# JVO Skynode Implementation Experience

Under Preparation

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  - VOTable transfer → attachment or URL
  - Standardize the error message

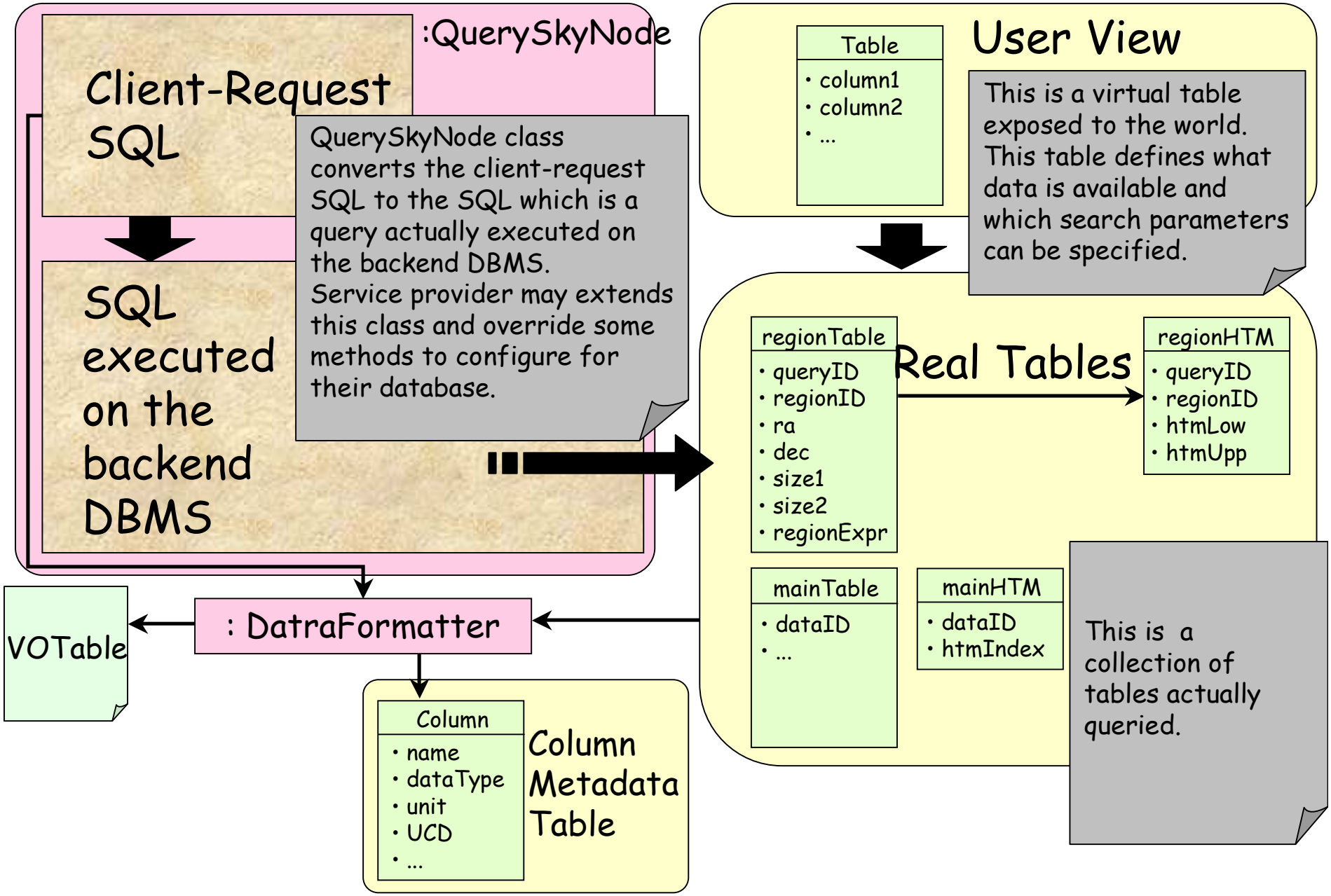
# Development of the JVO SkyNode Toolkit

- Primary aim : to provide a reference implementation for a VO data service using SkyNode/ADQL/VOTable interface
- Independent from the type of backend DBMS (PostgreSQL, Oracle, MySQL, XMLDB…)

