

1st 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://eurovotech.org/>

Reporting Period : from 01/01/2005 to 31/12/2005

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1. Progress Report

1.1 Summary of the activities and major achievements

VOTECH has already achieved a remarkable degree of European cohesion, as well as some impressive software construction and working prototypes. New staff employment was fairly slow, but partner contributions got off the blocks very quickly, so that in fact the project had a fast start. In its first year the project began by concentrating on establishing working practices, building cohesion between partners, and exchanging concepts and existing technologies already developed by partners. However this process worked extremely well, so that we rapidly moved on to concrete software construction and testing. Working prototypes in certain key areas are already at the stage where astronomers can use them to do real science. Full project meetings occur every six months, and within Design Studies, more frequent informal smaller meetings are common. However the key to successful partner collaboration was in fact the construction of an internal project web site, documentation system, and editable discussion area, by setting up a Twiki system by month two.

Some highlight achievements include:

- establishing a clear management process, collaboration methods, and documentation system
- completing three out of four deliverables on time or earlier; the final one was delayed by circumstances external to the project
- exchanging and integrating existing partner software
- achieving a high impact on international standards
- demonstrating the moving of files between international FileStores, leading to proposed VOStore international standard
- developing a clean client side API into all VO services (Astro Client Runtime), making it easy for third parties to write VO-aware tools
- developing client side UIs for building workflows, browsing distributed filestores, and managing long serverside tasks
- completing initial discussions on Identity, Authentication and Authorisation in Euro-VO, leading to proposed Universal Worker Service standard.
- completing external software surveys for tools and datamining packages
- developing new tools for manipulating Universal Content Descriptors (UCDs)
- completing preliminary testing of ontology tools
- developing the VoTechBroker interface for dispatching large computational jobs to external Grid systems
- integrating VisIVO and Astroneural data mining systems
- developing standard message protocol for applications (Plastic) which makes VO tools interoperable.

1.2 Consortium management activities (DS1)

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 meets at least annually; it has so far met twice, in November 2004 and June 2005.

The actual administration of consortium activities is however 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. At first this was largely undertaken by the co-ordinator and general infrastructural support services at the University. During the year however we appointed a **Consortium Administrator** (Peredur Williams) who is funded to support the project at 0.2FTE, and did so for 8 months of this reporting period. We have also now recruited a **Consortium Web Developer** (Mark Holliman). However, he does not start work until March 1st 2006.

Below is the staff effort expended in this task. Funded staff effort is exact; partner contributed staff months are approximate.

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	Total
Person-months - funded	1.6						1.6
Person-months - contributed	1.0						1.0
Person-months - TOTAL	2.6						2.6

The following formal meetings were held involving all partners and considered to be organised under this activity. Note that the DSRP and TAP meetings involve aspects of both DS1 (Consortium Management) and DS2 (Project Technical Management) and so are listed both here and in section 1.3.2

Date	Title/Subject of meeting	Location	No. of attendees	Website address
2004 Sept 2-3	First Board meeting	Edinburgh	9	none
2004 Nov 18-19	Kick-off meeting	Cambridge	50	http://wiki.eurovotech.org/bin/view/VOTech/VOTechKickoff
2005 Feb 21-24	DS Review and Planning	Leicester	25	http://wiki.eurovotech.org/bin/view/VOTech/StageOnePlanningMeetings
2005 Mar 8-9	Technical Advisory Panel	Leicester	9	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage01
2005 Jun 28	Second Board meeting	Garching	9	none
2005 Sep 14-16	DS Review and Planning	Edinburgh	25	http://wiki.eurovotech.org/bin/view/VOTech/StageTwoPlanningMeetings
2005 Sep 28-29	Technical Advisory Panel	Trieste	8	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage02

In DS1 just one **project deliverable** was due in this reporting period - the project web site. This was completed well in advance, by partner staff in Leicester. The public web pages are at <http://www.eurovotech.org> and are relatively simple so far. The internal project web pages are at <http://wiki.eurovotech.org/bin/view/VOTech/WebHome> and are extensively developed and used for project planning and Europe-wide interaction. Continued development of the web sites has now been taken over by Edinburgh, and will in future be the responsibility of the Consortium Web Developer.

Deliverable No.	Deliverable Name	Lead Contractor	Effort expended	Planned Date	Delivered
DS1-01	Project Website	3 (LU)	0	Jul 2005	Jan 2005

Other milestones for DS1 in this reporting period are as below.

Milestone	Date Planned	Date Achieved
Kick-off meeting	2005 January	2004 November 18-19
Board meeting 1	2005 November	2005 June 28

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.

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. We build our work in six month cycles, known within the Project as "Stages". This is an effective compromise between the well known need for iterative flexibility in software development, and the need for clear long term planning. We first completed a lifetime **Project Plan** which can be found at :

<http://wiki.eurovotech.org/bin/view/VOTech/ProjectPlan>

This set broad goals and deliverables and a firm long term framework. Then at the beginning of each Stage, we hold a **DS Review and Planning (DSRP)** meeting involving a large fraction of all staff working on the project. 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. 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.

