

Spatial Data Infrastructures (World Best Practice) Are Caused by State and Private Sector Collaboration with Shared Responsibilities

Warwick Jones, New Zealand, Micahel Ellyett, New Zealand, Ngo Duc Mau, Viet Nam

Key words: NSDI, public-private, best practice, framework reference model

SUMMARY

The work of building "Spatial Data Infrastructure" (SDI) is in progress all over the world. There are many challenges: governance, organisational, technical, data sharing, transitional and more.

These systems need to establish and evolve and over time. Therefore an understanding of what they lead to and how they currently are is critical. Too often this knowledge departs with individuals or lies in thousands of documents and files.

State and private sector organisations share the mandate and the roles. An understanding of the boundaries, and how those boundaries manifest, is critical to allowing change.

There are existing best practices emerging in how to establish industry frameworks. If we focus on SDI as an industry we can leverage off this best practice. This also addresses recognised issues associated with the implementation of complex information systems by government.

World best practice in creating effective, self-sustaining modern land administration needs to be available and usable. To enable this we suggest that a framework is used to capture the knowledge in a semantically precise way. To allow specific local implementations (reflecting local needs and practice) to be supported and to allow decisions to be made based on the framework (capturing best practice).

Spatial Data Infrastructures (World Best Practice) Are Caused by State and Private Sector Collaboration with Shared Responsibilities

Warwick Jones, New Zealand, Micahel Ellyett, New Zealand, Ngo Duc Mau, Viet Nam

1. INTRODUCTION

"The first man who, having fenced in a piece of land, said, 'This is mine,' and found people naïve enough to believe him, that man was the true founder of civil society." (from Discours sur l'Origine et le Fondement de l'Inégalité Parmi les Hommes, 1754, - Jean-Jacques Rousseau)

The building of 'Spatial Data Infrastructure' (SDI) is being undertaken all over the world. This work involves coordinating the development of the infrastructure needed to support: the maintenance of spatial information, the utilisation of spatial information in decision making and collaboration between various parties based on spatial information. These endeavours include a wide range of challenges: regulatory, governance, policy, institutional arrangements and agreements, organisation structure and roles, skills and capabilities, technologies and technical standards, transitional and project phasing.

The opportunity to use world best practice in establishing SDI should be available to everyone. Best practice needs to encapsulate the insights, lessons and experience from other nations and organisations involved in creating effective, self-sustaining modern land administration.

A national SDI (NSDI) can be considered to consist of a set of SDI's traditionally oriented at different constituencies and purposes. So a national SDI is a meta-system that sits across these and ensures their coherence and usefulness. AN NSDI needs to ensure that in line with the strategies and cultures of those countries and their agencies, organisations, enterprises, people and society benefit

State and private sector organisations share the mandate to establish an NSDI. The State necessarily plays a foundational role in the establishment of key building blocks of NSDI suited to land administration, as the SDI needs to tie intimately to management of land tenure. A key requirement in NSDI design is sustaining the capacity of the public and private sector entities. As an NSDI extends a framework is necessary that allows the roles of all the parties involved to be understood as a whole, for the entities to evolve themselves and for sum to be melded.

In implementing an NSDI one needs to ensure it can evolve. This allows it to be extended to address all the users' needs, though initially may only be focused on a narrow set of users. This evolution will be encompass renovation and innovation and involve improvements in design and implementation of operational support systems. The evolution of systems requires that the underlying purpose for the design of the systems and organisations are understood i.e. their experience is institutionalised and retrograde enhancements can be avoided.

The paper seeks to outline a framework for: expressing the natural boundaries of responsibility within an SDI; undertaking work in SDI that allows recognised best practice and standardised reference models to be used; managing the knowledge of why the SDI exists as it is as a basis for future extensions.

This framework ensures semantic precision (a series of increasingly precise definitions for data elements in knowledge representations) and allows easy case by case instantiation (e.g. by country, by culture). It relates patterns, principles, standards, building blocks, reference models and maturity levels and allows the adoption, emphasis or abnegation of the elements in the framework in each specific implementation.

This allows the framework to be common while each implementation is different with a mapping between the common framework and the specific implementation.

2. ANALYSIS OF THE NSDI META PROBLEM

NSDIs are complicated systems that relate to complex organisational structures. They are typically networks of systems, distributed and loosely coupled, in federated or discrete organisations, serving a multitude of purposes and audiences, support transactional and archival functions. They have all the complexities of traditional IT systems with additional concepts, data types and technologies that are not traditionally dealt in commercial solutions. So the NSDIs systems and the approaches for the implementation have the challenge of traditional large IT projects and additional challenges.

Many specialists in the area look at the specific or unique, technical, social and regulatory challenges of SDI systems. They fail often to realise that not all best practice needs to be reinvented and by focusing on the details there is a risk of not seeing the forest for the trees.

