Report on the
Election Markup Language (EML)
Interoperability Demonstration
held 29/30 October 2007
in Ditton Manor UK

OASIS (Organization for the Advancement of Structured Information Standards) is a not-for-profit, international consortium that drives the development, convergence, and adoption of e-business standards. Members themselves set the OASIS technical agenda, using a lightweight, open process expressly designed to promote industry consensus and unite disparate efforts. The consortium produces open standards for Web services, security, e-business, and standardization efforts in the public sector and for application-specific markets. OASIS was founded in 1993. More information can be found on the OASIS website at http://www.oasis-open.org.
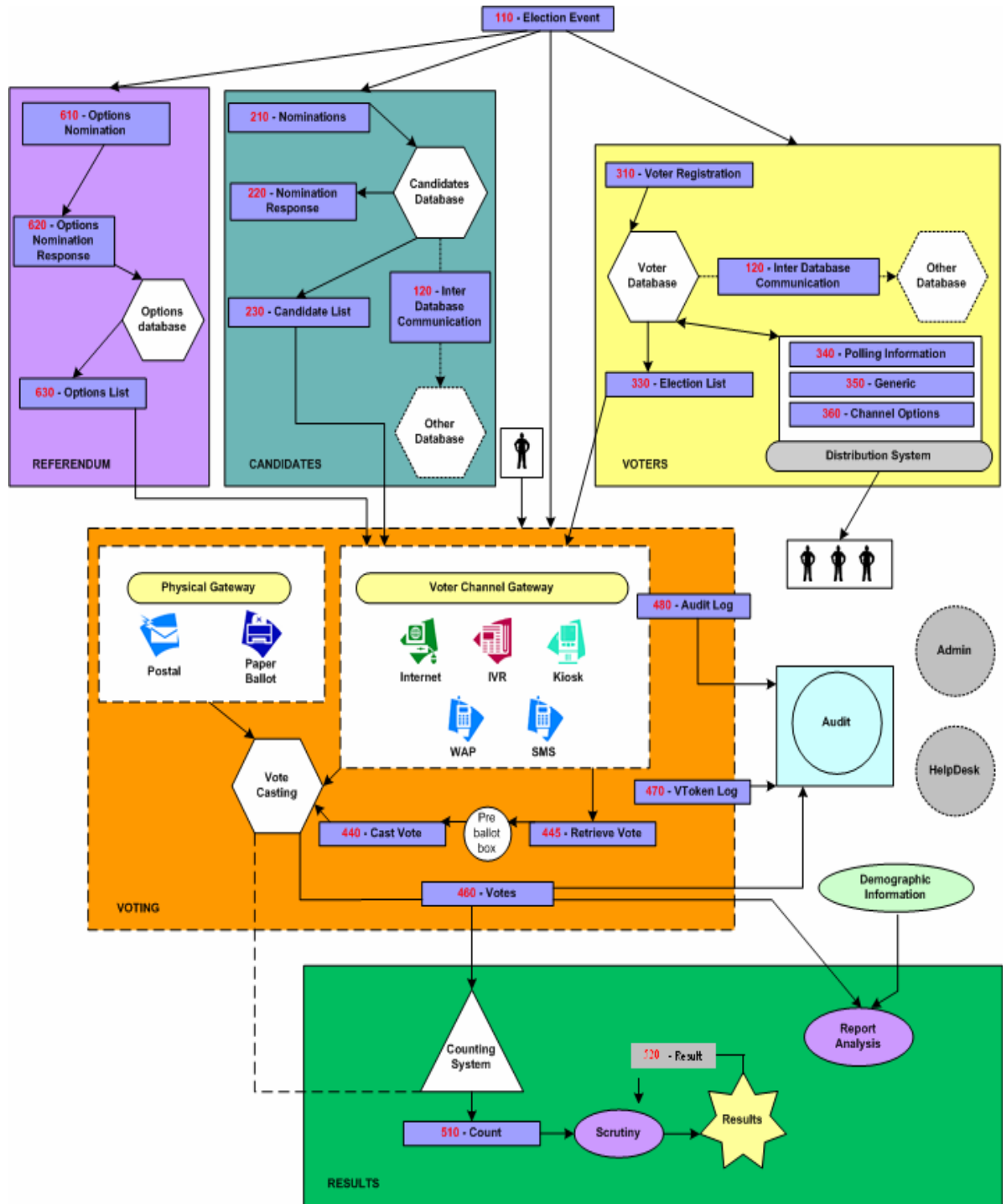
The Election & Voter Services Technical Committee's objective is to develop a standard for the structured interchange of data among hardware, software, and service providers who engage in any aspect of providing election or voter services to public or private organizations.

