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## 2 XACML Profile for Hierarchical 3 Resources

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23 **Abstract:**

24 This document provides a profile for the use XACML with resources that are structured as  
25 hierarchies. The profile includes both XML document resources and resources that are not XML  
26 documents. The profile covers requesting access to hierarchical resources and specifying  
27 policies that apply to hierarchical.

28 **Status:**

29 This version of the specification is a working draft of the committee. As such, it is expected to  
30 change prior to adoption as an OASIS Standard.

31 Committee members should send comments on this specification to the [xacml@lists.oasis-](mailto:xacml@lists.oasis-)  
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38 [open.org/committees/xacml/](http://www.oasis-open.org/committees/xacml/)).

39 For any errata page for this specification, please refer to the XACML Profile for Hierarchical  
40 Resources section of the XACML TC web page (<http://www.oasis-open.org/committees/xacml/>).

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# 63    1 Introduction

64 It is often the case that a **resource** is organized as a hierarchy. Examples include file systems, XML  
65 documents, and organizations. This Profile specifies how XACML can provide **access control** for a  
66 **resource** that is organized as a hierarchy.

67 In XACML, a **resource** organized as a hierarchy may be a “tree” (a hierarchy with a single root) or a  
68 “forest” (a hierarchy with multiple roots), but the hierarchy may not have cycles. Another term for this  
69 type of hierarchy is a Directed Acyclic Graph or DAG. Such **resources** are called **hierarchical**  
70 **resources** in this Profile.

71 In XACML, the **nodes** in the **hierarchical resource** are treated as individual **resources**. An  
72 authorization decision that permits **access** to an interior **node** does not imply that **access** to its  
73 descendant **nodes** is permitted. An authorization decision that denies **access** to an interior **node** does  
74 not imply that **access** to its descendant **nodes** is denied.

75 There are three types of facilities specified in this Profile for dealing with **hierarchical resources**:

- 76    • Representing the identity of a **node**.
- 77    • Requesting access to a **node**.
- 78    • Stating policies that apply to one or more **nodes**.

79 Support for each of these facilities is optional.

80 In dealing with a **hierarchical resource**, it may be useful to request authorization decisions for multiple  
81 **nodes** in the **resource** in a single authorization decision request. Ways to make such requests are  
82 specified in a separate profile – the XACML Profile for Requests for Multiple Resources [MULTIPLE].

83 This profile for **hierarchical resources** assumes that all requests for **access** to multiple **nodes** in a  
84 **hierarchical resource** have been resolved to individual requests for **access** to a single **node**.

## 85    1.1 Terminology

86 **Access - Performing an action**

87 **Access control** - Controlling **access** in accordance with a **policy**

88 **Applicable policy** - The set of **policies** and **policy sets** that governs **access** for a specific **decision**  
89 **request**

90 **Attribute** - Characteristic of a **subject**, **resource**, **action** or **environment** that may be referenced in a  
91 **predicate** or **target** (see also – **named attribute**)

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

95 **Bag** – An unordered collection of values, in which there may be duplicate values

96 **Context** - The canonical representation of a **decision request** and an **authorization decision**

97 **Decision** – The result of evaluating a **rule**, **policy** or **policy set**

98 **Decision request** - The request by a **PEP** to a **PDP** to render an **authorization decision**

99 **Hierarchical resource** – A resource that is organized as a tree or forest (Directed Acyclic Graph) of  
100 individual resources called **nodes**.

101 **Node** – An individual resource that is part of a **hierarchical resource**.

