The astronomical Virtual Observatory : lessons learnt, looking forward

Françoise Genova, ADASS, Paris, 8 November 2011

Examples taken from the European view, but other projects have followed similar paths

- The VO aim

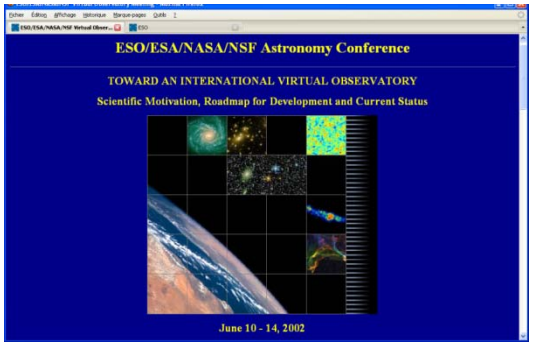
  Enable seamless access to the wealth of astronomical resources

  An ambitious goal and no pre-existing organisational model to follow
- We had to invent a way of building the VO
- Pragmatic approach with a few basic principles
  - A global VO
  - Keep in mind science usage and implementation by data centres
  - Fullfil astronomy's needs but when possible use generic building blocks to allow wider interoperability

A global VO

- The VO has been thought from the very beginning as a fully global endeavour
- Neither a French (or Alsacian – Strasbourg region) nor a US nor a Japanese VO, but the astronomical Virtual Observatory
- The basis of the VO is Interoperability
- Global interoperability requires international agreement

Interoperability: first steps



- January 2002 Strasbourg

  OPTICON European WG but international participation

  First Interoperability meeting – > VOTable

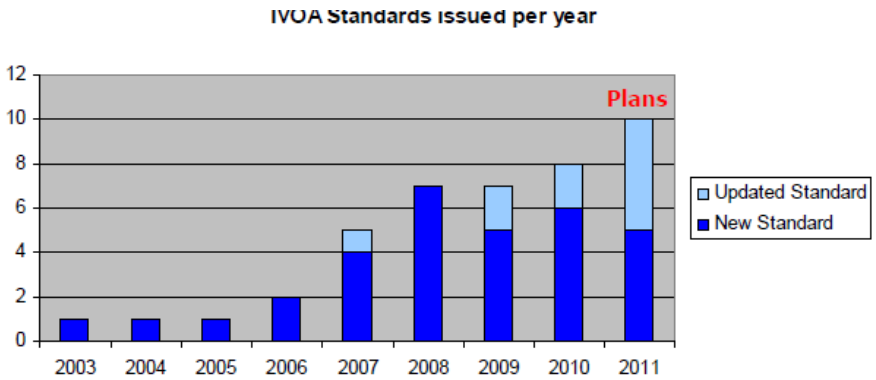
  CDS/NVO > Pre-IVOA standard
- June 2002 Garching
  - *Toward an International Virtual Observatory* (ESO/ESA/NASA/NSF)
  - Creation of IVOA

Interoperability : IVOA standards

Procedure adapted from W3C

Interoperability: current status

Passage to maintenance mode for many standards



From C. Arviset

Continuing to work on standards remains mandatory

- Feedback from implementation and scientific usage
- Evolution of astronomy – new facilities, new science
- Evolution of the technological context

