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#### Biography :

Puan Fuziah binti Abu Hanifah is currently the Director of Malaysian Centre for Geospatial Data Infrastructure (MaCGDI), Ministry of Natural Resources and Environment (NRE). Her role is managing the implementation of Malaysian Geospatial Data Infrastructure (MyGDI) where, among significant tasks includes the development of policies, standards, framework data, technology, capacity building as well as facilitating geospatial data sharing activities among agencies at Federal, State, and Local Authorities at all levels.

She is also the Chairperson of MyGDI Clearinghouse/Geodata Centre Technical Committee and Chairperson of Working Group on Geographical Names Database and National Gazetteer. Being a member of Technical Committee 2 (TC2) SIRIM, she involves in the development of Malaysian standard for Geographic Information/Geomatics. At the international level, she is among the Malaysian delegates attending ISO/TC 211 Plenary and Working Groups Meeting. She obtained Bachelor of Science (Hons) in Computer Science from National University of Malaysia and began her career as a System Analyst in 1983.

#### Academic Background :

Bachelor of Science (Hons) in Computer Science from National University of Malaysia (UKM), 1981  
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#### PRESENTATION BRIEF

Spatial data is a national capital asset. Malaysian Geospatial Data Infrastructure (MyGDI) facilitates collection, sharing and dissemination of spatial data among all levels of government organisations. Among the objectives of MyGDI is to assure that spatial data from multiple sources (Federal, State and Local Government) are widely available and can be easily integrated to facilitate spatially-enabled government towards enhancing the service delivery. As the amount of spatial data available increases very rapidly, the need for understandable and reliable measures of data quality becomes more important. Data collected by different agencies are often incompatible. The data may cover the same geographic area but use different geographic bases and standards. MyGDI framework initiatives will improve this situation by leveraging agencies geospatial data collection efforts so that data can be exchanged within governments at reasonable cost. There should be a common spatial data foundation organised according to accepted layers, scales (or resolution) and seamless sources that are available for the entire area of geographic coverage to which other geospatial data can be easily referenced. The establishment of MyGDI also requires an understanding of the requirements and responsibilities of the members of the community. The paper summarises the current initiatives that define the ways to effectively implement and enhance MyGDI taking into account the current challenges and the range of possible services to be included.

# **Malaysian Geospatial Data Infrastructure (MyGDI) - The Way Forward**

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## **Abstract**

Spatial data is a national capital asset. Malaysian Geospatial Data Infrastructure (MyGDI) facilitates collection, sharing and dissemination of spatial data among all levels of government organisations. Among the objectives of MyGDI is to assure that spatial data from multiple sources (Federal, State and Local Government) are widely available and easily integrated to facilitate spatially enabled government towards enhancing the service delivery.

As the amount of spatial data available increases very rapidly, the need for understandable and reliable measures of data quality becomes more important. Data collected by different agencies are often incompatible. The data may cover the same geographic area but use different geographic bases and standards. MyGDI framework initiatives will improve this situation by leveraging agencies geospatial data collection efforts so that data can be exchanged at reasonable cost by government. There should be a common spatial data foundation organised according to accepted layers, scales (or resolution) and seamless sources that is available for the entire area of geographic coverage to which other geospatial data can be easily referenced. The establishment of MyGDI also requires an understanding of the requirements and responsibilities of the members of the community.

The paper summarises the current initiatives that define the ways to effectively implement and enhanced MyGDI taking into account the current challenges and the range of possible services to be included.

Keywords: Spatial Data Infrastructure, Web Services, GIS

## **1.0 Introduction**

The fast growing GIS implementation technology has now focused on geospatial service and delivery. GIS has evolved from a project-oriented tool to become managers of enterprise-wide information resources. Hence, there is a need to provide the communities with the geospatial service infrastructure to support the interrelated aspects of strategic planning such as landuse management, resource management, environmental management, and physical infrastructure planning and development. Spatial data is a valuable resource and costly to acquire and the problem of sharing large volumes of spatial data information is becoming increasingly important. According to (Mehmet, S.A., Galip, A., 2005), the largest problem in sharing spatial data is however organisational, identifying who has the data, how the data was collected and how it is structured (metadata) and actually getting access to the data.

Spatial Data Infrastructure (SDI) defines a framework that allows online access to distributed geographic data and geoprocessing capabilities. Widespread adoption of internet-based tools allowed the creation of web geoportals to multiple geographic information resources. Many countries are developing SDIs to improve access and sharing of spatial data. The current SDI providing mainly an ability to access and retrieve spatial data. The development of these SDI models that have not met user needs as expected. Hence, the concept of an SDI needs to progress so that it allows more than just the ability to access geospatial information. It needs to be enhanced so that it is possible to share data, business goals, strategies, processes, operations and value added products and services in order to support a spatially enabled government (Rajabifard, A, 2005). An enabling platform needs to be established that will facilitate business transactions to be linked and further allows the evaluation and analysis of relationships between people, business transactions and government.

