THE WEB MAP SERVER INTERFACE: STANDARDIZATION AND APPLICATION DEVELOPMENT IN THAILAND AND ITS TRENDS TOWARD NATIONAL SPATIAL DATA INFRASTRUCTURE POLICY

Phurith Meeprom[1], Kaew Nualchawee[2]

Geoinformatics Faculty, Burapha University. 169 Long Had Rd. Bangsean, Chonburi, 20131, Thailand

[1]phurith@buu.ac.th, [2]knualchawee@yahoo.com

Abstract

This paper describes the Spatial Data Infrastructure (SDI) context and Thailand standards development which have been officially launched by The National Geo-Informatics Board in 2012. The SDI in Thailand consists of two periods, i.e. the first period is for five years (2011-2015) and the second term is for two years (2016-2017) to improve and refine the five activities. The SDI in Thailand development and implementation is to start with five action plans, namely, development of NSDI Portal, development of geospatial information standards, development and integration of base data, development and integration of FGDS, and capacity building.

For the WMS in Thailand development is in the part of SDI Portal and Data Clearinghouse, can support GIS community in Thailand leading to a more systematically development and usage of technology. In addition to, the part of the development of FGDS, the 13 fundamental geographic datasets development have been in progressing stages based on standardized protocols accepted and accessible by all stakeholders in the community.

Keywords: SDI; web map server; standard; FGDS

1. INTRODUCTION

Spatial Data Infrastructure (SDI) is Internet-based mechanisms to display the geospatial information in an efficient and flexible way. In the last two decades, SDI has diffused worldwide to a formally represented knowledge that is mainly used to improve data sharing and information retrieval. (J.Lacasta et al., 2005)

The SDI is often used to denote the basis for spatial data discovery, evaluation, and application for users and providers within all levels of government, the commercial sector, the non-profit sector, and academia and by citizens in general. The applications that access to geographically-related information uses a minimum set of standard practices, protocols, and specifications. (The SDI Cookbook, 2012; Chaowalit Silapathong et al., 2012).

An SDI consists of geographic data and attributes, sufficient documentation (metadata), a means to discover, visualize, and evaluate the data (catalogs and Web mapping), and technique to provide access to the geographic data. Beyond this are additional services or software to support applications of the data (The SDI Cookbook, 2012). SDI is understood differently by stakeholders from different disciplines. It is commonly recognized that an SDI can include core components of policy, original datasets, technical standards, access networks and people, and adopt different design and implementation processes. (Chaowalit Silapathong et al., 2012.)

The aim of this paper is: first describes the key data themes of the Thailand SDI, then reviews current Thailand SDI activities, follows by presenting and discussing the next steps needed to continue moving the Thailand SDI forward in support of the shifting paradigm in government management.

2. SPATIAL DATA INFRASTRUCTURE DEFINED

In brief, SDI can be defined as an "umbrella" of policies, standards and procedures under which organizations and technologies interact to faster more efficient use, management and production of geospatial data. (Ottichilo, 2006)

SDI is fundamentally a concept about facilitation and coordination of the exchange and sharing of spatial data between stakeholders from different jurisdictional levels in the spatial data community. The concept is well explained as an integrated, multi-levelled hierarchy of interconnected SDIs based on partnerships at corporate, local, state/provincial, national, regional (multi-national) and global (GSDI) levels. (Abbas Rajabifard and Ian P. Williamson, 2002)

