XForms 1.0

W3C Working Draft *19 December 2000*

This version:

http://www.w3.org/TR/2000/WD-xforms-20001219

(Available as: PDF, zip archive of HTML)

Latest version:

http://www.w3.org/TR/xforms

Previous versions:

http://www.w3.org/TR/2000/WD-xforms-datamodel-20000815

http://www.w3.org/TR/2000/WD-xforms-datamodel-20000406

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Abstract

This document presents a description of the architecture, concepts, processing model, and terminology underlying XForms, the next generation Web forms. Except as noted, it represents the current consensus of the Working Group.

"XForms" is W3C's name for a specification of Web forms that can be used with a wide variety of platforms of varying capabilities, for instance, desktop computers, television sets, personal digital assistants, cell phones, computer peripherals and even paper.

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 a Working Draft that incorporates decisions made at the Working Group's October 2000 face to face meeting, and is being released to the public to encourage feedback and comments.

This Working Draft is the latest version in a document series previously named XForms 1.0 Data Model. The Working Group decided to change the name from XForms 1.0 Data Model into XForms 1.0 as of this version based on feedback the Working Group received from previous Working Drafts.

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This document has been produced as part of the W3C HTML Activity.

Please send detailed comments on this document to www-forms@w3.org, the public forum for discussion of W3C's work on Web forms. To subscribe, send an email to <www-forms-request@w3.org> with the word `subscribe` in the subject line (include the word `unsubscribe` if you want to unsubscribe). The archive for the list is accessible online.

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30 October, 2000

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1 About the XForms 1.0 Specification

Contents

This chapter is informative.

1.1 Background

Forms are an important part of the Web, and they continue to be the primary means of interactivity used by many Web sites. Web applications and eCommerce solutions have sparked the demand for better Web forms with richer interactions. XForms are the response to this demand--extended analysis, followed by the creation of a new platform-independent markup language for online interaction between a XForms Processor and a remote entity. XForms are the successor to XHTML forms, and benefit from the lessons learned in the years of HTML forms implementation experience.

Further background information on XForms can be found at http://www.w3.org/MarkUp/Forms.

1.2 Reading the Specification

This specification has been written with various types of readers in mind--In particular XForms authors and XForms implementors. We hope the specification will provide authors with the tools they need to write efficient, attractive, and accessible documents, without overexposing them to the XForms implementation details. Implementors, however, should find all they need to build conforming XForms Processors. The specification begins with a general presentation of XForms and becomes more and more technical and specific towards the end. For quick access to information, a general table of contents, specific tables of contents at the beginning of each section, and an index provide easy navigation, in both the electronic and printed versions.

The specification has been written with two modes of presentation in mind: electronic and printed. In case of a discrepancy, the electronic version is considered the authoritative version

of the document.

1.3 How the Specification is Organized

The specification is organized into the following chapters:

Chapters 1 and 2: An introduction to XForms
The introduction includes a brief tutorial on XForms and a discussion of design principles behind XForms.

Chapters 3 and up: XForms reference manual.
The bulk of the reference manual consists of the specification of XForms. This reference defines what may go into XForms and how XForms Processors must interpret the various components in order to claim conformance.

Appendixes:
Appendixes contain a normative description of XForms described in XML Schema, information on optional function libraries, references, a change history, and other useful information.

1.4 Documentation Conventions

The following highlighting and typography is used to present technical material in this document and other documents from the XForms Working Group:

Special terms are defined in their own chapter; hyperlinks connect uses of the term to the definition.

Throughout this document, the namespace prefixes "`xfm:`" and "`xsd:`" are used to denote the XForms and XML Schema namespaces respectively. This is by convention only; any namespace prefix may be used.

BNF grammar productions are presented as follows:

```
[1] name1   ::=   BNF Grammar 1 /* Comments */
[2] name2   ::=   BNF Grammar 2
[3] name3   ::=   BNF Grammar 3
[4] name4   ::=   BNF Grammar 4
[5] name5   ::=   BNF Grammar 5
```

Non-normative short examples are set off typographically:

- Example item

While lengthier non-normative examples are set off typographically and may include a short explanation:

Good Example, using Tables

```
<foo href="http://www.example.com/XForms"/>
Multiple lines in length
```

And an explanation of the example of proper syntax or usage

Bad Example, using Tables

```
<foo href=http://www.example.com/XForms>
Multiple lines in length
```

And an explanation of the example of incorrect syntax or usage.

References to external documents are in [Square Brackets] with links to the references section of this document.

The XML representations of various elements within XForms are presented as follows:

XML Representation : `example` Simple Syntax
<example **count** = integer size = (small | medium | large) : medium> *Content:* (all | any*) </example>

Example Properties	
Property	**Representation**
{example property}	Description of what the property corresponds to, e.g. the value of the `size` [attribute]

The following highlighting is used for non-normative commentary:

[Note: Informational note intended for publication]

[Ed. General comments intended for removal before final publication.]

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2 Concepts

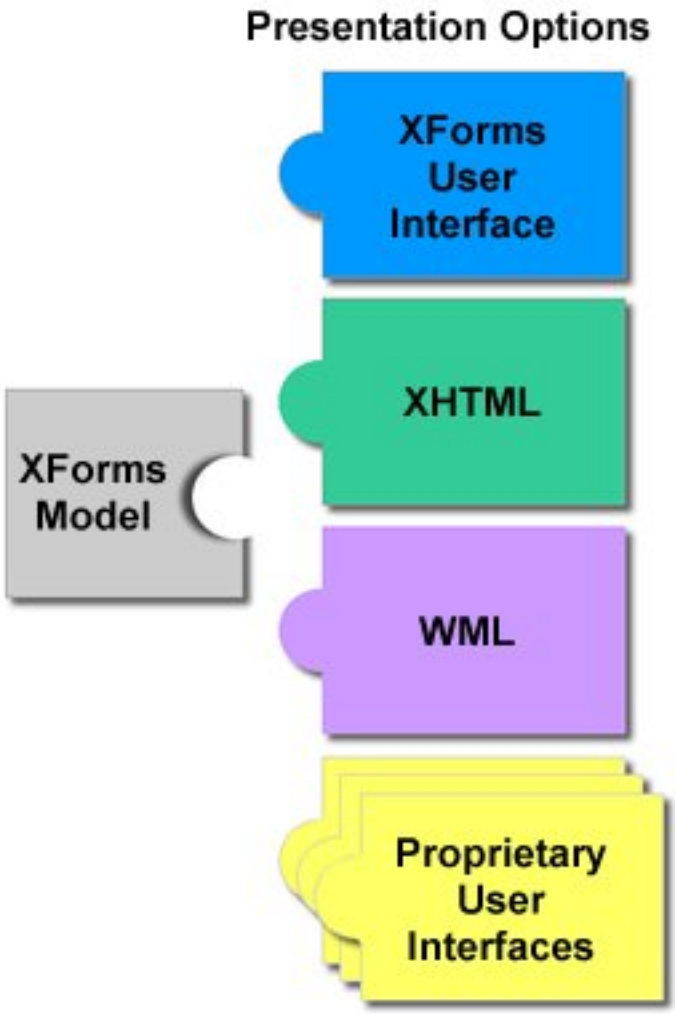
Contents

This chapter is informative.

2.1 What are XForms?

The design of existing Web forms didn't separate the *purpose* from the *presentation* of a form. XForms, in contrast, are comprised of separate sections that describe what the form does, and how the form looks. This allows for flexible presentation options, including classic XHTML forms, to be attached to an XML form definition.

The following illustrates how a single device-independent XML form definition, called the **XForms Model**, has the capability to work with a variety of standard or proprietary user interfaces:

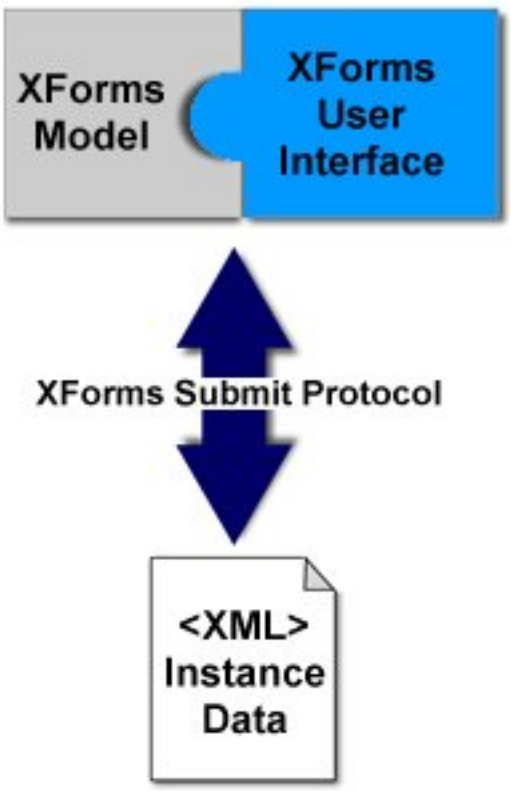


The **XForms User Interface** provides a standard set of visual controls that are targeted toward replacing today's XHTML form controls. These form controls are directly usable inside XHTML and other XML documents, like SVG. Other groups, such as the Voice Browser Working Group, are independently developing user interface components for XForms.

An important concept in XForms is that forms collect data, which is expressed as XML **instance data**. Among other duties, the XForms Model describes the structure of the instance data. This is important, since like XML, forms represent a structured interchange of data. Workflow, auto-fill, and pre-fill form applications are supported through the use of instance data.

Finally, there needs to be a channel for instance data to flow to and from the XForms Processor. For this, the **XForms Submit Protocol** defines how XForms send and receive data, including the ability to suspend and resume the completion of a form.

The following illustration summarizes the main aspects of XForms:



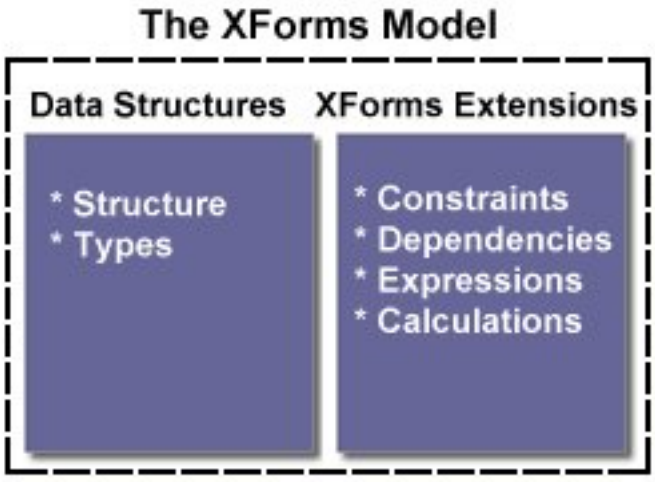
The following sections will explain these in greater detail.

2.2 What is the XForms Model?

The XForms Model is the non-visual definition of an XML form. It serves several purposes:

- It defines the model items that make up the XForms Model.
- It describes the structure of the associated XML instance data.
- It defines types that apply to model items and can be reused in the same or different XForms Model.
- It defines limits and restrictions that apply to model items when the form is being filled.
- It defines relationships and dependencies between model items.

The XForms Model is subdivided into two components: Data Structures and XForms Extensions.



The Data Structures Component provides a schema that describes the instance data and provides reusable data types, a role that fits well with XML Schemas. Due to this, the XForms Working Group is focusing on an XML Schema compatible definition for the Data Structures Component. In addition, we are investigating the option of a simpler syntax, more in tune with current XHTML authors.

Additionally, the XForms Model includes aspects that are not typically expressed in schemas, like additional constraints, dependencies, an Dynamic Constraints Language, and calculations. For instance, stating that a model item is "read only" is outside the scope of XML Schema, yet clearly an important capability for an XML form definition. XForms Extensions Components such as these will be handled through attributes that will extend the XML Schema syntax.

The XForms Model is capable of representing potentially complex interrelationships between model items. One example of this might be a "spouse information" section that is only applicable when the user has previously indicated that he or she has a spouse. Relationships such as these, along with calculations, will be represented in a lightweight, XML-friendly Dynamic Constraints Language.

The XForms Model will also keep track of numeric values using decimal arithmetic. Unlike "floating point" math which is unable to exactly represent certain commonly-used values, decimal arithmetic works with numbers in the way most users expect, and avoids many types of rounding errors.

Lastly, the XForms Model is closely related to the XML instance data. The definition of the XForms Model provides an area with an open content model where arbitrary well-formed instance data in any namespace can reside. XForms authors are typically not required to include instance data, although they are free to do so. Some useful applications of instance data include:

- A XForms Processor can submit the completed form as XML instance data.
- A server might pre-populate certain model items by sending XML instance data to the XForms Processor.

- A user might suspend form-filling, storing the partially-completed XML instance data on the server.
- A workflow application might route XML instance data to various users in a list.
- A data storage application might store only one copy of the XForms Model and XForms User Interface, but store many XML instance data entities.

2.3 What is the XForms User Interface?

The user interface is the part of electronic forms most immediately noticeable to users. By separating the user interface from the rest of the form, XForms provides flexibility in presentation options. In order to provide increased functionality, a separate XForms User Interface will be specified. This will include all the functionality of current XHTML forms, and more.

Typically, XHTML form controls are expressed in fairly generic terms, for instance `<select>` to represent menu controls. Web application designers have expressed a desire for more control over presentation. XForms enable this additional level of control, since presentations specific to desktop browsers, handheld devices, and even paper can be attached to a single XForms Model. This modular construction also leads to alternate user interfaces. In particular, the Voice Browser Working Group is interested in developing a specification for non-visual form controls for use with XForms.

XForms User Interface consists of a set of XHTML modularization elements used to define user interface widgets (form controls) and a binding mechanism for connecting these form controls to the underlying XForms Model. Even though the XForms form controls are designed for use with XHTML, we do not mandate a complete XHTML rendering engine for displaying XForms User Interfaces. Specifically, the intent is for XForms User Interface to be rendered without the need to implement a full table rendering model as required today by HTML 4.0.

The XForms form controls are designed for use with XHTML and are initially inspired by the set of form controls available in HTML 4.0 as well as common constructs in use today that require the use of scripting --rather than declarative markup. The intent is for these new set of XForms form controls to be used within XHTML documents to provide a rich end-user experience while using declarative markup.

The final necessary component of XForms is "binding", which in this case refers to making the connection between the XForms Model and XForms User Interface. The XForms Working Group will define a binding for XHTML form controls and XForms User Interface form controls. The binding mechanism is designed to be generic and device-independent i.e., it is intended that this mechanism be usable for binding a multiplicity of user interfaces suitable for use on different devices to the same underlying XForms Model. Other groups that define XForms presentations may define corresponding bindings.

2.4 What is the XForms Submit Protocol?

Conventional XHTML forms send instance data over HTTP, in flat name/value pairs, with unsophisticated URL-encoding. Later, the ability to include multipart mime-encoded data was added to support file upload. XForms are designed from the ground up to allow rich, internationalized, hierarchical XML instance data, transferred over the XForms Submit Protocol.

Besides just submitting data, XForms have the additional requirement of suspending a form-filling session, later resuming it. This also calls for another use for the XForms Submit Protocol--a way to remotely serialize the instance data.

As of this writing, an XML Protocol Working Group has been formed within the W3C, and is currently accepting requirements. The XForms Working Group will work closely with this effort to ensure that the end results will be compatible with the XForms Submit Protocol.

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3 Terminology

This chapter is normative.

binding

The connection between a model item in the XForms Model and a form control in the XForms User Interface, or other presentation. Can also refer to the connection between a model item and its representation as a instance data item.

binding expression

An addressing expression used by the binding to connect form controls to other parts of XForms.

Data Structures Component

The portion of the XForms Model that defines model items along with the structure of the associated instance data.

facet

A single defining aspect of a value space. Generally speaking, each facet characterizes a value space along independent axes or dimensions.

form control

A user interface control or "widget" that serves as a point of user interaction. The XForms User Interface defines several form controls.

instance data

Representation of the values of all the model items. When represented as XML, instance data can be accessed through the XML DOM.

instance data item

Representation of a single piece of data, constrained by the definition of a model item, and typically presented to the user through one or more form controls.

lexical space

A lexical space is the set of valid literals for a datatype.

model item

An abstract unit of data-collection within the XForms Model, which defines a type and possibly other constraints on a single piece of collected data.

value space

A set of values for a given datatype. Each value in the value space of a datatype is denoted by one or more literals in its lexical space.

XForms Extensions Component

The portion of the XForms Model that extends the Data Structures component with constraints, dependencies, a Dynamic Constraints Language, and calculations.

XForms Model

The non-visible definition of an XML form as specified by XForms. The XForms Model defines the model items that exist, the structure of the instance data to represent the data, and constraints and other run-time aspects of XForms.

XForms Processor

A software application or program that conforms to the XForms specification.

XForms Submit Protocol

The means by which instance data is transported from one place to another, such as part of a submit, suspend, or resume operation.

XForms User Interface

A set of graphical form controls designed to provide a higher-quality user experience when compared to conventional XHTML forms.

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4 Using XForms with Other Document Types

Contents

This chapter is normative.

4.1 XForms Elements

XForms have been designed for use within other XML vocabularies, in particular XHTML. This chapter discusses some of the high-level features of XForms that allow it to be used with other document types.

Note: This document uses the convention of an `xfm:` prefix to represent elements and attributes that are part of the XForms Namespace. The unique, persistent namespace identifier used in this document is `http://www.w3.org/2000/12/xforms`. Future revisions are expected to use a different identifier.

The `<xform>` element is used as a container for other XForms elements, namely, `<model>`, `<instance>`, `<submit>` and `<bind>`. It can serve as a convenient place to declare the XForms namespace. It has one optional attribute, `id` of type `xsd:ID`.

4.1.1 Model

The `<model>` element is used to define the XForms Model. An optional `id` attribute of type `xsd:ID` is allowed. An element `href` of type `xsd:uriReference` is allowed, providing a link to an externally defined XForms Model.

[Ed. We are actively investigating the potential of using XLink simple links within XForms.]

The content of the `<model>` element is restricted to either XML Schema content, or XForms simple syntax. Schema content must be enclosed in the `<xsd:schema>` element, defined in [XSchema-1]. Simple syntax must be enclosed in the `<simple>` element. The content of `<simple>` is defined in the XForms Model chapter.

[Ed. Need to define behavior if both an inline XForms Model and an external model are used together.]

4.1.2 Instance

The `<instance>` element is used to define initial instance data. An optional `id` attribute of type `xsd:ID` is allowed. An attribute `href` of type `xsd:uriReference` is allowed, providing a link to externally defined instance data. An attribute `model` of type `xsd:IDREF` connects the instance data to a specific XForms Model.

The content of the `<instance>` element is arbitrary XML in any namespace. Authors must ensure that proper namespace declarations are used for content within the `<instance>` element.

[Ed. We are also considering whether a `schemaLocation` attribute is needed here.]

4.1.3 Submit

The `<submit>` element provides information on how and where to submit the instance data. An optional `id` attribute of type `xsd:ID` is allowed. A required `target` attribute of type `xsd:uriReference` provides the submit location. An optional `method` attribute of type `xsd:string` provides the submit method. For HTTP, the default is `POST`.

The content of the `<submit>` element is empty.

4.1.4 Bind

The `<bind>` element is the connection between the different parts of XForms. The syntax and contents of this element are defined in the Binding chapter.

4.1.5 Example

```
<xform xmlns="http://www.w3.org/2000/12/xforms">
   <model id="Person-model" href="Schema-Questionaire.xfm" />
   <instance model="Person-model" id="p0"
        href="URL-to-retrieve-defaults" />
   ...
</xform>
```

Alternatively, the instance data can be included in the containing document:

```
<xform xmlns="http://www.w3.org/2000/12/xforms">
   <model id="Person-model" href="Schema-Questionaire.xfm" />
   <instance model="Person-model" id="p0" xmlns="inst-ns">
      <person>
      ...
      </person>
   </instance>
   ...
</xform>
```

5 Datatypes

Contents

This chapter is normative.

5.1 Introduction

This chapter sets out a core set of datatypes that all XForms Processors are expected to support. The XForms Model chapter describes the different ways that an XForms Model can be specified. For the purposes of this chapter, the most important distinction is "simple syntax" (defined by XForms) versus "Schema Syntax" (defined in [XSchema-1] and [XSchema-2]).

All XForms built-in datatypes reuse and extend a particular XML Schema [XSchema-2] built-in datatype, and hence inherit the constraining facets of the XML Schema datatype. These are called static facets, since they are predefined and unchangeable. In many cases, XForms defines like-named facets in the XForms namespace, which are semantically equivalent, however an XForms Dynamic Constraint can be used to define the facet. This allows the XForms facets to be dynamic, and freely change their evaluated result at run-time.

The XForms Model uses these datatypes to define how the submitted values bind to the instance

data. For instance, here is how you could define a "leavingDate", bound to an element in the instance data, which must have a value later in time than a "startingDate":

```
<date name="leavingDate" min="startingDate" />
<date name="startingDate" max="leavingDate" />
```

Here the constraints are totally dynamic, and in fact mutually dependent.

It is important to note that XForms dynamic constraints cannot change any underlying static constraints specified in an XML Schema. Whenever XForms facets and Schema facets have potentially conflicting values, the one that restricts the value space to the smallest subset is used.

For instance, here's an example of an XForms facet that conflict with underlying schema static constraints:

Example of conflicting facets:

```
<xsd:complexType name="myNumber">
  <xsd:restriction base="xfm:number">
    <xsd:maxInclusive value="20"/>
    <xfm:maxInclusive value="100"/>
  </xsd:restriction>
</xsd:complexType>
```

This example shows a Schema `maxInclusive` facet alongside a conflicting XForms `maxInclusive` facet. In this case, the XForms facet would have no effect, since the more restrictive constraint, `value="20"`, is used.

Like XML Schema, XForms datatypes are based on value spaces which have lexical space representations. For each datatype defined, the following will be specified:

- Lexical space - how are values represented when appearing as attributes or element content.
- Canonical Representation - When multiple lexical representations are possible, which is preferred? For instance, both "100" and "1e2" are valid as a `xfm:number`, but only the first is the canonical representation.
- Example - One or more examples of canonical lexical values.
- XForms Facets Used - Like Schema, XForms supports the concept of facets. In addition to constraining facets, XForms supports additional property facets that provide useful functionality for XForms processing. All XForms facets are listed later in this chapter.

5.2 String

The XForms datatype `string` is derived from the XML Schema [XSchema-2] datatype `string`.

Lexical Representation: as in Schema.

Canonical Representation: as in Schema.

Example: A value of "hello" would be represented as:

- hello

XForms Facets defined:

- enumeration
- mask
- max
- maxLength
- min
- minLength

The XForms `string` datatype inherits the static facets of its XML schema base datatype, which are:

```
length, minLength, maxLength, pattern, enumeration,
whiteSpace
```

5.3 Boolean

The XForms datatype `boolean` is derived from the XML Schema [XSchema-2] datatype `Boolean`

Lexical Representation: as in Schema.

Canonical Representation: as in Schema.

Example: A true value would be represented as:

- true

XForms Facets defined: No additional facets.

The XForms `boolean` datatype inherits the static facets of its XML schema base datatype, which are:

```
pattern, whiteSpace
```

5.4 Number

The XForms datatype `number` is derived from the XML Schema [XSchema-2] datatype `decimal`.

Lexical Representation: as in Schema.

Canonical Representation: as in Schema.

Example: A value of -42 would be represented as:

- -42

XForms Facets defined:

- enumeration
- max
- maxExclusive
- maxInclusive
- min
- minExclusive
- minInclusive
- precision
- scale

The XForms `number` datatype inherits the static facets of its XML schema base datatype, which are:

```
precision, scale, pattern, whiteSpace, enumeration,
maxInclusive, maxExclusive, minInclusive, minExclusive
```

Numeric calculations should be performed on the internal value space values (not the lexical space values) using decimal arithmetic, except where the resource constraints preclude this.

5.5 Currency

The XForms datatype `currency` is derived from the XForms datatype `string`.

Lexical Representation: a list of 3 character currency codes, as defined in defined in [ISO 4217]. This is considered an open list--additional currency codes not defined there are allowable.

Canonical Representation: No leading or trailing whitespace is allowed.

Example: A value 'US Dollars' would be represented as:

- USD

XForms Facets defined: The XForms `currency` datatype inherits all facets of its XForms base datatype. These are:

- enumeration
- mask
- max
- maxLength
- min
- minLength

5.6 Monetary Values

Note: The monetary datatype is essentially `xfm:number` plus an `xfm:currency` designator. The XForms Working Group does not have consensus on whether a momentary datatype should be an atomic datatype, or a compound type. Both alternatives are specified here. We would appreciate feedback on which alternative is better.

Alternative A - atomic datatype

The XForms datatype `money` is derived from the XForms datatype `number`.

Lexical Representation: currency is represented by concatenating the `xfm:currency` string to the end of the `xfm:number` string, with no whitespace in between.

Canonical Representation: both the `xfm:number` and `xfm:currency` portions must be their individual canonical representation.

Example: A value of 4.37 Euro would be represented as:

- 4.37EUR

XForms Facets defined:

- allowCurrency
- enumeration
- max
- maxExclusive
- maxInclusive
- min
- minExclusive
- minInclusive

- precision
- scale

Alternative B - compound datatype

The XForms datatype `money` datatype consists of two parts, the currency identifier and the value. The `currency` datatype is derived from the XForms datatype `currency`. The `value` subtype is derived from the XForms datatype `number`.

Lexical Representation: as a compound datatype, there is no single value space, and therefore no single lexical space. See example below.

Canonical Representation: See example below.

Example: A value of 4.37 Euro would be represented as two distinct lexical values:

- 4.37
- EUR

This is essentially a shortcut for separately defining instances of the `xfm:number` and `xfm:currency` datatypes, but without independently settable facets. When mapped to instance data, if the datatype is bound to an element, the `xfm:number` and `xfm:currency` portions can be bound to child elements or attributes, possibly in the XForms namespace. If the datatype is bound to an attribute, there is no way to present both portions, since attributes have no children.

XForms Facets defined: same as alternative A.

5.7 Date

The XForms datatype `date` is derived from the XML Schema [XSchema-2] datatype `date`.

Lexical Representation: as in Schema.

Canonical Representation: as in Schema.

Example: A value of '31st January 2000' would be represented as:

- 2000-01-31

A value of '4 years from now' would be represented as:

- +P4Y

A value of 'right now' would be represented as a Dynamic Constraint:

- now()

XForms Facets defined:

- enumeration
- max
- maxExclusive
- maxInclusive
- min
- minExclusive
- minInclusive
- precision

The XForms `date` datatype inherits the static facets of its XML schema base datatype, which are:

```
duration, period, pattern, enumeration, whiteSpace,
maxInclusive, maxExclusive, minInclusive, minExclusive
```

Note that a special Dynamic Constraint function, `now()` is defined. This can be used to specify any min or max facet. Additionally, time values relative to the submission date can be specified using positive or negative durations. The syntax for dates and durations are as per the subset of [ISO 8601] specified for XML Schemas for time instants and durations.

It is recommended that XForms Processors offer date and time pickers which offer date validation and choices from the distant past to the distant future. Small portable devices will likely validate and pick only dates in the range likely for business appointments near the current time; whereas, a full-featured desktop browser, which supports use cases such as historical records search and long-term financial obligations, should offer an extended range of dates. As always, the server must assume that the client has not performed the validation specified in the XForms Model and perform its own validation on the entered date.

5.8 Time

The XForms datatype `time` is derived from the XML Schema [XSchema-2] datatype `time`.

Lexical Representation: as in Schema.

Canonical Representation: as in Schema. For XForms Processors that have access to the correct local time zone, this must be included in the canonical representation.

Example: A value of '1:20 PM Eastern Standard Time' (5 hours behind of UTC) would be represented as:

- 13:20:00-5

XForms Facets defined:

- enumeration

- max
- maxExclusive
- maxInclusive
- min
- minExclusive
- minInclusive
- precision

The XForms `time` datatype inherits the static facets of its XML schema base datatype, which are:

```
duration, period, pattern, enumeration, whiteSpace,
maxInclusive, maxExclusive, minInclusive, minExclusive
```

5.9 Duration

The XForms datatype `duration` is derived from the XML Schema [XSchema-2] primitive datatype `timeDuration`.

Lexical Representation: as in Schema.

Canonical Representation: as in Schema.

Example: A value of '1 year, 2 months, 3 days, 10 hours, and 30 minutes' would be represented as:

- P1Y2M3DT10H30M

A value of 'negative 120 days' would be represented as:

- -P120D

XForms Facets defined:

- enumeration
- max
- maxExclusive
- maxInclusive
- min
- minExclusive
- minInclusive
- precision

The XForms `duration` datatype inherits the static facets of its XML schema base datatype,

which are:

```
pattern, enumeration, whiteSpace, maxInclusive,
maxExclusive, minInclusive, minExclusive
```

[Issue: Months only provide an approximate means to specify duration since individual months vary in length. The same holds true for years.]

5.10 URI

The XForms datatype `uri` is derived from the XML Schema [XSchema-2] datatype `uriReference`.

Lexical Representation: `uri` represents a Uniform Resource Identifier (URI) Reference as defined in Section 4 of [RFC 2396]. A `uri` may be absolute or relative, and may have an optional fragment identifier. This datatype is used for values representing an absolute Uniform Resource Identifier (URI) as defined in [RFC 2396].

Canonical Representation: as in Schema.

Note: currently an open issue in Schema is how to handle non-ASCII values in either the URI value space or lexical space. We plan to adopt whatever solution the XML Schema Working Group arrives at.

Example: A value of 'http://www.w3.org/' would be represented as:

- http://www.w3.org/

XForms Facets defined:

- enumeration
- length
- max
- maxLength
- min
- minLength
- scheme

The XForms `uri` datatype inherits the static facets of its XML schema base datatype, which are:

```
length, minLength, maxLength, pattern, enumeration,
whiteSpace
```

The `scheme` facet allows you to restrict URIs to a limited set of schemes. For instance, `http` or `mailto`. XForms Processors are encouraged to provide a means to pick or browse

addresses, for instance an email address picker. The user interface may allow users to enter relative URIs, but the internal values will always be absolute URIs.

5.11 Binary

The XForms datatype `binary` is derived from the XML Schema [XSchema-2] datatype `binary`.

Lexical Representation: as in Schema.

Canonical Representation: as in Schema.

