



ASTERICS - H2020 - 653477

Second ESFRI Forum and Training Event

ASTERICS GA DELIVERABLE: D4.10

Document identifier:	ASTERICS_D4.10.docx
Date:	23 February 2018
Work Package:	WP4 Data Access, Discovery and Interoperability
Lead Partner:	INAF
Document Status:	Final
Dissemination level:	WP4
Document Link:	www.asterics2020.eu/documents/ASTERICS-D4.10.pdf

Abstract

The Second ASTERICS DADI ESFRI Forum and Training Event was held in Trieste on 13-14 December 2017. It hosted a session dedicated to newcomers in the Virtual Observatory (VO) held on the afternoon of December 12th. The Forum and Training event gathered technical staff from the DADI partners, the ESFRI key projects as well as the VO teams. Besides the newcomers' session, the event began with a quick introduction of the goals of the forum and training event itself, the status of the ASTERICS DADI Work Package (WP4) and the relationship between the VO and the FAIR principles. The core part of the event was divided into three main blocks: the first one dedicated to presentation of DADI related

status and requirements from the ESFRI and key projects, the second devoted to VO-related DADI contributions, and the third (on the 14th) featuring a general discussion and subsequent splinter sessions on the topics which had emerged on the previous day. Topics that emerged during the presentation session included data modelling for dataset discovery and representation, time domain aspects, radio data VO interoperability, polarimetry and spectro-polarimetry modelling, data provenance, solar data and its connections to the various virtual interoperable projects, gravitational waves catalogue dissemination. The general discussion was mainly a discussion of data modelling, while radio datasets discovery, time series (as a follow-up of a dedicated meeting held in Strasbourg on 5-6 December), possible dedicated workshops build-up for the research infrastructures and Vizier overview with the catalogue requirements in mind were left to the splinter sessions. Some or all of these topics will have a follow up in the oncoming Fourth ASTERICS DADI Tech Forum (D4.11, April 2018, Edinburgh) as well as probably at the Second European Data Providers Forum and Training Event (D4.12, 27-28 June 2018, Heidelberg).

The goals of the event, which were providing status and updates of ESFRI and the VO since the last Forum, getting feedback and then helping in planning the last part of the ASTERICS project within DADI perspective, have thus been reached.

I. COPYRIGHT NOTICE

Copyright © Members of the ASTERICS Collaboration, 2015. See www.asterics2020.eu for details of the ASTERICS project and the collaboration. ASTERICS (Astronomy ESFRI & Research Infrastructure Cluster) is a project funded by the European Commission as a Research and Innovation Actions (RIA) within the H2020 Framework Programme. ASTERICS began in May 2015 and will run for 4 years.

This work is licensed under the Creative Commons Attribution-Noncommercial 3.0 License. To view a copy of this license, visit <http://creativecommons.org/licenses/by-nc/3.0/> or send a letter to Creative Commons, 171 Second Street, Suite 300, San Francisco, California, 94105, and USA. The work must be attributed by attaching the following reference to the copied elements: "Copyright © Members of the ASTERICS Collaboration, 2015. See www.asterics2020.eu for details of the ASTERICS project and the collaboration". Using this document in a way and/or for purposes not foreseen in the license, requires the prior written permission of the copyright holders. The information contained in this document represents the views of the copyright holders as of the date such views are published.

II. DELIVERY SLIP

	Name	Partner/WP	Date
From	M. Molinaro, F. Pasian	INAF	
Authors	M. Molinaro	INAF, WP4	2018, Jan. 11th
Reviewed by	F. Genova	CNRS/CDS, WP4 lead	2018, Jan. 30th
Approved by	R. van der Meer		2018 Feb 23 rd

III. DOCUMENT LOG

Issue	Date	Comment	Author/Partner
1	10/01/2018	V01: First draft, based on the 2 nd ESFRI Forum & Training Event notes and minutes	M. Molinaro, F. Pasian, INAF
2	14/01/2018	V02: Comments on draft	F. Genova, CNRS/CDS
3	25/01/2018	V03: New draft taking into account F. Genova's comments	M. Molinaro, INAF
4	29/01/2018	V04: Version sent to M. Molinaro for comment	F. Genova, CNRS/CDS
5	30/01/2018	V05: Minor fix on participants	M. Molinaro, INAF
6	30/01/2018	V06: Final check	F. Genova, CNRS/CDS

IV. APPLICATION AREA

This document is a formal deliverable for the GA of the project, applicable to all members of the ASTERICS project, beneficiaries and third parties, as well as its collaborating projects.

