

Runge Limited

- ◆ Global mining consultancy - 8 offices in 6 countries
- ◆ Leading consultancy in the coal sector for over 27 years
- ◆ Specialise in the areas of Mine Design, Planning, Scheduling and Budgeting

Runge Limited

- ◆ Leaders in converting our IP into software
 - XPAC for mine scheduling*
 - XERAS for budget forecasting*
 - TALPAC for haulage simulation*
 - DRAGSIM for dragline simulation*
- ◆ World renowned expertise in the coal industry, have also moved into other minerals domestically and overseas

Open Source,
Open Standards,
Open Sesame
on Interoperability to
Mining Industry SME' s.

www.cmXML.org

cmXML

**Coal Mining
eXtensible Markup
Language.**

Key Points

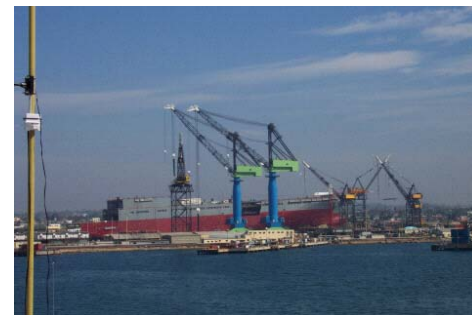
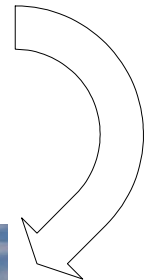
- ◆ How issues of interoperability were addressed
- ◆ How open source and open standards were used

Overview of Presentation

- ◆ The Problem and Considerations
- ◆ The Standard
- ◆ Issues and Future Improvements
- ◆ Applications

Behalf of Ben Axford

The Problem – Coal Mining Supply Chain



- *No mechanism for exchange of data about Coal*
- *Systems require translation tools and data factories*

From Boreholes to Bottom Line

The Problem – Coal Mining Supply Chain

- ◆ Historically no standard for data definition
- ◆ Recorded values can be ambiguous
eg. Coal ash content can vary depending on state, processes it has undergone
‘Air dried’ or ‘Dry, ash free’
- ◆ *Apples with apples* – context for measured values

Runge's Response to the Problem

ACARP

Australian Coal Association Research Program

Runge submitted a proposal to ACARP to
*“develop a standard for the interchange of
data in the coal mining value chain”*

Grant awarded in Summer 2003.

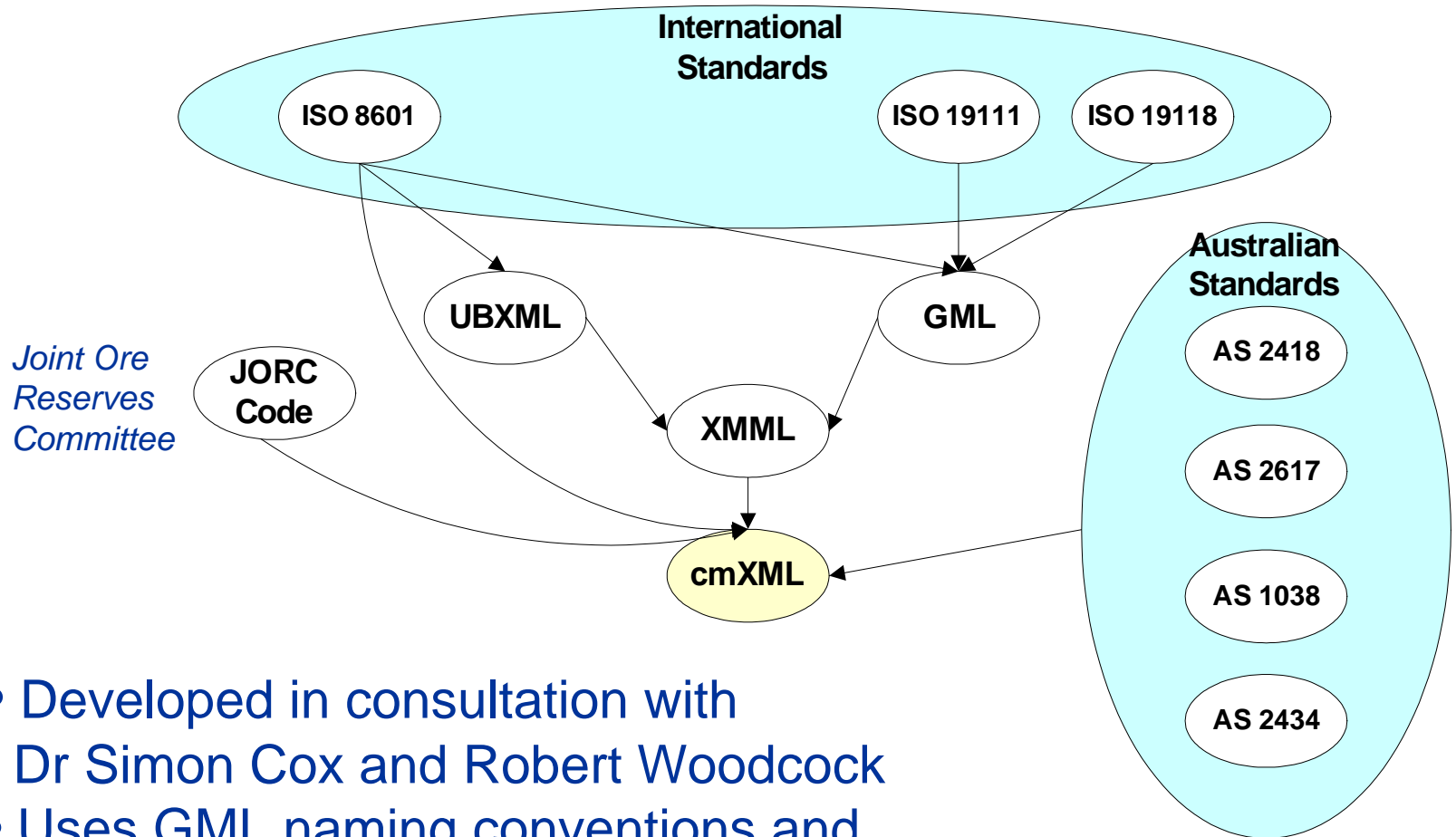
Considerations - Design Decisions

- ◆ Human readable and easily understood
- ◆ Easy to encode from other formats

Considerations - Design Decisions

- ◆ Only concerned with data *between* programs
- ◆ Based upon Standards and prior work by others