XForms Facets defined:

- enumeration
- length
- max
- maxLength
- mediaType
- min
- minLength

The XForms `binary` datatype inherits the static facets of its XML schema base datatype, which are:

```
encoding, length, minLength, maxLength, pattern,
enumeration, whiteSpace
```

This is a datatype for use with data appropriate to specific Internet media types. The XForms Processor could use the media type to determine how to prompt the user. For example, an image could be acquired from a digital camera, an image scanner, or a disk file.

In simple syntax, here is a possible representation for a model item that accepts JPEG or PNG images:

```
<binary name="photo">
  <mediaType>image/jpeg</mediaType>
  <mediaType>image/png</mediaType>
</binary>
```

Binary data could be packaged either in-place as part of XML instance data or held separately and referenced from XML. Further work is needed to cover the details.

[Issue: Is there a need for facets to further constrain the data, for instance, to place limits on the size of the data? Other kinds of constraints may be appropriate, for example, for audio clips,

you might want to set constraints on the bit rate and duration.]

5.12 XForms Facets

For each XForms facet, the following is specified:

- Availability - does this facet apply to the simple syntax, Schema syntax, or both?
- Description - a description of the function of the facet.
- Legal Values - a description of permissible values for the facet.
- Default Values - a description of behavior when the facet is not specified.
- Applies to - a listing of all XForms datatypes that support this facet.

5.12.1 XForms Facet: allowCurrency

Availability: Simple, Schema.

Description: indicates allowable currency datatypes.

Legal Values: a list of zero or more 3 letter currency codes (of subtype `currency`), e.g. `USD` or `GBP`.

Default Value: unrestricted.

Applies to:

- money

5.12.2 XForms Facet: enumeration

Availability: Simple, Schema.

Description: restricts the value space of the datatype to a specified list of possible values.

Legal Values: a list of datatype values compatible with the parent datatype.

Default Value: unrestricted.

Applies to:

- string
- number
- currency
- money
- date
- time

- duration
- URI
- binary

Note: the value of an XForms enumeration facet will almost always be a Dynamic Constraint, since the Schema enumeration facet handles static enumerations.

5.12.3 XForms Facet: length

Availability: Simple, Schema.

Description: restricts the value space of the datatype to only values which have the specified length. For string-based and binary-based datatypes, length is measured as in [XSchema-2].

Legal Values: any expression that evaluates to a non-negative `xfm:number`.

Default Value: unrestricted.

Applies to:

- string
- currency
- URI

5.12.4 XForms Facet: mask

Availability: only Simple.

Description: restricts the value space of the datatype according to a specified set of rules.

Legal Values: a list of 0 or more values representing legal mask syntax.

Default Value: unrestricted.

Applies to:

- string
- currency

XML Schema has defined a Regular Expression language which is "similar to the regular expression language used in the Perl Programming language", and can be applied to most built-in datatypes. However, regular expression syntax is considered complex by some. Therefore, XForms defines the concept of a `mask` facet. All `mask` facets are convertible into regular expressions.

The `mask` facet is available only using simple syntax. XML schema allows multiple `pattern` facets to be specified. Similarly, multiple `mask` or `pattern` facets, but not a mixture, are

permitted in simple syntax.

XForms `mask` uses the syntax and processing from [WML1.3] `format`. Some examples:

- `A` matches "A", "X", "$", "%", or "."
- `a` matches "a", "x", "$", "%", or "."
- `X` matches "A", "X", "$", "%", ".", or "4"
- `x` matches "a", "x", "$", "%", ".", or "4"
- `N` matches "0", "4", or "7"
- `3N` matches "0", "63", or "999" but not "1234" (Note: only allowed at end of mask)
- `*X` matches "$", "3.0", or "ABCDEFG" (Note: only allowed at end of mask)
- `\` causes the next literal character to be inserted into the mask
- `NNN\-NNNN` matches "123-4567" but not "1234567"

As with WML `format` processing, an XForms Processor must ignore invalid `masks`.

5.12.5 XForms Facet: max

Availability: only Simple.

Description: for string and binary datatypes, is a shortcut to the maxLength facet. For numeric datatypes, is a shortcut to the maxExclusive facet.

Legal Values: see maxLength and maxExclusive.

Default Value: see maxLength and maxExclusive.

Applies to:

- string
- number
- currency
- money
- date
- time
- duration
- URI
- binary

[Ed. `max` is being overloaded to perform two functions, either 'maximum value' or 'maximum length'. Feedback is welcome on whether this is confusing.]

5.12.6 XForms Facet: maxExclusive

Availability: only Schema.

Description: restricts the value space to values below the specified exclusive upper bound.

Legal Values: any expression that evaluates to a value compatible with the parent datatype.

Default Value: unrestricted.

Applies to:

- number
- money
- date
- time
- duration

5.12.7 XForms Facet: maxInclusive

Availability: only Schema.

Description: restricts the value space to values below the specified inclusive upper bound.

Legal Values: any expression that evaluates to a value compatible with the parent datatype.

Default Value: unrestricted.

Applies to:

- number
- money
- date
- time
- duration

5.12.8 XForms Facet: maxLength

Availability: only Schema.

Description: restricts the value space of the datatype to a maximum length. For string-based, binary-based, and list-based datatypes, length is measured as in [XSchema-2].

Legal Values: any expression that evaluates to a non-negative `xfm:number`.

Default Value: unrestricted.

Applies to:

- string
- currency
- URI
- binary

5.12.9 XForms Facet: mediaType

Availability: Simple, Schema.

Description: restricts the value space of the datatype to specific mime-types.

Legal Values: a list of zero or more mime-types.

Default Value: unrestricted.

Applies to:

- binary

5.12.10 XForms Facet: min

Availability: only Simple.

Description: for string and binary datatypes, is a shortcut to the minLength facet. For numeric datatypes, is a shortcut to the minExclusive facet.

Legal Values: see minLength and minExclusive.

Default Value: see minLength and minExclusive.

Applies to:

- string
- number
- currency
- money
- date
- time
- duration
- URI
- binary

Note: min is being overloaded to perform two functions. Is this confusing?

5.12.11 XForms Facet: minExclusive

Availability: only Schema.

Description: restricts the value space to values above the specified exclusive lower bound.

Legal Values: any expression that evaluates to a value compatible with the parent datatype.

Default Value: unrestricted.

Applies to:

- number
- money
- date
- time
- duration

5.12.12 XForms Facet: minInclusive

Availability: only Schema.

Description: restricts the value space to values above the specified inclusive lower bound.

Legal Values: any expression that evaluates to a value compatible with the parent datatype.

Default Value: unrestricted.

Applies to:

- number
- money
- date
- time
- duration

5.12.13 XForms Facet: minLength

Availability: only Schema.

Description: restricts the value space of the datatype to a minimum length. For string-based and binary-based datatypes, length is measured as in [XSchema-2].

Legal Values: any expression that evaluates to a non-negative `xfm:number`.

Default Value: unrestricted.

Applies to:

- string
- currency
- URI
- binary

5.12.14 XForms Facet: precision (applied to numeric datatypes)

Availability: Simple, Schema.

Description: for numeric datatypes, restricts the value space to values with the specified number of digits total are significant. Numeric datatypes always use precision along with scale, and precision must be greater than or equal to scale.

Legal Values: for numeric datatypes, any expression that evaluates to a non-negative `xfm:number`.

Default Value: unrestricted.

Applies to:

- number
- money

5.12.14.1 XForms Facet: precision (applied to date and time datatypes)

Availability: only Simple.

Description: for date and time datatypes, restricts the value space to values that include significant data in the specified precision.

Legal Values: for date and time datatypes, any expression that evaluates to "years", "months", "days", "hours", "minutes", or "seconds". Note that large precisions, such as "years" may be meaningless for time datatypes, and small precisions, such as "seconds" may be meaningless for date datatypes.

Default Value: unrestricted.

Applies to:

- date
- time
- duration

5.12.15 XForms Facet: scale

Availability: Simple, Schema.

Description: for numeric datatypes, restricts the value space to values with the specified number of digits after the decimal. E.g. `scale="0"` restricts the value space to integers. Numeric datatypes always use precision along with scale, and precision must be greater than or equal to scale.

Legal Values: any expression that evaluates to a non-negative `xfm:number`.

Default Value: unrestricted.

Applies to:

- number
- money

5.12.16 XForms Facet: scheme

Availability: Simple, Schema.

Description: restricts the value space of a datatype to the set of values that conform to one or more URI schemes, such as `http`, `ftp`, `mailto`, `news`, or `ldap`.

Legal Values: a list of zero or more strings that represent URI schemes.

Default Value: unrestricted.

Applies to:

- URI

---

6 XForms Model

Contents

This chapter is normative.

6.1 Introduction

The XForms Model supports XML Schema built-in datatypes such as `string` and custom datatypes defined using XML Schema syntax.

This chapter goes into further detail on the XForms simple syntax. XForms simple syntax is designed for easy hand-authoring and is targeted at HTML authors. Simple syntax provides an easy to learn interface for HTML authors; it achieves its simplicity by providing a smaller range of functionality than that afforded by XML Schemas. Specifically, XForms simple syntax allows the author to:

- Declare elements that conform to any of the elementary datatypes e.g., `string;`
- Declare elements that conform to complex types defined elsewhere using XML Schema e.g., `USPostalAddress`;
- Declare additional run-time (dynamic) XForms constraints e.g., date of birth precedes date of graduation;

In order to stay simple, simple syntax **does not** permit the definition of reusable datatypes. However, Reusable datatypes can be defined in XML Schema and instantiated using XForms simple syntax as described here.

Later on, this chapter discusses ways to combine XForms simple syntax with XML Schema.

6.2 XForms Specific Properties

The following XForms Specific Properties are very similar in syntax to constraining datatype facets. However, instead of constraining the value space of a datatype, they add properties specific to XForms, such as `readOnly` or `required`. The following properties are available for all datatypes, and their syntax is explained later in this document.

Many XForms Specific Properties can be represented by the Dynamic Constraints Language, and may evaluate to values that can change at any time. XForms Processors that implement form controls need to dynamically update as the evaluated properties change.

6.2.1 XForms Specific Property: id

Description: provides a document scoped unique identifier

Legal Values: only `xsd:ID`.

Default Value: none.

For the benefit of authors of XForms Dynamic Constraints or scripts, XForms defines an `id` attribute widely across XForms elements. By defining this as an XForms Specific Property, XML Schema-based or simple syntax XForms Models can be annotated with a unique identifier allowing convenient reference from other parts of the document.

6.2.2 XForms Specific Property: name

Description: provides a specific name for the declaring datatype.

Legal Values: only values of type `xsd:NCNAME`

Default Value: none.

Authors can associate a human-readable name with a declaring datatype through the use of the `name` property. Each `name` should be unique within the scope of the XForms Model where it is declared.

When using simple syntax to define elements that appear in the instance data, the `name` property provides the corresponding element name, as shown in the atomic datatype example below.

6.2.3 XForms Specific Property: readOnly

Description: describes whether the value is restricted from changing. The ability of form controls to have focus and appear in the tab order is unaffected by this property.

Legal Values: any expression that evaluates to `xfm:boolean`.

Default Value: `false`.

In addition to restricting value changes, the `readOnly` property provides a hint to the user interface. Form controls bound to a model item with the readOnly property should indicate that entering or changing the value is not allowed. The hint provided has no effect on visibility, focus, or tab order.

[Question: Should it be possible to make the `readOnly` facet immutable? i.e. if an element in marked as read-only and immutable, then the XForms Processor could rely on the facet not changing and employ a different rendering. Do we need a "constant"?]

6.2.4 XForms Specific Property: required

Description: describes whether a value is required before the instance data is submitted.

Legal Values: any expression that evaluates to `xfm:boolean`.

Default Value: `false`.

Often forms require certain values to be entered. Within XForms, this may be a static requirement and defined in an XML Schema (e.g. `xsd:minOccurs="1"`). Alternatively a value may only be required if some condition is satisfied. Future versions of this specification will describe details such as immediate validation vs. onsubmit validation.

Except as noted below, the `required` property does not provide a hint to the user interface regarding visibility, focus, or tab order. XForms authors are strongly encouraged to make sure that form controls that accept `required` data are visible. An XForms Processor may provide a unique indication that a form control is required.

Note: Suspend and resume operations are not restricted by the `required` property.

Note: As with the constraining facets, conflicting properties are resolved by choosing the most restrictive. For instance, if `required="false"` was specified but `xsd:minOccurs="1"` was also defined by the Schema for the element, the element would still be required.

[Question: it might be useful to set the default for the required attribute for an entire XForms Model. What should the default default be? How could we assign a default for a single XForms Model? This could apply to other attributes as well, e.g. readOnly, etc..]

[Question: Null values, XML Schema `nullable="true"`. We have not yet addressed the subject of *null*. It is of particular relevance for required items.]

6.2.5 XForms Specific Property: relevant

Description: indicates whether the model item is currently relevant to the rest of the XForms Model. XForms Processors would typically not render an associated form control, including children, when the value is `false`.

Legal Values: any expression that evaluates to `xfm:boolean`

Default Value: `true`.

Many forms have fields dependent on other conditions. For example, a form might ask whether the respondent owns a car. It is only appropriate to ask for information about their car if they have indicated that they own one. In XForms, this occurs through the `relevant` property.

The `relevant` property provides hints to the user interface regarding visibility, focus, and tab order. In general, when `true`,

associated form controls should be made visible. When `false`, associated form controls should be hidden, though an XForms Processor may only disable the form controls. In either case, the form controls should be removed from the tab order and not allowed focus.

The following table shows the interaction between `required` and `relevant`.

	required="true"	**required="false"**
relevant="true"	The form control (and any children) should be visible or available to the user. The user interface may indicate that a value is required.	The form control (and any children) should be visible or available to the user. The user interface may indicate that a value is optional.
relevant="false"	The form control (and any children) should be hidden or unavailable to the user. Entering a value or obtaining focus should not be allowed. The user interface may indicate that should the form control become relevant, a value would be required.	The form control (and any children) should be hidden or unavailable to the user. Entering a value or obtaining focus should not be allowed.

6.2.6 XForms Specific Property: calc

Description: indicates that the value of the declaring datatype is to be dynamically calculated.

Legal Values: any expression that evaluates to a datatype compatible with the declaring datatype.

Default Value: none.

An XForms Model may include model items that are computed from the other values elsewhere. For example, the sum over line items for quantity times unit price, or the amount of tax to be paid on an order. The computed value can be represented as an Dynamic Constraint using the values of other model items.

6.2.7 XForms Specific Property: validate

Description: indicates that the value of the declaring datatype is to be dynamically validated.

Legal Values: any expression that evaluates to `xfm:boolean`

Default Value: `true`.

An XForms Model may include model items that need to be validated. The specified Dynamic Constraint is invoked every time the value of the declaring datatype changes. The expression must evaluate to `true` for the model item to be considered valid. Future versions of this specification will describe details such as immediate validation vs. onsubmit validation.

Dynamic Constraints used here are not restricted to examining the instance data item they are invoked on. The Dynamic Constraints Language provides the means to traverse the instance data, as well as call-outs to external script.

The user interface may indicate whether a form control is currently valid or invalid.

[Question: Will the `validate` property be evaluated on all the parent or child model items whenever a value changes? We need to make sure that inter-model item constraints will get evaluated.]

6.3 Using Datatypes

The basic datatypes defined by XForms can be used individually or aggregated to build appropriate structures for use in XForms applications. XForms provides a number of structures that are mapped to corresponding constructs in XML Schema.

XForms Processors that are Schema compliant can use arbitrarily complex Schema constructs in the XForms Model. The full Schema syntax can be found in [XSchema-1] and [XSchema-2].

6.3.1 Atomic Datatype

Description: inserts an atomic datatype into the XForms Model.

Simple Syntax: for each atomic datatype in the Datatypes chapter, the simple syntax specifies an element with a matching name in the XForms Namespace. Optional allowed attributes in the XForms Namespace are the XForms constraining facets and XForms

Specific Properties, except as noted below. The element content is empty, except as noted below:

- `<string>` has 0 or more `<mask>` children representing the list members of the `mask` facet. `mask` is not allowed as an attribute.
- `<money>` has 0 or more `<allowedCurrency>` children representing the list members of the `allowedCurrency` facet. `allowedCurrency` is not allowed as an attribute.
- `<uri>` has 0 or more `<scheme>` children representing the list members of the `scheme` facet. `scheme` is not allowed as an attribute.
- `<binary>` has 0 or more `<mediaType>` children representing the members of the `mediaType` facet. `mediaType` is not allowed as an attribute.
- The `enumeration` facet is described below.
- The `name` XForms Specific Property is required.
- Note: `<money>` may not be considered an atomic datatype (see note in the Datatypes chapter), and thus may be considered a structure rather than a datatype.

A method is needed to include datatypes defined elsewhere (in either XForms or Schema format) into the XForms Model. One syntax proposal is:

- `<xfm:element type="...Schema or XForms datatype" ... />`

Example Simple Syntax:

```
<xfm:string name="foo" minLength="1" />
```

Example Equivalent Schema Syntax:

```
<xsd:element name="foo">
  <xsd:complexType>
    <xsd:restriction base="xfm:string">
      <xfm:minLength value="1"/>
    </xsd:restriction>
  </xsd:complexType>
</xsd:element>
```

Second Example Simple Syntax:

```
<xfm:binary name="foo">
  <xfm:mediaType>image/jpg</xfm:mediaType>
  <xfm:mediaType>image/png</xfm:mediaType>
</xfm:binary>
```

Second Example Equivalent Schema Syntax:

```
<xsd:element name="foo">
  <xsd:complexType>
    <xsd:restriction base="xfm:binary">
      <xsd:mediaType value="image/jpg"/>
      <xsd:mediaType value="image/png"/>
    </xsd:restriction>
  </xsd:complexType>
</xsd:element>
```

6.3.2 Enumerated Datatype

Description: inserts an atomic datatype, with a restricting enumeration, into the XForms Model. Enumerations are mentioned separately here only because of their special syntax.

Simple Syntax: an enumerated datatype is declared as an atomic datatype above, with the additional syntax as follows:

- Any datatype can be restricted to an enumerated value space by providing 1 or more `<value>` children with string content representing the individual enumerated value.
- Any datatype can be restricted to an enumerated value space by providing an attribute `choices` which contains an XForms

Dynamic Constraint that returns a list of values at runtime. This list is used in addition to any `<value>` children.

- An additional attribute `enum` can be either `open` (the default) or `closed`. When `closed`, the enumeration is strictly limited to the defined values. When `open`, other values are allowed, as long as they satisfy all other constraining facets.

Note that an open enumeration is useful for scenarios like the following, where a multiple choice question has an "other" option:

Note: functionality similar to open enumerations is available in XML Schema through the combination of union and enumeration features.

Simple Syntax:

```
<xfm:string name="foo" enum="closed">
  <xfm:value>Visa</xfm:value>
  <xfm:value>MasterCard</xfm:value>
  <xfm:value>Diner's Club</xfm:value>
  <xfm:value>American Express</xfm:value>
</xfm:string>
```

Equivalent Schema Syntax:

```
<xsd:element name="foo" enum="closed">
  <xsd:complexType>
    <xsd:restriction base="xfm:string">
      <xsd:enumeration value="Mastercard"/>
      <xsd:enumeration value="Diner's Club"/>
      <xsd:enumeration value="American Express"/>
    </xsd:restriction>
  </xsd:complexType>
</xsd:element>
```

Simple Syntax with Dynamic Choices:

```
<xfm:string name="foo" enum="closed" choices="getCreditCardList()"/>
```

6.3.3 Group

Description: allows aggregate hierarchical arrangement of datatypes.

Simple Syntax: the simple syntax specifies the element `<group>`, with the possible attributes representing the XForms Specific Properties.

Example Simple Syntax:

```
<xfm:group name="person">
  <xfm:string name="personName"/>
  <xfm:string name="personTitle"/>
</xfm:group>
```

Example Equivalent Schema Syntax:

```
<xsd:group name="person">
  <xsd:sequence>
    <xsd:element name="personName" type="xfm:string"/>
    <xsd:element name="personTitle" type="xfm:string"/>
  </xsd:sequence>
</xsd:group>
```

Note that here element `person` does not define a new datatype; when mapped to XML Schema syntax; i.e. `person` is an anonymous type that cannot be reused.

Note: The Working Group is looking for feedback on whether the option for an unordered group is necessary in addition to the ordered group as described above.

6.3.4 Union

Description: allows differing datatypes to be bound to a single model item.

Simple Syntax: the simple syntax specifies the element `<union>`, with the possible attributes representing the XForms Specific Properties. Child datatypes do not require the `name` attribute.

Example Simple Syntax:

```
<xfm:union name="weekday">
  <xfm:string enum="closed">
    <xfm:value>Monday</xfm:value>
    <xfm:value>Tuesday</xfm:value>
    <xfm:value>Wednesday</xfm:value>
    <xfm:value>Thursday</xfm:value>
    <xfm:value>Friday</xfm:value>
    <xfm:value>Saturday</xfm:value>
    <xfm:value>Sunday</xfm:value>
  </xfm:string>
  <xfm:number min="1" max="7" scale="0"/>
</xfm:union>
```

Example Equivalent Schema Syntax:

```
<xsd:element name="weekday">
  <xsd:simpleType>
    <xsd:union>
      <xsd:simpleType>
        <xsd:restriction base="xfm:string">
          <xsd:enumeration value="Monday"/>
          <xsd:enumeration value="Tuesday"/>
          <xsd:enumeration value="Wednesday"/>
          <xsd:enumeration value="Thursday"/>
          <xsd:enumeration value="Friday"/>
          <xsd:enumeration value="Saturday"/>
          <xsd:enumeration value="Sunday"/>
        </xsd:restriction>
      </xsd:simpleType>
      <xsd:simpleType>
        <xsd:restriction base="xfm:decimal">
          <xsd:maxInclusive value="7"/>
          <xsd:minInclusive value="1"/>
          <xsd:scale value="0"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:union>
  </xsd:simpleType>
</xsd:element>
```

[Issue: Is the name attribute required for each of the elements within a union?]

6.3.5 Array

Description: allows homogeneous collections (i.e., all members of an array are the same structure).

Simple Syntax: the simple syntax specifies the element `<array>`, with the possible attributes representing the XForms Specific

Properties.

Two additional attributes are defined: `minOccurs` and `maxOccurs`. The value of these must be either a non-negative `xfm:number` or for `maxOccurs`, "`unbounded`". These limit the minimum and maximum number of datatypes in the collection, respectively. The default for both is 1.

Note: The author has the ability to specify whether a containing element for the repeating elements is produced. If a `name` is specified for the array then a containing element will be created where the containing element name will be derived from the name of the array. If no `name` is provided for the array then no containing element will be created.

Example Simple Syntax:

```
<xfm:array name="children" minOccurs="0" maxOccurs="unbounded">
 <xfm:string name="child" />
</xfm:array>
```

Example Equivalent Schema Syntax:

```
<xsd:element name="children">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:element name="child" type="xfm:string" minOccurs="0"
maxOccurs="unbounded"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

Second Example Simple Syntax:

```
<xfm:array minOccurs="0" maxOccurs="unbounded">
 <xfm:string name="child" />
</xfm:array>
```

Second Example Equivalent Schema Syntax:

```
 <xsd:element name="child" type="xfm:string"  minOccurs="0" maxOccurs="unbounded"/>

<!-- note this syntax is only valid inside a group -->
```

6.3.6 Switch

Description: allows alternative structures to be defined within simple syntax and for a Dynamic Constraint to determine which should be created in the instance data.

Simple Syntax: the simple syntax specifies the element `<switch>`, with the possible attributes representing the XForms Specific Properties. The content model consists of `<case>` elements, which in turn contain datatype declarations. The `<case>` elements have two attribute: `name` from the XForms Specific Properties, and `condition`, which consists of a script to validate.

Example Simple Syntax:

```
<xfm:switch name="address">
  <xfm:case name="us" condition="property::locale is 'US'" >
    <xfm:string name="street"/>
    <xfm:string name="city"/>
    <xfm:string name="state"/>
    <xfm:string name="zip"/>
  </xfm:case>
  <xfm:case name="uk" condition="property::locale is 'UK'" >
    <xfm:string name="street"/>
    <xfm:string name="town"/>
    <xfm:string name="county"/>
    <xfm:string name="postcode"/>
  </xfm:case>
  <xfm:case name="default">
```

```
    <xfm:string name="street"/>
    <xfm:string name="town"/>
    <xfm:string name="county"/>
    <xfm:string name="postcode"/>
  </xfm:case>
</xfm:switch>
```

Example Equivalent Schema Syntax:

```
<xsd:element name="address">
  <xsd:complexType>
    <xsd:choice>
      <xsd:sequence>
        <xsd:element name="street"   type="xfm:string"/>
        <xsd:element name="city"     type="xfm:string"/>
        <xsd:element name="state"    type="xfm:string"/>
        <xsd:element name="zip"      type="xfm:string"/>
      </xsd:sequence>
      <xsd:sequence>
        <xsd:element name="street"   type="xfm:string"/>
        <xsd:element name="town"     type="xfm:string"/>
        <xsd:element name="county"   type="xfm:string"/>
        <xsd:element name="postcode" type="xfm:string"/>
      </xsd:sequence>
      <xsd:sequence>
        <xsd:element name="street"   type="xfm:string"/>
        <xsd:element name="town"     type="xfm:string"/>
        <xsd:element name="county"   type="xfm:string"/>
        <xsd:element name="postcode" type="xfm:string"/>
      </xsd:sequence>
    </xsd:choice>
  </xsd:complexType>
</xsd:element>
```

Note that this capability is an extension of the XML Schema `choice`.

Note: This impacts both the user interface and the XForms Model. An XForms Model can exploit the switch construct to define a number of variants and to determine at runtime which single variant should be created in the instance. The sequence is important, the first `case` whose condition evaluates to `true` will appear in the instance. If no conditions evaluate as `true` then a default may be produced by specifying a variant which has no condition associated with it.

6.4 Combining XForms and XML Schema

XML Schema allows annotations as foreign namespaced attributes. Adding elements is more problematic. Future versions of this specification will specify in greater detail how XForms datatypes, properties, and structures can be used within XML Schema.

- XForms namespaced datatypes can be used within XML Schema
- XForms Specific Properties can be used as namespaced attributes within XML Schema
- Using compound structures (group, array, union, switch, etc.) require further discussion.

6.4.1 Annotating an External Schema

XForms authors may wish to reuse datatypes and structures already defined in an external XML Schema. For use in an XForms application, such schemas may need to be annotated using XForms dynamic properties for expressing run-time constraints.

Future versions of this specification will describe how to add XForms annotations to an external Schema by reference without modifying the original Schema.

One syntax proposal is:

- `<xfm:annotateElement elementID="age" min="17" max="63" />`

7 Dynamic Constraints

Contents

This chapter is normative.

7.1 Introduction

Many forms define integrity constraints that act over multiple fields. For example, the total value of an order can be defined in terms of a computation over other values such as unit prices, quantities, discounts, and tax and shipping costs. Such computations can be conveniently represented using the syntax outlined in here. This chapter describes an XForms Dynamic Constraints Language (DCL) based on XPath that enables these types of expressions without the use of a separate scripting language.

Dynamic Constraints are also useful for declaratively stating when a form control or subform needs to be filled out, according to some other value. A further use is to functionally define the acceptable choices for some form control, when this depends on other values.

Note: For simplicity, this chapter currently defines DCL as being based on XPath without subsetting. However, there is not yet consensus within the XForms Working Group on this matter. Specific points under consideration are noted throughout this chapter.

In the following grammar, the non-terminal NCName is defined in [XML Names], and S is defined in [XML 1.0].

7.2 Datatypes

XForms Dynamic Constraints are built out of the XForms data types:

- **string** with single or double quote marks for delimiters
- **boolean** with the values *true* and *false*.
- **number** with subtypes for integers etc.
- **date**
- **time**
- **monetary value**
- **currency code**
- **binary data**
- **Internet media type** (also known as MIME types)
- **enumeration**, e.g. for names of days and months

The **string**, **boolean**, and **number** types correspond to those defined in XPath. Dates, time durations and monetary values etc. are subtypes of string. Additionally, the XPath datatypes **node-set** and **null** are allowed in the XForms Dynamic Constraint Language.

Note: Resource-limited XForms Processors may define implementation limits on the maximum size of a node-set.

Issue: XPath defines specific type conversions. The XForms Working Group is considering whether to include or exclude these as part of XForms Dynamic Constraints. Either way, there will be well-defined semantics of operations involving differing types.

If an operation cannot be performed an exception will be thrown. Exceptions are treated as events and can be caught using event handlers, declared in XML or in scripts.

Standalone XForms Datatypes are considered valid XForms Dynamic Constraints.

[Ed: The productions here currently do not properly reference and extend those found in XPath.]

```
[1] Digit        ::=  [0-9]
[2] HexDigit     ::=  Digit
                      | ['a' - 'f']
                      | ['A' - 'F']
[3] NullExp      ::=  'null'
[4] BoolExp      ::=  'true' | 'false'
[5] NumberExp    ::=  0x[HexDigit]+
                      | [['-']Digit+['.' Digit*] [('e' | 'E')['+' | '-']Digit+]
[6] StringExp    ::=  "" NCName? "" | """ NCName? """
[7] ArrayExp     ::=  '[]' | [Expr [',' Expr]*]
```

7.3 Addressing

Like XPath, the XForms DCL models an XML document as a tree of nodes. There are different types of nodes, including element nodes, attribute nodes and text nodes. XPath uses '/' as a location-step separator. XML doesn't permit the '/' character within element or attribute names, so this is unambiguous.

XPath additionally allows an array index notation to address the n-th element in a sequence, for example, the line items in a purchase order.

```
<purchaseOrder orderDate="1999-10-20">
  <item partNum="872-AA">
      ...
  </item>
  <item partNum="926-AA">
      ...
  </item>
</purchaseOrder>
```

The second item in the purchase order could be addressed as follows:

- `purchaseOrder/item[2]`

Many programming languages, including ECMAScript and Java, use zero rather than one for the index number for the first item in an array. Authors should be aware of this, especially when writing applications that combine scripting and XForms.

XPath also allows you to address attributes. For instance, the `orderDate` attribute in the `purchaseOrder` element could be addressed as follows:

- `purchaseOrder/@orderDate`

To address the `partNum` attribute in the second item you could write:

- `purchaseOrder/item[2]/@partNum`

As with XPath, all addressing is based on the concept of a context node. In many situations, using a context node can lead to shorter identifiers. As an example, if the second `item` element above was selected as the context node, the `partNum` attribute could be addressed as follows:

- `@partNum`

Identifiers are evaluated from left to right. The value of an identifier must resolve to one of the above types. The identifier syntax is a based on XPath and follows the same semantics. If an identifier starts with an element name, then the name must be in the current context (scope) or an ancestor context. If an identifier can't be resolved, an invalid identifier exception is thrown.

