



D-NA1.2.1: Intermediate Management and Progress Report At PM 24

30/09/2013

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¹ Alphabetical order

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VERCE (“Virtual Earthquake and seismology Research Community e-science environment in Europe”) is a project co-funded by the European Commission as an Integrated Infrastructure Initiative within the 7th Framework Programme. VERCE began in October 2011 and will run for 4 years.

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Declaration by the scientific representative of the project coordinator

Grant Agreement number: 283543

Project acronym: VERCE

Project title: Virtual Earthquake and seismology Research Community e-science environment in Europe

Funding Scheme: Combination of CP & CSA

Date of latest version of Annex I against which the assessment will be made: 16/08/2011

Intermediate Periodic report: 1st 2nd 3rd 4th

Period covered: from 1 April 2013 to 30 September 2013

Name, title and organisation of the scientific representative of the project's coordinator²:

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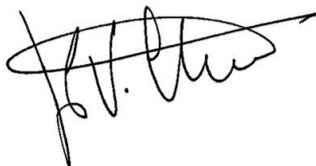
³ The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

I, as scientific representative of the coordinator of this project and in line with the obligations as stated in Article II.2.3 of the Grant Agreement declare that:

- The attached periodic report represents an accurate description of the work carried out in this project for this reporting period;
- The project (tick as appropriate) ⁴:
 - has fully achieved its objectives and technical goals for the period;
X has achieved most of its objectives and technical goals for the period with relatively minor deviations.
 - has failed to achieve critical objectives and/or is not at all on schedule.
- The public website, if applicable
 - X is up to date
 - is not up to date
- To my best knowledge, the financial statements which are being submitted as part of this report are in line with the actual work carried out and are consistent with the report on the resources used for the project (section 3.4) and if applicable with the certificate on financial statement.
- All beneficiaries, in particular non-profit public bodies, secondary and higher education establishments, research organisations and SMEs, have declared to have verified their legal status. Any changes have been reported under section 3.2.3 (Project Management) in accordance with Article II.3.f of the Grant Agreement.

Name of scientific representative of the Coordinator: **Jean-Pierre Vilotte**

Date: 11/04/2013



For most of the projects, the signature of this declaration could be done directly via the IT reporting tool through an adapted IT mechanism.

⁴ If either of these boxes below is ticked, the report should reflect these and any remedial actions taken.

Publishable summary

Context and objectives

Seismology addresses both fundamental problems in understanding Earth's internal wave sources and structures and augmented societal applications; and put a great premium on open-access data archives integrated globally. The nature of science in seismology is changing. Today our ability to acquire data outpaces our ability to explore and analyse them – new discoveries will emerge from statistical analysis and modeling of the wealth of data generated by observation and monitoring systems.

The VERCE strategy is driven by the needs of the earthquake and seismology research community and aims to deliver an e-science environment for data-intensive research that enables and productises a core of pilot advanced data analysis and modelling applications of the seismology research community. Another objective of VERCE is to deliver 'intellectual ramps' providing safe and supported means for seismology researchers to engage incrementally with the methods and the tools of innovative data-intensive research.

The VERCE e-science environment is built on a service-oriented data-intensive architecture. At the upper level, a user development platform supporting seismologists and the data-intensive experts through an extensive and evolving set of portals, data-intensive workflow tools and development environments in line with the diversity of the seismology research practice and applications. At the lower level, an *enactment platform*, supported by data and computing engineers and delegating the execution of the data analysis and modelling workflows to a community of resource providers - i.e. the European public Grid, HPC and Cloud infrastructures; and private seismology resources including seismology data archives – who deliver rapidly evolving multiple infrastructures and execution environments. At the neck of this hourglass architecture, a tightly defined and stable *gateway interface* through which the two diverse and dynamic layers communicate. The gateway interface is restrictive, that is, it is a minimal and simple protocol and language that is ultimately controlled by standards, so that the upper and lower communities may invest and secure in the knowledge that changes in this interface.

Following the second review meeting of the VERCE project, held on 25 April 2013, a number of recommendations were made for implementation:

These recommendations have been analysed, and the VERCE strategy and roadmap for their implementation by the next review in April 2014 have guided the work done in those last six months.

Work carried in the last six months

Pilot applications and use cases

Taking into account the last review recommendations, the use case development and implementation strategy has been reshaped - through regular meetings between WP2, WP7 and WP8 - as follow:

- The strategy will combine: a pragmatic short-term software-oriented approach, involving directly the research seismology developers, focussed on the main identified barriers in the current research practice and making use of the existing middleware stack and software implementation; a mid-term IT research-oriented approach, involving directly the IT researchers and engineers, aimed at integrating and adapting a first use case beta-version within the VERCE Scientific Gateway technology stack allowing a selected number of external and independent users to assess the VERCE platform. The overall strategy needs to be agile – start with first quick prototype implementation of research driven applications in line with the research practice and adjust them to the user requirements as they come up. Regular meetings between WP2, WP7, WP8 and WP9 should prevent the danger of re-designing parts of the architecture due to previous misconception.
- The HPC data-intensive use case has been considered as the priority beta-version use case to be integrated in the VERCE Scientific Gateway and provided as a service through well-defined a GUI portal interface for evaluation by external and independent seismology researchers within the EPOS (EU) and CIG (US) community. The use case entails waveform simulation for a selected number of

earthquake events and the analysis of the misfit between the simulated and the observed waveforms – retrieved from the seismological data archives - for a selected set of stations in order to evaluate the quality of various earth models. In particular users shall be able to (i) select the wave simulation solver from a set of solvers deployed and supported by VERCE; (ii) specify the input parameters for this simulation; (iii) select the earth model mesh for the simulation from a VERCE database; (iv) identify the seismic stations and earthquake events that are sought for simulation. For the beta-version the use case will be focussed on the Abruzzo region (Italy).

- The data-intensive use case efforts primarily focus on the integration of the data management layer supporting the internal scalability assessment of current Python-based workflow against selected data sets used by the seismology researchers in VERCE and in line with the actual research practice. The data management layer is based upon an iRODS federation platform, and involves close collaborations with EUDAT. Special attention is devoted to data ingestion and indexing in line with the data access patterns during the various phases of the data processing and analysis workflow together with data formats. A short-term software-oriented approach will be followed in order for seismology developers to adapt their research workflows to the underlying stream execution model advocated by VERCE and to do fast prototyping and evaluation of the scalability and the performance of the VERCE data management layer before integration within the VERCE architecture and platform.

The first beta-version of the HPC use case integration within the VERCE Scientific Gateway will be analysed by the end of January 2014; and training material dedicated to this beta-version will be prepared for a training session to be organized by WP3 early March 2014 and open to external users.

Training and user documentation

The strategy involves an internal-oriented component - to leverage the knowledge, the ontology and the community of practice within the VERCE project - and an external-oriented component - to engage incrementally the seismology at large with the methods, the codes and the tools library for data-intensive research within the VERCE environment. The activity is built in collaboration with a number of European seismology projects – i.e. EPOS (ESFRI PROJECT), Quest (ITN project) and WHISPER and WAVETOMO (ERC projects) – and European e-infrastructures – i.e. PRACE, EGI, and EUDAT.