Considerations – Use Existing Standards



- Developed in consultation with Dr Simon Cox and Robert Woodcock
- Uses GML naming conventions and Feature-Property design pattern

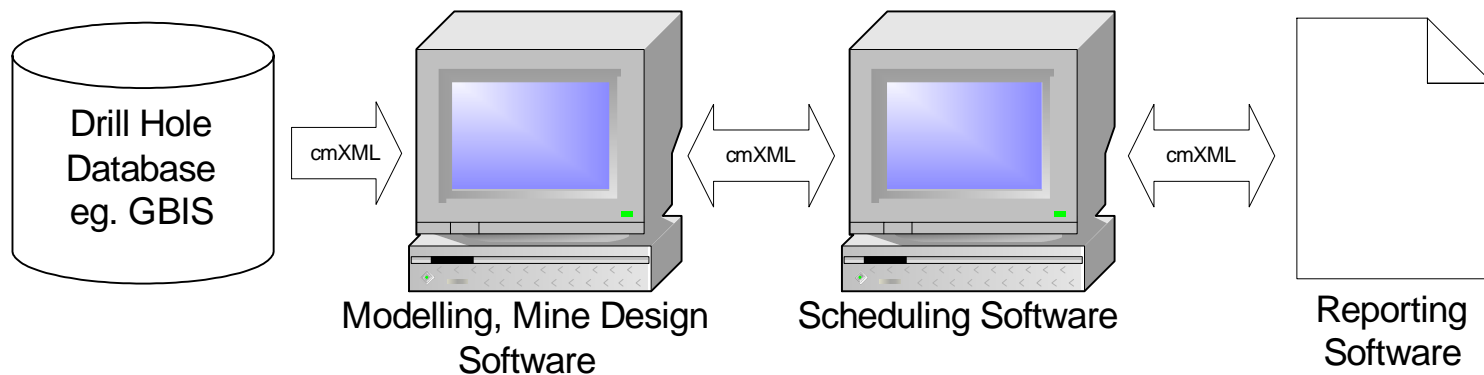
Considerations – Design Areas



- ◆ Supply chain is an extensive domain
- ◆ What areas should be modelled ?
- ◆ Coal Quality fundamental to the Standard
- ◆ Address elements in Runge's areas of expertise – mine planning
- ◆ Initial data model focus primarily on early phases of supply chain

Considerations – Areas of Expertise

Data Flow



- ◆ Borehole
- ◆ Geological Model

From Boreholes to Bottom Line

The Standard – Overview

- ◆ **CoalQuality.xsd**
- ◆ **Borehole.xsd**
- ◆ **GeologicalModel.xsd**

- ◆ **Outcomes**

Developed using xmlSpy by Altova

The Standard – CoalQuality.xsd

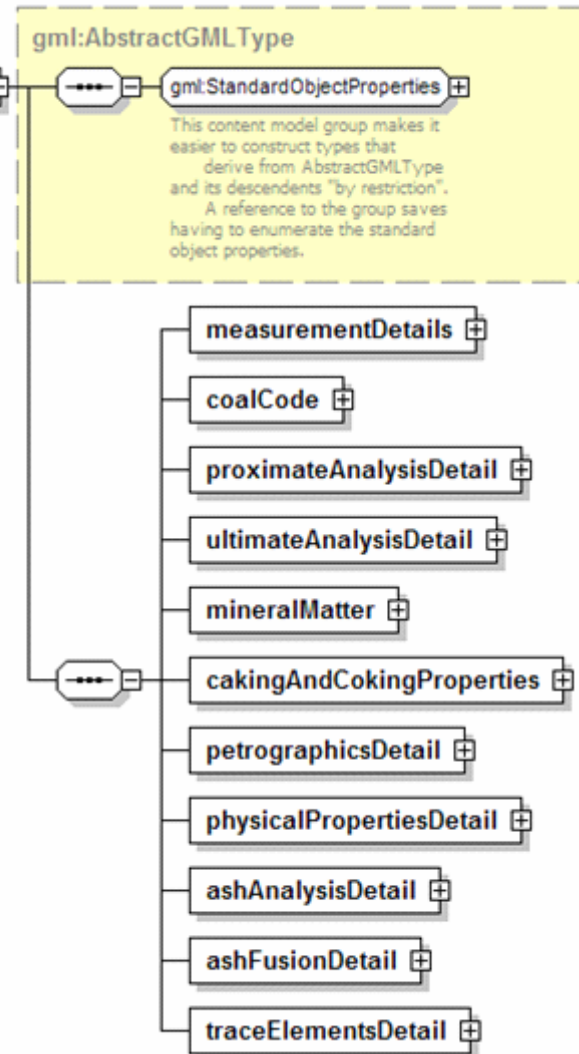
- ◆ Foundation of cmXML
- ◆ Based on Australian Standards
- ◆ Complete
- ◆ Leaf nodes of type *cm:MeasureType*
 - ◆ No optional elements
 - ◆ Gives context to measured values
eg. 'Air dried' or 'Dry, ash free'

