

Disaster Data Center (DDC)

a Natural Disaster historical data repository

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During the last decades, mankind has suffered from devastation caused by natural disasters and technological accidents of increased frequency.

Intense recurrent phenomena all over the world, such as floods, earthquakes, landslides and tsunamis, caused by strong geotectonic rearrangements, indicate an accelerated process of re-forming the earth's surface.

Furthermore, an increase in the frequency of technological disasters is also apparent over the last years. Human activities and management failure result in large scale technological disasters, such as nuclear accidents, explosions, contamination from waste and toxic chemicals, biological contamination etc.

These events are projected to be major issues for state and local authorities in the immediate future and a large number of scientists worldwide have started to systematically investigate them. Thus, expertise and knowledge on this field is constantly accumulated worldwide.

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When a natural hazard strikes, children are among the most vulnerable population group, especially those at-tending school in times of disaster.

During disasters, school buildings are destroyed, taking away the precious lives of children and teachers and stalling access to education in the aftermath of disaster. Rebuilding these schools can take years and is very costly.

Disasters such as the October 2005 earthquake in Pakistan, where over 16,000 children died in schools that collapsed, or the earthquake in Sichuan Province in the People's Republic of China in 2008, where more than 80.000 school children lost their lives while attending school, are just a few tragic examples of why more needs to be done to protect our children before disasters strikes.

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The **National and Kapodistrian University of Athens** (Greece) has developed a specialized **e-learning course** for educators in Greece, which focuses on disaster management in schools and utilizes the **innovative service called Disaster Data Centre (DDC)** to draw up-to-date data, information and references on recent major disasters in Greece and worldwide to be used as educational material.

Efficient education on disaster management protection measures and dissemination of up-to-date disaster information can contribute to the reduction of its impact at schools. The **innovative educational tool DDC** has the unique ability to offer real-time information on disaster events.

After completing the course, it is expected that educators will be able to communicate the knowledge on disaster preparedness and management to children and their families, to participate in both pre and post disaster activities for preparedness and mitigation of disaster in schools, to respond timely and effectively through in-formed decision-making in the event of a disaster and to promote school building safety, all of which are key action points in the unfortunate event of a calamity.

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The e-learning course developed by the Laboratory for the Study and Management of Natural Disasters of the National University of Athens (NUA) includes the following topics:

- **Hazards and Disasters:** Introduction to the concepts of disasters (geodynamic disasters, hydrometeorological disasters, biological disasters, technological disasters), major disasters worldwide, disasters in Greece, impact of disasters to school environments.
- **Prevention and mitigation of disaster impact to school environments:** Civil protection, School and community disaster management planning, reinforcement of schools, student safety and protection, prevention and protection measures.
- **Educating students – the role of the teacher in the disaster reduction education in schools:** Planning courses according to the students' age, planning mock drills, psychological issues, consulting and guidelines for student support.

The course utilizes numerous case studies, current, recent and older, **drawn from the DDC database.**

Numerous quizzes and assignments have been included to the course, not only to allow for the participants to evaluate their own progress, but also to evaluate and upgrade the course in general in order to answer the needs of school educators more efficiently and to upgrade the **DDC services** as well.

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The “Disaster Data Centre (DDC)” service

Currently, data on catastrophic events, regarding their cause, effect and management are collected, recorded, published, stored or archived by various public services responsible for preventing and managing disasters, the mass media, researchers, in scientific publications, local public or private entities and individuals who witnessed these events, or are somehow related to them. **This accumulation of information, however, lacks structure and organization, thus fails to be channeled promptly to the authorities and society.**

Disaster Data Centre (DDC) is a service which utilizes a modern and technologically advanced system in order to serve as an “Ark” which stores and preserves knowledge and information which may be lost or forgotten after the catastrophic events have taken place.

The **Disaster Data Centre** stores and preserves the countless information (recent and older) related to catastrophic events, organized and presented in a scientific and innovative way, which allows easy retrieval of individual and combined information through queries.

