

1 ElectionEventLogging and ElectionEventLogging-Documentation XML Schemas

[This document is an excerpt from what will be a larger publication on the common data format for election event logging.]

This section contains documentation and discussion of the features included in the *ElectionEventLogging* and *ElectionEventLogging-Documentation* XML schemas.

1.1 Schema Stylistic Conventions

The XML schemas were written observing the following stylistic conventions:

- Element, attribute, enumeration, and primitive names observe variations of “CamelCase” conventions¹, that is:
 - Element and enumeration and primitive names begin with a capital letter and names that consist of multiple words are concatenated and each word begins with a capital letter, thus “CamelCase”. For example, *<ElectionEventLog>*.
 - Enumeration value names are in non-capital letters, and names that consist of multiple words are separated by hyphens. For example, *opscan-central*.
- Element and enumeration value ordering is generally alphabetical, with the following exceptions:
 - Element names such as *<Type>* are followed by *<OtherType>*.
 - If there is an enumeration value of *other*, it comes last in the list of values.

In the sections below, an element or an enumeration name is denoted using italics and angle brackets, e.g., *<ElectionEvent>*. Enumeration values are in italics, e.g., *other*. An element is sometimes referred to as a “sub-element” when it is included in another element, e.g., *<ElectionEvent>* is a sub-element of *<ElectionEventLog>*. “Includes” is used to denote that an element contains another element as a sub-element, e.g., *<ElectionEventLog>* includes *<ElectionEvent>*.

1.2 Elements and Complex Types - ElectionEventLogging Schema

The following sections deal with major elements and complex types in the *ElectionEventLogging* schema.

¹ See <https://en.wikipedia.org/wiki/CamelCase>.

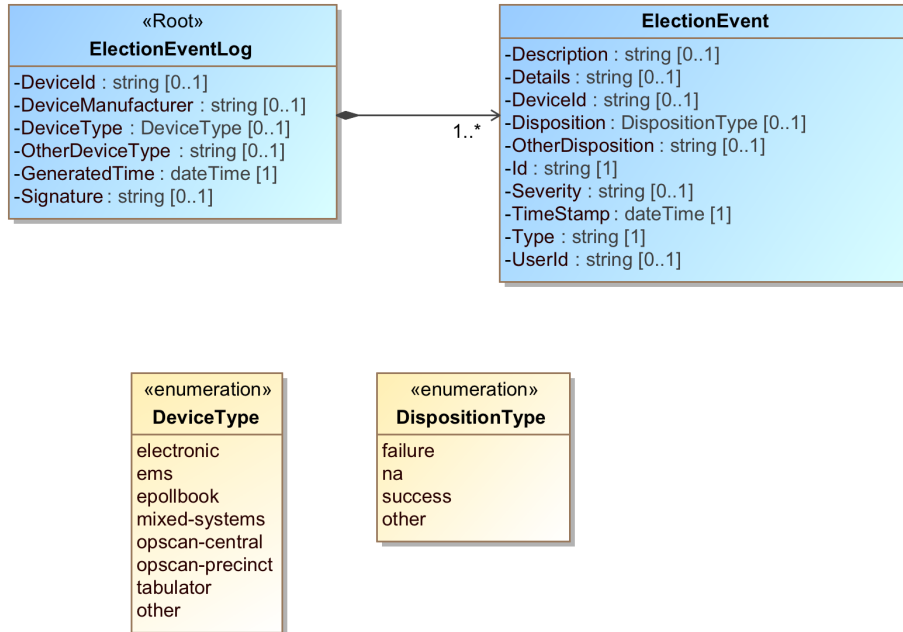


Figure 1 - ElectionEventLogging UML Class Diagram

The XML format represented by the *ElectionEventLogging* schema is very simple, with an `<ElectionEventLog>` root element and then multiple occurrences of `<ElectionEvent>` elements, one for each event that is logged. A brief example showing only the sub-elements that are required is as follows:

```

<ElectionEventLog>
  <ElectionEvent>
    <Id>1004022</Id>
    <TimeStamp>2013-12-13T16:51:43</TimeStamp>
    <Type>P_LOG</Type>
  </ElectionEvent>
  <ElectionEvent>
    <Id>1004150</Id>
    <TimeStamp>2013-12-13T16:51:55</TimeStamp>
    <Type>P_LOG</Type>
  </ElectionEvent>
  <ElectionEvent>
    <Id>6004041</Id>
    <TimeStamp>2013-12-13T16:52:00</TimeStamp>
    <Type>P_LOG</Type>
  </ElectionEvent>
  <GeneratedTime>2013-13-01T17:45:52.629000</GeneratedTime>
</ElectionEventLog>
  
```

1.2.1 The <ElectionEvent> Complex Type

<ElectionEvent> holds information about a specific event. As noted, <DeviceId> can be used to identify a device different from the device identified in the <ElectionEventLog> element.

