STC Lite: at the end of the tunnel?

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The USVOA is recognized by the American Astronomical Society (AAS) as a Special Interest Group (SIG) of the Working Group on Astronomical Software (WGAS).

Credits

Omar Laurino

- Exercise model and mapping as both server and client
  - Jovial DSL (model import; instance generation)
  - Python mapping parser
  - Jupyter Notebook software demo
- Provide feedback on where usability can be improved

Mark C-D

- Review feedback
- Implement model updates
  - Modelio + vo-dml xslt => vo-dml/XML

Arnold Rots

- Change review feedback (domain)

Project Scope

+ Test models for usability by clients and providers
  - Focus STC2, but includes Cube and Dataset as well
  - Current model focuses on generic representation to accommodate the broadest set of use cases
    - "Users should be able to identify and use basic content with minimal specialized information"
  - Define new usability requirements:
    - "simple/common cases should be simple to provide and consume"
    - "allow standardization of common instances"

Process

+ Use rapid iteration feedback to test alternative model representations
  - Find sweet spot balancing simplicity of implementation with complexity of the domain

+ Add shortcut (lite) elements consolidating common cases to a simple package. eg: Sky position

2D Position in ICRS – Current

Fully defined generic representation

```
<INSTANCE dmtype="stc2_measurements:domain.space.Position2D">
  <ATTRIBUTE dmrole="stc2_measurements:uncertainty.CoordMeasure.coord">
    <INSTANCE dmtype="stc2_coordinates:domain.space.SpatialValue2D">
      <ATTRIBUTE dmrole="stc2_coordinates:coords.MultiCoordValue.cmpt">
        <INSTANCE dmtype="stc2_coordinates:domain.space.SpatialCoordValue">
          <ATTRIBUTE dmrole="stc2_coordinates:coords.PhysicalCoordValue.cval">
            <LITERAL value="12.9768538031" dmtype="ivoa:RealQuantity" unit="deg"/>
          </ATTRIBUTE>
