Abstract

The XML Events module defined in this specification provides XML languages with the ability to uniformly integrate event listeners and associated event handlers with Document Object Model (DOM) Level 2 event interfaces [DOM2EVENTS] [p.23]. The result is to provide an interoperable way of associating behaviors with document-level markup.

Status of This Document

This section describes the status of this document at the time of its publication. Other documents may supersede this document. The latest status of this document series is maintained at the W3C.
This is an updated Working Draft of the XML Events specification. It has been modified from the previous public draft as a result of last call period comments. The Working Group expects that this document will soon move into Candidate Recommendation status.

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At the time of publication, the Working Group believed there were zero patent disclosures relevant to this specification. A current list of patent disclosures relevant to this specification may be found on the Working Group's patent disclosure page.

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Changes since the last version

This document has changed as a result of last-call comments from various commentators.

Reviewers can see a diff-marked version to understand the details of the changes.

Contents

1. Introduction ................................................. 5
2. The XML Events Module .................................... 7
   2.1. The listener Element .................................. 7
      2.1.1. Examples of listener usage ....................... 9
   2.2. Attaching Attributes Directly to the Observer Element .. 10
      2.2.1. Examples of Using Attributes Attached to an Observer Element ... 10
   2.3. Attaching Attributes Directly to the Handler Element .... 10
      2.3.1. Examples of Using Attributes Attached to a Handler Element .... 11
   2.4. Summary of Observer and Handler Attribute Defaulting .... 12
   2.5. Event Handlers ....................................... 12
   2.6. The Basic XML Events Profile ........................ 13
3. Naming Event Types ....................................... 13
   A. DTD Implementation ....................................... 15
      A.1. Qualified Names Module .............................. 15
      A.2. XML Events Module ................................... 17
   B. Schema Implementation .................................. 19
      B.1. Attributes Module ................................... 19
      B.2. XML Events Module ................................... 20
C. References .................................................. 23
   C.1. Normative References .................................. 23
   C.2. Other References ..................................... 23
D. Acknowledgments ......................................... 25
1.  Introduction

This section is informative.

An event is the representation of some asynchronous occurrence (such as a mouse click on the presentation of the element, or an arithmetical error in the value of an attribute of the element, or any of unthinkably many other possibilities) that gets associated with an element (targeted at it) in an XML document.

In the DOM model of events,[DOM2EVENTS][p.23], the general behavior is that when an event occurs it is dispatched by passing it down the document tree in a phase called capture to the element where the event occurred (called its target), where it then may be passed back up the tree again in the phase called bubbling. In general an event can be responded to at any element in the path (an observer) in either phase by causing an action, and/or by stopping the event, and/or by cancelling the default action for the event at the place it is responded to. The following diagram illustrates this:

Event flow in DOM2: an event targeted at an element (marked 'target') in the tree passes down the tree from the root to the target in the phase called 'capture'. If the event type allows it, the event then travels back up the tree by the same route in a phase called 'bubbling'. Any node in the route, including the root node and the target, may be an 'observer': that is to say, a handler may be attached to it that is activated when the event passes through in either phase. A handler can only listen for one phase. To listen for both you have to attach two handlers.
An *action* is some way of responding to an event; a *handler* is some specification for such an action, for instance using scripting or some other method. A *listener* is a binding of such a handler to an event targeting some element in a document.

HTML [HTML4][p.23] binds events to an element by encoding the event name in an attribute name, such that the value of the attribute is the action for that event at that element. This method has two main disadvantages: firstly it hardwires the events into the language, so that to add a new event, you have to make a change to the language, and secondly it forces you to mix the content of the document with the specifications of the scripting and event handling, rather than allowing you to separate them out. SVG [SVG][p.23] uses a similar method.

The process of defining a new version of HTML identified the need for an extensible event specification method. The design requirements were the following:

- Syntactically expose the DOM event model to an XML document [XML][p.23]
- Provide for new event types without requiring modification to the DOM or the DTD.
- Allow for integration with other XML languages.

The DOM specifies an event model that provides the following features:

- A generic event system,
- Means for registering event listeners and handlers,
- Means for routing events through a tree structure,
- Access to context information for each event, and
- A definition of event flow, as sketched above.

Element *listener* and its attributes defined in this specification is the method of binding a DOM level 2 event at an element to an event handler and encapsulates various aspects of the DOM level 2 event interface, thereby providing markup-level specification of the actions to be taken during the various phases of event propagation.

