

## 4. MILESTONES

Mil. no.	Milestone name	WP no.	Lead beneficiary	Delivery date from Annex I	Achieved	Actual/Forecast achievement date	Comments
1	Project Kick-Off meeting	WP1	STICHTING NEDERLANDSE WETENSCHAPPELIJK ONDERZOEK INSTITUTEN	31 May 2015	Yes	26 May 2015	Meeting held in Dwingeloo from 26 to 27 May 2015. <a href="https://indico.astron.nl/conferenceDisplay.py?confId=9">https://indico.astron.nl/conferenceDisplay.py?confId=9</a>
2	Presentation of progress and results and discussion of priorities at IVOA (1)	WP4	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	30 June 2015	Yes	19 June 2015	Milestone M4.1 "Presentation of progress and results and discussion of priorities at IVOA" is being met: the IVOA meeting took place in Sesto/Sexten Italy (Sunday 14th - Friday 19th June 2015). Web site of the meeting: <a href="http://www.sexten-cfa.eu/en/conferences/details/54-ivoa-interoperability-workshop--spring-2015.html">http://www.sexten-cfa.eu/en/conferences/details/54-ivoa-interoperability-workshop--spring-2015.html</a> The meeting programme: <a href="http://wiki.ivoa.net/twiki/bin/view/IVOA/InterOpJune2015">http://wiki.ivoa.net/twiki/bin/view/IVOA/InterOpJune2015</a> ASTERICS was in particular discussed during the first Executive Board meeting on Sunday 14th. The Euro-VO item is in the meeting web page at <a href="http://wiki.ivoa.net/twiki/bin/view/IVOA/IvoaExecMeetingFM58">http://wiki.ivoa.net/twiki/bin/view/IVOA/IvoaExecMeetingFM58</a>
3	1st AGA meeting Governance entities (e.g. AEB, AEAB) and AMST fully appointed	WP1	STICHTING NEDERLANDSE WETENSCHAPPELIJK ONDERZOEK INSTITUTEN	31 July 2015	Yes	1 July 2015	First AGA meeting was 27 May. Governance entities: - AEAB member policy decided, invitations sent. confirmation next AGA meeting - AEB filled on 1 May, confirmed on 27 May - AMST fully appointed on 1 July

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4	1st ASTERICS Policy Forum group meeting	WP1	STICHTING NEDERLANDSE WETENSCHAPPELIJK ONDERZOEK INSTITUTEN	31 October 2015	Yes	26 November 2015	The Policy Forum group held a successful telecon, discussing the scope and whom to invite to the Policy Forum. The scope document resulting from the telecon and email exchange will be discussed by the ASTERICS General Assembly before the first Policy Forum will be organised.
5	Progress and priorities at IVOA (2)	WP4	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	31 October 2015	Yes	1 November 2015	<p>The Sydney IVOA Interoperability meeting was 30 October - 1 November 2015.</p> <p>The programme of the IVOA meeting can be found on the website: <a href="http://wiki.ivoa.net/twiki/bin/view/IVOA/InterOpOct2015">http://wiki.ivoa.net/twiki/bin/view/IVOA/InterOpOct2015</a>.</p> <p>Staff from CDS (including WP4 lead), CTA, INAF, INTA, UHEI, and of the UK VO team (as well as from Euclid) participated actively in the meeting. ESA staff also participated in the meeting. The talks presented by participants from Europe are listed in Annex 1 as a means of verification of MS5, showing the European and DADI's influence in the IVOA.</p> <p>One key point is the definition of IVOA scientific priorities. The current IVOA priority areas of 'multi-dimensional data' and 'time domain' are currently well aligned with the ASTERICS' priorities. These priority areas will be the topics of "Focus Sessions" that are being organized for the next IVOA meeting (Cape Town, May 2016). The sessions are being designed to attract the participation of several large projects including the ASTERICS partners. These sessions will review the first steps towards multi-dimensional standards and their</p>