102    **Obligation** - An operation specified in a **policy** or **policy set** that should be performed by the **PEP** in  
103    conjunction with the enforcement of an **authorization decision**

104    **Policy** - A set of **rules**, an identifier for the **rule-combining algorithm** and (optionally) a set of  
105    **obligations**. May be a component of a **policy set**

106    **Policy administration point (PAP)** - The system entity that creates a **policy** or **policy set**

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

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

116    **Resource** - Data, service or system component

## 117    1.1. Notation

118    The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD  
119    NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this specification are to be interpreted as  
120    described in IETF RFC 2119 [RFC2119]:

121        "they MUST only be used where it is actually required for interoperation or to limit behavior which  
122        has potential for causing harm (e.g., limiting retransmissions)"

123        These keywords are thus capitalized when used to unambiguously specify requirements over protocol  
124        and application features and behavior that affect the interoperability and security of implementations.  
125        When these words are not capitalized, they are meant in their natural-language sense.

126        The phrase **{Normative, but optional}** means that the described functionality is optional for compliant  
127        XACML implementations, but, if the functionality is claimed as being supported according to this Profile,  
128        then it SHALL be supported in the way described.

129        Example code listings appear like this.

130        In descriptions of syntax, elements in angle brackets ("<", ">") are to be replaced by appropriate  
131        component values, square brackets ("[", "]") enclose optional elements, elements in quotes are literal  
132        components, and "\*" indicates that the preceding element may occur zero or more times.

---

## 133    2 Representing the identity of a node

134    {Normative}

135    In order for XACML **policies** to apply consistently to **nodes** in a **hierarchical resource**, it is necessary  
136    for the **nodes** in that **resource** to be represented in a consistent way. If a **policy** refers to a **node** using  
137    one representation, but a **request** refers to the **node** using a different representation, then the **policy** will  
138    not apply, and security may be compromised.

139    The following sections describe RECOMMENDED representations for **nodes** in **hierarchical**  
140    **resources**. Alternative representations of **nodes** in a given **resource** are permitted so long as all  
141    **Policy Administration Points** and all **Policy Enforcement Points** that deal with that **resource** have  
142    contracted to use the alternative representation.

### 143    2.1 Nodes in XML documents

144    {Normative, but optional}

145    The identity of a node in a **resource** that is an XML document instance SHALL be an XPath expression  
146    that evaluates to exactly that one node.

### 147    2.2 Nodes in resources that are not XML documents

148    {Normative, but optional}

149    The identity of a **node** in a **hierarchical resource** that is not an XML document instance SHALL be  
150    represented as a URI that conforms to [RFC2396]. Such URIs are of the following form.

151        <scheme> ":" <authority> "/" <pathname>

152    File system **resources** SHALL use the "file:" scheme. If no standard <scheme> for the **resource**  
153    type is specified in [RFC2396] or in a related standard for a registered URI scheme, then the URI SHALL  
154    use the "file:" scheme.

155    The <pathname> portion of the URI SHALL be of the form

156        <root name> [ "/" <node name> ]\*

157    The sequence of <root name> and <node name> values SHALL correspond to the individual  
158    hierarchical component names of ancestors of the represented **node** along the path from a <root>  
159    **node** to the represented **node**.

160    The following canonicalization SHALL be used.

- 161      • The encoding of the URI SHALL be UTF8.
- 162      • Case-insensitive portions of the URI SHALL be lower case.
- 163      • Escaping of characters SHALL conform to [RFC2396].
- 164      • The <authority> portion of the URI SHALL be specified and SHALL be the standard authority  
165        representation for the given **resource** type. Where the <authority> could be specified using either  
166        a Distributed Name Service (DNS) name or a numeric IPv4 or IPv6 address, the DNS name SHALL  
167        be used.
- 168      • The components of the <pathname> portion of the URI SHALL be specified using the canonical form  
169        for such path components at the <authority>.
- 170      • In accordance with [RFC2396], the separator character between hierarchical components of the  
171        <pathname> portion of the URI SHALL be the character "/". Sequences of the "/" character SHALL  
172        be resolved to a single "/". **Node** identities SHALL NOT terminate with the "/" character.