VO evolution

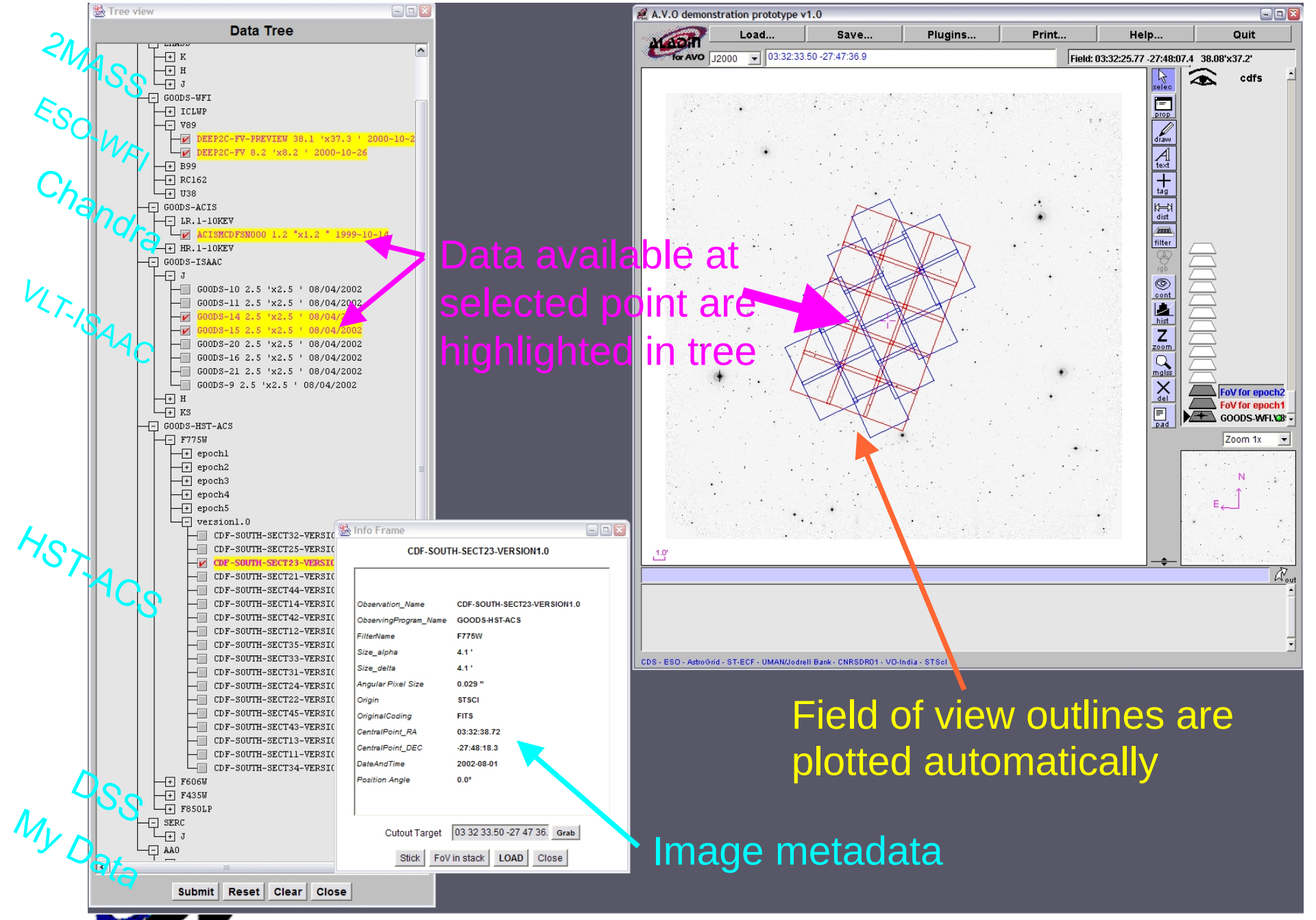
- The VO has never been solely a technology development
- Scientists and data providers participated from the beginning in the VO development
- Things had to be made in the proper order
- The basic building blocks (standards and tools) had to be – and have been – built, with in mind take-up by data centres and science users
- Now towards operational phase
- The focus is moving towards more support to take-up by scientists and data providers, plus outreach towards education

VO Science requirements

- Science requirements have been present from the beginning
  - Scientists in VO projects
  - Science Advisory Committees or equivalent
  - Science demos

  e.g. AVO RTD project (2001-2004)