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							implementation, and will discuss the definition of minimal requirements and the IVOA role with respect to time domain science (capturing current use, identify relevant projects). The time domain is of particular interest for both ASTERICS WP4 and WP5.
6	1st AEAB evaluation + Acceptance of annual reports	WP1	STICHTING NEDERLANDSE WETENSCHAPPELIJK ONDERZOEK INSTITUTEN	30 April 2016	Yes	29 November 2016	<p>This is a Milestone with a double action: First AEAB evaluation + acceptance of annual reports.</p> <p>During the 2nd AGA meeting on 11 February 2016 the ASTERICS External Advisory Board (AEAB) met for the first time. At the end of the day they presented their findings. They were happy with the work done so far and gave recommendations. The written report of the AEAB is in Annex 1.</p> <p>At the same AGA meeting (month 10) a 9 month report had been presented to the AGA. The AGA decided that Milestone M6 would only be completed after the report on the full first year had been approved. The completion of the first annual report was delayed over the summer holiday and officially approved during the 3rd AGA meeting in November. No project activity was impacted by the report delay.</p>
7	Progress and priorities at IVOA (3)	WP4	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	31 May 2016	Yes	13 May 2016	The Cape Town IVOA meeting was held from 8th to 13th May 2016. A report of the meeting is attached to the report of the second ASTERICS DADI Technical Forum in Deliverable D4.4
8	Design rules/simulations tool	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN	30 June 2016	Yes	30 June 2016	The design rules are described in the Deliverable 5.1

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			RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)				
9	Prototype software	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	30 June 2016	Yes	30 June 2016	The prototype software is described and stored on the ASTERICS CLEOPATRA Wiki page <a href="https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp5:prototype_software_for_the_e-transfer_application">https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp5:prototype_software_for_the_e-transfer_application</a>
10	Initial Analysis	WP3	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	31 October 2016	Yes	31 October 2016	Work Package 3, (OBELICS) is looking for the synergies in the data management for all the research facilities involved in ASTERICS. In order to find out where to start collaborative development the initial phase of investigation and analysis on the data structures, synergies and commonalities is closed with three reports: D3.3, D3.4, D3.5. Based on these reports the second phase will start.
11	Progress and priorities at IVOA (4)	WP4	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	31 October 2016	Yes	23 October 2016	DADI Italian partner INAF organises both the IVOA Interoperability meeting ( <a href="http://www.adass2016.inaf.it/index.php/13-ivoa-interop">http://www.adass2016.inaf.it/index.php/13-ivoa-interop</a> ) and the ADASS XXVI meeting ( <a href="http://www.adass2016.inaf.it/">http://www.adass2016.inaf.it/</a> ). As usual, the IVOA Interoperability meeting was a major milestone for the technological work performed by DADI teams. The meeting programme is here: <a href="http://wiki.ivoa.net/twiki/bin/view/IVOA/InterOpOct2016">http://wiki.ivoa.net/twiki/bin/view/IVOA/InterOpOct2016</a> .  With respect to DADI priorities, several key steps are on-going. The meeting highlights most relevant to DADI are the following: • The most important point with respect to DADI priorities is that the

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							<p>last standard required to complete the initial set of standards to deal with multi-dimensional data, SODA, is in the Proposed Recommendation stage, in the final stage of its Request for Comments. The long term discussions on this standard are settled and no further difficulty is expected. It should be promoted to Recommendation within a few months. CDS implemented a full reference implementation of SODA, which is one of the elements required for a Recommendation. The implementation also includes other relevant standards to demonstrate a fully operational IVOA framework for this priority.</p> <ul style="list-style-type: none"> <li>• The priority given by the IVOA to the time domain, which is the second DADI priority as well, is confirmed. The Time Domain Interest Group session, led by its vice-chair D. Morris (UEDIN), allowed the participants to compare Gravitational wave and LSST requirements, for the content and transport of the VOEvent standard. A standard is proposed by Jiri Nadvornik which meets the current use cases using the sparse cube data model. The discussion raised new use cases which will be explored.</li> <li>• The IVOA HiPS standard will be promoted to Proposed Recommendation, the last step before becoming a recommended standard.</li> <li>• The Grid &amp; Web Services Working Group continued the discussion on A&amp;A. An agreement was reached on Group Authorisation Standardization.</li> </ul>

