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Related work:
This specification replaces or supercedes:

- Multiple resource profile of XACML v2.0

This specification is related to:

- eXtensible Access Control Markup Language (XACML) Version 3.0, WD 11

Declared XML Namespace(s):
None

Abstract:
This document provides a profile for requesting access to more than one resource in a single XACML Request Context, or for requesting a single response to a request for an entire hierarchy.

Status:
This document was last revised or approved by the eXtensible Access Control Markup Language (XACML) TC on the above date. The level of approval is also listed above. Check the “Latest Version” or “Latest Approved Version” location noted above for possible later revisions of this document.

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Table of Contents

1 Introduction

{Non-normative}

The policy evaluation performed by an XACML Policy Decision Point, or PDP, is defined in terms of a single requested resource in the XACML Specification **[XACML]**, with the authorization decision contained in a single `<Result>` element of the response context. A Policy Enforcement Point, or PEP, however, may wish to submit a single request context for access to multiple resources, and may wish to obtain a single response context that contains a separate authorization decision (`<Result>` element) for each requested resource. Such a request context might be used to avoid sending multiple decision request messages between a PEP and PDP, for example. Alternatively, a PEP may wish to submit a single request context for all the ***nodes*** in a hierarchy, and may wish to obtain a single authorization decision (`<Result>` element) that indicates whether access is permitted to all of the requested ***nodes***. Such a request context might be used when the requester wants access to an entire XML document, to an entire sub-tree of elements in such a document, or to an entire file system directory with all its subdirectories and files, for example.

This Profile describes three ways in which a PEP can request authorization decisions for multiple resources in a single request context, and how the result of each such authorization decision is represented in the single response context that is returned to the PEP.

This Profile also describes two ways in which a PEP can request a single authorization decision in response to a request for all the ***nodes*** in a hierarchy.

Support for each of the mechanisms described in this Profile is optional for compliant XACML implementations.

1.1 Glossary

Hierarchical resource

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

Node

An individual resource that is part of a ***hierarchical resource***.

1.2 Abbreviated identifiers

Commonly used resource attributes are abbreviated as follows:

“resource-id” attribute

A resource attribute with an `AttributeId` of “urn:oasis:names:tc:xacml:1.0:resource:resource-id”.

“scope” attribute

A resource attribute with an `AttributeId` of “urn:oasis:names:tc:xacml:2.0:resource:scope”. See Section 4.1 for more information about this attribute.

1.3 Terminology

The key words “MUST”, “MUST NOT”, “REQUIRED”, “SHALL”, “SHALL NOT”, “SHOULD”, “SHOULD NOT”, “RECOMMENDED”, “MAY”, and “OPTIONAL” in this document are to be interpreted as described in **[RFC2119]**.

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

```
Example code listings appear like this.
```

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

1.4 Normative References

[Hierarchical] E.Rissanen, R. Levinson and H. Lockhart eds., *Hierarchical XACML v3.0 Hierarchical Resource Profile Version 1.0,* Working draft 8, 5 April 2009, FIXME URL

[RFC2119] S. Bradner, *Key words for use in RFCs to Indicate Requirement Levels*, http://www.ietf.org/rfc/rfc2119.txt, IETF RFC 2119, March 1997.

[XACML] E. Rissanen, ed., *eXtensible Access Control Markup Language (XACML) Version 3.0,* Working draft 11, 5 April 2009*,* FIXME URL

[XPath] *XML Path Language (XPath)*, Version 1.0, W3C Recommendation 16, November 1999. Available at http://www.w3.org/TR/xpath

1.5 Non-Normative References

None

2 Requests for multiple resources

{Optional}

A single XACML request context MAY represent a request for access to multiple resources, with a separate authorization decision desired for each resource. The syntax and semantics of such requests and responses are specified in this Section.

