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Open Geospatial Consortium

OGC GEOSPATIAL EXENSIBLE ACCESS CONTROL MARKUP LANGUAGE (GEOXACML) 3.0

STANDARD
Implementation

DRAFT

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Open Geospatial Consortium

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I ABSTRACT

This OGC Standard defines the Geospatial eXensible Access Control Markup Language (GeoXACML) 3.0, a geospatial extension to the OASIS eXtensible Access Control Markup Language (XACML) Version 3.0 standard. GeoXACML 3.0 supports the interoperable definition of access rights including geographic conditions based on the XACML 3.0 language, processing model and policy schema. GeoXACML 3.0 provides improvements not in GeoXACML 1.0 resulting from enhancements to the XACML standard, primarily the support of access conditions spanning different XACML categories. This enhancement empowers GeoXACML 3.0 to be a powerful decision engine with support for spatiotemporal access conditions.

As a result of XACML 3.0 deployment model and corresponding implementation flexibility, GeoXACML 3.0 can be operated as a traditional Policy Decision Point or as a cloud-native API gateway.

The OGC GeoXACML 3.0 Standard defines different conformance classes that supports flexible implementation conformance. Starting with the `Core` conformance class, an implementation supports the ISO 19125 geometry model including topological test functions which empowers the indexing of access conditions-based geometry. The `Spatial Analysis` conformance class extends the functions for defining access conditions including the processing of geometries. To support condition evaluation for geometries encoded in different Coordinate Reference System (CRS), the `CRS Transformation` conformance class enables a compliant implementation to undertake dynamic CRS transformation whilst decision making unless prohibited per request. Finally, the `API` conformance class enables operating a GeoXACML 3.0 compliant implementation as an OGC API conformant service (Policy Decision Point).

II KEYWORDS

The following are keywords to be used by search engines and document catalogues.

ogcdoc, OGC document, GeoXACML, XACML

III PREFACE

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IV SECURITY CONSIDERATIONS

As GeoXACML 3.0 defines and extension to XACML 3.0, all security considerations outlined in XACML Version 3.0 section 9 apply.

In addition, the GeoXACML 3.0 aspects outlined in Clause 6.2 should be considered.

V SUBMITTING ORGANIZATIONS

The following organizations submitted this Document to the Open Geospatial Consortium (OGC):

- Secure Dimensions GmbH
- Natural Resources Canada (NRCAN)
- Defense Information Systems Agency (DISA)

1

SCOPE

1 SCOPE

NOTEThis OGC Standard defines the Geospatial eXensible Access Control Markup Language (GeoXACML) 3.0 Core as a geospatial extension to the OASIS eXtensible Access Control Markup Language (XACML) Version 3.0.

This Standard further defines requirements, conformance classes and abstract tests for implementing a geospatially enriched Policy Decision Point (GeoPDP) as defined by the OASIS eXtensible Access Control Markup Language (XACML) Version 3.0.

2

CONFORMANCE

2 CONFORMANCE

All requirements-classes and conformance-classes described in this document are owned by the standard identified.

2.1. Introduction (informative)

As GeoXACML 3.0 is defined as an extension to the XACML Version 3.0 Standard, a GeoXACML 3.0 Core implementation must be fully compliant with the XACML 3.0 specification. In particular, all data types and functions marked **mandatory** are to be supported. In addition, XACML bag and set functions labelled `urn:oasis:names:tc:xacml:x.x:function:type-` must be implemented[1].

As GeoXACML 3.0 introduces the data type `urn:ogc:def:dataType:geoxacml:3.0:geometry` that is compliant with the OGC "Simple Features" geometry model with the restriction that a Geometry Collection to be homogeneous[2]. As such, GeoXACML 3.0 Core supports the use of geometry based on Well-Known-Text and Well-Known-Binary encoding as defined in OGC "Simple Features".

The default GeoXACML 3.0 Coordinate Reference System (CRS) is compliant with the The GeoJSON Format using the value `urn:ogc:def:crs:OGC::CRS84` with the axis order longitude / latitude. The encoding of geometry values in another CRS can be done by using the GeoXACML specific attribute `srid` to be used with the `AttributeValue` XML element. The `srid` is the integer portion of the `EPSG` definition for the CRS.

In order for GeoXACML 3.0 Core to support spatial indexing of policies by target matching, the set of XACML 3.0 condition functions is extended by topology predicates as defined in OGC "Simple Features", section 6.1.2.3.

The GeoXACML 3.0 Standard defines explicit error status codes to indicate processing termination caused by geometry ('geometry-error') and CRS ('crs-error') related errors. Processing a heterogeneous geometry collection will result in 'geometry-collection-error'.

The processing of geometry accuracy is supported via the GeoXACML specific attribute `precision` to be used with the `AttributeValue` XML element. The default precision of 'infinite' can be reduced to the number of decimal places: `precision=4` would indicate a geometry precision of 4 decimal places. The use of precision is optional but can be used in the Authorization Decision Request to express a minimum level of accuracy when deriving the authorization decision. Requesting a higher precision than supported by the implementation or

[1] x.x = 3.0

[2] all geometries of a homogeneous geometry collection must have the same type

by the geometries in the policy or involved in the decision making, the processing is terminated with `Indeterminate` and value 'precision-error'.

GeoXACML 3.0 Core leverages the extension points as identified in the XACML Version 3.0 Standard. Therefore, a GeoXACML 3.0 policy instance document is compliant to the XACML 3.0 Schema defined in the XACML Version 3.0 XML Schema. In addition, a GeoXACML 3.0 Authorization Decision Request and Authorization Response encoded in XML is compliant with the XACML 3.0 schema defined in the XACML Version 3.0 XML Schema.

2.2. GeoXACML 3.0 Conformance Classes

This OGC Standard defines one mandatory and three optional conformance classes.

Conformance to this Standard can be evaluated by using all the relevant tests specified in Annex A (normative) of this document. The framework, concepts, and methodology for testing, and the criteria to be achieved to claim conformance are specified in the OGC Compliance Testing Policies and Procedures and the OGC Compliance Testing web site.

In order to conform to this OGC® Standard, a software implementation SHALL implement the mandatory conformance class specified in Annex A (normative):

- **Core** (mandatory): Defines the data type `Geometry`, support to use the WKT and WKB geometry encoding, and a set of "simple" geometric functions based on OGC "Simple Features" Standard to support indexing of access conditions based on topology.

In addition to the `Core` conformance class, an implementation can further choose to be compliant with any combination of the following conformance classes:

- **Spatial Analysis** (optional): Defines an additional set of "spatial analysis" functions based on the OGC "Simple Features" Standard.
- **CRS Transformation** (optional): Enables an implementation to apply an ad-hoc CRS transformation while deriving an authorization decision.
- **API** (optional): Support OGC API compliance. An implementation provides an OGC API - Common - Part 1: Core[3] compliant landing page, conformance class listing, OpenAPI document and supports requesting an Authorization Decision via an HTTP POST request.

2.2.1. Conformance Model Illustration

The following UML diagram illustrates the GeoXACML 3 conformance classes and their dependencies.

[3]Draft OGC Standard at the time of writing

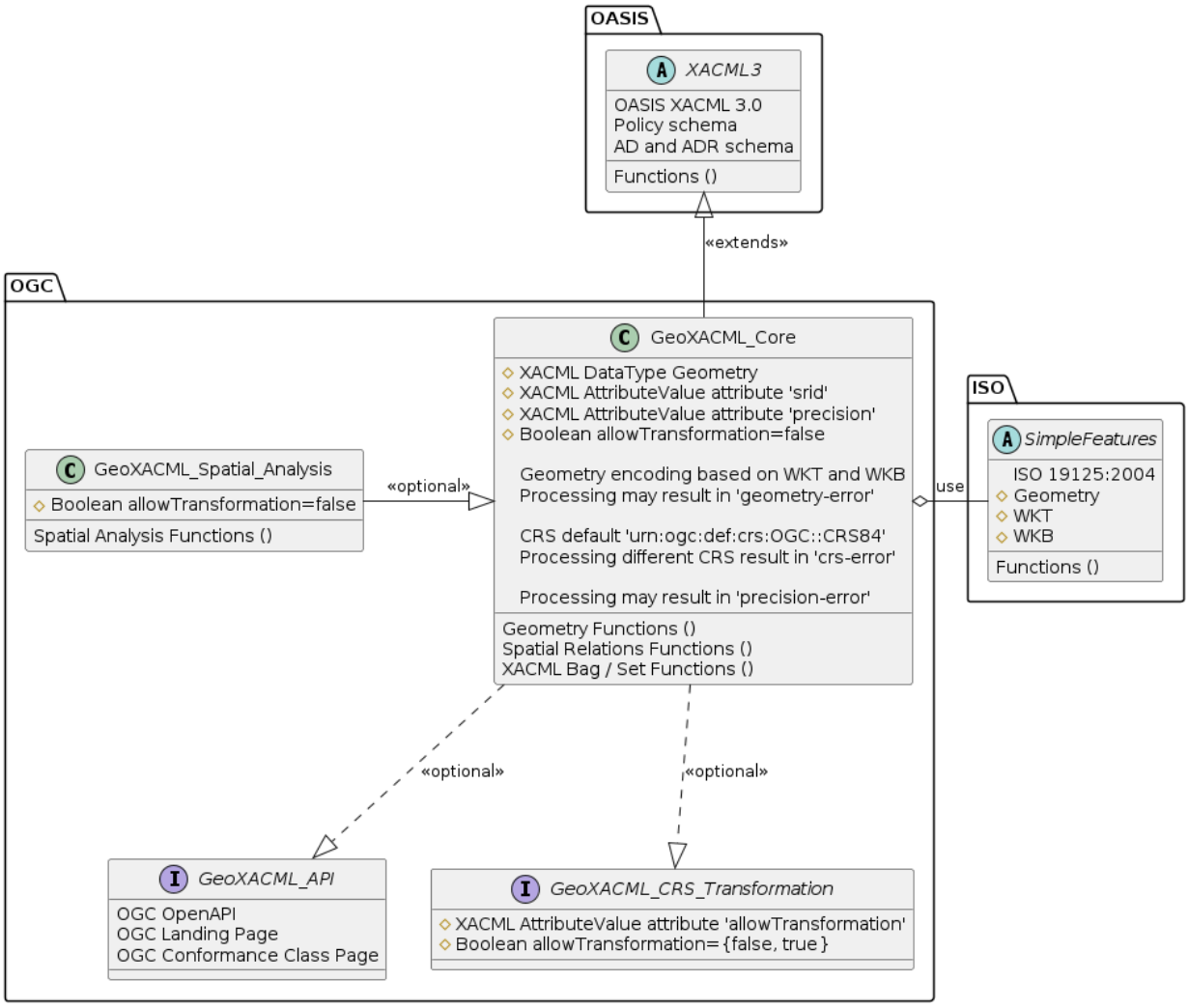

Figure 1 — Conformance Class Model

2.2.2. Conformance Class Core

The `Core` Conformance Class is defined as follows:

CONFORMANCE CLASS 1	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/core`
REQUIREMENTS CLASS	Requirements class 1: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification` Requirements class 2: `http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type` Requirements class 3: `http://www.opengis.net/spec/geoxacml/3.0/req-class/geometry-functions`

CONFORMANCE CLASS 1	
	Requirements class 4: http://www.opengis.net/spec/geoxacml/3.0/req-class/spatial-relations-functions Requirements class 5: http://www.opengis.net/spec/geoxacml/3.0/req-class/xacml-bag-functions Requirements class 6: http://www.opengis.net/spec/geoxacml/3.0/req-class/xacml-set-functions
TARGET TYPE	Implementation
CONFORMANCE TESTS	Conformance test A.1: http://www.opengis.net/spec/geoxacml/3.0/conf/specification/definition Conformance test A.2: http://www.opengis.net/spec/geoxacml/3.0/conf/core/wkt Conformance test A.3: http://www.opengis.net/spec/geoxacml/3.0/conf/core/wkb Conformance test A.4: http://www.opengis.net/spec/geoxacml/3.0/conf/core/geometry-error Conformance test A.5: http://www.opengis.net/spec/geoxacml/3.0/conf/core/default-crs Conformance test A.6: http://www.opengis.net/spec/geoxacml/3.0/conf/core/xacml-attribute-srid Conformance test A.7: http://www.opengis.net/spec/geoxacml/3.0/conf/core/axis-order-crs84 Conformance test A.8: http://www.opengis.net/spec/geoxacml/3.0/conf/core/axis-order-epsg4326 Conformance test A.9: http://www.opengis.net/spec/geoxacml/3.0/conf/core/crs-equal Conformance test A.10: http://www.opengis.net/spec/geoxacml/3.0/conf/core/crs84-epsg4326 Conformance test A.11: http://www.opengis.net/spec/geoxacml/3.0/conf/core/crs-not-equal Conformance test A.12: http://www.opengis.net/spec/geoxacml/3.0/conf/core/geometry-functions Conformance test A.13: http://www.opengis.net/spec/geoxacml/3.0/conf/core/test-functions Conformance test A.14: http://www.opengis.net/spec/geoxacml/3.0/conf/core/spatial-relations-functions Conformance test A.15: http://www.opengis.net/spec/geoxacml/3.0/conf/core/spatial-analysis-functions Conformance test A.16: http://www.opengis.net/spec/geoxacml/3.0/conf/core/xacml-bag-functions Conformance test A.17: http://www.opengis.net/spec/geoxacml/3.0/conf/core/xacml-set-functions

2.2.3. Conformance Class Spatial Analysis

The `Spatial Analysis` Conformance Class is defined as follows:

CONFORMANCE CLASS 2	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/spatial-analysis`
REQUIREMENTS CLASS	Requirements class 7: `http://www.opengis.net/spec/geoxacml/3.0/req-class/analysis`
TARGET TYPE	Implementation
CONFORMANCE TEST	Conformance test A.18: `http://www.opengis.net/spec/geoxacml/3.0/conf/core/advanced-functions`

2.2.4. Conformance Class CRS Transformation

The `CRS Transformation` Conformance Class is defined as follows:

CONFORMANCE CLASS 3	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation`
REQUIREMENTS CLASS	Requirements class 8: `http://www.opengis.net/spec/geoxacml/3.0/req-class/crs-transformation`
TARGET TYPE	Implementation
CONFORMANCE TESTS	Conformance test A.19: `http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation/crs-transformation` Conformance test A.20: `http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation/allow-transformation-1` Conformance test A.21: `http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation/allow-transformation-2` Conformance test A.22: `http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation/allow-transformation-3`

2.2.5. Conformance Class OGC API

The `OGC API` Conformance Class is defined as follows:

CONFORMANCE CLASS 4	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api`
REQUIREMENTS CLASS	Requirements class 9: `http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api`
TARGET TYPE	Implementation
CONFORMANCE TESTS	Conformance test A.23: `http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api/landing-page` Conformance test A.24: `http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api/openapi-page` Conformance test A.25: `http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api/conformance-page` Conformance test A.26: `http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api/decision-endpoint`

3

NORMATIVE REFERENCES

3 NORMATIVE REFERENCES

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

OGC Geographic information — Simple features access — Part 1: Common architecture, ISO, 2004, https://portal.opengeospatial.org/files/?artifact_id=25355

eXtensible Access Control Markup Language (XACML) Version 3.0, OASIS, 2013, http://docs.oasis-open.org/xacml/3.0/xacml-3.0-core-spec-os-en.html

OASIS eXtensible Access Control Markup Language (XACML) Version 3.0 XML Schema, OASIS, 2013, http://docs.oasis-open.org/xacml/3.0/xacml-core-v3-schema-wd-17.xsd

The GeoJSON Format, IETF, 2016, https://www.rfc-editor.org/rfc/rfc7946

4

TERMS, DEFINITIONS AND ABBREVIATED TERMS

4 TERMS, DEFINITIONS AND ABBREVIATED TERMS

This document uses the terms defined in OGC Policy Directive 49, which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word “shall” (not “must”) is the verb form used to indicate a requirement to be strictly followed to conform to this document and OGC documents do not use the equivalent phrases in the ISO/IEC Directives, Part 2.

