

# Developing SDI Community in Malaysia: The Role of Academia

## **Jawahir Che Mustapha @ Yusuf**

Department of Information System  
Malaysian Institute of Information Technology  
Universiti Kuala Lumpur, Malaysia  
50250 Kuala Lumpur, Malaysia  
Tel: +603-21754383  
Fax: +603-21754001  
E-mail: [jawahir@miit.unikl.edu.my](mailto:jawahir@miit.unikl.edu.my)

## **Muhammad Azmin Bin Mohamed Ghazali**

Department of Systems & Networking  
Malaysian Institute of Information Technology  
Universiti Kuala Lumpur, Malaysia  
50250 Kuala Lumpur, Malaysia  
Tel: +603-21754375  
Fax: +603-21754001  
E-mail: [azmin@miit.unikl.edu.my](mailto:azmin@miit.unikl.edu.my)

## **Muhammad. A**

Level 4, UniKL (City Campus) Kuala Lumpur, Malaysia  
Tel: 0060-10-2115002  
Fax: 0060-3-2175-4441  
Email: [muhammad.unikl@gmail.com](mailto:muhammad.unikl@gmail.com)

## **Abstract**

This paper will address the significant roles of academia in supporting the development and future direction of SDI community in Malaysia. Another aspect to be discussed is the current performance of SDI, participation and roles of various stakeholders such as JUPEM and DBKL, as well as Academic Institutions. This paper will further discuss the type of relationship that is needed between each stakeholder to ensure a smooth implementation of SDI. A SWOT analysis from academic perspective is used to evaluate the Strengths, Weaknesses, Opportunities, and Threats at present time for effective and efficient attainment of governmental SDI mission and vision. It is a known fact that no nation can grow without a strong coordination between the research communities, public agencies and the industry. SDI concepts has shown its successfulness and level of maturity can be seen among countries which has implemented it as a result of early awareness and realization of its importance.

## **1. Introduction**

In today's environment, the importance of National SDI is highlighted whenever a need for geo-spatial data arises. For example, in times of crisis such as natural and man-made disaster or controlling diseases outbreak in region. Even for daily administrative task such as administering land use by municipal authority. According to D. D. Nebert [1], Spatial Data Infrastructure (SDI) refers to collective technologies, policies and

arrangement that facilitate the availability and access to spatial data. It is a means to discover, visualize and evaluate the data. It can exist on a local, regional, national or even global scale. In this paper, we examine the close relation between each stakeholders and the presence of academia as a catalyst to a matured SDI. A simple analysis is conducted to evaluate the Strengths, Weaknesses, Opportunities, and Threats at present time for effective and efficient attainment of governmental SDI mission and vision. The concept of SDI has proven its successfulness and level of maturity among countries which has implemented it. This is seen as a result of early awareness and realization of its importance.

## **2. Malaysia NSDI Stakeholders**

In the Malaysian environment, similar to other countries, various organizations contribute to the growth of spatial data usage and its availability. In particular, there are vital or key organizations that play crucial roles in weaving the delicate balance between data privacy, ownership, as well as availability. These organizations fall into two categories namely data providers/owners and policy makers and sometimes both. Due to certain type of data being sensitive, each organization has its own rights in determining the level of availability of the said data to the public or the shared domain. In this paper we review some examples of these organizations that can be considered important to the development of the SDI.

Firstly, there is JUPEM (Malaysian Department of Survey and Mapping). This is the organization that sets the standards for geo-spatial data and they also provide geo-spatial data and services. JUPEM can be categorized as both Policy maker and data provider. Among important services offered by JUPEM includes Topographic data, Cartographic data and Cadastral data. Among the marked achievements of JUPEM are [4]:

### **1. Vital role in developing MYGDI**

A closer look at MYGDI will reveal some important objectives, which are:

- Providing a mechanism to facilitate the utilisation and sharing of geospatial data among the agencies that use and supply the data.
- Encouraging wider use of geospatial data at the state and national levels.
- Contributing towards strengthening the development of national geospatial data through collaboration. [2]