- The knowledge base has been revised and updated in order to describe a number of concept and acronym employed in the VERCE project and that may be foreign to many seismologists. The collected knowledge can be accessed on the project website.
- New tutorials and videos have been collected from presentations at the VERCE training events and contributions to various project meetings, and have been made available through the project website to all the VERCE participants.
- A list of selected external training and conference events is continuously updated and made available to the whole project with the Redmine platform.

The next objective is the organization in March 2014 of a training workshop dedicated to the first beta-version of the HPC use case, its implementation and integration within the VERCE Scientific Gateway. This session will be open to a number of selected external and independent users of the seismology research community. Dedicated material for this training workshop is being prepared together with WP3, WP7 and WP8.

Dissemination and Public Outreach

The dissemination and public outreach strategy and work plan have been defined and planned. Identified targeted audience includes: the VERCE partners and the solid Earth science community at large; the IT community through the European e-Infrastructures and related projects; the Industry actors, e.g. in hydrocarbon and resource exploration geophysics; and the general public and national agencies. Existing communication and outreach channels provided by VERCE partners are efficiently used, i.e. in particular those provided by ORFEUS and EMSC - the two seismology NPOs – that reach a broad international audience.

- Communication tools and channels - to promote and explain VERCE – has been reviewed and improved. The VERCE website is being redesigned and revamped - together with its contents – in order improve its attractiveness and interactivity. Existing general social media channels provided by ORFEUS, EMSC, and FRANHOFER SCAI– i.e., Facebook, Twitter, Google+ - have been used to promote the project and electronic and paper material. A LinkedIn VERCE account has been created - as a professional media channel – and promote discussions and the project website. A YouTube channel has been also created and its content based on educational videos. During this period the YouTube channel has been customized with the graphic VERCE material and is linked to the VERCE website and the LinkedIn page. A second version of the VERCE newsletter has been published and an electronic subscription added to the VERCE website. The next edition is planned for April 2014.
- Metrics are continuously collected for those different communication channels. In particular the social medias – Facebook, Twitter and Google+ - have reached more than 8 490 people, and the new YouTube channel has been viewed by more than 408 users from 44 countries who spent more than 369 minutes viewing the VERCE videos.

The objective in the next months is to finalize the new VERCE website and to improve the quality of the dissemination material. In particular, the objective is to deliver in time new communication material in line with the first beta-version of the HPC use case and the next coming training session that will be open to a number of external and independent users.

Management and operation of the research platform

The VERCE platform is deployed and operated on top of a set of distributed and heterogeneous public and private data and computing resources provided by European Grid and HPC e-Infrastructures, and by a number of VERCE partners. In these last months, the main activity has been focussed on:

- The standardisation of the VERCE platform: (1) a best practice document describing - beside the components approved for the VERCE platform – a suggested minimum set of components including alternatives where possible is being set up to help system administrators of new sites to join VERCE rapidly; (2) the ‘environment module software’ is today suggested as an additional component to be deployed – it is now adopted by PRACE HPC resources and some of the VERCE sites - for enabling the VERCE site computing resources to expose different version of the same software in a coherent environment, and to simplify the load of the right environment for final users; (3) discussions with the Eudoram project have been initiated regarding the Authentication and Authorization harmonization problem is a complex problem and a VERCE use case has been submitted to the GEANT3plus/RFEEDS Use case submission.
- The data management layer in support of the two data-intensive use cases: (1) an iRODS data platform has been set up - 6 VERCE partners are now federated – enabling seismology researchers to easily access and share data across distributed storage resources and management data policies; (2) active collaboration with EUDAT have been set up allowing VERCE to contribute to the EUDAT data platform and to make use of some of the EUDAT development within the PRACE HPC environment; (3) seismic data are being catalogued based on meta-data that can be query allowing flexible multiple data formats; (4) evaluation of the data platform is being performed.
- The monitoring of the VERCE test bed: (1) Inca – allowing to monitor a wide variety of services - is being deployed and is today installed in the HPC and Grid resources that VERCE has access to; (2) in coordination with WP6, Key Performance Indicators (KPI) have been defined are currently being reviewed.
- The evaluation of potential Cloud resources integration within the VERCE test bed: (1) two project environments are being currently investigated – i.e., the EGI Federated Cloud Task Force offering a kind of Cloud of Grids environment; and the secure Cloud4Health environment provided by SCAI based on OpenNebula; (2) First actions have been focused on interfaces allowing seismology end users to submit application through Virtual Machines (VMs), on unified accounting and authentication of VERCE users in those different Cloud environments, data access across data centre boundaries; (4) the next objectives are the integration of these Cloud environments into the verce.eu virtual organisation,

the iRODS integration into the VM templates for data transfer, the integration of the Cloud resources within the VERCE Inca monitoring system.

In the next months priority will be given to providing specialized test bed in support of the first beta-release of the data-intensive HPC use case that will be open for evaluation by a selected external and independent seismology users through its integration within the VERCE Scientific Gateway.

Integration and evaluation of the platform services

A Plan-Do-Check-Act (PDCA) cycle has been selected to manage the platform software components release process. Each cycle is estimated to be one year with two overlapping cycles to facilitate a six-monthly release of the platform. A release schedule and recommended work practices is documented and regularly updated. During this period:

- The third PDCA cycle was completed September 24th, 2013 and released: (1) component specific tests the Generic Mapping Tools (GMT) and the new ObsPy version, together with the Ses3d-NT and SpecfemGlobe application codes; (2) Two out of the four components have been approved for release (GMT and ObsPy), while Ses3d-NT and SpecfemGlobe have been delayed and are currently being improved in terms of modularity and compatibility.
- Key Performance Indicators (KPIs): (1) a first set of KPIs have been defined in coordination with WP5 and include availability of services, quality of software components, security, and quality of supports; (2) this first set of indicators is being reviewed and augmented in order to support the opening of the VERCE platform to a selected number of external users in relation with the first beta-release version of the data-intensive HPC use case.

The lessons learned in the previous releases resulted in a very smooth and efficient evaluation cycle with a strong support of WP8 and WP5. In the next months, attention will be focus to providing adaptation and support for the first beta-release version of the data-intensive HPC use case and its integration within the VERCE Scientific Gateway in order to open VERCE to a selected number of external and independent seismology users by the end of March 2014.

Scientific gateway and user interfaces

During the last six months, the efforts have focused on the development of a new release of the VERCE Science Gateway in support of the first beta-release version of the data-intensive HPC use case and in close collaboration with WP8 and WP2. Collaboration have ben intensified and formalized with the SCI-BUS project leading to the integration and adaptation of SCI-BUS components.

