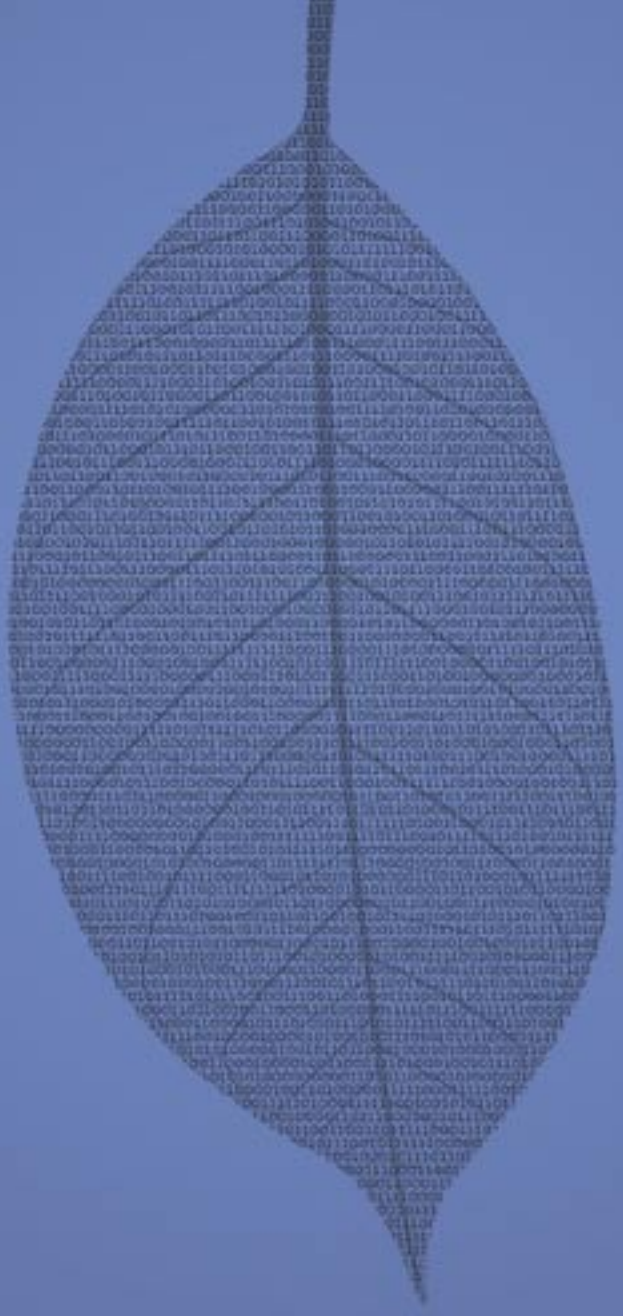

Roadmap *for* Open ICT Ecosystems

Berkman

Berkman Center for Internet & Society
at Harvard Law School

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Introduction

Technology's transformative power has always been a source of great expectations and challenges. Today, globalization, fueled by information and communication technologies (ICT), is rapidly changing every society. Our drive towards globalization creates a new set of unique demands on government, business, and our everyday lives. Increasingly, decision makers in all fields are looking to technology to provide solutions and drive desired changes by commingling local, national and global resources in innovative ways.

The fusion of technology and globalization has also produced a new way to adapt, innovate and grow in our changing world. A potent combination of connectivity, collaboration, access and transparency – or openness – is emerging. Governments and enterprises around the world are embracing it. This openness is helping governments, companies and individuals respond to the increasing requirements of our on-demand, high-speed world. As openness impacts an ICT ecosystem, it becomes a catalyst for unleashing newfound comparative advantage, invention, social development and market opportunities.

The Berkman Center for Internet & Society at Harvard University, with the support of IBM Corporation and Oracle, has facilitated the creation of this Roadmap for Open ICT Ecosystems. Our hope is to provide policymakers, managers and other stakeholders from industry and civil society a user-friendly tool for understanding what open ICT ecosystems are, why they are embraced and how to evolve them. As a result, we hope to change how people see and manage ICT ecosystems and innovation.