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							<p>In parallel, Single Sign On V2.0 has nearly completed its recommendation path.</p> <ul style="list-style-type: none"> <li>The Data Curation and Preservation Interest Group session was once again the vehicle of liaison between the IVOA and the RDA, including among others presentations from F. Genova and A. Schaaff (CDS), who had attended the last RDA Plenary on behalf of DADI, and a lively discussion of the reasons for astronomers to participate in the RDA.</li> </ul>
12	Multi Messenger Design	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	31 December 2016	Yes	25 May 2017	Milestone 12 was reached upon completion of deliverable D5.2 - The Multi-messenger alert handling design document. The document in question describes the agreed design.
13	Mid-Term Review + AEAB evaluation + Acceptance of annual reports	WP1	STICHTING NEDERLANDSE WETENSCHAPPELIJK ONDERZOEK INSTITUTEN	30 April 2017	Yes	20 June 2017	<p>The Milestone M13 is a combined milestone. At the proposal planning stage this seemed to be a good combination. In practice the various constituent events were spread in time over about a year. Therefore calling the Milestone closed is complicated.</p> <p>We will report on the the three events separately:</p> <ol style="list-style-type: none"> <li>1.The Mid-Term review was on March 14 2017 in Brussels.</li> <li>2.We did not see added value in parallel evaluations by the EC and the AEAB. Therefore, we wanted the EC review report as input for the AEAB. Since the EC review was very positive and no adjustments to the plan were requested, we decided to schedule the AEAB for late 2017, but for various reasons this has now slipped to early</li> </ol>

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							<p>2018. So the AEAB can evaluate the year after the EC review and plans for the final project year.</p> <p>3. Annual reports. Reports over the period since the last General Assembly (AGA) meeting (Nov 2016) were presented in the June 20 2017 meeting of the AGA and attached to the agenda. Comments and discussion have been reported in the minutes of the meeting. There were no major issues or requests for adjustments by the AGA.</p>
14	Mid-term Benchmarks	WP3	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	30 April 2017	Yes	1 June 2017	<p>The Milestone M14 marks the delivery of three Benchmark reports as Deliverables D3.8, D3.9 and D3.10. The GA erroneously mentions the numbers D3.7,8,9. Apparently the shift in Deliverable numbering at the GA preparation phase was not propagated into the Milestone text.</p> <p>The three Benchmark reports were delivered on time to the ASTERICS consortium and were uploaded to the participant portal.</p> <p>The purpose of benchmarking at this stage of the project is both to identify areas where improvements in software will have a significant positive effect on the scientific capabilities future observatories and to allow selection from competing technologies. Benchmarking plays a critical role in the because many of the challenges for the next generation observatories are challenges of scale and efficiency; can we process a much larger quantity of data; can we</p>

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							<p>efficiently extract information from these larger quantities of data?</p> <ul style="list-style-type: none"> <li>•D3.8: benchmarking different computing technologies and architectures for astrophysical data analysis, focusing on performances in execution time and power consumption.</li> <li>•D3.9: The developments and benchmarks realised concern all the stages in the life of the data - data format, data storage and transfer, integration into large databases - and processes to help its integration - automated pipelines and virtualization environments.</li> </ul> <p>Most of the tests and benchmarks are done in the frameworks of the ESFRI projects but could be extended to a more general context and be re-used broadly.</p> <ul style="list-style-type: none"> <li>•D3.10: Tools to analyse and interpret astronomical/astro-particle observations in an efficient manner (both in the sense of statistical efficiency and computational efficiency) and tools for controlling access to these observations in an appropriate way, allowing efficient remote and distributed analysis and working</li> </ul> <p>The reports describe the results of the first two years of work in the project and form the input for new discussions and research to find the best solutions for the data challenges addressed by the ASTERICS project and in finding new collaborations with Industry and other research fields. New findings</p>



