NERA

Network of European Research Infrastructures for Earthquake Risk Assessment and Mitigation

Report

Integrated Portal and Services

Activity:	*European Mediterranean Earthquake Portal and Services*
Activity number:	*WP9, task*
Deliverable:	*Integrated Portal and Services*
Deliverable number:	*D9.5*
Responsible activity leader:	*Remy Bossu*
Responsible participant:	*KNMI*
Author:	*Reinoud Sleeman*

Summary

This report presents the European Mediterranean Earthquake Data Portal (EDP; www.seismicportal.eu) and related webservices as developed and accomplished during the EC FP7 project NERA (www.nera-eu.org). The EDP provides a single point of access to diverse, distributed European datasets and services, including (a) broadband, seismic waveform data and related metadata from the European Integrated waveform Data Archive (EIDA; www.orfeus-eu.org/eida) in ORFEUS (www.orfeus-eu.org), (b) earthquake parametric data from the EMSC (www.emsc-csem.org), (c) accelerometric data (waveforms and parameters) from European accelerometric networks, (d) waveform simulation and data-intensive e-science services by integrating distributed European public data and computing infrastructures, (e) the European Facility for Earthquake Hazard & Risk (EFEHR; www.efehr.org), (f) the Open Structure Assessment Portlet (OSAP; osap.faw.at), an online service for easy structural assessment of civil buildings and (g) private and historical data from the Archive of Historical Earthquake Data (AHEAD). The use of international standards and open software implies a sustainable framework enabling further expansion of data services.

Introduction

NERA (2010-2014) is an EC FP7 infrastructure project that integrates key research infrastructures in Europe for earthquake monitoring and seismic hazard and risk assessment. NERA integrates and facilitates the use of these infrastructures to provide services and access to a) earthquake data and parameters for research, and b) hazard and risk products and tools.

Portals and webservices are key elements in an (e-science) infrastructure, like NERA, providing efficient interfaces to explore large amounts of data using complex tools and services. A portal is a website that serves a gateway or main entry point for a field specific domain providing, amongst others, search and download facilities. Webservices are a collection of open protocols and standards used for exchanging data between applications or systems on computer networks using standardized XML based information, and are todays standard in data access services (like portals).

One of the goals in the infrastructure project NERA was to develop both key elements: a portal and its underlying webservices, to provide a single, European, comprehensive, integrated entry point for all earthquake data and earthquake risk information, services and products. The strategy has been to combine waveform data and earthquake parameter data on one hand, with seismological hazard and risk data and products on the other hand. NERA provided the framework for significant coordination and collaboration to accomplish the integration of both elements in a single, sustainable focal point for seismological products and services. To ensure proper integration both components coordinated their developments on interoperability, open source and workbench definition.

Within NERA thematic leaders from the seismological community (EMSC, ORFEUS), the hazard community (ETHZ) and the engineering community (VCE, JKU) combined their expertise to define a common architecture and a common set of service standards to develop a standardized and operational portal and related webservices. The developments in NERA reflects the complementary services required within the community: interactive access for data exploration (through the portal) and programmatic access for data collection and analysis through webservice invocation. Dynamic earthquake information (e.g. constant update of earthquake catalogue) is mainly accessed through webservices, while more static (stable) hazard information has balanced programmatic and interactive access.

The developments in NERA resulted is a fully operational portal (www.seismicportal.eu) and a suite of underlying web-services (www.seismicportal.eu/webservices.html).
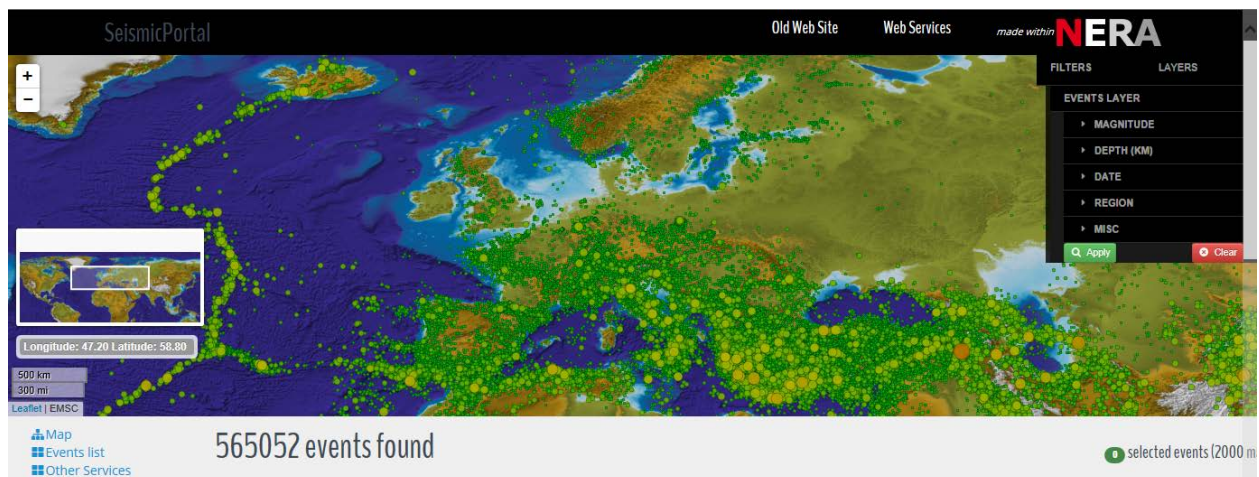

