



e-Government Interoperability

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Emmanuel C. Lallana



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FOREWORD

Using technology to automate public services can save countries a significant amount of money and can allow citizens to more easily access available services. All too often, however, such progress is hindered by difficulties connected to implementation. Today's e-government deployments can oftentimes resemble a patchwork of incompatible information and communications technology solutions rather than flexible and reusable assets that would provide essential building blocks of services for citizens.

Recognizing the benefits of improving the delivery of e-government services and enhancing access to government-held information, the UNDP Regional Centre in Bangkok initiated an e-Government Interoperability Project aimed at highlighting lessons learned from existing e-government interoperability efforts. As part of the Project, UNDP Regional Centre in Bangkok established an international study group comprised of members from fourteen nations, and this group produced a set of suggested guidelines for the development of a Government Interoperability Framework (GIF).

A well-developed GIF can assist governments in effectively implementing e-government services and can contribute to issues relevant to the achievement of the Millennium Development Goals. Such a GIF can, for instance, help countries make better and more informed decisions during times of both crisis and tranquility, effectively preserving electronic public records, incorporating new technologies seamlessly into existing systems, contributing to citizens' access to information, and stimulating competition among computer vendors for low-cost, innovative technologies.

One of the outputs of the e-Government Interoperability Project is this e-Primer. Through a question-and-answer format, the e-Primer walks its readers through the vision and value of e-government interoperability and the steps required to achieve effective interoperability. The e-Primer also answers some fundamental questions such as "who," "what," "why" and "how," namely who should be involved in such projects; why a GIF should be developed; how GIFs are produced and revised; and what the key factors are for the successful development and operationalization of a GIF.

A series on e-government interoperability has also been produced by the UNDP Regional Office in Bangkok. The series is comprised of four publications – an Overview, Guide and Review of Government Interoperability Frameworks in Selected Countries, together with this e-Primer. The Overview introduces the concept of e-government interoperability and is aimed at policy makers. The Guide is a practical tool for technical officials and policy makers who plan to draft or revise a GIF. The Review provides a comparative analysis of eight existing GIFs and serves as a useful resource for those involved in the development or revision of a GIF.

For more information on the e-Government Interoperability Project, please visit <http://www.apdip.net/projects/gif>

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PREFACE

In *Death of the Author*, Roland Barthes argued that “a text is made of multiple writings, drawn from many cultures and entering into mutual relations of dialogue, parody, contestation.” This e-Primer is certainly “made of multiple writings and drawn from many cultures.”

It is based on a review of existing Government Interoperability Frameworks (GIFs) and (National) Enterprise Architectures, published scholarly articles and industry white papers, as well as the discussion of a Study Group on Government Interoperability Frameworks convened by UNDP Asia-Pacific Development Information Programme (UNDP-APDIP) in cooperation with IBM, Oracle and the International Open Source Network.

It should be emphasized that while this e-Primer benefited greatly from the comments and suggestions of the members of the UNDP GIF Study Group, the ideas expressed in this e-Primer are not necessarily endorsed by them or by the institutions or organizations they represent. Ms. Kathryn Pauso provided research support in the drafting of this text. But, as part of the ‘author function’, I take full responsibility for the contents, including ideas, error and omissions of this e-Primer.

I was author of the first e-Primer (on *The Information Age*) and edited the first seven volumes of the e-Primers for the Information Economy, Society and Polity in 2003. The e-Primers were a result of a conversation that Shahid Akhtar and I had in Manila soon after he became Programme Coordinator of UNDP-APDIP.

The e-Primers have been well received. They were used by education institutions in Asia and the US, as well as by Nettel@Africa, a network of 20 African universities and regulatory associations and Afghan e-Quality Alliances. The e-Primers have also been translated into four Asian languages (Mongolian, Sinhala, Tamil and Vietnamese) and inspired the development of the e-Primers on Free/Open Source Software (<http://www.iosn.net>). They were also reprinted for, and distributed during, the ICT4D Platform held in conjunction with the World Summit on the Information Society Phase 1 in Geneva in 2003, and Phase 2 in Tunis in 2006.

I am pleased to write another e-Primer. But I am also a bit sad that this may well be the last e-Primer to be produced during Shahid’s watch and under the auspices of UNDP-APDIP. Shahid retired at the middle of this year and UNDP-APDIP will fold its proud banner at the end of 2007.

Not all ‘authors’ have the privilege of being part of the start and the end of what has become a successful series. I thank Shahid for making this possible. But, luckier still if the ‘author’ is able to join the transition from an old to a new series that continues the goals and aspirations of its predecessor. I have no doubt that my good fortune is due to the fact that I worked with great ‘authors’ and was given (and continue to get) wholehearted support by the UNDP-APDIP team.

Roland Barthes also wrote – “To give a text an Author is to impose a limit on that text, to furnish it with a final signified, to close the writing.”

Emmanuel C. Lallana
UNDP GIF Project Advisor

LIST OF ACRONYMS

APDIP	Asia-Pacific Development Information Programme
EA	Enterprise Architecture
EICTA	European Information and Communications Technology Industry Association
EPAN	European Public Administration Network
GIF	Government Interoperability Framework
ICT	Information and Communications Technology
NEA	National Enterprise Architecture
OMB	Office of Management and Budget
OSS	Open Source Software
SAGA	Standards and Architecture of e-Government Applications
SOA	Service-Oriented Architecture
UK	United Kingdom
UNDP	United Nations Development Programme
US	United States
VoIP	Voice over Internet Protocol

INTRODUCTION

What is e-government interoperability?¹

e-Government interoperability, in its broad sense, is the ability of constituencies to work together. At a technical level, it is the ability of two or more government information and communications technology (ICT) systems or components to exchange information and to use the information that has been exchanged to improve governance.

e-Government interoperability has become a crucial issue because recent ICT investments have reinforced the old barriers that made government decision-making, not to mention citizen access to public services, difficult. In a number of governments, agencies are deploying new ICT systems with specifications and solutions relevant to their particular needs but without adequate attention to the need to connect, exchange and re-use data with other agencies' ICT systems. The result is a patchwork of ICT solutions that is not always compatible with each other and an e-government programme that does not meet its goals.

What would e-government interoperability achieve?

Better decisions. Better public services. Better governance.

Today, far too often, the data needed by policy makers to make better decisions is available but inaccessible. Policy makers are faced not only with overlapping and uncoordinated data sources but also with the absence of common terms of reference and means of representing data. This results in the time-consuming and complex cost of comparing data that is represented differently. Interoperability will allow data compiled by different agencies to be used together to make faster and better decisions.

The seamless flow of data from one government office to another provides the policy maker with the information needed to draft sound policy and deliver better services.

Recognizing that e-governments should be transformative and become more citizen – rather than government – focused in delivering public services, investing in the development of an e-government interoperability framework is fundamental. Otherwise, the millions of dollars spent on e-governments would rarely lead to good governance and the achievement of the Millennium Development Goals.

e-Government interoperability enables one-stop, comprehensive online services for citizens and businesses by linking the diverse services that are offered by different agencies. Furthermore, increasing the ease at which information is shared among individual agencies (up to the point allowed by law) makes for better and/or new services. For instance, the administration of justice would be faster and more effective if the information systems of various agencies under the criminal justice system (police, public prosecutors, public attorneys, courts, prisons) were able to share data.

¹ In this study, e-government interoperability is limited to national government agencies and does not include the issue of national government and local government interoperability nor interoperability among local government units.