We had originally intended that we would have a short kick-off phase (2 months) followed by a short first stage (4 months) and then continue with six month stages in standard calendar semesters. In the event, we actually had a slightly longer kick off phase (3 months) and have then followed six month stages running April-August and September-March. We will continue this pattern in coming years.

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>

Our intention is to develop this in a more co-ordinated manner using GForge.

Science Activities. Scientific direction of VOTECH has been 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 1/3/2006) 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 to 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 first year of science activity has focused on the generation of the science framework document, together with the definition of a number of exemplar science cases, the first addressing a galactic and an extragalactic case. These will form the basis of initial scientific exploitation programmes utilising the early implementations of VO capabilities from the VOTECH design studies.

The need to co-ordinate VO-TECH science advice with other Euro-VO strands through the new combined Euro-VO science advisory committee (VO-SAC), meant that we took a decision to delay completion of the science framework document. This will now be delivered in April 2006. The VOTC PS will attend future meetings of the VO-SAC, in order to provide the VOTECH interface to this group.

A number of talks have been given during the first year of VOTECH describing the science aims of the VOTECH project. These include those of Walton et al at the 'X-Ray Universe' conference (ESAC, Sep 2005) and Walton et al at IAU Symposium 232, 'The Science Requirements of Extremely Large Telescopes' (Cape Town, Nov 2005).

The VOTC science team will be taking a leading role in the definition of the next possible Euro-VO workshops. Possibilities under consideration are either to focus on data centre participation, or to focus on scientific exploitation of VO systems.

The VOTECH science pages can be found on-line at:

<http://wiki.eurovotech.org/bin/view/VOTech/ScienceTeam>

Meetings. The following meetings were held involving all partners and considered to be organised under this activity. Note that the DSRP and TAP meetings involve aspects of both DS1 (Consortium Management) and DS2 (Project Technical Management) and so are listed both here and in section 1.2

Date	Title/Subject of meeting	Location	No. of attendees	Website address
2004 Nov 18-19	Kick-off meeting	Cambridge	50	http://wiki.eurovotech.org/bin/view/VOTech/VOTechKickoff
2005 Feb 21-24	DS Review and Planning	Leicester	25	http://wiki.eurovotech.org/bin/view/VOTech/StageOnePlanningMeetings
2005 Mar 8-9	Technical Advisory Panel	Leicester	9	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage01
2005 Sep 14-16	DS Review and Planning	Edinburgh	25	http://wiki.eurovotech.org/bin/view/VOTech/StageTwoPlanningMeetings
2005 Sep 28-29	Technical Advisory Panel	Trieste	8	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage02

Deliverables. The following deliverables were planned for the first reporting period. The project plan, and first software release, were delivered on time. (The original calendar date for software release was December 2005, but the intention was to deliver at the end of the second project cycle, Stage-2. The Project Stages were deliberately slipped by three months, so in fact the software deliverable was exactly as intended.) The Science Framework Document has been deliberately delayed. This is because we decided to plan a joint Science Framework for all three parts of Euro-VO - i.e. the VO Facility Centre (VOFC) and Data Centre Alliance (DCA) as well as the VO Technology Centre - and to take community advice by setting up a single joint VO Science Advisory Committee (VOSAC). The other components of Euro-VO are somewhat behind VOTECH, and this involved considerable multi-country complications. The membership of this committee has however now been established, and it will meet in the next few months. A revised target of June 2006 has been set for the Science Framework Document, and it is interpreted not simply as a requirements analysis for the VOTECH project, but as a vision for the long term future of Euro-VO as a whole.

Deliverable No.	Deliverable Name	Lead Contractor	Effort expended	Planned Date	Delivered (Revised)
DS2-01	Project Plan	3 (LU)	0	Feb 2005	Mar 2005
DS2-03	ScienceFramework Document	3 (LU)	0	Jun 2005	(Jun 2006)
DS2-04a	Baseline software release 1	3 (LU)	0	Dec 2005	Dec 2005

The project plan (DS2-01) can be found at
<http://wiki.eurovotech.org/bin/view/VOTech/ProjectPlan>

Planning information for the Science Framework Document (DS2-03) can be found at
<http://wiki.eurovotech.org/bin/view/VOTech/VotcSFD>

The first software release (DS2-04a) is collated at
<http://wiki.eurovotech.org/bin/view/VOTech/SoftwareDownload>

Other milestones. In addition to the above deliverables, DS2 was set the following milestones falling within this reporting period. These were

Milestone	Date Planned	Date Achieved (Expected)
Work Cycle plan (Stage 1)	2005 Feb	2005 Mar
Work Cycle plan (Stage 2)	2005 Jun	2005 Sep
Work Cycle plan (Stage 3)	2005 Dec	(2006 Mar)

Effort expended. Effort expended in DS2 is summarised below.

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	Total
Person-months - funded			0				0
Person-months - contributed			3	6			9
Person-months - TOTAL			3	6			9

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. Significant progress has been made in this first year.