V. DOCUMENT AMENDMENT PROCEDURE

Amendments, comments and suggestions should be sent to the authors. The procedures documented in the ASTERICS “Document Management Procedure” will be followed: <https://wiki.asterics2020.eu/wiki/Procedures>

VI. TERMINOLOGY

APC	AstroParticule et Cosmologie (CNRS)
ASTRON	Netherlands Institute for Radio Astronomy
CLEOPATRA	Connecting Locations of ESFRI Observatories and Partners in Astronomy for Timing and Real-time Alerts (ASTERICS WP5)
CNRS	Centre National de la Recherche Scientifique
CDS	Centre de Données astronomiques de Strasbourg
CTA	Cherenkov Telescope Array
DADI	Data Access, Discovery and Interoperability (ASTERICS WP4)
EGO	European Gravitational Observatory
ELT	Extremely Large Telescope
EOSC	European Open Science Cloud
ESFRI	European Strategy Forum on Research Infrastructures
ESO	European Southern Observatory
EST	European Solar Telescope
FAIR	Findable, Accessible, Interoperable, Re-usable

F&T	Forum and Training (event)
INAF	Istituto Nazionale di Astrofisica
INFN	Istituto Nazionale di Fisica Nucleare
INTA	Instituto Nacional de Tecnica Aeroespacial
IVOA	International Virtual Observatory Alliance
KM3NeT	Neutrino Telescope
LOFAR	Low Frequency Array
LSST	Large Synoptic Survey Telescope
OATs	Osservatorio Astronomico di Trieste
OC	Organizing Committee
RDA	Research Data Alliance
RI	Research Infrastructure
SAMP	Simple Application Messaging Protocol
SODA	Server-Side Operation for Data Access (previously AccessData)
SKA	Square Kilometer Array
TCG	Technical Coordination Group (IVOA)
UEDIN	University of Edinburgh
UHEI	Ruprecht-Karls-Universität Heidelberg
VO	Virtual Observatory
VOEvent	Sky Event Reporting Metadata
WP	Work Package
WP4	ASTERICS Work Package 4 Data Access, Discovery and Interoperability (DADI)

A complete project glossary is provided at the following page:

<http://www.asterics2020.eu/about/glossary/>

VII. PROJECT SUMMARY

ASTERICS (Astronomy ESFRI & Research Infrastructure Cluster) aims to address the cross-cutting synergies and common challenges shared by the various Astronomy ESFRI facilities (SKA, CTA, KM3NeT & ELT). It brings together for the first time, the astronomy, astrophysics and particle astrophysics communities, in addition to other related research infrastructures. The major objectives of ASTERICS are to support and accelerate the implementation of the ESFRI telescopes, to enhance their performance beyond the current state-of-the-art, and to see them interoperate as an integrated, multi-wavelength and multi-messenger facility. An important focal point is the management, processing and scientific exploitation of the huge datasets the ESFRI facilities will generate. ASTERICS will seek solutions to these problems outside of the traditional channels by directly engaging and collaborating with industry and specialised SMEs. The various ESFRI pathfinders and precursors will present the perfect proving ground for new methodologies and prototype systems. In addition, ASTERICS will enable astronomers from across the member states to have broad access to the reduced data products of the ESFRI telescopes via a seamless interface to the Virtual Observatory framework. This will massively increase the scientific impact of the telescopes, and greatly encourage use (and re-use) of the data in new and novel ways, typically not foreseen in the original proposals. By demonstrating cross-facility synchronicity, and by harmonising various policy aspects, ASTERICS will realise a distributed and interoperable approach that ushers in a new multi-messenger era for astronomy. Through an active dissemination programme, including direct engagement with all relevant stakeholders, and via the development of citizen scientist mass participation experiments, ASTERICS has the ambition to be a flagship for the scientific, industrial and societal impact ESFRI projects can deliver.