The <Result> elements produced by evaluating a request for access to multiple resources SHALL be identical to those that would be produced from a series of requests, each requesting access to exactly one of the resources. Each such resource is called an Individual Resource. The conceptual request context that corresponds to each <Result> element is called an Individual Resource Request. This mapping of an original request context containing multiple authorization decision requests to Individual Resource Requests, and the corresponding mapping of multiple authorization decisions to multiple <Result> elements in a single response context MAY be performed by the Context Handler described in the non-normative Data-flow model of the core XACML specification **[XACML]**. This Profile does NOT REQUIRE that the implementation of the evaluation of a request for access to multiple resources conform to the preceding model or that actual Individual Resource Requests be constructed. The Profile REQUIRES only that the <Result> elements SHALL be the same as if the preceding model were used.

Three ways of specifying requests for access to multiple resources are described in the following Sections. Each way of specifying requests describes the Individual Resource Requests that correspond to the <Result> elements in the response context.

A single XACML request context submitted by a PEP MAY use more than one of these ways of requesting access to multiple resources in different <Resource> elements.

2.1 Nodes identified by "scope"

{Optional}

This Section describes the use of two values for the "scope" resource attribute to specify a request for access to multiple resources in a hierarchy. This syntax MAY be used with any ***hierarchical resource*** **[Hierarchical]**, regardless of whether it is an XML document or not. The "scope" resource attribute is defined in Section 4.

2.1.1 Profile URI

The following URIs SHALL be used as URI identifiers for the functionality specified in this Section of this Profile. The first identifier SHALL be used when the functionality is supported for XML resources, and the second identifier SHALL be used when the functionality is supported for resources that are not XML documents:

- urn:oasis:names:tc:xacml:3.0:profile:multiple:scope:xml
- urn:oasis:names:tc:xacml:3.0:profile:multiple:scope:non-xml

2.1.2 Original request context syntax

The original XACML request context <Attributes> element in the resource category SHALL contain a "scope" attribute with a value of either "Children", or "Descendants". If the requested resources are in an XML document, then the <Content> element SHALL be present and SHALL contain the entire XML document of which the requested elements are a part. Also, if the requested resources are in an XML document, then the XPath **[XPath]** expression used as the value of the "resource-id" attribute SHALL evaluate to a nodeset containing exactly one node.

2.1.3 Semantics

Such a request context SHALL be interpreted as a request for access to a set of ***nodes*** in a hierarchy relative to the single ***node*** specified in the "resource-id" attribute. If the value of the "scope" attribute is "Children", each Individual Resource is the one ***node*** indicated by the "resource-id" attribute (or attributes, where the single resource has multiple normative identifiers) and all of its immediate child ***nodes***. If the value of the "scope" attribute is "Descendants", the Individual Resource is the one ***node*** indicated by the "resource-id" attribute and all of its descendant ***nodes***.

Each Individual Resource Request SHALL be identical to the original request context with two exceptions: the "scope" attribute SHALL NOT be present and the <Attributes> element SHALL represent a single Individual Resource. This <Attributes> element SHALL contain at least one "resource-id" attribute, and all values for such attributes SHALL be unique, normative identities of the Individual Resource. If the "resource-id" attribute in the original request context contained an Issuer, the "resource-id" attributes in the Individual Resource Request SHALL contain the same Issuer. If a <Content> element was present in the original request context, then that same <Content> element SHALL be included in each Individual Resource Request. If the "resource-id" attribute in the original request context contained an IncludeInResult, the "resource-id" attributes in the Individual Resource Request SHALL contain the same IncludeInResult.

Neither XACML nor this Profile specifies how the Context Handler obtains the information required to determine which ***nodes*** are children or descendants of a given ***node***, except in the case of an XML document, where the information SHALL be obtained from the <Content> element.

2.2 Nodes identified by XPath

{Optional}

This Section describes use of an XPath **[XPath]** expression in the "resource-id" attribute, together with an "XPath-expression" value in the "scope" attribute to specify a request for access to multiple ***nodes*** in an XML document. This syntax SHALL be used only with resources that are XML documents.

