XACML v3.0 Core and Hierarchical Role Based Access Control (RBAC) Profile Version 1.0

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Related work:

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- *Core and hierarchical role based access control (RBAC) profile of XACML v2.0*. Edited by Anne Anderson. 1 February 2005. OASIS Standard. http://docs.oasis-open.org/xacml/2.0/access_control-xacml-2.0-rbac-profile1-spec-os.pdf.

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- *eXtensible Access Control Markup Language (XACML) Version 3.0.* Edited by Erik Rissanen. Latest version: http://docs.oasis-open.org/xacml/3.0/xacml-3.0-core-spec-en.html.

Abstract:

This specification defines a profile for the use of XACML in expressing policies that use role based access control (RBAC). It extends the XACML Profile for RBAC Version 1.0 to include a

recommended Attribute field for roles, but reduces the scope to address only "core" and "hierarchical" RBAC. This specification has also been updated to apply to XACML v3.0.

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Technical Committee members should send comments on this specification to the Technical Committee's email list. Others should send comments to the Technical Committee by using the "Send A Comment" button on the Technical Committee's web page at https://www.oasis-open.org/committees/xacml/.

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1 Introduction

1.1 Background

{non-normative}

This specification defines a profile for the use of the OASIS eXtensible Access Control Markup Language (XACML) **[XACML]** to meet the requirements for "core" and "hierarchical" *role* based access control (*RBAC*) as specified in **[ANSI-RBAC]**. Use of this profile requires no changes or extensions to standard XACML Version 3.0. Compared to the Core and hierarchical *role* based access control (*RBAC*) profile of XACML v2.0 **[RBAC-V2]** there are is no new functionality, rather the specification has just been updated for XACML 3.0.

This specification begins with a non-normative explanation of the building blocks from which the *RBAC* solution is constructed. A full example illustrates these building blocks. The specification then discusses how these building blocks may be used to implement the various elements of the *RBAC* model presented in **[ANSI-RBAC]**. Finally, the normative section of the specification describes compliant uses of the building blocks in implementing an *RBAC* solution.

This specification assumes the reader is somewhat familiar with XACML. An introduction to the *RBAC* model is available in **[RBACIntro]**.

1.2 Glossary

HasPrivilegesOfRole policy

An optional type of `<Policy>` that can be included in a Permission `<PolicySet>` to allow support queries asking if a subject "has the privileges of" a specific *role*. See Section2.5: HasPrivilegesOfRole Policies and Requests.

Junior role

In a *role* hierarchy, Role A is junior to Role B if Role B inherits all the *permissions* associated with Role A.

Multi-role permissions

A set of *permissions* for which a user must hold more than one *role* simultaneously in order to gain access.

Permission

The ability or right to perform some action on some resource, possibly only under certain specified conditions.

PPS

Permission `<PolicySet>`. See Section 1.9: Policies.

RBAC

Role based access control. A model for controlling access to resources where permitted actions on resources are identified with *roles* rather than with individual subject identities.

Role Enablement Authority

An entity that assigns *role* attributes and values to users or enables *role* attributes and values during a user's session.

RPS

Role `<PolicySet>`. See Section 1.9: Policies.

Role

42   A job function within the context of an organization that has associated semantics regarding the
43   authority and responsibility conferred on the user assigned to the *role* **[ANSI-RBAC]**.

44   **Senior role**

45   In a *role* hierarchy, Role A is senior to Role B if Role A inherits all the *permissions* associated
46   with Role B.

1.3 XML Entity Declarations

48   In order to improve readability, the examples in this specification assume use of the following XML
49   Internal Entity declarations:

50

```
<!ENTITY xml "http://www.w3.org/2001/XMLSchema#">
<!ENTITY rule-combine "urn:oasis:names:tc:xacml:1.0:rule-combining-algorithm:">
<!ENTITY policy-combine "urn:oasis:names:tc:xacml:1.0:policy-combining-algorithm:">
<!ENTITY function "urn:oasis:names:tc:xacml:1.0:function:">
<!ENTITY subject-category "urn:oasis:names:tc:xacml:1.0:subject-category:">
<!ENTITY subject "urn:oasis:names:tc:xacml:1.0:subject:">
<!ENTITY role "urn:oasis:names:tc:xacml:2.0:subject:role">
<!ENTITY roles "urn:example:role-values:">
<!ENTITY resource "urn:oasis:names:tc:xacml:1.0:resource:">
<!ENTITY action "urn:oasis:names:tc:xacml:1.0:action:">
<!ENTITY actions "urn:oasis:names:tc:xacml:2.0:actions:">
<!ENTITY environment "urn:oasis:names:tc:xacml:1.0:environment:">
<!ENTITY category "urn:oasis:names:tc:xacml:3.0:attribute-category:">
```

