

VAMDC

Virtual Atomic and Molecular Data Centre

D5.5

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Final Infrastructure Support Report

Version 1.0

Grant agreement no: 239108

Combination of Collaborative Projects & Coordination and Support Actions



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8	Istituto Nazionale di Astrofisica	INAF	Italy	Month 1	Month 42
9	Queen's University Belfast	QUB	UK	Month 1	Month 42
10	Astronomska opservatorija	AOB	Serbia	Month 1	Month 42
11	Institute for Spectroscopy RAS	ISRAN	Russian Federation	Month 1	Month 42
12	Russian Federal Nuclear Centre All-Russian Institute of Technical Physics	RFNC-VNIITF	Russian Federation	Month 1	Month 42
13	Institute of Atmospheric Optics	IAO	Russian Federation	Month 1	Month 42
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Abstract	The objective of D5.5 is to describe VAMDC Infrastructure Deployment activities. This report corresponds to Activities in WP5: SA1 “Infrastructure Deployment”.
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Versioning and Contribution history

Version	Date	Reason for modification	Modified by
V0.1	December 2012	Preparation of document	M.L. Dubernet
V0.1	December 2012	WP5 Report	P. Le Sidaner
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WP5 ACTIVITIES DESCRIPTION

Work package number	5		Start date or starting event:	3							
Work package title	SA 2: Support to the Infrastructure										
Activity Type	OTHER										
Participant id	1	2	3	8	11	12	13	15			
Person-months per beneficiary: (Total = EU + Node Contributions)	54	36	24	3	18	5	6	11			

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1. WP5 Objectives

SA2 provides support for the delivery of the VAMDC e-infrastructure to users and producers (SA1) . SA2 will be responsible for the maintenance and monitoring of the core infrastructure;

Implementing Grid technology within the VAMDC: providing direct support to the users of the scientific data infrastructure as they enter the VAMDC portal and for the preservation and storage of digital data.

WP5 leader is CNRS (1)

2. WP5 Milestones and Deliverables

Milestones

M5.1	Deployment of Monitoring	WP5	CNRS	Months 10, 22, 34, 42	
M5.2	Deployment of Help Desk	WP5	CNRS	Months 10, 22, 34, 42	
M5.3	Deployment of Grid Operation	WP5	CNRS	Months 10, 22, 34, 42	
M5.4	Deployment of Preservation and QA	WP5	CNRS	Months 10, 22, 34, 42	

Deliverables

D5.1 Service Support Plan (PM 3)

D5.2 Infrastructure Support Report to be included in report to the EU– Year 1 (PM 10)

D5.3 Infrastructure Support Report to be included in report to the EU – Year 2 (PM 22)

D5.4 Infrastructure Support Report to be included in report to the EU – Year 3 (PM 34)

D5.5 Final Report of Service Support to be included in final report to the commission (PM41)

Annual Service Support Plan revisions included in Revised Annual VAMDC Project Plans – Year 1,2,3

3. WP5 Tasks Description

WP5 Leader	P. Le Sidaner / K. Benson CNRS:UMS / UCL :MSSL	
Task Number	Leader	Other Partners
1	A. Shih (CNRS:UMS)	All
2	J. Bureau (CNRS: LPMAA)	All
3	K. Benson (UCL)	All
4	P. Le Sidaner (CNRS: UMS)	All
5	M. Doronin (CNRS: LPMAA)	All

Description of work

Task1: Maintenance and monitoring of the core infrastructure (CNRS(1), all SA2 partners)

The core infrastructure will include partners who maintain existing databases and services. All the actors will be in charge of providing access to the databases/services deployed in SA1. The services include accessing the databases via different protocols, access to dictionaries and publishing registries. Task1 involves setting up the quality assurance of the infrastructure activities, service heartbeats and development and use of unit test packages. The monitoring activities will be implemented at VO-Paris Data Centre using the NAGIOS software. We will need to develop plugins specific to the various protocols which will need validation. Monitoring Software implemented at VOPARIS Data Centre will be distributed to regional centres.