This document neither specifies particular events, nor mandates any particular methods of specifying actions. These definitions are left to any markup language using the facilities described here.
2. The XML Events Module

This section is normative.

This specification defines a module called XML Events. The XML Events module uses the XML namespace \[NAME\] identifier \[p. 23\] http://www.w3.org/2001/xml-events.

Examples in this document that use the namespace prefix "ev" all assume an xmlns declaration xmlns:ev="http://www.w3.org/2001/xml-events" somewhere suitable in the document involved. All examples are informative.

The remainder of this section describes the elements and attributes in this module, the semantics, and provides an abstract module definition as required in \[XHTMLMOD\] [p. 23].

The XML Events Module supports the following element and attributes:

<table>
<thead>
<tr>
<th>Element</th>
<th>Attributes</th>
<th>Minimal Content Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>listener</td>
<td>event [NMTOKEN], observer [IDREF], target [IDREF], handler [URI], phase (\text{&quot;capture&quot;</td>
<td>&quot;default&quot;}), propagate (\text{&quot;stop&quot;</td>
</tr>
</tbody>
</table>

Implementations: \[DTD\] [p. 17], \[XML Schema\] [p. 20]

2.1. The listener Element

Element listener supports a subset of the DOM's EventListener interface. It is used to declare event listeners and register them with specific nodes in the DOM, and has the following attributes:

- **event**
  The required event attribute specifies the event type for which the listener is being registered. As specified by \[DOM2EVENTS\] [p. 23], the value of the attribute should be an XML Name \[XML\] [p. 23].

- **observer**
  The optional observer attribute specifies the id of the element with which the event listener is to be registered. If this attribute is not present, the observer is the element that the event attribute is on (see later under \[Attaching Attributes Directly to the Observer Element\] [p. 10]), or the parent of that element (see later under \[Attaching Attributes Directly to the Handler Element\] [p. 10]).
The optional target attribute specifies the id of the target element of the event (i.e., the node that caused the event). If this attribute is present, only events that match both the event and target attributes will be processed by the associated event handler. Clearly because of the way events propagate, the target element should be a descendent node of the observer element, or the observer element itself.

Use of this attribute requires care; for instance, if you specify

```xml
<listener event="click" observer="para1"
    target="link1" handler="#clicker"/>
```

where 'para1' is some ancestor of the following node

```xml
<a id="link1" href="doc.html">The <em>draft</em> document</a>
```

and the user happens to click on the word "draft", the <em>em> element, and not the <a>, will be the target, and so the handler will not be activated; to catch all mouse clicks on the <a> element and its children, use observer="link1", and no target attribute.

The optional handler attribute specifies the URI-reference of an element that defines the action that should be performed if the event reaches the observer. (This specification does not mandate what form that element should take: see further the section [Event Handlers [p.12] ]. If this attribute is not present, the handler is the element that the event attribute is on (see later under [Attaching Attributes Directly to the Handler Element [p.10] ]).

The optional phase attribute specifies when (during which DOM 2 event propagation phase) the listener will be activated by the desired event.

- capture
  - Listener is activated during capturing phase.

- default
  - Listener is activated during bubbling or target phase.

The default behavior is phase="default".

Note that not all events bubble, in which case with phase="default" you can only handle the event by making the event’s target the observer.

The optional propagate attribute specifies whether after processing all listeners at the current node, the event is allowed to continue on its path (either in the capture or the bubble phase).

- stop
  - event propagation stops

- continue
  - event propagation continues (unless stopped by other means, such as scripting, or by another listener).
The default behavior is `propagate="continue"`. 

**defaultAction**

The optional `defaultAction` attribute specifies whether after processing of all listeners for the event at the current element, the default action for the event (if any) should be performed or not. For instance, the default action for a mouse click on an `<a>` element in XHTML is to traverse the link. Note that this is only useful when the observer is the `<a>` element, and not some parent element.

- `cancel` if the event type is cancellable, the default action is cancelled
- `perform` the default action is performed (unless cancelled by other means, such as scripting, or by another listener).

The default value is `defaultAction="perform"`.

Note that not all events are cancellable, in which case this attribute is ignored.

**id**

The optional `id` attribute is a document-unique identifier. The value of this identifier is often used to manipulate the element through a DOM interface.

Note that `observer = "<element-id>"` and `event = "<event-type>"` are similar to the `begin = "<element-id>.<event-type>"` attribute in SMIL EventTiming [SMIL20] [p.23] .