### **2. MyRTKNet**

### **3. MyGeoid**

### **4. The creation of Geocentric Datum of Malaysia(GDM 2000)**

Another stakeholder is DBKL (Kuala Lumpur City Hall). An important fact to note is that DBKL plays a vital role in providing geo-data for Kuala Lumpur due to the fact that KL falls under its jurisdiction. According to Mohaizi [3] DBKL has taken the initiative to develop a depository hybrid/centralized GIS database integrating spatial information from six (6) pilot departments to ascertain the integration and interoperability of geospatial data within this departments. DBKL GISNet System follow the policy, data framework and standards as laid out by Malaysian Center for Geospatial Data

Infrastructure (MaCGDI) in facilitating, coordinating and managing ultimate geospatial information. This system is developed based on a business model designed specifically tailored to a Local Spatial Data Infrastructure, and will be known as Local Geospatial Data Centre (LGDC). An interesting fact regarding the DBKL-GISNET is that it serves as an inventory of spatial information infrastructure and interoperability status. Furthermore, it examines and makes recommendations on data preparedness and access, and on standards. It is also mentioned that the scope also includes symbology, technical infrastructure and capacity building. The six pilot departments that included in the initial phase of DBKL-GISNET [3] are:

- Information Technology and Communication Department;
- Planning Department
- Master Plan Department
- Valuation Department
- Landscape Department
- Health Department

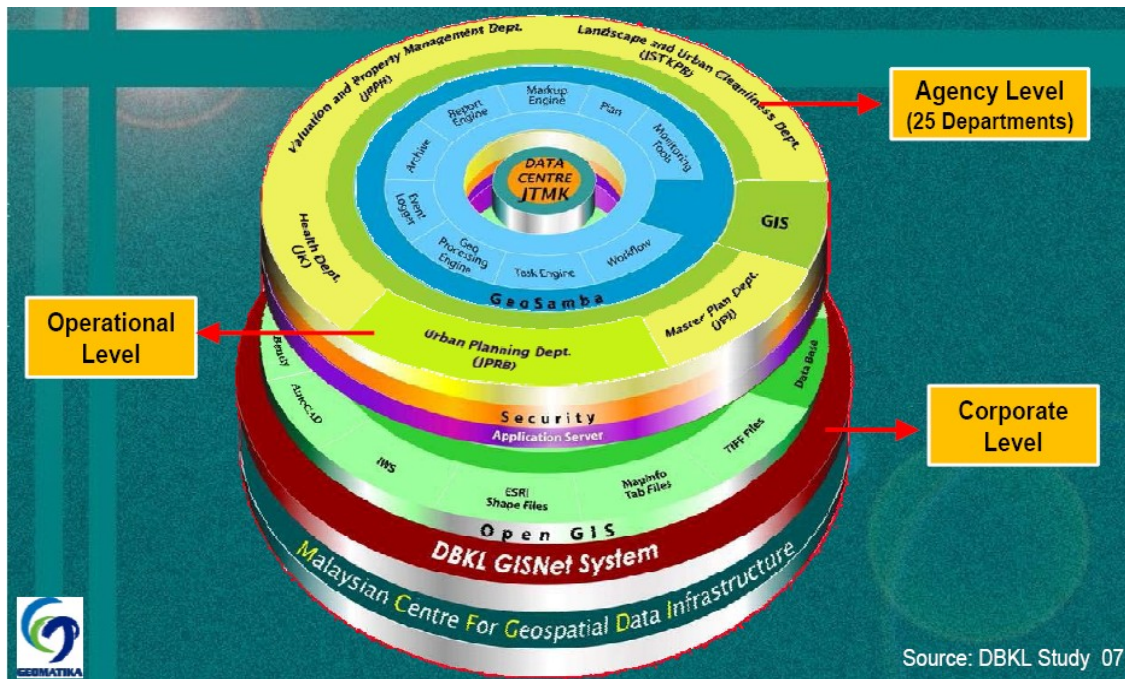


Figure 1: DBKL GISNET

Another interesting angle to look at is the participation of academic institutions in developing SDI. There is no denying that the role of academic institution is important in the sense that it completes the effort. This is seen in various research projects that contribute to the betterment of the SDI implementation. Participation of academic institute can be considered as bridging the differences between each stakeholder in the SDI. The major role that is played by academic institution is conducting academic research that will help the effort of developing a matured SDI.