The Standard – CoalQuality.xsd

cm:CoalQualityDescription

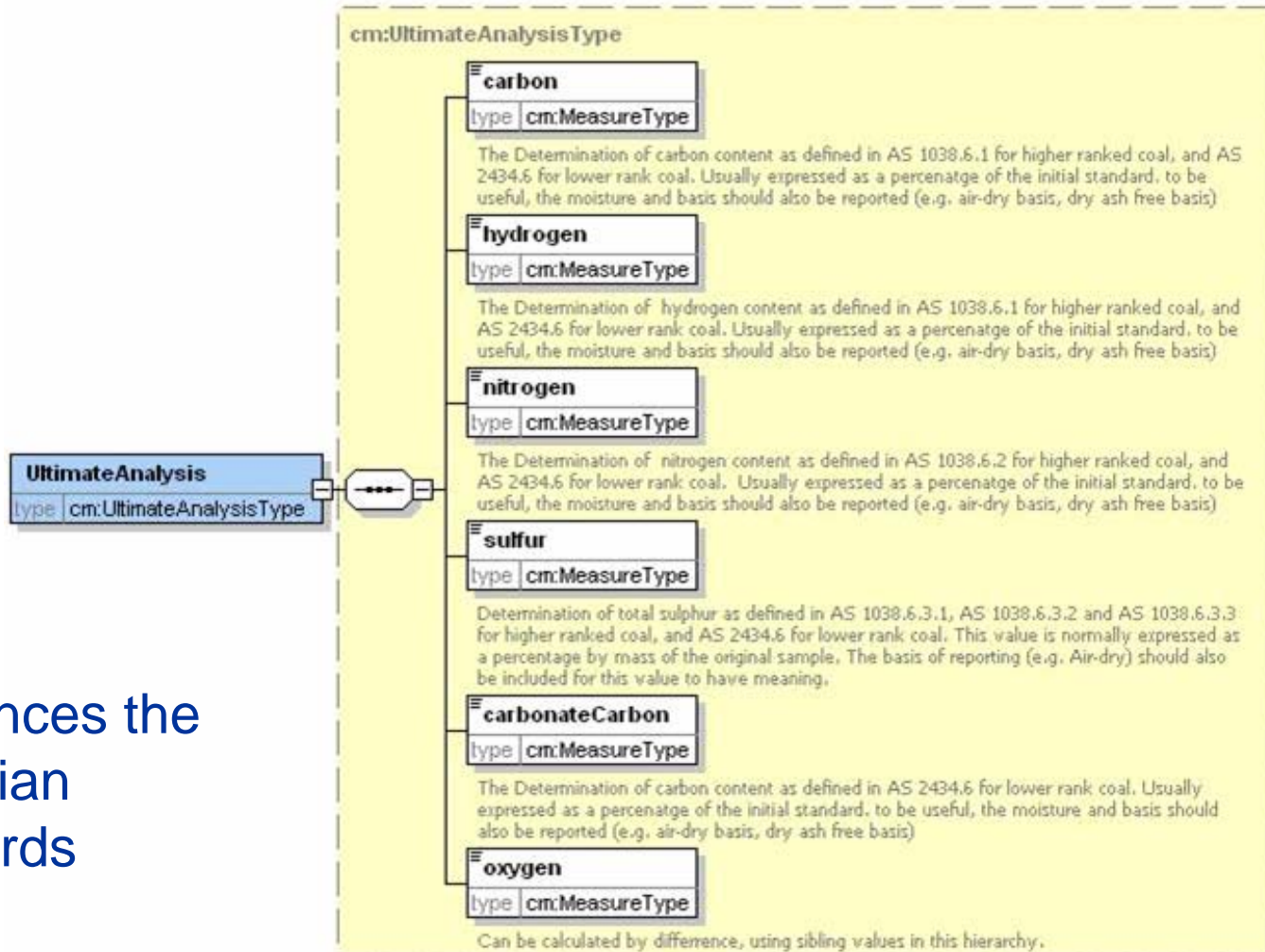
First level of
cm:CoalQualityDescription
heirarchy

- Data is semantic
- Highly structured
- Leaf nodes can be highly nested



The Standard – CoalQuality.xsd

cm:UltimateAnalysisType



References the
Australian
Standards

The Standard – CoalQuality.xsd

gml:MeasureType

MeasureType

Number with a scale.

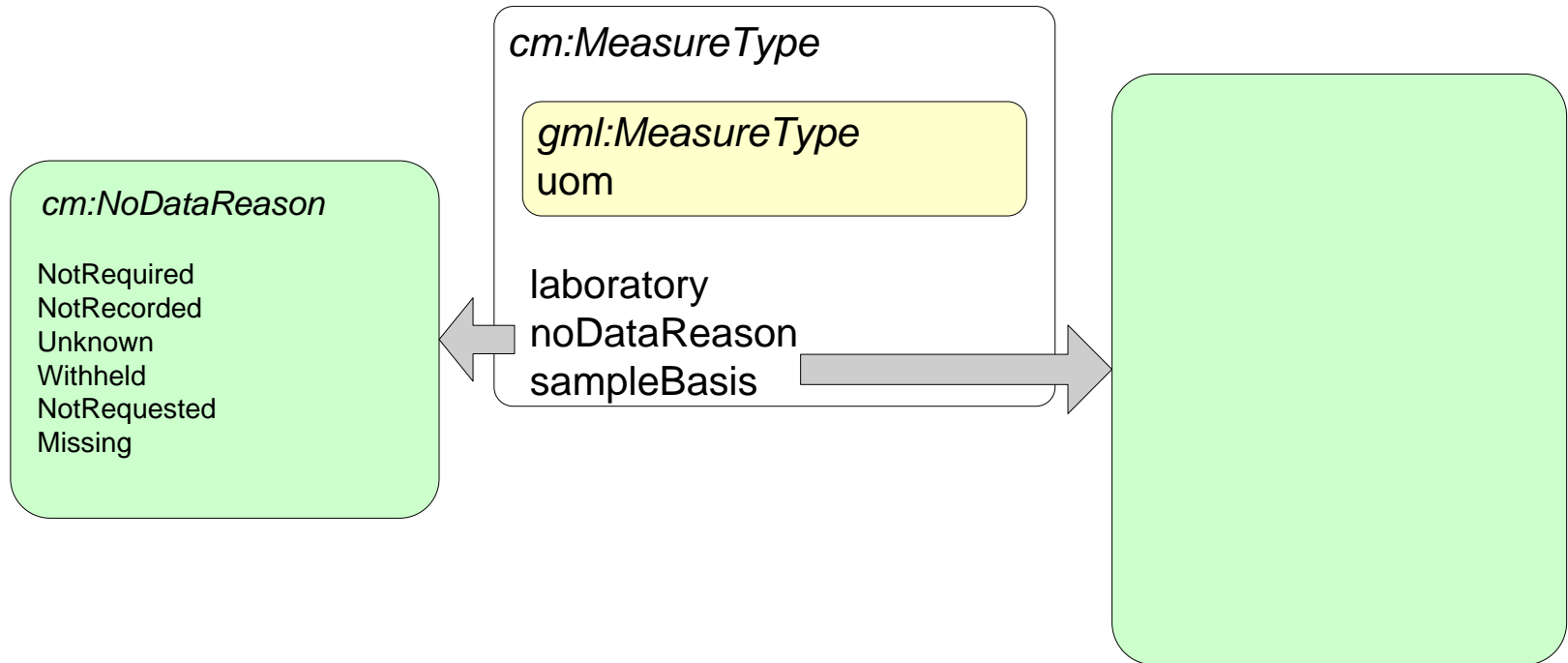
The value of uom (Units Of Measure) attribute is a reference to a Reference System for the amount, either a ratio or position scale.