To address the problems effectively we need to learn from other complex disciplines better and recognise that many of the best practice that applies to these other information infrastructures applies to NSDI.

Specifically we could start by looking at the generic problems associated with the implementation of complex IT systems (especially in government).

The Royal Academy of Engineering and The British Computer Society observed that

"A significant percentage of IT project failures, perhaps most, could have been avoided using techniques we already know how to apply. For shame, we can do better than this."

They go on to say:

"It is alarming that significant numbers of complex software and IT projects still fail to deliver key benefits on time and to target cost and specification. Whilst complex IT project success rates may be improving, the challenges associated with such projects are also increasing rapidly. These are fuelled in large part by the growth ... in the capability of

hardware and communications technology, and the corresponding inflation in people's expectations and ambition."

They examine how complex IT projects differ from other engineering projects, with a view to identifying ways to augment the successful delivery of IT projects. Amongst their findings and recommendations are:

- *"A striking proportion of project difficulties stem from people in both customer and supplier organisations failing to implement known best practice. This can be ascribed to the general absence of collective professionalism in the IT industry, as well as inadequacies in the education and training of customer and supplier staff at all levels"*
- *The significance of systems architecture is not appreciated.*
- *Further developments in methods and tools to support the design and delivery of such projects could also help to raise success rates. In particular, basic research into complexity is required to facilitate more effective management of the increasingly complex IT projects being undertaken.*
- *There is an urgent need to promote the adoption of best practice amongst IT practitioners and their customers.*

They also identify some things that we think most people have known for some time e.g. the need for good project management and risk analysis. However both of these tasks are significantly impeded if the underlying knowledge required for analysis is not available.

2.1 What issues does an NSDI framework address

The NSDI is a means to assemble geographic data nationwide to serve a variety of users. The framework is a collaborative community based effort in which these commonly needed data themes are developed, maintained, and integrated by public and private organizations within a geographic area.

The NSDI will provide a base or structure of relationships among data producers and users that will facilitate data sharing. The increased ability to share data through common standards and networks will, in turn, serve as a stimulus for growth. Building an effective NSDI will require a well coordinated effort among government authorities and academic institutions, as well as a broad array of private sector geographic, statistical, demographic, and other business information providers and users. Only through this cooperation will the NSDI become a reality.

In our view then an NSDI framework must help address these issues:

- *improving collective professionalism* – by providing all parties a way of undertaking analysis, design and planning in an effective and professional manner.
- *education and training* – by providing an explicit relationships between the outcomes, the procedures and systems, the organisations and roles, and the skills required.

- *architecture* – by provide a template for defining: sector or industry (NSDI) architect, the enterprise architectures and systems architectures
- *strategies for dealing with complexity* – by providing methods and tools that support the analysis, design and delivery of NSDIs
- *promote the adoption of best practice* – it is too easy to speak of adopting best practice, everyone does, but in order to do this we really need to define what the elements of best practice are, how this knowledge is manner and provide a strategy for its adoption. That is what our SDI frameworks seek to do.

2.2 What capabilities does an NSDI framework need provide

It needs to allow federated group (of public and private sector) participants to do a number of things. In all cases the greater the transparency the better the result. Transparency helps people understand what and why they agree or disagree on things in an objective and unemotional manner. Reaching consensus is therefore easier. The capabilities include the ability to:

- *Capture drivers and requirements* – these are the things that determine what an NSDI should do. Each and every elements of an NSDI solution (roles, skills, technologies etc.) must derive from these;
- *Undertake analysis* – a simple structured way to analysis is required. Analysis can be organised around simple set of canonical model (Goals, Facts, Beliefs and Recommendations). Where: goals are things you are trying to achieve, sometimes expressed as principles, issues (goals stated the reverse), visions, measures, objectives or KPIs; facts are not disputable and include laws, regulations, social factors and technical constraints; beliefs are based on facts and relate to goals and include causes, findings, implications; and recommendations are based on beliefs and achieve goals and strategies, plans etc. In addition we would want some grouping concepts (classification systems) for: terms, patterns, principles, technologies, standards etc. By support business or analysis with this paradigm we move for persuasive narrative to structured reasoning;
- *Design and decide* – Designs are assemblages of elements. So we need to be able to record these things (and relate to externalities e.g. technologies). Design and decision making is made based on analysis of alternatives. So we have the information on drivers and requirements and are able to undertake analysis we can make explain the basis of decisions and designs;
- *Plan, Programme & Phase* – these require us to understand sequencing, prerequisites and co-requisites. Intrinsic is the relationship between the requirements and the designs;
- *Promulgate, educate, communicate and socialise* – we need to be able to very selectively extract information for the framework that is suited to a particular audience, purpose or interest. We don't then need to manually reconstruct communication artefacts for each different purpose;

- *Estimate the effort, costs, risk and timeframes associated with people, technology, procedures* – in practice costs can only be effectively estimated by examining the proposed implementation i.e. the designs. But decisions need to be made related to the requirements and outcomes therefore we need to understand how the elements of the implementation relate to the requirements (and the marginal economic impact of each requirement);
- *Support the validation, assessment, quality assurance and review* – by making the above relationships explicit and transparent we provide a mechanism for doing this.