64   For example, "&xml;string" is equivalent to "http://www.w3.org/2001/XMLSchema#string".

1.4 Terminology

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

1.5 Normative References

70   **[RFC2119]**   Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP
71   14, RFC 2119, March 1997. http://www.ietf.org/rfc/rfc2119.txt.
72   **[XACML]**   *eXtensible Access Control Markup Language (XACML) Version 3.0*. 22 January
73   2014. OASIS Standard. http://docs.oasis-open.org/xacml/3.0/xacml-3.0-core-
74   spec-os-en.html

1.6 Non-Normative References

76   **[ANSI-RBAC]**   NIST, Role Based Access Control, ANSI INCITS 359-2004,
77   http://csrc.nist.gov/rbac/
78   **[RBACIntro]**   D. Ferraiolo, R. Sandhu, S. Gavrila, D.R. Kuhn, R. Chandramouli, Proposed
79   NIST Standard for Role-Based Access Control, ACM Transaction on Information
80   and System Security, Vol. 4, No. 3, August 2001, pages 224-274,
81   http://csrc.nist.gov/rbac/rbacSTD-ACM.pdf
82   **[RBAC-V2]**   *Core and hierarchical role based access control (RBAC) profile of XACML v2.0.* 1
83   February 2005. OASIS Standard. http://docs.oasis-
84   open.org/xacml/2.0/access_control-xacml-2.0-rbac-profile1-spec-os.pdf

1.7 Scope

86   *Role* based access control allows policies to be specified in terms of subject *roles* rather than strictly in
87   terms of individual subject identities. This is important for scalability and manageability of access control
88   systems.

89   The policies specified in this profile can answer two types of questions:

90   1. If a subject has **roles** R1 , R2, ... Rn enabled, can subject X access a given resource using a
91   given action?

92   2. If a subject has **roles** R1 , R2, ... Rn enabled, does that mean the subject will have **permissions**
93   associated with a given **role** R'? That is, is **role** R' either equal to or junior to any of **roles** R1 ,
94   R2, ... Rn?

95   The policies specified in this profile do not answer the question "What set of **roles** does subject X have?"
96   That question must be handled by a **Role Enablement Authority**, and not directly by an XACML PDP.
97   Such an entity may make use of XACML policies, but will need additional information. See Section 3:
98   Assigning and Enabling Role Attributes for more information about **Role Enablement Authorities**.

99   The policies specified in this profile assume all the **roles** for a given subject have already been enabled at
100   the time an authorization decision is requested. They do not deal with an environment in which **roles**
101   must be enabled dynamically based on the resource or actions a subject is attempting to perform. For
102   this reason, the policies specified in this profile also do not deal with static or dynamic "Separation of
103   Duty" (see **[ANSI-RBAC]**). A future profile may address the requirements of this type of environment.

104   1.8 Role

105   In this profile, **roles** are expressed as XACML Subject Attributes. There is one exception: in a
106   HasPrivilegesOfRole `<Policy>`, the **role** appears as a Resource Attribute. See Section 2.5:
107   HasPrivilegesOfRole Policies and Requests for more information.

108   **Role** attributes may be expressed in either of two ways, depending on the requirements of the application
109   environment. In some environments there may be a small number of "**role** attributes", where the name of
110   each such attribute is some name indicating "role", and where the value of each such attribute indicates
111   the name of the **role** held. For example, in this first type of environment, there may be one "**role** attribute"
112   having the `AttributeId` "&role;" (this profile recommends use of this identifier). The possible **roles** are
113   values for this one attribute, and might be "&roles;officer", "&roles;manager", and "&roles;employee". This
114   way of expressing **roles** works best with the XACML way of expressing policies. This method of
115   identifying **roles** is also most conducive to interoperability.

116   Alternatively, in other application environments, there may be a number of different attribute identifiers,
117   each indicating a different **role**. For example, in this second type of environment, there might be three
118   attribute identifiers: "urn:someapp:attributes:officer-role", "urn:someapp:attributes:manager-role", and
119   "urn:someapp:attributes:employee-role". In this case the value of the attribute may be empty or it may
120   contain various parameters associated with the **role**. XACML policies can handle **roles** expressed in this
121   way, but not as naturally as in the first way.

122   XACML supports multiple subjects per access request, indicating various entities that may be involved in
123   making the request. For example, there is usually a human user who initiates the request, at least
124   indirectly. There are usually one or more applications or code bases that generate the actual low-level
125   access request on behalf of the user. There is some computing device on which the application or code
126   base is executing, and this device may have an identity such an IP address. XACML identifies each such
127   Subject with a `Category` xml attribute in the `<Attributes>` element that indicates the type of subject
128   being described. For example, the human user has a `Category` of &subject-category;access-subject;
129   the application that generates the access request has a `Category` of &subject-category;codebase and
130   so on. In this profile, a **role** attribute may be associated with any of the categories of subjects involved in
131   making an access request.