Introduction

All attendees of the OASIS Open Standards Forum 2007 held in Ditton Manor UK were invited to participate in an Interoperability Demonstration of the Election Markup Language (EML) OASIS Standard. With their help the objective of the Demo was to show how EML can be used in a multi-channel e-voting ballot involving several suppliers.

EML, developed by the OASIS Election & Voter Services Technical Committee, standardises the structured interchange of data for election and voter services. Used in both public and private organisations, EML extends to all aspects of the election process and has been adopted by hardware, software, and service providers. In the context of EML, e-voting has a very wide definition. It is taken to encompass either an election or a referendum that involves the use of electronic means in all or part of the processes. The processes begin with the declaration of an election or referendum, voter and candidate registration, the casting of votes and ending with the counting and declaration of results. It also includes various scenarios ranging from voting supervised by election officials in a controlled environment to remote voting where the casting of the vote is done using a device, eg a PC or a telephone, not controlled by an election official.

The EML standard consists of tried and proven XML formats for handling both information pertaining to the operation of elections and also the election vote cast details, counts and election results. The following diagram depicts the end-to-end lifecycle of an election and shows where data flows between different processes and databases and where the EML XML schemas (the red numbers in the diagram) have been developed to support these flows.

110 - Election Event

REFERENDUM

- 610 - Options Nomination
- 620 - Options Nomination Response
- Options database
- 630 - Options List

CANDIDATES

- 210 - Nominations
- 220 - Nomination Response
- Candidates Database
- 230 - Candidate List
- 120 - Inter Database Communication
- Other Database

VOTERS

- 310 - Voter Registration
- Voter Database
- 120 - Inter Database Communication
- Other Database
- 340 - Polling Information
- 350 - Generic
- 360 - Channel Options
- 330 - Election List
- Distribution System

VOTING

- Physical Gateway
  - Postal
  - Paper Ballot
- Voter Channel Gateway
  - Internet
  - IVR
  - Kiosk
  - WAP
  - SMS
- 480 - Audit Log
- Vote Casting
- 440 - Cast Vote
- Pre ballot box
- 445 - Retrieve Vote
- 470 - VToken Log
- 460 - Votes

Audit

Admin

HelpDesk

Demographic Information

RESULTS

- Counting System
- 510 - Count
- Scrutiny
- 520 - Result
- Results
- Report Analysis

The Ballots

Delegates were asked to vote in two ballots. The results of the ballots will be used to inform future OASIS planning and policy development.

Ballot 1 relates to the reason why delegates were attending the Open Forum and specifically which of the topics would be of most interest to them at a future conference. They had a choice of the five main themes of the Forum and were asked to vote for the one that interests them most. The results of this ballot will help OASIS plan future events and focus them on the areas of most interest.

Ballot 2 relates to the work of the OASIS Technical Advisory Board and asked delegates to choose one of five topics for the Board to focus their efforts on in the coming year. To avoid any misinterpretations, explanations of the choices were contained on the reverse of the ballot paper.

See Appendices A and B for examples of the ballot forms.

Interoperability Demo Participants

The following organisations participated in the Demo:

Voter Registration
        Election list production – Opt2Vote
        Ballot papers preparation – Oracle/ES&S

Voting Channels
        Paper – ES&S
        Internet – Opt2Vote
        PDA – Everyone Counts
        Telephone – ES&S
        Kiosk – ES&S

Counting/Results
        Paper ballots scanning – ES&S
        Counting and Results – IBM

The Demo Processes and Schemas

As can be seen from the above diagram EML covers a lot of functionality and data interchanges. For the Demo only a small section of that complexity was used in an effort to keep it simple and manageable given the time, resources and environment involved.

Upon arrival at the voting station delegates were given a voting registration card which contained the voter ID and password they needed to cast their votes. Voters had a choice of channels to use in casting their votes; via the Internet running on a laptop PC, a PDA, a telephone, a simulated voting kiosk, and paper ballots. For the purpose of the demo we wanted to ensure that we got a good spread of votes across all the channels in order to demonstrate the full value of EML. So the plan was for each channel to have a maximum quota for votes and once that quota was reached that channel would be closed down. In the event this did not turn out to be necessary as most channels were popular with voters with the exception of the telephone.

