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Introduction: Digital Norway

Norway has profited from a well-functioning national spatial data infrastructure (NSDI) for quite some time. 'Digital Norway' is the name for this infrastructure, and it has a long-term strategy and implementation plan. This infrastructure is a collection of common standards and rules, Norwegian agencies' geospatial data and services, as well as common tools, solutions and agreements. www.geonorge.no is the website for cooperation and the national geodata portal with underlying directories and registries. The infrastructure is open to all agencies and stakeholders in Norway who wish to offer data and spatial data services or wish to be users of such services.

Political background

In 2002-2003, Parliamentary White Paper no. 30: "Digital Norway – a joint fundament for value-adding" was issued for the establishment of a national geospatial infrastructure, and this formed the basis for the Norwegian spatial data policy. The White Paper stated that all public enterprises that had a geodata responsibility or were major users of such data should contribute to the establishment, operation and maintenance of Digital Norway. The cooperation would be based on mutually binding agreements, and each party should commit to a two-part solution involving shared financing of basis geodata and an obligation to supply their own thematic data.

Digital Norway collaboration started in 2005, with more than 600 partners of Norwegian public authorities. The government was initially responsible for the overall management and financing of this infrastructure, with the ministry of Environment (now 'Ministry of Local Government and Modernisation') responsible for coordination of national partners. The Ministry directed the Norwegian Mapping authority, who since then has held primary responsibility for administrating cooperation between partners.

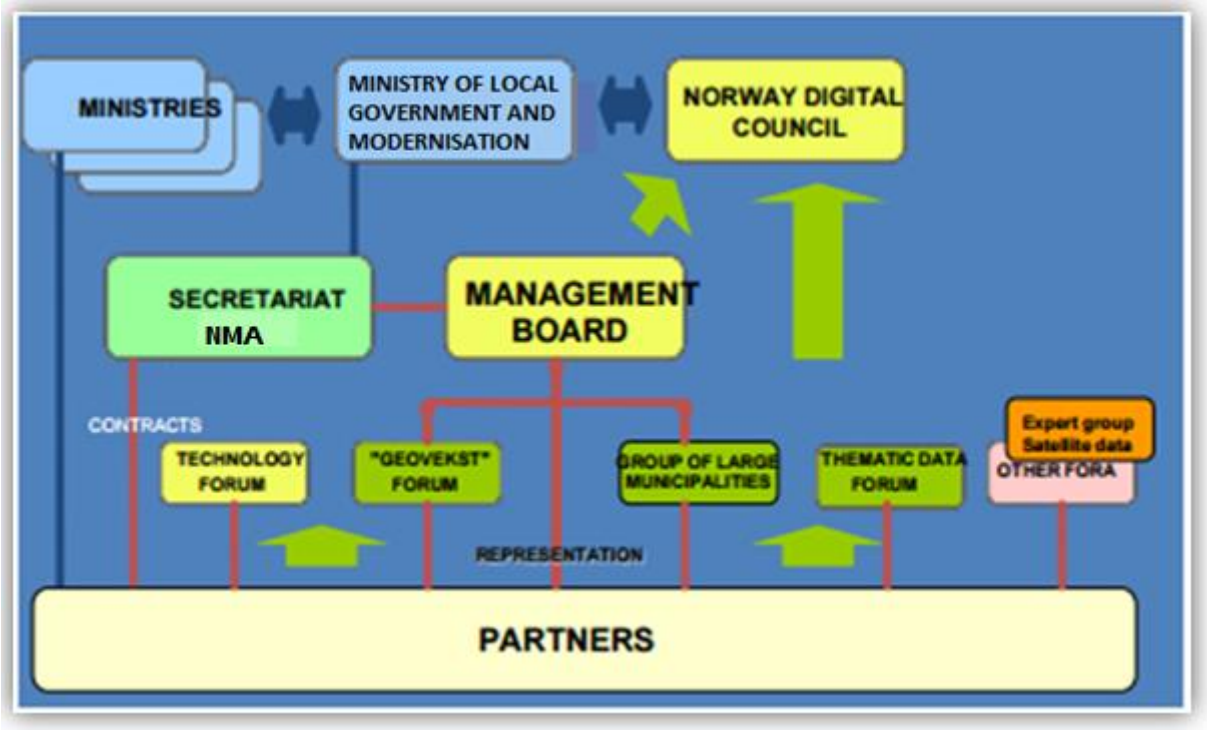
The European INSPIRE initiative initiated in 2007 laid the foundations for a "digital leap" in public sector services with the Norwegian eGovernment Program in 2009 and for a new Geodata Act and laws for Norway in 2010. The initiative strengthened cooperation and sharing of spatial data between agencies, but also promoted good and effective access to authoritative geographic information at local, regional and national levels via interoperable services.

