CIM for Weather

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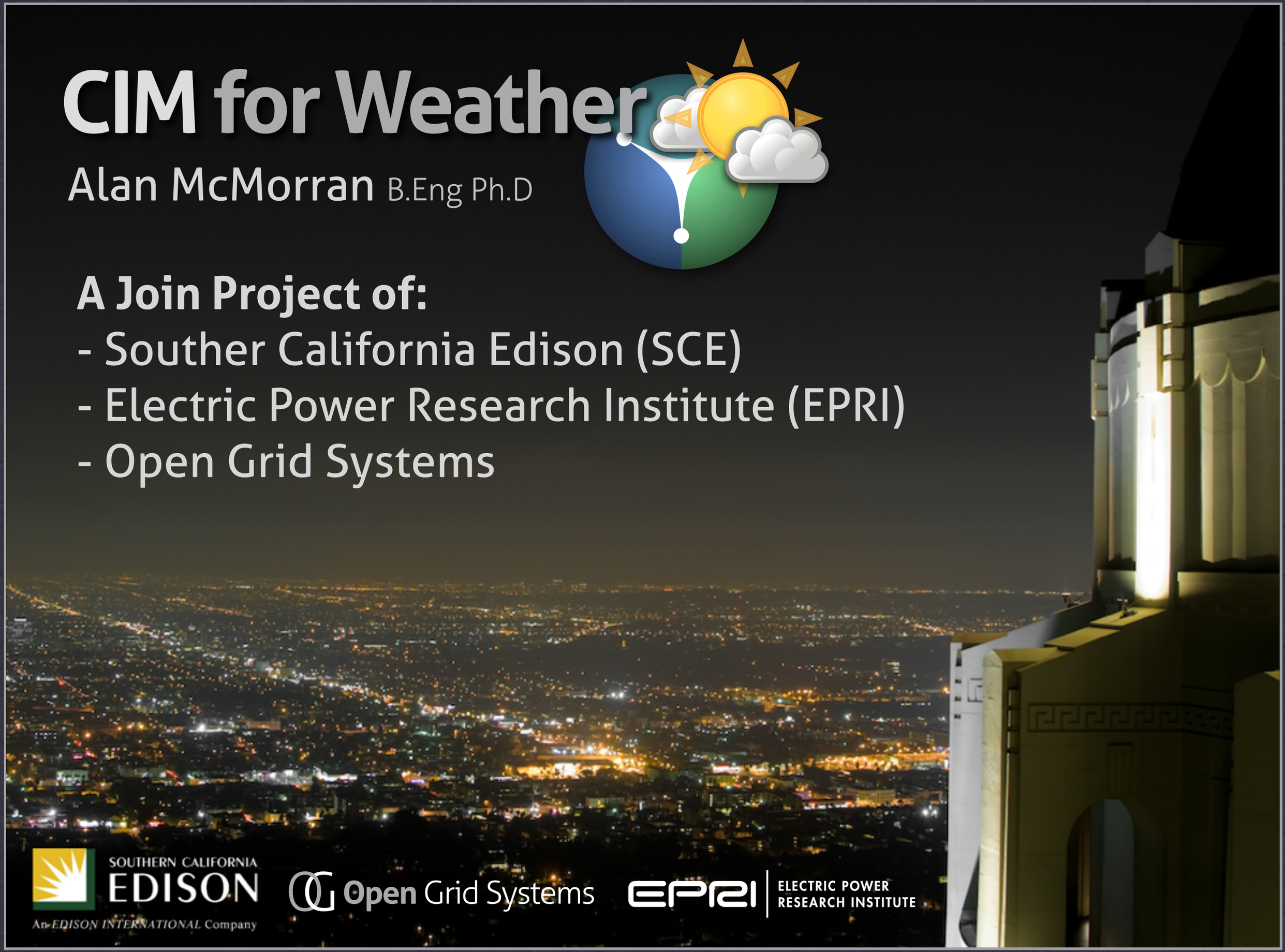
A Join Project of:

- Souther California Edison (SCE)
- Electric Power Research Institute (EPRI)
- Open Grid Systems



Introduction

CIM for Weather

- Extend the CIM to cover weather information
- Use of weather information is pervasive in utilities
  - Load forecasting
  - Planning for event (resource deployment)
  - Restoration
  - Root Cause Analysis
- Requirements driven by use cases

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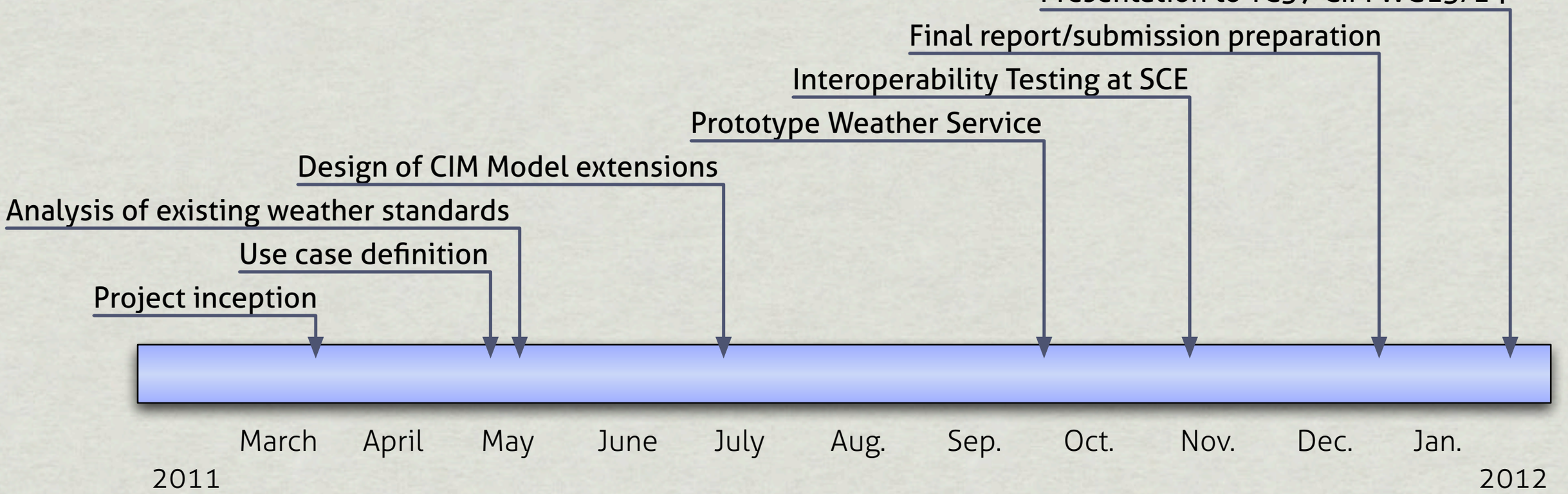
Schedule