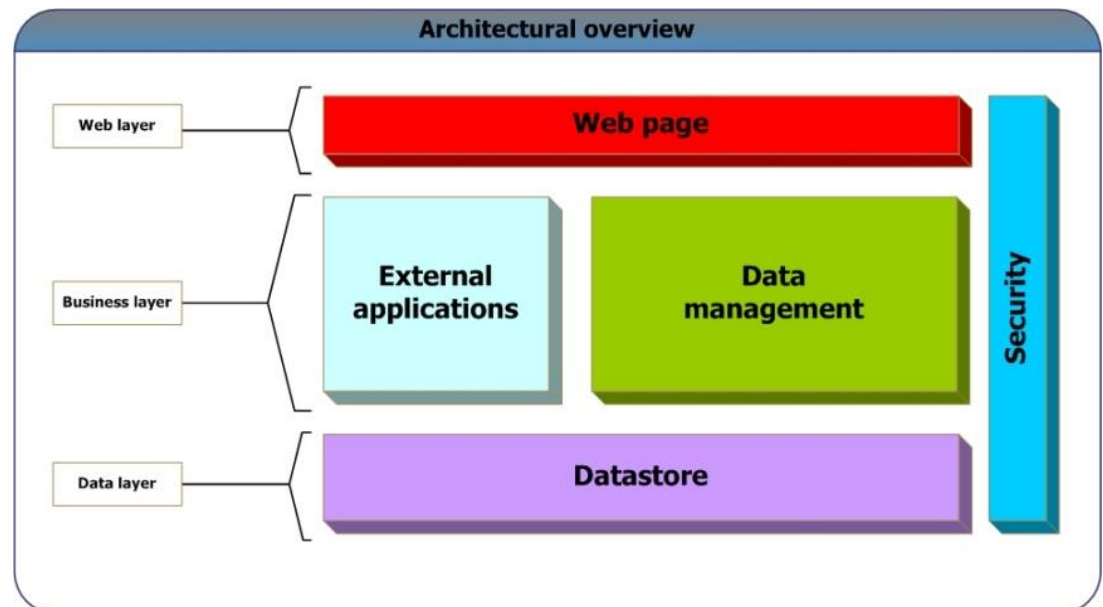
Emphasis has been given on **interactive communication applications and direct communication of anyone interested**. Separate applications enable the public to submit documents, audiovisual material, testimony and opinions about an event. The data entry is done through a special, user-friendly platform.

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Software architecture

- **The web layer** contains the web page which is responsible for the delivery and formatting of information to below layers for further processing or display. The web page is the gate of users to our system. Through web page users can search, add or modify content based on security permissions that apply.
- **The business layer** contains **data management** and **external applications** blocks. **Data management** is a system component that acts as intermediary between the upper software and the data. Data management exposes methods of managing the stored data without exposing or creating dependencies on the data storage mechanisms. The retrieval, insertion or modification of data is consumed through this block. **The external applications** block describes the applications that interact with the system datastore through data management, but overall their operation has nothing to do with users. This type of software acts as an information gathering service, with a main purpose of searching and collecting information on a particular disaster over social networks.
- **The data layer** is the base of the system and includes the data persistence mechanisms (database servers, file servers). A database is an organized collection of data. The data are typically organized to model relevant aspects of reality in a way that supports processes requiring this information. A file server is a computer attached to a network that has the primary purpose of providing a location for shared disk access.



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The Database Management System of DDC

Disaster Data Center uses the **Not Only SQL (NoSQL) βάση δεδομένων Apache Cassandra**.

Apache Cassandra is an open source distributed database management system designed to handle large amounts of data across many commodity servers, providing high availability with no single point of failure.

Cassandra offers robust support for clusters spanning multiple datacenters, with asynchronous masterless replication allowing low latency operations for all clients.

Cassandra's data model is a partitioned row store with tunable consistency.[Rows are organized into tables; the first component of a table's primary key is the partition key; within a partition, rows are clustered by the remaining columns of the key. Other columns may be indexed separately from the primary key.

Tables may be **created, dropped, and altered** at runtime **without blocking updates and queries**.

Cassandra does not support joins or subqueries, except for batch analysis via Hadoop. **Cassandra** emphasizes denormalization through features like collections.