This document also uses terms defined in the OGC Standard for Modular specifications (OGC 08-131r3), also known as the ‘ModSpec’. The definitions of terms such as standard, specification, requirement, and conformance test are provided in the ModSpec.

For the purposes of this document, the following additional terms and definitions apply.

4.1. Terms and definitions

4.1.1. **GeoPDP**

A Geospatial Policy Decision Point (PDP) is an implementation of GeoXACML 3.0 conformance class `API`. A PDP provides the capabilities to process the data-type Geometry and the functions defined in this OGC Standard. Because a GeoXACML compliant implementation must implement all XACML 3.0 mandatory capabilities, a GeoPDP is always capable of processing “pure” XACML 3.0 policies: Authorization Decision Request (ADR) and Authorization Decision (AD).

4.1.2. XACML definitions

The following definitions, as defined in the XACML Version 3.0 Standard are listed here for ease of reading.

4.1.2.1. Authorization Decision (AD)

The result of evaluating applicable policy, returned by the PDP to the PEP. A function that evaluates to “Permit”, “Deny”, “Indeterminate” or “NotApplicable”, and (optionally) a set of obligations.

4.1.2.2. Bag

An unordered collection of values, in which there may be duplicate values.

4.1.2.3. Decision

The result of evaluating a rule, policy or policy set.

4.1.2.4. Authorization Decision Request (ADR)

The request to a PDP or GeoPDP to render an authorization decision.

4.1.2.5. Policy

A set of rules, an identifier for the rule-combining algorithm and (optionally) a set of obligations.

4.1.2.6. Policy decision point (PDP)

The system entity that evaluates applicable policy and renders an authorization decision. This term is defined in a joint effort by the IETF Policy Framework Working Group and the Distributed Management Task Force (DMTF)/Common Information Model (CIM) in [RFC3198]. This term corresponds to “Access Decision Function” (ADF) in [ISO10181-3].

4.1.2.7. Policy enforcement point (PEP)

The system entity that performs access control, by making decision requests and enforcing authorization decisions. This term is defined in a joint effort by the IETF Policy Framework Working Group and the Distributed Management Task Force (DMTF)/Common Information Model (CIM) in [RFC3198]. This term corresponds to “Access Enforcement Function” (AEF) in [ISO10181-3].

4.1.2.8. Policy information point (PIP)

The system entity that acts as a source of attribute values.

4.1.2.9. Rule

A target, an effect and a condition.

4.2. Abbreviated terms

AD	Authorization Decision
ADR	Authorization Decision Request

5

CONVENTIONS

5 CONVENTIONS

This Clause provides details and examples for any conventions used in this Standard. Examples of conventions are symbols, abbreviations, use of XML schema, or special notes regarding how to read the document.

5.1. Identifiers

The normative provisions in this standard are denoted by the URI

`http://www.opengis.net/spec/geoxacml/3.0`

All requirements and conformance tests that appear in this document are denoted by partial URIs which are relative to this base.

6

GEOXACML 3.0 INTRODUCTION (INFORMATIVE)

6 GEOXACML 3.0 INTRODUCTION (INFORMATIVE)

This Clause introduces GeoXACML 3.0 concepts and how the extension points from XACML 3.0 are used to enable the declaration and enforcement of access conditions involving geographic conditions.

6.1. Defining an extension to XACML 3.0

The XACML 3.0 specification defines the extensibility points in (XACML Version 3.0, section 8). The `DataType`, `FunctionId`, `AttributeId` and `StatusCode` are extended by GeoXACML 3.0.

NOTEPlease see the XACML 3.0 schema definitions in http://docs.oasis-open.org/xacml/3.0/xacml-core-v3-schema-wd-17.xsd for details.

6.1.1. Defining a new Data-Type

Section 8.1 of the XACML 3.0 specification states that *The following XML attributes have values that are URIs. These may be extended by the creation of new URIs associated with new semantics for these attributes. ... "Category, AttributeId, DataType, FunctionId, MatchId, ObligationId, AdviceId, PolicyCombiningAlgId, RuleCombiningAlgId, StatusCode, SubjectCategory.*

This capability allows the definition of the `Geometry` data-type. The XACML compliant URN, defined in this OGC Standard is `urn:ogc:def:dataType:geoxacml:3.0:geometry`.

6.1.2. Encoding of Data-Type Geometry

Section 8.2 of the XACML specification states that *"<xacml:AttributeValue> and <xacml-context:AttributeValue> elements MAY contain an instance of a structured XML data-type."*.

This provides two options for encoding a geometry:

1. As a string value to the <AttributeValue> element

   The GeoXACML 3.0 Core defines the mandatory encoding for using the string value to use Well Known Text or Well Known Binary

2. As XML

   The GeoXACML 3.0 Core defines an extension point such that Encoding Extension can define different XML encodings.

```
<xs:element name="AttributeValue" type="xacml:AttributeValueType"
substitutionGroup="xacml:Expression"/>
<xs:complexType name="AttributeValueType" mixed="true">
  <xs:complexContent mixed="true">
    <xs:extension base="xacml:ExpressionType">
      <xs:sequence>
        <xs:any namespace="##any" processContents="lax" minOccurs="0"
                maxOccurs="unbounded"/>
      </xs:sequence>
      <xs:attribute name="DataType" type="xs:anyURI" use="required"/>
        <xs:anyAttribute namespace="##any" processContents="lax"/>
    </xs:extension>
  </xs:complexContent>
</xs:complexType>
```

Figure 2 — XACML schema definition of the <AttributeValue> element

Note: GeoXACML 3 Core does no support XML based geometry encoding.

```
<xacml3:AttributeValue
    DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
    >POINT(-77.035278 38.889444)</xacml3:AttributeValue>
```

Figure 3 — Geometry encoding example based on WKT and default CRS

```
<xacml3:AttributeValue xmlns:geoxacml="http://www.opengis.net/spec/geoxacml/3.
0"
    DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
    geoxacml:srid="4326"
    >POINT(38.889444 -77.035278)</xacml3:AttributeValue>
```

Figure 4 — Geometry encoding example based on WKT and explicit CRS definition

```
<xacml3:AttributeValue
    DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
    >01010000002c11a8fe414253c0cccf0d4dd9714340</xacml3:AttributeValue>
```

Figure 5 — Geometry encoding example based on WKB and default CRS

```
<xacml3:AttributeValue xmlns:geoxacml="http://www.opengis.net/spec/geoxacml/3.
0"
    DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
    geoxacml:srid="4326"
    >0101000000cccf0d4dd97143402c11a8fe414253c0</xacml3:AttributeValue>
```

Figure 6 — Geometry encoding example based on WKB and explicit CRS definition

6.1.3. Defining a new Function

A `<Function>` element has an attribute named FunctionId, which is of type `xs:anyURI`. According to the XACML extension capabilities, additional functions can be defined by associating a unique `FunctionId`.

As specified in GeoXACML, this capability allows the definition of geo-specific functions.

```
<xs:element name="Function" type="xacml:FunctionType"/>
<xs:complexType name="FunctionType">
  <xs:attribute name="FunctionId" type="xs:anyURI" use="required"/>
</xs:complexType>
```

Figure 7 — XACML schema definition of the <Function> element

```
<xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-equals">
    <xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-one-
and-only">
        <xacml3:AttributeDesignator AttributeId="resource-location"
            DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
            Category="urn:oasis:names:tc:xacml:3.0:attribute-category:resource"
            MustBePresent="false"/>
    </xacml3:Apply>
    <xacml3:AttributeValue xmlns:geoxacml="http://www.opengis.net/spec/
geoxacml/3.0"
          DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry" geoxacml:srid=
"4326"
          >POINT(38.889444 -77.035278)</xacml3:AttributeValue>
</xacml3:Apply>
```

Figure 8 — Using GeoXACML functions example in XACML Apply

6.1.4. Functions that help indexing of policies based on geometry

A policy writer using GeoXACML 3.0 may structure access conditions based on topological relations such as “if `subject-location` is `within` the `Polygon(…)`" or "if `device-location` is `within-distance` to the requested resource”. Such a condition would, for example, fetch the `subject-location` or `device-location` from an ADR, the `Polygon` from the policy and the resource geometry from the resource itself (see XACML 3.0 Policy Information Point (PIP) for more information).

The geographic indexing of `PolicySet`, `Policy` or `Rule` matching takes place inside the `Target` element. A `Match` element may use any function identified via `MatchId` whose signature has two parameters and the result is of type boolean () as we can interpret from the XML schema definition below.

```
<xs:element name="Match" type="xacml:MatchType"/>
<xs:complexType name="MatchType">
```

```
  <xs:sequence>
    <xs:element ref="xacml:AttributeValue"/>
    <xs:choice>
      <xs:element ref="xacml:AttributeDesignator"/>
      <xs:element ref="xacml:AttributeSelector"/>
    </xs:choice>
  </xs:sequence>
  <xs:attribute name="MatchId" type="xs:anyURI" use="required"/>
</xs:complexType>
```

Figure 9 — XACML schema definition of the <Match> element

The order of the child elements in the `Match` element influence the way GeoXACML 3.0 defines matching functions such as `is-within-distance`, `has-precision`, `srid-equals`, etc. Those functions must have the geometry as the second parameter and the function specific parameter as the first parameter.

The following example illustrates the use of the `srid-equals` function to make a `Rule` to only match CRS84 (the SRID parameter is first).

```
<xacml3:Match MatchId="urn:ogc:def:function:geoxacml:3.0:geometry-srid-equals">
    <xacml3:AttributeValue DataType="http://www.w3.org/2001/XMLSchema#integer">
-4326</xacml3:AttributeValue>
    <xacml3:AttributeDesignator
    Category="urn:oasis:names:tc:xacml:1.0:subject-category:access-subject"
    AttributeId="subject-location" DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry"
    MustBePresent="true" />
</xacml3:Match>
```

Figure 10 — Example of <Match> element for CRS84 geometries

The example `Match` above determines the CRS from the request attribute `subject-location` and compares it with the literal `-4326` (the SRID for representing CRS84).

6.1.5. Defining a new StatusCode

A `<StatusCode>` element has an attribute names `name`, which is of type `xs:anyURI`. According to the XACML extension capabilities, additional identifiers can be defined by associating a unique `StatusId`.

```
<xs:element name="StatusCode" type="xacml:StatusCodeType"/>
<xs:complexType name="StatusCodeType">
   <xs:sequence>
      <xs:element ref="xacml:StatusCode" minOccurs="0"/>
   </xs:sequence>
   <xs:attribute name="Value" type="xs:anyURI" use="required"/>
</xs:complexType>
```

Figure 11 — XACML schema definition of the <StatusCode> element

```
<xacml3:Response xmlns:xacml3="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17"
```

```
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17 http://docs.
oasis-open.org/xacml/3.0/xacml-core-v3-schema-wd-17.xsd">
  <xacml3:Result>
    <xacml3:Decision>Indeterminate</xacml3:Decision>
    <xacml3:Status>
      <xacml3:StatusCode Value="urn:ogc:def:function:geoxacml:3.0:geometry-
error"/>
    </xacml3:Status>
  </xacml3:Result>
</xacml3:Response>
```

Figure 12 — XACML schema compliant Response with GeoXACML <StatusCode>

```
<xacml3:Response xmlns:xacml3="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17 http://docs.
oasis-open.org/xacml/3.0/xacml-core-v3-schema-wd-17.xsd">
  <xacml3:Result>
    <xacml3:Decision>Indeterminate</xacml3:Decision>
    <xacml3:Status>
      <xacml3:StatusCode Value="urn:ogc:def:function:geoxacml:3.0:geometry-
error"/>
      <xacml3:StatusMessage>Geometry must be encoded using specified SRID</
xacml3:StatusMessage>
      <xacml3:StatusDetail>
        <xacml3:MissingAttributeDetail
        Category="urn:oasis:names:tc:xacml:1.0:subject-category:access-subject"
        AttributeId="subject-location"
        DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry">
          <xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry"
          xmlns:geoxacml="http://www.opengis.net/spec/geoxacml/3.0"
          geoxacml:srid="3857"/>
        </xacml3:MissingAttributeDetail>
      </xacml3:StatusDetail>
    </xacml3:Status>
  </xacml3:Result>
</xacml3:Response>
```

Figure 13 — XACML schema compliant Response with GeoXACML <StatusCode> and <MissingAttributeDetail>

The `<MissingAttributeDetail>` indicates that the ADR should be repeated using the `EPSG:3857` CRS for encoding the `AttributeValue` with `AttributeId=subject-location` and `CategoryId=urn:oasis:names:tc:xacml:1.0:subject-category:access-subject`. The reason for such a response could be that the implementation does not support CRS transformation and that the condition geometry in the GeoXACML 3.0 Policy/Rule is encoded in CRS `EPSG:3857`.

6.2. GeoXACML 3.0 Security and Privacy Considerations

In addition to the XACML 3.0 security and privacy considerations, GeoXACML 3.0 introduces geometry specific aspects.

6.2.1. User Privacy

Any deployment with policies that derive authorization decisions based on user location and require such information be submitted must evaluate the conditions such as, GDPR compliance, or more restrictive regulations, if applicable. This in particular is true when the request context requires to contain additional Personal Information (e.g. name) or Personal Identifiable Information (e.g. IP address).

6.2.2. Geometry Precision

When deriving authorization decisions based on geographic conditions[4] the precision of the coordinate values must be considered. Simply assuming a certain precision may result in false decisions.

To prevent false decision making caused by precision, the GeoXACML 3.0 Standard defines geometry precision which can be used in a request (ADR) to express the minimum precision for all geometries involved in the decision making. A GeoXACML 3.0 compliant implementation must terminate processing when the minimum requested precision cannot be achieved.

