Common Interface for Astronomical Data Service

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VOQL+DAL Joint session

Contents

- Objective of this talk
- Concept for adapting ADQL query interface to a General data service
- JVO SkyNode experimental implemenation
  - SkyNode Toolkit
  - Application to the science use case
- Required Specification
  - Data Service Classification and Table Data model
  - Definition of minimum subset of ADQL
  - Minor update on ADQL
  - Standard on usage of VOTable
  - Access to the Object data type

Objective of this talk

- From a Simple Protocol to an Intelligent Protocol
  - SIAP and SSAP are simple parameter-based query protocol.
  - ADQL is a SQL-based query protocol and have a capability to describe more complicated query conditions.
- What is the merit ?
  - Multiple regions condition, directly or by VOTable
  - Homogeneous data access to both of the catalog and observational data
  - Query to the multiple data services (Portal)
- Effect on the current SIAP and SSAP spec.
  - Introducing the ADQL to the DAL service does not affect to the data model of a returned VOTable.
  - Just introduce an additional query interface to the DAL service.

Concept for adapting SQL to Image Database.

I have shown that image query can be described in SQL syntax by introducing virtual column concept.

SIAP Query

POS	[mandatory]
SIZE	[mandatory]
FORMAT	[mandatory]
INTERSECT	[option]
...	

http://jvo.nao.ac.jp/Image?
Pos=23,+30&Size=1.0&Format=image/fits&
INTERSECT=OVERLAPS

SIAP parameters and returned metadata are taken as columns of the virtual table.

Image Query on Virtual Table

Pos	Size	Format	ImageURL
(23,+30)	1.0	image/ fits	http://jvo.nao.ac.jp/ Image?id=124214
(23,+23)	0.3	image/ jpeg	http://jvo.nao.ac.jp/ Image?id=124215
...	...	...	...

```
Select  imageURL
From    imageTable
Where   Pos = Point(23,+30)
        and Size = 1.0 and
        Format = 'fits'
```

This is a virtual table which has infinite number records.

Development of the JVO SkyNode Toolkit

- Primary aim:
  - to provide a reference implementation for every kind of data service which uses ADQL & VOTable interface
- Supported DBMS:
  - aimed to be independent on the type of DBMS
  - The only requirement is availability of JDBC driver.
  - but still PostgreSQL native SQL (copy command) is used...
- Restrictions:
  - Not all the ADQL syntax are supported.
  - String representation of ADQL is JVOQL.
- Experimental Release:
  - http://jvo.nao.ac.jp/download/skynode-toolkit/

Software used

- Tomcat 4.1.31 ---- servlet container
- Axis 1.2RC1 ---- web service engine
- J2SDK 1.4.2 ---- Java compiler & library
- Ant 1.6.1 ---- Java-based build tool
- JavaCC 3.2 ---- parser generator for Java
- JAXB v1.0.3-b18-fcs ---- XML↔Java conversion
- PostgreSQL 7.4.7 ---- DBMS
- Java HTM library (JHU) ---- spherical indexing
- Java FITS library (HEASARC) ---- FITS IO lib
- ...