Main actors involved in the Norwegian NSDI
Digital Norway is a cross-sector cooperation. In terms of stakeholder participation and responsibilities, the following contribute most – least in terms of creating and supplying geospatial data, assuring data quality, creating geospatial services, conducting R&D, contributing to GIM policies, driving the use of geospatial information, making strategic decisions for the national GIM, monitoring national GIM development, providing skills training and providing technology and infrastructure:

- Government
- Private sector
- Academia
- NGOs

Today more than 600 public organizations at national, regional and local levels (45 national parties, 18 counties, 428 municipalities and 123 utility companies) participate in activities aimed at increasing the use of geographic information at all levels and in all areas of the public sector in Norway.

Institutional arrangements and relationships among the entities



Organization of Digital Norway

The Ministry of Local Government and Modernisation coordinates Digital Norway activities at the ministerial level, has responsibility for implementing the spatial data act and guides the Mapping Authority in its' role as geodata coordinator.

The Norwegian Mapping Authority (NMA)
The NMA plays two important roles in the NSDI. As national geodata coordinator, they are responsible for making data sharing and cooperation between the participating parties and members possible both nationally and internationally - according to national specifications and the INSPIRE regulations.

In addition to its' coordinating role, the NMA has authoritative responsibility for rulemaking, standardisation, technological development, management and supervision of spatial data shared, and providing leadership for fulfilling the mandate of the NSDI.

The national geodata council with 16 representatives appointed by the Government assists the Ministry and the geodata coordinator in implementing the spatial data act. The vision of the council is "spatial data for benefit, innovation, value creation" and its mandate is to discuss and give recommendations concerning the national spatial data policy. They meet twice a year to discuss issues concerning the national geodata policy.

The Coordination Committee meets four times a year to discuss and make decisions on issues concerning the Digital Norway infrastructure. For instance, to:

- Identify relevant spatial data and user needs and promote dialogue across sectors and actors
- Indicate possible national projects and investments
- Prepare cases for discussion in the geodata council
- Establish working groups and arrange the yearly general assembly ensure that all actual plans for the cooperation are being followed up

Geovekst forum: Geovekst was established in 1992 through an agreement between six central public and private organizations with the idea that common financing of production and maintenance of basic spatial data would be beneficial and cost effective. Geovekst now includes all of the municipalities and functions as a separate unit under the Digital Norway umbrella and delivers detailed mapping data orthophotos and laser data covering nearly 60 % of the national surface. The forum is a representation of the central Geovekst parties with the Norwegian Mapping Authority acting as secretariat.

The regional geodata boards are administered by the Norwegian Mapping Authority's 12 regional offices nationwide, meeting twice a year to discuss and approve regional spatial data plans. Regional and local portals built mainly on basic spatial data are important information sources for the inhabitants, but also ease pressure on the national portal, thereby reducing the risks for breakdowns and security errors.

The county governors act on behalf of the central government and in cooperation with Kartverket as regional spatial data promoters.

The technology forum discusses technological challenges and relevant requirements, recommendations and guidance material. The forum has designated a working group to deal with the technological framework specifically.

The land use planning data forum discusses common standards for administration of and access to the relevant data based on the principles for Digital Norway.

The thematic data forum discusses common initiatives on development and use of the relevant data.

The satellite data group discusses the national need for data and related infrastructure and gives strategic advices and input to the EU program Copernicus. This group also considers the need for satellite data for land applications including coastal areas and assess the need for infrastructure, central databases and common solutions.

The general assembly for Digital Norway is the executive body for decision-making in collaboration among partners. The assembly has also coordinated a working group for Digital Norway partners to raise awareness of to raise awareness of information security.