          <REFERENCE dmrole="stc2_coordinates:coords.CoordValue.coordAxis">
            <REMOTEREFERENCE>file:///./standard-frames.vot#ICRS_RA_AXIS</REMOTEREFERENCE>
          </REFERENCE>
        </INSTANCE>
      </ATTRIBUTE>
      <ATTRIBUTE dmrole="stc2_coordinates:coords.MultiCoordValue.cmpt">
        <INSTANCE dmtype="stc2_coordinates:domain.space.SpatialCoordValue">
          <ATTRIBUTE dmrole="stc2_coordinates:coords.PhysicalCoordValue.cval">
            <LITERAL value="-72.9580158133" dmtype="ivoa:RealQuantity" unit="deg"/>
          </ATTRIBUTE>
          <REFERENCE dmrole="stc2_coordinates:coords.CoordValue.coordAxis">
            <REMOTEREFERENCE>file:///./standard-frames.vot#ICRS_DEC_AXIS</REMOTEREFERENCE>
          </REFERENCE>
        </INSTANCE>
      </ATTRIBUTE>
    </INSTANCE>
  </ATTRIBUTE>
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```
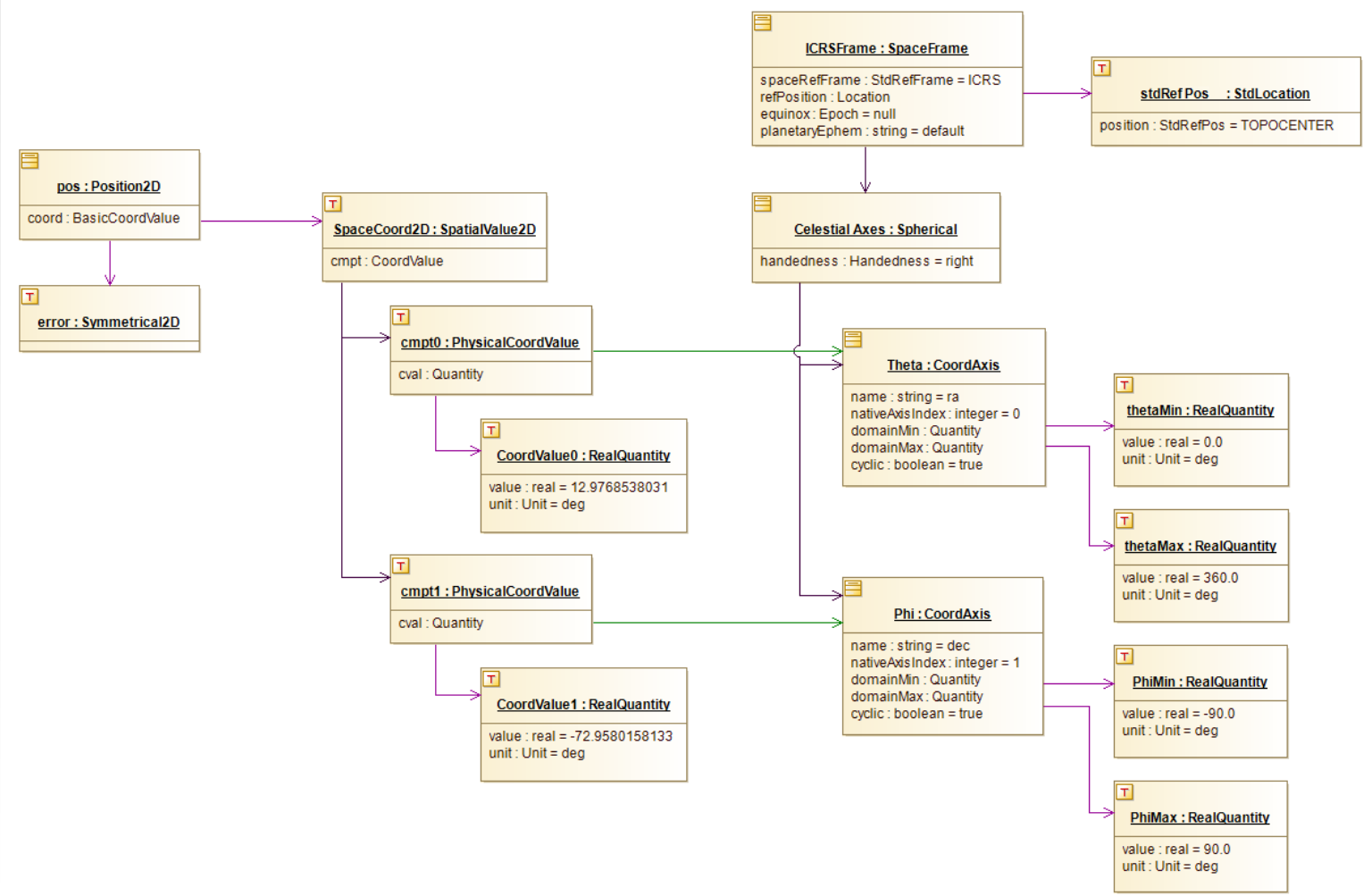

2D Position in ICRS – Current

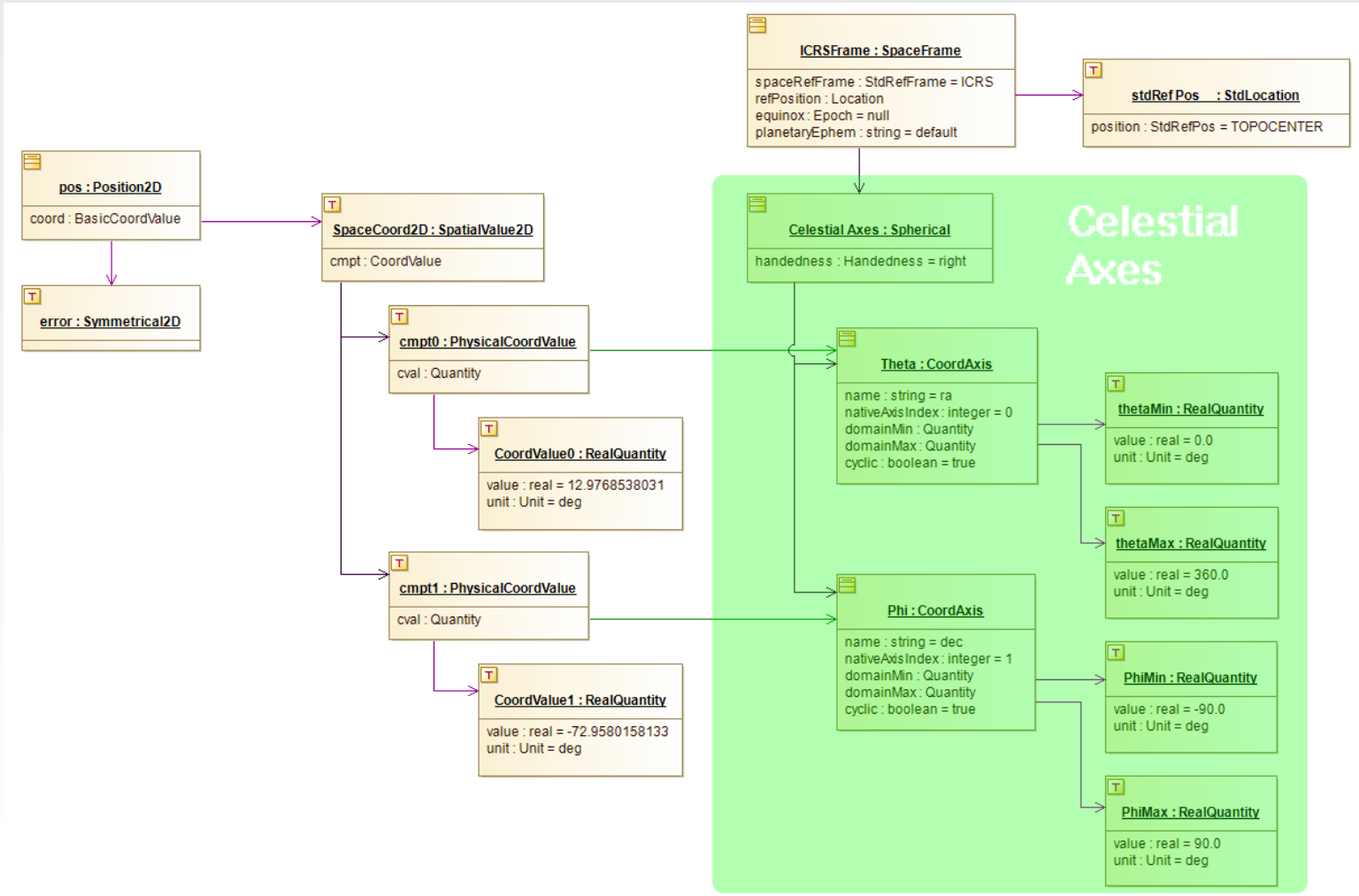