2.3 What is best practice (what can we learn from)

We can learn from a number of standards and approaches that are applied elsewhere by examining some existing methods e.g. ValIT (Val IT - is framework addressing the governance of IT-enabled business investments), COBIT (Control Objectives for Information and related Technology), OSIMM (Open group SOA Integration Maturity Model), CMMI (Capability Maturity Model Integration), FEAF (Federal Enterprise Architecture Framework), DODAF (Department of Defense Architecture Framework), TOGAF (The Open Group Architectural Framework), Zachman Framework, ITIL (Information Technology Infrastructure Library), IFW (Information FrameWork), DSM (Design Structure Matrix), Pattern Language (i.e. Alexander's seminal work). These are from many disciplines e.g. engineering, architecture, portfolio analysis, defense, IT, etc.

Our approach to an SDI framework is informed by these sources and others. We can also see that a number originated in Government (and have subsequently been adopted in the private sector). The effectiveness of these approaches has in the past significantly impacted in most cases by their means of implementation (usually many documents and consultants). We need an approach that minimises the need for both.

Space does not permit a full review of all of these but we believe that there is general consensus that following seem to make good sense:

- Business case and investment models – FEAF, ValIT
- Reference Models – FEAF, OSIMM
- Patterns – DODAF, Pattern Language, TOGAF
- Principles – Pattern Language, TOGAF,
- Standards – TOGAF, FEAF, ITIL, OSIMM
- Taxonomies – DODAF, Zachman,
- Maturity models – CMMI, OSIMM, TOGAF (implied)
- Compliance mechanism – Cobit, FEAF, OSIMM. CMMI
- Different levels (of detail, of technicality) – Zachman, Pattern Language
- Instantiation – almost all of these frameworks allow instantiated instances

2.4 Additional organisational and process challenges

Government is usually implemented via a set of federated agencies - global, regional, federal, state and local. A Model for data sharing through Government agreement is the one negotiated between the Victorian Government and local government (LG). [Gruen]

With an NSDI we are also able to deal with evolving roles of both public and private sector organisations, and both national and international players e.g. range from Google to United Nations.

In addition to the normal challenges we are usually dealing with federated and distributed organisations. That is to say that we have a network of organisations with different responsibilities goals and agenda and we need to under the basis on trade-offs are made. The Netherlands Gideon project offers excellent direction.[Gideon]

Further there is increasingly there is a demand for open government: citizen-centric services (giving people access to their data about their land); open and transparent government (being able to say what is known about land); innovation facilitation (facilitating innovation by all parties on knowledge about the NSDI) Reference the 'The three pillars of open government stated by the Australian Federal Government' [Senator Lundy]

- Citizen-centric services
- Open and transparent government
- Innovation facilitation

We also need to deal with archival and reference requirements; and transaction and functional requirements. This has a number of implications including that we need to use information engineering oriented techniques and process oriented techniques for understanding things.

In the ideal world the vast majority of data in an NSDI system is accretes as a natural by product of transactional activities i.e. few additional costs (non-transaction related costs) need to be incurred. In a similar fashion that data that populates an NSDI frameworks need to accrete as a by product of the work on NSDIs that is undertaken. In both cases frameworks and taxonomies are required to make this possible and small adjustments to day to day processes are required to enable to occur.

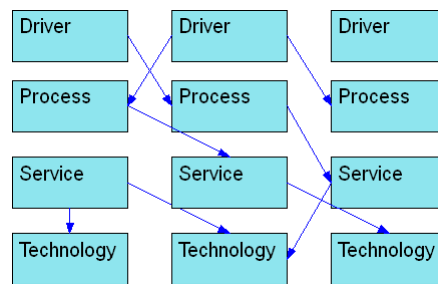
3. SDI FRAMEWORK BASED ON MULTIDISCIPLINE BEST PRACTICE

3.1 What analysis is enabled by semantic precision of the framework

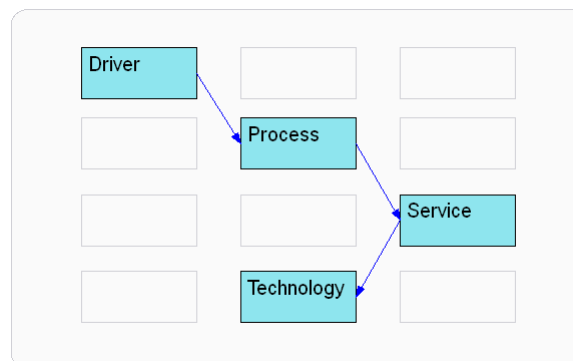
There are two types of analysis that we want to be able to do. We call them referential and inferential.