Government throughout the world had realised the importance of NSDI to maximise the use of the national geographic information assets. More than 120 countries are already considering projects of this type (Crompvoets, 2002). NSDI is critical because majority countries in the world have recognised the importance of geospatial data in the management of today's modern earth and the people. NSDI provides the tools for countries, regions and local government to better organise, plan and manage their natural, cultural and economic resources. A wide a range of professional and political manager have realised that geospatial data is a useful element in the information and communication technology (Fenney et al., 2004) Geospatial data is central in the provision of good governance, environmental and social management, and a useful tool to support economic growth. The need to support decision-making to address the

## **2.0 The Nature of NSDI**

The definition put forward by the Global Spatial Data Infrastructure (GSDI) Association for a global (and implicitly a national) SDI is as follows:

“A (National) Spatial Data Infrastructure supports ready access to geographic information. This is achieved through the co-ordinated actions of nations and organisations that promote awareness and implementation of complimentary policies, common standards and effective mechanisms for the development and availability of interoperable digital geographic data and technologies to support decision making at all scales for multiple purposes. These actions encompass the policies, organisational remits, data, technologies, standards, delivery mechanisms, and financial and human resources necessary to ensure that those working at the (national) and regional scale are not impeded in meeting their objectives”

From the long definition given above there lies conceptual thoughts of what NSDI really demonstrated. They can be described as the followings:

- Foremost, the prime objective is to promote ready access to the geographic information assets that are held by a wide range of stakeholders in both the public and the private sector with a view to maximising their overall usage.
- The second thought concerns the need for coordinated action on the part of governments to ensure that the prime objective is achieved. The next part of this sentence gives some examples of the kind of actions that are required from governments.
- The third thought stresses the extent to which NSDIs must be user driven. Their primary purpose is to support decision making for many different purposes and it must

be recognised that many potential users may be unaware of the original purposes for which the data was collected.

- Finally the last sentence illustrates the wide range of activities that must be undertaken to ensure the effective implementation of an NSDI. These include not only technical matters such as data, technologies, standards and delivery mechanisms but also institutional matters related to organisational responsibilities and overall national information policies as well as questions relating to the availability of the financial and human resources needed for this task.

It is therefore important that the above criteria of the definition be imposed for an efficient, well-organised and meaningful institutional spatial infrastructure. As for Malaysia, all except the concept of user-driven NSDI have the influence over the above nature of NSDI. It is acknowledged that top down process of running the NSDI is essential

## **2.1 Ideal NSDI**

The characteristics of what may be described as an 'ideal' NSDI are outlined below: (SDI cookbook, 2004)

- There is a common spatial data foundation organised according to widely accepted layers and scales (or resolution) that is available for the entire area of geographic coverage (city, state, regional, nation) to which other geospatial data can be easily referenced.
- The framework data is readily accessible and available at no or little cost from user-friendly and seamless sources to meet public needs and encourage conformance with it by producers of other geospatial data.
- Both framework and other geospatial data, as required and specified co-operatively by data producers and users, is updated according to commonly accepted standards and measures of quality.
- Thematic data are also available on terms should be compatible with the framework data.
- Geospatial data can be integrated with many other kinds or sets of data to produce information useful for decision makers and the public, when appropriate.
- Responsibility for generating, maintaining, and distributing the data is widely shared by different levels of government and the private sector.
- The costs of generating, maintaining, and distributing such data are justified in terms of public benefits; overlap and duplication among participating organisations is avoided wherever possible.
- Access arrangements should recognise confidentiality, privacy, security and intellectual property rights.

Many countries are developing NSDIs to improve access and sharing of spatial data. However, there are still many issues and challenges which need to be overcome in order to have functioning SDI. Data sharing and exchange among several organizations is hard to achieve. It involves a lot of political negotiation, agreements on standards, agreement on costs sharing and agreements on maintenance. Among challenges arise when someone tries to share geospatial information are data format issues, data quality issues, data content issues and semantics. In many cases, the temporal and spatial coverages and resolution, origination, format, and map projections are incompatible. According to (Douglas,N., 2006) among the technical challenges are (i) integrating multiple standards and specifications together; (ii) communicating complex standards and; (iii) designs in appropriate ways for different consumers and developing authoritative online resources for national and international use.