Fully defined generic representation



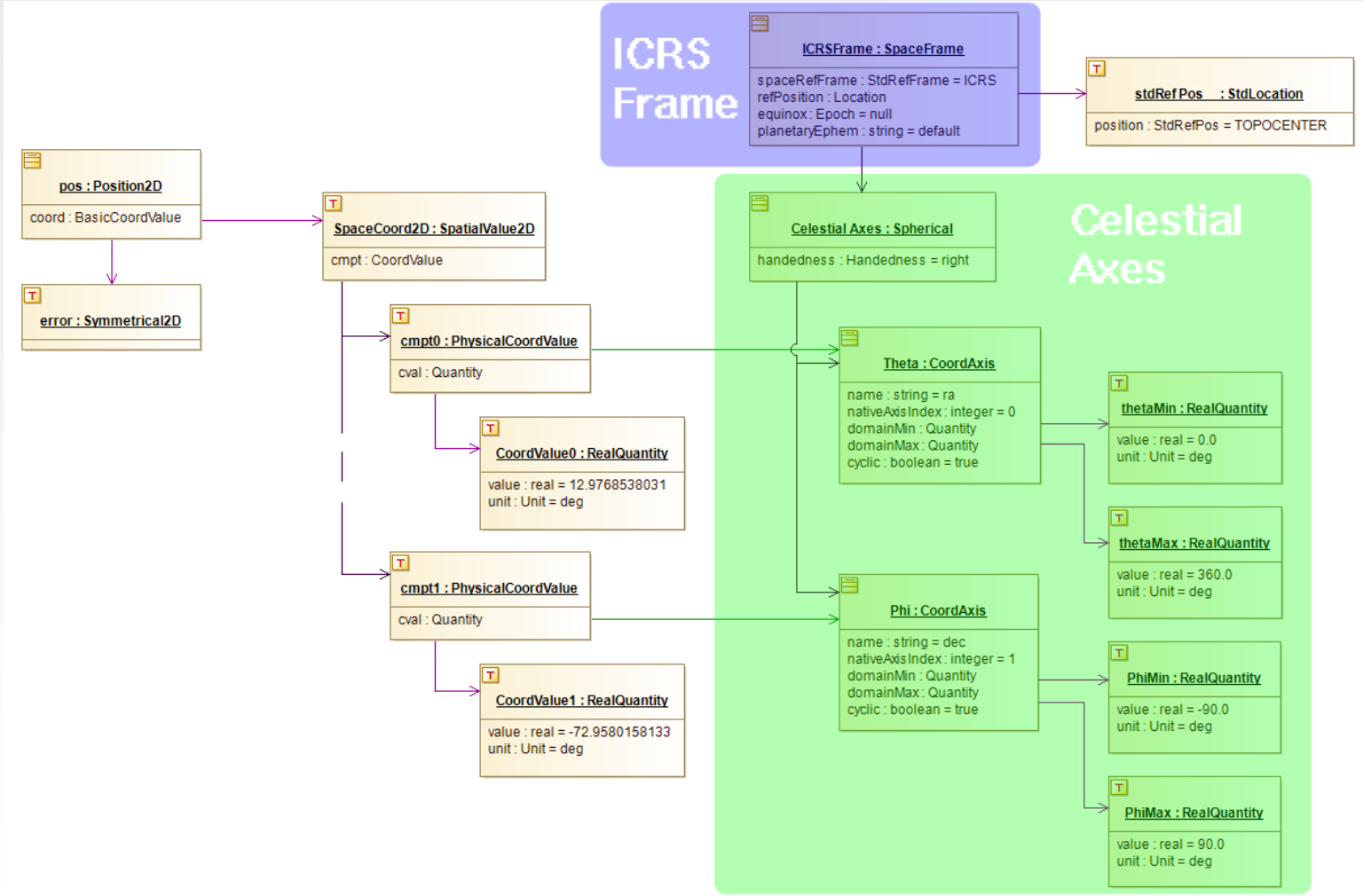
Assessment

Large sections of 'boilerplate' content which could be standardized and stored in a library of instances

Assessment


ICRSFrame : SpaceFrame
spaceRefFrame : StdRefFrame = ICRS
refPosition : Location
equinox : Epoch = null
planetaryEphem : string = default
stdRefPos : StdLocation
position : StdRefPos = TOPOCENTER
pos : Position2D
coord : BasicCoordValue
error : Symmetrical2D
SpaceCoord2D : SpatialValue2D
cmpt : CoordValue
cmpt0 : PhysicalCoordValue
cval : Quantity
CoordValue0 : RealQuantity
value : real = 12.9768538031
unit : Unit = deg
cmpt1 : PhysicalCoordValue
cval : Quantity
CoordValue1 : RealQuantity
value : real = -72.9580158133
unit : Unit = deg
Celestial Axes : Spherical
handedness : Handedness = right
Celestial Axes
Theta : CoordAxis
name : string = ra
nativeAxisIndex : integer = 0
domainMin : Quantity
domainMax : Quantity
cyclic : boolean = true
thetaMin : RealQuantity
value : real = 0.0