Referential analysis allows us to confirm that the relationships between element are correct this allows us to follow a path of relationships i.e. if this skill is unavailable what is affected, if this goal is to be achieved what is required, what elements are affected by this projects.

When we look at this:



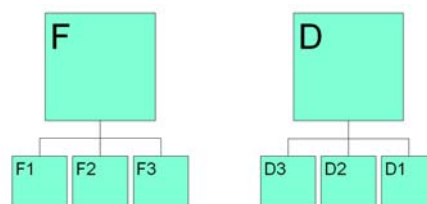
It allows us to quickly see:



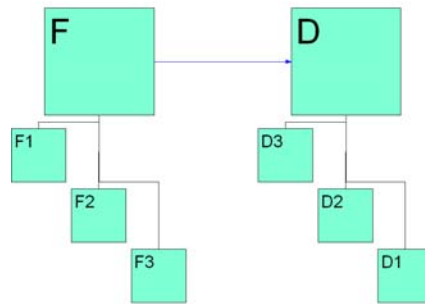
Inferential analysis is useful when we have compositions or when we have reference models - where we can relate our implementation to the reference models. It allows us to infer what relationships should exist i.e. are implied to exist but do not. It allows us a check on correctness.

Reference models would usually be instantiated e.g. for example a functional (F) reference models indicates a function is performed, our instantiation would indicate how we perform it. A data (D) reference model indicates the data we need and our instantiation would indicate how we manage it exactly.

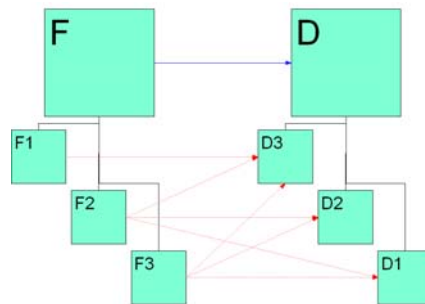
Let us say $F \rightarrow F1, F2, F3$ (i.e. F decomposes into F1, F2, F3) and $D \rightarrow D1, D2$ (i.e. D decomposes into D1, D2).



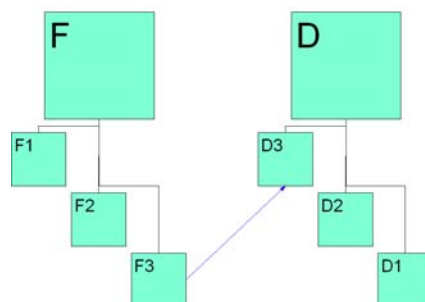
If D relates to F



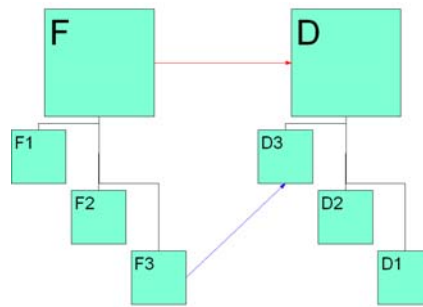
We can tell that one or more of F1, F2, F3 must relate to one or more of D1, D2 i.e. in the follow diagram one of the red relationships must exist.



We can also tell that if F3 relates to D3



We should expect to see F relating to D.



While this seems obvious in this example when the relationships above are all described textually e.g. in a document inconsistencies are not so easy to see.

Even when they are dealt with graphically when there are large amounts of information (or multiple level of decomposition) these inconsistencies are hard to see. In both cases best practice would be to have systems do these checks (rather than checking for them manually).

3.2 Scope of an SDI framework

Best practice implementations need to reflect experience: with cost effective world leading operational national systems; several generations of change i.e. experience with different models of private sector and public sector collaboration; in creating and extending systems of policy, regulation and governance; of the affects of different governance regimes, cultures and from international programmes. They therefore need to cover:

- Principles, Patterns and Anti-patterns i.e. lessons on what has worked and what to avoid. Arising from multiple generations of systems (reflecting the economic and social development);
- Collaboration models: indicating interfaces between roles and systems (that in different situations will be private sector or public sector);
- Service and components models: which describe the core components and applicable technologies and standards;
- Standards and technologies: including links to international standards and programmes (ISO/TC211, ISO 19115, FOSS4G etc.);
- Regulatory models: based on past success in the effective systems of policy, regulation and governance in national spatial systems operational delivery. Included in this needs to be recognition of different customary and cultural structures and approaches;
- Promulgation, educational and research models (explain, learn, find out): that identify the activities needed to raise awareness, and underpin new training required and provide a framework for research.