Figure 1: Earthquake Data Portal home page (www.seismicportal.eu)

Interoperability and Open Source

The EDP web-services are compatible with the Web Mapping Service (WMS) standards set by the Open Geospatial Consortium (OGC; www.opengeospatial.org) and the Tile Mapping Service (TMS) standard of OsGeo (Open Source Geospatial Foundation; www.osgeo.org). This allows the mapping of of layers from different portals and to use different non-proprietary geographical layers (e.g. geology layers from OneGeology (www.onegeology.org). Also the moment tensors database EMMA (http://www.emsc-csem.org/Earthquake/emma.php) has been integrated as example to demonstrate the compatibility and interoperability with the EDP when following the standards.

To further increase sustainability of the portal the developments are based on open source tools like PostgreSQL, Python and OpenLayers.

Seismological waveform data and earthquake data products

Within Europe the coordination of the seismological component has a long history and is well established by strong collaboration between ORFEUS (www.orfeus-eu.org; waveform data) and EMSC (www.emsc-csem.org; earthquake parameter data). During previous EC funded projects (e.g. MEREDIAN, NERIES) the foundation was made for data oriented collaboration and cooperation in Europe. This was extended within NERA through scope broadening cooperation with projects like VERCE (www.verce.eu) and through collaboration outside Europe with IRIS (www.iris.edu) and USGS (www.usgs.gov). The design developments of the Earthquake Data Portal (EDP) are coordinated with VERCE (www.verce.eu), an EC funded project that is developing a data-intensive e-science environment for innovative data analysis and modelling techniques. Through global coordination in the FDSN (International Federation of Digital Seismograph Networks) a set of standardized web-services has been implemented by ORFEUS and EMSC to serve uniform access to data.

Waveform data

Recent developments within ORFEUS increased the amount of waveform data available and accessible in Europe significantly through the establishment of the European Integrated waveform Data Archive (EIDA; www.orfeus-eu.org/eida). EIDA is the

federated Data Centre within ORFEUS, providing transparent access to high quality seismic data from data archives distributed across Europe. Currently 10 large data archives are directly connected. EIDA today offers access to standard broadband seismic data from permanent networks across Europe, and is supplemented by a few dedicated institutions, currently limited in number, that also provide access to temporary broadband deployments, accelerometric and infrasound data. Currently, data from more than 4700 seismic stations is available through EIDA and the EDP.
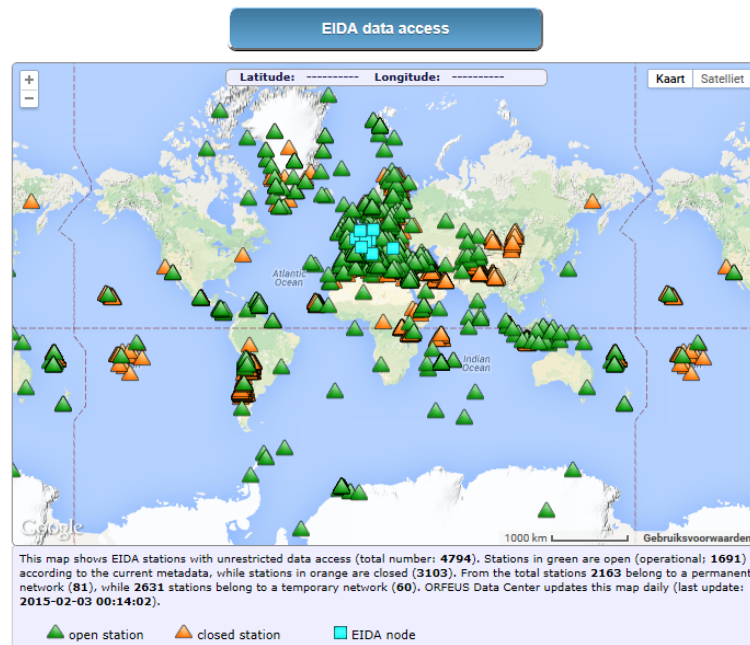
Figure 2: Geographical locations of seismic stations providing data to EIDA.