Agreement-based cooperation
The Norwegian NSDI is a voluntary partnership regulated by agreements between more than 600 partners that have responsibility for providing geodata or that are main users of such information. Deliveries are clarified through annual party negotiations and are specified in appendices of the agreement.

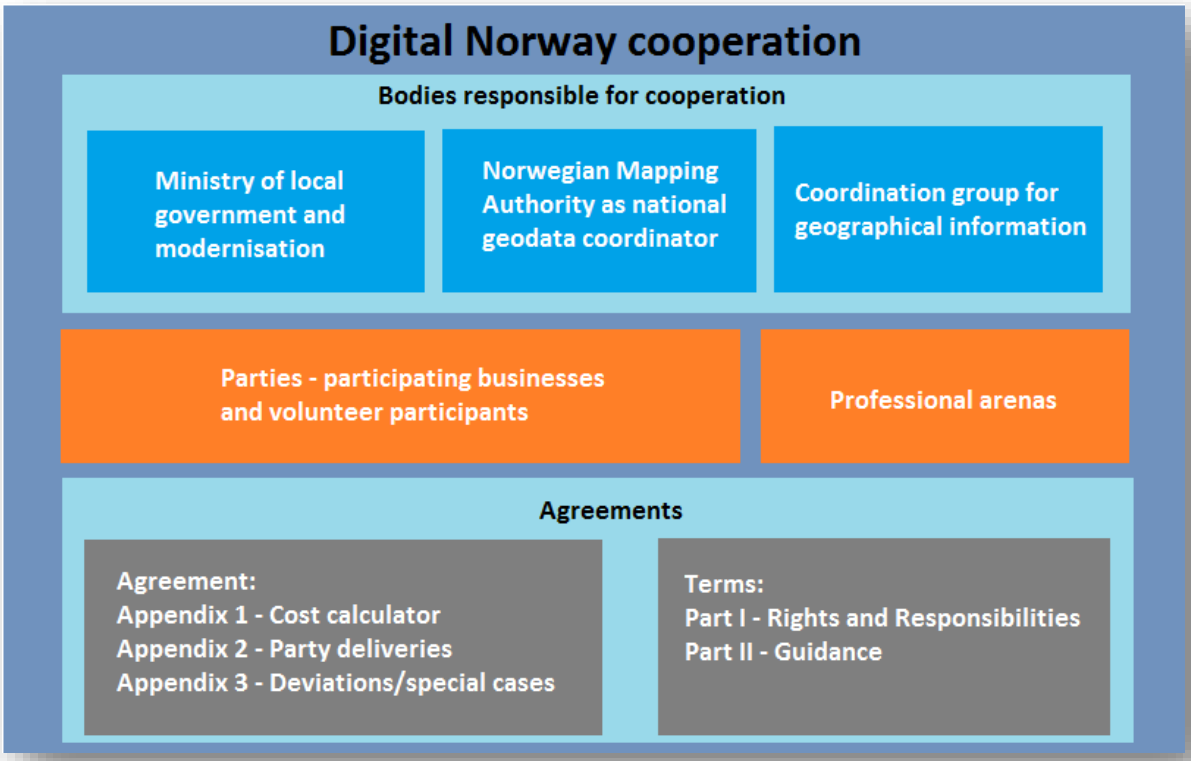
- Agreement: According to the Geodata law
- Appendix 1: Clarifies what the parties should deliver and pay.

  Parties are expected to deliver their own standardised thematic data, services, metadata and product specifications; and pay an annual fee which has been calculated based on the size of their organization and number of users. The annual fee contributes toward financing of 'basis geodata' that is available for all members of the NSDI.

  The parties then have the right to use all available data and services, and are responsible for ensuring that their use does not infringe the rights of others. (This means, inter alia, responsibility for resource referral and information security, and possibly for compensation of damages.)

- Appendix 2: Specifies which data parties should deliver and the quality standard that is expected, i.e. an environmental agency should deliver data on protected sites.
- Appendix 3: Special circumstances based on deviation from ordinary rights of use
- General Terms
- Technological framework of requirements and recommendations on technological conditions
- Annex I, II and III to the INSPIRE Directive

As Geodata Coordinator, the Mapping Authority controls deliveries from the parties and has developed tools and procedures for this purpose, such as a metadata validator, GML validator, service validators, product specifications and technical framework documents that facilitate standardised submissions and parties get feedback through a control report. The Mapping Authority also holds courses on requirements and practical solutions for delivery within metadata, WMS, WFS, GML and data harmonisation.



