

Report on Alternative methods of EML Localisation

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1 Summary

The Election Markup Language (EML) is the result of an international collaboration, and is designed to cater for inter-system communication for public and private elections worldwide. However, any specific election will have its own requirements which need to be accommodated.

These requirements fall into two categories:

- those that extend (where allowed in the base schemas) or restrict the information to be provided, so that the messages are compatible with the international version of EML; and
- those that change the formats of information, such as names and addresses, that lead to messages that are incompatible with the international EML schemas.

This paper looks at six ways (four in detail) of achieving the former case and comes down in favour of validating the documents against the international EML schemas, then further validating against local schemas developed using the Schematron language. This is a well-accepted schema language that is being adopted by ISO.

For the latter case, a mechanism has already been built into EML. EML specifies where such local variations are allowed by isolating them in a single document. This document can be replaced for local use.

Although this report relates to EML, the conclusions can be used for the general case of specialising schemas for specific purposes.

2 Background

The Election Markup Language (EML) [1] is a global specification developed by OASIS (<http://www.oasis-open.org/>) and implemented as a set of XML Schema [2] schemas. As is usual in this situation, the schemas have to cover a wide range of scenarios, and so are fairly generic in nature. Taking the scenario of a UK local government election, we find two types of requirement for change:

1. changes to constraints
 - many necessary data items for the election are optional in the schemas;
 - there are optional items in the schemas that are not allowed in the scenario; and
 - there are choices in the schemas, where one of the options will always be applicable to this scenario
2. locale-specific formats
 - name formats
 - address formats

The additional constraints from the first category lead to documents that are valid to the base EML schemas. The locales will specify additional constraints and possibly additional content where the base schemas allow. Use of locale-specific formats can lead to documents that are not valid to the EML externals schema document (which will be replaced for local use), but will be valid to all other EML schema documents.

The object of this document is to consider various technical options for implementing a specification that is specific to the UK local authority elections for 2003. In doing this, the general case needs to be considered so that the technical solution recommended is applicable to other EML localisation requirements scenarios and, indeed, to creating locale-specific versions of other schemas.

The example has been based on the ballot schema (410-ballots.xsd) produced for version 2 of the EML specification. This is referred to as the base schema. Anything specific to the scenario is referred to as locale-specific and the process of building the locale-specific specification as localisation. Note that the locale-specific changes for this exercise do not necessarily reflect the real requirements - they are purely illustrative. The locale-specific changes made are:

- the element `Rotation` is not used
- the element `MinVotes` is not used
- the element `MaxWriteIn` is not used
- the element `VTokenQualified` is not used
- the element `VoterIdentification` must have a `VToken` child
- there must be at least one `Election` element
- the element `Ballot` must have a `Voter` child

- the address format used is the `InternationalAddressStructure` from Address and Personal Details
- the name format used is the `PersonNameStructure` from Address and Personal Details
- The `VoterName` element is mandatory

3 Changes to Constraints

3.1 Technical Options

There are many possible technical solutions to EML localisation. In addition to those listed below and considered in more detail later, two others are worth mentioning:

The Schema Adjunct Framework (SAF) [3] was developed by Extensibility and submitted as a NOTE to the W3C. This was aimed at precisely this application - producing an addition to a generic schema for use by a specific application. However, since Extensibility's takeover by Tibco, there has been little or no activity on SAF.

There are also several business rules languages proposed [e.g. 4,5,6]. Some are proprietary and some are being presented as open standards. However, these require tool support for validation, and no language is yet sufficiently well supported to allow sufficient choice of tool in this area.

The following are therefore the technical options that have been considered further:

- modifying the base schema set to make it specific for a scenario;
- deriving a locale-specific schema set from the base schema set;
- adding an XSLT stylesheet for additional constraint validation; and
- adding a Schematron [7] or XCSL (XML Constraint Specification Language) [8] schema for additional constraint validation.

Each is reviewed under the headings of:

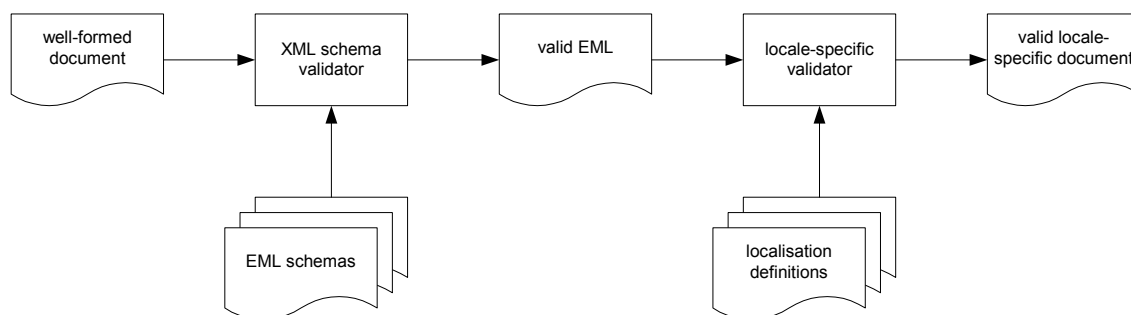
- simplicity of building (and testing) the additional constraints;
- ease of implementing a tool to test the constraints;
- resilience of the solution to change of the locale-specific requirement; and
- resilience of the solution to change of the base EML schemas.

In some cases, trials have been conducted to see how well the solutions work in practice. The appendices provide further information on these trials.

3.2 Processing Models

When looking at defining additional constraints, it is important to understand the two main categories of schema language (all the above options can be considered schema languages in this context). These are the open and closed models.

A schema language with a closed model prohibits any content that it does not explicitly allow. On the other hand, an open model allows anything that it does not explicitly forbid. Although constructs such as `xs:any` and `xs:anyAttribute` make some move towards an open model, XML Schema is fundamentally closed. This is good from the point of view of locking down message content as much as possible. Languages like Schematron, however, allow an open model. The two therefore work well sequentially as shown below.



First validate an incoming document against a base XML Schema EML schemas to check that it meets the basic EML requirements, then use an open model schema just to check additional constraints. This works since a valid locale-specific document must be a valid EML document (subject to the possible replacement of the EML externals schema document). A second closed schema will not work in this situation as all the base EML constraints would have to be respecified to allow the document to pass the locale-specific section of the processing.