Interoperability also allows governments to manage their internal operations better. Government agencies can interchange or substitute software between various providers. Interoperability also precludes the need to buy more hardware and software to get more (and better) information and deliver better services.

The enhanced flow of information between government and citizens, brought about by e-government interoperability, also increases transparency and accountability. Governments are better able to justify their programmes and citizens are better informed, both prerequisites for a vibrant democracy. Thus, at the national level, e-government interoperability leads to good governance.

Interoperability also promotes international cooperation. Interoperability among governments (inter-government interoperability) can help create the infrastructures necessary to solve cross-border problems like drug trafficking, environmental pollution, money laundering and illegal arms trade. Interoperability among governments can also mean delivery of e-government services to citizens and businesses across a region (as in the case of the European Union) and facilitate trade between a group of countries and their trading partners (as in the case of the Association of Southeast Asian Nations Single Window Initiative).

Even governments that are not yet fully-automated and are only beginning to digitize data should focus on interoperability. For them, setting standards and getting the architecture right in advance of full-scale informatization will be a way of avoiding the problems described above and of preparing the ground for better governance through the use of ICT.

STANDARDS AND ARCHITECTURE IN INTEROPERABILITY

How does one achieve e-government interoperability?

e-Government interoperability can be achieved through the adoption of **standards** – “agreement among independent parties about how to go about doing some task”² – or through **architecture** – “the fundamental organization of a system embodied by its components and their relationships to each other and to the environment, and the principles guiding its design and activity.”³

Achieving interoperability through standards usually entails adopting a **Government Interoperability Framework (GIF)**: a set of standards and guidelines that a government uses to specify the preferred way that its agencies, citizens and partners interact with each other.⁴ The GIF includes “the basic technical specifications that all agencies relevant to the e-government strategy implementation should adopt.”⁵

On the other hand, gaining interoperability through architecture could be achieved through a **National Enterprise Architecture (NEA)**: a strategic planning framework that relates and aligns government ICT with the governmental functions that it supports.

One way to consider the differences between a GIF and NEA is to think of the GIF as a building code and the NEA as a town plan. Like a building code, a GIF is a set of rules that specify what standards are to be used (in the case of GIF to achieve interoperability, while in the building code to ensure safety). The NEA, similar to a town plan, has common resources that are provided for, and rules for their use and re-use are defined.

While some stress the distinction between GIF and NEA, there are those who see the two as increasingly linked. Germany’s Standards and Architecture of e-Government Applications (SAGA) version 2 is an example of a document that contains both the architecture and standards for interoperability.

What are open standards? What role do they play in e-government interoperability?

As was noted above, standards, particularly open standards, play a key role in achieving interoperability. Open standards enable products to work together. They also lead to diversity of suppliers/vendors and technological development. Open standards also ensure quality. Many believe that open standards should be at the core of standards that governments adopt to achieve e-government interoperability.

² Jason Bloomberg and Ronald Schmelzer, *Service Orient or Be Doomed!*, (Hoboken, NJ: Wiley & Sons, 2006) p. 35.

³ IEEE cited in Bloomberg and Schmelzer, *Service Orient or Be Doomed!*, p. 118.

⁴ European Public Administration Network (EPAN) uses the phrase National Interoperability Architecture where “interoperability architecture” is seen as “a range of complementary technical specifications, systems, standards, guidelines and policies.” See EPAN eGovernment Working Group, *Key Principles of an Interoperability Architecture*. <http://www.reach.ie/misc/docs/PrinciplesofInteroperability.pdf>

⁵ Luis Guijarro, “Interoperability frameworks and enterprise architectures in e-government initiatives in Europe and the United States,” *Government Information Quarterly*, Volume 24, Issue 1, January 2007, p.90.

Open standards describe openness in both the setting process and access to the specifications. Open standard is usually contrasted with proprietary standard or a standard that is owned and controlled by an individual or a corporation. Bruce Perens, who argues for a comprehensive but restrictive view, suggests the following key are the main characteristics of open standards:

- ▶ **Availability:** Open standards are available for all to read and implement.
- ▶ **Maximize end-user choice:** Open standards create a fair, competitive market for implementations of the standard. They do not lock the customer into a particular vendor or group.
- ▶ **No royalty:** Open standards are free for all to implement, with no royalty or fee. Certification of compliance by the standards organization may involve a fee.
- ▶ **No discrimination:** Open standards and the organizations that administer them do not favour one implementer over another for any reason other than the technical standards compliance of a vendor's implementation. Certification organizations must provide a path for low- and zero-cost implementations to be validated, but may also provide enhanced certification services.
- ▶ **Extension or subset:** Implementations of open standards may be extended or offered in subset form. However, certification organizations may decline to certify subset implementations, and may place requirements upon extensions (see predatory practices).
- ▶ **Predatory practices:** Open standards may employ license terms that protect against subversion of the standard by embrace-and-extend tactics. The licenses attached to the standard may require the publication of reference information for extensions, and a license for all others to create, distribute and sell software that is compatible with the extensions. An open standard may not otherwise prohibit extensions.⁶

Not everybody agrees with Perens. Among the most contentious issues in defining open standard is the royalty-free implementation of standards. As noted in Wikipedia, some open standard definitions (like the International Telecommunication Union) allow 'reasonable and non-discriminatory' licensing. For the proponents of the royalty-free implementation, the issue is the added burden that consumers (in the case of e-government implementation, citizens) may have to bear if open standards are not implemented royalty-free.

While there is no universal agreement on the definition of open standards, the following are the minimum characteristics for a standard to be open:

- ▶ Easy accessibility for all to read and use;
- ▶ Developed by a process that is open and relatively easy for anyone to participate in; and
- ▶ No control or tie-in by any specific group or vendor.⁷

Open standards help ensure interoperability. Bob Sutor expounds:

For interoperability to work, I need everything necessary in order to understand and fully implement the processing of the information. Therefore, if you give me information and include something coming from somewhere else, then I must have full access to everything I need to handle that other data. This has implications about the openness and freedom from intellectual property legal entanglements of all interchange formats and methods involved.⁸

⁶ Bruce Perens, "Open Standards: Principles and Practice." <http://www.perens.com/OpenStandards/Definition.html>

⁷ Nah Soo Hoe, "Free/Open Source Software: Open Standards," Asia-Pacific Development Information Programme e-Primers on Free/Open Source Software, p. 2. <http://www.iosn.net/open-standards/foss-open-standards-primer> and http://en.wikibooks.org/wiki/FOSS_Open_Standards

⁸ Bob Sutor's Open Blogs, "Interoperability More or Less." <http://www.sutor.com/newsite/blog-open/?p=1372>

Open standards are also the backbone of a service-based approach to e-government interoperability. They ensure flexibility so that criteria and decisions are service-oriented and technology neutral. Open standards enable managers to combine, mix and match, and replace components without the expense and expertise of custom coding connections between service components.

Additionally, an e-government programme that is built around open standards will allow public agencies to keep up with technology innovations and benefit from technology cost reductions. Open standards help governments avoid vendor lock-in and give governments the option of more flexibility in technology choices. Open standards are also good for economic growth and local industry that need to be competitive globally and keep pace with technology advances, often with few resources. They benefit from lower costs and lessened risk, knowing that others can produce and implement follow-on products. By relying on open standards, companies can instead focus a greater portion of their resources on innovation and addressing the needs of the market, benefiting governments and their citizens.

Are open standards related to open source? Does open source have a role to play in e-government interoperability?