132   1.9 Policies

133   In this profile, three types of policies are specified.

134   1. **Role `<PolicySet>` or *RPS*** : a `<PolicySet>` that associates holders of a given **role** attribute
135   and value with a Permission `<PolicySet>` that contains the actual **permissions** associated with
136   the given **role**. The `<Target>` element of a Role `<PolicySet>` limits the applicability of the
137   `<PolicySet>` to subjects holding the associated **role** attribute and value. Each Role

138   `<PolicySet>` references a single corresponding Permission `<PolicySet>` but does not
139   contain or reference any other `<Policy>` or `<PolicySet>` elements.

140   2. **Permission `<PolicySet>` or _PPS_**: a `<PolicySet>` that contains the actual _permissions_
141   associated with a given _role_. It contains `<PolicySet>` and `<Policy>` elements and `<Rules>`
142   that describe the resources and actions that subjects are permitted to access, along with any
143   further conditions on that access, such as time of day. A given Permission `<PolicySet>` may
144   also contain references to Permission `<PolicySet>`s associated with other _roles_ that are junior
145   to the given _role_, thereby allowing the given Permission `<PolicySet>` to inherit all _permissions_
146   associated with the _role_ of the referenced Permission `<PolicySet>`. The `<Target>` element of
147   a Permission `<PolicySet>`, if present, must not limit the subjects to which the `<PolicySet>` is
148   applicable.

149   3. **HasPrivilegesOfRole `<Policy>`**: a `<Policy>` in a Permission `<PolicySet>` that supports
150   requests asking whether a subject has the privileges associated with a given _role_. If this type of
151   request is to be supported, then a HasPrivilegesOfRole `<Policy>` must be included in each
152   Permission `<PolicySet>`. Support for this type of `<Policy>`, and thus for requests asking
153   whether a subject has the privileges associated with a given _role_, is optional.

154 Permission `<PolicySet>` instances must be stored in the policy repository in such a way that they can
155 never be used as the initial policy for an XACML PDP; Permission `<PolicySet>` instances must be
156 reachable only through the corresponding Role `<PolicySet>`. This is because, in order to support
157 hierarchical _roles_, a Permission `<PolicySet>` must be applicable to every subject. The Permission
158 `<PolicySet>` depends on its corresponding Role `<PolicySet>` to ensure that only subjects holding
159 the corresponding _role_ attribute will gain access to the _permissions_ in the given Permission
160 `<PolicySet>`.

161 Use of separate Role `<PolicySet>` and Permission `<PolicySet>` instances allows support for
162 Hierarchical _RBAC_, where a more _senior role_ can acquire the _permissions_ of a more _junior role_. A
163 Permission `<PolicySet>` that does not reference other Permission `<PolicySet>` elements could
164 actually be an XACML `<Policy>` rather than a `<PolicySet>`. Requiring it to be a `<PolicySet>`,
165 however, allows its associated _role_ to become part of a _role_ hierarchy at a later time without requiring
166 any change to other policies.

167 1.10 Multi-Role Permissions

168 In this profile, it is possible to express policies where a user must hold several _roles_ simultaneously in
169 order to gain access to certain _permissions_. For example, changing the care instructions for a hospital
170 patient may require that the Subject performing the action have both the physician _role_ and the staff _role_.

171 These policies may be expressed using a Role `<PolicySet>` where the `<Target>` element requires the
172 `<Attributes>` element with the subject attribute category to have all necessary _role_ attributes. This is
173 done by using a single `<AllOf>` element containing multiple `<Match>` elements. The associated
174 Permission `<PolicySet>` should specify the _permissions_ associated with Subjects who simultaneously
175 have all the specified _roles_ enabled.

176 The Permission `<PolicySet>` associated with a multi-role policy may reference the Permission
177 `<PolicySet>` instances associated with other _roles_, and thus may inherit _permissions_ from other
178 _roles_. The _permissions_ associated with a given multi-role `<PolicySet>` may also be inherited by
179 another _role_ if the other _role_ includes a reference to the Permission `<PolicySet>` associated with the
180 multi-role policy in its own Permission `<PolicySet>`.

2 Example

{non-normative}

This section presents a complete example of the types of policies associated with *role* based access control.

Assume an organization uses two *roles*, manager and employee.   In this example, they are expressed as two separate values for a single XACML Attribute with `AttributeId` "&role;". The &role; Attribute values corresponding to the two *roles* are "&roles;employee" and "&roles;manager".   An employee has *permission* to create a purchase order. A manager has *permission* to sign a purchase order, plus any *permissions* associated with the employee *role*. The manager *role* therefore is senior to the employee *role*, and the employee *role* is junior to the manager *role*.