- Started at the San Francisco CIM User Group meeting in October 2010 as discussion between SCE & EPRI



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Parties Involved

- **Southern California Edison**
  - Sponsor
  - Provides detailed use-cases
  - Real-world perspective
- **EPRI**
  - Project management
  - Utility contacts & connection to larger standards world
- **Open Grid Systems**
  - Design
  - Technical knowledge of CIM & standards process

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Weather Modelling

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Business Context

- SCE obtains weather information from multiple **Weather Data Service Providers**
- If the provider is an external source, a **Service Agreement** defines the T&Cs for the service
- **Weather Stations** also send **Weather Measurements** to the SCE back office
- **Weather Analytics** produces the other **Weather Data Products** sent to the SCE back office.
- **Service Invoices** and **Service Payments** are exchanged between SCE and external Weather Data Service Providers

Scope

- For this project the required scope was to model environmental phenomena occurring in the:
  - Hydrosphere
  - Geosphere
  - Atmosphere
  - Space

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Abstraction

- There is a need to exchange weather data that is:
  - Historical
  - Current
  - Forecast
- This includes raw measurement data and classified phenomena/observations (e.g. storms) that are *derived* from the raw data
- It is more than weather, it is really *environmental* data

Link to CIM

- The intent was to create a model that re-uses existing CIM modelling concepts and links the weather to the existing CIM semantic model
- Existing CIM classes were used where applicable e.g. for defining geographical locations and time periods
- Existing CIM serialisation formats and processes can be re-used (e.g. deriving profiles and XML Schema from the UML, RDF XML and RDF Difference Models)

External Inputs

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Inputs to the Process

- AThree key inputs were assessed to create the information model:
  - **TMY3** (Typical Meteorological Year) from the US National Renewable Energy Laboratory (NREL)
  - **WXXM** (Weather Exchange Model) from the Open Geospatial Consortium
  - Previous work on modelling weather in the CIM donated by **ABB**

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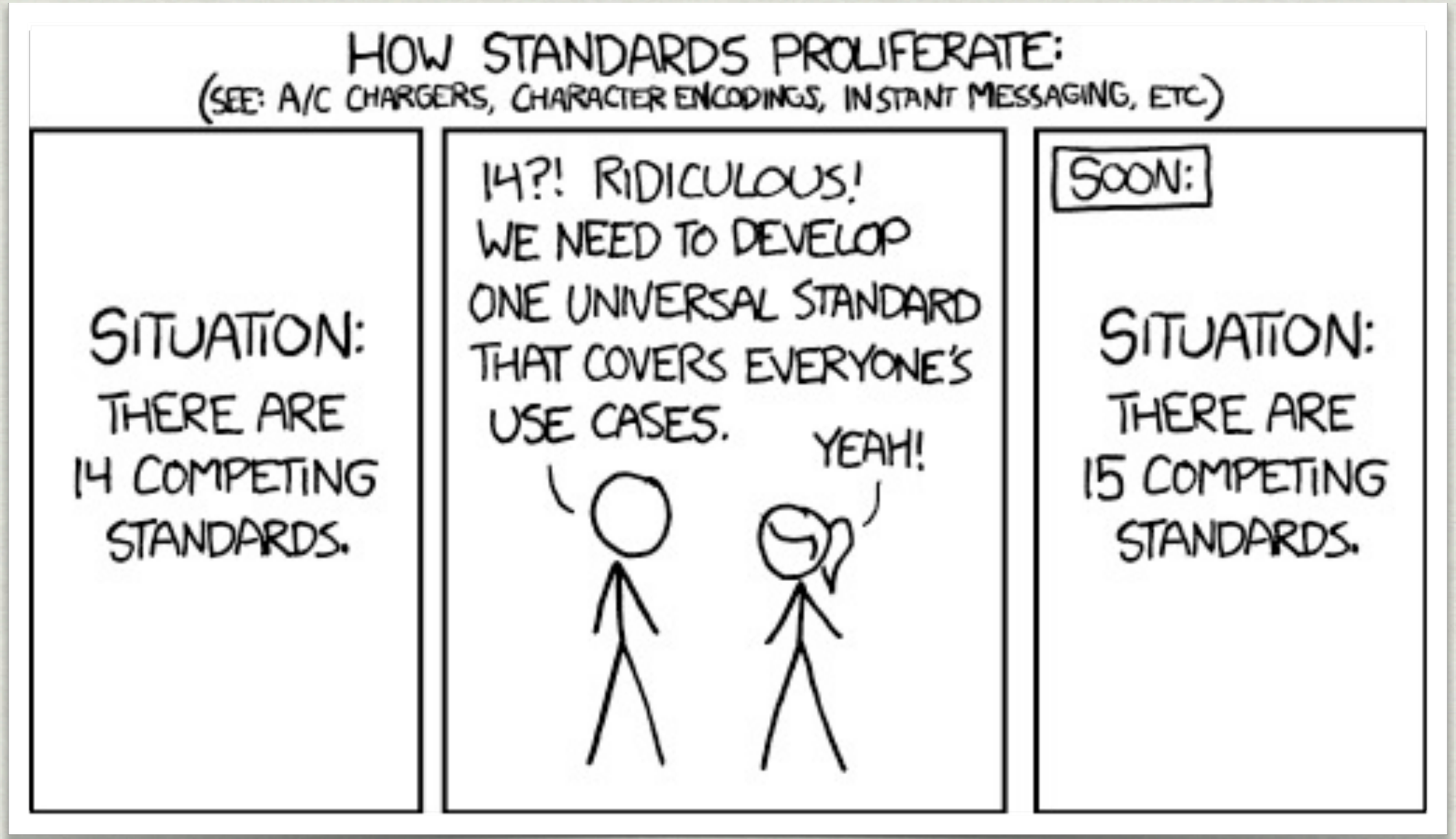
Additional Inputs