Open standards is not synonymous with open source. The former is a set of specifications, the latter is an implementation. What they share is a commitment to 'openness' – freedom from control by an individual, group or corporation, and equal opportunities for everyone to participate.

Open source software (OSS) as well as free software “are programmes whose licenses give users the freedom to run the program for any purpose, to study and modify the program, and to redistribute copies of either the original or modified program (without having to pay royalties to previous developers).”⁹ According to the Open Source Initiative, “Open source is a development method for software that harnesses the power of distributed peer review and transparency of process.”¹⁰

The European Information and Communications Technology Industry Association (EICTA) Interoperability White Paper enumerates how open source supports interoperability:

- ▶ The advantage of OSS is that the disclosure of source code allows any user to modify the code to ensure compliance with open standards for interoperability.
- ▶ A natural source for open source developers are open standards, which they then 'natively' implement in the OSS software. The result is de facto support of open standards in OSS software.
- ▶ Certain well-known examples of open source licensing enable distribution and usage of software without any restriction. This network effect is capable of accelerating propagation of standard usage and thereby can be a contributing factor to better interoperability.
- ▶ The accessibility of the source code and the design information as well as the rights to modify, onward develop and distribute OSS support reusability of good implementations.
- ▶ OSS enhances trust in interoperability through transparency. When source code and compiler are accessible, users are able to verify that the software interoperates as it should and organizations have a solution whose security, privacy and transparency is not dependent on the actions or continued support by their suppliers.

⁹ David Wheeler, cited in Kenneth Wong and Phet Sayo, “Free/Open Source Software: A General Introduction,” Asia-Pacific Development Information Programme e-Primers on Free/Open Source Software, p. 6. <http://www.iosn.net/foss/foss-general-primer> and http://en.wikibooks.org/wiki/FOSS_A_General_Introduction

¹⁰ <http://www.opensource.org>

- ▶ The open source rights model supports platform portability: the adaptability of a function to different operating systems or other platform elements. This can support wide dissemination on many platforms resulting in wide deployment of interoperable implementations.¹¹

What else should I know about standards and interoperability?

It is important that the open standards adopted to achieve e-government interoperability should be forward-looking and support the wider-encompassing national e-government strategy (or at least a clear vision of ICT use across government). This wider strategy usually sets out the values and principles for e-government. Tying in the standards with the policy directions of government ensures that the GIF or NEA is closely aligned with the overall strategy of government.

It is also critical that the philosophy, which animates the selection of the standards, be clearly articulated. This will help prevent an uncritical adoption of standards, particularly when new standards emerge and the previous ones have not been retired. For instance, the rigid insistence of using only standards specified in the GIF may constrain a government from using new standards that respond to all previous needs as well as to new ones. This will not only prevent the government from using the latest and the best, but will also consign it to using older and perhaps outmoded standards.

Clearly articulating the philosophy behind the standards chosen also builds flexibility in the GIF or NEA. Flexibility is important partly because standards follow a life cycle of emergence to obsolescence. As it is inevitable that standards will change, it is important to address how the framework can be designed to anticipate and accommodate change. A worthwhile idea is to insert a sunset clause on select standards.

In as much as the philosophy behind choosing standards must be well-defined and understood by all relevant parties, the relevant government agency should publish the standard selection criteria so that all stakeholders can know about it and can take it into account when developing new standard or specification.

Existing GIFs also provide standard selection principles that are worth considering. The GIFs reviewed for this study showed some similarities in the principles underpinning their selection of standards. These standards selection principles are:

- ▶ **Scalability:** Standards selected should be able to handle change or fluctuation in demand and volume of transactions.
- ▶ **Security and privacy:** Standards selected should be in accordance to an existing security policy including user data protection.
- ▶ **Market support:** Standards selection gives preference to standards with wide market support to reduce costs and risks to government systems.
- ▶ **Preference to established national or international standards:** Standards selection gives preference to existing international standards with the broadest remit.

¹¹ EICTA Interoperability White Paper, pp. 16-17.
http://www.eicta.org/fileadmin/user_upload/document/document1166548285.pdf

GOVERNMENT INTEROPERABILITY FRAMEWORK

What is included in the GIF?

As we know now, the GIF allows government to manage information better and provide services to citizens, businesses and other stakeholders in an integrated manner. It includes the technical specifications that all agencies involved in the e-government implementation should adopt.¹²

A GIF normally includes:

- ▶ Context;
 - ▶ Technical content;
 - ▶ Development process;
 - ▶ Implementation; and
 - ▶ Compliance regimes.¹³
-
- ▶ **Context can include:** Definitions, aims, objectives, principles, background, audience, benefits and relationship with other initiatives, as in the case of the UK's GIF. Denmark, quite similarly, has these sections: Principles, actors, approach and background.
 - ▶ **Technical content can include:** Key technical policy statements, standards, standards categories, standards selection criteria and standards status.
 - ▶ **Development process can include:** Development and revision process, actors and responsibilities, and mechanisms for consultation, as in New Zealand's GIF.
 - ▶ **Implementation can include:** Implementation support tools such as those in the Denmark and UK GIFs.
 - ▶ **Compliance regimes can include:** Interoperability indicators, responsibility for compliance, stakeholders, guide tools and non-compliance such as in the UK GIF.

What is the technical content of the GIF?

The technical content of the GIF includes: (1) business process or organizational interoperability; (2) information or semantic interoperability; and (3) technical interoperability.

Organizational interoperability is “concerned with the coordination and alignment of business processes and information architectures that span both intra- and inter-organizational boundaries.” It aims to bring about “the collaboration of administrations that wish to exchange information and may have different internal structures and processes.”¹⁴ Specifically, the business process or organizational interoperability “deals with common methods, processes and shared services for collaboration, including workflow, decision-making and business transactions.”¹⁵

¹² Guijarro, “Interoperability frameworks and enterprise architectures,” p. 90.

¹³ The ideas here are based on a review of the Government Interoperability Frameworks of Australia, Brazil, Denmark, Germany, Malaysia, New Zealand, United Kingdom, and the interoperability framework of the European Union.

¹⁴ European Interoperability Framework v1, p. 16. <http://ec.europa.eu/idabc/servlets/Doc?id=19528>

¹⁵ Australian Government Technical Interoperability Framework v2, p. 1a. <http://www.agimo.gov.au/publications/2005/04/agtifv2>

Information or semantic interoperability is “concerned with ensuring that the precise meaning of exchanged information is understandable by any person or application receiving the data.”¹⁶ Information interoperability “enables systems to combine received information with other information resources and to process it in a meaningful manner.”¹⁷ It also “provides a common methodology, definition, and structure of information, along with shared services for retrieval.”¹⁸

Technical interoperability is “concerned with the technicalities of connecting computer systems for the purpose of exchanging information or using functionality.”¹⁹ This interoperability refers to standards and specifications that would enable coherent exchange of information among computer systems and involves “setting principles, standards and guidelines for a common transfer mechanism, developing standardized metadata (data about data) and using a common language.”²⁰ It includes open interfaces, interconnection, data integration and middle ware, accessibility, data presentation and exchange, and security services.

Technical interoperability, itself, has several layers or categories. There are at least four layers:

- ▶ **Interconnection:** Covers standards related to networks and system development. This layer enables communications between systems.
- ▶ **Data integration:** Contains standards for the description of data that enables exchange between disparate systems.
- ▶ **Information access and presentation:** Refers to the presentation of data to the user in the various means of access to e-government services.
- ▶ **Content management and metadata:** Pertains to the standards for retrieving and managing government information.

