

# JVO Skynode Implementation Experience

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VOQL session

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  - ...
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  - Simplify the ADQL and STC → Define minimum subset of ADQL and STC and freeze them (never update, never change the namespace)
  - VOTable transfer → attachment or URL
  - Standardize the error message (not presented, as a future work)
  - ...

# 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/>

# What can be done with the toolkit ?

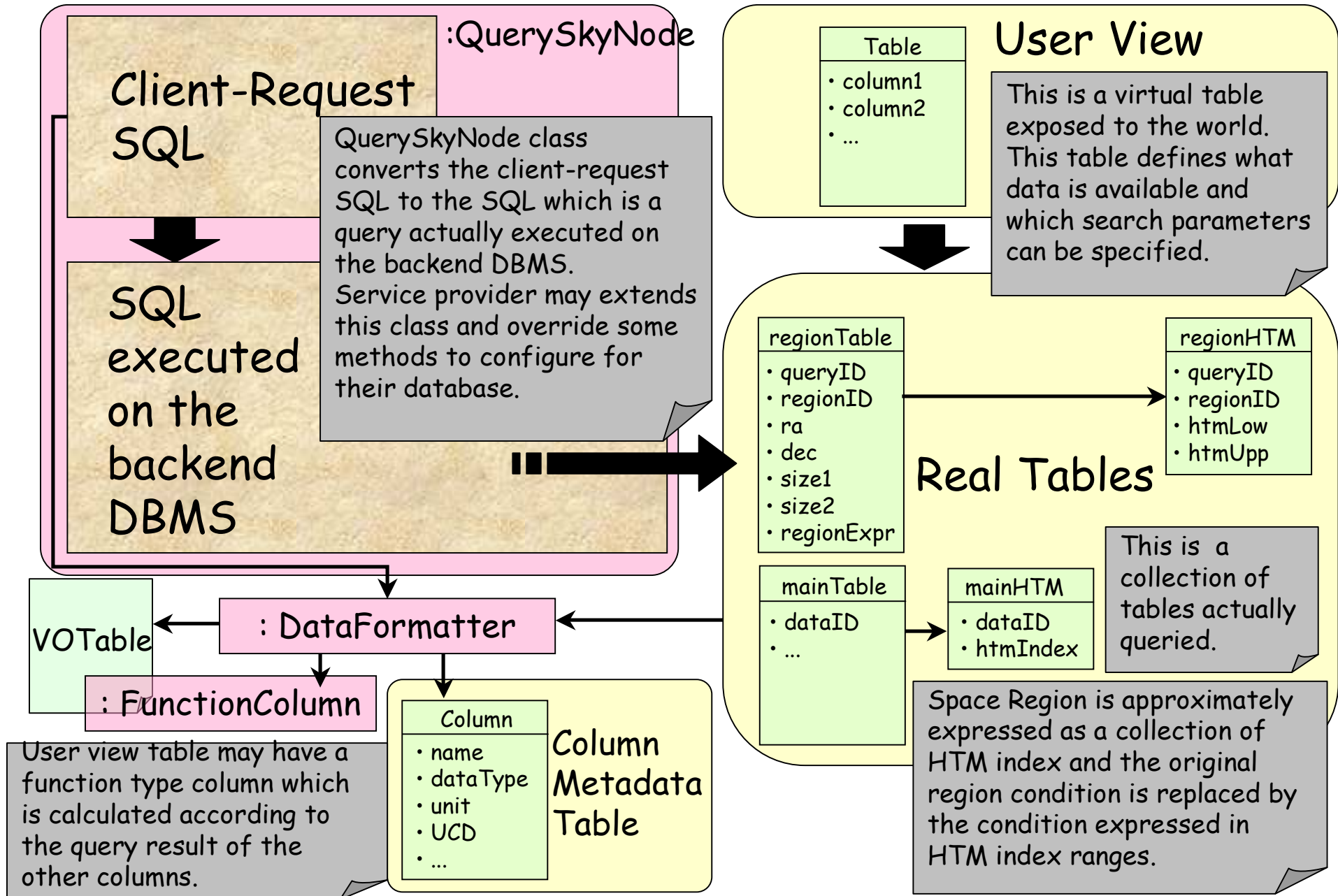
- Catalog data query
- Catalog data cross match query using VOTable
- Image data query
- Image data cross match query using VOTable
- Spectrum data is not supported, but the frame work will be the same as that of Catalog and Image. → next work
- You can build a sample SkyNode service.