When delegates had cast their votes their registration card was taken from you them to avoid duplicate voting. They were able to cast their votes during the Forum at any time from midday on Monday 29th October to midday on Tuesday 30th October. A presentation of the results was given during the final session of the Forum

In conducting the Demo, EML's schemas 330, 410, 510 and 520 were used and examples of these are shown at Appendix C. All personal data has been removed from these examples for obvious reasons. The 330 schema was created from the Forum delegate list and sent to all channel providers. They prepared their vote casting systems from this schema and added appropriate validation routines to counter duplicate and erroneous voting. At the conclusion of voting each channel provider constructed a 510 schema with the number of votes and sent it to IBM, who reconciled and counted the votes. The results were then posted to a remote website using a 520 schema.

This whole exercise was a very global event as data was being captured by back-end systems in Nova Scotia, Australia, Northern Ireland, as well as locally in Ditton Manor. The paper ballots were scanned locally. All the data was sent electronically to Belgium for counting and then posted to the remote website for use in the final presentation at the Forum.

The Results

The number of voters who accessed the systems to cast their votes was 54. This represented a 62% turn out of all delegates. The breakdown of voters by channel was:

Internet	14
Kiosk	14
Paper	5
PDA	19
Telephone	2

The number of votes cast for Ballot 1 was:

Business and Organizational Change	17
Quality of Service: Security	11
Applications and Processes	10
Collaboration	6
Quality of Service: Messaging	6
Total	**50**

The number of votes cast for Ballot 2 was:

Service Deployment, Management and Governance	13
Post-standard support	10
Messaging Layer protocols, functions and quality of service	9
Content Design, Semantics and Vocabularies	8
Vertical Domains	6
Total	**46**

As can be seen from the above numbers, there were some voters who didn't complete the casting of their votes for whatever reason, but that was their choice and is not untypical of real world elections where spoilt ballots are not uncommon. From the audit logs available we could show, with the exception of the paper ballots, how individuals voted, as is the legal option in the UK, and hence where the discrepancies occurred. Should we run an EML Demo in another country that facility would be turned off, as would be legally required, and not be available.

Summary

The unanimous opinion of all those involved was that the Demo was highly successful. A lot of effort had gone into the preparation for the Demo to ensure all suppliers agreed the schemas and the data to be handled. On the day everything went very smoothly, all the data exchanges worked without a hitch and the results were available within a matter of minutes of the close of the poll.

Clearly this was only a simple demonstration of a small section of EML, but it concentrated on using the real core aspects of EML and it has provided the Technical Committee with good confidence that they have developed a product that can be used reliably and safely in real world situations. Building on the success of this Demo we hope to run a further Interop Demo next year using more complexity, eg additional security, and further EML functionality.

Contacts and Additional Information

EML is a product of the OASIS Election & Voter Services Technical Committee. The processes, data and XML schemas mentioned in this paper are detailed in a number of documents produced by the Committee. These include:
- EML Process and Data Requirements
- EML Data Dictionary
- EML Schema Descriptions

Further details about EML and the membership and work of the TC are available on the following website: www.oasis-open.org/committees/election/. Alternatively you can e-mail member-services@oasis-open.org for information.

Appendix A – Ballot 1

EML INTEROPERABILITY DEMO - BALLOT 1

Which one of the topics at this conference would be of most interest to you at a future conference?

Place an X in the appropriate box of your choice:

Business and Organizational Change ☐

Applications and Processes ☐

Quality of Service: Security ☐

Collaboration ☐

Quality of Service: Messaging ☐

Appendix B – Ballot 2

EML INTEROPERABILITY DEMO - BALLOT 2

Which one of the following areas would you most like to see OASIS be more active in the coming year?

Place an X in the appropriate box of your choice.