According to this profile, there will be two Permission `<PolicySet>` instances: one for the manager *role* and one for the employee *role*. The manager Permission `<PolicySet>` will give any Subject the specific *permission* to sign a purchase order and will reference the employee Permission `<PolicySet>` in order to inherit its *permissions*. The employee Permission `<PolicySet>` will give any Subject the *permission* to create a purchase order.

According to this profile, there will also be two Role `<PolicySet>` instances: one for the manager *role* and one for the employee *role*. The manager Role `<PolicySet>` will contain a `<Target>` requiring that the Subject hold a &role; Attribute with a value of "&roles;manager". It will reference the manager Permission `<PolicySet>`. The employee Role `<PolicySet>` will contain a `<Target>` requiring that the Subject hold a &role; Attribute with a value of "&roles;employee". It will reference the employee Permission `<PolicySet>`.

The actual XACML policies implementing this example follow.

2.1 Permission <PolicySet> for the manager role

The following Permission `<PolicySet>` contains the *permissions* associated with the manager *role*. The PDP's policy retrieval must be set up such that access to this `<PolicySet>` is gained only by reference from the manager Role `<PolicySet>`.

```
<PolicySet xmlns="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 xacml-
core-v3-schema-wd-17.xsd"
  PolicySetId="PPS:manager:role"
  Version="1.0"
  PolicyCombiningAlgId="&policy-combine;permit-overrides">
  <Target/>

  <!-- Permissions specifically for the manager role -->
  <Policy PolicyId="Permissions:specifically:for:the:manager:role"
    Version="1.0"
    RuleCombiningAlgId="&rule-combine;permit-overrides">
    <Target/>
    <!-- Permission to sign a purchase order -->
    <Rule RuleId="Permission:to:sign:a:purchase:order" Effect="Permit">
      <Target>
        <AnyOf>
          <AllOf>
            <Match MatchId="&function;string-equal">
              <AttributeValue
                DataType="&xml;string">purchase order</AttributeValue>
              <AttributeDesignator
                MustBePresent="false"
```

```
232                          Category="&category;resource"
233                          AttributeId="&resource;resource-id"
234                          DataType="&xml;string"/>
235                      </Match>
236                    </AllOf>
237                  </AnyOf>
238                  <AnyOf>
239                    <AllOf>
240                      <Match MatchId="&function;string-equal">
241                        <AttributeValue
242                          DataType="&xml;string">sign</AttributeValue>
243                        <AttributeDesignator
244                          MustBePresent="false"
245                          Category="&category;action"
246                          AttributeId="&action;action-id"
247                          DataType="&xml;string"/>
248                      </Match>
249                    </AllOf>
250                  </AnyOf>
251                </Target>
252              </Rule>
253            </Policy>
254
255            <!-- Include permissions associated with employee role -->
256            <PolicySetIdReference>PPS:employee:role</PolicySetIdReference>
257          </PolicySet>
```

Listing 1 Permission <PolicySet> for managers

2.2 Permission <PolicySet> for employee role

The following Permission <PolicySet> contains the ***permissions*** associated with the employee ***role***.
The PDP's policy retrieval must be set up such that access to this <PolicySet> is gained only by
reference from the employee Role <PolicySet> or by reference from the more senior manager Role
<PolicySet> via the manager Permission <PolicySet>.

```
265          <PolicySet xmlns="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17"
266            xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
267            xsi:schemaLocation="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17 xacml-
268          core-v3-schema-wd-17.xsd"
269            PolicySetId="PPS:employee:role"
270            Version="1.0"
271            PolicyCombiningAlgId="&policy-combine;permit-overrides">
272
273            <Target/>
274            <!-- Permissions specifically for the employee role -->
275            <Policy PolicyId="Permissions:specifically:for:the:employee:role"
276              Version="1.0"
277              RuleCombiningAlgId="&rule-combine;permit-overrides">
278              <Target/>
279              <!-- Permission to create a purchase order -->
280              <Rule RuleId="Permission:to:create:a:purchase:order" Effect="Permit">
281                <Target>
282                  <AnyOf>
283                    <AllOf>
284                      <Match MatchId="&function;string-equal">
285                        <AttributeValue
286                          DataType="&xml;string">purchase order</AttributeValue>
287                        <AttributeDesignator
288                          MustBePresent="false"
289                          Category="&category;resource"
290                          AttributeId="&resource;resource-id"
```

```
291              DataType="&xml;string"/>
292            </Match>
293          </AllOf>
294        </AnyOf>
295        <AnyOf>
296          <AllOf>
297            <Match MatchId="&function;string-equal">
298              <AttributeValue
299                DataType="&xml;string">create</AttributeValue>
300              <AttributeDesignator
301                MustBePresent="false"
302                Category="&category;action"
303                AttributeId="&action;action-id"
304                DataType="&xml;string"/>
305            </Match>
306          </AllOf>
307        </AnyOf>
308      </Target>
309     </Rule>
310    </Policy>
311 </PolicySet>
```

312 *Listing 2 Permission <PolicySet> for employees*

2.3 Role <PolicySet> for the manager role

314 The following Role `<PolicySet>` is applicable, according to its `<Target>`, only to Subjects who hold a
315 &role; Attribute with a value of "&roles;manager". The `<PolicySetIdReference>` points to the
316 Permission `<PolicySet>` associated with the manager *role*. That Permission `<PolicySet>` may be
317 viewed in Section 2.1: Permission `<PolicySet>` for the manager *role* above.