unit : Unit = deg
thetaMax : RealQuantity
value : real = 360.0
unit : Unit = deg
Phi : CoordAxis
name : string = dec
nativeAxisIndex : integer = 1
domainMin : Quantity
domainMax : Quantity
cyclic : boolean = true
PhiMin : RealQuantity
value : real = -90.0
unit : Unit = deg
PhiMax : RealQuantity
value : real = 90.0
unit : Unit = deg

Assessment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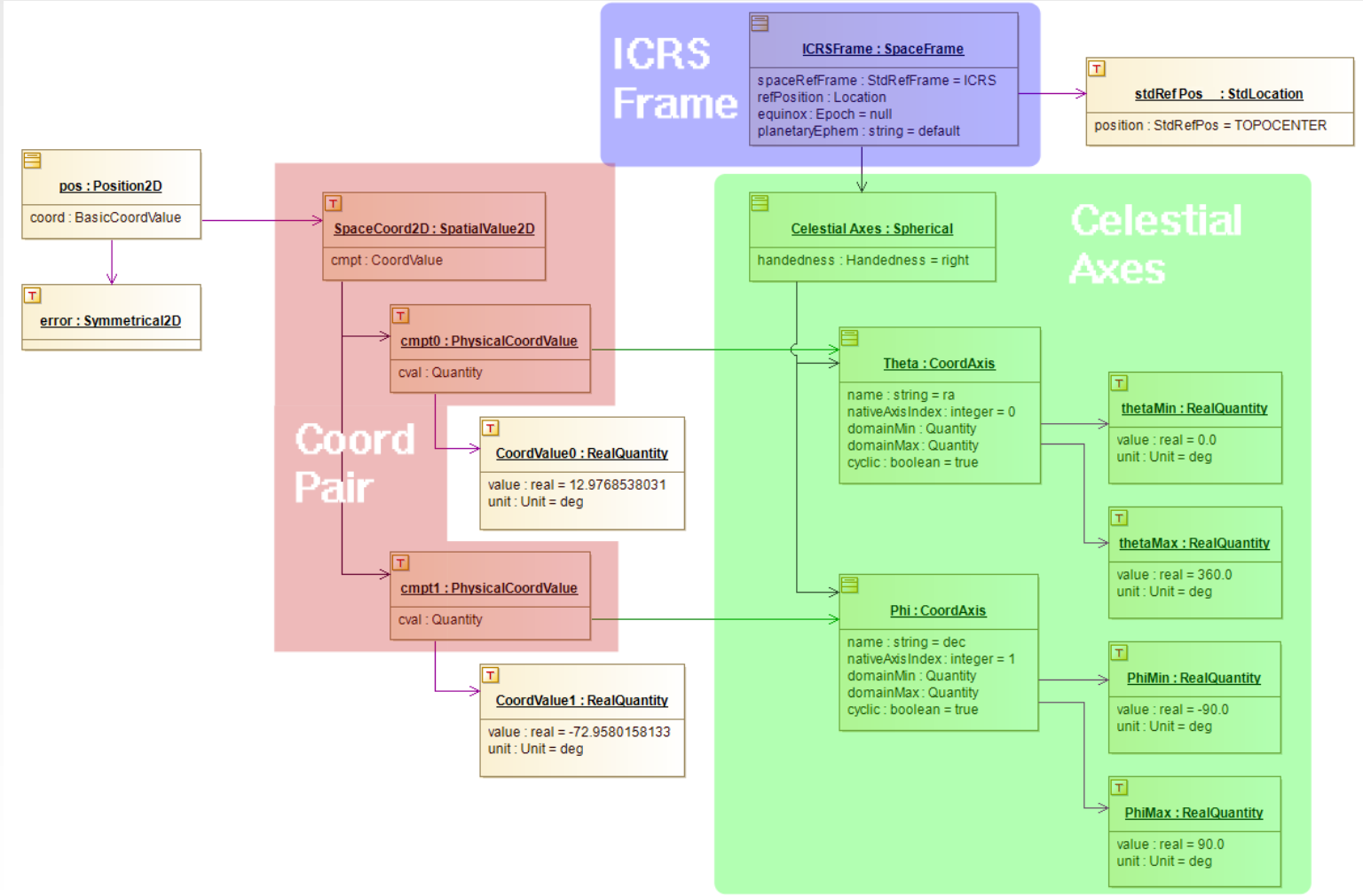
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Model Adjustments

+ Adjust relation of CoordFrame and CoordSpace
  - From CoordFrame composing CoordSpace
  - To CoordSpace referencing CoordFrame + AxisGroup
  - Allows most efficient canning of standard instances

+ Common 'flavors' to pre-defined instances
  - Referred to by standard ID: Celestial_AxisGroup

+ Add specialized objects **defined in terms of the general model** with standardized content
  - SkyCoord(ra, dec)

2D Position in ICRS - Lite

Equivalent instance after revisions