2.2.1 Profile URI

The following URI SHALL be used as the URI identifier for the functionality specified in this Section of this Profile:

- urn:oasis:names:tc:xacml:3.0:profile:multiple:xpath-expression

2.2.2 Original request context

The original XACML request context <Attributes> element in the resource category SHALL contain a <Content> element and a "resource-id" attribute with a DataType of "urn:oasis:names:tc:xacml:3.0:data-type:xpathExpression", such that the <AttributeValue> of the "resource-id" attribute is an XPath expression that evaluates to a nodeset that represents multiple nodes in the resource category <Content> element. The <Attributes> element with the resource category SHALL contain a "scope" attribute with a value of "XPath-expression".

2.2.3 Semantics

Such a request context SHALL be interpreted as a request for access to the multiple nodes in the nodeset represented by the <AttributeValue> of the "resource-id" attribute. Each such node SHALL represent an Individual Resource.

Each Individual Resource Request SHALL be identical to the original request context with two exceptions: the "scope" attribute SHALL NOT be present and the "resource-id" attribute value SHALL be an XPath expression that evaluates to a single node in the <Content> element. That node SHALL be the Individual Resource. If the "resource-id" attribute in the original request context contained an Issuer, the "resource-id" attribute in the Individual Resource Request SHALL contain the same Issuer. If the

"resource-id" attribute in the original request context contained an IncludeInResult, the "resource-id" attribute in the Individual Resource Request SHALL contain the same IncludeInResult.

2.3 Multiple <Attributes> elements

{Optional}

This Section describes use of multiple <Attributes> elements with the same category in a request context to specify a request for access to multiple resources or requests for access by multiple subjects. This syntax MAY be used with any resource or resources, regardless of whether they are XML documents or not and regardless of whether they are ***hierarchical resources*** **[Hierarchical]** or not.

2.3.1 Profile URI

The following URI SHALL be used as the URI identifier for the functionality specified in this Section of this Profile:

- urn:oasis:names:tc:xacml:3.0:profile:multiple:multiple-resource-elements

2.3.2 Original request context

The XACML request context SHALL contain multiple <Attributes> elements with the same category.

2.3.3 Semantics

Such a request context SHALL be interpreted as a request for access to all resources specified in the individual <Attributes> elements. Each <Attributes> element SHALL represent one Individual Resource, subject, or another category unless that element utilizes the other mechanisms described in this Profile.

For each combination of repeated <Attributes> elements, one Individual Resource Request SHALL be created. This Individual Request SHALL be identical to the original request context with one exception: only one <Attributes> element of each repeated category SHALL be present. If such a <Attributes> element contains a "scope" attribute having any value other than "Immediate", then the Individual Request SHALL be further processed according to the corresponding Section of this Profile listed in Section 4.1. This processing may involve decomposing the one Individual Request into other Individual Requests before evaluation by the PDP.

2.4 By reference to <Attributes> elements

{Optional}

This section describes use of a list of references to <Attributes> elements to construct multiple individual <Request> elements.

2.4.1 Profile URI

The following URIs SHALL be used as URI identifiers for the functionality specified in this Section of this Profile.

- urn:oasis:names:tc:xacml:3.0:profile:multiple:reference

2.4.2 Original request context

The original XACML <Request> element SHALL contain a <MultiRequests> element.

2.4.3 Semantics

Such a request context SHALL be interpreted as multiple individual request contexts specified by references to <Attributes> elements.

The context handler MUST construct a new <Request> element for each <RequestReference> element contained in the <MultiRequests> element, and process the generated <Request> element.

Each <RequestReference> element contains one or more <AttributesReference> elements, each of which refers to the xml:id XML attribute of one of the <Attributes> elements in the enclosing original <Request> element. The generated <Request> element MUST be identical to a <Request> element which contains the referenced <Attributes> elements.