### 2.1.1. Examples of listener usage

1. This example attaches the handler in the element at "#doit" that will get activated when the event called `activate` occurs on the element with `id="button1"`, or any of its children. The activation will occur during bubbling, or if the event happened on the observer element itself, when the event reaches the element (phase `target`).

```
<listener event="activate" observer="button1" handler="#doit"/>
```

2. This attaches the handler at `#overflow-handler` that will get activated when the event `overflow` occurs on the element with `id="expr1"` and bubbles up to the element with `id="progl"`.

```
<listener event="overflow" observer="progl" target="expr1"
         handler="#overflow-handler"/>
```

3. This attaches the handler at `#popup` that will get activated whenever an `activate` event occurs at the element with `id="embargo"` or any of its children. Since it will be activated during the capture phase, and propagation is stopped, this will have the effect (regardless of what the handler does) of preventing any child elements of the `embargo` element seeing any `activate` events.
4. This attaches a handler from another document.

```xml
<listener event="activate" observer="embargo" handler="#popup"
    phase="capture" propagate="stop"></listener>
```

2.2. Attaching Attributes Directly to the Observer Element

All the attributes from the `listener` element with the exception of `id` may be used as global attributes, as defined in *Namespaces in XML* [NAME][p. 23], to attach the attributes to other elements.

Note that this means that the `<listener>` element is strictly speaking redundant, since the following

```xml
<anyelement ev:event="click" ev:observer="button1" ev:handler="#clicker"/>
```

would have the same effect as

```xml
<ev:listener event="click" observer="button1" handler="#clicker"/>
```

Nonetheless, for utility the `<listener>` element has been retained.

If the `observer` attribute is omitted (but not the `handler` attribute), then the element that the other attributes are attached to is the observer element.

2.2.1. Examples of Using Attributes Attached to an Observer Element

1. This first example will attach the handler identified by "#popper" to the `<a>` element, and cancel the default action for the event.

```xml
<a href="doc.html" ev:event="activate" ev:handler="#popper"
    ev:defaultAction="cancel">The document</a>
```

2. This will attach the handler at #handle-overflow for the event overflow to the current element.

```xml
<div ev:event="overflow" ev:handler="#handle-overflow"> ... </div>
```

2.3. Attaching Attributes Directly to the Handler Element

If, when attaching the global attributes to an element, the `handler` attribute is omitted then the element that the other attributes are attached to is the handler element.

Note that, since the `observer` and `target` attributes are IDREFs, in this case the handler and observer/target elements must be in the same document (while in other cases, since the `handler` attribute is a URI, the handler element may be in another document).
If the `observer` attribute is also omitted, then the parent of the handler element is the observer element.

### 2.3.1. Examples of Using Attributes Attached to a Handler Element

1. In this case the element is the handler for the `submit` event on the element with `id="form1"`.

   ```html
   <script type="application/x-javascript"
   ev:event="submit" ev:observer="form1">
     return docheck(event);
   </script>
   ```

2. In this case the `<action>` element is the handler for event `q-submit`, and the observer is the `questionnaire` element.

   ```html
   <questionnaire submissionURL="/q/tally">
     <action ev:event="q-submit">
       ...
     </action>
     ...
   </questionnaire>
   ```

3. The `<script>` element is the handler for event `click`; the `<img>` element is the observer.

   ```html
   <img src="button.gif" alt="OK">
   <script ev:event="activate" type="application/x-javascript">
     doactivate(event);
   </script>
   </img>
   ```

4. The `<onevent>` element is the handler for event `enterforward`. The `<card>` element is the observer.

   ```html
   <card>
     <onevent ev:event="enterforward">
       <go href="/url"/>
     </onevent>
     <p>
       Hello!
     </p>
   </card>
   ```

5. The `<catch>` element is the handler for the `nomatch` event. The observer is the `<field>` element.

   ```html
   <form id="launch_missiles">
     <field name="password">
       <prompt>What is the code word?</prompt>
       <grammar>
         <rule id="root" scope="public">rutabaga</rule>
       </grammar>
       <help>It is the name of an obscure vegetable.</help>
     </field>
     <catch ev:event="nomatch">
   ```
6. This example shows three handlers for different events. The observer for all three is the 
<secret> element.