### **3. Roles of Academia in Developing SDI**

#### **3.1 Education, Training and Seminar: Reformation of Geospatial Subjects**

The academia or university is an educational and research institution, the place where the strength, intellectual and instructional leadership of human is born and trained. As an effort to take part in supporting the SDI development, the academia can offer assistance especially in terms of academic contributions such as an institute for education, training and seminar on SDI. University can operate as a medium to educate people to understand new subjects and concepts introduced in this field of studies. They can be encouraged to explore and expand the knowledge in order for the growth of geographic information community.

University in Malaysia can make an attempt to the reformation of new courses by offering geospatial subjects to develop and train group of expertise in geographic sciences. Some universities in other countries includes Asian Institute of Technology in Thailand, Gadjah Mada University in Indonesia, Nagoya University in Japan, and International Institute for Geo-Information Science and Earth Observation (ITC) in The Netherlands that established courses in GIS and remote sensing now emerge as a leader in these geospatial industries amongst world academia. Institute of Geographical Information Systems (IGIS) in Islamabad also offers a number of programmes from basic short courses to degree level such as MSc and PhD in GIS and remote sensing [5]. How they begin, how long it takes to establish and mature, their success stories can be a model for other institutions to start developing their own geospatial expertise.

Nevertheless, part of the challenge in any national SDI project is educational level and expertise in geospatial knowledge. According to Derek [6] in his article about GIS in Africa, to be effective in SDI activities, there must be a critical mass of expertise in GIS. He often criticise the local academic institutions due to incapability of offering the required technological skills. Students who have good knowledge in the field of geospatial were very limited and this situation becomes complicated when students studying abroad in this field do not return to their home country for some reasons. For those that do return will encounter problems in using their knowledge and expertise due to the lack of support from the government, including local authorities as well as the industry. A similar scenario is observed in Malaysian academia. Establishment of geospatial courses in some local and private institutions is viewed as not on the whole, immature and still unable to support current job requirements. In addition, information provided for students who want to pursue study in this field is clearly lacking. They are unaware about the employment opportunities offered by the government, industries and academia. Furthermore, their perception is always influenced by popular courses that is said to offer good job and many of them do not have interest to explore 'bizarre' subjects due to lack of exposure and information on current needs. Hence, the academia is responsible to deliver accurate and comprehensive information to the people who would like to pursue higher education.

#### **3.2 Academia and Industrial Partnership: Universities without Borders**

There are always obstacles to overcome when starting something from scratch. The challenge for academia is how to provide initial technology tools, infrastructure and

expertise to support the courses requirements. Funding is amongst the issues but some other constraints could be resolved by constituting relationship with the various institutions and organizations that surround them. For instance, Universiti Kuala Lumpur (UniKL), Malaysia had established collaboration between University of La Rochelle, France to create a split postgraduate program in area of GIS, remote sensing and image processing. UniKL is also involved in Images of natural Disasters from robot Exploration in urban Area (IDEA) project under French programme, ICT Asia (2007-2009) [8]. This will be a stepping stone to breed experts who will take the lead in research and development in this field. Another example is ITC that established an international knowledge network between scientific and professional organizations. Academic and professional partnerships allow ITC to offer its services in the field of research, education and project services worldwide.

Rosti [9] said both the academia and the industry played crucial roles in nurturing young people so that they were equipped with the necessary knowledge and competencies to function effectively in the market, and thus helped minimize the expectation gap between the university and the industry. Public and private university must consider expectations of key stakeholders and seek inputs from various stakeholders. The efforts must be followed with discussion with representatives of industries, relevant professional bodies and other interested parties in order to obtain better picture of the trends in employment pattern, technological changes and other issues. Universities should allow industries to provide inputs and feedback to universities on the desirable qualities employers were looking for, so that they could design the course curriculum accordingly. The partnership between academia and industries will serve as a platform to promote professional development of employees and nurture lifelong learning. Universities without borders should be practiced so that an advanced networking with experience and knowledge sharing can be established [7]. International cooperation would offer huge benefit to produce a competitive, dynamic and knowledge generation. This effort will also enhance formal and informal education and lifelong learning for all members of academic and non-academic communities.

