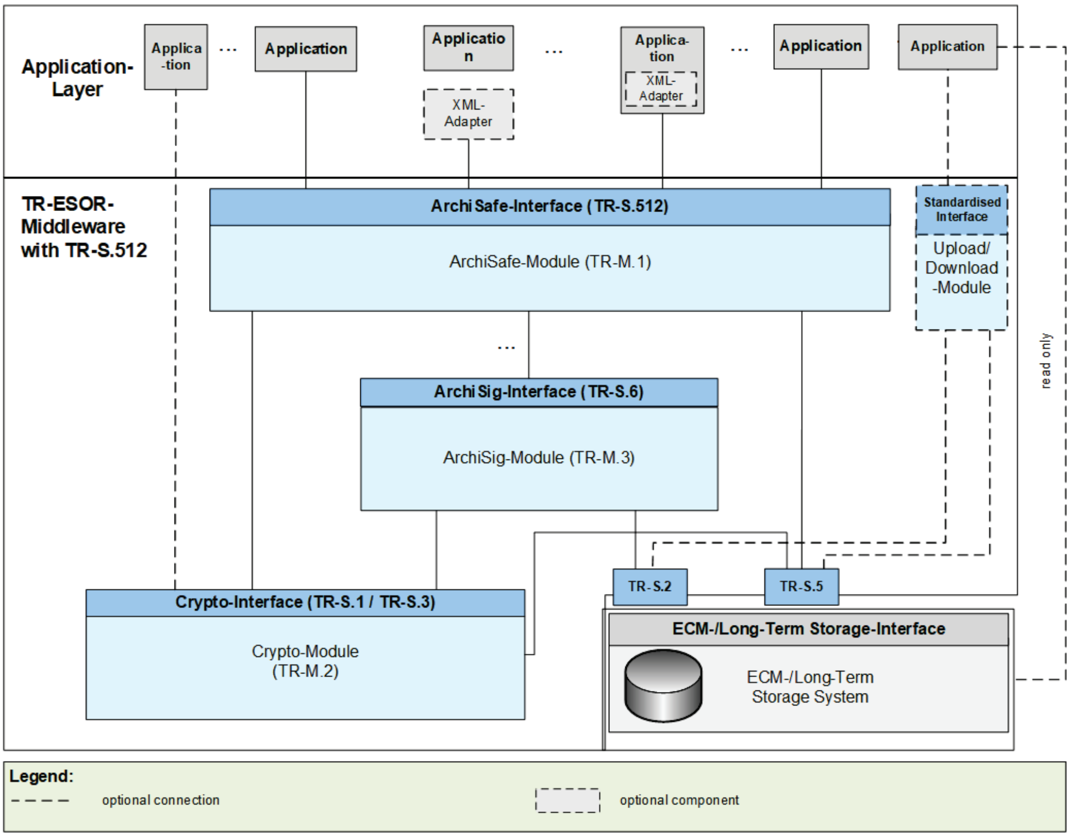


Figure 2: Schematic Depiction of the IT Reference Architecture with TR-S.512

The optional XML-Adapter and/or the optional TR-ESOR-512-Transformator[1] may be integrated under the following circumstances:

- Both as separate components with two interfaces to the IT-application and the ArchiSafe-Module,
- Both as separate components, but as parts of the IT-application with interfaces to the ArchiSafe-Module,
- One common component, separate from the IT-application and including the XML-Adapter and TR-ESOR-512-Transformator as parts, with two interfaces to the IT-application and the ArchiSafe-Module,
- One common component including the XML-Adapter and TR-ESOR-512-Transformator as parts, which is part of the IT-application, with an interface to the ArchiSafe-Module.

The “ETSI TS119512 TR-ESOR Transformator” enables preservation services pursuant to [eIDAS-VO] to transform incoming ETSI TS 119 512 (V1.1.2) messages[2] into TR-S.4 messages. These messages can be sent to an attached TR-ESOR system without any need for changing the TR-ESOR system.

The usage of the “ETSI TS119512 TR-ESOR Transformator” is recommended in case that a TR-ESOR-Product with a TR-S.4-Interface should be used in Europe supporting interoperability with other European (qualified) Preservation Services or Preservation Products.

This Technical Guideline is modularly structured, and the individual annexes to the Main Document specify the functional and technological security requirements for the needed IT components and interfaces of the TR-ESOR-Middleware. The specifications are strictly platform, product and manufacturer independent.

The document at hand bears the designation “Annex TR-ESOR-VR” and specifies verification reports for selected data structures.

[1] See https://github.com/de-bund-bsi-tr-esor/tresor-ETSITS119512-transformator.

[2] In the profiling of **[TR-ESOR-TRANS].**

2 Overview

The present section defines verification report structures for

- Evidence Records (see section 3) and
- XAIP (see section 4).

Unless otherwise specified the following identifier may appear in any ResultMajor-element:

- http://www.bsi.bund.de/ecard/api/1.1/resultmajor#ok
- http://www.bsi.bund.de/ecard/api/1.1/resultmajor#warning
- http://www.bsi.bund.de/ecard/api/1.1/resultmajor#error

Furthermore, following identifier may always appear in any ResultMinor-element:

- http://www.bsi.bund.de/ecard/api/1.1/resultminor/al/common#noPermission
- http://www.bsi.bund.de/ecard/api/1.1/resultminor/al/common#internalError
- http://www.bsi.bund.de/ecard/api/1.1/resultminor/al/common#parameterError
- http://www.bsi.bund.de/ecard/tr-esor/1.3/resultminor/arl/notSupported

NOTICE 1
Please consider, the official scheme definition of the OASIS verification report[3] provided by OASIS on the web page does not fully match the corresponding specification document[4]. According to the specification, the element `<vr:ChainingOK>` of the type `<vr:CertificateValidityType>` must be optional and not required.

NOTICE 2
*In TR-ESOR-Version1.3 the three terms „**Archive Information Package (AIP)**“, “**Archive Information Container”** and „**Archive Data Object**“ are used synonymously.*

NOTICE 3
*The TR-ESOR input interface TR-S.4 or the TS119512 input interface TR-S.512 pursuant to the preservation-API of **[ETSI TS 119 512]** in the profiling of **[TR-ESOR-TRANS]** shall be used which logically corresponds to the input-interface TR-S.4 of the TR-ESOR-Middleware **[TR-ESOR-E]**, as shown in the table 2 of **[TR-ESOR-E], clause 4.1**. Another input interface instead of TR-S.4 or TR-S.512 is not allowed.*

To improve readability, the insertion of the TS119512-function calls, equivalent to TR-S.4, is renounced, at several places in this document and the footnote “Either TR-S.4 or TR-S.512 shall be supported.” is added to each test case concerning “TR-S.4” or “TR-S.512.

NOTICE 4
In this TR-ESOR- Version, the word “AIP“ means in all TR-ESOR-Annexes :

a) *the XML-based archival information package “XAIP“ pursuant to **[TR-ESOR-F], clause 3.1** as well as*
b) *the logical XAIP “LXAIP“ pursuant to **[TR-ESOR-F], clause 3.2** as well as*
c) *the “ASiC-AIP” pursuant to **[TR-ESOR-F], clause 3.3** on base of **[ETSI EN 319162-1]**.*
In general, this TR-ESOR Version differentiates in detail between “XAIP”, “LXAIP” and “ASiC-AIP”.

[3] See http://docs.oasis-open.org/dss-x/profiles/verificationreport/oasis-dssx-1.0-profiles-vr-cd02.xsd.
[4] See http://docs.oasis-open.org/dss-x/profiles/verificationreport/oasis-dssx-1.0-profiles-vr-cs01.pdf.

To improve readability, at several places in this document, the insertion of “LXAIP” and “ASiC-AIP” is renounced, and the footnote **“***”XAIP” shall be supported, “LXAIP” and “ASiC-AIP, if implemented” may be supported***”** *is added to each “XAIP”.*

But in this document, the word “(L)XAIP” represents “XAIP” or “LXAIP” pursuant to **[TR-ESOR-F]** *and the word “DXAIP” represents “DXAIP” or “DLXAIP”” pursuant to* **[TR-ESOR-F]** *except in clause 4.3.1 , clause 4.4.1 and clause 4.5.1 .*

NOTICE 5

In this TR-ESOR- Version, ***BIN*** *is restricted to the following preservation object formats:*

