2nd Annual Report

VO-TECH

The European Virtual Observatory - VO Technology Centre

A DESIGN STUDY

implemented as

SPECIFIC SUPPORT ACTION

Contract Number : 011892

Project Co-ordinator : Professor A.Lawrence, University of Edinburgh

Project website : http://www.eurovotech.org/

Reporting Period : from 01/01/2006 to 31/12/2006

A. ACTIVITY REPORT

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1. Progress Report

1.1 Summary of the activities and major achievements

In its second year, VOTECH has built on the cohesion developed between partners and added a strong working link with the European Space Agency. Initial developments have been presented to the astronomy community at conferences and through the Euro-VO science advisory structure. Substantial technical progress has been made in key infrastructure components, application interoperability, and new tools, both on the client side and server side, and several of these developments have been brought forward for international standardisation. VOTECH technologies are already being deployed in some working systems.

Some highlight achievements include the following :

- VOTECH has become the main forum for VO technology exchange in Europe
- Strong working relationships have been established with key bodies outside the project, including the European Space Agency (ESA)
- A planned approach has developed for taking forward standards to international bodies
- The first key reports have been completed - on VO infrastructure, and on data exploration
- VOTECH software has been deployed in working data centre systems
- Prototype software has been demonstrated to the community through meetings of VO Science Advisory Committee, and through stalls at the IAU General Assembly
- Results of both technology and development and science use have been presented through scientific papers at the IAU General Assembly and elsewhere.
- The Astro Runtime has matured and is becoming the de facto API into the VO
- The PLASTIC protocol for tools interoperability has been further improved, and has been taken forward to the IVOA for standardisation.
- Tools interoperability through PLASTIC is being taken up by third parties
- Project management and co-ordination methods have been streamlined
- Significant progress has been made on key infrastructure components and protocols, including Authorisation, VO Space, and application message passing
- New prototype tools have been constructed constructed for SED building, cross matching, and access to theoretical data, and improvements made to key existing tools such as Aladin and Topcat
- Prototype ontologies have been constructed for data acccess, for space time co-ordinates, and for transient events
- New software has been developed for automatic recognition of astronomical object names within documents
- Data mining packages such as Astroneural and AstroWeka have been deployed within the VO infrastructure
- VOTECHBroker software has been written to interface between VO and Grid infrastructures

- New experiments in column ordered storage and access have been undertaken

1.2 Consortium management activities (DS1)

Consortium management activities are essentially the same as in the first year of the project, but with enhanced staff effort, having recruited a Consortium Web Developer.

All partners participate in consortium management activities at the level of policy development and decision making. This is done through a **Consortium Board** which is composed of the named investigators from each partner, supplemented by an administrative member if and when necessary. The purpose of the Consortium Board is oversight of the project - its setup, financial monitoring, resolution of issues between partners, and overall scientific and technical policy. The full Consortium Board had one formal meeting during this period (2006 Dec 11th), but there have been frequent informal email discussions.

The administration of consortium activities is undertaken purely by partner number 1, Edinburgh. The goals are (1) To oversee the project on behalf of all partners; (2) To co-ordinate financial and administrative matters; (3) To deliver an external presence. This work is undertaken by the **Consortium Administrator** (Peredur Williams, 0.2FTE on the project) and the **Consortium Web Developer** (Mark Holliman, 0.5 FTE on the project) who began in March 2006. (Staff effort in DS1 is detailed in section 1.3.1)

DS1 is responsible overall for oversight and planning of the whole project. We therefore give here lists of meetings, deliverables, and milestones, which are then referred to in other sections.

Project Meetings. The following formal meetings were held involving all partners and considered to be organised under this activity.

Date	Title/Subject of meeting	Location	No. of attendees	Website address
2006 Mar 6-9	Stage03 DS Review and Planning Meeting	Sorrento	30	http://wiki.eurovotech.org/twiki/bin/view/VOTech/StageThreePlanningMeetings
2006 Apr 27	Technical Advisory Panel	Telecon	8	http://wiki.eurovotech.org/twiki/bin/view/VOTech/TapMeetingStage03
2006 Sep 4-7	Stage04 DS Review and Planning Meeting	Strasbourg	30	http://wiki.eurovotech.org/twiki/bin/view/VOTech/StageFourPlanningMeetings
2006 Dec 11	Technical Advisory Panel	Telecon	12	http://wiki.eurovotech.org/twiki/bin/view/VOTech/BoardMeet20061211
2006 Dec 11	Third Board meeting	Telecon	12	http://wiki.eurovotech.org/twiki/bin/view/VOTech/BoardMeet20061211

Deliverables. The deliverables and their target dates are set out in the Project Plan. During the first year of the project we agreed that most of these should be put back by three months, because of the initial three month kick-off phase used. Below we summarise the deliverables falling in this reporting period according to the original plan, including one passed forward from the first reporting period. The status of the deliverables is discussed in the appropriate sections.

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Deliv. No.	Deliv. Name	Lead	Orig. Date	Revised Date	Achieved
DS2-02	Revised Project Plan	UEDIN	2006 Jun	2006 Sep	2006 Dec
DS2-03	Science Framework Document	UCAM	2005 Jun	2006 Jun	--
DS2-04b	2nd Baseline software release	LU	2006 Dec	2007 Mar	2007 Mar

Other milestones. The milestones and their target dates are set out in the Project Plan. As with the deliverables, they have mostly been put back by three months. Below we summarise milestones other than the deliverables listed above.

Milestone	Orig.Date	Revised Date	Achieved	Comment
Cycle-3 plan	2006 Jan	2006 Mar	2006 Mar	
Demo Event	2006 Feb	2006 May	2006 Apr	VOSAC meeting
TAP-3	2005 Nov	2006 Feb	2006 Apr	
Cycle-4 plan	2006 Jun	2006 Sep	2006 Sep	
TAP-4	2006 May	2006 Aug	2006 Dec	combined with Board
Board-3	2006 Nov	2007 Feb	2006 Dec	combined with TAP
Cycle-5 plan	2006 Dec	2007 Mar	---	next report
TAP-5	2006 Nov	2007 Feb	---	next report

1.3 Other specific activities

The project is divided into six "Design Study" tasks, DS1 to DS6. DS4-6 are substantive design studies which proceed in parallel. A **DS Leader** is chosen for each DS task. DS2 integrates the results from the other tasks. DS1 is simply the consortium management activities. This division into major parallel tasks plus an integration task has worked very effectively.

1.3.1 Task-1 : DS1 - Management of the Design Study

This is another name for the consortium management activities described at section 1.2.

Staff Effort in DS1. Below is the staff effort expended in this task. Funded staff effort is

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	**Total**

exact; partner contributed staff months are approximate.

Person-months - funded	5.6						5.6
Person-months - contributed	1			1	2		4.0
Person-months - TOTAL	6.6			1	2		9.6

Deliverables. DS1 is responsible for top-level oversight of deliverables. However no DS1 specific deliverables were due in this period.