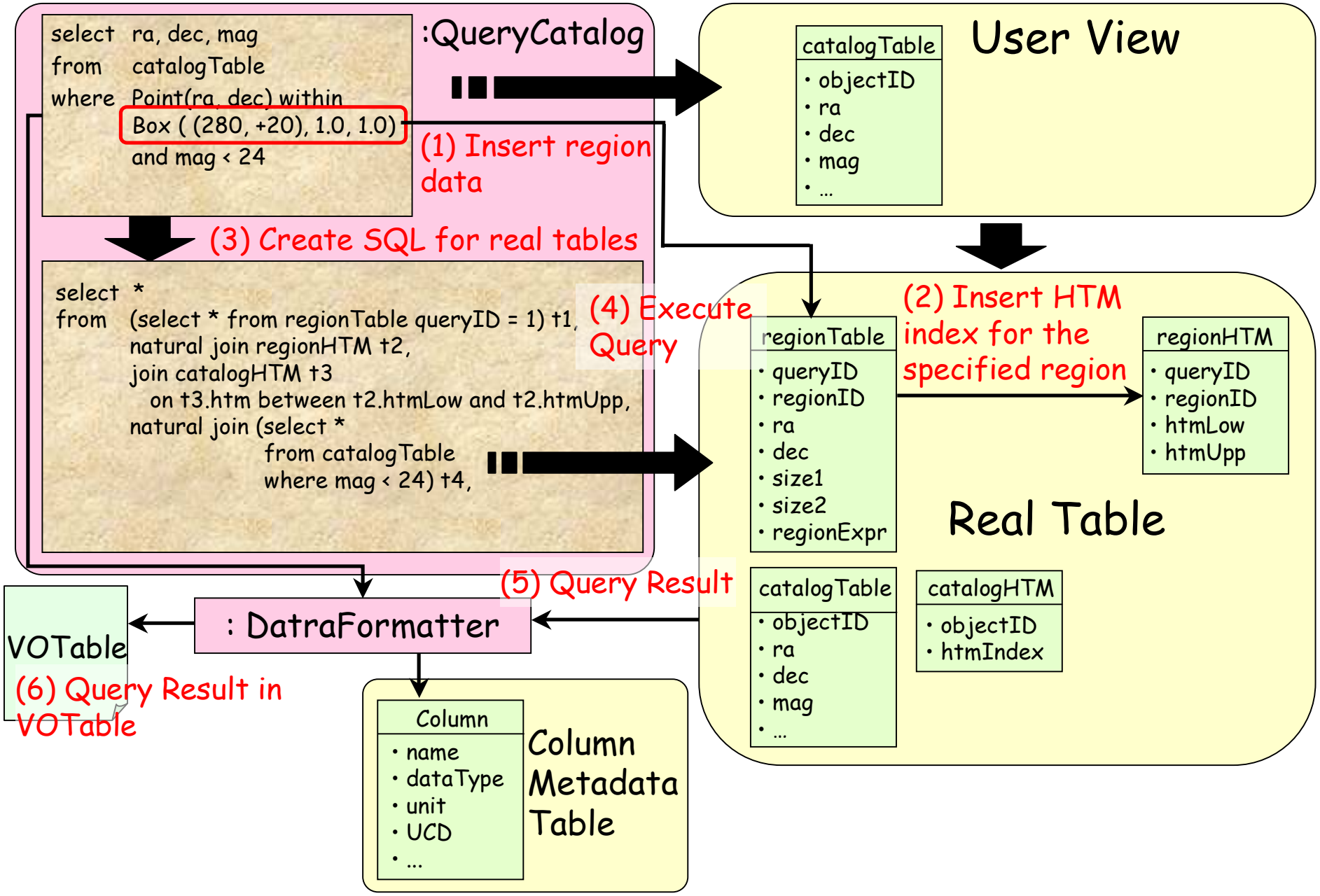
# Software used

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