3.3 The Options

3.3.1 Build New Schemas Based on the OASIS Schemas

3.3.1.1 Simplicity of Building

It is relatively simple to build new schemas based on the OASIS schemas. It is just a case of taking a copy and modifying it. There is a risk that changes could be made that do not meet the key criteria of only applying additional constraints or extending where allowed. Whilst it is possible to check instance documents against both base and locale-specific schemas, it is not possible to check that the locale-specific schemas themselves obey the key criteria.

3.3.1.2 Ease of Implementing a Tool to Test the Constraints

There is no work involved here. The schemas can be used by a standard validating parser.

3.3.1.3 Resilience of the Solution to Change of the Locale-specific Req^t

Changes to the locale-specific requirement are easy to implement. However, such changes carry even more risk of deviation from the base schemas.

3.3.1.4 Resilience of the Solution to Change of the Base EML Schemas

This is very poor. If the base schemas change, the changes must be manually incorporated into the locale-specific versions. There is no way of checking that these have been done correctly, leading to the likelihood of the two deviating over time. This will reduce the possibility of interoperability with other locales, and make it hard for product vendors to support multiple locales.

3.3.2 Deriving New Schemas Based on the OASIS Schemas

3.3.2.1 Simplicity of Building

The mechanism to do this is to use `xs:redefine`. Each element that changes would have to be respecified in the derived schema. For this reason, it helps if the base schema documents define most elements (at least those where we expect change) globally and reference them

where required. This is not the model that has been adopted in EML since it results in unnecessary globally-available definitions. Therefore, in the case of EML, this would involve changing most of every schema document.

There are other restrictions when using `xs:redefine`. For example, `xs:redefine` does not work well in limiting the values of an `xs:choice` element. There could be work-arounds for this, but they will involve changing the base schemas. In the general case, it does not seem to be a good idea to have to restrict the XML Schema features used in order to allow the use of `xs:redefine` later. This would need further investigation if this option were to be considered.

The advantage of use this approach is that a schema validator should be able to check that the derived schema has been correctly derived from the base and so all instance messages that comply with the derived schema will be guaranteed to comply with the base schema. Achieving this would require a slight change to the schemas to prohibit the extensions of base types (which would then allow the `<redefine>d` schemas to be incompatible with the base schemas).

In summary, the EML schemas should be re-workable to allow easier use of `xs:redefine` whilst remaining 100% compatible with the existing versions (i.e. there would be no changes to any existing EML applications or instance documents unless making definitions global results in multiple global definitions with the same name).

3.3.2.2 Ease of Implementing a Tool to Test the Constraints

There is no work involved here. The schemas can be used by a standard validating parser.

3.3.2.3 Resilience of the Solution to Change of the Locale-specific Req^t

Changes to the locale-specific requirement are easy to implement.

3.3.2.4 Resilience of the Solution to Change of the Base EML Schemas

Changes that do not affect redefined components do not require any changes to the locale-specific schema documents. Where redefined components are changed in the base schema documents, changes will also need to be made to the locale-specific schema documents. A schema validator should identify these situations, although XML Spy v4.4 (the only tool tested so far) does not.

3.3.3 Use an XSLT stylesheet

3.3.3.1 Simplicity of Building

Each base schema that has a locale-specific requirement will require a stylesheet to identify the additional constraints. Although there is no good tool support for such a stylesheet, the basic patterns (elements not allowed, restriction of choices etc) are simple and templates can be built and re-used.

3.3.3.2 Ease of Implementing a Tool to Test the Constraints

To test the locale-specific constraints, an application must apply the stylesheet to the document and interpret the result. This is a very simple task, needing only a few lines of code.

3.3.3.3 Resilience of the Solution to Change of the Locale-specific Req^t

This is very easy. The locale-specific requirements are coded in their own file that contains no other information. They are independent of the base schema and easy to find and modify.

3.3.3.4 Resilience of the Solution to Change of the Base EML Schemas

This is also good. If the base schema changes, it is simple to find any related changes. Unlike the W3C schema based solutions, changes in parts of the schemas where there are no locale-specific requirements do not require changes to the locale-specific documents.

3.3.4 Use Schematron

Schematron is a schema language that is currently in the process of being adopted by ISO. Although it is possible to build closed schemas, It is fundamentally an open schema language. It is written in XML using XPath, and a Schematron processor is basically an XSLT stylesheet that produces an XSLT document that validates the source XML using a standard XSLT processor. Any Schematron processor therefore defines the output format of the validation result.

There are competitors to Schematron, such as the XML Constraint Specification Language (XCSL). Whilst these might have advantages in some cases, they do not have the authority that Schematron has as part of the upcoming ISO DSDL standard.

Thanks to Rick Jelliffe, editor of the Schematron specification, for his help with this section.

3.3.4.1 Simplicity of Building

Since Schematron basically sits on top of XSLT as a language specialised for document validation, a Schematron schema is easier to build than an XSLT stylesheet, although it is limited in those aspects of XSLT that it uses. Appendix C shows an example of a Schematron schema for validation of the UK ballot.

3.3.4.2 Ease of Implementing a Tool to Test the Constraints

The XSLT solution required an XSLT processor. The Schematron solution also requires this to execute the validation, but also needs a Schematron processor (or XSLT stylesheet) to produce the XSLT for validation. There are several processors around, all of which are geared around a displayed output. To get the sort of XML output shown in the XSLT example (Appendix B.3.1), which can then be displayed using an XSLT stylesheet, we would need to modify an existing Schematron stylesheet. This is a relatively simple task.

3.3.4.3 Resilience of the Solution to Change of the Locale-specific Req^t

This is very easy. The locale-specific requirements are coded in their own file that contains no other information. They are independent of the base schema and easy to find and modify.

3.3.4.4 Resilience of the Solution to Change of the Base EML Schemas

This is also good. If the base schema changes, it is simple to find any related changes. Unlike the W3C schema based solutions, changes in parts of the schemas where there are no locale-specific requirements do not require changes to the locale-specific documents.

3.4 Conclusions

Defining new schemas might be a useful stop-gap - it is quick and easy to implement. However, it is not a good long-term solution as there is a great risk of the UK schemas diverging from the base schemas over time.

The use of `xs:redefine` is initially appealing, but is restricted in its use and would require re-working of the existing schema documents. On its own, it does not guarantee compatibility with the base EML schemas. It does not appear at first sight to be an appealing solution.