<secret ref="/login/password">
  <caption>Please enter your password</caption>
  <info ev:event="help">
    Mail help@example.com in case of problems
  </info>
  <info ev:event="hint">
    A pet’s name
  </info>
  <info ev:event="alert">
    This field is required
  </info>
</secret>

2.4. Summary of Observer and Handler Attribute Defaulting

The following table summarizes which elements play the role of observer or handler if the 
relevant attribute is omitted.

<table>
<thead>
<tr>
<th>Observer</th>
<th>Handler present</th>
<th>Handler omitted</th>
</tr>
</thead>
<tbody>
<tr>
<td>present</td>
<td>(As declared)</td>
<td>Element is handler</td>
</tr>
<tr>
<td>omitted</td>
<td>Element is observer</td>
<td>Element is handler</td>
</tr>
<tr>
<td></td>
<td>Parent is observer</td>
<td></td>
</tr>
</tbody>
</table>

2.5. Event Handlers

This specification does not require an XML application that uses XML Events to use any 
particular method for specifying handlers. However, the examples, particularly those in the 
section on attaching the attributes directly to the handler, are intended to give examples of how 
they could be specified.

It is however recognized that two methods are likely to occur often: scripting (such as XHTML’s 
<script> element) and declarative markup using XML elements (such as WML’s <onevent> 
element). A companion specification will provide markup to support these methods.
2.6. The Basic XML Events Profile

The Basic XML Events Profile allows restrictions on the usage of the XML Events Module in order to make processing easier on small devices.

The Basic Profile allows the following restrictions on the use of listener element and its attributes, and on the use of the attributes from the listener element as global attributes.

1. External Event Handlers

The ability to process external event handlers is not required. When the 'handler' attribute on the listener element is used, or when the global 'handler' attribute is used, the handler specified in the value of that attribute should be within the current document.

For example, the following is allowed:

```xml
<listener event="click" target="#button1" handler="#clicker"/>
```

while the following is not required to be processed:

```xml
<listener event="click" target="#button1" handler="doc2.html#clicker"/>
```

2. Ordering of Event Bindings

The binding of an event handler to an observer may be required to be lexically before the end of the observer element. In other words, a <listener> binding to an observer may not occur after the closing tag of the observer element, and an event handler carrying the attributes to bind it to an observer may also not occur after the closing tag of the observer element.

3. Naming Event Types

This section is informative.

This specification does not normatively specify how language designers should name events (i.e., the values used in the event attribute).

To avoid clashes with names used by other applications, it is recommended to use a prefix separated with a hyphen from the event name, for instance xforms-alert.

A number of event types are defined in DOM2 [DOM2EVENTS][p.23], to which you should refer for their names and semantics.
A. DTD Implementation

This appendix is normative.

The DTD implementation of XML Events conforms to the requirements defined in [XHTMLMOD] [p.23]. Consequently, it provides a Qualified Names sub-module, and a module file for the XML Events module defined in this recommendation.

A.1. Qualified Names Module

Note that this module defines the Parameter Entity %xml-events-attrs.qname. This entity is intended to be used in the attribute lists of elements in any host language that permits the use of event attributes on elements in its own namespace. In this case the Host Language driver should set a parameter entity XML-EVENTS.prefixed to INCLUDE and a parameter entity XML-EVENTS.prefix to a value that is the prefix for the XML Events attributes.

<!-- ............................................................... -->
<!-- XML Events Qname Module  ............................................ -->
<!-- file: xml-events-qname-1.mod

This is XML Events - the Events Module for XML, a definition of access to the DOM events model.

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This DTD module is identified by the PUBLIC and SYSTEM identifiers:

PUBLIC "-//W3C//ENTITIES XML Events Qnames 1.0//EN"
SYSTEM "http://www.w3.org/TR/xml-events/DTD/xml-events-qname-1.mod"

Revisions:
(none)
............................................................... -->

<!-- XML Events Qname (Qualified Name) Module

This module is contained in two parts, labeled Section ‘A’ and ‘B’:

Section A declares parameter entities to support namespace-qualified names, namespace declarations, and name prefixing for XML Events and extensions.

Section B declares parameter entities used to provide namespace-qualified names for all XML Events element types:

%listener.qname; the xmlns-qualified name for <listener>
...

XML Events extensions would create a module similar to this one. Included in the XML distribution is a template module (‘template-qname-1.mod’) suitable for this purpose.