Therefore we propose a set of reference models which capture the fundamental issues

3.2.1 SDI Determinants

- Legislative and regulatory reference model: describe the sets of laws, regulations and compliance issues (national and international).
- Local factors reference model: describes social and cultural factors that influence strategy

3.2.2 NSDI strategy

- Strategy reference models – which relates to the Determinants and covers the vision, goals, strategies etc.
- Performance reference models – which outlines the performance goals, measures etc. (Cf. FEAF's PRM)

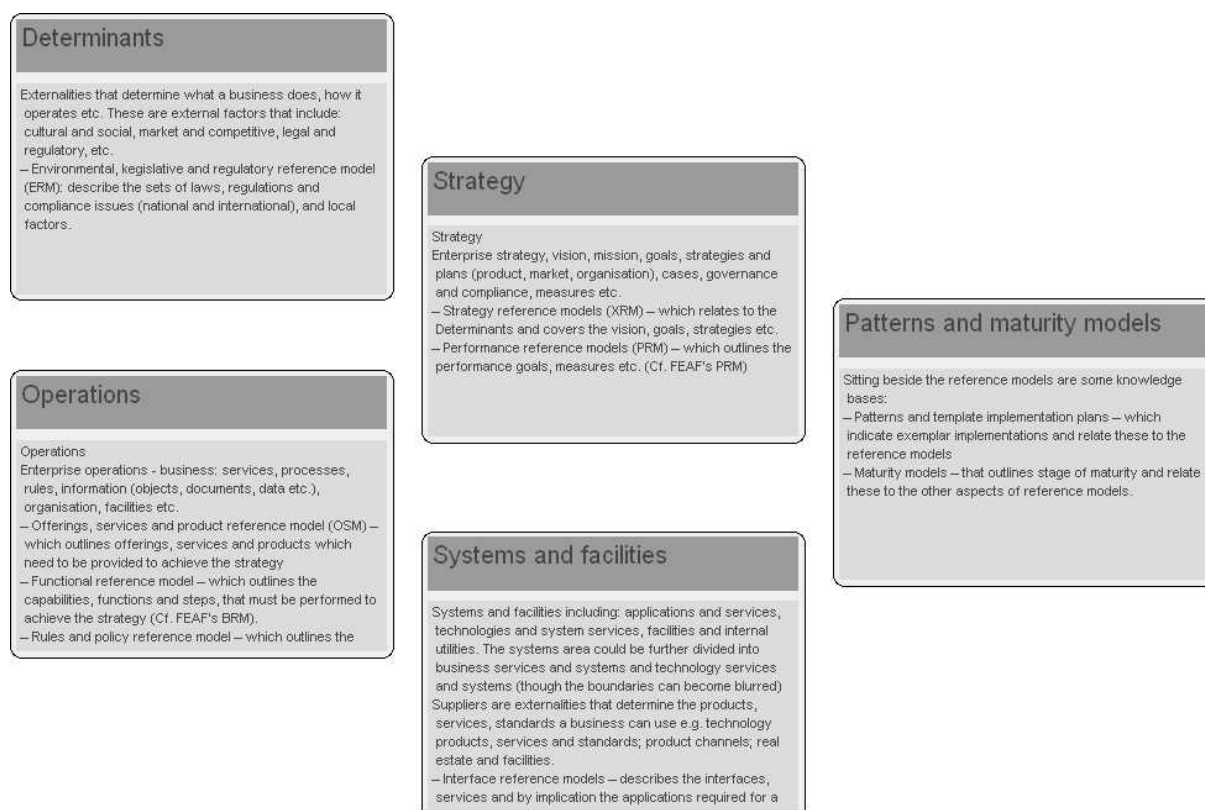
3.2.3 NSDI operations

- Services and product reference model – which outlines the services, products and offerings which need to be provided to achieve the strategy
- Functional reference model – which outlines the capabilities, functions and steps, that must be performed to achieve the strategy (Cf. FEAF's BRM).
- Rules and policy reference model – which outlines the rules and policies that are required by the strategy and determinants and to support operations.
- Information reference model – which outlines information, metadata and data required by the strategy and determinants and to support operations.
- Organisational reference models – which outlines the organisational units, roles, techniques, skills that are required by the strategy and determinants and to support operations.

3.2.4 NSDI systems and facilities

- Interface reference models – describes the interfaces, services and by implication the applications required for NSDI to operate.
- Technical reference models – describes the technologies, standards required to supports the interfaces.
- Vendor reference model – describes the products, agreements etc. required

3.2.5 NSDI patterns and maturity models



Sitting beside the reference models are some knowledge bases:

- Patterns and template implementation plans – which indicate exemplar implementations and relate these to the reference models
- Maturity models – that outlines stage of maturity and relate these to the other aspects of reference models.