### **3.0 Malaysian Geospatial Data Infrastructure (MyGDI)**

Malaysian Centre for Geospatial Data Infrastructure (MaCGDI) has developed MyGDI consisting of common data access policies and procedures such as data custodianship, use of standards and metadata and encouragement of activities within jurisdictions that support the MyGDI goals and objectives. MyGDI develops gradually and has been carried out phase-by-phase includes a wider geographical coverage. The current strategy has actually increased the presence of MyGDI thus raised the awareness as well as points out rooms for further improvements in line with other international NSDI models. The system as it has been implemented is based on data oriented and need GIS skilled users to integrate the data and information to produce the products they need in their analysis. There is a need to widen the services to materialise the potential and to address the demands from potential users by adopting the latest enabling technology.

In the very beginning, these issues focus on the collection of the data: what data should be collected and who should collect it. In the other stages of maturity, the issues of data quality and data interoperability become more and more critical. The introduction of new technology, and new products, which may change the way MyGDI performs. Furthermore, changes in the SDI environment may lead to new needs and new believes, changing the ultimate ideal of MyGDI.

Many government organisations spend millions of ringgit each year producing and using geospatial data. Yet, they still do not have enough information they need to solve critical problems. There are several aspects to this problem:

- Most organisations need more data than they can afford
- Organisations often need data outside their jurisdictions or operational areas. They do not collect these data themselves, but other organisations do.
- Data collected by different organisations are often incompatible. The data may cover the same geographic area but use different geographic bases and standards.
- Information needed to solve cross-jurisdictional problems is often unavailable.
- Many of the resources organisations spend on geographic information systems (GIS) go toward duplicating other organisations' data collection efforts. The same geographic data themes for an area are collected again and again, at great expense. Most organisations cannot afford to continue to operate this way.

MyGDI Framework initiatives will greatly improve this situation by leveraging individual geographic data efforts so data can be exchanged at reasonable cost by government. It provides compliant fundamental geodata in a common encoding and makes them discoverable through a catalogue in which anyone can participate.

#### **3.1 Implementation Issues and Challenges**

Among the issues in the process of geospatial knowledge discovery that data users spend considerable time on assembling the data and information into a ready-to-analyse form, even when the analysis is very simple. Users have to spend considerable amount of time to order and process the raw data to produce the data products they need in the analysis. Among significant problems faced by users are:

- Problems with getting access to the existing multi-source geospatial data;
- Difficulties with finding out which data is available;
- The data needed is not available;
- Difficulty to integrate the multiple-source data from multiple data providers;

- Existing data is of insufficient quality;
- Lack of knowledge to deal with geospatial data. Because of the diversity of geospatial data, expert knowledge in the data manipulation and information technology is needed to handle such data and not all users have such knowledge

There are several factors which hinder data exchange process which include:

- People do not want to lose control of their data
- People do not see their work as a service to other; they do not consider themselves as providing a public service
- People do not have sufficient understanding of how to exchange information
- There are administrative costs to exchanging information and many organisations do not have a budget for exchanging information
- Exchanging information is not an institutional priority
- Lack of policies to guide organisations on how to exchange information
- Legal concerns prevent the exchange of information
- Financial concerns prevent the exchange of information

Aspirations by the users indicate further potentials to be pursued. In other words, MyGDI is the necessary fundamental that will put in place standardisation, policies, and procedures to enable data sharing, however, considerations about the aspirations of the users are the elements that will make effective use of the MyGDI and the related services. The challenges in the current implementation are shown in Table 1.

**Table 1: Summaries of the challenges in the current implementation**

Challenges	Remarks
Raising issues with reliability, accuracy of data and increase expectation of data quality	Building compliant fundamental geospatial dataset and creating seamless geospatial data across the country
To increase the effectiveness of MyGDI application to meet users' expectation	To include other functionalities on top of the function to find data. To some degree this has been included in the current system; however, it is still data-driven rather than focus on the usage of data.
To widen the range of services in the application to accommodate wider users needs.	Apart from effectiveness of the application, a related consideration is the need to accommodate wider user base. While the current application is data-driven, focus on usage of data should also include users that look for spatial functionalities in which the questions of data are only implicit.
To strike a balance between data sharing functionalities and inclusion of focused application in	Possible solution could be to package the services to utilize data that are made available through the system. These services should be

the system. .	related to core activities in user agencies. A layer of services that are applicable across sectors should be identified rather than developing specific applications for individual agencies
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### 3.2 MyGDI and Electronic (e-) government

Electronic (e-) government has been proposed as a solution to the problems of traditional governments, such as declining revenues, high costs, poor quality of services, and corruption. In Malaysia, the governments have similar problems due mainly to the lack of interoperability within and among government agencies. These problems were identified and classified as high cost of services, poor service quality, and low efficiency. MyGDI is a very important component of e-government. The difference is the type of data they deal with; MyGDI deals with spatial data whereas e-government deals with just any type of data including spatial data. In other words, a functional MyGDI will be a very important component of e-government.