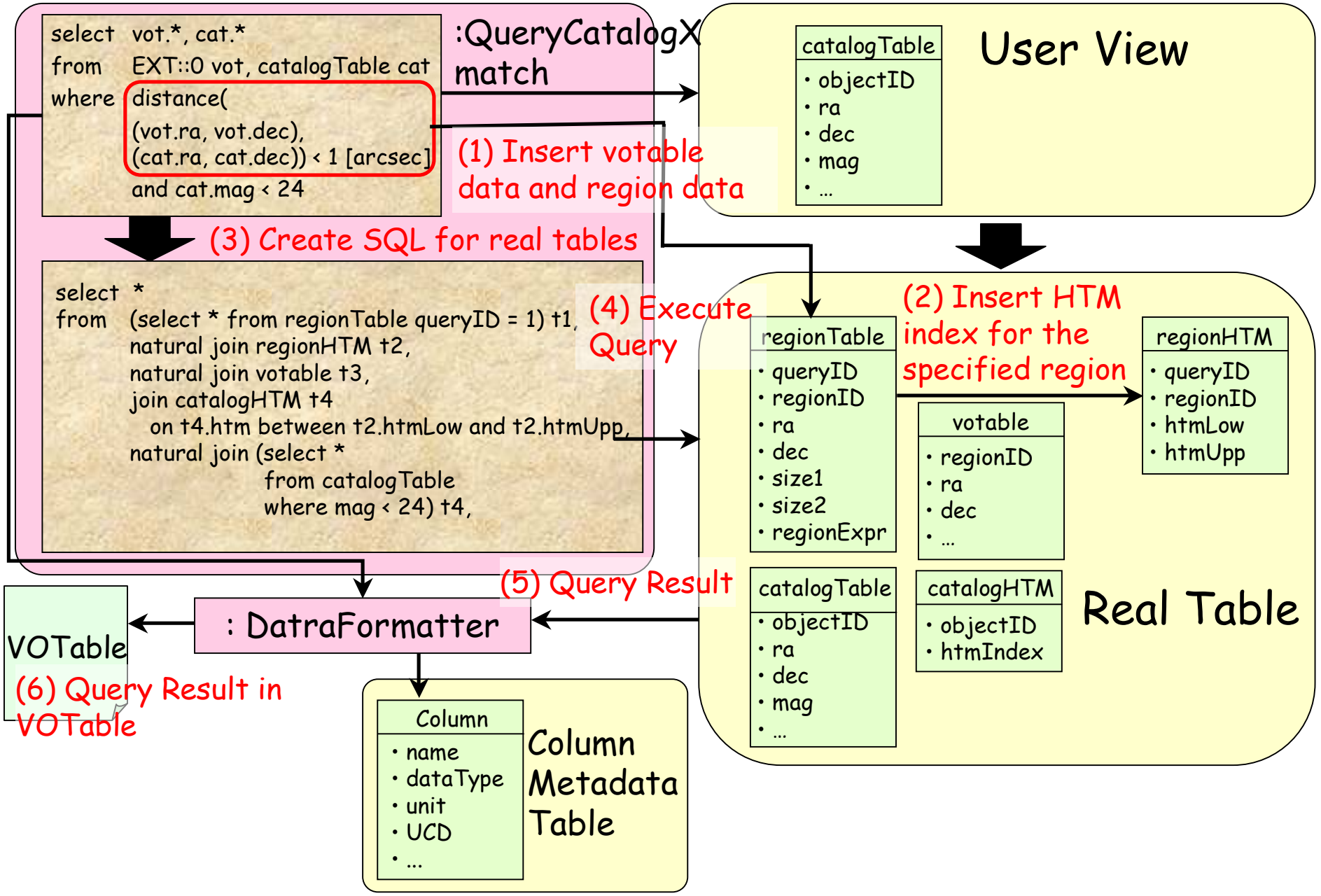
# Catalog Data Query by ADQL



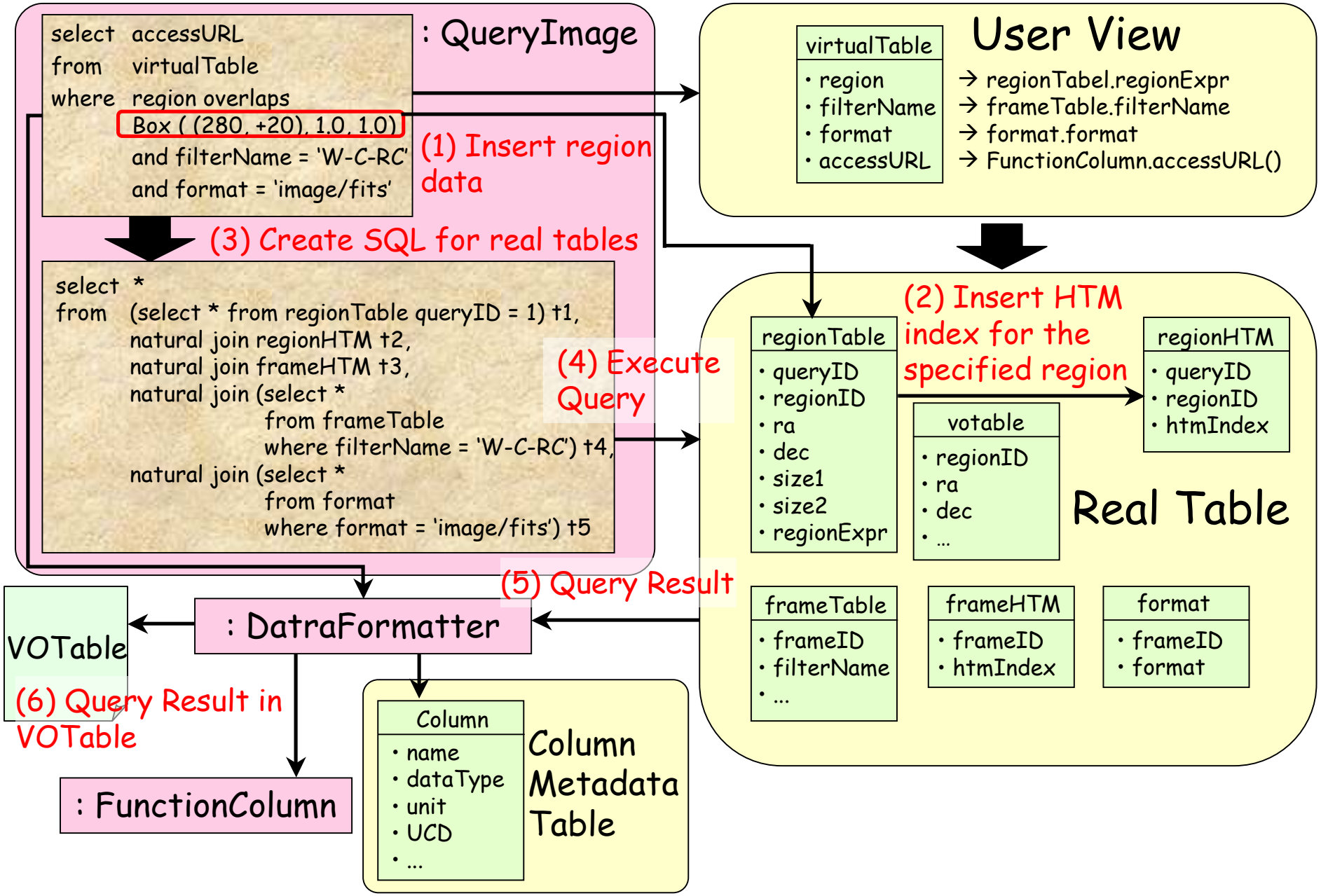
