ASTERICS - H2020 - 653477

First ASTERICS DADI Technology Forum

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Abstract

The First ASTERICS DADI Technology Forum was held in Strasbourg on 17 - 18 September 2015. It gathered almost all the teams involved in WP4 and was a successful kick-off of WP4.

General presentations were made about the ASTERICS project, the details of WP4 (DADI), and also about the IVOA framework. The goals were: information sharing among WP4 partners, presentations of several on-going technical activities, and open exchange on topics that emerged from discussions, as well as preparation of the Sydney IVOA Interoperability meeting and the First ESFRI VO Forum and Training Event (D4.3). ESFRI partners presented their activities and needs, VO partners presented their activities and expertise. Focus was given to several technical activities, and open discussions on several topics proposed by the participants were held during the so-called ”hack-a-thon” sessions. The meeting atmosphere was excellent and it allowed many exchanges and discussions. The status of several IVOA standards of interest for the ESFRI partners was discussed in preparation for the Sydney IVOA Interoperability meeting, which will be held 30 October – 1 November 2015. Preliminary topics for ESFRI-VO common work were identified, and these are to be confirmed during the ESFRI Forum and Training event in December.
This first Technology Forum allowed WP4 partners to build knowledge about the partners' activities and to start discussion and collaboration on technological topics. The second one will be organised in Edinburgh in 2016 by the UEDIN partner and will focus on discussion of on-going technological work, status report on the topics identified for ESFRI-VO collaboration, open exchange on topics defined on the spot through the hack-a-thon sessions, and preparation of the Cape Town IVOA Interoperability meeting which will be held on 8 - 13 May 2016.

I. COPYRIGHT NOTICE

II. DELIVERY SLIP

	Name	Partner/WP	Date
From	F. Genova	CNRS	31 October 2015
Authors	F. Genova (CNRS-CDS), M. Allen (CNRS-CDS), K. Noddle (UEDIN), A. Lawrence (UEDIN)	CNRS, WP4	
Reviewed by	WP4 partners		12 October 2015
Approved by	R. van der Meer, G Cimò	ASTRON	3 November 2015

III. DOCUMENT LOG

Issue	Date	Comment	Author/Partner

1	20 September 2015	First draft (V01) for discussion with co-authors, M.G. Allen (CNRS/UMR 7550) . Lawrence (UEDIN) and K. Noddle (UEDIN)	F. Genova, CDS
2	5 October 2015	Updated draft (V02) sent to WP4 partners for comments	F. Genova, CDS
3	12 October 2015	Minor updates (V03) following WP4 partners' comments	F. Genova, CDS
4	16 October 2015	Minor updates (VO4) following the first comments from the Project Manager	F. Genova, CDS
5	26 October 2015	Suggestions from Project manager and Project Scientist	R. van der Meer, G. Cimò, ASTRON
Final	31 October 2015	Final version taking into account the comments	F. Genova, CDS

IV. APPLICATON 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. TERMINOLOGY

ADASS	Astronomical Data Analysis Software and Systems
APC	AstroParticule et Cosmologie
ASTRON	Netherlands Institute for Radio Astronomy
B2FIND	Metadata catalogue of research data collections stored in EUDAT data centres and other repositories
CDS	Centre de Données astronomiques de Strasbourg
CNRS	Centre National de la Recherche Scientifique
CTA	Cherenkov Telescope Array
DaCHS	Data Center Helper Suite
DADI	Data Access, Discovery and Interoperability (ASTERICS WP4)

DAL	Data Access Layer
DOI	Digital Object Identifier
E-ELT	European Extremely Large Telescope
EGO	European Gravitational Observatory
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
ESO	European Southern Observatory
EUDAT	European Data Infrastructure
Euro-VO	European Virtual Observatory
GAVO	German Astrophysical Virtual Observatory
HiPS	Hierarchical Progressive Survey
INAF	Istituto Nazionale di Astrofisica
INTA	Instituto Nacional de Tecnica Aeroespacial
IVOA	International Virtual Observatory Alliance
LOFAR	Low Frequency Array
LUTH	Laboratoire de l'Univers et de ses Théories
MOC	Multi-Order Coverage
OAT	Osservatorio Astronomico di Trieste
ObsCore	Observation Core Data Model
pgsphere	Provides spherical data types, functions, and operators for PostgreSQL
SQL	Structured Query Language
TAP	Table Access Protocol
TOPCat	Tool for Operations of Catalogues And Tables
UEDIN	University of Edinburgh