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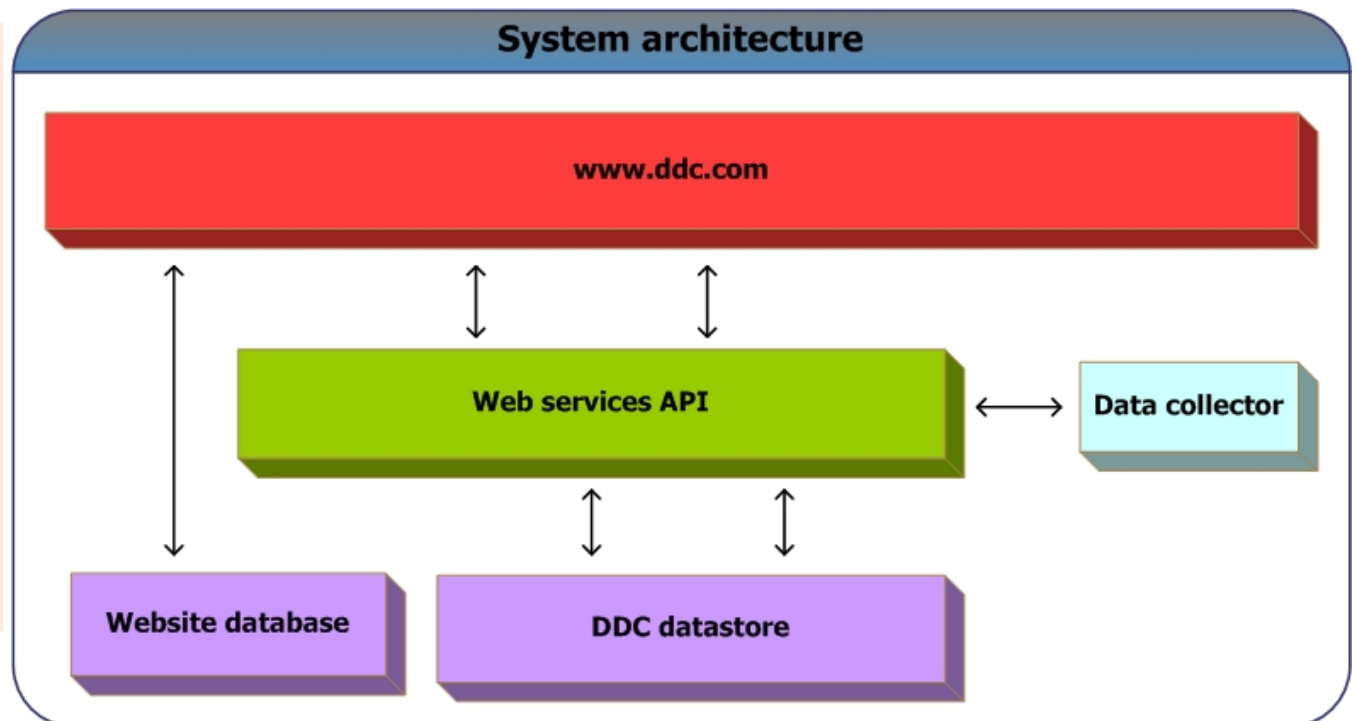
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System architecture

The Disaster data center is based on a multi-layer model architecture.

- The “**www.ddc.com**” is the website, which is a set of related web pages served from a single web domain, which in turn present the disaster information to users. It is built with Joomla! context management system.
- **Web services API** is a collection of web services that interact with the database and act as middleware between “www.ddc.com” and DDC-datastore. A Web service is a method of communications between two electronic devices over the World Wide Web. It is a software function provided at a network address over the web with the service always on as in the concept of utility computing. The web service API is built with Java using REST architectural style which allows interaction with a web-based system via simplified URL's.
- **Data collector** is the software that gathers data over social networks like Facebook, Twitter and YouTube.

Every **event** is defined by metadata which some of them are the keywords for additional searching and information gathering. The **data collector** application has been designed with time based rules so the information search applies to the **social network** restrictions.



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INSPIRE Annex III spatial data theme 12, Natural Risk Zones

There are **4 key spatial object types** that are modeled within the Data Specifications of Natural Risk Zones:

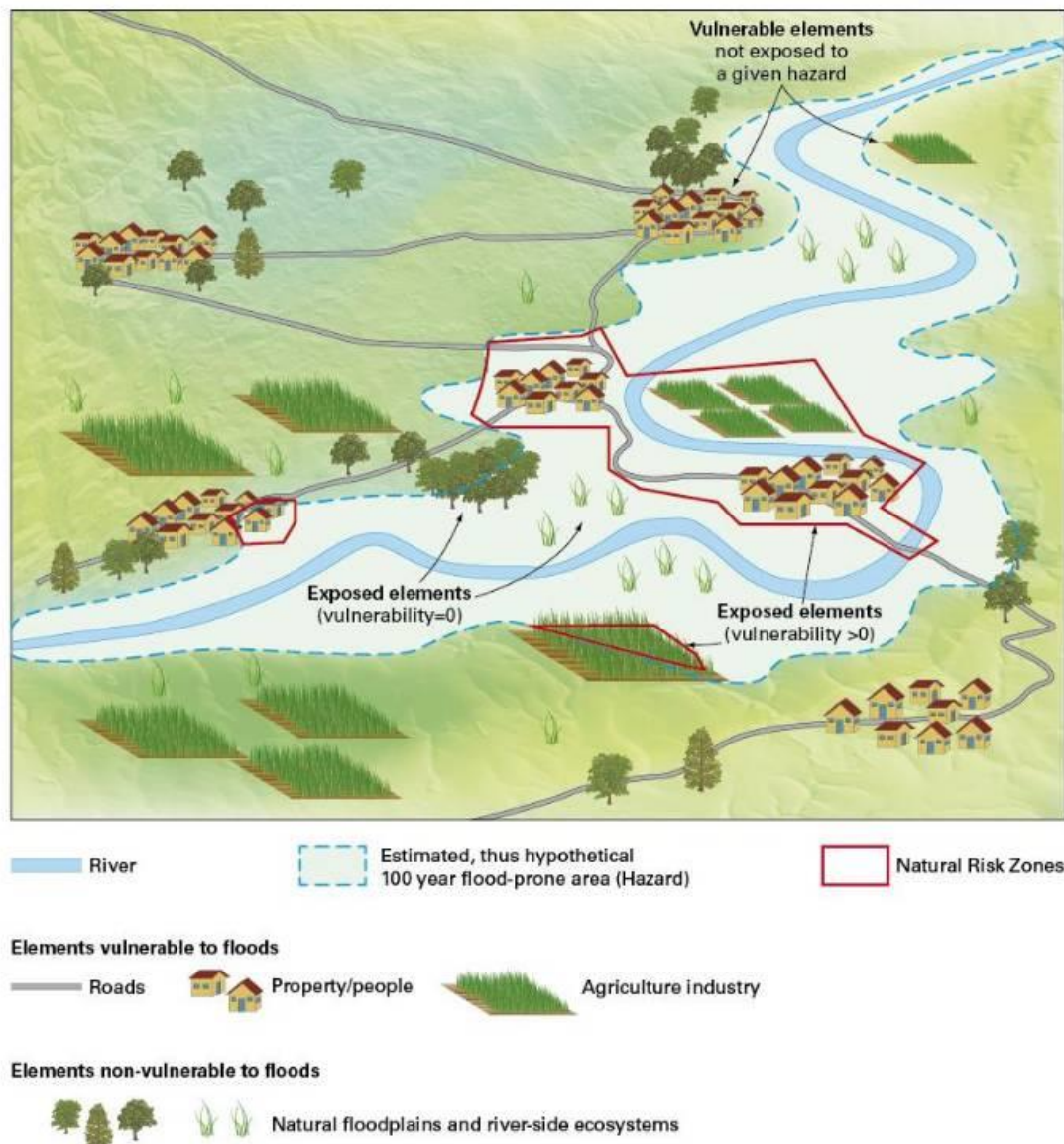
- Hazard area
- Exposed element
- Risk zone
- Observed event

What **has not been primary** considered are:

- Real time data
- Technological hazards
- Multi-hazard/risks
- Modelling of the processes and scientific methods or data used to define hazard areas, exposed elements and risk zones
- Disaster management

DDC has been designed to store the Inspire specified information **and** the related information of real time data, models, management etc.

This information can be consisted by any type of raw observations and processed data that precede or follow the events (earthquake, flood, etc.), in the form of photos, announcements, sort messages published in social media, publications etc. This information is linked to the event as multimedia attributes and permanent stored.



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Disaster Reduction Education for School Teachers

The necessity of disaster reduction education in schools is unambiguous.

Only in the last decade more than 150.000 children have lost their lives while at school during disaster events, and hundred thousands more have been injured physically and psychologically



Remains of school facilities that collapses after the great earthquake of 12th May 2008 in Sichuan Province, China. A monument was built as a reminder of the devastation

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Remains of school facilities after the tsunami of 11th March 2011 that stroke NE Japan. The evacuation plan failed resulting in the death of many small children. The statue was placed a reminder.



Remains of school buildings that collapsed after the earthquake of 12th May 1995 in Grevena Province, Greece

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Expected Results

The pilot operation of the e-learning tool provided by the **DDC** will take place in March 2015. A class of 25 K-12 educators will be formed who will complete the course within 8 weeks. The evaluation phase will follow and the results of the pilot operation will be demonstrated soon after the evaluation phase is completed.

It is expected that:

- More than 90% of the educators will successfully complete the course.
- More than 90% of the educators will evaluate the course positively.
- More than 60% of the educators will give useful feedback for upgrading the course.
- More than 90% of the educators will state that, after completing the course, they feel more confident to cope with a disaster than before.
- More than 70% of the educators will plan a mock drill customized to fit their school's particularity and environment.
- More than 80% of the educators will plan a disaster awareness course for their students, accommodated to their age and needs.
- More than 60% of the educators will plan a disaster awareness informative session for the parents.
- More than 70% of the educators will make suggestions for their school's reinforcement to the school council.

It should be noted that the **DDC software and services can easily be adopted by other countries**. It currently hosts information in Greek and English but it has been designed to embed any language.