# Catalog Data Query by ADQL



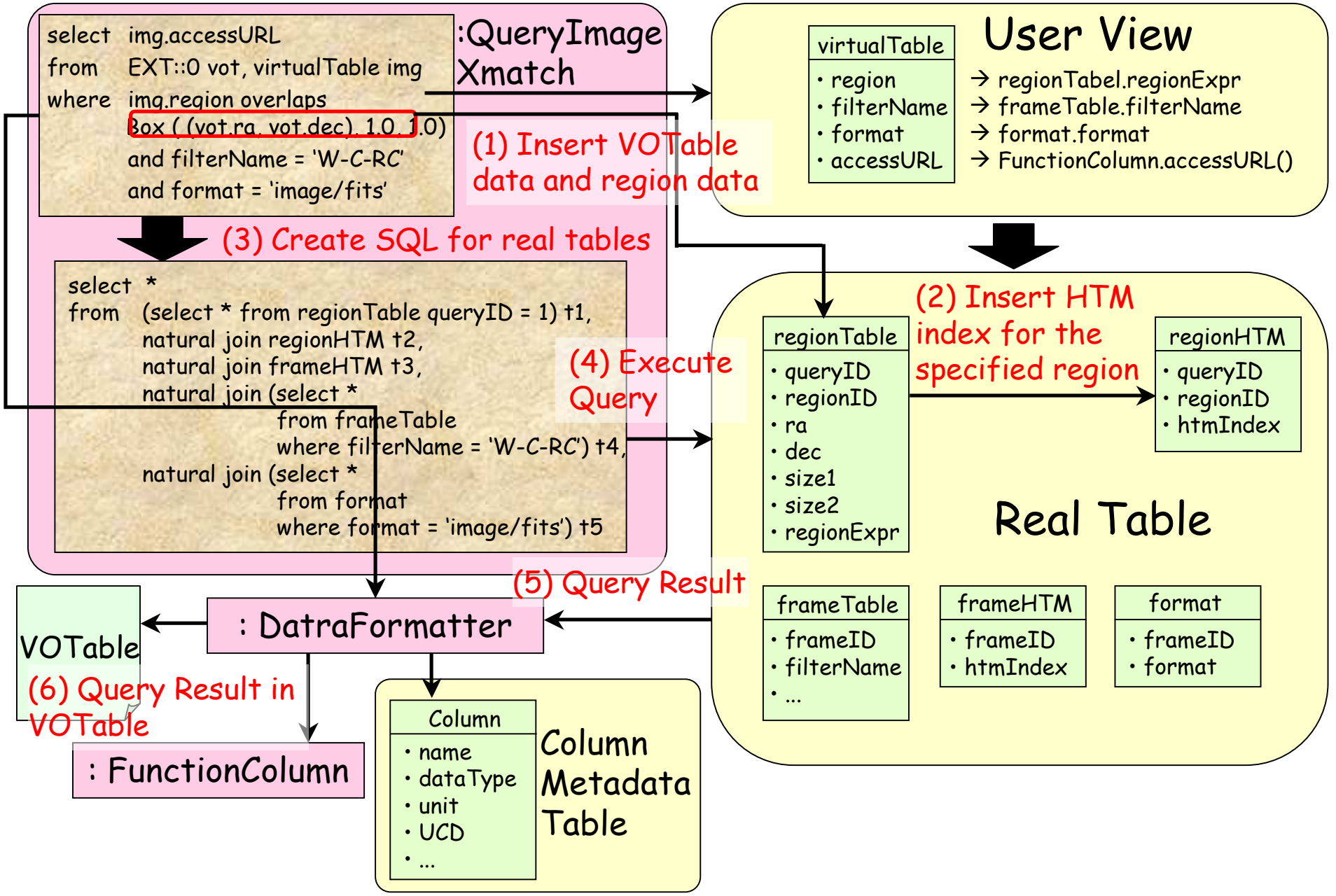
# Catalog Data Xmatch Query with VOTable