```
[8] Identifier   ::=   (('/'
                       | '../'
                       | element-name) ['[' Expr ']'])+
```

[9] PathExp ::= identifier ['@' attribute-name]
| '@' attribute-name

7.3.1 Data Spaces

XForms applications may need access to data beyond that immediately present in an XForms Model. Some possible examples include: the user's locale, information about the XForms Processor's capabilities, the user's name and address, location information for a mobile device, and temporary data which won't be submitted to the server. The XForms application may be part of a suite of applications that share a common data context. An architecture is needed that describes the relationship between data spaces as well as the access control mechanisms needed for security and privacy.

A given constraint may need to refer to multiple data spaces. There are several ways in principle that this could be achieved:

- **Library functions**. A function call can provide the appropriate context for resolving an address within the desired data space.
- **Multiple root nodes**. If each data space is associated with its own XML 'document', then the data spaces could be distinguished by the use of different root nodes.
- **Inheritance in nested data spaces**. If the data spaces are nested one within another, an inheritance mechanism could be used to inherit names from a parent data space. For instance the XML form could be included within the application data space, and in turn within a browser data space.

Note that XML namespaces solve a different problem. XPath permits the use of an XML namespace prefix for element names, but the element is still assumed to be in the same node tree. XML namespaces provide a way for XML documents to distinguish elements which have the same name but different semantics.

7.4 Operators

A small amount of work is still needed to specify operator precedence, associativity and the event names thrown upon exceptions.

XPath reserves '`/`' as a location-step separator, making it impractical to also use this symbol for division. The Dynamic Constraints Language makes consistent use of English names for operators is intended to minimize the potential for authoring errors, and to avoid the need for using character entity references for symbols.

The **`not`** operator can only be used with an operand that evaluates to a boolean value. If the operand is `true`, the `not` operator evaluates to `false`. If the operand is `false`, the `not` operator evaluates to `true`.

The **`if`** *cond* **`then`** *expr1* **`else`** *expr2* construct requires *cond* to evaluate to `true` or `false`. If *cond* is `true`, the value of the construct is the result of evaluating *expr1*, otherwise it is obtained from evaluating *expr2*.

The **`is`** operator compares two values, and produces a Boolean result.

The *expr* **`is within(`***expr1*, *expr2***`)`** construct evaluates to `true` if the result from evaluating *expr* falls within the inclusive range defined by *expr1* and *expr2*. If it falls outside the range the construct evaluates to `false`. The operands must be of the same type, and are restricted to numbers, strings, dates, times or monetary values with the same currency code. String comparison is defined as per the Unicode standard.

The *expr* **`is not within(`***expr1*, *expr2***`)`** construct evaluates to `false` if the result from evaluating *expr* falls within the inclusive range defined by *expr1* and *expr2*. If it falls outside the range the construct evaluates to `true`. The operands must be of the same type, and are restricted to numbers, strings, dates, times or monetary values with the same currency code. String comparison is defined as per the Unicode standard. Here are some examples of `true` statements:

- `3 is within(1,5)`
- `3 is not within(1,2)`
- `"aab" is within("aaa", "aac")`

The **`is before`** and related operators provide comparison operations similar to **`is within`**. The operands must be of the same type, and are restricted to numbers, strings, dates, times or monetary values with the same currency code. String comparison is defined as per the Unicode standard. Before and below denote earlier in the scalar range, while after and above denote later in the scalar range. For instance, here are some examples of `true` statements:

- `age is 60`
- `26 is not 27`
- `3 is below 4`
- `"Mary" is after "Mandy"`

The **`and`**, **`or`** and **`xor`** require Boolean operands and perform the corresponding Boolean operations. For instance, the following examples are all `true`:

- `false is true and false`
- `true is true or false`
- `true is true xor false`
- `false is true xor true`

The **`plus`**, **`minus`**, **`times`** and **`over`** operators require numeric operands (see below for exceptions) and perform the corresponding arithmetic operations. The `over` operator performs division and throws an overflow exception if the denominator is zero. The `plus` operator can also be applied to string operands, to perform string concatenation. The following examples are all `true`:

- `5 is 1 plus 4`
- `3 is 6 over 2`
- `3 is 5 minus 2`
- `"happy days" is "happy" plus " " plus "days"`

The **%** operator is a postfix operator that divides its operand by 100.

- `9 is 15% times 60`

The **=** operator performs assignment. The mechanism for binding XForms User Interface controls generally assumes that each form control is bound to a single model item. Some user interface controls such as buttons and image-maps may need to set the values of several model items in the same action. It is proposed that this is handled using one or more assignment statements separated by semicolons:

Here is a simple example which sets both the city and state:

- `city="London"; state="Ontario"`

[10] InfixOperator	::=	'and' | 'or' | 'xor' | 'plus' | 'minus' | 'times' | 'over' | 'is' [[PrefixOperator] ('above' | 'below' | 'before' | 'after')]
[11] InfixExp	::=	Expr InfixOperator Expr
[12] PrefixOperator	::=	'not'
[13] PrefixExp	::=	PrefixOperator Expr
[14] PostfixOperator	::=	'%'
[15] PostfixExp	::=	Expr PostfixOperator
[16] SpecialOperator	::=	'is' ['not'] 'within'
[17] SpecialExp	::=	Expr SpecialOperator '(' Expr ',' Expr ')'
[18] IfThenElseExp	::=	'if' Expr 'then' Expr ['else' Expr]
[19] Assignment	::=	[Lexpr '=']+ Expr [';' Assignment]* [';']
[20] Lexpr	::=	Identifier | Function | (Lexpr)

7.5 XForms Core Function Library

This section defines a set of required functions useful within XForms. Function syntax is based on XPath:

[21] Arg	::=	Expr

[22] FunctionExp ::= function-*name* '('*[arg [',' arg]*]* ')'

7.5.1 XPath Core Function Library

The XForms Core Function Library includes the entire [XPath] Core Function Library, including operations on node-sets, strings, numbers, and booleans.

Further input is required on the ability for resource-constrained devices to implement the complete XPath Core Function Library.

7.5.2 Number Methods

Note: the following are defined within [XPath] - `number(), sum(), floor(), ceiling(), and round()`

Function: *number* **average**(*node-set*)

The **average** function returns the arithmetic average value, for each node in the argument node-set, of the result of converting the string-values of the node to a number. Numbers are added with **plus**, and then taken **over** the **count()** of the specified node-set.

Function: *number* **min**(*node-set*)

The **min** function returns the minimum value, for each node in the argument node-set, of the result of converting the string-values of the node to a number. Numbers are compared with **is below**.

Function: *number* **max**(*node-set*)

The **max** function returns the arithmetic average value, for each node in the argument node-set, of the result of converting the string-values of the node to a number. Numbers are compared with **is below**.

7.5.3 String Methods

Note: the following are defined within [XPath] - `string(), concat(), starts-with(), contains(), substring-before(), substring-after(), substring(), string-length(), normalize-space(), and translate().`

7.5.4 Date/Time Methods

Function: *string* **now**()

The **now** function returns the current system time as a string value, in the canonical format defined within the XForms specification. If local time zone information is available, it is

included in the string.

7.5.5 Miscellaneous Methods

Function: *null* **submit**()

The **submit** function immediately submits the instance data bound to the node that contains the expression.

Function: *null* **reset**()

The **reset** function immediately resets the instance data bound to the node that contains the expression.

7.6 Lexical Structure

When tokenizing, the longest possible token is always returned.

White space is permitted between tokens with the following exceptions:

- before or after the `/` or `../` within compound identifiers.
- within number tokens
- within name tokens

Whitespace is required between adjacent alphanumeric tokens, e.g. white space is required between the operator "`not`" and the name of a function. Names follow the lexical rules for XML NAME tokens. Function names, however, are not permitted to include `-` or `.` for compatibility with externally defined functions.

Parentheses can be used for grouping, but otherwise have no effect on the semantics of Dynamic Constraints. The syntax caters for literals for null, booleans, numbers, and strings.

```
[23] Expr   ::=  NullExp
                 | BoolExp
                 | NumberExp
                 | StringExp
                 | ArrayExp
                 | PathExp
                 | InfixExp
                 | PrefixExp
                 | PostfixExp
                 | SpecialExp
                 | IfThenElseExp
```

7.7 Extensibility

This section will be expanded in future revisions, to cover extension functions and methods for calling out to script.

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8 XForms User Interface

Contents

This chapter is normative.

8.1 Introduction

This document describes:

- Markup for the visual user interface for XForms
- New style properties for use in combination with Cascading Style Sheets (CSS) style properties for laying out form controls.
- A mechanism for binding the user interface to the XForms Model section.

User interface controls are declared using markup elements, and their behavior refined via markup attributes. This markup may be further decorated with style properties that can be set using CSS stylesheets to deliver a customized look and feel. User interface controls defined here are bound to the underlying data instance by using the binding attributes as defined in the Binding chapter.

This chapter addresses accessibility by taking a uniform approach to such features as captions, help text, tabbing and short cuts.

The group plans to address internationalization and conformance profiles once the initial work on user interfaces has gone through the first round of publication.

8.1.1 Design Input

The following cases have been considered in this design:

- *Group boxes used to group form controls*
- *Explanatory text and graphics*

- *Output form controls used for computed values*
- *Single-line and multi-line text entry form controls*
- *Check boxes for yes/no questions*
- *radio buttons and drop down menus for multiple choice questions*
- *Lists allowing multiple selections*
- *Buttons for navigation or instance data submission*
- *Image maps functioning as one or more buttons*
- *Tree controls with the ability to open and close nodes*
- *Sliders or rotary controls for picking from a range*
- *Spin controls for incrementing or decrementing a value*
- *Custom pickers e.g. for dates or colors*
- *Additional (pop-up) help*
- *Mechanisms for navigation through form controls*
- *Keyboard shortcuts for moving to particular form controls*
- *The ability to disable particular form controls, thereby removing them from the navigation order, and from the submitted data*
- *The ability to prevent users from changing the values of particular form controls*
- *The ability for form controls to indicate an error in some manner*
- *The ability to selectively hide or reveal groups of form controls*
- *The ability to present XForms as a sequence of cards*

Eventually, this chapter will describe functionality for most or all of the above cases.

8.2 Abstract Form Controls

Because many types of form controls share similar properties, we here specify a few abstract form controls which serves no purpose but to contain common attributes, properties, and elements. It is an error to include an abstract form control directly. Other form controls are later defined in terms of these abstract form controls.

Note: This approach does not constrain implementations to utilize abstract form controls.

The following pieces of markup (core elements and attributes) are common to all user interface controls defined in this document.

8.2.1 anyControl

An abstract form control anyControl is the basis for all XForms form controls. It is defined as follows:

XML Representation Summary: `anyControl`

```
<anyControl
  xml:lang
  id
  class
  style
  accesskey
  navindex>
  { child elements specified separately}
</anyControl>
```

Common Attributes

In addition to the common elements and attributes defined here, see the chapter on binding for common attributes specific to binding.

`xml:Lang`
: This attribute may be used to specify the language as per the XML specification.

`id`
: A document level unique ID, as defined in [XML 1.0]

`class`
: This attribute may be used to specify a string for use in a style rule selector.

`style`
: This attribute may be used to specify local styles as per the XHTML specification.

Common Style Properties

Style properties specify custom look and feel, such as color and border styles. The specification uses the box model and style properties defined in the Cascading Style Sheets level 2 specification [CSS2] and also introduces a few new properties for an extended layout model for XForms. Note that the XForms Working Group is aware that the definition of new CSS properties is beyond the scope of our work. The additional style properties mentioned in this chapter are meant as an initial basis for discussions with the CSS Working Group. Style properties can be specified via style sheets, and changed via scripts though the DOM.

Some common properties include:

- `display`: used to hide or display the form control
- `width`: the width of the form control
- `height`: the height of the form control
- `border`: (and related longhand properties) the style of the form control's border
- `caption-style`: Style for the form control label.

Note that interpretation of attributes like `height` are dependent on the layout model we use.

The new `caption-style` style property may be used to specify the position of the caption text

relative to the form control. The value is top, left, right, bottom or hidden. It may be used together with the CSS *text-align* property to set left, center or right alignment.

The above list is illustrative; for the exhaustive list of CSS style properties, refer to the CSS specification.

Common Child Elements

The `caption` element

This element labels the form control with a descriptive summary. The caption makes it possible for someone who can't see the form controls to obtain a short description as they navigate between form controls. This element is required. It contains inline content as defined by XHTML. Attributes `xml:lang`, `class` and `style` can be used to further qualify the `caption` element. Attribute `style` on element `caption` styles the caption text; attribute `captionStyle` on the form control containing the caption determines the position of the caption text relative to the associated form control.

The `help` element

This element provides a longer description that will help users to understand how to fill out this form control. The `help` text will normally be shown only on request. This optional element contains inline content as defined by XHTML. Attributes `xml:lang`, `class` and `style` can be used to further qualify the help element. Attribute `style` on element `help` styles the caption text; attribute `helpStyle` on the containing form control determines the position of the help text relative to the associated form control.

The `hint` element

This optional element provides a short hint for the user, typically represented as a tooltip by graphical XForms Processors. The tooltip text will normally be shown when the user remains on the form control for more than a certain length of time. It contains inline content as defined by XHTML. Attributes `xml:lang`, `class` and `style` can be used to further qualify the `hint` element. Attribute `style` on element `hint` styles the `hint` text; attribute `hintStyle` on the containing form control determines the position of the `hint` text relative to the associated form control.

The `onevent` element

This element can be used to bind event handlers to form controls. It is defined in [XHTML Events]. Details on XForms events can be found in the Reference Processing Model chapter.

8.2.2 anyNavControl

The abstract form control `anyNavControl` represents any navigable form control. It is based on `anyControl`, sharing all its attributes and stylable properties. The following attributes are additionally defined:

`accesskey`

This attribute defines a short cut for moving the input focus directly to a particular form control. The value of this attribute is a string. This is typically a single character which when pressed together with a platform specific modifier key (e.g. the *alt* key) results in the focus being set to this form control.

`navindex`

This attribute is a non-negative integer used to define the navigation sequence. This gives the author control over the sequence in which form controls are traversed.

The default navigation order is a depth first traversal of the hierarchy of form controls.

8.3 Core Form Controls

The following form controls are defined in terms of the abstract form control on which they are based in terms of syntax. Unless noted otherwise, all form controls here are treated as inline text for purposes of XHTML processing.

8.3.1 Hidden

Issue: Given a separate XForms Model that can store data values not visible to the end user, is there a need for a "hidden" form control, perhaps for compatibility with XHTML forms?

8.3.2 Output

Description: The `output` form control allows the display of a view of a data value, typically as part of other content. The resulting form control cannot be modified by the user.

Based On: `anyControl`

Syntax Definition: The element name is `output`.

Example:

```
The total comes to <output ref="order/totalPrice"/>
```

The `output` form control may be used in a `caption` , for instance when authors want to say: "I charged you 100.0 - and here is why".

8.3.3 Text Entry

Description: allows for the single or multiple line entry of text values.

Based On: `anyNavControl`

Syntax Definition: The element name is `textbox`.

Two additional attributes, `rows` and `cols` specify a number to be used as the form control's height and width in characters, respectively. `rows` defaults to 1. Note that these do not constrain the amount of text that can be entered.

[Ed. We need a default for `cols`.]

Example:

```
<textbox ref="order/shipTo/street">
  <caption>Street<caption>
  <help>Please enter the number and street name</help>
</textbox>
```

8.3.4 Checkbox

Description: allows for binary (yes/no) input.

Based On: `anyNavControl`

Syntax Definition: The element name is `checkbox`.

Example:

```
<checkbox ref="questionaire/married">
  <caption>Are you married?</caption>
  <help>We need this to determine your tax allowance</help>
</checkbox>
```

The `checkbox` element is used for yes/no questions.

8.3.5 Single Select: radio buttons, drop-down menus and list boxes

Description: allows for various representations of form controls that allow the user to choose one option out of many.

Based On: `anyNavControl`

Syntax Definition: The element name is `exclusiveSelect`. One or more child `item` elements define the caption text for an individual radio button or menu item, with an optional attribute of `value`, which specifies the associated value to be used in the instance data.

Example:

```
<exclusiveSelect ref="icecream/flavor">
  <caption>Flavor</caption>
  <item value="a">Vanilla</item>
  <item value="b">Strawberry</item>
  <item value="c">Chocolate</item>
</exclusiveSelect>
```

These constructs are used to encapsulate various forms of selection. We support two broad classes of selection characterized by the type of data being obtained from the user. When the XForms Model allows the user to pick one or more from a set of choices, the type of the underlying instance is a container; contrast this with the case where the XForms Model permits the user to pick **only one**. We parallel this distinction in the user interface markup by introducing elements `multipleSelect` and `exclusiveSelect`.

User interfaces typically support a wide range of selection widgets characterized by distinctive appearances and behaviors. We capture these distinctions e.g., pull down list versus a combo box, via `style` attributes on elements `exclusiveSelect` and `multipleSelect`.

The `list-ui` style property must be one of the following values:

- `radio`
- `checkbox`
- `menu`
- `listbox`

Each option may have a platform-specific behavior.

[Ed. We need a default representation, to be used in the absence of a style sheet.]

The items are bound to the choices in the data type in the lexical order in which they appear in the markup. This avoids the need to redundantly name things in both the presentation markup and in the XForms Model.

Layout can be handled through the automated layout mechanisms described later, or can use absolute positioning via style properties.

Accessibility requirement: long lists of choices are easier to use if they are grouped in some way, preferably with associated captions. Is there a need for hierarchical menus? An `itemgroup` or empty `separator` element would do the trick.

8.3.6 Multiple Select: Lists

Description: allows for various representations of form controls that allow the user to choose several options out of many.

Based On: `anyNavControl`

Syntax Definition: The element name is `multipleSelect`. One or more child `item` elements are allowed, as for `exclusiveSelect`.

Example:

```
<multipleSelect ref="icecream/flavors">
  <caption>Flavors</caption>
  <item value="a">Vanilla</item>
  <item value="b">Strawberry</item>
  <item value="c">Chocolate</item>
</multipleSelect>
```

This construct can be used to populate structures like `array` in the XForms Model.

8.3.7 Buttons

Description: similar to the XHTML form control of the same name, allows for one-time actions to occur.

Based On: `anyNavControl`

Syntax Definition: The element name is `button`. The attribute `action` may contain an XForms Dynamic Constraint to call when the form control is activated.

Example:

```
<button action="city = 'London'; state = 'Ontario'">
  <caption>Set Values</caption>
</button>
```

The `button` element is derived from XHTML. It allows you to submit the instance data, or to set one or more data values at the same time. The caption is generally shown on the face of the button.

8.3.8 Submit

Description: a specific control for submitting the instance data.

Based On: `button`

Syntax Definition: The element name is `submit`. The attribute `action` defaults to the binding expression `submit()`. The attribute `to` of type `xsd:IDREF` points to a `<submit>` element that defines the specifics of where and how to submit the instance data.

Example:

```
<submit ref="instance::foo" to="...">
  <caption>Send XML</caption>
</submit>
```

The binding expression on submit should select the instance data that will be submitted.

In future revisions, we will define similar controls, like `reset` or `suspend`.

8.3.9 Future Work

The XForms Working Group is continuing to investigate and design additional controls for use within the XForms User Interface. These include sliders, spin controls, rotary controls, image maps, tree controls, and scrolling record controls.

8.4 Custom Form Controls

The following section outlines some of our ideas for reusing user interface markup.

8.4.1 Custom Pickers

Custom pickers allow us to create reusable user interface components. Just as we can define data types and structures that can be reused within the XForms Model, reusable user interface components allow us to design complex XForms using the basic building blocks described above, and then reuse these components in multiple situations. As with any component framework, this has two basic requirements:

- Components need to declare what aspects of the component are parameterizable by the caller.
- The caller needs to be able to override the default values of the parameters declared in the component.

Here, we describe such a component framework along with sample markup. For this example, assume that `USShippingAddress` is a reusable data type that is used in multiple places in the XForms Model, e.g. the user will be asked for a `billingAddress` and `shippingAddress` --both of type `USShippingAddress`.

First, we show a simple example that is designed to bind a user interface to a model item of type `USShippingAddress` with no attention to making the component reusable.

```
<groupbox>
  <textbox ref="address/street">
    <caption>Please enter your street address</caption>
  </textbox>
  <textbox ref="address/zip">
    <caption>Zip Code</caption>
  </textbox>
</groupbox>
```

Next, we prepare the above XForms Model fragment to become a reusable component that could be used for obtaining both the shipping and billing address. To do this, we need to parameterize those portions of the *component* that the caller will wish to modify.

```
<component name="AddressWidget" dataType="USShippingAddress">
  <param name="streetPrompt"/>
  <param name="zipPrompt"/>
  <param name="border" value="line"/>
  <groupbox border="$border">
    <textbox ref="address/street">
      <caption>
        <value-of name="streetPrompt"/>
      </caption>
    </textbox>
    <textbox ref="address/zip">
      <caption>
        <value-of name="zipPrompt"/>
      </caption>
    </textbox>
  </groupbox>
</component>
```

Note that the UI component as defined above does not create a user interface; user interface is created by explicitly instantiating the component via element `use-component` described next.

Finally, we use this component to instantiate the user interface for obtaining the shipping and billing address.

```
<use-component name="address" component="AddressWidget">
  <with-param name="streetPrompt">
    Shipping Street Address
  </with-param>
  <with-param name="zipPrompt">
    Zip Code for state where we are shipping to
  </with-param>
  <with-param name="border" value="dotted"/>
</use-component>
```

The reusable component is instantiated by element `use-component`; parameter values are specified by the contained `with-param` elements.

8.5 Multiple Pages

The following section outlines some of our ideas for allowing multiple-page forms.

8.5.1 Subpages

Subpages provide a means to present XForms one bit at a time, breaking a complex task into smaller, simpler parts. Presentation of a subpage can occupy the entire "page" or just part of a page. Different presentations are possible, e.g. a stack of *pages* with visible name tags, or as a set of

buttons for flipping through the stack or navigating directly to a particular subpage. One possible representation is a `formset` element enclosing one or more `subpage` elements, each of which starts with a `caption` element.

As the name implies `subpage` is not specific to XForms --our intent is to design `subpage` so that it can be used within XForms --and more generally within XHTML to create presentations where document views are presented to progressively reveal the document structure and content.

8.6 Layout

The following section outlines some of our ideas for making XForms independent from any particular presentation technology, for example XHTML tables.

Note: All style properties used by XForms to specify layout will be as defined by the CSS working group.

8.6.1 Grouping

The `groupbox` element is used as a container for defining a hierarchy of form controls. A groupbox element can contain other groupbox elements.

The hierarchy defined by nested groupbox elements is used to determine the traversal order specified by attribute `navindex` on form controls. Setting the input focus on a group box results in the focus being set to the lowest form control in the tabbing order within that group box.

[Ed. Currently, `groupbox` is being used to both group controls and provide binding context. It is an open issue whether the binding attribute `ref` is allowed here.]

8.6.2 Additional Style Properties

The following are preliminary ideas intended to start a dialog with the CSS Working Group and other interested parties.

Element `groupbox` allows the following additional layout attributes to control the layout of the form controls being packed inside the container. The `layout` property can be used to control whether the form controls within a group box are laid out from left to right or top to bottom. The value of the property is `horizontal`, `vertical` or `inherit`. It can be used together with CSS padding properties.

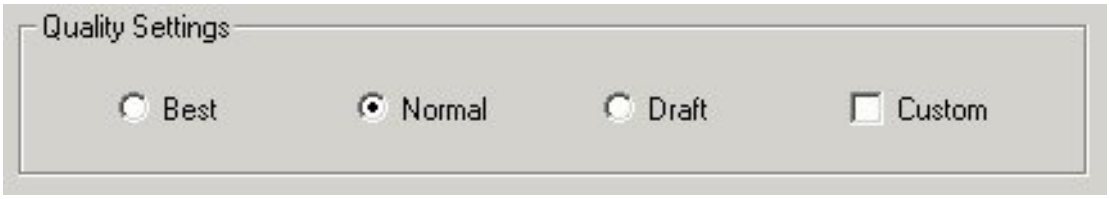
As we develop the layout model, we may factor out some of the more common behaviors desired of element `groupbox` into elements such as `grid` to avoid overloading element `groupbox` with multiple functions.

The `field-align` property controls the amount of whitespace between the caption and the form control so as to ensure the desired alignment of all the form controls within the group box. The value of the property can be one of: `left`, `right`, `top`, `bottom`, `center`, `justify` or `inherit`. The default is `justify`.

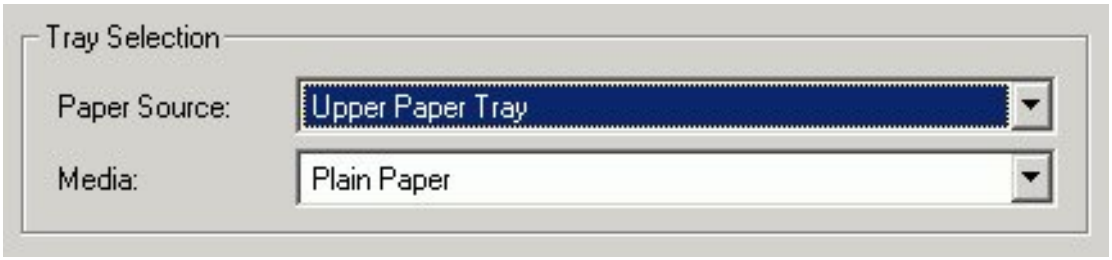
[Ed. This could meet our requirement to not be dependent on XHTML tables.].

The width and height of a group box can be set via the corresponding CSS properties. The default is to size the box to the minimum needed for the contents of the group box. Setting the width to 100% ensures that the box is the maximum width permitted by the enclosing CSS block.

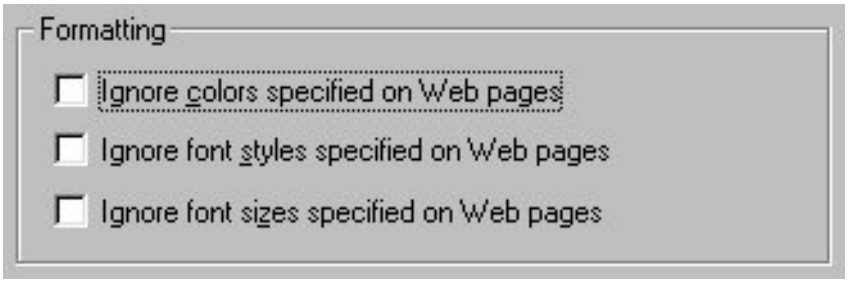
In the following example, the form controls are laid out horizontally and justified to fill the available space.



Here is another example, but this time with a vertical layout:



To justify the form controls for a vertical layout, the XForms Processor adjusts the spacing between each form control and its caption. In the next example, the `field-align` property has been set to *left*. As a result, the spacing between the controls and the caption is the same for all form controls.



8.6.3 Grid Layout

Sometimes a simple horizontal or vertical layout is not enough. The next example uses a grid layout:

Note that we plan to introduce distinct markup elements for grouping constructs like grids --rather than overloading element `groupbox`.

Note: "in" in the example is an output form control that can display either "in" or "cm".

Grid layout is potentially complex, and further study is needed to find the most appropriate solution for XForms. Here are several possibilities:

- Use explicit positioning for each form control. This is how most Windowing systems specify dialog boxes. It is common for the form controls to be constrained to positions on a grid with a spacing relative to the dialog font size. A subtlety is to make text input form controls use the same baseline as the caption text. This is a simple approach, and works fine provided the width and height of the group box are fixed.
- Use explicit positioning, but distinguish between hard and soft spacings. The soft spacings are adjusted automatically to match the width and height of the group box, and the font size etc. This is inspired by the approach used by Donald Knuth for T_EX.
- Use a style property on form controls to force that form control to appear on the next row, e.g. `break-before`. This could be combined with another style property to specify which form controls need to be vertically aligned with one another. One possibility for this is a named tab stop (such as "foo" in `tab-stop: foo`), where the position of the stop is determined automatically by the XForms Processor. Another possibility is to define a penalty scheme where layout engine adjusts the positioning to minimize the sum over the positioning penalties. This approach would involve little or no effort on behalf of the author.
- Use explicit markup for each row, either a container element similar to XHTML's table row element <tr>...</tr> or an empty element such as
- A generalization is to allow explicit markup to divide the remaining space up progressively horizontally or vertically, similar to the mechanism provided by XHTML's frames.

Issue: What about "repeating structures" when these are specified in the XForms Model? One possibility is a record set control which allows users to add and delete records, where all of the records satisfy the same XForms Model. An example is a line item in an order form, consisting of the quantity, product code and unit price.

8.6.4 Text and graphics

It is often desirable to include graphics and additional text within group boxes, for instance, the following uses graphics to illustrate the idea of printing in black & white versus printing in color.

Group boxes can, in principle, include graphics marked up using the XHTML `img` element, or vector graphics marked up in SVG etc.

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9 Binding

Contents

This chapter is normative.

9.1 Introduction

Binding is the glue that connects the separate pieces of XForms -- the XForms Model, instance data, and form controls. The binding is independent of the language used in the XForms Model (Schema or simple syntax) and also independent of the user interface language used.

Binding has been designed with the following design rationale:

1. Authoring simplicity ("keep the simple things simple and the hard things possible")
2. Leveraging of existing standards, like XPath and XLink
3. support for multiple instances per XForms Model
4. support for multiple XForms Models per document
5. protocol independence (notably tricky for multiple instances)

A future revision of the binding specification will address reuse across XForms Models, for instance declaring an "address" in one place and reusing it in another.

9.2 Binding Attributes

XForms defines an attribute `ref` that can be placed on any form control. When placed on form controls outside of XForms, it must be appropriately namespaced. The value of the attribute is a binding expression, based on the XForms Dynamic Constraints Language, that links the form control to a particular location in the instance data (and therefore a particular model item). For example:

XForms User Interface Markup with Binding Attributes

