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Country Report - Germany
The German NSDI (GDI-DE)[*]

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Summary

This report summarizes the status of development of the NSDI for the Federal Republic of Germany, called GDI-DE (**G**eo-spatial **D**ata **I**nfrastructure for Germany (**De**utschland). The development of GDI-DE as a public infrastructure began in 1998 within the Federal government. According to a decision of the CEOs of the public administrations on federal, state and municipal levels GDI-DE became a cooperative project steered since 2005 by a steering committee (so-called LG GDI-DE) which is made up of representatives from the federal government, the federal states and the communal head associations. While at the beginning the development was driven only by national needs it is now guided by the EU INSPIRE Directive put in force on 17 May 2007. Furthermore, the development of GDI-DE is also influenced by the EU project Global Monitoring for Environment and Security (GMES). Currently, work concentrates on uniform geodetic referencing and on the provision of uniform topographic reference data. The approach to the nationwide implementation of GDI-DE, especially through the GeoPortal.DE and a national geodatabase (NGDB), is explained.

Résumé

Le présent rapport donne un aperçu de l'état actuel du développement de l'NSDI pour la République fédérale d'Allemagne, appelé GDI-DE (**G**eo-spatial **D**ata **I**nfrastructure for Germany (**De**utschland)). Le développement de la GDI-DE en tant qu'infrastructure publique a commencé en 1998 au sein du gouvernement fédéral. Selon une décision des PDG de l'administration publique à l'échelon de la fédération, des Länder et des communes, le GDI-DE est devenu un projet coopératif géré depuis 2005 par un comité directeur (appelé LG GDI-DE) se composant de représentants du gouvernement fédéral, des Länder et des associations des têtes communales. Tandis que le développement avait été poussé au début seulement par des besoins nationaux, il est aujourd'hui géré par la Directive INSPIRE qui est entré en vigueur le 17 mai 2007. De plus, le développement de la GDI-DE est aussi influencé par le projet de l'UE intitulé Surveillance Mondiale pour l'Environnement et la Sécurité (GMES). Actuellement les travaux se concentrent sur une référence géodésique uniforme et sur la mise à disposition de données uniformes de référence topographique. Sont expliquées l'approche à l'introduction nationale de la GDI-DE, en particulier par le GeoPortal.DE, et la base nationale de données spatiales (NGDB).

Sumario

Este reporte resume el estado de desarrollo del NSDI para la República Federal de Alemania, denominada GDI-DE (Infraestructura de Datos Geo-espaciales para Alemania). El desarrollo del GDI-DE como una infrastructura pública comenzó en 1998 en el gobierno federal. De acuerdo a la decisión de los CEOs de las administraciones públicas de nivel federal, estatal y munincipal el GDI-DE se convirtió en un proyecto cooperativo dirigido desde 2005 por un comité directivo (también llamado LG GDI-DE) constituido por representantes del gobierno federal, los estados federales y principales asociaciones comunales. Mientras que al principio el desarrollo fue guiado sólo por necesidades nacionales, ahora está guiado por la Directiva EU INSPIRE puesta en vigor el 17 de Mayo del 2007. Más aún, el desarrollo del GDI-DE esta también influenciado por el proyecto Global Monitoring for Environment and Security (GMES) de EU. Actualmente, el trabajo se concentra en el referenciamiento geodésico uniforme y en la provisión de datos de referencia topográfica uniforme. El enfoque a la implementación de carácter general al GDI-DE, especialmente a través del GeoPortal.DE y la national geodatabase (NGDB), es explicado.