1.3.2 Task-2 : DS2 - Technical Project Management

This task provides technical and scientific leadership, planning, and integration. The four substantive tasks DS3-6 produce their deliverables to DS2, which is responsible for external technical deliverables. This task also aims at technical co-ordination amongst the partners, developing common coding standards, development processes, software repository and version control, etc. Finally, it also provides scientific leadership and co-ordination.

Technical Management. Our work planning cycle has stabilised and is working well. All work is in the context of the long term Project Plan, which can be found at http://wiki.eurovotech.org/bin/view/VOTech/ProjectPlan . During this year we produced a **Revised Project Plan**, which can be found at the same web page. Within this long term context, we produce detailed plans in six month cycles, known as "Stages", which cover work in April-September and October-March. Shortly before each Stage, we hold a **DS Review and Planning (DSRP)** meeting, which is essentially a full open project meeting. During this period, we have held two such meetings, for Stage03 and Stage04 planning.

At these meetings we review results of the previous stage, exchange experiences, and debate plans for the next stage. Detailed plans are written on the project web site by the DS Leads, and these are reviewed at a meeting of the **Technical Advisory Panel (TAP)**. This is a smaller body with partner representatives and key technical staff. They agree the final plan and the contributions of each partner. During this year, we decide to amalgamate TAP and Board meetings, as the membership overlap is large, many similar issues are discussed, and it felt wise to cut down on meetings. Once the plans are agreed, the various DS tasks proceed more or less separately until the next planning cycle debate. This debate and planning process is quite expensive in travel and staff time, but has been very fruitful, keeping the project on track and keeping a remarkable sense of cohesion for such a distributed project.

Technical Co-ordination. As well as oversight and planning, DS2 aims at technical co-ordination. Partly this is achieved by the sequence of meetings described above, but also by a wiki based **project document system** (http://wiki.eurovotech.org). This is an internal web

site, where information, documents, reports and debates are all stored. Any project staff member can upload and edit information in this communal documentation system. We are also working towards common standards for coding, versioning and software repository. All partners have some kind of CVS-like system, and we have been able to exchange software with little trouble. We do not intend to develop a single CVS system. Currently software sharing is by a central download site at

http://wiki.eurovotech.org/bin/view/VOTech/SoftwareDownload

During this year some components of VOTECH maintained SourceForge repositories, and we ran an experimental GForge setup. We concluded that the GForge software is still too immature and difficult to use, and so for now at least we have not gone down this route, and instead maintain a simple central download site linked to partners own sites, including SourceForge repositories.

Science Activities.

The scientific direction of VOTECH has continued to be carried out under the leadership of the Project Scientist in conjunction with the VOTC Science team. This team, chaired by the PS, consists of a lead scientist from each Design Study with a scientist from ESA as an observer. The current composition of the VOTC science team (as 10/2/2007) is:

- Nicholas Walton VOTC Project Scientist AstroGrid
- Eduardo Gonzalez Solares DS2 AstroGrid
- Anita Richards DS3 AstroGrid
- Andreas Wicenec DS4 ESO
- Mark Allen DS5 CDS
- Guiseppe Longo DS6 INAF
- Matteo Guainazzi ESA

Science drivers are input at each of the VOTECH stage planning meetings, with a focus on both listing high science priority features for study, and returning scientific analysis of the designs and implementations developed during the preceding stage. The second year of science activity has included the completion (Feb 2007) of the Science Framework Document, this in turn has been factored into DS area reports such as the DS6 Data mining report.

Building on the exemplar science cases which were defined in Year 1, a number of these have been implemented utilising VO systems and capabilities determined in the context of the VOTECH project. These exemplar cases have resulted in preliminary scientific exploitation which will be published in peer reviewed journals during the third year of VOTECH. Additionally, lessons learned from the implementation of these cases have been fed back to the VOTECH development streams.

- The extra galactic case has been presented at the IAU General Assembly in Prague which took place in August 2006 (Gonzalez-Solares et al, 2006). This work demonstrates a number of key VOTECH tools and capabilities in action whereby sophisticated analysis of deep multi-wavelength data sets reveals the properties of galaxy cluster and obscured quasar distributions at high redshift. Tools such as data mining capabilities from DS6 were utilised in this work.
- The galactic case is currently being prepared for publication (Richard et al 2007). In this capabilities from DS4 - such as a new tool to enable the automated fit of model to observed spectra - are demonstrated allowing for the improved determination of massive star formation histories in the local Universe.

VOTECH science advice is coordinated with other Euro-VO strands through the combined Euro-VO science advisory committee (VO-SAC), which the VOTECH PS attends. This groups is aiming to develop a user driven science agenda for the Euro-VO as a whole. At the last two meetings, Apr and Nov 2006 the key data sets of high inport to the European community have been determined. The technical issues surrounding accessing these have been fed back to the VOTECH technical team. This has resulted in, for instance, hightened improtnace being attached to the development of a robust security infrastructure to ensure that high value surveys, where access restrictions to non European astronomers are in place, are accessible to authorised European astronomers in a secure manner (examples include UKIRT Wide Field Camera survey data which are public exclusively to the European community).

During 2006, the partner Euro-VO project, the Data Centre Alliance (DCA: funded through the FP6 IST programme of the EU), begun operations. The DCA is tasked with informing the wider European astronomy resource providers as to how to implement the Euro-VO technical infrastructure, being defined and created through the Euro-VO VOTECH project, such that the widest possible set of European astronomy data, application and compute resources are published through the Euro-VOP to the astronomy science end user community. In order to ensure fullest scientific coordination between the VOTC and DCA, Richards from the VOTC Science Team participates on the Project Coordination Team of the DCA. Allen is Project Scientist of the DCA.

A number of talks have been given during the second year of VOTECH describing the science aims, and relevant technical progress of the VOTECH project. These include a significant presence at the 'Virtual Observatory in Action' three day Special Session at the IAU General Assembly, Aug 2006. (Lawrence was Chair of the Science Organising committee, and Walton was Editor for the proceedings). Full details of the special session can be found at http://www.astronomy2006.com/special-sessions.php#sps3, http://www.ivoa.net/pub/VOScienceIAUPrague/ and with all presentations available at http://www.ivoa.net/pub/VOScienceIAUPrague/programme/index.html

A number of the VOTC science team have given talks or participated in lecture courses focused on the Virtual Observatory, these have included;

- Walton: Invited Discourse, South African Institute of Physics, Cape Town, July 2006

- Allen & Walton: lectures and practical sessions: 'Virtual Observations' Kapteyn Institute, Groningen, The Netherlands, Nov 2006 - Feb 2007 - see http://www.astro.rug.nl/~valentyn/vo.html

Members of the VOTC science team, in conjunction with colleagues in the related Euro-VO DCA activity, are taking a leading role in the definition and execution of Euro-VO workshops. Guainazzi is Chair of the Organising committee of the Euro-VO/ESA VO Workshop on Spectral Data (ESAC, March 2007). Members of the VOTECH science team have contributed to a wide range of workshops organised by the partners constituting the VOTECH project. At these, the opportunity has been taken to demonstrate VO capabilities developed by VOTECH to a wide range of European astronomers

These workshops have included the science workshops held by AstroGrid in the UK:

- Sussex (Feb 2006): http://wiki.astrogrid.org/bin/view/Astrogrid/AgSussexWorkshopFeb06
- Imperial (Mar 2006): http://wiki.astrogrid.org/bin/view/Astrogrid/AgImperialWorkshopMar06
- Durham (Apr 2006) : http://wiki.astrogrid.org/bin/view/Astrogrid/AgDurhamWorkshopJun06
- Birmingham (Jun 2006): http://wiki.astrogrid.org/bin/view/Astrogrid/AgBirminghamWorkshopOct06
- Oxford (Dec 2006): http://wiki.astrogrid.org/bin/view/Astrogrid/AgOxfordWorkshopDec06
- Radionet @Oxford (Dec 2006): http://wiki.astrogrid.org/bin/view/Astrogrid/AgRadionetWorkshopDec06
- Liverpool JM (Dec 2006): http://wiki.astrogrid.org/bin/view/Astrogrid/AgLivJMWorkshopDec06
- Cardiff (Jan 2007): http://wiki.astrogrid.org/bin/view/Astrogrid/AgCardiffWorkshopJan07

Further workshops with significant VOTECH related content have been held in:

- Rome, Italy (Nov 23-24 2006): http://vobs.astro.it/index.php?option=com_content&task=view&id=17
- Paris, France (Dec 2006): http://www.france-vo.org/twiki/bin/view/GROUPEStravail/Workflow

The VOTECH project has stimulated an increased level of scientific interaction between the partners in the project, to the benefit of the Euro-VO. Through EARA funding, Rafaelle D'Abrusco, a final year PhD student from the group of Longo in Naples, has visited Walton at the IoA, Cambridge on an extended 6 month visit. During this the generalised neural network tool, AstroNeural, which has been developed in the context of VOTECH DS6, is being deployed in the common Euro-VO infrastructure as an application available through the Euero-VO Workbench. The tool is being scientifically used to mine high redshift quasars

from the large scale SDSS and UKIDSS optical and infrared surveys. This work will be published summer 2007 (D'Abrusco et al, 2007). Further interaction has occured through the frequent exchange of ideas between VOTECH science team and visits, e.g. Richards to ESO and ESAC to further the development of the exemplar galactic science case.

The VOTECH science pages can be found on-line at: http://wiki.eurovotech.org/bin/view/VOTech/ScienceTeam

A draft of the VOTECH Science Framework Document is available at

http://wiki.eurovotech.org/twiki/bin/view/VOTech/VotcSFD

Publications produced by VOTECH

These are listed in Section 3, "Use and Diseemination of Knowledge".

Meetings. Staff working in DS2 attended the Review and Planning meetings as listed in section 1.2. There were other informal meetings and telecons within the DS that are not listed.

Deliverables. DS2 had two deliverables which within the original project plan fell within this reporting period. The first (DS2-02) is the Revised Project Plan, which can be found on the project web site. Future Annual Reports will track the revised milestone dates from this plan. The second (DS2-04b) is the Second Baseline Software Release. This was originally scheduled for December 2006, but had a revised date of March 2007, given the overall project re-scheduling following the three month kick-off phase. As of the time of writing, this has now been achieved. Finally we note that an earlier deliverable (DS2-03), the Science Framework Document, originally scheduled for June 2005, and revised for June 2006, has still not been delivered. The production of this document has been deliberately delayed while the overall Euro-VO science advisory structure has been developed. However, it is partially complete in draft form, as referenced above.

Other milestones. DS2 is expected to make contributions to the general project milestones listed in section 1.2, especially the six-monthly review and design planning. This is done (a) by attending the meetings and making presentations on progress, and (b) placing reports and internal DS plans on the project wiki-based documentation system. These contributions have been successfully accomplished.

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	**Total**

DS2 Effort expended. Staff effort expended in DS2 is summarised below.

Person-months - funded							0
Person-months - contributed			4	4			8
Person-months - TOTAL			4	4			8

1.3.3 Task-3 : DS3 - New Infrastructure

This task aims at producing final designs of mature components, as well as assessments, designs, and trials of new components that don't fit into the major categories of DS4-6 below. In addition it has a responsibility for considering interoperability, integration and testing within the context of the overall Euro-VO architecture. Following a solid start in year one, further significant progress has been made this year, and we have completed a key deliverable, the production of the "Infrastructure Study Report".

The priority areas have been :

- Developing a VO API
- Tooling to make existing applications VO-aware
- Making datasets VO aware
- VO Service profiling
- Client-side VO applications interoperability
- Authentication/Authorisation
- Work-flow
- Distributed storage

In addition, DS3 has a responsibility for considering interoperability, integration and testing within the context of the overall EuroVO architecture and hence liaising with the VOFC. This includes designing customisation tools for deployment across Europe and mix-and-match integration with other projects.

Fundamental to the development of VO services as well as applications which make use of them is an API (Application Programming Interface) layer to provide an abstract layer making development of such applications much easier. The earlier work developing the Astro Client Runtime (ACR) has been extended to produce the Astro Runtime or AR. This is fast becoming the de-facto API into the VO and is of great value to all consumers of VO services.

Easy accessibility of VO services requires the provision of secure controls; an unfortunate necessity. Significant progress has been made in the area, from both VOTech partner participation within the IVOA to help define suitable standards and in the deployment of authenticated access to datasets within the purview of the EuroVO. Further work is now being undertaken to provide Authorised access control for fine-grained resource provisioning.

A range of new services are being worked upon including tools for Reference server-side "R" implementation, VizieR SkyNode and support for new protocols within Data Set Access components.

Critical to VOTech is the evolution of standards across the Virtual Observatory world to ensure interoperability of components. DS3 is actively involved in preparing or contributing to such standards including: VOSpace, Single Sign-On, UWS, CEA, ADQL refactoring, Table Access Protocol, Simple time-series Access Protocol and IVOA WS Basic Profile.

Interoperability between client-side applications emerged as an obvious area for investigation. This has resulted in PLASTIC, a protocol for communication between desktop astronomy applications facilitating the sharing of data, link views and allowing applications to instruct each other to load an image of a particular area of sky. With PLASTIC the astronomer has a suite of interoperating, specialized tools composable according to particular needs.

Investigation into server and client-side workflow systems have been undertaken. the importance of workflow to enable complex autonomous research activities cannot be overstated and this is a key area for DS3 activity. It is also possible that more than one workflow service may be required to meet all needs. The conclusions from these research areas will prove very interesting.

Initial predictions that distributed storage is vital to successful large scale VO research have proved accurate. The initial success of FileManager/FileStore has prompted the IVOA to pursue formal adoption of a distributed storage mechanism incorporating all lessons learned from the initial implementations. This is the emerging VOSpace specification which in it's V2.0 standard will provide the next generation features distributed storage mechanisms require.

Meetings. Staff working in DS3 attended the Review and Planning meetings as listed in section 1.2. There were other informal meetings and telecons within the DS that are not listed.

Deliverables. The first major deliverable for DS3, due for delivery within the reporting period, was the "Infrastructure Study Report". The VOTECH Board wished a further report in thsi important area by the end of the project, and so have labelled this deliverable "Preliminary Study Report" expecting a final DS3 Study Report towards the end of the project. The conclusions of the infrastructure team are of great importance to Euro-VO overall, and so much continues to evolve both inside and outside the project, that it was felt important to plan a concluding report.

