



VOTables in SExtractor 2.5

E.Bertin, (IAP & Obs. de Paris/LERMA)



Motivation

- The idea behind VOTables is to propose a modern standard for exchanging astronomical data and metadata.
- The goals are similar to those of FITS 25 years ago
 - Should be portable, versatile and easy to decode.
- Additional advantages:
 - Based on XML
 - Benefits from existing validation tools (DTD, XSchema) and transformation tools (XSLT)
 - Can be modified or completed from a simple text editor.
 - “Naturally” behaves in a hierarchical way.
 - Streamable content
 - No NAXIS2 required in tables or images.
 - Self-descriptive
 - UCDs (Universal Content Descriptors)



Bref historique

- The project took form in 2002 in the context of an [interoperability OPTICON meeting](#).
- The current schema is actually derived essentially from the XML astrores format created at CDS in the late nineties ([Ochsenbein et al. 1999](#))
 - Original choices influenced by the requirements of translating with minimum losses to and from the FITS table format (for Vizier).
 - Changes to the standard published during several VO meetings from 2002 to 2004
 - April 2002: VOTable 1.0
 - August 2004: VOTable 1.1



Description

- VOTable header example:

```
<?xml version="1.0" encoding="UTF-8"?>
<?xml-stylesheet type="text/xsl"
href="file:///usr/local/share/sextractor/sextractor.xsl"?>
<VOTABLE xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:noNamespaceSchemaLocation="http://www.ivoa.net/xml/VOTable/v1.1">
  <DESCRIPTION>produced by SExtractor</DESCRIPTION>
  <!-- VOTable description at http://www.ivoa.net/Documents/latest/VOT.html -->
  <RESOURCE ID="SExtractor" name="BCS2327-5530Ai.051119_0248.073_01.fits">
    <DESCRIPTION>Catalog of sources extracted with SExtractor</DESCRIPTION>
    <INFO name="QUERY_STATUS" value="OK" />
    <COOSYS ID="J2000" equinox="J2000" epoch="J2000" system="ICRS"/>
    <TABLE ID="Source_List" name="BCS2327-5530Ai.051119_0248.073_01.fits/out">
      <DESCRIPTION>Table of sources detected in image</DESCRIPTION>
      <!-- Now comes the definition of each SExtractor parameter -->
      <FIELD name="XWIN_IMAGE" ucd="pos.cartesian.x;instr.det" datatype="double"
unit="pix">
        <DESCRIPTION>Windowed position estimate along x</DESCRIPTION>
      </FIELD>
      ...
    </RESOURCE>
  </VOTABLE>
```



Structure

- The various hierarchical levels of a VOTable:





VOTable elements

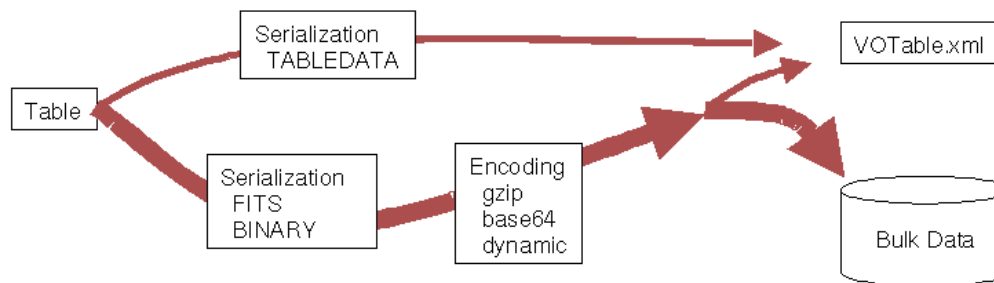
- Possible attributes for VOTable elements:

VOTABLE (definition) ID version	RESOURCE (definition) ID name type utype	TABLE (definition) ID name ucd utype ref nrows	STREAM (definition) type href actuate encoding expires rights	FITS (definition) extnum	COOSYS (definition) ID equinox epoch system
GROUP (definition) ID name ref ucd utype	PARAM (definition) ID unit datatype precision width ref name ucd utype arraysize value	FIELD (definition) ID unit datatype precision width ref name ucd utype arraysize type	VALUES (definition) ID type null ref	MIN (definition) value inclusive	INFO (definition) ID name value
FIELDref (definition) ref	PARAMref (definition) ref			MAX (definition) value inclusive	LINK (definition) ID content-role content-type title value href action
				OPTION (definition) name value	



Les données

- “Serialization”:



- Example of a “Tabledata”:

```

...
<FIELD name="VIGNET" ucd="obs.image" datatype="float" unit="ct"
arraysize="3x2">
  <DESCRIPTION>Pixel data around detection</DESCRIPTION>
</FIELD>
<DATA><TABLEDATA>
<TR><TD> 333.600</TD><TD> 207.335</TD><TD>351.3283057</TD><TD>--
55.8174862</TD><TD> 39332.31 39393.14 39287.81 39483.16 39362.48
39345.91</TD></TR>

```

- Example of a “FITS stream”:

```

<DATA>
<FITS extnum="2"><STREAM href="file:test.cat" /> </FITS>
</DATA>

```



VOTables in SExtractor 2.5

- Supported only in output
 - Catalog structure:
 - <VOTABLE>
 - <RESOURCE ID="SExtractor" name="image.fits">
 - <TABLE ID="Source_List" name=".fits/out">
 - <DATA><TABLEDATA> ... </TABLEDATA></DATA>
 - </TABLE>
 - <RESOURCE ID="MetaData" name="MetaData">
 - <TABLE ID="Extension_Data" name="Extension_Data">
 - <DATA><TABLEDATA> ...</TABLEDATA></DATA>
 - </TABLE>
 - <TABLE ID="Warnings" name="Warnings">
 - <DATA><TABLEDATA>
 - <TR><TD>2006-07-14</TD><TD>19:33:32</TD><TD>default.sex not found, using internal defaults</TD></TR>
 - </TABLEDATA></DATA>
 - </TABLE>
 - <RESOURCE ID="Config" name="Config">
 - </RESOURCE>
 - </RESOURCE>
 - </RESOURCE>
 - </VOTABLE>



VOTables in SExtractor 2.5 (cont.)

- Catalogs:
 - Field description inspired by AVOCat developments by Gérard in 2004.
 - UCDs external and obsoleted.
 - Missing datatypes.
 - The current organization of UCDs is not satisfactory
 - Examples:
 - No UCD to describe a conversion factor in e^-/ADU or a photometric aperture diameter.
 - UCDs common to the observation and data processing contexts.
 - Confusion between physical linear sizes and projected sizes (on the detector).



VOTables in SExtractor 2.5 (end)

- Catalogs
 - Option CATALOG_TYPE ASCII_VOTABLE
 - Streaming option with CATALOG_NAME STDOUT
 - Up to 100 warnings stored together with avec date et time of occurrence.
 - In case of a fatal but catchable error (no segfault):
 - If the extractor had already begun: the data being written are closed and the error message is put in the “Error_Msg” PARAM of the SExtractor metadata sub-RESOURCE.
 - Otherwise a “lite” metadata RESOURCE is created containing the error message plus the date and time of occurrence.
- Fichier XML de metadata
 - Option WRITE_XML Y (default: N)
 - Structure identical to that of ASCII_VOTABLE catalogs
 - In the case of binary output catalogs a serialization link pointing to the data is included.