To do this, we needed global perspective from those with on-the-ground knowledge and hands-on experiences in such activities as developing ICT architectures, establishing government policies and studying global technology trends. We formed the Open ePolicy Group in February 2005 with members from every region of the world to share insights from governments, companies and organizations at the forefront of global technology.

By gathering compelling case studies and lessons learned from governments, industry and other stakeholders across the globe, members have provided practical insights that can help everyone move toward openness. The Roadmap presents a coherent set of principles, best practices and case studies that can help create and sustain open ICT ecosystems.

I am grateful to each member of the working group for their support of this important project. They are truly the authors of this document, as well as the architects and visionaries for open ICT ecosystems.

We hope that the Roadmap will be a catalyst for changing mental models globally about ICT ecosystems and pathways to innovation. We consider this Roadmap a work in progress. It is our intent to share it with the broadest possible audience. We welcome your ideas, best practices and case studies, which will keep this Roadmap a vital, living tool.

Please visit us online at our website: http://cyber.law.harvard.edu/epolicy

Jeff Kaplan
Founder & Director
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Acknowledgments

The Berkman Center for Internet & Society at Harvard Law School, the host institution of the Open ePolicy Group and publisher of this report, would like to express its deep thanks to Jeff Kaplan, whose inspiration this project was. Mr. Kaplan has carried much of the heaviest load in seeing this project through to the publication of this document – in terms of the project conception, in coordinating the broad and effective participation of the group's remarkable members, and in substantive and editorial leadership.

We also acknowledge the tremendous support and insights from each of our working group members representing diverse governments and organizations from across the globe. The Roadmap for Open ICT Ecosystems is only the remarkable product that it is because of the collaborative hard work of every member of this project.

The Berkman Center would like also to thank the project's sponsors – IBM Corporation and Oracle – for their generous support, without which this project would not have been possible. In particular, we would like to recognize the invaluable contributions, effort and patience of Roslyn Docktor and Peter Lord; they have each been instrumental to the project's success and this exceptional report. The Berkman Center's staff has also played a key role: most notably Erica George, whose hard work on project logistics held everything together. We extend also our special thanks to Molly Krause and Susie Lindsey of the Berkman Center for their support and stamina during our initial meeting and online H2O dialogues and to Sara Akbar of Oracle for managing that initial event.

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Finally, our heartfelt thanks to Miguel Porrua, e-Government Program Coordinator at the Organization of American States. As advisor to our project Director, he has been an endless source of wisdom and inspiration from the very beginning.

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Individual members of the Open ePolicy Group, listed above, do not necessarily agree with every statement in the Roadmap. All members do agree, however, that the Roadmap draws faithfully upon the Group's discussions and that it offers useful advice on open ICT ecosystems.

December 26, 2004. 7:58 am. A thirty-foot-high wall of water – a tsunami – slams into the famed resort islands off Thailand's southern coast. In one tragic moment, thousands of lives are lost, and thousands more are missing.

In the race to identify victims and assist survivors, Thailand's government hits its own wall. Responding agencies and non-governmental groups are unable to share information vital to the rescue effort. Each uses different data and document formats. Relief is slowed; coordination is complicated. The need for common, open standards for disaster management was never more stark or compelling. The Royal Government of Thailand responded by creating a common website for registering missing persons and making open file formats in particular an immediate national priority.

Executive Summary

This Roadmap – and the best practices and recommendations it provides – represents an unprecedented collaborative effort of senior government officials from thirteen nations, thought leaders from five global organizations, experts from two leading technology companies and academics from one of the world's most respected universities. Economic growth depends increasingly on information and communications technologies (ICT); countries, enterprises and individuals need to harness this power through collaboration, innovation and development. This report demonstrates, by its process and its outcome, the enormous potential of open collaboration and information sharing.