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							will be presented in reports at the end of the project (D3.18, D3.19).
15	WRE functionality guaranteed for equipment in harsh conditions	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	31 October 2018	Yes	11 March 2019	With the completion of deliverable D5.3, milestone M15 was reached.
16	Progress and priorities at IVOA (5)	WP4	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	31 May 2017	Yes	19 May 2017	<p>The "Northern Spring" IVOA Interoperability meeting was held in Shanghai, China, 14#19 May 2017 &lt;<a href="http://ivoa2017shanghai.csp.escience.cn/dct/page/1">http://ivoa2017shanghai.csp.escience.cn/dct/page/1</a>&gt;, with significant participation of DADI VO partners.</p> <p>The list of talks related to topics discussed in DADI which were presented during the meeting is attached to DADI Repository of products here:  &lt;<a href="https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:dadiproductrepository">https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:dadiproductrepository</a>&gt;  &lt;<a href="https://www.asterics2020.eu/dokuwiki/lib/exe/fetch.php?media=open:wp4:ivoa_shanghai_asterics">https://www.asterics2020.eu/dokuwiki/lib/exe/fetch.php?media=open:wp4:ivoa_shanghai_asterics</a>&gt;</p> <p>IVOA Standards: The IVOA reached a milestone with the completion of the set of standards dealing with multi# dimensional data (DALI and SODA were approved during the meeting) # which were also one of the two DADI initial priorities. The second priority, time domain, is now very actively tackled (two dedicated plenary session and one splinter session, plus input to other sessions), input from DADI partners and activities (in particular the Technology Forums and the specific meeting held in March in Strasbourg) being key for the endeavour. Dave</p>

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							<p>Morris (UEDIN) was designated as Vice Chair of the IVOA Time Domain Interest Group in 2016, and Ada Nebot (CDS) as Chair during the Shanghai Interoperability meeting. HiPS and a new version of the IVOA SSO standard, which are of high interest for DADI community and were made possible by work done within the project, were also approved as IVOA Recommendations during the meeting. The Science session included Theory and Time Domain talks. Comparison of observational and theoretical results were identified as a requirement of large projects at the 2016 Cape Town Interoperability meeting. This comforts IVOA activities to provide an interoperability framework for theory. The possible DADI role in that domain is to be explored.</p> <p>The excellent Education and Outreach session including well received presentations of DADI activities. Hendrik Heintz (UHEI) was designated vice-chair of the IVOA Education and Outreach Interest Group.</p> <p>Cross-project aspects: liaison with other projects has been ongoing since nearly the beginning of the IVOA.</p> <ul style="list-style-type: none"> <li>• Active presence of solar system community, which is aligning its own standards with the IVOA ones in the framework of the Europlanet project. Creation of an IVOA Solar System Interest Group in Shanghai. Input from that community to many IVOA WGs to improve alignment. They have in particular an excellent practice of the time domain.</li> </ul>

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							<ul style="list-style-type: none"> <li>The Virtual Atomic and Molecular Data Centre community has also been present from its origin. They are updating the relevant IVOA standard and present their implementation of RDA recommendation on dynamic data citation.</li> <li>As usual, the Interoperability meeting was also used to discuss the RDA activities and their interest for astronomy.</li> </ul>
17	Hardware for maser-level time & frequency distribution in optical transport networks demonstrated	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	30 June 2017	Yes	9 August 2017	MS17 was reached upon completion of deliverable D5.4 (Hardware for maser-level time & frequency distribution in public networks). The prototype has been built and tested, and this is documented in D5.4.
18	Delivery software client	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	31 August 2017	Yes	6 September 2017	Milestone MS18 was successfully passed when deliverable D5.5, "Data streaming software client", delivered a working product, which is now available to the community at large on github. Features are still being added, also per customer requests, but the basic functionality is fully implemented.
19	In situ verification of WRE sub-ns timing uncertainty	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	31 October 2018	Yes	11 March 2019	With the completion of deliverable D5.3, milestone M19 was reached.
20	Progress and priorities at IVOA (6)	WP4	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	31 October 2017	Yes	31 October 2017	Like all the IVOA meetings held during the ASTERICS project, the IVOA Interoperability meeting held in Santiago (Chile) 29-29 October 2017 was a milestone for ASTERICS DADI Work Package, both formally (ASTERICS Milestone 20 – Project and priorities at IVOA (6)) and in practice. As usual,