Task 2: Grid Operations (CNRS(1))

The infrastructure includes the possibility to use the GRID technology in order to run numerical codes that produce AM data or that use AM data on hardware provided outside VAMDC. This is separate from and complementary to the execution of codes on hardware provided at VAMDC nodes (the latter facility is part of SA1). Task 2 will make selected codes useable on the grid. The work involves:

- making the codes executable on grid nodes, either by making the codes themselves portable or by packaging them in virtual machines;
- providing grid portals where the codes can be invoked and from which the results can be retrieved;
- negotiating access for VAMDC users with grid providers, especially with EGEE

Task 3: Support to "users" of the infrastructure (UCL(3) with partners (2), (12), (15))

"Users" of the infrastructure, meaning all people interacting with the infrastructure, will need to have access to information concerning the composition of the infrastructure, the services which are available, the procedures about how to enter the infrastructure, the procedures about how to implement the standards, how to use or adapt the various tools. The support to the "users" will be operated in Task 3 through the provision of on-line support materials, a help desk and a service providers/users forum where people could share best operation practice. We intend to produce a self-studying e-tutorial that can be incorporated in university courses on molecular and atomic physics, astronomy, energy systems, environment (etc). Also we intend to operate an e-tool for general public to take a virtual guided tour of VAMDC: statistics, content, geography of clients and producers, databases locations.

Dissemination and Tutorials organized in WP3 will show and teach how to implement and use the infrastructure, will advertise all those tools. Note that the actual generation of the training materials and support events will be organised by WP3 (NA2).

Task 4: Preservation of digital data and resources (CNRS(1))

The Preservation of digital data and resources is one of the key aspect of sustainability. It is the purpose of SA3 to set up a system of preservation through archiving and mirroring. Some nodes will act as repositories: the nodes already supporting such preservation (nodes linked to VALD, CHIANTI, etc..), VOPARIS Data Centre which will act for most of CNRS resources and could be extended to other partners. The first proposed technology will be to create a virtual machine for a certain number of projects who will implement their resources and we will implement synchronisation. This first step of a mirroring site is the simplest approach and will be implemented during the whole project. During Phase 1 we will work at the EPT level in order to follow preservation activities in other areas. We will adjust our preservation policy accordingly in Phase 2.

Task 5: Quality Assurance of data and resources (CMSUC(2), with partners 3, 11, 12, 15)

Another crucial point is the reliability of the data transferred via the various protocols. The database providers are responsible for the entries in their own database. The usual and slow way of accessing data via classical web interface or via ftp obliges the user to understand the structure of the database, to read instructions in order to get the meaning, definition of columns and lines. An interoperable e-infrastructure will remove some of this verification process of the user. Therefore it is indispensable to check that all resources (core and new ones) use the protocols, standards in the best and reliable way. In Task 5 small groups of VAMDC people understanding the protocols/standards and the physics of the retrieved data will test the output of databases in order to check the good use of protocols, whenever there is a new release handling new cases.

4. WP5 Final Tasks Reports

Period: 01/07/2009 – 31/12/2012

WorkPackage: WP5 deployment

WorkPackage Leader and co-Leader: G. Rixon, A. Shih

Participants in the WorkPackage: CNRS, CMSUC, UCL, OU, UNIVIE, UU, KOLN, INAF, RFNC-VNIITF, IAO, IVIC

Part 1

A summary of progress towards objectives and details for each tasks

Task 1 On Maintenance and monitoring of the core infrastructure:

All services and major information web sites as well as registries of services are monitored to ensure reliability and sustainability. The middleware Nagios is used to pool services.

All the new services have been added to monitored system using Nagios and deprecated one have been removed during period 4. All service providers have access to the interface.