VIII. EXECUTIVE SUMMARY

The ASTERICS/DADI ESFRI Forum and Training events aim at bringing together staff from ESFRI facilities and VO developers to continue active participation in the development of the VO framework and to train ESFRI technical staff on the VO technical environment.

The goal of the Second ESFRI Forum & Training Event was to provide updates on the status of the projects, of the DADI Work Package and of the VO framework. It also aimed at verifying the status of VO acceptance within the projects after 2 years from the First ESFRI Forum & Training Event (D4.3, 3-4 December 2015, Trieste). The goals were reached, getting feedback on the developments made, and those planned, and evaluating what can be done by ASTERICS and DADI until the end of the project (April 2019).

Since EST (the European Solar Telescope) entered the list of ESFRIs after the previous Forum & Training Event and some new staff from the other projects planned to attend this event, a preliminary session on the VO dedicated to newcomers was prepared to introduce the

capabilities of the IVOA-enabled technologies and the landscape they live and are developed within. The usefulness of such a session was also a conclusion of the European Data Provider Forum and Training Event (D4.6, 15-17 June 2016), which did not include one.

After this session, held on 12 December 2017, a one-day-and-a-half schedule followed for the core Workshop, including a networking dinner. The tight meeting schedule was focused to limit the out-of-office time for the participants, letting the breaks and the dinner fill the need for more informal contact between the participants.

The first day of the event was filled in with contributed talks from ESFRI and pathfinder projects as well as contributions by DADI VO partners. While the former were focused on the VO developments and future plans of the projects and on highlighting the research infrastructure (RI) requirements, the latter reported on the status of VO specific efforts and latest tool and tool-kit developments. A report from ASTERICS CLEOPATRA (WP5) was also presented, including its connections to the time domain efforts within DADI. On the second day, discussion was then informed from the first day presentation topics.

The topics picked up from the contributions were: radio interferometric data discovery and representation in the VO, polarimetry and spectro-polarimetry, time domain interoperability, provenance, the need for workshops to disseminate knowledge of the VO solutions to the projects' scientific staff, connections between Vizier and gravitational waves catalogues, solar virtual initiatives and IVOA connections (especially regarding metadata annotations and standards), the role of data modelling in the interoperability scenario.

Some of the topics were discussed in an initial plenary session, especially data model and data access issues highlighted by the Research Infrastructure contributions. Polarimetry and solar and heliospheric data interoperability discussions had to be postponed to further collaboration due to early leaves of relevant participants. Discussions of radio interferometry, time domain, tutorials for dissemination and Vizier overview were granted splinter discussion sessions. Other networking topics and collateral discussions were taken care of by smaller groups.

The objectives of the Second ESFRI Forum and Training Event were reached, providing the current status of the projects and partners activities and future plans and identifying the topics to focus upon during the last period of the project.

Discussions held at this event will be followed up at the oncoming Fourth Technology Forum (D4.11, April 2018, Edinburgh), will be brought at IVOA level at the next Interoperability Meeting (28 May – 1 June, Victoria, BC, Canada), and will possibly continue at the Second European Data Provider Forum and Training Event (D4.13, 27-28 June 2018, Heidelberg).

Table of contents

I.	COPYRIGHT NOTICE.....	1
II.	DELIVERY SLIP	2
III.	DOCUMENT LOG	2
IV.	APPLICATON AREA	3
V.	DOCUMENT AMENDMENT PROCEDURE.....	3
VI.	TERMINOLOGY	3
VII.	PROJECT SUMMARY	5
VIII.	EXECUTIVE SUMMARY	5
	Table of contents.....	7
1.	Introduction.....	7
2.	Participants.....	9
3.	Meeting programme	10
4.	Proceedings & Analysis	12
5.	Conclusion and next steps.....	16