- A number of Skype calls and face-to-face meetings, involving also the SCI-BUS group, a pragmatic road map of actions have been initiated that includes: (1) integration, adaptation and deployment of the SCI-BUS WS-PGRADE/gUSE bundle with an operational installation of the Distributed Computing Infrastructure (DCI) middleware - provided by gUSE and required by the VERCE resources – for evaluation and production; (2) establish – in collaboration with WP6 and WP8 - the selected set of job submission middleware for the beta-release version of the data-intensive HPC use case workflow that will enable the communication the VERCE Science Gateway and the HPC computational resources; (3) integration of the security issues – with the support of WP5, WP6 and WP9, through the authentication and authorisation mechanism adopted by the VERCE computational infrastructures; (3) integration of DISPEL workflows in the VERCE implementation of gUSE offering the possibility to execute DISPEL jobs alongside the HPC ones together with a strategy for inter-workflows data exchange; (4) Integration of the back-end of the VERCE user interface component that shall communicate with the gUSE services allowing the configuration of a specific workflow instance via the gateway, its execution and monitoring; (5) integration of private local VERCE clusters – beside the PRACE and EGI resources – through collaboration with the SCI-BUS project and WP5/WP6.
- Progress achieved so far in the development of the front-end of the VERCE gateway in line with specific requirements - formulated by WP2 and WP8 in priority for the first beta-release of the data-

intensive HPC use case – has led to the adoption of the Geotext framework and the realization of a set of interactive tools fully integrated into the Liferay portal framework through iteration with the seismology developers within VERCE. This includes: (1) a forward modelling GUI allowing a solver selection and configuration, earthquake events and seismic stations selection; (2) a visualization component integrating several geographical layers including geological, hazard and seismic faults information through existing WMS (OGC Web Map Services) supported by other EC projects like OneGeology and EFEHR; (3) the user interface connects to a new provenance store – implemented in MongoDV – which is accessible via a REST web API.

The last six months initiated a very intensive implementation phase - taking into account the last review recommendations – and a big step ahead has been achieved in terms of the scientific gateway development and its integration into the WPS-GRADE framework and active collaboration with the SCI-BUS project. The next objectives will be to provide a full integration of the first beta-release data-intensive HPC use case that has been prioritized for evaluation by external seismology users by March 2014.

Harnessing intensive applications

The initially selected pilot applications and scientific use cases - and their software implementation on the VERCE platform and architecture - have been analysed and evaluated against the seismology research practice and the last review recommendations in a close interaction between research seismologists, IT experts and computer scientists. In parallel continuous development and adaptation of the use case implementation have been pursued together with proto-typing workflow structures for integration within the VERCE platform.

In the last six months an agile strategy has been adopted overlaying: (1) a pragmatic short-term software-oriented approach allowing research seismologists to actually prototype and explore workflow structures and requirements of the two use cases against current research practice and actual data sets; (2) a mid-term architecture-oriented approach allowing the IT researchers and engineers to adapt and extend the current architecture and platform to the needs of the research application use cases and to their integration within an updated version of the VERCE Science Gateway and well supported middleware stack including SCI-BUS components, Liferay and possibly STORM; (3) the full support of the first beta-release version of the data-intensive HPC wave form simulation use case – that has been prioritized – for external and independent evaluation by a selected number of seismology researchers in synergy with EPOS and the US CIG project. Close interaction and coordination across the different VERCE WPs through regular meetings and dedicated task forces shall steer the detailed work and insure proper information flow between these overlaying approaches to avoid the danger of re-designing parts of the architecture due to possible misconception with regard to the needs of the seismology research practice.

Analysis and implementation of the HPC data-intensive use case: (1) improvement and integration of the ObsPy tools have been pursued in collaboration with the ObsPy developers including full support of QuakeML and StationXML standards and integration of new FDSN services; (2) analysis of the data format challenges in relation with efficient and usable parallel I/Os that led to the definition of more abstract data format based on existing technologies – StationXML, QuakeML and HDF5 – allowing significant reduction of the number of files to be manipulated and of the I/O bottleneck, together with the efficient management associated with the data provenance; (3) development of a generic input file generator supporting the different VERCE wave simulation solvers and the integration within VERCE workflow environments; a first prototype of an end-to-end workflow environment – the Large Scale Seismic Inversion Environment – has been developed to explore the requirements of the HPC use case - using the ObsPy environment – and to define requirements for the VERCE Science Gateway integration, including data retrieval and management, quality check and preprocessing, time window selection for the misfit calculations, derivation of adjoint sources, model updates and interfaces with wave simulation codes.

Analysis and implementation of the data-intensive analysis use case: (1) priority has been given to a short-term software-oriented approach allowing seismologists to prototype workflow structures based on data stream Python implementation of their current research practice; (2) exploration of the data management layer – to

handle large shared data sets – based on an iRODS platform and federation together with the investigation of the data and metadata organisation and formats in line with the data access patterns during the different stages of the data processing and analysis; (3) mid-term integration of these prototypes within the DISPEL workflow environment supported by the VERCE Science Gateway.

Architecture and platform tools for data analysis and modelling

Efforts are devoted to the development of a high-level architecture for enabling and enhancing data-intensive research in seismology and in line with the research practice. During the last period, significant progress has been achieved in:

The specification and the implementation of the VERCE registry: (1) the current implementation of the registry allows to register and query a number of Dispel components associated to workflow and other research components via a RESTful interface; (2) those entities include all the seismology processing implemented in Python, and are integrated to the Dispel gateway on a development/testing capacity; (3) extension for including other information about data and computing resources is under progress and will soon be evaluable for testing and evaluation before adoption as a product service by WP6.

Collaboration with SCI-BUS: (1) following the last review recommendations, an agreement between VERCE and SCI-BUS has been reached and formalized by a MOU with a collaboration roadmap for the next six months; (2) on the practical level the two projects are already working together in order to integrate the SCI-BUS technology within the VERCE architecture leading to rapid developments of an updated version of the VERCE Science Gateway and helping VERCE to become more relevant and sustainable; (3) the collaboration focus in particular in the submission to HPC and other remote resources through DCI-Bridge and other components, and in the portal technology to help scientists perform such submission and monitor their progress.

In addition exploratory discussions are in progress with ER-FLOW and SHIWA projects that should lead to more extended collaborations.

Impact of the VERCE project

VERCE will lay the basis for a transformative development in data exploitation and modelling of the seismology research community in Europe; and strengthen the European earthquake and seismology research competitiveness. VERCE will provide an important contribution to the European solid Earth e-science environment of EPOS, and improve the scientific exploitation of the Data and Computing European e-infrastructures and of wealth of data generated by the high-cost observation and monitoring systems. VERCE will enable data-intensive analysis and data modelling for societal applications, i.e. natural hazards and risk assessment, energy resources, environmental change and national security. VERCE will contribute to a European e-science environment for education and training of young researchers and life-long learners in earth sciences by integrating e-science environments with data collections, computational resources, learning objects and materials.

Website: <http://www.verce.eu>

1. Project objectives and work progress for the period

This document - D.NA1.2.1 - is the second intermediate management and progress report. It focuses on the last six months – from month 18 to month 24 – and complement two previous management and progress reports at month 6 and month 18.

VERCE is structured into nine work packages (WPs): Management activities (NA1/WP1), Network activities (NA2/WP2 to NA4/WP4), Service activities (SA1/WP5 to SA3/WP7), and Research & Development activities (JRA1/WP8 and JRA2/WP9).