Host	Service	Status	Last Check	Duration	Attempt	Status Information
CDSD	CDSD-tap	OK	12-20-2012 13:18:51	21d 12h 29m 47s	1/3	HTTP OK: HTTP/1.1 200 OK - 726 octets en 0.390 secondes de temps de réponse
OA_Cagliari_PAH-tap	Theoretical spectral database of polycyclic aromatic hydrocarbons	OK	12-20-2012 13:15:58	0d 3h 15m 26s	1/3	HTTP OK: HTTP/1.1 200 OK - 719 octets en 0.130 secondes de temps de réponse
OA_Catania_LAS-tap	Catania LAS tap	OK	12-20-2012 13:13:05	11d 11h 48m 19s	1/3	HTTP OK: HTTP/1.1 200 OK - 710 octets en 0.104 secondes de temps de réponse
SMPO	Spectroscopy and Molecular Properties of Ozone	OK	12-20-2012 13:14:12	36d 22h 51m 50s	1/3	HTTP OK: HTTP/1.1 200 OK - 14210 octets en 0.591 secondes de temps de réponse
axis_xms	AXIS optical spectra XMM	OK	12-20-2012 13:15:19	9d 2h 36m 5s	1/3	HTTP OK: HTTP/1.1 200 OK - 4987 octets en 0.067 secondes de temps de réponse
basecol-tap	Basecol-tap-11_12-availability	OK	12-20-2012 13:18:26	16d 1h 42m 58s	1/3	HTTP OK: HTTP/1.1 200 OK - 833 octets en 0.016 secondes de temps de réponse
	Basecol-tap-12_07-availability	OK	12-20-2012 13:13:33	16d 1h 37m 51s	1/3	HTTP OK: HTTP/1.1 200 OK - 573 octets en 0.005 secondes de temps de réponse
	Basecol-tap-availability	OK	12-20-2012 13:18:40	16d 1h 42m 44s	1/3	HTTP OK: HTTP/1.1 200 OK - 627 octets en 0.006 secondes de temps de réponse
	tomcat-mid	OK	12-20-2012 13:13:47	16d 1h 37m 37s	1/3	HTTP OK: HTTP/1.1 200 OK - 2134 octets en 0.002 secondes de temps de réponse
cdms	CDMS: Cologne database for molecular spectroscopy	OK	12-20-2012 13:14:54	26d 2h 53m 50s	1/3	HTTP OK: HTTP/1.1 200 OK - 11957 octets en 0.213 secondes de temps de réponse
cdms-tap	CDMS-tap-availability-django	OK	12-20-2012 13:20:02	50d 5h 39m 49s	1/3	HTTP OK: HTTP/1.1 200 OK - 747 octets en 0.037 secondes de temps de réponse
	jddev-tap-availability	OK	12-20-2012 13:15:08	50d 5h 39m 49s	1/3	HTTP OK: HTTP/1.1 200 OK - 746 octets en 0.038 secondes de temps de réponse
chant	CHANT-tap-availability	OK	12-20-2012 13:20:15	23d 5h 12m 50s	1/3	HTTP OK: HTTP/1.1 200 OK - 749 octets en 0.031 secondes de temps de réponse
	CHANT-tap-dev-availability	OK	12-20-2012 13:15:22	23d 5h 11m 49s	1/3	HTTP OK: HTTP/1.1 200 OK - 746 octets en 0.031 secondes de temps de réponse
dijon_methane_lines	dijon-methane-lines tap availability	OK	12-20-2012 13:12:29	4d 20h 38m 55s	1/3	HTTP OK: HTTP/1.1 200 OK - 747 octets en 0.054 secondes de temps de réponse
ghoset-tap	ghoset-tap-availability	OK	12-20-2012 13:15:36	34d 0h 29m 48s	1/3	HTTP OK: HTTP/1.1 200 OK - 759 octets en 0.231 secondes de temps de réponse
hitrans-tap	hitrans-tap-availability	OK	12-20-2012 13:14:43	2d 18h 36m 41s	1/3	HTTP OK: HTTP/1.1 200 OK - 705 octets en 0.036 secondes de temps de réponse
ideadb-tap	ideadb-tap-availability	OK	12-20-2012 13:15:50	13d 2h 55m 34s	1/3	HTTP OK: HTTP/1.1 200 OK - 699 octets en 0.083 secondes de temps de réponse
kida	kida-tap	OK	12-20-2012 13:20:57	16d 3h 40m 27s	1/3	HTTP OK: HTTP/1.1 200 OK - 699 octets en 0.036 secondes de temps de réponse
lund-tap	lund-tap-availability	OK	12-20-2012 13:20:04	0d 1h 11m 20s	1/3	HTTP OK: HTTP/1.1 200 OK - 714 octets en 0.239 secondes de temps de réponse
reims-smop-tap	reims-smop-tap-availability	OK	12-20-2012 13:21:11	33d 21h 48m 52s	1/3	HTTP OK: HTTP/1.1 200 OK - 740 octets en 0.014 secondes de temps de réponse