Architecture

JVO SkyNode Toolkit Architecture

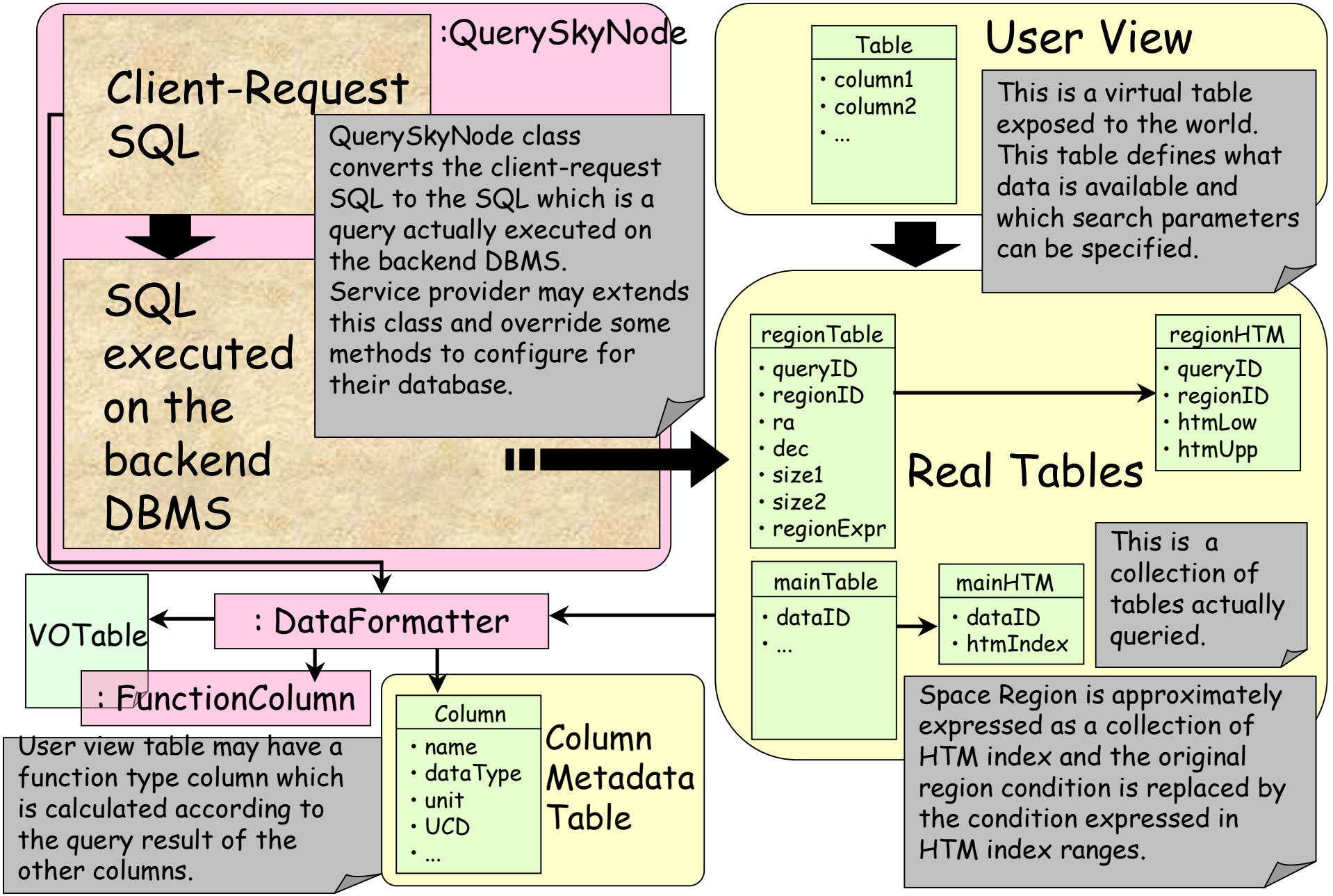