Content of Deliverable

1. Introduction

Technology Forums, successfully operated by European VO initiatives since the beginning of the VO experience, are devoted to building collaborations aimed at the development of software and architecture for the VO framework of standards and tools, following up their developments and sharing the results and lessons learnt. DADI continues them, widening the scope to ESFRI projects: already 3 *Technology Forums* were held since the beginning of the project and another one is about to happen in spring 2018. *ESFRI Forum and Training Events (ESFRI F&T Events)*, a new experience started by DADI, are meant to help developing the collaborations by identifying the core and common areas of interest of the ESFRI projects and their requirements, on the topics specific to DADI: data access, discovery and interoperability. The Events are also used to disseminate and discuss the pre-existing expertise of the VO partners, with specific connection to the IVOA activities and standards. Two of these events have been planned as ASTERICS deliverables for the DADI WP. The first *ESFRI F&T Event (D4.3)*

was one of the series of Workshops organised during the first months of ASTERICS to set up DADI collaboration and work programme. It was focused on gathering requirements from the ESFRI teams and strengthening networking among DADI partners. This *Second ESFRI F&T Event* had the goal to provide updates on the status and requirements, verify VO acceptance among ESFRIs, and get feedback in view of organising the activities during the last part of the ASTERICS project.

ESFRI Forums are networking and training events that fall within Task 4.1 of DADI, an activity coordinated by INAF-OATs and UHEI. The requirements gathered at these meetings are passed on to Task 4.3 to improve the VO framework. The networking activity should lead to actual technical support during DADI Workshops and during dedicated follow-up interaction or visits to projects sites. All this effort is meant to facilitate the uptake of the VO standards by the ESFRI projects. The discussions held at this *Second ESFRI F&T event* provided indeed topics to follow up at the next *Technology Forum*.

An evolution this time was to officially invite EST to participate. EST entered the ESFRI list in 2016. Two EST members participated in the First Data Provider Forum and Training Event organised in Heidelberg on the same year, which showed mutual interest. Also one of the recommendations of ASTERICS review was to strengthen the links with EST. It was decided to offer the project to be involved in the organisation of the meeting and to send representatives.

The ESFRI Forum programme was built starting from a video conference of the event Organizing Committee (OC) involving representatives of DADI partners, and a representative of EST, which was held on 29 September 2017. This gave the start to an agenda that took into account, alongside the status reports from ESFRIs and VO experts, the idea of a newcomers sessions for people approaching the IVOA scene for the first time. The OC also pointed out that a fair amount of time should be devoted to discussion. Among the topics presumed to be discussed, time domain issues, provenance, and solar system data requirements were listed.

The programme then evolved taking into account contributions submitted during the registration phase and ended up with a good share of ESFRI contributions (~60% of the talks) and VO partners or experts talks (the remaining part of the first day). This left a full morning for discussions beyond the usual question time at the end of the presentations.

The schedule was prepared since the beginning to fit a one-day-and-a-half time span, to help participants fit the event in their schedules. Nonetheless the second day afternoon was made available for further discussion for those who could plan a longer stay.

The ASTERICS Deliverable 4.10 “Second ESFRI Forum and Training Event” was organized by INAF-OATs in the Villa Bazzoni building of the INAF – Astronomical Observatory of Trieste on 13 – 14 December 2017, with a VO newcomer session attached to it the day before (12 December 2017). Remote participation was made possible. Participation in the event is described in Section 2 of this document, Section 3 is devoted to detailing the meeting programme while Section 4 describes the meeting development and outcome and Section 5 briefly describes the next steps.

The page <https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:wp4esfriforum2> displays the agenda with the slides presented during the meeting, notes taken during the discussion of the topics, and the list of participants.

2. Participants

The forum gathered 29 participants (including 3 remote participants, one of them performing a remote presentation) representing INAF, CNRS/CDS, APC and LUTH, UEDIN, INTA, UHEI, ASTRON, JIVE, as well as the CTA, SKA, LOFAR, EGO/Virgo/ET, EST, ELT and ESO. Participation thus involved most of the partners to the DADI WP as well as nearly all the ESFRI and pathfinder projects, including the ESO associate partner, plus EST as explained.