Among the public sectors challenges in implementing Electronic (e-) government applications are:

- Better and more efficient solutions
- Save resources
- Individual services for citizens and businesses
- Easier access to the public sector
- Increase transparency and access to information

### 4.0 MyGDI Actions Plans

MaCGDI as the responsible organisation on the implementation of NSDI in Malaysia has facilitated MyGDI and demonstrated how it can break down institutional, policy and technological barriers and provide valued geospatial data directly to users. A set of goals, objectives and deliverables has accelerated collaborative implementation of MyGDI. The Action Plans encourages participation by jurisdictions, agencies and business enterprises under a common sharing approach. Priorities for further actions as described below:

#### 4.1 Governance and Partnership

Partnerships present an opportunity to develop MyGDI in a way to meet business needs and to share the load in developing the various components of MyGDI. However, this requires considerable coordination of effort and leadership on the part of MaCGDI and the various jurisdictional coordination mechanisms. Partnerships are also being established with other agencies representing key user groups at both national and jurisdictional levels, such as land administration and natural resource management which have strongly supported the need for the solutions offered by MyGDI approach. Data and service providers, users in government agencies, business enterprises, academic institutions and community groups benefit from and, where appropriate, contribute to the enhancement of MyGDI. Among actions taken include:

- Identify barriers to access to spatial data and develop institutional arrangements to lower the barriers to data access and use;
- Continue to strengthen coordination arrangements in jurisdictions to provide a whole of jurisdiction response to MyGDI implementation;
- Develop agreements targeted at relationship management and consensus building for MyGDI;
- Raise awareness, demonstrate the benefits, obtain support and promote investment for implementation of the MyGDI within provider and user communities;
- Implement a MyGDI Communications Plan to communicate progress and obtain stakeholder feedback on MyGDI implementation through the MyGDI workshop series

## 4.2 Framework Data Development

MyGDI Data Framework refers to the collaborative effort define a common source of basic geographic data. It provides the most common data themes that geographic data users need, as well as an environment to support the development and use of these data on which organisations can build by adding their own details and compiling other data sets. Through the collaboration, several government agencies or industry groups can define consistent data themes to fulfil their common objectives. A number of 12 data layers have been considered to be common-use and of national framework data. Framework layers commonly nominated in national context include:

- i. **Aeronautical** - This category contains the geospatial information related to air space and aerodrome.
- ii. **Built Environment** - Building, property or place designated for use as premises for residential, commercial, industrial, institutional, educational, religious, recreational, cemetery and built-up.
- iii. **Demarcation** - This category holds information on topographic, maritime and cadastral
- iv. **Geology** - The Geology category includes all geological mapping information and related geoscience geospatial data including geolithology, mineral, fossils, mining, exploration, and geological features
- v. **Hydrography** - The Hydrography category includes geospatial data on coastal hydrograph, shoreline structures, fishing facilities, ports and harbours, navigation aids, danger and hazard, depth information, inland water, river structure, offshore and miscellaneous.
- vi. **Hypsography** - This category contains the geospatial information related to relief portrayal.
- vii. **Soil** - This category contains geospatial features such as Histosols, Spodosols, Andisols, Oxisols, Vertisols, Ultisols, Mollisols, Alfisols, Inceptisols and Entisols.
- viii. **Transportation** - The Transportation category includes both land and water transportation geospatial information.
- ix. **Utility** - This category contains the geospatial information related to electricity, telecommunication, water supply, oil and gas, broadcasting, sewerage, waste management and meteorological.

- x. **Vegetation** - The Vegetation category includes geospatial data on cropland (Perennials), cropland (Annuals), cropland (Cash-Crops), natural vegetation (Dryland), natural vegetation (Wetland) and natural vegetation (Miscellaneous)
- xi. **Special Use(Dataset Specific)** - Terrain Analysis Dataset and Meteorological Dataset
- xii. **General** - The General category includes geospatial data on Control Points such as GPS stations, Trigonometry station and Gravity Reference Point.

#### 4.2.1 Framework's key aspects

- 12 themes of digital geographic data that are commonly used;
- Procedures, technology and guidelines that provide for integration, sharing and use of these data; and
- Institutional relationships and business practices that encourage the maintenance and use of data.
- The framework represents **data that you can trust.**
- The best available data for an area, certified and described according to Malaysian Standard for Features and Attribute Codes (MS1759)
- The framework is the backbone of NSDI

#### 4.2.2 Framework benefits

- Local governments need the data theme as a base in their application and they frequently integrate these data themes when they build GIS applications.
- State agencies need high resolution data for specific regions such as state-owned lands and facilities.
- Federal governments need and produce higher resolution data, particularly in managing federally owned lands or facilities, or working on specific projects.