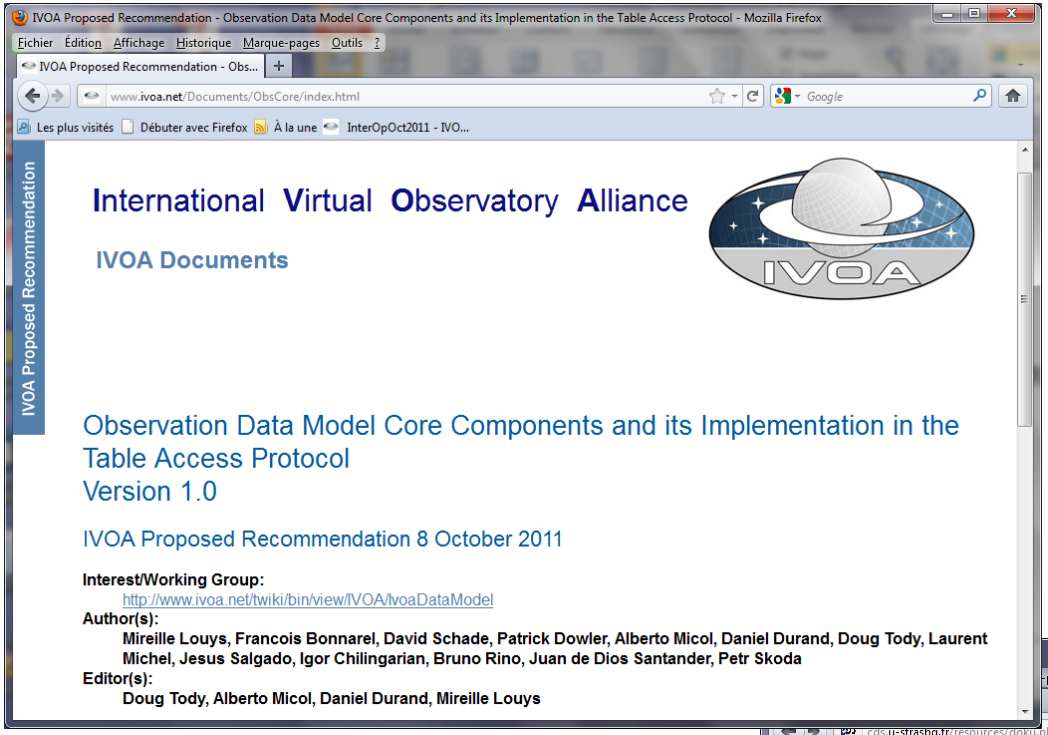
  WA1 Science/WA2 Interoperability/WA3 Technology