The use of XSLT for localisation gets around the problems of trying to use XML Schema. Because documents are validated against the base specifications and then the locale-specific variations, adherence to the base specifications is guaranteed. The disadvantages are that this is a second processing stage using a different tool and that XSLT as a language is not optimised for validation and so has complexities that could result in incompatible styles of use and errors in schemas.

Schematron and its competitors get around the second weakness of XSLT in this context by defining a schema language that can be processed into XSLT. However, it still requires an XSLT processing stage for validation. Schematron has the advantage over its competitors such as XCSL that it is being adopted as part of the ISO DSDL specification. With these languages, the schema developer uses a language optimised for schema development. The downside compared to using XSLT directly is the requirement for a separate Schematron processor to produce the stylesheet. However, this can be a one-off task that is relatively simple.

The Schema Adjunct Framework and various business rules languages were not studied in detail because of their disadvantages outlined in section 2.

The recommendation for this type of localisation is therefore to use Schematron. It would be best to use this from the start and not try any interim solution, although there could be pressure from system vendors to do otherwise. However, they should be aware that there is no need to perform this additional (or indeed, any) validation if it is not required by their system design.

4 Locale-Specific Formats

The second requirement is to use locale-specific formats for items such as name and address. In this case, the locale-specific instance documents will only be valid to EML if the EML itself is locale-specific

EML was designed from the start to allow locale-specific name and address formats. These have all been included in a single EML externals file. The intention is that formats incompatible with the base schemas can be used for locale-specific election requirements, but that international requirements should use the Extensible Name and Address Language (xNAL) [9] formats of the base EML externals schema document.

By isolating these parts in a separate file, EML controls which element definitions can be changed in this way.

The changes are simple to implement as shown in Appendix D.

5 References

1. Election Markup Language (OASIS)
<http://www.oasis-open.org/committees/election/>
2. XML Schema 1.0 (W3C)
<http://www.w3.org/XML/Schema>
3. The Schema Adjunct Framework
http://www.tibco.com/solutions/products/extensibility/resources/saf_dec2000.htm
4. Simple Rules Markup Language
<http://xml.coverpages.org/srml.html>
5. Business Rules Markup Language
<http://www.alphaworks.ibm.com/tech/commonrules>
<http://www.oasis-open.org/cover/brml.html>
6. Rule Markup Language
<http://www.dfki.uni-kl.de/ruleml/>
7. The Schematron Assertion Language 1.5
<http://www.ascc.net/xml/schematron/>
8. XCSL - XML Constraint Specification Language
<http://www.di.uminho.pt/~jcr/PROJS/xcsl-www/>
9. The Extensible Name and Address Language
<http://www.oasis-open.org/committees/ciq/ciq.shtml#4>

Appendix A. The Test Documents

A.1 A Message Valid to the Locale-Specific Requirements

```
<?xml version="1.0" encoding="UTF-8"?>
<EML xmlns="urn:oasis:names:tc:evs:schema:eml"
xmlns:apd="http://www.govtalk.gov.uk/people/AddressAndPersonalDetails"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oasis:names:tc:evs:schema:eml ../schemas/UK-410-
ballots.xsd" Id="410" SchemaVersion="0.4">
  <Ballots>
    <ElectionEventName Id="LA2003" DisplayOrder="1">UK Local Elections
2003</ElectionEventName>
    <EventDescription DisplayOrder="2">
      <Message Format="html">
        <html xmlns="http://www.w3.org/TR/REC-html40">
          <head>
            <title>UK Local Elections 2003</title>
          </head>
          <body>
            <H1 align="center">The local elections for England, Wales and
Northern Ireland 2003</H1>
            <H1 align="center">8 May 2003</H1>
          </body>
        </html>
      </Message>
      <Message Format="text">
        The local elections for England, Wales and Northern Ireland 2003. 8
May 2003
      </Message>
    </EventDescription>
    <Ballot>
      <ReportingUnitName Id="RBWM-BH">Royal Borough of Windsor and
Maidenhead - Boyn Hill</ReportingUnitName>
      <Election>
        <ElectionName Id="LA2003" DisplayOrder="3">RBWM Local
Authority</ElectionName>
        <Description DisplayOrder="4">
          <Message Format="html">
            <html xmlns="http://www.w3.org/TR/REC-html40">
              <head>
                <title>RBWM Local Authority</title>
              </head>
              <body>
                <p>The election of councillors for the Royal Borough of
Windsor and Maidenhead</p>
              </body>
            </html>
          </Message>
          <Message Format="text">The election of councillors for the Royal
Borough of Windsor and Maidenhead</Message>
        </Description>
        <Contest DisplayOrder="5">
          <ContestName Id="BH">Boyn Hill Ward</ContestName>
          <VotingInformation>
            <Message Format="html">
              <html xmlns="http://www.w3.org/TR/REC-html40">
```

```

        <head>
            <title>Voting</title>
        </head>
        <body>
            <p style="color:red;">This is a message giving
instructions for voting for the local council</p>
        </body>
    </html>
</Message>
    <Message Format="text">This is a message giving instructions
for voting for the local council</Message>
</VotingInformation>
<VotingMethod>FPP</VotingMethod>
<MaxVotes>2</MaxVotes>
<Options Contested="yes">
    <Option>
        <OptionName Id="101">A Anderson</OptionName>
        <Affiliation>Labour</Affiliation>
    </Option>
    <Option>
        <OptionName Id="102">B Brown</OptionName>
        <Affiliation>Conservative</Affiliation>
    </Option>
    <Option>
        <OptionName Id="103">C Charles</OptionName>
        <Affiliation>Conservative</Affiliation>
    </Option>
    <Option>
        <OptionName Id="104">D Draper</OptionName>
        <Affiliation>Liberal Democrat</Affiliation>
    </Option>
    <Option>
        <OptionName Id="105">E Eco</OptionName>
        <Affiliation>Green Party</Affiliation>
    </Option>
    <Option>
        <OptionName Id="106">F Fox</OptionName>
        <Affiliation>Pro-hunting Alliance</Affiliation>
    </Option>
    <Option>
        <OptionName Id="107">G Green</OptionName>
        <Affiliation>Labour</Affiliation>
    </Option>
    <Option>
        <OptionName Id="108">H Harcourt</OptionName>
        <Affiliation>Liberal Democrat</Affiliation>
    </Option>
    <Option>
        <OptionName Id="109">I India</OptionName>
        <Affiliation>Independent</Affiliation>
    </Option>
</Options>
</Contest>
</Election>
<Election>
    <ElectionName Id="MB2003" DisplayOrder="10">Mayor of
Berkshire</ElectionName>
    <Description DisplayOrder="11">
        <Message Format="html">
            <html xmlns="http://www.w3.org/TR/REC-html40">
                <head>