Presenting relevant and timely information about the benefits and practical use of open technologies, this Roadmap is the first full resource for anyone either designing or implementing open ICT ecosystems. We share how open ICT ecosystems enable efficiency, innovation and growth. Case studies highlight the limitless possibilities. One case details how Denmark has achieved remarkable cost-savings through the government's use of an open standard. And in India the government has been collaborating with business to promote innovative services within the entrepreneur community based on open architectures. Open standards bind together open ICT ecosystems and drive interoperability.

To evolve to open ICT ecosystems, governments have taken different approaches; our report shares best practices. All agree that success in the use of open environments requires active participation and support from governments. For example, the government of Chile has decreed that all digital documents must conform to an open standard in a pragmatic three-phase rollout. By mandating interoperability and changing procurement policies, government will reap clear economic benefits that support the use of these open processes. Similarly, Japan is revising its laws to dictate that where open standards exist they will be given priority in government procurements. Successful results depend on successful beginnings and we offer you the most comprehensive toolkit available to create your own unique roadmap.

For us, this document will be a catalyst for continued discussions to both learn and educate. We will continue to share with governments and help them understand how they can successfully adopt open standards and develop open ICT ecosystems. We hope that you will also start a dialogue on the benefits of open ICT ecosystems that support open standards and drive growth, innovations and efficiencies.

What Makes an ICT Ecosystem Open?

Openness Emerges

Globalization, low-cost technology, the Internet and the massive flows of information they create are transforming our economies, communities and personal lives. The pressure on governments and businesses alike to meet demands for customer-centric services and real-time information is intensifying. They must change, and quickly. Agencies must become more efficient; economies and industry must be more innovative and competitive.

Almost by necessity, a new openness, fueled by a wave of information and communication technologies (ICT), is evolving and unlocking the efficiencies, standardization and flexibility needed to propel the transformation of governments and businesses. Openness — a synthesis of collaborative creativity, connectivity, access and transparency — is revolutionizing how we communicate, connect and compete. It reshapes ICT ecosystems, and makes it possible to re-engineer government, rewrite business models and deliver customized services to citizens.

As technology commingles with other disciplines, this new openness is driving innovation in politics, health care, disaster management and countless other sectors. Today, evolving to more open ICT ecosystems is a decisive, even necessary, step in governance reform, market success or medical discovery.

More than Technology

This Roadmap focuses on openness across an entire ICT ecosystem. An ICT ecosystem encompasses the policies, strategies, processes, information, technologies, applications and stakeholders that together make up a technology environment for a country, government or an enterprise. Most importantly, an ICT ecosystem includes people -– diverse individuals who create, buy, sell, regulate, manage and use technology.

The Roadmap defines an ICT ecosystem as open when it is capable of incorporating and sustaining interoperability, collaborative development and transparency. Increasing these capacities helps create flexible, service-oriented ICT applications that can be taken apart and recombined to meet changing needs more efficiently and effectively.

Closed technology will not vanish. Open ecosystems are heterogeneous, combining open and closed, and proprietary and non-proprietary technologies. In this environment, a government plays multiple roles –- as an enterprise with its own ICT ecosystem and as a facilitator, manager and early adopter in a national ICT ecosystem.

Guiding Principles

The evolution and management of an entire ICT ecosystem — its standards, management, procurement, public/private/non-government relationships, legal and macroeconomic environment, research and development (R&D) and technologies — should be constructed on the basis of five core principles of openness:

Guiding Principles of Open ICT Ecosystems

An open ICT ecosystem should be:

Interoperable – allowing, through open standards, the exchange, reuse, interchangeability and interpretation of data across diverse architectures.

User-Centric – prioritizing services fulfilling user requirements over perceived hardware or software constraints.

Collaborative – permitting governments, industry, and other stakeholders to create, grow and reform communities of interested parties that can leverage strengths, solve common problems, innovate and build upon existing efforts.