These reference models are related to allow referential and inferential analysis to be performed. The first three can be considered to represent the requirements and the last two are in the solution domain.

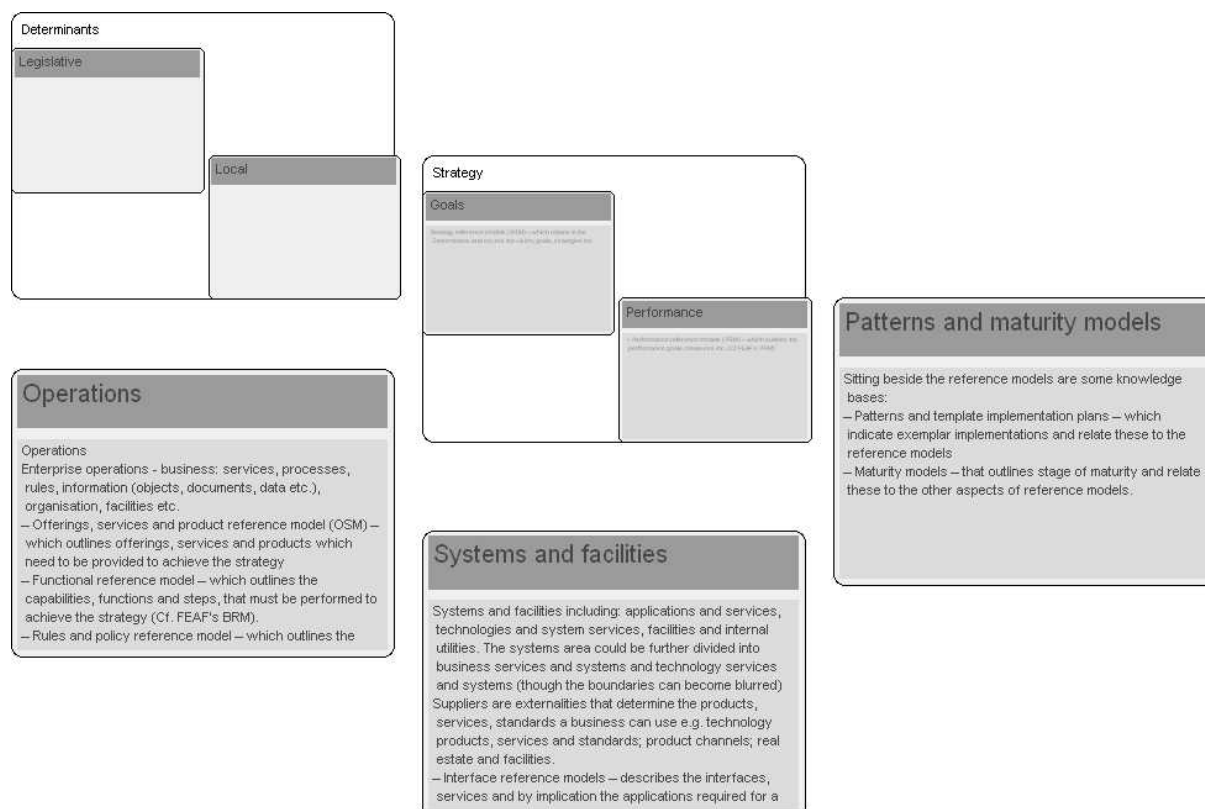
3.3 Key characteristics of the SDI framework proposed

We can see a number of other key characteristics we require

- Implementation technology neutral and non-aligned – our NSDI must intrinsically technology and vendor neutral i.e. having no affiliation of alignment, and no preferred

SDI technology, products. This allows a clearer focus on the real needs and on standards.

- Accessible by anyone from anywhere – this effectively means Web accessible and is key so that knowledge can be accessed where, when and by whom it is required and that knowledge can be captured as a natural by-product of field work.
- Supporting different roles, scenarios of use, and levels of control – that is with role based access and presentation, so that people can see what they are interested in in a way that makes sense to them and can change information that is in their domain of control.
- Ensure semantic precision - which ensures it may be analysed with efficiency, fully auditable, that the basis of decisions is explicit, objective and transparent. The lack of semantic precision is one of the key problems with most documents.
- Represent idealised models of NSDI – that has a holistic, coherent and complete set of well-structured, unambiguous and well partitioned and categorised set of business definitions (roles, functions, interfaces etc.). Has an explicit conceptual model of how the NSDI organisations are structured and operate (e.g. reporting, controls, data flows etc.)
- Divides the generic framework from the country specific implementation - so the generic framework is reusable and extensible. Allows nations to maintain their know-how i.e. how they do things, why they do things - rather than this knowledge be in the hands of third parties with vested interests e.g. consultants, vendors.
- Allows relationships and concepts to be – visualised, analysed and reported on (in SDI we all know that a visualisation can tell convey information in a powerful way).
- As simple as possible – to reduce complexity we limit connections within each level and between each touching levels.