Figure 1: The SDI hierarchies (Abbas Rajabifard and Ian P. Williamson, 2002)
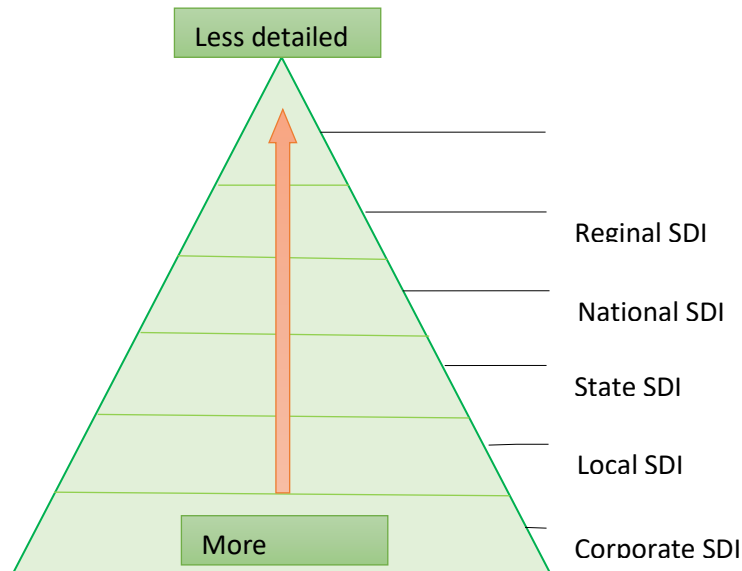
Therefore, it is essential that SDI practitioners understand the significance of human and community issues, as much as technical issues, as they determine the long-running success of an SDI development. Having said that, SDI, therefore, can no longer be regarded, or taught, primarily as just a technical matter. Developing a successful SDI initiative depends at least as much upon issues such as political support, clarifying the business objectives which the SDI is expected to achieve, sustaining a culture of sharing, maintaining reliable financial support and enlisting the cooperation of all members of the community, as upon technical issues relating to spatial data access, networking, and standards. Therefore, the argument is that developing a successful SDI within a jurisdictional level must be seen as a sociotechnical, rather than a purely technical, exercise; the communities concerned are expecting to reap benefits from their investment in SDI regarding improved corporate performances and cooperation. (Abbas Rajabifard and Ian P. Williamson, 2002)

3. NSDI DEVELOPMENT IN THAILAND

The Spatial Data Infrastructure in Thailand was initiatives by Geo-Informatics and Space Technology Development Agency (Public Organization); GISTDA. Starting point to learn more or to follow in the case of adopting SDI development, given "learning from the

experience of others." since two decades ago. The Government decided to establish the National Geographic Information Committee (NGIC) by the Order of the Prime Minister's Office, dated 16 June 2003 which went into effect on 9 July 2003 with GISTDA being appointed as Secretariat to the Committee. Moreover, the National Geographic Information Committee (NGIC) marked the policies on geospatial information development, cartography, and remote sensing to proceed systematically, minimizing duplication, promoting integration and sharing and coordinating effectively. (Chaowalit Silapathong et al., 2012)

The components of NSDI are 1) Institutional Framework, 2) Geospatial Information Standards and Standardization, 3) Fundamental Geographic Data Set: FGDS, 4) Metadata and 5) Clearinghouse or Portal. The ThaiSDI has been established to be a forum for communication of activities dealing with all elements of NSDI to promote activities leading to interoperability in all sectors and all levels of operation.

3.1   Institutional Framework

The current institutional infrastructure that is in place includes GISTDA, charged with the responsibility in geospatial information development and The Office of Thai Industrial Standard Institute (TISI) is an official organization to publicize the developed and accepted standard(s). The National GIS Committee, appointed by the cabinet is a strong geospatial information infrastructure to the Thai SDI in a similar way the FGDC is to the United States' NSDI. (Chaowalit Silapathong et al., 2012)

3.2   Geospatial Information Standards and Standardization

The NGIC and TISI considered geospatial information standards which became to standardization for the country. The metadata standard ISO 19115:2005 has publicly announced by TISI as Thai Industrial Standard 19115:2548. While 23 standards have been formally announced by NGIC such as; Web Map Server Interface standard ISO 19128:2005 as Thai Industrial Standard 19128:2555; Profile-FACC Data Dictionary standard ISO 19126 as Thai Industrial Standard 19126:2555. However, NGIC realized that how to people are adopting or using the standards in their everyday undertaking, so GISTDA has been carrying out the Outreach Program to build awareness and capacity in geospatial information area as well as all about NSDI itself. (Chaowalit Silapathong et al., 2012)

3.3   Fundamental Geographic Data Set: FGDS

A survey by GISTDA in 2010 on data was made given upcoming NSDI development and found that activities regarding FGDS had been put into two areas, namely: development of base data, and development of FGDS themselves.

The base data includes orthophotos (aerial photos), orthoimages (satellite images), geodetic base stations and network (geodetic control), and digital elevation model (DEM). These activities have been conducted by certain organizations which can be identified as one or more organizations doing the same or similar activities.

The FGDS, there were 9 activities being carried out by different organizations, and sometimes the same situation occurred the similar way as that of the base data. The 9 activities include administrative boundary, transportation, water resources/waterways/rivers, urban/built-up areas, land use, forest area, topographic map data, land parcel, and marine/oceanographic data. These were known to exist in the survey, but all these are now readjusted to take a better form in going into the NSDI development and implementation.