```
<xfm:textbox ref="binding-expression">
   <xfm:caption>Your first name</xfm:caption>
</xfm:textbox>
```

The `ref` attribute links the form control to the instance data and XForms Model declared elsewhere in the containing document.

This can also be used on non-XForms form controls, for instance XHTML:

XHTML with Binding Attributes

```
<html:input type="text" name="ncname" xfm:ref="binding-expression" />
```

Here the `ref` attribute links an XHTML form control to the instance data and XForms Model contained elsewhere in the containing document. Note that the `html:` prefix is used here to represent the XHTML namespace.

Details on legal binding expressions are given throughout the rest of this chapter.

9.3 Binding in the Presence of a Single Model

When a containing document has only a single XForms Model and a single set of instance data, binding is simpler because there is no possibility of ambiguity as to which XForms Model and instance data will participate. The following syntax can be used for the binding expression:

- A binding expression (with the context node set to the `<instance>` element) that evaluates to an element or attribute in the instance data.

For example:

Binding Expression with an XForms Dynamic Constraint

```
<xfm:textbox ref="orderForm/shipTo/firstName">
...
```

Here the `ref` attribute specifies a path through the instance data to the desired location.

Instance Data

```
<orderForm>
  <shipTo>
    <firstName>value</firstName>
  </shipTo>
</orderForm>
```

Here is the optional instance data for the above example.

Note that the binding expression implies the structure of the instance data.

A special case applies when binding to an element in the instance data that contains an attribute of type `xsd:ID`. In this case, an XPath function `id()` , can be used:

Binding Expression with XPath id() Syntax

```
<xfm:textbox ref="id('myfirstname')">
...
```

Here the `ref` attribute specifies a link to an instance data element with an id of `myfirstname`.

Instance Data

```
<a>
  <b id="myfirstname">value</b>
</a>
```

Here is the required instance data for the above example.

For this syntax to be valid, the following conditions must be true:

- there is exactly one instance
- the instance data is included in the same document as the user interface
- every referenced element in the instance data is marked with a valid ID (i.e. the ID is unique throughout the whole document)
- there are no Dynamic Constraints used to determine the data element to be referenced. (Note that this does not prevent changing the IDREF through scripting)

Note also that:

- this method is limited, because it requires exactly one instance, decorated with ID attributes.
- It is still legal to have undecorated elements in the instance.
- Only elements can be addressed.

9.4 Binding in the Presence of Multiple Models

One design goal of XForms is to support multiple forms per page. This is accomplished by having multiple XForms Models within a containing document. Each XForms Model might have separate instance data defined. This makes binding slightly more complex, because the correct instance data elements need to be referenced.

[Ed. The case where a single XForms Model has more than one instance data section is not dealt with in this revision of the specification. The Working Group is discussing ways to accomplish this. Additionally, when discussing how to describe repeating structures (arrays), we have to revisit this.]

The default context node for a binding expression is the first `<instance>` element in document order. To indicate a different instance, binding expressions can use a syntax similar to XPath axis specifiers. The axis specifier is `instance::`, and serves to reset the context node for the remainder of the binding expression to the `<instance>` element with the matching `id`. The binding expression is in error if there is no matching `id`. For example:

Binding Expression Specifying Non-default Instance Data

```
<xfm:textbox ref="instance::b/orderForm/shipTo/firstName">
...
```

Here the `ref` attribute specifies a link to an instance data element with an id of `myfirstname`.

Instance Data

```
<xfm:instance href="..."/>
<xfm:instance id="b">
  <orderForm>
    <shipTo>
      <firstName>value</firstName>
    </shipTo>
  </orderForm>
</xfm:instance>
```

Here is the instance data for the above example.

In cases where there is no explicitly specified instance data, the `model::` axis can be used to select the virtual instance data associated with an XForms Model.

[Ed. This syntax is under discussion and does not yet have full Working Group consensus.

In many cases, it may be undesirable for the user interface markup to refer to specific instance data identifiers or contain lengthy binding expressions. XForms allows the binding expression to appear in a separate element `<bind>`, a sibling to `<model>` and `<instance>`.

The attributes of `<bind>` are `id` of type `xsd:ID` and `ref` which takes a binding expression. When a binding expression is defined this way, the form control can reference the `id` of the `<bind>` element, as seen here:

Binding Expression Using Indirection

```
<xfm:textbox ref="id('myfirstname')">
...
```

Here the `ref` attribute specifies a link to a binding expression defined elsewhere.

Instance Data

```
<xfm:bind id="myfirstname" ref="orderForm/shipTo/firstName""/>
<xfm:instance>
  <orderForm>
    <shipTo>
      <firstName>value</firstName>
    </shipTo>
  </orderForm>
</xfm:instance>
```

Here is the instance data for the above example.

The binding expression used on the form control looks suspiciously like our first example. So, what have we actually won?

- it is no longer necessary to add IDs to the instance
- the binding supports multiple models and multiple instances
- The binding mechanism is *independent* of the schema and user interface mechanisms.
- The resources can be pulled together from various locations via URIs
- XPointer can be used to minimize the binding expressions

Acknowledgments: The editor would like to thank Kai Scheppe, Malte Wedel and Götz Bock for lots of constructive criticism on early versions of this document and their contributions to its present content.

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10 Processing Model and Conformance

Contents

This chapter is normative.

10.1 Introduction

This chapter is currently under development and discussion in the XForms Working Group, and does not yet represent consensus.

The XForms Reference Processing Model is intended as a normative explanation of the components, predictive behavior, and mechanisms for interacting with XForms Processors. It is not intended to constrain implementations; any implementation that produces the specified results and meets conformance guidelines can be considered conforming.

Design Rationale

The processing model set out in this chapter will:

- Identify components and stages of the processing model
- Define predictive behavior for XForms Processors
- Define device independent mechanisms for user interaction
- Provide compatibility with existing form processing

10.2 Components

An XForms Processor can be considered as having the following components. Not every component is necessary in every case:

- Containing document(s), for instance XHTML
- XForms Model (specification)
- Instance data - (specification)

- XForms User Interface (specification) or other UI
- Implementation-specific Presentation
- Binding - (specification)

Note that XForms User Interface and Presentation are treated as separate by the processing model. XForms User Interface refers to the markup (specification) that defines form controls, while presentation here refers to the implementation-specific presentation controls, for instance a Macintosh edit box control. As defined below, there is not necessarily a one to one correspondence; for instance the XForms Specific Property `relevant` might dynamically determine whether a form control is available in the presentation.

For ease of authoring, certain XForms elements may be omitted in common cases. Under discussion are:

- `<instance>` may be optional when the initial state for every `<model>` is empty.
- `<model>` may be optional when a simple, flat XForms Model can be inferred from the XForms User Interface.
- Binding may be optional when only a single `<model>`, `<submit>`, `<instance>` and UI are specified.
- `<submit>` is required whenever a submit action is defined.

10.3 Processing Stages

An XForms Processor can be considered as performing the following processing steps, in no particular order. Not every step will be performed in every case:

- Initialization
- Deinitialization
- User interaction
- Mapping from XForms User Interface to presentation
- Validation
- Suspension of user interaction
- Resumption of user interaction
- Instance data submission

Future revisions of this document will define the processing steps for each of the above cases.

10.4 Events

XForms will use the DOM Level 2 and XHTML events syntax. Under discussion are the following events:

- xforms-construct
- xforms-destruct
- xforms-interactive-value-changing
- xforms-value-changing
- xforms-notify-value-changed
- xforms-submit

- xforms-reset
- xforms-suspend
- xforms-resume
- xforms-refresh
- xforms-exception

DOM Level 2 events require a target node. The definition of the target node for each event is under discussion. Future revisions of this document will provide descriptions and semantics for each of the above event types.

10.5 XForms Submit Protocol

The XForms processing model provides three different formats for persisting instance data.

- application/x-www-form-urlencoded
- multipart/form-data
- text/xml

The following sections describe how to instance data is prepared for submission.

10.5.1 application/x-www-form-urlencoded

This format is intended to facilitate the integration of XForms into HTML forms processing environments, and represents an extension of the [XHTML 1.0] form content type of the same name that expresses the hierarchical nature of XForms state information.

This format is not suitable for the persistence of binary content. Therefore, it is recommended that XForms capable of containing binary content use either the multipart/form-data or text/xml formats.

The XForms Working Group would appreciate feedback on whether application/x-www-form-urlencoded is necessary.

Note: Also under discussion is the intent to have the data be UTF8 encoded; however, this is dependent upon IETF developments.

The steps for building this persistence format is as follows:

1. Prepare a new UTF-8 encoded string buffer to hold the persisted XForms state information
2. Beginning with the root element of the instance data, iterate over the content of the instance in document order and build an ordered set of strings by performing the following steps:
    1. For each element with an attribute :
        - Append, to the set, a string of the format "*path=value*" where *path* is the [XPath] AbsoluteLocationPath that refers to each attribute, and *value* is the character content of each attribute (urlencoded if necessary)
    2. For each element enclosing character content:
        - Append, to the set, a string of the format "*path=value*" where *path* is the [XPath] AbsoluteLocationPath that refers to the element, and *value* is the character content of the element (urlencoded if necessary)

3. For each element enclosing element content:
    - Continue the iteration
3. Append the strings from the ordered set together, delimiting the strings with an ampersand (&) character, and place the result of the append into the UTF-8 encoded string buffer of step #1

Example:

application/x-www-form-urlencoded

```
/PersonName/PersonTitle=Mr&/PersonName/FirstName=Roland
```

This format consists of sets of an AbsoluteLocationPath paired with a value.

Corresponding Instance Data

```
<PersonName>
  <PersonTitle>Mr</PersonTitle>
  <FirstName>Roland</FirstName>
</PersonName>
```

Here is the instance data for the above example.

10.5.2 multipart/form-data

This format is intended to facilitate the integration of XForms into HTML forms processing environments, and represents an extension of the [XHTML 1.0] form content type of the same name that expresses the hierarchical nature of XForms state information. Unlike the application/x-www-form-urlencoded format, this format is suitable for the persistence of binary content.

This format follows the rules of all multipart MIME data streams as outlined in [RFC 2045]. Each part is expected to contain:

1. A "Content-Disposition" header whose value is "form-data"
2. A name attribute specifying the [XPath] AbsoluteLocationPath of the corresponding value from the instance data. Names originally encoded in non-ASCII character sets may be encoded using the method outlined in .

Example:

multipart/form-data

```
Content-Type: multipart/form-data; boundary=AaB03x
--AaB03x
  Content-Disposition: form-data; name="/PersonName/PersonTitle"

Mr
--AaB03x
  Content-Disposition: form-data; name="/PersonName/FirstName"

Roland
--AaB03x

...possibly more data...

--AaB03x-
```

This format consists of sets of an AbsoluteLocationPath paired with a value.

Corresponding Instance Data

```
<PersonName>
  <PersonTitle>Mr</PersonTitle>
  <FirstName>Roland</FirstName>
</PersonName>
```

Here is the instance data for the above example.

Binary Content

Each part may be encoded and the "Content-Transfer-Encoding" header supplied if the value of that part does not conform to the default (7 bit) encoding.

Where a value within the instance data represents binary content, the value should be identified by the appropriate content type (e.g., "application/octet-stream"). If multiple values of binary content are to be returned as the result of a single model item, they should be returned as "multipart/mixed" embedded within the "multipart/form-data".

The XForms Processor may wish to supply a file name for each value of binary content. The file name may be specified with the "filename" parameter of the 'Content-Disposition: form-data' header, or in the case of multiple values of binary content, in a 'Content-Disposition: file' header of the subpart. If the file name of the client's operating system is not in US-ASCII, the file name might be approximated or encoded using the method of [RFC 2045]. This is convenient for those cases where, for example, the uploaded files might contain references to each other (e.g., a TeX file and its ".sty" auxiliary style description).

10.5.3 text/xml

This format permits the expression of the XForms state information as an XML-based format that is straightforward to process with off-the-shelf XML processing tools. In addition, this format is suitable for the persistence of binary content.

The steps for building this persistence format is as follows:

1. Prepare a new empty XML document to hold the persisted XForms state information
2. If there is one child element of the `<instance>` node:
    1. Serialize, into the XML document of step #1, the entire content of the `<instance>` node
3. If there are multiple child elements of the `<instance>` node:
    1. Create a root element of `<xfm:instance>` in the XML document of step #1. Note that a prefix and namespace declaration will be needed. Any prefix may be used, not just `xfm`.
    2. Serialize, into the root element, the entire content of the `<instance>` node

Binary Content

Handling of binary content will likely be based on the ongoing work in the XML Protocol Working Group.

Where a value within the instance data represents binary content, can we store meta-information with an `xfm:mediaType` attribute reflecting the appropriate content type (e.g., "image/jpg")?

10.6 Conformance

XForms have been designed for use among a wide variety of XForms Processors, of varying size and resource constraints. Because of this, multiple conformance levels are being discussed. This chapter will be updated in the future with more details.

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Appendix A: Schema for XForms Model

Contents

A.1 XForms Model Schema

```
<?xml version="1.0"?>
<xsd:schema  xmlns:xsd="http://www.w3.org/2000/10/XMLSchema"
  xmlns="http://www.w3.org/2000/12/xforms"
  targetNamespace="http://www.w3.org/2000/12/xforms"
  xmlns:xfm="http://www.w3.org/2000/12/xforms"
  elementFormDefault="qualified">
<!--

  We actually need to import the schema for XMLSchema, to use the
  <xsd:schema> element. Commented out temporarily to avoid problems
  with some schema validators.

  <xsd:import namespace="http://www.w3.org/2000/10/XMLSchema"/>

  -->

<!--

  Defines the schema for the XForm <model> element, and everything
  contained in it. This includes the XForms defined data types, and XForms
  specific properties whose values are dynamic, and may may change at
  runtime. It also contains a definition of the XForms Simple Syntax
  elements, which can be used as an alternative to XML syntax, for
  defining the XForms model's elements.

  -->
<!--

      XForms structure element definitions.

  -->

<!--

  Definition of the xform container element.

  -->
  <xsd:element name="xform">
    <xsd:complexType>
```

```
      <xsd:choice maxOccurs="unbounded">
        <xsd:element ref="model"/>
        <xsd:element ref="instance"/>
        <xsd:element ref="submit"/>
        <xsd:element ref="bind"/>
      </xsd:choice>
      <xsd:attribute name="id" type="xsd:ID" use="optional"/>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of top-level model element.

  -->
  <xsd:element name="model">
    <xsd:complexType>
       <xsd:choice>
        <xsd:element ref="xsd:schema"/>
        <xsd:element ref="simple"/>
        <xsd:sequence>
          <xsd:element ref="xsd:schema"/>
          <xsd:element ref="simple"/>
        </xsd:sequence>
      </xsd:choice>
      <xsd:attribute name="id" type="xsd:ID" use="optional"/>
      <xsd:attribute name="name" type="xsd:NCName" use="optional"/>
      <xsd:attribute name="href" type="xsd:uriReference" use="optional"/>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of top-level instance element.

  -->
  <xsd:element name="instance">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:any namespace="##any" processContents="skip"
          maxOccurs="unbounded"/>
      </xsd:sequence>
      <xsd:attribute name="id" type="xsd:ID" use="optional"/>
      <xsd:attribute name="model" type="xsd:IDREF" use="optional"/>
      <xsd:attribute name="href" type="xsd:uriReference" use="optional"/>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of top-level submit element.

  -->
  <xsd:element name="submit">
    <xsd:complexType>
      <xsd:attribute name="id" type="xsd:ID" use="optional"/>
      <xsd:attribute name="target" type="xsd:uriReference" use="required"/>
```

```
      <xsd:attribute name="method" type="xsd:string" use="optional"/>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of top-level bind element.

  -->
  <xsd:element name="bind">
    <xsd:complexType>
      <xsd:attribute name="id" type="xsd:ID" use="optional"/>
      <xsd:attribute name="ref" type="xsd:string" use="optional"/>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of XForms expression type.
  Note: we need to replace this with a real XForm expression type,
  if we can manage to define one that fits our expression language,
  if there is a way to do that using XML Schema (may be possible
  with the correct combination of string & patterns).

  -->
  <xsd:simpleType name="xfmExpr">
    <xsd:restriction base="xsd:string"/>
  </xsd:simpleType>

<!--

  XForms types used in attribute group definitions.
  Note: all of these are simple derivations from xfmExpr. we need to
  change them to enforce the desired typed result, if there is a way
  to do that using XML schema.

  -->

<!--

  Definition of stringExpr type, used for expressions that must
  return a String value.

  -->
  <xsd:simpleType name="stringExpr">
    <xsd:union memberTypes="xsd:string xfmExpr" />
  </xsd:simpleType>

<!--

  Definition of boolExpr type, used for expressions that must
  return a Boolean value.

  -->
  <xsd:simpleType name="boolExpr">
    <xsd:union memberTypes="xsd:boolean xfmExpr" />
  </xsd:simpleType>
```

```
<!--

  Definition of numberExpr type, used for expressions that must
  return a Number value.

  -->
  <xsd:simpleType name="numberExpr">
    <xsd:union memberTypes="xsd:decimal xfmExpr" />
  </xsd:simpleType>

<!--

  Definition of positiveIntExpr type, used for expressions that must
  return a positive integer value.

  -->
  <xsd:simpleType name="positiveIntExpr">
    <xsd:union memberTypes="xsd:positiveInteger xfmExpr" />
  </xsd:simpleType>

<!--

  Definition of dateExpr type, used for expressions that must
  return a Date value.

-->
  <xsd:simpleType name="dateExpr">
    <xsd:union memberTypes="xsd:date xfmExpr" />
  </xsd:simpleType>

<!--

  Definition of timeExpr type, used for expressions that must
  return a Time value.

-->
  <xsd:simpleType name="timeExpr">
    <xsd:union memberTypes="xsd:time xfmExpr" />
  </xsd:simpleType>

<!--

  Definition of durationExpr type, used for expressions that must
  return a Duration value.

-->
  <xsd:simpleType name="durationExpr">
    <xsd:union memberTypes="xsd:timeDuration xfmExpr" />
  </xsd:simpleType>

<!--

  Definition of schemeExpr type, used for expressions that must
  return a list of zero or more scheme values.
  Scheme is used to restrict the value space of
```

```
  URIs to specific URI schemes.

-->

  <xsd:simpleType name="schemeType">
    <xsd:restriction base="xsd:string">
      <xsd:pattern value="[a-z]+"/>
    </xsd:restriction>
  </xsd:simpleType>

  <xsd:simpleType name="schemeExpr">
    <xsd:union memberTypes="schemeType xfmExpr" />
  </xsd:simpleType>

<!--

  Definition of uriExpr type, used for expressions that must
  return a URI value.

-->
  <xsd:simpleType name="uriExpr">
    <xsd:union memberTypes="xsd:uriReference xfmExpr" />
  </xsd:simpleType>

<!--

  Definition of mediaTypeExpr type, used for expressions that must
  return a list of zero or more MediaType values.  MediaType is
  used to restrict the value space of Binary elements to one or
  more MIME media Types.

-->

  <xsd:simpleType name="mediaTypeType">
    <xsd:restriction base="xsd:string">
      <xsd:pattern value="[a-z]+/[a-z]+"/>
    </xsd:restriction>
  </xsd:simpleType>

  <xsd:simpleType name="mediaTypeExpr">
    <xsd:union memberTypes="mediaTypeType xfmExpr" />
    <xsd:restriction base="xfmExpr"/>
  </xsd:simpleType>

<!--

  Definition of binaryExpr type, used for expressions that must
  return a Binary value.

-->
  <xsd:simpleType name="binaryExpr">
    <xsd:union memberTypes="xsd:binary xfmExpr" />
  </xsd:simpleType>


<!--
```

```
  Definition of currencyType type, a type used for a single,
  3-character currency code.

-->
  <xsd:simpleType name="currencyType">
      <xsd:restriction base="xsd:string">
        <xsd:pattern value="[A-Z]{3}"/>
      </xsd:restriction>
  </xsd:simpleType>

<!--

  Definition of currencyExpr type, used for expressions that must
  return a list of zero or more 3-character currency codes.

-->

  <xsd:simpleType name="currencyExpr">
    <xsd:union memberTypes="currencyType xfmExpr" />
  </xsd:simpleType>

<!--
    XForms Specific Properties attribute groups
  -->
  <xsd:attributeGroup name="XFSPcommonMinusEnum">
    <xsd:attribute name="id" type="xsd:ID" use="optional"/>
    <xsd:attribute name="required" type="boolExpr"
      use="default" value="false"/>
    <xsd:attribute name="readOnly" type="boolExpr"
      use="default" value="false"/>
    <xsd:attribute name="relevant" type="boolExpr"
      use="default" value="true"/>
    <xsd:attribute name="validate" type="boolExpr"
      use="default" value="true"/>
  </xsd:attributeGroup>

  <xsd:attributeGroup name="XFSPcommon">
    <xsd:attributeGroup ref="XFSPcommonMinusEnum"/>
    <xsd:attribute name="enum" use="optional">
      <xsd:simpleType>
        <xsd:restriction base="xsd:NMTOKEN">
          <xsd:enumeration value="open"/>
          <xsd:enumeration value="closed"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:attribute>
  </xsd:attributeGroup>

  <xsd:attributeGroup name="XFSPname">
    <xsd:attribute name="name" type="xsd:NCName" use="required"/>
  </xsd:attributeGroup>

  <xsd:attributeGroup name="XFSPcommonMinusEnumSimple">
    <xsd:attributeGroup ref="XFSPname"/>
    <xsd:attributeGroup ref="XFSPcommonMinusEnum"/>
  </xsd:attributeGroup>
```

```
  <xsd:attributeGroup name="XFSPcommonSimple">
    <xsd:attributeGroup ref="XFSPname"/>
    <xsd:attributeGroup ref="XFSPcommon"/>
  </xsd:attributeGroup>

<!--

  Attribute group defining @calc and @choices.  choices is an
  expression that returns a list of enumerated, properly typed
  values at runtime.  calc returns a single value of the
  correct type, at runtime.

-->
  <xsd:attributeGroup name="XFSPcalcAndChoices">
    <xsd:attribute name="calc" type="xfmExpr" use="optional"/>
    <xsd:attribute name="choices" type="xfmExpr" use="optional"/>
  </xsd:attributeGroup>

  <xsd:attributeGroup name="XFSPcalcAndChoicesString">
    <xsd:attribute name="calc" type="stringExpr" use="optional"/>
    <xsd:attribute name="choices" type="stringExpr" use="optional"/>
  </xsd:attributeGroup>

  <xsd:attributeGroup name="XFSPcalcAndChoicesBoolean">
    <xsd:attribute name="calc" type="boolExpr" use="optional"/>
    <xsd:attribute name="choices" type="boolExpr" use="optional"/>
  </xsd:attributeGroup>

  <xsd:attributeGroup name="XFSPcalcAndChoicesNumber">
    <xsd:attribute name="calc" type="numberExpr" use="optional"/>
    <xsd:attribute name="choices" type="numberExpr" use="optional"/>
  </xsd:attributeGroup>

  <xsd:attributeGroup name="XFSPcalcAndChoicesDate">
    <xsd:attribute name="calc" type="dateExpr" use="optional"/>
    <xsd:attribute name="choices" type="dateExpr" use="optional"/>
  </xsd:attributeGroup>

  <xsd:attributeGroup name="XFSPcalcAndChoicesTime">
    <xsd:attribute name="calc" type="timeExpr" use="optional"/>
    <xsd:attribute name="choices" type="timeExpr" use="optional"/>
  </xsd:attributeGroup>

  <xsd:attributeGroup name="XFSPcalcAndChoicesDuration">
    <xsd:attribute name="calc" type="durationExpr" use="optional"/>
    <xsd:attribute name="choices" type="durationExpr" use="optional"/>
  </xsd:attributeGroup>

  <xsd:attributeGroup name="XFSPcalcAndChoicesURI">
    <xsd:attribute name="calc" type="uriExpr" use="optional"/>
    <xsd:attribute name="choices" type="uriExpr" use="optional"/>
  </xsd:attributeGroup>

  <xsd:attributeGroup name="XFSPcalcAndChoicesBinary">
    <xsd:attribute name="calc" type="binaryExpr" use="optional"/>
    <xsd:attribute name="choices" type="binaryExpr" use="optional"/>
  </xsd:attributeGroup>
```

```
  <xsd:attributeGroup name="XFSPcalcAndChoicesCurrency">
    <xsd:attribute name="calc" type="currencyExpr" use="optional"/>
    <xsd:attribute name="choices" type="currencyExpr" use="optional"/>
  </xsd:attributeGroup>

  <!-- applied to Number, and Money -->
  <xsd:attributeGroup name="XFSPmmNumber">
    <xsd:attribute name="minInclusive" type="numberExpr" use="optional"/>
    <xsd:attribute name="minExclusive" type="numberExpr" use="optional"/>
    <xsd:attribute name="maxInclusive" type="numberExpr" use="optional"/>
    <xsd:attribute name="maxExclusive" type="numberExpr" use="optional"/>
  </xsd:attributeGroup>

  <!--
  -->
  <xsd:attributeGroup name="XFSPmmNumberSimple">
    <xsd:attribute name="min" type="numberExpr" use="optional"/>
    <xsd:attribute name="max" type="numberExpr" use="optional"/>
  </xsd:attributeGroup>

  <!--
  -->
  <!-- applied to Date -->
  <xsd:attributeGroup name="XFSPmmDate">
    <xsd:attribute name="minInclusive" type="dateExpr" use="optional"/>
    <xsd:attribute name="minExclusive" type="dateExpr" use="optional"/>
    <xsd:attribute name="maxInclusive" type="dateExpr" use="optional"/>
    <xsd:attribute name="maxExclusive" type="dateExpr" use="optional"/>
  </xsd:attributeGroup>

<!--
 -->
  <xsd:attributeGroup name="XFSPmmDateSimple">
    <xsd:attribute name="min" type="dateExpr" use="optional"/>
    <xsd:attribute name="max" type="dateExpr" use="optional"/>
  </xsd:attributeGroup>
<!--
  -->
<!-- applied to Duration -->

  <xsd:attributeGroup name="XFSPmmDuration">
    <xsd:attribute name="minInclusive" type="durationExpr" use="optional"/>
    <xsd:attribute name="minExclusive" type="durationExpr" use="optional"/>
    <xsd:attribute name="maxInclusive" type="durationExpr" use="optional"/>
    <xsd:attribute name="maxExclusive" type="durationExpr" use="optional"/>
  </xsd:attributeGroup>

<!--
  -->
  <xsd:attributeGroup name="XFSPmmDurationSimple">
    <xsd:attribute name="min" type="durationExpr" use="optional"/>
    <xsd:attribute name="max" type="durationExpr" use="optional"/>
  </xsd:attributeGroup>

<!--
  -->
```

```
<!-- applied to Time -->
  <xsd:attributeGroup name="XFSPmmTime">
    <xsd:attribute name="minInclusive" type="timeExpr" use="optional"/>
    <xsd:attribute name="minExclusive" type="timeExpr" use="optional"/>
    <xsd:attribute name="maxInclusive" type="timeExpr" use="optional"/>
    <xsd:attribute name="maxExclusive" type="timeExpr" use="optional"/>
  </xsd:attributeGroup>

<!--
  -->
  <xsd:attributeGroup name="XFSPmmTimeSimple">
    <xsd:attribute name="min" type="timeExpr" use="optional"/>
    <xsd:attribute name="max" type="timeExpr" use="optional"/>
  </xsd:attributeGroup>

<!--
  -->
<!-- applied to String, Binary, URI -->
  <xsd:attributeGroup name="XFSPlengthNumber">
    <xsd:attribute name="length" type="positiveIntExpr"
      use="optional"/>
    <xsd:attribute name="minLength" type="positiveIntExpr"
      use="optional"/>
    <xsd:attribute name="maxLength" type="positiveIntExpr"
      use="optional"/>
</xsd:attributeGroup>

<!--
  -->
  <xsd:attributeGroup name="XFSPlengthNumberSimple">
    <xsd:attribute name="length" type="positiveIntExpr" use="optional"/>
    <xsd:attribute name="min" type="positiveIntExpr" use="optional"/>
    <xsd:attribute name="max" type="positiveIntExpr" use="optional"/>
  </xsd:attributeGroup>

<!--
  -->
  <!-- applied to Number, and Money -->
  <xsd:attributeGroup name="XFSPspNumber">
    <xsd:attribute name="scale" type="positiveIntExpr" use="optional"/>
    <xsd:attribute name="precision" type="positiveIntExpr" use="optional"/>
  </xsd:attributeGroup>

<!--

  XForms basic Data types for Models in Schema syntax

-->

<!--

  Definition of string type.

-->
  <xsd:complexType name="string">
    <xsd:complexContent>
```

```
      <xsd:extension base="xsd:string">
        <xsd:attributeGroup ref="XFSPcommon"/>
        <xsd:attributeGroup ref="XFSPlengthNumber"/>
        <xsd:attributeGroup ref="XFSPcalcAndChoicesString"/>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>

<!--

  Definition of boolean type.

-->
  <xsd:complexType name="boolean">
    <xsd:complexContent>
      <xsd:extension base="xsd:boolean">
        <xsd:attributeGroup ref="XFSPcommonMinusEnum"/>
        <xsd:attribute name="calc" type="boolExpr" use="optional"/>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>

<!--

  Definition of number type.

  -->
  <xsd:complexType name="number">
    <xsd:complexContent>
      <xsd:extension base="xsd:decimal">
        <xsd:attributeGroup ref="XFSPcommon"/>
        <xsd:attributeGroup ref="XFSPmmNumber"/>
        <xsd:attributeGroup ref="XFSPspNumber"/>
        <xsd:attributeGroup ref="XFSPcalcAndChoicesNumber"/>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>

<!--

  Definition of currency type.