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ABBREVIATIONS AND ACRONYMS

ALB	Automated Real Estate Book (attributes of parcels)
ALK	Automated Real Estate Map (position, shape and topology of parcels)
ALKIS	Authoritative Real Estate Cadastral Information System
ATKIS	Authoritative Topographic-Cartographic Information System
BfN	Federal Agency for Nature Conservation
BKG	Federal Agency for Cartography and Geodesy
BMU	Fed. Min. for the Environment, Nature Conservation and Nuclear Safety
CRS	Coordinate Reference System
DFD	German Remote Sensing Data Centre, a DLR institute
DGM	Digital Terrain Model
DLM	Digital Landscape Model
DLR	German Aerospace Centre
DOM	Digital Surface Model
DTK	Digital Topographic Map
EOWEB	Earth Observation WEB
GDI-DE	National **G**eo-Spatial **D**ata **I**nfrastructure for Germany (**De**utschland)
GeoZG	German Law for Geo Data Access (Draft)
GI	Geographical Information
GIW-Komm.	Commission for Geo Business
GNSS	Global Navigation Satellite Systems (GPS, GLONASS,…)
KSt. GDI-DE	Co-ordination Office of the GDI-DE
IFG	German Law for free access to public information
IMAGI	Inter-Ministerial Committee for Geo Information
INSPIRE	Infrastructure for Spatial Information in Europe
ISO	International Organization for Standardization
IWG	German law for reuse of public sector information
LG GDI-DE	Steering Committee of the GDI-DE
MoE	Ministry of Environment
NGDB	National geodatabase

PortalU	German Environmental Information Portal
PPP	Public-private partnerships
PSI	Policy and legislation on access to public sector information
SDI	Spatial Data Infrastructure
SOA	Service Orientated Architecture
UBA	Federal Environmental Agency
UDK	Environmental Data Catalogue (Metadata model of PortalU)
UIG	German Environmental Information Law
UrhG	German Copyright Act (Urheberrechtgesetz)
WMS	Web Mapping Service

1 Introduction

Germany is on track towards a spatially enabled society underpinned by a national geo-spatial data infrastructure, called GDI-DE. According to a resolution of the German Parliament (`Deutscher Bundestag`) adopted on 15 Feb 2001, the German Federal Government launched activities to develop the GDI-DE in collaboration with the federal states, universities and industry. Currently, the works concentrate on the provision of interoperable reference data according to the INSPIRE directive. The provision of such data is the task of official surveying and mapping carried out by the 16 federal states. However, each of the states is responsible for its own topographic and cadastral service, environmental and statistical data collection, and in general for data policies.

BKG, the federal centre of competence for geodesy and geoinformation science contributes significantly to the coordinated establishment and development of the GDI-DE by providing nationwide uniform geodetic reference frames, topographic reference data via its Geo Data Centre, the GeoPortal.Bund (upcoming GeoPortal.DE). Furthermore, BKG is also responsible for the coordination of the practical works related to the implementation of GDI-DE (see 2.1).

2   Details of the German NSDI: GDI-DE

2.1 Component 1: Coordination and organizational issues

A first measure of improving the coordination of geodata collection and geoinformation usage on the federal level was the establishment of the IMAGI (Inter-Ministerial Committee for Geo-information) (www.imagi.de) by the Federal Government in 1998. Within the IMAGI the fundamental conceptual framework for GDI-DE was developed and endorsed by the German Parliament in 2001 and 2003. The IMAGI secretariat was assigned to BKG.

As the structure of public administrations in Germany has three distinct tiers: (1) local, regional and national, all of which are generators and holders of public information (2) the establishment of GDI-DE needs to be a cooperative project. This was achieved by a decision of the CEOs of the federal chancellery and the federal states Chancelleries that adopted a resolution related to the set-up of the GDI-DE and its assignment to the German eGovernment strategy in November 2003. Thus the organisational structure for development and implementation of GDI-DE was established in 2004 (Figure 1).
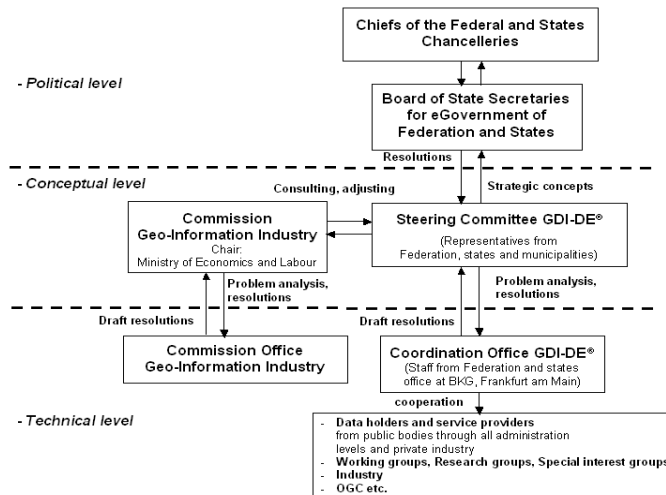
Figure 1: Organisational structure of the GDI-DE illustrating the integration the administrations of the Federation, federal states and municipalities