### **3.3 Defined funding plans: Utilizing research grants and inviting participation**

Researches have become the core components in academia activities. Conducting research on topics related to SDI is an effort to enhance the understanding on geospatial data among organizations. To understand SDI is not a matter on just to know the creation and how to store the data but more importantly, to understand the real needs to document the data for future use. Research in SDI always focuses on current and future frameworks of technologies, data, policies, organizational arrangements and primary people to support the SDI development. There are also researches to identify the use of spatial data and services to support policy, business, research, and society for large communities. Hence, as part of research communities, academia should seek out external 'drivers' or 'levers' to tap into funding because SDI projects will involve much participation from various stakeholders and this is proven to be complicated. Since the funds or grants are easily awarded to groups or teams that have wide and good experiences in research environment, universities that have expertise and good reputation in research projects will not face many difficulties in obtaining funds. What happen to the beginners, to the novices that have great interest but without or little experience?

In Malaysia, several new universities exist to provide graduates with the knowledge, skills and attitude required to contribute towards and play major roles in globalize and knowledge-based economy. Research environment are still at its infancy and the journey is still long towards maturity. These new universities are striving and competing with the established universities to get funding for research projects. Thus, proper planning and methodologies in seeking funds for research should be done correctly. The researcher should begin with small scope of works but can deliver results with major contribution. Individual effort is impossible and the researcher needs to find a team. Before applying for external grant, the researcher could attempt to apply internal grants and this basically for short term period. Then, with few short term research grant projects accomplished, they can begin inviting participation from other universities to share projects and expand the research network. Shared projects will bring up issues on ownership and need proper illumination among stakeholders. A good method for sharing experience and building up networks is through participation in conferences, workshops and seminars. These activities provide good opportunities to cultivate new ideas, having new connections and firms up existing relationships. The journey might be time-consuming, but the values will benefit all parties.

Many research projects in universities are like a silo where only the research community would know about it and often isolated from public knowledge. There are many projects with a good initialisation and developed progressively but the functionalities failed to be exploited fully. The research projects also contributed to certain academician and professional in certain events only. Of course from academic perspective, these researches were not meant for commercialization. However, it is important to form smart partnership between Malaysian universities to ensure the researches on SDI can gives more benefits to all stakeholders. This effort is also crucial to promise the researches under studies are not repetitive and redundant. The expertise, tools and equipment they possess could be joined to strengthen the quality of research in Malaysian academia.

#### **4. SWOT Analysis for Malaysian Academia**

Strength, weaknesses, opportunity and threaten (SWOT) is an analysis tool to evaluate organization current situation and environment. Any organization whether military, product oriented, service-oriented or even governmental are required to remain effective and must use a rational approach toward anticipating, responding to and even altering the future environment. We observe it is vital to unite all Malaysian universities under one SDI framework with other organization to promote geospatial information sharing. In order to enhance the capacity building for Malaysian NSDI, Malaysian universities should acts as leading institution to provide relevant knowledge in line with SDI requirements.

We start by identifying **strengths** in Malaysian academia to represent the internal capabilities and resources we have to achieve the goals for SDI academia. Currently, the development of Malaysian SDI has already contained some good foundations and improvements with the establishment of Malaysian Geospatial Data Infrastructure as the Malaysian NSDI. In developing and providing geospatial knowledge among academic communities, some universities had started to introduce subjects in areas of geographic information sciences. Faculty of Geoinformation Science & Engineering (Universiti Teknologi Malaysia) [11] currently leading pure geo-information courses amongst Malaysian local and private universities. In term of RnD, many research projects in this

area are lead by well-known and acknowledged professionals and academicians. Malaysia Ministry of Science, Technology and Innovation (MOSTI) and other government agencies as well as the private sectors provides sizeable sums of funding to selected and good projects to ensure RnD expands in a healthy direction in Malaysia. Proactive partnerships and project sharing culture ensures the strength and successfulness of Malaysian NSDI. Good connection among Malaysian universities also enables a lot of activities such as seminars, conferences, exhibitions as well as workshops to carry out on a regular basis. This activity is important to maintain enthusiasm and momentum apart from increasing acceptance and support from all stakeholders.

