VO-URP and UTYPEs

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Overview

- Need common meta-model
- VO-URP has one: **vo-urp**
  - UML Profile + XML schema
- Use of meta-model in UTYPE
  - Mapping **vo-urp** to VOTable TBD

VO-URP meta-model I

- **Derived from UML2**
  - Industry standard
  - Whiteboard modeling
  - Implementation independent, in contrast to XML Schema, RDB etc
- **Originally in *UML Profile* =**
  - Subset of UML modeling elements
  - Extended with
    - Predefined primitive types
    - Stereotypes+tag definitions for refinements.
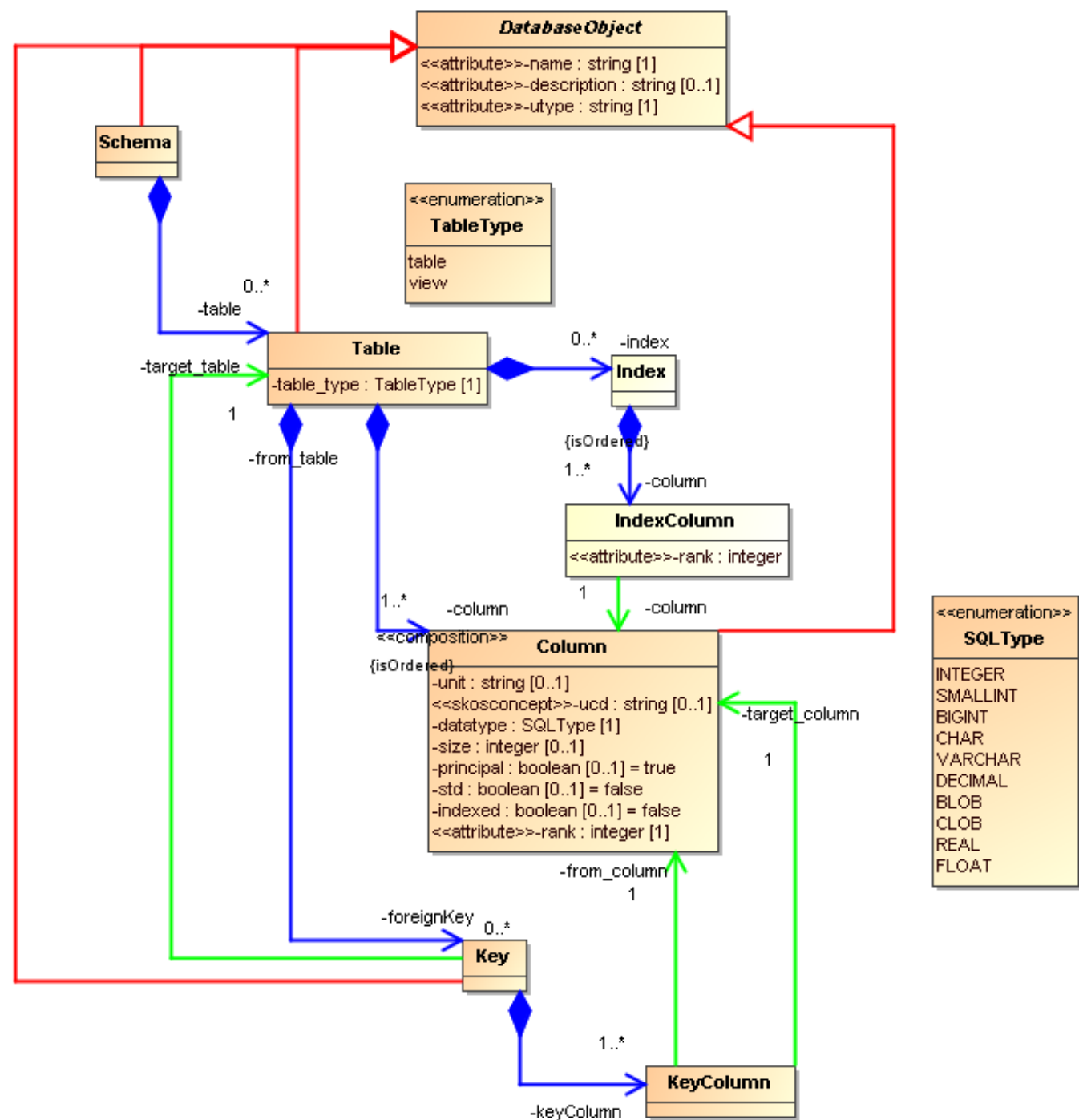   - E.g. SKOSConcept