The result(s) of each such generated <Request> element MUST be included as one or more <Result> elements in the <Response> element corresponding to the original <Request> element. There may be multiple results for a single generated <Request> element when the generated <Request> element makes use of one or more of the other multiple request schemes in this profile. There MUST be exactly one <Response> element for the original <Request> element.

If a <RequestReference> contains an invalid reference, then the corresponding <Result> MUST contain an Indeterminate decision with status code urn:oasis:names:tc:xacml:1.0:status:syntax-error.

3 Requests for an entire hierarchy

{Optional}

In some cases, a resource is hierarchical, but the authorization decision request is intended to request access to all the ***nodes*** within that resource or to an entire sub-hierarchy of ***nodes*** within that resource. This might be the case when access to an XML document is being requested for purposes of making a copy of the entire document, or where access to an entire file system directory with all its subdirectories and files is being requested. A single `<Result>` is desired, indicating whether the requester is permitted to access the entire set of ***nodes***.

The `<Result>` element produced by evaluating such a request for access SHALL be identical to that produced by the following process. A series of request contexts is evaluated, each requesting access to exactly one ***node*** of the hierarchy. The `<Decision>` in the single `<Result>` that is returned to the PEP SHALL be "Permit" if and only if all `<Result>` elements resulting from the evaluation of the individual ***nodes*** contained a `<Decision>` of "`Permit`". Otherwise, the `<Decision>` in the single `<Result>` returned to the PEP SHALL be "`Deny`". This Profile does NOT REQUIRE that the implementation of the evaluation of a request for access to such a ***hierarchical resource*** conform to the preceding model or that actual request contexts corresponding to the individual ***nodes*** in the hierarchy be constructed. This Profile REQUIRES only that the `<Result>` element SHALL be the same as if the preceding model were used.

Two syntax's for this functionality are specified in the following Sections, one for use with resources that are XML documents, and the other for use with resources that are not XML documents.

3.1 XML resources

{Optional}

This Section describes the syntax for requesting access to an entire XML document, or to an element within that document with all its recursive sub-elements.

3.1.1 Profile URI

The following URI SHALL be used as the identifier for the functionality specified in this Section of this Profile:

- urn:oasis:names:tc:xacml:3.0:profile:multiple:entire-hierarchy:xml

3.1.2 Original request context

The `<Attributes>` element with the resource category in the original request context SHALL contain a "`scope`" attribute with a value of "`EntireHierarchy`".

The `<Attributes>` element in the original request context SHALL contain a single "`resource-id`" attribute with a `DataType` of "urn:oasis:names:tc:xacml:3.0:data-type:xpathExpression" (defined in **[Hierarchical]**), such that the `<AttributeValue>` evaluates to a nodeset that represents exactly one node in the `<Content>` element.

The `<Attributes>` element in the original request context MAY contain other attributes.

3.1.3 Semantics

The `<Result>` of such a request SHALL be equivalent to that produced by the following process. For each ***node*** in the requested hierarchy, the Context Handler SHALL create a new request context. Each such request context SHALL contain a single `<Attributes>` element with the resource category having a "`resource-id`" attribute with a `DataType` of "urn:oasis:names:tc:xacml:3.0:data-type:xpathExpression" (defined in **[Hierarchical]**) and a value that is an XPath **[XPath]** expression that

evaluates to a nodeset that contains exactly that one node in the <Content> element. The Context Handler SHALL submit each such new request context to the PDP for evaluation and SHALL keep track of the <Decision> in the corresponding <Result> elements. If and only if all the new request contexts evaluate to "Permit", then a single <Result> containing a <Decision> of "Permit" SHALL be placed into the response context returned to the PEP. If any of the new request contexts evaluates to "Deny", "Indeterminate", or "NotApplicable", then a single <Result> containing a <Decision> of "Deny" SHALL be placed into the response context returned to the PEP. If any attribute in the original request context contained an IncludeInResult, then the attribute SHALL be included in the result.

3.2 Non-XML resources

{Optional}

This Section describes the syntax for requesting access to an entire hierarchy of ***nodes*** within a ***hierarchical resource*** that is not an XML document.