Image Data Query by ADQL

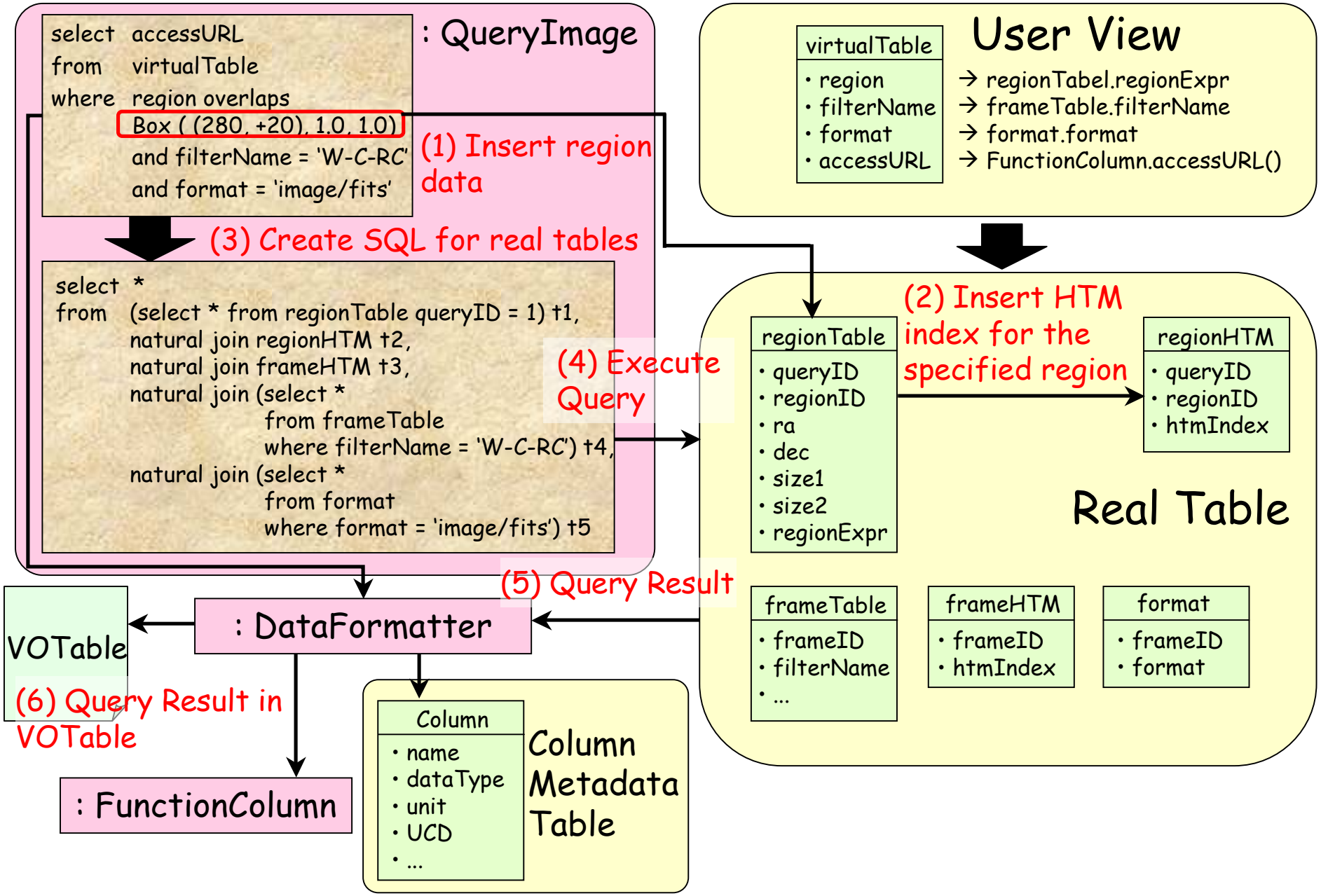
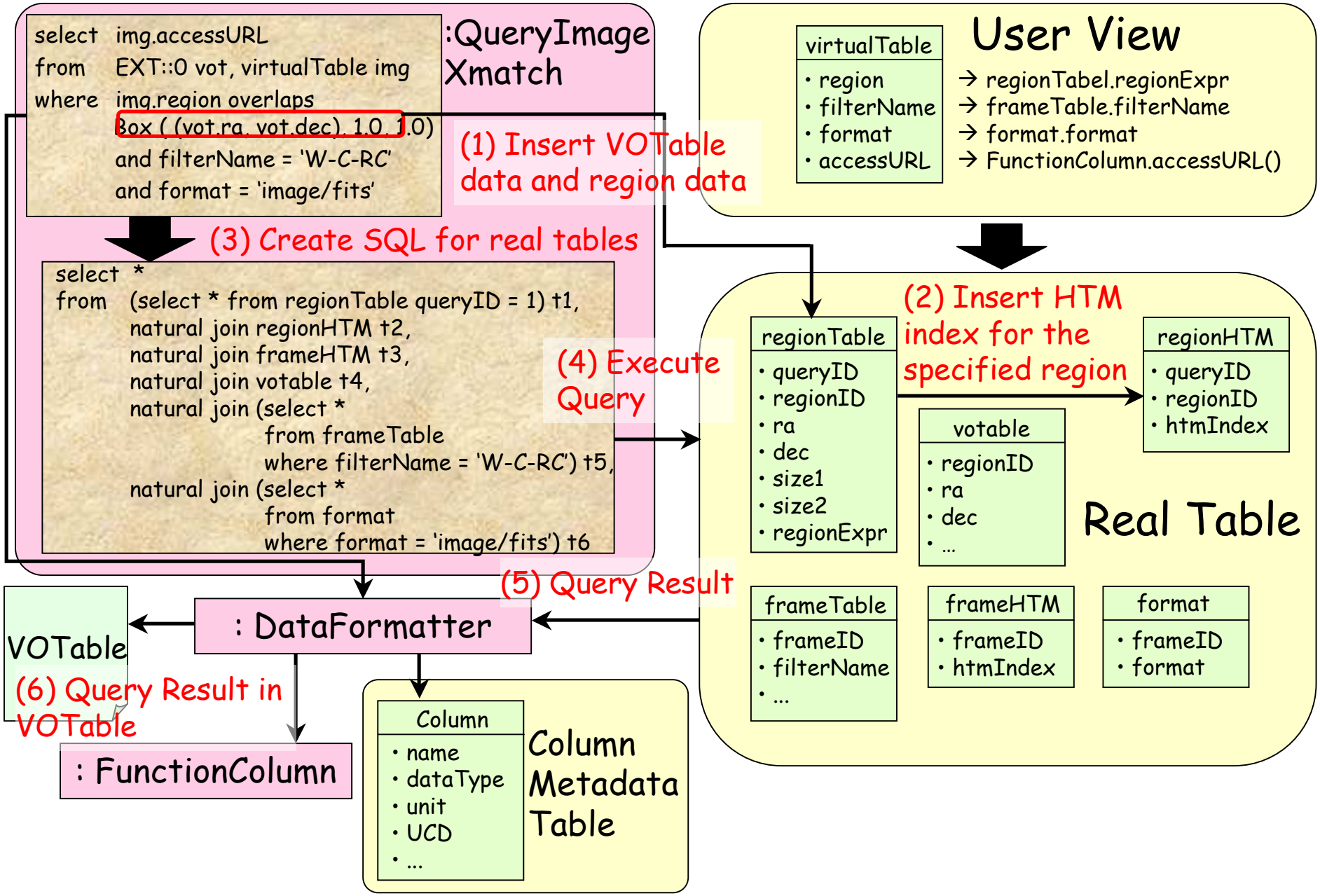