-->
  <xsd:complexType name="currency">
    <xsd:complexContent>
      <xsd:extension base="currencyType">
        <xsd:attributeGroup ref="XFSPcommon"/>
        <xsd:attributeGroup ref="XFSPcalcAndChoicesCurrency"/>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>

<!--

  Definition of money type.
  Alternative B: compound datatype
```

```
-->
  <xsd:complexType name="money">
    <xsd:sequence>
      <xsd:element name="value">
        <xsd:complexType>
          <xsd:simpleContent>
            <xsd:extension base="xsd:decimal">
              <xsd:attribute name="calc" type="numberExpr"/>
            </xsd:extension>
          </xsd:simpleContent>
        </xsd:complexType>
      </xsd:element>
      <xsd:element name="currency">
        <xsd:complexType>
          <xsd:simpleContent>
            <xsd:extension base="currencyType">
              <xsd:attribute name="calc" type="currencyExpr"/>
            </xsd:extension>
          </xsd:simpleContent>
        </xsd:complexType>
      </xsd:element>
<!--
      allow zero or more allowCurrency elements to restrict
      the value space of money.
  -->
      <xsd:element name="allowCurrency" type="currencyExpr"
        minOccurs="0" maxOccurs="unbounded"/>
    </xsd:sequence>
    <xsd:attributeGroup ref="XFSPcommon"/>
    <xsd:attributeGroup ref="XFSPmmNumber"/>
    <xsd:attributeGroup ref="XFSPspNumber"/>
  </xsd:complexType>

<!--

  Definition of date type.

  -->
  <xsd:complexType name="date">
    <xsd:complexContent>
      <xsd:extension base="xsd:date">
        <xsd:attributeGroup ref="XFSPcommon"/>
        <xsd:attributeGroup ref="XFSPmmDate"/>
        <xsd:attributeGroup ref="XFSPcalcAndChoicesDate"/>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>

<!--

  Definition of time type.

  -->
  <xsd:complexType name="time">
    <xsd:complexContent>
      <xsd:extension base="xsd:time">
        <xsd:attributeGroup ref="XFSPcommon"/>
```

```
        <xsd:attributeGroup ref="XFSPmmTime"/>
        <xsd:attributeGroup ref="XFSPcalcAndChoicesTime"/>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>

<!--

  Definition of duration type.

  -->
  <xsd:complexType name="duration">
    <xsd:complexContent>
      <xsd:extension base="xsd:timeDuration">
        <xsd:attributeGroup ref="XFSPcommon"/>
        <xsd:attributeGroup ref="XFSPmmDuration"/>
        <xsd:attributeGroup ref="XFSPcalcAndChoicesDuration"/>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>

<!--
  -->
<!--

  Definition of uri type.

  -->
  <xsd:complexType name="uri">
    <xsd:complexContent>
      <xsd:extension base="xsd:uriReference">
        <xsd:sequence>
          <!--
            allow zero or more scheme elements to restrict
            the value space of the uri.
          -->
          <xsd:element name="scheme" type="schemeExpr"
            minOccurs="0" maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:attributeGroup ref="XFSPcommon"/>
        <xsd:attributeGroup ref="XFSPlengthNumber"/>
        <xsd:attributeGroup ref="XFSPcalcAndChoicesURI"/>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>

<!--

  Definition of binary type.

-->
  <xsd:complexType name="binary">
    <xsd:complexContent>
      <xsd:extension base="xsd:binary">
        <xsd:sequence>
      <!--
          allow zero or more mediaType elements to restrict
```

```
          the value space of the binary.
      -->
          <xsd:element name="mediaType" type="mediaTypeExpr"
            minOccurs="0" maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:attributeGroup ref="XFSPcommon"/>
        <xsd:attributeGroup ref="XFSPlengthNumber"/>
        <xsd:attributeGroup ref="XFSPcalcAndChoicesBinary"/>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>

<!--

  XForms simple syntax element definitions
  Structure elements, followed by datatype elements.

-->

<!--

  Definition of the simple element, used to contain the simple syntax element
declarations.

  -->
  <xsd:element name="simple">
    <xsd:complexType>
      <xsd:choice maxOccurs="unbounded">
        <xsd:element ref="string"/>
        <xsd:element ref="boolean"/>
        <xsd:element ref="number"/>
        <xsd:element ref="currency"/>
        <xsd:element ref="money"/>
        <xsd:element ref="date"/>
        <xsd:element ref="time"/>
        <xsd:element ref="duration"/>
        <xsd:element ref="uri"/>
        <xsd:element ref="binary"/>
        <xsd:element ref="element"/>
        <xsd:element ref="array"/>
        <xsd:element ref="group"/>
        <xsd:element ref="switch"/>
        <xsd:element ref="union"/>
      </xsd:choice>
      <xsd:attribute name="id" type="xsd:ID" use="optional"/>
      <xsd:attribute name="name" type="xsd:NCName" use="optional"/>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of simple syntax group element.

  -->
  <xsd:element name="group">
    <xsd:complexType>
      <xsd:choice maxOccurs="unbounded">
```

```
        <xsd:element ref="string"/>
        <xsd:element ref="boolean"/>
        <xsd:element ref="number"/>
        <xsd:element ref="currency"/>
        <xsd:element ref="money"/>
        <xsd:element ref="date"/>
        <xsd:element ref="time"/>
        <xsd:element ref="duration"/>
        <xsd:element ref="uri"/>
        <xsd:element ref="binary"/>
        <xsd:element ref="element"/>
        <xsd:element ref="switch"/>
        <xsd:element ref="union"/>
      </xsd:choice>
      <xsd:attributeGroup ref="XFSPname"/>
    </xsd:complexType>
  </xsd:element>


<!--
  The occurs attribute group used on array.
  -->
  <xsd:attributeGroup name="occurs">
    <xsd:attribute name="minOccurs" use="default" value="1">
      <xsd:simpleType>
        <xsd:union memberTypes="xfmExpr xsd:nonNegativeInteger"/>
      </xsd:simpleType>
    </xsd:attribute>
    <xsd:attribute name="maxOccurs" use="default" value="1">
      <xsd:simpleType>
        <xsd:union memberTypes="xfmExpr xsd:nonNegativeInteger">
          <xsd:simpleType>
            <xsd:restriction base="xsd:NMTOKEN">
              <xsd:enumeration value="unbounded"/>
            </xsd:restriction>
          </xsd:simpleType>
        </xsd:union>
      </xsd:simpleType>
    </xsd:attribute>
  </xsd:attributeGroup>

<!--

  Definition of simple syntax array element.
  Issue: should we allow switches or unions?

-->
  <xsd:element name="array">
    <xsd:complexType>
      <xsd:choice>
        <xsd:element ref="string"/>
        <xsd:element ref="boolean"/>
        <xsd:element ref="number"/>
        <xsd:element ref="currency"/>
        <xsd:element ref="money"/>
        <xsd:element ref="date"/>
```

```
        <xsd:element ref="time"/>
        <xsd:element ref="duration"/>
        <xsd:element ref="uri"/>
        <xsd:element ref="binary"/>
        <xsd:element ref="element"/>
      </xsd:choice>
      <xsd:attribute name="name" type="xsd:NCName" use="optional"/>
      <xsd:attributeGroup ref="occurs"/>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of simple syntax union element.

  Note: the schema for <union> requires a name attribute on its
  child datatypes because it simply reuses their definitions, which do.
  The spec says name isn't required on child datatypes.  This is a known
inconsistency that will be fixed in a future version.

-->
  <xsd:element name="union">
    <xsd:complexType>
      <xsd:choice maxOccurs="unbounded">
        <xsd:element ref="string"/>
        <xsd:element ref="boolean"/>
        <xsd:element ref="number"/>
        <xsd:element ref="currency"/>
        <xsd:element ref="money"/>
        <xsd:element ref="date"/>
        <xsd:element ref="time"/>
        <xsd:element ref="duration"/>
        <xsd:element ref="uri"/>
        <xsd:element ref="binary"/>
      </xsd:choice>
      <xsd:attributeGroup ref="XFSPname"/>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of simple syntax switch element.

  -->
  <xsd:element name="switch">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element name="case" maxOccurs="unbounded">
          <xsd:complexType>
            <xsd:choice maxOccurs="unbounded">
              <xsd:element ref="string"/>
              <xsd:element ref="boolean"/>
              <xsd:element ref="number"/>
              <xsd:element ref="currency"/>
              <xsd:element ref="money"/>
              <xsd:element ref="date"/>
              <xsd:element ref="time"/>
```

```
              <xsd:element ref="duration"/>
              <xsd:element ref="uri"/>
              <xsd:element ref="binary"/>
              <xsd:element ref="element"/>
              <xsd:element ref="group"/>
              <xsd:element ref="array"/>
            </xsd:choice>
            <xsd:attributeGroup ref="XFSPname"/>
            <xsd:attribute name="condition" type="xfmExpr" use="optional"/>
          </xsd:complexType>
        </xsd:element>
      </xsd:sequence>
      <xsd:attributeGroup ref="XFSPname"/>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of simple syntax element element.

  -->
  <xsd:element name="element" id="element">
    <xsd:complexType>
      <xsd:attribute name="type" type="xsd:QName" use="required"/>
      <xsd:attributeGroup ref="XFSPcommonMinusEnumSimple"/>
    </xsd:complexType>
  </xsd:element>

<!--
  Definition of the mask facet, used in strings and currency,
  in simple syntax only.
  Modeled after WAP/WML's format attribute.
  -->
  <xsd:simpleType name="maskType">
    <xsd:restriction base="xsd:string">
      <xsd:pattern
  value="((A|a|X|x|N|n|M|m)|(\\.))*([0-9\*](A|a|X|x|N|n|M|m))?"/>
    </xsd:restriction>
  </xsd:simpleType>

  <xsd:simpleType name="maskExpr">
    <xsd:union memberTypes="maskType xfmExpr"/>
  </xsd:simpleType>

<!--

  Definition of simple syntax string element.

  -->
  <xsd:element name="string" id="string">
    <xsd:complexType>
      <xsd:complexContent>
        <xsd:extension base="xsd:string">
          <xsd:sequence>
            <!-- allow zero or more masks or patterns, but not a mixture -->
            <xsd:choice minOccurs="0" maxOccurs="unbounded">
              <xsd:element name="mask" type="maskType"
```

```
                minOccurs="0" maxOccurs="unbounded"/>
            <xsd:element name="pattern" type="xsd:string"
                minOccurs="0" maxOccurs="unbounded"/>
          </xsd:choice>
          <!-- allow zero or more enumerations -->
          <xsd:element name="value" type="xsd:string"
              minOccurs="0" maxOccurs="unbounded"/>
        </xsd:sequence>
        <xsd:attributeGroup ref="XFSPcommonSimple"/>
        <xsd:attributeGroup ref="XFSPlengthNumber"/>
        <xsd:attributeGroup ref="XFSPcalcAndChoicesString"/>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
</xsd:element>

<!--

  Definition of simple syntax boolean element.

  -->
  <xsd:element name="boolean">
    <xsd:complexType>
      <xsd:complexContent>
        <xsd:extension base="xsd:boolean">
          <xsd:attributeGroup ref="XFSPcommonMinusEnumSimple"/>
          <xsd:attribute name="calc" type="boolExpr" use="optional"/>
        </xsd:extension>
      </xsd:complexContent>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of simple syntax number element.

  -->
  <xsd:element name="number">
    <xsd:complexType>
      <xsd:complexContent>
        <xsd:extension base="xsd:decimal">
          <xsd:sequence>
            <!-- allow zero or more enumerations -->
            <xsd:element name="value" type="xsd:decimal"
              minOccurs="0" maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attributeGroup ref="XFSPcommonSimple"/>
          <xsd:attributeGroup ref="XFSPmmNumberSimple"/>
          <xsd:attributeGroup ref="XFSPspNumber"/>
          <xsd:attributeGroup ref="XFSPcalcAndChoicesNumber"/>
        </xsd:extension>
      </xsd:complexContent>
    </xsd:complexType>
  </xsd:element>

<!--
```

```
  Definition of simple syntax currency element.

  -->
  <xsd:element name="currency">
    <xsd:complexType>
      <xsd:complexContent>
        <xsd:extension base="currencyType">
          <xsd:sequence>
            <!-- allow zero or more masks -->
            <xsd:element name="mask" type="maskType"
              minOccurs="0" maxOccurs="unbounded"/>
            <!-- allow zero or more enumerations -->
            <xsd:element name="value" type="currencyType"
              minOccurs="0" maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attributeGroup ref="XFSPcommonSimple"/>
          <xsd:attributeGroup ref="XFSPcalcAndChoices"/>
        </xsd:extension>
      </xsd:complexContent>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of simple syntax money element.
  Alternative B: compound datatype

  -->
  <xsd:element name="money">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element name="value">
          <xsd:complexType>
            <xsd:simpleContent>
              <xsd:extension base="xsd:decimal">
                <xsd:attribute name="calc" type="numberExpr"/>
              </xsd:extension>
            </xsd:simpleContent>
          </xsd:complexType>
        </xsd:element>
        <xsd:element name="currency">
          <xsd:complexType>
            <xsd:simpleContent>
              <xsd:extension base="currencyType">
                <xsd:attribute name="calc" type="currencyExpr"/>
              </xsd:extension>
            </xsd:simpleContent>
          </xsd:complexType>
        </xsd:element>
<!--
        allow zero or more allowCurrency elements to restrict
        the value space of money.
  -->
        <xsd:element name="allowCurrency" type="currencyExpr"
          minOccurs="0" maxOccurs="unbounded"/>
      </xsd:sequence>
      <xsd:attributeGroup ref="XFSPcommonSimple"/>
```

```
      <xsd:attributeGroup ref="XFSPmmNumberSimple"/>
      <xsd:attributeGroup ref="XFSPspNumber"/>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of simple syntax date element.

  -->
  <xsd:element name="date">
    <xsd:complexType>
      <xsd:complexContent>
        <xsd:extension base="xsd:date">
          <xsd:sequence>
            <!-- allow zero or more enumerations -->
            <xsd:element name="value" type="xsd:date"
              minOccurs="0" maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attributeGroup ref="XFSPcommonSimple"/>
          <xsd:attributeGroup ref="XFSPmmDateSimple"/>
          <xsd:attribute name="precision" use="optional">
            <xsd:simpleType>
              <xsd:restriction base="xsd:NMTOKEN">
                <xsd:enumeration value="years"/>
                <xsd:enumeration value="months"/>
                <xsd:enumeration value="days"/>
              </xsd:restriction>
            </xsd:simpleType>
          </xsd:attribute>
          <xsd:attributeGroup ref="XFSPcalcAndChoicesDate"/>
        </xsd:extension>
      </xsd:complexContent>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of simple syntax time element.

  -->
  <xsd:element name="time">
    <xsd:complexType>
      <xsd:complexContent>
        <xsd:extension base="xsd:time">
          <xsd:sequence>
            <!-- allow zero or more enumerations -->
            <xsd:element name="value" type="xsd:time"
              minOccurs="0" maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attributeGroup ref="XFSPcommonSimple"/>
          <xsd:attributeGroup ref="XFSPmmTimeSimple"/>
          <xsd:attribute name="precision" use="optional">
            <xsd:simpleType>
              <xsd:restriction base="xsd:NMTOKEN">
                <xsd:enumeration value="hours"/>
```

```
              <xsd:enumeration value="minutes"/>
              <xsd:enumeration value="seconds"/>
            </xsd:restriction>
          </xsd:simpleType>
        </xsd:attribute>
        <xsd:attributeGroup ref="XFSPcalcAndChoicesTime"/>
      </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>
</xsd:element>

<!--

  Definition of simple syntax duration element.

  -->
  <xsd:element name="duration">
    <xsd:complexType>
      <xsd:complexContent>
        <xsd:extension base="xsd:timeDuration">
          <xsd:sequence>
            <!-- allow zero or more enumerations -->
            <xsd:element name="value" type="xsd:timeDuration"
              minOccurs="0" maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attributeGroup ref="XFSPcommonSimple"/>
          <xsd:attributeGroup ref="XFSPmmDurationSimple"/>
          <xsd:attribute name="precision" use="optional">
            <xsd:simpleType>
              <xsd:restriction base="xsd:NMTOKEN">
                <xsd:enumeration value="years"/>
                <xsd:enumeration value="months"/>
                <xsd:enumeration value="days"/>
                <xsd:enumeration value="hours"/>
                <xsd:enumeration value="minutes"/>
                <xsd:enumeration value="seconds"/>
              </xsd:restriction>
            </xsd:simpleType>
          </xsd:attribute>
          <xsd:attributeGroup ref="XFSPcalcAndChoicesDuration"/>
        </xsd:extension>
      </xsd:complexContent>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of simple syntax uri element.

  -->
  <xsd:element name="uri">
    <xsd:complexType>
      <xsd:complexContent>
        <xsd:extension base="xsd:uriReference">
          <xsd:sequence>
            <!-- allow zero or more scheme qualifiers -->
            <xsd:element name="scheme" type="schemeExpr"
```

```
              minOccurs="0" maxOccurs="unbounded"/>
            <!-- allow zero or more enumerations -->
            <xsd:element name="value" type="xsd:uriReference"
              minOccurs="0" maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attributeGroup ref="XFSPcommonSimple"/>
          <xsd:attributeGroup ref="XFSPlengthNumberSimple"/>
          <xsd:attributeGroup ref="XFSPcalcAndChoicesURI"/>
        </xsd:extension>
      </xsd:complexContent>
    </xsd:complexType>
  </xsd:element>

<!--

  Definition of simple syntax binary element.

  -->
  <xsd:element name="binary">
    <xsd:complexType>
      <xsd:complexContent>
        <xsd:extension base="xsd:binary">
          <xsd:sequence>
            <!-- allow zero or more mediaType qualifiers -->
            <xsd:element name="mediaType" type="mediaTypeExpr"
              minOccurs="0" maxOccurs="unbounded"/>
            <!-- allow zero or more enumerations -->
            <xsd:element name="value" type="xsd:binary"
              minOccurs="0" maxOccurs="unbounded"/>
          </xsd:sequence>
          <xsd:attributeGroup ref="XFSPcommonSimple"/>
          <xsd:attributeGroup ref="XFSPlengthNumberSimple"/>
          <xsd:attributeGroup ref="XFSPcalcAndChoicesBinary"/>
        </xsd:extension>
      </xsd:complexContent>
    </xsd:complexType>
  </xsd:element>
</xsd:schema>
```

Appendix B: XSLT from Simple to Schema Syntax

Contents

B.1 XSLT

The following non-normative XSLT can be used to convert XForms simple syntax into XML Schema syntax.

```
<?xml version='1.0'?>

<!-- NOTE: this XSLT transforms a XForms simple syntax into an
     XML Schema conforming to the October 24, 2000 candidate
     recomendation -->

<xsl:transform version="1.0"
               xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
               xmlns:xsd="http://www.w3.org/2000/10/XMLSchema"
               xmlns="http://www.w3.org/2000/10/XMLSchema"
               xmlns:xfm="http://www.w3.org/2000/12/xforms" >

<xsl:strip-space elements="xform"/>

<xsl:output method="xml" indent="yes" encoding="UTF-8"
            standalone="no" />


<!-- the special indicator used for maxOccurs to mean unbounded -->
<xsl:variable name="maxOccursSpecial">*</xsl:variable>
<!-- the special value used for maxLength to mean unbounded -->
<xsl:variable name="maxLengthSpecial">unlimited</xsl:variable>
<!-- the special value used for min to mean minus infinity -->
<xsl:variable name="minInfinity">minus infinity</xsl:variable>
<!-- the special value used for max to mean plus infinity -->
<xsl:variable name="maxInfinity">plus infinity</xsl:variable>
<!-- the special value used for scale to mean unlimited decimals -->
<xsl:variable name="unlimitedScale">unlimited</xsl:variable>
<!-- the special value used for precision to mean unlimited precision -->
<xsl:variable name="unlimitedPrecision">unlimited</xsl:variable>

<!-- the list of WML classes -->
<xsl:variable name="classesList" >AaNnXxMm</xsl:variable>
<xsl:variable name="classesTrans">01234567</xsl:variable>
```

```
<!-- special characters to escape in patterns -->
<xsl:variable name="specialCharacters">\|.-^?*+{}()[]</xsl:variable>


<!-- template:   match="/"
     function:   matches the root node, calls the template "xform" for
                 all &lt;xform> elements. drops any other elements.
     parameters: none
     output:     &lt;schema> skeleton.
-->
<xsl:template match="/">
    <xsl:element name="xsd:schema">
        <xsl:element name="xsd:annotation">
            <xsl:element name="xsd:documentation">
<xsl:text>Automatically generated from an XForms data model.</xsl:text>

<xsl:text>Using</xsl:text>
<xsl:value-of select="system-property('xsl:vendor')"/>
<xsl:text>at XSL version</xsl:text>
<xsl:value-of select="format-number(system-property('xsl:version'),
                                    '#0.0')"/>.

<xsl:if test="system-property('xsl:version') &gt; 1.0">
Note, the stylesheet was designed for a XSLT version 1.0 processor.
</xsl:if>
            </xsl:element>
        </xsl:element>
        <!-- output the xform -->
        <xsl:apply-templates />
    </xsl:element>
</xsl:template>


<!--
xform element
-->
<!-- template:   match="xform"
     function:   matches an xform, calls the templates for all childs
     parameters: none
     output:     none of it's own
-->
<xsl:template match="xform">
  <!-- output the elements -->
  <xsl:apply-templates />
</xsl:template>


<!--
model element
-->
<!-- template:   match="model"
     function:   matches an xform, calls the templates for all childs
     parameters: none
     output:     none of it's own
-->
```

```
<xsl:template match="model">
  <!-- output the elements -->
  <xsl:apply-templates />
</xsl:template>


<!--
schema element
-->
<!-- template:   match="schema"
     function:   matches an schema, and copies the inlined schema definition
                 to the result tree
     parameters: none
     output:     copy of the input
-->
<xsl:template match="xsd:schema">
  <!-- copy XML Schema definition -->
  <xsl:copy-of select="node()"/>
</xsl:template>


<!--
simple element
-->
<!-- template:   match="simple"
     function:   matches an simple, and processes the child elements
     parameters: none
     output:     none of its own
-->

<xsl:template match="simple">
  <!-- output the elements -->
  <xsl:apply-templates />
</xsl:template>


<!--
isntance element
-->

<!-- template:   match="instance"
     function:   filters the instance
     parameters: none
     output:     none
-->
<xsl:template match="instance"/>


<
binding element
-->
<!-- template:   match="binding"
     function:   filters the binding
     parameters: none
     output:     none
```

```
-->
<xsl:template match="binding"/>



<!--
submit element
-->

<!-- template:   match="submit"
     function:   filters the submit elements
     parameters: none
     output:     none
-->
<xsl:template match="submit"/>




<!--
group element
-->
<!-- template:   matches="group"
     function:   converts the group into a complex type and processes
                 all childs
     parameters: none
     output:     a complex type representing the group
-->
<xsl:template match="group">
  <xsl:element name="xsd:element">
    <xsl:attribute name="name">
      <xsl:value-of select="@name"/>
    </xsl:attribute>
    <!-- check attributes -->
    <xsl:call-template name="checkAttributes"/>

    <xsl:element name="xsd:complexType">
      <xsl:element name="xsd:complexContent">
        <xsl:element name="xsd:extension">
          <!-- check for a base -->
          <xsl:attribute name="base">xsd:anyType</xsl:attribute>
          <!-- the rest of the elements are always a sequence -->
          <xsl:element name="xsd:sequence">
            <!-- include all chile elements -->
            <xsl:apply-templates/>
          </xsl:element>
        </xsl:element>
      </xsl:element>
    </xsl:element>
  </xsl:element>
</xsl:template>



<!--
```

```
union element
-->
<!-- template:   matches="union"
     function:   converts a union into a union of simpleTypes.
     parameters: none
     output:     converted definition
-->
<xsl:template match="union">
  <xsl:choose>
    <xsl:when test="string-length(@name)=0">
      <xsl:message terminate="no">
        An anonymous union definition is not supported.
      </xsl:message>
      <xsl:comment> Anonymous union definition dropped </xsl:comment>
    </xsl:when>
    <xsl:otherwise>
      <xsl:element name="xsd:element">
        <xsl:attribute name="name">
          <xsl:value-of select="@name"/>
        </xsl:attribute>
        <!-- check common attributes -->
        <xsl:call-template name="checkAttributes"/>

        <xsl:element name="xsd:simpleType">
          <xsl:element name="xsd:union">
            <xsl:apply-templates />
          </xsl:element>
        </xsl:element>
      </xsl:element>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>



<!--
switch element
-->

<!-- template:   matches="switch"
     function:   converts the switch into a choice and processes all
                 cases
     parameters: none
     output:     a choice representing the variant
-->
<xsl:template match="switch">
  <xsl:choose>
    <xsl:when test="string-length(@name)=0">
      <xsl:message terminate="no">
        An anonymous variant definition is not supported.
      </xsl:message>
      <xsl:comment> Anonymous variant definition dropped </xsl:comment>
    </xsl:when>
    <xsl:otherwise>
      <xsl:element name="xsd:element">
```

```
        <xsl:attribute name="name">
          <xsl:value-of select="@name"/>
        </xsl:attribute>
        <!-- check common attributes -->
        <xsl:call-template name="checkAttributes"/>

        <xsl:element name="xsd:complexType">
          <xsl:element name="xsd:complexContent">
            <xsl:element name="xsd:extension">
              <xsl:attribute name="base">xsd:anyType</xsl:attribute>
              <xsl:element name="xsd:choice">
                <xsl:apply-templates select="case"/>
              </xsl:element>
            </xsl:element>
          </xsl:element>
        </xsl:element>
      </xsl:element>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>


<!--
case element
-->

<!-- template:   matches="caase"
     function:   converts the case into a sequence of other elements
     parameters: none
     output:     a sequence representing the case
-->
<xsl:template match="case">
  <xsl:element name="xsd:sequence">
    <xsl:if test="string-length(@name) &gt; 0">
      <xsl:attribute name="xfm:name">
        <xsl:value-of select="@name"/>
      </xsl:attribute>
    </xsl:if>
    <xsl:if test="string-length(@condition) &gt; 0">
      <xsl:attribute name="xfm:condition">
        <xsl:value-of select="@condition"/>
      </xsl:attribute>
    </xsl:if>

    <!-- include elements -->
    <xsl:apply-templates />

  </xsl:element>
</xsl:template>




<!--
string element
```

```
-->

<!-- template:   matches="string"
     function:   converts a string.
     parameters: none
     output:     converted definition
     note:       it is assumed that all value childs
                 conform to all other restrictions, otherwise their
                 value will be allowed despide the further
                 restrictions.
-->
<xsl:template match="string">
  <!-- create definition -->
  <xsl:variable name="definition">

    <xsl:element name="xsd:simpleType">
      <xsl:choose>
        <!-- if we have a closed range, or no enumeration value, we can
             create a simple type -->
        <xsl:when test="@enum='closed' or
                        count(value)=0">
          <xsl:element name="xsd:restriction">
            <xsl:attribute name="base">xsd:string</xsl:attribute>
            <xsl:call-template name="restrictString"/>
            <xsl:apply-templates select="value"/>
          </xsl:element>
        </xsl:when>
        <xsl:otherwise>
          <xsl:element name="xsd:union">
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
                <xsl:attribute name="base">xsd:string</xsl:attribute>
                <xsl:call-template name="restrictString"/>
                <xsl:apply-templates select="value"/>
              </xsl:element>
            </xsl:element>
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
                <xsl:attribute name="base">xsd:string</xsl:attribute>
                <xsl:call-template name="restrictString"/>
              </xsl:element>
            </xsl:element>
          </xsl:element>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:element>
  </xsl:variable>

  <!-- if we have a name, we can create an element or attribute,
       otherwise we're part of a union -->
  <xsl:choose>
    <xsl:when test="string-length(@name) &gt; 0">
      <!-- create element or attribute -->
      <xsl:element name="xsd:element">
        <xsl:attribute name="name">
```

```
          <xsl:value-of select="@name"/>
        </xsl:attribute>
        <!-- check common attributes -->
        <xsl:call-template name="checkAttributes"/>

        <xsl:choose>
          <!-- if we have no children, and no other restrictions,
               we can make a short definition -->
          <xsl:when test='count(child::node())=0 and @minLength="0" and
                          @maxLength="unlimited" and
                          string-length(@pattern)=0 and
                          string-length(@mask)=0'>
            <xsl:attribute name="type">xsd:string</xsl:attribute>
          </xsl:when>
          <xsl:otherwise>
            <!-- dump full definition -->
            <xsl:copy-of select="$definition"/>
          </xsl:otherwise>
        </xsl:choose>
      </xsl:element>
    </xsl:when>
    <xsl:otherwise>
      <!-- just dumpe definition -->
      <xsl:copy-of select="$definition"/>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>

<!-- template:   name="restrictString"
     function:   add erstrictions to a string
     parameters: a string context node with the following attributes
                     @maxLength
                     @minLength
                     @mask
                     @pattern
                 and the following child elements
                     <pattern/>
                     <mask/>
     output:     elements to represent the restrictions
-->
<xsl:template name="restrictString">
  <!-- create pattern -->
  <xsl:variable name="pattern">
    <xsl:for-each select="mask|pattern">
      <xsl:text>(</xsl:text>
      <xsl:choose>
         <xsl:when test='name()="mask"'>
          <xsl:call-template name="make-pattern">
            <xsl:with-param name="mask">
              <xsl:value-of select="."/>
            </xsl:with-param>
          </xsl:call-template>
        </xsl:when>
        <xsl:otherwise>
          <xsl:value-of select="."/>
```

```
      </xsl:otherwise>
    </xsl:choose>
    <xsl:text>)</xsl:text>
    <xsl:if test="not(position()=last())">
      <xsl:text>|</xsl:text>
    </xsl:if>
  </xsl:for-each>

  <xsl:if test="@mask">
    <xsl:if test="count(mask|pattern) &gt; 0">
      <xsl:text>|</xsl:text>
    </xsl:if>
    <xsl:text>(</xsl:text>
    <xsl:call-template name="make-pattern">
      <xsl:with-param name="mask">
        <xsl:value-of select="@mask"/>
      </xsl:with-param>
    </xsl:call-template>
    <xsl:text>)</xsl:text>
  </xsl:if>

  <xsl:if test="@pattern">
    <xsl:if test="string-length(@mask) &gt; 0 and
                  count(mask|pattern) &gt; 0">
      <xsl:text>|</xsl:text>
    </xsl:if>
    <xsl:text>(</xsl:text>
    <xsl:value-of select="@pattern"/>
    <xsl:text>)</xsl:text>
  </xsl:if>
</xsl:variable>

<!-- check if @length is an non negative integer -->
<xsl:variable name="lengthIsNNI">
  <xsl:call-template name="checkNonNegInt">
    <xsl:with-param name="test">
      <xsl:value-of select="@length"/>
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>