# Image Data Query by ADQL



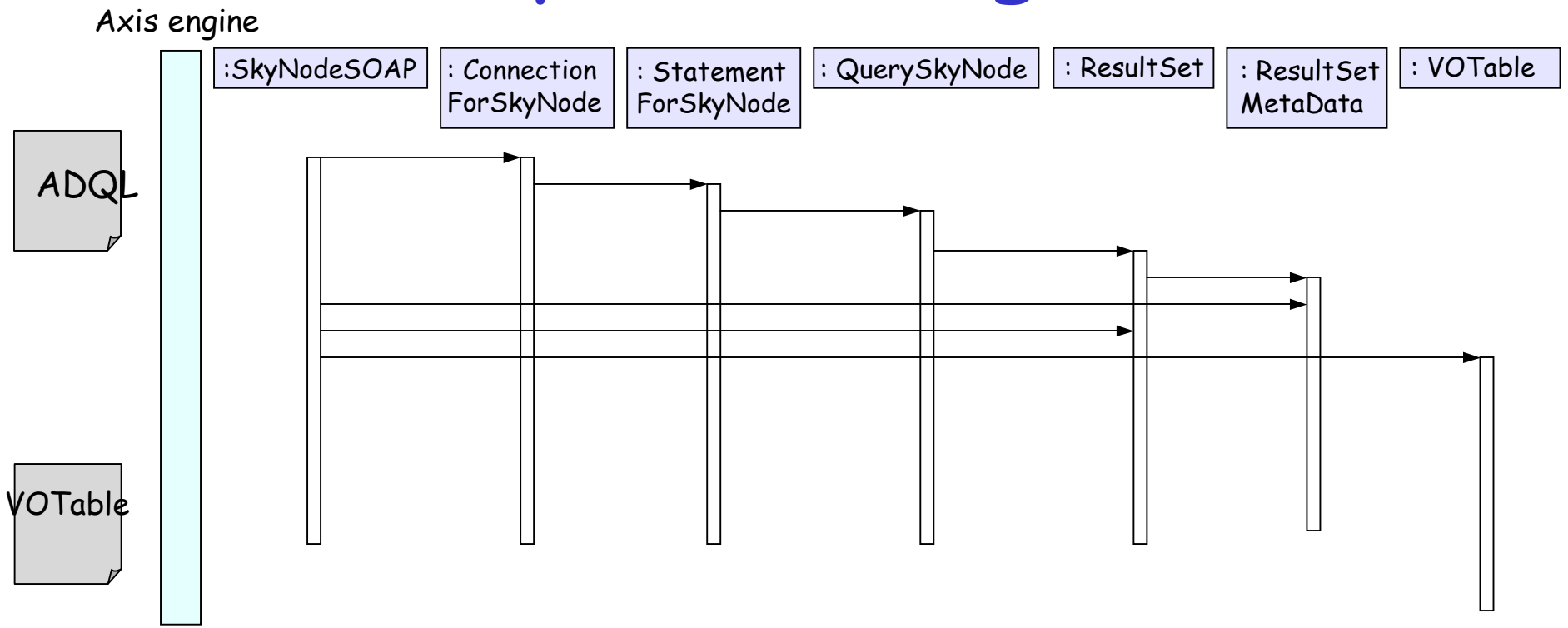
# Image Data Xmatch Query with VOTable



# How to treat object data

- Most of the recent RDB support object data type (SQL99).
- relate one object type to one table.
- make it flat

# Sequence Diagram



# Problems encountered in implementation (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
  - External interface → ADQL v0.74, VOTable v1.0
  - Internal interface → ADQL v0.8, VOTable v1.1
  - Namespace exchanger
- 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.

# Problems encountered in implementation (2)

- XML→ Java deserialization in AXIS
  - With the standard usage of AXIS, an XML document (ADQL, VOTable) is, as a default, deserialized to Java objects.