When crafting GeoXACML 3.0 policies (`PolicySet`, `Policy` and `Rule`) always making the geometry precision explicit and matching the actual precision of the coordinates is recommended.

```
<xacml3:AttributeValue xmlns:geoxacml="urn:ogc:def:dataType:geoxacml:3.0"
    DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
    geoxacml:srid="4326"
    >POINT(38.88, -77.03)</xacml3:AttributeValue>
```

Figure 14 — Example where default precision is higher (default is infinite) to actual precision

```
<xacml3:AttributeValue xmlns:geoxacml="urn:ogc:def:dataType:geoxacml:3.0"
    DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
    geoxacml:srid="4326"
    geoxacml:precision="6"
    >POINT(38.889444, -77.035278)</xacml3:AttributeValue>
```

Figure 15 — Example where expressed precision meets the precision of the coordinate value

[4] the condition involves processing of `AttributeValue` with data-type `Geometry`

A policy writer can use the `-has-precision` function to index policies (`PolicySet`, `Policy` and `Rule`) as illustrated in the following `Rule` snippet.

```
<xacml3:Rule RuleId="precision6" Effect="Permit">
    <xacml3:Target>
      <xacml3:AnyOf>
        <xacml3:AllOf>
          <xacml3:Match MatchId="urn:ogc:def:function:geoxacml:3.0:geometry-
has-precision">
            <xacml3:AttributeValue DataType="http://www.w3.org/2001/
XMLSchema#integer">4</xacml3:AttributeValue>
            <xacml3:AttributeDesignator
              Category="urn:oasis:names:tc:xacml:1.0:subject-category:access-
subject"
              AttributeId="subject-location" DataType="urn:ogc:def:dataType:
geoxacml:3.0:geometry"
              MustBePresent="true" />
          </xacml3:Match>
        </xacml3:AllOf>
      </xacml3:AnyOf>
    </xacml3:Target>
    <xacml3:Condition>
      <xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-
equals">
        <xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry"
          xmlns:geoxacml="http://www.opengis.net/spec/geoxacml/3.0"
          geoxacml:srid="-4326"
        >POINT(-77.0352 38.8894)</xacml3:AttributeValue>
        <xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-
one-and-only">
          <xacml3:AttributeDesignator
            Category="urn:oasis:names:tc:xacml:1.0:subject-category:access-
subject"
            AttributeId="subject-location" DataType="urn:ogc:def:dataType:
geoxacml:3.0:geometry"
            MustBePresent="true" />
        </xacml3:Apply>
      </xacml3:Apply>
    </xacml3:Condition>
  </xacml3:Rule>
```

Figure 16 — Example Rule testing request `AttributeValue` for minimum precision

6.2.3. Geometry CRS

A GeoXACML 3.0 implementation that is compliant to the `CRS Transformation` conformance class may apply CRS transformation while deriving an authorization decision. Any CRS transformation produces a distortion that may result in false decision making.

To prevent false decision making caused by distortion, the GeoXACML 3.0 Standard defines the `allowTransformation` attribute that prevents dynamic CRS transformation by default whilst deriving an authorization decision. To explicitly allow a CRS transformation, the policy writer or the application requesting a decision must overwrite the default by adding `allowTransformation="true"` to the the `AttributeVaule`.

When attempting to make authorization decisions based on the default `allowTransformation="false"`, the processing of policy and request geometries may stop "somewhere" and result in an `Indeterminate` decision. This is because the CRSs do not match. A policy writer that wants to craft different policies for different CRS can use the `urn:ogc:def:function:geoxacml:3.0:geometry-srid-equals` and `urn:ogc:def:function:geoxacml:3.0:geometry-bag-srid-equals` functions to index `PolicySet`, `Policy` or `Rule` via `Target` matching.

```
<xacml3:Rule RuleId="crs84" Effect="Permit">
    <xacml3:Target>
    <xacml3:AnyOf>
        <xacml3:AllOf>
        <xacml3:Match MatchId="urn:ogc:def:function:geoxacml:3.0:geometry-srid-
equals">
            <xacml3:AttributeValue DataType="http://www.w3.org/2001/
XMLSchema#integer">-4326</xacml3:AttributeValue>
            <xacml3:AttributeDesignator
            Category="urn:oasis:names:tc:xacml:1.0:subject-category:access-
subject"
            AttributeId="subject-location" DataType="urn:ogc:def:dataType:
geoxacml:3.0:geometry"
            MustBePresent="true" />
        </xacml3:Match>
        </xacml3:AllOf>
    </xacml3:AnyOf>
    </xacml3:Target>
    <xacml3:Condition>
    <xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-
equals">
        <xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry"
        xmlns:geoxacml="http://www.opengis.net/spec/geoxacml/3.0"
        geoxacml:srid="-4326"
        >POINT(-77.035278 38.889444)</xacml3:AttributeValue>
        <xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-
one-and-only">
        <xacml3:AttributeDesignator
            Category="urn:oasis:names:tc:xacml:1.0:subject-category:access-
subject"
            AttributeId="subject-location" DataType="urn:ogc:def:dataType:
geoxacml:3.0:geometry"
            MustBePresent="true" />
        </xacml3:Apply>
    </xacml3:Apply>
    </xacml3:Condition>
</xacml3:Rule>
```

Figure 17 — Example `Target` matching for a `Rule` with geometry conditions using CRS84

7

GEOXACML 3.0 CORE REQUIREMENTS

7 GEOXACML 3.0 CORE REQUIREMENTS

7.1. Requirements Class Specification

REQUIREMENTS CLASS 1: SPECIFICATION	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification`
OBLIGATION	requirement
TARGET TYPE	Implementation Specification
CONFORMANCE CLASS	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
PREREQUISITES	OGC "Simple Features" XACML Version 3.0
NORMATIVE STATEMENTS	Requirement 1: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-data-type-urn-prefix` Requirement 2: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-geometry` Requirement 3: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xacml-bag` Requirement 4: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xacml-bag-crs` Requirement 5: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-iso` Requirement 6: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-homogeneous-collection` Requirement 7: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-heterogeneous-collection` Requirement 8: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-function-urn-prefix` Requirement 9: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xml-namespace-uri` Requirement 10: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-crs` Requirement 11: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-axis-order` Requirement 12: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-schema`

REQUIREMENTS CLASS 1: SPECIFICATION	
	Requirement 13: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xml-attribute-srid Requirement 14: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xml-attribute-precision Requirement 15: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-crs-error Requirement 16: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-geometry-error Requirement 17: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-geometry-collection-error Requirement 18: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-precision-error Requirement 19: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-subject-location Requirement 21: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-resource-extend Requirement 22: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-resource-aoi Requirement 23: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-device-location

REQUIREMENT 1	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-data-type-urn-prefix
STATEMENT	GeoXACML 3.0 Core defines a non-resolvable URN base identifier for data-types urn:ogc:def:dataType:geoxacml:3.0

REQUIREMENT 2	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-geometry
STATEMENT	GeoXACML 3.0 Core defines the URN identifier for the data-type Geometry as value urn:ogc:def:dataType:geoxacml:3.0:geometry

REQUIREMENT 3	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xacml-bag
STATEMENT	A GeometryBag SHALL be an XACML bag with the data-type urn:ogc:def:dataType:geoxacml:3.0:geometry

REQUIREMENT 4

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xacml-bag-crs`
STATEMENT	All geometries in a `GeometryBag` SHALL have the same CRS.

REQUIREMENT 5

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-iso`
STATEMENT	GeoXACML 3.0 Core SHALL be compliant with the geometry model defined in the OGC "Simple Features" Standard with the restriction of homogeneous `GeometryCollection`.

REQUIREMENT 6

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-homogeneous-collection`
STATEMENT	GeoXACML 3.0 Core constraints a `GeometryCollection` to be homogeneous. A homogeneous `GeometryCollection` is an OGC "Simple Features" compliant `GeometryCollection` where all geometries are of the same geometry type and not of type `GeometryCollection`.

REQUIREMENT 7

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-heterogeneous-collection`
STATEMENT	GeoXACML 3.0 Core supports a heterogeneous collection of geometries as a bag of geometries.

REQUIREMENT 8

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-function-urn-prefix`
STATEMENT	GeoXACML 3.0 Core defines a non-resolvable URN base identifier for functions `urn:ogc:def:function:geoxacml:3.0:geometry`

REQUIREMENT 9

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xml-namespace-uri`
STATEMENT	GeoXACML 3.0 Core defines the XML namespace `geoxacml` with URI `http://www.opengis.net/spec/geoxacml/3.0`.

REQUIREMENT 10

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-crs`
STATEMENT	GeoXACML 3.0 Core defines a default CRS `urn:ogc:def:crs:OGC::CRS84` as defined in The Geo JSON Format.

REQUIREMENT 11

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-axis-order`
STATEMENT	GeoXACML 3.0 Core defines the axis order for the default CRS `urn:ogc:def:crs:OGC::CRS84`as defined in The GeoJSON Format to be longitude / latitude.

REQUIREMENT 12

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-schema`
STATEMENT	GeoXACML 3.0 Core SHALL adopt the XACML 3.0 Schema as defined in XACML Version 3.0 XML Schema for constructing a Policy, Authorization Decision Request and Authorization Decision.

REQUIREMENT 13

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xml-attribute-srid`
STATEMENT	GeoXACML 3.0 Core defines the XML attribute `srid` of type `Integer` in namespace `http://www.opengis.net/spec/geoxacml/3.0` to be used in the `<AttributeValue>` element for expressing an explicit geometry SRID as defined in OGC "Simple Features". The CRS identifier SHALL be valid in the `EPSG` authority namespace.

REQUIREMENT 14

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xml-attribute-precision`
STATEMENT	GeoXACML 3.0 Core defines the XML attribute `precision` of type `Integer` in namespace `http://www.opengis.net/spec/geoxacml/3.0` to be used in the `<AttributeValue>` element for expressing the required minimum precision when processing a geometry. The default `precision` SHALL be infinite. The value of the `precision` attribute SHALL be a positive integer including zero (0). The value expresses the number of decimal places of the coordinate values that SHALL be considered when processing the geometry. When used in an ADR, a PEP SHALL use the `precision` for indicating the minimum precision for geometries involved in the decision making. When used in an AD a PDP SHALL use the `precision` for indicating to the PEP the maximum possible precision that can be guaranteed when deriving a decision. An implementation SHALL abort processing with an `Indeterminate` decision using `StatusCode` value `urn:ogc:def:error:geoxacml:3.0:precision-error` when the expected precision cannot be guaranteed. The `StatusDetail` SHALL contain the `MissingAttributeDetail` for each involved geometry the corresponding `AttributeValue` including the maximum `precision` supported by the PDP. The `AttributeValue` SHALL not include a value.

REQUIREMENT 15

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-crs-error`
STATEMENT	GeoXACML 3.0 Core defines the `StatusCode` value `urn:ogc:def:identifier:geoxacml:3.0:crs-error` to indicate a processing error caused by CRS.

REQUIREMENT 16

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-geometry-error`
STATEMENT	GeoXACML 3.0 Core defines the `StatusCode` value `urn:ogc:def:identifier:geoxacml:3.0:geometry-error` to indicate that processing of a geometry caused an error.

REQUIREMENT 17

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-geometry-collection-error`
STATEMENT	GeoXACML 3.0 Core defines the `StatusCode` value `urn:ogc:def:identifier:geoxacml:3.0:geometry-collection-error` to indicate that processing of a `GeometryCollection` caused an error.

REQUIREMENT 18	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-precision-error
STATEMENT	GeoXACML 3.0 Core defines the StatusCode value urn:ogc:def:identifier:geoxacml:3.0:precision-error to indicate that processing of a geometry was aborted due to requested precision could not be met.

REQUIREMENT 19	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-subject-location
STATEMENT	GeoXACML 3.0 Core defines the AttributeId identifier urn:ogc:def:identifier:geoxacml:3.0:subject-location in the XACML subject-category to indicate the location of a user in the Authorization Decision Request.

REQUIREMENT 20	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-resource-location
STATEMENT	GeoXACML 3.0 Core defines the AttributeId identifier urn:ogc:def:identifier:geoxacml:3.0:resource-location in the XACML resource-category to indicate the location of a resource in the Authorization Decision Request.

REQUIREMENT 21	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-resource-extend
STATEMENT	GeoXACML 3.0 Core defines the AttributeId identifier urn:ogc:def:identifier:geoxacml:3.0:resource-extend in the XACML resource-category to indicate the boundary of a resource geometry in the Authorization Decision Request.

REQUIREMENT 22	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-resource-aoi
STATEMENT	GeoXACML 3.0 Core defines the AttributeId identifier urn:ogc:def:identifier:geoxacml:3.0:resource-aoi in the XACML resource-category to indicate the BBOX of a resource in the Authorization Decision Request.

REQUIREMENT 23	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-device-location
STATEMENT	GeoXACML 3.0 Core defines the AttributeId identifier urn:ogc:def:identifier:geoxacml:3.0:device-location in the XACML environment-category to indicate the location of a device in the Authorization Decision Request.

7.2. Requirements Class Geometry Data-Type

The standardization target for this requirements class is *implementation*.

The Geometry data-type is based on the definition from OGC "Simple Features".

Any instance of a Geometry data-type requires a well-defined Coordinate Reference System (CRS). This Standard defines the default CRS and axis order in compliance with The GeoJSON Format as urn:ogc:def:crs:OGC::CRS84 with axis order longitude/latitude.

The coordinate tuples of a Geometry data-type must be encoded compliant with the XACML 3.0 Policy schema. GeoXACML 3.0 Core supports Well-Known-Text and Well-Known-Binary encodings.

REQUIREMENTS CLASS 2: GEOMETRY DATA-TYPE	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type
OBLIGATION	requirement
TARGET TYPE	Implementation
PREREQUISITES	<ISO19125-1>> XACML Version 3.0
NORMATIVE STATEMENTS	Requirement 24: http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-default-crs Requirement 25: http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-xacml-attribute-srid Requirement 26: http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-geometry-error Requirement 27: http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-crs-equal Requirement 28: http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-wkt

REQUIREMENTS CLASS 2: GEOMETRY DATA-TYPE

Requirement 29: `http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-wkb`

REQUIREMENT 24

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-default-crs`
STATEMENT	An implementation SHALL use the default CRS when constructing a `Geometry` instance unless the `AttributeValue` element contains the attribute `srid` in the XML namespace `http://www.opengis.net/spec/geoxacml/3.0`.

REQUIREMENT 25

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-xacml-attribute-srid`
STATEMENT	An implementation SHALL overwrite the default CRS with the definition from the XACML3 Attribute Value attribute `srid` defined in the XML namespace `namespace`.

REQUIREMENT 26

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-geometry-error`
STATEMENT	An implementation SHALL abort policy evaluation for any function processing a `Geometry` when the geometry instantiation results in an error. The resulting Authorization Response SHALL have the `Decision` value `Indeterminate` and `StatusCode` value `urn:ogc:def:identifier:geoxacml:3.0:geometry-error`

REQUIREMENT 27

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-crs-equal`
STATEMENT	An implementation SHALL abort policy evaluation for any function with more than one input parameter of date-type `Geometry` when the SRID identifiers are **not** identical. The resulting Authorization Response SHALL have the `Decision` value `Indeterminate` and `StatusCode` value `urn:ogc:def:identifier:geoxacml:3.0:crs-error`. The `StatusDetail` SHALL contain a `MissingAttriuteDetail` element that lists all `AttributeValue` elements that are affected. The use of the `srid` attribute in namespace `http://www.opengis.net/spec/geoxacml/3.0` is mandatory to express the CRS identifier to be used.

REQUIREMENT 27

The use of the `allowTransformation` attribute in namespace `http://www.opengis.net/spec/geoxacml/3.0` is optional but SHALL be used to indicate that a geometry in the expressed CRS SHALL not be transformed to another CRS.

```
<StatusDetail xmlns:geoxacml="{namespace}">
    <MissingAttributeDetail Category="access-subject" Attributeidentifier=
"subject-location" DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry">
        <AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry" geoxacml:sridentifier="4711" geoxacl:allowTransformation="true"/>
        <AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry" geoxacml:sridentifier="3857" geoxacl:allowTransformation="true"/>
        <AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry" geoxacml:sridentifier="4326" geoxacl:allowTransformation="false"/>
        <AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry" geoxacml:sridentifier="-4326" geoxacl:allowTransformation="false"/
>
    </MissingAttributeDetail>
</StatusDetail>
```

Example GeoXACML StatusDetail and MissingAttributeDetail to express supported CRS identifiers

REQUIREMENT 28

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-wkt`
STATEMENT	An implementation SHALL support the WKT geometry encoding as defined in OGC "Simple Features".