In most instances, the security layer cuts across all technical interoperability layers. Sometimes, the security layer is a stand alone (or another) layer. The security layer contains standards that ensure safe access and exchange of information in public services.

Some GIFs focus on improving standards for **business services**. These standards are meant to support data exchange, particularly in business areas like e-learning, e-health, etc. Another extension to the layers are categories of standards for **web-based services**. These standards connect and integrate web-based applications over the Internet. Another layer is **best practice layer**. Only the German SAGA included an applications layer.

Do all GIFs cover all aspects of interoperability?

No. The GIFs of Australia, Brazil, Denmark, Malaysia, New Zealand and the UK only address technical interoperability, possibly because this is the easiest to do. Others tackle the technical aspect because they deal with the other dimensions of their interoperability in their respective NEA. The European Union and German frameworks, which grouped standards according to services, (i.e. job search, income tax declaration, enrolment in university, etc.) address the three dimensions of interoperability.

¹⁶ EPAN, Key Principles of an Interoperability Architecture.

¹⁷ European Interoperability Framework v1, p. 16.

¹⁸ Australian Government Technical Interoperability Framework v2, p. 1a.

¹⁹ European Interoperability Framework v1, p. 16.

²⁰ Ibid.

What is interoperability governance? And who is responsible for it?

Simply put, **interoperability governance** is about ensuring the GIF's proper implementation. The European Public Administration Network (EPAN) defines it as “the ownership, definition, development, maintenance, monitoring and promotion of standards, protocols, policies and technologies” of the GIF.²¹

EPAN recommends that a single agency should be responsible for two of three aspects of the GIF, such as technical and semantic aspects. This agency should have the following characteristics:

- ▶ Separate from all sectoral domains to ensure independence;
- ▶ Seen as expert in the field of interoperability to engender trust;
- ▶ Capable of working as a collaborative partner with fulfilment agencies and sectors;
- ▶ Pro-active in the promotion and promulgation of standards and their use;
- ▶ Responsible for monitoring usage of and policing adherence to standards, guidelines, policies and protocols;
- ▶ Singularly focused on standardizing and providing interoperability on a pan-public service basis; and
- ▶ An advisory body to fulfilment agencies in developing strategies and implementing solutions, to fulfilment agencies in coordinating cross agency aggregated services and to communities of practice in setting and publishing standards.²²

EPAN also believes that, depending on national circumstances, another agency could be in charge of organizational interoperability.²³

The GIF governing agency (as described above) would also have standards selection powers, which could have some of the following general principles, as recommended for standards setting for the Internet:

- ▶ Allowing for diversity and democratic participation in order to ensure that interests other than those of direct stakeholders have a chance to be represented and for legitimate consensus to be possible.
- ▶ Exhibiting informational openness and transparency so that, at a minimum, multi-stakeholders can access standards specifications and so that institutional affiliations and policy deliberations become transparently accessible to the public.
- ▶ Defining intellectual property rights constraints to prevent manipulation of standards for rent-seeking and market dominance.
- ▶ Subscribing to principles of universal access and security to support a global competitive market and the compatibility of new technologies within growing interdependent systems.²⁴

What are the challenges for GIF governance?

The challenges that governments face regarding GIF governance include: (1) bureaucratic challenges due to the nature of bureaucracy and the autonomy enjoyed (or lack of accountability of) different agencies; (2) ensuring compliance or enforcement of the adopted standards; (3) capacity development; and (4) using the right metrics to measure the success of the GIF.

²¹ EPAN, Key Principles of an Interoperability Architecture, p. 11.

²² Ibid, p. 31.

²³ Ibid, p. 32.

²⁴ Eddan Katz and Laura DeNardis, “Best Practices for Internet Standards Governance.”

http://www.intgovforum.org/Substantive_1st_IGF/BestPracticesforInternetStandardsGovernance.pdf

Bureaucratic challenges

There are a number of reasons why the bigger and more complex the bureaucracy, the more difficult it is to implement a GIF. Agencies that have entrenched cultures, which do not value openness and cooperation with other agencies, would find it very hard to share data with other agencies. There are also laws and rules that prohibit or limit agencies from exchanging data and information: Data Protection acts, privacy laws and/or confidentiality of financial records policies. Some national agencies, most often those dealing with national security and public safety agencies, have specific mandates that make it difficult for them to participate in cooperative activities. Furthermore, recent public management reform initiatives (like New Public Management, which endorses disaggregation – splitting large bureaucracies into smaller, more fragmented ones), have resulted in competition between different public agencies, and between public agencies and private firms. This has not only made the bureaucracy more complex but has also given more autonomy to organizational units in it.

It has been the experience of countries implementing GIFs that securing buy-in from the bureaucracy at the formulation phase helps create a predisposition for cooperation during GIF implementation phase. Beyond this, the following are also important conditions to secure cooperation in GIF implementation: (1) strong support from the political leadership; (2) sufficient incentives to stay the course; and (3) a relatively small number of players.²⁵

Compliance

While it is easy to mandate all government agencies to comply with the GIF, there is no guarantee that agencies will actually follow. It would be more prudent for governments to adopt an incentives-based approach to GIF compliance.

The most common version of this approach is linking the GIF with the budget: Only GIF compliant e-government projects will receive new funding and non-compliant projects would not be funded by the government. This will be particularly effective if all ICT projects are funded centrally and the GIF lead-agency would have effective control (or even just a veto) over the use and disbursement of this fund. Another variation is a central fund for e-government that supplements agency funds for ICT projects. Non-GIF compliant projects would be funded, without the high-handed standards for GIF compliance.

It is also important for governments to create constraints to encourage re-use among government ICT departments. Thus, funds would be allocated to projects that are not similar to existing initiatives or the purchase software that is useful for multiple agencies. For example, only funding one HR or one accounting application for the whole government. Agencies that re-use applications could be awarded, such as in an annual recognition event or ceremony.

Another way to promote compliance is to build a community that will support GIF standards, similar to how international standards organizations ensure compliance. This community, acting as a support group, would be composed of both users and suppliers of GIF compliant technologies and/or services. Such a community will assist agencies who are implementing GIF standards for the first time. 'Market-based' standards emerge similarly through user communities dedicated to certain standards.

Another way to secure compliance is to publish reference manuals that describe how to build GIF-compliant systems. Agencies who are starting to develop their own systems would benefit from actual prototypes with included source codes, documentation and designs.

Enforcement

It is difficult to imagine a successful GIF implementation based solely on voluntary compliance. Governments must also develop mechanisms to enforce extensive use of the GIF.

²⁵ Hans J. (Jochen) Scholl, Interoperability in e-Government: More than Just Smart Middleware. <http://csdl2.computer.org/comp/proceedings/hicss/2005/2268/05/22680123.pdf>

Governments should see enforcement on the use of the GIF as a process. One approach is to adopt a ‘gating’ process to approve projects, where projects would be regularly reviewed and could be stopped if the project has not followed the original specifications. Random inspection of major ICT projects is also a way of enforcing GIF standards.

When legislation is necessary to GIF enforcement, said law should be broad enough to empower an agency to secure compliance, but not overly specific about standards. Specific standards should be defined in regulations, since it is very difficult to update and retire standards if they are legislated.

Another possible enforcement mechanism is the establishment of an **Interoperability Certification**. Certification represents an agencies’ interoperability level, and might encourage agencies to adopt GIF specifications.

A successful GIF must also respond to ‘realities’ that specific governments face. Thus, the use of mandatory and/or recommended standards should relate to the particular conditions (level of maturity) of each country.