The EIDA data access interface (developed by GFZ, hosted by ORFEUS) allows users to search for and explore earthquake data from different catalogues (EMSC, GFZ, USGS, INGV), explore seismic stations from EIDA and request waveform data and related metadata (both in SEED) from station-event combinations that fulfill the criteria. Technically, the connection to data within EIDA is through ArcLink, a protocol developed by GFZ to collect the appropriate waveform data from each archive in the EIDA infrastructure, and thus providing transparent access to each node.

Figure 3: Data access interface to EIDA.

EIDA is core component of the Seismology part of EPOS (European Pate Observing System), which aims to coordinate Earth Science data in Europe. Within EPOS, EIDA will be used to collect and distribute a significantly increased set of seismological and related data. In particular, EIDA will provide comprehensive access to 1) accelerometric data, with dedicated portals (e.g. EDP) offering data selection targeted towards strong motion; 2) temporary broadband seismic deployments across Europe (including experiments past eg TopoIberia and future eg AlpArray); 3) OBS data recorded by European institutions; 4) all seismic and infrasound data recorded by the EPOS Near Fault Observatory and Volcano Observatory communities; and 5) accelerometric data recorded within structures.

EIDA is thus entering in a phase of rapid growth, in terms of the number of contributing data archives, the volume of these archives, the variability of the data, as well as the number of users and the volume of downloads. The success of EIDA is thus challenging the current architecture and is the driving force behind the design of the next generation EIDA (EIDA NG). EIDA NG must cope with further expansion of the system and more complex user requirements by developing new techniques and extended services. Various projects, including EPOS-IP, EUDAT2020, and ENVRI+ provide support

Parametric data

The coordination of earthquake parameters in Europe is done by the EMSC, providing access to rapidly determined earthquake parameters from European and Mediterranean earthquakes. Parametric data in the EDP comes from the EMSC bulletin and the EMSC real-time gathering system for phase arrival times from various seismic networks. Provides picks, manually or automated, are merged to create an earthquake with origins and phase arrivals that are stored into a database. After the event information is

available from the real-time processing several processes are initiated to create different types of information, like a 'felt-map' or a regional seismicity map.

The database with recent earthquake information can be accessed by standardized webservices, like FDSN webservice 'fdsnws_event' (http://www.fdsn.org/webservices/) and the OGC Web Map Service (WMS) for serving georeferenced map images from a GIS database. This webservice has been immediately adopted by the community and smartphone application developers. It serves 3.5 million invocations from more than 110, 000 unique IP (i.e. unique users) a month, a level of traffic which is obviously not generated by seismologists only.
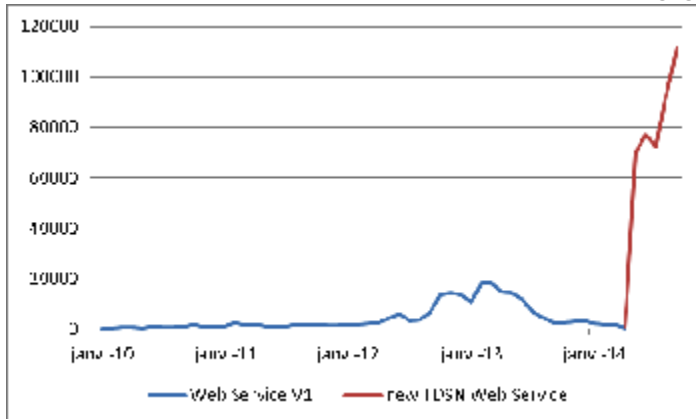
Figure 4: Invocation of the webservice for parametric data during the course of the NERA project.

Seismological hazard and risk

The coordination of the hazard and risk component in Europe started more recently, within NERA and the EC FP7 projects SHARE (2010-2013), partly in cooperation with the Global Earthquake Model (GEM) initiative. The European Facilities for Earthquake Hazard and Risk (EFEHR, www.efehr.org) was established in 2010 as part of NERA to provide coordinated services for earthquake hazard and, to a limited extend, risk information on European level. The EFEHR web platform provides access to homogeneous and harmonized datasets and tools relevant for analysis and assessment of seismic hazard across Europe.