REQUIREMENT 29

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-wkb`
STATEMENT	An implementation SHALL support the WKB geometry encoding as defined in OGC "Simple Features" and be able to construct a `Geometry` instance from the hex representation of the WKB's binary value.

7.3. Requirements Class Geometry Functions

The standardization target for this requirements class is *implementation*.

GeoXACML 3 Core supports functions on on the `Geometry` data-type as defined in OGC "Simple Features" section 6.1.2.2, 6.1.2.3 and the function “Distance” from section 6.1.2.4.

In addition, GeoXACML 3 Core supports functions on the `Geometry` data-type mandated by XACML Version 3.0.

REQUIREMENTS CLASS 3: GEOMETRY DATA-TYPE	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/geometry-functions`
OBLIGATION	requirement
TARGET TYPE	Implementation
PREREQUISITES	<ISO19125-1>> XACML Version 3.0
NORMATIVE STATEMENTS	Requirement 30: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-dimension` Requirement 31: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-type` Requirement 32: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-srid` Requirement 33: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-empty` Requirement 34: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-simple` Requirement 35: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-srid-equals` Requirement 36: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-srid` Requirement 37: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-precision` Requirement 38: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-length` Requirement 39: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-area` Requirement 40: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-distance` Requirement 41: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-has-distance` Requirement 42: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-is-within-distance`

7.3.1. Requirement Function Dimension

REQUIREMENT 30	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-dimension`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Dimension(this:Geometry):Integer` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-dimension` This function SHALL be compliant with `Dimension():Integer` as defined in OGC "Simple Features", section 6.1.2.2

7.3.2. Requirement Function GeometryType

REQUIREMENT 31	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-type`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `GeometryType(this:Geometry):String` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-type` This function SHALL be compliant with `GeometryType():String` as defined in OGC "Simple Features", section 6.1.2.2

7.3.3. Requirement Function SRID

REQUIREMENT 32	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-srid`
OBLIGATION	requirement
STATEMENT	This function SHALL have the `signature SRID(this:Geometry):Integer` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-srid` This function SHALL be compliant with SRID():Integer* as defined in OGC "Simple Features", section 6.1.2.2

7.3.4. Requirement Function IsEmpty

REQUIREMENT 33	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-empty`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `IsEmpty(this:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-is-empty` This function SHALL be compliant with `IsEmpty():Integer` as defined in OGC "Simple Features", section 6.1.2.2 This function SHALL return the value `False` if `IsEmpty()` returns the value `0` and the value `True` otherwise.

7.3.5. Requirement Function IsSimple

REQUIREMENT 34	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-simple`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `IsSimple(this:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-is-simple` This function SHALL be compliant with `IsSimple():Integer` as defined in OGC "Simple Features", section 6.1.2.2 This function SHALL return the value `False` if `IsSimple()` returns the value `0` and the value `True` otherwise.

7.3.6. Requirement Function SRIDEquals

REQUIREMENT 35	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-srid-equals`
OBLIGATION	requirement
STATEMENT	This function SHALL have the `signature SRIDEquals(srid:Integer,this:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-srid-equals` This function SHALL return `True` if the geometry's SRID is identical to the given `srid` parameter and `False` otherwise.

7.3.7. Requirement Function EnsureSRID

REQUIREMENT 36	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-srid`
OBLIGATION	requirement
STATEMENT	This function SHALL have the `signature EnsureSRID(srid:Integer,this:Geometry):Geometry` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-ensure-srid` This function SHALL return a geometry where the `srid` parameter is used to calculate the coordinate values. This function SHALL raise an `Indeterminate` exception with `StatusCode` value `urn:ogc:def:identifier:geoxacml:3.0:crs-error` if the output geometry could not be created. The `MissingAttributeDetail` element SHALL be used to list the `AttributeValue` with acceptable SRID values. The `AttributeValue` value SHALL be empty. When this function is implemented as part of the `Core` conformance, this function basically asserts that the geometry's `srid` value equals a give value. When this function is implemented as part of the `CRS Transformation` conformance, this function SHALL attempt to do a CRS transformation on the geometry with the target CRS identified by the `srid` parameter.

7.3.8. Requirement Function EnsurePrecision

REQUIREMENT 37	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-precision`
OBLIGATION	requirement
STATEMENT	This function SHALL have the `signature EnsurePrecision(precision:Integer,this:Geometry):Geometry` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-ensure-precision` This function SHALL return a geometry where the `precision` parameter is used to calculate the coordinate values. This function SHALL raise an `Indeterminate` exception with `StatusCode` value `urn:ogc:def:identifier:geoxacml:3.0:precision-error` if the `precision` parameter requests higher precision than given by the input geometry (in other words, the requested precision cannot be reached). The `MissingAttributeDetail` element SHALL be used to list the `AttributeValue` with maximum possible `precision` value. The `AttributeValue` value SHALL be empty.

7.3.9. Requirement Function Length

REQUIREMENT 38	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-length`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Length(this:Geometry):Double` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-length` This function SHALL be compliant with `Length():Double` as defined in OGC "Simple Features", section 6.1.3.2

7.3.10. Requirement Function Area

REQUIREMENT 39	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-area`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Area(this:Geometry):Double` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-area` This function SHALL be compliant with `Area():Double` as defined in OGC "Simple Features", section 6.1.10.2

7.3.11. Requirement Function Distance

REQUIREMENT 40	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-distance`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Distance(this:Geometry,another:Geometry):Double` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-distance` This function SHALL be compliant with `Distance(another:Geometry):Double` as defined in OGC "Simple Features", section 6.1.2.4

7.3.12. Requirement Function HasDistance

REQUIREMENT 41	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-has-distance`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `HasDistance(distance:Double,this:Geometry, another:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-distance-equals` This function is a convenience function to evaluate the distance between geometries using the function `Distance(another:Geometry):Double` as defined in OGC "Simple Features", section 6.1.2.4. This function SHALL return `true` value if the given distance equals the distance between the two geometries.

7.3.13. Requirement Function IsWithinDistance

REQUIREMENT 42	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-is-within-distance`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `IsWithinDistance(d:Double,this:Geometry, another:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-is-within-distance` This function SHALL be compliant with `IsWitinDistance():Boolean` as defined in Java Topology Suite#isWithinDistance-org.locationtech.jts.geom.Geometry-double.

7.4. Requirements Class Spatial Relations Functions

Definitions of testing functions on on the `Geometry` data-type as defined in OGC "Simple Features" section 6.1.2.3.

REQUIREMENTS CLASS 4: SPATIAL RELATIONS FUNCTIONS	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/spatial-relations-functions
OBLIGATION	requirement
TARGET TYPE	Implementation
PREREQUISITES	<ISO19125-1>> XACML Version 3.0
NORMATIVE STATEMENTS	Requirement 43: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equal Requirement 44: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equals Requirement 45: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-disjoint Requirement 46: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-intersects Requirement 47: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-touches Requirement 48: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-crosses Requirement 49: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-within Requirement 50: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-contains Requirement 51: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-overlaps Requirement 52: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-relate

7.4.1. Requirement Function Equals

REQUIREMENT 43	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equal
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature Equals(this:Geometry,another:Geometry):Boolean and the identifier as urn:ogc:def:function:geoxacml:3.0:geometry-equal This function SHALL be compliant with Equals(Geometry):Integer as defined in OGC "Simple Features", section 6.1.2.3.

REQUIREMENT 43	
	This function SHALL return the value `False` if `Equals()` returns the value `0` and the value `True` otherwise. The identifier `urn:ogc:def:function:geoxacml:3.0:geometry-equal` is an alias for the `urn:ogc:def:function:geoxacml:3.0:geometry-equals` function[5].

[5] This alias is required to be compliant with XACML bag and set functions where the equality of elements is determined via the urn:oasis:names:tc:xacml:3.0:function:type-equal` function. Because `type` is substituted by `geometry`, the GeoXACML function identifier to determine equality is `urn:ogc:def:function:geoxacml:3.0:geometry-equal`.

REQUIREMENT 44	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equals`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Equals(this:Geometry,another:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-equals` This function SHALL be compliant with Equals(Geometry):Integer as defined in OGC "Simple Features", section 6.1.2.3. This function SHALL return the value `False` if `Equals()` returns the value `0` and the value `True` otherwise.

7.4.2. Requirement Function Disjoint

REQUIREMENT 45	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-disjoint`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Disjoint(this:Geometry,another:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-disjoint` This function SHALL be compliant with Disjoint(Geometry):Integer as defined in OGC "Simple Features", section 6.1.2.3. This function SHALL return the value `False` if `Disjoint()` returns the value `0` and the value `True` otherwise.

7.4.3. Requirement Function Intersects

REQUIREMENT 46	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-intersects`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Intersects(this:Geometry,another:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-intersects` This function SHALL be compliant with `Intersects(Geometry):Integer` as defined in OGC "Simple Features", section 6.1.2.3. This function SHALL return the value `False` if `Intersects()` returns the value `0` and the value `True` otherwise.

7.4.4. Requirement Function Touches

REQUIREMENT 47	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-touches`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Touches(this:Geometry,another:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-touches` This function SHALL be compliant with `Touches(Geometry):Integer` as defined in OGC "Simple Features", section 6.1.2.3. This function SHALL return the value `False` if `Touches()` returns the value `0` and the value `True` otherwise.

7.4.5. Requirement Function Crosses

REQUIREMENT 48	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-crosses`
OBLIGATION	requirement

REQUIREMENT 48	
STATEMENT	This function SHALL have the signature `Crosses(this:Geometry,another:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-crosses` This function SHALL be compliant with Crosses(Geometry):Integer as defined in OGC "Simple Features", section 6.1.2.3. This function SHALL return the value `False` if `Crosses()` returns the value `0` and the value `True` otherwise.

7.4.6. Requirement Function Within

REQUIREMENT 49	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-within`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Within(this:Geometry,another:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-within` This function SHALL be compliant with Within(Geometry):Integer as defined in OGC "Simple Features", section 6.1.2.3. This function SHALL return the value `False` if `Within()` returns the value `0` and the value `True` otherwise.

7.4.7. Requirement Function Contains

REQUIREMENT 50	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-contains`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Contains(this:Geometry,another:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-contains` This function SHALL be compliant with `Contains(Geometry):Integer` as defined in OGC "Simple Features", section 6.1.2.3. This function SHALL return the value `False` if `Contains()` returns the value `0` and the value `True` otherwise.

7.4.8. Requirement Function Overlaps

REQUIREMENT 51	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-overlaps`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Overlaps(this:Geometry,another:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-overlaps` This function SHALL be compliant with `Overlaps(Geometry):Integer` as defined in OGC "Simple Features", section 6.1.2.3. This function SHALL return the value `False` if `Overlaps()` returns the value `0` and the value `True` otherwise.

7.4.9. Requirement Function Relate

REQUIREMENT 52	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-relate`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Relate(intersectionPatternMatrix:String, this:Geometry,another:Geometry):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-relate` This function SHALL be compliant with `Relate(Geometry,String):Integer` as defined in OGC "Simple Features", section 6.1.2.3. This function SHALL return the value `False` if `Relate()` returns the value `0` and the value `True` otherwise.

7.5. Requirements Class XACML Bag Functions

Definitions of XACML functions on the data-type `Geometry` as mandated by XACML Version 3.0.

REQUIREMENTS CLASS 5: XACML BAG FUNCTIONS	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/xacml-bag-functions`
OBLIGATION	requirement
TARGET TYPE	Implementation
PREREQUISITE	XACML Version 3.0
NORMATIVE STATEMENTS	Requirement 53: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-one-and-only` Requirement 54: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-bag-size` Requirement 55: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-is-in` Requirement 56: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-bag` Requirement 5-5: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-collection-from-geometry-bag` Requirement 5-6: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-from-geometry-collection` Requirement 59: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-srid` Requirement 60: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-srid-equals`

7.5.1. Requirement Function GeometryOneAndOnly

REQUIREMENT 53	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-one-and-only`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `GeometryOneAndOnly(bag:GeometryBag):Geometry` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-one-and-only` This function SHALL be compliant with `urn:oasis:names:tc:xacml:3.0:function:type-one-and-only` as defined in XACML Version 3.0, section A.3.10.

REQUIREMENT 54

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-bag-size`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `GeometryBagSize(bag:GeometryBag):Integer` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-bag-size` This function SHALL be compliant with `urn:oasis:names:tc:xacml:3.0:function:type-bag-size` as defined in XACML Version 3.0, section A.3.10.

REQUIREMENT 55

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-is-in`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `GeometryIsIn(g:Geometry,bag:GeometryBag):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-is-in` The function SHALL return `True` if and only if the first argument matches by the `urn:ogc:def:function:geoxacml:3.0:geometry-equals` any value in the bag. This function SHALL return `False` otherwise or if the argument is an empty bag.

REQUIREMENT 56

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-bag`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Bag(Geometry):GeometryBag` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-bag` This function SHALL be compliant with `urn:oasis:names:tc:xacml:3.0:function:type-bag` as defined in XACML Version 3.0, section A.3.10.

REQUIREMENT 57

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-to-collection`
OBLIGATION	requirement

REQUIREMENT 57

STATEMENT	This function SHALL have the signature `GeometryBagToCollection(bag:GeometryBag):GeometryCollection` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-bag-to-collection` This function SHALL return a homogeneous `GeometryCollection` as defined in ISO 19125 by adding each member of the bag as a geometry to the collection. This function SHALL return an `Indeterminate` status with value `urn:ogc:def:identifier:geoxacml:3.0:geometry-collection-error` if the bag is heterogeneous (contains geometries of different types).

REQUIREMENT 58

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-from-collection`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `GeometryBagFromCollection(gc:GeometryCollection):GeometryBag` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-bag-from-collection` This function SHALL return a bag of values of type `Geometry` by adding each geometry of the GeometryCollection as a member of type `Geometry`.

REQUIREMENT 59

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-srid`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `GeometryBagSRID(bag:GeometryBag):Integer` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-bag-srid` This function SHALL return an Integer which value is the `srid` of the geometries of the bag. **NOTE** Per GeoXACML definition, all geometries of a bag SHALL have the same `srid` value.

REQUIREMENT 60

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-srid-equals`
OBLIGATION	requirement

REQUIREMENT 60	
STATEMENT	This function SHALL have the signature `GeometryBagSRIDEquals(srid:Integer, bag: GeometryBag): Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-bag-srid-equals` This function SHALL return a `True` value if the `srid` of the bag equals the value of the `srid` parameter and a `False` value otherwise.

7.6. Requirements Class XACML Set Functions

Definitions of XACML functions on the `Geometry` data-type as mandated by XACML Version 3.0.

REQUIREMENTS CLASS 6: XACML BAG FUNCTIONS	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/xacml-set-functions`
OBLIGATION	requirement
TARGET TYPE	Implementation
PREREQUISITE	XACML Version 3.0
NORMATIVE STATEMENTS	Requirement 62: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-intersection` Requirement 61: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-at-least-one-member-of` Requirement 63: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-union` Requirement 64: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-subset` Requirement 65: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-set-equals`

7.6.1. Requirement Function AtLeastOneMemberOf

REQUIREMENT 61	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-at-least-one-member-of`

REQUIREMENT 61	
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `BagAtLeastOneMemberOf(bag1:GeometryBag,bag2:GeometryBag):Boolean` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-at-least-one-member-of` This function SHALL be compliant with `urn:oasis:names:tc:xacml:3.0:function:type-at-least-one-member-of` as defined in XACML Version 3.0, section A.3.11.