# Software used

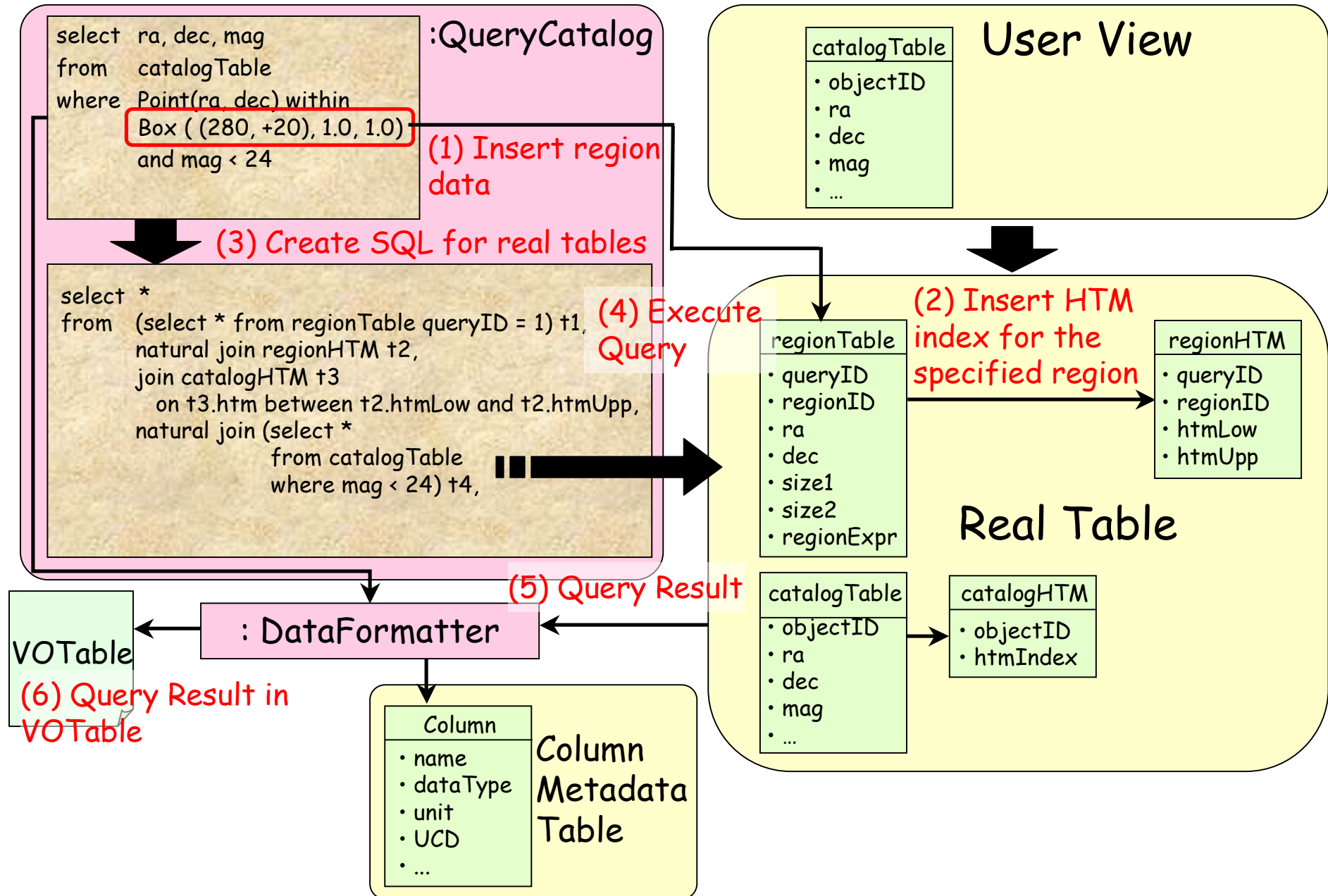
- Tomcat 4.1.31 ---- servlet container
- Axis 1.2RC1 ---- web service engine
- J2SDK 1.4.2 ---- Java compiler & library
- Ant 1.6.1 ---- Java-based build tool
- JavaCC 3.2 ---- parser generator for Java
- JAXB v1.0.3-b18-fcs ---- XML $\leftrightarrow$ Java conversion
- PostgreSQL 7.4.7 ---- DBMS
- Java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