cm:MeasureType extends *gml:MeasureType* to include attributes –

- ◆ *laboratory*
- ◆ *noDataReason* – no optional elements
- ◆ *sampleBasis* – context to measured values

The Standard – CoalQuality.xsd

cm:MeasureType



- No optional elements
- Context to measured values

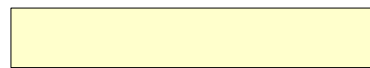
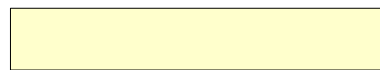
The Standard – Borehole.xsd

- ◆ Extends *xmml:Borehole* for use by the Coal mining industry
- ◆ Adds information about sedimentary intervals and coal quality parameters by using Substitution Groups

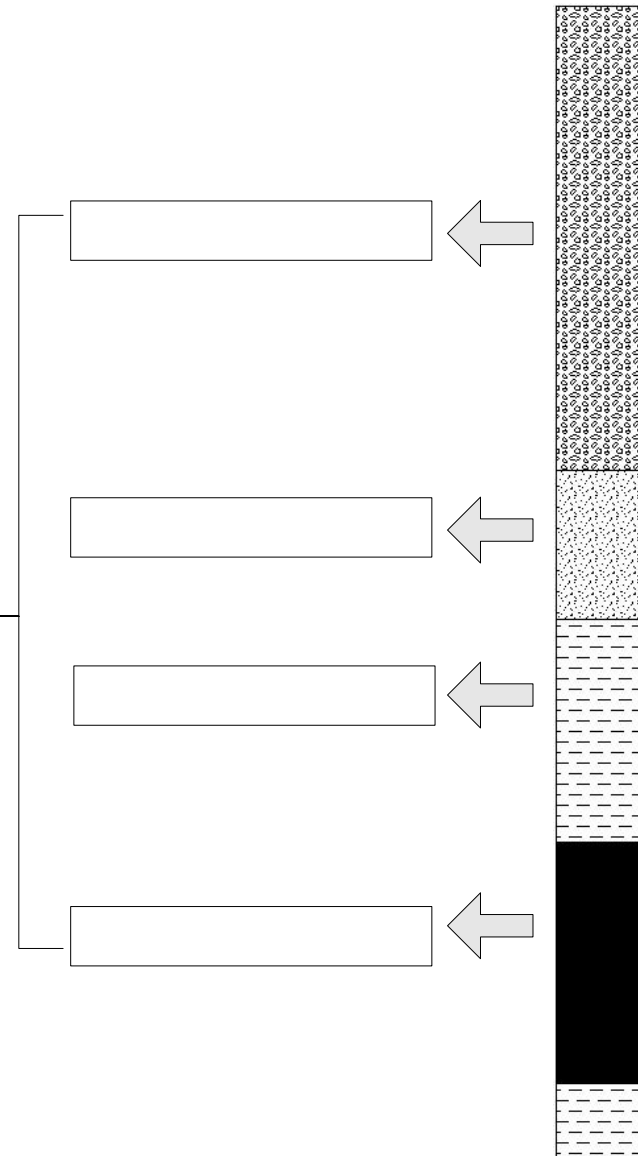
The Standard – Borehole.xsd Overview

xmml:Borehole generic

Way to store coal quality parameters for the coal seams and a material description for sediment