Service Deployment, Management and Governance

Content Design, Semantics and Vocabularies

Messaging protocols, functions and service quality

Approved standard support

Vertical Domains

Ballot 2 – Definitions

Service Deployment, Management and Governance - includes monitoring, change management, policies, repositories, SOA aspects more linked to operation and management

Content Design, Semantics and Vocabularies - includes XML design, ontologies and semantics, document design, mapping and transforms

Messaging protocols, functions and service quality -includes transport-related specifications, integration of Quality of Service specifications, security and access

Approved standard support - includes adoption activities, conformance and interoperability testing, usage profiling of standards by user communities, localisation

Vertical Domains – includes industry-specific or domain-specific: environment, insurance, geographics, government

Appendix C – XML Schemas used in the Demo

Schema 330

```xml
<?xml version="1.0" encoding="UTF-8"?>
<EML Id="330-2" SchemaVersion="5.0" xmlns="urn:oasis:names:tc:evs:schema:eml"
xmlns:nl="urn:oasis:names:tc:ciq:xsdschema:xNL:2.0" xmlns:xs="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oasis:names:tc:evs:schema:eml /330-electionlist-v5-0.xsd">
        <TransactionId>12345678</TransactionId>
        <ElectionList>
                <EventIdentifier Id="Evt1">
                        <EventName>EventOne</EventName>
                </EventIdentifier>
                <VoterDetails>
                        <VoterRegistration>
                                <Voter>
                                        <VoterIdentification>
                                                <VoterName>
                                                        <nl:PersonName>
                                                                <nl:FirstName>John</nl:FirstName>
                                                                <nl:LastName>Bloggs</nl:LastName>
                                                        </nl:PersonName>
                                                </VoterName>
                                                <VToken>
                                                        <Component>49721752</Component>
                                                        <Component>337197</Component>
                                                </VToken>
                                        </VoterIdentification>
                                        <VoterInformation>
                                                <DateOfBirth>1970-01-01</DateOfBirth>
                                        </VoterInformation>
                                </Voter>
                        </VoterRegistration>
                        <Election>
                                <ElectionIdentifier Id="Elc1">
                                        <ElectionName>OASIS Open Standards Forum 2007</ElectionName>
                                </ElectionIdentifier>
                                <ContestIdentifier Id="Con1">
                                        <ContestName>Which one of the topics at this conference would be of
most interest to you at a future conference?</ContestName>
                                </ContestIdentifier>
                        </Election>
                        <Election>
                                <ElectionIdentifier Id="Elc1">
                                        <ElectionName>OASIS Open Standards Forum 2007</ElectionName>
                                </ElectionIdentifier>
                                <ContestIdentifier Id="Con2">
                                        <ContestName>Which of the following areas would you most like to
see OASIS be more active in the coming year?</ContestName>
                                </ContestIdentifier>
                        </Election>
                </VoterDetails>
```

```xml
                <VoterDetails>
                        <VoterRegistration>
                                <Voter>
                                        <VoterIdentification>
                                                <VoterName>
                                                        <nl:PersonName>
                                                                <nl:FirstName>Mark</nl:FirstName>
                                                                <nl:LastName>Nobody</nl:LastName>
                                                        </nl:PersonName>
                                                </VoterName>
                                                <VToken>
                                                        <Component>71613576</Component>
                                                        <Component>131635</Component>
                                                </VToken>
                                        </VoterIdentification>
                                        <VoterInformation>
                                                <DateOfBirth>1970-01-01</DateOfBirth>
                                        </VoterInformation>
                                </Voter>
                        </VoterRegistration>
                        <Election>
                                <ElectionIdentifier Id="Elc1">
                                        <ElectionName>OASIS Open Standards Forum 2007</ElectionName>
                                </ElectionIdentifier>
                                <ContestIdentifier Id="Con1">
                                        <ContestName>Which one of the topics at this conference would be of
most interest to you at a future conference?</ContestName>
                                </ContestIdentifier>
                        </Election>
                        <Election>
                                <ElectionIdentifier Id="Elc1">
                                        <ElectionName>OASIS Open Standards Forum 2007</ElectionName>
                                </ElectionIdentifier>
                                <ContestIdentifier Id="Con2">
                                        <ContestName>Which of the following areas would you most like to
see OASIS be more active in the coming year?</ContestName>
                                </ContestIdentifier>
                        </Election>
                </VoterDetails>
        </ElectionList>
</EML>
```