3.2.1 Profile URI

The following URI SHALL be used as the identifier for the functionality specified in this Section of this Profile:

- urn:oasis:names:tc:xacml:3.0:profile:multiple:entire-hierarchy:non-xml

3.2.2 Original request context

The <Attributes> element with the resource category in the original request context SHALL contain a "scope" attribute with a value of "EntireHierarchy".

The <Attributes> element in the original request context SHALL contain a single "resource-id" attribute that represents a single ***node*** in a ***hierarchical resource***.

The <Attributes> element in the original request context MAY contain other attributes.

The representation of ***nodes*** in a ***hierarchical resource*** specified in Section FIXME 2.2 of the Hierarchical resource profile of XACML v3.0 **[Hierarchical]** MAY be used to represent the identity of the single ***node***.

3.2.3 Semantics

The <Result> of such a request SHALL be equivalent to that produced by the following process. For each ***node*** in the requested hierarchy, the Context Handler SHALL create a new request context. Each such request context SHALL contain a single <Attributes> element with the resource category having a "resource-id" attribute with a value that is the identity of that one ***node*** in the hierarchy. The Context Handler SHALL submit each such new request context to the PDP for evaluation and SHALL keep track of the <Decision> in the corresponding <Result> elements. If and only if all the new request contexts evaluate to "Permit", then a single <Result> containing a <Decision> of "Permit" SHALL be placed into the response context returned to the PEP. If any of the new request contexts evaluates to "Deny", "Indeterminate", or "NotApplicable", then a single <Result> containing a <Decision> of "Deny" SHALL be placed into the response context returned to the PEP. If any attribute in the original request context contained an IncludeInResult, then the attribute SHALL be included in the result.

Neither XACML nor this Profile specifies how the Context Handler obtains the information required to determine which ***nodes*** are descendants of the originally specified ***node***, or how to represent the identity of each such ***node***. The representation of ***nodes*** in a ***hierarchical resource*** specified in Section FIXME 2.2 of the Hierarchical resource profile of XACML v3.0 **[Hierarchical]** MAY be used to represent the identity of each such ***node***.

4 New attribute identifiers

4.1 “scope”

The following identifier is used as the `AttributeId` of a resource attribute that indicates the scope of a request for access in a single `<Attributes>` element of a request context.

- urn:oasis:names:tc:xacml:2.0:resource:scope

The attribute SHALL have a `DataType` of “http://www.w3.org/2001/XMLSchema#string“.

The valid values for this attribute are listed below, along with a reference to the Section of this Profile or to the core XACML specification that describes how the `<Attributes>` element with the resource category is to be processed. An implementation MAY support any subset of these values, including the empty set.

- “`Immediate`” - The `<Attributes>` element refers to a single non-***hierarchical resource*** or to a single ***node*** in a ***hierarchical resource***. This is the default value, if no “`scope`” attribute is present. The <Attributes> element SHALL be processed according to the core XACML specification **[XACML]**.
- “`Children`” - The `<Attributes>` element refers to multiple resources in a hierarchy. The set of resources consists of a single ***node*** described by the “`resource-id`” resource attribute and of all that ***node***'s immediate children in the hierarchy. The `<Attributes>` element SHALL be processed according to Section 2.1 of this Profile.
- “`Descendants`” - The `<Attributes>` element refers to multiple resources in a hierarchy. The set of resources consists of a single ***node*** described by the “`resource-id`” resource attribute and of all that ***node***'s descendants in the hierarchy. The `<Attributes>` element SHALL be processed according to Section 2.1 of this Profile.
- “`XPath-expression`” - The `<Attributes>` element refers to multiple resources. The set of resources consists of the nodes in a nodeset described by the “`resource-id`” resource attribute. Each of the ***nodes*** SHALL be contained in the <Content> element of the <Attributes> element. The `<Resource>` element SHALL be processed according to Section 2.2 of this Profile.
- “`EntireHierarchy`” - The `<Resource>` element refers to a single resource. The resource consists of a ***node*** described by the “`resource-id`” resource attribute along with all that ***node***'s descendants. All of the ***nodes*** SHALL be nodes in an XML document that is contained in the `<Content>` element of the `<Attributes>` element. The `<Attributes>` element SHALL be processed according to Section 2.4.