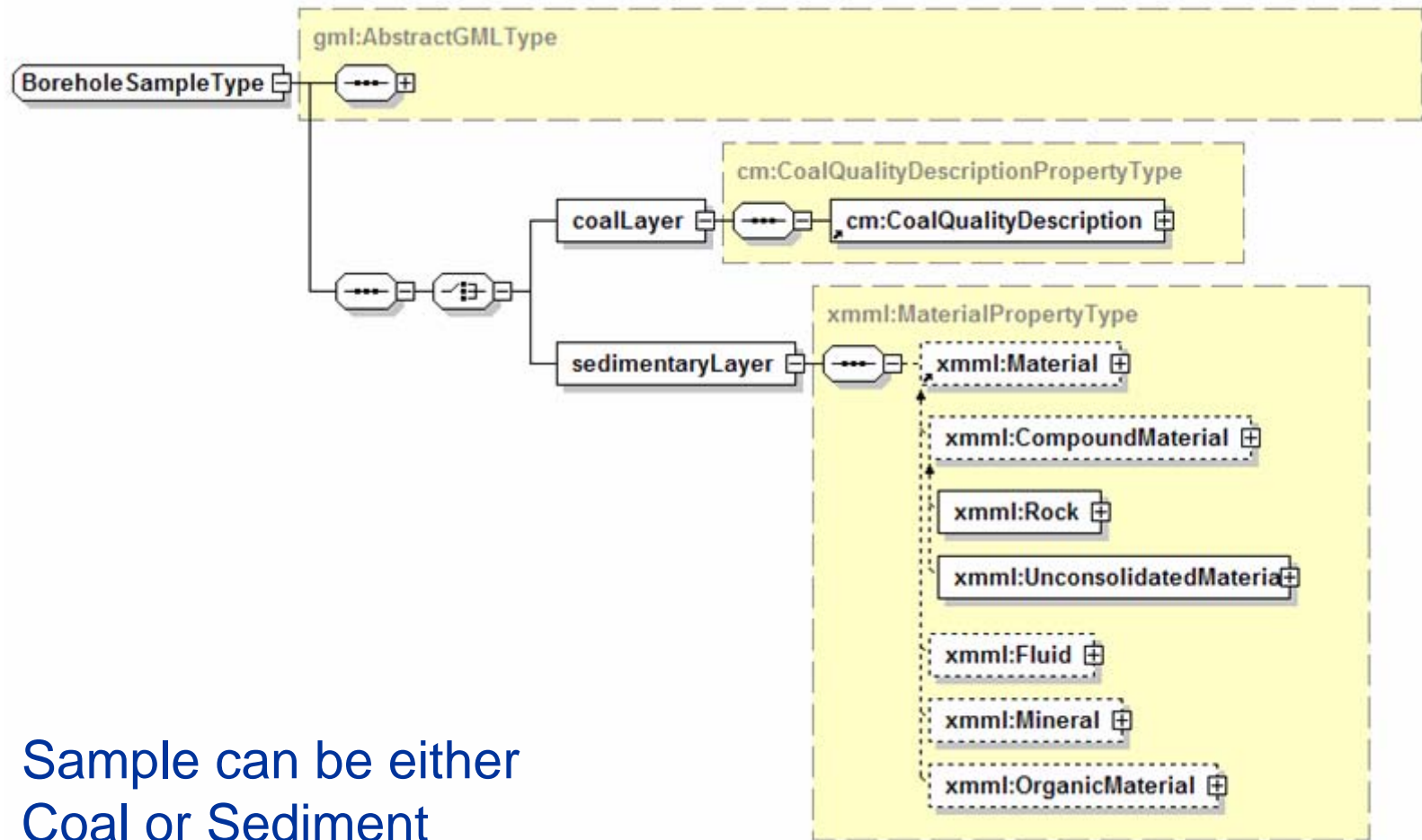


Extends
xmml:Borehole
to accommodate
cm:BoreholeSampleType



The Standard – Borehole.xsd

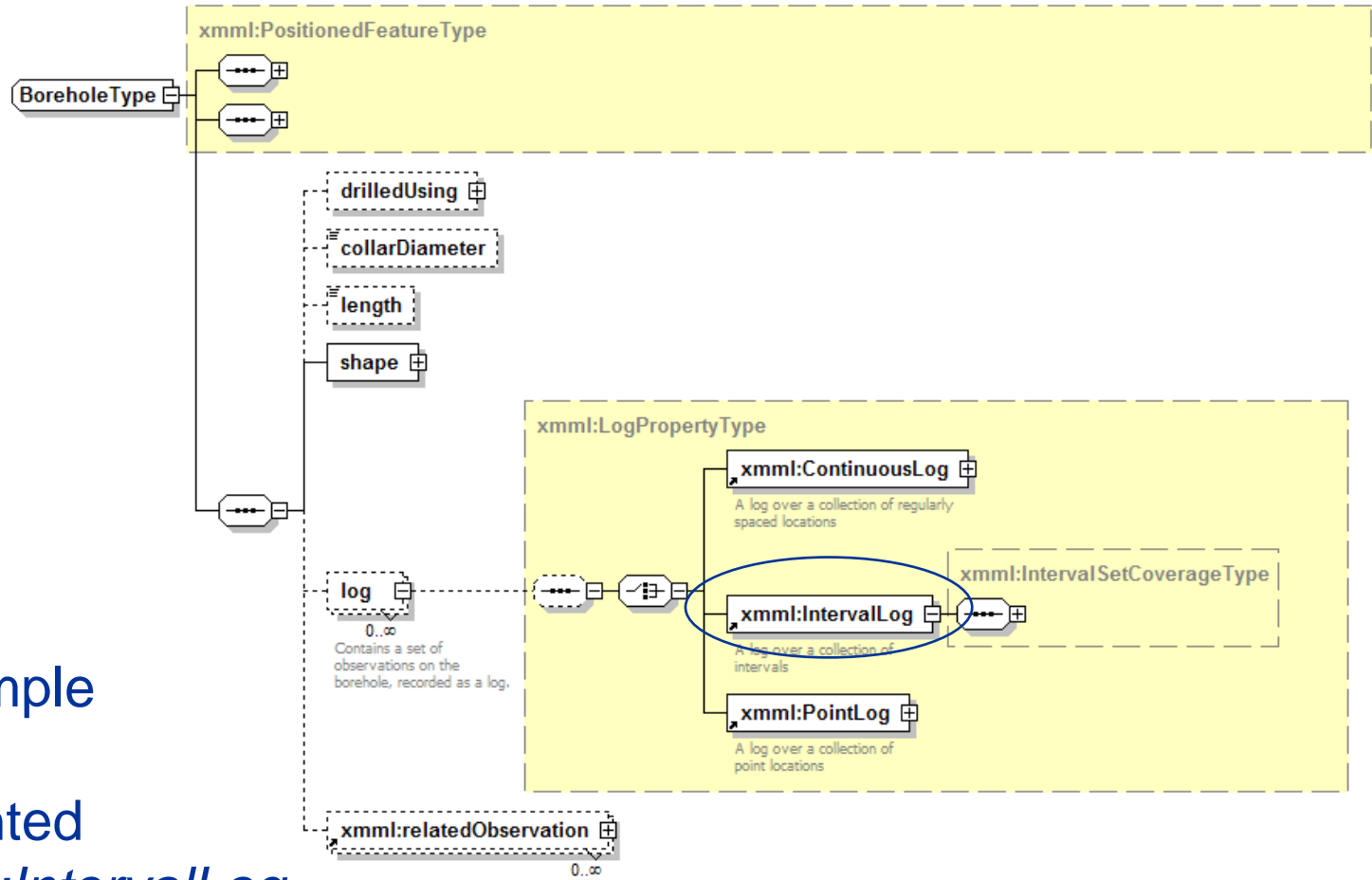
cm:BoreholeSampleType



Sample can be either
Coal or Sediment

The Standard – Borehole.xsd

xmml:BoreholeType



Coal sample