reims-tap	reims-ethylene-tap-availability	OK	12-20-2012 13:14:18	2d 23h 17m 6s	1/3	HTTP OK: HTTP/1.1 200 OK - 750 octets en 0.019 secondes de temps de réponse
replication-registry	VAMDC replication developpement registry	OK	12-20-2012 13:15:25	13d 19h 35m 59s	1/3	HTTP OK: HTTP/1.1 200 OK - 11322 octets en 0.013 secondes de temps de réponse
	VAMDC replication production registry	OK	12-20-2012 13:20:32	13d 19h 40m 52s	1/3	HTTP OK: HTTP/1.1 200 OK - 11310 octets en 0.013 secondes de temps de réponse
spect-w3-tap	spect-w3-tap-availability	OK	12-20-2012 13:11:39	21d 17h 44m 50s	1/3	HTTP OK: HTTP/1.1 200 OK - 715 octets en 0.248 secondes de temps de réponse
stark_b	Stark-B-TAP	OK	12-20-2012 13:20:46	15d 3h 40m 38s	1/3	HTTP OK: HTTP/1.1 200 OK - 728 octets en 0.010 secondes de temps de réponse
tpbase	TPbase-tap	OK	12-20-2012 13:15:53	15d 3h 45m 31s	1/3	HTTP OK: HTTP/1.1 200 OK - 744 octets en 0.005 secondes de temps de réponse
tpbase	TOPbase-tap	OK	12-20-2012 13:21:00	15d 3h 40m 24s	1/3	HTTP OK: HTTP/1.1 200 OK - 744 octets en 0.005 secondes de temps de réponse
umist	UMIST Database for Astrochemistry	OK	12-20-2012 13:17:17	8d 13h 7m 17s	1/3	HTTP OK: HTTP/1.1 200 OK - 1309 octets en 0.209 secondes de temps de réponse
umist-host-TAP	UDFA-tap-availability	OK	12-20-2012 13:17:14	17d 0h 47m 50s	1/3	HTTP OK: HTTP/1.1 200 OK - 721 octets en 0.808 secondes de temps de réponse
	UMIST-tap-availability	OK	12-20-2012 13:14:28	9d 4h 7m 3s	1/3	HTTP OK: HTTP/1.1 200 OK - 709 octets en 0.178 secondes de temps de réponse
valid_moscow-tap	DESIRE TAP acces in Moscow	OK	12-20-2012 13:11:28	14d 10h 49m 56s	1/3	HTTP OK: HTTP/1.1 200 OK - 812 octets en 0.139 secondes de temps de réponse
	VALD TAP acces in Moscow	OK	12-20-2012 13:16:37	9d 21h 34m 49s	1/3	HTTP OK: HTTP/1.1 200 OK - 784 octets en 0.138 secondes de temps de réponse
valid_upsala	VALD acces in Uppsala	OK	12-20-2012 13:11:42	0d 1h 49m 42s	1/3	HTTP OK: HTTP/1.1 200 OK - 8494 octets en 0.199 secondes de temps de réponse
valid_upsala-tap	VALD TAP acces Uppsala	OK	12-20-2012 13:14:49	0d 1h 46m 35s	1/3	HTTP OK: HTTP/1.1 200 OK - 711 octets en 0.089 secondes de temps de réponse
	VALD TAP dev acces in Uppsala	OK	12-20-2012 13:17:10	0d 1h 45m 28s	1/3	HTTP OK: HTTP/1.1 200 OK - 711 octets en 0.089 secondes de temps de réponse
vamdc-registry	VAMDC registry	OK	12-20-2012 13:13:03	23d 8h 25m 49s	1/3	HTTP OK: HTTP/1.1 200 OK - 11324 octets en 0.052 secondes de temps de réponse
vamdc.eu	Basecol-tap-dev-12_07-availability	OK	12-20-2012 13:18:10	18d 1h 35m 49s	1/3	HTTP OK: HTTP/1.1 200 OK - 575 octets en 0.006 secondes de temps de réponse
	Site VAMDC	OK	12-20-2012 13:15:17	9d 2h 36m 7s	1/3	HTTP OK: HTTP/1.1 200 OK - 17510 octets en 0.391 secondes de temps de réponse
	kida-tap-dev-11_12-availability	OK	12-20-2012 13:18:24	18d 1h 35m 49s	1/3	HTTP OK: HTTP/1.1 200 OK - 650 octets en 0.006 secondes de temps de réponse
wadis-tap	wadis-tap-availability	OK	12-20-2012 13:13:31	21d 11h 17m 49s	1/3	HTTP OK: HTTP/1.1 200 OK - 725 octets en 0.221 secondes de temps de réponse
xstardb-tap	VAMDC developpement registry	OK	12-20-2012 13:18:38	58d 4h 15m 50s	1/3	HTTP OK: HTTP/1.1 200 OK - 11471 octets en 0.064 secondes de temps de réponse
	xstardb-tap-availability	OK	12-20-2012 13:13:45	58d 4h 15m 50s	1/3	HTTP OK: HTTP/1.1 200 OK - 582 octets en 0.045 secondes de temps de réponse