3.4   Metadata

GISTDA has developed metadata Editor Program under the ThaiSDI Data Clearinghouse project for creating, editing, updating metadata, and also searching for conditions.The scheme is under the ISO 19115: Geographic Information Metadata and ISO19115-2 Part 2: Extension For Imagery and Gridded Data of ISO/TC211. The Thailand NSDI Feasibility Study reports on the standard that significant amount of data properties which are used to capture and describe the data set should be modified the Fundamental Geographic Data Set: FGDS to be fit in case of Thailand. This project leads to encouraging and support the data service for users in Thailand and other countries in the Geospatial-One-stop system. The information showed the appropriated elements for ThaiSDI derived from the study by collecting data from 11 government agencies, which involve in fundamental spatial data in Thailand. (Thitawadee Suvachananonda et al.,2006)

3.5   Clearinghouse/ Portal.

The development of geospatial data clearinghouse/portal for accessing, assessing, enquiring and transaction of spatial data between users and producers of spatial data that meet their needs. ThaiSDI, representing Thailand geospatial data clearinghouse/portal has been officially launched at the inauguration chaired by the Minister of Science and Technology on 9th February 2012.

At this occasion, representatives of all the custodians of the already identified 13 FGDS layers were enthusiastically present to assure the cooperation and meaningful

contribution into the Thailand SDI that has been under the development for some time now. (Chaowalit Silapathong et al., 2012)

Figure 2: NGIS Map Portal (http://www.ngis.go.th/home/)
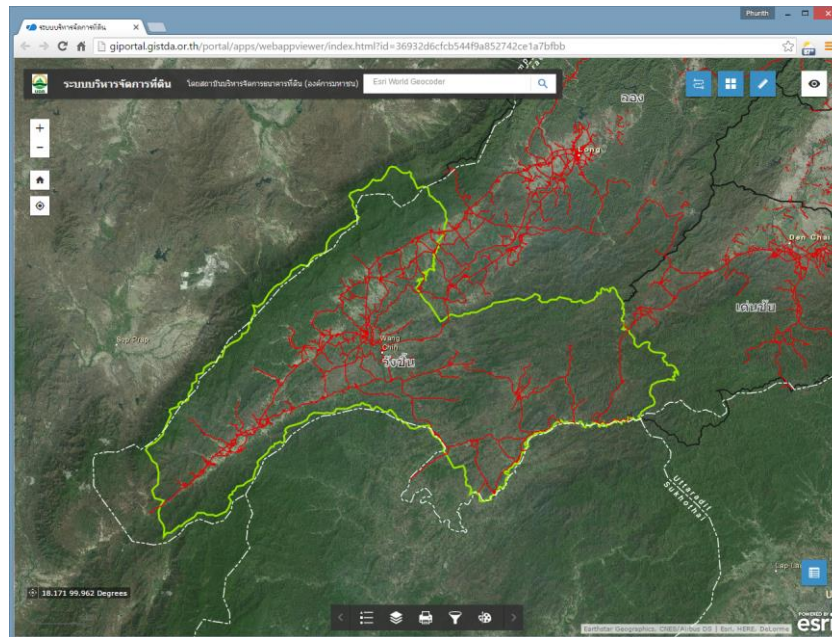
## 4. WEB MAP SERVER INTERFACE THAILAND

A Web Map Service (WMS) produces maps of spatially referenced data dynamically from geographic information. This International Standard defines a "map" to be a portrayal of geographic information as a digital image file suitable for display on a computer screen. A map is not the data itself. WMS-produced maps are generally rendered in a pictorial format such as PNG, GIF or JPEG, or occasionally as vector-based graphical elements in Scalable Vector Graphics (SVG) or Web Computer Graphics Metafile (WebCGM) formats.

The International Standard defines three operations: one returns service-level metadata; another return a map whose geographic and dimensional parameters are well-defined; and an optional third operation returns information about particular features shown on a map. Web Map Service operations can be invoked using a standard web browser by submitting requests in the form of Uniform Resource Locators (URLs). The content of such URLs depends on which operation is requested. In particular, when requesting a map the URL indicates what information is to be shown on the map, what

portion of the Earth is to be mapped, the desired coordinate reference system, and the output image width and height. When two or more maps are produced with the same geographic parameters and output size, the results can be accurately overlaid to produce a composite map. The use of image formats that support transparent backgrounds (e.g. GIF or PNG) allows underlying maps to be visible. Furthermore, individual maps can be requested from different servers. (ISO19128, 2005)

For the Web Map Server Interface in Thailand development is in the part of SDI Portal and Data Clearinghouse. The WMS has been formulated based upon the study conducted by Burapha University (2008) and sponsored by GISTDA. The results of studying ISO19128: Web Map Interface (2005) in Thailand reports on the web map service was modified to Web Map Server Interface Standardization. This project leads to support organizations both government and private sector in Thailand created web map service for users. In addition to, the part of the development of FGDS, the 13 fundamental geographic datasets development have been in progressing stages based on standardized protocols accepted and accessible by all stakeholders in the community.