- The existing models and formats being looked at were not the limit of the work
- Some of the requirements already raised extend beyond the scope of models like WXXM and TMY (e.g. solar flares, coronal mass ejections, ~~black holes~~)
- The core of the model is focussed on the use-cases identified for testing and profile development
- Additional use-cases can influence the information model for future profiles as the current model is a first draft

Approach

The Risk.... (courtesy of XKCD)



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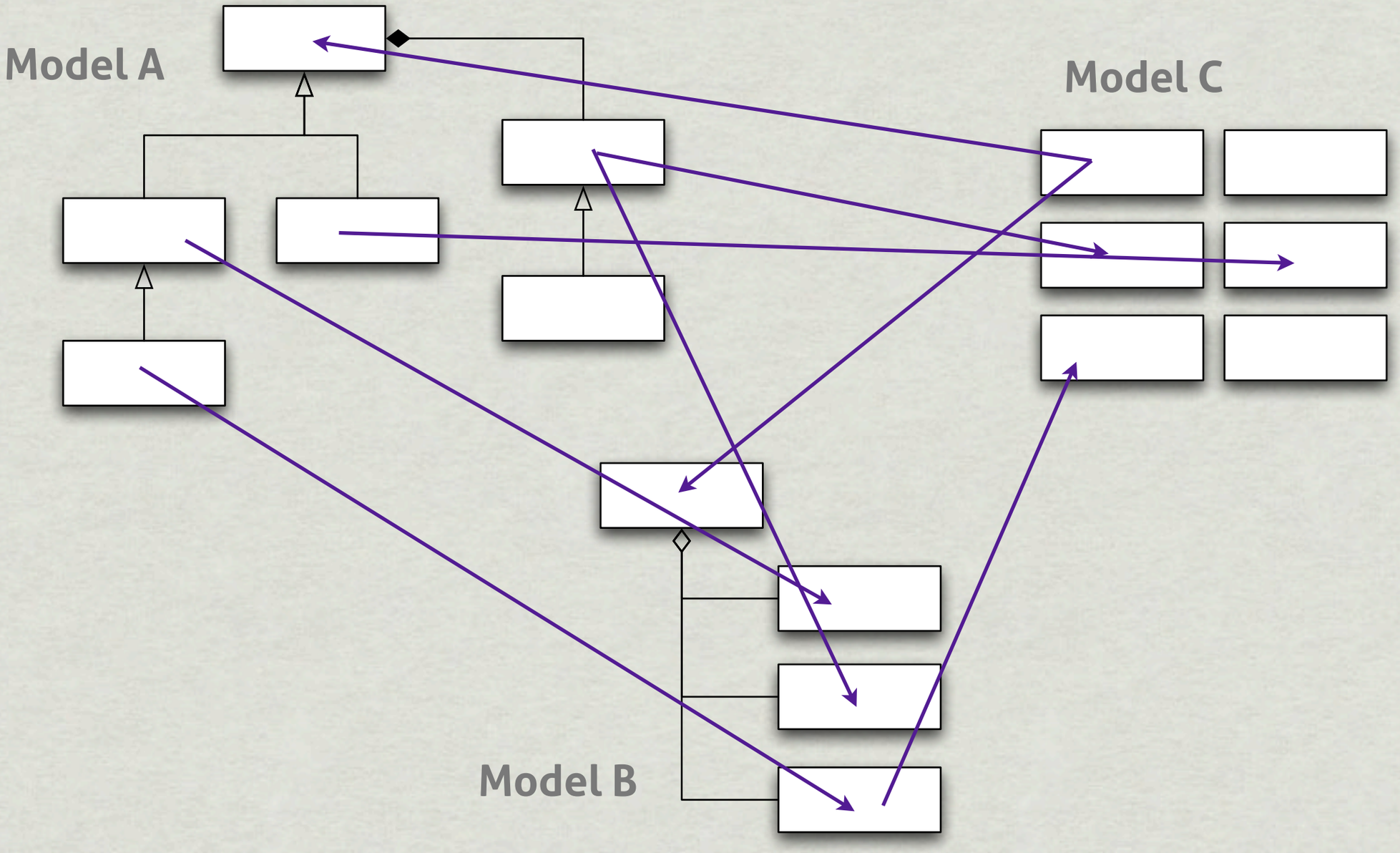
Identify Commonality