Fig 1: the view of all services in the Nagios dashboard

In addition an internal service allows to follow statistics for the nodes as well as some compliance of the nodes with the standards (in relation with task 5). This is not public since it relates to maintenance of the infrastructure.

Task 2 Grid Operations

During the project tutorials have been provided on the use of NGI Grid via the Paris Observatory Node. The EGEE node is fully operational and accepts the VAMDC users on its Virtual Organization.

Here are subsets of the statistics report for nodes including obspm (VOParis) from EGI Availability and Reliability Report for VO ops (ROC_CRITICAL)

Region	Site	Phy. CPU	Log. CPU	HS06	Availa bility	Relia bility	Unkn own	Availability History		
								Jul-12	Aug-12	Sep-12
	IN2P3-SUBATECH	108	432	4,960	100 %	100 %	7 %	100 %	91 %	99 %
	INSU01-PARIS	32	32	N/A	98 %	98 %	7 %	100 %	85 %	93 %
	M3PEC	128	720	6,048	67 %	96 %	6 %	100 %	90 %	100 %
	MSFG-OPEN	46	200	1,580	97 %	97 %	7 %	97 %	95 %	100 %
	OBSPM	28	112	1,605	95 %	98 %	6 %	99 %	89 %	100 %
	UNIV-LILLE	240	662	7,944	84 %	84 %	8 %	99 %	87 %	96 %

Fig 2: Report of May from NGI about some of the French nodes

- Documents are available to help users accessing the grid step by step at <http://www.vamdc.eu/usersupport/tutorials/114-gridtuts>

Task 3 Support to "users" of the infrastructure

- The HelpDesk has been installed in the previous period using Request Tracker <https://voparis-vamdc-support.obspm.fr> with a single point of entry: support@vamdc.eu. More than 130 tickets have been sent, most concerning trouble in service behavior.

- Documentation is organised in different sections:

The “Data providers” section provides access to standards, software and tools that include their own documentation

The section “User Support” redirects towards 2 entries: an FAQ and a Tutorial section where support documents can be found. These sections will be further enriched and a hierarchy established according to the targeted audience. This work will be accomplished in SUP@VAMDC.

The Website has been re-organised so that the Access to Data has more information on the front page (<http://www.vamdc.eu/access-data/portal>), as well as the standards/software access (<http://www.vamdc.eu/data-providers/software>, <http://www.vamdc.eu/data-providers/standards>).

Now the website of the different projects VAMDC EU project (<http://www.vamdc-project.vamdc.eu/>) and SUP@VAMDC EU project (<http://www.sup-vamdc.vamdc.org/>) are separated from the consortium website (www.vamdc.eu) where all information/data are provided for our users.