318

```
319 <PolicySet xmlns="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17"
320   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
321   xsi:schemaLocation="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17 xacml-
322 core-v3-schema-wd-17.xsd"
323   PolicySetId="RPS:manager:role"
324   Version="1.0"
325   PolicyCombiningAlgId="&policy-combine;permit-overrides">
326   <Target>
327     <AnyOf>
328       <AllOf>
329         <Match MatchId="&function;anyURI-equal">
330           <AttributeValue
331             DataType="&xml;anyURI">&roles;manager</AttributeValue>
332           <AttributeDesignator
333             MustBePresent="false"
334             Category="&subject-category;access-subject"
335             AttributeId="&role;"
336             DataType="&xml;anyURI"/>
337         </Match>
338       </AllOf>
339     </AnyOf>
340   </Target>
341
342   <!-- Use permissions associated with the manager role -->
343   <PolicySetIdReference>PPS:manager:role</PolicySetIdReference>
344 </PolicySet>
```

345 *Listing 3 Role <PolicySet> for managers*

2.4 Role <PolicySet> for employee role

The following Role `<PolicySet>` is applicable, according to its `<Target>`, only to Subjects who hold a &role; Attribute with a value of "&roles;employee". The `<PolicySetIdReference>` points to the Permission `<PolicySet>` associated with the employee **role**. That Permission `<PolicySet>` may be viewed in Section 2.2: Permission `<PolicySet>` for employee **role** above.

```
<PolicySet xmlns="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 xacml-
core-v3-schema-wd-17.xsd"
  PolicySetId="RPS:employee:role"
  Version="1.0"
  PolicyCombiningAlgId="&policy-combine;permit-overrides">
  <Target>
    <AnyOf>
      <AllOf>
        <Match MatchId="&function;anyURI-equal">
          <AttributeValue
            DataType="&xml;anyURI">&roles;employee</AttributeValue>
          <AttributeDesignator
            MustBePresent="false"
            Category="&subject-category;access-subject"
            AttributeId="&role;"
            DataType="&xml;anyURI"/>
        </Match>
      </AllOf>
    </AnyOf>
  </Target>

  <!-- Use permissions associated with the employee role -->
  <PolicySetIdReference>PPS:employee:role</PolicySetIdReference>
</PolicySet>
```

Listing 4 Role <PolicySet> for employees

2.5 HasPrivilegesOfRole Policies and Requests

An XACML **RBAC** system MAY choose to support queries of the form "Does this subject have the privileges of **role** X?" If so, each Permission `<PolicySet>` MUST contain a HasPrivilegesOfRole `<Policy>`.

For the Permission `<PolicySet>` for managers, the HasPrivilegesOfRole `<Policy>` would look as follows:

```
<!-- HasPrivilegesOfRole Policy for manager role -->
<Policy xmlns="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 xacml-
core-v3-schema-wd-17.xsd"
  PolicyId="Permission:to:have:manager:role:permissions"
  Version="1.0"
  RuleCombiningAlgId="&rule-combine;permit-overrides">

  <Target/>
  <!-- Permission to have manager role permissions -->
  <Rule RuleId="Permission:to:have:manager:permissions" Effect="Permit">
    <Condition>
      <Apply FunctionId="&function;and">
        <Apply FunctionId="&function;anyURI-is-in">
```

```
401              <AttributeValue
402                DataType="&xml;anyURI">&roles;manager</AttributeValue>
403              <AttributeDesignator
404                MustBePresent="false"
405                Category="&category;resource"
406                AttributeId="&role;"
407                DataType="&xml;anyURI"/>
408            </Apply>
409            <Apply FunctionId="&function;anyURI-is-in">
410              <AttributeValue
411                DataType="&xml;anyURI">&actions;hasPrivilegesofRole</AttributeValue>
412              <AttributeDesignator
413                MustBePresent="false"
414                Category="&category;action"
415                AttributeId="&action;action-id"
416                DataType="&xml;anyURI"/>
417            </Apply>
418          </Apply>
419        </Condition>
420      </Rule>
421    </Policy>
```