- *ASiC-ERS (in TR-ESOR v1.3 called ASiC-AIP) pursuant to* **[ETSI TS 119 512]** *Annex A.3.1 and A.3.1.3 (http://uri.etsi.org/ades/ASiC/type/ASiC-ERS) and pursuant to* **[TR-ESOR-F]** *Clause 3.3;*
- *CAdES pursuant to* **[ETSI TS 119 512]** *Annex A.1.1 (http://uri.etsi.org/ades/CAdES). If there is no MIME type filled, then the default application/cms is used;*
- *XAdES pursuant to* **[ETSI TS 119 512]** *Annex A.1.2 (http://uri.etsi.org/ades/XAdES). If there is no MIME type filled, then the default application/xml is used*
- *-PAdES pursuant to* **[ETSI TS 119 512]** *Annex A.1.3 (http://uri.etsi.org/ades/PAdES). If there is no MIME Type filled, then the default application/pdf is used;*
- *ASiC-E pursuant to* **[ETSI TS 119 512]** *Annex A.1.4 (http://uri.etsi.org/ades/ASiC/type/ASiC-E). If there is no MIME type filled, then the default application/vnd.etsi.asic-e+zip is used;*
- *ASiC-S pursuant to* **[ETSI EN 319 162]** *(http://uri.etsi.org/ades/ASiC/type/ASiC-S). If there is no MIME type filled, then the default application/vnd.etsi.asic-s+zip is used;*
- *DigestList pursuant to* **[ETSI TS 119 51***2] Annex A.1.6 (http://uri.etsi.org/19512/format/DigestList). If there is no MIME Type filled, then the default application/xml is used;*

In case of Upload- and Download-function the following format is allowed additionally:

- *Binary Data (BIN) as Octet Stream, which is stored in the ECM-/Long-Term Storage by an “Upload-Request”, – but only,*
- *if connected with a corresponding LXAIP and referenced there acc. to* **[TR-ESOR-F]***, Sec. 3.2,*
- *if appropriate, retrieved by a “Download-Request” – linked to a corresponding LXAIP or embedded in a XAIP and retrieved by an ArchiveRetrieval-Request – and*
- *no Upload of XAIP, nor LXAIP, nor ASiC-AIP is possible.*

NOTICE 6

If implemented, an ASiC-AIP-Container pursuant to clause 3.3 in **[TR-ESOR-F]** *shall be inserted in the TS119152-interface as a base64Binary-coded ASiC-AIP-Container with the Type=http://uri.etsi.org/ades/ASiC/type/ASiC-ERS Attribute (see https://www.w3.org/TR/xmlschema-2/#base64Binary).*

Attention 1.

In TR-ESOR V1.3, actually, ASiC-AIP is announced but it is still not released and does not lead to a certification.

NOTICE 7

*In the following text the term “***digital signature“** *covers “advanced electronic signatures“ pursuant to* **[eIDAS-VO]***, Article 3(11), “qualified electronic signatures“ pursuant to* **[eIDAS-VO]***, Article 3(12), “advanced electronic seals“ pursuant to* **[eIDAS-VO]***, Article 3(26) and “qualified electronic seals“ pursuant to* **[eIDAS-VO]***, Article 3(27). Insofar, the term “digital signed document“ covers documents signed by advanced electronic signatures or seals as well as documents signed by qualified electronic signatures or seals.*

*In this TR the term “***cryptographic signed documents***“ covers not only qualified signed documents pursuant to* **[eIDAS-VO]***, Article 3(12) or qualified sealed documents pursuant to* **[eIDAS-VO]***, Article 3(27) or qualified* *time-stamped documents pursuant to* ***[eIDAS-VO]****, Article 3(34) (within the meaning of the* ***eIDAS*** *regulation), but also documents with advanced electronic signatures pursuant to* ***[eIDAS-VO]****, Article 3(11) or with advanced electronic seals pursuant to* ***[eIDAS-VO]****, Article 3(26) or with electronic time-stamps pursuant to* ***[eIDAS-VO]****, Article 3(33), as they are often used in the internal communication of public authorities. The documents with simple signatures or seals based on other (e.g. non-cryptographic) technologies are not meant here.*

3 Evidence Record

In order to verify the conformity of evidence records according to **[RFC4998]** or **[RFC6283]** the `VerifyRequest` returns an `<EvidenceRecordReport>`-element in the `<Details>`-element within the `<IndividualReport>`-element defined in section 3.3 of **[OASIS VR]**.

This element is defined as follows, where changes to **[OASIS VR]** are marked yellow:

```
<element name="EvidenceRecordReport" type="tr:EvidenceRecordValidityType" />
```

3.1 EvidenceRecordValidityType

The **tr:EvidenceRecordValidityType** is based on the definition of the `EvidenceRecord`-element in **[RFC4998]** defined as follows:

```
<complexType name="EvidenceRecordValidityType">
  <sequence>
    <element name="FormatOK" type="vr:VerificationResultType"/>
    <element name="Version" type="anyURI" minOccurs="0"/>
    <element name="DigestAlgorithm" type="vr:AlgorithmValidityType"
        maxOccurs="unbounded" minOccurs="0"/>
    <element name="CryptoInfos" minOccurs="0">
      <complexType>
        <sequence>
          <element name="Attribute" type="vr:AttributeType" maxOccurs="unbounded"/>
        </sequence>
      </complexType>
    </element>
    <element name="EncryptionInfo" minOccurs="0">
      <complexType>
        <sequence>
          <element name="EncryptionInfoType" type="vr:AlgorithmValidityType"/>
          <element name="EncryptionInfoValue" type="dss:AnyType"/>
        </sequence>
      </complexType>
    </element>
    <element name="ArchiveTimeStampSequence">
      <complexType>
        <sequence maxOccurs="unbounded" minOccurs="0">
          <element name="ArchiveTimeStampChain">
            <complexType>
              <sequence maxOccurs="unbounded" minOccurs="0">
                <element name="ArchiveTimeStamp"
                    type="vr:ArchiveTimeStampValidityType"/>
              </sequence>
            </complexType>
          </element>
        </sequence>
      </complexType>
    </element>
  </sequence>
  <attribute name="Id" type="ID" use="optional"/>
  <attribute name="ReportVersion" fixed="1.3.0" use="required"/>
</complexType>
```

It contains the following elements and attributes:

`@Id` [optional]

This attribute contains an optional identifier for the element.

`@ReportVersion` [fixed]

This attribute describes the version of current verification report and is set in this case to “1.3.0”.

`<FormatOK>` [required]

This element indicates whether the format of the evidence record according to **[RFC4998]** or **[RFC6283]** is ok or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.The following identifier for `ResultMinor` may occur in case of an error:

- http://www.bsi.bund.de/ecard/api/1.1/resultminor/al/common#parameterError
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/arl/notSupported
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/invalidFormat

`<Version>` [optional]

This element contains, if present, the format and version of the Evidence Record Syntax, where the following values are supported:

- `urn:ietf:rfc:4998` for Evidence Records according to **[RFC4998]**
- `urn:ietf:rfc:6283` for Evidence Records according to **[RFC6283]**

A missing `<Version>` element indicates that an ASN.1-based Evidence Record according to **[RFC4998]** is used.

`<DigestAlgorithm>` [optional[5], unbounded]

This element appears for each hash algorithm used to produce the evidence record and contains information about the hash algorithm and possibly its suitability. The **vr:AlgorithmValidityType** is defined in section 3.5.2 of **[OASIS VR]**.

The currently supported digest algorithms are listed in **[TR-ESOR-ERS]**.

For `DigestAlgorithm/Suitability/ResultMinor` the following URI may appear in case of an error:

- http://www.bsi.bund.de/ecard/api/1.1/resultminor/il/algorithm#hashAlgorithmNotSuitable
- http://www.bsi.bund.de/ecard/api/1.1/resultminor/il/algorithm#hashAlgorithmNotSupported

`<CryptoInfos>` [optional]

In general this element may contain further data useful in the validation of the `<ArchiveTimeStampSequence>`-element. As explained in **[RFC4998]** and **[RFC6283]** (cf. `<SupportingInformationList>`-element) this may include possible Trust Anchors, certificates, revocation information, or the information concerning the suitability of cryptographic algorithms. In the present profile of the `EvidenceRecordReport`-structure[6] this element must be omitted.

`<EncryptionInfo>` [optional]

In general this element MAY contain the necessary information to support encrypted content (cf. **[RFC4998]**, section 6.1 and **[RFC6283]**, sections 2.1 and 6, `<EncryptionInformation>`-element). In the present profile of the `EvidenceRecordReport`-structure[7] this element must be omitted.

`<ArchiveTimeStampSequence>` [required]

This element is required and MAY contain a sequence of `<ArchiveTimeStampChain>`-elements (cf. **[RFC4998]**, section 5 and **[RFC6283]**, section 4), which in turn MAY contain a sequence of `<ArchiveTimeStamp>`-elements, which are of type **vr:ArchiveTimeStampValidityType** defined below.

3.2 ArchiveTimeStampValidityType

The **vr:ArchiveTimeStampValidityType** is based on the definition of the `ArchiveTimeStamp`-element in **[RFC4998]** defined as follows:

```
<complexType name="ArchiveTimeStampValidityType">
  <sequence>
```

[5] Note! In case an evidence record according to [RFC4998] is about to be verified, this element is required and has to be contained in the verification report. In case an evidence record according to [RFC6283] is verified, the element remains optional and can be omitted in the verification report.

[6] See BSI, [TR-ESOR-ERS].