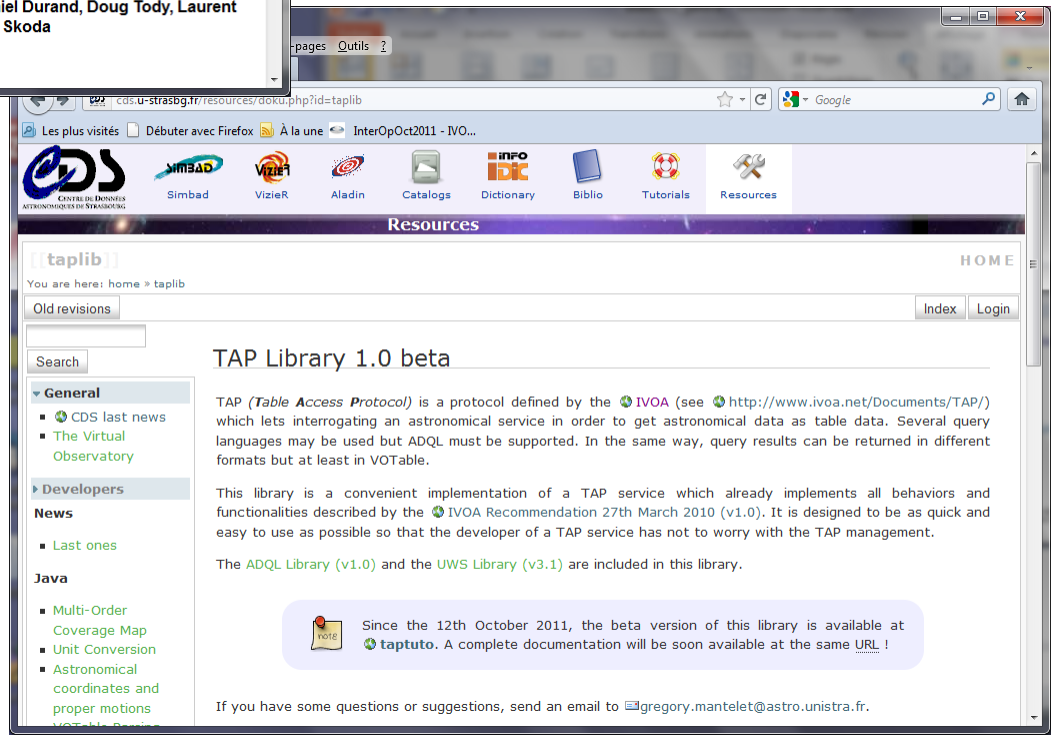


Centre de Données astronomiques de Strasbourg

Science feedback and priorities

- IVOA has set up a Committee, then a Standing Committee for Science Priorities to identify in high priority science cases, then gap analysis to identify the lacking standards
- First example: help implementation by data providers > the ObsDM metadata subset
- SED building, Search by object class/list
- Work more closely with the VO projects' Science Advisory Committees to gather 'global' requirements and feedback





TAP Library with documentation and tutorials

Take-up by data providers

- A major action of IVOA during the last years has been to define a ‘simple’ subset of metadata to be provided by data providers to facilitate implementation, good enough for data discovery and access tools
- Here at ADASS we see the archives of the major facilities but not only
- Huge diversity of possible data providers – the VO aims at giving access to the wealth of astronomical knowledge

The Euro-VO census of data providers

- Census of European Data Centres (EuroVO-DCA, EuroVO-AIDA, 2009, 2010)
- Inclusive definition : Data Centres populate the VO with data and services, service to the community, added-value, sustainability, quality
- 69 ‘data centres’ answered
  - Data archives, services, theory data and services
- Some of these services are are widely used by scientists to access to bibliography, data and tools
- The provision of data and services has clearly been strongly encouraged by the develoment of the VO

Data centres in Europe (and elsewhere!)

- A huge diversity in aims
  - large services provided by international agencies, with archives of the large ground-based and space instruments
  - large systematic surveys of the sky, results of large simulations
  - generalist data bases and services
  - smaller contributions of scientific teams which share their expertise
- Huge diversity in size and organisations
- An *ecosystem* of data and service providers willing to share data and knowledge - a distributed, heterogeneous system with no a central point nor hierarchical organisation

Strands of work during operational phase

- Support to take-up by data providers
- Support to take-up by the scientific community
- Continuous technical development
  - Standards (update of existing standards and new standards because of feedback/evolutions) – VO teams + IVOA
  - Tools
- Outreach towards education and the general public (appeared in IVOA meeting in May 2011)

Support to take-up

- Scientists
  - Topical ‘Community feedback’ workshop
  - Calls for proposals for advanced usage
  - Schools
  - Tutorial
- Data providers
  - Implementation tools
  - Tutorials
  - Data Centre Schools
  - Data Centre Forum to discuss requirements and feedback?

IVOA evolution

- Better connection with SACs to get science requirements
- Implementation feedback
- Development of the information sharing role: on take-up activities, implementation tools, outreach activities, etc, although all these activities are not under IVOA responsibility

VO status

- The strands of work necessary during operational phase are well understood
- The basic building blocks are here
- Major challenge: sustainability
- Interdisciplinary usage can appear as a must in many « political » contexts

Interdisciplinary aspects

- IVOA had in mind to use generic components when possible. e.g. for two critical components for « wide » interoperability
  - Registry of Resources: OAI-PMH, Dublin Core
  - Vocabulary: RDF + SKOS (semantic web)
- Re-use/adaptation by other disciplines: pragmatic approach through dissemination of knowledge through staff (HELIO et al., VAMDC)