Initial DS3 planning meetings identified a limited set of Tasks for the first stage, together with a wide range of Studies to help plan future work. Of the tasks that were allocated, the most far reaching was the provision of true distributed data storage through the use of

distributed FileStore (an implementation of the emerging IVOA VOSTore standard). This allows users associated with any given FileManager (itself a prototype of the IVOA VOSpace standard) to store data wherever an associated FileStore has been deployed. Distributed FileStores were delivered and working by April 2005. Further work with IVOA partners followed culminating in the successful demonstration at ADASS of data moving not only between VOTech FileStores, but also between FileStores based in the USA. The IVOA is currently embarked upon finalising the VOSTore V1.0 specification based upon this work.

It was also recognised at this time that the provision of a high quality User Interface was essential. This resulted in a prototype workflow builder being developed and an in depth study for workflow and other interfaces being undertaken. The prototype was demonstrated at the Stage-2 planning meetings and in conjunction with the study resulted in more work being planned in this area. We now have working client-side User Interfaces for, amongst other things, creating workflows as well as browsing distributed data stores and managing long running serverside work (jobs).

The above prototypes and studies revealed the need for a clean client API into all VO services, not just those provided by VOTech. Further investigation and prototyping resulted in the creation of an Astro Client Runtime, a thin layer of code analogous to the Java Runtime Environment which provides seamless access to all IVOA compliant VO services. It was upon this that the AstroGrid Workbench was built as well as the Plastic specification and prototypes which enables VO Tools interoperability. Such was the success of the ACR that the AstroGrid Workbench was very quickly built and extra tools (such as the AstroGrid AstroScope, or the ACR implementation of Aladin) developed. In addition, other projects within VOTech have successfully used ACR to VO enable their applications. These include tools from ESA (e.g. VOSpec) and CDS who have developed an Aladin prototype which has very successfully demonstrated the general use of ACR. The ACR is now in it's second major revision and plans are in hand to extend its capability to server side operations, thus helping remove the current barriers to delivering true VO Grid based services.

VOTech has ambitious plans for implementing Authentication, Authorisation and Accounting capabilities, but needs to keep the IVOA apace with developments. This has slowed our initial plans for a working prototype, but good progress has been made agreeing an outline standard with our international colleagues. We anticipate working prototypes by the end of Stage-3.

In addition to these major pieces of work, many other studies and prototypes have also been undertaken, each of which has made satisfactory progress. These include: Universal Worker Service standards, Web Service Profiling, Service proxies, lightweight workflow building (JLow) as well as a major CDS study for providing a SkyNode interface to the VizieR data archives. It is anticipated that much concrete work will emerge from these activities within the next 2 Stages..

Meetings. Staff working in DS3 attended the Review and Planning meetings as below. In addition for DS3 we paid considerable attention to joining together the infrastructural activities of CDS-Strasbourg and the AstroGrid project, with specific exchange meetings in April and August 2005. This resulted in a CDS document entitled "Exploration of the AstroGrid project" (T. Hertenstein)

There were other informal meetings and telecons within the DS that are not listed here.

Date	Title/Subject of meeting	Location	No. of attendees	Website address
2004 Nov 18-19	Kick-off meeting	Cambridge	50	http://wiki.eurovotech.org/bin/view/VOTech/VOTechKickoff
2005 Feb 21-24	DS Review and Planning	Leicester	25	http://wiki.eurovotech.org/bin/view/VOTech/StageOnePlanningMeetings
2005 Mar 8-9	Technical Advisory Panel	Leicester	9	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage01
2005 Sep 14-16	DS Review and Planning	Edinburgh	25	http://wiki.eurovotech.org/bin/view/VOTech/StageTwoPlanningMeetings
2005 Sep 28-29	Technical Advisory Panel	Trieste	8	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage02

Deliverables. No formal deliverables for DS3 were planned during this reporting period. The first major deliverable for DS3 is the "Infrastructure Study Report", scheduled in Project Plan for March 2006, during the second Reporting Period. Work for this is well on schedule, but given our revised work-cycle Stage timing, is likely to be actually produced during the middle of Stage 3, around June 2006. Following this report, DS3 will then work towards software releases that are made upwards to DS2, the integration task; the first of these is currently planned for December 2006, but is likely to be revised to March 2007.

Other milestones. In addition to the above deliverables, DS3 is expected to make contributions to 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.

Milestone	Date Planned	Date Achieved (Expected)
Work Cycle plan (Stage 1)	2005 Feb	2005 Mar
Work Cycle plan (Stage 2)	2005 Jun	2005 Sep
Work Cycle plan (Stage 3)	2005 Dec	(2006 Mar)

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

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	Total
Person-months - funded		12			6.2		18.2
Person-months - contributed	12		3		0.4		15.4
Person-months - TOTAL	12	12	3		6.6		33.6

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.