Listing 5 HasPrivilegesOfRole <Policy> for manager role

For the Permission <PolicySet> for employees, the HasPrivilegesOfRole <Policy> would look as follows:


```
<!-- HasPrivilegesOfRole Policy for employee role -->
<Policy xmlns="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 xacml-
core-v3-schema-wd-17.xsd"
  PolicyId="Permission:to:have:employee:role:permissions"
  Version="1.0"
  RuleCombiningAlgId="&rule-combine;permit-overrides">

  <Target/>
  <!-- Permission to have employee role permissions -->
  <Rule RuleId="Permission:to:have:employee:permissions" Effect="Permit">
    <Condition>
      <Apply FunctionId="&function;and">
        <Apply FunctionId="&function;anyURI-is-in">
          <AttributeValue
            DataType="&xml;anyURI">&roles;employee</AttributeValue>
          <AttributeDesignator
            MustBePresent="false"
            Category="&category;resource"
            AttributeId="&role;"
            DataType="&xml;anyURI"/>
        </Apply>
        <Apply FunctionId="&function;anyURI-is-in">
          <AttributeValue
            DataType="&xml;anyURI">&actions;hasPrivilegesofRole</AttributeValue>
          <AttributeDesignator
            MustBePresent="false"
            Category="&category;action"
            AttributeId="&action;action-id"
            DataType="&xml;anyURI"/>
        </Apply>
      </Apply>
    </Condition>
```

```
461        </Rule>
462    </Policy>
```

Listing 6 HasPrivilegesOfRole <Policy> for employee role

A Request asking whether subject Anne has the privileges associated with &roles;manager would look as follows.

```
468    <Request xmlns="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17"
469      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
470      xsi:schemaLocation="urn:oasis:names:tc:xacml:3.0:core:schema:wd-17 xacml-
471    core-v3-schema-wd-17.xsd"
472      CombinedDecision="false"
473      ReturnPolicyIdList="false">
474    <Attributes Category="&subject-category;access-subject">
475      <Attribute AttributeId="&subject;subject-id"
476        IncludeInResult="false">
477        <AttributeValue DataType="&xml;string">Anne</AttributeValue>
478      </Attribute>
479    </Attributes>
480    <Attributes Category="&category;resource">
481      <Attribute AttributeId="&role;"
482        IncludeInResult="false">
483        <AttributeValue DataType="&xml;anyURI">&roles;manager</AttributeValue>
484      </Attribute>
485    </Attributes>
486    <Attributes Category="&category;action">
487      <Attribute AttributeId="&action;action-id"
488        IncludeInResult="false">
489        <AttributeValue
490          DataType="&xml;anyURI">&actions;hasPrivilegesOfRole</AttributeValue>
491      </Attribute>
492    </Attributes>
493    </Request>
```

Listing 7 Example of HasPrivilegesOfRole Request

Either the <Request> must contain Anne's direct *roles* (in this case, &roles;employee), or else the PDP's Context Handler must be able to discover them. *HasPrivilegesOfRole policies* do not do the job of associating *roles* with subjects. See Section 3: Assigning and Enabling Role Attributes for more information on how *roles* are associated with subjects.

3 Assigning and Enabling Role Attributes

{non-normative}

The assignment of various *role* attributes to users and the enabling of those attributes within a session are outside the scope of the XACML PDP. There must be one or more separate entities, referred to a ***Role Enablement Authorities***, implemented to perform these functions. This profile assumes that the presence in the XACML Request Context of a *role* attribute for a given user (Subject) is a valid assignment at the time the access decision is requested

So where do a subject's *role* attributes come from? What does one of these ***Role Enablement Authorities*** look like? The answer is implementation dependent and this profile prescribes no specific form for them.

In some cases, *role* attributes might come from an identity management service that maintains information about a user, including the subject's assigned or allowed *roles*; the identity management service acts as the ***Role Enablement Authority***. This service might store static *role* attributes in an LDAP directory, and a PDP's Context Handler might retrieve them from there. Or this service might respond to requests for a subject's *role* attributes from a PDP's Context Handler, where the requests are in the form of SAML Attribute Queries.

Role Enablement Authorities could use XACML policies to determine whether a subject is allowed to have a particular *role* attribute and value enabled. However, there are multiple possible ways to do so depending on the specific requirements, so the XACML TC has decided to not standardize any specific form for such policies in this profile.

4 Implementing the RBAC Model

520

521 **{non-normative}**

522 The following sections describe how to use XACML policies to implement various components of the
523 **RBAC** model as described in **[ANSI-RBAC]**.

4.1 Core RBAC

524

525 **{non-normative}**

526 Core **RBAC**, as defined in **[ANSI-RBAC]**, includes the following five basic data elements:

527   1. Users

528   2. **Roles**

529   3. Objects

530   4. Operations

531   5. **Permissions**

532 Users are implemented using XACML Subjects. Any of the XACML attribute `Category` values which are
533 semantically associated with subjects may be used, as appropriate.