European VO specific challenge

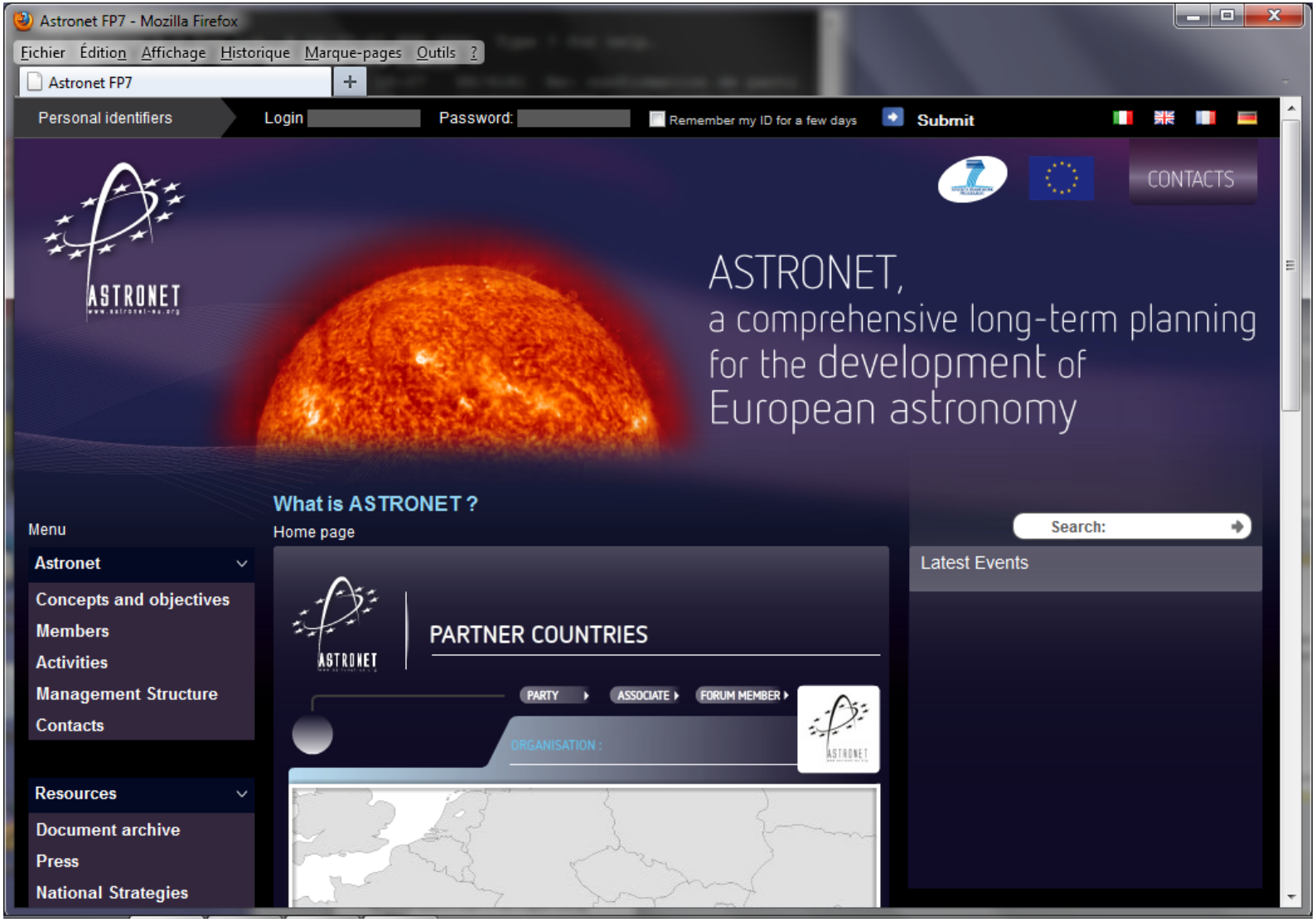
- A rich landscape including the two European Agencies, ESA and ESO, and national programmes
- Several of the founding parents of the astronomical VO
- *Challenge*: coordinate/federate VO projects
  - Different research/funding systems
  - Different projects
- Euro-VO: the European ‘glue’
  - coordinate activities (e.g. regular Technology Forums)
  - reach all EU countries including those with no organised VO project
  - critical mass for Science Advisory Committee, support to take-up and outreach (templates re-used in the national context)