#### 4.2.3 Building Geospatial Data Centre

MaCGDI has been required to develop National Geospatial Data Centre (NGDC). NGDC is built to speed-up data explorer function, and thus enhance the facilities that have been established for MyGDI. This is also to accomplish the directive from Malaysian Administration Modernisation and Management Planning Unit (MAMPU) under *Perakuan 40, Para 29 Hasil Kajian Permodenan Pentadbiran Tanah*, where MaCGDI has been obligated to develop National Geospatial Data Centre (NGDC). Enhancing the purpose of MyGDI, NGDC will focus in the development of a portal to support access and encourage greater collaboration and coordination in the use of geospatial data across all levels of government.

Detailed and specialized data that are part of the solution will be placed and maintained centrally. The National Geospatial Data Centre (NGDC) will accommodate this requirement, which provide accessibility to the geospatial data across the solution. NGDC will further capitalize on the investment on NSDI. It will complement the data that are made available by all data providers who maintain and update from their respective locations. The data in NGDC will overcome various problems Examples of the problems are the inability of data providers to provide data in GIS ready format that are beyond what is required in their daily tasks and hesitation to share and update data at a significant level of details. Thus GDC will establish a thorough and formal approach to provide all the required data to ensure meaningful data sharing facility and smooth running of all the services to be included in the GI-SDI. NGDC will be the facility to host data centrally to be used by

end users from the various groups with properly established access. NGDC can also be the point to distribute data that are not readily provided by any data providers. This includes publishing high resolution satellite imageries through proper licensing arrangements with the image suppliers so that a wide group of end users can access the imageries through, for example, Web Services. This allows users to have quick mapping which otherwise would be prohibitively costly for them to obtain individually.

Spatial databases (geodatabase) are databases that provide storage, seamless access mechanisms and management of data sets. Key characteristics of a geodatabase include:

- Access and delivery of arbitrary features
- Seamless repository
- Common data model
- Application neutral, supporting a heterogeneous application environment
- Support of large volumes of data
- Multi-temporal support
- Common repository for spatial and non-spatial data
- Efficient access to large volumes of data

The principles adopted in developing geodatabase are:

- Data should be collected once and use by many
- Geodata should be as seamless as possible, with co-ordination across jurisdictions and boundaries when possible.
- Data should be collected, processed and maintained according to national standards to maintain data integrity across databases, and to enable the data integration
- Upon agreement, partners should contribute equitably to the costs of collecting and managing the data, and should be allowed to integrate the resulting information into their own databases, for their own use and for further distribution to their stakeholders.
- There should be an attempt to harmonise terms and conditions for use where practical. In the absence of such agreement, each agency should be free to establish its own terms and conditions for such information.
- Partnerships between agencies should be simple and support the principles of the MyGDI,
- A group or agency within each province and within the federal government should be designated to promote and co-ordinate the development of a common geospatial data infrastructure, both within its jurisdiction and between jurisdictions.
- MyGDI is national in scope, and must meet the needs of a wide range of geospatial user communities, data producers and different areas of the private sector.
- MyGDI must consist of a set of co-ordinated and interrelated policies, practices and possibilities that build on the vision.

### **4.3 Inclusion of Services in MyGDI**

The services that are currently available in the system can be further enhanced. An example of the enhancement would be expanding the users that are currently categorized as G2G to include G2B. The services that are relevant for these groups are NSDI Application (MyGDI) and Land Integrated Information Services (MyLIIS). Further enhancement for sectoral-based applications that are applicable for G2G additionally can be tuned towards service-oriented (developing the functionality according to what the user needs) rather than data-oriented. The services described below are those that will be employed to further enhance the infrastructure.

#### **4.3.1 Component-based Web Services**

Capitalizing on the established MyGDI infrastructure and enhancing it to next levels to become GI-SDI, Web Services can be introduced into the application. Web Services enables placing of reusable application services on the web, which can be accessed and use by other compliant applications and web sites. Relevant services that can be covered in GI-SDI include user-oriented functions and maps. These will be selfcontained modular applications, which services when published can be located and invoked across the web. Web Services architecture requires three fundamental operations: publish, find, and bind. Service providers publish services to a service broker, which in our case will be the GI-SDI. Users can find required services or service providers using a GI-SDI application and use to the services.

This approach in standard Web Services architecture is in line with NSDI where users can check out the functionalities offered by the Web Service before using or binding to them. The difference is that in conventional NSDI approach, users find data and metadata then they can get access to the data using various means whereas in Web Services, users not only find relevant data but instantaneously use the application including data. Web Service: GIS Web services give a diverse user community access to geospatial functionalities and contents.