534 **Roles** are expressed using one or more XACML Subject Attributes. The set of **roles** is very application-
535 and policy domain-specific, and it is very important that different uses of **roles** not be confused. For
536 these reasons, this profile does not attempt to define any standard set of **role** values, although this profile
537 does recommend use of a common `AttributeId` value of "urn:oasis:names:tc:xacml:2.0:subject:role".
538 It is recommended that each application or policy domain agree on and publish a unique set of
539 `AttributeId` values, `DataType` values, and `<AttributeValue>` values that will be used for the
540 various **roles** relevant to that domain.

541 Objects are expressed using XACML Resources.

542 Operations are expressed using XACML Actions.

543 **Permissions** are expressed using XACML Role `<PolicySet>` and Permission `<PolicySet>` instances
544 as described in previous sections.

545 Core **RBAC** requires support for multiple users per **role**, multiple **roles** per user, multiple **permissions**
546 per **role**, and multiple **roles** per **permission**. Each of these requirements can be satisfied by XACML
547 policies based on this profile as follows. Note, however, that the actual assignment of **roles** to users is
548 outside the scope of the XACML PDP. For more information see Section 3: Assigning and Enabling Role
549 Attributes.

550 XACML allows multiple Subjects to be associated with a given **role** attribute. XACML Role
551 `<PolicySet>`s defined in terms of possession of a particular **role** `<Attribute>` and
552 `<AttributeValue>` will apply to any requesting user for which that **role** `<Attribute>` and
553 `<AttributeValue>` are in the XACML Request Context.

554 XACML allows multiple **role** attributes or **role** attribute values to be associated with a given Subject. If a
555 Subject has multiple **roles** enabled, then any Role `<PolicySet>` instance applying to any of those **roles**
556 may be evaluated, and the **permissions** in the corresponding Permission `<PolicySet>` will be
557 permitted. As described in Section 1.10: Multi-Role Permissions, it is even possible to define policies that
558 require a given Subject to have multiple **role** attributes or values enabled at the same time. In this case,
559 the **permissions** associated with the multiple-**role** requirement will apply only to a Subject having all the
560 necessary **role** attributes and values at the time an XACML Request Context is presented to the PDP for
561 evaluation.

562 The Permission `<PolicySet>` associated with a given **role** may allow access to multiple resources
563 using multiple actions. XACML has a rich set of constructs for composing **permissions**, so there are
564 multiple ways in which multi-permission **roles** may be expressed. Any Role A may be associated with a

565 Permission `<PolicySet>` B by including a `<PolicySetIdReference>` to Permission `<PolicySet>`
566 B in the Permission `<PolicySet>` associated with the Role A. In this way, the same set of **permissions**
567 may be associated with more than one **role**.

568 In addition to the basic Core **RBAC** requirements, XACML policies using this profile can also express
569 arbitrary conditions on the application of particular **permissions** associated with a **role**. Such conditions
570 might include limiting the **permissions** to a given time period during the day, or limiting the **permissions**
571 to **role** holders who also possess some other attribute, whether it is a **role** attribute or not.

572 4.2 Hierarchical RBAC

573 **{non-normative}**

574 Hierarchical **RBAC**, as defined in **[ANSI-RBAC]**, expands Core **RBAC** with the ability to define
575 inheritance relations between **roles**. For example, Role A may be defined to inherit all **permissions**
576 associated with Role B. In this case, Role A is considered to be senior to Role B in the **role** hierarchy. If
577 Role B in turn inherits **permissions** associated with Role C, then Role A will also inherit those
578 **permissions** by virtue of being senior to Role B.

579 XACML policies using this profile can implement **role** inheritance by including a
580 `<PolicySetIdReference>` to the Permission `<PolicySet>` associated with one **role** inside the
581 Permission `<PolicySet>` associated with another **role**. The **role** that includes the
582 `<PolicySetIdReference>` will then inherit the **permissions** associated with the referenced **role**.

583 This profile structures policies in such a way that inheritance properties may be added to a **role** at any
584 time without requiring changes to `<PolicySet>` instances associated with any other **roles**. An
585 organization may not initially use **role** hierarchies, but may later decide to make use of this functionality
586 without having to rewrite existing policies.

5 Profile

5.1 Roles and Role Attributes

Roles SHALL be expressed using one or more XACML Attributes. Each application domain using this profile for *role* based access control SHALL define or agree upon one or more `AttributeId` values to be used for *role* attributes. Each such `AttributeId` value SHALL be associated with a set of permitted values and their `DataTypes`. Each permitted value for such an `AttributeId` SHALL have well-defined semantics for the use of the corresponding value in policies.

This profile RECOMMENDS use of the "urn:oasis:names:tc:xacml:2.0:subject:role" `AttributeId` value for all *role* attributes. Instances of this Attribute SHOULD have a `DataType` of "http://www.w3.org/2001/XMLSchema#anyURI".

5.2 Role Assignment or Enablement

A *Role Enablement Authority* is responsible for assigning *roles* to users and for enabling *roles* for use within a user's session. This profile prescribes no specific form for a *Role Enablement Authority*.