Standardisation
Norway has invested heavily in standardisation – first at the national level from 1990 onwards, and at the European and global level.

A national standard for describing and exchanging digital geodata (SOSI) was developed in the mid-80's, and has has been crucial for the exchange of spatial data in Norway. The standard is revised and developed continuously, and now fully builds on and complies with international standards.

Since 1994 Norway has been leading the development of global international standards through the committee ISO/TC 211 Geographic information/Geomatics of the International Organization for Standardization. Norway has the secretariat through Standards Norway, and the chairperson through the Norwegian Mapping Authority. Currently the committee has 65 countries as national members and around 60 international organizations as liaison members – many of these UN bodies or affiliated. ISO/TC 211 has developed more than 60 international standards that underpin geospatial management across the world and, in many cases, are the legal basis for the NSDIs.

ISO/TC 211 has over the last years recognized the importance of UN-GGIM and contributed heavily to its work together with other standards developing bodies like OGC and IHO.

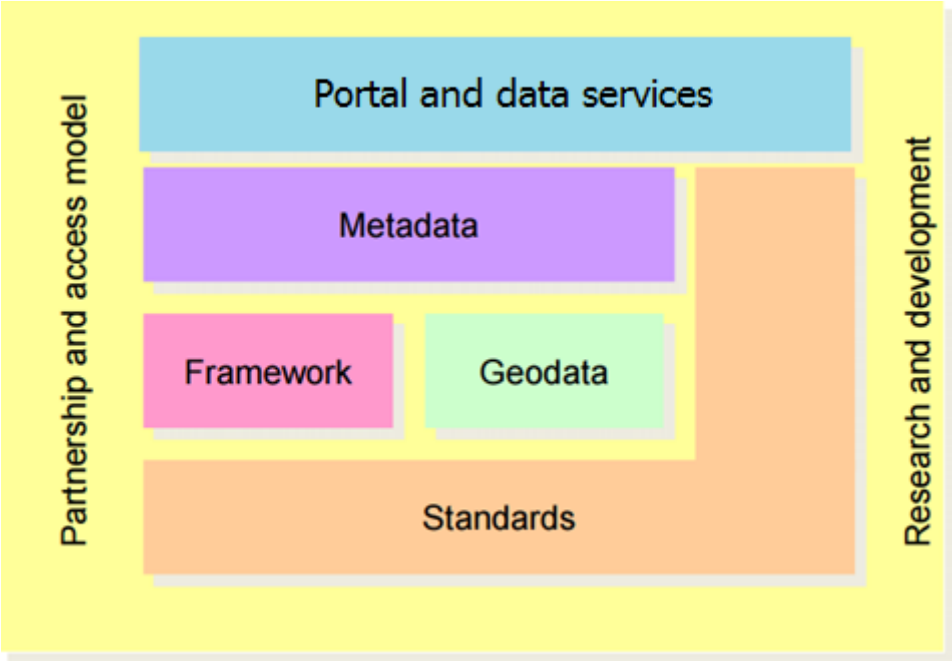
Geospatial management is quality assured at all levels - from data capture to maintenance and management of spatial data services to users.

- Data: Data made available should be compliant with ISO 19157 Geographic information – Data quality and the national extension, the Geodata standard, and documented as metadata. Control of syntax and content shall be in accordance with SOSI general object catalogue or specifications.

- Services: Services made available should be described both as metadata and request type, for example using GetCapabilities or DescribeFeatureType.

- Metadata: Metadata for data and services in Digital Norway shall follow the ISO 19115 parts on: metadata and ISO 19119 Services. SOSI part 1 Metadata, describing the national implementation of the international standard, and ISO 19139 Metadata - Implementation of XML schema must be applied.

- Quality Certification: Each Party and data producer is responsible for describing processes related to data creation, management, dissemination and coordination, as part of their management of the business. The Mapping Authority has made a strategic decision to focus on quality control in line with ISO 9001: 2008.



