CEVO (CTAO + High energy) datamodels and standards for interoperability

François Bonnarel, CDS, ESCAPE-CEVO Task2

CEVO goals

- Plans to make the seamless connection of ESFRI and other astronomy and astroparticle research infrastructures to the EOSC through the Virtual Observatory framework.

- The high-level objectives of CEVO are to:

  - Assess and implement the connection of the ESFRI and other astronomy Research Infrastructures to the EOSC through the Virtual Observatory framework.

  - Refine and further pursue implementation of FAIR principles for astronomy data via the use and development of common standards for interoperability including the extension of the VO to new communities.

  - Establish data stewardship practices for adding value to the scientific content of ESFRI data archives.

CEVO tasks

- Task 4.1 - Integration of astronomy VO data and services into the EOSC

- Task 4.2 – Implementation of FAIR principles for ESFRI data through the Virtual Observatory

- Task 4.3 – Adding value to trusted content in astronomy archives

High energy ESFRis, Radio ESFRIS

- CTAO
- KM3Net
- Virgo
- --
- JIVE
- LOFAR
- SKAO
- ALMA

ESFRIS detailed plan

- CTAO :

  - Extend and implement the VO Provenance Scheme to fit the needs of ESFRI projects and scientific research

    - Explore the use of the VO Provenance scheme in the context of multi-messenger astrophysics and transients, and its use with VOEvent systems

    - Contribute to extension of the VO Provenance scheme for other ESFRI projects.

  - Develop VO Data Models relevant to CTA and for multi-observatory astronomy in the multi-messenger context.

    - Contribute to the definition of Data Models to support multi-observatory observations and scheduling.

    - Contribute to Data Models for high level data relevant to CTA (VOEvents, VOTables) and other ESFRIs

      - Revision of implementations of VO data models in FITS, HDF5, and other formats *(collaboration to be facilitated with KM3NeT partners)*.

      - Revision of the VOEvent data model definition.

      - Investigation of VO data models for (high-level) simulations

    - Visualisation of multi-messenger data model (incl. provenance) and workflows in the context of VO *(in coordination with WP5)*

ESFRIS detailed plan

- ## CTAO :

  - Contribute to the scientific training events.

    - Development of tutorials dedicated to CTA users for the VO schools.

  - Description of CTA VO services for their connection to EOSC

    - Describe the CTA data in preparation for VO connection to the EOSC.

    - Test implementation of the CTA VO archive within the EOSC catalogue.

    - Explore implications to (CTA and other ESFRI) data centres of being VO compliant.

ESFRIS detailed plan

- ## KM3NET :

  - Mapping of KM3NeT events/alerts information into the VOEvent standard.

    - Provide feedback to IVOA.

    - Explore the needs of KM3NeT users, and identify how to address them in the framework of VOEvent

  - Archiving of KM3NeT events and associated information.

    - Explore the use of VO standards for the archive system *(collaboration to be facilitated with CTA partners, and EGO and EST for alerts).* Initial priorities include:

      - Mapping of VOEvent and other information into VOTables.

      - Mapping of high-level data to VOTables and explore representations in FITS and HDF5 formats.

      - Development of techniques for handling the specific aspects of neutrino events, including sensitivities or simulated events to understand the data.

      - Explore the use of the VO Provenance scheme in the context of multi-messenger astrophysics and transients, and its use with VOEvent systems.

- ## KM3NET :

  – Automatizing VO search mechanisms for the identification of potentially interesting EM sources in VO accessible catalogues.

    - Use of APIs for existing services (SIMBAD, VizieR etc.).

    - Use cases for tools such as Aladin, TOPCAT, astropy and for IVOA protocols such as TAP, and cone search including time.

    - Tests of the cross-correlation between astrophysical catalogs (X-Match).

ESFRIS detailed plan

- ## EGO-VIRGO :

  - Development of VO infrastructure and tools for GW events relevant to EGO-Virgo (Use of VO applications and HiPS, MOC)

  - Input to the development of VO standards relevant to gravitational wave astronomy. (STMOC and TimeSeries)

  - Update of tutorials for training events.

  - Build the connection to EGO/Virgo/LIGO to foster use of common standards for gravitational wave astronomy.

Detailed CTAO plans for datamodels

- Datamodels for science data products (DL3 and higher) → see June 25th meeting

- Exploration of commonalities with other wavelengths (eg KM3Net).

- Support for MWL/MM physics : follow up of science alerts

- Scheduling / visibility of sources

- Provenance

- Evolution of VoEvent (connection with provenance?)

Work done so far : radioastronomy exemple

- Development of VO services at ALMA, Astron, JIVE : HiPS, ObsTAP, SIA collaboration with UHEI and CDS

- Use of HiPS (simulated data) and plans for Provenance at SKAO

- Collaboration on evolution of standards for specific data : visibilities, pulsars. → plan for an ObscOre extension,

- All this in close relationship with IVOA radioIG

Work done so far

- Provenance in CTAO : Opus, voprov, inclusion in gammapy

- Provenance Workshop with other partners

- Datamodel for DL3 products and higher. Meeting in June

Our goals

- Organize a CEVO Workshop : HEA in the VO
  - date,
  - Location,
  - extent
  - topics to address,
  - proposal for invited talks,
  - goals to achieve,
  - proposal for an agenda.