The next step is to identify the **weaknesses**, which represent internal liabilities in academia. In many cases, the lack of a strength or resource can be considered a weakness. Universities have less facilities and manpower due to the limited resources for faculty and staff development and this become a major challenge for SDI expansion. For instance, some universities that are still inexperienced need to request for external professionals that are proficient in this field. Furthermore, it is time consuming process to ensure the graduates are well trained to re-contribute to the universities in education, research and development.

Malaysian universities also still frail in terms of coordination for information sharing. In person communication during conference, forum and seminar still ineffective to ensure the information delivered is complete and can be understood en bloc. Some research projects uninformed broadly and failed to be disclosed amongst research communities. As a results repetitive projects take place, deteriorate valuable resources. It is better to have alternative medium (eg: web based geo-information portal for academic communities) to obtain an updated information regularly. If this can be achieved, issues on security and trustworthiness will arise. We discuss the approach to solve these issues in next section.

The next step in SWOT analysis is to identify academia **opportunities** for profit, growth and improvement. Malaysia education sector is always expanding with new and tremendous future opportunities for success. SDI is one of new fields that still grow. Numerous efforts have been carried out to encourage involvement from various stakeholders to maneuver smart partnerships in support of universities initiatives. Good reputation institutes can be take over, merge with to form strategic alliance amongst other institutes focusing on specific areas, and of course on current and crucial discipline; geo-information. Luckily, we observe good trends and positive sign to achieve mutual cooperation among academic communities, governments and industries while involving in few exhibitions and meeting on constituting one GRID project (Landslide Monitoring and Prediction) between MIMOS, UniKL, JKR, MKN and many more agencies.

Final analysis is on **threats** which represent external events, environmental factors, or changes that could affect the academia negatively. Basis for SDI is information sharing, but process to achieve mutual understanding is lengthy. Meeting and discussion is not necessarily can guarantee collective understanding among groups. Who are the main leaders and actors, what are the core components in supporting the SDI are issues that

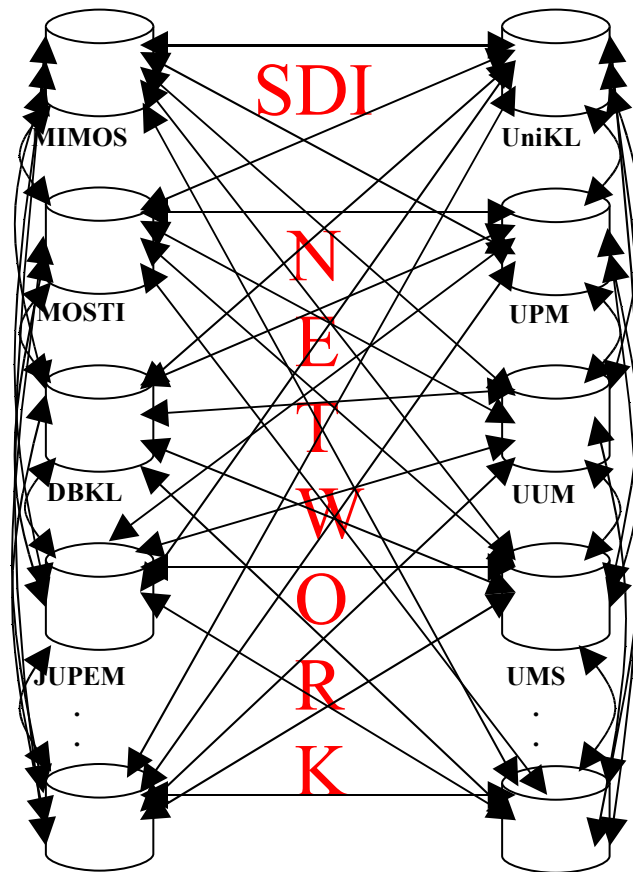
always surround. Information sharing also can only be appreciated if all data available can fulfill needs of all stakeholders. However, in process to achieve the understanding, requirement for the geospatial information is too forceful. This situation turns out to be a threat for smooth and fast implementation of SDI. Data availability that resides at each stakeholder also becomes an issue. At one side, the interested group may not have enough and good resources to offer the other groups. We realize that all stakeholders must have data and resources preparation ideally and continuous effort must be made to strengthen geospatial data at their own place.