VO-URP meta-model II

- Translated to XML schema: **vo-urp.xsd**
  - Simpler (!) than XMI (= xml serialisation of UML)
  - More explicit
- **vo-urp** based XML document == data model
  - Easily parsable
  - Explicit \<utype\> elements as identifiers for "referencable" data model constructs

VO-URP's meta-model elements

- Model

- Package

- Type {ObjectType, ValueType{PrimitiveType, DataType, Enumeration}}

- Attribute

- Relation {Collection,Reference}

- Some details:
  - Constraints
  - SKOS Concept

Example: TAP model

Model

```
<model xmiid="...">
  <name>TAP</name>
  <description>This is the data model for describing a
TAP_SCHEMA.</description>
  <utype>TAP</utype>
  <lastModifiedDate>1349964334212</lastModifiedDate>
  <title>TAP_SCHEMA Data Model ala VO-URP</title>
  <package xmiid="_12_1_1dfa04c4_1349943899446_25247_168">
    <name>ivoa</name>
    <description>
...
</model>
```
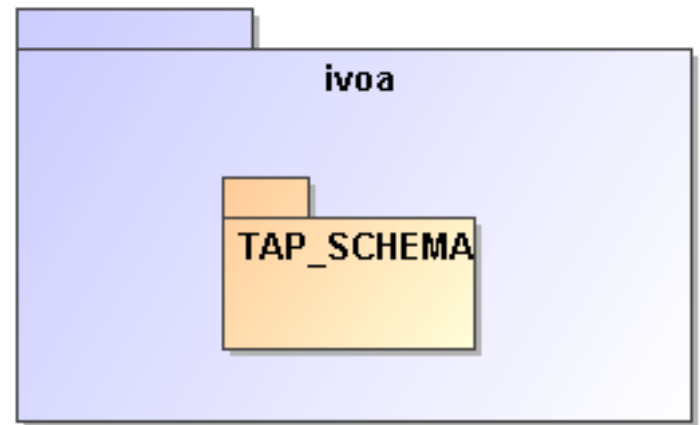
Package


```xml
<package xmiid="_12_1_1dfa04c4_1349943899446_2
    <name>ivoa</name>
    <description>
Root package used by all IVOA data models.
    </description>
    <utype>TAP:/ivoa/</utype>
...
    <package xmiid="_12_1_1dfa04c4_1338117847390_608441_799">
        <name>TAP_SCHEMA</name>
        <description>
    Package representing the TAP_SCHEMA, contains all TAP metadata objects.
        </description>
        <utype>TAP:/ivoa/TAP_SCHEMA/</utype>
        <objectType xmiid="...">
            <name>Schema</name>
            <description>
...
</package>
```

Class (or ObjectType)