As a first step the current situation and needs were assessed. This entailed an analysis of the AVO science reference mission and breaking down functional themes into a list of tools (1). Specific use cases for a Theory VO (2) were defined because bridging observational and simulated scenarios is a particular challenge for data modellers. Based on the tool list a study on existing software (3) was conducted. The definition of technical tutorials and demos of existing VO tools at the EURO-VO workshop (4) held at ESO in June 2005 and packaging them as a CD-ROM release for three major operating systems has been supported.

Following these initial studies, a number of initiatives resulted in software prototypes and compute services:

For instance, a specification for exchanging instrumental footprints of observed regions on the sky has been worked out (5) and it is already supported by the Aladin suite. Similarly a study of the Java Web Start technology resulted in a new deployment method for software updates (6). Another example is the first use and adaptation of the Simple Image Access (SIA) protocol to attach and transfer world coordinate system information together with well supported industry standard formats like .gif and .png (7). This improvement to and exploitation of the SIA protocol is one example for the global collaboration at the level of the International Virtual Observatory Alliance (IVOA). Finally, a facility which was greatly enhanced because of its high demand in the community is the positional cross match compute service for celestial objects (8). In addition, an architecture study of a general positional index of the VizieR catalogue connection has begun.

No	Short Description	Further Reading (requires Wiki account)
1	Analysis of AVO SRM and derived list of tools	http://wiki.eurovotech.org/bin/view/VOtech/AvoSrmAnalysis
2	Use cases for a Theory VO	http://wiki.eurovotech.org/bin/view/VOtech/InafCases
3	Study on existing tools	http://wiki.eurovotech.org/bin/view/VOtech/StudyOnExistingTools
4	tools at EURO-VO workshop	http://euro-vo.org/workshop2005
5	Simple Footprint Previewing	http://wiki.eurovotech.org/bin/view/VOtech/SFoVReqs
6	Web Start evaluation report	http://wiki.eurovotech.org/bin/view/VOtech/WebStartEvalReport
7	Coordinate system support (WCS) for graphic files	http://wiki.eurovotech.org/pub/VOtech/DS4Plan01/wcs-jpegs.ppt
8	Requirements document for a positional cross match tool	http://wiki.eurovotech.org/bin/view/VOtech/CrossMatchReq

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

Date	Title/Subject of meeting	Location	No. of attendees	Website address
2004 Nov 18-19	Kick-off meeting	Cambridge	50	http://wiki.eurovotech.org/bin/view/VOTech/VOTechKickoff
2005 Feb 21-24	DS Review and Planning	Leicester	25	http://wiki.eurovotech.org/bin/view/VOTech/StageOnePlanningMeetings
2005 Mar 8-9	Technical Advisory Panel	Leicester	9	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage01
2005 Sep 14-16	DS Review and Planning	Edinburgh	25	http://wiki.eurovotech.org/bin/view/VOTech/StageTwoPlanningMeetings
2005 Sep 28-29	Technical Advisory Panel	Trieste	8	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage02

Deliverables. No formal deliverables for DS4 are planned until March 2007, when this task will produce the User Tools Study Report, followed by its first prototype release later that same year.

Other milestones. In addition to the above deliverables, DS4 is expected to make contributions to 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, at <http://wiki.eurovotech.org/bin/view/VOTech/UserTools>

These contributions have been successfully accomplished.

Milestone	Date Planned	Date Achieved (Expected)
Work Cycle plan (Stage 1)	2005 Feb	2005 Mar
Work Cycle plan (Stage 2)	2005 Jun	2005 Sep
Work Cycle plan (Stage 3)	2005 Dec	(2006 Mar)

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

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	Total
Person-months - funded		26.4			6.7	11.3	44.4
Person-months - contributed					2.9		2.9
Person-months - TOTAL		26.4			9.6	11.3	47.3

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.

The first goal of this task was to evaluate the existing tools related to the semantic web and ontologies, their capabilities, and what was achieved in other domains with these technologies. This was done during the first six-month stage of the project, and reports were posted on the project web site at

<http://wiki.eurovotech.org/bin/view/VOTech/OntologySurvey>

It was agreed from the beginning that no programming language was mandatory for the prototyping of implementations, but for interoperability reasons, ontologies would be saved and exchanged using the OWL (Web Ontology Language) standard, and the Protégé editor would be preferred for ontology edition. Three of the DS5 participants attended the 8th International Protégé Conference in July 2005 to improve their knowledge on the tool and explore possible collaborations with other teams.

The development of ontologies started, focusing on well-defined domains like the description of astronomical object types (based on the list of standard object types used in the SIMBAD database at CDS). A set of use cases is being defined during Stage02 in collaboration with DS4, in order to plan trial implementations during the next periods.

During the first year, we worked on several issues related to astronomical metadata management. The SAADA package (for automated database creation and management, see <http://amwdb.u-strasbg.fr/saada/>) was tested on various datasets available at ESO to test the management of heterogeneous metadata. This work led to a document summarizing a set of specifications and requirements for Metadata extraction.

