

**OPERATIONAL CORE OF GDI NRW SET UP
- JOINT PROJECT 2004 -**

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ABSTRACT

‘GDI NRW’ stands for one of the leading RSDI developments in Europe; with more than 100 institutional members, it forms a living public private partnership. The overall goal of the GDI NRW 2004 joint project is to initialise the operational kernel of the GDI NRW, whereby the term ‘operational’ here denotes a system operating in its designed function. The kernel consists of a set of collaborating GI services, metainformation services and applications. Pragmatic aspects such as availability, quality, interoperability and suitability for use are strongly addressed. More than 140 GI content services will form the operational core. The project ends on December 31 2004 but the operational kernel remains. It will form the basis of the ongoing development of the implementations of GDI NRW.

GDI NRW – A REGIONAL SDI FOR NORTH RHINE-WESTPHALIA, GERMANY

GDI NRW is a regional Spatial Data Infrastructure (RSDI)¹ which covers the needs of the North Rhine-Westphalia geoinformation market.² Furthermore, the GDI NRW initiative is a public private partnership aiming at the development of policies, standards and content of this RSDI. This addresses not only technical matters but all existing impediments regarding technical, socio-economical and organisational factors. GDI NRW is designed to be an open geoinformation network in the sense of an electronic market place, where geoinformation may be located, purchased and accessed like an eBook, or where a number of geoinformation resources can be combined on the fly to form a new, value added product, which can, in turn, itself be incorporated in the geoinformation network.

The GDI NRW initiative is a rather informal open membership organisation (Figure 1). Membership is established by signing a memorandum of understanding with a commitment to the goals and rules of the GDI NRW initiative. Members have access to all documents and may

¹ Rajabifard et al use the term ‘State SDI’ for state level SDIs and ‘regional SDI’ for international SDIs (Rajabifard et al. 2003). Since the term ‘regional’ has a broader semantic than ‘global’, ‘national’ and ‘local’ we prefer to use the term regional in its broader sense.

² Cp. EUROSTAT & DGENV (2003)

contribute to the GDI NRW activities such as Special Interest Groups (SIGs), special task forces, testbeds and pilots. The work of SIGs and task forces is based upon a specific mission and roadmap respectively. These groups elaborate technical specifications, initialise projects, contribute to national and international SDI activities, etc. Right now, nine SIGs exist, covering the topics Architecture, 3D, Metadata, Geocoding, eCommerce, Traffic & Transport, Local Authorities, Agriculture and Forestry, and Real Estate Business. Testbeds and pilots exist in the form of joint projects dealing with the development of new technical approaches and implementations.

The GI committee is a board of state departments – including the Ministry of Internal Affairs and the State Surveying and Mapping Agency of NRW. This board is responsible for the coordination of the GI-related policies and activities of North Rhine-Westphalia. The GI committee is the highest authority within the GDI NRW initiative.

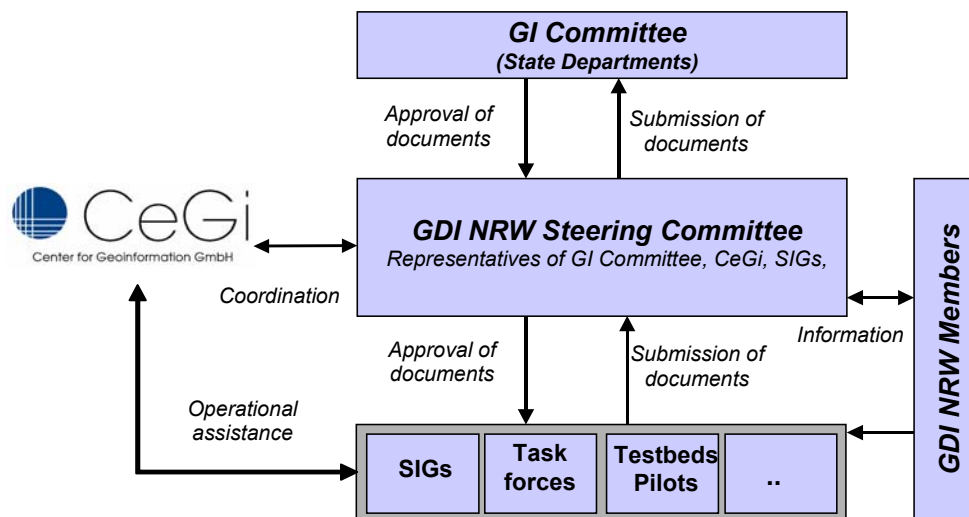


Figure 1: GDI NRW Initiative - Organisational Model

CeGi Center for Geoinformation GmbH is a PPP company which provides GDI NRW with consultancy, support of internal communication and public relations, back office functions, and the coordination of meetings and projects. Some members of the GDI NRW initiative and additional IT companies are shareholders of CeGi GmbH. CeGi GmbH provides its services on a regional, national and international level.