Sustainable – maintaining balance and resiliency while addressing organizational, technical, financial and legal issues in a manner that allows an ecosystem to thrive and evolve.

Flexible – adapting seamlessly and quickly to new information, technologies, protocols and relationships while integrating them as warranted into market-making and government processes.

Defining Terms

The word open conveys a sense of unconstrained access and use, and is widely employed with a great sense of shared ownership. Open by itself is difficult to define outside of a specific context. However, consensus has emerged on its use contextualized by essential aspects of an open ICT ecosystem, including development, access and ownership of technologies.

Interoperability

Interoperability refers to the ability to efficiently transfer and use information uniformly across organizations, systems or components. It helps link systems, information and processes within and across enterprises. Open and interoperable, however, are different. Interoperability is possible even within a closed system. Open ICT ecosystems, however, must be interoperable.

Open standards are the mortar holding interoperable ICT ecosystems together. Open standards make interoperability possible, turning a principle into active policies and specifications. Open standards enable interoperability in and among diverse ICT ecosystems.

Interoperability is not only technology-driven. While technology is an enabler, interoperability must be designed to respond to the needs and desired business outcomes of the communities that use, develop and maintain systems. It requires attention to other enablers such as information sharing, leadership, change management and the reengineering of administrative processes. Frequently, the main barriers to interoperability are not technical, and include:

- *legal and privacy* restrictions on sharing information;
- *organizational barriers* between agencies that operate as separate silos;
- *incomplete grasp* of what services exist, which are needed and how they will be governed;
- *legal and management constraints* on cross-agency service agreements;
- *resistance to* perceived loss of control over information and processes;
- *absence of business managers* to steer the development of interoperability;
- *resistance to* perceived loss of intellectual property;
- *resistance to* perceived loss of business opportunities;
- *fear of* fierce competition; and
- *security* considerations.

Open Standards

Open standards are created by standards-setting organizations including consortia like the Internet Engineering Task Force, World Wide Web Consortium (W3C), and the Organization for the Advancement of Structured Information Standards (OASIS), and formal standards bodies such as the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO). For these organizations, openness allows any interested party to contribute to proposals and thereby makes it possible to base decisions on a near consensus. Users often emphasize access to documentation and free usage as key features of open standards. Care is needed by these bodies when developing open standards to ensure that they do not build upon or reference a closed proprietary standard. When this happens, the resulting standard is not open.

This Roadmap considers a standard to be open when it complies with all these elements:

- *cannot be controlled* by any single person or entity with any vested interests;
- *evolution and management* in a transparent process open to all interested parties;
- *platform independent,* vendor neutral and usable for multiple implementations;
- *openly published* (including availability of specifications and supporting material);
- *available royalty free or at minimal cost,* with other restrictions (such as field of use and defensive suspension) offered on reasonable and non-discriminatory terms; and
- *approved through due process* by rough consensus among participants.

Open standards do not necessarily require government input in the standards-setting process. Like any interested party, governments can participate in community-controlled standards-setting and they should not be excluded from the process. Governments can provide important user feedback, especially when public or governmental use of a specific standard is broad or access to specifications and documentation is most needed. Governments also play a critical role in the adoption and endorsement of open standards.

Open Source Software

Open standards are not the same as open source software. Open source software (or open source) is a type of software defined by its collaborative development, accessibility of code and distribution models. For example, the GNU General Public License (GPL) enables free, non-discriminatory use, modification, copying and distribution. A more complete definition is available at: www.opensource.org/docs/definition.php. Implementation of an open standard under an open source development model can sometimes drive or accelerate standards adoption.

Open Standards vs. Open Source

Open standards and open source are both parts of an open ecosystem, but they differ:

Attribute	Open Standards	Open Source
Nature	Set of specifications	Software code
Openness of interface	By definition	By design
Interoperability	Enabled	Cannot be assumed
Licensing	Various types	Various types (GPL, BSD, etc)
Development model	Collaborative	Collaborative

Open standards and open source do share common ground. Both result from a community oriented, collaborative process in which anyone can contribute and access the end product — either standard specifications or source code. As noted previously, there is a complementary relationship with the implementation of an open standard in open source, which promulgates adoption of that standard.