<!-- check if @max is an non negative integer -->
<xsl:variable name="maxIsNNI">
  <xsl:call-template name="checkNonNegInt">
    <xsl:with-param name="test">
      <xsl:value-of select="@max"/>
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>

<!-- check if @min as an non negative integer -->
<xsl:variable name="minIsNNI">
  <xsl:call-template name="checkNonNegInt">
    <xsl:with-param name="test">
      <xsl:value-of select="@min"/>
```

```
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>

<!-- write xfm:length restriction -->
<xsl:if test="string-length(@length) &gt; 0 and
              not(@length=$maxLengthSpecial) and
              $lengthIsNNI='false'">
  <xsl:attribute name="xfm:length">
    <xsl:value-of select="@length"/>
  </xsl:attribute>
</xsl:if>

<!-- write xfm:maxLength restriction -->
<xsl:if test="string-length(@max) &gt; 0 and
              not(@max=$maxLengthSpecial) and
              $maxIsNNI='false'">
  <xsl:attribute name="xfm:maxLength">
    <xsl:value-of select="@max"/>
  </xsl:attribute>
</xsl:if>

<!-- write xfm:minLength restriction -->
<xsl:if test="string-length(@min) &gt; 0 and
              not(@min='0') and
              $minIsNNI='false'">
  <xsl:attribute name="xfm:minLength">
    <xsl:value-of select="@min"/>
  </xsl:attribute>
</xsl:if>

<!-- write xsd:length restriction -->
<xsl:choose>
  <xsl:when test="$lengthIsNNI='true'">
    <xsl:if test="not(@length=$maxLengthSpecial)">
      <xsl:element name="xsd:length">
        <xsl:attribute name="value">
          <xsl:value-of select="@length"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:if>
  </xsl:when>
  <xsl:when test="count(length) &gt; 0">
    <xsl:element name="xsd:length">
      <xsl:attribute name="value">
        <xsl:value-of select="length[1]"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
</xsl:choose>

<!-- write xsd:maxLength restriction -->
<xsl:choose>
  <xsl:when test="$maxIsNNI='true'">
    <xsl:if test="not(@max=$maxLengthSpecial)">
```

```
        <xsl:element name="xsd:maxLength">
          <xsl:attribute name="value">
            <xsl:value-of select="@max"/>
          </xsl:attribute>
        </xsl:element>
      </xsl:if>
    </xsl:when>
    <xsl:when test="count(max) &gt; 0">
      <xsl:element name="xsd:maxLength">
        <xsl:attribute name="value">
          <xsl:value-of select="max[1]"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
  </xsl:choose>

  <!-- write xsd:minLength restriction -->
  <xsl:choose>
    <xsl:when test="$minIsNNI='true'">
      <xsl:if test="not(@min='0')">
        <xsl:element name="xsd:minLength">
          <xsl:attribute name="value">
            <xsl:value-of select="@min"/>
          </xsl:attribute>
        </xsl:element>
      </xsl:if>
    </xsl:when>
    <xsl:when test="count(min) &gt; 0">
      <xsl:element name="xsd:min">
        <xsl:attribute name="value">
          <xsl:value-of select="min[1]"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
  </xsl:choose>

  <!-- write xsd:pattern -->
  <xsl:if test="string-length($pattern) &gt; 0">
    <xsl:element name="xsd:pattern">
      <xsl:attribute name="value">
        <xsl:value-of select="$pattern"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:if>
</xsl:template>


<!-- template:   name="make-pattern"
     function:   converts a mask to a pattern
     parameters: mask       : the mask to transform
                 i          : current position inside mask
                 last       : last source character
                 count      : how many times did the last character
                              occur
     output:     a pattern with the same meaning
```

```
-->
<xsl:template name="make-pattern">
  <xsl:param name="mask"/>
  <xsl:param name="i">0</xsl:param>
  <xsl:param name="last"/>
  <xsl:param name="count"/>

  <xsl:choose>
    <!-- if there are characters to process, do so -->
    <xsl:when test="$i &lt; string-length($mask)">
      <!-- get current character -->
      <xsl:variable name="c">
        <xsl:value-of select="substring($mask, $i + 1, 1)"/>
      </xsl:variable>
      <!-- process it -->
      <xsl:choose>
        <!-- check for special characters first -->
        <!-- the backslash (\): the next character is ment literally -->
        <xsl:when test="$c='\'">
          <!-- output old count -->
          <xsl:if test="$count &gt; 1">
            <xsl:text>{</xsl:text>
            <xsl:value-of select="$count"/>
            <xsl:text>}</xsl:text>
          </xsl:if>
          <!-- check if the character has to be escaped -->
          <xsl:call-template name="escape-char">
            <xsl:with-param name="char">
              <xsl:value-of select="substring($mask, $i + 2, 1)"/>
            </xsl:with-param>
          </xsl:call-template>

          <!-- call recursively -->
          <xsl:call-template name="make-pattern">
            <xsl:with-param name="mask">
              <xsl:value-of select="$mask"/>
            </xsl:with-param>
            <xsl:with-param name="i">
              <xsl:value-of select="$i + 2"/>
            </xsl:with-param>
            <xsl:with-param name="last">
              <xsl:text>\</xsl:text>
            </xsl:with-param>
            <xsl:with-param name="count">
              <xsl:value-of select="0"/>
            </xsl:with-param>
          </xsl:call-template>
        </xsl:when>
        <!-- the asterix (*): any other number of the following class -->
        <xsl:when test="$c='*'">
          <!-- get next character -->
          <xsl:variable name="next">
            <xsl:value-of select="substring($mask, $i + 2, 1)"/>
          </xsl:variable>
          <xsl:choose>
```

```
          <!-- it the next is equal to the last, create special output -->
          <xsl:when test="$last=$next">
            <xsl:text>{</xsl:text>
            <xsl:value-of select="$count"/>
            <xsl:text>,}</xsl:text>
          </xsl:when>
          <xsl:otherwise>
            <!-- output old count -->
            <xsl:if test="$count &gt; 1">
              <xsl:text>{</xsl:text>
              <xsl:value-of select="$count"/>
              <xsl:text>}</xsl:text>
            </xsl:if>
            <!-- converte wml character class into unicode class -->
            <xsl:call-template name="convert-characterClass">
              <xsl:with-param name="class">
                <xsl:value-of select="$next"/>
              </xsl:with-param>
            </xsl:call-template>

            <xsl:text>*</xsl:text>
          </xsl:otherwise>
        </xsl:choose>
        <!-- keep in mind, that any mask ends after a *. -->
      </xsl:when>
      <!-- a number [1-9]: repeat next character n times -->
      <xsl:when test="contains('0123456789', $c)">
        <!-- get next character -->
        <xsl:variable name="next">
          <xsl:value-of select="substring($mask, $i + 2, 1)"/>
        </xsl:variable>
        <xsl:choose>
          <!-- when the next character equals the last,
               just increase count -->
          <xsl:when test="$last=$next">
            <xsl:call-template name="make-pattern">
              <xsl:with-param name="mask">
                <xsl:value-of select="$mask"/>
              </xsl:with-param>
              <xsl:with-param name="i">
                <xsl:value-of select="$i + 2"/>
              </xsl:with-param>
              <xsl:with-param name="last">
                <xsl:value-of select="$last"/>
              </xsl:with-param>
              <xsl:with-param name="count">
                <xsl:value-of select="$count + $c"/>
              </xsl:with-param>
            </xsl:call-template>
          </xsl:when>
          <xsl:otherwise>
            <!-- output old count -->
            <xsl:if test="$count &gt; 1">
              <xsl:text>{</xsl:text>
              <xsl:value-of select="$count"/>
```

```
            <xsl:text>}</xsl:text>
          </xsl:if>
          <!-- convert character class -->
          <xsl:variable name="out">
            <xsl:call-template name="convert-characterClass">
              <xsl:with-param name="class">
                <xsl:value-of select="$next"/>
              </xsl:with-param>
            </xsl:call-template>
          </xsl:variable>
          <!-- output unicode character classes -->
          <xsl:value-of select="$out"/>
          <!-- call recursively -->
          <xsl:call-template name="make-pattern">
            <xsl:with-param name="mask">
              <xsl:value-of select="$mask"/>
            </xsl:with-param>
            <xsl:with-param name="i">
              <xsl:value-of select="$i + 2"/>
            </xsl:with-param>
            <xsl:with-param name="last">
              <xsl:value-of select="$next"/>
            </xsl:with-param>
            <xsl:with-param name="count">
              <xsl:value-of select="$c"/>
            </xsl:with-param>
          </xsl:call-template>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:when>
    <!-- if it's the same as the last, just increase count -->
    <xsl:when test='$c=$last'>
      <!-- call recursively -->
      <xsl:call-template name="make-pattern">
        <xsl:with-param name="mask">
          <xsl:value-of select="$mask"/>
        </xsl:with-param>
        <xsl:with-param name="i">
          <xsl:value-of select="$i + 1"/>
        </xsl:with-param>
        <xsl:with-param name="last">
          <xsl:value-of select="$last"/>
        </xsl:with-param>
        <xsl:with-param name="count">
          <xsl:value-of select="$count + 1"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:when>
    <!-- a new/different character -->
    <xsl:otherwise>
      <!-- catches the fact that the user missed the backslash in
           front of a literal character -->
      <!-- output old count -->
      <xsl:if test="$count &gt; 1">
        <xsl:text>{</xsl:text>
```

```
            <xsl:value-of select="$count"/>
            <xsl:text>}</xsl:text>
          </xsl:if>
          <!-- convert character class -->
          <xsl:variable name="out">
            <xsl:call-template name="convert-characterClass">
              <xsl:with-param name="class">
                <xsl:value-of select="$c"/>
              </xsl:with-param>
            </xsl:call-template>
          </xsl:variable>
          <!-- output unicode character classes -->
          <xsl:value-of select="$out"/>
          <!-- call recursively -->
          <xsl:call-template name="make-pattern">
            <xsl:with-param name="mask">
              <xsl:value-of select="$mask"/>
            </xsl:with-param>
            <xsl:with-param name="i">
              <xsl:value-of select="$i + 1"/>
            </xsl:with-param>
            <xsl:with-param name="last">
              <xsl:value-of select="$c"/>
            </xsl:with-param>
            <xsl:with-param name="count">
              <xsl:value-of select="1"/>
            </xsl:with-param>
          </xsl:call-template>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:when>
    <xsl:otherwise>
      <xsl:if test="$count &gt; 1">
        <xsl:text>{</xsl:text>
        <xsl:value-of select="$count"/>
        <xsl:text>}</xsl:text>
      </xsl:if>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>

<!-- template:   name="convert-characterClass"
     function:   converts a wml character class into the proper
                 unicode character classes, as defined by <characterClasses/>
     parameter:  class :wml character class
     output:     matching unicode class(es)
-->
<xsl:template name="convert-characterClass">
  <xsl:param name="class"/>


  <xsl:if test='contains($classesList, $class)'>
    <xsl:variable name="i">
      <xsl:value-of select="translate($class, $classesList, $classesTrans)"/>
    </xsl:variable>
```

```
    <xsl:value-of select="document('')//this:class[$i + 1]/this:unicode"/>
  </xsl:if>
</xsl:template>

<!-- template:   name="escape-char"
     function:   escapes characters, to not have a special meaning in
                 reg exp
     parameters: char  :character to escape
     output:     save version
-->
<xsl:template name="escape-char">
  <xsl:param name="char"/>
  <xsl:choose>
    <!-- check if the character must be escaped -->
    <xsl:when test='contains($specialCharacters, $char)'>
      <xsl:text>\</xsl:text>
      <xsl:value-of select="$char"/>
    </xsl:when>
    <xsl:otherwise>
      <!-- no escaping needed, just return $char -->
      <xsl:value-of select="$char"/>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>



<!--
boolean element
-->

<!-- template:   match="boolean"
     function:   converts a boolean into a xsd:boolean
     parameters: none
     output:     converted definition
-->
<xsl:template match="boolean">
  <!-- create definition -->
  <xsl:variable name="definition">
    <xsl:element name="xsd:simpleType">
      <xsl:choose>
        <!-- if we have closed range, or no enumeration value, we can
             create simple type -->
        <xsl:when test="@enum='closed' or
                        count(value)=0">
          <xsl:element name="xsd:restriction">
            <xsl:attribute name="base">xsd:boolean</xsl:attribute>
            <xsl:apply-templates select="value"/>
          </xsl:element>
        </xsl:when>
        <xsl:otherwise>
          <xsl:element name="xsd:union">
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
```

```
                <xsl:attribute name="base">xsd:boolean</xsl:attribute>
                <xsl:apply-templates select="value"/>
              </xsl:element>
            </xsl:element>
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
                <xsl:attribute name="base">xsd:boolean</xsl:attribute>
              </xsl:element>
            </xsl:element>
          </xsl:element>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:element>
  </xsl:variable>

  <!-- if we have a name, we can create an element or attribute,
       otherwise we're part of a union -->
  <xsl:choose>
    <xsl:when test="string-length(@name) &gt; 0">
      <!-- create element or attribute -->
      <xsl:element name="xsd:element">
        <xsl:attribute name="name">
          <xsl:value-of select="@name"/>
        </xsl:attribute>
        <!-- check common attributes -->
        <xsl:call-template name="checkAttributes"/>

        <xsl:choose>
          <!-- if we have no children, and no other restrictions,
               we can make a short definition -->
          <xsl:when test='count(child::node())=0'>
            <xsl:attribute name="type">xsd:boolean</xsl:attribute>
          </xsl:when>
          <xsl:otherwise>
            <!-- dump full definition -->
            <xsl:copy-of select="$definition"/>
          </xsl:otherwise>
        </xsl:choose>
      </xsl:element>
    </xsl:when>
    <xsl:otherwise>
      <!-- just dumpe definition -->
      <xsl:copy-of select="$definition"/>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>



<!--
number element
-->

<!-- template:   matches="number"
     function:   converts a number into an xsd:number.
```

```
     parameters: none
     output:     converted definition
-->
<xsl:template match="number">
  <!-- create definition -->
  <xsl:variable name="definition">
    <xsl:element name="xsd:simpleType">
      <xsl:choose>
        <!-- if we have closed range, or no enumeration value, we can
             create simple type -->
        <xsl:when test="@enum='closed' or
                        count(value)=0">
          <xsl:element name="xsd:restriction">
            <xsl:attribute name="base">xsd:decimal</xsl:attribute>
            <xsl:call-template name="restrictNumber"/>
            <xsl:apply-templates select="value"/>
          </xsl:element>
        </xsl:when>
        <xsl:otherwise>
          <xsl:element name="xsd:union">
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
                <xsl:attribute name="base">xsd:decimal</xsl:attribute>
                <xsl:call-template name="restrictNumber"/>
                <xsl:apply-templates select="value"/>
              </xsl:element>
            </xsl:element>
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
                <xsl:attribute name="base">xsd:decimal</xsl:attribute>
                <xsl:call-template name="restrictNumber"/>
              </xsl:element>
            </xsl:element>
          </xsl:element>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:element>
  </xsl:variable>

  <!-- if we have a name, we can create an element or attribute,
       otherwise we're part of a union -->
  <xsl:choose>
    <xsl:when test="string-length(@name) &gt; 0">
      <!-- create element or attribute -->
      <xsl:element name="xsd:element">
        <xsl:attribute name="name">
          <xsl:value-of select="@name"/>
        </xsl:attribute>
        <!-- check common attributes -->
        <xsl:call-template name="checkAttributes"/>

        <xsl:choose>
          <!-- if we have no children, and no other restrictions,
               we can make a short definition -->
          <xsl:when test='count(child::node())=0 and
```

```
                    (string-length(@min)=0 or @min=$minInfinity) and
                    (string-length(@max)=0 or @max=$maxInfinity) and
                    (string-length(@precision)=0 or
                     @precision=$unlimitedPrecision) and
                    (string-length(@scale)=0 or @scale=$unlimitedScale)'>
            <xsl:attribute name="type">xsd:decimal</xsl:attribute>
          </xsl:when>
          <xsl:otherwise>
            <!-- dump full definition -->
            <xsl:copy-of select="$definition"/>
          </xsl:otherwise>
        </xsl:choose>
      </xsl:element>
    </xsl:when>
    <xsl:otherwise>
      <!-- just dumpe definition -->
      <xsl:copy-of select="$definition"/>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>


<!-- template:   name="restrictNumber"
     function:   add erstrictions to a number
     parameters: a number context node with the following attributes
                     @max
                     @min
                     @precision
                     @scale
                 and the following child elements
                     <min>
                     <max>
                     <precision>
                     <scale>
     output:     elements to represent the restrictions
-->
<xsl:template name="restrictNumber">

  <xsl:message terminate="no">@max:<xsl:value-of select="@max"/></xsl:message>
  <!-- check if max is a number -->
  <xsl:variable name="maxIsNumber">
    <xsl:call-template name="checkNumber">
      <xsl:with-param name="test">
        <xsl:value-of select="@max"/>
      </xsl:with-param>
    </xsl:call-template>
  </xsl:variable>
  <xsl:message terminate="no">$maxIsNumber:<xsl:value-of
select="$maxIsNumber"/></xsl:message>

  <!-- check if min is a number -->
  <xsl:variable name="minIsNumber">
    <xsl:call-template name="checkNumber">
      <xsl:with-param name="test">
        <xsl:value-of select="@min"/>
```

```
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>

<!-- check if precision is a number -->
<xsl:variable name="precisionIsNNI">
  <xsl:call-template name="checkNonNegInt">
    <xsl:with-param name="test">
      <xsl:value-of select="@precision"/>
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>

<!-- check if scale is a number -->
<xsl:variable name="scaleIsNNI">
  <xsl:call-template name="checkNonNegInt">
    <xsl:with-param name="test">
      <xsl:value-of select="@scale"/>
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>

<!-- write xfm:max restriction -->
<xsl:if test="string-length(@max) &gt; 0 and
              not(@max=$maxInfinity) and
              $maxIsNumber='false'">
  <xsl:attribute name="xfm:maxInclusive">
    <xsl:value-of select="@max"/>
  </xsl:attribute>
</xsl:if>

<!-- write xfm:min restriction -->
<xsl:if test="string-length(@min) &gt; 0 and
              not(@min=$minInfinity) and
              $minIsNumber='false'">
  <xsl:attribute name="xfm:minInclusive">
    <xsl:value-of select="@min"/>
  </xsl:attribute>
</xsl:if>

<!-- write xfm:precision restriction -->
<xsl:if test="string-length(@precision) &gt; 0 and
              not(@precision=$unlimitedPrecision) and
              $precisionIsNNI='false'">
  <xsl:attribute name="xfm:precision">
    <xsl:value-of select="@precision"/>
  </xsl:attribute>
</xsl:if>

<!-- write xfm:scale restriction -->
<xsl:if test="string-length(@scale) &gt; 0 and
              not(@scale=$unlimitedScale) and
              $scaleIsNNI='false'">
  <xsl:attribute name="xfm:scale">
    <xsl:value-of select="@scale"/>
```

```
    </xsl:attribute>
  </xsl:if>


  <!-- write xsd:max restriction -->
  <xsl:choose>
    <xsl:when test="$maxIsNumber='true'">
      <xsl:element name="xsd:maxInclusive">
        <xsl:attribute name="value">
          <xsl:value-of select="@max"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
    <xsl:when test="count(max) &gt; 0">
      <xsl:element name="xsd:maxInclusive">
        <xsl:attribute name="value">
          <xsl:value-of select="max[1]"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
  </xsl:choose>

  <!-- write xsd:min restriction -->
  <xsl:choose>
    <xsl:when test="$minIsNumber='true'">
      <xsl:element name="xsd:minInclusive">
        <xsl:attribute name="value">
          <xsl:value-of select="@min"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
    <xsl:when test="count(min) &gt; 0">
      <xsl:element name="xsd:minInclusive">
        <xsl:attribute name="value">
          <xsl:value-of select="min[1]"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
  </xsl:choose>

  <!-- write xsd:precision restriction -->
  <xsl:choose>
    <xsl:when test="$precisionIsNNI='true'">
      <xsl:element name="xsd:precision">
        <xsl:attribute name="value">
          <xsl:value-of select="@precision"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
    <xsl:when test="count(precision) &gt; 0">
      <xsl:element name="xsd:precision">
        <xsl:attribute name="value">
          <xsl:value-of select="precision[1]"/>
        </xsl:attribute>
      </xsl:element>
```

```
    </xsl:when>
  </xsl:choose>

  <!-- write xsd:scale restriction -->
  <xsl:choose>
    <xsl:when test="$scaleIsNNI='true'">
      <xsl:element name="xsd:scale">
        <xsl:attribute name="value">
          <xsl:value-of select="@scale"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
    <xsl:when test="count(scale) &gt; 0">
      <xsl:element name="xsd:scale">
        <xsl:attribute name="value">
          <xsl:value-of select="scale[1]"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
  </xsl:choose>

</xsl:template>



<!--
currency element
-->

<!-- template:   matches="currency"
     function:   converts a currency into a currency.
     parameters: none
     output:     partially converted definition
-->
<xsl:template match="money">
  <!-- create definition -->
  <xsl:variable name="definition">
    <xsl:element name="xsd:simpleType">
      <xsl:choose>
        <!-- if we have closed range, or no enumeration value, we can
             create simple type -->
        <xsl:when test="@enum='closed' or
                        count(value)=0">
          <xsl:element name="xsd:restriction">
            <xsl:attribute name="base">xfm:currency</xsl:attribute>
            <xsl:call-template name="restrictCurrency"/>
            <xsl:apply-templates select="value"/>
          </xsl:element>
        </xsl:when>
        <xsl:otherwise>
          <xsl:element name="xsd:union">
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
                <xsl:attribute name="base">xfm:currency</xsl:attribute>
                <xsl:call-template name="restrictCurrency"/>
```

```
              <xsl:apply-templates select="value"/>
            </xsl:element>
          </xsl:element>
          <xsl:element name="xsd:simpleType">
            <xsl:element name="xsd:restriction">
              <xsl:attribute name="base">xfm:currency</xsl:attribute>
              <xsl:call-template name="restrictCurrency"/>
            </xsl:element>
          </xsl:element>
        </xsl:element>
      </xsl:otherwise>
    </xsl:choose>
  </xsl:element>
</xsl:variable>

<!-- if we have a name, we can create an element or attribute,
     otherwise we're part of a union -->
<xsl:choose>
  <xsl:when test="string-length(@name) &gt; 0">
    <!-- create element or attribute -->
    <xsl:element name="xsd:element">
      <xsl:attribute name="name">
        <xsl:value-of select="@name"/>
      </xsl:attribute>
      <!-- check common attributes -->
      <xsl:call-template name="checkAttributes"/>

      <xsl:choose>
        <!-- if we have no children, and no other restrictions,
             we can make a short definition -->
        <xsl:when test='count(child::node())=0 and
                  (string-length(@min)=0 or @min=0) and
                  (string-length(@max)=0 or @max=$maxLengthSpecial)'>
          <xsl:attribute name="type">xfm:currency</xsl:attribute>
        </xsl:when>
        <xsl:otherwise>
          <!-- dump full definition -->
          <xsl:copy-of select="$definition"/>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:element>
  </xsl:when>
  <xsl:otherwise>
    <!-- just dumpe definition -->
    <xsl:copy-of select="$definition"/>
  </xsl:otherwise>
</xsl:choose>

</xsl:template>


<!-- template:   name="restrictCurrency"
     function:   add erstrictions to a currency
     parameters: a currency context node with the following attributes
                   @max
```

```
                    @min
                    @mask
                and the following child elements
                    <min>
                    <max>
                    <mask>
     output:    elements to represent the restrictions
-->
<xsl:template name="restrictCurrency">
<!-- this is currently not implemented, because it is unclear what min, max
     or mask are supposed to mean -->
</xsl:template>



<!--
money element
-->

<!-- template:   matches="money"
     function:   converts a money into a money.
     parameters: none
     output:     partially converted definition
-->
<xsl:template match="money">
  <!-- only elements of type money can be converted into Schemas -->
  <xsl:choose>
    <xsl:when test="string-length(@name) = 0">
      <xsl:message terminate="no">
        An anonymous money definition is not supported.
      </xsl:message>
      <xsl:comment> Anonymous money definition dropped </xsl:comment>
    </xsl:when>
    <xsl:otherwise>
      <xsl:element name="xsd:element">
        <xsl:attribute name="name">
          <xsl:value-of select="@name"/>
        </xsl:attribute>
        <!-- check common attributes -->
        <xsl:call-template name="checkAttributes"/>

        <xsl:attribute name="type">xfm:money</xsl:attribute>

        <!-- add allowCurrency -->
        <xsl:if test="string-length(@allowCurrency) &gt; 0">
          <xsl:attribute name="xfm:allowCurrency">
            <xsl:value-of select="@allowCurrency"/>
          </xsl:attribute>
        </xsl:if>

        <!-- add min value -->
        <xsl:if test="string-length(@min) &gt; 0 and
                      not(@min=$minInfinity)">
          <xsl:attribute name="xfm:minInclusive">
            <xsl:value-of select="@min"/>
```

```
          </xsl:attribute>
        </xsl:if>

        <!-- add max value -->
        <xsl:if test="string-length(@max) &gt; 0 and
                      not(@max=$maxInfinity)">
          <xsl:attribute name="xfm:maxInclusive">
            <xsl:value-of select="@max"/>
          </xsl:attribute>
        </xsl:if>

        <!-- add precision value -->
        <xsl:if test="string-length(@precision) &gt; 0 and
                      not(@precision=$unlimitedPrecision)">
          <xsl:attribute name="xfm:precision">
            <xsl:value-of select="@precision"/>
          </xsl:attribute>
        </xsl:if>

        <!-- add scale value -->
        <xsl:if test="string-length(@scale) &gt; 0 and
                      not(@scale=$unlimitedScale)">
          <xsl:attribute name="xfm:scale">
            <xsl:value-of select="@scale"/>
          </xsl:attribute>
        </xsl:if>

      </xsl:element>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>



<!--
date element
-->

<!-- template:   matches="date"
     function:   converts a date into an xsd:date.
     parameters: none
     output:     converted definition
-->
<xsl:template match="date">
  <!-- create definition -->
  <xsl:variable name="definition">
    <xsl:element name="xsd:simpleType">
      <xsl:choose>
        <!-- if we have closed range, or no enumeration value, we can
             create simple type -->
        <xsl:when test="@range='closed' or
                        count(value)=0">
          <xsl:element name="xsd:restriction">
            <xsl:attribute name="base">xsd:date</xsl:attribute>
            <xsl:call-template name="restrictDate"/>
```

```
          <xsl:apply-templates select="value"/>
        </xsl:element>
      </xsl:when>
      <xsl:otherwise>
        <xsl:element name="xsd:union">
          <xsl:element name="xsd:simpleType">
            <xsl:element name="xsd:restriction">
              <xsl:attribute name="base">xsd:date</xsl:attribute>
              <xsl:call-template name="restrictDate"/>
              <xsl:apply-templates select="value"/>
            </xsl:element>
          </xsl:element>
          <xsl:element name="xsd:simpleType">
            <xsl:element name="xsd:restriction">
              <xsl:attribute name="base">xsd:date</xsl:attribute>
              <xsl:call-template name="restrictDate"/>
            </xsl:element>
          </xsl:element>
        </xsl:element>
      </xsl:otherwise>
    </xsl:choose>
  </xsl:element>
</xsl:variable>

<!-- if we have a name, we can create an element or attribute,
     otherwise we're part of a union -->
<xsl:choose>
  <xsl:when test="string-length(@name) &gt; 0">
    <!-- create element -->
    <xsl:element name="xsd:element">
      <xsl:attribute name="name">
        <xsl:value-of select="@name"/>
      </xsl:attribute>
      <!-- check common attributes -->
      <xsl:call-template name="checkAttributes"/>

      <xsl:choose>
        <!-- if we have no children, and no other restrictions,
             we can make a short definition -->
        <xsl:when test='count(child::node())=0 and
                        string-length(@min)=0  and
                        string-length(@max)=0  and
                        (string-length(@precision)=0 or
                         @precision="days")'>
          <xsl:attribute name="type">xsd:date</xsl:attribute>
        </xsl:when>
        <xsl:otherwise>
          <!-- dump full definition -->
          <xsl:copy-of select="$definition"/>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:element>
  </xsl:when>
  <xsl:otherwise>
    <!-- just dumpe definition -->
```

```
      <xsl:copy-of select="$definition"/>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>


<!-- template:   name="restrictDate"
     function:   add erstrictions to a date
     parameters: a date context node with the following attributes
                     @max
                     @min
                     @precision
                 and the following child elements
                     <min>
                     <max>
                     <precision>
     output:     elements to represent the restrictions
-->
<xsl:template name="restrictDate">

  <!-- check if @max is a date -->
  <xsl:variable name="maxIsDate">
    <xsl:call-template name="checkDate">
      <xsl:with-param name="test">
        <xsl:value-of select="@max"/>
      </xsl:with-param>
    </xsl:call-template>
  </xsl:variable>

  <!-- check if @min is a date -->
  <xsl:variable name="minIsDate">
    <xsl:call-template name="checkDate">
      <xsl:with-param name="test">
        <xsl:value-of select="@min"/>
      </xsl:with-param>
    </xsl:call-template>
  </xsl:variable>

  <!-- check if precision is valid -->
  <xsl:variable name="precisionIsValid">
    <xsl:call-template name="checkDatePrecision">
      <xsl:with-param name="test">
        <xsl:value-of select="@precision"/>
      </xsl:with-param>
    </xsl:call-template>
  </xsl:variable>

  <!-- write xfm:max restriction -->
  <xsl:if test="string-length(@max) &gt; 0 and
                $maxIsDate='false'">
    <xsl:attribute name="xfm:max">
      <xsl:value-of select="@max"/>
    </xsl:attribute>
  </xsl:if>
```

```
<!-- write xfm:min restriction -->
<xsl:if test="string-length(@min) &gt; 0 and
              $minIsDate='false'">
  <xsl:attribute name="xfm:min">
    <xsl:value-of select="@min"/>
  </xsl:attribute>
</xsl:if>

<!-- write xfm:precision restriction -->
<xsl:if test="string-length(@precision) &gt; 0 and
              $precisionIsValid='false'">
  <xsl:attribute name="xfm:precision">
    <xsl:value-of select="@precision"/>
  </xsl:attribute>
</xsl:if>