As described in section 3-c, the work done in DS5 can contribute to the definition of standards for the IVOA. We created a set of tools for the management of the UCDs (Unified Content Descriptors), which became an IVOA standard during 2005. We also started working on a tool for helping retrieving and extracting tabular data for the construction of spectral energy distributions (SEDs): the tool uses UCDs to locate relevant resources in the VO Registry, retrieves their descriptions, and lets the astronomer extract homogenized data from heterogeneous resources. The development of this SED prototype has led to the suggestion of improvements to the IVOA Registry working group, and also to the first implementation of the Characterization data model developed by the IVOA Data Model working group. The SED tool will be demonstrated during the next IAU (International Astronomical Union) meeting in August 2006.

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

Date	Title/Subject of meeting	Location	No. of attendees	Website address
2004 Nov 18-19	Kick-off meeting	Cambridge	50	http://wiki.eurovotech.org/bin/view/VOTech/VOTechKickoff
2005 Feb 21-24	DS Review and Planning	Leicester	25	http://wiki.eurovotech.org/bin/view/VOTech/StageOnePlanningMeetings
2005 Mar 8-9	Technical Advisory Panel	Leicester	9	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage01
2005 Sep 14-16	DS Review and Planning	Edinburgh	25	http://wiki.eurovotech.org/bin/view/VOTech/StageTwoPlanningMeetings
2005 Sep 28-29	Technical Advisory Panel	Trieste	8	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage02

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. In addition to the above deliverables, DS5 is expected to make contributions to 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.

Milestone	Date Planned	Date Achieved (Expected)
Work Cycle plan (Stage 1)	2005 Feb	2005 Mar
Work Cycle plan (Stage 2)	2005 Jun	2005 Sep
Work Cycle plan (Stage 3)	2005 Dec	(2006 Mar)

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

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	Total
Person-months - funded		12	2		11.4	6	31.4
Person-months - contributed					7.4		7.4
Person-months - TOTAL		12	2		18.8	6	38.8

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 the DS6 topics within the reporting period. DS6 is unique within VOTECH in having a majority of staff who had not been previously involved in VObs development; these people having been brought into the DS6 team on the basis of their particular expertise in the areas of data mining and visualization, which are the focus of this design study. So, an important initial task was to **familiarise the new members of staff with the details of the Euro-VO infrastructure** developed by AstroGrid. This was achieved through demonstrations and tutorials at DS6 meetings, and by the preparation of a report on how to make existing data exploration tools VObs-compliant. This paper is available from the VOTECH wiki:

<http://wiki.eurovotech.org/bin/view/VOTech/Ds6ToolIntegrationReport>.

This has proven to be very successful, and only a small amount of DS6 effort has had to be devoted to providing advice and support to the new staff since it became available. It is also proving to be a very useful document for developers outside the project who want to integrate their own tools into the Euro-VO infrastructure, and so should extend the range of data exploration tools available through the Euro-VO beyond those produced by the DS6 team itself.

The first deliverable from DS6 is to be its **Software Survey**, which will describe existing data exploration tools which may be of relevance to VObs users and will discuss how they can be made available within the Euro-VO infrastructure. A preliminary survey of existing tools has been conducted:

<http://wiki.eurovotech.org/bin/view/VOtech/DS6SoftwareSurvey>

and its results are already influencing the direction of DS6 work. It became clear from this preliminary survey that few (if any) existing multivariate visualization tools would meet the challenging requirements in terms of the volume and dimensionality of the data which astronomers wish to visualize. Since one of the goals of DS6 is to work out how data exploration tools can be extended to run on **extremely large datasets**, it was obvious that a key research topic for DS6 would be to investigate techniques for reducing the volume and dimensionality of datasets prior to visualization. A draft of a detailed report on the range of such techniques has been written (and is available from the VOTECH wiki site at the following URL:

<http://wiki.eurovotech.org/pub/VOtech/DS6RelatedPublications/DimenReducAlgs.pdf>

and its conclusions have informed the design of a data selection tool, *Eirik*, which is currently being prototyped. This will initially aid the manual selection by users of subsets of rows and columns from tables for visualization, but future versions will incorporate algorithms for selecting automatically “interesting” sets of rows and columns on the basis of statistical tests.

One of the ways in which scalable data exploration services will be delivered is through parallelisation, and other members of the DS6 team have been developing **VOtechBroker**, which is an interface allowing computational jobs described using the Euro-VO workflow system to be despatched to compute-grid resources via a number of job scheduling/management systems widely used in the Grid community. This software will be of particular utility to DS6 for the running of large-scale statistical analyses, but will also be of great benefit to the other design study teams, as it effectively attaches Euro-VO to the Grid.

The new groups within the DS6 team include those from Catania/Bologna and Napoli who have developed, respectively, the **VisIVO visualization tool** and the **Astroneural data mining system**. These are both significant existing tools, developed specifically for astronomical data exploration over the course of many years, and their availability within the Euro-VO would be of great benefit to European astronomy. The first task for these two groups has been to port their software in preparation for integration into the Euro-VO: for the VisIVO team this has meant recasting existing Windows-only code to run under linux, while for Astroneural the task is to convert it from being an application running in the commercial

MATLAB environment to C. This work is progressing well, and it is hoped that both tools will be available as part of the first DS6 prototype software release.