There are three intertwined considerations that will shape the solutions to tackle the challenges hence realizing the potential of MyGDI. These are:

- Widening the services to materialize the potential and to address the demands by potential users
- Adoption of the enabling Technology
- Assimilation of the trend in the field that progresses in response to the common challenges elsewhere.

The following diagram (Figure 1.1) presents the progress in the implementation of spatial data sharing efforts towards the establishment of GIS Networks and Social Infrastructure. Note that within GIS Networks and Social Infrastructure, a significant development is the second generation SDI, which is service driven rather than data oriented.

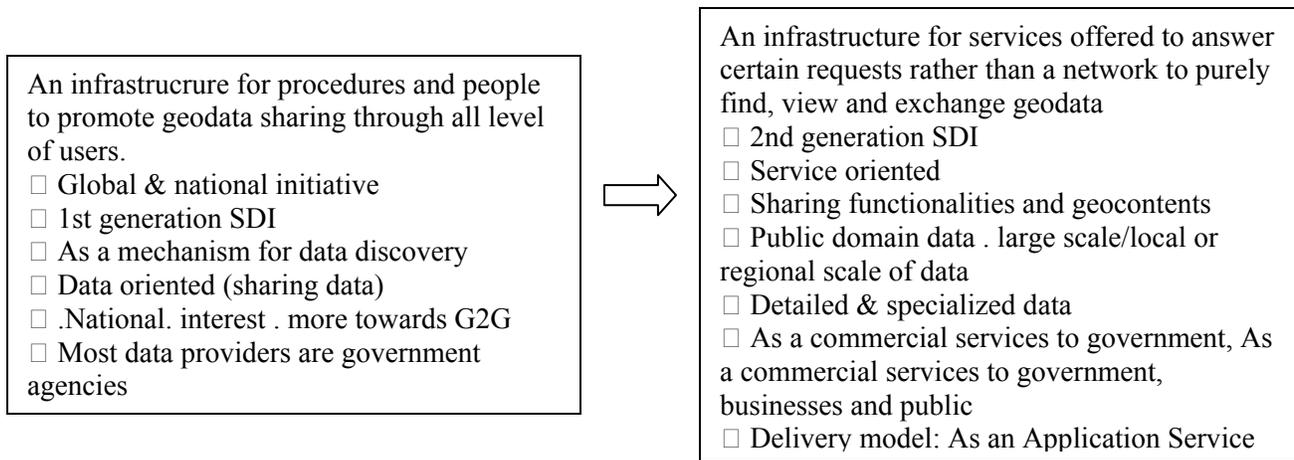


Figure 1.1: The development of NSDI

The services to be available through the solution moreover are provided yet by a wide range of providers with varying degrees of integration with the system. These sets of service providers include government agencies and business entities as well as the public in general. The types of services that can be provided through the solution can be categorized into 4 groups according to the relations between the service providers and the end users. These are:

- Services that are provided by government for use by government
- Services that are mainly provided by government and used by government and businesses (G2G and G2B)
- Services that are provided by business entities and used mainly by other businesses.
- Services that are provided by business entities and used by other business entities as well as the consumer at large.

The system as it has been implemented in Malaysia fulfills the criteria of NSDI but it is still data oriented and imperative for issues about data and user needs to be fully addressed. (Figure 1.2). Inclusion of services in MyGDI need to be developed to materialise the potential and to address the demands by potential users by adoption of the enabling technology to improve GIS decision making in communities. (Figure 1.3)