Image Data Xmatch Query with VOTable



Science Use Case
QSO/Galaxy
Clustering Study

Work flow for studying the QSO/Galaxy clustering

1. Select QSO coordinates from the QSO catalog → Query to the Skynode Catalog Database.
2. Search deep imaging data which covers the QSO regions → Query to the Skynode of Subaru Image Database
3. Create catalog from the imaging data → Invoke the SExtractor Web service.
4. Estimate the distance to the objects around the QSO → Invoke the HyperZ Web service
5. Try Clustering Analysis → Invoke the clustering analysis web service.

Query Flow Chart

1. User request SQL
2. SQL to the QSO catalog DB
3. QSO coordinates in VOTable
4. SQL & VOTable to Image DB
5. AccessURL for images around QSOs

(1)

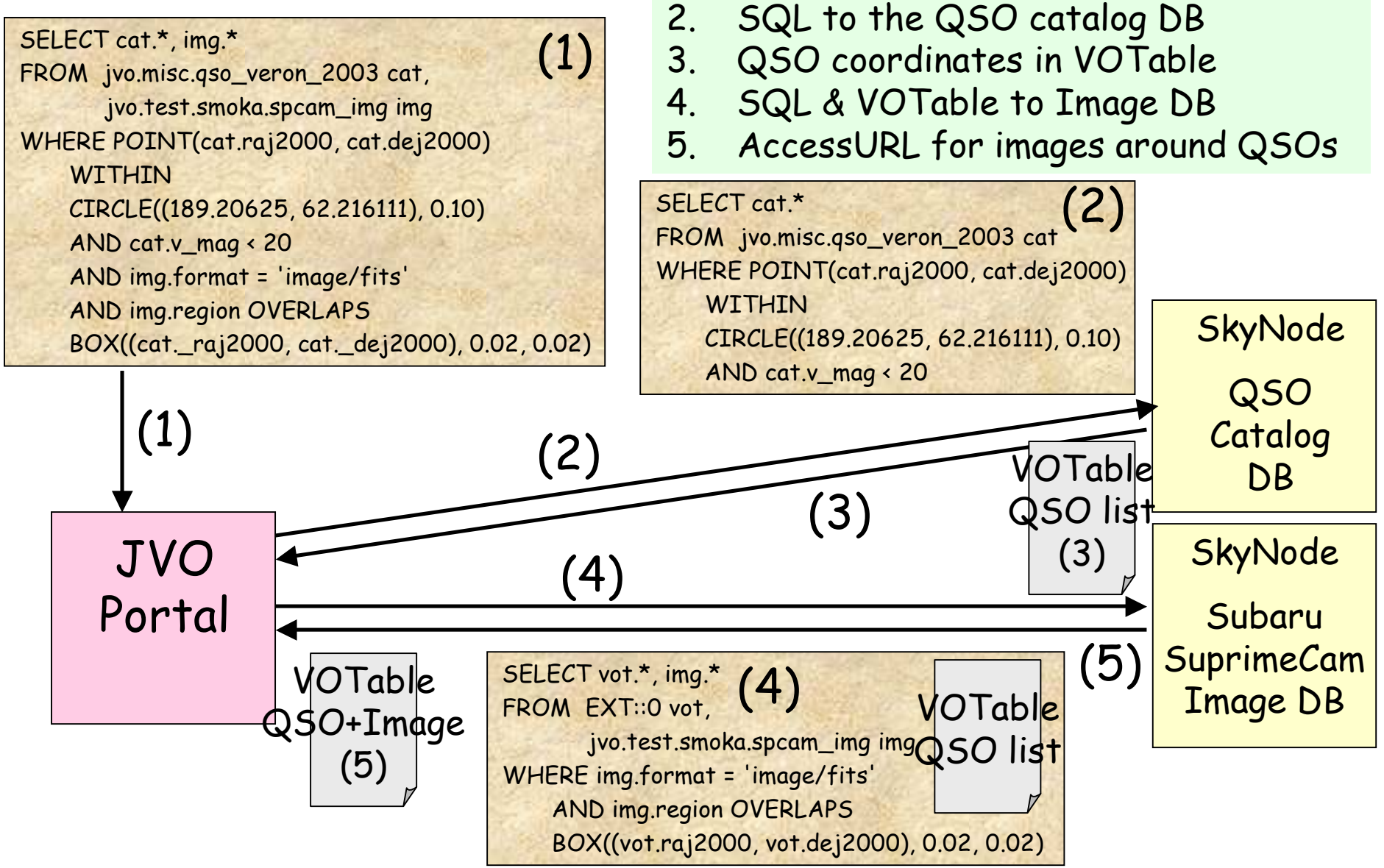
```
SELECT cat.*, img.*
FROM  jvo.misc.qso_veron_2003 cat,
        jvo.test.smoka.spcam_img img
WHERE POINT(cat.raj2000, cat.dej2000)
      WITHIN
      CIRCLE((189.20625, 62.216111), 0.10)
      AND cat.v_mag < 20
      AND img.format = 'image/fits'
      AND img.region OVERLAPS
      BOX((cat._raj2000, cat._dej2000), 0.02, 0.02)
```

