WMO Codes Registry:
http://codes.wmo.int

web-based publication of the Manual on Codes

Jeremy Tandy, 20 November 2013
Motivation: XML-encoded data exchange standards

ICAO Annex 3 / WMO No. 49 II

Meteorological Service for International Air Navigation

Amendment 76 (2013) to ICAO Annex 3 shall, for states in a position to do so to, permit bilateral exchange of OPMET data via XML.

TAF
METAR/SPECI
SIGMET

XML
Model-driven approach to data exchange standards

Geographic Information
[ISO 19100-series]

**Application Schema**
(aka ‘conceptual model’)

**Conformance to Technical Regulation requires strong validation**
Nominal value-types; regulated set of terms (code-table)

Technical Regulation mandates the use of terms only from a specified controlled vocabulary.
Design choice: avoid use of «enumeration» entities (fragile)
Best practice: use «CodeList» class (external reference)
Referencing terms using canonical labels

```xml
<iwxxm:runwayState>
  <iwxxm:AerodromeRunwayState>
    <iwxxm:depositType>
      Damp
    </iwxxm:depositType>
  </iwxxm:AerodromeRunwayState>
</iwxxm:runwayState>
```

Canonical labels don’t work well as identifiers as their use is error prone …
Referencing terms using canonical labels

<iwxxm:runwayState>
  <iwxxm:AerodromeRunwayState>
    <iwxxm:depositType>
      DAMP
    </iwxxm:depositType>
  </iwxxm:AerodromeRunwayState>
</iwxxm:runwayState>

CAPITALISATION?
Referencing terms using canonical labels

<iwxxm:runwayState>
  <iwxxm:AerodromeRunwayState>
    <iwxxm:depositType>
      Dammp
    </iwxxm:depositType>
  </iwxxm:AerodromeRunwayState>
</iwxxm:runwayState>

Typographic errors?
Referencing terms using canonical labels

<iwxxm:runwayState>
  <iwxxm:AerodromeRunwayState>
    <iwxxm:depositType>
      влажный
    </iwxxm:depositType>
  </iwxxm:AerodromeRunwayState>
</iwxxm:runwayState>

Multilingual content?
Referencing terms using local identifiers; “code-figure”

```
<iwxxm:runwayState>
  <iwxxm:AerodromeRunwayState>
    <iwxxm:depositType>
      1
    </iwxxm:depositType>
  </iwxxm:AerodromeRunwayState>
</iwxxm:runwayState>
```

“1” what? Because XML is a generalised exchange format, there are no implied semantics like for BUFR and GRIB
Referencing terms using local identifiers; “code-figure”

```
<iwxxm:runwayState>
  <iwxxm:AerodromeRunwayState>
    <iwxxm:_depositType>
      0-20-086/1
    </iwxxm:depositType>
  </iwxxm:AerodromeRunwayState>
</iwxxm:runwayState>
```

Qualifying the code-figure with the code-table identifier is still fairly meaningless unless you’re a BUFR expert!
Referencing terms using local identifiers; “code-figure”

<iwxxm:runwayState>
  <iwxxm:AerodromeRunwayState>
    <iwxxm:depositType>
      bufr4/codeflag/0-20-086/1
    </iwxxm:depositType>
  </iwxxm:AerodromeRunwayState>
</iwxxm:runwayState>

Adding context (e.g. BUFR edition 4, code- and flag-tables) helps – but who’s the publishing authority?
We want to be sure that this is the authoritative version from WMO; prefix identifier with WMO’s Internet domain name.
Referencing terms using global identifiers; xlink & URN

<iwxxm:runwayState>
  <iwxxm:AerodromeRunwayState>
    <iwxxm:depositType>
      xlink:href="urn:foo:wmo.int/bufr4/codeflag/0-20-086/1"
      xlink:title="Damp"/>
    </iwxxm:depositType>
  </iwxxm:AerodromeRunwayState>
</iwxxm:runwayState>

A URN may be used – but then one needs additional knowledge to determine how to resolve the identifier.

GML requires use of xlink for «CodeList» references; the Locator Attribute “href” must be a URI.
Referencing terms using URIs; an Open Data approach

5 ★ Open Data scheme: the degree to which data is (re-)usable

★★★★ use URIs to denote things – so that people can point to your stuff

Better still – use HTTP URIs and let the Internet take the strain to resolve the identifier to useful information!

source: http://5stardata.info/
HTTP URI – it’s just an identifier!