Euro-VO Results

- A very significant increase in collaboration
  - Technical collaboration, e.g. on the definition of standards and tools but also on R&D
  - Different kinds of meetings which have shaped the collaborations and relations with data centres and users
- Attention given to non-partner European countries to support their communities and to help them shape their own politicies

The European context

- Strategy for astronomy discussed and set-up by AstroNet ERA-NET, which includes ~all funding agencies from ~all EU countries
- Science Vision (2008) and Infrastructure Roadmap (2009)
- The VO is recognized as an important infrastructure of astronomy
- But the recommendations are not easy to implement


Astronet FP7 - Mozilla Firefox
Fichier Édition Affichage Historique Marque-pages Outils ?
Astronet FP7
Personal identifiers
Login
Password:
Remember my ID for a few days
Submit
CONTACTS
ASTRONET
ASTRONET,
a comprehensive long-term planning
for the development of
European astronomy
What is ASTRONET ?
Home page
Search:
Latest Events
Menu
Astronet
Concepts and objectives
Members
Activities
Management Structure
Contacts
Resources
Document archive
Press
National Strategies
PARTNER COUNTRIES
PARTY
ASSOCIATE
FORUM MEMBER
ORGANISATION :

Theory, Computing and Data Archiving

The development of theory and computing capacity must go hand-in-hand with that of observational facilities. Systematic archiving of properly calibrated observational data in standardised, internationally recognised formats will preserve this precious information obtained with public funds for future use by other researchers, creating a Virtual Observatory (VO).

The Virtual Observatory will enable new kinds of multi-wavelength science and presents new challenges to the way that results of theoretical models are presented and compared with real data. Along with other initiatives, the Roadmap proposes that a European Astrophysical Software Laboratory (ASL), a centre without walls, be created to accelerate developments in this entire area on a broad front.

6.6 Recommendations

I. *Relevant to VO*

1. Provision of a public VO-compliant archive should be an integral part of the planning for any new facility. We recommend that data centres provide science-ready data.

2. Providers of astronomical tools should make them VO-compliant so they can easily talk to other VO tools and can be accessed within the VO environment.

3. The infrastructure established with EC support will need to be sustained by the national funding agencies to allow continuity of the VO.

4. The development of the VO should be coordinated with evolution of the generic e-infrastructure, and that evolution should reflect the domain-specific needs of astronomy.

5. To prepare for the challenges posed by large surveys, multi-wavelength astronomy and the VO, modelling codes need to be made modular.

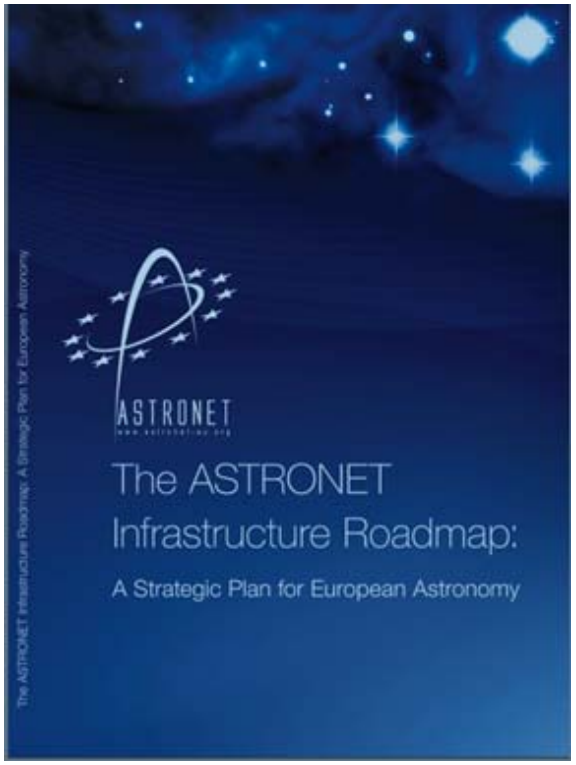
6. Substantial investments are required in software that simulates mock data with the observational biases inherent in current and future facilities. Publication of such software in VO-compliant form should become an integral part of the construction of any instrument.