Figure 3: WMS of Department of Highways (http://gisweb.doh.go.th/doh/)
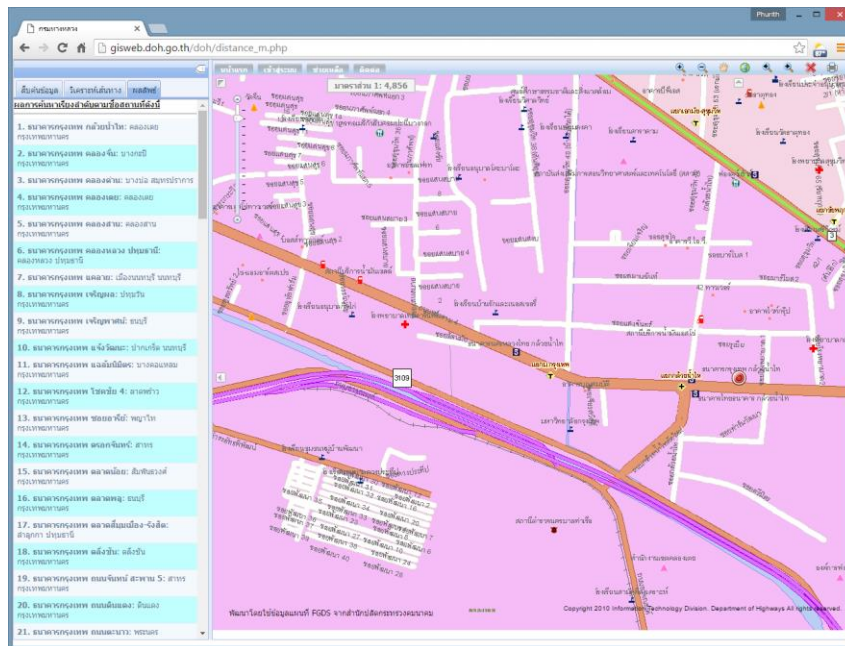
5. NSDI POLICIES IN THAILAND

The Plan to drive Thailand SDI Implementation is in National Spatial Data Infrastructure: NSDI Master Plan (2011-2017).

For the efficient and effective mobilization of the Thailand SDI to take place, the implementation plan has been devised to take two consecutive periods, i.e. a 5-year period (2011-2015) and a 2-year period (2016-2017) respectively. The brief account of activities in each period can be presented as follows.

5.1 The First Period (Phase) (2011-2015)

Under the first period, all the assigned FGDS custodians will collect, collate and integrate all FGDS under their responsibilities based on standardized approaches guided by the National GIS Committee. Part of FGDS can be put to service at the start and finally by 2015 all the FGDS service will be available to all sectors of the society. At the beginning of this period, development and establishment of complete NSDI Portal/Clearinghouse will commence by connecting the existing ThaiSDI clearinghouse to the FGDS custodian nodes (Web-GIS service) based on standardized protocols accepted and accessible by all stakeholders in the community. Additionally, capacity building for all concerned including data producers, data distributors, and end users will be in effect for the benefit of all concerned and the country as a whole.

5.2 The Second Period (Phase) (2016-2017)

This period has been set up to accommodate all necessary activities to ensure a fully functional Thai SDI as a result of taking all the necessary steps identified in the cookbook of the pilot project. At the end of this period, it is expected that all the FGDS developed will have been integrated among them and with other relevant datasets to be instituted in the Thai SDI system. NSDI portal/clearinghouse including all FGDS nodes will be up and functional to serve the next plan to accommodate business, as well as high-level government administration activities. (National Committee on Geo-Informatics, 2013)

The SDI in Thailand development and implementation is to start with five action plans, namely, 1) Development of NSDI Portal, 2) Development of geospatial information standards, 3) Development and integration of base data, 4) Development and integration of FGDS and 5) Capacity building.

Nowaday, the activities under the NSDI efforts, under the guidance of the NGIC, have been in progressing stages covering the development of 13 fundamental geographic datasets and the identification of the respective custodians; the development of

geospatial data clearinghouse/portal for accessing, assessing, enquiring and transaction of spatial data between users and producers of spatial data that meet their needs.