Another area where visualization is of great importance in the nascent VObs is in the exploration of **metadata** to aid selection of relevant datasets from archives. Within Euro-VO this topic is being studied by the CDS, who have a great deal of experience of providing good visual tools for users. Progress has been made both in prototyping metadata visualization functionality and, in parallel, in developing the requisite standards, under the aegis of the IVOA. In particular, significant progress has been made by the CDS team in extending the existing Simple Image Access protocol and advancing the draft Characterisation Data model.

The final success of the first year of DS6 work has been the development of **PLASTIC**, the Platform for Astronomical Tool Intercommunication. This is a new protocol whereby data exploration tools can interact through the exchange of a defined set of messages and which enables astronomers to use them together for exploring their data. The motivation for PLASTIC came from the realisation that no single tool will ever be able to offer all the functionality required by astronomers, and that the set of existing tools, taken together, already provide much of what is wanted. So, instead of choosing one tool to extend significantly – adding to it the capabilities already present in other tools – it makes more sense to make the existing tools interoperable, and this is proving to be possible through the definition of a set of simple messages implementing the PLASTIC protocol. The developers of a number of leading VObs data exploration tools – both within VOTECH and beyond it – have taken the PLASTIC protocol to heart, and are now implementing it within their own software.

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

Date	Title/Subject of meeting	Location	No. of attendees	Website address
2004 Nov 18-19	Kick-off meeting	Cambridge	50	http://wiki.eurovotech.org/bin/view/VOTech/VOTechKickoff
2005 Feb 21-24	DS Review and Planning	Leicester	25	http://wiki.eurovotech.org/bin/view/VOTech/StageOnePlanningMeetings
2005 Mar 8-9	Technical Advisory Panel	Leicester	9	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage01
2005 Sep 14-16	DS Review and Planning	Edinburgh	25	http://wiki.eurovotech.org/bin/view/VOTech/StageTwoPlanningMeetings
2005 Sep 28-29	Technical Advisory Panel	Trieste	8	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage02

Deliverables. No formal deliverables for DS6 were planned during this reporting period. The first major deliverables for DS6 are the "Data Exploration Discovery Study Report" and the first prototype software release, both scheduled for the second reporting period.

Other milestones. In addition to the above deliverables, DS6 is expected to make contributions to 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.

Milestone	Date Planned	Date Achieved (Expected)
Work Cycle plan (Stage 1)	2005 Feb	2005 Mar
Work Cycle plan (Stage 2)	2005 Jun	2005 Sep
Work Cycle plan (Stage 3)	2005 Dec	(2006 Mar)

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

Participant number*	1	2	3	4	5	6	
Participant short name	UEDIN	ESO	LU	UCAM	CNRS	INAF	Total
Person-months - funded	21				8.8	8	37.8
Person-months - contributed	1				0.4	11	12.4
Person-months - TOTAL	22				9.2	19	50.2

1.4 Update of the non-confidential Project information

1.4.1 Project Summary

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 first year, VOTECH has achieved a strong degree of cohesion between partners across Europe working on Virtual Observatory Infrastructure and tools. Key concepts and existing software components have been exchanged and integrated. External tools and technologies in resource discovery and data mining have been assessed. Key areas for standardisation have been identified and taken onto the global agenda through. Several new infrastructure components have been developed jointly and working prototypes constructed.

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 for this reporting period and their status.

Deliverable Number	Deliverable Name	Lead Contractor	Planned Date (2005)	Achieved (Revised)	Comments
DS1-01	Project Website	LU	Jun	Jan	http://www.eurovotech.org
DS2-01	Project Plan	UEDIN	Feb	Mar	Available online at http://wiki.eurovotech.org/bin/view/VOTech/ProjectPlan
DS2-03	Science Framework Document	UCAM	Jun	(Jun 2006)	Deliberately postponed. Merged into larger plan for overall science planning of Euro-VO through new VO Science Advisory Committee (VOSAC)
DS2-04a	First Baseline software release	LU	Dec	Mar 2006	Available on-line through central download page at http://wiki.eurovotech.org/bin/view/VOTech/SoftwareDownload

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. We are now in the process of integrating this with a more general Euro-VO public web page. More active public relations will become relevant as the project matures.

Euro-VO partners. Euro-VO is being established by an MOU between eight European organisations and funding agencies. Regular progress reports are made to the Euro-VO Executive Board, which has now been enhanced by ESA membership. The VO Facility Centre (VOFC) is beginning operation, run jointly by ESO and ESA. VOTECH makes software and standards available to VOFC for integration into the evolving Euro-VO infrastructure. The Funding for the activities of the Data Center Alliance (DCA) through the EuroVO-DCA project are being negotiated in the FP6 Communication Network Development framework. A prime aim of DCA is providing effort to deploy VOTECH software.