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							<p>European participation in the meeting was strong. The list of European contributions, with a link to the slides presented, was published in the Repository of DADI products (<a href="https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:dadiproductrepository">https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:dadiproductrepository</a>) just after the meeting (30 October 2017).</p> <p>Significant contribution was provided to Working Group (WG) and Interest Group (IG) sessions (WGs: Applications, Data Access Layer, Data Model, Grid &amp; Web Services, Registry, Semantics; IGs: Data Curation and Preservation, Knowledge Discovery in Databases, Operations, Time Domain). Only a few examples are summarized here. One can cite in particular the session of the Time Domain Interest Group, which was common with the Data Model and Data Access Layer Working Groups: the Time Domain IG brings specifications, and the WGs are in charge of defining the standards with active participation of the IG members. The activity in this domain started again in IVOA during the Cape Town IVOA meeting (May 2016) under DADI influence. Input from DADI again played a prominent role during the session, both for the discussion of use cases to derive requirements, and for the development of data models and data access protocols. Provenance, which is a major topic of DADI thanks to the CTA partner, was also discussed: M. Servillat (CNRS/</p>

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							<p>LUTH) presented in particular the Provenance Data Model Proposed Recommendation, and how to track it from a job controller. As usual, RDA status, and its relevance for the IVOA community, was discussed during the session of the Data Curation and Preservation IG, including information on the discussions held at the RDA Montréal Plenary meeting (September 2017).</p> <p>Like all the “Southern Spring” IVOA Interoperability meetings, this one was attached to the annual Astronomical Data Analysis Software and Systems conference, this year ADASS XXVII, which was also held in Santiago, 22-26 October 2017. The VO was present in many contributions to the Conference, and several persons involved in DADI presented a contribution. Among them, G. Iafrate (INAF) and M. Taylor (U. Bristol) were invited to present talks, respectively “VO for education: virtual and remote observing” and “TOPCAT: working with data and working with users”. Many of the talks presented in particular in the session “Human-Computer Interaction, user interfaces design guidelines and interfaces projects to Big Data” were presented by active DADI participants, and many other presentations made reference to the VO. Two posters were directly linked to DADI: “Provenance as a requirement for large-scale complex astronomical instruments” (M. Servillat, CNRS/LUTH) and “What can Open Clouds do for Astronomy? Interaction between the ASTERICS and EOSCpilot”.</p>

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21	Interoperability with live networks demonstrated	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	31 December 2017	Yes	30 March 2018	MS21 has been reached. The delay was mainly caused by the slight delay in the deployment of the new SURFNet8 network. The cross-talk between the WR-waves and the DWDM system waves was tested. This test revealed a cross-talk power level of at least -60dBm down. This is not surprising as the time-transfer link has three optical filters: the ones in the bidirectional amplifier, the ones in the CWDM MUX, and the ones on the line filter. We also measured return power levels (ORL) and also here power levels were below -60dBm. Note that -60dBm is the lowest power level the used power meters can measure. These results, together with the successful staging campaign at SURFnet HQ, provides a very strong indication that the WR system and DWDM will work in parallel without affecting each other, such that the green light can be given to the final installation phase.
22	Final Analysis	WP3	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	30 April 2018	Yes	25 June 2018	Concerns D3.13 D3.14 and D3.15 The Analysis Report on Frameworks and Architectures (D3.13) was submitted end of June. The repositories "OBELICS D-ANA Software Repository" and "OBELICS D-INT Services Repository" are accessible to the world.
23	Define algorithms	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	30 April 2018	Yes	18 June 2018	With the completion of deliverable D5.9, milestone M23 was reached.
24	Progress and priorities at IVOA (7)	WP4	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	31 May 2018	Yes	4 June 2018	The International Virtual Observatory Alliance (IVOA) Interoperability meeting was held on the dates of

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							<p>27 May – 01 June 2018 in Victoria, Canada. Like all of the IVOA meetings held during the ASTERICS project, it is a milestone for the ASTERICS DADI Work Package (ASTERICS Milestone 24 – Progress and priorities at IVOA (7)). These bi-annual meetings continue to be important focal points for the global coordination of the development and implementation of interoperability standards. The active participation of ASTERICS DADI partners in these meetings supports the DADI objective to adapt the VO framework and tools to ESFRI project needs and to ensure European astronomers remain lead actors in IVOA so that European interest are taken into account. The participation of DADI partners in the Victoria Interoperability meeting was very visible, showing the mature results of work that has been conducted during the course of the ASTERICS project. The list of European contributions (see note 1) , with a link to the slides presented, was published in the Repository of DADI products (see note 2) soon after the meeting (20 June 2018).</p> <p>Significant contributions were made to the Working Group (WG) and Interest Group (IG) sessions (WGs: Applications, Data Access Layer, Data Model, Grid &amp; Web Services, Registry, Semantics; IGs: Data Curation and Preservation, Knowledge Discovery in Databases, Operations, Time Domain). Here we summarize a few of the highlights.</p>