[7] See BSI, [TR-ESOR-ERS].

```
    <element name="FormatOK" type="vr:VerificationResultType"/>
    <element name="DigestAlgorithm" type="vr:AlgorithmValidityType" minOccurs="0"/>
    <element name="Attributes" minOccurs="0">
      <complexType>
        <sequence>
          <element name="Attribute" type="vr:AttributeType" maxOccurs="unbounded"/>
        </sequence>
      </complexType>
    </element>
    <element name="ReducedHashTree" minOccurs="0">
      <complexType>
        <sequence maxOccurs="unbounded">
          <element name="PartialHashTree">
            <complexType>
              <sequence maxOccurs="unbounded">
                <element name="HashValue" type="vr:HashValueType"/>
              </sequence>
            </complexType>
          </element>
        </sequence>
      </complexType>
    </element>
    <element name="TimeStamp" type="vr:TimeStampValidityType"/>
  </sequence>
  <attribute name="Id" type="ID" use="optional"/>
</complexType>
```

It contains the following elements and attributes:

`@Id` [optional]

This attribute contains an optional identifier for the element.

`<FormatOK>` [required]

This element indicates whether the format of the evidence record according to **[RFC4998]** or **[RFC6283]** is ok or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in `ResultMinor` in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/invalidFormat
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/hashValueMismatch

  This error code indicates that the hash value in the time stamp (`MessageImprint`) under consideration is not equal to the hash value of the data (user provided content data or previous time-stamps in a time stamp chain / sequence), which is meant to be protected by the given time stamp.
- http://www.bsi.bund.de/ecard/api/1.1/resultminor/il/signature#signatureFormatNotSupported
- http://www.bsi.bund.de/ecard/api/1.1/resultminor//il/algorithm#signatureAlgorithmNotSupported
- http://www.bsi.bund.de/ecard/api/1.1/resultminor//il/algorithm#signatureAlgorithmNotSuitable
- http://www.bsi.bund.de/tr-esor/api/1.1/resultminor/unknownAttribute
- http://www.bsi.bund.de/ecard/api/1.1/resultminor/al/common#parameterError
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/arl/notSupported.

`<DigestAlgorithm>` [optional]

This element contains, if present, information about the hash algorithm and possibly its suitability. The **vr:AlgorithmValidityType** is defined in section 3.5.2 of **[OASIS VR]**.

For `DigestAlgorithm/Suitability/ResultMinor` the following URI may appear in case of an error:

- http://www.bsi.bund.de/ecard/api/1.1/resultminor/il/algorithm#hashAlgorithmNotSuitable
- http://www.bsi.bund.de/ecard/api/1.1/resultminor/il/algorithm#hashAlgorithmNotSupported

`<Attributes>` [optional]

This element contains, if present, information about further attributes related to the archive time stamp. In the present profile of the `EvidenceRecordReport`-structure[8] this element must be omitted.

`<ReducedHashTree>` [optional]

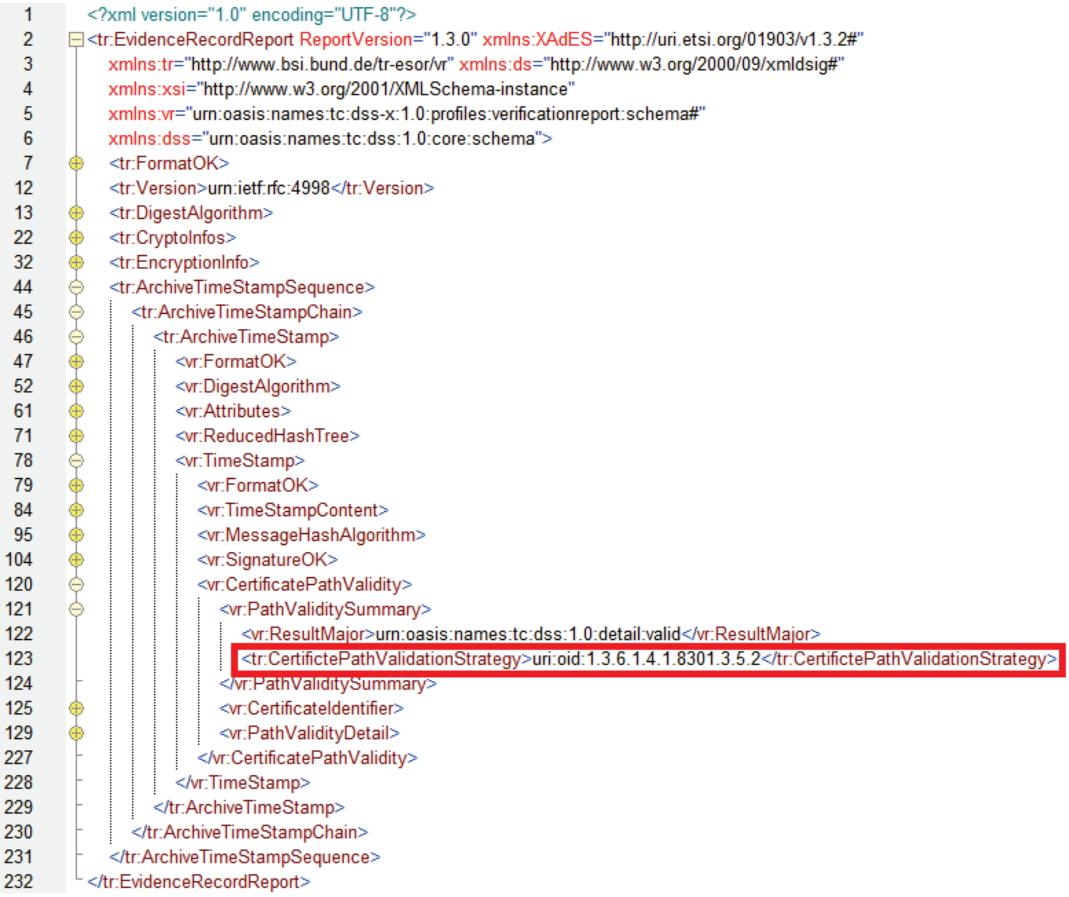
This element MAY contain a sequence of `<PartialHashTree>`-elements, which in turn contain a list of `<HashValue>`-elements of type **vr:HashValueType** defined below.

`<TimeStamp>` [required]

This element is of type **vr:TimeStampValidityType** (cf. section 3.5.4.4 of [OASIS VR]) and contains information about the validity of the conventional time stamp, which is included in the present archive time stamp.

The used certificate path validation strategy SHOULD be manifested by inserting a corresponding instance of element `<CertificatePathValidationStrategy>` (cf. section 3.2.1) as a last subelement of the element:

- `<TimeStamp>/<CertificatePathValidity>/<PathValiditySummary>`, e.g.:



```
<?xml version="1.0" encoding="UTF-8"?>
<tr:EvidenceRecordReport ReportVersion="1.3.0" xmlns:XAdES="http://uri.etsi.org/01903/v1.3.2#"
  xmlns:tr="http://www.bsi.bund.de/tr-esor/vr" xmlns:ds="http://www.w3.org/2000/09/xmldsig#"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:vr="urn:oasis:names:tc:dss-x:1.0:profiles:verificationreport:schema#"
  xmlns:dss="urn:oasis:names:tc:dss:1.0:core:schema">
  <tr:FormatOK>
  <tr:Version>urn:ietf:rfc:4998</tr:Version>
  <tr:DigestAlgorithm>
  <tr:CryptoInfos>
  <tr:EncryptionInfo>
  <tr:ArchiveTimeStampSequence>
    <tr:ArchiveTimeStampChain>
      <tr:ArchiveTimeStamp>
        <vr:FormatOK>
        <vr:DigestAlgorithm>
        <vr:Attributes>
        <vr:ReducedHashTree>
        <vr:TimeStamp>
          <vr:FormatOK>
          <vr:TimeStampContent>
          <vr:MessageHashAlgorithm>
          <vr:SignatureOK>
          <vr:CertificatePathValidity>
            <vr:PathValiditySummary>
              <vr:ResultMajor>urn:oasis:names:tc:dss:1.0:detail:valid</vr:ResultMajor>
              <tr:CertificctePathValidationStrategy>uri:oid:1.3.6.1.4.1.8301.3.5.2</tr:CertificctePathValidationStrategy>
            </vr:PathValiditySummary>
            <vr:CertificateIdentifier>
            <vr:PathValidityDetail>
          </vr:CertificatePathValidity>
        </vr:TimeStamp>
      </tr:ArchiveTimeStamp>
    </tr:ArchiveTimeStampChain>
  </tr:ArchiveTimeStampSequence>
</tr:EvidenceRecordReport>
```

Figure 3: Usage of `CertificatePathValidationStrategy`*-element in* `EvidenceRecordReport`*-element*

3.2.1 tr:CertificatePathValidationStrategyType

The strategy has been used to validate the given certificate path SHOULD be manifested by using the dedicated element `<CertificatePathValidationStrategy>` of type **tr:CertificatePathValitationStrategyType**, as defined below:

```
<element name="CertificatePathValidationStrategy"
```

[8] See BSI, [TR-ESOR-ERS].

```
       type="tr:CertificatePathValidationStrategyType"/>
<simpleType name="CertificatePathValidationStrategyType">
  <restriction base="string">
    <enumeration value="uri:oid:1.3.6.1.4.1.8301.3.5.1"/>
    <enumeration value="uri:oid:1.3.6.1.4.1.8301.3.5.2"/>
  </restriction>
</simpleType>
```

The `CertificatePathValidationStrategy`-element shall contain one of the following values:

- **uri:oid:1.3.6.1.4.1.8301.3.5.2**[9] – the certificate path has been validated pursued to the shell-validation-model
- **uri:oid:1.3.6.1.4.1.8301.3.5.1** – the certificate path has been validated pursued to the chain-validation-model (c.f. **[Common-PKI]**).