6. CONCLUSIONS

This paper serves to convey information on two related subjects, namely "Spatial Data Infrastructure: SDI" in general, "Thai SDI", and "Web Map Server Interface" GISTDA is the core organization of the national spatial data infrastructure development in Thailand by learning from the experience of others. After the Government decided to establish the National Geographic Information Committee (NGIC), ThaiSDI implementation is continue moving in support of the shifting paradigm in government management.

The ThaiSDI portal setup to accommodate the metadata editor software to assist in developing metadata was already in place. More than 20 general geospatial information standards were developed and publicized. In all, the Thai SDI development and implementation is to start with 5 activities to be carried out, namely, development of NSDI Portal, development of geospatial information standards, development and integration of base data, development and integration of FGDS, and capacity building. The implementation to ion plan to drive the Thai SDI consists of two periods, i.e. the first period is for 5 years (2011-2015) and the second period is for 2 years (2016-2017) to improve and refine the 5 activities. In addition to the plans mentioned, there are plans for budgetary, plan for follow-up and evaluation, and direction/measures for the implementation as well. It is hoped that the plan to drive the Thai SDI will be successful.

For the Web Map Server Interface in Thailand development is in the part of SDI Portal and Data Clearinghouse. The 13 fundamental geographic datasets development have been in progressing stages based on standardized protocols accepted and accessible by all stakeholders in the community.

7. REFERENCES

Abbas Rajabifard and Ian P. Williamson, 2002. Key Factors Influencing Regional SDI Development and Relevance to Global and other Levels at http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.140.8490&rep=rep1&type=pdf. [accessed 30 June 2016]

Burapha University (2008). Studying in ISO19128: Web Map Interface (2005) in Thailand, Bangkok: Geo-Informatics and Space Technology Development Agency (Public Organization).

Chaowalit Silapathong, Kaew Nualchawee and Supan Karnchanasutham (2012). "Toward Spatially Enabled Country and Society: The Case of Thailand", In Proceedings of the 33rd Asian Conference on Remote Sensing, November 26-30 2012, Pattaya Thailand, at http://a-a-r-s.org/acrs/index.php/acrs/acrs-overview/proceedings-1?view=publication&task=show&id=481. [accessed 27 June 2016].

Christiaan Lemmen, Peter van Oosterom and Rohan Bennett (2015). The Land Administration Domain Model, Land Use Policy, 49, (December) at http://www.sciencedirect.com/science/article/pii/S0264837715000174 [accessed 25 June 2016].

Chulalongkorn University (2004). Master Plan on National GIS, Bangkok: Geo-Informatics and Space Technology Development Agency (Public Organization).

ISO 19128 (2005). http://www.iso.org/obp/ui/#iso:std:32546:en

Lacasta, J., Muro-Medrano, P. R., Nogueras-Iso, J., & Zarazaga-Soria, F. J. (2005). Web ontology service, a key component of a spatial data infrastructure. In Proceedings of the 11th EC GI & GIS Workshop, ESDI Setting the Framework (pp. 19-22).

National Committee on Geo-Informatics (2010). National Geo-Informatics Development Integration Plan 2011-2015. Bangkok: Geo-Informatics and Space Technology Development Agency (Public Organization).

National Committee on Geo-Informatics (2013). National Geo-Informatics Development Integration Plan 2014-2018. Bangkok: Geo-Informatics and Space Technology Development Agenc (Public Organization) at http://thaisdi.gistda.or.th/index.php?option=com_phocadownload&view=category&id=21:170956&Itemid=57)

The SDI Cookbook (2012). http://gsdiassociation.org/images/publications/cookbooks/SDI_Cookbook_from_Wiki_2012_update.pdf. [accessed 27 June 2016].

Thitawadee Suvachananonda, Chaowalit Silapathong and Anusorn Kunarsa (2006). "Metadata Implementation for Thailand Spatial Data Infrastructure," In Proceedings of the 27th Asian Conference on Remote Sensing, October 9-13 2006, Ulaanbaatar, Mongolia, at http://a-a-r-s.org/aars/proceeding/ACRS2006/Papers/P-3_Q38.pdf. [accessed 25 June 2016].

Wilber K. Ottichilo (2006). Regional Centre for Mapping of Resources for Development (RCMRD): Geo-Information Capacity Building Activities in Africa. In Proceedings of the International Archives of the Photogrammetry, Remote Sensing and Spatial Information Science, Volume XXXVI, Part 6, Tokyo Japan at http://www.isprs.org/proceedings/XXXVI/part6/295_XXXVI-part6.pdf