The Science Data Model for ALMA and EVLA:

The Triumphs and Pitfalls of Software Sharing and Reuse

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Software Sharing / Reuse

- Generally hailed as “Good Practice”
  - Reduces developmental costs
  - Makes use of expertise in the community
  - Avoids reinvention of the wheel
- Broad range of meanings
  - You're welcome to use my code
  - Project developed with reuse and generality in mind
  - Must strike a balance between generality and pragmatism.

Software Sharing / Reuse

We know this, so...

why is the amount of software sharing/reuse in the Astronomical community smaller than it could be?

- Small size of the Astronomical community
  - Projects with similar software needs rarely overlap in time.
- Obtaining political support can be difficult
  - Extra cost to the institution NOW for potential LONG-TERM benefits to the community.

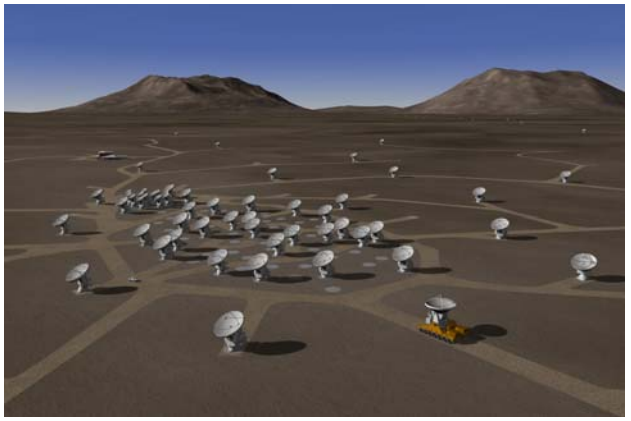
ALMA / EVLA Software Sharing Project

- Unique position of overlap
  - Time: concurrent development
  - Institutional involvement: NRAO is playing a significant role in both projects.

- Development of a common Science Data Model

ALMA

- Atacama Large Millimeter / submillimeter Array
- Partnership of Europe, Japan and North America, in cooperation with the Republic of Chile.
- A 66-antenna array at a high-altitude (5000m) site in northern Chile, operating at λ~0.85-3mm.
- Early science expected in 2011.



EVLA

- Expanded Very Large Array
- Multiply the VLA's capabilities ten-fold
- λ=1-50GHz, 1μJy point-source continuum sensitivity, new correlator with 8GHz/polarisation capability.
- Completion by 2012

ALMA / EVLA Science Data Model (SDM)

