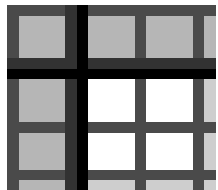




# Starlink Table/VOTable software

*Open source Java software for table manipulation*



**STIL:** Table I/O & processing library

<http://www.starlink.ac.uk/stil/>



**TOPCAT:** Graphical table view/edit/analysis application

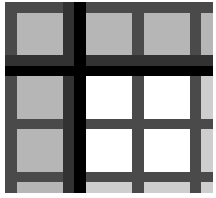
<http://www.starlink.ac.uk/topcat/>

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<http://www.starlink.ac.uk/>

# Outline

- What is STIL?
  - Architecture
  - Generic features
  - Features for VOTable processing
- Why is it relevant for VO(-Tech)?
- Quick look at TOPCAT
- Format-neutral approach for VO software



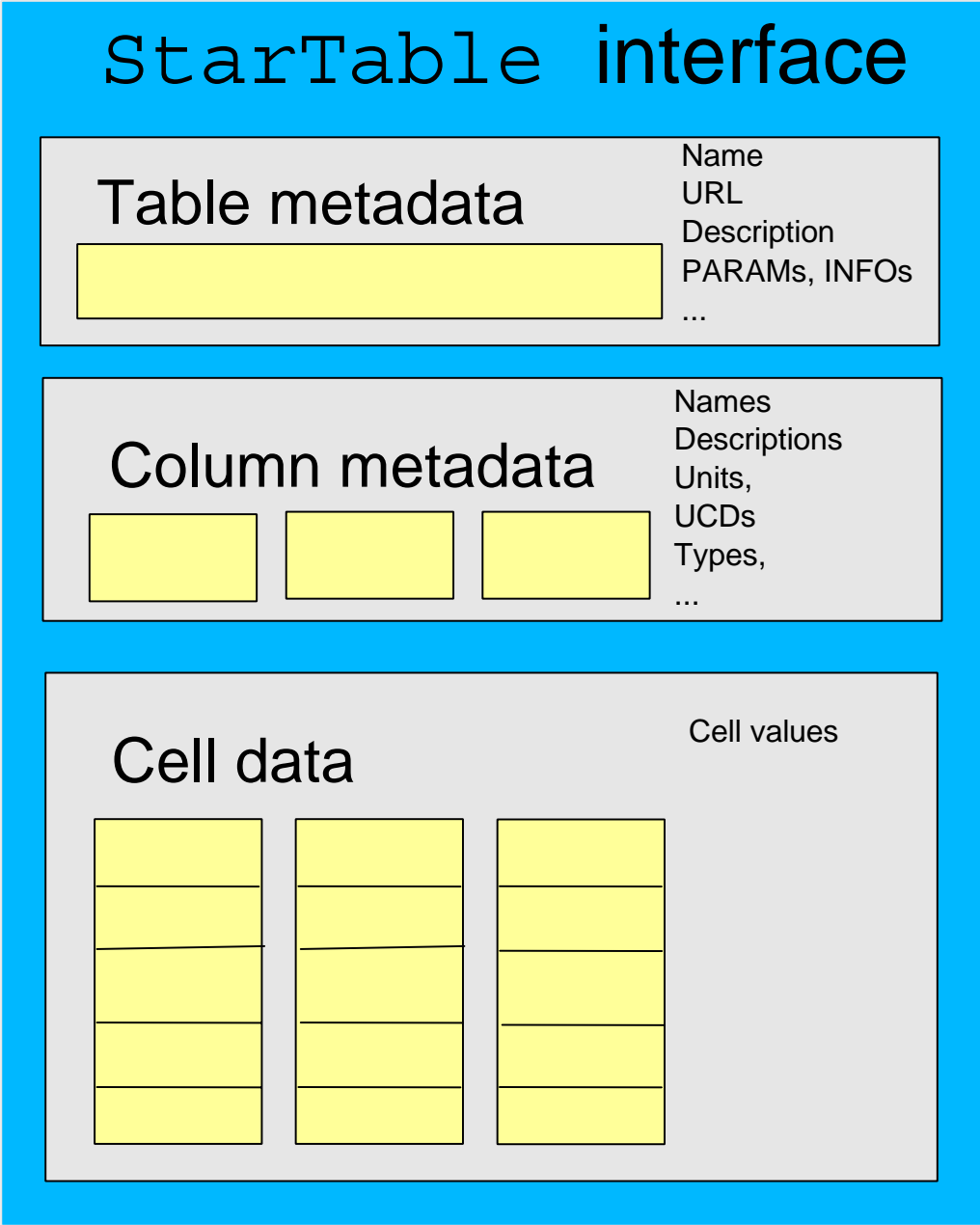
# STIL



## Starlink Tables Infrastructure Library

- Generic table I/O & processing library
- Presents abstract view of table to programmer
- I/O provided by pluggable format handlers:
  - VOTable, FITS, SQL, ASCII, CSV ...
  - Pluggable architecture for adding more

<http://www.starlink.ac.uk/stil/>



VOTable  
FITS  
SQL query  
ASCII  
CSV  
...

**Input handlers**

VOTable  
FITS  
SQL table  
ASCII  
HTML  
LaTeX  
Mirage  
...

**Output handlers**

random-access  
sequential

**Table Processing**

# STIL generic features

- Easy use/deployment
  - Portable (Pure J2SE1.4 Java)
  - Open source (GPL)
- Fully documented
  - Javadocs plus overview document in HTML/PDF
- Scalable design
  - 'Pull-model' processing works with arbitrarily large tables
  - Choose random-access or sequential row access mode
- Utility classes for table processing
  - Rearrange/add/remove rows/columns, join tables...
  - (Crossmatching functionality but not stable yet)

# Format Independence

- Supports many useful formats
  - VOTable, FITS, SQL, ASCII-based, ...
- Pluggable architecture is extensible