7.6.2. Requirement Function Intersection

REQUIREMENT 62	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-intersection`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Intersection(bag1:GeometryBag,bag2:GeometryBag):GeometryBag` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-intersection` This function SHALL be compliant with `urn:oasis:names:tc:xacml:3.0:function:type-intersection` as defined in XACML Version 3.0, section A.3.11.

7.6.3. Requirement Function Union

REQUIREMENT 63	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-union`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Union(bag1:GeometryBag,bag2:GeometryBag):GeometryBag` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-union` This function SHALL be compliant with `urn:oasis:names:tc:xacml:3.0:function:type-union` as defined in XACML Version 3.0, section A.3.11.

7.6.4. Requirement Function Subset

REQUIREMENT 64	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-subset
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature Subset(bag1:GeometryBag,bag2:GeometryBag):Boolean and the identifier as urn:ogc:def:function:geoxacml:3.0:geometry-subset This function SHALL be compliant with urn:oasis:names:tc:xacml:3.0:function:type-subset as defined in XACML Version 3.0, section A.3.11.

7.6.5. Requirement Function SetEquals

REQUIREMENT 65	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-set-equals
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature SetEquals(bag1:GeometryBag,bag2:GeometryBag):Boolean and the identifier as urn:ogc:def:function:geoxacml:3.0:geometry-set-equals This function SHALL be compliant with urn:oasis:names:tc:xacml:3.0:function:type-set-equals as defined in XACML Version 3.0, section A.3.11.

8

GEOXACML 3.0 SPATIAL ANALYSIS REQUIREMENTS

8 GEOXACML 3.0 SPATIAL ANALYSIS REQUIREMENTS

8.1. Requirements Class Spatial Analysis

REQUIREMENTS CLASS 7: SPATIAL ANALYSIS	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/analysis`
OBLIGATION	requirement
TARGET TYPE	Implementation
CONFORMANCE CLASS	Conformance class 2: `http://www.opengis.net/spec/geoxacml/3.0/conf/spatial-analysis`
PREREQUISITES	<ISO19125-1>> XACML Version 3.0
NORMATIVE STATEMENTS	Requirement 66: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-envelope` Requirement 67: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-boundary` Requirement 68: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-buffer` Requirement 69: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-convex-hull` Requirement 70: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-geometry-intersection` Requirement 71: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-geometry-union` Requirement 72: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-difference` Requirement 73: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-sym-difference` Requirement 74: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-centroid`

8.1.1. Requirement Function Envelope

REQUIREMENT 66	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-envelope`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Envelope(this:Geometry):Geometry` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-envelope` This function SHALL be compliant with `Envelope():Geometry` as defined in OGC "Simple Features", section 6.1.2.2

8.1.2. Requirement Function Boundary

REQUIREMENT 67	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-boundary`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Boundary(this:Geometry):Geometry` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-boundary` This function SHALL be compliant with `Boundary():Geometry` as defined in OGC "Simple Features", section 6.1.2.2

8.1.3. Requirement Function Buffer

REQUIREMENT 68	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-buffer`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Buffer(this:Geometry,distance:Double):Geometry` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-buffer` This function SHALL be compliant with `Buffer(Double):Geometry` as defined in OGC "Simple Features", section 6.1.2.4

8.1.4. Requirement Function ConvexHull

REQUIREMENT 69	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-convex-hull`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `ConvexHull(this:Geometry):Geometry` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-convex-hull` This function SHALL be compliant with `ConvexHull():Geometry` as defined in OGC "Simple Features", section 6.1.2.4

8.1.5. Requirement Function GeometryIntersection

REQUIREMENT 70	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-geometry-intersection`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Intersection(this:Geometry,another:Geometry):Geometry` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-geometry-intersection` This function SHALL be compliant with `Intersection(Geometry):Geometry` as defined in OGC "Simple Features", section 6.1.2.4

8.1.6. Requirement Function GeometryUnion

REQUIREMENT 71	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-geometry-union`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Union(this:Geometry,another:Geometry):Geometry` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-geometry-union`

REQUIREMENT 71	
	This function SHALL be compliant with `Union(Geometry):Geometry` as defined in OGC "Simple Features", section 6.1.2.4

8.1.7. Requirement Function Difference

REQUIREMENT 72	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-difference`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Difference(this:Geometry,another:Geometry):Geometry` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-difference` This function SHALL be compliant with `Difference(Geometry):Geometry` as defined in OGC "Simple Features", section 6.1.2.4

8.1.8. Requirement Function SymDifference

REQUIREMENT 73	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-sym-difference`
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `SymDifference(this:Geometry,another:Geometry):Geometry` and the identifier as `{SYM_DIFFERENCE}` This function SHALL be compliant with `SymDifference(Geometry):Geometry` as defined in OGC "Simple Features", section 6.1.2.4

8.1.9. Requirement Function Centroid

REQUIREMENT 74	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-centroid`

REQUIREMENT 74	
OBLIGATION	requirement
STATEMENT	This function SHALL have the signature `Centroid(this:Geometry):Geometry` and the identifier as `urn:ogc:def:function:geoxacml:3.0:geometry-centroid` This function SHALL be compliant with `Centroid():Point` as defined in OGC "Simple Features", section 6.1.10.2

9

GEOXACML 3.0 CRS TRANSFORMATION REQUIREMENTS

9 GEOXACML 3.0 CRS TRANSFORMATION REQUIREMENTS

9.1. Requirements Class CRS Transformation

REQUIREMENTS CLASS 8: OGC API	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/crs-transformation
OBLIGATION	requirement
TARGET TYPE	Implementation
CONFORMANCE CLASS	Conformance class 3: http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation
PREREQUISITE	http://www.opengis.net/spec/geoxacml/3.0/req-class/core
NORMATIVE STATEMENTS	Requirement 75: http://www.opengis.net/spec/geoxacml/3.0/req-class/crs-transformation/req-allow-transformation Requirement 76: http://www.opengis.net/spec/geoxacml/3.0/req-class/crs-transformation/req-crs-transformation

9.1.1. Requirement Allow Transformation

REQUIREMENT 75	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/crs-transformation/req-allow-transformation
OBLIGATION	requirement
STATEMENT	The GeoXACML 3.0 CRS Transformation requirements class defines the XML attribute allowTransformation of type Boolean in namespace http://www.opengis.net/spec/geoxacml/3.0 to be used in the AttributeValue for expressing an explicit allowance that a coordinate transformation can be applied to the comprised geometry. The default value is False. When used in an ADR, the PEP SHALL use the allowTransformation for indicating to the PDP (the GeoXACML implementation) the acceptance that the geometry may get transformed to another CRS while deriving an authorization decision.

REQUIREMENT 75	
	When used in an AD (as part of the `MissingAttributeDetail`), the PDP SHALL indicate to the PEP the assurance that a geometry with the indicated CRS would not be transformed to another CRS during processing.

9.1.2. Requirement Support CRS Transformation

REQUIREMENT 76	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/crs-transformation/req-crs-transformation`
OBLIGATION	requirement
STATEMENT	An implementation SHALL apply CRS transformation to avoid having to abort processing as defined in [conf-class-core_req-crs-equal]. An implementation SHALL abort processing with `Decision` of `Indeterminate` and `StatusCode` `urn:ogc:def:identifier:geoxacml:3.0:crs-error` if • An error occurred during CRS transformation, or; • The transformation cannot be accomplished based on the geometries' CRS definitions, or; • At least one CRS definition is not understood. The `StatusDetail` SHALL include a `MissingAttributeDetail` listing the `AttributeValue`(s) including the `srid` and the `allowTransformation` attributes to indicate which geometry and CRS are accepted by the policy.

10

GEOXACML 3.0 OGC API REQUIREMENTS

10 GEOXACML 3.0 OGC API REQUIREMENTS

10.1. Requirements Class OGC API

REQUIREMENTS CLASS 9: OGC API	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api
OBLIGATION	requirement
TARGET TYPE	Implementation
CONFORMANCE CLASS	Conformance class 4: http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api
PREREQUISITES	https://opengeospatial.github.io/ogcna-auto-review/19-072.html http://www.opengis.net/spec/geoxacml/3.0/req-class/core
NORMATIVE STATEMENTS	Requirement 77: http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-landing-page Requirement 78: http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-conformance-page Requirement 79: http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-openapi-page Requirement 80: http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-decision Requirement 80: http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-decision

10.1.1. Requirement Landing Page

REQUIREMENT 77	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-landing-page
OBLIGATION	requirement
STATEMENT	An implementation SHALL support the path / to display general information about the implementation.

REQUIREMENT 77	
	An implementation SHALL support the response in JSON and HTML. An implementation SHALL return the JSON representation of the landing page when the HTTP request contains the query string parameter `f=json` or the HTTP header `Accept: application/json`. An implementation SHALL return the HTML representation of the landing page when the HTTP request contains the query string parameter `f=html` or the HTTP header `Accept: text/html`. An implementation SHALL return the HTML representation of the landing page in all other cases.

10.1.2. Requirement Conformance Page

REQUIREMENT 78	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-conformance-page`
OBLIGATION	requirement
STATEMENT	An implementation SHALL support the path `/conformance` to display the supported conformance classes in format HTML or JSON. An implementation SHALL return the JSON representation of the conformance page when the HTTP request contains the query string parameter `f=json` or the HTTP header `Accept: application/json`. An implementation SHALL return the HTML representation of the conformance page when the HTTP request contains the query string parameter `f=html` or the HTTP header `Accept: text/html`. An implementation SHALL return the HTML representation of the conformance page in all other cases.

10.2. Requirement OpenAPI Page

REQUIREMENT 79	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-openapi-page`
OBLIGATION	requirement
STATEMENT	An implementation SHALL support the path `/api` to display the OpenAPI document describing the API.

REQUIREMENT 79	
	An implementation SHALL return the JSON representation of the OpenAPI definition when the HTTP request contains the query string parameter `f=json` or the HTTP header `Accept: application/json`. An implementation SHALL return the HTML representation of the OpenAPI page when the HTTP request contains the query string parameter `f=html` or the HTTP header `Accept: text/html`. An implementation SHALL return the HTML representation of the OpenAPI definition in all other cases.

10.2.1. Requirement GeoXACML Decision

REQUIREMENT 80	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-decision`
OBLIGATION	requirement
STATEMENT	An implementation SHALL support the path `/decision` to support HTTP POST of a GeoXACML ADR compliant with the XACML 3 `<Request>` as defined in [xml3schema]. The response SHALL be a GeoXACML AD compliant with the XACML 3 `<Response>` as defined in [xml3schema]. The implementation SHALL accept the media type `xacml+xml` and `geoxacml+xml` indicating a XACML 3.0 schema compliant ADR that may contain `AttributeValue` elements of type `Geometry`. The implementation SHALL support the response media type `xacml+xml` and `geoxacml+xml` for a XACML 3.0 schema compliant AD.

11

MEDIA TYPES FOR ANY DATA ENCODING(S)

11 MEDIA TYPES FOR ANY DATA ENCODING(S)

OGC has registered the MIME-Type `application/geoxacml+xml` with IANA: https://www.iana.org/assignments/media-types/application/geoxacml+xml

A GeoXACML policy shall be exchanged using MIME-Type `application/geoxacml+xml`.

Any request to the OGC GeoXACML 3.0 PDP SHALL be XACML 3.0 schema compliant but use `Content-Type: application/geoxacml+xml` to indicate the use of GeoXACML 3.0 defined data-type `Geometry`.

A client (PEP) requesting a decision SHALL use `Accept: application/geoxacml+xml` to indicate that it is capable to handle GeoXACML 3.0 specific status codes.

A

ANNEX A (NORMATIVE) CONFORMANCE CLASS ABSTRACT TEST SUITE

A

ANNEX A (NORMATIVE) CONFORMANCE CLASS ABSTRACT TEST SUITE

This normative section defines the GeoXACML 3.0 conformance classes tests.

A.1. Conformance Class Specification (mandatory)

A.1.1. Requirements Class Specification

CONFORMANCE TEST A.1	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/specification/definition`
REQUIREMENTS	http://www.opengis.net/spec/geoxacml/3.0/conf/specification Requirement 1: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-data-type-urn-prefix` Requirement 1: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-data-type-urn-prefix` Requirement 2: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-geometry` Requirement 3: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xacml-bag` Requirement 4: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xacml-bag-crs` Requirement 5: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-iso` Requirement 6: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-homogeneous-collection` Requirement 7: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-heterogeneous-collection` Requirement 8: `http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-function-urn-prefix`

CONFORMANCE TEST A.1	
	Requirement 9: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xml-namespace-uri Requirement 10: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-crs Requirement 12: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-schema Requirement 13: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xml-attribute-srid Requirement 14: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-xml-attribute-precision Requirement 15: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-crs-error Requirement 16: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-geometry-error Requirement 17: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-geometry-collection-error Requirement 18: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-precision-error Requirement 19: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-subject-location Requirement 20: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-resource-location Requirement 21: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-resource-extend Requirement 22: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-resource-aoi Requirement 23: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-device-location
INCLUDED IN	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core
TEST PURPOSE	Verify that the implementation supports the definitions.
TEST-METHOD-TYPE	Manually Inspect
TEST METHOD	Evaluate that the implementation uses all of the definitions in a compliant way.

A.2. Conformance Class Core (mandatory)

A.2.1. Requirements Class Geometry Data-Type

CONFORMANCE TEST A.2	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/conf/core/wkt
REQUIREMENTS	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core Requirement 28: http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-wkt
INCLUDED IN	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core
TEST PURPOSE	Verify that the implementation supports the instantiation of a AttributeValue of data-type urn:ogc:def:dataType:geoxacml:3.0:geometry based on Well-Known-Text.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML policy that contains an AttributeValue of data-type urn:ogc:def:dataType:geoxacml:3.0:geometry with a value describing the geometry using Well-Known-Text.
DESCRIPTION	<xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry" >POINT(-77.035278 38.889444)</xacml3:AttributeValue> **Geometry encoding example based on WKT**

CONFORMANCE TEST A.3	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/conf/core/wkb
REQUIREMENTS	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core Requirement 29: http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-wkb
INCLUDED IN	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core
TEST PURPOSE	Verify that the implementation supports the instantiation of a AttributeValue of data-type urn:ogc:def:dataType:geoxacml:3.0:geometry based on Well-Known-Binary.

CONFORMANCE TEST A.3

TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML policy that contains an `AttributeValue` of data-type `urn:ogc:def:dataType:geoxacml:3.0:geometry` with a value describing the geometry using WKB.
DESCRIPTION	`<xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry" >01010000002c11a8fe414253c0cccf0d4dd9714340</xacml3:AttributeValue>` **Geometry encoding example based on WKB**

CONFORMANCE TEST A.4

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/core/geometry-error`
REQUIREMENTS	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core` Requirement 26: `http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-geometry-error`
INCLUDED IN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
TEST PURPOSE	Verify that the implementation aborts processing for an `AttributeValue` with a value not compliant to WKT and WKB.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML policy that processes an erroneous geometry value. Verify that the processing is aborted using the Status Code `urn:ogc:def:identifier:geoxacml:3.0:geometry-error`.
DESCRIPTION	`<xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry" >foo bar</xacml3:AttributeValue>` **Geometry encoding example that results in a geometry error**

CONFORMANCE TEST A.5

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/core/default-crs`
REQUIREMENTS	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`

CONFORMANCE TEST A.5

	Requirement 24: `http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-default-crs`
INCLUDED IN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
TEST PURPOSE	Verify that the implementation supports the instantiation of a `AttributeValue` of data-type `urn:ogc:def:dataType:geoxacml:3.0:geometry`using the default CRS `urn:ogc:def:crs:OGC::CRS84`.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML policy that contains an `AttributeValue` of data-type `urn:ogc:def:dataType:geoxacml:3.0:geometry` with a value describing the geometry using WKT or WKB and verify that the geometry SRID is equal to the default CRS.