Service Orientation

A service orientation defines needs and outcomes in terms of services, independent of the technology (the hardware platform, operating system, and programming language) that implements them. Services are more granular than applications. They are easier to orchestrate, interchangeable and transferable, providing a flexible operating environment for partners, suppliers, and customers to interconnect and respond to new business requirements. A service orientation is needs-focused, business-driven and component-based.

Services can be built with modular components on different systems using a service-oriented architecture (SOA). An SOA is a system architecture in which business functions are built as components (services) that are loosely coupled and well defined to support interoperability, and improve flexibility and reuse. It essentially breaks the application architecture into discrete service components. This frees individual business processes from the constraints of application platforms and creates flexibility for them to interact more universally.

Open standards are the backbone of a service-based approach. They ensure that criteria and decisions are service-oriented and technology neutral. Open standards add the flexibility needed for a service-oriented approach. They allow managers to combine, mix and match, and replace components without the expense and expertise of custom coding connections between service components.

Open Document Formats

Open document (or file or data) formats are an example of an open standard, as noted in the opening case study from Thailand. For reference, OASIS has approved a technical specification for an open document format standard. Designed to provide an open format for desktop systems, this standard will help drive information interoperability as more users move to SOAs and paper records become web-based.

Why Open an ICT Ecosystem?

Motivations behind the evolution to open ICT ecosystems vary. For some, it is economic while for others it is political or about social development. The ROADMAP focuses on three major drivers: *efficiency, innovation* and *growth.* Below is a chart that highlights some of the potential benefits to governments, end users and industry.

Openness enables...	Bringing benefits to...		
	Government Managers, procurers, personnel, etc.	**End Users** Citizens, businesses, etc.	**Industry** Local companies, developers, vendors, etc.
Choice / Competition	· Stronger negotiating position (and lower costs) · Lower migration burdens · Ability to buy newest, most appropriate technology · Ability to select functionality and scope · Enablement of procuring off-the-shelf products, while ensuring interoperability with custom products	· Better product selection and lower costs · Choice of devices to interact and receive services and information · Increased ability to balance costs, needs and performance	· Better products · New and niche market creation
Access	· Interoperability and breakdown of silos · Flexibility of use · Ability to work with existing systems · Information collaboration · Transparency in security	· Transparency · Flexibility of use · Ability to work with existing systems · Knowledge sharing	· Reduction of technology uncertainties · Collaborative innovation · Savings in time and resources for non value-added activities · Lower barriers of entry
Control	· Decisions over functionality, scalability and upgrades · Ability to keep pace with and shape technology developments · Advocacy for user requirements · Set requirements and contractual terms	· Future use of data and information created · Choices preserved · Project control	· Level playing fields · Ability to keep pace with technology developments · Protection of market value
Bottom line:	**Efficiency**	**Innovation**	**Growth**

Efficiency

With open ICT ecosystems, governments (indeed all enterprises) gain new efficiencies from increased competition, access and control.

Greater competition among suppliers, products and services helps governments maximize their return on investments and performance. Openness can also strengthen a buyer's negotiating position since they have more options. This ability to choose not only lowers costs but gives end users more latitude to set requirements and performance criteria. Cost is one factor which should be weighed with other business decisions during the process of determining the functional needs of the organization. Making good business choices — balancing solution costs, policy priorities and functional requirements — is easier in open ICT ecosystems.

Spotlight: Denmark

Denmark's eBusiness initiative (discussed in greater detail in Section III) is creating a fully implemented, centralized ordering and invoicing process based on an open standard, which was selected after a business case analysis. This open standard-based system is expected to save the government approximately 160 million Euros per year.