Schema 410

```xml
<?xml version="1.0" encoding="UTF-8"?>
<EML xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns="urn:oasis:names:tc:evs:schema:eml"
xmlns:ts="urn:oasis:names:tc:evs:schema:eml:ts" xmlns:ds="urn:oasis:names:tc:evs:schema:eml:ds"
xmlns:al="urn:oasis:names:tc:ciq:xsdschema:xAL:2.0" xmlns:nl="urn:oasis:names:tc:ciq:xsdschema:xNL:2.0"
Id="eml-410" SchemaVersion="0.1" xsi:schemaLocation="urn:oasis:names:tc:evs:schema:eml C:\EML-
v5\EMLv5.0Schemas\410-ballots-v5-0.xsd">
        <TransactionId> 410</TransactionId>
        <Ballots>
                <EventIdentifier Id="Evt1"/>
                <Ballot>
```

```xml
<Election>
	<ElectionIdentifier Id="Elc1"/>
	<Contest>
		<ContestIdentifier Id="Con1">
			<ContestName>Which one of the topics at this conference would be of most interest to you at a future conference?</ContestName>
		</ContestIdentifier>
		<MaxVotes>1</MaxVotes>
		<MinVotes>0</MinVotes>
		<BallotChoices>
			<ReferendumOptionIdentifier Id="1629">Business and Organizational Change</ReferendumOptionIdentifier>
			<ReferendumOptionIdentifier Id="1631">Applications and Processes</ReferendumOptionIdentifier>
			<ReferendumOptionIdentifier Id="1728">Quality of Service: Security</ReferendumOptionIdentifier>
			<ReferendumOptionIdentifier Id="2375">Collaboration</ReferendumOptionIdentifier>
			<ReferendumOptionIdentifier Id="3762">Quality of Service: Messaging</ReferendumOptionIdentifier>
		</BallotChoices>
	</Contest>
</Election>
<BallotIdentifier Id="thisballotid1"/>
</Ballot>
<Ballot>
	<Election>
		<ElectionIdentifier Id="Elc1"/>
		<Contest>
			<ContestIdentifier Id="Con2">
				<ContestName>Which of the following areas would you most like to see OASIS be more active in the coming year?</ContestName>
			</ContestIdentifier>
			<MaxVotes>1</MaxVotes>
			<MinVotes>0</MinVotes>
			<BallotChoices>
				<ReferendumOptionIdentifier Id="2763">Service Deployment, Management and Governance</ReferendumOptionIdentifier>
				<ReferendumOptionIdentifier Id="3218">Content Design, Semantics and Vocabularies</ReferendumOptionIdentifier>
				<ReferendumOptionIdentifier Id="4218">Messaging Layer protocols, functions and quality of service</ReferendumOptionIdentifier>
				<ReferendumOptionIdentifier Id="5283">Post-standard support</ReferendumOptionIdentifier>
				<ReferendumOptionIdentifier Id="5391">Vertical Domains</ReferendumOptionIdentifier>
			</BallotChoices>
		</Contest>
	</Election>
	<BallotIdentifier Id="thisballotid2"/>
</Ballot>
</Ballots>
</EML>
```