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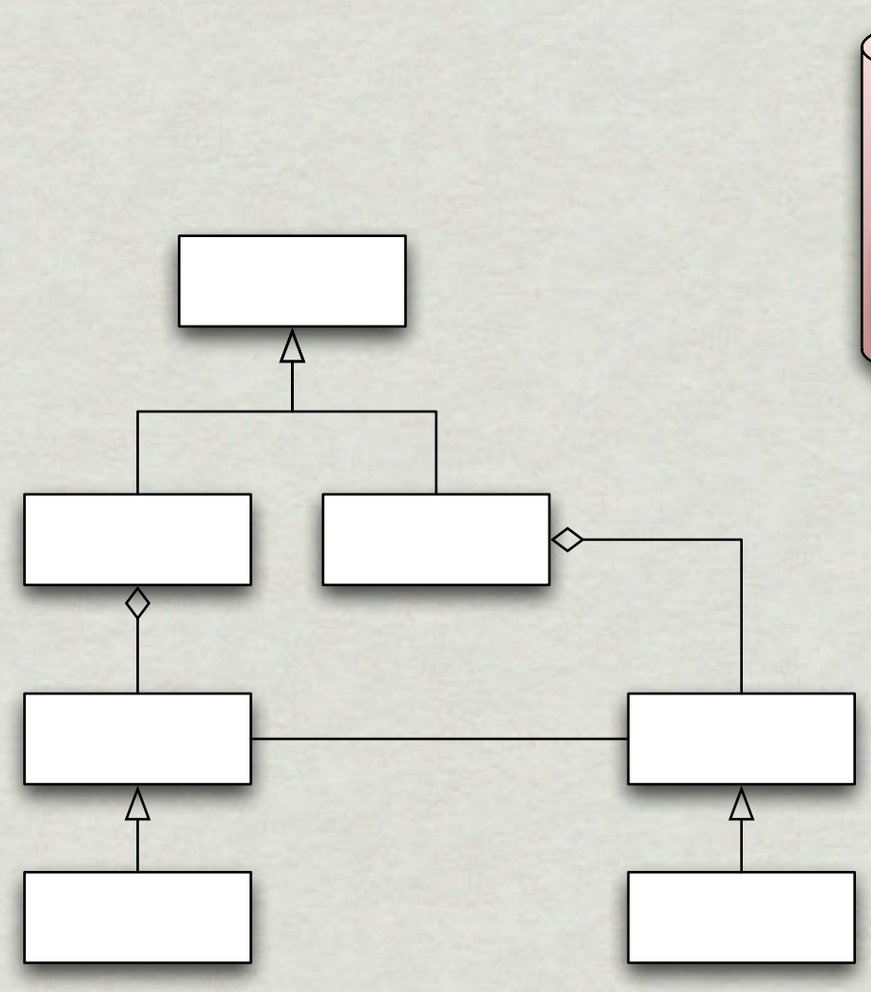
Use CIM Components

- This produced a base weather model that defined our scope
- There were elements in this model already in the CIM
- These were identified and used so as to prevent duplication



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Stateless Transformation

- The intent was not to "copy & paste" existing standards into the CIM, this benefits nobody
- This does not mean re-inventing the wheel and the aim was to allow bi-directional transformation between CIM for Weather and other standards (e.g. WXXM) where they overlap
- They were harmonised, not unified*
- CIM modelling conventions were be used and existing elements re-used and extended where necessary

* ©2011 Herb Falk & Jay Britton (re 61850)

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Common Information Model

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A Single Model

- The reason for extending the CIM to cover weather is that the CIM is more than just an information model
- With the CIM comes processes, tools and formats that are widely used in utilities
- SCE wanted all data exchanges within their enterprise to be defined by a single *common* model
- CIM for Weather thus becomes a package within the overall CIM that covers a large number of systems within a utility