The DS3 team have also released prototype software to DS2.

Other milestones. DS3 is expected to make contributions the general project milestones listed in section 1.2, especially the six-monthly review and design planning. This is done (a) by attending the meetings and making presentations on progress, and (b) placing reports and internal DS plans on the project wiki-based documentation system. These contributions have been successfully accomplished.

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	**Total**

DS3 Effort expended. Staff effort expended in DS3 is summarised below.

Person-months - funded	11	12			8.23		31.23
Person-months - contributed	0		8	6	1.5		15.5

Person-months - TOTAL	11	12	8	6	9.73		46.73

1.3.4 Task-4 : DS4 - New User Tools

This task works to produce designs for new VO-compliant end-user tools, both from internally developed concepts, and from externally requested user requirements. The main items delivered by the DS4 study to date are explained below, and then listed in the following table together with links to the reports and software etc.

No	Deliverable	Further Reading/Download
1	Download: Aladin, Astrogrid Workbench and Workflows, Flux Converter, SSA Ranking, Topcat	http://wiki.eurovotech.org/twiki/bin/view/VOTech/SoftwareDownload
2	Aladin Interface with IDL	http://wiki.eurovotech.org/twiki/bin/view/VOTech/AladinIDL
3	Infrastructure Requirements of Multi-waveband Tool	http://wiki.eurovotech.org/twiki/bin/view/VOTech/MySpaceNotes
4	Note on Ranking Algorithm	http://www.ivoa.net/Documents/latest/Ranking.html
5	SAVOT VOTable library	http://cdsweb.u-strasbg.fr/devcorner.gmls
6	Simple Footprint Previewing	http://wiki.eurovotech.org/bin/view/VOTech/SFoVReqs
7	Spectral Data Model	http://www.ivoa.net/Documents/latest/SpectrumDM.html
8	Spectral Energy Distribution Building	http://wiki.eurovotech.org/twiki/bin/view/VOTech/SEDBuilding
9	Theory VO Status Report	http://wiki.eurovotech.org/twiki/pub/VOTech/DS4PlanningStage04/VoTechStrasb.pdf

DS4 work focused on a number of concrete tools and subcomponents as identified in the previous reporting period, namely the multi-waveband image tool, generic source extraction, spectral energy distribution (SED) builder from archival data, positional cross matcher and access to theoretical data.

Multi-waveband Image Tool. Requirements for a multi-waveband image tool (3) led to improvements of infrastructure components (DS3) such as the server side version of the Astrogrid Runtime library (ASR) and the design of the VOSpace storage system. Independently, a number of new colour image manipulation features were added to the Aladin Interactive Sky Atlas (1) .

Generic Source Extraction. The Redshift Maker workflow available through the Astrogrid workbench (1) is a service performing automated extraction of object properties from observational data. It derives photometric redshifts from optical imaging based on data from the INT Wide Field Survey.

SED Builder from Archival Data. Work towards spectral energy distribution (SED) building (8) entailed contributions to an IVOA standard spectral data model (7) and its utilization for a public service converting photometric magnitudes to physical flux densities (1). Furthermore, a colour cutter for the selection of objects based on photometric colours has been implemented as a configurable workflow to the Astrogrid workbench (1).

Positional Cross Matcher. Work on cross matching capabilities continued and an improved version was integrated into the Aladin prototype (1). The creation of a positional index on several thousand source (Vizier) catalogues started. It will further improve the correlation of unrelated observations with different telescopes and at different epochs.

Access to Theoretical Data. Linking theoretical and observational Astronomy is the aim of three combined and ongoing activities. Firstly, the definition of a data model specifying terms for interaction between the two domains. This happens in close collaboration with the IVOA Semantics and Theory working groups. Secondly, the definition of the Simple Numerical Access Protocol (SNAP). Thirdly, the implementation of a prototype Theory Virtual Observatory TVO (9) for this selected scenario: A view on hydrodynamic simulations as Chandra satellite observations through a SNAP service. Its implementation is the goal of a feasibility study in the coming reporting period.

Further Achievements. In order to improve overall robustness, versatility and interchange capabilities across tools several further software updates and documentation items were released. They are not specific to a particular of above applications but complement at least one of them. Some examples are mentioned below:

New features of the Aladin Interactive Sky Atlas prototype (1) include support of the PLatform for AStronomical Tool InterConnection protocol (PLASTIC), a programmatic interface to the widely used commercial IDL computing language (2), an improved cross-matcher, improved support of data cubes as well as colour images and solar images as well as integration of an experimental workflow engine (JLOW). Furthermore, it acts as a testbed for a newly defined format for encoding instrumental footprints of observations (6) and for visually representing ranked query results (4).

Binary data support was added to the SAVOT library (5) for reading and writing data files in VOTable format.

Topcat (1) - the Tool for OPerations on Catalogues And Tables - now supports also solar time series data, additional plot and data formats as well as the PLASTIC interface. STILTS - the Starlink Tables Infrastructure Library Tool Set - the sister package of Topcat for command-line tools has added support for most of its facilities through the Common Execution Architecture (CEA) web service framework.

A number of workflows became available through the Astrogrid workbench (1). Apart from above mentioned Colour Cutter and Redshift Maker there is the Movie Maker for assembling solar image time series, GouldBelt for the identification of components of the Gould Belt in multi wavelength catalogues and a workflow investigating solar Coronal Mass Ejections (CME) and their influence on geomagnetic storms at the Earth.

Astroscope (1) - a browser for dynamic discovery of data available for further processing via a VO interface - has numerous new features available through its graphical user interface and can now dynamically perform registry look-up queries.

Dissemination to scientific community. An exhibition booth at the General Assembly of the International Astronomical Union (IAU), Aug 14 – 25, 2006, in Prague has been set up on behalf of and in coordination with the 16 partner projects of the International Virtual Observatory Alliance. The conference pages http://www.ivoa.net/pub/VOScienceIAUPrague/ of IAU special session no. 3 *"The Virtual Observatory in action: New science, new technology, and next generation facilities"* were designed and hosted. Publications related to DS4 are listed in Annex 3.

Meetings. Staff working in DS4 attended the Review and Planning meetings as listed in section 1.2. There were other informal meetings and telecons within the DS that are not listed.

Deliverables. No formal deliverables for DS4 were planned during this reporting period. The first major deliverables for DS4 are the "User Tools Study Report" and the first prototype software release, both scheduled for the third reporting period.

Other milestones. DS4 is expected to make contributions the general project milestones listed in section 1.2, especially the six-monthly review and design planning. This is done (a) by attending the meetings and making presentations on progress, and (b) placing reports and internal DS plans on the project wiki-based documentation system. These contributions have been successfully accomplished.

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	**Total**

Effort expended. Staff effort expended in DS4 is summarised below.