```



```

        <title>Mayor of Berkshire</title>
    </head>
    <body>
        <p>The election of mayor for the County of Berkshire</p>
    </body>
</html>
</Message>
<Message Format="text">The election of mayor for the County of
Berkshire</Message>
</Description>
<Contest DisplayOrder="12">
    <ContestName Id="MB2003">Mayor of Berkshire</ContestName>
    <VotingInformation>
        <Message Format="html">
            <html xmlns="http://www.w3.org/TR/REC-html40">
                <head>
                    <title>Voting</title>
                </head>
                <body>
                    <p style="color:blue;">This is a message giving
instructions for voting for Mayor</p>
                </body>
            </html>
        </Message>
        <Message Format="text">This is a message giving instructions
for voting for Mayor</Message>
    </VotingInformation>
    <VotingMethod>FPP</VotingMethod>
    <MaxVotes>1</MaxVotes>
    <Options Contested="yes">
        <Option>
            <OptionName Id="201">X Xavier</OptionName>
            <Affiliation>Libreal Democrat</Affiliation>
        </Option>
        <Option>
            <OptionName Id="202">Y Young</OptionName>
            <Affiliation>Labour</Affiliation>
        </Option>
        <Option>
            <OptionName Id="203">Z Zidane</OptionName>
            <Affiliation>Conservative</Affiliation>
        </Option>
    </Options>
</Contest>
</Election>
<Voter>
    <VoterIdentification>
        <VoterName>
            <apd:CitizenNameForename>Anthony</apd:CitizenNameForename>
            <apd:CitizenNameSurname>Blair</apd:CitizenNameSurname>
        </VoterName>
        <VToken>
            <Component Type="PIN">1234</Component>
        </VToken>
    </VoterIdentification>
    <VoterContact><MailingAddress>
        <apd:IntAddressLine>10 Downing Street</apd:IntAddressLine>
        <apd:IntAddressLine>London</apd:IntAddressLine>
        <apd:InternationalPostCode>W1</apd:InternationalPostCode>
    </MailingAddress>
    <Email>tony@numberten.gov.uk</Email>

```

```
<PreferredContact xlink:href="../../../Email"/>

</VoterContact>

</Voter>
</Ballot>
<Messages DisplayOrder="6">
  <Message Format="html">
    <html xmlns="http://www.w3.org/TR/REC-html40">
      <head>
        <title>Voting</title>
      </head>
      <body>
        <p style="color:red;">This is a final message</p>
      </body>
    </html>
  </Message>
  <Message Format="text">This is a final message</Message>
</Messages>
</Ballots>
</EML>
```

A.2 A Valid EML message with Locale-Specific Errors

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
This file is valid to EML, but contains the following locale-specific
errors:
  the first election has a Rotation element
  the second election has a MinVotes element
  the second election has a MaxWriteIn element
  There is a VTokenQualified instead of a VToken
  There is no VoterName
-->
<EML xmlns="urn:oasis:names:tc:evs:schema:eml"
xmlns:apd="http://www.govtalk.gov.uk/people/AddressAndPersonalDetails"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oasis:names:tc:evs:schema:eml ../schemas/UK-410-
ballots.xsd" Id="410" SchemaVersion="0.4">
  <Ballots>
    <ElectionEventName Id="LA2003" DisplayOrder="1">UK Local Elections
2003</ElectionEventName>
    <EventDescription DisplayOrder="2">
      <Message Format="html">
        <html xmlns="http://www.w3.org/TR/REC-html40">
          <head>
            <title>UK Local Elections 2003</title>
          </head>
          <body>
            <H1 align="center">The local elections for England, Wales and
Northern Ireland 2003</H1>
            <H1 align="center">8 May 2003</H1>
          </body>
        </html>
      </Message>
      <Message Format="text">
        The local elections for England, Wales and Northern Ireland 2003. 8
May 2003
      </Message>
    </EventDescription>
    <Ballot>
      <ReportingUnitName Id="RBWM-BH">Royal Borough of Windsor and
Maidenhead - Boyn Hill</ReportingUnitName>
      <Election>
        <ElectionName Id="LA2003" DisplayOrder="3">RBWM Local
Authority</ElectionName>
        <Description DisplayOrder="4">
          <Message Format="html">
            <html xmlns="http://www.w3.org/TR/REC-html40">
              <head>
                <title>RBWM Local Authority</title>
              </head>
              <body>
                <p>The election of councillors for the Royal Borough of
Windsor and Maidenhead</p>
              </body>
            </html>
          </Message>
          <Message Format="text">The election of councillors for the Royal
Borough of Windsor and Maidenhead</Message>
        </Description>
      </Election>
    </Ballot>
  </Ballots>
</EML>
```

```

<Contest DisplayOrder="5">
  <ContestName Id="BH">Boyn Hill Ward</ContestName>
  <VotingInformation>
    <Message Format="html">
      <html xmlns="http://www.w3.org/TR/REC-html40">
        <head>
          <title>Voting</title>
        </head>
        <body>
          <p style="color:red;">This is a message giving
instructions for voting for the local council</p>
        </body>
      </html>
    </Message>
    <Message Format="text">This is a message giving instructions
for voting for the local council</Message>
  </VotingInformation>
  <Rotation>no</Rotation>
  <VotingMethod>FPP</VotingMethod>
  <MaxVotes>2</MaxVotes>
  <Options Contested="yes">
    <Option>
      <OptionName Id="101">A Anderson</OptionName>
      <Affiliation>Labour</Affiliation>
    </Option>
    <Option>
      <OptionName Id="102">B Brown</OptionName>
      <Affiliation>Conservative</Affiliation>
    </Option>
    <Option>
      <OptionName Id="103">C Charles</OptionName>
      <Affiliation>Conservative</Affiliation>
    </Option>
    <Option>
      <OptionName Id="104">D Draper</OptionName>
      <Affiliation>Liberal Democrat</Affiliation>
    </Option>
    <Option>
      <OptionName Id="105">E Eco</OptionName>
      <Affiliation>Green Party</Affiliation>
    </Option>
    <Option>
      <OptionName Id="106">F Fox</OptionName>
      <Affiliation>Pro-hunting Alliance</Affiliation>
    </Option>
    <Option>
      <OptionName Id="107">G Green</OptionName>
      <Affiliation>Labour</Affiliation>
    </Option>
    <Option>
      <OptionName Id="108">H Harcourt</OptionName>
      <Affiliation>Liberal Democrat</Affiliation>
    </Option>
    <Option>
      <OptionName Id="109">I India</OptionName>
      <Affiliation>Independent</Affiliation>
    </Option>
  </Options>
</Contest>
</Election>
<Election>

```