European funding system

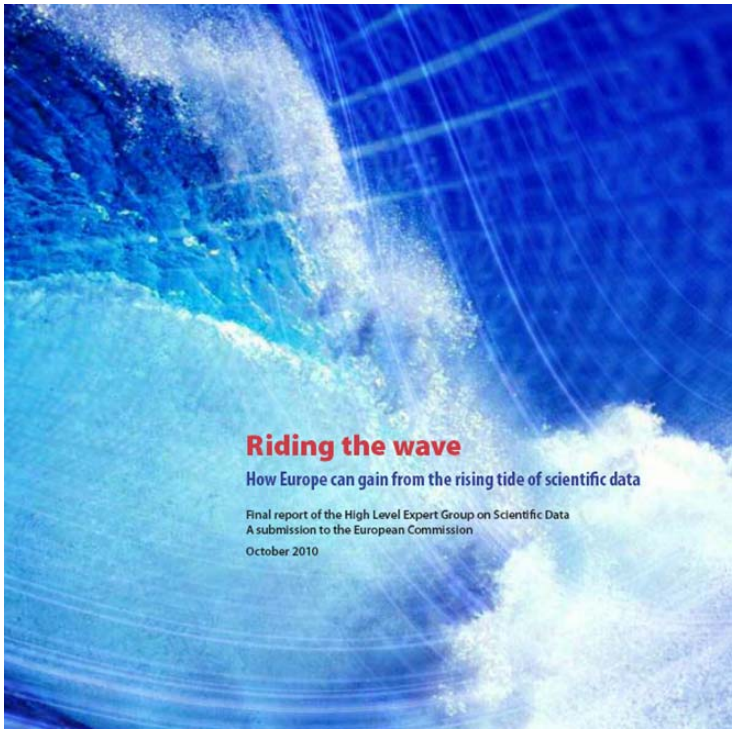
- European funding: a complex system which evolves continuously
  - Organized into successive Framework Programmes
  - Calls and « instruments »
- Euro-VO: a series of projects which progressively built the landscape
- Structured in phases in three successive Framework Programmes
  - Phase A (FP5): AVO, OPTICON Interoperability WG
  - Development (FP6): VO-TECH, EuroVO-DCA
  - Transition to operations (FP7): EuroVO-AIDA, EuroVO-ICE (on-going, ‘bridging’)

The future for Euro-VO

- How to implement Astronet recommendation?
- Define articulation/balance between national/Agency level and European level
- Sustainability of national/Agency projects
- Sustainability of the European layer
  - Strongly dependent on European funding opportunities
  - Continuing European/international coordination is mandatory
- Projects on-going in ‘neighboring’ disciplines (HELIO, Europlanet, VAMDC)



Astronet Roadmap



High Level Expert Group on Scientific Data

The VO in the general context of scientific data policies

- The general context in which we work is rapidly evolving
  - High Level Expert Group: Collaborative Data Infrastructure
  - Requirement that data obtained on public funds are made publicly available
- Astronomy at the forefront: a global, heterogeneous, interoperable, OPEN, widely used, data infrastructure
- WE HAVE USERS: on-line services are everyday tools for the astronomical community
- Interdisciplinary usage is seen as the basis, but disciplinary pillars are necessary in a Collaborative Data Infrastructure
- Astronomy can be seen as an interesting use case! Let's convince our funding Agencies…