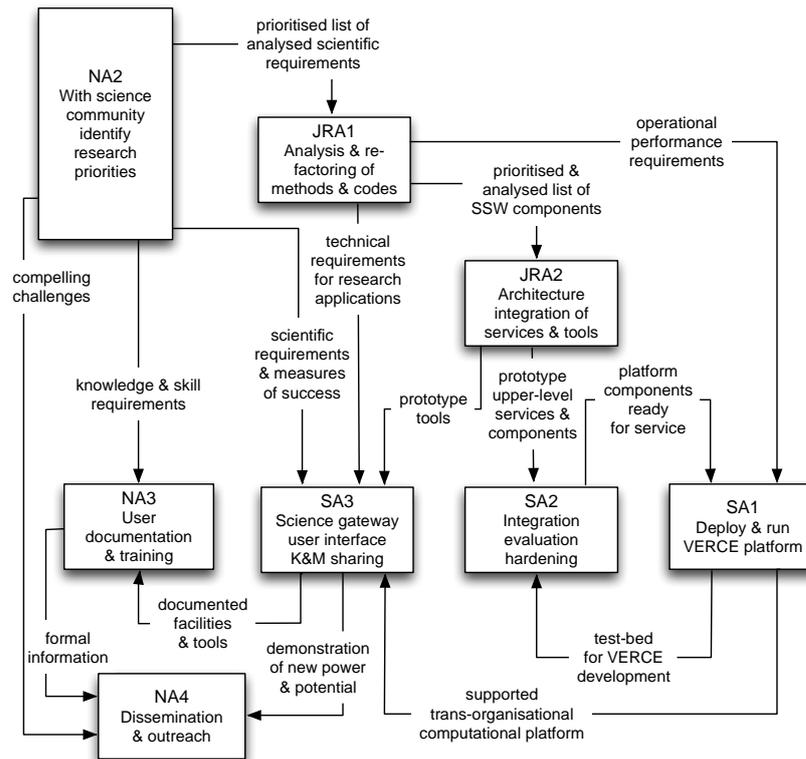


Figure 1 - Work packages in VERCE

1.1. Network activities

The network activities are user- and application-driven horizontal orchestration activities. The main strategy is to:

- Smooth the path from theoretical research to a dependable research e-science environment in phase with the research practice in data-intensive seismology.
- Create and share data-intensive analysis and modelling methods, tools and practices for exploiting the wealth of continuous waveform seismological observations.
- Build “intellectual ramps” by providing education and training to foster the adoption of the data-intensive methods and of the VERCE e-science environment by the earthquake seismology community and beyond.
- Provide dissemination and outreach material and activities aimed at a wide range of targeted audiences.

The main objectives and deliverables for the last six months were:

- Validation of enabled and deployed applications and use cases (DNA2.3, NA2 in collaboration with SA3 and JRA1); application demonstrators for dissemination and outreach (D-NA2.3.1, in collaboration with NA3). The deliverables are on time with a revised use case and demonstrator strategy - taking into account the last review recommendations – giving priority to a first beta-version of the HPC data-intensive use case for external evaluation by seismology researchers. The next six months road map has been defined.
- Updated report on training and user documentation (D-NA3.2.1, NA3 in collaboration with NA2). The deliverable is on time taking into account last review recommendations with an updated document providing explanation and reference for a number of concepts and acronyms employed by the project and that may be foreign to the seismology or the IT communities. The next six months roadmap has been defined with a training session – open to a selected number of external users -focussed on the HPC data-intensive use case and its integration within the Science Gateway.
- Report and evaluation of the dissemination and public outreach strategy (D-NA4.3.1, NA4 in collaboration with NA1 and NA2). The deliverable is on time with updated dissemination and public outreach material and communication channels. The project website is currently under revision in order to increase its attractiveness and its interactivity.

1.2. *Service activities*

The service activities are at the interface between the user-oriented coordination activities and the application and architecture oriented research and development activities. The main strategy is to:

- Evaluate and integrate a platform of tools, services and application software components, relevant to the selected pilot applications, including software components that are already adopted by the existing European e-Infrastructures and service providers like EGI, PRACE, IGE, or supported by other EU projects or other related projects like EUDAT and SCI-BUS.
- Deploy and operate the successive versions of the platform providing a framework that eases the access across a set of public data and computing resources supplied by the European e-Infrastructures and of private resources of the VERCE community.
- Manage the release process of the research platform through a Plan-Do-Check-Act (PDCA) cycle.
- Define and support a VERCE Virtual Organization (VO) providing a flexible and integrating framework for the users and the resource provider community.
- Define and integrate a user-oriented science gateway: enabling the use of a targeted set of tools and services for data-intensive applications; providing access to the underlying set of computing and data resources within the VERCE consortium; hiding some of the complexity and the heterogeneity of task submission and execution.

The main objectives and deliverables of the last 6 months of this reporting period were:

- Update operation and management report of the VERCE platform (D-SA1.3, SA1 in collaboration with SA2 and NA2). The deliverable is on time with: a new best practice document suggesting a minimum set of additional components for the standardisation of the platform and the management of the distributed resource sites, including the adoption of the Modules system; the deployment of an iRods data storage and management federated platform in synergy with EUDAT; and the continuous deployment of the Inca monitoring system together with the definition of Key Performance Indicators with SA2. Coordination and collaboration with the Eduroam project have been set up with respect to the Authentication and Authorization issue within the verce.eu Virtual Organization. Taking into account the last review recommendations, the evaluation of a possible integration of Cloud resources within the platform has been initiated, i.e. more specifically with

regard to the EGI Federated Cloud Task force – a kind of “Grid of Clouds” and the SCAI Cloud Environment based on OpenNebula. The next six months road map has been defined taking into account the support for the first beta-version of the HPC data-intensive use case that will be under external evaluation by March 2014.

- VERCE platform integration: updated release report and integrated services and tools (D-SA2.3, SA1 with JRA2, JRA1, SA3 and SA1); performance indicators and quality measurements (D-SA2.3.0, SA2 with SA1, SA3, JRA2). The deliverables are on time. The third release has been successfully completed: four new components have been evaluated and two-components approved in this release-cycle. A first set of Key Performance Indicators (KPIs) have been defined with SA1 and implemented, and the classification of the quality measurements provided. Provide a second release of integrated services and tools for the VERCE platform based upon the requests of the JRAs, SA1 and SA3 (D-SA2.2.1, SA2). A agile strategy has been defined for the next six months roadmap in order to support the first beta-version release of the HPC data-intensive use case and for its external evaluation by March 2014.
- Second report on the Science Gateway development and integration of new services and management tools (D-SA3.3, SA3 in collaboration with JRA2, JRA1 and SA2). The deliverable is on time. Taking into account the last review recommendations, further integration of the SCI-BUS technology – WS-PGRADE/gUSE – has been pursued in collaboration with the SCI-BUS project. Progress on the integration of new Science Gateway services – mostly concerning the HPC data-intensive use case that has been prioritized by NA2 and JRA1 – includes implementation of the workflow using gUSE and refinement of the PEs allowing the visualization of the results and the provenance. A HPC use case GUI allowing interactive selection of the solver, the earthquake event and seismic stations together with integrated interactive maps based on WMS standards adopted by a number of related projects, in particular OneGeology and EFEHR. The next six months roadmap has been defined in order to provide a first integration release within the Science Gateway of the HPC data-intensive use case for evaluation by a selected number of external and independent seismology researchers.

1.3. Research and Development activities

The Research and Development activities draw on the selected data-intensive pilot applications and use cases to enable the transition from proof-of-concept demonstration to dependable research e-science environment in the seismology community. The main strategy is to:

- Analyse and adapt the data-intensive pilot applications software implementation to facilitate their adoption and sharing by a wider users community through reusable data and work flow environments on the VERCE architecture and platform;
- Define and provide a data-intensive application-oriented architecture and platform of data and work tools and services enabling the data-intensive applications and providing a flexible hub between the seismology research-oriented world and the infrastructure-oriented world of data archives, HPC, Grid and Cloud computing.
- Maintain a balance between long-term sustainability considerations and fast use case implementation for scientific imperative in the architecture and platform development, and in the software refactoring and adaptation.