-->
<!-- Section A: XML Events XML Namespace Framework :------------------ -->

<!-- 1. Declare a %XML-EVENTS.prefixed; conditional section keyword, used to activate namespace prefixing. The default value should inherit '%NS.prefixed;' from the DTD driver, so that unless overridden, the default behaviour follows the overall DTD prefixing scheme. -->

<!ENTITY % NS.prefixed "IGNORE" >
<!ENTITY % XML-EVENTS.prefixed "%NS.prefixed;" >

<!-- 2. Declare a parameter entity (eg., %XML-EVENTS.xmlns;) containing the URI reference used to identify the XML Events namespace -->

<!ENTITY % XML-EVENTS.xmlns "http://www.w3.org/2001/xml-events" >

<!-- 3. Declare parameter entities (eg., %XML.prefix;) containing the default namespace prefix string(s) to use when prefixing is enabled. This may be overridden in the DTD driver or the internal subset of an document instance. If no default prefix is desired, this may be declared as an empty string. 

NOTE: As specified in [XMLNAMES], the namespace prefix serves as a proxy for the URI reference, and is not in itself significant. -->

<!ENTITY % XML-EVENTS.prefix "" >

<!-- 4. Declare parameter entities (eg., %XML-EVENTS.pfx;) containing the colonized prefix(es) (eg., '%XML-EVENTS.prefix;:') used when prefixing is active, an empty string when it is not. -->

<!ENTITY % XML-EVENTS.pfx "" >

<!-- declare qualified name extensions here ............ -->

<!ENTITY % xml-events-qname-extra.mod "" >
%xml-events-qname-extra.mod;

<!-- 5. The parameter entity %XML-EVENTS.xmlns.extra.attrib; may be redeclared to contain any non-XML Events namespace declaration attributes for namespaces embedded in XML. The default is an empty string. XLink should be included here if used in the DTD. -->

<!ENTITY % XML-EVENTS.xmlns.extra.attrib "" >

<!-- Section B: XML Qualified Names :------------------------ -->

<!-- 6. This section declares parameter entities used to provide namespace-qualified names for all XML Events element types. -->

<!ENTITY % xml-events.listener.qname "%XML-EVENTS.pfx;listener" >
A.2. XML Events Module

This is XML Events - the Events Module for XML. a redefinition of access to the DOM events model.

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This DTD module is identified by the PUBLIC and SYSTEM identifiers:

    PUBLIC "-//W3C//ENTITIES XML Events 1.0//EN"
    SYSTEM "http://www.w3.org/TR/xml-events/DTD/xml-events-1.mod"

Revisions:
    (none)

XML Events defines the listener element and its attributes

<!ENTITY % xml-events.listener.content "EMPTY" >
<!ELEMENT %xml-events.listener.qname; %xml-events.listener.content;>
<!ATTLIST %xml-events.listener.qname;
    id               ID           #IMPLIED
    event            NMTOKEN      #REQUIRED
    observer         IDREF        #IMPLIED
    target           IDREF        #IMPLIED
    handler          %anyURI.datatype;        #IMPLIED
    phase            (capture|default) #IMPLIED
    propagate        (stop|continue) #IMPLIED
    defaultAction    (cancel|perform) #IMPLIED
>
<!-- end of xml-events-1.mod -->
B. Schema Implementation

This appendix is normative.

The SCHEMA implementation of XML Events conforms to the requirements defined in [XHTMLSCHEMAMOD][p.23]. It is divided into an attributes module and an element module for the XML Events module defined in this recommendation.

B.1. Attributes Module

```xml
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema
    targetNamespace="http://www.w3.org/2001/xml-events"
    xmlns:ev="http://www.w3.org/2001/xml-events"
    xmlns:xs="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://www.w3.org/2001/XMLSchema
    http://www.w3.org/2001/XMLSchema.xsd"
    elementFormDefault="unqualified"
    version="1.1"
    blockDefault="#all"
    finalDefault="#all"
    attributeFormDefault="unqualified">
    <!--
    <xs:annotation>
        <xs:documentation>
            This is the XML Schema for XML Events global attributes
            $Id: xml-events-attribs-1.xsd,v 1.3 2002/08/12 14:52:13 ahby Exp $
        </xs:documentation>
    </xs:annotation>
    <!--
    <xs:annotation>
        <xs:documentation>
            XML Event Attributes
            These "global" event attributes are defined in "Attaching Attributes Directly to the Observer Element" of the XML Events specification.
        </xs:documentation>
    </xs:annotation>
    <!--
    <xs:attribute name="event" type="xs:NMTOKEN"/>
    <xs:attribute name="observer" type="xs:IDREF"/>
    <xs:attribute name="target" type="xs:IDREF"/>
    <xs:attribute name="handler" type="xs:anyURI"/>
    <xs:attribute name="phase" default="default">
```
<xs:simpleType>
  <xs:restriction base="xs:NMTOKEN">
    <xs:enumeration value="capture"/>
    <xs:enumeration value="default"/>
  </xs:restriction>
</xs:simpleType>