Architecture

# JVO SkyNode Toolkit Architecture

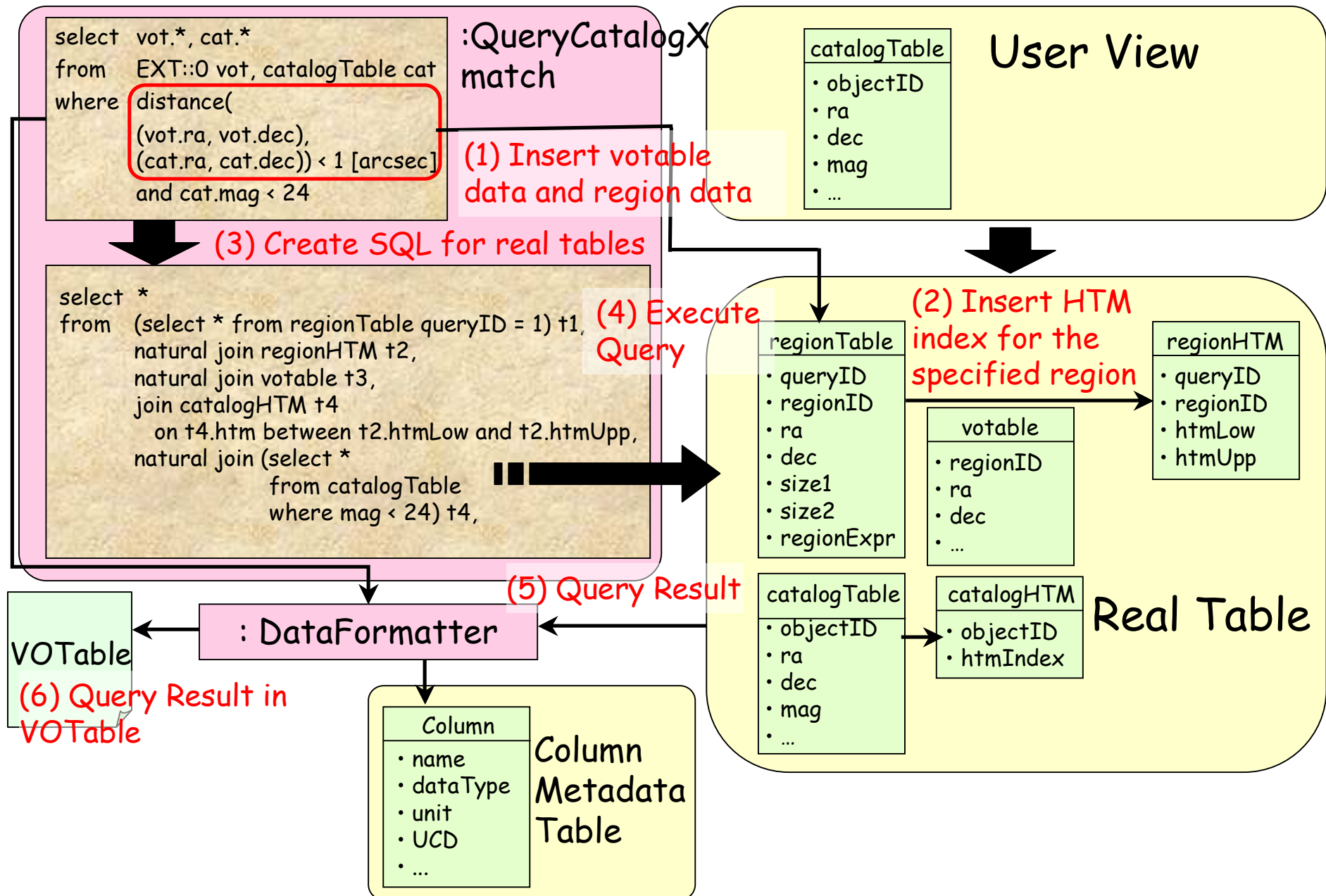


# Catalog Data Query by ADQL





# Catalog Data Xmatch Query with VOTable



Problem encountered  
in implementation  
and problem for  
interoperability

## Problems encountered in implementation (1)

- XML ↔ Java auto-conversion in AXIS
  - With the standard usage of AXIS, creation of a Java object corresponding to a XML document (e.g. VOTable) is, as a default, required.
  - Server memory is easily exhausted.
  - Even several hundreds records of VOTable suffers from out of memory error.
- Possible Solution :
  - Don't use the auto-serialization and deserialization mechanism of AXIS (suggestion from an AstroGrid person).
  - return VOTable as an attachment
  - return a reference URL to retrieve the VOTable