```

    <ElectionName Id="MB2003" DisplayOrder="10">Mayor of
Berkshire</ElectionName>
    <Description DisplayOrder="11">
    <Message Format="html">
    <html xmlns="http://www.w3.org/TR/REC-html40">
    <head>
    <title>Mayor of Berkshire</title>
    </head>
    <body>
    <p>The election of mayor for the County of Berkshire</p>
    </body>
    </html>
    </Message>
    <Message Format="text">The election of mayor for the County of
Berkshire</Message>
    </Description>
    <Contest DisplayOrder="12">
    <ContestName Id="MB2003">Mayor of Berkshire</ContestName>
    <VotingInformation>
    <Message Format="html">
    <html xmlns="http://www.w3.org/TR/REC-html40">
    <head>
    <title>Voting</title>
    </head>
    <body>
    <p style="color:blue;">This is a message giving
instructions for voting for Mayor</p>
    </body>
    </html>
    </Message>
    <Message Format="text">This is a message giving instructions
for voting for Mayor</Message>
    </VotingInformation>
    <VotingMethod>FPP</VotingMethod>
    <MaxVotes>1</MaxVotes>
    <MinVotes>0</MinVotes>
    <MaxWriteIn>2</MaxWriteIn>
    <Options Contested="yes">
    <Option>
    <OptionName Id="201">X Xavier</OptionName>
    <Affiliation>Libreal Democrat</Affiliation>
    </Option>
    <Option>
    <OptionName Id="202">Y Young</OptionName>
    <Affiliation>Labour</Affiliation>
    </Option>
    <Option>
    <OptionName Id="203">Z Zidane</OptionName>
    <Affiliation>Conservative</Affiliation>
    </Option>
    </Options>
    </Contest>
</Election>
<Voter>
<VoterIdentification>
<VTokenQualified>
<Component Type="PIN">1234</Component>
<Reason Type="1">Challenged by another voter</Reason>
</VTokenQualified>
</VoterIdentification>
<VoterContact>

```

```
<MailingAddress>
  <apd:IntAddressLine>10 Downing Street</apd:IntAddressLine>
  <apd:IntAddressLine>London</apd:IntAddressLine>
  <apd:InternationalPostCode>W1</apd:InternationalPostCode>
</MailingAddress>
<Email>tony@numberten.gov.uk</Email>
<PreferredContact xlink:href="../../../Email"/>
</VoterContact>
</Voter>
</Ballot>
<Messages DisplayOrder="6">
  <Message Format="html">
    <html xmlns="http://www.w3.org/TR/REC-html40">
      <head>
        <title>Voting</title>
      </head>
      <body>
        <p style="color:red;">This is a final message</p>
      </body>
    </html>
  </Message>
  <Message Format="text">This is a final message</Message>
</Messages>
</Ballots>
</EML>
```

A.3 A Message not using the Locale-Specific Name and Address Formats

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- This file is invalid because it tries to use xNAL rather than APD -->
<EML xmlns="urn:oasis:names:tc:evs:schema:eml"
xmlns:apd="http://www.govtalk.gov.uk/people/AddressAndPersonalDetails"
xmlns:xnal="urn:oasis:names:tc:somethinghere:schema:xnal"
xmlns:xlink="http://www.w3.org/1999/xlink"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="urn:oasis:names:tc:evs:schema:eml ../schemas/UK-410-
ballots.xsd" Id="410" SchemaVersion="0.4">
  <Ballots>
    <ElectionEventName Id="LA2003" DisplayOrder="1">UK Local Elections
2003</ElectionEventName>
    <EventDescription DisplayOrder="2">
      <Message Format="html">
        <html xmlns="http://www.w3.org/TR/REC-html40">
          <head>
            <title>UK Local Elections 2003</title>
          </head>
          <body>
            <H1 align="center">The local elections for England, Wales and
Northern Ireland 2003</H1>
            <H1 align="center">8 May 2003</H1>
          </body>
        </html>
      </Message>
      <Message Format="text">
        The local elections for England, Wales and Northern Ireland 2003. 8
May 2003
      </Message>
    </EventDescription>
    <Ballot>
      <ReportingUnitName Id="RBWM-BH">Royal Borough of Windsor and
Maidenhead - Boyn Hill</ReportingUnitName>
      <Election>
        <ElectionName Id="LA2003" DisplayOrder="3">RBWM Local
Authority</ElectionName>
        <Description DisplayOrder="4">
          <Message Format="html">
            <html xmlns="http://www.w3.org/TR/REC-html40">
              <head>
                <title>RBWM Local Authority</title>
              </head>
              <body>
                <p>The election of councillors for the Royal Borough of
Windsor and Maidenhead</p>
              </body>
            </html>
          </Message>
          <Message Format="text">The election of councillors for the Royal
Borough of Windsor and Maidenhead</Message>
        </Description>
        <Contest DisplayOrder="5">
          <ContestName Id="BH">Boyn Hill Ward</ContestName>
          <VotingInformation>
            <Message Format="html">
              <html xmlns="http://www.w3.org/TR/REC-html40">
                <head>
                  <title>Voting</title>
```

```

        </head>
        <body>
            <p style="color:red;">This is a message giving
instructions for voting for the local council</p>
        </body>
    </html>
</Message>
    <Message Format="text">This is a message giving instructions
for voting for the local council</Message>
</VotingInformation>
<VotingMethod>FPP</VotingMethod>
<MaxVotes>2</MaxVotes>
<Options Contested="yes">
    <Option>
        <OptionName Id="101">A Anderson</OptionName>
        <Affiliation>Labour</Affiliation>
    </Option>
    <Option>
        <OptionName Id="102">B Brown</OptionName>
        <Affiliation>Conservative</Affiliation>
    </Option>
    <Option>
        <OptionName Id="103">C Charles</OptionName>
        <Affiliation>Conservative</Affiliation>
    </Option>
    <Option>
        <OptionName Id="104">D Draper</OptionName>
        <Affiliation>Liberal Democrat</Affiliation>
    </Option>
    <Option>
        <OptionName Id="105">E Eco</OptionName>
        <Affiliation>Green Party</Affiliation>
    </Option>
    <Option>
        <OptionName Id="106">F Fox</OptionName>
        <Affiliation>Pro-hunting Alliance</Affiliation>
    </Option>
    <Option>
        <OptionName Id="107">G Green</OptionName>
        <Affiliation>Labour</Affiliation>
    </Option>
    <Option>
        <OptionName Id="108">H Harcourt</OptionName>
        <Affiliation>Liberal Democrat</Affiliation>
    </Option>
    <Option>
        <OptionName Id="109">I India</OptionName>
        <Affiliation>Independent</Affiliation>
    </Option>
</Options>
</Contest>
</Election>
<Election>
    <ElectionName Id="MB2003" DisplayOrder="10">Mayor of
Berkshire</ElectionName>
    <Description DisplayOrder="11">
        <Message Format="html">
            <html xmlns="http://www.w3.org/TR/REC-html40">
                <head>
                    <title>Mayor of Berkshire</title>
                </head>