So there are bureaucratic challenges as well as compliance and enforcement issues. What are the other GIF governance challenges?

The other GIF governance challenges include capacity development and defining the right metrics to evaluate GIF implementation.

Capacity development

It is critical to undertake efforts to disseminate information as well as to educate and train government personnel on the GIF and its standards. Therefore, interoperability can take place at both strategic and practical levels. To ensure success of e-government services, governments should invest in capacity development in management, system and service procurement, as well as necessary IT skills.

Metrics

Defining **metrics**, the measure of success of interoperability, is also very important in GIF governance. However, interoperability is difficult to measure because it is not an absolute, as many researchers have found out:

True interoperability is much more than just connectivity. It is also a function of operational concepts and scenarios, policies, processes, and procedures. For this reason, developing and applying precise measurements in an area as multidimensional and complex as interoperability is difficult.²⁶

While difficult, many have taken on the challenge. Among them is Dr. Lee Whitt who proposes an interoperability test for the system view composed of 10 External Interface Tests and 10 Internal Context Tests.²⁷ Mark Kasunic and William Anderson offer four sets of measures to address interoperability: (1) technical compliance measures; (2) systems interoperability measures; (3) operational interoperability measures; and (4) organizational and cultural measures.²⁸

²⁶ John Hamilton, Jerome Rosen, Paul Summers, “Developing Interoperability Matrix.” http://www.eng.auburn.edu/users/hamilton/security/spawar/6_Developing_Interoperability_Metrics.pdf

²⁷ Dr. Lee Whitt, “The Good, The Bad, and The Ugly of Interoperability Metrics,” February 2004. <http://www.opengroup.org/public/member/proceedings/q104/ges-whit.pdf>

²⁸ Mark Kasunic and William Anderson, “Measuring Systems Interoperability: Challenges and Opportunities,” April 2004. <http://www.sei.cmu.edu/pub/documents/04.reports/pdf/04tn003.pdf>

Many governments will probably not seek very precise metrics, yet some basic measurements must be done in order to determine the success of the GIF. An interesting basic test has been offered by John Hamilton, Jerome Rosen, Paul Summers in their “Developing Interoperability Matrix.” They propose that for interoperability to happen a system should meet at least one of the following requirements:

- ▶ Generates data that is used by another system.
- ▶ Processes or consumes data that is generated by another system.
- ▶ Relies on another system for the delivery of data.
- ▶ Uses software that operates on the same platform as another system.²⁹

Beyond this simple but effective test, governments may wish to consider other metrics to measure the success of its GIF initiative.

²⁹ Hamilton, Rosen and Summers, “Developing Interoperability Matrix.”

GIF DEVELOPMENT³⁰

Who is involved in the development of a GIF?

The development of a GIF includes the setting-up of an organization to lead the process. Normally, the first body of the GIF is a GIF **Lead Agency**, which ensures that the GIF development process has an institutional base to support its activities. The Lead Agency provides personnel, budget and other logistical needs in GIF development. It also has the final recommendatory power in approving the GIF and acts as the rallying centre for all efforts towards GIF.

A **GIF Secretariat** is the next body to be created as the organizational base of GIF development. The lead agency can create a unit and assign personnel to act as the GIF Secretariat. The GIF Secretariat is responsible for translating the GIF vision into action. The Secretariat normally establishes the format of the GIF, division of tasks and timetables. However, actual work on the technical policies is usually assigned to Working Groups. The Secretariat is also responsible for the logistical preparations for GIF development, like workshops or conferences.

Aside from operational work, the Secretariat also coordinates with the different stakeholders of GIF development. This involves creating **Working Groups** with members from other government agencies. If there are other involved players, like industry representatives or non-governmental organizations (NGOs), the Secretariat has to ensure their participation. The Secretariat performs documentation functions and collects recommendations by the Working Groups. The Working Groups are sometimes GIF joint authors with the Secretariat. Lastly, the Secretariat can manage the presentation of the draft GIF for public consultation. In short, the GIF Secretariat oversees the operations of the GIF document from the development process and approval process to the revision process.

GIF Working Groups, composed of experts from various government agencies, are technical bodies that work on standards selection.

In the case of the UK GIF development, the Working Group shared many of the functions of the GIF Secretariat. It was the Working Group, not the Secretariat, that decided on the format and content of the GIF. In that instance, the GIF Secretariat became a coordinating body while the Working Group sets the direction.

In another scenario, the functions of GIF Secretariat and the GIF Working Group are lodged in one body. In the case of Denmark, the IT Architecture Committee is both GIF Secretariat and Working Group. The same is true for Malaysia's ICT Policy and Planning Division.

The GIF Lead Agency, the GIF Secretariat and the Working Groups are the main actors in GIF development. Other agencies and organizations play a supporting role for two reasons: to ensure support for the document (buy-in) and for quality control.

Since a successful standard is one that is widely used, it is prudent to involve all government agencies in GIF development. Representatives of public sector agencies can participate in the development process through various mechanisms. Malaysia conducted consultations with government agencies regarding the GIF. For Australia and Denmark, the lead authorities are composed of representatives from different government agencies. For New Zealand and the UK, government agencies act as individual contributors by filing their comments or complaints regarding the specifications contained in the GIF.

³⁰ The subsequent account is based on the aforementioned review of eight GIFs conducted for this study.

Involving the bureaucracy not only ensures buy-in but also forces programme and IT staff to think about the who, what, why, where, when, how questions that they do not normally think about.

e-Government interoperability development helps government technical officials understand the ICT in the bureaucracy.

Some countries have used the services of independent expert groups in addition to Working Groups in the development of their GIF. Australia, Germany and the UK have expert groups such as Senior IT Personnel in the UK and a private consultancy group in Australia. These expert groups functioned as an advisory group or as an independent review committee to the GIF document.

Wider stakeholder participation that involves industry, NGOs and citizens, is also important to GIF development.

The ICT industry has an important role to play in GIF development and implementation. Industries are usually the leaders in technological development. In the UK, industry representatives are included in the Working Groups. A private corporation (the Distributed Systems Technology Centre) acted as an external consultant to review the contents of the Australian GIF. Furthermore, consultation mechanisms like websites, emails and discussion forums can elicit industry participation.

While industry can and do provide important inputs to the GIF development, government should also be able to manage the risk of industry players capturing the GIF process to serve their own narrow corporate agenda.

The participation of NGOs should also be welcomed. NGOs usually articulate the views of the users/consumers of online government services, thus taking their views into account could help formulate a better GIF.

The GIF Secretariat could establish public consultation mechanisms so that citizens would be able to participate in the GIF development. Citizen perspective is important to evaluate the impact and usability of GIF for the end user. The mechanisms for eliciting public participation are: (1) websites – including wikis and email; (2) public hearings; (3) request for comments; and (4) request for proposals.

How are GIFs produced?

The GIF development process starts when the GIF Secretariat has been established. The GIF Secretariat acts as the nerve centre of the GIF development, drafting the action plan, timetables, and tasking of the whole process. The GIF Secretariat also conducts a review of GIFs in other countries. Finally, the Secretariat prepares a draft GIF outline and tasks for the Working Group(s).

The Working Groups then conduct further research on the standards and specifications to be included in the GIF.

The first draft of the GIF is submitted for consultation either to the public or an independent expert group. The Working Group incorporates any changes and comments to the GIF. The Secretariat then forwards the reworked draft for formal review by the lead authority or policy maker.