4. ROLES BOUNDARIES AND FLOWS

4.1 Natural Boundaries around Responsibilities

An operationally effective NSDI is contributed to by meeting the key challenges in developing an inclusive model of governance and effective data sharing.

Our themes are that public and private certainly share the task of establishing efficient, operational NSDI and new governance mechanisms are needed to get us there.

The boundaries around the responsibilities need to be drawn and re-drawn. Reorganised government agencies are necessary and relatively simple, being ultimately single legal entities, but sufficient change also requires private sector engagement. So the reorganisation of responsibility is not so simple.

The Spatially Enabled Government in Victoria Australia including [SEG,2007] and the work of the Australian Office of Spatial Data Management (OSDM) suggests “there is general acknowledgement that the major challenges in implementing an enabling platform are not technical, but institutional, legal and administrative in nature.”

They [SEG, 2007] identifies three strategic challenges: governance, data sharing and access and an overarching challenge regarding how to develop a SDI that will provide an enabling platform in a transparent manner that will serve the majority of society. It also suggest SDI development has often been “dominated by the concerns of central governments usually without the participation of stakeholders from the sub national levels of government, the private sector and academia” and oriented at “professional elite rather the population as a whole who are the main beneficiaries”. They suggest an SDI includes “enabling platform linking those who produce, provide and add value to data”.

SEG reference many aspects of an NSDI: organisations, roles and relationships; data, technology and standards; processes, actions and practices; policies and decisions; criteria, business goals, strategies, products and services, laws and regulations.

We see our work building upon past results by facilitating the strategic challenges related to inclusive models of governance for NSDI establishment. What we propose is both a renewed focus on the definition of the responsibility boundaries and a supporting framework to articulate, visualise and analyse the information and knowledge flows.

SEG suggested that “a new business paradigm [promoting] the partnership of spatial information organisations (public/private) to provide access to a wider scope of data and services, of size and complexity that is beyond their individual capacity.” There are recognitions in the SEG work also that we need something above the detail instance and implementation specific data that we commonly find referred to by technical specialists.

4.2 Public and private roles

When considering an NSDI we have to balance two opposing flows i.e. of control and of data

- Top to bottom – control and governance naturally flows from top to bottom
- Bottom to top – data naturally flows from bottom to top.

Our implementation mediates between these flows. The state plays a pivotal role in the sound initial establishment of new key national infrastructures e.g. post, telephony, power, broadcasting, road and rail. As approaches to national developments mature we see individuals, the state and private sectors organisations increasingly share these roles and responsibilities (as we have in the other areas of national infrastructure). NSDI is a new class of ‘data’ infrastructure. It enables efficient economies and supports the nation’s socio-economic development objectives and policies.

The challenge for many years, including those when paper based maps, plans, designs and specialised dedicated models suited to a single audience or purpose were common, has been to integrate, maintain, analyse, and enable access by a wide range of different parties.

Individuals, state and private sector organisations share the mandate and responsibility for their establishment and operation. The framework proposed provides a means for dealing with the information about these things (meta-information) that enable governance. SEG suggests a broad goal for an NSDI is to support “more effective and more transparent coordination”. The framework approach here, in the first place allows an effective and transparent co-ordination of the meta-information so that the professional elite and all other stakeholders are able to participate. In this way the framework relates to the flexible setting of public/private responsibility boundaries.

The implementation of complex IT infrastructures (e.g. NSDI), with governance, stakeholders, business users, designers, engineers and planners is assisted by inclusive, early, persistent engagement on responsibilities. Frameworks that enable visualisation of the meta information (functions, meta-data, roles, assets, networks of related elements, ...) allow the overall picture to be worked with to suit the needs of the entire constituency.

We want to be able to understand how a number of parties can collaborate in an NSDI. To map the roles, functions, assets, data etc. of these entities we need a framework which is a canonical model. If we wish to be able safely encourage the private sector to engage in some areas we need to very clearly understand the upstream and downstream implications e.g. from a function upstream to what regulations or goals it is critical to from the NSDI perspective and not merely the perspective of an implementing party. The down stream flows are to what technologies and assets are interrelated.

Such an understanding is fundamental to knowledge of gaps, overlaps, risks and impacts of a set of organisations engaging collaboratively to implement, operate and evolve an NSDI.

4.3 Engaging the Private Sector

In the agreements needed on responsibility boundaries a flexible approach contributes success. Agreement and definition of NSDI would be shared, state undoubtedly have the mandate for governance and private are the likely location of efficient implementation and operation.