```



```

        <body>
          <p>The election of mayor for the County of Berkshire</p>
        </body>
      </html>
    </Message>
    <Message Format="text">The election of mayor for the County of
Berkshire</Message>
  </Description>
  <Contest DisplayOrder="12">
    <ContestName Id="MB2003">Mayor of Berkshire</ContestName>
    <VotingInformation>
      <Message Format="html">
        <html xmlns="http://www.w3.org/TR/REC-html40">
          <head>
            <title>Voting</title>
          </head>
          <body>
            <p style="color:blue;">This is a message giving
instructions for voting for Mayor</p>
          </body>
        </html>
      </Message>
      <Message Format="text">This is a message giving instructions
for voting for Mayor</Message>
    </VotingInformation>
    <VotingMethod>FPP</VotingMethod>
    <MaxVotes>1</MaxVotes>
    <Options Contested="yes">
      <Option>
        <OptionName Id="201">X Xavier</OptionName>
        <Affiliation>Libreal Democrat</Affiliation>
      </Option>
      <Option>
        <OptionName Id="202">Y Young</OptionName>
        <Affiliation>Labour</Affiliation>
      </Option>
      <Option>
        <OptionName Id="203">Z Zidane</OptionName>
        <Affiliation>Conservative</Affiliation>
      </Option>
    </Options>
  </Contest>
</Election>
<Voter>
  <VoterIdentification>
    <VoterName>
      <xnal:NameDetails CustomerType="Person">
        <xnal:Name>Tony Blair</xnal:Name>
      </xnal:NameDetails>
    </VoterName>
    <VToken>
      <Component Type="PIN">1234</Component>
    </VToken>
  </VoterIdentification>
  <VoterContact>
    <MailingAddress>
      <xnal:AddressDetails>
        <xnal:AddressLines>
          <xnal:AddressLine>10 Downing Street</xnal:AddressLine>
          <xnal:AddressLine>London</xnal:AddressLine>
          <xnal:AddressLine>W1</xnal:AddressLine>
        </xnal:AddressLines>
      </xnal:AddressDetails>
    </MailingAddress>
  </VoterContact>

```

```
        </xnal:AddressLines>
    </xnal:AddressDetails>
</MailingAddress>
    <Email>tony@numberten.gov.uk</Email>
    <PreferredContact xlink:href="../../../Email"/>
</VoterContact>
</Voter>
</Ballot>
<Messages DisplayOrder="6">
    <Message Format="html">
        <html xmlns="http://www.w3.org/TR/REC-html40">
            <head>
                <title>Voting</title>
            </head>
            <body>
                <p style="color:red;">This is a final message</p>
            </body>
        </html>
    </Message>
    <Message Format="text">This is a final message</Message>
</Messages>
</Ballots>
</EML>
```

Appendix B. Documents Relating to the XSLT Solution

B.1 The XSLT Stylesheet

```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0"
xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
xmlns:eml="urn:oasis:names:tc:evs:schema:eml">
<xsl:import href="utils.xsl"/>

<xsl:template match="text()|@*" />

<xsl:template match="/">
  <Errors>
    <xsl:apply-templates select="*" />
  </Errors>
</xsl:template>

<xsl:template
match="eml:Rotation|eml:MinVotes|eml:MaxWriteIn|eml:VTokenQualified">
  <Error>
    <Path><xsl:call-template name="fullpath" /></Path>
    <Text>The element <xsl:value-of select="name()" /> should not occur at
this location in this message</Text>
  </Error>
</xsl:template>

<xsl:template match="eml:VoterIdentification">
  <xsl:if test="not(eml:VoterName)">
    <Error>
      <Path><xsl:call-template name="fullpath" /></Path>
      <Text>The element VoterName is mandatory at this location in this
message</Text>
    </Error>
  </xsl:if>
  <xsl:if test="not(eml:VToken)">
    <Error>
      <Path><xsl:call-template name="fullpath" /></Path>
      <Text>The element VToken is mandatory at this location in this
message</Text>
    </Error>
  </xsl:if>
  <xsl:apply-templates />
</xsl:template>

<xsl:template match="eml:Ballot">
  <xsl:if test="not(eml:Voter)">
    <Error>
      <Path><xsl:call-template name="fullpath" /></Path>
      <Text>The element Voter is mandatory at this location in this
message</Text>
    </Error>
  </xsl:if>
  <xsl:apply-templates />
</xsl:template>

</xsl:stylesheet>
```

B.2 The Result of Testing the Locale-Valid Document

This is the result as returned by the stylesheet:

```
<?xml version="1.0" encoding="UTF-16"?>
  <Errors xmlns:e="urn:oasis:names:tc:evs:schema:e" >
  </Errors>
```