5.3 Access Control

Role based access control SHALL be implemented using two types of `<PolicySet>`s: Role `<PolicySet>`, Permission `<PolicySet>`. The specific functions and requirements of these two types of `<PolicySet>`s are as follows.

For each *role*, one Role `<PolicySet>` SHALL be defined. Such a `<PolicySet>` SHALL contain a `<Target>` element that makes the `<PolicySet>` applicable only to Subjects having the XACML Attribute associated with the given *role*; the `<Target>` element SHALL NOT restrict the Resource, Action, or Environment. Each Role `<PolicySet>` SHALL contain a single `<PolicySetIdReference>` element that references the unique Permission `<PolicySet>` associated with the *role*. The Role `<PolicySet>` SHALL NOT contain any other `<Policy>`, `<PolicySet>`, `<PolicyIdReference>`, or `<PolicySetIdReference>` elements.

For each *role*, one Permission `<PolicySet>` SHALL be defined. Such a `<PolicySet>` SHALL contain `<PolicySet>`, `<Policy>` and `<Rule>` elements that specify the types of access permitted to Subjects having the given *role*. The `<Target>` of the `<PolicySet>` and its included or referenced `<PolicySet>`, `<Policy>`, and `<Rule>` elements SHALL NOT limit the Subjects to which the Permission `<PolicySet>` is applicable.

If a given *role* inherits *permissions* from one or more *junior roles*, then the Permission `<PolicySet>` for the given (senior) *role* SHALL include a `<PolicySetIdReference>` element for each *junior role*. Each such `<PolicySetIdReference>` shall reference the Permission `<PolicySet>` associated with the *junior role* from which the *senior role* inherits.

A Permission `<PolicySet>` MAY include a HasPrivilegesOfRole `<Policy>`. Such a `<Policy>` SHALL have a `<Rule>` element with an effect of "Permit". This Rule SHALL permit any Subject to perform an Action with an Attribute having an `AttributeId` of &action;action-id, a `DataType` of &xml;anyURI, and an `<AttributeValue>` having a value of &actions;hasPrivilegesOfRole on a Resource having an Attribute that is the *role* to which the Permission `<PolicySet>` applies (for example, an `AttributeId` of &role;, a `DataType` of &xml;anyURI, and an `<AttributeValue>` whose value is the URI of the specific *role* value). Note that the *role* Attribute, which is a Subject Attribute in a Role `<PolicySet>` `<Target>`, is treated as a Resource Attribute in a HasPrivilegesOfRole `<Policy>`.

The organization of any repository used for policies and the configuration of the PDP SHALL ensure that the PDP can never use a Permission `<PolicySet>` as the PDP's initial policy.

6 Identifiers

This profile defines the following URN identifiers.

6.1 Profile Identifier

The following identifier SHALL be used as the identifier for this profile when an identifier in the form of a URI is required.

urn:oasis:names:tc:xacml:3.0:profiles:rbac:core-hierarchical

6.2 Role Attribute

The following identifier MAY be used as the `AttributeId` for *role* Attributes.

urn:oasis:names:tc:xacml:2.0:subject:role

6.3 Action Attribute Values

The following identifier MAY be used as the `<AttributeValue>` of the &action;action-id Attribute in a HasPrivilegesOfRole `<Policy>`.

urn:oasis:names:tc:xacml:2.0:actions:hasPrivilegesOfRole

7 Conformance

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

7.1 As a policy processor

An implementation conforms to this specification as a policy processor if it makes use of XACML policies in the manner described in sections 5 and 6.

7.2 As an XACML request generator

An implementation conforms to this specification as an XACML request generator if it produces XACML requets in the manner described in sections 5 and 6.

Appendix A. Acknowledgments

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682 # Appendix B. Revision History

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 the current OASIS template.
WD 3	4 Nov 2008	Erik Rissanen	Fixed typos in the examples.
WD 4	5 Apr 2009	Erik Rissanen	Editorial cleanups. Added conformance section.
WD 5	14 Dec 2009	Erik Rissanen	Also allow <PolicySet> in permission policyset.
WD 06	17 Dec 2009	Erik Rissanen	Fixed formatting issues Updated acknowledgments
WD 07	12 Jan 2010	Erik Rissanen	Updated cross references. Corrected examples so they are valid against the XACML schema. Updated acknowledgments
WD 08	8 Mar 2010	Erik Rissanen	Updated cross references Fixed OASIS formatting issues Removed reference to XACML 2.0 intro
WD 09	24 May 2011	Erik Rissanen	Also allow <PolicySet> in permission policyset in the non-normative text in section 1.8.
WD 10	23 Jan 2014	Erik Rissanen	Migrated to current OASIS document template.
WD 11	15 May 2014	Erik Rissanen	Removed examples of XACML based role enablement authorities.

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