[9] See https://www.hrz.tu-darmstadt.de/services/it_services/oids/oids_der_informatik_cdc/index.en.jsp .

4 XAIP

To verify the conformity of an XAIP according to **[TR-ESOR-F]** one may use the `Verify` function, which returns an `<XAIPReport>`-element in the `<Details>`-element within the `<IndividualReport>`-element defined in section 3.3 of **[OASIS VR]**.

This element is defined as follows:

```
<element name="XAIPReport" type="tr:XAIPValidityType" />
```

4.1 XAIPValidityType

The **tr:XAIPValidityType** is defined as follows:

```
<complexType name="XAIPValidityType">
  <sequence>
    <element name="FormatOK" type="vr:VerificationResultType"/>
    <element name="packageHeader" type="tr:packageHeaderValidityType"/>
    <element name="metaDataSection" type="tr:metaDataSectionValidityType"
        minOccurs="0"/>
    <element name="dataObjectsSection" type="tr:dataObjectsSectionValidityType"
        minOccurs="0"/>
    <element name="credentialsSection" type="tr:credentialsSectionValidityType"
        minOccurs="0"/>
    <element name="updateSection" type="tr:updateSectionValidityType"
        minOccurs="0"/>
  </sequence>
  <attribute name="ReportVersion" type="string" use="required"/>
  <attribute name="XAIPVersion" fixed="1.3.0" use="required"/>
</complexType>
```

`@ReportVersion` [required, fixed]

This attribute contains the version of the underlying XAIP verification report specification. In this case, it shall be set to "**1.3.0**".

`@XAIPVersion` [required]

This attribute contains the version of the verified XAIP.

`<FormatOK>` [required]

This element indicates whether the format of the XAIP according to **[TR-ESOR-F]** is syntactically correct or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in `ResultMinor` in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/invalidFormat.

`<packageHeader>` [optional]

This element provides information about the result of the verification of the `packageHeader`-element of the XAIP as specified in **[TR-ESOR-F]**. More details about the **tr:packageHeaderValidityType** are provided below (see section 4.2, page 16).

`<metaDataSection>` [optional]

This element provides information about the result of the verification of the `metaDataSection`-element of the XAIP as specified in **[TR-ESOR-F]**. More details about the **tr:metaDataSectionValidityType** are provided below (see section 4.3, page 19).

`<dataObjectSection>` [optional]

This element provides information about the result of the verification of the `dataObjectSection`-element of the XAIP as specified in **[TR-ESOR-F]**. More details about the **tr:dataObjectSectionValidityType** are provided below (see section 4.4, page 21).

`<credentialSection>` [optional]

This element provides information about the result of the verification of the `credentialSection`-element of the XAIP as specified in **[TR-ESOR-F]**. More details about the **tr:credentialSectionValidityType** are provided below (see section 4.5, page 23).

`<updateSection>` [optional]

This element provides information about the result of the verification of the `updateSection`-element of the XAIP as specified in **[TR-ESOR-F]**. More details about the **tr:updateSectionValidityType** are provided below (see section 4.6, page 27).

4.2 packageHeaderValidityType

The **tr:packageHeaderValidityType** is based on the definition of the `packageHeader`-element in **[TR-ESOR-F]** defined as follows:

```
<complexType name="packageHeaderValidityType">
  <sequence>
    <element name="AOID" type="string" maxOccurs="1" minOccurs="0"/>
    <element name="versionManifest" type="tr:versionManifestValidityType"
        maxOccurs="unbounded" minOccurs="0"/>
    <element name="canonicalizationMethod" type="vr:VerificationResultType"
        minOccurs="0"/>
    <element name="extension" type="vr:VerificationResultType" minOccurs="0"/>
  </sequence>
  <attribute name="packageID" type="string" use="required"/>
</complexType>
```

It contains the following elements and attributes:

`@packageID` [required]

Contains the `packageID`-attribute of the XAIP for informational purposes.

`<AOID>` [optional]

Contains the `AOID`-element of the XAIP for informational purposes, if it is present.

`<versionManifest>` [optional, unbounded]

This element is present for each version of the XAIP and provides information about the result of the verification step. The **tr:versionManifestValidityType** is described below (see section 4.2.1, page 17).

`<canonicalizationMethod>` [optional]

This element indicates whether the provided `canonicalizationMethod`-URI is among the admissible values, which are currently specified as follows (see **[XML-SACR]**):

- http://www.w3.org/TR/2001/REC-xml-c14n-20010315
- http://www.w3.org/2001/10/xml-exc-c14n#

More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**. If the provided URI is not among the admissible values the following error code is provided in `ResultMinor`:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/unknownCanonicalizationMethod.

`<extension>` [optional]

This element indicates whether the content of the `extension`-element is correct or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**. In the present profile of the `XAIP`-structure the extension element must be omitted.

4.2.1 versionManifestValidityType

The **tr:versionManifestValidityType** is based on the definition of the `versionManifest`-element in **[TR-ESOR-F]** defined as follows:

```
<complexType name="versionManifestValidityType">
  <sequence>
    <element name="preservationInfo" type="vr:VerificationResultType"/>
    <element name="submissionInfo" type="tr:submissionInfoValidityType"
        minOccurs="0" />
    <element name="packageInfoUnit" type="tr:packageInfoUnitValidityType"
        maxOccurs="unbounded" minOccurs=”0”/>
    <element name="idAssignmentList" type="tr:idAssignmentListValidityType"
        minOccurs="0"/>
    <element name="extension" type="vr:VerificationResultType" minOccurs="0"/>
  </sequence>
  <attribute name="VersionID" type="string" use="required"/>
</complexType>
```

It contains the following elements and attributes:

`@VersionID` [required]

Contains the `VersionID`-attribute of the archive data object for informational purposes.

`<preservationInfo>` [required]

Contains the result of the verification process for the `preservationInfo`-element. Within this check, which is applied within the execution of `ArchiveSubmissionRequest` for example, it is verified that the preservation period of the XAIP is not yet expired. The result is structured as **vr:VerificationResultType** according to section 3.4 of **[OASIS VR]** where the following identifier may appear in `ResultMinor` in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/preservationPeriodExpired.

`<submissionInfo>` [optional]

This element provides information about the result of the verification of the `submissionInfo`-element of the XAIP as specified in **[TR-ESOR-F]**. More details about the **tr:submissionInfoValidityType** are provided below (see section 4.2.1.1, page 17).

`<packageInfoUnit>` [optional, unbounded]

This element provides information about the result of the verification of the `packageInfoUnit`-element of the XAIP as specified in **[TR-ESOR-F]**. More details about the **tr:packageInfoUnitValidityType** are provided below (see section 4.2.1.2, page 18).

`<idAssignmentList>` [optional]

This element provides about the result of the verification of the `idAssignmentList`-element of the XAIP as specified in **[TR-ESOR-F]**. More details about tr:idAssignmentListValidityType are provided below (see section 4.2.1.3, page 18).

`<extension>` [optional]

This element indicates whether the content of the `extension`-element is correct or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**. In the present profile of the `XAIP`-structure the extension element must be omitted.

4.2.1.1 submissionInfoValidityType

The **tr:SubmissionInfoValidityType** is based on the definition of the `submissionInfo`-element in **[TR-ESOR-F]** defined as follows:

```
<complexType name="submissionInfoValidityType">
  <sequence>
    <element name="submissionTime" type="vr:VerificationResultType" minOccurs="0"/>
    <element name="extension" type="vr:VerificationResultType" minOccurs="0"/>
  </sequence>
</complexType>
```

It contains the following elements and attributes:

`<submissionTime>` [optional]

Contains the result of the verification process for the `submissionTime/generalTime`-element. Within this check, which is applied within the execution of `ArchiveSubmissionRequest` for example, it is verified that the submission time is equal to the system time of the TR-ESOR-middleware modulo a specified tolerance range. The result is structured as **vr:VerificationResultType** according to section 3.4 of **[OASIS VR]** where the following identifier may appear in `ResultMinor` in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/submissionTimeDeviationBeyondLimit.

`<extension>` [optional]

This element indicates whether the content of the `extension`-element is correct or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**. In the present profile of the `XAIP`-structure the extension element must be omitted.

4.2.1.2 packageInfoUnitValidityType

The **tr:packageInfoUnitValidityType** is based on the definition of the `packageInfoUnit`-element in **[TR-ESOR-F]** defined as follows:

```
<complexType name="packageInfoUnitValidityType">
  <sequence>
    <element name="objectPointer" type="vr:VerificationResultType"/>
    <element name="extension" type="vr:VerificationResultType" minOccurs="0"/>
  </sequence>
  <attribute name="packageUnitID" type="string" use="required"/>
</complexType>
```

It contains the following elements and attributes:

`@packageUnitID` [required]

Contains the `packageUnitID`-attribute of this content data unit for informational purposes.