Task 4 Preservation of digital data and resources

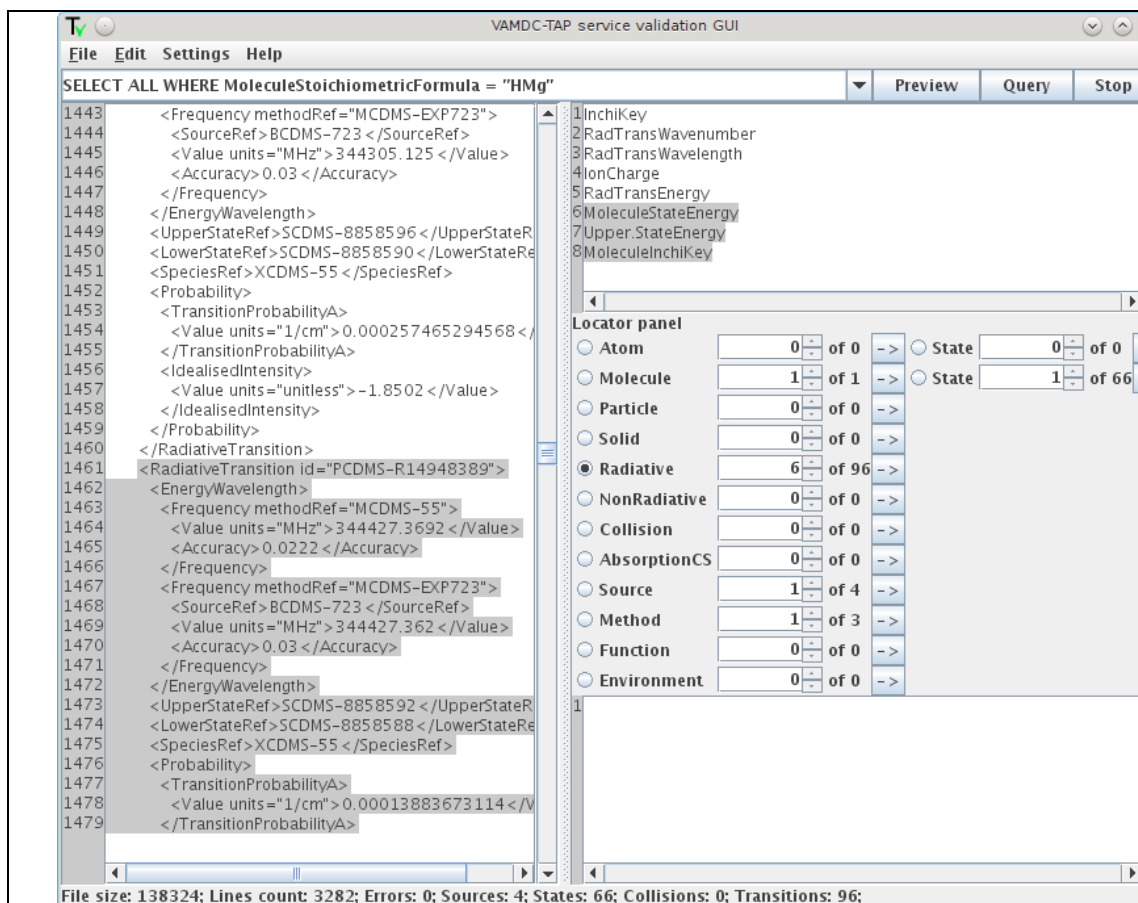
- The architecture for replication has been set up for basecol, stark-b, tipbase, topbase, hitran. Other databases are still in the process.
 - For VALD: Work has begun to set up a third server of VALD via the VAMDC portal. That server is hosted at UNIVIE (T. Rank-Lueftinger). VALD nodes at UU and INASAN are already available.
 - Mirror in Toulouse of the theoretical PAH spectral database is hosted in Cagliari.
 - Mirroring has also been set up for both development and production registries.
- The procedure for mirroring has been rebuilt using information about nodes available in the GIT-HUB maintained by the providers themselves. Database information mirroring depends on the security policies of each node and multiples solutions are proposed to be compatible. The process is a consultation between the technical manager of the initial service and the IT team of VO-Paris. That new approach is simpler for data providers as they will not have to maintain another distant machine and the configuration deployed for their service will be up to date in the GIT HUB maintained by the providers themselves.

Task 5 Quality Assurance of data and resources

A specific application has been developed : TAP Validator that simplifies the development and verification of TAP-VAMDC services. The application supports both [Graphical user interface](#) and [Command-Line mode](#) operation. In command-line mode document validation results are saved in specific XML format, defined by the report.xsd schema, provided in sources. The software can be downloaded from <http://www.vamdc.eu/data-providers/software> and includes a full documentation (PDF and online). This software has been extensively used to test by the nodes to test the validity of their outputs. Scientific validation of data has been carried out independently by all nodes since the validation procedures depend on the specificity of the nodes.