The steering committee includes representatives of the aforementioned working groups, CeGi GmbH and the GI committee. This board is responsible for GDI NRW strategies, the initialisation of new working groups and activities, and the approval of concepts coming from the working groups.

This open public-private-partnership has proven to be an effective means of buying in capacity and assistance for the development of the RSDI.³ The GDI NRW consensus process efficiently combines both a top-down and a bottom-up control flow. The role of the GI committee is to make sure that the activities and outcomes of the initiative comply with state policies (top-down). On the other hand, open SIGs and task forces constitute an instrument for integrating broad expertise from industry and research (bottom up).

STATE OF PLAY

Since its formation in 1999, GDI NRW has undergone considerable development. Today, GDI NRW is a living community, comprising more than 100 institutional members, who contribute to a broad range of activities. GDI NRW collaborates in a network with other SDI developments on state, national and international levels, one area of emphasis being the development of standards and pilot implementations, for instance in the fields of cadastres, metadata and eCommerce.⁴ Results and experience are ploughed back into the ISO and OGC consensus processes. There is a significant regional awareness of the potentials of RSDI, and hence, there is also broad assistance from suppliers and users of geoinformation in NRW.

A GDI NRW handbook has been developed that contains the vision statement, the organisational model, the reference model and a set of technical specifications, which form the basis for interoperability within the RSDI. So far, the GDI NRW specifications comprise the following service types:

- GDI NRW Profiles
 - WPOS Profil 1.0
 - Basis-FE Profil 1.0
 - Basis-WFS Profil 1.0
 - Basis-WMS-SLD Profil 1.0
 - Basis-WMS Profil 1.0
- GDI NRW Specifications (Drafts)
 - Web Catalog Services (CS)
 - Web Authentication and Authorization Services (WAAS)
 - Web Security Services (WSS)
 - Web Coordinate Transformation Services (WCTS)
 - Web Gazetteer Services (WGAS)
 - Web 3D Services (W3DS)

As far as possible GDI NRW standards are profiles of specifications both of ISO and OGC. A number of specifications (e.g. WPOS, WGAS, WCTS, CS-W profile) have been brought into the OGC consensus process as discussion papers or recommendation papers.

³ Cp. discussion of Economical Clusters, Learning Regions and Regional Innovation Systems in Craglia & Johnston (2004)

⁴ Cp. Riecken et. al. (2003)

Some NRW state departments are already offering their reference data and thematic data in the internet using a central geodata server. Furthermore, a number of public, regional and local authorities and private companies have begun providing geoinformation via standardised web services.

It is not intended that all GI resources will be provided for free. GI is regarded as a tradable good, which should be available at reasonable and use-specific prices. A common pricing model is neither existent nor is its development intended. The RSDI will be the marketplace where supply and demand are coordinated.

The CeGi Center for Geoinformation GmbH operates as a central clearing-house (www.geocatalog.de), which provides metainformation about the GI resources currently available within the GDI NRW. This catalogue service will be complemented by a number of collaborating metainformation services, which together will form the GDI NRW metainformation network.

<p>Strengths:</p> <ul style="list-style-type: none"> • Well organised structure, effective consensus process • State of the art concepts, technology, experience • Considerable awareness, broad willingness to contribute to the development of GDI NRW • Existing geoinformation resources • Existing pilot implementations • Capacity 	<p>Weaknesses:</p> <ul style="list-style-type: none"> • Lack of adopted GDI NRW standards • No legal framework for implementing these standards available • No operational implementations • Almost vertical implementations • No money for substantial public funding available
<p>Opportunities:</p> <ul style="list-style-type: none"> • Get over the 'last dirty mile' adopting GDI NRW standards • Establish a legal framework (official statements, directives ...) for implementing GDI NRW standards • Bring early adopters together and improve usability, sustainability of the existing developments (quick win) 	<p>Threats:</p> <ul style="list-style-type: none"> • Frustration of potential contributors if there is no progress evident • Frustration may lead to collapsing support

Table 1: SWOT Matrix - Evaluation of GDI NRW in November 2003

In November 2003 the development status of GDI NRW was evaluated by the steering committee. The results of this assessment are summarised in the strengths-weaknesses-opportunities-threats matrix shown in table 1.