best
represented
by *xmml:IntervalLog*

The Standard – Borehole.xsd

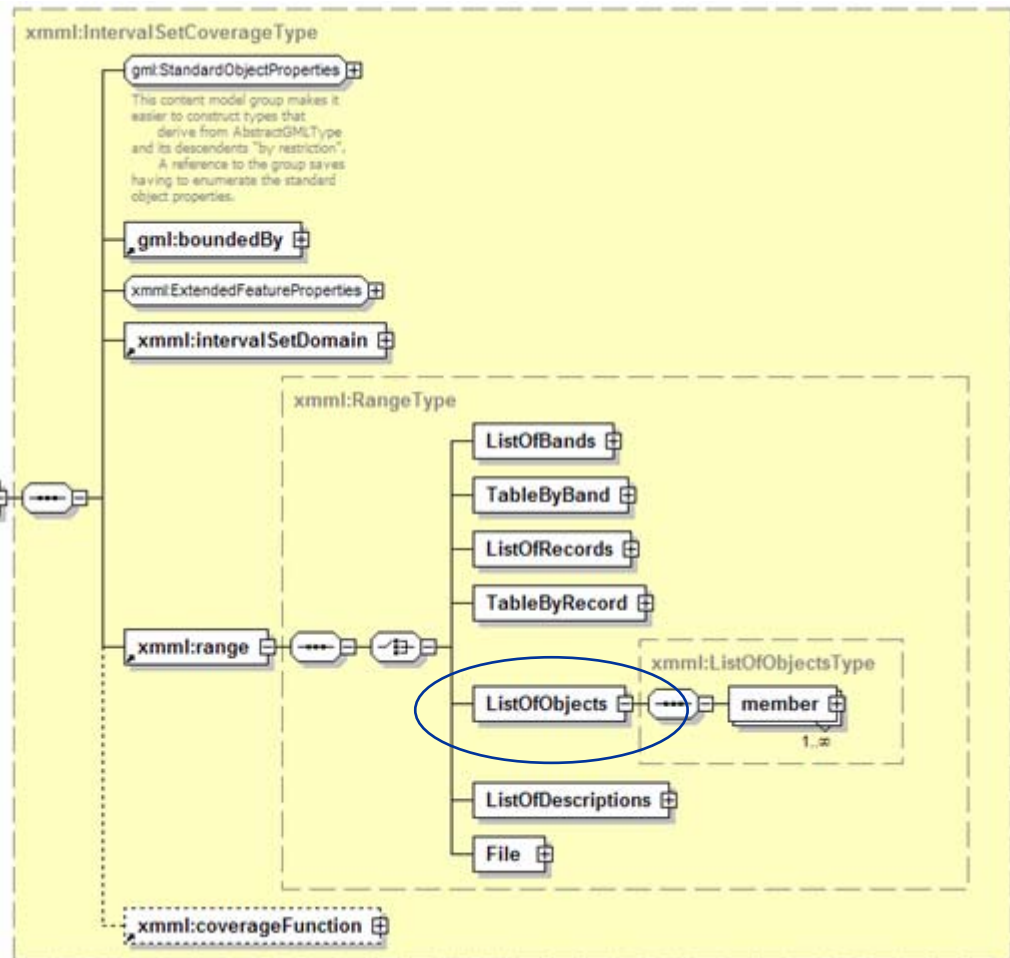
xmml:IntervalSetCoverageType

xmml:range allows us to ‘attach’ data to an interval

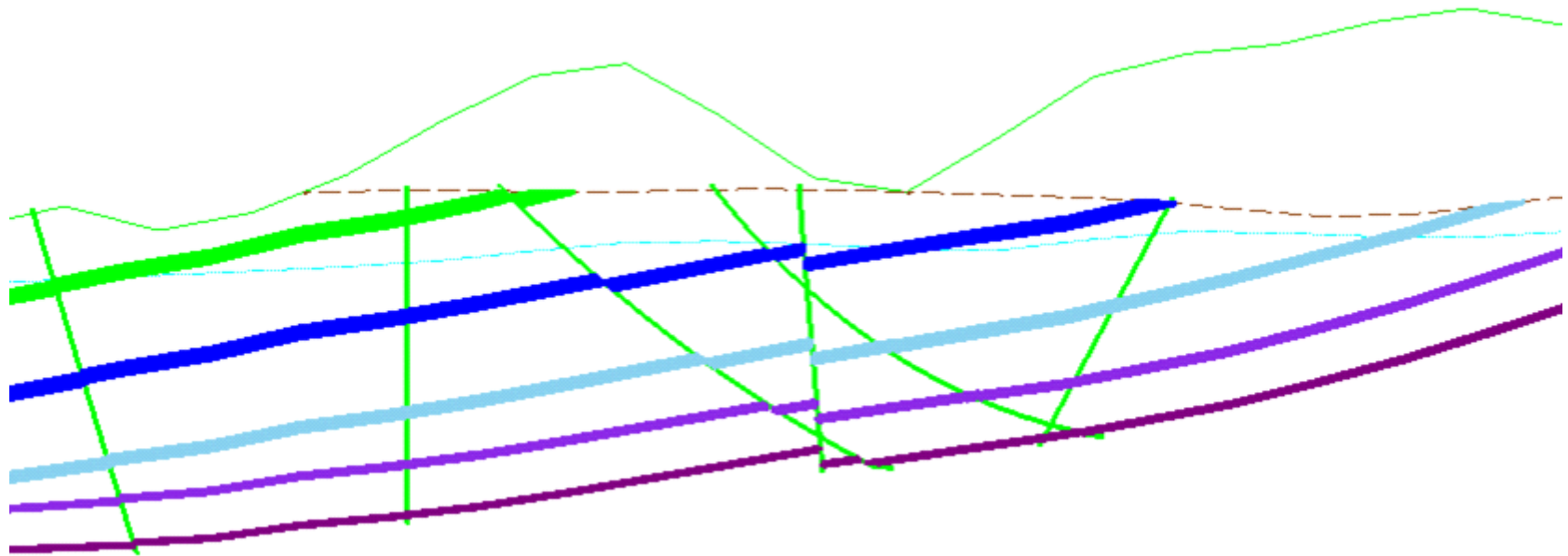
xmml:range supports many different types of storage methods