`<objectPointer>` [required]

Contains the result of the verification process for the `protectedObjectPointer` and `unprotectedObjectPointer` elements. Within this check, it is verified that there is no object, which is protected and unprotected. The result is structured as **vr:VerificationResultType** according to section 3.4 of **[OASIS VR]** where the following identifier may appear in `ResultMinor` in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/ambiguousObjectPointerStatus.

`<extension>` [optional]

This element indicates whether the content of the `extension`-element is correct or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**. In the present profile of the XAIP-structure the `extension`-element must be omitted.

4.2.1.3 idAssignmentListValidityType

The **tr:idAssignmentListValidityType** is based on the definition of the `idAssignmentList`-element in **[TR-ESOR-F]** defined as follows:

```
<complexType name="idAssignmentListValidityType">
  <sequence>
    <element name="idAssignmentPointer" type="tr:idAssignmentPointerValidityType"
      maxOccurs="unbounded"/>
  </sequence>
  <attribute name="idAssignmentListID" type="string" use="required"/>
</complexType>
```

It contains the following elements and attributes:

@idAssignmentListID [required]

Contains the idAssignmentListID-attribute of this data structure for informational purposes.

<idAssignmentPointer> [required, unbounded]

Contains the result of the verification procedure for a idAssignmentPointer-element, which is of type **tr:idAssignmentPointerValidityType**.

The **tr:idAssignmentPointerValidityType** is based on the definition of the idAssignmentPointer-element in **[TR-ESOR-F]** defined as follows:

```
<complexType name="idAssignmentPointerValidityType">
  <sequence>
    <element ref="checkSum" type="vr:VerificationResultType"/>
  </sequence>
  <attribute name="objectRef" type="string" use="required"/>
</complexType>
```

It contains the following elements and attributes:

@objectRef [required]

Contains the value of the referenced dataObjectID-attribut or metaDataID-attribut, as defined in **[TR-ESOR-F]**, chapter 3.1.2.

<idAssignmentPointer> [required, unbounded]

Contains the result of the verification procedure. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in ResultMinor in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checkSumAlgorithmNotSupportedWarning
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checkSumInvalid.

4.3 metaDataSectionValidityType

The **tr:metaDataSectionValidityType** is based on the definition of the metadataSection-element in **[TR-ESOR-F]** defined as follows:

```
<complexType name="metaDataSectionValidityType">
  <sequence>
    <element name="metaDataObject" type="tr:metaDataObjectValidityType"
        maxOccurs="unbounded">
    </element>
  </sequence>
</complexType>
```

It contains the following sequence of elements:

<metaDataObject> [required, unbounded]

Contains the result of the verification procedure for a metaDataObject-element, which is of type **tr:metaDataObjectValidityType**.

The **tr:metaDataObjectValidityType** is defined as follows:

```
<complexType name="metaDataObjectValidityType">
  <sequence>
    <element name="relatedObjects" minOccurs="0">
      <complexType>
        <sequence>
          <element name="XPath" type="string" maxOccurs="unbounded"/>
        </sequence>
      </complexType>
    </element>
    <element name="checkSum" type="vr:VerificationResultType" minOccurs="0"/>
    <element name="category" type="vr:VerificationResultType" minOccurs="0"/>
    <element name="classification" type="vr:VerificationResultType" minOccurs="0"/>
    <element name="content" type="vr:VerificationResultType" minOccurs="0"/>
    <element name="dataObjectReference" type="tr:dataObjectReferenceValidityType"
        minOccurs="0"/>
  </sequence>
  <attribute name="metaDataID" type="string" use="required"/>
</complexType>
```

`@metaDataID` [required]

This attribute contains a unique identifier of current meta data object.

`<relatedObjects>` [optional]

If the `metaDataObject`-element in the XAIP contains a `relatedObjects`-attribute there will be a `relatedObjects`-element in the verification report, which point to the elements in the XAIP using corresponding XPath-expressions.

`<checkSum>` [optional]

If the `metaDataObject`-element contains a `checkSum`-element there will be a corresponding `checkSum`-element within the verification report, which contains the result of the corresponding verification procedure. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in the `dataObjectCheckSum/ResultMinor`-element:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checkSumAlgorithmNotSupportedWarning
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checkSumInvalid.

`<category>` [optional]

This element indicates whether the specified `category`-attribute is among the admissible or recommended values as specified in **[TR-ESOR-F]** or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

`<classification>` [optional]

This element indicates whether the specified `classification`-attribute is among the admissible or recommended values as specified in **[TR-ESOR-F]** or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

`<content>` [optional]

This element indicates whether the content of the provided `metaDataObject`-element is as specified by a certain profile. Unless the verification of the XAIP is performed with respect to a specific profile, this element is omitted. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

`<dataObjectReference>` [optional]

This element may contains the result of the verification of given reference of a meta data object, in case of LXAIP (c.f. section 4.3.1 for more information).

4.3.1 Referenced metaDataObjects in the metaDataSection

In case of a LXAIP, there will be one or more `asic:DataObjectReference`-elements (c.f. **[TR-ESOR-F]**, section 3.2.1) in `xaip:xmlMetaData` -elements existing. The verification result of such elements can be documented in **tr:dataObjectReferenceValidityType**, which is defined as follows:

```
<complexType name="dataObjectReferenceValidityType">
  <sequence>
    <element name="FormatOK" type="vr:VerificationResultType"/>
    <element name="ReferenceOK" type="vr:VerificationResultType"/>
  </sequence>
</complexType>
```

It contains the following sequence of elements:

`<FormatOK>` [required]

This element indicates whether the format of the given `asic:DataObjectReference`-element according to

[TR-ESOR-F] is syntactically correct or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in `ResultMinor` in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/invalidFormat.

`<ReferenceOK>` [required]

This element indicates whether the reference contained in the given `asic:DataObjectReference`-element according to **[TR-ESOR-F]** could be successfully resolved. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in `ResultMinor` in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checkSumAlgorithmNotSupportedWarning
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checkSumInvalid
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/unknownURIType
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/URINotResolvable.

4.4 dataObjectsSectionValidityType

The **tr:dataObjectsSectionValidityType** is based on the definition of the `dataObjectSection`-element in **[TR-ESOR-F]** defined as follows:

```
<complexType name="dataObjectsSectionValidityType">
  <sequence>
    <element name="dataObject" type="tr:dataObjectValidityType"
        maxOccurs="unbounded" />
    </sequence>
</complexType>
```

It contains the following sequence of elements:

`<dataObject>` [required, unbounded]

Contains the result of the verification procedure for a `dataObject`-element, which is of type **tr:dataObjectValidityType**.

The **tr:dataObjectValidityType** is defined as follows:

```
<complexType name="dataObjectValidityType">
  <sequence>
    <element name="relatedObjects" minOccurs="0">
      <complexType>
        <sequence>
          <element name="XPath" type="string" maxOccurs="unbounded"/>
        </sequence>
      </complexType>
    </element>
    <element name="FormatOK" type="vr:VerificationResultType" minOccurs="0"/>
    <element name="checkSum" type="vr:VerificationResultType" minOccurs="0"/>
    <element name="transformInfo" type="tr:transformInfoValidityType"
        minOccurs="0"/>
    <element name="dataObjectReference" type="tr:dataObjectReferenceValidityType"
        minOccurs="0"/>
  </sequence>
  <attribute name="dataObjectID" type="string" use="required"/>
</complexType>
```

`@dataObjectID` [required]

The value of this attribute describes the unique id of this data object.

`<relatedObjects>` [optional]

If the `dataObject`-element in the XAIP contains a `relatedObjects`-attribute there will be a `relatedObjects`-element in the verification report, which point to the designated `metaDataObject` or `credential`-elements etc. in the XAIP using corresponding XPath-expressions.

<FormatOK> [optional]

If present, this element indicates whether the format of the dataObject-element is syntactically correct or not. For data provided in the binaryData alternative, this check should include a validation according to the document format specified by the MimeType-attribute within the binaryData-element. For XML-based data within xmlData-element this check must ensure that the contained data is well formed XML. Furthermore, an implementation may support additional XML-schema validation steps. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in the FormatOK/ResultMinor-element:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/invalidFormat
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/uncheckedFormatWarning.

<checkSum> [optional]

If the dataObject-element contains a checkSum-element there will be a checkSum-element within the verification report, which contains the result of the corresponding verification procedure. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in the checkSum/ResultMinor-element:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checksumAlgorithmNotSupportedWarning
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checksumInvalid.

<transformInfo> [optional]

If present, this element contains the verification for the transformation objects. The element is of type **tr:transformInfoValidityType**.

The **tr:transformInfoValidityType** is defined as follows:

```
<complexType name="TransformInfoValidityType">
  <sequence>
    <element name="transformObject" type="vr:VerificationResultType"
        maxOccurs="unbounded"/>
  </sequence>
  <attribute name="transformObjectID" type="string" use="required"/>
</complexType>
```

@transformObjectID [required]

This attribute allows to unique reference given transformation object.