(2)

```
SELECT cat.*
FROM  jvo.misc.qso_veron_2003 cat
WHERE POINT(cat.raj2000, cat.dej2000)
      WITHIN
      CIRCLE((189.20625, 62.216111), 0.10)
      AND cat.v_mag < 20
```

(4)

```
SELECT vot.*, img.*
FROM  EXT::0 vot,
        jvo.test.smoka.spcam_img img
WHERE img.format = 'image/fits'
      AND img.region OVERLAPS
      BOX((vot.raj2000, vot.dej2000), 0.02, 0.02)
```




QSO-Galaxies Search - Mozilla Firefox
ファイル(F) 編集(E) 表示(V) 移動(G) ブックマーク(B) ツール(T) ヘルプ(H)
QSO-Galaxies Search
Status | Registry | Search | Result | Database | QSO Search | Image Viewer | Logout
⇒ Query | Catalog | PhotoZ
Data Search
Search
ID for your query
Observation Name
Region
RA: 189.2062 [deg]
Dec: 62.21611 [deg]
Radius: 0.2 [deg]
Image Size: 1.0 [arcmin]
Brightness
V_mag between 10.0 [mag] and 20.0 [mag]
Redshift
z between 0.0 [mag] and 2.0 [mag]
QSO Catalog Search
Service For QSO
ivo://ivo/misc
Table For QSO
qso veron 2003
Image Data Service Search
Service For Image
ivo://ivo/test/smoka
Table For Image
spcam img
Search
User ID
User Name
Group
Last Login
yshirasa
Yuji Shirasaki
jvo
Sat Mar 12 21:36:49 JST 2005

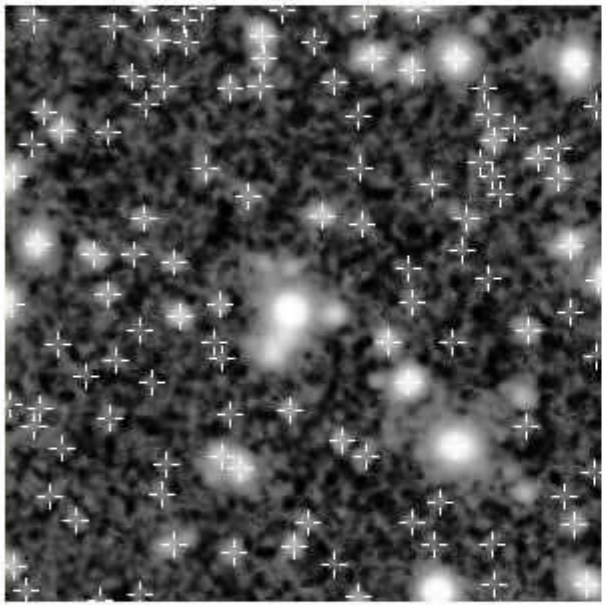
Image Viewer - Mozilla Firefox

ファイル(F) 編集(E) 表示(V) 移動(G) ブックマーク(B) ツール(T) ヘルプ(H)

Image Viewer

Status | Registry | Search | Result | Database | QSO Search | Image Viewer | Logout

Name	Origin	Scale	Contrast
fits0	http://grido.dc.nao..	hist	min = 0.0 max = 65535.0 auto = true



Scale : hist eq.

Contrast : auto

min = 0.0

max = 0.0

Submit

VOTable : votable0

Overplot

User ID	User Name	Group	Last Login
yshirasa	Yuji Shirasaki	jvo	Tue Mar 29 22:16:43 JST 2005

Total memory = 266403kB Used momory = 161121kB (60%)