Inserted
cm:BoreholeSample
into Substitution
Group under
ListOfObjects tag



The Standard – GeologicalModel.xsd



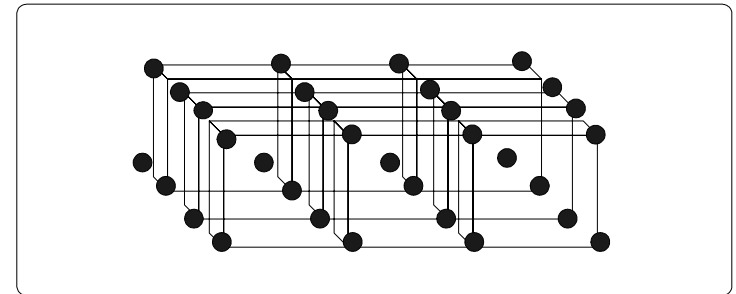
Collection of layers

From Boreholes to Bottom Line

The Standard – GeologicalModel.xsd Overview

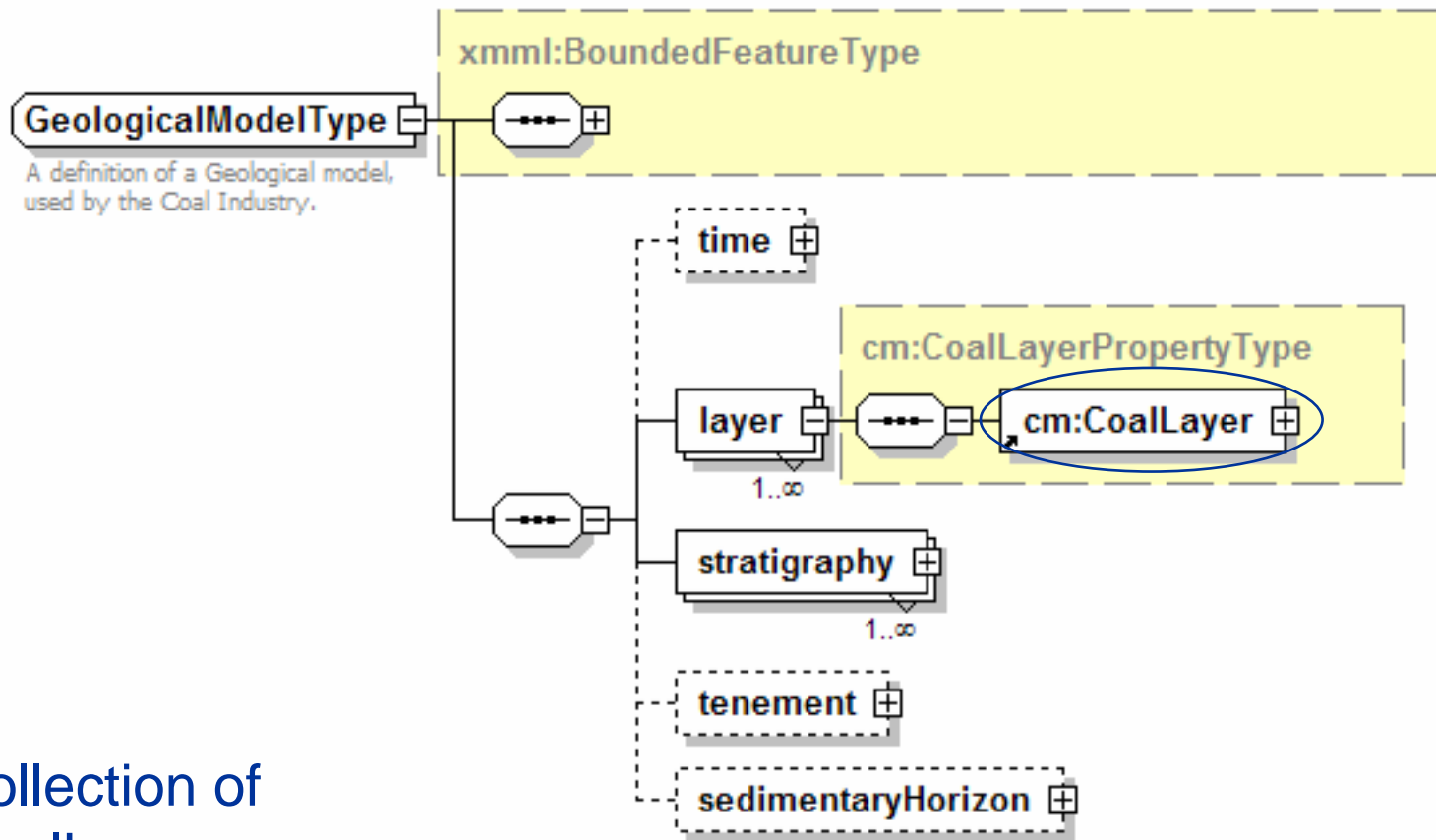
Way to store coal quality parameters for the coal seams and a material description for layers of sediment

Derived *cm:CoalLayer* from *xmml:RectifiedGridCoverage* which supports gridded data