UHEI	Ruprecht-Karls-Universität Heidelberg
UMR	Unité Mixte de Recherche
VIRGO	Interferometer for detection of Gravitational Waves
VO	Virtual Observatory
VOEvent	Sky Event Reporting Metadata
W3C	World Wide Web Consortium
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/glossary/

VI. 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 & E-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.

VII. EXECUTIVE SUMMARY

The First ASTERICS DADI Technology Forum was the first occasion to gather the ASTERICS WP4 team. The meeting was organised to allow sharing of information about the ASTERICS project and ASTERICS WP4, about the partners' expertise, and about the Virtual Observatory (VO) framework and work currently on-going in the partners' teams. The "hack-a-thon" sessions allowed participants to hold open discussions on points of common interest.

The meeting fulfilled its objectives, and was an efficient first step to build the ASTERICS WP4 community. A first list of topics of interest for the ESFRIs and pathfinders was established, some of them already tackled in collaboration with VO teams, i.e. Provenance. The strategy with respect to the next IVOA Interoperability meeting was also discussed. The status of the IVOA standards that are being prepared to support better multi-dimensional data in the VO was assessed. This is one of the current priorities of the IVOA as well as one of the initial strands of work of ASTERICS WP4. The strategy to discuss the Hierarchical Progressive Survey (HiPS) in the IVOA framework was also debated.

The next steps are the RDA Plenary meeting, held in Paris 23 - 25 September 2015, and the IVOA Interoperability meeting and its companion ADASS meeting which will be held in Sydney during the period 25 October - 1 November 2015. The next WP4 deliverable will be the First ESFRI Forum and Training Workshop, which will be held in Trieste 3 - 4 December 2015. The results of the First DADI Technology Forum will be used as input to establish the Workshop programme.

This first meeting was instrumental for exchanging background information on the project, the partners and the Virtual Observatory. The next DADI Technology Forum will be organised in Edinburgh by UEDIN during the first trimester of 2016. This second meeting will be more focussed on technology aspects and collaborations.

Table of contents

1. Introduction

The European Virtual Observatory initiative began to organise regular “Technology Forums” during the VO-TECH Design Study (2005-2009). VO-TECH was led by the University of Edinburgh (UEDIN), now co-lead of the ASTERICS WP4 Task 4.3 with CNRS/UMR 7550-CDS. These meetings gathered the European teams involved in the development of the VO framework of standards and tools to disseminate information about technological activities and expertise, to build collaborations, to discuss future activities and to coordinate European participation in bi-yearly International Virtual Observatory Alliance (IVOA) “Interoperability” meeting. The astronomical Virtual Observatory is an international endeavour, and the IVOA

leads the development of the interoperability standards, in which European teams have been playing a key role since the beginning.

The usefulness of these meetings was immediately obvious, and they were continued by all of the follow-up projects funded by the European Commission in the e-Infrastructure framework during FP7: the Integrated Infrastructure Initiative Euro-VO Astronomical Infrastructure for Data Access (EuroVO-AIDA, 2008-2010), as well as the two small Coordination Actions on which the coordination of European VO activities relied from 2010 to 2015: Euro-VO International Coordination Empowerment (EuroVO-ICE, 2010-2012) and Collaborative and Sustainable Astronomical Data Infrastructure for Europe (CoSADIE, 2012-2015).

Coordination of technological activities has been identified as one of the three pillars of the European Virtual Observatory[1], together with the support given to data providers to publish their data in the VO, and to astronomers in their usage of the VO. It was clear, when the *Data Access, Discovery and Interoperability* Work Package was set up for the ASTERICS proposal, that regular gatherings of the technical teams would be necessary. In addition to continuing the coordination of the technical work on VO development in Europe, Technology Forums were also identified as a key vehicle to put in touch the technical teams working on the VO and those from the ESFRI and pathfinder teams, to share knowledge and build collaborations on technical work. The Forums are thus part of ASTERICS WP4 Task 4.3 "*Update of the VO framework from feedback and requirements*". The ESFRI Forums and Training Events organised within Task 4.1 "*Support to astronomy ESFRI facilities, their pathfinders and other infrastructures of pan-European interest for implementation of their data in the VO framework*" are aimed to support the uptake of the VO framework by the ESFRIs and pathfinders, and to gather their requirements. The first of those events will be organised in Trieste by INAF on 3 - 4 December 2015.