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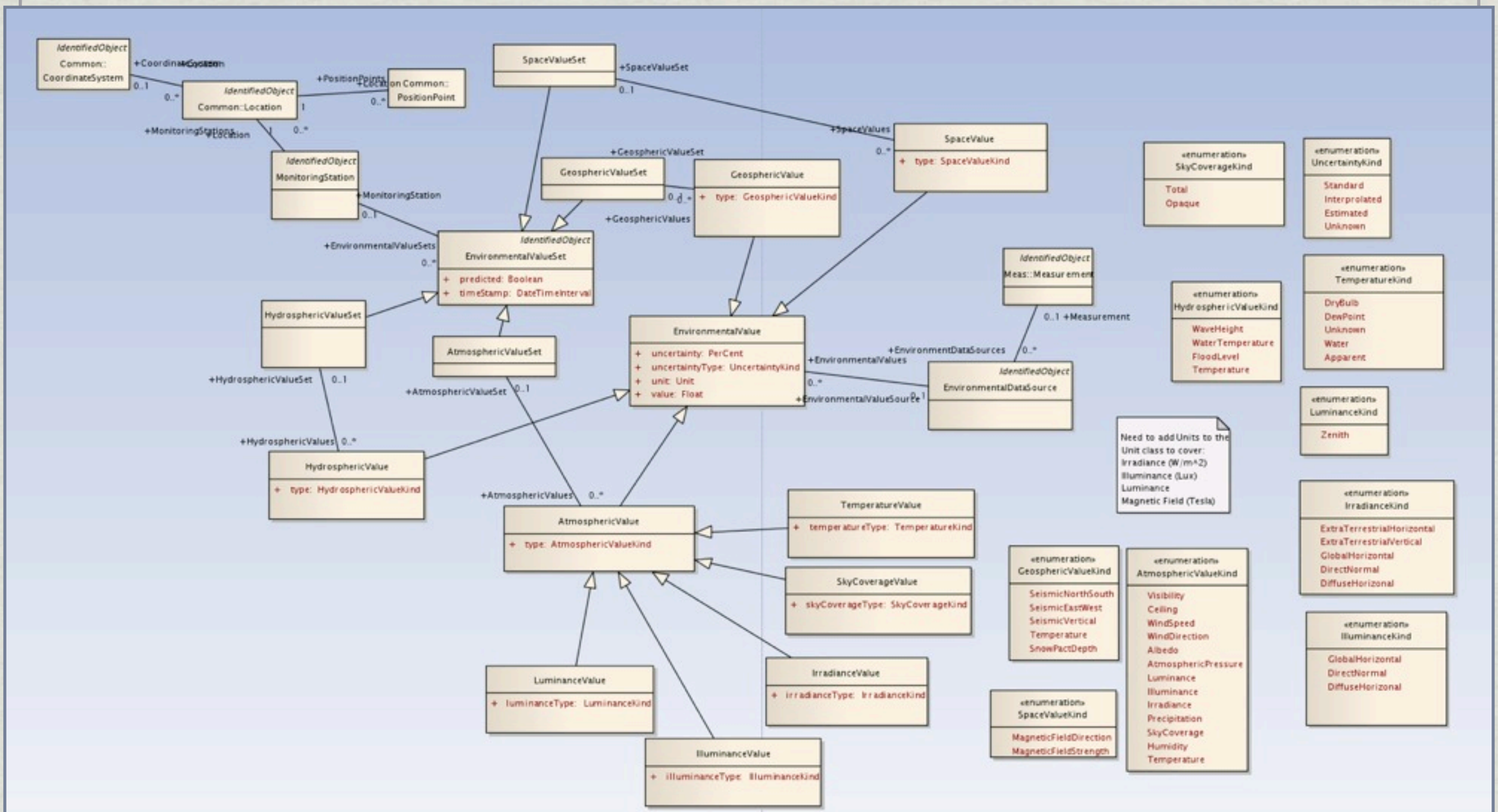
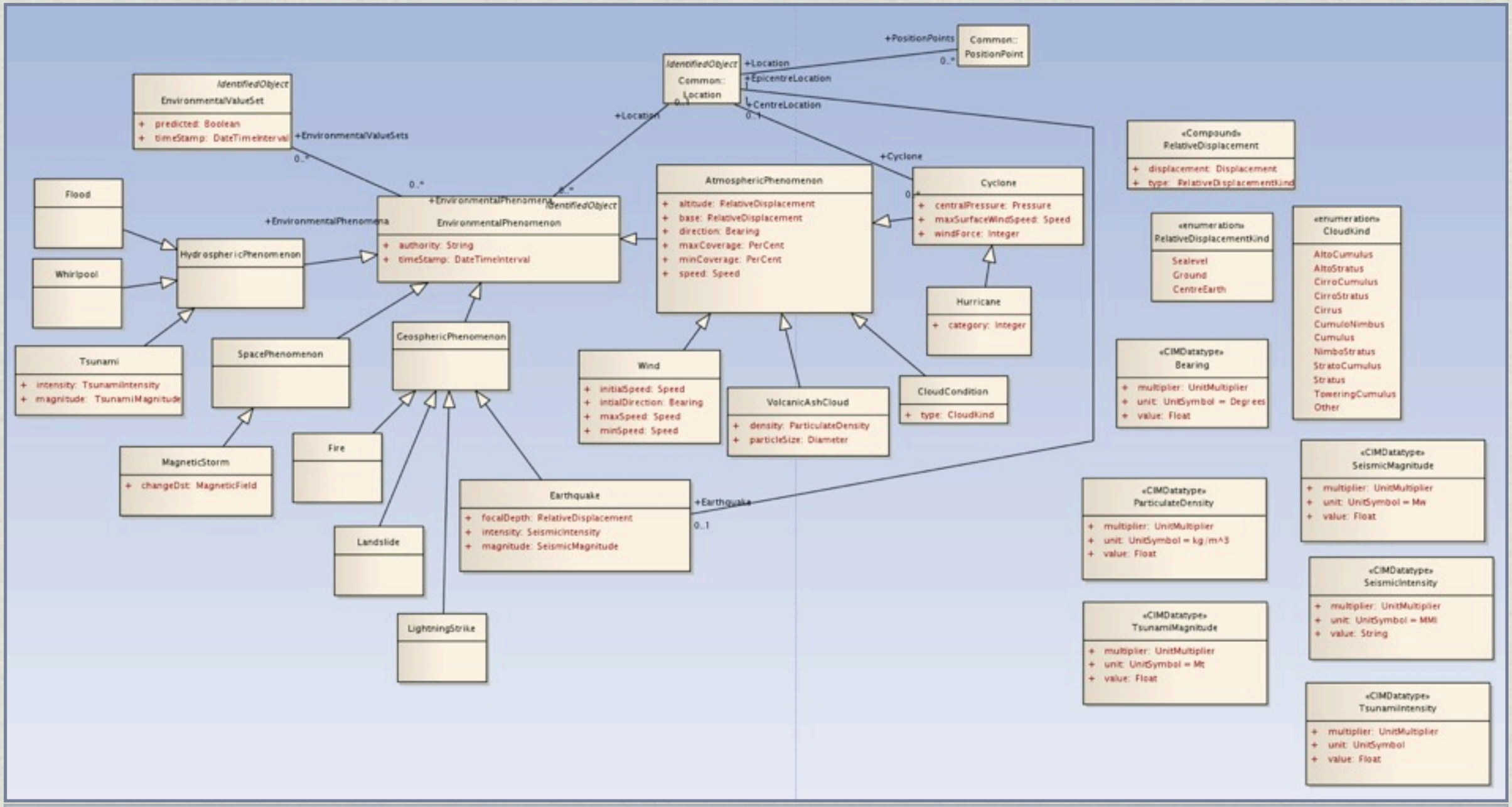
Environmental Data