The Standard – GeologicalModel.xsd

cm:Geological Model



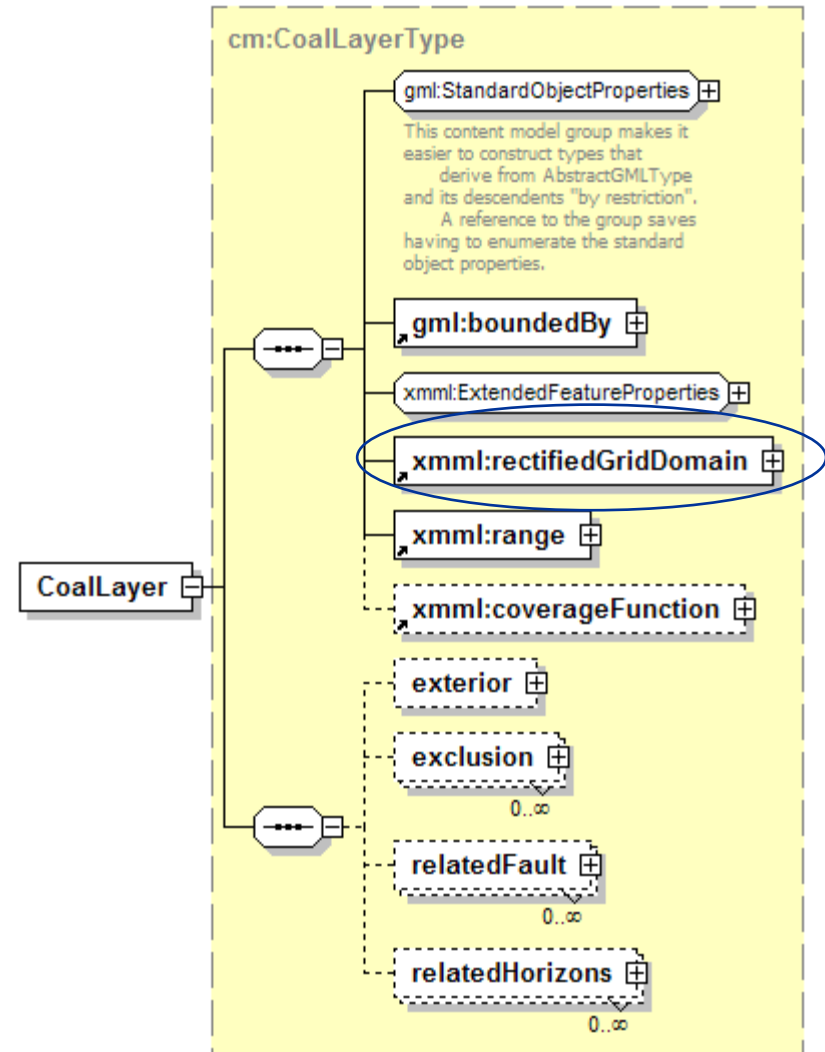
Collection of
CoalLayers

The Standard – GeologicalModel.xsd

cm:CoalLayer

Use
xmml:RectifiedGridDomain
to store
cm:BoreholeSampleType
for each node on the grid

Substitution Groups
are used



The Standard - Outcomes

- ◆ Report submitted to ACARP in June 2004
- ◆ Schema available <http://www.cmxml.org/>
- ◆ Possible to construct an XML schema for technical information for all functional areas in the Coal Mining Supply Chain

Issues and Future Improvements - Management

- ◆ Freezing the model – “this is what we’re going to run with”
- ◆ How do we handle upgrades

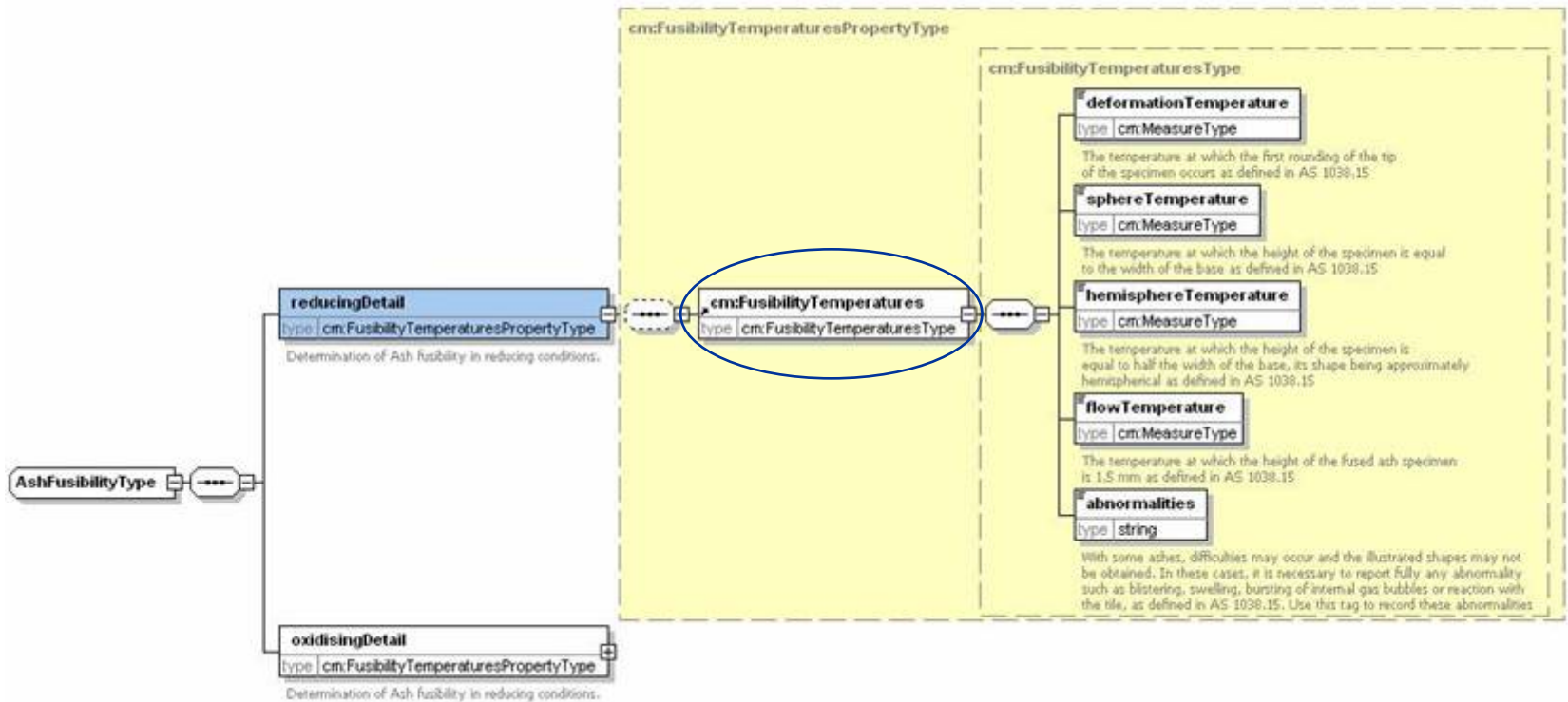
Improvements - Publishing?

- ◆ Fragile base class
- ◆ Parent schemas are maintained and managed (and served) in a variety of ways

Issues and Future Improvements - Modelling

- ◆ Broad Substitution Groups
- ◆ Qualified means of specifying
xmml:RectifiedGridDomain instance
documents
- ◆ Feature-property design pattern can be
restrictive – features may have multiple
properties, properties have only one value

Issues and Future Improvements - Feature-Property Design Pattern



Redundant nodes in structure

From Boreholes to Bottom Line

Applications

- ◆ Facilitator of data exchange between software applications, mining companies
- ◆ Standard for the articulation of Coal Quality across the Mining Value Chain
- ◆ Supply chain – enabler for e-business



Thank you

<http://www.cmxml.org/>