ESFRI projects committed specific technical people to bring useful contribution and requirements to the event and report on what was done and is planned for the future with respect to DADI topics. EST participated for the first time in this kind of event and reported both the status of the telescope itself and the ongoing work in interoperability and data management foreseen for it. The WP leader of the CLEOPATRA ASTERICS WP5 also participated and reported on the status of the package he coordinates, which is particularly relevant for DADI activities in the time domain.

The majority of the attendees have technical profiles, as required by the meeting goal, but with the presence of scientists and people having also a scientific background in the ratio of about 4 to 1, thus ensuring that the scientific requirements were fully taken into account. Figure 1 below reports the pie chart of the countries of origin (in terms of affiliation) of the attendees.

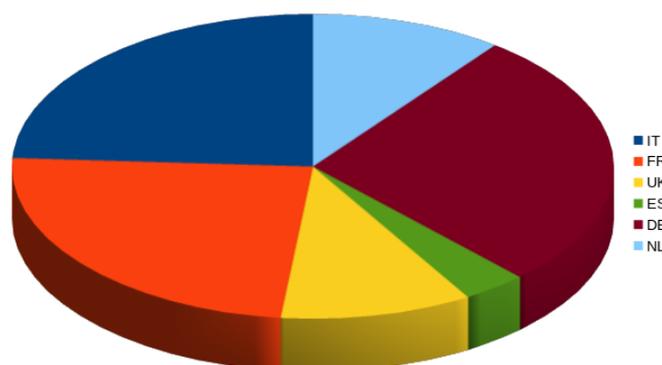


Figure 1: Country of affiliation of the participants

The number of participants is comparable (slightly higher) with respect to the previous ESFRI F&T Event, showing a continued interest in the topics proposed and in the technological effort underlying this kind of events.

One more thing to note was the high number of members of the IVOA Technical Coordination Group (TCG) that attended this event, 8 out of the 29 participants. The members of the TCG are the chairs and vice-chairs of the IVOA Working and Interest Groups. Their presence ensured both that the meeting was fully informed of IVOA activities and that its findings will be properly taken into account at the IVOA level.

3. Meeting programme

The *Second ESFRI Forum and Training Event* programme (see tables below) was initially drafted from the ideas collected by the OC, based on the project ongoing efforts as well as the VO advance, i.e. from ESFRIs discovery, access and interoperability requirements on their data archives and from the standardization process and developments within the IVOA community.

Programme refinement were subsequently based on the proposed contributions from the participants (ESFRI and VO partners) and a final setup with a few identifiable blocks was arranged as reported in the following tables.

The VO newcomer prior event (Table 1 below), as already said, was meant to give an overview of the possibilities the VO offers to the researchers and how a data provider can implement them. The target audience was technical staff of the ESFRIs that were not familiar with VO technologies.

Day 0 - Tuesday December 12		
15:00-18:00	VO primer for newcomers	
	Use case	Hendrik Heini
	Introducing the IVOA	Françoise Genova
(16:00)	coffee break	
	Use case traverse with WG insight	Hendrik/Markus/Marco

Table 1: VO Newcomer Session agenda

Participants to the newcomer session (most of them involved in the EST data management or in the gravitational waves field) were presented with a scientific use case of the VO performed by a VO dissemination expert. After that, an overview of the IVOA architecture and governance was introduced by DADI WP leader and, finally, the same use case was scanned with stop marks where an IVOA standard was involved; at these stop marks detailed explanation was given to the audience.