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							<p>The activities pursued within the Time Domain Interest Group are of the utmost importance as an ASTERICS DADI priority, as well as a global IVOA priority. DADI partners played a major role in these sessions (lead by A. Nebot (CDS)) on the topics of Time Domain data serialization, Time Domain metadata and their practical use in real services, as well as the introduction of an innovative generalised method for encoding “time coverage” of an observation or event. The prior preparation via the special DADI Time Domain meeting (Strasbourg, 5-6 December 2017) significantly facilitated progress on the definition of time domain metadata. Two of the Time Domain IG sessions were held jointly with the Applications, Data Model and Data Access Layer groups. The joint sessions have enabled progress on the overall approach to time domain data discovery, access and interoperability.</p> <p>The Applications Working Group sessions included presentations on user tools and services that have implemented VO standards (often advanced features). Here we can note the new ‘ESO Archive Science Portal and VO interfaces’, and other services that have used VO to make the largest new astronomy data sets (e.g. Gaia, PanSTARRS) available for discovery and use. Operational aspects of managing VO tools and services, as well as the usage statistics were discussed during Operations IG sessions, indicating heavy use of VO</p>



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							<p>services for the recent Gaia DR2 data release. The participation of the LSST project should also be noted, with the adoption of IVOA standards in their tools, and in their plans for LSST data management. Also focus session was held on the use of python language tools and in particular the access to VO services via Astropy. The emphasis on the use of python notebooks was very much in line with the topics of science analysis platforms, and user portals that has been discussed in the last DADI technology forum.</p> <p>The Data Access Layer Working Group sessions included many presentations providing feedback on the implementation of standards related to the 'multi-dimensional data' priority area. The status of the prototypes shows that a wider-spread uptake is now feasible and should be promoted. Other topics included proposals for the use of VO to facilitate coordinated multi-messenger astronomy observations, for example the observational follow-up of gravitational wave events.</p> <p>The Victoria Interoperability meeting included a new hack-a-thon session, following the successful model of the DADI Technical Forum hack-a-thons. This session highlights the hands-on practical aspect of the meeting where tools and code are used and modified in real time. The hack-a-thon focused on the use of data models and revealed a number of challenges to be faced for using the models in a programmatic</p>

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							<p>way (beyond their definition as a set of concepts).</p> <p>There is an increasing level of cross-disciplinary work being done in IVOA, notably in the Solar System Interest Group where tools and services have been adapted to planetary data, and this meeting included the participation of a representative from the PDS (Planetary Data System) community. Also notable was the discussion of topics relevant to atomic and molecular data and in particular the Virtual Atomic and Molecular Data Centre (VAMDC). Authentication and authorisation is another cross-disciplinary topic that was discussed in detail at the Grid and Web Services sessions.</p> <p>The status of the RDA and its relevance for the IVOA community was discussed during the session of the Data Curation and Preservation IG, including information on the recent RDA recommendations and outputs.</p> <p>Note 1: <a href="https://www.asterics2020.eu/dokuwiki/lib/exe/fetch.php?media=open:wp4:ivoa_victoria_asterics_dadi.pdf">https://www.asterics2020.eu/dokuwiki/lib/exe/fetch.php?media=open:wp4:ivoa_victoria_asterics_dadi.pdf</a></p> <p>Note 2: <a href="https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:dadiproductrepository">https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:dadiproductrepository</a></p>
25	AEAB evaluation + Acceptance of annual reports	WP1	STICHTING NEDERLANDSE WETENSCHAPPELIJK ONDERZOEK INSTITUTEN	30 June 2018	Yes	3 December 2018	<p>The AEAB has evaluated the project during the General assembly of November 26, 2018.</p> <p>A report of the evaluation is added to the minutes of the General assembly meeting. Overall the AEAB was content with the progress. A general</p>