```
<INSTANCE dmtype="meas:SkyPosition">
  <ATTRIBUTE dmrole="meas:CoordMeasure.coord">
    <INSTANCE dmtype="coords:domain.spatial.CelestialCoord">
      <ATTRIBUTE dmrole="coords:domain.spatial.CelestialCoord.ra">
        <LITERAL value="12.9768538031" dmtype="ivoa:RealQuantity" unit="deg"/>
      </ATTRIBUTE>
      <ATTRIBUTE dmrole="coords:domain.spatial.CelestialCoord.dec">
        <LITERAL value="-72.9580158133" dmtype="ivoa:RealQuantity" unit="deg"/>
      </ATTRIBUTE>
    </INSTANCE>
  </ATTRIBUTE>
  <REFERENCE dmrole="meas:CoordMeasure.coordFrame">
    <IDREF>_SPACE_FRAME</IDREF>
  </REFERENCE>
</INSTANCE>
```

NOTE: This is how the position looks **in any context.**
Clients can code to these tags once and find them anywhere.
(eg: embedded in TimeSeries.. see examples)

2D Position in ICRS - Lite

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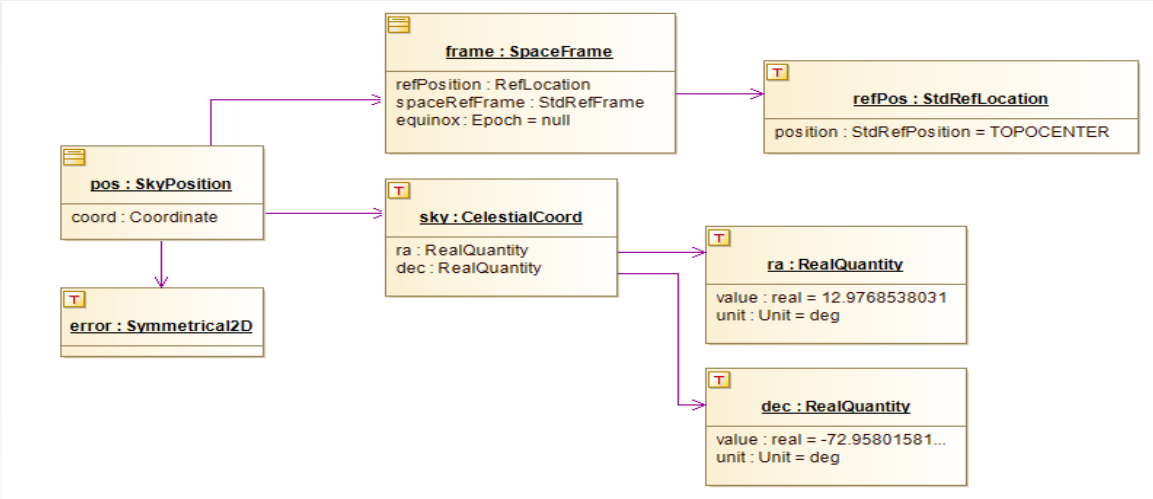

Summary

+ small change in modeling choices can simplify common uses without changing 'meaning'
  - Need to review for side-effects
+ adding 'shortcut' elements
  - Simplifies serializations and 'readability'
  - But, increases # of elements clients/providers need to know
+ mapping syntax and usage
  - implemented both the server and client sides
    - Several different example cases
    - the specification is robust
    - Implementations were **very** straightforward
  - syntax itself could be simplified (some)
  - changes easily tested with minor code change

Conclusions

STC Model:

This approach satisfies the end goal:

"Make the simple things simple, the hard things possible"

Need more requirements:

- What exactly is STC **required** to cover?
  - Current requirement is 'everything'
  - Hard to test.. currently basing off Cube file set
- Which items would be most useful to stanardize?
  - Axis Groups (Celestial, Cartesian, etc)
  - Standard Frames (space, time, other?)
- Most useful shortcuts
  - CelCoord, GalCoord, MJD, MET..

More info

Full details and complete example sets:

https://gitlab.com/olaurino/ivoa-dm-examples