International context. VO-TECH 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. Key amongst these are leadership of the new UCD standard (URL), as part of the DS5 resource discovery work, leadership of Registry (URL), Universal Worker Service (URL) and Web Services Basic Profile standards as part of the DS3 New Infrastructure work, and leadership in the Characterisation Data Model as part of DS6. Lawrence, Linde, and Walton, Pasian, Genova and Quinn are also members of the IVOA Executive. The first VO-TECH results in terms of proposals for international standards have been presented and discussed at the two 2005 Interoperability meetings (Kyoto, May 2005; Villafranca del Castillo, October 2005). In addition, visits of key staff from other IVOA projects to VO-TECH partners have been very useful for some of the VO-TECH objectives (e.g., visits to CDS of M. Ohishi, M. Tanaka and Y. Shirasaki of Japan VO (DS3); P. Osuna, A. Strebe and I. Ortiz of ESA (DS3); J. McDowell of US National Virtual Observatory (DS6)

Scientific community. Together with our Euro-VO partners, we helped to organise and staff a workshop to train data centre staff from across Europe in VO technologies to date (Munich, June 27 - July 1st 2005, <http://www.euro-vo.org/pub/workshop/index.html>). This was a highly successful start to this important activity. Since then all the partners have also been involved with similar workshops organised on a national basis. As well as this direct training activity, initial results from VOTECH studies have been disseminated to the astronomical community via talks at the annual ADASS conference (San Lorenzo de El Escorial, 2-5 October 2005, http://www.adass.org:8080/Conferences/2005/Venue/events/final_program) the main global forum for astronomical software matters. The next key opportunity for general community dissemination is at the General Assembly of the International Astronomical Union in Prague during August 2006.

Wider e-science links. Links with other scientific communities involved in e-science have mostly been undertaken at national level. However, the VOTECH project scientist (Walton) is the co-organiser (with Reagan Moore from San Diego Supercomputer Center) of an BOF grouping within the Grid Global Forum. VO-TECH partners participated in three thematic

meetings organized by CDS in the frame of the Massive Data in Astronomy project of the ACI MD, together with scientists from IT teams: Multispectral images, 15 March 2005 (WP6; INAF); Grid Workshop, 7 June 2005 (WP3; AstroGrid, INAF); Ontologies Workshop, 25 October 2005 (WP5; AstroGrid, INAF).

Licensing policy. The VOTECH project manager (Linde) has been leading the development of a license based on open-source principles, which we hope will become a standard agreed across the IVOA.

Publications

The following are example publications wholly or partly due to VOTECH work.

Markus Dolensky, Mark Allen, Thomas Boch, Francois Bonnarel, Sebastien Derriere, Pierre Fernique, Keith Noddle, Francesco Pierfederici, Riccardo Smareglia, 2005, *Status of the VOTech Design Study about User Tools*, ADASS XV, ASP Conf. Ser., eds. C. Gabriel, C. Arviset, D. Ponz and E. Solano, in press

E.De Filippis, M.Serenio, M.W.Bautz, G.Longo; *Measuring the Three-dimensional Structure of Galaxy Clusters. I. Application to a Sample of 25 Clusters*; The Astrophysical Journal, Volume 625, Issue 1, 2005

C.Gheller, U.Becciani, G.Castelli, M.Comparato, C.Donalek, G.Longo, F.Pasian, A.Pepe, R.Smareglia, G.Taffoni, R.Tagliaferri, C.Vuerli; *Development of VO-enabled Applications in Italy*; in: Astronomical Data Analysis Software and Systems 14, P.L.Shopbell, M.C.Britton, R.Ebert eds., Publications of the Astronomical Society of the Pacific

Paul Harrison, Jens Knudstrup, Andreas Wicenec, Markus Dolensky, 2005, *Implementing a VOStore Interface for NGAS*, ADASS XV, ASP Conf. Ser., eds. C. Gabriel, C. Arviset, D. Ponz and E. Solano, in press

A.Lawrence, 2005, *VOTECH : the next wave of technology for the European Virtual Observatory*, European Astronomical Society Newsletter.

G.Taffoni, G. De Gasperis, D.Maino, A.Zacchei, G.Castelli, C.Vuerli, F.Pasian, S.Ansari, J.Tauber, T.Ensslin, R.Barbera; *Prototypes of a computational grid for the Planck satellite*; in: Astronomical Data Analysis Software and Systems 14, P.L.Shopbell, M.C.Britton, R.Ebert eds., Publications of the Astronomical Society of the Pacific

G.Taffoni, C.Vuerli, A.Barisani, R.Smareglia, F.Pasian; *Running Cosmic Structure Formation on the GRID*; Computational Grids for Italian Astrophysics, in press

G.Taffoni, C.Vuerli, A.Barisani, R.Smareglia, F.Pasian; *Performing orbital satellite evolution using the GRID*; Computational Grids for Italian Astrophysics, in press

G.Taffoni, E.Ambrosi, C.Vuerli, A.Barisani, R.Smareglia, A.Volpato, S.Pastore, A. Baruffolo, A.Ghiselli, F.Pasian, L. Benacchio; *Bridging the Virtual Observatory and the GRID with the query element*; Computational Grids for Italian Astrophysics, in press

In addition a number of unpublished conference talks have been given, for example at the annual ADASS meeting. This is a specialist astro software meeting. In addition, a number of talks have been given during the first year of VOTECH describing the science aims of the

VOTECH project. These include those of Walton et al at the 'X-Ray Universe' conference (ESAC, Sep 2005) and Walton et al at IAU Symposium 232, 'The Science Requirements of Extremely Large Telescopes' (Cape Town, Nov 2005).