<transformObject> [required]

For each transformObject-element contained in the XAIP there will be transformObject within the verification report, which contains the result of the corresponding verification procedure. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**. In the present profile of the XAIP-structure the transformInfo-element must be omitted.

<dataObjectReference> [optional]

This element may contains the result of the verification of given reference of a data object, in case of LXAIP (c.f. section 4.4.1 for more information).

4.4.1 Referenced dataObjects in the dataObjectsSection

In case of a LXAIP, there will be one or more asic:DataObjectReference-elements (c.f. **[TR-ESOR-F]**, section 3.2.1) in xaip:xmlData-elements existing. The verification result of such elements can be documented in **tr:dataObjectReferenceValidityType**, which is defined as follows:

```
<complexType name="dataObjectReferenceValidityType">
  <sequence>
    <element name="FormatOK" type="vr:VerificationResultType"/>
    <element name="ReferenceOK" type="vr:VerificationResultType"/>
  </sequence>
</complexType>
```

It contains the following sequence of elements:

`<FormatOK>` [required]

This element indicates whether the format of the given `asic:DataObjectReference`-element according to **[TR-ESOR-F]** is syntactically correct or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in `ResultMinor` in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/invalidFormat.

`<ReferenceOK>` [required]

This element indicates whether the reference contained in the given `asic:DataObjectReference`-element according to **[TR-ESOR-F]** could be successfully resolved. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in `ResultMinor` in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checkSumAlgorithmNotSupportedWarning
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checkSumInvalid
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/unknownURIType
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/URINotResolvable.

4.5 credentialsSectionValidityType

The **tr:credentialsSectionValidityType** is based on the definition of the `credentialsSection`-element in **[TR-ESOR-F]** defined as follows:

```
<complexType name="credentialsSectionValidityType">
  <sequence>
    <element name="credential" type="tr:credentialValidityType"
        maxOccurs="unbounded"/>
  </sequence>
</complexType>
```

It contains the following sequence of elements:

`<credential>` [required, unbounded]

Contains the result of the verification procedure for a `credential`-element, which is of type **tr:credentialValidityType**.

NOTICE 8
As the given signature object could consist of multiple signatures[10], the resulting verification report must include the same number of `credential`*-elements, containing the same* `credentialID`*.*

NOTICE 9
Some attached signatures embedded into the signed data[11] would not be placed in the credential section but depending of kind of carrying data (together with the data) in the data section or (together with the metadata) in the metadata section of an XAIP. In such a case, dedicated `credential`*-elements (containing the verification reports of the particular embedded signatures) must be created in the element* `tr:credentialsSection` *of the verification report (element* `tr:XAIPReport`*). The* `credentialID`*–attribute of each created* `credential`*-element must be set to the value of the corresponding* `dataObject`*-element.*

[10] E.g. a single CAdES could contain multiple `SignerInfo`-elements and thus consists of multiple signatures, which are referencing the same signed object.

[11] This could be e.g. PAdES or enveloped XAdES etc..

The **tr:credentialValidityType** is defined as follows:

```
<complexType name="credentialValidityType">
  <sequence>
    <element name="relatedObjects" minOccurs="0">
      <complexType>
        <sequence>
          <element name="XPath" type="string" maxOccurs="unbounded"/>
        </sequence>
      </complexType>
    </element>
    <choice>
      <element ref="vr:DetailedSignatureReport"/>
      <element ref="vr:IndividualCertificateReport"/>
      <element ref="vr:IndividualAttributeCertificateReport"/>
      <element ref="vr:IndividualCRLReport"/>
      <element ref="vr:IndividualOCSPReport"/>
      <element ref="vr:IndividualTimeStampReport"/>
      <element ref="tr:EvidenceRecordReport"/>
      <element ref="evr:ValidityReport"/>
      <element name="other" type="vr:VerificationResultType"/>
    </choice>
    <element name="dataObjectReference" type="tr:dataObjectReferenceValidityType"
        minOccurs="0"/>
  </sequence>
  <attribute name="credentialID" type="string" use="required"/>
</complexType>
```

`@credentialID` [required]

Contains the `credentialID`-attribute of the current credential object for informational purposes.

`<relatedObjects>` [optional]

If the `credential`-element in the XAIP contains a `relatedObjects`-attribute there will be a `relatedObjects`-element in the verification report, which point to the elements in the XAIP using corresponding XPath-expressions.

`<DetailedSignatureReport>` [choice]

If the `credential`-element in the XAIP contains a `dss:SignatureObject`-element with an included `ds:Signature`, `dss:Base64Signature` or `dss:SignaturePtr` there will be a `vr:DetailedSignatureReport`-element according to **[OASIS VR]**, section 3.5 in the verification report.

`<IndividualCertificateReport>` [choice]

If the `credential`-element in the XAIP contains a `certificateValues`- or `certificateRefs`-element with an X.509-based public key certificate, there will be a `vr:IndividualCertificateReport`-element according to **[OASIS VR]**, section 3.5.6 in the verification report.

`<IndividualAttributeCertificateReport>` [choice]

If the `credential`-element in the XAIP contains a `certificateValues`- or `certificateRefs`-element with an X.509-based attribute certificate, there will be a `vr:IndividualAttributeCertificateReport`-element according to **[OASIS VR]**, section 3.5.7 in the verification report.

`<IndividualCRLReport>` [choice]

If the `credential`-element in the XAIP contains a `revocationValues`- or `revocationsRefs`-element with an X.509-based certificate revocation list, there will be a `vr:IndividualCRLReport`-element according to **[OASIS VR]**, section 3.5.8 in the verification report.

`<IndividualOCSPReport>` [choice]

If the `credential`-element in the XAIP contains a `revocationValues`- or `revocationsRefs`-element with an OCSP response according to **[RFC2560]** there will be a `vr:IndividualOCSPReport`-element according to **[OASIS VR]**, section 3.5.8 in the verification report.

`<IndividualTimeStampReport>` [choice]

> If the `credential`-element in the XAIP contains a `dss:SignatureObject`-element with an included `dss:Timestamp-element` there will be a `vr:IndividualTimeStampReport`-element according to **[OASIS VR],** section 3.5.5 in the verification report.

`<EvidenceRecordReport>` [choice]

> If the `credential`-element in the XAIP contains an `evidenceRecord`-element there will be an `tr:EvidenceRecordReport`-element according to section 3.1 in the verification report.

`<ValidityReport>` [choice]

> Alternative to the elements named above a validation report according to **[ETSI TS 119102-2]** can be placed in the `evr:ValidityReport`-element in the verification report.

`<other>` [choice]

> If the `credential`-element in the XAIP contains an `other`-element there will be other verification information. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**. In the present profile of the `XAIP`-structure the `other`-element must be omitted.

NOTICE 10

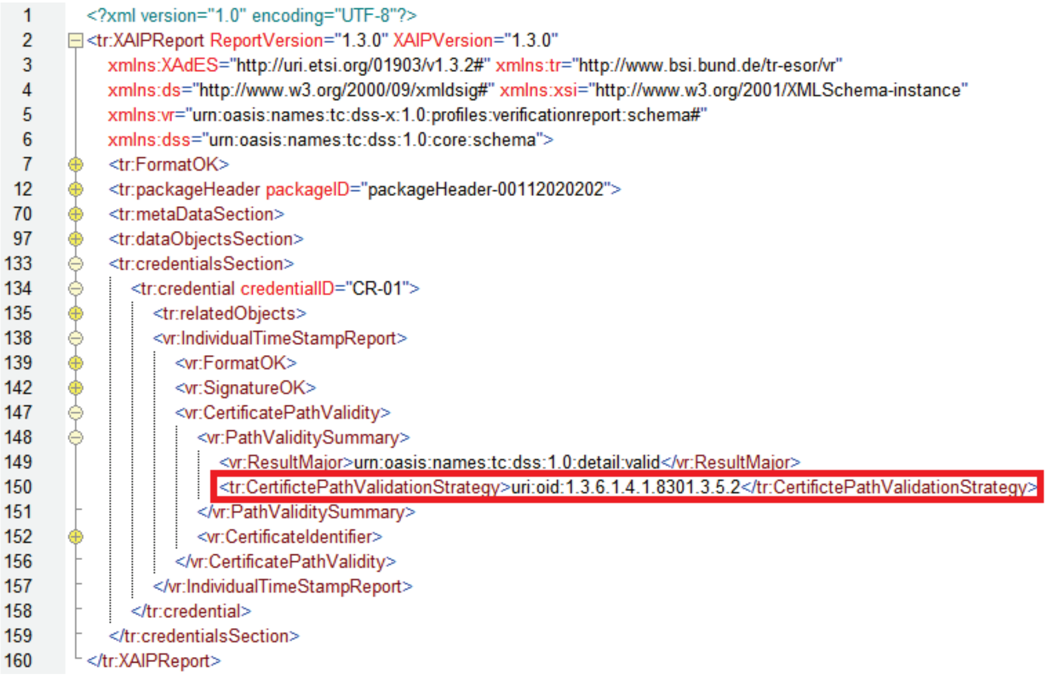
The used certificate path validation strategy should be manifested by inserting a corresponding instance of element <CertificatePathValidationStrategy> (cf. section 3.2.1) in the corresponding element of a particular report under consideration:

- *<DetailedSignatureReport>/<CertificatePathValidity>/<PathValiditySummary>*
- *<IndividualCertificateReport>/<ChainingOK>*
- *<IndividualAttributeCertificateReport>/<CertificatePathValidity>/<PathValiditySummary>*
- *<IndividualCRLReport>/<CertificatePathValidity>/<PathValiditySummary>*
- *<IndividualOCSPReport>/<CertificatePathValidity>/<PathValiditySummary>*
- *<IndividualTimeStampReport>/<CertificatePathValidity>/<PathValiditySummary>*
- *<tr:EvidenceRecordReport> → c.f. section 3.1*

, e.g. for XAIPReport:

<tr:XAIPReport>/<tr:credentialsSection>/<tr:credential>/<vr:IndividualTimeStampReport>/<vr:CertificatePathValidity>/<vr:PathValiditySummary>/<tr:CertificatePathValidationStrategy>

, see also the following Figure 4.



```
<?xml version="1.0" encoding="UTF-8"?>
<tr:XAIPReport ReportVersion="1.3.0" XAIPVersion="1.3.0"
  xmlns:XAdES="http://uri.etsi.org/01903/v1.3.2#" xmlns:tr="http://www.bsi.bund.de/tr-esor/vr"
  xmlns:ds="http://www.w3.org/2000/09/xmldsig#" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:vr="urn:oasis:names:tc:dss-x:1.0:profiles:verificationreport:schema#"
  xmlns:dss="urn:oasis:names:tc:dss:1.0:core:schema">
  <tr:FormatOK>
  <tr:packageHeader packageID="packageHeader-00112020202">
  <tr:metaDataSection>
  <tr:dataObjectsSection>
  <tr:credentialsSection>
    <tr:credential credentialID="CR-01">
      <tr:relatedObjects>
      <vr:IndividualTimeStampReport>
        <vr:FormatOK>
        <vr:SignatureOK>
        <vr:CertificatePathValidity>
          <vr:PathValiditySummary>
            <vr:ResultMajor>urn:oasis:names:tc:dss:1.0:detail:valid</vr:ResultMajor>
            <tr:CertifictePathValidationStrategy>uri:oid:1.3.6.1.4.1.8301.3.5.2</tr:CertifictePathValidationStrategy>
          </vr:PathValiditySummary>
          <vr:CertificateIdentifier>
        </vr:CertificatePathValidity>
      </vr:IndividualTimeStampReport>
    </tr:credential>
  </tr:credentialsSection>
</tr:XAIPReport>
```

Figure 4: XAIPReport

`<dataObjectReference>` [optional]

This element may contains the result of the verification of given reference of a credential, in case of LXAIP (c.f. section 4.5.1 for more information).

4.5.1 Referenced Credentials in the credentialSection

In case of a LXAIP, there will be one or more `asic:DataObjectReference`-elements (c.f. [TR-ESOR-F], section 3.2.1) in `xaip:other` -elements existing. The verification result of such elements can be documented in **tr:dataObjectReferenceValidityType**, which is defined as follows:

```
<complexType name="dataObjectReferenceValidityType">
  <sequence>
    <element name="FormatOK" type="vr:VerificationResultType"/>
    <element name="ReferenceOK" type="vr:VerificationResultType"/>
  </sequence>
</complexType>
```

It contains the following sequence of elements:

`<FormatOK>` [required]

This element indicates whether the format of the given `asic:DataObjectReference`-element according to **[TR-ESOR-F]** is syntactically correct or not. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in `ResultMinor` in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/invalidFormat

`<ReferenceOK>` [required]

This element indicates whether the reference contained in the given `asic:DataObjectReference`-element according to **[TR-ESOR-F]** could be successfully resolved. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

The following identifier may appear in `ResultMinor` in case of an error:

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checkSumAlgorithmNotSupportedWarning
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/checkSumInvalid
- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/unknownURIType

- http://www.bsi.bund.de/tr-esor/api/1.3/resultminor/URINotResolvable.

4.6 updateSectionValidityType

The **tr:updateSectionValidityType** is based on the definition of the `updateSection`-element in **[TR-ESOR-F]** defined as follows:

```
<complexType name="updateSectionValidityType">
  <sequence>
    <element name="prevVersion" type="vr:VerificationResultType"/>
    <element name="placeHolder" type="vr:VerificationResultType"
        maxOccurs="unbounded" minOccurs="0"/>
  </sequence>
</complexType>
```

It contains the following sequence of elements:

`<prevVersion>` [required]

Indicates whether the indicated previous version exists and is the most recent version within the existing XAIP. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

`<placeHolder>` [optional, unbounded]

Indicates whether the corresponding element, which is specified by the `placeHolder`-element exists within the existing XAIP. More information on the use of the **vr:VerificationResultType** may be found in section 3.4 of **[OASIS VR]**.