Day 1 - Wednesday December 13		
09:00-09:15	Welcome, Logistics, Objectives of the meeting	Marco Molinaro
09:15-10:00	FAIR principles and the VO, DADI status	Françoise Genova
10:00-11:00	Contributions by the ESFRI projects and precursors	
10'	EST project overview	Ilaria Ermolli
20'	EST community related to solar VO and DH	Nazaret Bello-González
30'	SKA DADI requirements	Rosie Bolton
11:00-11:30	coffee break	
11:30-13:00	Contributions by the ESFRI projects and precursors	
15'	First ASTRON/LOFAR steps towards the VO standards	Marco Iacobelli
30'	CTA DADI status	Mathieu Servillat
20'	The Dawn of Multi-Messenger Astronomy	Giuseppe Greco
20'	LIGO/Virgo open science	Agata Trovato
13:00-14:00	lunch break	
14:00-15:00	Contributions by the ESFRI projects and precursors	
20'	VO-protocol-based access to the ESO Science Archive Facility	Alberto Micol
20'	The ESO Science Archive: towards the La Silla Paranal Armazones Observatory	Martino Romaniello
20'	LSST:UK Data Access Centre	Andy Lawrence
15:00-15:20	Status of the Cleopatra Work Package	Arpad SZomoru
15:20-16:00	Contributions by DADI partners	
25'	Summary of DADI contribution to IVOA TimeDomain effort	François Bonnarel
15'	VOEvent status report	Dave Morris
16:00-16:30	coffee break	
16:30-18:30	Contributions by DADI partners	
20'	ASTERICS: suggestions for the project's end period	Hendrik Heint
25'	Provenance: status	Mireille Louys
15'	PURX	Markus Demleitner
25'	AladinV10/AladinLite functionalities for ESFRI projects and others	François Bonnarel
20'	A VOSpace deployment: interoperability and integration in big infrastructures	Sara Bertocco
20:00	Working Dinner (Networking towards dedicated meetings for ESFRIs)	

Table 2: ESFRI Forum and Training Event - Day 1 agenda

Table 2 reports the schedule of the first day of the Second ESFRI F&T Event. After a quick introduction with usual logistics information, a status report of the DADI Work Package was presented alongside an explanation of the connections and commonalities between the IVOA scene and the FAIR principles for Open Data management.

After that, the day was mainly divided in two blocks, the first one dedicated to the presentation by the ESFRI representatives, and the second one contributed by DADI and VO experts.

At the end of the day a working dinner was organized to enable networking and continue discussing given the tight and compressed event schedule.

Day 2 - Thursday December 14	
09:00-10:00	1st day report and general discussion
10:00-11:00	splinter sessions
	Radio Data discovery
	Tutorials Overview for RIs Workshops
11:00-11:30	coffee break
11:30-13:00	splinter sessions
	Radio topic - continued
	Vizier overview to the benefit of GW & al.
13:00-14:00	lunch break
14:00-15:00	Wrap-up and actions
(15:00)	Additional Hands-on / splinter time slot
	Time Domain

Table 3: ESFRI Forum and Training Event - Day 2 - Discussion session

The second day of the event was left open for general discussion and dedicated splinter sessions or hands-on meetings among the participants (Table 3). The initial part of the morning was actually used for a wrap up of the previous day and discussion of topics of general interest. After that, 2 sessions were used for splinter meetings on selected topics.

After lunch, a wrap up of the full meeting took place and the event was eventually closed, leaving free room and time to those interested in continuing discussions.

A more detailed view of the event content is provided in the next section

4. Proceedings & Analysis

The event started with an introduction, not only on the status of the DADI WP, but also on the alignment between the FAIR principles for open data, currently highly disseminated and of high interest for the European Commission, for instance through the EOSC (European Open

Science Cloud) initiative, and the discovery, accessibility and interoperability scenario that the Virtual Observatory has been developing for the astrophysical community for more than 15 years. Points were made about the re-use of the VO technologies outside the IVOA community (VAMDC, EuroPlanet RI, material sciences through a RDA Working Group), and about the connections to other open data initiatives like EUDAT or RDA.

After this introduction a series of presentations from the ESFRI projects and precursors provided an overview of the status of and requirements for their data management. Talks were held for: EST, SKA, LOFAR/ASTRON, CTA, EGO/Virgo, ESO & ELT and also for the UK effort related to LSST (which is not an ESFRI but a large international project with efforts also in several European countries).