The main objectives and deliverables during the last 6 months of this reporting period were:

- Second report on enabling data-intensive pilot applications and validation of the VERCE architecture (D-JRA1.2.2, JRA1 with NA2 and SA2). The deliverable is on time. Taking into account the last review recommendations, the HPC data-intensive use case has been prioritized for a first beta-version release to be integrated within the Science Gateway and evaluated by a selected number of external users, while for the Data-intensive analysis use case (seismic noise correlation) priority is given to internal evaluation in terms of scalability and performance against realistic data sets used in current research

practice. A first prototype of a Large-scale Integration Framework has been developed integrating a generic input file generator and supporting extended data and file formats – QuakeML, StationXML, HDF5 - allowing to reduce the I/O bottleneck and the number of generated files to be manipulated. In collaboration with the ObsPy developers a new update of the ObsPy library has been released - and approved by SA2 - integrating those developments. For the data-intensive use case, priority was given to prototyping new formats and data management - using iRODS – against the different data access patterns during the data processing and analysis workflow.

- Annual revision of the VERCE architecture with prototyped and upgraded services and tools; and Science Gateway components (D-JRA2.1.2, JRA2 with SA3, JRA1 and SA2). The deliverable is on time. Progress on the development of the VERCE registry includes the integration of the Dispel components, and the seismology processing elements developed in Python. Integration of the registry with the Dispel gateway has been implemented on a development/testing capacity. A prototype service is being released for testing and evaluation by SA2 and JRA1 for the next release cycle. A collaboration roadmap has been established – based on a mutual agreement - with the SCI-BUS project and formalized by a MOU between the two projects. The collaboration concerns in particular: job submission to HPC and other remote resources through DCI-Bridge and related components; portal technology to help scientists perform job submissions and monitoring. This initiated active work toward the integration of SCI-BUS gUSE in the development of the Science Gateway framework. Exploratory discussions with ER-FLOW and SHIWA projects have been initiated. The next six months roadmap has been established.

1.4. Milestones and Deliverables

Table 1- Milestones

MILESTONES							
Milestone no.	Milestone name	Work package no	Lead beneficiary	Delivery date from Annex I	Achieved Yes/No	Actual / Forecast achievement date	Comments
MS1	M-NA1.1	1	CNRS	Month 6	yes	25/05/2012	
MS2	M-NA2.1	2	INGV	Month 6	yes	25/05/2012	
MS3	M-NA3.1	3	ULIV	Month 6	yes	25/05/2012	
MS4	M-NA1.1.1	4	CNRS	Month 6	yes	31/03/2012	
MS5	M-NA4.1.1	4	EMSC	Month 6	yes	25/05/2012	
MS6	M-SA1.1	5	CNRS	Month 6	yes	25/05/2012	
MS7	MSA3.1	7	KNMI	Month 6	yes	25/05/2012	
MS13	M-JRA2.1	9	UEDIN	Month 6	yes	25/05/2012	Slight deviation; see paragraph 2.8 in periodic report 1. "WP9 - JRA2: Tools for data analysis on modeling"
MS8	M-NA1.1.2	1	CNRS	Month 12	yes	01/10/2012	
MS9	M-NA2.4	2, 4	INGV, EMSC	Month 12	yes	01/10/2012	

MS10	M-SA2.1	5, 6	CNRS, BADW-LRZ	Month 12	yes	01/10/2012	
MS11	M-SA3.2	7	KNMI	Month 12	yes	01/10/2012	
MS12	M-JRA1.1	2, 8	INGV, LMU	Month 12	yes	01/10/2012	
MS24	M-JRA2.2	9	UEDIN	Month 12	yes	01/10/2012	
MS14	M-NA1.2	1	CNRS	Month 18	yes	01/04/2013	
MS15	M-NA2.2	2, 3	INGV	Month 18	yes	01/04/2013	
MS16	M-NA3.4.1	3	ULIV	Month 18	yes	01/04/2013	
MS17	M-SA2.2	5, 6	BADW-LRZ	Month 18	yes	01/04/2013	
MS18	M-SA3.3	7	KNMI	Month 18	yes	01/04/2013	
MS19	M-JRA1.2	2, 6, 8	LMU	Month 18	yes	01/04/2013	
MS20	M-NA1.2.1	1	CNRS	Month 24	yes	01/10/2013	
MS21	M-SA2.3	5,6	CNRS, BADW-LRZ	Month 24	yes	01/10/2013	

DELIVERABLES											
Del. no.	Deliverable name	Version	WP no.	Lead beneficiary	Nature	Dissemination level ⁵	Delivery date from Annex I (proj. month)	Actual / Forecast delivery date	Status	Contractual Yes/No	Comments
D2.1	D-NA2.1	1	2	INGV	Report	Public	Month 6	25/05/2012	Submitted	Yes	
D3.1	D-NA3.1	1	3	ULIV	Report	Public	Month 6	25/05/2012	Submitted	Yes	
D4.1	D-NA4.1	1	4	EMSC	Report	Public	Month 6	25/05/2012	Submitted	Yes	
D5.1	D-SA1.1	1	5	CNRS	Report	Public	Month 6	25/05/2012	Submitted	Yes	
D6.1	D-SA2.1	1	6	BADW-LRZ	Report	Public	Month 6	25/05/2012	Submitted	Yes	
D7.1	D-SA3.1	1	7	KNMI	Report	Public	Month 6	25/05/2012	Submitted	Yes	
D8.1	D-JRA1.1	1	8	LMU	Report	Public	Month 6	25/05/2012	Submitted	Yes	
D9.1	D-JRA2.1	1	9	UEDIN	Report	Public	Month 6	25/05/2012	Submitted	Yes	
D1.1.1	D-NA1.1.1	1	1	CNRS	Report	Public	Month 12	01/10/2012	Submitted	Yes	
D2.2	D-NA2.2	1	2	INGV	Report	Public	Month 12	01/10/2012	Submitted	Yes	

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D2.2.1	D-NA2.2.1	1	2	INGV	Report	Public	Month 12	01/10/2012	Submitted	Yes	
D3.2	D-NA3.2	1	3	ULIV	Report	Public	Month 12	01/10/2012	Submitted	Yes	
D4.3	D-NA4.3	1	4	EMSC	Report	Public	Month 12	01/10/2012	Submitted	Yes	
D5.2	D-SA1.2	1	5	CNRS	Report	Public	Month 12	01/10/2012	Submitted	Yes	
D6.2	D-SA2.2	1	6	BADW-LRZ	Report	Public	Month 12	01/10/2012	Submitted	Yes	
D7.2	D-SA3.2	1	7	KNMI	Report	Public	Month 12	01/10/2012	Submitted	Yes	
D8.2.1	D-JRA1.2.1	1	8	LMU	Report	Public	Month 12	01/10/2012	Submitted	Yes	
D9.1.1	D-JRA2.1.1	1	9	UEDIN	Report	Public	Month 12	01/10/2012	Submitted	Yes	
D2.2.2	D-NA2.2.2	1	2	INGV	Report	Public	Month 18	01/04/2013	Submitted	Yes	
D5.2.1	D-SA1.2.1	1	5	CNRS	Report	Public	Month 18	01/04/2013	Submitted	Yes	
D6.2.1	D-SA2.2.1	1	6	BADW-LRZ	Report	Public	Month 18	01/04/2013	Submitted	Yes	
D7.2.1	D-SA3.2.1	1	7	KNMI	Report	Public	Month 18	01/04/2013	Submitted	Yes	
D1.2.1	D-NA1.2.1	1	5	CNRS	Report	Public	Month 24	01/10/2013	Submitted	Yes	
D2.3	D-NA2.3	1	2	INGV	Report	Public	Month 24	01/10/2013	Submitted	Yes	