Column

-unit : string [0..1]
<<skosconcept>>-ucd : string [0..1]
-datatype : SQLType [1]
-size : integer [0..1]
-principal : boolean [0..1] = true
-std : boolean [0..1] = false
-indexed : boolean [0..1] = false
<<attribute>>-rank : integer [1]

```xml
<objectType xmiid="_12_1_1dfa04c4_1338117889157_666237_915">
    <name>Column</name>
    <description>A database column as viewed by... </description>
    <utype>TAP:/ivoa/TAP_SCHEMA/Column</utype>
    <extends name="DatabaseObject" xmiidref="_12_1_1dfa04c4_1349934092637_129667_830"/>
    <container name="Table" xmiidref="_12_1_1dfa04c4_1338117883357_182995_843"
                relation="column">
      <utype>TAP:/ivoa/TAP_SCHEMA/Column.CONTAINER</utype>
    </container>
    <attribute xmiid="_12_1_1dfa04c4_1349934643248_140187_1059">
      <name>unit</name>
      <description>The physical unit...</description>
      <utype>TAP:/ivoa/TAP_SCHEMA/Column.unit</utype>
      <datatype name="string" xmiidref="_10_0_42c01ac_1131109909359_121421_1981"/>
      <multiplicity>0..1</multiplicity>
    </attribute>
    <attribute xmiid="_12_1_1dfa04c4_1349934257990_123196_873">
      <name>ucd</name>
      <description>An identifier for...</description>
      <utype>TAP:/ivoa/TAP_SCHEMA/Column.ucd</utype>
      <datatype name="string" xmiidref="_10_0_42c01ac_1131109909359_121421_1981"/>
      <multiplicity>0..1</multiplicity>
      <skosconcept>
        <broadestSKOSConcept>UCD</broadestSKOSConcept>
        <vocabularyURI>[UCD Vocabulary]</vocabularyURI>
      </skosconcept>
    </attribute>
  ...
```
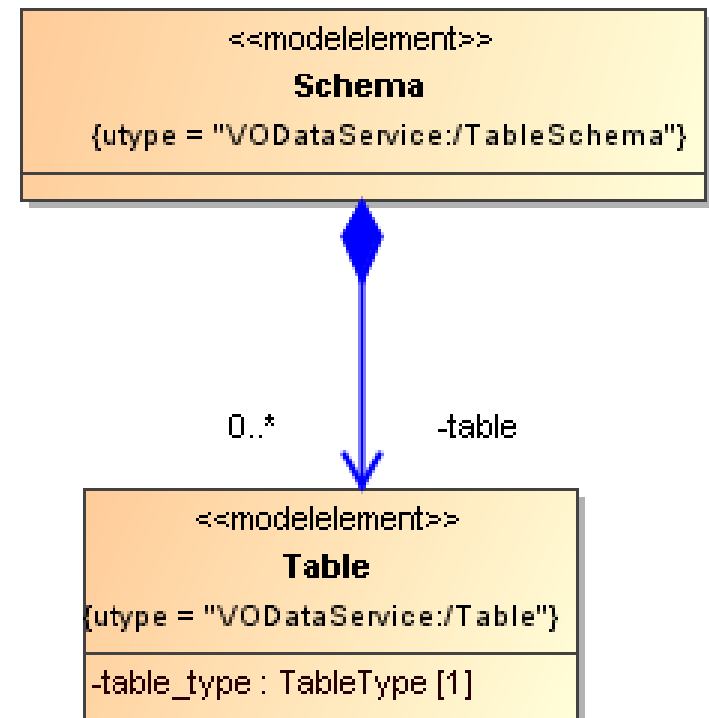
otherutype

```
<objectType xmiid="..">
  <name>Table</name>
  <description>Represents a table in a TAP_SCHEMA</description>
  <utype otherutype="VODataService:/Table">
   TAP:/ivoa/TAP_SCHEMA/Table
  </utype> ...
```

PrimitiveType

IVOAValueTypes

<<primitive>>
integer

<<primitive>>
rational

<<primitive>>
real

<<primitive>>
complex

<<primitive>>
bit

<<primitive>>
decimal

<<primitive>>
string

<<primitive>>
anyURI

<<primitive>>
nonnegativeInteger

<<primitive>>
datetime

<<primitive>>
duration

<<primitive>>
boolean

<<primitive>>
ivoIdentifier

DataType

<<dataType>>
ColumnType

-datatype : SQLType [1]
-size : integer [0..1]

```xml
<datatype xmiid="_12_1_1dfa04c4_1349963242684_442824_398">
  <name>ColumnType</name>
  <description>...</description>
  <utype>TAP:/ivoa/TAP_SCHEMA/ColumnType</utype>
  <attribute xmiid="_12_1_1dfa04c4_1349963253308_78768_419">
    <name>datatype</name>
    <description>...</description>
    <utype>TAP:/ivoa/TAP_SCHEMA/ColumnType.datatype</utype>
    <datatype name="SQLType"
            xmiidref="_12_1_1dfa04c4_1349934530679_323443_1012"/>
    <multiplicity>1</multiplicity>
  </attribute>
  <attribute xmiid="_12_1_1dfa04c4_1349963266474_224500_423">
    <name>size</name>
    <description>...</description>
    <utype>TAP:/ivoa/TAP_SCHEMA/ColumnType.size</utype>
    <datatype name="integer"
            xmiidref="_10_0_42c01ac_1131110115640_104165_2107"/>
    <multiplicity>0..1</multiplicity>
  </attribute>
</datatype>
```