More about TAP Validator

VAMDC-TAP Validator (TAPValidator) is an universal tool aimed for development and testing of VAMDC data nodes. It allows to ensure correct operation of a node on low-level, by directly sending data queries and analyzing XSAMS XML response. Written entirely in Java, it is cross-platform over Linux, Mac and Windows, and requires no installation.



Developed initially to speed-up Java Node Software node plugin development, due to its extensible architecture, TAPValidator was later adapted to work with any kind of node over network, validate XSAMS documents originating from files or any URL. Command-line mode was also introduced to allow script operation.

Main feature of TAPValidator is that it formats XML and allows to quickly navigate through XSAMS document using graphical interface. Not only pointing out all XML Schema validation errors and allowing navigation between them, it also permits to go quickly through all the major XSAMS blocks, like molecular and atomic states, bibliography, processes.

TAPValidator provides three usage profiles: tool for node developers, tool for client software developers, and tool for infrastructure monitoring.

For node developers TAPValidator allows to quickly determine correctness and completeness of data export, plus identify common misconfiguration points of node software. TAPValidator allows to test all aspects of node against standards:

- XSAMS output document validity;
- query keywords match to standard dictionary;
- sample queries validity;
- preview query response headers;
- transfer compression over HTTP;
- node response for queries that match no data.

Thoroughly testing the node with TAPValidator is proven to be a way to reach the

necessary quality of service.

Client software developers will find use of TAPValidator to check the response of the node in case something goes wrong. Immediately it allows to clearly determine the origin of the failure: invalid XSAMS document provided by the node, or incorrect processing by the client software. Both cases were already identified, and node maintainers are usually quick in fixing such errors.

Command-line mode permits the use of TAPValidator for node monitoring. A minimum set of arguments is node URL and report directory path. By default, node is queried using self-provided sample queries, but any other valid VSS queries may be specified during the program launch. Response validity is indicated using program return codes, plus a full validation report is written in separate XML files.

For full usage details please refer to the TAPValidator usage manual, available on the official VAMDC website.

Significant results (Activities and Deliverables)

- a) Follow-up on monitoring
- b) Service replication
- c) Tools for validation

For internal usage only (check of compliance of nodes and statistics of nodes)

Deliverables to EU

D5.1 Service Support Plan –DONE-

See <http://www.vamdc-project.vamdc.eu/public-deliverables/16-deliverables-wp5>

D5.2 Infrastructure Support Report to be included in report to the EU– Year 1-

DONE – see <http://www.vamdc-project.vamdc.eu/public-deliverables/16-deliverables-wp5>

D5.3 Infrastructure Support Report to be included in report to the EU – Year 2-

DONE –see <http://www.vamdc-project.vamdc.eu/public-deliverables/16-deliverables-wp5>

D5.4 Infrastructure Support Report to be included in report to the EU – Year 3-

DONE –see <http://www.vamdc-project.vamdc.eu/public-deliverables/16-deliverables-wp5>

Annual Service Support Plan revisions included in Revised Annual VAMDC Project Plans – Year 1,2,3

See ***D1.2, D1.5, D1.7*** <http://www.vamdc-project.vamdc.eu/public-deliverables/12-deliverables-wp1>

Internal Deliverables

- 1) Nagios Monitoring : . <https://voparis-vamdc-monitoring.obspsm.fr> (document

currently drafted to explain system)

2) **GRID** = explanations about how to use the GRID at <http://www.vamdc.eu/usersupport> - In addition the grid tutorial provides some more information to users at <http://voparis-twiki.obspm.fr/twiki/bin/view/VAMDC/GridWorkshopTutorial>

3) **Support to Users**

- Help Desk and User Support Material (see report for links)

4) VAMDC-TAP Service Validator Tool : <http://www.vamdc.eu/software>

Deviations from the contract (Annex I) and reasons for them (if applicable)

none

Failures to achieve critical objectives and/or not being on schedule and reasons for them (if applicable)

NA

Proposed corrective actions (if applicable)

NA