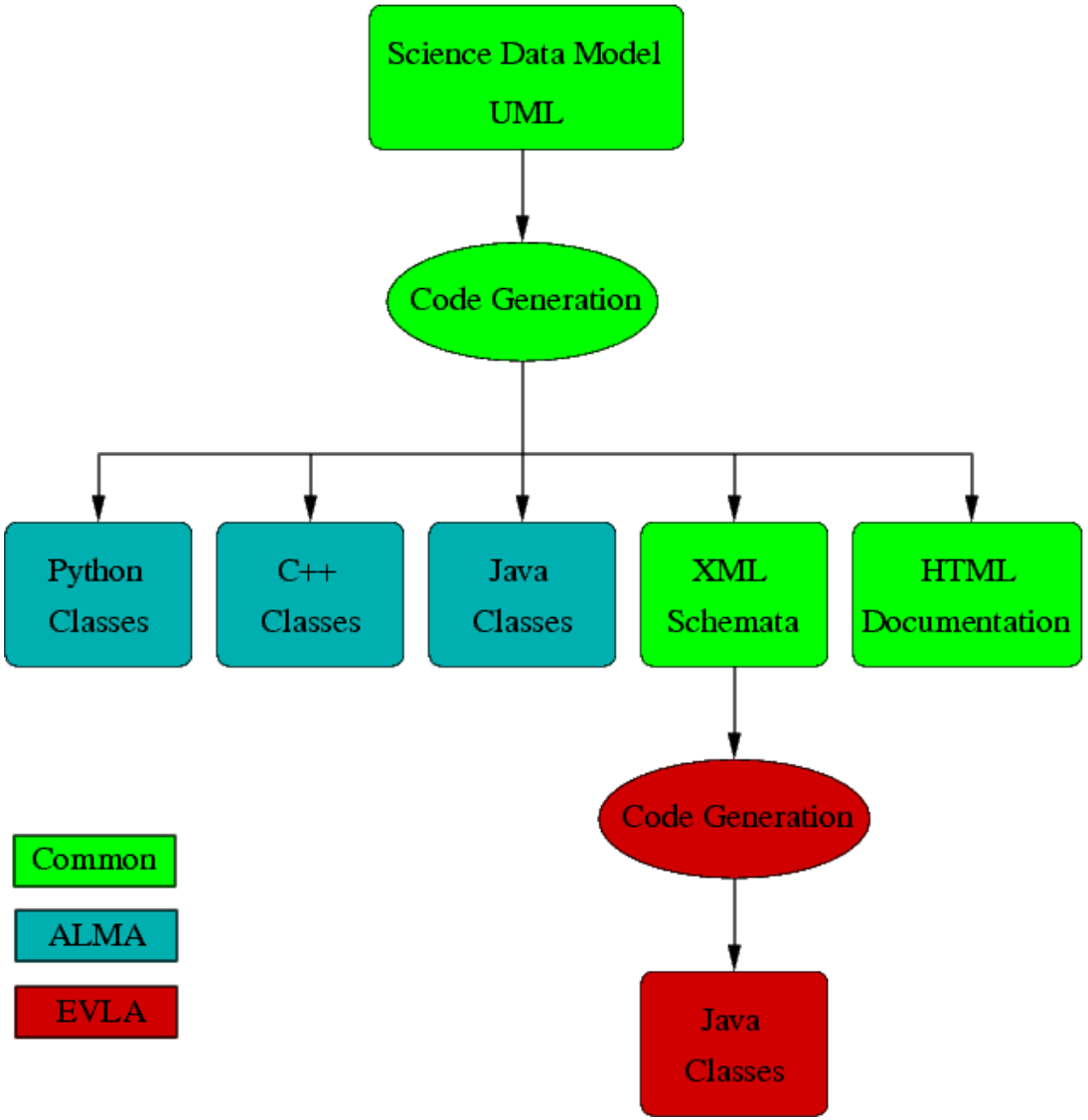
- The SDM must contain all the information necessary for the astronomical processing of raw data from the telescope.
- Format in which raw science data will be archived and provided to astronomical observers.
- Supported by the Common Astronomy Software Applications (CASA) post-processing software
  - Measurement Set filler

Science Dataset

- Set of tables represented as XML documents
- Data from correlators, square-law detectors, radiometers, etc. stored in binary blocks.

Science Data Model Definition

- Binary Data Format Specification (BDF)
  - Text document
- Binary Data XML Schemata
  - Hand-crafted
- Meta-data Protocol Specification
  - UML & text document
- Meta-data XML Schemata
  - Auto-generated


Science Data Model
UML
Code Generation
Python
Classes
C++
Classes
Java
Classes
XML
Schemata
HTML
Documentation
Code Generation
Java
Classes
Common
ALMA
EVLA

What have we learned?

- People's work priorities
  - Very easy for the shared project to get lower priority than one's “main” project
- The smaller project's needs are sometimes lost in the momentum of the larger project
  - Becomes software reuse
- Communication
  - Most significant issues were not to do with the “shared” aspects, but by the distributed nature of the shared project

What have we learned?

- Timing conflicts between the ALMA and EVLA projects
  - Individual project priorities take precedence, which leads to
  - Duplication of features
  - Sometimes temporary implementations are replaced by the “common version”, but at other times this results in
  - Divergence of software, for non-technical reasons.

Conclusion

- Software sharing / reuse
  - Possibility of many benefits
  - To the organisations involved
  - To the wider community
- Makes best use of areas of expertise
- Encourages development of more flexible and general solutions to problems
  - Need to reinvent the wheel less often!

Conclusion

BUT:

- It does not have zero cost
  - Will only happen if
    effort to reuse/share < effort to rewrite!
- Requires significant support
  - Staff involvement
  - Project priorities and timelines
- Major benefits are likely to be noticed long-term