Access — in the broadest information, process and technical context — produces greater interoperability, flexible architectures and information collaboration. Diverse populations of individuals, departments and disciplines are now able to share information and collaborate as never before. Access based on open processes can give a voice to users, allowing them to make contributions to the development of new technology and to the evolution of open standards.

Access to standards specifications and supporting materials, less cumbersome terms for usage and more maintenance, provides governments and other consumers with more flexibility and leverage in the procurement process. It also facilitates the breakdown of silos in enterprises and architectures. New components can be combined with existing systems, with interoperability assured. Access also lowers the burdens of migration by increasing flexibility. End users and implementers alike can configure information systems, choose interfaces, and adapt to ever changing requirements, though major changes will still require concerted effort.

Open ICT ecosystems allow greater control over the future use of technologies. Openness can transform the dynamic of control from industry to government. For example, the ability to see, use, implement and build from an open standard allows managers and users to exert more control to determine if and when they need to add functionality, swap components or fix bugs. By relying on open standards, managers can decide when to upgrade and who provides software support. They can replace

suppliers or even implement upgrades in house. In keeping pace with changing technology, governments become more efficient and effective in meeting citizen and taxpayer needs.

Governments also benefit from greater transparency for critical ICT ecosystem security requirements and decision making through open standards. With greater transparency, governments and end users are able to determine the best balance among protection, control, risk and cost. Security certification is one way to achieve balance in this area. Accredited third parties can perform evaluations based upon established open standards such as the Common Criteria (www.commoncriteriaportal.org) — an ICT security standard for the assessment of security functionality and evaluation assurance, which is mutually recognized by twenty-two nations.

Security is not merely an issue of code. A well-designed and rigorously maintained security framework, combined with transparent management and business processes, is more vital than the choice between software development models. Internationally recognized, open security standards and security norms already exist that can be referenced or even incorporated into procurement policies. While their use does not guarantee security, it increases the odds that vulnerabilities will be found and fixed.

Spotlight: Argentina

Argentina's national tax agency implemented a project to allow access by agencies and enterprises to its unified taxpayer database. The informational model was based on W3C standards together with other well-developed standards to ensure security.

Security conditions were met using a combination of standards addressing different protocol layers and special security requirements. Inter-agency collaboration and improved internal management enabled the tax agency to provide real time access and validation of information to users for different transaction in a secure environment.

Innovation

Innovation is fundamental for any country or company that intends to compete in today's global economy. In many countries, it is also important to bridge digital divides and build a robust local ICT industry.

Open ICT ecosystems create new pathways to innovation for end users — citizens, businesses and governments. All may realize substantial benefits as innovation and collaboration start to generate a broader selection of products at lower costs from a variety of competing vendors. As technologies, such as data formats, become more open and accessible, the diversity of electronic devices increases. This enables users to access information and communicate more easily.

Access also fosters innovation. Collaborative partnerships can thrive in open ICT ecosystems in ways not possible in more closed technology environments. Today's complex problems cannot be solved by a lone individual, government or company; collaborations are fundamental for innovation and solving global issues. Open ICT ecosystems enable users to build competencies and communities and share knowledge in new ways by accessing standard specifications, supporting materials and source code. This community effect spreads knowledge and the seeds of innovation across society.

Spotlight: Public-private collaboration

Breakthrough innovation of the Internet resulted from an ambitious public–private collaboration to achieve a shared vision by building on each other's work. Cascading, collaborative development by enthusiastic users immediately broadened the scope and usefulness of their nascent network by creating new technologies to send e-mail, collaborate with colleagues and participate in groups with shared interests.

Openness was at the heart of these communities that standardized new protocols and adopted procedures to ensure wide access and availability to the Internet's specifications and documentation. Collaboration worked by pragmatic decision making based on rough consensus and running code. These interrelated systems – based on open standards – were built to enhance the usability and interoperability of the network. Alone, individual technologies were not enough. However, as participants commingled technologies, platforms of innovation were created resulting in a whole that is greater than the sum of its parts. Open standards were critical to this cycle of innovation.