  - STIL will be upgraded with later versions of VOTable etc
  - Handlers for new important handlers will be added
  - Write your own handlers for obscure legacy formats
- Any-to-any format conversion is trivial
  - `tablecopy` command-line tool provided as convenience

# Tablecopy

STIL's format-neutral architecture makes any-to-any format conversion trivial. STIL includes the `tablecopy` command-line tool for this:

- VOTable to FITS:

```
tablecopy cat.vot cat.fits
```

- SQL query to VOTable:

```
tablecopy 'jdbc:mysql://localhost/db1#SELECT id,ra,dec FROM dgc'  
db1query.xml
```

- Compressed comma-separated value to BINARY inline VOTable:

```
tablecopy -ifmt csv -ofmt votable-binary objects.csv.gz objects.vot
```

- Remote FITS file to HTML TABLE on standard output:

```
tablecopy -ofmt html http://data.org/astro/cat1.fits -
```

# STIL VOTable features

- The only library to parse all forms of VOTable
  - Understands TABLEDATA, BINARY, FITS (inline or by URL)
  - VOTable 1.0 or 1.1 versions
- Flexible options for writing VOTables
  - Can write TABLEDATA, BINARY, FITS (inline or by URL)
- Custom SAX parsing
  - Builds compact DOM view of hierarchical structure
  - Table data streamed to memory/disk cache or custom processor
- Best-efforts parsing of non-conforming documents

# Why use STIL for VO(-Tech)?

- Use it to parse VOTables
  - Copes with all VOTable variants
  - Process large tables in limited memory (stream in)
  - Small fast DOMs for large VOTable documents
- Use it to generate VOTables
  - Writes all formats, easy to switch between them
  - Generate large tables in limited memory (stream out)
- Use it for format translation
  - Adapt legacy formats to VOTable etc
  - Allow web service users to select chosen format for results
  - Interface database queries (SQL) to VOTable?