Person-months - funded		18.48		3	1.4	15.5	38.38
Person-months - contributed					10.5		10.5
Person-months - TOTAL		18.48		3	11.9	15.5	48.88

1.3.5 Task-5 : DS5 - Intelligent Resource Discovery

This task aims at undertaking a feasibility study for developing components based on emergent technologies in the areas of the semantic web and ontologies. On the assumption that these studies are successful, the project will proceed to trial implementations, and standards development.

In the second year of the project, a large fraction of DS5 work has been related to ontologies, with the maturation of ontologies applied to various topics, and the definition of specific use-cases. Ontologies have been specifically developed for:

- VO access control, applying ontological reasoning (with the SPARQL reasoner) to digital certificates for access control to VO resources (http://wiki.eurovotech.org/

twiki/bin/view/VOTech/AccessControlUseCases)

- Registry metadata, describing VO resources into an ontology in order to apply ontological reasoning and SPARQL queries to browse VO registries
- VOEvent, the VO packet message exchange format for transient phenomena (http://wiki.eurovotech.org/twiki/bin/view/VOTech/VoEventOntology)
- STC, the Space Time Coordinates standard adopted in the VO (http://wiki.eurovotech.org/twiki/bin/view/VOTech/StcOntology) and the characterization data model (using schema v0.95) (http://wiki.eurovotech.org/twiki/bin/view/VOTech/CharacterisationOntology)
- Describing the various astronomical object types in SIMBAD (follow-up of work started in first year) (http://wiki.eurovotech.org/twiki/bin/view/VOTech/OntologyOfObjectTypes)

The VOEvent and STC ontologies have been used to query via SPARQL a knowledge base populated with solar events (following the work done on SuaveCAT in the first year: http://wiki.eurovotech.org/twiki/bin/view/VOTech/SolarVOEventCatalogue). Queries were sent to a remote knowledge base using the Quaestor frontend, and allowed answers to some practical use cases.

The work on the astronomical object types ontology was presented during the IAU meeting in Prague in august 2006, during the Special Session 3 (SPS3: **The Virtual Observatory in action: new science, new technology, and next generation facilities**), and a first technical note was circulated to the IVOA on october 31 (http://www.ivoa.net/Documents/latest/AstrObjectOntology.html).

Some other DS5 tasks are not directly related to ontologies, but explore other areas of resource discovery:

- The registry query tool using UCDs to locate relevant resources in the VO registry has been improved, and has also been demonstrated during the SPS3 at IAU meeting in august 2006. The implementation of the characterization data model has also been improved, and a java library should be released to the IVOA in early 2007 together with the homogenized data retrieval tool that has been improved and tested on a set of radio catalogues.
- The development of MEx, a FITS keyword mapping utility was continued (http://wiki.eurovotech.org/twiki/bin/view/VOTech/DpSubmitKWmappingDoc). This tool will allow an easy mapping from keywords present in an heterogeneous data collection (like the data products available at ESO) to an homogenized description in terms of physical quantities, vocabulary and concepts.
- A software for automated detection of astronomical object names in journal articles is under development. A preliminary version working on PDF articles was released and evaluated by domain experts, giving promising results.

Meetings. Staff working in DS5 attended the Review and Planning meetings as listed in section 1.2. There were other informal meetings and telecons within the DS that are not listed.

Deliverables. No formal deliverables for DS5 were planned during this reporting period. The first major deliverables for DS5 are the "Resource Discovery Study Report" and the first prototype software release, both scheduled for the third reporting period.

Other milestones. DS5 is expected to make contributions the general project milestones listed in section 1.2, especially the six-monthly review and design planning. This is done (a) by attending the meetings and making presentations on progress, and (b) placing reports and internal DS plans on the project wiki-based documentation system. These contributions have been successfully accomplished.

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	**Total**

DS5 Effort expended. Staff effort expended in DS5 is summarised below.

Person-months - funded		12	10		26.35	15	63.35
Person-months - contributed			2		7.4		9.4
Person-months - TOTAL		12	12		33.75	15	72.75

1.3.6 Task-6 : DS6 - Data Exploration

This task assesses datamining and visualisation algorithms and packages, with a view to determining how they can be run as distributed services, how they can be made VObs-compliant, and how they can be extended to extremely large datasets. On the assumption that these studies are successful, the project will proceed to actual component designs, trial implementations and standards development.

Significant progress has been made on all DS6 topics within the reporting period. This is detailed in the DS6 "Preliminary Design Study Report" (see Deliverables below), so we present only a summary here.

Interoperability of desktop tools with PLASTIC. The PLASTIC protocol continues to be adopted with enthusiasm by the developers of astronomical data exploration tools: the current list of "PLASTICized" tools is given at http://plastic.sourceforge.net/apps.html. An IVOA Note entitled "PLASTIC - a protocol for desktop application interoperability" has been published (see http://ivoa.net/Documents/latest/PlasticDesktopInterop.html) and the new IVOA Applications Working Group has as its first task the development of an IVOA standard protocol along similar lines to PLASTIC. The PLASTIC home page is http://plastic.sourceforge.net/index.html

Other IVOA standards work The DS6 team has continued to contribute through the reporting period to the further development of IVOA standards in the Data Modelling and Data Access Layer working groups. These have centred on the development of sufficiently

rich metadata representations to enable astronomers to work with ease with the complicated collections of data products which often arise in modern-day observational programmes. This work continues to be influenced, and tested, by the further development of the Aladin tool.

VisiVO. Stable releases of VisIVO are now available for both Linux and Windows platforms - see http://visivo.cineca.it - and the VisIVO team are currently preparing for their first User Tutorial, to be held at CINECA (Bologna) in March 2007. Under the aegis of DS6, VisIVO has become a sophisticated visualization tool for the VO, which can interoperate with other desktop applications through use of the PLASTIC protocol.

Astroneural. Significant progress has been made in the development of the Astroneural data mining toolkit during the past year. The MATLAB prototype (implementing Multi-Layer Perceptrons, Self-Organising Maps, Probabilistic Principal Surfaces, and several other machine learning techniques) has been completed, and the development of a more portable version, in C++, in well advanced. Detailed planning for this new version (VO-Neural) has benefitted greatly from close interaction with other members of the DS6 team, e.g.: TOPCAT provides all the data pre-processing capabilities required, so these do not need to be included in VO-Neural, while plans for integration with VisIVO have been revised, as it has been realised that VO-Neural will require some specialised visualizations not readiy provided by VisIVO.

AstroWeka. Weka, a popular Java data mining package, has been VO-enabled in the past year. Initially this was done as part of Brian Walshe's e-Science MSc studies at the University of Edinburgh, but this work is being completed within DS6, which Brian Walshe joined in October 2006. The resulting tool, AstroWeka, will provide astronomers with a wide range of data mining algorithms which they can readily run on data loaded from AstroGrid's MySpace virtual storage system or returned from queries to IVOA-compliant ConeSearch query services, as well as data available as local files. Weka does have some scalability limits, and the final part of the AstroWeka project is the production of a User Guide which will guide users as to the situations in which Weka can be used. The AstroWeka home page is http://astroweka.sourceforge.net/ .