Schema 510

```xml
<?xml version="1.0" encoding="utf-8"?>
<EML Id="eml-510" SchemaVersion="5.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:ts="urn:oasis:names:tc:evs:schema:eml:ts" xmlns:ds="urn:oasis:names:tc:evs:schema:eml:ds"
xmlns:al="urn:oasis:names:tc:ciq:xsdschema:xAL:2.0" xmlns:nl="urn:oasis:names:tc:ciq:xsdschema:xNL:2.0"
xsi:schemaLocation="urn:oasis:names:tc:evs:schema:eml file:C:\Cairo\XMLSchemas\v5.0\510-count-v5-0.xsd"
xmlns="urn:oasis:names:tc:evs:schema:eml">
  <TransactionId>510</TransactionId>
 <Count>
  <EventIdentifier Id="Evt1" />
  <Election>
   <ElectionIdentifier Id="Elc1" />
   <Contests>
    <Contest>
     <ContestIdentifier Id="Con1" />
     <TotalVotes>
      <Selection>
       <ReferendumOptionIdentifier Id="1629" />
       <ValidVotes>2</ValidVotes>
      </Selection>
      <Selection>
       <ReferendumOptionIdentifier Id="1631" />
       <ValidVotes>0</ValidVotes>
      </Selection>
      <Selection>
       <ReferendumOptionIdentifier Id="1728" />
       <ValidVotes>1</ValidVotes>
      </Selection>
      <Selection>
       <ReferendumOptionIdentifier Id="2375" />
       <ValidVotes>2</ValidVotes>
      </Selection>
      <Selection>
       <ReferendumOptionIdentifier Id="3762" />
       <ValidVotes>0</ValidVotes>
      </Selection>
     </TotalVotes>
    </Contest>
    <Contest>
     <ContestIdentifier Id="Con2" />
     <TotalVotes>
      <Selection>
       <ReferendumOptionIdentifier Id="2763" />
       <ValidVotes>1</ValidVotes>
      </Selection>
      <Selection>
       <ReferendumOptionIdentifier Id="3218" />
       <ValidVotes>0</ValidVotes>
      </Selection>
      <Selection>
       <ReferendumOptionIdentifier Id="4218" />
       <ValidVotes>1</ValidVotes>
      </Selection>
      <Selection>
```

```
        <ReferendumOptionIdentifier Id="5283" />
        <ValidVotes>2</ValidVotes>
       </Selection>
       <Selection>
        <ReferendumOptionIdentifier Id="5391" />
        <ValidVotes>1</ValidVotes>
       </Selection>
      </TotalVotes>
     </Contest>
    </Contests>
   </Election>
   <AuditInformation>
    <ProcessingUnits>
     <OriginatingDevice Role="sender">
      <Id>Scanner</Id>
     </OriginatingDevice>
    </ProcessingUnits>
   </AuditInformation>
  </Count>
</EML>
```

Schema 520

```
<?xml version="1.0" encoding="UTF-8"?>
<EML Id="520" SchemaVersion="5" xmlns="urn:oasis:names:tc:evs:schema:eml">
 <TransactionId></TransactionId>
 <Result>
  <EventIdentifier>
   <EventName>EML Demo</EventName>
  </EventIdentifier>
  <Election>
   <ElectionIdentifier Id="99">
    <ElectionName>EML Demo</ElectionName>
   </ElectionIdentifier>
   <Contest>
    <ContestIdentifier Id="Con1">
     <ContestName>Con1</ContestName>
    </ContestIdentifier>
    <Selection>
     <ReferendumOptionIdentifier Id="1629"></ReferendumOptionIdentifier>
     <Votes>17</Votes>
     <Ranking>1</Ranking>
    </Selection>
    <Selection>
     <ReferendumOptionIdentifier Id="1728"></ReferendumOptionIdentifier>
     <Votes>11</Votes>
     <Ranking>2</Ranking>
    </Selection>
    <Selection>
     <ReferendumOptionIdentifier Id="1631"></ReferendumOptionIdentifier>
     <Votes>10</Votes>
     <Ranking>3</Ranking>
    </Selection>
    <Selection>
     <ReferendumOptionIdentifier Id="2375"></ReferendumOptionIdentifier>
```

```
      <Votes>6</Votes>
      <Ranking>4</Ranking>
     </Selection>
     <Selection>
      <ReferendumOptionIdentifier Id="3762"></ReferendumOptionIdentifier>
      <Votes>6</Votes>
      <Ranking>5</Ranking>
     </Selection>
    </Contest>
    <Contest>
     <ContestIdentifier Id="Con2">
      <ContestName>Con2</ContestName>
     </ContestIdentifier>
     <Selection>
      <ReferendumOptionIdentifier Id="2763"></ReferendumOptionIdentifier>
      <Votes>13</Votes>
      <Ranking>1</Ranking>
     </Selection>
     <Selection>
      <ReferendumOptionIdentifier Id="5283"></ReferendumOptionIdentifier>
      <Votes>10</Votes>
      <Ranking>2</Ranking>
     </Selection>
     <Selection>
      <ReferendumOptionIdentifier Id="4218"></ReferendumOptionIdentifier>
      <Votes>9</Votes>
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     </Selection>
     <Selection>
      <ReferendumOptionIdentifier Id="3218"></ReferendumOptionIdentifier>
      <Votes>8</Votes>
      <Ranking>4</Ranking>
     </Selection>
     <Selection>
      <ReferendumOptionIdentifier Id="5391"></ReferendumOptionIdentifier>
      <Votes>6</Votes>
      <Ranking>5</Ranking>
     </Selection>
    </Contest>
   </Election>
  </Result>
</EML>
```