Annexes

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

First Board Meeting : 2004 Sept 2-3 (Edinburgh) . This was the first formal meeting of the consortium, and took place during contract negotiations, before the formal start of the project. All partners were represented, along with key senior staff provided by the partners, who would be responsible for technical project management and science leadership. Basic policy agreements were established for operation of the consortium, along with working methods. We also agreed deliverables and milestones for inclusion in the project contract.

Kick Off Meeting : 2004 Nov 18-19 (Cambridge) . This meeting was also before the formal project start. The aim was a scientific and technical debate to clarify key issues and aims before setting off on the programme of work. We invited all interested staff from the partner organisations, and guests from other related organisations. This lively meeting was both intellectually successful and important in setting a cohesive project ethos.

DS Review and Planning Meeting : 2005 Feb 21-24 (Leicester) . This was the first in our standard cycle of work planning meetings. It brought together all staff contributing to the project, presented the results of initial studies, and developed plans for the next six months for all task areas.

Technical Advisory Panel Meeting : 2005 Mar 8-9 (Leicester) . This was a slightly more formal meeting immediately following the DSRP. We reviewed the proposed plans from DS leaders, made minor adjustments, and discussed the contribution of each partner to these plans. Various other policy matters were discussed for recommendation to the Consortium Board, mostly concerning the precise management process and how partner efforts were to be monitored.

Second Board Meeting : 2005 June 28 (Munich) . This board meeting immediately followed the successful Euro-VO workshop. The partners reported progress in recruitment and other expenditure plans, and debated a variety of issues concerning our relation to the other strands of Euro-VO, and to the developing VO efforts of the European Space Agency. We also clarified uncertainties about the consortium management process, and how partner efforts were to be directed. We also agreed principles for establishing science requirements advice together with VOFC and DCA.

DS Review and Planning Meeting : 2005 Sep 14-16 (Edinburgh) . This was the second in our standard cycle of work planning meetings. Significant progress by all partners was reported, and plans were debated for the following six months.

Technical Advisory Panel Meeting : 2005 Sep 28-29 (Trieste) . We reviewed the proposed plans from DS leaders, made minor adjustments, and discussed the contribution of each partner to these plans. No significant policy discussions were necessary.

Tabular summary of General Meetings :

Date	Title/Subject of meeting	Location	No. of attendees	Website address
2004 Nov 18-19	Kick-off meeting	Cambridge	50	http://wiki.eurovotech.org/bin/view/VOTech/VOTechKickoff
2005 Feb 21-24	DS Review and Planning	Leicester	25	http://wiki.eurovotech.org/bin/view/VOTech/StageOnePlanningMeetings
2005 Mar 8-9	Technical Advisory Panel	Leicester	9	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage01
2005 Sep 14-16	DS Review and Planning	Edinburgh	25	http://wiki.eurovotech.org/bin/view/VOTech/StageTwoPlanningMeetings
2005 Sep 28-29	Technical Advisory Panel	Trieste	8	http://wiki.eurovotech.org/bin/view/VOTech/TapMeetingStage02

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

1. Project Summary

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.

2 Project website address : <http://www.eurovotech.org>

3 Project Achievements

In its first year, VOTECH has achieved a strong degree of cohesion between partners across Europe working on Virtual Observatory Infrastructure and tools. Key concepts and existing software components have been exchanged and integrated. External tools and technologies in resource discovery and data mining have been assessed. Key areas for standardisation have been identified and taken onto the global agenda through. Several new infrastructure components have been developed jointly and working prototypes constructed.

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

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

The table below summarises the status of project deliverables which were originally planned for delivery in this first reporting period.

Deliverable Number	Deliverable Name	Lead Contractor	Planned Date (2005)	Achieved (Revised) Date (2005)	Comments
DS1-01	Project Website	LU	Jun	Jan	http://www.eurovotech.org
DS2-01	Project Plan	UEDIN	Feb	Mar	Appended here. Also available online at http://wiki.eurovotech.org/bin/view/VOTech/ProjectPlan
DS2-03	Science Framework Document	UCAM	Jun	(Jun 2006)	Deliberately postponed. Merged into larger plan for overall science planning of Euro-VO through new VO Science Advisory Committee (VOSAC)
DS2-04a	First Baseline software release	LU	Dec	Dec	Available on-line through partner repositories. Central link page at http://xxxx

The deliverables are all available online. The Project Plan is also appended provided on a CDROM as per standard request.