Eirik.Richard Holbrey left the DS6 team in November 2006, after completing development of the Eirik prototype tool. This tool - see http://www.comp.leeds.ac.uk/richardh/eirik.shtml for documentation and download instructions - implements a number of the techniques described in the DS6 Report on "Dimensional Reduction Algorithms for Data Mining and Visualization" discussed in the VOTECH First Annual Report.

VOTECHBroker.Work on the VOTECHBroker (VOTB, see https://portals.rdg.ac.uk/votb/ for more details) system was completed before Garry Smith left the DS6 team. VOTB provides a mechanism whereby VObs jobs can be submitted to a range of computational Grid resources. While VOTB is quite a generic piece of software, it was developed with DS6 specifically in mind, and is currently being tested through the running of large-scale parameter sweep jobs as part of data exploration analyses.

File mapping and column-ordered storage. During this reporting period, one noteworthy self-contained piece of work was completed, assessing the benefits which could be obtained from using techniques for scalable data access. This research (which is detailed in the Preliminary Design Study Report) concluded that both the file mapping of tabular data files and their storage in column-ordered (rather than the conventional row-ordered) format could significantly improve the performance of a significant class of data exploration operatons run on tabular datasets, to the point where very large tables could be studied interactively. These techniques are most likely to be implemented within data centres, rather than by individual users on their desktops, so this is one area where VOTECH can help to guide the work of the EuroVO Data Centre Alliance.

Meetings. Staff working in DS6 attended the Review and Planning meetings as listed in section 1.2. There were other informal meetings and telecons within the DS that are not listed.

Deliverables. The first major deliverable for DS6, due for delivery within the reporting period, was the "Data Exploration Design Study Report". The VOTECH Board decided that it would be better to release a "Preliminary Design Study Report" at this stage, and defer the delivery of the final DS6 Study Report until later in the project. This would ensure that this key deliverable from DS6 covered all the team's work, and not just that before December 2006, while release of the Preliminary report - itself a substantial document of ~85 pages - would keep the community apprised of developments in the DS6 design study.

The DS6 Preliminary Design Study is available from the following URL:
http://wiki.eurovotech.org/twiki/bin/view/VOTech/DS6StudyReport

The DS6 team have also delivered their first prototype software release to DS2.

Other milestones. DS6 is expected to make contributions the general project milestones listed in section 1.2, especially the six-monthly review and design planning. This is done (a) by attending the meetings and making presentations on progress, and (b) placing reports and internal DS plans on the project wiki-based documentation system. These contributions have been successfully accomplished.

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	**Total**

DS6 Effort expended. Staff effort expended in DS6 is summarised below.

Person-months - funded	33			3	7.47	53.5	96.97
Person-months - contributed	1				2	3	6
Person-months - TOTAL	34			3	9.47	56.5	102.97

1.4 Update of the non-confidential Project information

A Design Study is being undertaken aimed at completing all technical preparatory work necessary for the construction of the European Virtual Observatory (Euro-VO). Euro-VO is a specifically European implementation of the Virtual Observatory (VObs) concept, and will produce a world leading infrastructure providing a unified virtual data resource and the ability to perform complex data discovery and manipulation tasks across the whole range of astronomy. Access to data and tools will be equally good across Europe, regardless of location. This will require establishing an alliance of data centres, and a VObs facility centre in support of the community, but crucially requires the construction of an infrastructural glue of software components, in the context of rapidly evolving background developments in IT and the grid. The VO-TECH project aims specifically at feasibility studies and design work aimed at integrating such new technologies into the Euro-VO. Key IT advances to build on are in intelligent resource discovery (ontology and the semantic web), data mining, and visualisation capabilities. These will be integrated via global astronomical interoperability standards coupled with the latest distributed grid computing services. Additionally this project covers design and preparatory work to ensure that data from the major European telescopes and facilities (as represented by the Opticon and RadioNet networks) is fully accessible through the Euro-VO.

1.4.2 Project website address : http://www.eurovotech.org

1.4.3 Project Achievements

In its second year, VOTECH has built on the cohesion developed between partners and added a strong working link with the European Space Agency. Initial developments have been presented to the astronomy community at conferences and through the Euro-VO science advisory structure. Substantial technical progress has been made in key infrastructure components, application interoperability, and new tools, both on the client side and server side, and several of these developments have been brought forward for international standardisation. VOTECH technologies are already being deployed in some working systems.

1.4.4 List of participants

Participant number (co-ordinator = N°1)	**Participant name** (Organisation, city, country)	**Short name**
1	University of Edinburgh, representing UK AstroGrid Consortium	UEDIN
2	European Southern Observatory, Garching bei München, Germany	ESO
3	University of Leicester, representing UK AstroGrid Consortium	LU
4	University of Cambridge, representing UK AstroGrid Consortium	UCAM

5	Centre National de la Recherche Scientifique, representing French VO	CNRS DR10
6	Istituto Nazionale di Astrofisica, Roma, Italy	INAF

2. List of deliverables

Below is a list of deliverables that were scheduled for this reporting period according to the original project plan, together with their target date in the revised project plan, and their current status. Brackets indicate that the deliverable was delivered outside the reporting period, but before the completion of this report.

Deliv. No.	Deliv. Name	Lead	Orig. Date	Revised Date	Achieved	Comments
DS2-02	Revised Project Plan	UEDIN	2006 Jun	2006 Sep	2006 Dec	Available online
DS2-03	Science Framework Document	UCAM	2005 Jun	2006 Jun	--	Draft Status : see note (1)
DS2-04b	2nd Baseline software release	LU	2006 Dec	2007 Mar	(2007 Mar)	Available online
DS3-01	Infrastructure Study Report	LU	2006 Mar	2006 Jun	(2007 Feb)	Available online : see note (2)
DS3-02	DS3 1st proto. release to DS2	LU	2006 Dec	2007 Mar	(2007 Mar)	Available online
DS6-01	Data Explorn. Study Report	UEDIN	2006 Sep	2006 Dec	(2007 Feb)	Available online : see note (2)
DS6-02	DS6 1st proto. release to DS2	UEDIN	2006 Dec	2007 Mar	(2007 Mar)	Available online

Note (1) : The Science Framework Document (SFD) was postponed during the last period because its development was merged into the larger plan for overall science planning of Euro-VO through the new VO Science Advisory Committee (VOSAC). The VOSAC is now fully underway. The SFD is expected soon, and is under construction at http://wiki.eurovotech.org/twiki/bin/view/VOTech/VotcSFD

Note (2) : For both of these study reports, there was a large amount of progress to report, and a strong feeling that these studies should continue to the end of the project. It was decided that an *initial report* should be issued (almost) on time, with *final reports* to be added at the end of the project.

3. Use and dissemination of knowledge

Public dissemination. The public web page (http://www.eurovotech.org) has been available since very early in the project, and is now linked from a more general Euro-VO public web page (http://www.euro-vo.org/pub/)

Euro-VO partners. Euro-VO has been established by an MOU between eight European organisations and funding agencies. Regular progress reports are made to the Euro-VO Executive Board. The VO Facility Centre (VOFC) is beginning operation, run jointly by ESO and ESA. The VO Technology Centre (VOTC) makes software and standards available to VOFC for integration into the evolving Euro-VO infrastructure. It currently oversees two projects - VOTECH, funded by FP6, and ESA-VO, funded internally by ESA. The Data Centre Alliance (DCA) has now been established between twelve national partners, and is supported by an FP6 contract. A prime aim of the DCA is co-ordinating national efforts to deploy VOTECH software.