D2.3.1	D-NA2.2.1	1	2	INGV	Report	Public	Month 24	01/10/2013	Submitted	Yes	
D3.2.1	D-NA3.2.1	1	3	ULIV	Report	Public	Month 24	01/10/2013	Submitted	Yes	
D4.3.1	D-NA4.3.1	1	4	EMSC	Report	Public	Month 24	01/10/2013	Submitted	Yes	
D5.3	D-SA1.3	1	1	CNRS	Report	Public	Month 24	01/10/2013	Submitted	Yes	
D6.3	D-SA2.3	1	6	BADW-LRZ	Report	Public	Month 24	01/10/2013	Submitted	Yes	
D6.3.0	D-SA2.3.0	1	6	BADW-LRZ	Report	Public	Month 24	01/10/2013	Submitted	Yes	
D7.3	D-SA3.3	1	7	KNMI	Report	Public	Month 24	01/10/2013	Submitted	Yes	
D8.2.2	D-JRA1.2.2	1	8	LMU	Report	Public	Month 24	01/10/2013	Submitted	Yes	
D9.1.2	D-JRA2.1.2	1	2	UEDIN	Report	Public	Month 24	01/10/2013	Submitted	Yes	

2. Project management during the period

2.1. *VERCE consortium: management, structure and governance*

No change in the Consortium composition and beneficiaries’.

The **Project Management Office (PMO)**: Anja Busch, who was appointed as project manager, left the position end of June 2013. Antoine Weexsten (CNRS-INSU) took over and is acting as the new project manager of the project. We are on the process of hiring a new half-time project manager at the CNRS-INSU, one person has been identified and the position should be fulfilled by January 2013. The composition of the PMO is now as follow:

- Jean-Pierre Vilotte (IPGP-CNRS) - Project Coordinator
- Antoine Weexsten (CNRS-INSU) – Project Manager
- Rosa Bernal-Carrera (IPGP)
- Geneviève Moguilny (CNRS-INSU)

One of the last review recommendations was a clearer separation between the SC and the PEB with respect to their respective role and relationship in order to ensure the accomplishment of the project objectives.

Since the beginning of the project, regular joint SC/PEB online meetings - on average every four weeks – have contributed to active collaboration across the VERCE consortium, and to ensure a common understanding and ontology, and drive progress towards project objectives.

At the end of the first year, two VERCE Task Forces (TFs) were set up as a means to establish cross-WP collaboration to progress the driving Data-intensive analysis (seismic noise correlation) and CPU-intensive modelling use-cases (seismic waveform simulation). The Task Forces have been instrumental for: a better understanding and documentation of the requirements of the scientists in terms of adaptation of the VERCE infrastructure to the research practice as well as the technological heterogeneities of the participating sites; the beta-version release - at a proof-of-concept capacity and capability - of two use-case demonstrators - including stream-based Dispel workflow and Python-based framework – that were presented at the last review meeting.

As the technical requirements became clearer and the TF groups larger, it was decided that the TF organization - concluded successfully in April 2013 - was no more at this stage of the project the right organization to progress. At the same time, one of the last review recommendations was a clearer separation between the SC and the PEB with respect to their respective role and relationship in order to ensure the accomplishment of the project objectives.

Separation in role and composition of the SC and the PEB was discussed at the SC meeting held early July 2013. It was decided in line with the VERCE management description provided in the DOW document that:

- The project Steering Committee (SC) directs the strategic orientation of the project and safeguards the interests of all participants. It directs the project work plane, establishes priorities and quality control criteria, evaluate the overall performance and progress of the project and takes appropriate action if needed. It explores opportunities for furthering project collaborations and endeavour strategic actions with other related projects and infrastructures. The SC meets remotely on a monthly basis or whenever a particular need arises. Each partner of the consortium is represented in the SC together with the project manager.
- The Project Executive Board (PEB) is in charge of the day-to-day technical and science management and operation of the project. It meets remotely frequently on a weekly basis and shape technical decisions in accord with the project strategic goals. The PEB is in charge of organizing and following the day-to-day work across the different WPs, as well as across the IT and seismology researchers and engineers researchers and engineers involved in the project. The PEB can set up whenever needed specialized and temporary transversal working groups. An IT and a seismologist chair the PEB, where each WP is represented. The PEB reports regularly to the Project Coordinator, and on a monthly basis to the SC on a monthly basis or whenever a particular need arises. The IT deputy and/or the project coordinator can assist to PEB meetings.

This reorganization of the VERCE management will insure a better transition of work from proof-of-concept prototypes to production component and services.

2.2. Internal communication

No major change has occurred in the organisation of internal communication beside the effective use of two separate channel of communication for the SC and the PEB. Overall the use of the VERCE Redmine online collaborative environment is now well adopted, and partners seem to be familiar and at ease with its structure and tools.

The Redmine wiki section is the heart of the internal communication system, and is growing fast with minor time-to-time reorganisation in order to reduce the number of pages by regrouping some of its content. In each WP, one person is in charge to keep each WP's wiki section up-to-date.

The NA1 (WP1) wiki section contains all SC and PEB meetings' minutes and many of the transversal issues such as: collaboration with other projects - each project has a wiki page that the partners and the coordinator keep updated, reporting deadlines, procedures, templates, deliverables' state of the art, risk management, sustainability strategy, etc.

Participation of partners at related events and relevant seminars and the representation of VERCE in national and international contexts are tracked in an *ad hoc* wiki page in the NA4 section, called "Other events and VERCE presentations".

The News section as an internal tool for sharing information on other related events is still not sufficiently used by partners and needs to be regularly updated by the PMO. Nevertheless it represents the most appropriate way to keep partners informed on important issues without sending them too many emails.

The Meeting section is where all information on on-going and past meetings, both within and across WPs and at project level, can be found, either on the space made available from that tool or on a linked wiki page that contains further details. Finally the Doodle tool for online polls has proved to be very useful and used especially for the organisation of the various VERCE meetings.

The Document section is mainly updated by the PMO to share official documents or project internal templates.

The Repository (SVN) is used for uploading/downloading the different versions of the deliverables and other drafts that need a version tracking.

Forums are not used frequently but are still an important means of communication and allow keeping track of important on-going discussions.

An ad-hoc Issues Tracking System has been set up for NA3 (WP3) and is part of the training strategy allowing to deal with direct user requests on technical questions regarding the VERCE tools and technologies. During the last period, the Redmine Issue tracking system has been configured as part of the deployment and monitoring strategy for the VERCE test bed and platform, as well as for the unified access strategy.

The rate of usage by partners - and the level of their feedback - of the Redmine environment are being monitored continually; and partners asked to suggest improvements in order to plan relevant adjustments.