Table 1.1 – Elements for <ElectionEvent>

Element	Multiplicity	Type	Element Description
<Description>	0 or 1	xsd:string	Used for a brief description of the event.
<Details>	0 or 1	xsd:string	Used for additional information about the event, e.g., vendor reserved information.
<DeviceId>	0 or 1	xsd:string	A serial number or otherwise identifier associated with the device.
<Disposition>	0 or 1	DispositionType	The disposition, e.g., success or failure, of the event.
<OtherDisposition>	0 or 1	xsd:string	Used when <DispositionType> is <i>other</i> .
<Id>	1	xsd:string	An identifier associated with the event.
<Severity>	0 or 1	xsd:string	Used for an indication of the severity of the event, as determined by the device vendor.
<TimeStamp>	1	xsd:dateTime	Identifies the date and time the event was generated.
<Type>	1	xsd:string	Used for the type of event, as determined by the device vendor.
<UserId>	0 or 1	xsd:string	An identifier associated with a user, as relevant.

Schema Definition:

```
<xsd:complexType name="ElectionEvent">
  <xsd:sequence>
    <xsd:element name="Description" type="xsd:string" minOccurs="0"/>
    <xsd:element name="Details" type="xsd:string" minOccurs="0"/>
    <xsd:element name="DeviceId" type="xsd:string" minOccurs="0"/>
    <xsd:element name="Disposition" type="DispositionType" minOccurs="0"/>
    <xsd:element name="OtherDisposition" type="xsd:string" minOccurs="0"/>
    <xsd:element name="Id" type="xsd:string"/>
    <xsd:element name="Severity" type="xsd:string" minOccurs="0"/>
    <xsd:element name="TimeStamp" type="xsd:dateTime"/>
    <xsd:element name="Type" type="xsd:string"/>
    <xsd:element name="UserId" type="xsd:string" minOccurs="0"/>
  </xsd:sequence>
</xsd:complexType>
```

1.2.2 The <ElectionEventLog> Complex Type

<ElectionEventLog> is the root element. It includes one or more <ElectionEvent> elements as well as other information for identifying the specific device associated with the election events and the date and time when the election event log was created.

A device identifier can be included in <DeviceId>, however each <ElectionEvent> element can contain a different device identifier for cases when the election event log may be produced by a logging device that combines events from multiple devices. In this case, <DeviceId> would be the identifier associated with the logging device and each <ElectionEvent> element would identify a specific device.

The optional <Signature> element is used for an XML digital signature². <Signature> must be the last element of <ElectionEventLog>.

Table 1.2 – Elements for <ElectionEventLog>

Element	Multiplicity	Type	Element Description
<DeviceId>	0 or 1	xsd:string	A serial number or otherwise identifier associated with the device.
<DeviceManufacturer>	0 or 1	xsd:string	Manufacturer of the device.
<DeviceType>	0 or 1	DeviceType	Enumerated type of device, e.g., DRE, opscan-precinct, etc.
<OtherDeviceType>	0 or 1	xsd:string	Used when <DeviceType> is <i>other</i> .
<ElectionEvent>	1 or more	ElectionEvent	Used to describe a logged event.
<GeneratedTime>	1	xsd:dateTime	Identifies the date and time the log report was generated.
<Signature>	0 or 1	Signature	Reference to the <Signature> element of the W3C digital signature schema imported into this schema.

Schema Definition:

```
<xsd:complexType name="ElectionEventLog">
  <xsd:sequence>
    <xsd:element name="DeviceId" type="xsd:string" minOccurs="0"/>
    <xsd:element name="DeviceManufacturer" type="xsd:string" minOccurs="0"/>
    <xsd:element name="DeviceType" type="xsd:string" minOccurs="0"/>
    <xsd:element name="OtherDeviceType" type="xsd:string" minOccurs="0"/>
    <xsd:element name="ElectionEvent" type="ElectionEvent" maxOccurs="unbounded"/>
    <xsd:element name="TimeStamp" type="xsd:dateTime"/>
  </xsd:sequence>
</xsd:complexType>
```

² See XML Signature Syntax and Processing (Second Edition), W3C Recommendation June 10, 2008, <http://www.w3.org/TR/xmlsig-core/>.

```
<xsd:element ref="ds:Signature" minOccurs="0"/>  
</xsd:sequence>  
</xsd:complexType>
```

1.3 Elements and Complex Types - ElectionEventLogging-Documentation Schema

The following sections deal with major elements and complex types in the *ElectionEventLogging-Documentation* schema.