The Steering Committee for GDI-DE (further referred to as LG GDI-DE, i.e. the German acronym) is responsible for decision making that is binding on all three tiers of public administration in Germany. This is to ensure that all public administrations apply a common set of standards and specifications. The decisions of the LG GDI-DE are carried out by the Coordination Office GDI-DE (further referred to as KSt.GDI-DE) which belongs to BKG, but comprises civil servants both from the Federation and the federal states. An administrative agreement between Federal Government and State government provides primarily staffing and budget, and the terms of reference taking also into account the INSPIRE requirements, e.g. support of the LG GDI-DE as the National Point of Contact for the EU Commission. The organisation of GDI-DE is complemented by the Commission for Geo-Information Business. Furthermore, an INSPIRE Task Force (ITF) chaired by the BMU was established to coordinate the INSPIRE related activities in Germany. The ITF coordinates the German experts in the EC working groups and develops Germany's position to be presented in the INSPIRE commission.

2.2 Component 2: Legal framework and funding

Up to the beginning of this decade there was no federal law related to the area of geoinformation. This has changed through the legislation of the European Union starting in the first half of this decade.

Thus Directive 2003/4 on access to environmental information has been transformed by the Federation into the German Environmental Information Law put into force in February 2005. Meanwhile also the 16 Federal states have adopted similar legislation. Thus. access to the information on the environment held by public authorities is guaranteed. Furthermore, the Federation transformed the European Directive 2003/98/EG on Public Sector Information (PSI) into national law in 2006 which regulates the reuse of public sector information in Germany ('IWG'). In 2006 the Federation adopted also the ´Free Access to Public Information´ law enabling access to public sector information. And on 17 Feb 2008 the Federal Parliament passed a law to guarantee access to federal geodata according to the INSPIRE directive (i. e. 'Geodatenzugangsgesetz'). Similar legislation is underway in the federal states.

In general, development and implementation of GDI-DE are funded using the budget endorsed by the Federal Parliament.

- *As regards the Pricing Policy*

Regularly public sector geodata are made available at the costs of economic value and of dissemination. Variations do exist in the pricing policies of the different public authorities.

The costs for reference data are determined by the AdV. However; there is a tendency to deregulate data access. A good example for this is a contract between the Federal states and the Federal Ministry of the Interior serving the provision of reference datasets of the federal states for the federal administration. BKG pays an annual general license fee which allows to deliver topographic data sets and services to Federal Agencies free of charge. Furthermore, the IMAGI developed a common 'template of terms of use for delivery and service of Geo information from the Federal administration'. It provides three categories of pricing rules: (1) a certain set of general free information for non-commercial use will be distributed via the web, (2) standard products will be available at fixed reasonable prices, and (3) special on-demand services will be charged according to full cost recovery.

2.3 Component 3: Geo datasets of GDI-DE (focusing on reference data)

An expert group of the IMAGI has been developing an explicit definition of the National Geo Database (NGDB) as the central component of GDI-DE since 2005. The NGDB includes public geo datasets relevant for legal tasks as well as for the support of good governance, and also serving the demands of Sciences and German Economy. The result of this activity is available at GeoPortal.Bund (http://geoportal.bkg.bund.de/).

As the INSPIRE directive requires the EU-member states to deliver the spatial reference data as defined in the annexes I and II, first the implementing rules (data specifications) for those data are being developed with highest priority by experts from both the member states (e. g. BKG) and the EC services starting with the reference data defined in annex I.