ASTERICS Deliverable 4.1 "*First ASTERICS DADI Technology Forum*", organised by CNRS/UMR 7550-CDS in Strasbourg on 17 - 18 September 2015, has been the first event organised by ASTERICS WP4. Participation in the meeting is described in Section 2 of this document. In addition to the above mentioned aims of an ASTERICS Technology Forum, the meeting was also organised as the WP4 kick-off. The attendance at the ASTERICS kick-off organised in Dwingeloo in May 2015 was limited to the partners' managerial level. The Technology Forum was the first occasion to gather the partners' teams and to have them work together, and to disseminate information about ASTERICS and WP4. The WP4 wiki was updated before the meeting to display essential information about the WP4 objectives and tasks, and the meeting programme was organised to disseminate relevant information, in addition to technical discussions. This is detailed in Section 3. Findings and results are analysed in Section 4. The next steps are given in Section 5.

[1] Genova,F., Allen, M.G., Arviset, C., Lawrence, A., Pasian, F., Solano, E., Wambsganss, J. : Euro-VO – Coordination of virtual observatory activities in Europe, Astronomy & Computing, Vol. 11, pp. 181-189, 2015, ArXiv 1506.06567

The meeting web site https://www.astron.nl/asterics/doku.php?id=open:wp4:wp4techforum1 displays the agenda with the viewgraphs presented during the meeting and the list of participants.

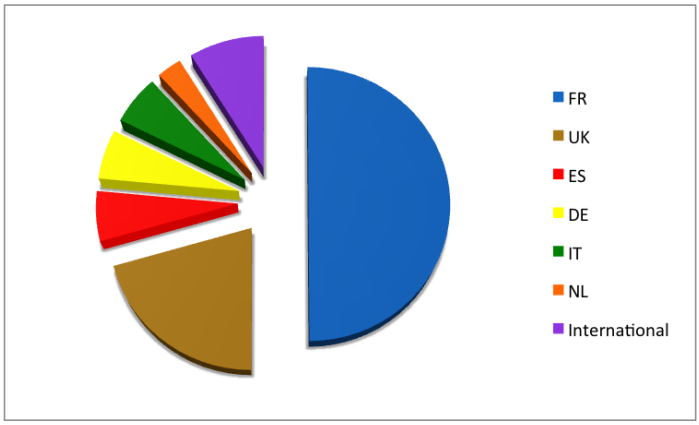
2. Participants

The meeting gathered 34 participants. All WP4 partners except KM3Net were represented, i.e. representatives from ASTRON (LOFAR), CNRS/CDS, CNRS/LUTH (CTA), CNRS/APC (VIRGO/EGO), INAF, INTA, UEDIN and UHEI attended the meeting. The UK partner was successful in bringing relevant experts from several Universities in addition to Edinburgh (Bristol, Glasgow, Manchester). KM3Net was unable to attend because the Technology Forum was held at the same time as a major conference in the domain, the so-called VLVvT (Very Large Volume Telescope) 2015 Workshop[2], and they have not yet hired staff dedicated to WP4. For logistical reasons it was not possible to organise the Technology Forum at another time. ASTERICS Project Manager presented the project at the VLVvT Workshop.

It is worth noting that ESO, which is an associate partner of ASTERICS and in particular of WP4 for E-ELT, was represented, as was ESA, which is not formerly an ASTERICS partner but has been closely associated with the Euro-VO project, both on their own resources. The current chair of the IVOA Executive Board, Christophe Arviset is the Head of ESA Science Archives and Computer Support Engineering Unit. He attended the meeting and presented the introductory talk on the IVOA architecture. The ESA future Multi-Mission Interface was also presented.

Attendee profiles were a healthy mixture of scientists and software engineers working in VO and ESFRI/pathfinder teams, about one quarter of the participants with a scientist profile.

Figure 1: Origin of the participants



[2] http://www.phys.uniroma1.it/fisica/archivionotizie/vlvvt-2015-workshop

3. Meeting programme

As explained in Section 1, the meeting programme was customized to allow for presentations of the VO for the newcomers from the ESFRI/pathfinder teams, of ASTERICS and WP4, and of the WP4 partner activities relevant to WP4. These talks were presented on the first day, and they led to lively discussions, in particular to identify the specific interests of the ESFRI/pathfinders. The second day was devoted to activities more usual in the framework of Technology Forums: presentations of the partners' technical activities and of the status of relevant IVOA standards, and hack-a-thon sessions, which as explained allow open discussions on topics defined by the participants.

