

Space-Time (and other) Coordinate Metadata

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Outline

- Principles
- Overview
- Recent Changes
- Usage and Examples
- Implementations
- Status

Principles

- Space and Time (and Spectral and Redshift/Doppler) coordinates are, or can be, intertwined:
 - Handle them in one model
- Metadata requirements:
 - Complete
 - Internally consistent
 - Unambiguous

Principles

- Complete and unambiguous:
 - No defaults: only valid in limited communities
 - The only allowable default: “*UNKNOWN*”
- However: requirements on user interfaces are not the same as on metadata
 - UIs function in smaller communities and may state their default assumptions
 - *UNKNOWN* means it’s up to the client
 - (which may amount to a default)

Overview

- Objective:
 - Full description of all relevant information pertaining to coordinate axes:
 - Coordinate system (collection of Frames)
 - Volume of coordinate space that is occupied – bounds, support, form of sensitivity
 - Any specific info: positions, errors, resolution, size, pixelsize
 - Support for all coordinate frames, including dependent variables and pixel space

Overview

- Coordinate System
 - Frames
 - Reference Frame (ICRS, UTC, ...)
 - Reference Position (geocenter, barycenter, topocenter, ...)
 - Allows full definition of any coordinate frame, including WCS-like transformations

Overview

- Support for spatial regions in 2-D (spherical or Cartesian) and on Unit Sphere:
 - Shapes: circle, ellipse, polygon, box, sector
 - Operations: intersection, union, negation, difference
- JHU Footprint Service (Budavari & Dobos)

Overview

- XML schema realization:
 - Attempt to enforce consistency and completeness as far as possible (but ultimately I'm pretty powerless)
- STC-S:
 - String implementation which is the basis for ADQL Region definition

Recent Changes

- Full support for coordinate transformations on all axes
- Revised inheritance structure, getting rid of derivation by restriction (largely; though meaningful, XML schema support is poor)
- Enhanced support for Characterisation
- Expanded examples
- No impact on existing applications

Usage

- STC can express (almost) anything there is to know about coordinate metadata (see, e.g., examples 2, 6, and 9)
- But I have no illusion that everybody (anybody?) will take full advantage of it
- Data providers may add as much or as little metadata as they see fit –always think they know better than their users
- STC ↔ FITS WCS converter is feasible

Usage

- Just beware that the client may interpret anything you don't supply in a way that suits his/her purposes
- On the other hand, recall the distinction between UI specification and metadata content – and UI code could (should) fill in the gaps; much of it is boiler plate
- No user should ever see the raw XML

Examples

- A search area (by JCM, but fixed up):

```
<AstroCoordSystem xlink:type="simple"
  xlink:href="ivo://STClib/CoordSys#UTC-ICRS-BARY"
  id="UTC-ICRS-BARY"xsi:nil="true"/>
<AstroCoordArea coord_system_id="UTC-ICRS-BARY">
  <Circle unit="deg">
    <Center><C1>148.9</C1><C2>69.1</C2></Center>
    <Radius>2</Radius>
  </Circle>
</AstroCoordArea>
```

Examples

- An image (same):

```
<ObservatoryLocation id="KPNO" xlink:type="simple"
  xlink:href="ivo://STClib/Observatories#KPNO" xsi:nil="true"/>
<ObservationLocation>
  <AstroCoordSystem id="UTC-ICRS-TOPO" xlink:type="simple"
    xlink:href="ivo://STClib/CoordSys#UTC-ICRS-TOPO" xsi:nil="true"/>
  <AstroCoordArea coord_system_id="UTC-ICRS-TOPO">
    <TimeInterval>
      <StartTime><ISOTime>2003-04-01T01:00:00</ISOTime></StartTime>
      <StopTime><ISOTime>2003-04-01T01:10:00</ISOTime></StopTime>
    </TimeInterval>
    <Box unit="deg">
      <Center><C1>148.9</C1><C2>69.1</C2></Center>
      <Size><C1>1.2</C1><C2>1.2</C2></Size>
    </Box>
  </AstroCoordArea>
</ObservationLocation>
```

Implementations

- JHU Footprint service – Regions
- Registry – Resource profiles, coverage
- VOEvent – WhereWhen: ObsDataLocation
- David Berry's interface – Transformations
- Characterisation
- Examples

Status

- The document is 87 pages
- There is an issue to be resolved with Registry over how to refer to the standard coordinate systems in the library
 - This does not affect model or schema
- JCM is working on a *utype* model of STC
- Agreement with VOTable
- Proposed STC *utype* instance aliases for string applications, such as ADQL

Status

- Issue arose with Registry over use of ID/IDREF pairs:
 - Unambiguous association mechanism, requires IDs to be unique
 - Potential problem when concatenating documents
 - Required fix should:
 - Allow unambiguous association
 - Allow recognition of ID/IDREF without schema
 - Proposed fix is backward-compatible