- 173 • All links in the <pathname> SHALL be resolved.
- 174 • All <pathname> values SHALL be absolute.
- 175 • The “..” and “.” <pathname> components used to specify “level above this hierarchy level” and “this  
176 hierarchy level”, respectively, SHALL be resolved to their actual component values.
- 177 • If there is more than one fully resolved, absolute path from a <root> at the <authority> to the  
178 represented **node**, then a separate **resource attribute** with AttributeId  
179 “urn:oasis:names:tc:xacml:2.0:resource:resource-id” SHALL be included in the  
180 XACML Request for each such path.

---

## 181    3 Requesting access to a node

182    {Normative}

183    In order for XACML **policies** to apply consistently to **nodes** in a **hierarchical resource**, it is necessary  
184    for each request **context** that represents a request for **access** to a **node** in that **resource** to use a  
185    consistent description of that **node access**. If a **policy** refers to certain expected **attributes** of a **node**,  
186    but the request **context** does not contain those **attributes**, or if the **attributes** are not expressed in the  
187    expected way, then the **policy** may not apply, and security may be compromised.

188    The following sections describe RECOMMENDED request **context** descriptions of **access** to **nodes** in  
189    **hierarchical resources**. Alternative representations of such requests are permitted so long as all  
190    **Policy Administration Points** and all **Policy Enforcement Points** that deal with that **resource** have  
191    contracted to use the alternative representation consistently for all requests for **access** to **nodes** in the  
192    given **resource**.

### 193    3.1 Nodes in an XML document

194    {Normative, but optional}

195    In order to request **access** to a **node** in an XML document, the Request Context <Resource> element  
196    SHALL contain the following elements and **attributes**.

- 197    • A <ResourceContent> element that contains the entire XML document instance of which the  
198    requested **node** is a part.
- 199    • An <Attribute> element with an AttributeId of  
200    “urn:oasis::names:tc:xacml:2.0:resource:resource-id” and a DataType of  
201    “urn:oasis:names:tc:xacml:2.0:data-type>xpath-expression”. The  
202    <AttributeValue> of this <Attribute> SHALL be an XPath expression that evaluates to a  
203    single **node** in the <ResourceContent> element. That single **node** SHALL be the **node** to which  
204    **access** is requested. This <Attribute> MAY specify an Issuer.
- 205    • An <Attribute> element with an AttributeId of  
206    “urn:oasis::names:tc:xacml:2.0:resource:resource-parent” and a DataType of  
207    “urn:oasis:names:tc:xacml:2.0:data-type>xpath-expression”. The  
208    <AttributeValue> of this **attribute** SHALL be an XPath expression that evaluates to a nodeset  
209    containing only a single **node** in the <ResourceContent> element, and that **node** SHALL be the  
210    immediate parent of the **node** represented in the “resource-id” **attribute**. This <Attribute>  
211    MAY specify an Issuer
- 212    • For each node in the XML document instance that is an ancestor of the **node** represented by the  
213    “resource-id” **attribute**, an <Attribute> element with an Attributeld of  
214    “urn:oasis::names:tc:xacml:2.0:resource:resource-ancestor” and a DataType of  
215    “urn:oasis:names:tc:xacml:2.0:data-type>xpath-expression”. The  
216    <AttributeValue> of each such **attribute** SHALL be an XPath expression that evaluates to a  
217    nodeset containing only a single **node**, in the <ResourceContent> element, and that **node** SHALL  
218    be the respective ancestor **node**. This <Attribute> MAY specify an Issuer.

219    Additional **attributes** MAY be included in the <Resource> element. In particular, the following  
220    **attribute** MAY be included.

- 221    • An <Attribute> element with an AttributeId of  
222    “urn:oasis::names:tc:xacml:2.0:resource:document-id” and a DataType of  
223    “urn:oasis:names:tc:xacml:2.0:data-type:anyURI”. The <AttributeValue> of this  
224    <Attribute> SHALL be a URI that identifies the XML document of which the requested **resource** is  
225    a part. This <Attribute> MAY specify an Issuer.