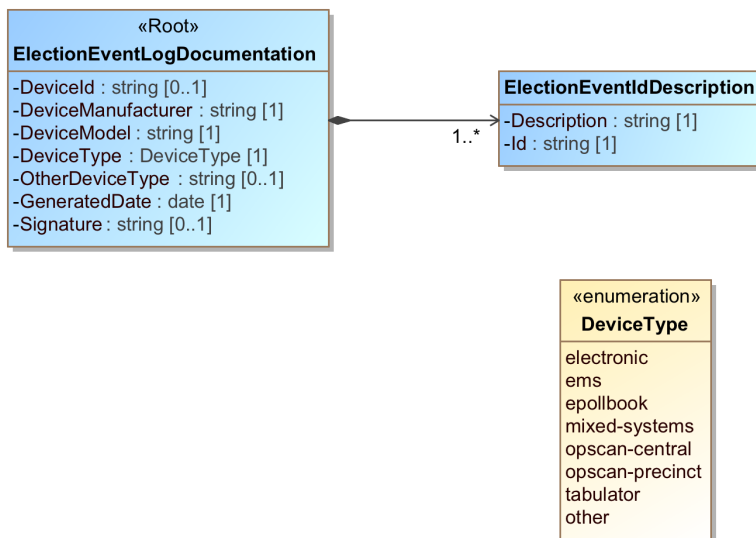


Figure 2 - Election Event Logging Documentation UML CLASS Diagram

The purpose of the *ElectionEventLogging-Documentation* schema is to provide a format for vendor documentation of the election event identifiers used in the log files. Rather than requiring vendors to standardize on a specific set of election event identifiers and their meaning, the approach represented here is for vendors to use their own specific identifiers but to provide descriptions for those identifiers. The XML format represented by the *ElectionEventLogging-Documentation* schema is very simple, with a root `<ElectionEventLogDocumentation>` element followed by multiple occurrences of `<ElectionEventIdDescription>` elements, each element providing a description for an election event identifier. A brief example is as follows:

```

<ElectionEventLogDocumentation>
  <DeviceManufacturer>Blackburd</DeviceManufacturer>
  <DeviceModel>SR-71</DeviceModel>
  <DeviceType>dre</DeviceType>
  <ElectionEventIdDescription>
    <Description>Voting session complete</Description>
    <Id>1004022</Id>
  </ElectionEvent>
  <ElectionEvent>
    <Description>Attempting to Close Poll</Description>
    <Id>1004150</Id>
  </ElectionEvent>
  <ElectionEvent>
    <Description>Close process complete</Description>
    <Id>6004041</Id>
  </ElectionEvent>
  <GeneratedDate>2010-10-01T16:50:46</GeneratedDate>
  
```

`</ElectionEventLogDocumentation>`

1.3.1 The `<ElectionEventIdDescription>` Complex Type

For associating a brief description with an election event log ID.

Table 1.3 – Elements for `<ElectionEventIdDescription>`

Element	Multiplicity	Type	Element Description
<code><Description></code>	1	<code>xsd:string</code>	Used for a brief description of the event.
<code><Id></code>	1	<code>xsd:string</code>	An identifier associated with the event.

Schema Definition:

```
<xsd:complexType name="ElectionEventIdDescription">  
  <xsd:sequence>  
    <xsd:element name="Description" type="xsd:string"/>  
    <xsd:element name="Id" type="xsd:string"/>  
  </xsd:sequence>  
</xsd:complexType>
```

1.3.2 The <ElectionEventLogDocumentation> Complex Type

<ElectionEventLogDocumentation> is the root element. It includes one or more <ElectionEventIdDescription> elements as well as other information for identifying the specific device associated with the election event documentation.

The optional <Signature> element is used for an XML digital signature. <Signature> must be the last element of <ElectionEventLogDocumentation>.

Table 1.4 – Elements for <ElectionEventLogDocumentation>

Element	Multiplicity	Type	Element Description
<DeviceId>	0 or 1	xsd:string	A serial number or otherwise identifier associated with the device.
<DeviceManufacturer>	1	xsd:string	Manufacturer of the device.
<DeviceModel>	1	xsd:string	Model of the device.
<DeviceType>	1	DeviceType	Enumerated type of device, e.g., DRE, opscan-precinct, etc.
<OtherDeviceType>	0 or 1	xsd:string	Used when <DeviceType> is <i>other</i> .
<ElectionEventIdDescription>	1 or more	ElectionEventIdDescription	For associating a description with an event ID.
<GeneratedDate>	1	xsd:date	Identifies the date the documentation report was generated.
<Signature>	0 or 1	Signature	Reference to the <Signature> element of the W3C digital signature schema imported into this schema.