Lacking sustainable funding for projects can also threaten the attempt to reinforce SDI in Malaysia. Malaysian government gives well support to the implementation of SDI especially for all government agencies. Big allocations for development of Malaysian NSDI have been provided under Malaysian Development Plan for each period. Nevertheless, due to the world economic downturn in specific years beginning in 1997, in fact, less allocation provided [10]. This situation delayed the progress of projects activities that have been pre-scheduled involving many government and private agencies and universities.

## **5. SDI Architecture Proposed for Academia Community**

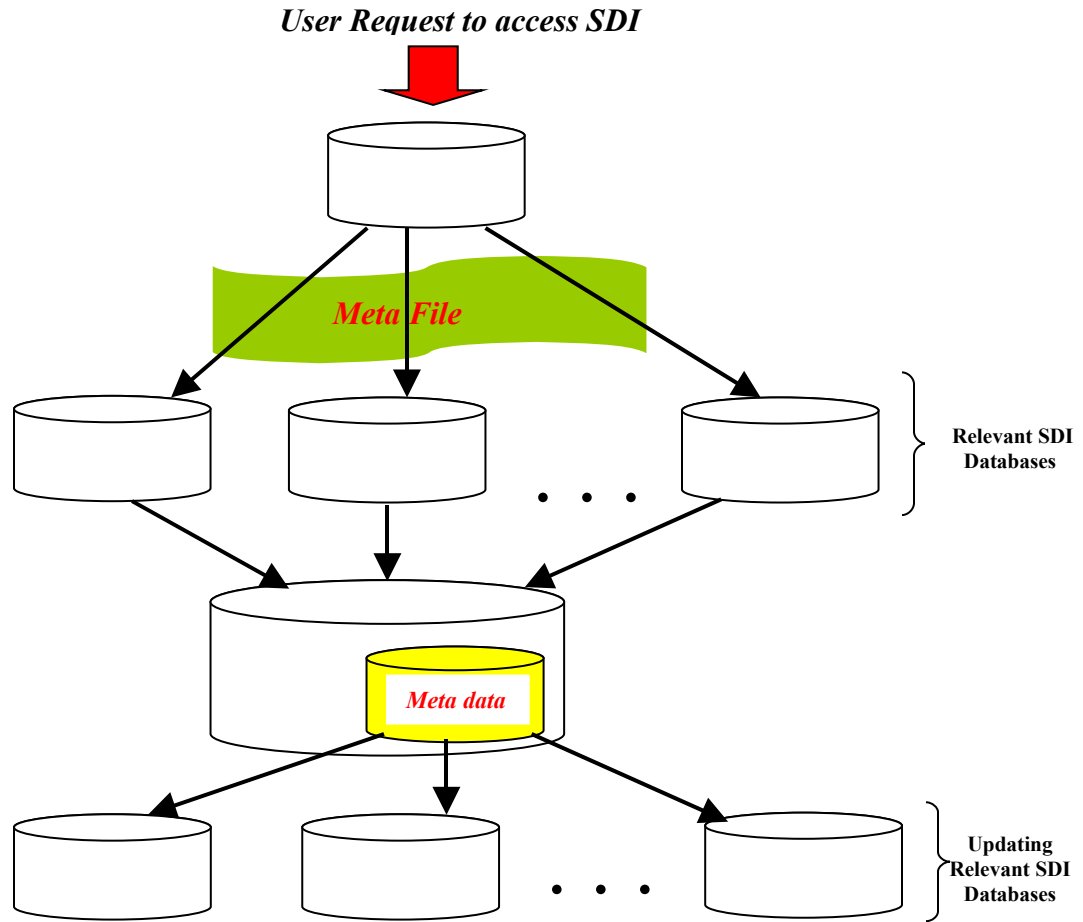
In current era no one can deny the benefits of the SDI. By implementing SDI in research institutions, universities and the industry we can achieve better result as a research output as all stakeholders will be able to share their ideas and knowledge with each other through SDI database. But the security is one of the big challenges while sharing information. Stakeholders from different jurisdictional level require peace of mind about the security of their data they allow others to share through SDI Database. But the question is how to build up the infrastructure of SDI in order to avoid redundancy in research by achieving security.