- *Geodetic reference frames (CRS)*

The uniform geodetic reference frames for Germany are provided by BKG in cooperation with the IAG services, and partly in cooperation with the state surveying offices. BKG operates geodetic observatories in Wettzell/Germany and in Concepcion/Chile.

In 1991 the AdV decided to replace the Gauß-Krüger system based on the Bessel ellipsoid by the European Terrestrial Reference System 1989 (ETRS89/GRS80). In 1995 the UTM projection was endorsed in order to achieve geometrical interoperability across borders in Europe. Transformation services need to be applied for the integration of the bulk of geo data in different Coordinate Reference Systems (CRS) into ETRS89. With AdV decision of 1993 the German Principal Height Network (Deutsches Haupthöhennetz, DHHN92) was introduced as the official height reference system for Germany. For the DHHN92 normal heights above Normal Height Zero (NHN, related to Normal Amsterdams Peil) are going to be derived. The level and scale for the gravity measurements in Germany are determined by the German Gravity Basic Network (Deutsches Schweregrundnetz 1994, DSGN94), which has been validated by absolute gravity measurements. For the territory of the Federal Republic of Germany a combined satellite-geodetic gravimetric levelling *quasigeoid* was computed that allows the conversion of ellipsoidal GNSS heights with reference to the reference ellipsoid GRS80/ETRS89 into levelling heights related to the mean sea level height reference system (DHHN92) with an accuracy between 1 cm in (flatlands) and 3-5 cm (high mountains) and a planimetric resolution of 1.5´ x 1.5´.

For the management of the control points that realize the geodetic reference system AdV is going to implement the Authoritative Geodetic Control Station Information System (AFIS).

- *Geographical names*

Germany has given importance to UNGEGN since its foundation. The related work on the national level is done by StAGN (German acronym for Permanent Committee for the Standardization of Geographical Names), e. g. the spelling rules for geographical names are documented in 'Toponymic guidelines' (http://www.stagn.de/Portals/0/020809_TOPGUIDE ZWEISPR MIT ABB.pdf). BKG maintains two stand-alone databases of geographical names: GN250 and GN1000. These databases contain names of the municipalities, villages and parts of municipalities, landscapes, mountains, islands, rivers, canals, lakes, seas and others. The database GN250 (1:250k) contains about 61.000 entries and the database GN1000 (1:1.000k) about 13.000 entries. BKG is aiming at connecting the stand-alone geographical names

databases with the ATKIS DLMs. Here, geographical names are attributes of topographic features. Hereby the outcome of the recently finished EU project EuroGeoNames is taken into account.

- *Topographic reference data (Annexes I and II of the INSPIRE directive)*

The product line of ATKIS provides digital feature based landscape models, digital topographic maps and digital terrain models. These datasets enable Germany to deliver the required topographic reference data on both national and European levels.

Currently, there are 3 ATKIS *Digital Landscape Models (DLM)* available describing the topographic features of the landscape and the relief of the earth's surface in vector format and in different resolutions, i. e. Basic DLM 1:10k/25k, DLM250 (1:250k) and DLM1000 (1:1,000k). The related feature catalogues comprise six themes: settlements, transport, vegetation, hydrography, relief and designated areas (e.g. protected areas, national parks, etc.). Each theme contains one or more feature classes. Most recently, BKG has started to produce an additional uniform DLM for the German territory using the Basis DLM and satellite-based Earth observation data as input for an enriched and updated DLM-DE which is primarily used for monitoring the German envoirnment.

Right now customers are primarily provided with the rasterized *conventional topographic map series* at scales 1:25k, 1:50k, 1:100k, 1:200k, 1:500k, and 1:1000k. Recently the production of *new topographic maps* (DTK) derived from the DLMs has started using digital cartographic processes. There are *Digital Terrain Models (DTM)* of different resolutions available that describe the relief of the German territory. Resolution in terms of standard deviation of heights varies between ±0,2 m and 100 m and in terms of spacing between 2 m (LIDAR) and 100 m.

All products are harmonised and delivered by the National Geo Data Centre at BKG.