A URI doesn’t have to resolve to anything – but it’s helpful if it does …

Don’t confuse a URI with a URL; operational systems not connected to the Internet can still use URIs as identifiers.

source: https://github.com
The WMO Codes Registry service: resolving identifiers

<iwxxm:runwayState>
  <iwxxm:AerodromeRunwayState>
    <iwxxm:depositType>
      xlink:href="http://codes.wmo.int/bufr4/codeflag/0-20-086/1"
      xlink:title="Damp"/>
    </iwxxm:depositType>
  </iwxxm:AerodromeRunwayState>
</iwxxm:runwayState>

“codes” sub-domain prefix added to wmo.int Internet domain name to enable redirection using DNS …
The WMO Codes Registry service: resolving identifiers

Entity: Damp

URI: http://codes.wmo.int/bufr4/codeflag/0-20-086/1

Type: runwayDeposits

no description supplied

Properties:
- Metadata
- History

<table>
<thead>
<tr>
<th>label</th>
<th>Damp</th>
</tr>
</thead>
<tbody>
<tr>
<td>type</td>
<td>runwayDeposits</td>
</tr>
</tbody>
</table>

Submitted on: 25 Sep 2013 12:56:34.668
Submitted by: bootstrap
Overview of WMO Codes Registry

- **WMO Codes Registry** is the Service that resolves these HTTP URIs
- Provides *useful* information about each identified resource or concept (as determined by WMO) – using *content negotiation* to render both human- and machine-readable content (*HTML*, *RDF/XML*, *Turtle* & *JSON-LD*)
- Newly deployed: September 2013
- Operated by Met Office on behalf of WMO
- Founded on Linked Data principles and RDF
- Built using [open-source Registry software](#) developed by UK Government
HTTP URIs assigned to code-tables too …

```xml
<complexType name="RunwayDepositsType">
  <annotation>
    <appinfo>
      <vocabulary>
        http://codes.wmo.int/bufr4/codeflag/0-20-086
      </vocabulary>
      <extensibility>none</extensibility>
    </appinfo>
    <documentation>
      Type of deposit on a runway [..snip..]
    </documentation>
  </annotation>
  <complexContent>
    <extension base="gml:ReferenceType"/>
  </complexContent>
</complexType>
```

We needed an external reference from the model to the code-table; “vocabulary” tagged value is code-table URI.
HTTP URIs assigned to code-tables too ...

Each code-table is published as a “Register”
Register hierarchy aligned with WMO Technical Regulation

Code-tables are “leaf-Registers” within a sub-register hierarchy; where possible aligned with Tech Regulation structure.
Answering the “membership” question: *is this a valid term?*

The Registry service provides a validation API (web browser-based & programmatic) to assess whether a specified term is a valid member of the code-table.

[POST] http://codes.wmo.int/bufr4?

validate=http://codes.wmo.int/bufr4/codeflag/0-20-086/1

[HTTP 200 OK] http://codes.wmo.int/bufr4/codeflag/0-20-086/1 is
http://codes.wmo.int/bufr4/codeflag/0-20-086/1
Sophisticated underpinning data model & simple views

- RegisterItem relates an *entity* to a specific Register – like the index-card in a library …
- RegisterItem identifiers use a underscore “_” syntax
- RegisterItem defines the status of an *entity* with respect to the Register
- Life cycle management of terms built in
- RegisterItems are versioned – enabling traversal through historical changes
Current status and future plans

- **WMO Codes Registry** is available now!
- Web-application and RESTful API – both for READ and UPDATE operations
- Authentication via OpenID (Google); self-registration permitted – *only members of WMO Expert Team will authorized to make changes*
- Current coverage of WMO No. 306 is sparse as initial objective is support for [IWXXM](#); commitment from WMO to expand coverage and add multilingual content
- Planned enhancements include:
  - support for offline operational systems (export & validation)
  - improvements to User Interface (less technical)
  - addition of ‘back-catalogue’ terms from previous versions of TDCF
And finally …

- We set out to support IWXXM …
- But along the way, we have unlocked one of the best kept secrets of WMO – the code-tables which provide a definitive shared language for talking about weather, water and climate …
- Although previously these were tightly bound into complex data format specifications, the concepts and terms defined in the code-tables can now be used by the everyone interested in meteorology – not just WMO members.
- We’ve made it easy for everyone to talk about the weather using consistent and unambiguous semantics.
Thank you for your attention
For further information please refer to the User Guide, FAQ and technical documentation