CONFORMANCE TEST A.6

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/core/xacml-attribute-srid`
REQUIREMENTS	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core` Requirement 25: `http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-xacml-attribute-srid`
INCLUDED IN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
TEST PURPOSE	Verify that the implementation uses the `AttributeValue` XML attribute `srid` in namespace `http://www.opengis.net/spec/geoxacml/3.0` when constructing the geometry.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML policy that contains the following `AttributeValue` where the value of the `srid` attribute is of value `3857`. Verify that the instantiated geometry has CRS `EPSG:3857`.

DESCRIPTION	`<xacml3:AttributeValue xmlns:geoxacml="urn:ogc:def:dataType:geoxacml:3.0"`
	`DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"`
	`geoxacml:srid="3857"`
	`>POINT(-8571600.791082066 4579425.812870098)</xacml3:AttributeValue>`
	Geometry encoding example based on WKT and explicit SRS definition

CONFORMANCE TEST A.7

IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/conf/core/axis-order-crs84
REQUIREMENTS	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core Requirement 11: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-axis-order
INCLUDED IN	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core
TEST PURPOSE	Verify that the implementation uses the correct axis order for CRS urn:ogc:def:crs:OGC::CRS84 which is longitude/latitude.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML policy that contains an AttributeValue of data-type urn:ogc:def:dataType:geoxacml:3.0:geometry with a value describing the geometry using WKT or WKB in CRS {CRS} and verify that the axis order is longitude/latitude.

DESCRIPTION	`<xacml3:AttributeValue xmlns:geoxacml="urn:ogc:def:dataType:geoxacml:3.0"`
	`DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"`
	`>POINT(-77.035278, 38.889444)</xacml3:AttributeValue>`
	Location of Washington Monument in CRS84

CONFORMANCE TEST A.8

IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/conf/core/axis-order-epsg4326
REQUIREMENTS	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core Requirement 11: http://www.opengis.net/spec/geoxacml/3.0/req-class/specification/req-axis-order
INCLUDED IN	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core
TEST PURPOSE	Verify that the implementation uses the correct axis order for CRS EPSG:4326 which is latitude/longitude.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML policy that contains an AttributeValue of data-type urn:ogc:def:dataType:geoxacml:3.0:geometry with a value describing the geometry using WKT or WKB in CRS EPSG:4326 and verify that the axis order is latitude/longitude.
DESCRIPTION	`<xacml3:AttributeValue xmlns:geoxacml="urn:ogc:def:dataType:geoxacml:3.0"`

CONFORMANCE TEST A.8

```
DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
geoxacml:crs="EPSG:4326"
>POINT(38.889444, -77.035278)</xacml3:AttributeValue>
```

Location of Washington Monument in EPSG:4326

CONFORMANCE TEST A.9

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/core/crs-equal`
REQUIREMENTS	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core` Requirement 27: `http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-crs-equal`
INCLUDED IN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
TEST PURPOSE	Verify that the implementation processes two geometries or bags of geometries encoded in the identical CRS.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML policy that contains all of the `Core` functions where all geometry CRS, represented by their SRID value are identical. Verify that the processing was not aborted.

CONFORMANCE TEST A.10

IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/core/crs84-epsg4326`
REQUIREMENTS	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core` Requirement 27: `http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-crs-equal`
INCLUDED IN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
TEST PURPOSE	Verify that the implementation supports processing of functions where parameters of type `Geometry` are encoded using CRS84 and EPSG:4326.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML policy that contains all of the `Core` functions where both parameters are of type `urn:ogc:def:dataType:geoxacml:3.0:geometry` and the first geometry is encoded in the default CRS `urn:ogc:def:crs:OGC::CRS84` and the other geometry is encoded in the CRS `EPSG:4326`. Repeat the test with swapping parameters. Verify that the implementation applies axis swapping and produces correct results. A paramount

CONFORMANCE TEST A.10

	test function is urn:ogc:def:function:geoxacml:3.0:geometry-equal or urn:ogc:def:function:geoxacml:3.0:geometry-equals.

DESCRIPTION	<xacml3:Rule RuleId="swap-axis" Effect="Permit">
	  <xacml3:Condition>
	  <xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-equals">
	  <xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
	  >POINT(-77.035278, 38.889444)</xacml3:AttributeValue>
	  <xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
	  xmlns:geoxacml="http://www.opengis.net/spec/geoxacml/3.0" geoxacml:crs="EPSG:4326"
	  >POINT(38.889444, -77.035278)</xacml3:AttributeValue>
	  </xacml3:Apply>
	  </xacml3:Condition>
	</xacml3:Rule>

GeoXACML 3.0 Rule for testing axis-order swapping

CONFORMANCE TEST A.11

IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/conf/core/crs-not-equal
REQUIREMENTS	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core Requirement 27: http://www.opengis.net/spec/geoxacml/3.0/req-class/data-type/req-crs-equal
INCLUDED IN	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core
TEST PURPOSE	Verify that the implementation aborts processing by returning the StatusCode with value urn:ogc:def:identifier:geoxacml:3.0:crs-error when processing a function that operates on at least two geometries and their CRS definitions are not identical and where CRS transformation would be required to complete the processing.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML policy that contains all of the Core functions where both parameters are of data-type urn:ogc:def:dataType:geoxacml:3.0:geometry and processing would require a CRS transformation. Example CRS combination is EPSG:4326 and EPSG:3857. Verify that the implementation aborts processing with the status code urn:ogc:def:identifier:geoxacml:3.0:crs-error.
DESCRIPTION	<xacml3:Rule RuleId="swap-axis" Effect="Permit"> <xacml3:Condition> <xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-equals"> <xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry" >POINT(-77.035278, 38.889444)</xacml3:AttributeValue>

CONFORMANCE TEST A.11

```
        <xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:
3.0:geometry"
        xmlns:geoxacml="http://www.opengis.net/spec/geoxacml/3.0"
geoxacml:crs="EPSG:3857"
        >POINT(-8571600.791082066 4579425.812870098)</xacml3:
AttributeValue>
    </xacml3:Apply>
    </xacml3:Condition>
</xacml3:Rule>
```

GeoXACML 3.0 Rule for testing CRS error

A.2.2. Requirements Class Geometry Functions

CONFORMANCE TEST A.12: GEOMETRY FUNCTIONS CONFORMANCE TESTS

IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/conf/core/geometry-functions
REQUIREMENTS	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core Requirement 30: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-dimension Requirement 31: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-type Requirement 32: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-srid Requirement 33: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-empty Requirement 34: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-simple Requirement 35: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-srid-equals Requirement 36: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-srid Requirement 37: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-precision Requirement 38: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-length Requirement 39: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-area Requirement 40: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-distance Requirement 41: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-has-distance Requirement 42: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-is-within-distance

CONFORMANCE TEST A.12: GEOMETRY FUNCTIONS CONFORMANCE TESTS	
INCLUDED IN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
TEST PURPOSE	To validate that the implementation supports all functions of Requirements Class **Geometry Functions**.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Instantiate the implementation with a GeoXACML 3.0 policy that contains all functions listed below:
A	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-dimension
B	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-type
C	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-srid
D	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-empty
E	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-simple
F	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-srid-equals
G	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-srid
H	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-precision
I	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-length
J	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-area
K	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-distance
L	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-has-distance
M	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-is-within-distance

A.2.3. Requirements Class Test Functions

CONFORMANCE TEST A.13: TEST FUNCTIONS CONFORMANCE TESTS	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/core/test-functions`

CONFORMANCE TEST A.13: TEST FUNCTIONS CONFORMANCE TESTS	
REQUIREMENTS	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core` Requirement 30: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-dimension` Requirement 31: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-type` Requirement 32: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-srid` Requirement 33: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-empty` Requirement 34: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-simple`
INCLUDED IN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
TEST PURPOSE	To validate that the implementation supports all functions of Requirements Class **Test Functions**.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Instantiate the implementation with a GeoXACML 3.0 policy that contains all functions listed below:
A	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-dimension
B	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-type
C	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-srid
D	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-empty
E	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-is-simple

A.2.4. Requirements Class Spatial Relations Functions

CONFORMANCE TEST A.14: SPATIAL RELATIONS FUNCTIONS CONFORMANCE TESTS	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/core/spatial-relations-functions`
REQUIREMENTS	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core` Requirement 43: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equal` Requirement 44: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equals`

CONFORMANCE TEST A.14: SPATIAL RELATIONS FUNCTIONS CONFORMANCE TESTS	
	Requirement 45: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-disjoint` Requirement 46: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-intersects` Requirement 47: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-touches` Requirement 48: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-crosses` Requirement 49: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-within` Requirement 50: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-contains` Requirement 51: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-overlaps`
INCLUDED IN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
TEST PURPOSE	To validate that the implementation supports all functions of Requirements Class **Spatial Relations Functions**.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Instantiate the implementation with a GeoXACML 3.0 policy that contains all functions listed below:
A	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equal
B	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equals
C	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-disjoint
D	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-intersects
E	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-touches
F	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-crosses
G	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-within
H	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-contains
I	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-overlaps

A.2.5. Requirements Class Spatial Analysis Functions

CONFORMANCE TEST A.15: SPATIAL ANALYSIS FUNCTIONS CONFORMANCE TESTS	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/core/spatial-analysis-functions`
REQUIREMENTS	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core` http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-jts-is-within-distance Requirement 41: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-has-distance` Requirement 40: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-distance` Requirement 52: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-relate` Requirement 38: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-length` Requirement 39: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-area`
INCLUDED IN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
TEST PURPOSE	To validate that the implementation supports all functions of Requirements Class **Spatial Analysis Functions**.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Instantiate the implementation with a GeoXACML 3.0 policy that contains all functions listed below:
A	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-jts-is-within-distance
B	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-has-distance
C	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-distance
D	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-relate
E	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-length
F	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-area

A.2.6. Requirements Class XACML Bag Functions

CONFORMANCE TEST A.16: XACML BAG FUNCTIONS CONFORMANCE TESTS	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/core/xacml-bag-functions`
REQUIREMENTS	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core` Requirement 53: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-one-and-only` Requirement 54: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-bag-size` Requirement 55: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-is-in` Requirement 56: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-bag` Requirement 57: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-to-collection` Requirement 58: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-from-collection` Requirement 59: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-srid` Requirement 60: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-srid-equals` Requirement 59: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-srid` Requirement 60: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-srid-equals`
INCLUDED IN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
TEST PURPOSE	To validate that the implementation supports all functions of Requirements Class **XACML Bag Functions**.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Instantiate the implementation with a GeoXACML 3.0 policy that contains all functions listed below:
A	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-one-and-only
B	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-bag-size
C	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-is-in
D	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-bag

CONFORMANCE TEST A.16: XACML BAG FUNCTIONS CONFORMANCE TESTS	
E	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-to-collection
F	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-geometry-bag-from-collection

A.2.7. Requirements Class XACML Set Functions

CONFORMANCE TEST A.17: XACML SET FUNCTIONS CONFORMANCE TESTS	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/core/xacml-set-functions`
REQUIREMEN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core` Requirement 62: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-intersection` Requirement 61: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-at-least-one-member-of` Requirement 63: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-union` Requirement 64: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-subset` Requirement 65: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-set-equals`
INCLUDED IN	Conformance class 1: `http://www.opengis.net/spec/geoxacml/3.0/conf/core`
TEST PURPOSE	To validate that the implementation supports all functions of Requirements Class **XACML Set Functions**.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Instantiate the implementation with a GeoXACML 3.0 policy that contains all functions listed below:
A	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-intersection
B	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-at-least-one-member-of
C	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-union
D	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-subset
E	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-set-equals

A.3. Conformance Class Spatial Analysis (optional)

CONFORMANCE TEST A.18: GEOMETRY ADVANCED FUNCTIONS CONFORMANCE TESTS	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/conf/core/advanced-functions
REQUIREMENT	Conformance class 1: http://www.opengis.net/spec/geoxacml/3.0/conf/core Requirement 66: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-envelope Requirement 67: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-boundary Requirement 68: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-buffer Requirement 69: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-convex-hull Requirement 70: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-geometry-intersection Requirement 71: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-geometry-union Requirement 72: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-difference Requirement 73: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-sym-difference Requirement 74: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-centroid
INCLUDED IN	Conformance class 2: http://www.opengis.net/spec/geoxacml/3.0/conf/spatial-analysis
TEST PURPOSE	To validate that the implementation supports all functions of Requirements Class **Geometry Advanced Functions**.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Instantiate the implementation with a GeoXACML 3.0 policy that contains all functions listed below:
A	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-envelope
B	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-boundary
C	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-buffer
D	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-convex-hull

CONFORMANCE TEST A.18: GEOMETRY ADVANCED FUNCTIONS CONFORMANCE TESTS	
E	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-geometry-intersection
F	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-geometry-union
G	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-difference
H	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-sym-difference
I	http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-geometry-centroid

A.4. Conformance Class CRS Transformation (optional)

CONFORMANCE TEST A.19: CRS TRANSFORMATION	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation/crs-transformation`
REQUIREMENTS	Conformance class 3: `http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation` Requirement 76: `http://www.opengis.net/spec/geoxacml/3.0/req-class/crs-transformation/req-crs-transformation` Requirement 50: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-contains` Requirement 48: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-crosses` Requirement 45: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-disjoint` Requirement 43: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equal` Requirement 44: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equals` Requirement 46: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-intersects` Requirement 51: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-overlaps` Requirement 47: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-touches` Requirement 49: `http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-within`

CONFORMANCE TEST A.19: CRS TRANSFORMATION	
	Requirement 52: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-relate Requirement 42: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-is-within-distance Requirement 41: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-has-distance Requirement 40: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-distance Requirement 55: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-is-in Requirement 61: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-at-least-one-member-of Requirement 62: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-intersection Requirement 63: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-union Requirement 64: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-subset Requirement 65: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-set-equals Requirement 36: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-srid
INCLUDED IN	Conformance class 3: http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation
TEST PURPOSE	To validate that the implementation supports a CRS transformation.
TEST-METHOD-TYPE	Manual Inspection
TEST METHOD	Validate the implementation via code inspection to ensure CRS transformation is implemented in all functions that process two or more geometries:
A	urn:ogc:def:function:geoxacml:3.0:geometry-contains
B	urn:ogc:def:function:geoxacml:3.0:geometry-crosses
C	urn:ogc:def:function:geoxacml:3.0:geometry-disjoint
D	urn:ogc:def:function:geoxacml:3.0:geometry-equal
E	urn:ogc:def:function:geoxacml:3.0:geometry-equals
F	urn:ogc:def:function:geoxacml:3.0:geometry-intersects
G	urn:ogc:def:function:geoxacml:3.0:geometry-overlaps