  - Server memory is easily exhausted.
  - Even several hundreds records of VOTable suffers out of memory error.
- Possible Solution :
  - Stop auto-deserialization of AXIS (learned from an AstroGrid person)
  - return VOTable as an attachment
  - return a reference URL to retrieve the VOTable

# Problems encountered in implementation (3)

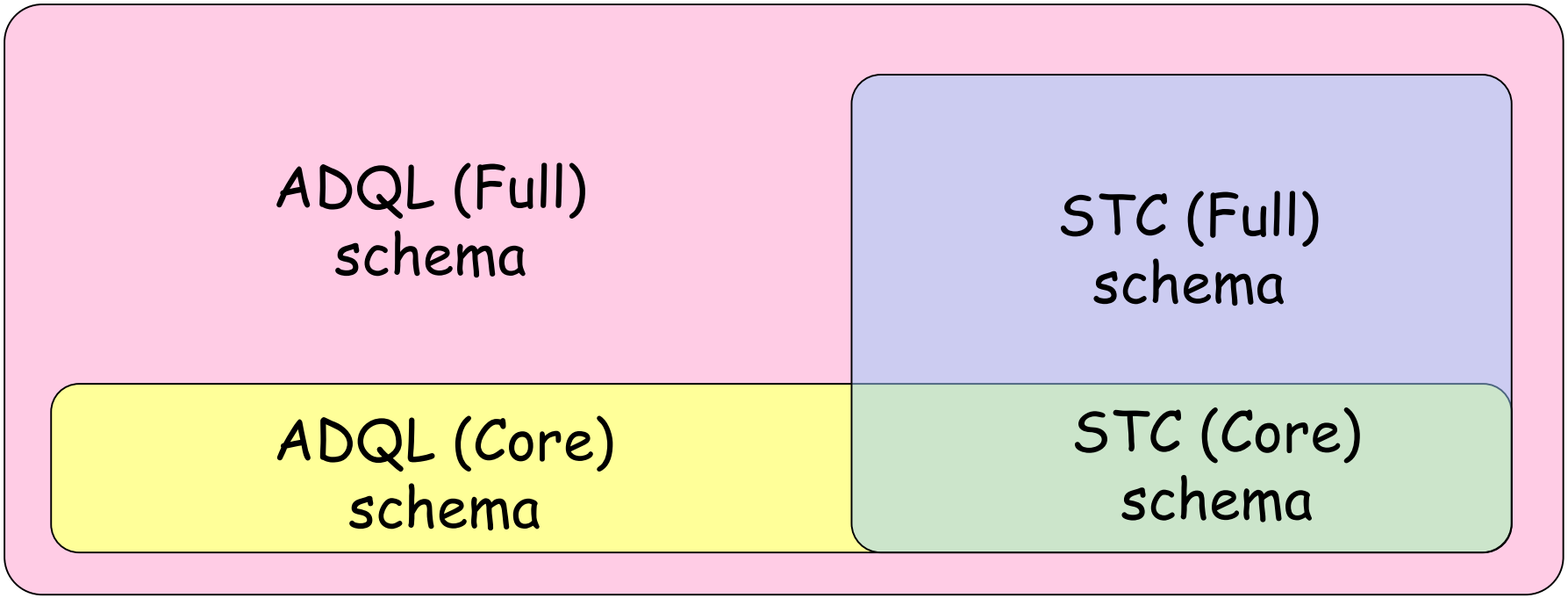
- Usage of VOTable
  - id and name attribute → what should be filled ?
  - Where column alias name should be put. This information is required for post-search processing on portal side.
  - Information on the origin of the column data should be kept anywhere in VOTable. Where ?