In current research we introduce the concept of SDI shared metadata which will be implemented at two layer architectural approaches to create the virtual wall between the shared data and the restricted data. In the proposed architecture the data of the organization will reside in its own premises all the databases will be connected with each other at the network level (Figure 2) and the metadata will be created at the transport level on user request. When the user enquire about the relevant data a metafile will be created and will fetch the relevant information from the linked databases of SDI and that information will be placed in metadata at user end. After update if other users from the same jurisdiction or from different jurisdiction enquire about the same data then the same metadata will be shared, otherwise another metafile will be created to established new metadata.



**Figure 2: Presentation of network architecture of SDI framework for academic research**

The idea behind the SDI network is similar to GRID architecture [1] as resources can be heterogeneous in the SDI network. After the creation and the up-gradation of metadata all the relevant information will be forwarded to the relevant databases through metafile for necessary changes to keep them updated. Figure above is representing a SDI network in which databases of stakeholders are located in their premises and are shareable through the SDI network. As shown in the architecture all databases are connected with each other through a dedicated link. If a user of an organization wants to access SDI network he has to place a request on his network. The user request will be forwarded to the relevant SDI databases by creating a metafile. Metafile will collect and place data and information in the user database at a metadata. After user changes, metadata will be forwarded to SDI databases for updating of databases. Figure below is presenting the same.



**Figure 3: Creation of metafile, search of relevant data, creation of metadata and up gradation of SDI databases**

## 6. Conclusion

With the findings revealed in the SWOT analysis, it is clear that the academia plays a vital role in the implementation of a mature SDI. A closely knit relationship is needed among each stakeholder and academia will act as a lubricant in ensuring that the goals of a mature SDI are met. The proposed architecture is following the same framework as followed by GRID architecture therefore it will cater all of the advantages of GRID architecture as well. With this finding, it safe to say that the critical success factor of a mature SDI depends on the level of involvement by the academia.

## Acknowledgments

We would like to record our gratitude to Prof. Patrice Boursier, Dr. Mazliham and Dr. Shahrulniza for their supervision, advice, and guidance from the very early stage of this research as well as giving us extraordinary experiences through out the work. We also gratefully acknowledge our colleague Tg. Azhar for their valuable ideas and advice that contributing to this research.

## Reference:

- [1] D. D. Nebert, Developing Spatial Data Infrastructures: The SDI Cookbook, GSDI Cookbook Version 2.0, January 2004.
- [2] Malaysia Geoportal, access on 1 April 2009 <[www.mygeoportal.gov.my/en/objectives.html](http://www.mygeoportal.gov.my/en/objectives.html)>
- [3] M. Mohaizi, DBKL GISNet - Data sharing for efficient Natural Disaster Management and Rehabilitation, Map Malaysia Conference, April 2009.
- [4] A. Kadir, Expanding Geospatial community in Malaysia, Map Malaysia 2009 conference, April 2009.
- [5] Institute of Geographical Information System, National University of Science and Technology, Pakistan, access on 2 May 2009 <<http://www.igis.edu.pk/>>
- [6] C. Derek, Status of GIS in Africa. GIS Development Vol. 12 issue 1, January 2008.
- [7] K. Uno, Universities without borders: Is Joint Curriculum for Sustainable Development Possible?, Asia Pacific Forum for Environment and Development Phase 2, Bogor, Indonesia, November 2005.
- [8] Images of natural Disasters from robot Exploration in urban Area, access on 15 May 2009, <<http://www.ifi.auf.org/IDEA/>>
- [9] R. Saruwono, Linking Academia and Industry: Bridging the Gap through Collaborative Efforts, 35th International Federation of Training and Development Organisations (IFTDO) Conference and Exhibition, Kuala Lumpur Convention Centre, 2006.
- [10] A. F. Nordin, Malaysian Spatial Data Infrastructure (SDI) Initiatives and Issues, in Seminar on Implementation Models of Asia and the Pacific Spatial Data Infrastructure (APSDI) Clearinghouse, Brunei, 2002.
- [11] Faculty of Geoinformation Science & Engineering, Universiti Teknologi Malaysia, access on 6 June 2009, <<http://www.fksg.utm.my/>>
- [12] A. Chervenak, I. Foster, C. Kesselman, C. Salisbury, S Tuecke, The Data Grid: Towards an Architecture for the Distributed Management and Analysis of Large Scientific Datasets, Journal of Network and Computer Applications, 2000.