As globalization continues, the importance of continued access to data and specifications will only grow. The more information and critical data is digitized, the more it is essential that owners have the ability to store, modify, share and search these information assets without being subject to the whims of a single vendor. By preventing lock-in, open ICT ecosystems can preserve future options for data and ICT management.

Spotlight: Chile

In Chile, a new law guarantees citizens access to updated information that the government collects from them. Fulfilling this important guarantee to its citizens requires efficient mechanisms for information exchange among government agencies.

The Chilean government will develop an electronic information exchange platform that will be a web-based system built on top of a technological architecture using open standards (XML for data exchange; SOAP and Web Services). In its first stage, the project aims to integrate the platforms of five of the biggest public agencies. Eventually, all public agencies will be part of the platform.

Growth

For many governments, open ICT ecosystems are becoming a key element of their economic development strategy. They see a virtuous cycle of openness increasing access to technology and market opportunities for local industries. Elsewhere others strike a different balance between openness and competition, but the value of open ICT ecosystems to industry as a driver of growth is clear.

Spotlight: United Kingdom

According to a recent study by the United Kingdom's Department of Trade and Industry, standards contribute £2.5 billion annually to the national economy. By establishing a common language for businesses, standards increase growth, innovation and international trade. They have also produced 13 percent growth in labor productivity.

Open ICT ecosystems provide all stakeholders, including small and medium enterprises, with the framework and means for integration and collaboration, elements fundamental for innovation. Aligning innovative business designs with new entrepreneurship and technology models, such as open standards, helps drive the creation of new and niche markets. For industry and their consumers, the increased competition also yields better, lower-cost products.

Open technologies lower barriers in the marketplace and in the community. Open standards, in particular, allow any company or person to build on existing protocols and procedures, and to innovate on top of them. By reaching consensus on open standards, technology providers benefit from lower costs and lessened risks that others will produce and implement follow-on products. Instead, they can focus a greater portion of their resources on innovation and addressing the needs of the market. Ultimately, the time and expense associated with non-value-added activities are avoided. This is especially valuable for local industry and developers, since they need to deliver new solutions and keep pace with technology advances often with fewer resources.

Companies can compete on a more level playing field when no single vendor can control or restrict technology, thus promoting competition. Open standards are a prime example of this. While vendors still play an important role within an open community, often developing and maintaining open standards, access and control of specifications remains open to interested parties.

Spotlight: India

India is using open technologies to promote growth and innovation. Its eBiz project aims to create a framework for providing hundreds of Government to Business (G2B) services of federal, state and local agencies through a single portal.

Initially, eBiz will establish a core infrastructure based on open standards to provide 25 G2B services in four states. By publishing the open standards and policies at the end of the pilot phase, the goal is to encourage entrepreneurs to design innovative solutions based on these standards in certain vertical and horizontal G2B services. Companies, responding to market demands, will develop solutions to plug into the core eBiz architecture. Thus, open technologies will create a level playing field for a wide market of services ripe for innovative entrepreneurs.

How Do Open ICT Ecosystems Evolve?

Open ICT ecosystems are not built overnight; they evolve. To guide this evolution, governments must address technology, user needs and business processes. They must carefully monitor the provisional outcomes to make sure the process is on-track. Accomplishing this, governments learn to manage a heterogeneous ICT ecosystem composed of a mixture of technologies and processes that exist with varying degrees of openness. Successfully managing the transition to a more open ICT ecosystem requires managers to address more than just changes to an individual technology.

Presented here are three practical exercises for open ICT ecosystems to show how this can be accomplished. These are not restricted to the order in which they are presented, but are open, interrelated and can be used as required to achieve an open ICT ecosystem.