Day 1	***Thursday September 17***	
9h	Coffee	
9h30	Introduction to the Tech Forum, and round table introductions	Mark Allen & Keith Noddle
9h40	Introduction to ASTERICS	Francoise Genova
10h	Architecture of the IVOA	Christophe Arviset (also IVOA Architecture Document)
10h30	Coffee	
11h	*Supporting VO infrastructure, DADI activities*	
	Technical Sustainability of the Euro-VO	Mark Allen
	ASTERICS DADI Activities	Francoise Genova
12h30	Lunch	
14h	*Presentations of ESFRI and pathfinder projects*	
	EGO/VIRGO	Eric Chassande-Mottin
	CTA	Catherine Boisson
	Additional input from LOFAR and E-ELT	
15h30	Coffee	

16h	*Summaries of activities of VO teams*	
	INTA	Enrique Solano, presented by Carlos Rodrigo
	UEDIN	Andy Lawrence
	INAF	Marco Molinaro on behalf of Fabio Pasian
	CNRS/CDS	Francoise Genova
17h30	Close	
19h	Tech Forum Dinner	
Day 2	***Friday September 18***	
9h	*Contributed presentations of technical activities of the partners*	
	TOPCAT and TAP	Mark Taylor
	Reviving and extending pgsphere	Markus Nullmeier
	Provenance Data Model	Mireille Louys
10h	Observatory Coffee	
10h30	*Contributed presentations (continued)*	
	INAF-OATs VO status	Marco Molinaro
	ESA's Future Astronomy Multi-mission Interface	Jesus Salgado
11h10	*Hack-a-thon I*	Keith Noddle
12h	Lunch (provided)	
13h30	*Current IVOA standards in progress*	
	Data Access Layer (DAL) Standards	Francois Bonnarel
	Also the Provenance talk, given in the morning	

	for practical availability reasons	
	Preparation for IVOA Interoperability Meeting	
	Progress toward registering HiPS data collections	Pierre Fernique
14h50	New-comer perceptions	
15h	Coffee	
15h30	*Hack-a-thon II*	
17h	Conclusions	
17h30	Close	

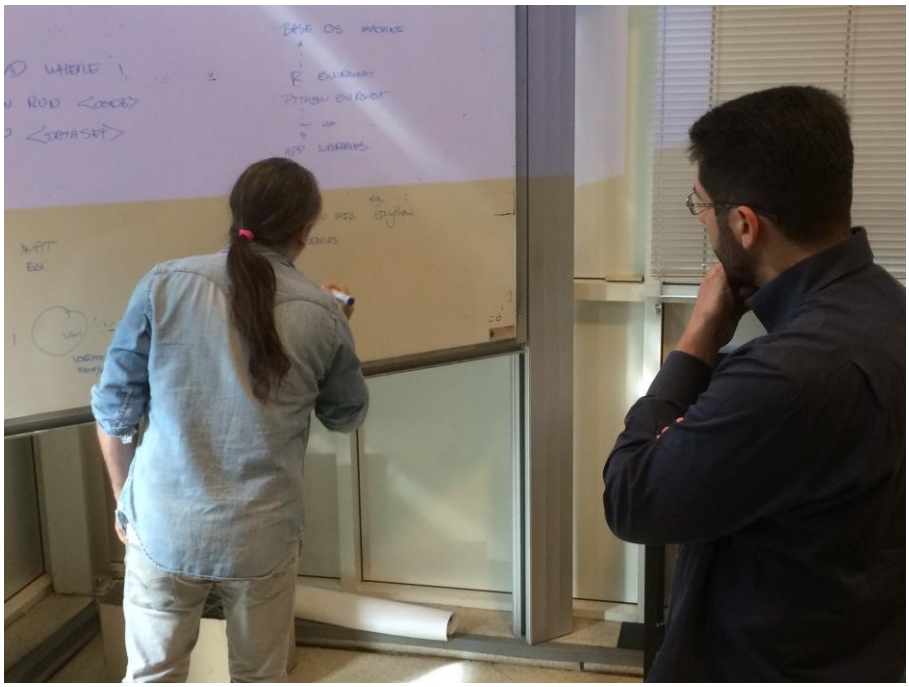
A record of the topics addressed during the hack-a-thon is kept on the wiki page, which has been filled by the participants during the course of the meeting. Various themes were addressed:

- Inclusion of the IVOA Registry in B2FIND EUDAT Registry
- Provenance discussion
- Moving the code to data
- Simulation Data Model
- Example of scientific usage of the Table Access Protocol
- MOC and pgsphere
- DOIs for astronomical data

4. Proceedings & Analysis

The meeting successfully set the scene for the DADI collaboration. The partners learnt about the relevant activities performed in the different teams. The newcomers from the ESFRIs and pathfinders, and staff newly recruited in one of the VO teams, were immediately integrated in the collaboration with the VO teams, which had been working together for over the course of the Euro-VO projects. In addition to the discussions following the talks, the hack-a-thon allowed small groups to discuss topics of interest to them (Figure 2).

Figure 2: Photographs taken during the hack-a-thon



The presentations and discussions allowed us to determine topics of particular interest for the ESFRIs, which can be used as a first basis for further discussion during the follow-up ESFRI Forum and Training Event in December 2015:

- Alerts and time series (VIRGO/EGO and CTA). On this topic the IVOA expertise on the VOEvent[3] standards and time domain Interest Group is more in the US, and UEDIN is interested to get involved. The time domain is one of the current priorities of the IVOA.
- Authorisation and authentication, and the handling of proprietary data (CTA, LOFAR), which is a topic of particular interest for INAF.
- Provenance (CTA and others), a topic on which collaboration is established with participation of CNRS/CDS and UHEI/GAVO. A CTA/CDS meeting had been held 6 - 7 July 2015 in Paris to discuss the Provenance concept developed by W3C and IVOA in the context of CTA. This concept is useful to efficiently trace the various processing activities performed to generate final data products. At the moment "IVOA" provenance model (or W3C) is very generic. The main question is how the CTA model is portable to other domains and experiments.
- Non SQL technologies (ESO). Several partners performed tests of these technologies.
- Sharing of modular software components and libraries, which was a theme throughout many of the presentations and discussions. Examples of this include ESA's use of Aladin Lite in their Multi-Mission Interface, the use of GAVO DACHS at ASTRON, and also the new TOPCAT TAP interface that is designed to work as a modular interface that can be used in other tools.

The IVOA Registry of Resource is also of general interest for the partners.

Other topics of interest that arose during the discussions include i) multi-wavelength correlation (EGO/VIRGO with CDS, with a lower priority than time domain aspects), i) the use of units in the VO (CTA would like an extension of the current standard), and iii) issues related to the mandatory information in the IVOA ObsCore[4] standard, which is sometimes not well adapted (CTA).

A particular focus was given to the Data Access Layer standards currently being discussed in the IVOA to tackle multi-dimensional data, a priority of the IVOA as well as of ASTERICS WP4.

HiPS[5], the Hierarchical Progressive Survey scheme for the representation of astronomical data sets observed on the celestial sphere, including images, catalogues, and 3D data cubes, is a hot topic since its usage expands rapidly. Its relation with pgsphere, the SQL extension which manages sky coordinates, was discussed. HiPS is not (yet?) an IVOA standard, and the

[3] http://wiki.ivoa.net/twiki/bin/view/IVOA/IvoaVOEvent
[4] ObsCore defines the core components of the Observation data model that are necessary to perform data discovery when querying data centers for observations of interest. Its current version is here: http://www.ivoa.net/documents/ObsCore/20111028/index.html
[5] Fernique et al.: Hierarchical progressive surveys. Multi-resolution HEALPix data structures for astronomical images, catalogues, and 3-dimensional data cubes, *Astronomy & Astrophysics*, Vol. 578, A114, 2015 http://www.aanda.org/component/content/article?id=1117

next steps for discussing it in the IVOA were also discussed (Applications Working Group, registration in Registry, etc.).