5 New profile identifiers

The following URI values SHALL be used as URI identifiers for the functionality specified in various Sections of this Profile:

Section 2.1: "scope attribute of "`children`" or "`descendants`" in `<Attributes>`: XML resources

- urn:oasis:names:tc:xacml:3.0:profile:multiple:scope:xml

Section 2.1: "scope attribute of "`children`" or "`descendants`" in `<Attributes>`: Non-XML resources

- urn:oasis:names:tc:xacml:3.0:profile:multiple:scope:non-xml

Section 2.2: XPath expression in "`resource-id`" attribute

- urn:oasis:names:tc:xacml:3.0:profile:multiple:xpath-expression

Section 2.3: Multiple `<Attributes>` elements

- urn:oasis:names:tc:xacml:3.0:profile:multiple:multiple-resource-elements

Section 2.4: By reference to `<Attributes>` elements

- urn:oasis:names:tc:xacml:3.0:profile:multiple:reference

Section 3.1: Requests for an entire hierarchy: XML resources

- urn:oasis:names:tc:xacml:3.0:profile:multiple:entire-hierarchy:xml

Section 3.2: Requests for an entire hierarchy: Non-XML resources

- urn:oasis:names:tc:xacml:3.0:profile:multiple:entire-hierarchy:non-xml

6 Conformance

An implementation may conform to this specification in one or more of the following ways.

6.1 Processor of requests for multiple resources as nodes identified by "scope"

An implementation conforms as a processor of requests for multiple resources as nodes identified by "scope" if it is able to process XACML requests in the manner described in sections 2.1 and 4 of this specification.

6.2 Processor of requests for multiple resources as nodes identified by XPath

An implementation conforms as a processor of requests for multiple resources as nodes identified by XPath if it is able to process XACML requests in the manner described in sections 2.2 and 4 of this specification.

6.3 Processor of requests for multiple resources by multiple <Attributes> elements

An implementation conforms as a processor of requests for multiple resources by multiple `<Attributes>` elements if it is able to process XACML requests in the manner described in sections 2.3 and 4 of this specification.

6.4 Processor of requests for multiple resources by reference to <Attributes> elements

An implementation conforms as a processor of requests for multiple resources by references to `<Attributes>` elements if it is able to process XACML requests in the manner described in sections 2.4 and 4 of this specification.

6.5 Processor of requests for an entire hierarchy of XML resources

An implementation conforms as a processor of requests for an entire hierarchy of XML resources if it is able to process XACML requests in the manner described in sections 3.1 and 4 of this specification.

6.6 Processor of requests for an entire hierarchy of non-XML resources

An implementation conforms as a processor of requests for an entire hierarchy of non-XML resources if it is able to process XACML requests in the manner described in sections 3.2 and 4 of this specification.

A. Acknowledgements

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Participants:

Anthony Nadalin
Bill Parducci
Daniel Engovatov
Hal Lockhart
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Seth Proctor
Steve Anderson
Tim Moses

B. Revision History

[optional; should not be included in OASIS Standards]

Revision	Date	Editor	Changes Made
WD 1	[Rev Date]	Erik Rissanen	Initial update to XACML 3.0.
WD 2	28 Dec 2007	Erik Rissanen	Update to current OASIS template.
WD 3	4 Nov 2008	Erik Rissanen	Define behavior for the IncludeInResult attribute.
WD 4	3 Mar 2009	Erik Rissanen	Added the new <MultiRequests> scheme.
WD 5		Erik Rissanen	Changed error behavior in <MultiRequests> Clarified some text Editorial cleanups Conformance section