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							comment was that because projects move fast and are complex the AEAB should be more updated more frequently on the overall progress.
26	Simulation software	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	31 October 2018	Yes	3 June 2019	Milestone 26 was reached upon completion of deliverable D5.12 Multi-facility scheduling simulation and performance analysis software
27	Progress and priorities at IVOA (8)	WP4	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	31 October 2018	Yes	14 November 2018	Like all the IVOA meetings held during the ASTERICS project, the IVOA Interoperability meeting held in College Park, Maryland (USA) 8-10 November 2018 was a formal milestone for ASTERICS DADI Work Package (ASTERICS Milestone 27 – Project and priorities at IVOA (8)). It was the final IVOA meeting during the ASTERICS project. European participation in this meeting was strong. The list of European contributions, with a link to the slides presented, is published in the Repository of DADI products ( <a href="https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:dadiproductrepository">https://www.asterics2020.eu/dokuwiki/doku.php?id=open:wp4:dadiproductrepository</a> ). Significant contributions were made to the overall motivation and organisation of the meeting and in particular to the Working Group (WG) and Interest Group (IG) sessions (WGs: Applications, Data Access Layer, Data Model, Grid & Web Services, Registry, Semantics; IGs: Data Curation and Preservation, Operations, Time Domain, Solar System). The opening plenary address on the “State of the IVOA” was led by the current IVOA Executive board Chair

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							<p>(M. Allen, CDS) and included an outline of a number of important policy developments in Europe with respect to the ESFRI Roadmap and Open Science initiatives (in particular EOSC) and the role that ASTERICS has played in the European and international contexts. The transition of ASTERICS DADI activities to the new ESCAPE project was also presented. Here we provide a brief summary of some of the highlights of the contributions to the Working Group and Interest Group sessions: The series of talks by DADI participants in the Time Domain Interest Groups session showed the maturation of efforts in this (DADI and IVOA) priority area, in particular the very practical introduction of the TIMESYS element for VOTable representations of time series data. The Data Curation and Preservation IG session focused on the use of Digital Object Identifiers (DOIs) with the discussion led by A. Schaaff (CDS) who also provided the overview of DOIs in the context of RDA. Provenance continued to be a major topic at IVOA, with numerous DADI contributions, in particular related to the CTA partner, with M. Servillat (CNRS/LUTH) presenting the status of the Provenance Data Model Proposed Recommendation, and other DADI related partners showing reference implementations (some of which were shown in the Applications session, e.g. OPUS). Contributions to the Data Access Layer WG sessions included authenticated use of the TAP protocol in the widely used TOPCAT/</p>

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							<p>STILTS tools by M. Taylor (University of Bristol), and also an update by D. Morris (UEDIN) on the Astronomy Data Query Language (ADQL) which is a key component of VO services</p> <p>The results of DADI efforts that build on HiPS and MOC (for access to survey data and to manage complex regions on the sky) were very visible in the Data Layer Access WG and Applications WG sessions, with the HiPStoFITS prototype, and access to HiPS and MOC via popular python tools, and also on-the-fly generation of subsets of data from large HiPS surveys.</p> <p>This IVOA Interoperability meeting was attached to the annual Astronomical Data Analysis Software and Systems conference (ADASS XXVIII), which was also held in College Park, 11-15 November 2018. The VO was very visible in many of the contributions to the Conference, several of which were presented by persons involved in DADI. Two of the tutorials selected for ADASS XXVIII were focused on VO, the “All-sky astrophysics with HiPS and MOC” presented by S. Derriere (CDS), and “A comprehensive use case scenario of VO standards and protocols” by H. Heigl (UHEI) and D. Morris (UEDIN). An invited talk on “Data Challenges of the VO in Time Domain Astronomy” was presented by A. Nebot (CDS). Other contributions included “ProvTAP: A TAP service for providing IVOA provenance metadata” (F. Bonnarel, CDS). Presentations by ESA and ESO</p>