A big part of the internal communication still passes through emails, especially for communications from the PMO to the project's boards and for communication within WPs. The mailing lists system works well and helps targeting groups. The full integration of new personnel during this last period helped to better differentiate roles and delegate some tasks from scientific representatives. Mailing lists are regularly updated by the PMO on the basis of the Manpower file that lists all personnel working on VERCE and their roles and involvement in the different WPs.

2.3. Meetings

Project and WP meetings are very important for the effective management of the Consortium and to foster work progress. Between April and end September 2013, many online WP, cross-WPs and task force meetings have taken place, focusing on specific issues. Those have facilitated the collaboration between IT experts and seismologists across all the involved partners in the consortium. WP leaders are in charge of

organising and documenting these meetings on Redmine, and of sharing information using ad-hoc mailing lists.

Following is the list of main WPs' online and F2F meetings that took place during this timeframe (the list is not exhaustive since only main meetings have been registered on Redmine, and not the everyday exchange of information and ad-hoc discussions of issues):

- 4 April 2013, SA1 online meeting
- 22 April 2013, Paris face-to-face project meeting
- 26 April 2013, Paris face-to-face meeting and project review meeting
- 7 May 2013, SA2 online meeting
- 21 May 2013, SA2 online meeting
- 30 May 2013, DI and HPC Task Forces online meetings
- 3 June 2013, JRA2 & SA2 online meeting
- 4 June 2013, JRA2 & SA3 online
- 6 June 2013, SA1 online meeting
- 7 June 2013, SA1 data management meeting between IPGP and Grenoble
- 18 June 2013, SA2 online meeting
- 20 June 2013, DI and HPC Task Forces online meetings
- 28 June 2013, NA2 online meeting
- 28 June 2013, SA1 data management online meeting between IPGP & Grenoble
- 2 July 2013, SA2 online meeting
- 4 July 2013, PEB meeting
- 10 July 2013, SA3 online meeting
- 16 July 2013, SA1 & SA2 online meetings
- 17 July 2013, JRA1 meeting at the CIG meeting
- 26 July 2013, DI and HPC Task Forces meetings
- 30 July 2013, SA2 online meeting
- 30 July 2013, SC meeting
- 26 August 2013, SC meeting
- 5 September 2013, SA1 online meeting
- 10 September 2013, SA2 online meeting
- 24 September 2013: SA2 online meeting
- 29 September 2013, NA2 meeting at the EPOS Erice meeting

Partners also participate and meet at major international events in relation with the VERCE activities, for updating, exchanging and dissemination purposes. Those meetings also provide opportunities to organize coordination meetings with other related projects, and make sure VERCE develops coherently with the Community's needs and wishes. A full and always updated list of these events is kept on the Redmine by WP4. Some examples are:

- 29 Avril – 3 May 2013, **Big Data and Exascale Computing meeting**, Charleston, US. Participant: Jean-Pierre Vilotte (CNRS-IPGP), invited talk. <http://www.exascale.org/bdec/>
- 16 – 21 May 2013, **Advanced Computing and Analysis Techniques (ACAT 2013)**, Beijing, China. Participant: Jean-Pierre Vilotte (CNRS-IPGP), invited talk. <http://acat2013.ihep.ac.cn/proceedings.htm>
- 19 – 25 May 2013, **4th QUEST meeting**, Benodet, France. Participants: Heiner Igel, Nikolai Shapiro, Michel Campillo, invited talks. <http://www.quest-itn.org/events/4th-quest-workshop>
- 18 June 2013, **ICS 2013 & UNICORE summit 2013**, Leipzig, Germany. Participant: Michelle Carpené (CINECA): ICS paper: http://link.springer.com/chapter/10.1007%2F978-3-642-38750-0_5.
- 5-7 July 2013, **ICS 2013 meeting**, Barcelonna, Spain. Participant: Siew Hoon Leong (BADW-LRZ). Published at Science Direct: <http://www.sciencedirect.com/science/article/pii/S1877050913005310>

- 14-17 July 2013, **2013 CIG-QUEST-IRIS meeting**, Fairbanks, US. Participants: Heiner Igel (LMU), Lion Krisher (LMU), Emanuele Casarotti (INGV), Jean-Pierre Vilotte (CNRS-IPGP), Michel Campillo (CNRS-Grenoble), invited talks.
<http://geodynamics.org/cig/community/workinggroups/seismo/workshops/CIGQUESTIRIS>
- 26 Août – 4 Septembre 2013, **41st Workshop of the International School of Geophysics on 'A Roadmap for Earth Science in Europe: The next generation of Geophysical Research Infrastructures' EPOS**, Erice, Italy. Participants : Malcolm Atkinson (UEDIN), Alberto Michelini (INGV), Torild van Eck (KNMI) , Alessandro Spinoso (KNMI), Massimo Coco (INGV), Jean-Pierre Vilotte (CNRS-IPGP), Michel Campillo (CNRS-Grenoble), Paul Martin (UEDIN), Amy Krause (UEDIN). Invited talks
<http://www.epos-eu.org/meetings/41st-workshop-of-the-international-school-of-geophysics.html>
- 16-19 September 2013, **EGI Community Forum**, Madrid, Spain. Participants: Siew Hoon Leong (LMU), Horst Schwichtenberg (SCAI), Geneviève Moguilny (CNRS-IPGP), two presentations.
- 28 – 30 Octobre 2013, **EUDAT second conference**, Rome, Italy. Participants: Alberto Michelini (INGV). Invited talks. <http://www.eudat.eu/2nd-conference>

2.4. *On-going Cooperation with other projects*

The main cooperation and coordination strategy with related European and International projects was detailed in the first management and progress report and is continuously updated since.

Part of the effort to build a sustainable and interoperable infrastructure is the investigation of possible collaborations with other sharing relevant projects.

A first aspect of this strategy is to foster synergies and collaborations with other projects in the seismology and the solid Earth sciences.

- Of particular importance is the collaborations between VERCE and EPOS, the solid Earth science ESFRI project, i.e. especially with regard to the core services and the architecture of the EPOS e-science environment to which VERCE is seen as a major contribution.
- VERCE has collaborations with other international NPOs in seismology like IRIS, Earthscope in the US; JAMSTEC and NIED in Japan.
- Another important aspect is the synergy and the collaborations between VERCE and a number of strategic projects in the seismology research infrastructure, i.e. for example NERIES, SHARE, REAKT.
- Finally, with regard to the research applications and the dissemination of the VERCE environment in the seismology research community, the synergy and the collaborations between VERCE and a number of European seismology projects: QUEST (ITN), WaveTomo (ERC), WHISPER (ERC).

Another aspect of the strategy is to foster synergies and collaborations with the European infrastructures, i.e. EGI, PRACE and EUDAT.

- VERCE is currently participating to two pilot case-studies within the EGI-PRACE-EUDAT synergy.
- VERCE is currently collaborating with EUDAT with regard to iRODS based data management federation and the movement of large data sets using gridFTP, GLOBUSonline, Griffin.
- A formal MOU between EGI.eu and Verce.eu has been finalized.

In line with the last review recommendations, the last aspect of this strategy is to develop synergies and collaborations with other related projects that develop methodologies and software components that can be integrated within the VERCE platform.

- SCI-BUS: providing science gateway/portal technology to integrate access to computing, storage and other facilities and infrastructures. The gateways are based on widely used production quality frameworks and solutions (Liferay and WS-PGRADE/gUSE), which aligns also with the preliminary technological preferences mentioned in D-SA3.3 and D-JRA2.1.2 reports. A common understanding and a collaboration roadmap have been finalized and formalized as a MOU between the two projects.