# TOPCAT



Tool for Operations on Catalogues And Tables

- View/analyse/edit/write tabular data
  - Manipulate table data and metadata
  - Plot, match, sort, calculate, select, ...
  - Powerful and extensible expression language
- Based on STIL
  - Multi-format, including VOTable (all encodings) & SQL
  - Large tables ( $10^6$  rows x  $10^2$  columns)

<http://www.starlink.ac.uk/topcat/>

# TOPCAT Deployment

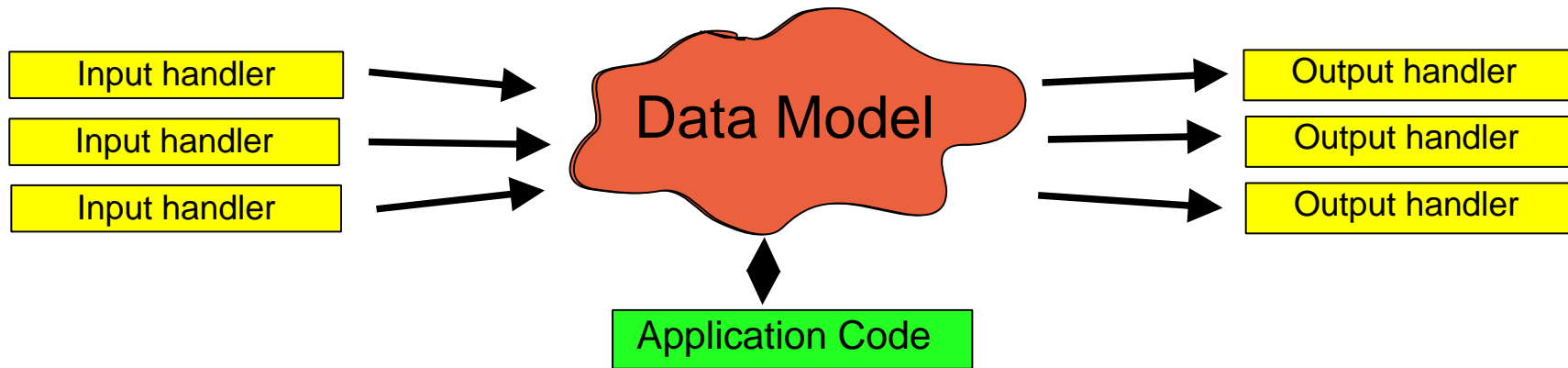
The TOPCAT application can be deployed in one of the following ways:

- It's part of the starjava set
  - Starjava also includes SPLAT, FROG, Treeview
- Standalone jar file available
- WebStart
  - This can be used to launch TOPCAT on a client's machine displaying a VOTable served from your web page
  - Works either signed (with access to client's filesystem for file load/save) or unsigned (secure)
- No applet version is currently available though

# TOPCAT facilities

- View/edit table data and metadata
- Move/hide/reveal columns
- Create new 'synthetic' columns (algebraic)
- Join tables (flexible crossmatch, concatenate)
- Sort rows
- Define row subsets in various ways
- Plot columns against each other
- Calculate statistics

# Format-Neutral Architecture



- Insulates application code from format details:
  - Version changes in particular formats
  - Changes in fashionable formats for data storage/transmission
- Flexibility
  - Easy to support new data serialization formats
  - Any-to-any format conversion comes for free

Particularly suitable for heterogeneous/unstable environment such as VO?

# Conclusions

- **STIL** (<http://www.starlink.ac.uk/stil/>)
  - Scalable I/O for VOTables
  - Only VOTable parser which supports all VOTable variants
  - Supports other table formats too (FITS, SQL, ASCII...)
- **TOPCAT** (<http://www.starlink.ac.uk/topcat/>)
  - Graphical table analysis/manipulation tool based on STIL
- **Format-neutral/Data-model-centric architecture**
  - Useful model for VO data access?