A weak point is the lack of operational SDI nodes in NRW. Most of the implementations are in the status of prototypes or field tests and, as such, they are just provisional offers. Common web-based communication platforms (e.g. the internet, NRW public authorities' network, and NRW state departments network) are used, but slight differences in the implementation of standards still lead to interoperability problems. A number of GDI NRW draft standards serve as a draft conceptual framework, but adopted specifications - GDI NRW standards – are still rare. A legal framework for the implementation of GDI NRW standards is in progress but not yet available. A huge effort has been made in attaining the current status, but still the surplus value of

the GDI NRW has not been reached. The last dirty mile towards an operational RSDI still has to be overcome.

It is this assessment that led to the GDI NRW 2004 work plan, which focuses on developing an operational RSDI. This includes a) the elaboration of a cabinet proposal by the ministry of internal affairs, aiming at concretising the state policy regarding GDI NRW, b) the adoption of GDI NRW standards derived from existing drafts, and c) initialising the GDI NRW 2004 joint project, aiming at developing the operational kernel of GDI NRW.

THE GDI NRW JOINT PROJECT 2004 – CFP AND ORGANISATIONAL STRUCTURE

The overall goal of the GDI NRW joint project 2004 is to develop the operational kernel of GDI NRW, whereby the term 'operational here denotes a system operating in its designed function. Regarding the main objectives of GDI NRW, the designed function of its components is to provide both geoinformation and related metainformation by means of standardised web services. This excludes prototypes and field-tests. Reliability of SDI components is essential for those who are willing to substitute local resources (data) by remote resources (GI services) and it is precisely these very value chains that realise the surplus value of the spatial data infrastructure. The GDI NRW operational kernel consists of a set of collaborating GI services, metainformation services and applications. Pragmatic aspects such as availability, quality, interoperability and suitability for use are strongly addressed. Regarding GI content services, the focus lies on Web Mapping Services, because the WMS specification is highly matured, and a lot of tools are available. Metadata and collaborating metainformation services are to be implemented so as to provide transparency about the GI content available within GDI NRW.

The joint project has been initialised with a call for participation. This call was open for all potential public and private contributors. The CFP determines all technical and organisational requirements, which are essential for GDI NRW core components, i.e.:

- Services and applications have to be compliant with adopted GDI NRW standards
- Services and applications have to be accessible by a broad user community
 - Services have to be available through the internet
 - Access to applications may be restricted to large communities (e.g. intranet portal of a local authority or state department, info terminal in a bank institute)
 - Access to GI content may be charged through licence fees or they may be free of charge
- Services and applications have to be online for at least 3 years; prototype implementations are not accepted
- Nodes within the geoinformation network have to collaborate with other SDI nodes to enable value chains; practical interoperability with at least two other nodes has to be proven (pure vertical applications are not acceptable)
- Services and applications - as far as they are available through the internet – must be described by metadata, which have to be accessible through catalogue services in the internet.
- Metainformation systems – so far as they are available on the internet – must be capable to collaborate with other metainformation systems using the Web Catalogue Services interface.

The joint project – as the term implies – consists of a number of autonomous and independent projects with individual objectives. No central funding is available for these projects. All participants have to use their own resources to achieve their respective goals. The majority of these projects would have been performed anyway. For instance, a local authority who wishes to offer geoinformation to enhance its e-government portal; or a private company, which provides ortho-imagery data and related services and is prepared to spend money on the development of a new GDI NRW enabled online product. The joint project is a common platform for early adopters. It provides them with a common conceptual framework, which leads to coherency and a considerable step in the development of GDI RW.

Each individual project is represented within the project coordination board, which decides on all project-related topics (Figure 2). This board is bound to any decisions which may be made by the GDI NRW steering committee. This ensures that there are no developments which might conflict with the ideas and concepts of GDI NRW. The CeGi GmbH provides the joint project with project management and back office services such as communication support and public relation activities. Sponsors provide a degree of funding to support the projects administration. Additionally, they provide special offers which add to the benefits for participants in this joint project.