International context. VOTECH is part of an international drive towards the Virtual Observatory. Most project staff are members of one or another IVOA working group and have contributed throughout the year to standards development, attending meetings during 2006 in Victoria (Canada) and Moscow. VOTECH staff are active in all technical areas, including Registry, Grid and Web Services, Semantics, Data Model, and Data Access Layer. Because of our success with PLASTIC, VOTECH staff have been particularly instrumental in promoting the creation of a new Applications Working Group. Within the VOTECH leaders, Lawrence, Genova, and Linde are all members of the IVOA Executive.

Scientific community. The key advance during 2006 was promoting the VO at the General Assembly of the International Astronomical Union in Prague during August 2006, through a three day "Special Session" and through several VO related demonstration stalls. Lawrence was the chair of the SOC, and many other VOTECH staff contributed in organisation and talks. VO related talks have been given at many other national and international astronomical conferences. The next key opportunity is another special VO session at the Joint European National Astronomy Meeting (JENAM) in Armenia in August 2007.

Wider e-science links. All the partners have strong links with other e-science projects at national level, and also within the EGEE project. Of particular interest is a "Birds of a Feather (BOF)" grouping within the Grid Global Forum, which is jointly run by the VOTECH project scientist (Walton), together with Reagan Moore from San Diego Supercomputer Center.

Licensing policy. The VOTECH project manager (Linde) has continued leading inernational discussion on the development of a license based on open-source principles, which we hope will become a standard agreed across the IVOA; however this has not yet reached a conclusion.

Publications

The following publications have resulted from wholly or partly funded VOTECH activity during the period Feb 2006 to Feb 2007:

Becciani, U., et al. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3 'VisiVO : an interoperable visualisation tool for VO data'

Boch, T., et al. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3 'Aladin, a VO portal'

N. Delmotte, M. Dolensky, et al., 2006, ESO Science Archive Interfaces, ASP Conf. Ser., 315, 690

Derriere, S., Richards, A. M. S., Preite-Martinez, A. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3, #35 'An ontology of astronomical object types for the VO'

Dolensky, M., Pierfederici, F., Allen, M., Boch, T., Bonnarel, F., Derriere, S., Fernique, P., Noddle, K., Smareglia, R. 2006, ASP Conf. Ser. 351: Astronomical Data Analysis Software and Systems XV 'Status of the VOTech Design Study about User Tools'

M. Dolensky, B. Rino, 2006, IVOA Note: Ranking Query Result Sets
http://www.ivoa.net/Documents/latest/Ranking.html

González-Solares, E. A. & Walton, N. 2006, ASP Conf. Ser. 351: Astronomical Data Analysis Software and Systems XV Exploring the high redshift Universe using VO Tools

Gonzalez-Solares, E. A., Walton, N., Richards, A., & Tedds, J. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3, #43 Near-IR properties of Spitzer selected sources

Guainazzi, M., et al. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3 'A VO-based solution to the origin of soft X-ray emission'

M. Leoni, M. Dolensky, et al., 2006, Multi-Purpose Metadata Repository for a Real & Virtual Ovservatory, ASP Conf. Ser., 351, 414

Louys, M., et al., 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3 'Implementing astronomical image analysis pipelines using VO standards'

J. McDowell, D. Tody, M. Dolensky, et al., 2006, Spectral Data Model http://www.ivoa.net/Documents/latest/SpectrumDM.html

Padovani, P., 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3 'Towards a VO compliant ESO Science Archive'

Pasian, F., et al. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3 'Interconnecting the Virtual Observatory with computational grid infrastructures'

Pasian, F., et al. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3 'Interoperability and Integration of Theoretical Data in the Virtual Observatory'

Prema, P., Walton, N. A., & McMahon, R. G. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3, #24 Galaxy Formation And Evolution Using Multi-Wavelength, Multi-Resolution Imaging Data In The Virtual Observatory

Richards, A. M. S., Beswick, R., Garrington, S. T., Muxlow, T. W. B., Winstanley, N., Harrison, P. A., Gonzalez-Solarez, E., Walton, N. A., Kettenis, M., & van Langevelde, H. J. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3, #51 The MERLINImager - a customised radio interferometry image server provided by AstroGrid

Rixon, G., Morris, D., & Benson, K. 2006, ASP Conf. Ser. 351: Astronomical Data Analysis Software and Systems XV Towards IVOA-Standard Access Control

R. Slijkhuis, M. Dolensky, et al., 2006, Feeding VO Data Products into the ESO Archive, ASP Conf., Ser., 351, 425

Tedds, J. A., Law-Green, D. L., Watson, M. G., Noddle, K. T., Morris, D., & Walton, N. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3, #74 The 2XMM Pre-Release Catalogue: A Test Case for VO Cross Correlation of Large Archives

Vollmer, B., et al. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3 'Determination of radio spectra from catalogues and dentification of GHz peaked sources using the VO'

Walton, N. A. & Astrogrid Consortium 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3, #70 AstroGrid Virtual Observatory Release 2006.3

Walton, N. A., Drew, J., Gonzalez-Solares, E., Greimel, R., Hopewell, E., & Irwin, M. J. 2006, The Virtual Observatory in Action: New Science, New Technology, and Next Generation Facilities, 26th meeting of the IAU, Special Session 3, 17-18, 21-22 August, 2006 in Prague, Czech Republic, SPS3, #27 Mapping Galactic Spiral Arm Structure: The IPHAS Survey and Virtual Observatory Access

Walton, Nicholas A., Gonzalez-Solarez, Eduardo, Dalla, Silvia, Richards, Anita, & Tedds, Jonathon 2006, Astronomy and Geophysics AstroGrid: A place for your science

Annexes

Annex 1 - Summaries and main conclusions of the General Meetings *(section 1.2)*

Stage03 DS Review and Planning Meeting : 2006 Mar 6-9 (Sorrento) . This was the third in our standard cycle of work planning meetings, and firmly cemented the spirit of collaboration in the project. These DSRP meetings have become essentially full open consortium meetings. This meeting brought together all staff contributing to the project. Furthermore our colleagues at ESAC now have a standing invitation to informally join in activities. All the substantive tasks (DS3-6) reported significant technical progress, and work plans for the next six months for all areas were produced.

Technical Advisory Panel Meeting : 2006 Apr 27 (Telecon) . The TAP formally reviewed reviewed the progress made at the Stage03 DSRP and the proposed plans. Minor amendments were suggested to the workplans, which were then formally agreed. A representative from ESA (Christophe Arviset) now attends TAP meetings. No significant policy matters were raised for Board attention.

Stage04 DS Review and Planning Meeting : 2006 Sep 4-7 (Strasbourg) . This was the fourth in our standard cycle of full consortium work planning meetings. Significant technical progress was again reported, and work plans for the next six months produced.