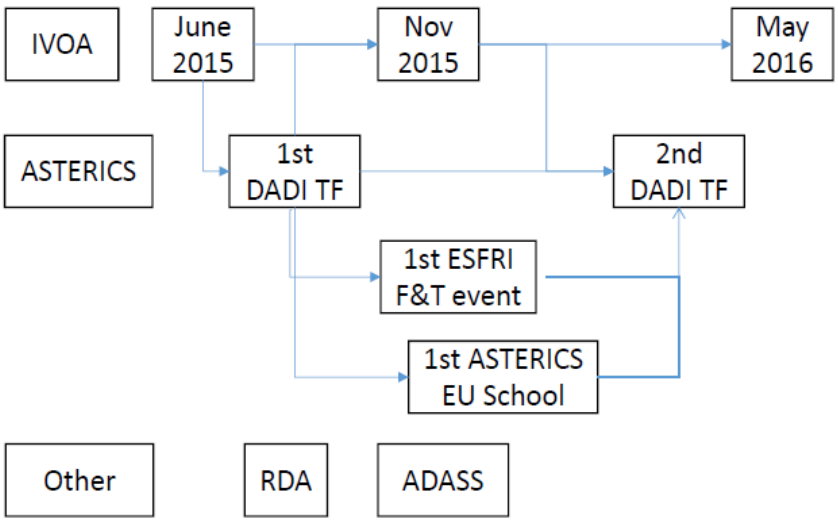
The diversity of themes proposed by the participants for the hack-a-thon is particularly interesting. They cover a wide range of aspects:

- Relationship with the generic scientific data framework (inclusion of the IVOA Registry in B2FIND EUDAT Registry, DOIs for astronomical data)
- IVOA standards and their adaptation to the ESFRI and pathfinder needs (Provenance, DAL standards, Simulation, MOC and pgsphere)
- A forward look at emerging needs (moving the code to data)
- The necessary and fruitful collaboration between scientists and software engineers is exemplified by the topic “Example of scientific usage of the Table Access Protocol”.

The newcomers were asked to provide comments at the end of the meeting. It appeared that the level of presentations and discussions was suitable for a first meeting, the only negative comment being that names on badges should be larger (!).

5. Next steps

Figure 3 : Schema of the meetings relevant to DADI



The immediate next event relevant for WP4 was the Sixth RDA Plenary meeting, which has been held in the week following the Technology Forum. The DataCite meeting organized the day before the RDA Plenary was also of interest. It was attended by staff from CDS and ESO. Staff from CDS (including WP4 lead), CTA, EGO, INAF, and UHEI participated in the RDA Plenary meeting. IVOA Provenance activities, which involve CDS, CTA and the German partner, were presented at the Research Data Provenance Interest Group meeting (https://rd-alliance.org/ig-research-data-provenance-p6-meeting-session.html).

The next major milestones are the IVOA Interoperability meeting in Sydney from 30 October to 1 November 2015 (http://www.caastro.org/international-virtual-observatory-alliance-ivoa-meeting), and the co-located ADASS meeting (http://www.caastro.org/event/2015-adass). The topics discussed during the First ASTERICS DADI Technology Forum will feed into the discussions at the Interoperability meeting, for instance on DAL standards, Provenance, HiPS, Single Sign On. ADASS conferences are the place to be to discuss data from large projects in astronomy with the data providers. Fabio Pasian (ASTERICS General Assembly Chair, WP3, WP4) will present a talk on behalf of ASTERICS at the ADASS Conference, Mark Allen (WP4, CNRS) presents work on the use of HiPS to interoperate between large data sets, and Christophe Arviset one about the IVOA ("*The VO: a powerful tool for global astronomy*").

The next DADI event will be the First ESFRI Forum & Training Event (D4.3) organized by INAF in Trieste on 3 - 4 December 2015. This event was identified during the WP4 discussion at the ASTERICS kick-off in May 2015 as a major milestone for the ESFRIs and pathfinders to present their requirements with respect to the VO framework of standards and tools, and to begin to get support on how to implement their data in the VO. The latter component will be more developed in future meetings, when the ESFRI needs will be better identified, the main aim of the first edition this year. The First ASTERICS DADI Technology Forum was a necessary first step to disseminate information about the VO and the partners' interest to prepare for the ESFRI Forum, and to identify preliminary topics for discussion. The organization of the meeting will involve all the partners to make it as efficient as possible.

The next Technology Forum (D4.4) will be organized in Edinburgh in 2016 before the next IVOA Interoperability meeting. Two Technology Forums have been scheduled during the first year of ASTERICS, the first with a large information dissemination component. The second one will have a more "normal" format and focus on technology discussions, with presentations and a more developed hack-a-thon space.

Figure 4: Participants in the amphitheatre