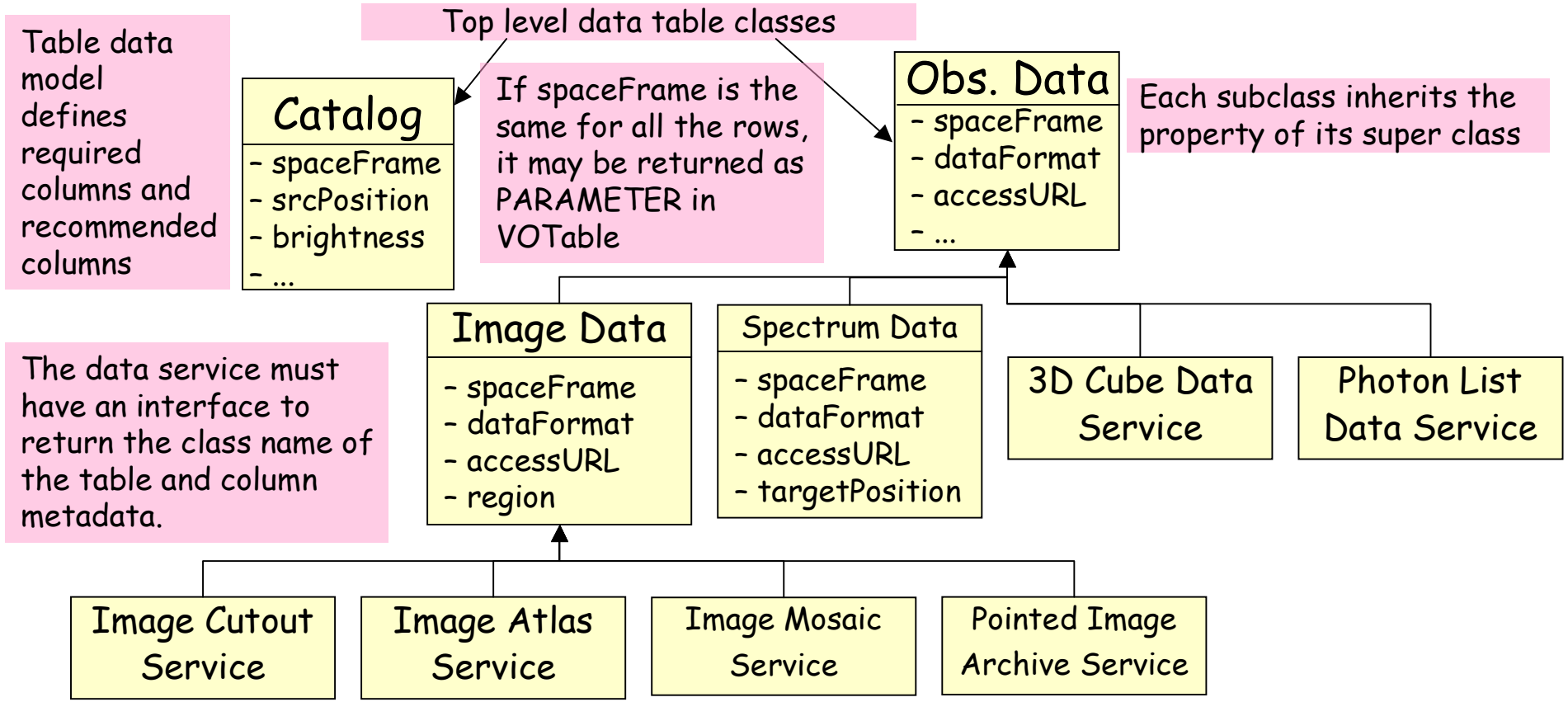
JVO

JAPANESE VIRTUAL OBSERVATORY

Required Standard

Table Data Model for Astro-Data Service

- Query is described in SQL construct (ADQL).
- Query result is returned in a tabular form (VOTable).
- To write a SQL, table structure (column name) need to be known in advance.
- Table Data Model for each data service are required.



Column metadata

- All the column must have the following attributes:
  - name, datatype, unit, arraysize, width, precision, ucd, utype. These are used in the FIELD element attributes of VOTable. A coordinate column must have an coordinateFrame attribute.
  - column name can be specified by a data provider.
  - datatype must follows the VOTable specification.
  - expression of unit must follows the VOTable spec.
  - utype is supplied by VO data model. For columns not defined in the data model, utype is not required.
  - appropriate ucd is assigned by the data provider.

Minimum Requirement for Query Spec.

Current ADQL:

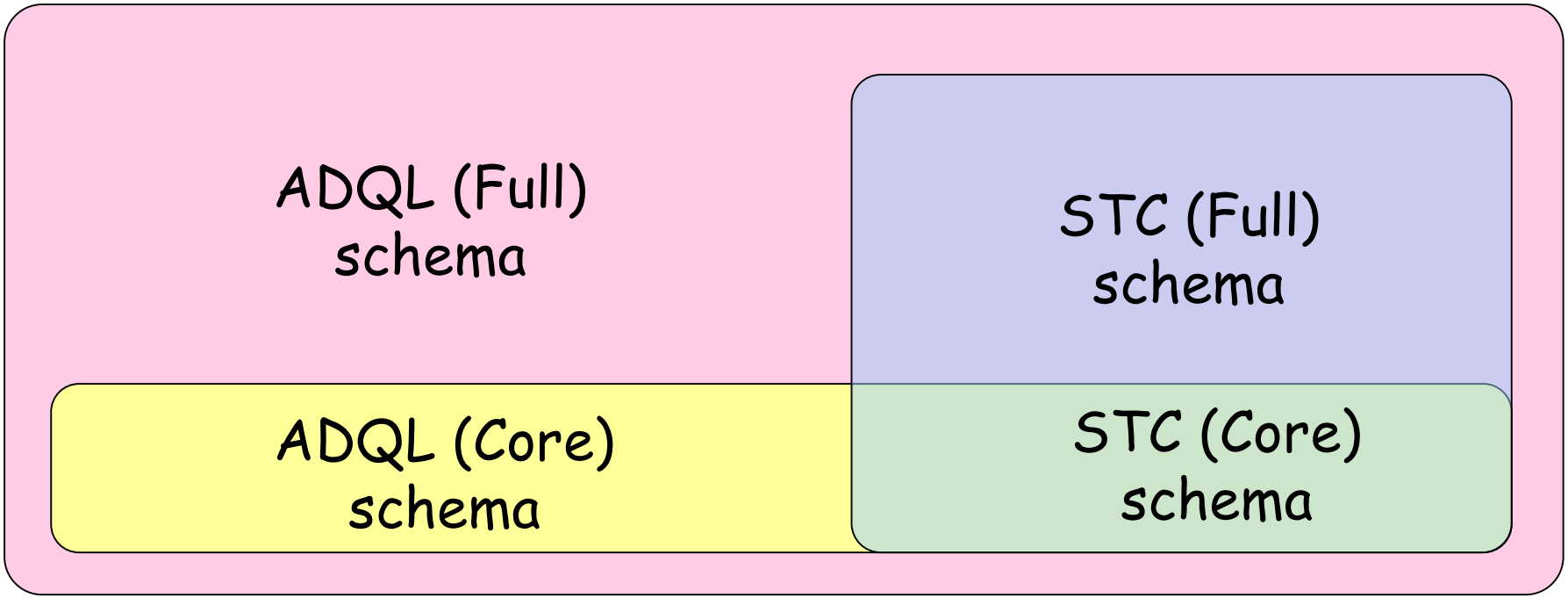
→  describe most of the SQL92 syntax and some astro-extension

→  many elements (33) & many data types (69), hard to build a data service. It is helpful to define minimum subset ADQL spec as a base line

- SelectionItemType (13 sub types in ADQL 0.8)
  - Only AliasSelectionItem and ColumnReferenceType
- FromTableType (3 sub types in ADQL 0.8)
  - Only TableType
- SearchType (16 sub types in ADQL 0.8)
  - Only IntersectionSearchType and ComparisonPredType
  - Region Search Criterion can be specified by ComparisonPredType.

Proposed ADQL Schema structure

- STC (Full) schema imports STC (Core) schema
- ADQL (Core) imports STC (Core)
- ADQL (Full) imports ADQL (Core) and STC (Full)
- ADQL (Core) and STC (Core) should not be changed. These are critical standard for interoperability.
- Each schema has a difference namespace.



Substitution of Column Name by UCD or UType

- Without knowing the column names, we cannot write an SQL…
- Possible Solution → use UCD or Utype for describing the query condition and selection list.
- Instroduce "ucd" and "utype" attributes to the columnReferenceType

```
<Item xsi:type="columnReferenceType" Name="ra" Table="qso"/>
<Item xsi:type="columnReferenceType" ucd="pos.eq;src" Table="qso"/>
<Item xsi:type="columnReferenceType" utype="Target.pos" Table="qso"/>
```

ComparisonPredType as a "must-support" ConditionType

- A basic SkyNode MUST support "comparisonPredType" .
- A basic SkyNode MAY support the other searchType.
- A basic SkyNode MUST recognize an unsupported searchType as a "trueType".
- A basic SkyNode MUST support the following construct:
  - <STC_columnName> <STC_operator> <STC_searchLocationType>
  - STC_operator ::= within, overlaps, outside
    - point within STC('Circle ICRS 200 -20 2.0') (Catalog Query)
    - region overlaps STC('Circle ICRS 200 -20 2.0') (Image Query)
    - spectrum overlaps STC('SpectralInterval A 4000 7000') and observationTime within STC('TimeInterval 2004-05-01 2004-05-31') (Specturm Query)

STC-type column must be compared with an object of STC seachLocationType

utype defines which column represents STC.