5 Appendix - XML-Schema-Definition

```
<?xml version="1.0" encoding="UTF-8"?>
<schema xmlns="http://www.w3.org/2001/XMLSchema"
        xmlns:tr="http://www.bsi.bund.de/tr-esor/vr"
        xmlns:vr="urn:oasis:names:tc:dss-x:1.0:profiles:verificationreport:schema#"
        xmlns:xaip="http://www.bsi.bund.de/tr-esor/xaip"
        xmlns:dss="urn:oasis:names:tc:dss:1.0:core:schema"
        xmlns:evr="http://uri.etsi.org/19102/v1.2.1#"
        targetNamespace="http://www.bsi.bund.de/tr-esor/vr"
        elementFormDefault="qualified" attributeFormDefault="unqualified"
        version="1.3.0">
  <!-- ======================================= -->
  <!-- Version 1.3.0 vom 14.03.2022            -->
  <!-- ======================================= -->
  <import namespace="urn:oasis:names:tc:dss:1.0:core:schema"
    schemaLocation="./deps/oasis-dss-core-schema-v1.0-os.xsd"/>
  <import namespace="urn:oasis:names:tc:dss-x:1.0:profiles:verificationreport:schema#"
    schemaLocation="./deps/oasis-dssx-1.0-profiles-verification-report-cs1.xsd"/>
  <import namespace="http://uri.etsi.org/19102/v1.2.1#"
    schemaLocation="./deps/TS119102-2-v122.xsd"/>
  <!-- ===================================================== -->
  <!-- EvidenceRecordValidityType, section 3.1 of TR-ESOR-VR -->
  <!-- ===================================================== -->
  <element name="EvidenceRecordReport" type="tr:EvidenceRecordValidityType"/>
  <complexType name="EvidenceRecordValidityType">
    <sequence>
      <element name="FormatOK" type="vr:VerificationResultType"/>
      <element name="Version" type="anyURI" minOccurs="0"/>
      <element name="DigestAlgorithm" type="vr:AlgorithmValidityType" minOccurs="0"
        maxOccurs="unbounded"/>
      <element name="CryptoInfos" minOccurs="0">
        <complexType>
          <sequence>
            <element name="Attribute" type="vr:AttributeType" maxOccurs="unbounded"/>
          </sequence>
        </complexType>
      </element>
      <element name="EncryptionInfo" minOccurs="0">
        <complexType>
          <sequence>
            <element name="EncryptionInfoType" type="vr:AlgorithmValidityType"/>
            <element name="EncryptionInfoValue" type="dss:AnyType"/>
          </sequence>
        </complexType>
      </element>
      <element name="ArchiveTimeStampSequence">
        <complexType>
          <sequence minOccurs="0" maxOccurs="unbounded">
            <element name="ArchiveTimeStampChain">
              <complexType>
                <sequence minOccurs="0" maxOccurs="unbounded">
                  <element name="ArchiveTimeStamp"
                    type="vr:ArchiveTimeStampValidityType"/>
                </sequence>
              </complexType>
            </element>
          </sequence>
        </complexType>
      </element>
    </sequence>
    <attribute name="Id" type="ID" use="optional"/>
    <attribute name="ReportVersion" use="required" fixed="1.3.0"/>
  </complexType>
  <!-- section 3.2 of TR-ESOR-VR -->
  <complexType name="ArchiveTimeStampValidityType">
    <sequence>
      <element name="FormatOK" type="vr:VerificationResultType"/>
      <element name="DigestAlgorithm" type="vr:AlgorithmValidityType" minOccurs="0"/>
      <element name="Attributes" minOccurs="0">
        <complexType>
          <sequence>
            <element name="Attribute" type="vr:AttributeType" maxOccurs="unbounded"/>
          </sequence>
        </complexType>
      </element>
      <element name="ReducedHashTree" minOccurs="0">
        <complexType>
          <sequence maxOccurs="unbounded">
            <element name="PartialHashTree">
              <complexType>
                <sequence maxOccurs="unbounded">
                  <element name="HashValue" type="vr:HashValueType"/>
                </sequence>
              </complexType>
            </element>
          </sequence>
        </complexType>
      </element>
      <element name="TimeStamp" type="vr:TimeStampValidityType"/>
    </sequence>
    <attribute name="Id" type="ID" use="optional"/>
  </complexType>
  <complexType name="HashValueType">
    <sequence>
      <element name="HashValue" type="hexBinary"/>
    </sequence>
    <attribute name="HashedObject" type="IDREF" use="optional"/>
  </complexType>
  <!-- section 3.2.1 of TR-ESOR-VR, introduced in the TR-ESOR-1.3 in order to document
the signature validation model -->
  <element name="CertificatePathValidationStrategy"
    type="tr:CertificatePathValidationStrategyType"/>
  <simpleType name="CertificatePathValidationStrategyType">
    <restriction base="string">
      <!-- validityModelChain -->
      <enumeration value="uri:oid:1.3.6.1.4.1.8301.3.5.1"/>
      <!-- validityModelShell -->
      <enumeration value="uri:oid:1.3.6.1.4.1.8301.3.5.2"/>
    </restriction>
  </simpleType>
  <!-- =============== -->
  <!-- XAIPValidityType: section 4 of TR-ESOR-VR -->
  <!-- =============== -->
  <element name="XAIPReport" type="tr:XAIPValidityType"/>
  <!-- section 4.1 of  TR-ESOR-VR -->
  <complexType name="XAIPValidityType">
    <sequence>
      <element name="FormatOK" type="vr:VerificationResultType"/>
      <element name="packageHeader" type="tr:packageHeaderValidityType"/>
      <element name="metaDataSection" type="tr:metaDataSectionValidityType"
        minOccurs="0"/>
      <element name="dataObjectsSection" type="tr:dataObjectsSectionValidityType"
        minOccurs="0"/>
      <element name="credentialsSection" type="tr:credentialsSectionValidityType"
        minOccurs="0"/>
      <element name="updateSection" type="tr:updateSectionValidityType" minOccurs="0"/>
    </sequence>
    <attribute name="XAIPVersion" type="string" use="required"/>
    <attribute name="ReportVersion" use="required" fixed="1.3.0"/>
  </complexType>
  <!-- section 4.2 of TR-ESOR-VR -->
  <complexType name="packageHeaderValidityType">
    <sequence>
      <element name="AOID" type="string" minOccurs="0"/>
      <element name="versionManifest" type="tr:versionManifestValidityType" minOccurs="0"
        maxOccurs="unbounded"/>
      <element name="canonicalizationMethod" type="vr:VerificationResultType"
        minOccurs="0"/>
      <element name="extension" type="vr:VerificationResultType" minOccurs="0"/>
    </sequence>
    <attribute name="packageID" type="string" use="required"/>
  </complexType>
  <!-- section 4.2.1 of TR-ESOR-VR -->
  <complexType name="versionManifestValidityType">
    <sequence>
      <element name="preservationInfo" type="vr:VerificationResultType"/>
      <element name="submissionInfo" type="tr:submissionInfoValidityType" minOccurs="0"/>
      <element name="packageInfoUnit" type="tr:packageInfoUnitValidityType" minOccurs="0"
        maxOccurs="unbounded"/>
      <element name="idAssignmentList" type="tr:idAssignmentListValidityType"
        minOccurs="0"/>
      <element name="extension" type="vr:VerificationResultType" minOccurs="0"/>
    </sequence>
    <attribute name="VersionID" type="string" use="required"/>
  </complexType>
  <!-- section 4.2.1.1 of TR-ESOR-VR -->
  <complexType name="submissionInfoValidityType">
    <sequence>
      <element name="submissionTime" type="vr:VerificationResultType" minOccurs="0"/>
      <element name="extension" type="vr:VerificationResultType" minOccurs="0"/>
    </sequence>
  </complexType>
  <!-- section 4.2.1.2 of TR-ESOR-VR -->
  <complexType name="packageInfoUnitValidityType">
    <sequence>
      <element name="objectPointer" type="vr:VerificationResultType"/>
      <element name="extension" type="vr:VerificationResultType" minOccurs="0"/>
    </sequence>
    <attribute name="packageUnitID" type="string" use="required"/>
  </complexType>
  <!-- section 4.2.1.3 of TR-ESOR-VR -->
  <complexType name="idAssignmentListValidityType">
    <sequence>
      <element name="idAssignmentPointer" type="tr:idAssignmentPointerValidityType"
        maxOccurs="unbounded"/>
    </sequence>
    <attribute name="idAssignmentListID" type="string" use="required"/>
  </complexType>
  <complexType name="idAssignmentPointerValidityType">
    <sequence>
      <element name="checkSum" type="vr:VerificationResultType"/>
    </sequence>
    <attribute name="objectRef" type="string" use="required"/>
  </complexType>
  <!-- section 4.3 of TR-ESOR-VR -->
  <complexType name="metaDataSectionValidityType">
    <sequence>
      <element name="metaDataObject" type="tr:metaDataObjectValidityType"
        maxOccurs="unbounded"/>
    </sequence>
  </complexType>
  <complexType name="metaDataObjectValidityType">
    <sequence>
      <element name="relatedObjects">
        <complexType>
          <sequence>
            <element ref="tr:XPath" maxOccurs="unbounded"/>
          </sequence>
        </complexType>
      </element>
      <!-- depending on the discussion outcome -->
      <element name="checkSum" type="vr:VerificationResultType" minOccurs="0"/>
      <element name="category" type="vr:VerificationResultType" minOccurs="0"/>
      <element name="classification" type="vr:VerificationResultType" minOccurs="0"/>
      <element name="content" type="vr:VerificationResultType" minOccurs="0"/>
      <element name="dataObjectReference" type="tr:dataObjectReferenceValidityType"
        minOccurs="0"/>
    </sequence>
    <attribute name="metaDataID" type="string" use="required"/>
  </complexType>
  <!-- section 4.4 in TR-ESOR-VR -->
  <complexType name="dataObjectsSectionValidityType">
    <sequence>
      <element name="dataObject" type="tr:dataObjectValidityType" maxOccurs="unbounded"/>
    </sequence>
  </complexType>
  <complexType name="dataObjectValidityType">
    <sequence>
      <element name="metaDataObjectRefs" minOccurs="0">
        <complexType>
          <sequence>
            <element ref="tr:XPath" maxOccurs="unbounded"/>
          </sequence>
        </complexType>
      </element>
      <element name="FormatOK" type="vr:VerificationResultType" minOccurs="0"/>
      <element name="checksum" type="vr:VerificationResultType" minOccurs="0"/>
      <element name="transformInfo" type="tr:transformInfoValidityType" minOccurs="0"/>
      <element name="dataObjectReference" type="tr:dataObjectReferenceValidityType"
        minOccurs="0"/>
    </sequence>
    <attribute name="dataObjectID" type="string" use="required"/>
  </complexType>
  <complexType name="transformInfoValidityType">
    <sequence>
      <element name="transformObject" type="vr:VerificationResultType"
        maxOccurs="unbounded"/>
    </sequence>
    <attribute name="transformObjectID" type="string" use="required"/>
  </complexType>
  <complexType name="dataObjectReferenceValidityType">
    <sequence>
      <element name="FormatOK" type="vr:VerificationResultType"/>
      <element name="ReferenceOK" type="vr:VerificationResultType"/>
    </sequence>
  </complexType>
  <!-- section 4.5 in TR-ESOR-VR -->
  <complexType name="credentialsSectionValidityType">
    <sequence>
      <element name="credential" type="tr:credentialValidityType" maxOccurs="unbounded"/>
    </sequence>
  </complexType>
  <element name="XPath" type="string"/>
  <complexType name="credentialValidityType">
    <sequence>
      <element name="relatedObjects" minOccurs="0">
        <complexType>
          <sequence>
            <element ref="tr:XPath" maxOccurs="unbounded"/>
          </sequence>
        </complexType>
      </element>
      <choice>
        <element ref="vr:DetailedSignatureReport"/>
        <element ref="vr:IndividualCertificateReport"/>
        <element ref="vr:IndividualAttributeCertificateReport"/>
        <element ref="vr:IndividualCRLReport"/>
        <element ref="vr:IndividualOCSPReport"/>
        <element ref="vr:IndividualTimeStampReport"/>
        <element ref="tr:EvidenceRecordReport"/>
        <!-- in order to support ETSI verification reports according to ETSI TS 119102-2
-->
        <element ref="evr:ValidationReport"/>
        <element name="other" type="vr:VerificationResultType"/>
      </choice>
      <element name="dataObjectReference" type="tr:dataObjectReferenceValidityType"
        minOccurs="0"/>
    </sequence>
    <attribute name="credentialID" type="string" use="required"/>
  </complexType>
  <!-- section 4.6 in TR-ESOR-VR -->
  <complexType name="updateSectionValidityType">
    <sequence>
      <element name="prevVersion" type="vr:VerificationResultType"/>
      <element name="placeHolder" type="vr:VerificationResultType" minOccurs="0"
maxOccurs="unbounded"/>
    </sequence>
  </complexType>
</schema>
```