Phenomena



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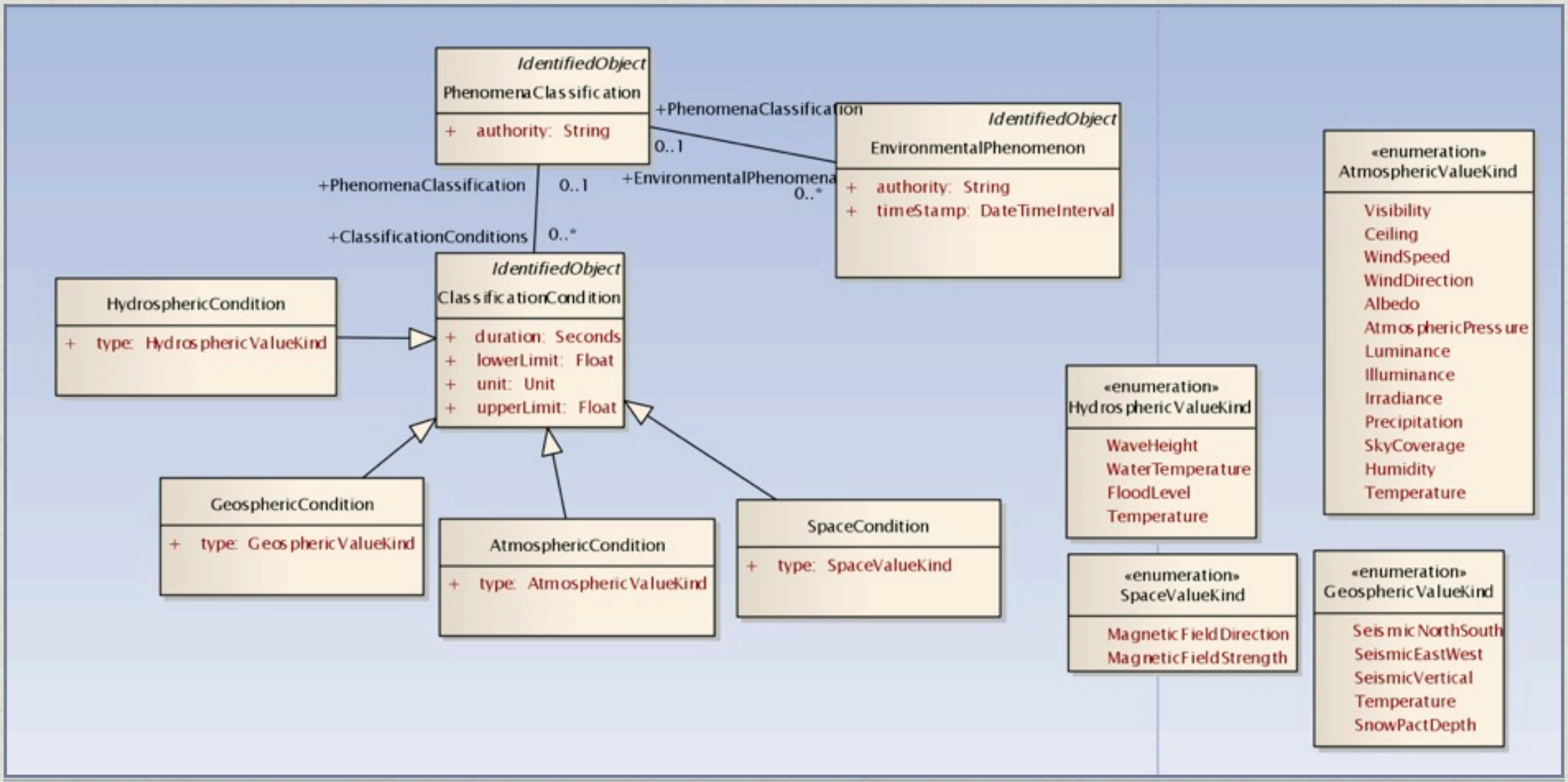
Phenomena Classification



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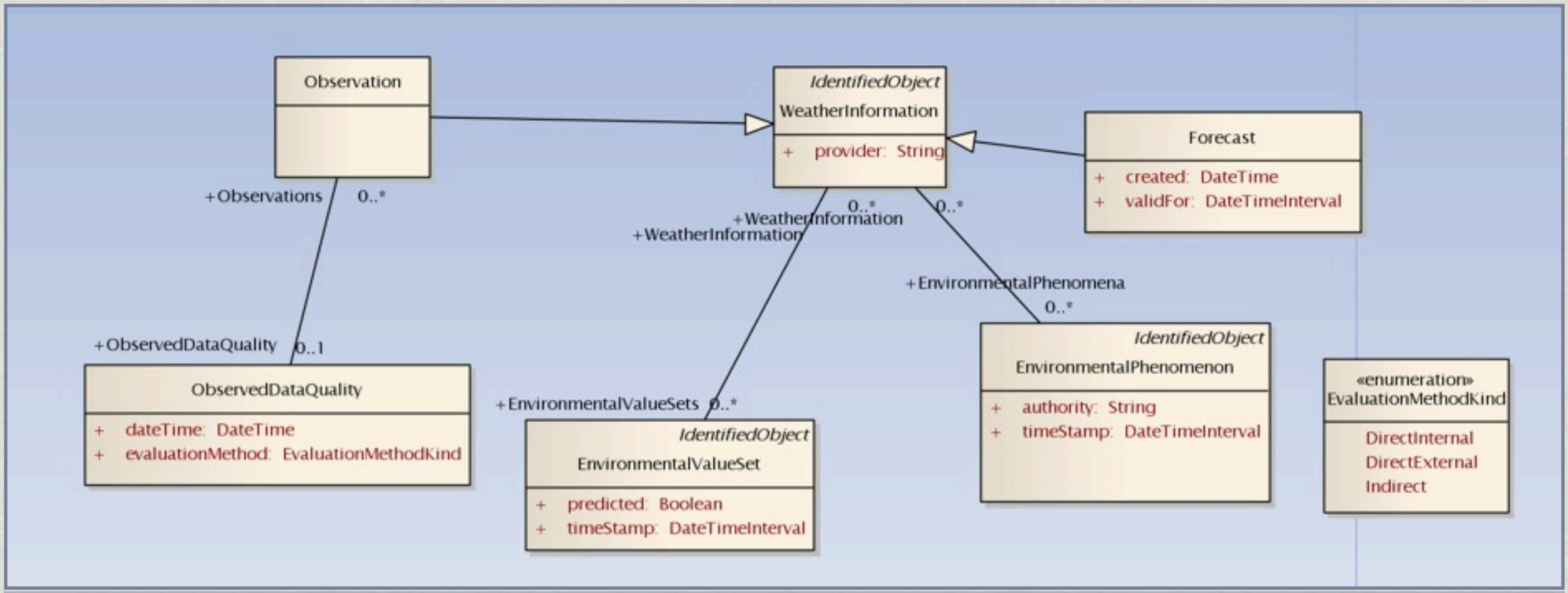
Observations