Technical Advisory Panel Meeting : 2006 Dec 11 (Telecon) . The formal TAP meeting following the Stage04 DSRP meeting was somewhat delayed, due to the difficulty of finding an agreed date. It was eventually held in conjunction with the Board meeting (see below). DSRP progress and work plans were reviewed, and very minor changes made before formal agreement. The TAP process was discussed, and it was agreed that in future they should be fixed in advance and held within two weeks of the DSRP, and that holding them in conjunction with Board meetings was very desirable.

Third Board Meeting : 2006 Dec 11 (Telecon) . This board meeting was held in conjunction with the TAP, with the Board reserving right to ask the TAP-only members to leave at appropriate points. (There is a large overlap between TAP and Board membership). At this meeting there were significant discussions on project finance, the working relation between Board and TAP, and future plans for VOTC work through FP7.

Tabular summary of General Meetings

Date	Title/Subject of meeting	Location	No. of attendees	Website address
2006 Mar 6-9	Stage03 DS Review and Planning Meeting	Sorrento	30	http://wiki.eurovotech.org/twiki/bin/view/VOTech/StageThreePlanningMeetings
2006 Apr 27	Technical Advisory Panel	Telecon	8	http://wiki.eurovotech.org/twiki/bin/view/VOTech/TapMeetingStage03
2006 Sep 4-7	Stage04 DS Review and Planning Meeting	Strasbourg	30	http://wiki.eurovotech.org/twiki/bin/view/VOTech/StageFourPlanningMeetings
2006 Dec 11	Technical Advisory Panel	Telecon	12	http://wiki.eurovotech.org/twiki/bin/view/VOTech/BoardMeet20061211
2006 Dec 11	Third Board meeting	Telecon	12	http://wiki.eurovotech.org/twiki/bin/view/VOTech/BoardMeet20061211

Annex 2 - Updated non-confidential Project information *(section 1.4)*

A Design Study is being undertaken aimed at completing all technical preparatory work necessary for the construction of the European Virtual Observatory (Euro-VO). Euro-VO is a specifically European implementation of the Virtual Observatory (VObs) concept, and will produce a world leading infrastructure providing a unified virtual data resource and the ability to perform complex data discovery and manipulation tasks across the whole range of astronomy. Access to data and tools will be equally good across Europe, regardless of location. This will require establishing an alliance of data centres, and a VObs facility centre in support of the community, but crucially requires the construction of an infrastructural glue of software components, in the context of rapidly evolving background developments in IT and the grid. The VO-TECH project aims specifically at feasibility studies and design work aimed at integrating such new technologies into the Euro-VO. Key IT advances to build on are in intelligent resource discovery (ontology and the semantic web), data mining, and visualisation capabilities. These will be integrated via global astronomical interoperability standards coupled with the latest distributed grid computing services. Additionally this project covers design and preparatory work to ensure that data from the major European telescopes and facilities (as represented by the Opticon and RadioNet networks) is fully accessible through the Euro-VO.

Project website address : http://www.eurovotech.org

Project Achievements

In its second year, VOTECH has built on the cohesion developed between partners and added a strong working link with the European Space Agency. Initial developments have been presented to the astronomy community at conferences and through the Euro-VO science advisory structure. Substantial technical progress has been made in key infrastructure components, application interoperability, and new tools, both on the client side and server side, and several of these developments have been brought forward for international standardisation. VOTECH technologies are already being deployed in some working systems.

List of participants

Participant number (co-ordinator = N°1)	**Participant name** (Organisation, city, country)	**Short name**
1	University of Edinburgh, representing UK AstroGrid Consortium	UEDIN
2	European Southern Observatory, Garching bei München, Germany	ESO
3	University of Leicester, representing UK AstroGrid Consortium	LU
4	University of Cambridge, representing UK AstroGrid Consortium	UCAM
5	Centre National de la Recherche Scientifique, representing French VO	CNRS DR10
6	Istituto Nazionale di Astrofisica, Roma, Italy	INAF

Annex 3 - Deliverables during the reporting period *(section 2)*

Location of Deliverables. All the deliverables are available on line, linked through a single web page listing the deliverables and milestones :

http://wiki.eurovotech.org/twiki/bin/view/VOTech/ProjectContract

Deliverables which are documents are also appended to this report on a CDROM.

Past deliverables For context, we first give the deliverables from the previous report. Note that because of the three month preliminary exploratory phase, following which we started the formal six month cycle, most of the deliverables were agreed to put back by three months.

Deliv. No.	**Deliv. Name**	**Lead**	**Orig. Date**	**Revised Date**	**Achieved**	**Comments**
DS1-01	Project Website	LU	2005 Jun	--	2005 Jan	http://www.eurovotech.org
DS2-01	Project Plan	UEDIN	2005 Feb	--	2005 Mar	Available online.
DS2-03	Science Framework Document	UCAM	2005 Jun	2006 Jun	--	Deliberately postponed. : see note (1)
DS2-04a	1st Baseline software release	LU	2005 Dec	2006 Mar	2006 Mar	Released through central download page.

Deliverables due this period. The table below summarises the status of project deliverables which were due during this reporting period (calendar year 2006), according to the original project plan. This includes the one deliverable that was not accomplished in the previous period (DS2-03), which has been brought forward. Where the "achieved" date is in brackets, this indicates that the deliverable was completed outside this reporting period, but before the completion of this report.

Deliv. No.	**Deliv. Name**	**Lead**	**Orig. Date**	**Revised Date**	**Achieved**	**Comments**
DS2-02	Revised Project Plan	UEDIN	2006 Jun	2006 Sep	2006 Dec	Available online
DS2-03	Science Framework Document	UCAM	2005 Jun	2006 Jun	--	Draft Status : see note (1)
DS2-04b	2nd Baseline software release	LU	2006 Dec	2007 Mar	(2007 Mar)	Available online
DS3-01	Infrastructure Study Report	LU	2006 Mar	2006 Jun	2007 Feb	Available online : see note (2)
DS3-02	DS3 1st proto. release to DS2	LU	2006 Dec	2007 Mar	(2007 Mar)	Available online
DS6-01	Data Explorn. Study Report	UEDIN	2006 Sep	2006 Dec	(2007 Feb)	Available online : see note (2)
DS6-02	DS6 1st proto. release to DS2	UEDIN	2006 Dec	2007 Mar	(2007 Mar)	Available online

Note (1) : The Science Framework Document (SFD) was postponed during the last period because its development was merged int the larger plan for overall science planning of Euro-VO through the new VO Science Advisory Committee (VOSAC). The VOSAC is now fully underway. The SFD is expected soon, and is under construction at

http://wiki.eurovotech.org/twiki/bin/view/VOTech/VotcSFD

Note (2) : For both of these study reports, there was a large amount of progress to report, and a strong feeling that these studies should continue to the end of the project. It was decided that an *initial report* should be issued (almost) on time, with *final reports* to be added at the end of the project.

B. MANAGEMENT REPORT (FINANCIAL INFORMATION)

Provided separately.

C. REPORT ON THE DISTRIBUTION OF THE COMMUNITY FINANCIAL CONTRIBUTION

Provided separately