Schema Definition:

```

<xsd:complexType name="ElectionEventLogDescription">
  <xsd:sequence>
    <xsd:element name="DateTime" type="xsd:dateTime"/>
    <xsd:element name="DeviceType" type="xsd:string"/>
    <xsd:element name="OtherDeviceType" type="xsd:string" minOccurs="0"/>
    <xsd:element name="DeviceId" type="xsd:string" minOccurs="0"/>
  
```



```
    <xsd:element name="DeviceManufacturer" type="xsd:string"/>
    <xsd:element name="ElectionEventIdDescription"
type="ElectionEventIdDescription" maxOccurs="unbounded"/>
    <xsd:element ref="ds:Signature" minOccurs="0"/>
  </xsd:sequence>
</xsd:complexType>
```

1.4 Enumerations

The following sections deal with simple type enumerations in both the *ElectionEventLogging* and *ElectionEventLogging-Documentation* schemas.

1.4.1 The DeviceType Enumeration

Enumeration for the type of device in the `<DeviceType>` element, used in both schemas.

Table 1.5 – Values for `<DeviceType>`

Value	Value Description
electronic	For DRE (Direct Record Electronic) and touchscreen devices such as tablets.
ems	For election management systems.
epollbook	For electronic poll book devices.
mixed-systems	For devices, e.g., that print voter choices on an optical scan ballot (hybrid of a DRE and an optical scan system)
opscan-central	For an optical scanner used at a central office with no opportunity for voter correction of mistakes.
opscan-precinct	For an optical scanner used at a precinct or other location where voter correction of mistakes such as overvotes is possible.
tabulator	For tabulation devices.
other	Used when the device type is not listed in this enumeration.

Schema Definition:

```
<xsd:simpleType name="DeviceType">
  <xsd:restriction base="xsd:string">
    <xsd:enumeration value="electronic"/>
    <xsd:enumeration value="ems"/>
    <xsd:enumeration value="epollbook"/>
    <xsd:enumeration value="mixed-systems"/>
    <xsd:enumeration value="opscan-central"/>
    <xsd:enumeration value="opscan-precinct"/>
    <xsd:enumeration value="tabulator"/>
    <xsd:enumeration value="other"/>
  </xsd:restriction>
</xsd:simpleType>
```

1.4.2 The DispositionType Enumeration

Enumeration for types of dispositions in the *<Disposition>* element, used only in the *ElectionEventLogging* schema.

Table 1.6 – Values for <DispositionType>

Value	Value Description
failure	For a failure disposition.
na	Used when the disposition is not applicable or there is no disposition.
success	For a successful disposition.
other	Used when the type of disposition is not included in this enumeration.

Schema Definition:

```
<xsd:simpleType name="DispositionType">  
  <xsd:restriction base="xsd:string">  
    <xsd:enumeration value="failure"/>  
    <xsd:enumeration value="na"/>  
    <xsd:enumeration value="success"/>  
    <xsd:enumeration value="other"/>  
  </xsd:restriction>  
</xsd:simpleType>
```