## Problem in implementation (2)

- Usage of VOTable is not clearly defined
  - id and name attribute → what should be filled ?
  - Where column alias name should be put. This information might be used for post-search processing on portal side.
  - Location where a table name and an alias table name are put.
  - Information on the origin of the column data should be kept anywhere in VOTable.

# Problems for interoperability (1)

- Name space problem (as of 2005 Jan)
  - JVO → ADQL v0.8 + VOTable v1.1 + STC v1.1
  - NVO → ADQL v0.74 + VOTable <v1.0 + NVO-STC
- Temporal workaround
  - External interface → ADQL v0.74, VOTable v1.0
  - Internal interface → ADQL v0.8, VOTable v1.1
  - Namespace exchanger
- Complexity of ADQL and STC object
  - ADQL → 33 elements, 69 types
  - STC → 250 elements, 88 types
- Possible Solutions:
  - Define a core part of ADQL as a minimum subset and assign a permanent namespace. Never update, never change the namespace of the core part.

# Minimum subset of ADQL

Element: 33 (full) → 12 (basic)

Simple Type: 13 (f) → 4 (b)

Complex Type: 56 (f) → 12 (b)

## Fundamental Type

xs:unsignedInt  
 xs:string(\*)  
 xs:double(\*)  
 xs:long(\*)

## Simple Type

aggregateFunctionNameType  
 allOrDistinctType  
 binaryOperatorType  
 comparisonType(\*)  
 jointTableQualifierType  
 mathFunctionNameType  
 orderDirectionType  
 trigonometricFunctionNameType  
 unaryOperatorType

## Element

Allow	Restrict
Arg(*)	Select(*)
Column	SelectionList(*)
Condition(*)	Set
EndComment	Sigma
Expression(*)	StartComment
From(*)	Table(*)
GroupBy	TableName
Having	Tables
InTo	Unit(*)
Item(*)	Where(*)
Literal(*)	fromTableType
Name	selection
Nature	
Order	
OrderBy	
Params	
Pattern	
Qualifier	
Region(*)	

## Complex Type

ArrayOfFromTableType	includeTableType	searchType
ConstantListSet	inclusionSetType	selectType
aggregateFunctionType	inclusiveSearchType	selectionItemType
aliasSelectionItemType(*)	integerType(*)	selectionLimitType
allSelectionItemType	intersectionSearchType(*)	selectionListType
archiveTableType	intoType	selectionOptionType
atomType(*)	inverseSearchType	stringType(*)
betweenPredType	jointTableType	subQuerySet
binaryExprType	likePredType	tableType(*)
closedExprType	literalType(*)	trigonometricFunctionType
closedSearchType	mathFunctionType	unaryExprType
columnReferenceType(*)	notBetweenPredType	unionSearchType
comparisonPredType(*)	notLikePredType	userDefinedFunctionType
dropTableType	numberType	whereType(*)
exclusiveSearchType	orderExpressionType	xMatchTableAliasType
fromTableType	orderOptionType	xMatchType
fromType(*)	orderType	
functionType	realType(*)	
groupByType	regionSearchType	
havingType	scalarExpressionType	

## 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') (Spectrum Query)

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

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:type="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



## Problem for interoperability (2)

- Column name must be known in advance for writing ADQL.
  - We can get column names by "Columns" interface and write ADQL, but it requires human intervention.
  - A possible solution:
    - use UCD or Utype for specifying a column
    - Introduce "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"/>
```
- If the specified utype or ucd is not found in the queried table,
    - ignore the condition for that column
    - return PARAMETER of "NaN" for that column

# Summary

- Experimental release of JVO SkyNode toolkit
  - <http://jvo.nao.ac.jp/download/skynode-toolkit/>
  - Support for Catalog query, Image query
- Some Proposals
  - Need minimum subset of ADQL and STC
  - Minor update on ADQL: ucd and utype attributes to the ColumnReferenceType.
  - Usage of VOTable. Location where column name, column alias name, table name and table alias name are described.
  - Error message (for future work)