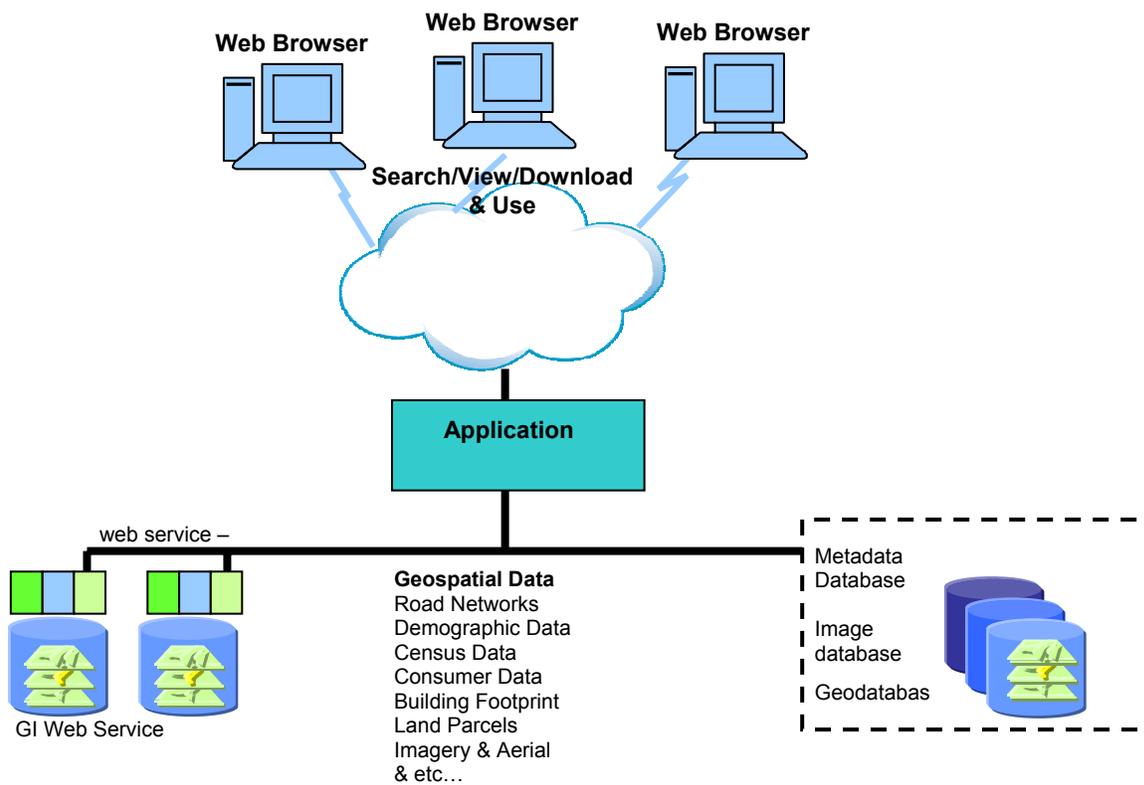


Figure 1.2 MyGDI with Data Oriented

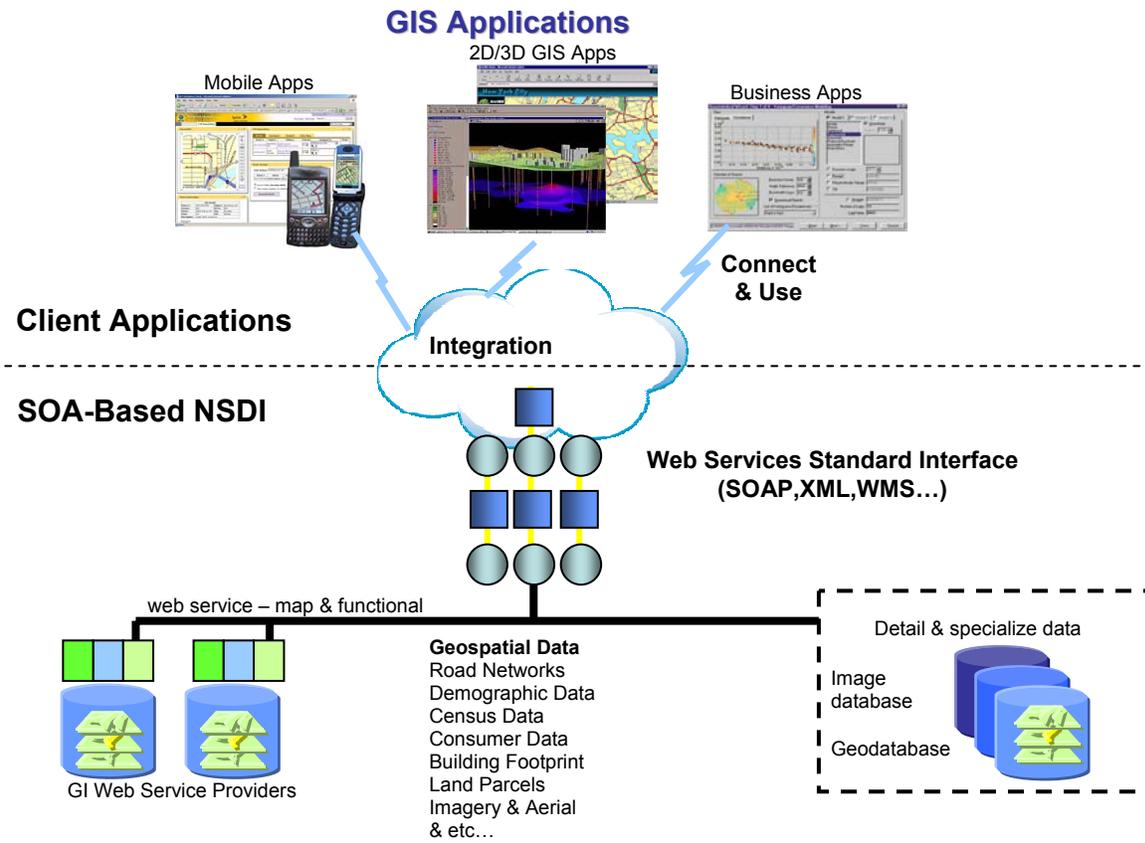


Figure 1.3 MyGDI with Service Oriented

#### 4.4. People (Human Resources)

Like data, people also play an important and fundamental role in SDI. People in SDI are normally data providers, value adders and data users. In developing an SDI, it is important that data user's requirement be considered, so that the SDI becomes user driven as mentioned by Strain et al., (2004). MaCGDI has put a priority to build-up capacity of MaCGDI personnel and appropriate agencies related to MyGDI services. MaCGDI in collaboration with National Land and Survey Institute (INSTUN) has organised various training and courses pertaining to GIS technology and applications. These courses were attended by operational personnel from federal and state agencies as well as local authorities. Besides that, series of seminar and technical workshops were also organised to create awareness and understanding about the needs and geoinformation standards to comply with MyGDI needs. These include Metadata Workshop, Data Collection Training, Data Pricing Workshop, Malaysian Standard MS1759 Workshop, and Geographical Names Database and Web Gazetteer Workshop.

The main objectives for SDI capacity is to enhance the abilities of stakeholders to evaluate and address issues related to policies, data, standards and infrastructure development. Capacity building programmes are essential to support national geodatabase, economic development, geospatial data exploration for ministerial administration, land information systems, natural resources and environmental management. MaCGDI has made few collaboration learning ventures with private sectors in a field of data collection and GIS analysis which include hardware, software and application. MaCGDI also has participated actively in academic cooperation with various internal and external universities.

Three elements of capacity relevance to MyGDI include Individual, Institutional and Infrastructure capacity as below:

- Individual capacity building
  - Technical and professional competencies and responsibilities
  - The education, training, collaborative learning venture and courses initiatives to be aware of access, use and develop MyGDI data and products
  - Workshops, hands-on software courses and seminar
- Institutional Capacity Building
  - Focus on developing and fostering an environment for the use of SDI and GIS to enhance service delivery and decision making.
  - Building policies, data, standards and organizational structures in organizations aimed at enhancing the understanding of the value of MyGDI data and products.
  - Ongoing review of the capacity of the entities or organisations which build and manage SDI at all these levels
- Infrastructure Capacity Building is related to the hardware, software and other technology required to access, use and develop SDI data and products for decision making