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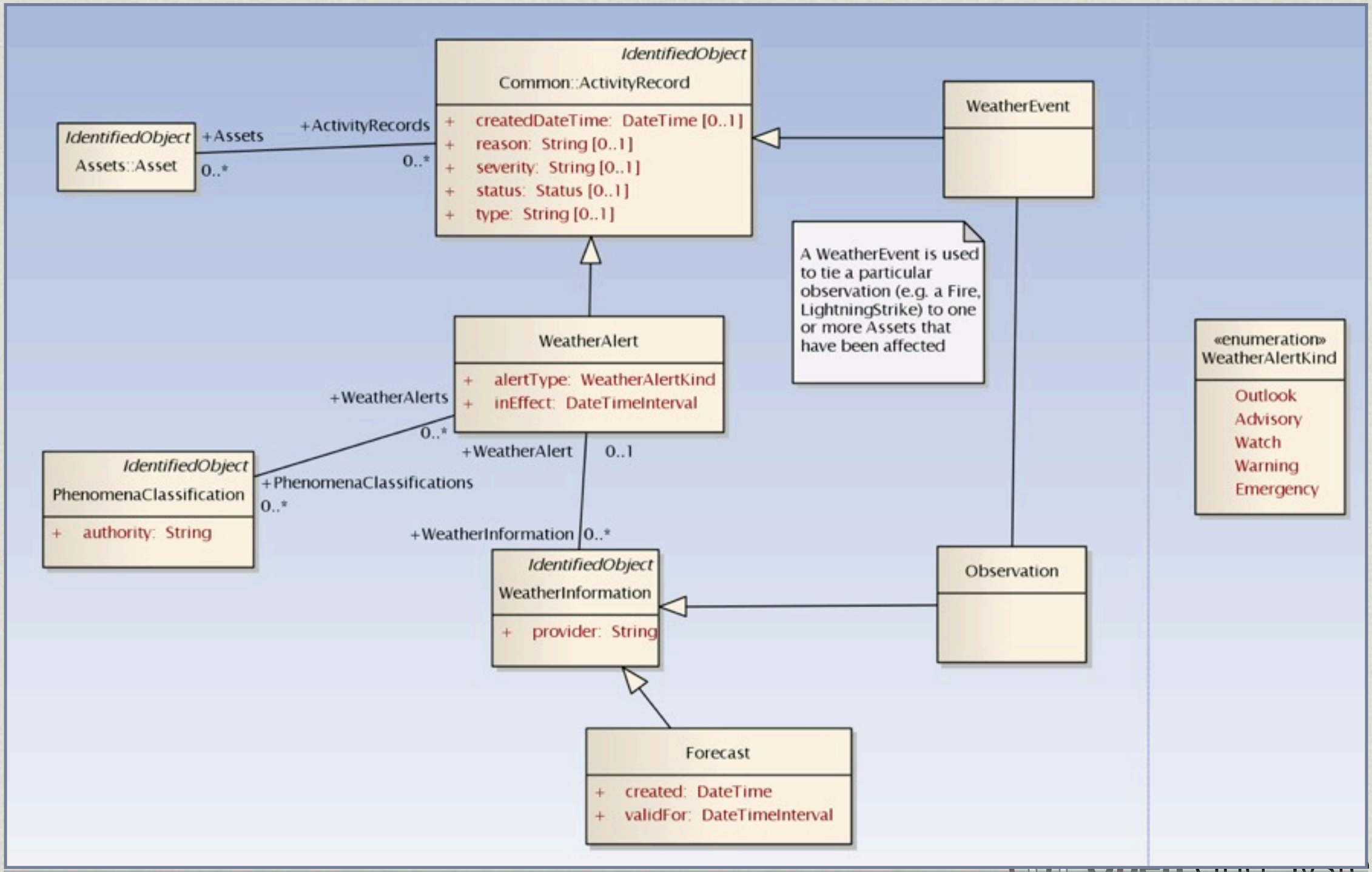
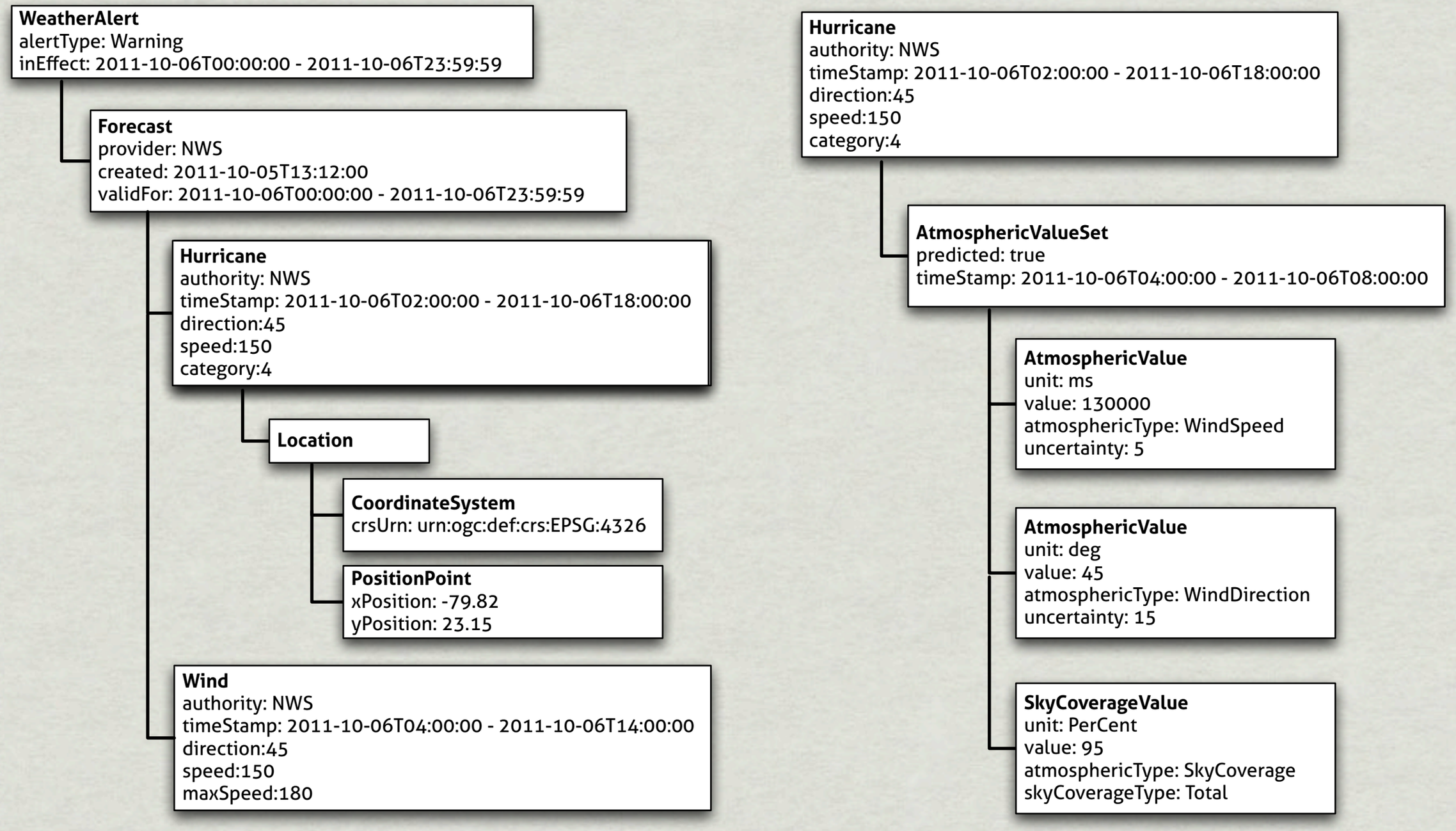
Weather Alerts