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							were also made about their data and archives, and there were talks on the themes of Big Data, Science Platforms and Multi-messenger astronomy, many of which made reference to the VO. A number of posters were directly related to ASTERICS DADI, “Time in Aladin” (P. Fernique, CDS), “Getting ready for the fourth ASTERICS DADI virtual observatory school” (K. Lutz, CDS), “The IVOA Provenance Data Model” (M. Servillat, CNRS/LUTH). Another highlight of the posters was “The new science portal and the programmatic and VO interfaces of the ESO science archive” (A. Micol, ESO). A ‘Hackathon’ was run as a side event to ADASS XXVIII, this involved local undergraduate students paired with professional developers/scientists to make short projects related to astronomy data. Two of the ASTERICS DADI developers and a local University of Maryland student won first prize for a project that musically “sonified” time series data from the Gaia mission accessed by VO ( <a href="https://tboch.github.io/music-lightcurves-hack/">https://tboch.github.io/music-lightcurves-hack/</a> ).
28	Multi Messenger Pilot	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	28 February 2019	Yes	29 April 2019	Coupled to D5.13.  The demonstration took place on April 29th 2019. Three EVN telescopes participated in this demonstration; the 25m telescope at Onsala Space Observatory in Sweden (On), the 26m telescope at Hartebeesthoek in South-Africa (Hh) and one of the 25m telescopes of the Westerbork

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							Synthesisis Radio Telescope in the Netherlands (Wb).
29	AEAB evaluation + Acceptance of annual reports + Final project review (incl. lessons learned)	WP1	STICHTING NEDERLANDSE WETENSCHAPPELIJK ONDERZOEK INSTITUTEN	30 April 2019	Yes	25 September 2019	The AEAB evaluation was done during the AGA-6 meeting in November 2018. The final project report was reviewed by the AGA in July 2019. Annual reports were not produced separately, but included in the project periodic reports.
30	Final Benchmarks	WP3	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS	30 April 2019	Yes	14 June 2019	MS 30 is coupled to deliverable D3.18 Technology Benchmark Report (D-GEX, final) and D3.19 Technology Benchmark Report (D-INT, final). In these report the benchmarks can be found.
31	VLBI with fibre-optic synchronisation demonstrated	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	30 April 2019	Yes	8 March 2019	Coupled to D5.14.  On March 8th 2019, the Dwingeloo telescope joined in a regular EVN network measurement experiment (NME), named N19L1. Twenty telescopes participated in this observation. With the new fibre connection, the DT VLBI backend could be connected at 10 Gb/s to a JIVE server for recording the data, removing the earlier limit of ten seconds of observation time.  Fringes between the DT and many of the participating stations were detected, in our first observation using the remote hydrogen maser
32	WRE equipment with 10 Gb/s capacity, advanced algorithms and common interface	WP5	JOINT INSTITUTE FOR VERY LONG BASELINE INTERFEROMETRY AS A EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM (JIV-ERIC)	30 April 2019	Yes	3 June 2019	MS 32 was reached after completion of deliverable D5.15 Advanced algorithms and WRE upgrade to 10 Gb/s capacity
33	Test on The feasibility of using neural networks for	WP3	LEIBNIZ-INSTITUT FÜR SONNENPHYSIK (KIS)	30 April 2019	Yes	30 April 2019	Test on the feasibility of using neural netwros were performed. It was

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	guessing wavefront parameters inside a new multi frame blind deconvolution framework						found that the used neural networks could not generalise on guessing of coefficients. It was also found that the neural network of Asensio Ramos et al. (2018) would not generalise on some of the selected datasets. We therefore continued with further study on possible networks and new metrics.
34	Presentation of the progress and discussion of development at the Tech Forum.	WP4	LEIBNIZ-INSTITUT FÜR SONNENPHYSIK (KIS)	31 March 2019	Yes	28 February 2019	The progress was reported to the DADI partners in the tech Forum on 27 February 2019, introducing the European Solar Telescope EST, underlining the specific challenges for archiving and dissemination of solar data. EST and the VO had been discussed in more details during the preliminary meeting, before the Tech Forum on 26 February.
35	Functional prototype of the multi-messenger platform	WP4,WP5	GTD SISTEMAS DE INFORMACION SA	30 April 2019	Yes	28 June 2019	Prototype described in D5.16.