Appendix A—ElectionEventLogging XML Schema

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- Version 1.0, November 30, 2015, NIST ElectionEventLogging, National Institute of Standards
and Technology -->
<xsd:schema xmlns="NIST_V1_election_event_logging.xsd"
xmlns:ds="http://www.w3.org/2000/09/xmldsig#" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
targetNamespace="NIST_V1_election_event_logging.xsd" elementFormDefault="qualified"
version="1.0">
  <!-- ===== Imports ===== -->
  <xsd:import namespace="http://www.w3.org/2000/09/xmldsig#"
schemaLocation="http://www.w3.org/2000/09/xmldsig#" />
  <!-- ===== Roots ===== -->
  <xsd:element name="ElectionEventLog" type="ElectionEventLog"/>
  <!-- ===== Primitives ===== -->
  <!-- ===== Enumerations ===== -->
  <xsd:simpleType name="DeviceType">
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="electronic"/>
      <xsd:enumeration value="ems"/>
      <xsd:enumeration value="epollbook"/>
      <xsd:enumeration value="mixed-systems"/>
      <xsd:enumeration value="opscan-central"/>
      <xsd:enumeration value="opscan-precinct"/>
      <xsd:enumeration value="tabulator"/>
      <xsd:enumeration value="unknown"/>
      <xsd:enumeration value="other"/>
    </xsd:restriction>
  </xsd:simpleType>
  <xsd:simpleType name="DispositionType">
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="failure"/>
      <xsd:enumeration value="na"/>
      <xsd:enumeration value="success"/>
      <xsd:enumeration value="other"/>
    </xsd:restriction>
  </xsd:simpleType>
  <!-- ===== Elements ===== -->
  <xsd:complexType name="ElectionEvent">
    <xsd:sequence>
      <xsd:element name="Description" type="xsd:string" minOccurs="0"/>
      <xsd:element name="Details" type="xsd:string" minOccurs="0"/>
      <xsd:element name="DeviceId" type="xsd:string" minOccurs="0"/>
      <xsd:element name="Disposition" type="DispositionType" minOccurs="0"/>
      <xsd:element name="OtherDisposition" type="xsd:string" minOccurs="0"/>
      <xsd:element name="Id" type="xsd:string"/>
      <xsd:element name="Severity" type="xsd:string" minOccurs="0"/>
      <xsd:element name="TimeStamp" type="xsd:dateTime"/>
      <xsd:element name="Type" type="xsd:string"/>
      <xsd:element name="UserId" type="xsd:string" minOccurs="0"/>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="ElectionEventLog">
    <xsd:sequence>
      <xsd:element name="DeviceId" type="xsd:string" minOccurs="0"/>
      <xsd:element name="DeviceManufacturer" type="xsd:string" minOccurs="0"/>
      <xsd:element name="DeviceType" type="xsd:string" minOccurs="0"/>
      <xsd:element name="OtherDeviceType" type="xsd:string" minOccurs="0"/>
      <xsd:element name="ElectionEvent" type="ElectionEvent" maxOccurs="unbounded"/>
      <xsd:element name="GeneratedTime" type="xsd:dateTime"/>
      <xsd:element ref="ds:Signature" minOccurs="0"/>
    </xsd:sequence>
  </xsd:complexType>
```

</xsd:schema>

Appendix B—ElectionEventLogging-Documentation XML Schema

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- Version 1.0, November 30, 2015, NIST ElectionEventLogging, National Institute of Standards
and Technology -->
<xsd:schema xmlns="NIST_V1_election_event_logging_description.xsd"
xmlns:ds="http://www.w3.org/2000/09/xmldsig#" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
targetNamespace="NIST_V1_election_event_logging_description.xsd" elementFormDefault="qualified"
version="1.0">
  <!-- ===== Imports ===== -->
  <xsd:import namespace="http://www.w3.org/2000/09/xmldsig#"
schemaLocation="http://www.w3.org/2000/09/xmldsig#"/>
  <!-- ===== Roots ===== -->
  <xsd:element name="ElectionEventLogDescription" type="ElectionEventLogDescription"/>
  <!-- ===== Primitives ===== -->
  <!-- ===== Enumerations ===== -->
  <xsd:simpleType name="DeviceType">
    <xsd:restriction base="xsd:string">
      <xsd:enumeration value="electronic"/>
      <xsd:enumeration value="ems"/>
      <xsd:enumeration value="epollbook"/>
      <xsd:enumeration value="mixed-systems"/>
      <xsd:enumeration value="opscan-central"/>
      <xsd:enumeration value="opscan-precinct"/>
      <xsd:enumeration value="tabulator"/>
      <xsd:enumeration value="unknown"/>
      <xsd:enumeration value="other"/>
    </xsd:restriction>
  </xsd:simpleType>
  <!-- ===== Elements ===== -->
  <xsd:complexType name="ElectionEventIdDescription">
    <xsd:sequence>
      <xsd:element name="Description" type="xsd:string"/>
      <xsd:element name="Id" type="xsd:string"/>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="ElectionEventLogDescription">
    <xsd:sequence>
      <xsd:element name="DeviceId" type="xsd:string" minOccurs="0"/>
      <xsd:element name="DeviceManufacturer" type="xsd:string"/>
      <xsd:element name="DeviceModel" type="xsd:string"/>
      <xsd:element name="DeviceType" type="xsd:string"/>
      <xsd:element name="OtherDeviceType" type="xsd:string" minOccurs="0"/>
      <xsd:element name="EventEventIdDescription" type="ElectionEventIdDescription"
maxOccurs="unbounded"/>
      <xsd:element name="GeneratedDate" type="xsd:date"/>
      <xsd:element ref="ds:Signature" minOccurs="0"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:schema>
```