Core elements of the Norwegian SDI

The geodata portal, "Geonorge"
The goal of the geodata portal is to establish a common knowledge base, which is available to everyone through the infrastructure. To establish the knowledge base, spatial data must be shared and this is only possible with cooperation between parties in Digital Norway. Each party agrees to deliver their most up-to-date geographic reference and thematic data and services that will be made available in the national geoportal www.geonorge.no as interoperable web services - such that participating parties can build their applications and information services based on access to distributed geodata services from other parties.

The data and services that are available to partners include:

Basis geodata
- Common map database (FKB) data from Geovekst cooperation and from the largest municipalities. These are the most detailed and updated vector datasets available in Norway, for use at scales 1:500 to 1:30 000, with an accuracy of +/- 0.2 - 2m depending on the object type and data capture method.

- National map data from the Norwegian Mapping Authority (vector and raster data for use at scales 1:25 000 or less)
- Digital terrain models
- Road networks
- Administrative subdivisions
- Place names
- Satellite imagery
- Property (land register)
- Hydrographic and bathymetric data
- Position services (CPOS and DPOS)
- Data from the Norwegian Polar Institute for Svalbard and Jan Mayen
- Aerial orthophotos: From 2006 – 2013 photo coverage for photogrammetric map construction and orthophotos for the whole country with an average of 70,300 km² annually were produced. (Orthophotos for 18,800 km² with ground resolution from 0.1 to 0.20 m, FKB data for 31,200 km² and elevation data using airborne laser for 13,700 km² from Geovekst are available to the parties in Digital Norway.)

  Orthophotos are available via the solution "Norway in Pictures" which contains more than 1200 different new and historical projects. Digital Norway parties have access to WMS, cache and download solutions, while a simpler viewing solution is open to the public.

Thematic maps

Thematic maps or geodata within certain sectors or disciplines, such as

- Fisheries
- Coastal management
- Waterways
- Forestry
- Agriculture
- Population
- Cultural heritage
- Conservation
- Geological resources
- Biodiversity
- Pollution
- Emergency preparedness
- Meteorology
- Land use

Plan data

Plan Data: An overview of municipal land use plans, showing plan spaces with a link to the municipal plan records that exist on the Internet. The main purpose is to give parties an overview of the status of the establishment of municipal planning records and access to information on municipal land-use plans. The national map services are available for integration in the parties' solutions.

Speciality Data

Data obtained by national specialist agencies who provide information and thematic data about, inter alia, habitats, rainfall, avalanche risks, bedrock and cultural heritage, depth, seabed conditions, biodiversity, habitats and pollution in sediments in Norwegian coastal and marine areas, etc.

Each partner jointly funds maintenance of this shared data and infrastructure.

Recent developments in the NSDI and its applications

As part of the Norwegian Government's strategy to give society access to open data, the Norwegian Mapping Authority has released digital data for free, granting free access to a variety of spatial datasets, illustration maps and historical maps. Most users can freely view detailed digital maps on the web, while those with a bit more technical expertise can download data or integrate digital mapping services into their own online solutions. The datasets include:

- Basis vector and raster datasets for accuracy ranging from +/- 2m to 50, 250, 500, 1000, 2000 or 5000 m, depending on object type
- Administrative boundaries
- Road data with addresses
- Digital terrain models
- Place name data
- Historic maps

Conclusions

Access to spatial data has become an important part of the basis for an electronic public administration and generally for Norwegian policy. Better access to spatial data also provides great opportunities for businesses. Release of public geodata is therefore now on the political agenda in Norway and the Mapping Authority has been provided with funds to provide more data free to both personal and corporate use.

Digital Norway has since its outset in 2005 succeeded in building a robust and adaptable geographic infrastructure of considerable social value, and we are now facing a new era where spatial data is an integrated component of the national IT architecture. This is highlighted by the focus on development of the NSDI in the Norwegian e-government strategy.

Further technological developments are foreseen to result in even better access to and quality of spatial data and our ambition is to provide functional services of high quality for the widest possible scope of use, including across borders. Access to spatial data is essential both for a digital public administration, for innovation and value creation, and finally for efficient and reasonable policy making under rapidly changing conditions.