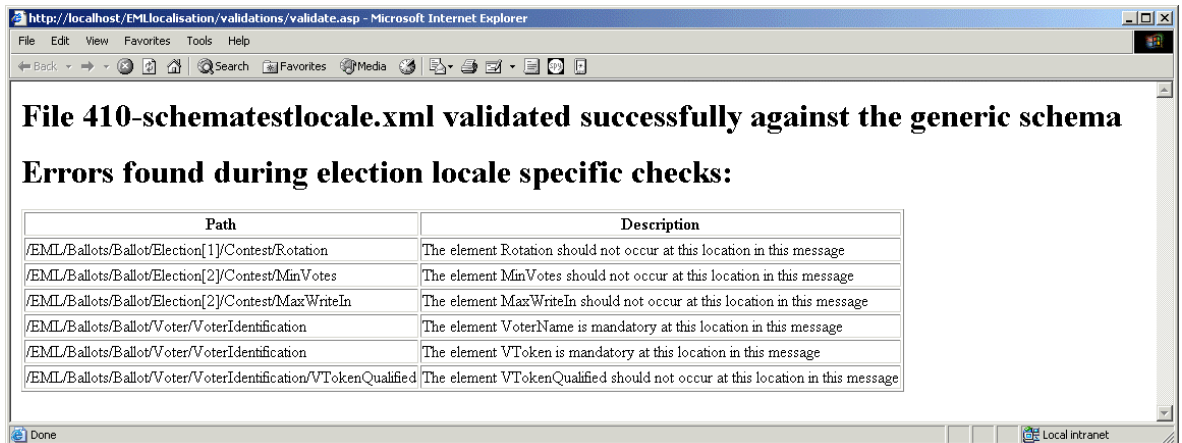
B.3 The Result of Testing the Locale-Invalid Document

The file below is the raw error report for the locale-specific checks. The screen image is a simple example of displaying this in a browser.

B.3.1 The Error File

```
<?xml version="1.0" encoding="UTF-16"
  <Errors xmlns:e="urn:oasis:names:tc:evs:schema:e" >
  <Error >
    <Path>/EML/Ballots/Ballot/Election[1]/Contest/Rotation</Path>
    <Text>The element Rotation should not occur at this location in this
message</Text>
  </Error >
  <Error >
    <Path>/EML/Ballots/Ballot/Election[2]/Contest/MinVotes</Path>
    <Text>The element MinVotes should not occur at this location in this
message</Text>
  </Error >
  <Error >
    <Path>/EML/Ballots/Ballot/Election[2]/Contest/MaxWriteIn</Path>
    <Text>The element MaxWriteIn should not occur at this location in
this message</Text>
  </Error >
  <Error >
    <Path>/EML/Ballots/Ballot/Voter/VoterIdentification</Path>
    <Text>The element VoterName is mandatory at this location in this
message</Text>
  </Error >
  <Error >
    <Path>/EML/Ballots/Ballot/Voter/VoterIdentification</Path>
    <Text>The element VToken is mandatory at this location in this
message</Text>
  </Error >
  <Error >
    <Path>/EML/Ballots/Ballot/Voter/VoterIdentification/VTokenQualified
</Path>
    <Text>The element VTokenQualified should not occur at this location
in this message</Text>
  </Error >
</Errors >
```

B.3.2 A Simple Display of the Error File



File 410-schematestlocale.xml validated successfully against the generic schema

Errors found during election locale specific checks:

Path	Description
/EML/Ballots/Ballot/Election[1]/Contest/Rotation	The element Rotation should not occur at this location in this message
/EML/Ballots/Ballot/Election[2]/Contest/MinVotes	The element MinVotes should not occur at this location in this message
/EML/Ballots/Ballot/Election[2]/Contest/MaxWriteIn	The element MaxWriteIn should not occur at this location in this message
/EML/Ballots/Ballot/Voter/VoterIdentification	The element VoterName is mandatory at this location in this message
/EML/Ballots/Ballot/Voter/VoterIdentification	The element VToken is mandatory at this location in this message
/EML/Ballots/Ballot/Voter/VoterIdentification/VTokenQualified	The element VTokenQualified should not occur at this location in this message