The lead authority either provides corrections to the draft or approves it for use.

Are GIFs revised? How often does one revise a GIF?

Achieving e-government interoperability is a process of many incremental steps coming together over time. Among others, technology and processes will change, and standards will become obsolete as new standards emerge. Hence it is best to view GIF as an organic document – evolving over time to respond to the emerging environment and needs.

A good example of the evolution of a GIF is the UK GIF. Figure 1 below depicts a work flow for the creation of a GIF.

Figure 1: From GIF Version 0 to Version 1

Tasks	Responsibility
Establishment of a GIF Secretariat	Lead Authority
▼	
Creation of action plan, time tables, Working Groups	GIF Secretariat
▼	
Review other GIFs, internal needs and national ICT strategies	GIF Secretariat
▼	
Draft initial GIF outline	GIF Secretariat
▼	
Draft principles, definitions, goals and selection criteria	Working Groups
▼	
Release v0 for consultation or informal review	GIF Secretariat
▼	
Solicit input and contributions from experts, other government agencies, industry, the public	GIF Secretariat and Working Groups
▼	
Re-draft v0 to incorporate contributions and develop technical content more fully	GIF Secretariat and Working Groups
▼	
Solicit input from experts, etc.	GIF Secretariat
▼	
Re-draft v0.5 to incorporate contributions, refine principles, technical content and add governance structures	GIF Secretariat and Working Groups
▼	
Release v0.9 for approval	GIF Secretariat and Working Groups
▼	
Approval of document	Minister, Cabinet (as appropriate)
▼	
Release v1 for policy use	Lead Authority

The main thrust of the UK GIF Version 1 (Oct 2000) is to adopt the Internet and World Wide Web standards for all government systems. There is a strategic decision to adopt XML and XSL as the core standards for data integration and presentation. This includes the definition and central provision of XML schemas for use throughout the public sector. The UK GIF also adopts standards that are well supported in the market place. It is a pragmatic strategy that aims to reduce cost and risk for government systems while aligning them to the global Internet revolution.

The main sections of the first version of the UK GIF are: Overview, Policies and Technical Standards, Implementation Support, and Management Processes. Policies and Technical Standards are categorized into Interconnection Policies and Specifications, Data Integration Policies and Specifications, and Information Access Policies and Specifications.

Six months later, Version 2 (April 2001) was released. Version 2 has new sections on Content Delivery, and Wireless Application Protocol Access Standards and Specifications. The other sections remain the same. Other changes include:

- ▶ The standards to be used for service delivery by mobile phones;
- ▶ Guidance on content delivery and the potential uses of transcoders: i.e. technologies that enable web content to be delivered to a variety of destination environments;
- ▶ Guidance on linking the UK GIF to the work of public sector communities;
- ▶ Support for low functionality browsers and viewers;
- ▶ Provision of the ability to support the citizen in their own time and at their own pace i.e. asynchronously; and
- ▶ Separation of interoperability issues from presentation and user interface issues.

The UK GIF Version 3 (released in Autumn 2001) included a new section on Complying with the GIF. Specifications on Mobile Access were also improved. Other changes include:

- ▶ Alignment with EC procurement rules;
- ▶ Advice on the protection of sensitive information;
- ▶ Guidance on the move from IPv4 to IPv6;
- ▶ Guidance on emerging specifications;
- ▶ Support for access by ethnic minorities and the disabled;
- ▶ Revisions to Basic and Additional Browser specifications;
- ▶ Changes to the Management Groups;
- ▶ Further details of the compliance processes; and
- ▶ New appendix of abbreviations and acronyms.

The main change in UK GIF Version 4 is the separation of the Technical Policies and Specifications from the Framework. Part 1 maintained the same sections: Policy and Scope, Implementation Support, Management Processes, and Complying with the GIF. Part 2 contained the Technical Policies and Specifications, categorized according to Interconnection, Data Integration, Content Management Metadata, Information Access, and Specifications for Business Areas.

The UK GIF Version 5 is still divided into two parts. The main change for Part 1, Framework, is the section on Change Management, which used to be included under Management Processes. For Part 2, the new classification of standards was: A-Adopted; R-Recommended; U-Under Consideration; and F-Future Consideration. One change in the Access category is the addition of Specifications for Access – Smart Cards.

The UK GIF Version 6 saw changes in Parts 1 and 2. The main changes for part 1 are:

- ▶ The expansion of Management Processes to include delineation of tasks among GIF players: i.e. e-Government Units, Working Groups, citizens and the public sector;
- ▶ Updates on the Change Management processes to include more specific consultation procedures; and
- ▶ Inclusion of Technical Policies as one of the sections.

Part 2 of the GIF version 6 is renamed the Technical Standards Catalog. The Interconnection category now has a separate topic on Web Services Specifications. The Information Access category has been renamed e-Services Access, which expanded its specifications to cover Voice over Internet Protocol (VoIP) systems and more detailed aspects of smart cards. Specifications for business areas were also expanded to cover the following areas: e-Learning, e-Health and Social Care, Finance, Commerce, Purchasing and Logistics, and Work Flow and Web Service. Many specifications for smart cards, VoIP and business areas are still under consideration.

How does one revise a GIF?

Below is a stylized procedure for revising the GIF.

Figure 2: From GIF Version 1 to Version 2

Tasks	Responsibility
Continuous inputs via consultation mechanisms	GIF Secretariat
▼	
Monitoring and compilation of contributions	GIF Secretariat
▼	
Review other GIFs, internal e-government developments, etc.	GIF Secretariat
▼	
Create working groups and provide list of topics for review	GIF Secretariat
▼	
Review existing technical policy and specifications	Working Groups
▼	
Draft v1.1- v1.3	GIF Secretariat and Working Groups
▼	
Release v1.3 for consultation and informal review	GIF Secretariat
▼	
Solicit input and contributions from all stakeholders	GIF Secretariat and Working Groups
▼	
Re-draft v1.3 to incorporate contributions	GIF Secretariat
▼	
Release v1.5 for formal review	GIF Secretariat
▼	
Re-draft v1.5 to incorporate contributions	GIF Secretariat and Working Groups
▼	
Release v1.9 for approval	GIF Secretariat
▼	
Approval of document	Minister, Cabinet (as appropriate)
▼	
Release v2 for policy use	Lead Authority

ARCHITECTURE

What about e-government interoperability through architecture?

Many believe that an NEA is the solution to the integration and interoperability challenges that governments face.³¹

An enterprise architecture (EA), according to the US Chief Information Officers Council, is an agency-wide roadmap for the efficient use of ICT.³² Marijn Janssen and Kristian Hjort-Madsen define NEA as a framework or umbrella to explain the relationships among governments' ICT projects and for managing change. For them, "architecting public administration involves designing public administrations to reflect the political and public managers' decisions at a strategic level in operational activities and decisions."³³

There are a number of reasons why governments use NEA. Denmark believes that its NEA can help meet the following objectives:

- ▶ Ensure better public service through higher-quality IT support.
- ▶ Support the development of innovative cross functional administrative processes through greater coherence in information.
- ▶ Achieve more efficient administration through more efficient use of IT.
- ▶ Provide the capability for fast support of new or modified administrative processes or organizational changes through reliable infrastructure solutions.
- ▶ Provide easier access to public information through open interfaces among citizens, companies and authorities.
- ▶ Provide adequate protection of public information through secure solutions for handling and exchanging data.
- ▶ Create more successful IT solutions through greater predictability of the results of IT investments.
- ▶ Provide a solid platform for public administration through stable IT systems with sufficient capacity.³⁴

While Denmark used the NEA to secure interoperability, other countries, such as the Netherlands and the United States, use NEA to reduce red tape in order to reap positive long-term effects on economic growth, employment and income.