226    **3.2 Nodes in a resource that is not an XML document**

227    **{Normative, but optional}**

228    In order to request **access** to a **node** in a **hierarchical resource** that is not an XML document, the  
229    Request Context **<Resource>** element SHALL contain the following elements and **attributes**.

- 230    • For each normative representation of the requested **node**, an **<Attribute>** element with  
231       AttributeId “urn:oasis::names:tc:xacml:2.0:resource:resource-id”. The  
232       **<AttributeValue>** of this **<Attribute>** SHALL be a unique, normative identity of the **node** to  
233       which **access** is requested. The **DataType** of this **<Attribute>** SHALL depend on the  
234       representation chosen for the identity of **nodes** in this particular **resource**. This **<Attribute>** MAY  
235       specify an Issuer.
- 236    • For each immediate parent of the **node** specified in the “resource-id” **attribute** or **attributes**, and  
237       for each normative representation of that parent **node**, an **<Attribute>** element with  
238       AttributeId “urn:oasis::names:tc:xacml:2.0:resource:resource-parent”. The  
239       **<AttributeValue>** of this **<Attribute>** SHALL be the normative identity of the parent **node**.  
240       The **DataType** of this **<Attribute>** SHALL depend on the representation chosen for the identity of  
241       **nodes** in this particular **resource**. This **<Attribute>** MAY specify an Issuer. Note that there may  
242       be multiple instances of this **attribute** if the requested **node** is part of a forest rather than part of a  
243       single tree, or if the parent **node** has more than one normative representation.
- 244    • For each ancestor of the **node** specified in the “resource-id” **attribute** or **attributes**, and for each  
245       normative representation of that ancestor **node**, an **<Attribute>** element with AttributeId  
246       “urn:oasis::names:tc:xacml:2.0:resource:resource-ancestor”. The  
247       **<AttributeValue>** of this **<Attribute>** SHALL be the normative identity of the ancestor **node**.  
248       The **DataType** of this **<Attribute>** SHALL depend on the representation chosen for the identity of  
249       **nodes** in this particular **resource**. This **<Attribute>** MAY specify an Issuer. For each  
250       “resource-parent” **attribute**, there SHALL be a corresponding “resource-ancestor” **attribute**.  
251       Note that there may be multiple instances of this **attribute** if the requested **node** is part of a forest  
252       rather than part of a single tree, or if the ancestor **node** has more than one normative representation.  
253       The values for this **attribute** do not necessarily reflect the position of each ancestor **node** in the  
254       hierarchy.

255    Additional **attributes** MAY be included in the **<Resource>** element.

---

## 256 4 Stating policies that apply to nodes

257 {Non-normative}

258 This Section describes various ways to specify a **policy** predicate that can apply to multiple **nodes** in a  
259 **hierarchical resource**. This is not intended to be an exhaustive list.

### 260 4.1 Policies applying to nodes in XML documents

261 {Non-normative}

262 For **hierarchical resources** that are XML document instances, the following function, described in the  
263 XACML 2.0 Specification [XACML] MAY be used to state **policy** predicates that apply to one or more  
264 **nodes** in that **resource**.

265 urn:oasis:names:tc:xacml:2.0:function>xpath-node-match

266 The standard XACML <AttributeSelector> element MAY be used in **policies** to refer to all or  
267 portions of an XML document contained in the <ResourceContent> element of a request **context**.

### 268 4.2 Policies applying to nodes in non XML resources

269 {Non-normative}

270 For **hierarchical resources** that are not XML document instances, and where the URI representation of  
271 **nodes** specified in Section 2 of this Profile is used, the following functions described in the XACML 2.0  
272 Specification [XACML] MAY be used to state **policies** that apply to one or more **nodes** in that **resource**.