- *Real estate cadastre*

The German real estate cadastre comprises the geometric and attributive descriptions of the parcels. It is up-dated and managed by the state cadastre administrations. In the early 1980ties the Automated Real Estate Register (ALB) comprising information about the parcels (parcel identifiers, location, area, history, land use, etc.), plot of land (identifiers from land register, type of property), stand of parcel (proprietor/owner) was created by digitizing the paperbased cadastre. At the same building up the Automated Real Estate Map (ALK) began by digitizing and harmonizing the cadastral maps in vector format. The ALK datasets are parcel-based and contain cadastral boundaries, land parcels, nature of use, buildings, streets, landuse, names, and districts names, house numbers, etc.. Most recently ALK and ALB are going to be integrated into ALKIS, the new Official Real Estate Informations System based on ISO and OGC standards (see: http://www.adv-online.de).

- *Core thematic data (protected areas etc)*

Core thematic data mainly exist in the state administrations, but also in several federal agencies. With regard to the INSPIRE directive protected areas have the highest priority. Those geo data (i. e. nature protection sites, landscape protection sites, biosphere reserves, nature parks, national parks) are provided by the Federal Agency for Nature Conservation (Bundesamt für Naturschutz – BfN) according to an agreement of the responsible public authorities of federal and state levels.

- *Satellite imagery*

Satellite data and their metadata are provided by the DLR EOWEB (Earth Observation WEB) Satellite Data Information Service, a data catalogue of the German Remote Sensing Data Centre (DFD).

2.4 Component 4: Metadata

Consistent metadata have been created for the reference and the core thematic data since 2004 when the development of a 'geodata catalogue' as a part of GeoPortal.Bund began as an online metainformation broker and central entrance point to the metadata catalogues of the GDI-DE. The 'geodata catalogue' functions as the main interface for the enquiry of core thematic metadata. The meta information available describe geodata regarding, e. g. biota and environment, basic data, air, water, statistics, infrastructure, geology, etc.

2.5 Component 5: Network Services

GeoPortal.Bund operated by BKG has been the central entry to the GDI-DE online since October 2005. It plays an important role in the development of GDI-DE, in particular, with the harmonisation of geodatasets and geo services, and it also functions as entrypoint to GDI-DE for the EU services and for GEOSS, the Global Earth Obersavtion System of Systems. At present GeoPortal.Bund connects 14 catalogue services and 55 OGC web mapping services with more than 500 thematic layers.

2.6 Component 6: Thematic environmental data

The German Environmental Information Portal PortalU (http://www.portalu.de) has been online since June 2006 and linked to GeoPortal.Bund. PortalU provides a variety of environmental information and related metadata by a powerful search engine. Furthermore an integrated map-viewer allows access to geospatial data. PortalU does not only provide access to the web pages, online-documents and several data bases of almost 200 public agencies in Germany, but also integrates the major environmental metadata model in Germany, the Environmental Data Catalogue (UDK). Since the mid-1990's, the UDK has been used by most of the 16 German federal states.