Building Interfaces

Example Weather Alert Message



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XML

Hurricane
authority: NWS
timeStamp: 2011-10-06T02:00:00 - 2011-10-06T18:00:00
direction:45
speed:150
category:4

AtmosphericValueSet
predicted: true
timeStamp: 2011-10-06T04:00:00 - 2011-10-06T08:00:00

AtmosphericValue
unit: ms
value: 130000
atmosphericType: WindSpeed
uncertainty: 5

AtmosphericValue
unit: deg
value: 45
atmosphericType: WindDirection
uncertainty: 15

SkyCoverageValue
unit: PerCent
value: 95
atmosphericType: SkyCoverage
skyCoverageType: Total

```
<cim:Hurricane>
   <cim:authority>NWS</cim:authority>
   <cim:timeStamp>
      <cim:start>2011-10-06T02:00:00</cim:start>
      <cim:end>2011-10-06T18:00:00</cim:end>
   </cim:timeStamp>
   <cim:direction>45</cim:direction>
   <cim:speed>150</cim:speed
   <cim:category>4</cim:category>
   <cim:AtmosphericValueSet>
      <cim:predicted>true</cim:predicted>
      <cim:timeStamp>
         <cim:start>2011-10-06T04:00:00</cim:start>
         <cim:end>2011-10-06T08:00:00</cim:end>
      </cim:timeStamp>
      <cim:AtmosphericValue>
         <cim:unit>ms</cim:unit>
         <cim:value>130000</cim:value>
         <cim:atmosphericType>WindSpeed</cim:atmosphericType>
         <cim:uncertainty>5</cim:uncertainty>
      </cim:AtmosphericValue>
      <cim:AtmosphericValue>
         <cim:unit>deg</cim:unit>
         <cim:value>45</cim:value>
         <cim:atmosphericType>WindDirection</cim:atmosphericType>
         <cim:uncertainty>15</cim:uncertainty>
      </cim:AtmosphericValue>
      <cim:SkyCoverageValue>
         <cim:unit>PerCent</cim:unit>
         <cim:value>95</cim:value>
         <cim:atmosphericType>SkyCoverage</cim:atmosphericType>
         <cim:skyCoverageType>Total</cim:skyCoverageType>
      </cim:SkyCoverageValue>
   </cim:AtmosphericValueSet>
</cim:Hurricane>
```

XML Messages

- The resulting XML message is thus derived from the UML and multiple messages share common definitions
- An actual implementation message would contain additional identification data (e.g. UUID or GUID) to uniquely identify alerts, locations etc.
- Multiple tools are available to build these XSDs from the CIM UML (CIMTool, CIM EA, CIMConteXtor)
- You could equally serialise the same message in other formats (e.g. JSON)

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Conclusions

Summary

- The project is still on-going, the initial draft of the UML is complete and interfaces are being defined for a test service
- The model will be a new package for CIM that re-uses and links to existing elements
- We didn't want to re-invent the wheel
- We didn't want to "copy & paste" an existing standard
- CIM for Weather must be consistent with existing CIM modelling practises but with sufficient scope to model existing environmental data relevant to the industry

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Questions?

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