<xs:attribute name="propagate" default="continue">
  <xs:simpleType>
    <xs:restriction base="xs:NMTOKEN">
      <xs:enumeration value="stop"/>
      <xs:enumeration value="continue"/>
    </xs:restriction>
  </xs:simpleType>
</xs:attribute>

<xs:attribute name="defaultAction" default="perform">
  <xs:simpleType>
    <xs:restriction base="xs:NMTOKEN">
      <xs:enumeration value="cancel"/>
      <xs:enumeration value="perform"/>
    </xs:restriction>
  </xs:simpleType>
</xs:attribute>

<!--
-->

<!--
<xs:attributeGroup name="XmlEvents.attlist">
  <xs:attribute ref="ev:event"/>
  <xs:attribute ref="ev:observer"/>
  <xs:attribute ref="ev:target"/>
  <xs:attribute ref="ev:handler"/>
  <xs:attribute ref="ev:phase"/>
  <xs:attribute ref="ev:propagate"/>
  <xs:attribute ref="ev:defaultAction"/>
</xs:attributeGroup>

</xs:schema>

B.2. XML Events Module

<?xml version="1.0" encoding="UTF-8"?>
<xs:schema
targetNamespace="http://www.w3.org/2001/xml-events"
xmlns="http://www.w3.org/2001/xml-events"
xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="http://www.w3.org/2001/XMLSchema
http://www.w3.org/2001/XMLSchema.xsd"
elementFormDefault="unqualified"
version="1.1"
blockDefault="#all"
finalDefault="#all"
attributeFormDefault="unqualified"/>

<!--
-->
<xs:annotation>
  <xs:documentation>
    This is the XML Schema XML Events
  </xs:documentation>
  $Id: xml-events-1.xsd,v 1.3 2002/08/12 14:52:13 ahby Exp $
</xs:annotation>

<xs:annotation>
  <xs:documentation source="xml-events-copyright-1.xsd"/>
</xs:annotation>

<xs:attributeGroup name="listener.attlist">
  <xs:attribute name="event" use="required" type="xs:NMTOKEN"/>
  <xs:attribute name="observer" type="xs:IDREF"/>
  <xs:attribute name="target" type="xs:IDREF"/>
  <xs:attribute name="handler" type="xs:anyURI"/>
  <xs:attribute name="phase" default="default">
    <xs:simpleType>
      <xs:restriction base="xs:NMTOKEN">
        <xs:enumeration value="capture"/>
        <xs:enumeration value="default"/>
      </xs:restriction>
    </xs:simpleType>
  </xs:attribute>
  <xs:attribute name="propagate" default="continue">
    <xs:simpleType>
      <xs:restriction base="xs:NMTOKEN">
        <xs:enumeration value="stop"/>
        <xs:enumeration value="continue"/>
      </xs:restriction>
    </xs:simpleType>
  </xs:attribute>
  <xs:attribute name="defaultAction" default="perform">
    <xs:simpleType>
      <xs:restriction base="xs:NMTOKEN">
        <xs:enumeration value="cancel"/>
        <xs:enumeration value="perform"/>
      </xs:restriction>
    </xs:simpleType>
  </xs:attribute>
  <xs:attribute name="id" type="xs:ID"/>
</xs:attributeGroup>
<xs:complexType name="listener.type">
  <xs:attributeGroup ref="listener.attlist"/>
</xs:complexType>

<xs:element name="listener" type="listener.type"/>

</xs:schema>
C. References

This appendix is normative.

C.1. Normative References

[DOM2EVENTS]

/XML]

/NAME]

/[SCHEMA]

C.2. Other References

/[HTML4]

/[SMIL20]

/[SVG]
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D. Acknowledgments

This section is informative.

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At the time of publication, the members of the W3C HTML Working Group were:

List will be inserted when this document becomes a Recommendation.