<!-- write xsd:max restriction -->
<xsl:choose>
  <xsl:when test="$maxIsDate='true'">
    <xsl:element name="xsd:max">
      <xsl:attribute name="value">
        <xsl:value-of select="@max"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
  <xsl:when test="count(max) &gt; 0">
    <xsl:element name="xsd:max">
      <xsl:attribute name="value">
        <xsl:value-of select="max[1]"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
</xsl:choose>

<!-- write xsd:min restriction -->
<xsl:choose>
  <xsl:when test="$minIsDate='true'">
    <xsl:element name="xsd:min">
      <xsl:attribute name="value">
        <xsl:value-of select="@min"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
  <xsl:when test="count(min) &gt; 0">
    <xsl:element name="xsd:min">
      <xsl:attribute name="value">
        <xsl:value-of select="min[1]"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
</xsl:choose>

<!-- write xsd:duration restriction -->
<xsl:choose>
  <xsl:when test="$precisionIsValid='true'">
```

```
      <xsl:call-template name="writeDatePrecision">
        <xsl:with-param name="precision">
          <xsl:value-of select="@precision"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:when>
    <xsl:when test="count(precision) &gt; 0">
      <xsl:call-template name="writeDatePrecision">
        <xsl:with-param name="precision">
          <xsl:value-of select="precision[1]"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:when>
  </xsl:choose>
</xsl:template>


<!-- template:   name="writeDatePrecision"
     function:   writes the definitions to matche the precision
                 attribute
     parameters: $precision: one of years, months, days
     output:     proper definition to allow only the requested
                 precision
-->
<xsl:template name="writeDatePrecision">
  <xsl:param name="precision"/>

  <xsl:choose>
    <xsl:when test="$precision='years'">
      <xsl:element name="xsd:duration">
        <xsl:attribute name="value">P1Y</xsl:attribute>
      </xsl:element>
      <xsl:element name="xsd:pattern">
        <xsl:attribute name="value">\d*\d{4}</xsl:attribute>
      </xsl:element>
    </xsl:when>
    <xsl:when test="$precision='months'">
      <xsl:element name="xsd:duration">
        <xsl:attribute name="value">P1M</xsl:attribute>
      </xsl:element>
      <xsl:element name="xsd:pattern">
        <xsl:attribute name="value">\d*\d{4}-\d{2}</xsl:attribute>
      </xsl:element>
    </xsl:when>
  </xsl:choose>
</xsl:template>



<!--
time element
-->

<!-- template:   matches="time"
     function:   converts a time into an xsd:time.
```

```
     parameters: none
     output:     converted definition
-->
<xsl:template match="time">
  <!-- create definition -->
  <xsl:variable name="definition">
    <xsl:element name="xsd:simpleType">
      <xsl:choose>
        <!-- if we have closed range, or no enumeration value, we can
             create simple type -->
        <xsl:when test="@range='closed' or
                        count(value)=0">
          <xsl:element name="xsd:restriction">
            <xsl:attribute name="base">xsd:time</xsl:attribute>
            <xsl:call-template name="restrictTime"/>
            <xsl:apply-templates select="value"/>
          </xsl:element>
        </xsl:when>
        <xsl:otherwise>
          <xsl:element name="xsd:union">
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
                <xsl:attribute name="base">xsd:time</xsl:attribute>
                <xsl:call-template name="restrictTime"/>
                <xsl:apply-templates select="value"/>
              </xsl:element>
            </xsl:element>
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
                <xsl:attribute name="base">xsd:time</xsl:attribute>
                <xsl:call-template name="restrictTime"/>
              </xsl:element>
            </xsl:element>
          </xsl:element>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:element>
  </xsl:variable>

  <!-- if we have a name, we can create an element or attribute,
       otherwise we're part of a union -->
  <xsl:choose>
    <xsl:when test="string-length(@name) &gt; 0">
      <!-- create element -->
      <xsl:element name="xsd:element">
        <xsl:attribute name="name">
          <xsl:value-of select="@name"/>
        </xsl:attribute>
        <!-- check common attributes -->
        <xsl:call-template name="checkAttributes"/>

        <xsl:choose>
          <!-- if we have no children, and no other restrictions,
               we can make a short definition -->
          <xsl:when test='count(child::node())=0 and
```

```
                          string-length(@min)=0  and
                          string-length(@max)=0  and
                          (string-length(@precision)=0 or
                           @precision="seconds")'>
            <xsl:attribute name="type">xsd:time</xsl:attribute>
          </xsl:when>
          <xsl:otherwise>
            <!-- dump full definition -->
            <xsl:copy-of select="$definition"/>
          </xsl:otherwise>
        </xsl:choose>
      </xsl:element>
    </xsl:when>
    <xsl:otherwise>
      <!-- just dumpe definition -->
      <xsl:copy-of select="$definition"/>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>


<!-- template:   name="restrictTime"
     function:   add erstrictions to a time
     parameters: a time context node with the following attributes
                     @max
                     @min
                     @precision
                 and the following child elements
                     <min>
                     <max>
                     <precision>
     output:     elements to represent the restrictions
-->
<xsl:template name="restrictTime">

  <!-- check if max is a time -->
  <xsl:variable name="maxIsTime">
    <xsl:call-template name="checkTime">
      <xsl:with-param name="test">
        <xsl:value-of select="@max"/>
      </xsl:with-param>
    </xsl:call-template>
  </xsl:variable>

  <!-- check if min is a time -->
  <xsl:variable name="minIsTime">
    <xsl:call-template name="checkTime">
      <xsl:with-param name="test">
        <xsl:value-of select="@min"/>
      </xsl:with-param>
    </xsl:call-template>
  </xsl:variable>

  <!-- check if precision is valid -->
  <xsl:variable name="precisionIsValid">
```

```
  <xsl:call-template name="checkTimePrecision">
    <xsl:with-param name="test">
      <xsl:value-of select="@precision"/>
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>

<!-- write xfm:max restriction -->
<xsl:if test="string-length(@max) &gt; 0 and
              $maxIsTime='false'">
  <xsl:attribute name="xfm:max">
    <xsl:value-of select="@max"/>
  </xsl:attribute>
</xsl:if>

<!-- write xfm:min restriction -->
<xsl:if test="string-length(@min) &gt; 0 and
              $minIsTime='false'">
  <xsl:attribute name="xfm:min">
    <xsl:value-of select="@min"/>
  </xsl:attribute>
</xsl:if>

<!-- write xfm:precision restriction -->
<xsl:if test="string-length(@precision) &gt; 0 and
              $precisionIsValid='false'">
  <xsl:attribute name="xfm:precision">
    <xsl:value-of select="@precision"/>
  </xsl:attribute>
</xsl:if>

<!-- write xsd:max restriction -->
<xsl:choose>
  <xsl:when test="$maxIsTime='true'">
    <xsl:element name="xsd:max">
      <xsl:attribute name="value">
        <xsl:value-of select="@max"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
  <xsl:when test="count(max) &gt; 0">
    <xsl:element name="xsd:max">
      <xsl:attribute name="value">
        <xsl:value-of select="max[1]"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
</xsl:choose>

<!-- write xsd:min restriction -->
<xsl:choose>
  <xsl:when test="$minIsTime='true'">
    <xsl:element name="xsd:min">
      <xsl:attribute name="value">
        <xsl:value-of select="@min"/>
```

```
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
    <xsl:when test="count(min) &gt; 0">
      <xsl:element name="xsd:min">
        <xsl:attribute name="value">
          <xsl:value-of select="min[1]"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
  </xsl:choose>

  <!-- write xsd:duration restriction -->
  <xsl:choose>
    <xsl:when test="$precisionIsValid='true'">
      <xsl:call-template name="writeTimePrecision">
        <xsl:with-param name="precision">
          <xsl:value-of select="@precision"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:when>
    <xsl:when test="count(precision) &gt; 0">
      <xsl:call-template name="writeTimePrecision">
        <xsl:with-param name="precision">
          <xsl:value-of select="precision[1]"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:when>
  </xsl:choose>
</xsl:template>


<!-- template:   name="writeTimePrecision"
     function:   writes the definitions to matche the precision
                 attribute
     parameters: $precision: one of hours, minutes, seconds
     output:     proper definition to allow only the requested
                 precision
-->
<xsl:template name="writeTimePrecision">
  <xsl:param name="precision"/>

  <xsl:choose>
    <xsl:when test="$precision='hours'">
      <xsl:element name="xsd:duration">
        <xsl:attribute name="value">PT60M</xsl:attribute>
      </xsl:element>
      <xsl:element name="xsd:pattern">
        <xsl:attribute name="value">
          <xsl:text>([01][0-9]|2[0-3])(:00(:00(.000)?)?)?</xsl:text>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
    <xsl:when test="$precision='minutes'">
      <xsl:element name="xsd:duration">
```

```
        <xsl:attribute name="value">PT60S</xsl:attribute>
      </xsl:element>
      <xsl:element name="xsd:pattern">
        <xsl:attribute name="value">
          <xsl:text>([01][0-9]|2[0-3])</xsl:text>
          <xsl:text>(:[0-5][0-9](:00(.000)?)?)?</xsl:text>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
  </xsl:choose>
</xsl:template>



<!--
duration element
-->

<!-- template:   matches="duration"
     function:   converts a duration into an xsd:timeDuration.
     parameters: none
     output:     converted definition
-->
<xsl:template match="duration">
  <!-- create definition -->
  <xsl:variable name="definition">
    <xsl:element name="xsd:simpleType">
      <xsl:choose>
        <!-- if we have closed range, or no enumeration value, we can
             create simple type -->
        <xsl:when test="@range='closed' or
                        count(value)=0">
          <xsl:element name="xsd:restriction">
            <xsl:attribute name="base">xsd:timeDuration</xsl:attribute>
            <xsl:call-template name="restrictDuration"/>
            <xsl:apply-templates select="value"/>
          </xsl:element>
        </xsl:when>
        <xsl:otherwise>
          <xsl:element name="xsd:union">
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
                <xsl:attribute name="base">
                  <xsl:text>xsd:timeDuration</xsl:text>
                </xsl:attribute>
                <xsl:call-template name="restrictDuration"/>
                <xsl:apply-templates select="value"/>
              </xsl:element>
            </xsl:element>
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
                <xsl:attribute name="base">
                  <xsl:text>xsd:timeDuration</xsl:text>
                </xsl:attribute>
                <xsl:call-template name="restrictDuration"/>
```

```
            </xsl:element>
          </xsl:element>
        </xsl:element>
      </xsl:otherwise>
    </xsl:choose>
  </xsl:element>
</xsl:variable>

<!-- if we have a name, we can create an element or attribute,
     otherwise we're part of a union -->
<xsl:choose>
  <xsl:when test="string-length(@name) &gt; 0">
    <!-- create element or attribute -->
    <xsl:element name="xsd:{@as}">
      <xsl:attribute name="name">
        <xsl:value-of select="@name"/>
      </xsl:attribute>
      <!-- check common attributes -->
      <xsl:call-template name="checkAttributes"/>

      <xsl:choose>
        <!-- if we have no children, and no other restrictions,
             we can make a short definition -->
        <xsl:when test='count(child::node())=0 and
                        string-length(@min)=0  and
                        string-length(@max)=0  and
                        (string-length(@precision)=0 or
                         @precision="seconds")'>
          <xsl:attribute name="type">xsd:timeDuration</xsl:attribute>
        </xsl:when>
        <xsl:otherwise>
          <!-- dump full definition -->
          <xsl:copy-of select="$definition"/>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:element>
  </xsl:when>
  <xsl:otherwise>
    <!-- just dumpe definition -->
    <xsl:copy-of select="$definition"/>
  </xsl:otherwise>
</xsl:choose>
</xsl:template>


<!-- template:   name="restrictDuration"
     function:   add erstrictions to a duration
     parameters: a duration context node with the following attributes
                     @max
                     @min
                     @precision
                 and the following child elements
                     <min>
                     <max>
                     <precision>
```

```
     output:     elements to represent the restrictions
-->
<xsl:template name="restrictDuration">

  <!-- check if max is a duration -->
  <xsl:variable name="maxIsDuration">
    <xsl:call-template name="checkDuration">
      <xsl:with-param name="test">
        <xsl:value-of select="@max"/>
      </xsl:with-param>
    </xsl:call-template>
  </xsl:variable>

  <!-- check if min is a duration -->
  <xsl:variable name="minIsDuration">
    <xsl:call-template name="checkDuration">
      <xsl:with-param name="test">
        <xsl:value-of select="@min"/>
      </xsl:with-param>
    </xsl:call-template>
  </xsl:variable>

  <!-- check if precision is valid -->
  <xsl:variable name="precisionIsValid">
    <xsl:variable name="test">
      <xsl:call-template name="checkDatePrecision">
        <xsl:with-param name="test">
          <xsl:value-of select="@precision"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:variable>

    <xsl:choose>
      <xsl:when test="$test='false'">
        <xsl:call-template name="checkTimePrecision">
          <xsl:with-param name="test">
            <xsl:value-of select="@precision"/>
          </xsl:with-param>
        </xsl:call-template>
      </xsl:when>
      <xsl:otherwise>
        <xsl:value-of select="$test"/>
      </xsl:otherwise>
    </xsl:choose>
  </xsl:variable>

  <!-- write xfm:max restriction -->
  <xsl:if test="string-length(@max) &gt; 0 and
                $maxIsDuration='false'">
    <xsl:attribute name="xfm:max">
      <xsl:value-of select="@max"/>
    </xsl:attribute>
  </xsl:if>

  <!-- write xfm:min restriction -->
```

```
<xsl:if test="string-length(@min) &gt; 0 and
              $minIsDuration='false'">
  <xsl:attribute name="xfm:min">
    <xsl:value-of select="@min"/>
  </xsl:attribute>
</xsl:if>

<!-- write xfm:precision restriction -->
<xsl:if test="string-length(@precision) &gt; 0 and
              $precisionIsValid='false'">
  <xsl:attribute name="xfm:precision">
    <xsl:value-of select="@precision"/>
  </xsl:attribute>
</xsl:if>

<!-- write xsd:max restriction -->
<xsl:choose>
  <xsl:when test="$maxIsDuration='true'">
    <xsl:element name="xsd:max">
      <xsl:attribute name="value">
        <xsl:value-of select="@max"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
  <xsl:when test="count(max) &gt; 0">
    <xsl:element name="xsd:max">
      <xsl:attribute name="value">
        <xsl:value-of select="max[1]"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
</xsl:choose>

<!-- write xsd:min restriction -->
<xsl:choose>
  <xsl:when test="$minIsDuration='true'">
    <xsl:element name="xsd:min">
      <xsl:attribute name="value">
        <xsl:value-of select="@min"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
  <xsl:when test="count(min) &gt; 0">
    <xsl:element name="xsd:min">
      <xsl:attribute name="value">
        <xsl:value-of select="min[1]"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
</xsl:choose>

<!-- write xsd:duration restriction -->
<xsl:choose>
  <xsl:when test="$precisionIsValid='true'">
    <xsl:call-template name="writeDurationPrecision">
```

```
        <xsl:with-param name="precision">
          <xsl:value-of select="@precision"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:when>
    <xsl:when test="count(precision) &gt; 0">
      <xsl:call-template name="writeDurationPrecision">
        <xsl:with-param name="precision">
          <xsl:value-of select="precision[1]"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:when>
  </xsl:choose>
</xsl:template>


<!-- template:   name="writeDurationPrecision"
     function:   writes the definitions to matche the precision
                 attribute
     parameters: $precision: one of hours, minutes, seconds
     output:     proper definition to allow only the requested
                 precision
-->
<xsl:template name="writeDurationPrecision">
  <xsl:param name="precision"/>

  <xsl:choose>
    <xsl:when test="$precision='years'">
      <xsl:element name="xsd:pattern">
        <xsl:attribute name="value">
          <xsl:text>P(\d+(\.\d+)?|\.\d+)Y</xsl:text>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
    <xsl:when test="$precision='months'">
      <xsl:element name="xsd:pattern">
        <xsl:attribute name="value">
          <xsl:text>P(\d+(\.\d+)?|\.\d+)Y|</xsl:text>
          <xsl:text>P(\d+Y)?(\d+(\.\d+)?|\.\d+)M</xsl:text>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
    <xsl:when test="$precision='days'">
      <xsl:element name="xsd:pattern">
        <xsl:attribute name="value">
          <xsl:text>P(\d+(\.\d+)?|\.\d+)Y|</xsl:text>
          <xsl:text>P(\d+Y)?(\d+(\.\d+)?|\.\d+)M|</xsl:text>
          <xsl:text>P(\d+Y)?(\d+M)?(\d+(\.\d+)?|\.\d+)D</xsl:text>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
    <xsl:when test="$precision='hours'">
      <xsl:element name="xsd:pattern">
        <xsl:attribute name="value">
          <xsl:text>P(\d+(\.\d+)?|\.\d+)Y|</xsl:text>
```

```
          <xsl:text>P(\d+Y)?(\d+(\.\d+)?|\.\d+)M|</xsl:text>
          <xsl:text>P(\d+Y)?(\d+M)?(\d+(\.\d+)?|\.\d+)D|</xsl:text>
          <xsl:text>P(\d+Y)?(\d+M)?(\d+D)?T(\d+(\.\d+)?|</xsl:text>
          <xsl:text>\.\d+)H</xsl:text>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
    <xsl:when test="$precision='minutes'">
      <xsl:element name="xsd:pattern">
        <xsl:attribute name="value">
          <xsl:text>P(\d+(\.\d+)?|\.\d+)Y|</xsl:text>
          <xsl:text>P(\d+Y)?(\d+(\.\d+)?|\.\d+)M|</xsl:text>
          <xsl:text>P(\d+Y)?(\d+M)?(\d+(\.\d+)?|\.\d+)D|</xsl:text>
          <xsl:text>P(\d+Y)?(\d+M)?(\d+D)?T(\d+(\.\d+)?|</xsl:text>
          <xsl:text>\.\d+)H|</xsl:text>
          <xsl:text>P(\d+Y)?(\d+M)?(\d+D)?T(\d+H)?</xsl:text>
          <xsl:text>(\d(\.\d+)?|\.\d+)M</xsl:text>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
  </xsl:choose>
</xsl:template>



<!--
uri element
-->

<!-- template:   matches="uri"
     function:   converts a uri into an xsd:uriReference.
     parameters: none
     output:     converted definition
-->
<xsl:template match="uri">
  <!-- create definition -->
  <xsl:variable name="definition">
    <xsl:element name="xsd:simpleType">
      <xsl:choose>
        <!-- if we have closed range, or no enumeration value, we can
             create simple type -->
        <xsl:when test="@range='closed' or
                        count(value)=0">
          <xsl:element name="xsd:restriction">
            <xsl:attribute name="base">xsd:uriReference</xsl:attribute>
            <xsl:call-template name="restrictUri"/>
            <xsl:apply-templates select="value"/>
          </xsl:element>
        </xsl:when>
        <xsl:otherwise>
          <xsl:element name="xsd:union">
            <xsl:element name="xsd:simpleType">
              <xsl:element name="xsd:restriction">
                <xsl:attribute name="base">
                  <xsl:text>xsd:uriReference</xsl:text>
```

```
              </xsl:attribute>
              <xsl:call-template name="restrictUri"/>
              <xsl:apply-templates select="value"/>
            </xsl:element>
          </xsl:element>
          <xsl:element name="xsd:simpleType">
            <xsl:element name="xsd:restriction">
              <xsl:attribute name="base">
                <xsl:text>xsd:uriReference</xsl:text>
              </xsl:attribute>
              <xsl:call-template name="restrictUri"/>
            </xsl:element>
          </xsl:element>
        </xsl:element>
      </xsl:otherwise>
    </xsl:choose>
  </xsl:element>
</xsl:variable>

<!-- if we have a name, we can create an element or attribute,
     otherwise we're part of a union -->
<xsl:choose>
  <xsl:when test="string-length(@name) &gt; 0">
    <!-- create element -->
    <xsl:element name="xsd:element">
      <xsl:attribute name="name">
        <xsl:value-of select="@name"/>
      </xsl:attribute>
      <!-- check common attributes -->
      <xsl:call-template name="checkAttributes"/>

      <xsl:choose>
        <!-- if we have no children, and no other restrictions,
             we can make a short definition -->
        <xsl:when test='count(child::node())=0 and
                        string-length(@scheme)=0'>
          <xsl:attribute name="type">xsd:uriReference</xsl:attribute>
        </xsl:when>
        <xsl:otherwise>
          <!-- dump full definition -->
          <xsl:copy-of select="$definition"/>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:element>
  </xsl:when>
  <xsl:otherwise>
    <!-- just dumpe definition -->
    <xsl:copy-of select="$definition"/>
  </xsl:otherwise>
</xsl:choose>
</xsl:template>


<!-- template:   name="restrictUri"
     function:   add restrictions to a uri
```

```
     parameters: a duration context node with the following attributes
                     @scheme
                 and the following child elements
                     <scheme>
     output:     elements to represent the restrictions
-->
<xsl:template name="restrictUri">

  <!-- make pattern from scheme -->
  <xsl:variable name="pattern">
    <xsl:for-each select="scheme">
      <xsl:call-template name="convertScheme">
        <xsl:with-param name="scheme">
          <xsl:value-of select="."/>
        </xsl:with-param>
      </xsl:call-template>
      <xsl:if test="not(position()=last())">
        <xsl:text>|</xsl:text>
      </xsl:if>
    </xsl:for-each>

    <xsl:if test="@scheme">
      <xsl:if test="count(scheme) &gt; 0">
        <xsl:text>|</xsl:text>
      </xsl:if>
      <xsl:call-template name="convertScheme">
        <xsl:with-param name="scheme">
          <xsl:value-of select="@scheme"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:if>
  </xsl:variable>

  <xsl:if test="string-length($pattern) &gt; 0">
    <xsl:element name="xsd:pattern">
      <xsl:attribute name="value">
        <xsl:value-of select="$pattern"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:if>
</xsl:template>


<!-- template:   name="convertScheme"
     function:   converts a scheme to a pattern
     parameters: scheme     : the scheme to transform
     output:     a pattern with the same meaning
-->
<xsl:template name="convertScheme">
  <xsl:param name="scheme"/>

  <xsl:choose>
    <xsl:when test="contains($scheme, ' ')">
      <!-- splitt scheme -->
      <xsl:call-template name="convertScheme">
```

```
        <xsl:with-param name="scheme">
          <xsl:value-of select="substring-before($scheme, ' ')"/>
        </xsl:with-param>
      </xsl:call-template>
      <xsl:text>|</xsl:text>
      <xsl:call-template name="convertScheme">
        <xsl:with-param name="scheme">
          <xsl:value-of select="substring-after($scheme, ' ')"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:when>
    <xsl:otherwise>
      <xsl:text>(</xsl:text>
      <xsl:choose>
        <xsl:when test="$scheme='mailto'">
          <xsl:value-of select="$scheme"/>
          <xsl:text>:.*</xsl:text>
        </xsl:when>
        <xsl:otherwise>
          <xsl:value-of select="$scheme"/>
          <xsl:text>://.*</xsl:text>
        </xsl:otherwise>
      </xsl:choose>
      <xsl:text>)</xsl:text>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>



<!--
binary element
-->

<!-- template:   matches="binary"
     function:   converts a binary into an xsd:binary.
     parameters: none
     output:     converted definition
-->
<xsl:template match="binary">
  <!-- create definition -->
  <xsl:variable name="definition">
    <xsl:element name="xsd:simpleType">
       <xsl:element name="xsd:restriction">
         <xsl:attribute name="base">xsd:binary</xsl:attribute>
         <xsl:call-template name="restrictBinary"/>
       </xsl:element>
    </xsl:element>
  </xsl:variable>

  <!-- if we have a name, we can create an element or attribute,
       otherwise we're part of a union -->
  <xsl:choose>
    <xsl:when test="string-length(@name) &gt; 0">
      <!-- create element -->
```

```
      <xsl:element name="xsd:element">
        <xsl:attribute name="name">
          <xsl:value-of select="@name"/>
        </xsl:attribute>
        <!-- check common attributes -->
        <xsl:call-template name="checkAttributes"/>

        <xsl:choose>
          <!-- if we have no children, and no other restrictions,
               we can make a short definition -->
          <xsl:when test='count(child::node())=0 and
                          string-length(@type)=0'>
            <xsl:attribute name="type">xsd:binary</xsl:attribute>
          </xsl:when>
          <xsl:otherwise>
            <!-- dump full definition -->
            <xsl:copy-of select="$definition"/>
          </xsl:otherwise>
        </xsl:choose>
      </xsl:element>
    </xsl:when>
    <xsl:otherwise>
      <!-- just dumpe definition -->
      <xsl:copy-of select="$definition"/>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>


<!-- template:   name="restrictBinary"
     function:   add erstrictions to a binary
     parameters: a duration context node with the following attributes
                     @length
                     @max
                     @min
                     @mediaType
                 and the following child elements
                     <length>
                     <min>
                     <max>
                     <mediaType>
     output:     elements to represent the restrictions
-->
<xsl:template name="restrictBinary">

  <!-- converte list of types into media attribute -->
  <xsl:attribute name="xfm:mediaType">
    <xsl:for-each select="mediaType">
      <xsl:variable name="isMedia">
        <xsl:call-template name="checkMedia">
          <xsl:with-param name="test">
            <xsl:value-of select="."/>
          </xsl:with-param>
        </xsl:call-template>
      </xsl:variable>
```

```
    <xsl:if test="$isMedia='true'">
      <xsl:value-of select="."/>
      <xsl:if test="not(position()=last())">
        <xsl:text> </xsl:text>
      </xsl:if>
    </xsl:if>
  </xsl:for-each>

  <xsl:if test="not(string-length(@mediaType)=0)">
    <xsl:text> </xsl:text>
    <xsl:variable name="isMedia">
      <xsl:call-template name="checkMedia">
        <xsl:with-param name="test">
          <xsl:value-of select="@mediaType"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:variable>
    <xsl:if test="isMedia='true'">
      <xsl:value-of select="@mediaType"/>
    </xsl:if>
  </xsl:if>
</xsl:attribute>

<!-- check if @length is an non negative integer -->
<xsl:variable name="lengthIsNNI">
  <xsl:call-template name="checkNonNegInt">
    <xsl:with-param name="test">
      <xsl:value-of select="@length"/>
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>

<!-- check if @max is an non negative integer -->
<xsl:variable name="maxIsNNI">
  <xsl:call-template name="checkNonNegInt">
    <xsl:with-param name="test">
      <xsl:value-of select="@max"/>
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>

<!-- check if @min as an non negative integer -->
<xsl:variable name="minIsNNI">
  <xsl:call-template name="checkNonNegInt">
    <xsl:with-param name="test">
      <xsl:value-of select="@min"/>
    </xsl:with-param>
  </xsl:call-template>
</xsl:variable>

<!-- write xfm:length restriction -->
<xsl:if test="string-length(@length) &gt; 0 and
              not(@length=$maxLengthSpecial) and
              $lengthIsNNI='false'">
  <xsl:attribute name="xfm:length">
```

```
    <xsl:value-of select="@length"/>
  </xsl:attribute>
</xsl:if>

<!-- write xfm:maxLength restriction -->
<xsl:if test="string-length(@max) &gt; 0 and
              not(@max=$maxLengthSpecial) and
              $maxIsNNI='false'">
  <xsl:attribute name="xfm:maxLength">
    <xsl:value-of select="@max"/>
  </xsl:attribute>
</xsl:if>

<!-- write xfm:minLength restriction -->
<xsl:if test="string-length(@min) &gt; 0 and
              not(@min='0') and
              $minIsNNI='false'">
  <xsl:attribute name="xfm:minLength">
    <xsl:value-of select="@min"/>
  </xsl:attribute>
</xsl:if>

<!-- write xsd:length restriction -->
<xsl:choose>
  <xsl:when test="$lengthIsNNI='true'">
    <xsl:if test="not(@length=$maxLengthSpecial)">
      <xsl:element name="xsd:length">
        <xsl:attribute name="value">
          <xsl:value-of select="@length"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:if>
  </xsl:when>
  <xsl:when test="count(length) &gt; 0">
    <xsl:element name="xsd:length">
      <xsl:attribute name="value">
        <xsl:value-of select="length[1]"/>
      </xsl:attribute>
    </xsl:element>
  </xsl:when>
</xsl:choose>

<!-- write xsd:maxLength restriction -->
<xsl:choose>
  <xsl:when test="$maxIsNNI='true'">
    <xsl:if test="not(@max=$maxLengthSpecial)">
      <xsl:element name="xsd:maxLength">
        <xsl:attribute name="value">
          <xsl:value-of select="@max"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:if>
  </xsl:when>
  <xsl:when test="count(max) &gt; 0">
    <xsl:element name="xsd:maxLength">
```

```
        <xsl:attribute name="value">
          <xsl:value-of select="max[1]"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
  </xsl:choose>

  <!-- write xsd:minLength restriction -->
  <xsl:choose>
    <xsl:when test="$minIsNNI='true'">
      <xsl:if test="not(@min='0')">
        <xsl:element name="xsd:minLength">
          <xsl:attribute name="value">
            <xsl:value-of select="@min"/>
          </xsl:attribute>
        </xsl:element>
      </xsl:if>
    </xsl:when>
    <xsl:when test="count(min) &gt; 0">
      <xsl:element name="xsd:min">
        <xsl:attribute name="value">
          <xsl:value-of select="min[1]"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:when>
  </xsl:choose>
</xsl:template>



<!--
element element
-->

<!-- template:   matches="element"
     function:   converts a element into an xsd:element.
     parameters: none
     output:     converted definition
-->
<xsl:template match="element">
  <xsl:choose>
    <xsl:when test="string-length(@name)=0">
      <xsl:message terminate="no">
        An anonymous element definition is not supported.
      </xsl:message>
      <xsl:comment> Anonymous element definition dropped </xsl:comment>
    </xsl:when>
    <xsl:otherwise>
      <xsl:element name="xsd:element">
        <xsl:attribute name="name">
          <xsl:value-of select="@name"/>
        </xsl:attribute>

        <!-- check common attributes -->
        <xsl:call-template name="checkAttributes"/>
```

```
        <xsl:attribute name="type">
          <xsl:value-of select="@type"/>
        </xsl:attribute>
      </xsl:element>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>