#### 4.5 Enhancing MyGDI through Collaboration

The experience in the implementation of MyGDI brings forward issues to be dealt with further. The experience also brings out the realization of the latent value of NSDI that can be further augmented to capitalize on the existing investment on and other matters that are closely related to NSDI. A private entity will undertake the effort to deal with data issues that otherwise would be left unresolved. For data that has clear custodianship, as opposed to taking over the custody of the data from the government, the private entity will only be the liaison to the respective government agency who acts as the custody to the data. In this way, the government can continue to concentrate on their mandated tasks in their daily operations without additional responsibilities to prepare data for sharing. Arrangements like licensing, royalty, transaction auditing, and other guidelines can be formally established. Private sectors is also working to provide technology, data and services in support of MyGDI activities. In particular, industry plays a key role in ensuring that effective information technologies (consistent with standards and specifications being developed by SIRIM) exist and that these technologies support MyGDI requirements. Therefore it is imperative that such organisations play an important, proactive role in the development of a MyGDI.

#### 5.0 Conclusion

Since 1997, there has been consideration discussion and effort to develop the MyGDI concept. Some elements have been implemented, including policies, action agendas and tools such as the MyGDI spatial data directory. However, with the current MyGDI Action Plans, MaCGDI and agencies partners are now turning words into action. They will be mobilising support and active involvement from all spatial information industry players and users of spatial information services. To this date, MyGDI has established a working framework and component that provide a basis for geospatial data exploration, assessment, and application for its user community within all levels of government, business industries, non-profit sectors, the academia as well as the public. Through Malaysia Geoportal at [www.mygeoportal.gov.my](http://www.mygeoportal.gov.my) as a one-stop geospatial data centre will improve Government Electronic Delivery Services. The development and implementation of MyGDI need commitment and contribution from many agencies in many aspects such as information, time, cost and human resource. Capacity building is a one process that has to be focused especially in education, training and research within universities in a country.

A future challenge of MyGDI coordinating agency such as MaCGDI is to apply different level of capacity building framework to the development of SDI for any jurisdictions. Relatively, data policy and copyrights needs to be clearly identified possibly to become one of the driving forces in the context of the use and sharing of data among geospatial community. The benefits of MyGDI are *dynamic* in that they will grow over time as MyGDI participation increases and standards and procedures are established.

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