Using an interactive data portal and web-services, EFEHR provides background information as well as access to data and products on seismic hazard, links to the earthquake related vulnerability and fragility of buildings and infrastructures, and seismic risk related information.

5

Figure 4: EFEHR web site

The long-term governance structure of EFEHR is currently being implemented as part of the European Plate Observatory System (EPOS) initiative.
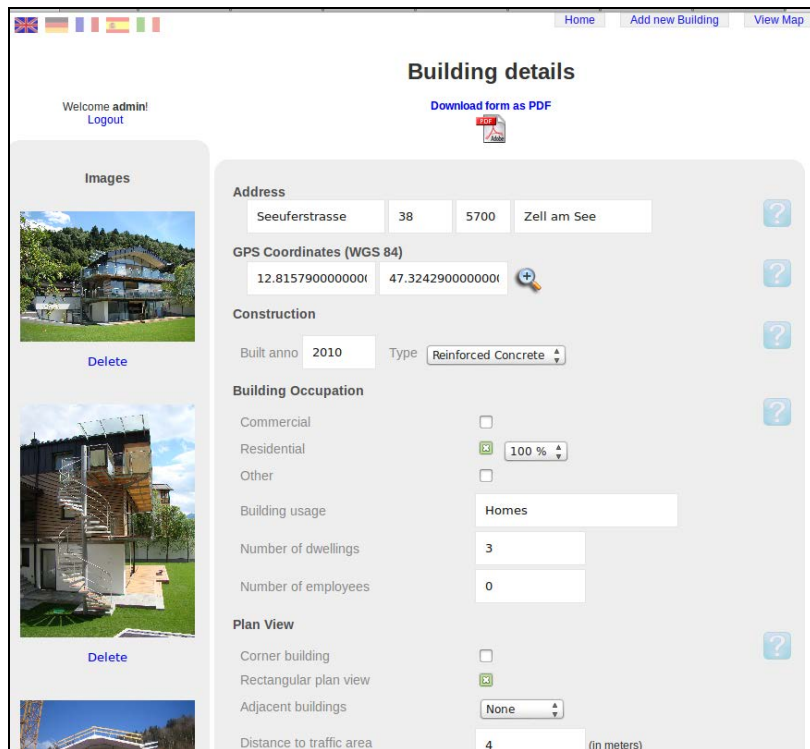
Structural Assessment Data

VCE and FAW have collaborated towards designing and implementing an online service for easy structural assessment of civil buildings. These efforts have resulted in the establishment of OSAP (osap.faw.at), the Open Structure Assessment Portlet. OSAP has been designed and intended for being used by virtually everyone on the Internet, especially targeting non-professionals and non-experts among the fields of seismology and civil engineering. The platform allows to assess arbitrary buildings, along with their address and geo-coordinates, in order to describe its current structural health using easily understandable and assessable parameters, like the number of floors, typical usage and year of construction.

The very main objective towards the creation of OSAP, was to allow non-experts to do basic but important structural assessment, which in turn allows professionals to utilize the given datasets for further calculations, e.g. for disaster simulations in case of earthquakes. Especially in such cases, it is crucial to know about structural conditions of affected buildings, and maybe even an expected number of people occupying the building at the time of the simulated event.

OSAP itself contains a simple web-frontend for adding new building assessments and viewing buildings currently available in the database. In addition, and perhaps even more importantly, OSAP provides a web-service for third-party web-sites and applications, for querying the central building database and making use of the data contained therein for research, simulation and emergency.

The Seismic Portal created during NERA implements such a data connection to OSAP, and allows adding new layers to the Seismic Portal world map, specifically using the OSAP datasets.

Figure 5: OSAP Building Details

NERA Glossary

Moreover, a NERA Glossary browser web-site (see Fig. 6) has been developed by FAW and VCE, which tries to establish a common understanding of both, domain-specific and cross-domain technical terms, which more often than not are subject to being overloaded. In order to arrange a common ground, the NERA Glossary contains detailed descriptions of technical terms from multiple important sources, which include (but are not limited to) the IAEA Safety Glossary, ISO standards 14001, 2041, 22301, 31000, 55000 and 9000, as well as the SAMCO Monitoring Glossary, UNISDR, Wikipedia and others. The NERA Glossary is still under development and will continue to grow even after the NERA project came to completion, as we are still maintaining and fine-tuning the list of terms, sources and the web-site itself.

Figure 6: The NERA Glossary Browser

Links

http://www.seismicportal.eu
http:// www.orfeus-eu.org/eida
http://www.emsc-csem.org
http://www.efehr.org
http://osap.faw.at