Enumeration

```
<enumeration xmiid="_12_1_1dfa04c4_1349934530679_323443_1012">
  <name>SQLType</name>
  <utype>TAP:/ivoa/TAP_SCHEMA/SQLType</utype>
  <literal>
    <value>INTEGER</value>
    <utype>TAP:/ivoa/TAP_SCHEMA/SQLType.INTEGER</utype>
  </literal>
  <literal>
    <value>SMALLINT</value>
    <utype>TAP:/ivoa/TAP_SCHEMA/SQLType.SMALLINT</utype>
  </literal>
  <literal>
    <value>BIGINT</value>
    <utype>TAP:/ivoa/TAP_SCHEMA/SQLType.BIGINT</utype>
  </literal>
  <literal>
    <value>CHAR</value>
...
</enumeration>
```

<<enumeration>>
SQLType

INTEGER
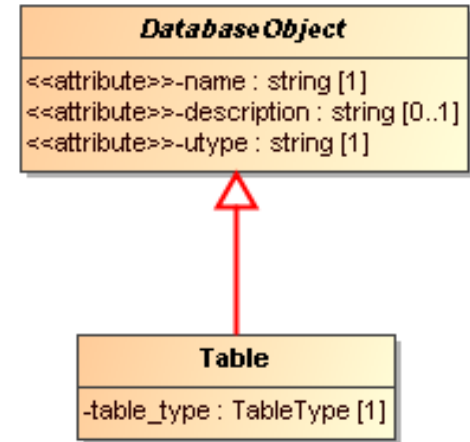SMALLINT
BIGINT
CHAR
VARCHAR
DECIMAL
BLOB
CLOB
REAL
FLOAT

Attribute

Column

-unit : string [0..1]
<<skosconcept>>-ucd : string [0..1]
-datatype : ColumnType [1]
-principal : boolean [0..1] = true
-std : boolean [0..1] = false
-indexed : boolean [0..1] = false
<<attribute>>-rank : integer [1]

<<dataType>>
ColumnType

-datatype : SQLType [1]
-size : integer [0..1]

```
<attribute xmiid="_12_1_1dfa04c4_1349934257990_123196_873">
  <name>ucd</name>
  <description>...</description>
  <utype>TAP:/ivoa/TAP_SCHEMA/Column.ucd</utype>
  <datatype name="string„
          xmiidref="_10_0_42c01ac_1131109909359_121421_1981"/>
  <multiplicity>0..1</multiplicity>
  <skosconcept>
    <broadestSKOSConcept>
       http://www.ivoa.net/Document/WD/vocabularies/vocabularies-1.0/UCD
    </broadestSKOSConcept>
    <vocabularyURI>
       http://www.ivoa.net/Document/WD/vocabularies/vocabularies-1.0/UCD
    </vocabularyURI>
  </skosconcept>
</attribute>
```