ADQL-x version of point within 'Circle ICRS 200 -20 2.0'

It might be convenient to define substitution types for frequently used frames such as <SpaceFrame xsi:tye="ICRSFrameType"/>

```
<Condition comparison="within" xsi:type="comparisonPredType">
  <Arg Table="t" utype="src.position" xsi:type="columnReferenceType"/>
  <Arg xsi:type="searchLocationType">
    <AstroCoordSystem ID="ICRS">
      <SpaceFrame>
        <ICRS/><BARYCENTER/><SPHERICAL coord_naxes="2"/>
      </SpaceFrame>
    </AstroCoordSystem>
    <AstroCoordArea ID="SearchRegion" coord_system_id="ICRS">
      <Region>
        <Circle unit="deg"> <Center>200 -20</Center> <Radius>2.0</Radius>
        </Circle>
      </Region>
    </AstroCoordArea>
  </Arg>
</Condition>
```

Which frame should be defined as a "must be supported" frame

Returned VOTable

- FIELD id → If alias name is specified "adql:aliasName", otherwise "adql:tableAliasName.columnName".
- TABLE id → table alias name
- FIELD & TABLE name → free, client app may use it
- STC metadata (CoordSys) for STC column
  - If each record in the STC column has a different STC metadata, STC metadata column must be included. Otherwise STC metadata must be included as PARAMETER.
- Some of the columns must always be included in the output VOTable. These columns are defined in SIAP, SSAP and SXAP document.

How to treat object data

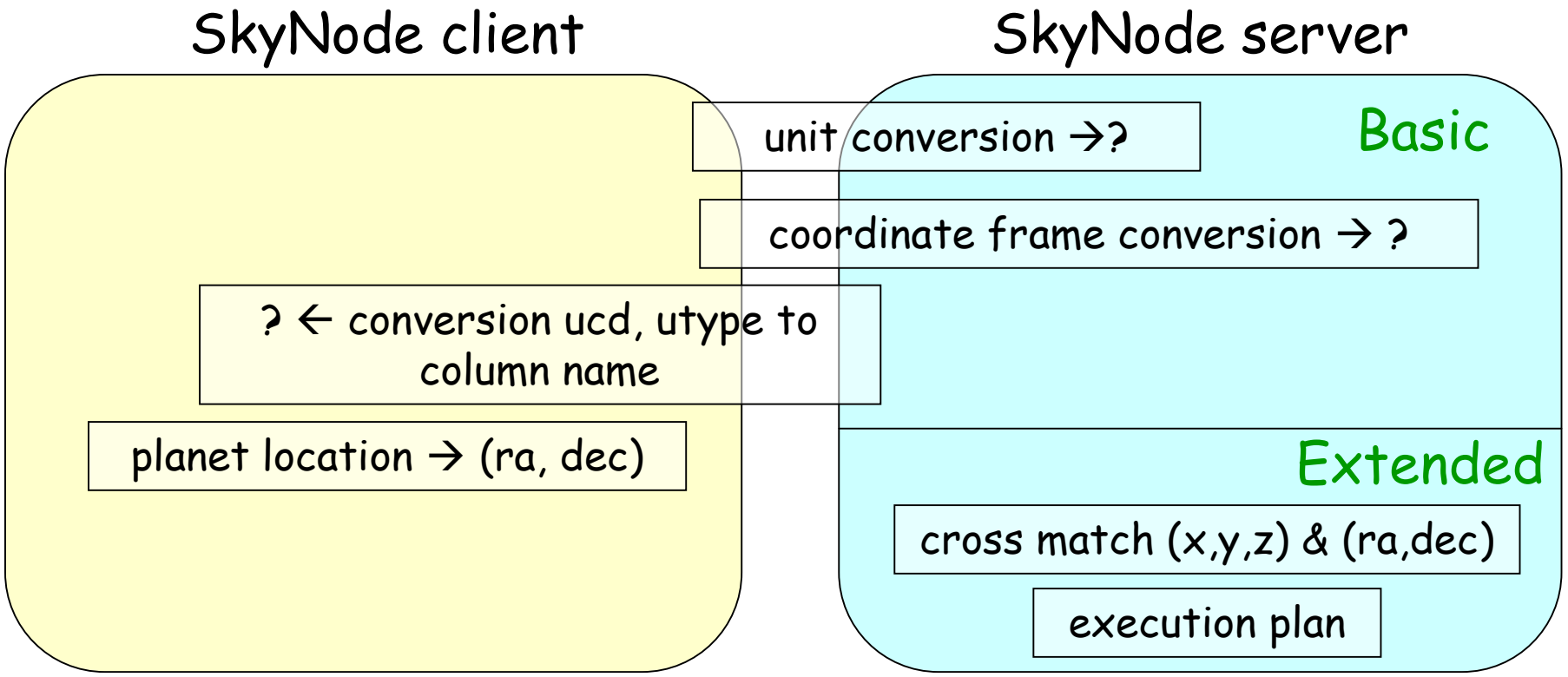
- Spectrum metadata data has a structured data type. Access method to an object data is defined in SQL99. Example is:

  ```
  Select t.*
  From spectrumTable t
  Where t.target.position within STC(' ... ')
  ```

  (*) target is a column name, position is a field name of Target object. Always specify alias table name to express a column.
- Most of the recent RDB support object data type.
- If you don't want to use an object data type of RDB, relate one object type to one table or just have a flat table, then emulate object datatype column.

Client & Server roll separation

Skynode draft should clearly identify which functionalities must be on the server.



Require reference implementation of client too.