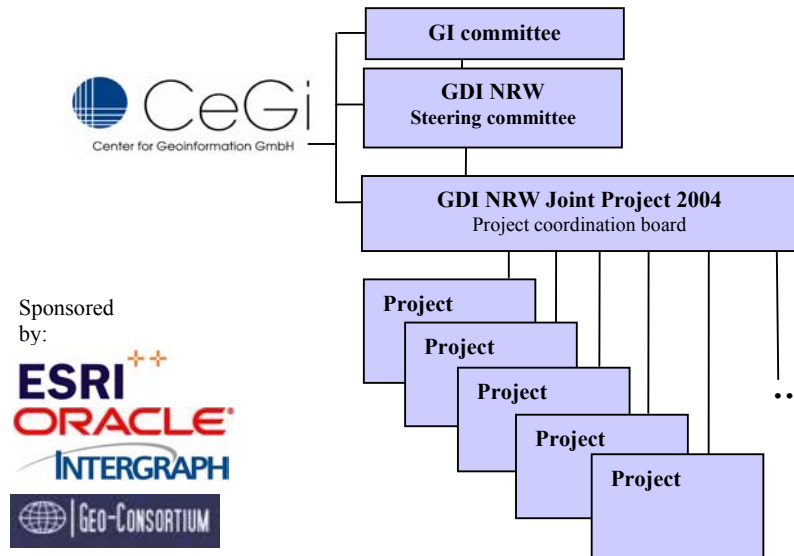


Figure 2: Organisational structure of GDI NRW Joint Project 2004

The GDI NRW joint project 2004 started with a KickOff meeting in April 2004. The results will be presented comprehensively at the international INTERGEO fair⁵ October 13-15 2004 in Stuttgart, Germany.

⁵ See www.intergeo.de

GDI NRW 2004 - performance indicators

Stuedler (2003) suggests a set of evaluation criteria for SDIs which considers three organisational levels: a) the policy level, dealing with SDI related policies b) the management level, dealing with organisational aspects, concepts and standards c) the operational level, dealing with data and data access (Figure 3). Furthermore, a very important factor influencing all organisational levels is the capacity supplied by the people who develop and operate the respective SDI.

The GDI NRW 2004 workplan (see above) tackles all organisational levels. The GDI NRW 2004 joint project is targeting the operational level and addressing both suppliers and users, who constitute the operational units within this RSDI.

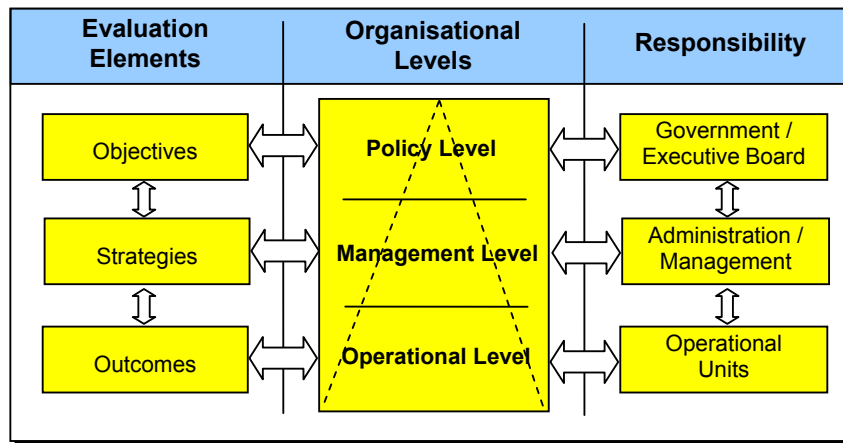


Figure 3: Relationships between Evaluation Elements and Organisational Levels (Stuedler 2003)

The outcomes of this project are operational geoinformation resources (i.e. data, services, applications), representing the content of GDI NRW and accessible by a broad user community.

Table 2 shows a number of indicators which will be used to describe the achievements of the GDI NRW 2004 joint project. These indicators do not represent a comprehensive evaluation schema, but they are sufficient for defining goals and assessing significant progress. Within the first project phase, in which the majority of implementations are not yet available, it is mainly the aspects participants and geoinformation content that can be assessed. Metainformation and accessibility will be evaluated within the later phase of this project.