<!--
value element
-->

<!-- template:   matches="value"
     function:   converte value into an enumeration.
     parameters: none
     output:     <enumeration> that represents the value
-->
<xsl:template match="value">
  <xsl:element name="xsd:enumeration">
    <xsl:attribute name="value">
      <xsl:value-of select="."/>
    </xsl:attribute>
  </xsl:element>
</xsl:template>



<!--
Named templates
-->

<!--
Datatype checks
-->

<!-- template:   name="checkXpression"
     function:   checks if a given string is an Xpression or not
     parameter:  test
     output:     true   if it's an Xpression
                 false  otherwise
     note:       this can not work, it must always return true.
                 But perhapes it can be made to work later
-->
<xsl:template name="checkXpression">
  <xsl:param name="test"/>

  <!-- we can not test this, so we must return true -->
  <xsl:text>true</xsl:text>
</xsl:template>


<!-- template:   name="checkBoolean"
```

```
     function:   check if $test is a boolean
     parameters: test
     output:     true   if it's a boolean
                 false  otherwise
-->
<xsl:template name="checkBoolean">
  <xsl:param name="test"/>

  <xsl:choose>
    <xsl:when test="true">
      <xsl:text>true</xsl:text>
    </xsl:when>
    <xsl:when test="false">
      <xsl:text>true</xsl:text>
    </xsl:when>
    <xsl:otherwise>
      <xsl:text>false</xsl:text>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>


<!-- template:   name="checkNumber"
     function:   check if $test is a number
     parameters: test
     output:     true   if it's a number
                 false  otherwise
-->
<xsl:template name="checkNumber">
  <xsl:param name="test"/>

  <xsl:variable name="number">
    <xsl:value-of select="number($test)"/>
  </xsl:variable>

  <xsl:choose>
    <xsl:when test="$number='NaN'">
      <xsl:text>false</xsl:text>
    </xsl:when>
    <xsl:otherwise>
      <xsl:text>true</xsl:text>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>


<!-- template:   name="checkNonNegInt"
     function:   check if $test is a non negativ integer
     parameters: test
     output:     true   if it's a non negativ integer
                 false  otherwise
-->
<xsl:template name="checkNonNegInt">
  <xsl:param name="test"/>
```

```
  <xsl:variable name="number">
    <xsl:value-of select="number($test)"/>
  </xsl:variable>

  <xsl:choose>
    <xsl:when test="$number='NaN'">
      <xsl:text>false</xsl:text>
    </xsl:when>
    <xsl:otherwise>
      <xsl:variable name="integer">
        <xsl:value-of select="round($number)"/>
      </xsl:variable>
      <xsl:choose>
        <xsl:when test="not($integer=$number)">
          <xsl:text>false</xsl:text>
        </xsl:when>
        <xsl:otherwise>
          <xsl:choose>
            <xsl:when test="$integer &lt; 0">
              <xsl:text>false</xsl:text>
            </xsl:when>
            <xsl:otherwise>
              <xsl:text>true</xsl:text>
            </xsl:otherwise>
          </xsl:choose>
        </xsl:otherwise>
      </xsl:choose>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>


<!-- template:   name="checkDate"
     function:   checks if a given string is a date or not
     parameter:  test   :the string to test
     output:     true   if it's a date
                 false  otherwise
     note:       this does not work, it always returns false
-->
<xsl:template name="checkDate">
  <xsl:param name="test"/>

  <xsl:text>false</xsl:text>
</xsl:template>


<!-- template:   name="checkTime"
     function:   checks if a given string is a time or not
     parameter:  test   :the string to test
     output:     true   if it's a time
                 false  otherwise
     note:       this does not work, it always returns false
-->
<xsl:template name="checkTime">
  <xsl:param name="test"/>
```

```
  <xsl:text>false</xsl:text>
</xsl:template>


<!-- template:   name="checkDuration"
     function:   checks if a given string is a duration or not
     parameter:  test   :the string to test
     output:     true   if it's a duration
                 false  otherwise
     note:       this does not work, it always returns false
-->
<xsl:template name="checkDuration">
  <xsl:param name="test"/>

  <xsl:text>false</xsl:text>
</xsl:template>


<!-- template:   name="checkDatePrecision"
     function:   checks if a given string is a valid precision for a
                 date
     parameter:  test
     output:     true   if it is
                 false  otherwise
-->
<xsl:template name="checkDatePrecision">
  <xsl:param name="test"/>

  <xsl:choose>
    <xsl:when test="$test='years'">
      <xsl:text>true</xsl:text>
    </xsl:when>
    <xsl:when test="$test='months'">
      <xsl:text>true</xsl:text>
    </xsl:when>
    <xsl:when test="$test='dayss'">
      <xsl:text>true</xsl:text>
    </xsl:when>
    <xsl:otherwise>
      <xsl:text>false</xsl:text>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>


<!-- template:   name="checkTimePrecision"
     function:   checks if a given string is a valid precision for a
                 time
     parameter:  test
     output:     true   if it is
                 false  otherwise
-->
<xsl:template name="checkTimePrecision">
  <xsl:param name="test"/>
```

```
  <xsl:choose>
    <xsl:when test="$test='hours'">
      <xsl:text>true</xsl:text>
    </xsl:when>
    <xsl:when test="$test='minutes'">
      <xsl:text>true</xsl:text>
    </xsl:when>
    <xsl:when test="$test='seconds'">
      <xsl:text>true</xsl:text>
    </xsl:when>
    <xsl:otherwise>
      <xsl:text>false</xsl:text>
    </xsl:otherwise>
  </xsl:choose>
</xsl:template>


<!-- template:   name="checkMedia"
     function:   checks is a string is a valid mimetype
     parameters: test       : the string to test
     output:     true       : is it's a valid mimetype
                 false      : otherwise
     note:       does not work, always returns false
-->
<xsl:template name="checkMedia">
  <xsl:param name="test"/>

  <xsl:text>false</xsl:text>
</xsl:template>



<!--
Common attributes
-->

<!-- template:   name="checkAttributes"
     function:   check the common XForms attributes and produces
                 apropriated attributes
     parameters: a context node, with the following attributes
                 @id        ()
                 @required  (false)
                 @relevant  (false)
                 @readOnly  (false)
                 @calc      ()
                 @choices   ()
                 @validate  ()
     glob. var.: $maxOccursSpecial
     output:     transformation of attributes
-->
<xsl:template name="checkAttributes">
  <!-- copy ID, if any -->
  <xsl:if test="string-length(@id) &gt; 0">
    <xsl:attribute name="id">
```

```
    <xsl:value-of select="@id"/>
  </xsl:attribute>
</xsl:if>

<!-- check if this element is optional, it is optional,
     if: it's not relevant or it's not required, or it's
     minOccurs = 0 -->
<xsl:choose>
  <xsl:when test="@relevant='true'">
    <xsl:choose>
      <xsl:when test="@required='true'">
        <xsl:if test="not(@minOccurs='1')">
          <!-- check if $minOccurs if a non negative integer -->
          <xsl:variable name="nn">
            <xsl:call-template name="checkNonNegInt">
              <xsl:with-param name="test">
                <xsl:value-of select="@minOccurs"/>
              </xsl:with-param>
            </xsl:call-template>
          </xsl:variable>
          <xsl:choose>
            <xsl:when test="$nn='false'">
              <!-- if it's not, the element needs not to occur in
                   a Schema -->
              <xsl:if test="not(name(..)='model' or name(..)='simple')">
                <!-- root elements must not have minOccurs -->
                <xsl:attribute name="minOccurs">foo0</xsl:attribute>
              </xsl:if>
              <!-- but preserve it in the xfm namespace -->
              <xsl:attribute name="xfm:minOccurs">
                <xsl:value-of select="@minOccurs"/>
              </xsl:attribute>
            </xsl:when>
            <xsl:otherwise>
              <!-- minOccurs is a non negative Integer, so we can
                   have the Schema follow the restriction -->
              <xsl:if test="not(name(..)='model' or name(..)='simple')">
                <xsl:attribute name="minOccurs">
                  <xsl:value-of select="@minOccurs"/>
                </xsl:attribute>
              </xsl:if>
            </xsl:otherwise>
          </xsl:choose>
          <!-- there is no else, because the default for minOccurs
               in Schemas is 1 -->
        </xsl:if>
      </xsl:when>
      <xsl:otherwise>
        <xsl:if test="not(name(..)='model' or name(..)='simple')">
          <!-- root elements must not have minOccurs -->
          <xsl:attribute name="minOccurs">foo10</xsl:attribute>
        </xsl:if>
        <!-- preserver required and minOccirs in xfm namespace -->
        <xsl:attribute name="xfm:required">
          <xsl:value-of select="@required"/>
```

```
        </xsl:attribute>
        <xsl:attribute name="xfm:minOccurs">
          <xsl:value-of select="@minOccurs"/>
        </xsl:attribute>
      </xsl:otherwise>
    </xsl:choose>
  </xsl:when>
  <xsl:otherwise>
    <xsl:if test="not(name(..)='model' or name(..)='simple')">
      <!-- root elements must not have minOccurs -->
      <xsl:attribute name="minOccurs">foo20</xsl:attribute>
    </xsl:if>
    <!-- preserver relevant, required and minOccurs in xfm
         namespace -->
    <xsl:if test="not(string-length(@relevant)=0 or @relevant='false')">
      <xsl:attribute name="xfm:relevant">
        <xsl:value-of select="@relevant"/>
      </xsl:attribute>
    </xsl:if>
    <xsl:if test="not(string-length(@required)=0 or @required='false')">
      <xsl:attribute name="xfm:required">
        <xsl:value-of select="@required"/>
      </xsl:attribute>
    </xsl:if>
    <xsl:if test="not(string-length(@minOccurs)=0 or @minOccurs='1')">
      <xsl:attribute name="xfm:minOccurs">
        <xsl:value-of select="@minOccurs"/>
      </xsl:attribute>
    </xsl:if>
  </xsl:otherwise>
</xsl:choose>

<!-- check maxOccurs, it can be: "unbounded", "1" (default), a none
     negative integer, or an expression -->
<xsl:choose>
  <xsl:when test="@maxOccurs=$maxOccursSpecial">
    <!-- copy it into the Schema -->
    <xsl:if test="not(name(..)='model' or name(..)='simple')">
      <!-- root elements must not have maxOccurs -->
      <xsl:attribute name="maxOccurs">unbounded</xsl:attribute>
    </xsl:if>
  </xsl:when>
  <xsl:when test="not(@maxOccurs='1')">
    <!-- check if $maxOccurs if a non negative integer -->
    <xsl:variable name="nn">
      <xsl:call-template name="checkNonNegInt">
        <xsl:with-param name="test">
          <xsl:value-of select="@maxOccurs"/>
        </xsl:with-param>
      </xsl:call-template>
    </xsl:variable>
    <xsl:choose>
      <xsl:when test="$nn='false'">
        <!-- if it's not, the element may occur an unlimited number
             of times in a Schema -->
```

```
        <xsl:if test="not(name(..)='model' or name(..)='simple')">
          <!-- root elements must not have maxOccurs -->
          <xsl:attribute name="maxOccurs">unbounded</xsl:attribute>
        </xsl:if>
        <!-- but preserve maxOccurs it in the xfm namespace -->
        <xsl:if test="not(@maxOccurs='unbounded')">
          <xsl:attribute name="xfm:maxOccurs">
            <xsl:value-of select="@maxOccurs"/>
          </xsl:attribute>
        </xsl:if>
      </xsl:when>
      <xsl:otherwise>
        <!-- maxOccurs is a non negative Integer, so we can
             have the Schema follow the restriction -->
        <xsl:if test="not(name(..)='model' or name(..)='simple')">
          <!-- root elements must not have maxOccurs -->
          <xsl:attribute name="maxOccurs">
            <xsl:value-of select="@maxOccurs"/>
          </xsl:attribute>
        </xsl:if>
      </xsl:otherwise>
    </xsl:choose>
  </xsl:when>
  <!-- there is no otherwise, because the default for maxOccurs in
       Schemas is 1 -->
</xsl:choose>

<!-- readOnly is of general interest, but can only be mapped into the
     xfm namespace -->
<xsl:if test="not(string-length(@readOnly)=0 or @readOnly='false')">
  <xsl:attribute name="xfm:readOnly">
    <xsl:value-of select="@readOnly"/>
  </xsl:attribute>
</xsl:if>

<!-- validate is of general interest, but can only be mapped into the
     xfm namespace -->
<xsl:if test="not(string-length(@validate)=0 or @validate='true')">
  <xsl:attribute name="xfm:validate">
    <xsl:value-of select="@validate"/>
  </xsl:attribute>
</xsl:if>

<!-- calc is of general interest, but can only be mapped into the
     xfm namespace -->
<xsl:if test="string-length(@calc) &gt; 0">
  <xsl:attribute name="xfm:calc">
    <xsl:value-of select="@calc"/>
  </xsl:attribute>
</xsl:if>

<!-- choices is of general interest, but can only be mapped into the
     xfm namespace -->
<xsl:if test="string-length(@choices) &gt; 0">
  <xsl:attribute name="xfm:choices">
```

```
      <xsl:value-of select="@choices"/>
    </xsl:attribute>
  </xsl:if>
</xsl:template>

</xsl:transform>
```

B.2 Required DTD for Transformation

```
<?xml version="1.0"?>
<!-- DTD for XForms -->

<!-- ENTITY definitions -->

<!-- Taken from the Schema definition:
     can be overritten in the internal subset of a xforms document to
     establish a namespace prefix -->
<!ENTITY % p          ''>
<!-- add optional namespace to all elements -->
<!ENTITY % xform     "%p;xform">
<!ENTITY % model     "%p;model">
<!ENTITY % submit    "%p;submit">
<!ENTITY % instance  "%p;instance">
<!ENTITY % bind      "%p;bind">
<!ENTITY % simple    "%p;simple">

<!-- data types -->
<!ENTITY % string    "%p;string">
<!ENTITY % boolean   "%p;boolean">
<!ENTITY % number    "%p;number">
<!ENTITY % currency  "%p;currency">
<!ENTITY % money     "%p;money">
<!ENTITY % date      "%p;date">
<!ENTITY % time      "%p;time">
<!ENTITY % duration  "%p;duration">
<!ENTITY % uri       "%p;uri">
<!ENTITY % binary    "%p;binary">
<!ENTITY % element   "%p;element">
<!ENTITY % attribute "%p;attribute">
<!ENTITY % null      "%p;null">

<!ENTITY % datatype  "%string;|%boolean;|%number;|%currency;|%money;|
                      %date;|%time;|%duration;|%uri;|%binary;">

<!ENTITY % group     "%p;group">
<!ENTITY % union     "%p;union">
<!ENTITY % array     "%p;array">
<!ENTITY % switch    "%p;switch">
<!ENTITY % case      "%p;case">
```

```
<!-- facets -->
<!ENTITY % mask          "%p;mask">
<!ENTITY % pattern       "%p;pattern">
<!ENTITY % mediaType     "%p;mediaType">
<!ENTITY % scheme        "%p;scheme">
<!ENTITY % value         "%p;value">
<!ENTITY % allowCurrency "%p;allowCurrency">
<!ENTITY % length        "%p;length">
<!ENTITY % max           "%p;max">
<!ENTITY % min           "%p;min">
<!ENTITY % precision     "%p;precision">
<!ENTITY % scale         "%p;scale">
<!-- common datatype facets -->
<!ENTITY % cdf           "%value;">


<!-- attribute names -->
<!ENTITY % URIref    "CDATA">
<!ENTITY % bool      "(true|false)">
<!ENTITY % datesteps "years|months|days">
<!ENTITY % timesteps "hours|minutes|seconds">

<!ENTITY % name        "name        NMTOKEN       #IMPLIED">
<!-- NOTE: while a name is required, it can not be a required attribute
           as the union defines a name and the elements don't need a
           name in this case -->
<!ENTITY % id          "id          ID            #IMPLIED">
<!ENTITY % ref         "ref         %URIref;      #IMPLIED">
<!ENTITY % readOnly    "readOnly    CDATA         'false'">
<!ENTITY % required    "required    CDATA         'true'">
<!-- NOTE: while required is a boolean field, the real value can come
           from an expression, this is a text -->
<!ENTITY % relevant    "relevant    CDATA         'true'">
<!-- NOTE: while relevant is a boolean field, the real value can come
           from an expression, this is a text -->
<!ENTITY % enum        "enum        (open|closed) 'open'">
<!ENTITY % choices     "choices     CDATA         #IMPLIED">
<!ENTITY % calc        "calc        CDATA         #IMPLIED">
<!ENTITY % validate    "validate    CDATA         'true'">
<!ENTITY % condition   "condition   CDATA         'true'">
<!ENTITY % minOccurs   "minOccurs   CDATA         '1'">
<!ENTITY % maxOccurs   "maxOccurs   CDATA         '1'">
<!-- NOTE: The special value "unbounded" represents an unlimited
     repetition. -->
<!ENTITY % precisiona  "precision   CDATA         'unlimited'">
<!ENTITY % scalea      "scale       CDATA         'unlimited'">

<!-- common attributes -->
<!ENTITY % comatt     "%name;
                       %id;
                       %required;
                       %relevant;
                       %readOnly;
                       %validate;" >
<!-- data type attributes -->
```

```
<!ENTITY % dtattr     "%comatt;
                       %enum;" >
<!-- simpel data type attributes -->
<!ENTITY % sdtattr    "%dtattr;
                       %calc;
                       %choices;
                       %minOccurs;
                       %maxOccurs;" >
<!-- NOTE: I've added minOccurs and mxOccurs while they are not explicitely
           in the spec -->
<!-- NOTE: I would have liked to include min and max here, but there
           are element specific defaults that can not be generalised
     -->


<!-- ELEMENT definitions -->

<!ELEMENT %xform; ((%submit;)*,(%model;)*,(%instance;)*,(%bind;)*)>
<!ATTLIST %xform; action  %URIref;    #IMPLIED
                  method  CDATA       #IMPLIED
                  id      ID          #IMPLIED >

<!ELEMENT %submit; ANY>
<!-- NOTE: the syntax for submit is not finalized, so I allow anything -->
<!ELEMENT %bind;   ANY>
<!-- NOTE: the syntac for bind is not finalized, so I allow anything -->
<!ELEMENT %instance; ANY>
<!-- NOTE: there's no way to tell a validating parser to ignore the
           content of an element, if it has child elements, therefor
           no xform with an instance can ever be valid -->


<!ELEMENT %model; (%simple;|%group;|%array;|%union;|%switch;|
                   %datatype;|%element;)*>
<!ATTLIST %model; %id;
                  %ref; >


<!ELEMENT %simple; (%group;|%array;|%union;|%switch;|%datatype;|%element;)*>
<!ATTLIST %simple; %id;
                   %ref;
                   %name; >


<!ELEMENT %group; (%group;|%array;|%union;|%switch;|%datatype;|
                   %element;|%attribute;)*>
<!ATTLIST %group; %comatt;
                  %minOccurs;
                  %maxOccurs; >


<!ELEMENT %switch; (%case;,(%case;)+)>
<!ATTLIST %switch; %comatt;
                   %minOccurs;
                   %maxOccurs; >
```

```
<!ELEMENT %case; (%datatype;|%element;)*>
<!ATTLIST %case; %name;
                 %condition; >


<!ELEMENT %union; ((%datatype;)+)>
<!ATTLIST %union; %comatt;
                  %minOccurs;
                  %maxOccurs; >


<!ELEMENT %string; (%cdf;|%length;|%mask;|%max;|%min;|%pattern;)*>
<!ATTLIST %string; %sdtattr;
                   length   CDATA  #IMPLIED
                   max      CDATA  "unlimited"
                   min      CDATA  "0"
                   mask     CDATA  #IMPLIED
                   pattern  CDATA  #IMPLIED >
<!-- NOTE: there can be any number of masks and patterns, an entry
           that matches any mask/pattern is valide
           (e.i., they are ORed) -->

<!ELEMENT %length; (#PCDATA)*>

<!ELEMENT %mask;   (#PCDATA)*>

<!ELEMENT %max;    (#PCDATA)*>

<!ELEMENT %min;    (#PCDATA)*>

<!ELEMENT %pattern; (#PCDATA)*>


<!ELEMENT %value; (#PCDATA|%null;)*>

<!ELEMENT %null; EMPTY>


<!ELEMENT %boolean; EMPTY>
<!ATTLIST %boolean; %comatt;
                    %calc;
                    %minOccurs;
                    %maxOccurs; >


<!ELEMENT %number; (%cdf;|%max;|%min;|%precision;|%scale;)*>
<!ATTLIST %number; %sdtattr;
                   min       CDATA  "minus infinity"
                   max       CDATA  "plus infinity"
                   %precisiona;
                   %scalea;>

<!ELEMENT %precision; (#PCDATA)*>
```

```
<!ELEMENT %scale;     (#PCDATA)*>


<!ELEMENT %currency; (%cdf;|%mask;)*>
<!ATTLIST %currency; %sdtattr;
                     mask     CDATA  #IMPLIED >


<!ELEMENT %money; (%cdf;|%allowCurrency;|%max;|%min;|%precision;|%scale;)*>
<!ATTLIST %money; %sdtattr;
                  min            CDATA  "minus infinity"
                  max            CDATA  "plus infinity"
                  %precisiona;
                  scale          CDATA  "2"
                  allowCurrency  CDATA  #IMPLIED >

<!ELEMENT %allowCurrency; (#PCDATA)*>


<!ELEMENT %date; (%cdf;|%max;|%min;|%precision;)*>
<!ATTLIST %date; %sdtattr;
                 min  CDATA   #IMPLIED
                 max  CDATA   #IMPLIED
                 precision (%datesteps;) #IMPLIED>
<!-- NOTE: the special value of "now" for min and max indecate the
           current time -->


<!ELEMENT %time; (%cdf;|%max;|%min;|%precision;)*>
<!ATTLIST %time; %sdtattr;
                 min  CDATA   #IMPLIED
                 max  CDATA   #IMPLIED
                 precision (%timesteps;) #IMPLIED >
<!-- NOTE: The time zone is expressed as hours relative to UTC -->


<!ELEMENT %duration; (%cdf;|%max;|%min;|%precision;)*>
<!ATTLIST %duration; %sdtattr;
                     precision (%datesteps;|%timesteps;) #IMPLIED
                     min  CDATA   #IMPLIED
                     max  CDATA   #IMPLIED >


<!ELEMENT %uri; (%cdf;|%length;|%max;|%min;|%scheme;)*>
<!ATTLIST %uri; %sdtattr;
                length   CDATA  #IMPLIED
                max      CDATA  "unlimited"
                min      CDATA  "0"
                scheme   CDATA  #IMPLIED>

<!ELEMENT %scheme; (#PCDATA)>


<!ELEMENT %binary; (%cdf;|%mediaType;|%length;|%max;|%min;)*>
```

```
<!ATTLIST %binary; %sdtattr;
                   length    CDATA  #IMPLIED
                   max       CDATA  "unlimited"
                   min       CDATA  "0"
                   mediaType CDATA  #IMPLIED >

<!ELEMENT %mediaType; (#PCDATA)*>


<!ELEMENT %element; EMPTY>
<!ATTLIST %element; %comatt;
                    type   CDATA   #REQUIRED
                    %minOccurs;
                    %maxOccurs; >
```

---

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Appendix C: Sample Forms

Contents

C.1 XForms and XHTML

XHTML Document with Multiple XForms - Page.html

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
     "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xml:lang="en" lang="en"
  xmlns="http://www.w3.org/1999/xhtml"
  xmlns:xsd="http://www.w3.org/2000/10/XMLSchema"
  xmlns:xfm="http://www.w3.org/2000/12/xforms">

<head>
  <title>Sample XForms Document</title>
  <xform xmlns="http://www.w3.org/2000/12/xforms">

    <submit id="sub-a" target="http://example.com/app1" />
    <submit id="sub-b" target="http://example.com/app2" />

    <!-- Define the XForms Model for the opinion poll -->

    <model id="poll">
      <simple>
        <number name="choiceCode" enum="closed">
          <value>-1</value>
          <value>10</value>
          <value>20</value>
          <value>30</value>
        </number>
      </simple>
    </model>

    <!-- Define the XForms Model for the search -->

    <model id="search">
      <schema xmlns="http://www.w3.org/2000/10/XMLSchema">
        <element name="query">
          <complexType>
            <attribute name="searchstring" type="string" />
          </complexType>
        <element>
      <schema>
    </model>
```

```
    <!-- pre-initialized instance data for the search form -->

    <instance model="search" xmlns="http://example.org/ns">
      <query searchstring="Enter your Query Here" />
    </instance>

    <bind id="Query" ref="instance::search/query/searchstring"/>

  </xform>
</head>

<body>
  <!-- ... -->

  <!-- Site Search Markup -->
  <xfm:textbox ref="id('Query')">
    <xfm:caption>Search our Web Site<xfm:caption>
    <xfm:help>Enter your search term here and hit "Go!"</xfm:help>
  </xfm:textbox>
  <xfm:submit ref="instance::sitesearch" to="sub-a">
    <xfm:caption>Go!</xfm:caption>
  </xfm:button>

  <!-- ... -->

  <!-- Daily Poll Markup -->
  <xfm:exclusiveSelect style="list-ui: radio" ref="model::poll/choiceCode">
    <xfm:caption>When do you plan to implement XForms?</xfm:caption>
    <xfm:item value="-1">Don't know</xfm:item>
    <xfm:item value="10">0-6 Months</xfm:item>
    <xfm:item value="20">6-12 Months</xfm:item>
    <xfm:item value="30">More than 12 Months</xfm:item>
  </xfm:exclusiveSelect>
  <xfm:submit ref="model::poll" to="sub-b">
    <xfm:caption>Submit</xfm:caption>
  </xfm:submit>

  <!-- ... -->

</body>
</html>
```

This is an example of a single document that might be hand authored. This example shows an XHTML document with two separate XForms embedded using simple syntax, one with a set of initial instance data.

Sample Instance Data for Poll

```
<choiceCode>30</choiceCode>
```

Here is a sample of the instance data for the Poll form.

Sample Instance Data for Site Search

```
<query xmlns="http://example.com/ns" searchstring="MP3" />
```

Here is a sample of the instance data for Site Search form.

Appendix D: Optional Function Libraries

Contents

D.1 Finance Methods

This is an optional library that supports a variety of common financial calculations for interest rates, monthly payments etc.

apr(n1, n2, n2)

> Returns the annual percentage rate for a loan, where n1 is the principal amount of the loan, n2 is the monthly payment, and n3 is the number of months payments will have to be made. For example "`apr(35000, 269.50, 30 times 12)`" returns 0.085 (or 8.5%) for the annual interest rate on a loan of $35,000 being repaid at $269.50 per month over 30 years.

cterm(n1, n2, n2)

> Returns the number of periods needed for an investment earning a fixed, but compounded, interest rate to grow to a future value, where n1 is the interest rate per period, n2 is the future value of the investment, and n3 is the amount of the initial investment. For example "`cterm(.02, 200, 100)`" returns 35 as the required period for $100 invested at 2% to grow to $200.

fv(n1, n2, n3)

> Returns the future value of periodic constant payments at a constant interest rate, where n1 is the amount of each equal payment, n2 is the interest rate per period, and n3 is the total number of periods. For example "`fv(100, .075 over 12, 10 times 12)`" returns 17793.03 as the amount present after paying $100 a month for 10 years in an account bearing an annual interest of 7.5%.

ipmt(n1, n2, n2, n3, n4, n5)

> Returns the amount of interest paid on a loan over a period of time, where n1 is the principal amount of the loan, n2 is the annual interest rate, n3 is the monthly payment, n4 is the first month of the computation, and n5 is the number of months to be computed. For example "`ipmt(30000, .085, 295.50, 7, 3)`" returns 624.88 as the

amount of interest paid starting in July (month 7) for 3 months on a loan of $30,000.00 at an annual interest rate of 8.5% being repaid at a rate of $295.50 per month.

npv(n1, n2 [, ...])

Returns the the net present value of an investment based on a discount rate, and a series of periodic future cash flows, where n1 is the discount rate over one period, n2 ... are cash flow values which must be equally spaced in time and occur at the end of each period. For example "`npv(0.15, 100000, 120000, 130000, 140000, 50000)`" returns 368075.16 as the net present value of an investment projected to generate $100,000, $120,000, $130,000, $140,000 and $50,000 over each of the next five years and the rate is 15% per annum.

pmt(n1, n2, n3)

Returns the payment for a loan based on constant payments and a constant interest rate, where n1 is the principal amount of the loan, n2 is the interest rate per period, and n3 is the number of monthly payments. For example, "`pmt(30000.00, .085 over 12, 12 times 12)`" returns 333.01 as the monthly payment for a loan of a $30,000, borrowed at a yearly interest rate of 8.5%, repayable over 12 years (144 months).

ppmt(n1, n2, n2, n3, n4, n5)

Returns the amount of principal paid on a loan over a period of time, where n1 is the principal amount of the loan, n2 is annual interest rate, n3 is the monthly payment, n4 is is the first month of the computation, and n5 is the number of months to be computed. For example "`ppmt(30000, .085, 295.50, 7, 3)`" returns 261.62 as the amount of principal paid starting in July (month 7) for 3 months on a loan of $30,000 at an annual interest rate of 8.5%, being repaid at $295.50 per month. The annual interest rate is used in the function because of the need to calculate a range within the entire year.

pv(n1, n2, n3)

Returns the present value of an investment of periodic constant payments at a constant interest rate, where n1 is the amount of each equal payment, n2 is the interest rate per period, and n3 is the total number of periods. For example "`pv(1000, .08 over 12, 5 times 12)`" returns 49318.43 as the present value of $1000.00 invested at 8% for 5 years.

rate(n1, n2, n3)

Returns the compound interest rate per period required for an investment to grow from present to future value in a given period, where n1 is the future value, n2 is the present value and n3 is is the total number of periods. For example "`rate(110, 100, 1)`" returns 0.10 as what the rate of interest must be for and investment of $100 to grow to $110 if invested for 1 term.

term(n1, n2, n3)

Returns the number of periods needed to reach a given future value from periodic constant payments into an interest bearing account, where n1 is the payment amount made at the end of each period, n2 is the interest rate per period, and n3 is the future value. For example "`term(475, .05, 1500)`" returns 3 as the number of months for an investment of $475, deposited at the end of each period into an account bearing 5%

compound interest, to grow to $1500.00.

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Appendix E: References

Contents

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Appendix F: Changes

Changes from last published version

Future revisions of this spec will contain a list of all changes here.