EST and SKA showed the terrific amount of data that they will have to manage. But their similarities nearly stop there, the first one being a single-site telescope and the latter a globally distributed radio interferometer. EST data management is already focussing on interoperability and metadata annotation of its datasets. Efforts have been existing for a long time in the solar community, but mainly for space-based observations, towards interoperable data access and discovery, the so-called Solar Virtual Observatory. EST data management teams are trying to bring ground-based solar and heliospheric observations at the same level. Polarimetry and spectro-polarimetry and metadata are the main focus topics for this community. Trying to bring together European and North America solar virtual observatory efforts (even if not in the scope of ASTERICS) could be a benefit for all and may attach to IVOA efforts.

SKA talk pointed out the role of the SKA Regional Centres (SRC) that will actually provide data and services to the scientific community. Anyway a common gateway, a single general entry point for discovery of SKA resources, is planned, even if it is not yet known whether it would be managed by the SKA Organization directly or by SRCs themselves. A point not yet clear for SKA is whether VO technologies will sit at the core of the data infrastructure of the observatory or simply work as a layer deployed towards the user community.

ASTRON presentation showed the continuing efforts for building a VO interface and archive for its data resources, not only the LOFAR one. An interface, AstroWISE, will serve all the data resources and provide some processing pipeline functionalities. Current efforts are on science ready data, with metadata enrichment being the largest effort going on. Radio interferometry and its attachments to a discovery scenario inside the current VO framework was one of the topics that led to a dedicated splinter meeting on the second day of the event.

The CTA talk pointed out how the project is moving from the experiment-based view of high-energy particle physics into a more observatory-like implementation. CTA uses VO technology at its core data management solution, plus it has been directly involved from the beginning in the development of the IVOA Provenance model to describe dataset generation from raw data to higher scientific products. Authentication and authorization is also another point of interest for CTA.

Gravitational Waves (GW) contribution focused on the one hand on the usage of VO Application standards for analysing their datasets and interoperate them through existing VO-aware tools (like Aladin). Interest is focused on footprints, tessellation and application-to-application messaging. On the other hand, activity is going on to bring GW observations into an open data scenario. A splinter discussion took place on the second day to have a look into the Vizier database to see how it could host an evolving catalogue of GW events.

ESO presented both its internal efforts in implementing and using the VO standards and technologies and the ELT expected impact in its internal scenario. The latter is seen as an improvement of the existing VLT system, with an increase in the amount of data, but not a dramatic one, especially when compared to EST and SKA figures. ESO presentation on the efforts in implementing the VO stack of standards and protocols points also out a set of issues identified during the development phase that will be brought at the IVOA TCG level (mainly Data Access Layer) for discussion.

The last talk contributed from ESFRI, precursors and other large RIs was given by LSST UK. The main issue to face for LSST is the continuous flow of events and its attachment to the VOEvent scenario. Besides that follows the effort, sitting in the hands of the community and not the telescope itself, to deliver science ready data and services. The UK project dedicated to this will also provide data mining, time domain and general VO services on top of the data they will mirror. The time domain splinter on the second day focused on assessing the status of the VO in that respect.

After the ESFRI contributions, before the DADI/VO ones, a status report of the CLEOPATRA work package (ASTERICS WP5) was given, where, besides reporting the White Rabbit experiments made in connection to WP3 (OBELICS), a view on the VOEvent standard was given from the perspective of the new multi-messenger astronomy.

Contributions from DADI partners and VO experts collected status reports and tool and tool-kit presentations.

From the Time Domain community all DADI contributions to the IVOA efforts on the topic were summarized, including the meeting held at CDS in Strasbourg¹ the week before the ESFRI F&T event. Time series dataset discovery, access and modelling efforts and issues were reported, including possible actions to take them at the standardisation level. Working on current standards (ObsCore, SIAv2 namely), it should be possible to accommodate the basic requirements from the various use cases.

1 <https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:timeseriesdatameeting>

A specific report was presented on the evolution of the VOEvent specification, of high priority to LSST. Here the goal is to find a path towards merging technologies currently used by the specification to the proposed ones, needed to cope with the high event throughput (Apache Avro and JSON serialisation of the event messages, and Apache KAFKA as the transmission protocol).

ESO then introduced the need for dedicated, on-site at the research infrastructure venue, tutorials and hands-on sessions to be organized in this last period of the project. The discussion followed into a dedicated splinter the second day.