CONFORMANCE TEST A.19: CRS TRANSFORMATION	
H	urn:ogc:def:function:geoxacml:3.0:geometry-touches
I	urn:ogc:def:function:geoxacml:3.0:geometry-within
J	urn:ogc:def:function:geoxacml:3.0:geometry-relate
K	urn:ogc:def:function:geoxacml:3.0:geometry-is-within-distance
L	urn:ogc:def:function:geoxacml:3.0:geometry-distance-equals
M	urn:ogc:def:function:geoxacml:3.0:geometry-distance
N	urn:ogc:def:function:geoxacml:3.0:geometry-is-in
O	urn:ogc:def:function:geoxacml:3.0:geometry-at-least-one-member-of
P	urn:ogc:def:function:geoxacml:3.0:geometry-intersection
Q	urn:ogc:def:function:geoxacml:3.0:geometry-union
R	urn:ogc:def:function:geoxacml:3.0:geometry-subset
S	urn:ogc:def:function:geoxacml:3.0:geometry-set-equals
T	urn:ogc:def:function:geoxacml:3.0:geometry-ensure-srid

CONFORMANCE TEST A.20: ALLOWTRANSFORMATION CONFORMANCE TESTS	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation/allow-transformation-1
REQUIREMENTS	Conformance class 3: http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation Requirement 75: http://www.opengis.net/spec/geoxacml/3.0/req-class/crs-transformation/req-allow-transformation Requirement 50: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-contains Requirement 48: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-crosses Requirement 45: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-disjoint Requirement 43: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equal

CONFORMANCE TEST A.20: ALLOWTRANSFORMATION CONFORMANCE TESTS	
	Requirement 44: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equals Requirement 46: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-intersects Requirement 51: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-overlaps Requirement 47: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-touches Requirement 49: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-within Requirement 52: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-relate Requirement 42: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-is-within-distance Requirement 41: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-has-distance Requirement 40: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-distance Requirement 55: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-is-in Requirement 61: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-at-least-one-member-of Requirement 62: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-intersection Requirement 63: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-union Requirement 64: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-subset Requirement 65: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-set-equals Requirement 36: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-srid
INCLUDED IN	Conformance class 3: http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation
TEST PURPOSE	Verify that the implementation supports coordinate transformation if the geometries processed in a function have different CRS. Verify that processing does result in StatusCode with value urn:ogc:def:identifier:geoxacml:3.0:crs-error if CRS transformation is not allowed due to allowTransformation=false.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML 3.0 policy that contains the following functions with geometries using different CRS and allowTransformation=true:
A	urn:ogc:def:function:geoxacml:3.0:geometry-contains

CONFORMANCE TEST A.20: ALLOWTRANSFORMATION CONFORMANCE TESTS	
B	urn:ogc:def:function:geoxacml:3.0:geometry-crosses
C	urn:ogc:def:function:geoxacml:3.0:geometry-disjoint
D	urn:ogc:def:function:geoxacml:3.0:geometry-equal
E	urn:ogc:def:function:geoxacml:3.0:geometry-equals
F	urn:ogc:def:function:geoxacml:3.0:geometry-intersects
G	urn:ogc:def:function:geoxacml:3.0:geometry-overlaps
H	urn:ogc:def:function:geoxacml:3.0:geometry-touches
I	urn:ogc:def:function:geoxacml:3.0:geometry-within
J	urn:ogc:def:function:geoxacml:3.0:geometry-relate
K	urn:ogc:def:function:geoxacml:3.0:geometry-is-within-distance
L	urn:ogc:def:function:geoxacml:3.0:geometry-distance-equals
M	urn:ogc:def:function:geoxacml:3.0:geometry-distance
N	urn:ogc:def:function:geoxacml:3.0:geometry-is-in
O	urn:ogc:def:function:geoxacml:3.0:geometry-at-least-one-member-of
P	urn:ogc:def:function:geoxacml:3.0:geometry-intersection
Q	urn:ogc:def:function:geoxacml:3.0:geometry-union
R	urn:ogc:def:function:geoxacml:3.0:geometry-subset
S	urn:ogc:def:function:geoxacml:3.0:geometry-set-equals
T	urn:ogc:def:function:geoxacml:3.0:geometry-ensure-srid

CONFORMANCE TEST A.21: ALLOWTRANSFORMATION CONFORMANCE TESTS	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation/allow-transformation-2
REQUIREMENTS	Conformance class 3: http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation Requirement 75: http://www.opengis.net/spec/geoxacml/3.0/req-class/crs-transformation/req-allow-transformation Requirement 50: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-contains Requirement 48: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-crosses Requirement 45: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-disjoint Requirement 43: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equal Requirement 44: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equals Requirement 46: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-intersects Requirement 51: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-overlaps Requirement 47: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-touches Requirement 49: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-within Requirement 52: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-relate Requirement 42: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-is-within-distance Requirement 41: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-has-distance Requirement 40: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-distance Requirement 55: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-is-in Requirement 61: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-at-least-one-member-of Requirement 62: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-intersection Requirement 63: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-union Requirement 64: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-subset Requirement 65: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-set-equals Requirement 36: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-srid

CONFORMANCE TEST A.21: ALLOWTRANSFORMATION CONFORMANCE TESTS	
INCLUDED IN	Conformance class 3: `http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation`
TEST PURPOSE	Verify that the implementation aborts processing with result `StatusCode` and value `urn:ogc:def:identifier:geoxacml:3.0:crs-error` if CRS transformation is not allowed due to `allowTransformation=false`.
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML 3.0 policy that contains the following functions with geometries using different CRS and `allowTransformation=false`:
A	`urn:ogc:def:function:geoxacml:3.0:geometry-contains`
B	`urn:ogc:def:function:geoxacml:3.0:geometry-crosses`
C	`urn:ogc:def:function:geoxacml:3.0:geometry-disjoint`
D	`urn:ogc:def:function:geoxacml:3.0:geometry-equal`
E	`urn:ogc:def:function:geoxacml:3.0:geometry-equals`
F	`urn:ogc:def:function:geoxacml:3.0:geometry-intersects`
G	`urn:ogc:def:function:geoxacml:3.0:geometry-overlaps`
H	`urn:ogc:def:function:geoxacml:3.0:geometry-touches`
I	`urn:ogc:def:function:geoxacml:3.0:geometry-within`
J	`urn:ogc:def:function:geoxacml:3.0:geometry-relate`
K	`urn:ogc:def:function:geoxacml:3.0:geometry-is-within-distance`
L	`urn:ogc:def:function:geoxacml:3.0:geometry-distance-equals`
M	`urn:ogc:def:function:geoxacml:3.0:geometry-distance`
N	`urn:ogc:def:function:geoxacml:3.0:geometry-is-in`
O	`urn:ogc:def:function:geoxacml:3.0:geometry-at-least-one-member-of`
P	`urn:ogc:def:function:geoxacml:3.0:geometry-intersection`
Q	`urn:ogc:def:function:geoxacml:3.0:geometry-union`

CONFORMANCE TEST A.21: ALLOWTRANSFORMATION CONFORMANCE TESTS	
R	urn:ogc:def:function:geoxacml:3.0:geometry-subset
S	urn:ogc:def:function:geoxacml:3.0:geometry-set-equals
T	urn:ogc:def:function:geoxacml:3.0:geometry-ensure-srid

CONFORMANCE TEST A.22: ALLOWTRANSFORMATION CONFORMANCE TESTS	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation/allow-transformation-3
REQUIREMENTS	Conformance class 3: http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation Requirement 75: http://www.opengis.net/spec/geoxacml/3.0/req-class/crs-transformation/req-allow-transformation Requirement 50: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-contains Requirement 48: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-crosses Requirement 45: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-disjoint Requirement 43: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equal Requirement 44: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-equals Requirement 46: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-intersects Requirement 51: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-overlaps Requirement 47: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-touches Requirement 49: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-within Requirement 52: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-relate Requirement 42: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-is-within-distance Requirement 41: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-has-distance Requirement 40: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-iso-distance Requirement 55: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-is-in Requirement 61: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-at-least-one-member-of

CONFORMANCE TEST A.22: ALLOWTRANSFORMATION CONFORMANCE TESTS	
	Requirement 62: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-intersection Requirement 63: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-union Requirement 64: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-subset Requirement 65: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-xacml-geometry-set-equals Requirement 36: http://www.opengis.net/spec/geoxacml/3.0/req-class/functions/req-ensure-srid
INCLUDED IN	Conformance class 3: http://www.opengis.net/spec/geoxacml/3.0/conf/crs-transformation
TEST PURPOSE	Verify that the implementation aborts processing with result StatusCode and value urn:ogc:def:identifier:geoxacml:3.0:crs-error if CRS transformation is not allowed due to allowTransformation=false. Verify that the MissingAttributeDetail contains information about the accepted CRS where no transformation would be required (allowTransformation=false).
TEST-METHOD-TYPE	Unit Tests
TEST METHOD	Execute the implementation on a GeoXACML 3.0 policy that contains the following functions with geometries using different CRS and one geometry uses allowTransformation=false and the other allowTransformation=true. Verify that the MissingAttributeDetail contains a list of the AttributeValue (s) from the request with CRS and allowTransformation=false attributes to indicate a successful re-submission of the request:
A	urn:ogc:def:function:geoxacml:3.0:geometry-contains
B	urn:ogc:def:function:geoxacml:3.0:geometry-crosses
C	urn:ogc:def:function:geoxacml:3.0:geometry-disjoint
D	urn:ogc:def:function:geoxacml:3.0:geometry-equal
E	urn:ogc:def:function:geoxacml:3.0:geometry-equals
F	urn:ogc:def:function:geoxacml:3.0:geometry-intersects
G	urn:ogc:def:function:geoxacml:3.0:geometry-overlaps
H	urn:ogc:def:function:geoxacml:3.0:geometry-touches
I	urn:ogc:def:function:geoxacml:3.0:geometry-within

CONFORMANCE TEST A.22: ALLOWTRANSFORMATION CONFORMANCE TESTS	
J	urn:ogc:def:function:geoxacml:3.0:geometry-relate
K	urn:ogc:def:function:geoxacml:3.0:geometry-is-within-distance
L	urn:ogc:def:function:geoxacml:3.0:geometry-distance-equals
M	urn:ogc:def:function:geoxacml:3.0:geometry-distance
N	urn:ogc:def:function:geoxacml:3.0:geometry-is-in
O	urn:ogc:def:function:geoxacml:3.0:geometry-at-least-one-member-of
P	urn:ogc:def:function:geoxacml:3.0:geometry-intersection
Q	urn:ogc:def:function:geoxacml:3.0:geometry-union
R	urn:ogc:def:function:geoxacml:3.0:geometry-subset
S	urn:ogc:def:function:geoxacml:3.0:geometry-set-equals
T	urn:ogc:def:function:geoxacml:3.0:geometry-ensure-srid

A.5. Conformance Class OGC API (optional)

CONFORMANCE TEST A.23: LANDING PAGE CONFORMANCE TESTS	
IDENTIFIER	http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api/landing-page
REQUIREMENTS	Conformance class 4: http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api Requirement 77: http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-landing-page
INCLUDED IN	Conformance class 4: http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api
TEST PURPOSE	Verify that the implementation renders the landing page in the formats html and json.
TEST-METHOD-TYPE	Postman or Web Browser

CONFORMANCE TEST A.23: LANDING PAGE CONFORMANCE TESTS	
TEST METHOD	Execute the root URL of the implementation and verify that the response contains the landing page in the requested format:
A	Use the URL query string `f=html` to request the HTML format of the landing page
B	Use the URL query string `f=json` to request the JSON format of the landing page

CONFORMANCE TEST A.24: OPENAPI PAGE CONFORMANCE TESTS	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api/openapi-page`
REQUIREMENTS	Conformance class 4: `http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api` Requirement 79: `http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-openapi-page`
INCLUDED IN	Conformance class 4: `http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api`
TEST PURPOSE	Verify that the implementation renders the OpenAPI page in the formats `html` and `json`.
TEST-METHOD-TYPE	Postman or Web Browser
TEST METHOD	Execute the `/api` URL of the implementation and verify that the response contains the landing page in the requested format:
A	Use the URL query string `f=html` to request the HTML format of the OpenAPI page
B	Use the URL query string `f=json` to request the JSON format of the OpenAPI page

CONFORMANCE TEST A.25: CONFORMANCE PAGE CONFORMANCE TESTS	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api/conformance-page`
REQUIREMENTS	Conformance class 4: `http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api` Requirement 78: `http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-conformance-page`
INCLUDED IN	Conformance class 4: `http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api`
TEST PURPOSE	Verify that the implementation renders the Conformance page in the formats `html` and `json`.

CONFORMANCE TEST A.25: CONFORMANCE PAGE CONFORMANCE TESTS	
TEST-METHOD-TYPE	Postman or Web Browser
TEST METHOD	Execute the `/conformance` URL of the implementation and verify that the response contains the conformance page in the requested format:
A	Use the URL query string `f=html` to request the HTML format of the conformance page
B	Use the URL query string `f=json` to request the JSON format of the conformance page

CONFORMANCE TEST A.26: DECISION ENDPOINT CONFORMANCE TESTS	
IDENTIFIER	`http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api/decision-endpoint`
REQUIREMENTS	Conformance class 4: `http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api` Requirement 80: `http://www.opengis.net/spec/geoxacml/3.0/req-class/ogc-api/req-api-decision`
INCLUDED IN	Conformance class 4: `http://www.opengis.net/spec/geoxacml/3.0/conf/ogc-api`
TEST PURPOSE	Verify that the implementation accepts ADR via HTTP POST and Content-Type `application/geoxacml+xml` and `application/geoxacml+json` if supported on the `/decision` path.
TEST-METHOD-TYPE	Postman or Web Browser
TEST METHOD	Execute a HTTP POST request with a compliant ADR to the path `/decision` using the following HTTP Headers:
A	`Content-Type: application/geoxacml+xml` (mandatory)
B	`Content-Type: application/geoxacml+json` (optional) but mandatory if the implementation is compliant to GeoXACML 3.0 JSON Profile v1.0

B

ANNEX B (INFORMATIVE) CONFORMANCE SUMMARY

B

ANNEX B (INFORMATIVE) CONFORMANCE SUMMARY

This appendix lists all identifiers and their conformance classes.