Appendix C. Documents Relating to the Schematron Solution

C.1 The Schematron Schema

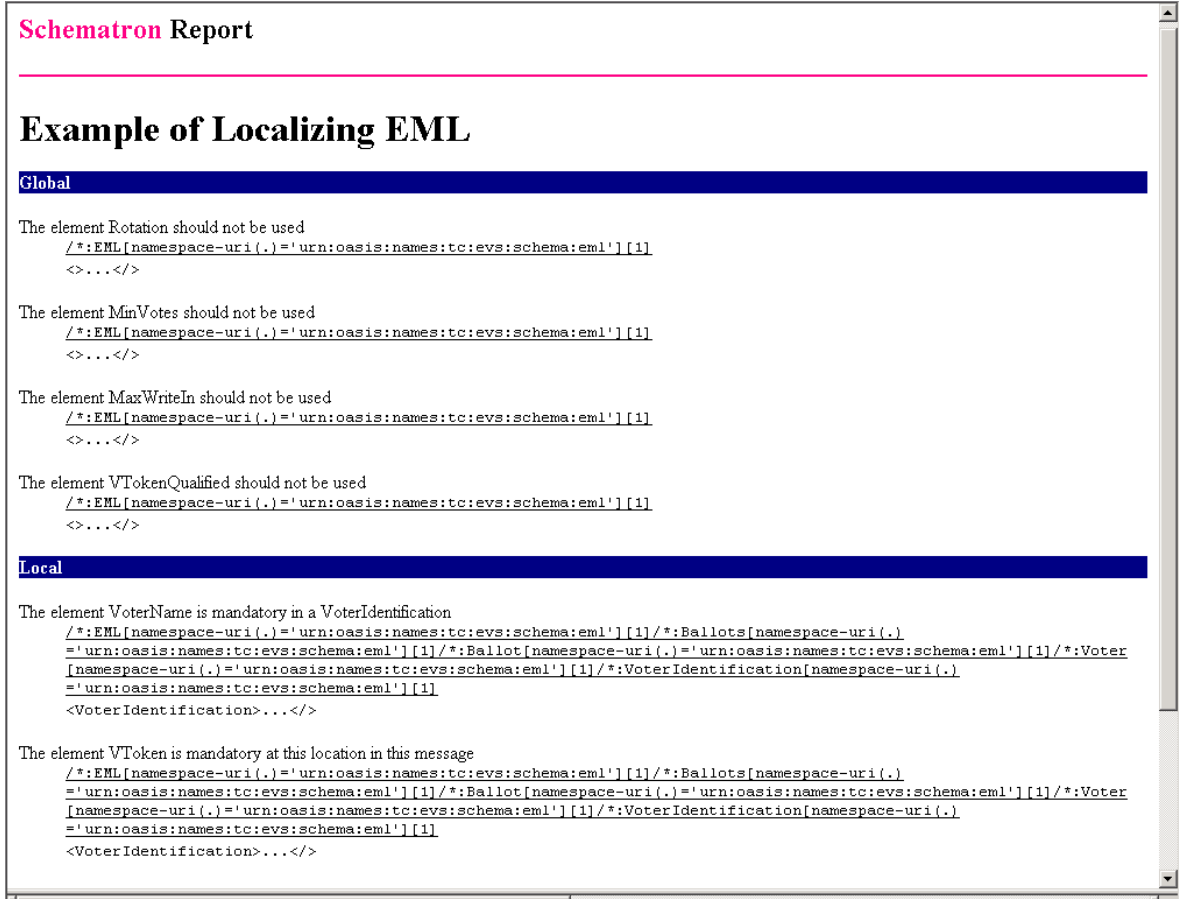
```
<?xml version="1.0"?>
<?xar Schematron?>
<schema xmlns="http://www.ascc.net/xml/schematron">
  <title>Example of Localising EML</title>

  <ns prefix="eml" uri="urn:oasis:names:tc:evs:schema:eml"/>
  <ns prefix="apd"
uri="http://www.govtalk.gov.uk/people/AddressAndPersonalDetails"/>

  <pattern name="Global">
    <rule context="/">
      <report test="//eml:Rotation">The element Rotation should not be
used</report>
      <report test="//eml:MinVotes">The element MinVotes should not be
used</report>
      <report test="//eml:MaxWriteIn">The element MaxWriteIn should not be
used</report>
      <report test="//eml:VTokenQualified">The element VTokenQualified should
not be used</report>
      <assert test="//eml:Election">There must be at least one Election
element</assert>
    </rule>
  </pattern>
  <pattern name="Local">
    <rule context="eml:VoterIdentification">
      <assert test="eml:VoterName">The element VoterName is mandatory in a
VoterIdentification</assert>
      <assert test="eml:VToken">The element VToken is mandatory at this
location in this message</assert>
    </rule>
    <rule context="eml:Ballot">
      <assert test="eml:Voter">The element Ballot must have a Voter
child</assert>
    </rule>
    <rule context="eml:MailingAddress">
      <assert test="apd:*">
        The address format used is the InternationalAddressStructure from
Address and Personal Details</assert>
    </rule>
    <rule context="eml:VoterName">
      <assert test="apd:*">
        The name format used is the PersonNameStructure from Address and
Personal</assert>
    </rule>
  </pattern>
</schema>
```

C.2 The Result of Testing the Locale-Invalid Document

This screen shot was made using the Topologi Schematron validator. In practice, the schema and processor would be changed to produce results matching those from the XSLT processor.



Schematron Report

Example of Localizing EML

Global

The element Rotation should not be used
`/*:EML[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]`
<>...</>

The element MinVotes should not be used
`/*:EML[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]`
<>...</>

The element MaxWriteIn should not be used
`/*:EML[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]`
<>...</>

The element VTokenQualified should not be used
`/*:EML[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]`
<>...</>

Local

The element VoterName is mandatory in a VoterIdentification
`/*:EML[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]/*:Ballots[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]/*:Ballot[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]/*:Voter[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]/*:VoterIdentification[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]`
<VoterIdentification>...</>

The element VToken is mandatory at this location in this message
`/*:EML[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]/*:Ballots[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]/*:Ballot[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]/*:Voter[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]/*:VoterIdentification[namespace-uri(.)='urn:oasis:names:tc:evs:schema:eml'][1]`
<VoterIdentification>...</>

Appendix D. Changes to EML Externals

D.1 Base EML Externals Schema Document

The base document imports the xNAL schema (note that this example uses a temporary namespace) and defines the EML complex data types `AddressStructure` and `NameStructure` in terms of the imported definitions.

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema
  targetNamespace="urn:oasis:names:tc:evs:schema:eml"
  xmlns:xnal="urn:oasis:names:tc:somethinghere:schema:xnal"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns="urn:oasis:names:tc:evs:schema:eml"
  elementFormDefault="qualified"
  attributeFormDefault="unqualified"
  version="0.1" id="eml-externals">

  <xsd:import
    namespace="urn:oasis:names:tc:somethinghere:schema:xnal"
    schemaLocation="xNAL.xsd"/>

  <xsd:complexType name="AddressStructure">
    <xsd:sequence>
      <xsd:element ref="xnal:AddressDetails"/>
    </xsd:sequence>
  </xsd:complexType>
  <xsd:complexType name="NameStructure">
    <xsd:sequence>
      <xsd:element ref="xnal:NameDetails"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:schema>
```


D.2 UK-specific EML Externals Schema Document

For the UK, rather than importing the xNAL definitions, we import the Address and Personal Details (APD) definitions from UK GovTalk™. Since APD defines suitable global data types, we just define the UK-specific EML types to be the same.

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema
  targetNamespace="urn:oasis:names:tc:evs:schema:eml"
  xmlns="urn:oasis:names:tc:evs:schema:eml"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:apd="http://www.govtalk.gov.uk/people/AddressAndPersonalDetails"
  elementFormDefault="qualified"
  attributeFormDefault="unqualified"
  version="0.1" id="eml-externals">

  <xsd:import
    namespace="http://www.govtalk.gov.uk/people/AddressAndPersonalDetails"
    schemaLocation="AddressTypes-v1.xsd"/>
  <xsd:import
    namespace="http://www.govtalk.gov.uk/people/AddressAndPersonalDetails"
    schemaLocation="PersonalDetailsTypes-v1.xsd"/>

  <xsd:complexType name="AddressStructure">
    <xsd:complexContent>
      <xsd:extension base="apd:InternationalAddressStructure"/>
    </xsd:complexContent>
  </xsd:complexType>
  <xsd:complexType name="NameStructure">
    <xsd:complexContent>
      <xsd:extension base="apd:CitizenNameStructure"/>
    </xsd:complexContent>
  </xsd:complexType>
</xsd:schema>
```