What is SOA? And how does it promote e-government interoperability?

Service-Oriented Architecture (SOA) is a kind of EA. It has been suggested that SOA is the best underlying paradigm with which to develop e-government services that can be used in cross-agency and cross-border situations.³⁵

³¹ Kristian Hjort-Madsen, "Enterprise Architecture Implementation and Management: A Case Study on Interoperability," Proceedings of the 39th Hawaii International Conference on System Sciences, 2006, p. 2.

³² CIO Council, "A Practical Guide to Federal Enterprise Architecture, Version 1, February 2001", p iii.
<http://www.gao.gov/bestpractices/bpeaguide.pdf>

³³ Marijn Janssen and Kristian Hjort-Madsen, "Analyzing Enterprise Architecture in National Governments: The cases of Denmark and the Netherlands," Proceedings of the 40th Hawaii International Conference on System Sciences, 2007.
<http://csdl2.computer.org/comp/proceedings/hicss/2007/2755/00/27550218a.pdf>

³⁴ Ministry of Science, Technology and Innovation, White Paper on Enterprise Architecture (Denmark), p. 19.
<http://www.oio.dk/files/whitepaper.pdf>

³⁵ Peter's Pensieve OASIS Symposium, SOA and e-Government Panel.
<http://www.xmlbystealth.net/blog/2007/04/oasis-symposium-soa-and-e-government.html>

A more precise definition of SOA is as an “enterprise-wide IT architecture that promotes loose coupling, reuse and interoperability between systems.”³⁶ Its proponents argue that SOA “offers a better way of designing integrable, reusable application(s)..., orchestrated from existing services rather than rebuilt from scratch.”³⁷ Furthermore, it closes the business/IT alignment gap created by traditional development approach.

What distinguishes SOA is its implementation of “a service platform consisting of many services that signify elements of business processes that can be combined and recombined into different solutions and scenarios, as determined by the business needs.” This capability to integrate and recombine services is what gives a service-oriented enterprise the agility to respond quickly and effectively to new situations and requirements.

The advantage of a service orientation is that it defines the needs and outcomes of e-government in terms of services, independent from the technology (the hardware platform, operating system and programming language) that implements them. The three main benefits of SOA for e-government are: Adaptability, Predictability and Accountability.³⁸

The Government of Canada has adopted an SOA to “cut through the current information silos, promote interoperability and enable services to be delivered more effectively and uniformly.”³⁹ By using SOA, the Canadian Government believes it can achieve the following:

- ▶ Facilitate the manageable growth of large-scale enterprise systems;
- ▶ Provide a simple scalable paradigm for organizing large networks of systems that require interoperability;
- ▶ Minimize trust assumptions among providers and consumers to further promote greater business agility and autonomy; and still
- ▶ Integrate functionality across ownership boundaries.⁴⁰

What are architectural design principles?

Any government considering interoperability through architecture should adopt architectural design principles to realize its goals. Architectural design principles or guidelines “are textual statements that describe the constraints imposed upon the organization, and/or the decisions taken in support of realizing the business strategies and can be used to guide future projects.”⁴¹

Marijn Janssen and George Kuk endorse the idea of adopting complex adaptive system theory in the design of NEA since “the design of enterprise architecture has to balance between excessive and no controls, and allow flexibility and adaptability such that systems are not frozen because they are tightly constrained or disintegrate due to little order.” They suggest that governments should consider the following Architectural Design Principles:

- ▶ **Stimulate/breed diversity:** Like Complex Adaptive Systems, the NEA should encourage variety within the system in order to create new possibilities to co-evolve with their environment. From an ICT perspective, an ICT ‘monoculture’ is generally fragile and cannot effectively respond to the changing needs of an organization. However, stimulating/breeding variety should be done with care. Conditions such as reusability and cost justification should be defined without disputing the autonomy of the initiatives.

³⁶ Norbert Biebertein, Sanjay Bose, Marc Fiammente, Keith Jones and Rawn Shah, *Service Oriented Architecture Compass: Business Value, Planning, and Enterprise Roadmap* (Upper Saddle, NJ: IBM Press, 2006), p. 4.

³⁷ Oracle, *Bringing SOA Value Patterns to Life: An Oracle White Paper*, p 5. <http://www.oracle.com/technologies/soa/soa-value-patterns.pdf>

³⁸ Peter’s Pensieve. <http://www.xmlbystealth.net/blog/2007/04/3-main-benefits-of-soa-for-e-government.html>

³⁹ Government of Canada *Service Oriented Architecture Strategy Statement of Direction*, p. 6. http://www.tbs-sct.gc.ca/cio-dpi/webapps/architecture/sd-ao/sd-ao00_e.asp

⁴⁰ Ibid, pp. 6-7.

⁴¹ Marijn Janssen and George Kuk, “A Complex Adaptive System Perspective of Enterprise Architecture in Electronic Government,” *Proceedings of the 39th Hawaii International Conference on System Sciences*, 2006, p. 3. <http://csdl2.computer.org/comp/proceedings/hicss/2006/2507/04/250740071b.pdf>

- ▶ **Set targets as well as constraints:** Setting of targets without constraints results in a variety of heterogeneous systems and accompanying interoperability problems.
- ▶ **Stimulate growth of successful projects:** The principle is to breed initiatives that might become successful and result in best practices.
- ▶ **Develop standard infrastructure components:** The reuse of available and proven infrastructure components can help develop lower costs and new systems quicker.
- ▶ **Develop modular architectures:** The development should focus on defining the basic component functionality and interfaces, instead of complex system architectures. This should limit the number of systems and ensure that they can interoperate.
- ▶ **Stimulate sharing:** Sharing of ICT departments, functionalities and services reduces costs, and the increase of available budgets provide access to expertise and systems formerly out-of-reach.
- ▶ **Develop competencies:** Mechanism should be in place to develop knowledge and capabilities that are necessary to integrate the infrastructure components and other results of the programme.
- ▶ **Stimulate the formation of coalitions:** Since agencies tend to do things on their own and resist government-wide initiatives, coalitions between various agencies would help breed new ideas.⁴²

What are the other (more practical) architectural issues that must be addressed?

Governments should consider a number of issues specific to architecture.

First, the architecture of public service must design what is needed, not limited by the available technology. A technology-led approach to NEA will not achieve greater interoperability nor more effective public services.

Second, effective architecture will accelerate the delivery of services to market and lead to cost savings. In its 2007 Federal Enterprise Architecture Assessment, the US Office of Management and Budget (OMB) noted that the majority (19 of 24) of agencies were “realizing IT cost savings, cost avoidance, and/or satisfactory program performance...”⁴³ OMB also believes that further cost savings/avoidance can still be realized if agencies give more focus to this objective. In the case of a SOA, cost savings/cost avoidance is due to reusable services.

Third, architecture should support the overall vision of flexible public service. Advances in open standards and software-development tools have made a responsive NEA (or an SOA) possible. It would be unfortunate if governments adopt an architecture that limits its ability to respond quickly to changing conditions.

⁴² Ibid, pp. 6-8.

⁴³ http://www.whitehouse.gov/omb/egov/documents/2007_EA_Assessment_Results_Summary.pdf

What are the challenges to e-government interoperability through architecture?