A report was presented on the status of the Provenance data model, showing how it is moving towards a discoverable structured set of information on datasets, including examples and a possible attachment into a TAP based service. This effort has attachments to RDA, as well as DADI and the IVOA.

The last three talks presented tools available that may be used by ESFRIs in their interoperability stack developments: PURX, an HTTP simple transfer based solution to publish VOResource records in the IVOA registry; evolution of the Aladin tool with HiPS integration, AladinLite for web portals embedding and a solution to embed Aladin into Jupyter notebooks; and a pre-packaged solution for installing a VOSpace instance.

This led to the close of the first day, with the subsequent dinner devoted to connecting the participants; the event restarted in the morning of December 14th with a summary of the topics which had emerged from the previous day presentations and discussions.

A plenary discussion took place on the role of data modelling in the interoperability context, including the distinction between modelling for dataset discovery (e.g., like the ObsCore case) and modelling for representational purposes.

Subsequently splinter sessions took place: four main topics were identified, while face to face discussions between groups of two or more on specific minor topics were formed on the fly by the participants.

The main topics were: radio interferometric data discovery using VO technologies; a time domain discussion and more detailed report; a follow up discussion on preparing tutorials and use cases dedicated to a specific RI; and a Vizier database overview to the benefit of GW and other interested participants. Notes about the outcomes of these splinters can be found attached to the F&T Event wiki page.

The final wrap-up of the meeting helped cross feeding the participants and discussing the future events which should include discussions of the radio and time domain topics, the Fourth Technology Forum and the Second European Data Providers F&T Event.

5. Conclusion and next steps

The Second ESFRI Forum and Training Event was a successful and dense meeting that continued the networking among ESFRIs and VO expert groups, checked the status of the VO technologies take up by the various involved projects and research infrastructures, and provided a place to gather requirements for the subsequent Technology Forums and other tasks of the DADI package.

In this event the focus moved on from the previous “multi-dimensional data” topic to the radio interferometry, polarimetry and time domain areas. This is linked to the fact that the initial set of VO multi-D standards is now complete. Time domain has been one of DADI priorities from the beginning, and progress is done in collaboration with the research infrastructures to gather use cases. A preliminary discussion on interferometric data had been held with LOFAR in a dedicated meeting (Strasbourg, 18 November 2016)², and the subject has matured so that the relevant research infrastructures contribute comments and requirements.

Participation in the meeting was good, representing nearly all the DADI partners and involved projects. The schedule was tight. It could probably have fitted an additional half-day, but this happened in practice since some participants continued discussion in the available rooms till the 14th evening, mainly on Time Domain and radio interferometry.

The first attempt to have a newcomer session to level up IVOA/VO knowledge among the participants proved to be a good choice, allowing the less VO knowledgeable attendees to better follow the concepts used during the presentations and discussion sessions of the Forum.

Participants will continue to work on topics such as radio data modelling, time domain serializations, application developments and similar. They will certainly be topics for the oncoming Fourth Technology Forum (April 2018, Edinburgh) and, probably, the Second European Data Providers Forum and Training Event (June 2018, Heidelberg). The Technology Forum is a good venue for technical hands-on activities to solve direct implementation issues while advancing the VO technology architecture.

Inputs to task 4.3 of DADI involve updates and discussion of specific aspects of the IVOA Data Access Layer activity, mainly for addition of dataset discovery use cases related to radio interferometry and time series requirements. This should lead to revisions or additions to the current ObsCore/ObsTAP specifications and SIAv2/SODA protocols.

² <https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:wp4lofarstrasbourg2016>

EST participation was also a success, and gave rise to a formal proposal for collaboration (also including collaboration in the frame of OBELICS) received early January by ASTERICS.

In addition to the events organised directly by ASTERICS, follow ups are expected to happen also at IVOA level in the work of IVOA Working and Interest Groups and during the IVOA “Northern Spring” 2018 Interoperability Meeting to be held in Victoria (BC, Canada) in the 28 May – 1 June week. Activities such as Provenance may also find a place at RDA plenary meetings (the next one is scheduled in Berlin, 21-23 March 2018).