- IGE: providing tools to share computing resources, databases and other on-line tools. IGE is a member of the Globus Alliance. Collaborations between VERCE and IGE have been formalized by a signed MOU. This collaboration has been important and has led to the adoption by VERCE of a number of components provided by IGE, as detailed in the D-SA2.2.1 report.
- ER-Flow: a follow-on project to SHIWA, which developed technologies to allow interoperability between workflow systems. This includes the SHIWA Simulation Platform (SSP) which allows users to upload and run workflows created by different workflow systems on different distributed computing infrastructure, to create meta-workflows, i.e. workflows composed of other workflows in the SHIWA repository, and where each of the constituent workflows may have been created by different systems.

Finally, this strategy includes also international components.

- Through EPOS, VERCE is developing synergies with the EU-US bilateral initiatives, i.e. COOPEUS and i-CORDI.
- Through the participation of some of VERCE partners to the EU Big Data and Extreme-scale initiatives, i.e. for example EESI2 and BDEC, VERCE is developing synergies with EU-US initiatives.
- Collaboration with the US CIG initiative is related to the HPC data-intensive use case with in particular the issue of data formats and orchestrated workflows. Selected CIG external users are foreseen for the evaluation of the first beta-version release of the HPC data-intensive use case and its integration within the VERCE Science Gateway.
- Finally active collaboration between VERCE and the developer team of ObsPy has led to a new version of the ObsPy library supporting abstract data formats as well as a prototype of a Larfe-scale Seismic Inversion Framework (LASIF).

This strategy is continuously reviewed and updated as the project evolves keeping track in order to collect experience and acquired know-how not only for the VERCE project but also for further projects of the solid Earth sciences.

2.5. Project activities monitoring

Partners have finalized their recruitments in the past months. The situation had been closely monitored by the PMO until all vacancies had been filled. With the new staff, VERCE is now running at full capacity and the risk of manpower shortage identified in the last review meeting solved.

2.6. Risk Management Plan

Following one of the recommendation at the last review meeting, the Risk Management Plan was actualized and refined. The Risk Management Plan and the monitoring strategy and tools were detailed in the Management and Progress Report D-NA1.1.1.

The PEB monitors the Risk Management Plan periodically. Each risk is assessed in terms of likelihood and impact, and is recorded in the Risks Register. This metric allows defining a Risk Exposure factor, which help to prioritize the different risks for management control. This dynamic document is continuously reviewed and updated throughout the project in interaction with the different work package leaders.

2.7. Sustainability Strategy

A sustainability strategy plane is under preparation through regular SC/PEB meetings. The VERCE sustainability strategy plane is linked also to: (a) the sustainability of the European infrastructures, e.g. PRACE, EGI; (b) the sustainability of EPOS both in terms of observational, data and e-science infrastructures; (c) the sustainability of the seismology community at the international level. This activity is presently led by LRZ, UEDIN, ORFEUS, INGV and the CNRS-INSU.

Collaboration with EPOS and the Earth Science community toward such a sustainability plane and a European Earth Science roadmap has been initiated during the last August-September meeting in Erice, Italy.

2.8. Last review recommendations

The last review report made a number of explicit recommendations:

- **Consider the roles of SC and PEB with respect to their mutual relationship in order to ensure the accomplishment of project objectives.**
 - This has been taken into account as explained in the VERCE management section.
- **Intensify collaboration with members of the SCI-BUS project. Aim at making full use of their technology and frameworks and possibly adapt their solutions for the VERCE platform.**
 - This has been taken into account. A collaboration roadmap has been agreed between the two projects and formalized by a MOU. Integration and adaptation of SCI_BUS components in the development of the VERCE Science Gateway and architecture is actively pursued - in collaboration with the SCI-BUS project – as detailed in the SA3 and JRA2 reports. In parallel, exploratory discussions have also been initiated with ER-FLOW and SHIWA projects. The current collaboration with the SCI-BUS project will help VERCE to become more relevant and sustainable.
- **Develop beta-versions for at least two use case applications (HPC use case with Specfem; HTC use case with noise correlation) and invite external/independent researchers to test/use the VERCE platform. Develop benchmarks for the beta-test applications to assess the performance and scalability of the VERCE platform.**
 - This has been taken into account and led to a revision of the implementation strategy. Priority has been given to providing a beta-version release of the HPC data-intensive use case - and to its integration within the VERCE Science Gateway - for evaluation by a selected number of external and independent seismology users from the EPOS (EU) and CIG (US) community. Priority for the Data-intensive analysis use case has been given to internal evaluation in the next six months of the scalability/performance issues against realistic data sets currently analysed in research practice involving a proper data management layer. The adopted strategy overlays a pragmatic short-term software-oriented approach, making use of the development environment of the seismology researchers, allowing rapid and agile prototyping of data-stream based workflow structures and precise requirements driven by research practice for the VERCE architecture and platform; and a mid-term IT-oriented approach allowing the integration of those applications within a consistent and well architecture infrastructure.
- **Define a process and technology strategy to explore the use of public clouds within the VERCE platform.**
 - A first step has been initiated and currently the possibility of integrating Cloud resources within the VERCE platform is being investigated – as detailed in the SA1 report – with the EGI Federated Cloud Task Force, which offers a kind of “Grid of Clouds” and the SCAI Cloud Environment based on OpenNebula. In parallel, an analysis of the Public Cloud business model and capability with respect to the European and International seismology community observational organization and research practice has been initiated in collaboration with EPOS.

Together with

- **Make more explicit the strategy for dissemination and "marketing" of the VERCE platform. Consider also the use of professional services. Manage user expectations very carefully and plan implementing the strategy once independent researchers have successfully beta-tested the VERCE system.**
 - A revised dissemination and public outreach strategy is under progress and in particular for the next six months a reshaping of the verce public website and material will be done. Collaboration with a selected potential external users within the EPOS (EU) and the CIG (US) community with regard to their expectation and their evaluation of the first beta-version release of the HPC data-intensive use case has been initiated and will shape the forthcoming training session that will be open to those selected users.
- **Many of the concepts employed in the VERCE project, and many of the acronyms of projects that VERCE relates to, are foreign to many if not most seismologists. A one-page PDF file or a web site with hyperlinks or tooltips briefly describing a concept or an acronym would significantly help the readers to grasp the full picture and better appreciate VERCE's added value.**
 - This has been incorporated in the Knowledge base provided by NA3 and will be continuously updated both in direction to the seismology community and to the IT community with regard to the seismology concepts and methods. This is further detailed in the NA3 report.

3. Next steps

During the next reporting period, the PMO will continue monitoring the updates of the Risk Register. It will also further focus on the drafting of a Sustainability Plan as asked by reviewers during the first Project Review.

It will keep coordinating and monitoring the partners' contributions and project activities making sure they are coherent with the DoW while at the same time guaranteeing the needed flexibility to adapt to research developments, changing needs of the Community and collaboration with other projects.

The PMO will make sure all deliverables (and milestones) are ready for the next deadline on 1 April 2014.

The VERCE management will be done with a clear separation of concern between the SC and the PBE following the adopted reconfiguration.

The collaboration strategy will be continuously monitored and updated.