# Problems encountered in implementation (4)

- Complexity of ADQL & STC object
- Number of defined element
  - ADQL v0.8 → 33
  - STC v1.20 → 250
- Number of defined ComplexType and SimpleType
  - ADQL v0.8 → 69
  - STC v1.20 → 88

# 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.



# Minimum subset of ADQL for basic Skynode Service

Element: 33 (full) → 12 (basic)

Simple Type: 13 (f) → 4 (b)

Complex Type: 56 (f) → 12 (b)

## Fundamentral Type

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

## Simple Type

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

## Element

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

## Complex Type

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

stc-v1.20.xsd

## region-v1.20.xsd

AllSky
Box
Center*
Circle*
Constraint
Convex
ConvexHull
Ellipse
Intersection
MinorRadius
Negation
Offset
Point
Pole
Polygon
PosAngle
PosAngle1
PosAngle2
Position
Radius*
Region
Sector
Size
SkyIndex
SmallCircle
Union
Vector
Vertex

boxType
circleType*
constraintType
convexHullType
convexType
ellipseType
intersectionType
negationType
polygonType
regionType*(abstract)
sectorType
shapeType*(abstract)
skyIndexType
smallCircleType
unionType
vertexType

## coords-v1.20.xsd

AbsoluteTime
AstroCoords
CError
CError2
CError3
CPixSize
CPixSize2
CPixSize3
CResolution
CResolution2
CResolution3
CSize
CSize2
CSize3
CValue
CValue2
CValue3
CoordFile
CoordValue
Coordinate
Coords
Error
Error2
Error2Matrix
Error2PA
Error2Ref
Error3
Error3Matrix
Error3PA
Error3Ref
ErrorRef
FITSFile
FITSPosition
FITSRedshift
FITSSpectral
FITSTime
FITSVelocity
ISOTime
ISOTimeRef
JDTime
JDTimeRef
MJDTime
MJDTimeRef
Name
PixSize
PixSize2
PixSize2Matrix
PixSize2PA
PixSize2Ref
PixSize3
PixSize3Matrix
PixSize3PA
PixSize3Ref
PixSizeRef
PixelCoordinate
PixelCoords
PosAngle
PosAngle1
PosAngle2
Position
Position1D
Position2D
Position3D
Redshift
RelativeTime
Resolution
Resolution2
Resolution2Matrix
Resolution2PA
Resolution2Ref
Resolution3
Resolution3Matrix
Resolution3PA
Resolution3Ref
ResolutionRef
ScalarCoordinate
Size
Size2
Size2Matrix
Size2PA
Size2Ref
Size3
Size3Matrix
Size3PA
Size3Ref
SizeRef
Spectral
StringCoordinate
Time
TimeInstant
TimeOffset
TimeOffsetRef
TimeOrigin
Timescale
Value
Value2
Value2Ref
Value3
Value3Ref
ValueRef
Velocity
Velocity1D
Velocity2D
Velocity3D

angleUnitType
double2Type*
double3Type
double4Type
double9Type
doubleArrayType*
posAngleReferenceType
posUnitType
spectralUnitType
timeScaleType
timeUnitType
unitType
velTimeUnitType

astroCoordsFileType
astroCoordsType
astronTimeType
coordFITSColumnsType
coordinateType
coordsType
fitsType
pixelCoordsType
posAngleType
scalarCoordinateType
size2Type
size3Type
timeCoordinateType
vector2CoordinateType
vector3CoordinateType