Inheritance


```
<objectType xmiid="_12_1_1dfa04c4_1338117883357_182995_843">
   <name>Table</name>
   <description>Represents a table in a TAP_SCHEMA</description>
   <utype>TAP:/ivoa/TAP_SCHEMA/Table</utype>
   <extends name="DatabaseObject"
         xmiidref="_12_1_1dfa04c4_1349934092637_129667_830"/>
...
```
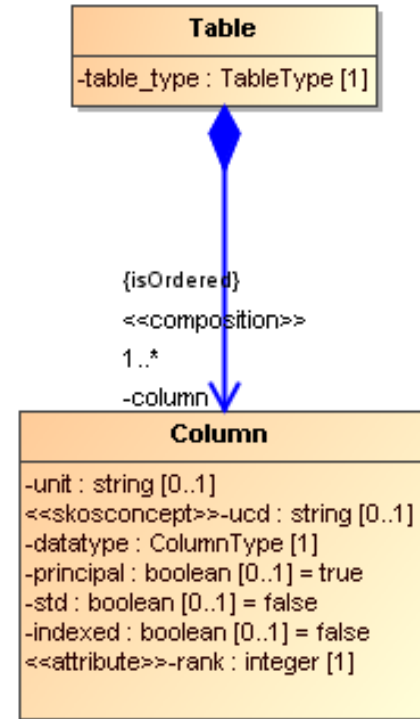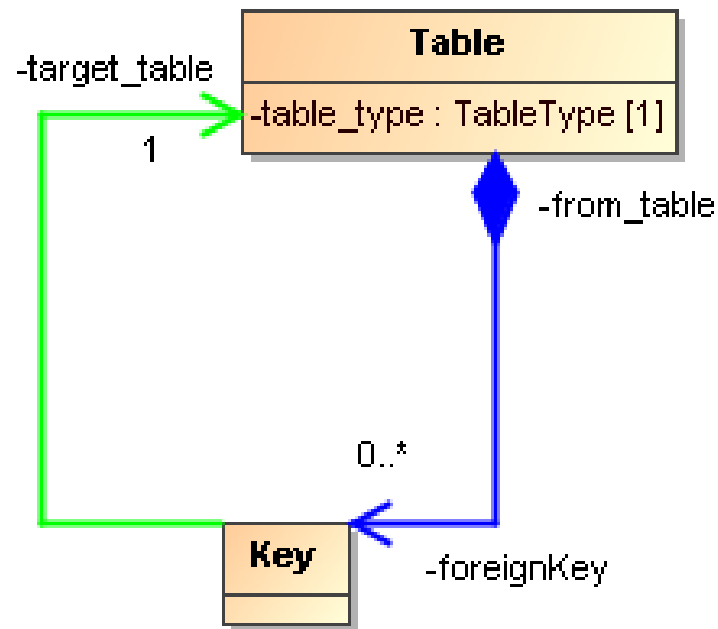
Collection


```xml
<objectType xmiid="_12_1_1dfa04c4_1338117883357_182995_843">
  <name>Table</name>
  <utype>TAP:/ivoa/TAP_SCHEMA/Table</utype>
...
  <collection xmiid="_12_1_1dfa04c4_1338117889176_173806_918">
    <name>column</name>
    <description>...</description>
    <utype>TAP:/ivoa/TAP_SCHEMA/Table.column</utype>
    <datatype name="Column"
              xmiidref="_12_1_1dfa04c4_1338117889157_666237_915"/>
    <multiplicity>1..*</multiplicity>
  </collection>
...
```

Reference


```
<objectType xmiid="_12_1_1dfa04c4_1349933582391_188826_431">
    <name>Key</name>
...
    <utype>TAP:/ivoa/TAP_SCHEMA/Key</utype>
...
    <reference xmiid="_12_1_1dfa04c4_1349933652942_342334_636">
        <name>target_table</name>
...
        <utype>TAP:/ivoa/TAP_SCHEMA/Key.target_table</utype>
        <datatype name="Table"
                  xmiidref="_12_1_1dfa04c4_1338117883357_182995_843"/>
        <multiplicity>1</multiplicity>
    </reference>
...
```

UTYPE grammar
(some kind of path into **vo-urp** doc)

```
utype                   :=      [model-utype | package-utype |
                                class-utype | attribute-utype |
                                collection-utype | container-utype |
                                reference-utype ]
model-utype             :=      <model-name>
package-utype           :=      model-utype ":/" package-hierarchy
package-hierarchy       :=      <package-name> ["/" <package-name>]*
class-utype             :=      package-utype "/" <class-name>
attribute-utype         :=      class-utype "." attribute
attribute               :=      [primitive-attr | struct-attr]
primitive-attr          :=      <attribute-name>
struct-attr             :=      <attribute-name> "." attribute
collection-utype        :=      class-utype "." <collection-name>
reference-utype         :=      class-utype "." <reference-name>
container-utype         :=      class-utype "." "CONTAINER"
identifier-utype        :=      class-utype "." "ID"
```

Embedding data model elements

- UTYPE alone are not sufficient
  - Only can identify a type of data model element
- Need to understand how to interpret and constrain such mapping
- Example: VOTable
  - TABLE -> ObjectType
  - FIELD -> attribute (or reference, or container)
  - GROUP -> dataType, attribute, objectType etc
    - FIELDref -> attribute ?

Possible mapping (TBD!!)

vo-urp ⇨ VOTable ⇩	Model	Package	ObjectType	DataType	Attribute	Collection	Reference	Container	ID
INFO	?								
FIELD					x		x	x	x
PARAM					x		x	x	x
GROUP			x	x	x	x	x	x	x
FIELDref					x		x	x	x
PARAMref					x		X	x	x
TABLE			x	x		x	x		
RESOURCE		x	x						

Thank you