Aspect	Indicator	Evaluation method
Participants	<ul style="list-style-type: none"> Reasonable number of participants involved The main players are involved 	<ul style="list-style-type: none"> Evaluate proposals
Geoinformation	<ul style="list-style-type: none"> Content covers a broad range of themes Reference information covers NRW Core thematic information covers NRW Content fits significantly existing demands (themes, geographical extent, quality) 	<ul style="list-style-type: none"> Workshops & interviews Content statistics Connectivity matrix
Metainformation	<ul style="list-style-type: none"> Metainformation fits significantly existing demands (quality, level of details) 	<ul style="list-style-type: none"> Workshops & interviews Metadata analysis (GEOcatalog)
Accessibility	<ul style="list-style-type: none"> Performance of services and applications fits existing demands Availability (reliability) of services and applications fits existing demands 	<ul style="list-style-type: none"> Workshops & interviews Service monitor
	<ul style="list-style-type: none"> Interoperability of SDI components 	<ul style="list-style-type: none"> Testing interfaces using existing implementations (selected use cases) Service monitor
	<ul style="list-style-type: none"> The publish, find and bind paradigm is sufficiently supported 	<ul style="list-style-type: none"> Workshops & interviews Testing (selected use cases)

Table 2: Performance Indicators GDI NRW 2004 joint project

GDI NRW 2004 - Participants

By the end of May, proposals had been submitted by 37 institutions. The majority of participants are state and regional institutions (State Surveying and Mapping Agency, Ministry for Environment, Ministry for Traffic & Transport, Chamber of Agriculture, State Forestry Department, State Department for Computing and Statistics) and local authorities (Figure 4).

The state departments focus both on the operational provision of reference data and thematic data in their respective fields of competence. The forestry and agricultural bodies concentrate on enabling their specific information systems to use GDI NRW web services instead of locally maintained data resources. Most of the local authorities aim at enhancing their e-government portal through integrating geoinformation by means of web-mapping services. Some of them are implementing catalogue services which will be connected to the GDI NRW metainformation network. All of the private companies belong to the GI industry sector; most of them assist public authorities by providing specific software and consulting services. Additionally operational GI content services have been implemented (e.g. clearing house information services, GDI enabled information portal for real estate business, traffic intensity information service, web services monitoring, value adding 3d visualisation service). Since the joint project focuses on implementing state of the art technology, only two research institutes are participating in this activity. They are

dealing with special GDI NRW features such as security concepts (authentication and authorisation), business transactions and quality management of web services.

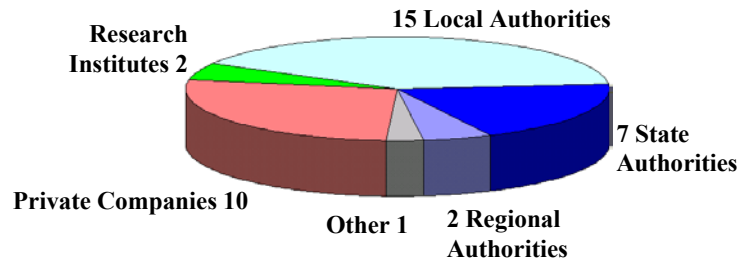


Figure 4: Participants in the GDI NRW Joint Project 2004

The total investment volume is about 1m euros. The equivalent value of the data provided by the contributing parties (in particular the State Surveying and Mapping Agency) amounts to another 1m euros.

GDI NRW 2004 – Geoinformation Content

More than 140 web mapping services (WMS, WMS-SLD) will contribute to the operational content of GDI NRW (Figure 5). The State Surveying and Mapping Agency provides both ortho-imagery and topographic maps in a scale range from 1:10.000 to 1:200.000. Furthermore, selected themes in the categories Nature & Landscape, Water, Soil, Traffic & Transport and Forestry, provided by a number of state departments, cover the whole region of North Rhine-Westphalia.

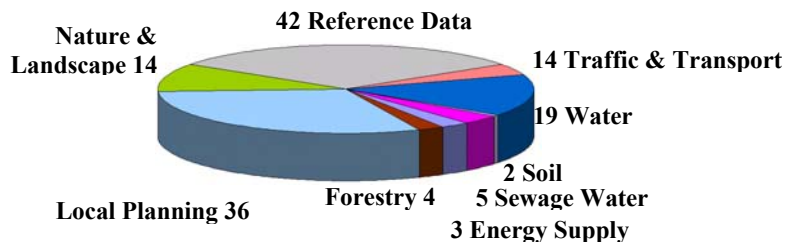


Figure 5: Operational GDI NRW Web Mapping Services

This includes the heavy metal contamination of soils, protected areas, flood risk areas, roads and traffic intensity on roads in NRW, administrative boundaries, etc. The local authorities offer large-scale reference data such as 1:5.000 topographic maps, city maps and ortho-imagery. A large set of services contains information on land-use planning, parcels, sewage systems, protected areas, industrial areas, etc. The local authorities who participate in the joint project cover about 25% of the area of North Rhine-Westphalia. Private companies offer ortho-imagery (together with

related services) and added value services such as a 3d Web Terrain Service, which uses existing WMS, and a digital terrain model to derive three-dimensional views.