“Government has to be a smart buyer, meaning knowing what to buy, deciding from whom to buy it, and then determining what it has bought; that is, preparing careful specifications as what is to be purchased, conducting a competitive procurement in a competitive market, and monitoring the contractor’s performance.” (Ref Kettl 1993)

Strong commitment from the top is needed to build the capacity for effective contracting and procurement because of the complexity and challenges of public contract management. (Ref Savas)

NSDI, being relatively new national infrastructures as well as complex systems are ideal programmes to which past lessons on responsibility setting be applied. Hernando de Soto himself illustrates this opportunity. “In many countries, years of state regulatory intervention have produced bureaucratic obstacles and economic stagnation. Hernando de Soto illustrates

how much time is wasted in Peru following the labyrinthine official procedures to start a business or build a house: It takes 289 days to register an industrial enterprise and 26 months to license informal taxi operators, for example. The informal economy (i.e., 'black market') encourages far greater productivity than the official sector." (HDS Ref 1989) He advocates deregulation, de-bureaucratisation, and decentralisation.

State and private engagement is necessary for delivery of NSDI. New mechanisms for governance are required for NSDI implementations to work. Engagement between state and private sector should aim to achieve economic efficiency through exposure to market discipline. The emergence of demand-driven, market-based arrangements can be used to satisfy new needs associated with NSDI.

While privatisation can indeed be mismanaged in these ways, management of ordinary public services suffers from many of these same shortcomings; that is, poor management can sometimes be found whether government is managing public employees or the privatisation process. When mismanagement occurs in the private sector, market forces tend to weed it out ruthlessly. Privatisation and public-private partnerships reflect market principles and together constitute a strategy for improving public management.

5. CONCLUSIONS

We seek to make a non-incremental step in the way that NSDIs are implemented.

We believe that an NSDI requires a framework with specific characteristics, capabilities and structure in order to allow best practice to be captured and applied. It is only by establishing this that we will significantly affect the efficacy of NSDI implementations. Assuring implementation schedules, operational effectiveness and fit for purpose.

Many best practice methods have been identified that we can learn from and we believe there are better ways now available to implement a framework to assure NSDIs to operate effectively.

At present many parties are focused on capturing knowledge that should reside in a such a framework. Sadly much of the knowledge still resides in documents or in people's heads where it is not particularly useful in regard to accessibility, capacity to be integrated and analysed.

Individuals, state and private sector organisations share the mandate and responsibility for NSDI establishment and operation. The strategic challenges related to the inclusiveness of the governance models and inherent approaches to data access, renewal and use.

What we propose is both a renewed focus on the definition of the responsibilities associated with NSDI establishment and a supporting framework to articulate, visualise and analyse the information and knowledge flows.

REFERENCES

- Alexander, C (1977). A Pattern Language: Towns, Buildings, Construction. Oxford University Press; ISBN 0195019199.
- CMMI – www.sei.cmu.edu/cmmi/
- COBIT – www.isaca.org
- DODAF – www.defenselink.mil/cio-nii/docs/DoDAF_Volume_I.pdf
- DSM – www.dsmweb.org/
- FEAF – www.whitehouse.gov/omb/e-gov/fea
- Gideon Project, 2008, Key geo-information facility for the Netherlands, Approach and implementation strategy, Netherlands GI Council
- Gruen, N. Dr, Chair, State of Victoria, Australia, Government 2.0 Taskforce (Aug 2009)
- Henderson-Sellers, B. et al., 1999, "Instantiating the Process Metamodel," *JOOP*, 12(3): 51–57, (June 1999)
- IFW – www.evernden.net/content/ifw.htm
- ITIL – www.itil-officialsite.com/ .
- Kettl, D.; 1993, Sharing Power: Public Governance and Private Markets (Washington, DC: Brookings Institution), chapter 8
- Lundy, K (2009). Three pillars of Open Government
- SEG – Masser I., Rajabifard A. and Williamson, I.; Spatially Enabling Governments through SDI implementation; Centre for Spatial Data Infrastructures and Land Administration; Department of Geomatics, University of Melbourne, Victoria 3010, Australia; (July 2007).
- The Royal Academy of Engineering (2004), The Challenges of Complex IT Projects, Published by The Royal Academy of Engineering, London; ISBN 1-903496-15-2
- TOGAF – www.opengroup.org/togaf/
- ValIT – www.isaca.org/Content/ContentGroups/Val_IT1/Val_IT.htm
- Zachman – www.zifa.com/

CONTACTS

CEO Warwick Jones
LANDZONE
Wellington, New Zealand
Tel. +64 27 443 0677
Email: office@landzone.com
Web site: www.landzone.com

CEO Michael Ellyett
ESTO
Auckland, New Zealand
Tel. +64 21 74 87 52
Email: michael.ellyett@gmail.com

Ngo Duc Mau
Official, General Department of Land Administration
Hanoi, Vietnam
Tel. + 84 4 3629 0628
Fax + 84 4 3629 0631
Email: ndmau@tnmt.vn
Web site: <http://www.gdla.gov.vn>