3 State of Implementation in 2009

The Coordination Office GDI-DE developed a comprehensive implementation plan (IP) for the construction of the GDI-DE. The IP is based on the Technical Architecture GDI-DE framework (TA) developed between 2006 and 2008. The IP determines procedures and tools which shall be implemented in all administrations participating in the GDI-DE exercise. Furthermore implementation tasks to be carried out until 2011 are defined which encompass activities in the fields of administration and coordination, technical specification, metadata management, vertical integration and spatial data offerings. Figure 2 provides an overview of the IP's building blocks.
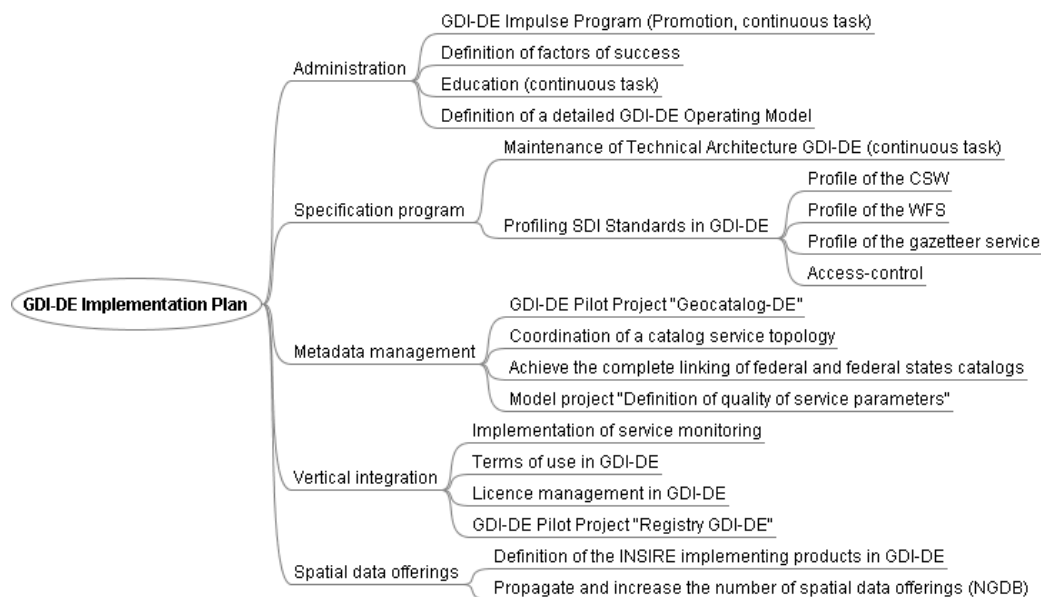

Figure 2: Building blocks of the GDI-DE Implementation Plan

The TA was developed with the objective to ensure the interoperability of GDI-DE's constituent components. An investigation of typical use cases resulted in the definition of functions relevant to spatial information handling, to legal frameworks, and to E-Government policies. The functions have been categorized according to the level of maturity of available specifications and products. Those which are supported by nationally and internationally recognized specifications and corresponding products form the obligatory core of the GDI-DE

architecture. Table 1 comprises a list of specifications relevant for the implementation of the GDI-DE (Wytzisk et.al. 2009).

Service type, data format, reference system	Specification
Catalogue service	OpenGIS catalogue service specification 2.0.2 - ISO metadata application profile, version 1.0.0
Vector data service	OpenGIS WFS 1.0 – Web feature service implementation specification OpenGIS WFS 1.1 – Web feature service implementation specification
Raster data service	OpenGIS WCS 1.0 – Web coverage service implementation specification
Visualisation service	WMS-DE version 1.0 (based on WMS 1.1.1)
Gazetteer service	OpenGIS Gazetteer service – application profile of the web feature service implementation specification 0.9.3
Coordinate reference systems	ETRS89 with the UTM 32 mapping (EPSG code: 25832) Geographic coordinates in WGS84 (EPSG code: 4326)
Metadata and metadata formats	ISO 19115:2003 – spatial data metadata ISO 19119:2005/PDAM1 Geographic Information – Services ISO/TS 19139 (RC2) – metadata – XML schema (when available)
Vector data formats	OpenGIS geography mark-up language (GML) encoding specification 2.1.1 OpenGIS geography mark-up language (GML) encoding specification 3.1.1)
Raster data formats	GeoTIFF (Geo-tagged image file format) HDF-EOS (Hierarchical data format – earth observing system) DTED (Digital terrain elevation data) NITF (National imagery transmission) GML3 (Geography Markup Language)

Table 1: GDI-DE Essential Specifications

Conclusion

The implementation of GDI-DE is based on a common Implementation Plan which is an important tool for a successful cooperation in the German federal structure. Currently, the works concentrate on the reference data and the related metadata according to INSPIRE annexes I and II in a cooperative approach of BKG and the state surveying administrations. BKG is contributing significantly by providing the geodetic reference frames, the standardization of geographical names, harmonization of the topographic datasets of the states and enriching them by using satellite-based Earth observations.

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