An interesting aspect of this development is to observe where and why redundancies appear. Ortho-imagery, for instance, is provided by state departments, regional authorities, local authorities and private companies. Actually, in most cases the respective datasets are different regarding, for instance, extent, resolution and currentness. In this case, market mechanisms should be sufficient for coordinating supply and demand. A second case is the 1:25000 topographic map, which is provided by both the State Surveying and Mapping Agency and local authorities. In this case, the only reason for local authorities accepting redundancies may be to ensure the availability of this important resource by avoiding a single point of failure. In this case, central devices should be used to organise redundancies in a more efficient way. A third case is the 1:5000 topographic map, which is produced by the local authorities. A complete dataset for the whole region of NRW is maintained by the State Surveying and Mapping Agency. Since the updating procedure takes some time, it may occur that in a certain situation a centrally offered map may be out of date. In this case, an improved (service-based) update procedure will avoid unnecessary redundancies.

Regarding GDI NRW enabled applications; there are a number of portal solutions which will be able to provide dynamic access to GDI NRW resources (metadata, WMS). Additionally, specialised information systems (e.g. mobile emergency assistant, forestry information system) are beginning to substitute local resources through GDI NRW services.

The criticality of most of these applications is low, since the operational kernel still has to prove its reliability.

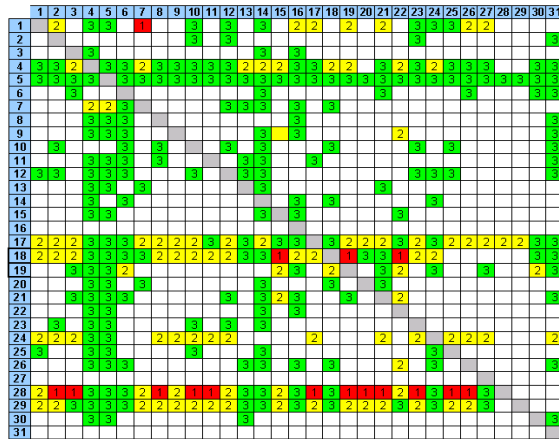


Figure 6: Connectivity matrix: consortia (rows) using resources of consortia (column)
 1 (red) = no usage, 2 (yellow) = to be evaluated, 3 (green) = reasonable usage

The connectivity matrix (Figure 6) shows the intensity of interactions between the resources of the contributing parties. Each row stands for a company which uses more or less resources from another consortium, indicated by a column. Supplier of basic information resources (reference data, environmental data, metainformation) are demanded by most of the participating institutions.

GDI NRW 2004 – Metainformation

The CeGi GmbH is the central clearing house for GDI NRW. The GEOcatalog (www.geocatalog.de) provides a search engine, which processes metadata about data, services and applications implementing the OGC catalogue services specification, ISO 19115 and ISO 19119. Currently an ISO 19115/19119 Profile for the OGC CS-W 2.0 specification is under development and will be implemented (Senkler 2004).

Metadata about web services and applications are automatically supplemented with information about their availability. This information comes from a monitoring service, which observes the respective status of registered resources. A number of local authorities are prepared to integrate metainformation services into their web portal solutions so as to reference local resources. They will be able to explore GDI NRW by accessing CeGi's GEOcatalog. The GEOcatalog, on the other hand, will be able to harvest metadata by accessing these local catalogues.

Conclusion

The focus of the GDI NRW 2004 joint project lies on developing the operational kernel of this RSDI. A considerable number of participants (37 institutions) are contributing to this project. Most of the principal stakeholders and segments of the NRW geoinformation market are involved.

The content, which will be part of the GDI NRW operational kernel, covers a broad range of themes. NRW reference data and core thematic data are part of this content, covering the whole region of NRW. The connectivity between resources of the contributing consortia indicates a reasonable coverage of existing demands.

The majority of implementations are still under (re-)construction. For this reason, performance indicators for metadata, services and service interoperability can not yet be assessed. But the implementations and reengineering procedures, which are currently being performed are based on mature concepts and previous experience in implementing web-service architectures. Hence, these developments are expected to show positive results.

The joint project ends on December 31 2004, but the operational kernel will remain. It will form the basis of the ongoing development of the implementations of GDI NRW.

Acknowledgements

We would like to thank all the project teams, sponsors and NRW representatives, both for their commitment to GDI NRW and for their great efforts. It is neither policies nor technology but people that create spatial data infrastructures.

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