273 urn:oasis:names:tc:xacml:1.0:function:anyURI-equal

274 urn:oasis:names:tc:xacml:2.0:function:anyURI-match

### 275 4.3 Policies applying to nodes in any hierarchical resource

276 {Non-normative}

277 **Resource attributes** with the following AttributeId values, described in Section 6 of this Profile MAY  
278 be used to state **policies** that apply to one or more **nodes** in any **hierarchical resource**.

279 urn:oasis:names:tc:xacml:2.0:resource:resource-ancestor

280 urn:oasis:names:tc:xacml:2.0:resource:resource-parent

281 Note that a <ResourceAttributeDesignator> that refers to the “resource-ancestor” or  
282 “resource-parent” **attribute** will return a bag of values representing all ancestors or parents,  
283 respectively, of the **resource** to which **access** is being requested.

284 The standard XACML [XACML] bag and higher-order bag functions MAY be used to state **policies** that  
285 apply to one or more **nodes** in any **hierarchical resource**. The **nodes** used as arguments to these  
286 functions MAY be specified using an <AttributeSelector> that selects a portion of the  
287 <ResourceContent> element of the <Resource> or may be specified using a  
288 <ResourceAttributeDesignator> with the “resource-parent” or “resource-ancestor”  
289 AttributeId value.

---

## 290    5 New data-types for hierarchical resources

291    *{Normative, but optional}*

292    The following `DataType` values MAY be supported for use with *hierarchical resources* or with other  
293    uses of XML schema instances within XACML request *contexts* or *policies*.

### 294    5.1 xpath-expression

295    **Attribute** values having the following `DataType` SHALL be strings that SHALL be evaluated as XPath  
296    expressions. The result of evaluating such an **attribute** value SHALL be the nodeset resulting from an  
297    evaluation of the XPath expression.

298              urn:oasis:names:tc:xacml:2.0:data-type>xpath-expression

---

## 299    6 New attribute identifiers for hierarchical resources

300    *{Normative, but optional}*

### 301    6.1 resource-ancestor

302    The following identifier indicates the identity of one ancestor **node** in the tree or forest of which the  
303    requested **node** is a part. Whenever **access** to a **node** in a **hierarchical resource** is requested, one  
304    instance of an **attribute** with this AttributeId SHALL be provided in the <Resource> element of the  
305    request **context** for each normative representation of each **node** that is an ancestor of the requested  
306    **node**.

307        urn:oasis:names:tc:xacml:2.0:resource:resource-ancestor

### 308    6.2 resource-parent

309    The following identifier indicates the identity of one parent **node** in the tree or forest of which the  
310    requested **node** is a part. Whenever **access** to a **node** in a **hierarchical resource** is requested, one  
311    instance of an **attribute** with this AttributeId SHALL be provided in the <Resource> element of the  
312    request **context** for each normative representation of each **node** that is a parent of the requested **node**.

313        urn:oasis:names:tc:xacml:2.0:resource:resource-parent

---

## 314 7 References

### 315 7.1 Normative References

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317 RFC 2119, March 1997, <http://www.ietf.org/rfc/rfc2119.txt>.
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322 Version 2.0, <http://www.oasis-open.org/committees/xacml>

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## B. Revision History

Rev	Date	By Whom	What
01	14 Apr 2004	Anne Anderson	Initial rewrite of Section 7.13.
02	13 May 2004	Anne Anderson	“xpath-expression” DataType. Remove resource attributes no longer needed. New section for requesting multiple resources. Require <ResourceContent> for XML resources. Added “resource-ancestor” and “resource-parent”.
03	25 May 2004	Anne Anderson	Standard URI representation of non-XML nodes. Multiple resource-id Attributes if multiple normative representations. “resource-ancestor” and “resource-parent” for any hierarchical resource. Referenced “anyURI-equal” and “anyURI-match”.
04	2 Jun 2004	Anne Anderson	Formatted as a separate profile, making each feature optional.

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