B.1. Conformance Class Core

B.1.1. GeoXACML Data-type `Geometry`

- `urn:ogc:def:dataType:geoxacml:3.0:geometry`

B.1.2. GeoXACML Error Codes

- `urn:ogc:def:identifier:geoxacml:3.0:crs-error`
- `urn:ogc:def:identifier:geoxacml:3.0:geometry-error`
- `urn:ogc:def:identifier:geoxacml:3.0:geometry-collection-error`
- `urn:ogc:def:identifier:geoxacml:3.0:precision-error`

B.1.3. GeoXACML Attribute Identifiers

- `urn:ogc:def:identifier:geoxacml:3.0:subject-location`
- `urn:ogc:def:identifier:geoxacml:3.0:resource-location`
- `urn:ogc:def:identifier:geoxacml:3.0:device-location`
- `urn:ogc:def:identifier:geoxacml:3.0:resource-extend`
- `urn:ogc:def:identifier:geoxacml:3.0:resource-aoi`

B.1.4. GeoXACML Default CRS

- `urn:ogc:def:crs:OGC::CRS84`

B.1.5. GeoXACML XML element `AttributeValue` attributes

- XML namespace: `http://www.opengis.net/spec/geoxacml/3.0`
- XML attribute: `srid`
- XML attribute: `precision`

B.1.6. Geometry Functions

- urn:ogc:def:function:geoxacml:3.0:geometry-dimension
- urn:ogc:def:function:geoxacml:3.0:geometry-type
- urn:ogc:def:function:geoxacml:3.0:geometry-srid
- urn:ogc:def:function:geoxacml:3.0:geometry-is-empty
- urn:ogc:def:function:geoxacml:3.0:geometry-is-simple
- urn:ogc:def:function:geoxacml:3.0:geometry-srid-equals
- urn:ogc:def:function:geoxacml:3.0:geometry-ensure-srid

B.1.7. Topology Predicates

- urn:ogc:def:function:geoxacml:3.0:geometry-equal
- urn:ogc:def:function:geoxacml:3.0:geometry-equals
- urn:ogc:def:function:geoxacml:3.0:geometry-disjoint
- urn:ogc:def:function:geoxacml:3.0:geometry-intersects
- urn:ogc:def:function:geoxacml:3.0:geometry-touches
- urn:ogc:def:function:geoxacml:3.0:geometry-crosses
- urn:ogc:def:function:geoxacml:3.0:geometry-within
- urn:ogc:def:function:geoxacml:3.0:geometry-contains

- urn:ogc:def:function:geoxacml:3.0:geometry-overlaps
- urn:ogc:def:function:geoxacml:3.0:geometry-relate

B.1.8. Analysis Functions

- urn:ogc:def:function:geoxacml:3.0:geometry-length
- urn:ogc:def:function:geoxacml:3.0:geometry-area
- urn:ogc:def:function:geoxacml:3.0:geometry-distance
- urn:ogc:def:function:geoxacml:3.0:geometry-distance-equals
- urn:ogc:def:function:geoxacml:3.0:geometry-is-within-distance

B.1.9. XACML Bag / Set Functions

- urn:ogc:def:function:geoxacml:3.0:geometry-one-and-only
- urn:ogc:def:function:geoxacml:3.0:geometry-bag-size
- urn:ogc:def:function:geoxacml:3.0:geometry-is-in
- urn:ogc:def:function:geoxacml:3.0:geometry-bag
- urn:ogc:def:function:geoxacml:3.0:geometry-bag-to-collection
- urn:ogc:def:function:geoxacml:3.0:geometry-bag-from-collection
- urn:ogc:def:function:geoxacml:3.0:geometry-at-least-one-member-of
- urn:ogc:def:function:geoxacml:3.0:geometry-intersection
- urn:ogc:def:function:geoxacml:3.0:geometry-union
- urn:ogc:def:function:geoxacml:3.0:geometry-subset
- urn:ogc:def:function:geoxacml:3.0:geometry-set-equals

B.2. Conformance Class Spatial Analysis

B.2.1. Analysis Functions

- urn:ogc:def:function:geoxacml:3.0:geometry-envelope
- urn:ogc:def:function:geoxacml:3.0:geometry-boundary
- urn:ogc:def:function:geoxacml:3.0:geometry-buffer
- urn:ogc:def:function:geoxacml:3.0:geometry-convex-hull
- urn:ogc:def:function:geoxacml:3.0:geometry-geometry-intersection
- urn:ogc:def:function:geoxacml:3.0:geometry-geometry-union
- urn:ogc:def:function:geoxacml:3.0:geometry-difference
- {SYM_DIFFERENCE}
- urn:ogc:def:function:geoxacml:3.0:geometry-centroid

B.3. Conformance Class CRS Transformation

B.3.1. GeoXACML XML element `AttributeValue` attribute

- XML namespace: `http://www.opengis.net/spec/geoxacml/3.0`
- XML attribute: `allowTransformation`

C

ANNEX C (INFORMATIVE) ISSUES AND HOW THEY ARE RESOLVED.

C

ANNEX C (INFORMATIVE) ISSUES AND HOW THEY ARE RESOLVED.

Different conceptual issues were identified while creating the GeoXACML 3.0 Standard. This appendix explains the issues and how the issues got resolved.

C.1. Issue: Default CRS

The GeoXACML 3.0 Standard defines the Well-Known-Text (WKT) “string” and Well-Known-Binary (WKB) “hex-string” representation of a geometry. The WKT and WKB encoding does not include the value of the CRS that was used to calculate the values of the coordinates.

To support the WKT and WKB encoding of geometries, as specified in OGC "Simple Features", the GeoXACML Core defines a default CRS. This default CRS is the same as the CRS defined in The GeoJSON Format.

Even though the definition of a default CRS ensures straight interoperability, a default CRS reduces flexibility where alternative CRS definitions are more appropriate. XACML defines two XML elements in XACML Version 3.0 XML Schema that allow to specifying default key values:

- `<PolicySetDefaults>` allows setting a default for the given key that is valid within the realm of a `<PolicySet>`.
- `<PolicyDefaults>` allows setting a default for the given key that is valid within the realm of a `<Policy>`.

It would be good if the GeoXACML core could specify a `<CRS>` element that contains the default CRS identifier for the scope of the `<PolicySet>` or `<Policy>` would be good. Unfortunately, XACML does **not** define these elements to be extendable:

```
<xs:element name="PolicySetDefaults" type="xacml:DefaultsType"/>
<xs:element name="PolicyDefaults" type="xacml:DefaultsType"/>
<xs:complexType name="DefaultsType">
    <xs:sequence>
        <xs:choice>
            <xs:element ref="xacml:XPathVersion"/>
        </xs:choice>
    </xs:sequence>
</xs:complexType>
```

```
<xs:element name="XPathVersion" type="xs:anyURI"/>
```

Figure C.1 — XACML Schema definition for the <PolicySetDefaults> and <PolicyDefaults>

To overcome the limitation of using the default CRS, any GeoXACML Policy or Authorization Decision Request (in XML) can override the default CRS by leveraging the `AttributeValue` attribute `geoxacml:srid`.

```
<xacml3:AttributeValue xmlns:geoxacml="http://www.opengis.net/spec/geoxacml/3.
0"
    DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
    geoxacml:srid="4326"
    >POINT(38.889444 -77.035278)</xacml3:AttributeValue>
```

Figure C.2 — Geometry encoding example based on WKT and explicit SRID definition

C.2. Issue: CRS Processing Error

A GeoXACML 3.0 implementation can process multiple geometries in one function. In the case where the `AttributeValue` carries an explicit SRID definition, an implementation may have to abort processing when the SRID definition is not known, mis-understood or a coordinate transformation based upon the CRS results in an error. Furthermore, failure is possible for any function that has two or more parameters of type `Geometry` may fail when applying a coordinate transformation.

To signal that the cause is based on one or multiple SRS definitions, GeoXACML Core 3.0 defines the `StatusCode` value `urn:ogc:def:identifier:geoxacml:3.0:crs-error`.

To indicate the cause of the processing error, an application may list the involved SRSs in the `StatusDetail` using the `MissingAttributeDetail`. The following example illustrates such a case.

```
<xacml3:Response xmlns:xacml3="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17 http://docs.
oasis-open.org/xacml/3.0/xacml-core-v3-schema-wd-17.xsd">
  <xacml3:Result>
    <xacml3:Decision>Indeterminate</xacml3:Decision>
    <xacml3:Status>
      <xacml3:StatusCode Value="urn:ogc:def:function:geoxacml:3.0:geometry-
error"/>
      <xacml3:StatusMessage>Geometry must be encoded using specified SRID</
xacml3:StatusMessage>
      <xacml3:StatusDetail>
        <xacml3:MissingAttributeDetail
        Category="urn:oasis:names:tc:xacml:1.0:subject-category:access-subject"
        AttributeId="subject-location"
        DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry">
          <xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry"
          xmlns:geoxacml="http://www.opengis.net/spec/geoxacml/3.0"
```

```
          geoxacml:srid="3857"/>
        </xacml3:MissingAttributeDetail>
      </xacml3:StatusDetail>
    </xacml3:Status>
  </xacml3:Result>
</xacml3:Response>
```

Figure C.3 — GeoXACML Response indicating processing error caused by SRS

NOTE The `allowTransformation={True|False}` can occur on an `AttributeValue` element contained in a XACML Policy or Authorization Decision Request. When the `allowTransformation=True` is present in the policy, the policy writer indicates explicit agreement that a coordinate transformation can take place. When the `allowTransformation=True` is present in an Authorization Decision Request, the PEP indicates explicit consent that the provided geometry may undergo a coordinate transformation while deriving an authorization decision.

C.3. Issue: XACML bag/set of geometries vs. GeometryCollection

OGC "Simple Features", §6.1.3 defines a GeometryCollection as follows: *"A GeometryCollection is a geometric object that is a collection of some number of geometric objects."* with the following constraint: *"All the elements in a GeometryCollection shall be in the same Spatial Reference System. This is also the Spatial Reference System for the GeometryCollection."*

OGC "Simple Features", §7.2.2 defines the Well-Known-Text encoding of a GeometryCollection.

Operations on an OGC "Simple Features" geometry instance may involve a GeometryCollection. For example, the ConvexHull method may return an empty GeometryCollection if the input geometry has zero points (is empty). Also, operations like Intersection or Union allow the processing of or result in a GeometryCollection.

XACML Version 3.0, §7.3.2 defines a bag of attributes as follows: *"XACML defines implicit collections of its data types. XACML refers to a collection of values that are of a single data-type as a bag. Bags of data-types are needed because selections of nodes from an XML resource or XACML request context may return more than one value."* The XACML `<AttributeDesignator>` and `<AttributeSelector>` produce a bag of attributes from an Authorization Decision Request. Also, XACML3 defines operations on a bag of attributes and on bags.

XACML Version 3.0, §A.3.10 defines bag functions and §A.3.11 defines set functions. The difference between a bag and set is that a set shall not contain any duplicates.

GeoXACML 3 Core inherits the GeometryCollection from OGC "Simple Features" by adopting the geometry model of the bag / set and their processing semantics from XACML Version 3.0.

In order to switch between the processing semantics from XACML 3.0 bag / set to Simple Features and vice versa, GeoXACML 3.0 Core defines the function `urn:ogc:def:function:geoxacml:3.0:geometry-bag-to-collection` and `urn:ogc:def:function:geoxacml:3.0:geometry-bag-from-collection`.

To avoid processing errors caused by a GeometryCollection containing different geoemtry types, the GeoXACML 3.0 Core restricts the use to **homogeneous** GeometryCollection. All geometries of a **homogeneous** GeometryCollection have the same type.

C.3.1. Example converting from XACML Bag to GeometryCollection

A Policy may specify a condition that requires an assertion of equality of all geometries in an Authorization Decision Request with a given GeometryCollection. The input to the `Equals` function can be a `GeometryCollection` but not a XACML bag of geometries as returned by the `<AttributeDesignator>` or `<AttributeSelector>`.

To calculate the GeometryCollection, the Policy writer may leverage the function `urn:ogc:def:function:geoxacml:3.0:geometry-bag-from-collection` as follows:

```
<xacml3:Condition>
      <xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-
equals">
       <!-- Result is Simple Features GeometryCollection -->
       <xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-
bag-to-collection">
          <!-- Result is XACML3 bag -->
          <xacml3:AttributeDesignator AttributeId="subject:location"
            DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
            Category="urn:oasis:names:tc:xacml:3.0:attribute-category:access-
subject"
            MustBePresent="true"/>
        </xacml3:Apply>
        <xacml3:AttributeValue xmlns:geoxacml="http://www.opengis.net/spec/
geoxacml/3.0"
          DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
          >GEOMETRYCOLLECTION(Point (-122.4538755 37.8106729), POINT(-77.
035278 38.889444))</xacml3:AttributeValue>
      </xacml3:Apply>
    </xacml3:Condition>
```

Figure C.4 — GeoXACML Condition that converts the XACML bag of geometries to a GeometryCollection

```
<Request xmlns="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17"
    ReturnPolicyIdList="false"
    CombinedDecision="false"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17
    http://docs.oasis-open.org/xacml/3.0/xacml-core-v3-schema-wd-17.xsd">
    <Attributes Category="urn:oasis:names:tc:xacml:3.0:attribute-category:
access-subject">
        <Attribute AttributeId="subject-location" IncludeInResult="false">
            <AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry">Point (-122.4538755 37.8106729)</AttributeValue>
        </Attribute>
        <Attribute AttributeId="subject-location" IncludeInResult="false">
            <AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry">Point (-77.035278 38.889444)</AttributeValue>
        </Attribute>
```

```
    </Attributes>
</Request>
```

Figure C.5 — GeoXACML Authorization Decision Request producing a bag of geometries

The request above produces a bag of Geometries with `AttributeId` value `subject-location`.

C.4. Issue: NULL Geometry

The GML encoding of geometry allows to defining a 'NULL' geometry.

GeoXACML 3 Core does support the encoding of geometries using WKT and WKB but not GML. Therefore, this issue of how to operate on a 'NULL' geometry must be addressed when writing a GeoXACML 3.0 GML Encoding Extension.

C.5. Issue: Circle Geometry

GeoXACML 3.0 Core does not support the geometry type `Circle` is not supported by GeoXACML 3.0 Core because it is not supported by the OGC "Simple Features" Standard. However, use cases exist that naturally would best be solved using a `Circle` geometry: Permit decision if the user's location (a `Point` is within the coverage of a GSM Cell described by a `Circle`). Such a condition can be expressed by leveraging the `urn:ogc:def:function:geoxacml:3.0:geometry-is-within-distance` function:

```
<xacml3:Rule Effect="Permit" RuleId="rule:isWithinDistance">
    <xacml3:Description>This rule constraints access based on a Point and
distance</xacml3:Description>
    <xacml3:Target/>
    <xacml3:Condition>
      <xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-is-
within-distance">
        <!-- distance is equal to radius in Meter because EPSG:3857 measures
in 'm'-->
        <xacml3:AttributeValue DataType="http://www.w3.org/2001/
XMLSchema#double">1500</xacml3:AttributeValue>
        <xacml3:Apply FunctionId="urn:ogc:def:function:geoxacml:3.0:geometry-
one-and-only">
        <!-- Point is center of circle -->
          <xacml3:AttributeValue DataType="urn:ogc:def:dataType:geoxacml:3.0:
geometry"
            xmlns:geoxacml="http://www.opengis.net/spec/geoxacml/3.0"
            geoxacml:srid="3857"
            >POINT(-21180911.712903 12601672.604027)</xacml3:AttributeValue>
          <xacml3:AttributeDesignator AttributeId="subject-location"
            DataType="urn:ogc:def:dataType:geoxacml:3.0:geometry"
            Category="urn:oasis:names:tc:xacml:3.0:subject-category:access-
subject"
            MustBePresent="false"/>
```

```
      </xacml3:Apply>
    </xacml3:Apply>
  </xacml3:Condition>
</xacml3:Rule>
```

Figure C.6 — GeoXACML Condition 'within a circle'

The above Rule fires Permit if the `subject-location` is within 1500m from the Washington Monument (the fictitious location of the GSM cell tower).

D

ANNEX D (INFORMATIVE) REVISION HISTORY

ANNEX D (INFORMATIVE) REVISION HISTORY

Table D.1

DATE	RELEASE	EDITOR	PRIMARY CLAUSES MODIFIED	DESCRIPTION
2022-11-07	0.1	Andreas Matheus	all	initial version
2022-12-13	0.2	Andreas Matheus	all	soundness of definitions
2022-12-23	0.3	Andreas Matheus	all	added Annex C containing a list of all identifiers per conformance class, use of AsciiDoc attributes to avoid redundancy with identifiers
2023-01-10	0.4	Andreas Matheus	all	applied changes from pull request
2023-01-13	0.5	Andreas Matheus	all	applied OGC NA-Policy to Metanorma annotations
2023-02-06	0.6	Andreas Matheus	all	incorporated Carl Reed's comments

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BIBLIOGRAPHY

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