Kristian Hjort-Madsen captures the challenge of interoperability via architecture succinctly: “The reality in most e-government settings is that there is a complex goal structure and strict legal norms, while interoperable services must still be delivered in a secure and transparent way.”⁴⁴

The biggest challenge that must be overcome is the limitation of the approach itself. In their study of the NEA of Denmark and the Netherlands, Janssen and Hjort-Madsen argue that:

The NEA frameworks and models that we use in the public sector were built for private companies and have a limited scope, while e-government is about a large set of organizations, including many autonomous agencies having various levels of readiness and different circumstances, governed by a democratic system and embedded in a certain institutional situation.⁴⁵

It is also important to recognize that doing an NEA or an SOA is a huge and complex undertaking that requires a significant amount of skills and resources.

At the same time, the challenges faced by governments implementing an NEA/SOA are the same as those countries implementing a GIF: bureaucratic obstacles, governance issues, inadequate information dissemination and human capital requirements.

Bureaucratic issues

As has been pointed out in the section on GIF Governance, interoperability is as much political as it is a technical issue. For ICT-enabled systems to ‘talk’ to each other through architecture, there needs to be a desire and the will for that to happen. The elements of success include: (1) the cooperation of various government agencies; (2) the right incentive structure; and (3) strong and demonstrated support from political leaders.

Governance

For the effective management of the Architecture Contract, the joint agreements between development partners and sponsors on the deliverables, quality and fitness-for-purpose of an architecture, the Open Group considers the following key success factors for architecture governance:

- ▶ Establishment and operation of best practices for the submission, adoption, re-use, reporting and retirement of architecture policies, procedures, roles, skills, organizational structures and support services;
- ▶ Establishment of the correct organizational responsibilities and structures to support the architecture governance processes and reporting requirements;
- ▶ Integration of tools and processes to facilitate the take-up of the processes, both procedurally and culturally;
- ▶ Management of criteria for the control of the architecture governance processes, dispensations, compliance assessments, Service Level Agreements and Operational Level Agreements; and
- ▶ Meeting the internal and external requirements for the effectiveness, efficiency, confidentiality, integrity, availability, compliance and reliability of all architecture governance-related information, services and processes.⁴⁶

⁴⁴ Hjort-Madsen “Enterprise Architecture Implementation and Management: A Case Study on Interoperability”, p. 9.

⁴⁵ Janssen and Hjort-Madsen “Analyzing Enterprise Architecture in National Governments.”

⁴⁶ TOFAF. <http://www.opengroup.org/architecture/togaf8-doc/arch/>

In the case of the SOA, “SOA Governance isn’t optional – it’s imperative. Without it, return on investment will be low and every SOA project out of pilot phase will be at risk.”⁴⁷ The four critical areas that SOA governance should address are: (1) establishing decision rights; (2) defining high-value business (government) services; (3) managing the lifecycle of assets; and (4) measuring effectiveness.⁴⁸

Information dissemination

There is also the need to extensively communicate the architecture to increase awareness, understanding and use, particularly among the ICT community. Aside from writing up and promoting the architecture, the Canadian province of Ontario conducts an annual Enterprise Architecture Open House to discuss the latest progress in EA as well as the ways in which Businesses and IT have worked together successfully through EA.

Human capital requirements

NEA/SOA formulation and implementation requires individuals with both business and technical know-how. For instance, an Enterprise Architect would need the following qualifications:

- ▶ Systems Thinking: the ability to see the big picture – how parts interact with the whole;
- ▶ Knowledge of the business that will develop EA;
- ▶ Interpersonal and leadership skills: servant leadership, collaboration, facilitation and negotiation skills;
- ▶ Emotional Intelligence: self awareness, confidence, ability to manage conflict and empathy;
- ▶ Good written and spoken communication skills;
- ▶ Ability to explain complex technical issues to non-technically minded people;
- ▶ Knowledge of IT governance and operations;
- ▶ Comprehensive knowledge of hardware, software, application and systems engineering;
- ▶ Project and programme management, planning and organizational skills;
- ▶ Knowledge of financial modeling as it pertains to IT investment;
- ▶ Customer service orientation; and
- ▶ Time management and prioritization.⁴⁹

Aside from having people with the right skills, there is also the need to have the right number of people with the right skills.

⁴⁷ Paolo Malinverno cited in Sandy Carter *The New Language of Business: SOA & Web 2.0* (Upper Saddle NJ: IBM Press, 2007), p. 105.

⁴⁸ *Ibid.*, p. 116.

⁴⁹ http://en.wikipedia.org/wiki/Enterprise_architect

CONCLUSION

Does one start with a GIF, NEA/SOA or both?

The schedule of e-government interoperability depends on what a government wants to accomplish. If a government only desires a better exchange of information across the government, starting with a GIF with focus on technical interoperability may be sufficient. A government with little experience or just starting with e-government projects may want to develop an NEA. However, developing an NEA is more demanding as it is not just about interoperability but also integration. A government with many legacy systems would do well to consider SOA.

Earlier we used the analogy of GIF as building code and NEA/SOA as town plan. Another way of looking at them is to see them at two ends of a continuum (see Figure 3 below).

Figure 3: GIF-NEA Continuum

GIF – focus on	GIF – focus on	NEA/SOA
Technical Interoperability	Technical, Semantic and Operational Interoperability	
	Hybrid GIF-NEA (e.g. Germany's SAGA)	

Depending on a government's objective, capabilities and available resources, they may choose any point in the continuum to achieve e-government interoperability.

What is the role of senior government officials in ensuring e-government interoperability?

Achieving e-government is not easy and requires leadership and commitment. The lack of interoperability is due to a number of factors, such as policy reasons, national security and privacy, particularly as it relates to personal health information. Lack of interoperability also has to do with heterogeneous government information systems regarding hardware, software and legacy systems. There is also the 'turf' issue: Various agencies want their own systems and are worried about sharing data and common services. Thus, for interoperability to happen (for ICT-enabled systems to 'talk' to each other) there needs to be a desire and cooperation among the various agencies of government. Unless the highest levels of government commit to interoperability, many policy, bureaucratic and narrowly-construed corporate interests can frustrate interoperability.

The GIF and NEA/SOA can help a government achieve better public service through technology. Policy makers must play various roles in developing and implementing the GIF and NEA/SOA. The policy maker must provide:

- ▶ Specific vision that the government hopes to achieve with the use of technology; and
- ▶ Political sponsorship.

What are the key points to remember about e-government interoperability?

No government will achieve interoperability in one big step. Securing interoperability is a process of many incremental activities over time. Hence, a significant infrastructure of people, technology and knowledge needs to be in place to create, use and revise the e-government interoperability document - be it a GIF or an NEA.

The lead agency should be charged and empowered to lead the interoperability development and implementation process.

The process of developing and revising the GIF or NEA must be open and inclusive. This will help create a better document and ensure support for the document among those who will eventually implement it.

Open standards are essential. One cannot achieve e-government interoperability through the technical issues only. The issue of interoperability emerged as a result of the proliferation of independent e-government projects, which often have limited coherence and remain largely uncoordinated. To truly enable interoperability across a government, one does not start with technology. One starts with the government's strategic framework and the vision and goals of its leaders.

e-Government interoperability, through standards or architecture, is a technically demanding undertaking that requires significant commitments from government leaders. But the benefits – the ability of a government to act as one enterprise, managing spiraling ICT costs, providing integrated citizen services, and the condition for greater citizen participation through greater transparency, in short good governance – outweigh the costs.

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