Excercises for Evolving Open ICT Ecosystems		
Scoping	**Policymaking**	**Management**
Baseline Audits and Mapping **Maturity Models** **Business Case** **Selection Criteria**	**Open Standards** · Policies · Interoperability Framework · Procurement · Development **Lateral Policies** · Service Orientation · Software · Innovation	**Managing** **Monitoring** **Sustaining**

Exercise 1: Scoping

Building and sustaining an open ICT ecosystem requires scoping, which means defining wants, assessing control or influence, prioritizing requirements and selecting entry points. As part of this process, governments need to clearly set and communicate their vision and goals. It is also essential that they determine the structures necessary for governance, risk management and compliance. These structures should always account for the unique challenges governments face organizationally, financially and professionally.

By following these recommended actions governments can better understand what they can do to achieve their goals for openness and refine those goals accordingly.

Baseline Audits and Mapping

Like enterprises, governments conduct baseline audits and process mapping to identify technologies in use, expertise to be leveraged and existing processes.

Spotlight: State of São Paulo, Brazil

São Paulo State Government in Brazil implemented a web-based system called the Information Technology and Communication Sectional Program which enables the inventorying of all existing ICT assets. The system also allows the government to track software licenses, ICT professionals (and their areas of expertise) and communications resources across government. Every state agency and entity is required to register (and update) its ICT inventory in this system.

Baseline audit, mapping, and selective benchmarking efforts that are guided by a clear vision and goals make later policymaking more focused, effective and user driven. These efforts, with early engagement of stakeholders, will help identify siloed systems, inhibitors to interoperability, and where open standards are likely to have the greatest impact. Audits and maps help to define the business architecture and service boundaries for each component of an ICT ecosystem, which can then be replicated in technical services or solutions. Failure to identify and document business processes and requirements before deployment can cause major problems.

- **Audit existing services and business processes.** To construct an accurate baseline, identify and document elements of existing services or business processes including business functions implemented by applications, data used by processes, services provided by systems and tasks done by people.
- **Map the relationships and touch points** among the services, processes and people.
- **Verify with input from consumers and information** from the results of relevant applications.

- **Assess the availability of professionals,** inside and outside the public sector, with ICT and business information expertise.
- **Identify institutions responsible for conducting baseline audits and give them appropriate authority and support.** Stakeholders should also be invited to participate in these assessment activities.

Spotlight: Canada

In Canada, when a customs or police officer seizes illegal drugs, logging and tracking cases are largely paper-based, costly, time-consuming processes. Data is entered separately by at least three different agencies with an error rate approaching 25 percent. A better system was needed.

The government launched a project to test a cross-agency, end-to-end solution to allow secure, electronic transmission of data for its drug crime reporting system. The agencies jointly mapped business processes as well as the benefits and risks of adopting evolving standards and technologies. They also evaluated an ebXML registry to help identify services and reusable components. Using a collaborative, open standards approach, the agencies found common requirements and defined architectures in ways that promote interoperability and the reusability of methodologies and infrastructure.

- **Consider mapping standards.** Mapping standards means identifying all standards in use within and across agencies. An early mapping effort enables agencies to focus on making legacy systems interoperate and minimizes any disagreement over definitions that may impede progress. Where possible, consider this standards map jointly with the above business process map to help identify gaps and prioritize future actions.

See Annex 1 for a more detailed description of baseline auditing.

Maturity Models

Governments have found various capability maturity models (CMM) to be effective tools to help benchmark their readiness and guide management of an ICT environment.

Spotlight: U.S. Federal Agencies

U.S. federal agencies are required by law to establish a comprehensive plan to manage the acquisition, use and disposal of ICT. In response, agencies are using capability maturity models to meet their ICT investment management and audit requirements.

The Department of Commerce developed an ICT Architecture Capability Maturity Model to help with internal assessments. The goal is to improve ICT architecture by identifying weak areas and providing a defined path to improving the overall architecture process.

The Census Bureau began using a Capability Maturity Model to test the possibility of implementing a repeatable software process. It believed that applying a CMM would enable it to create an improved and well-documented process at the corporate level to increase the quality of the Bureau's software.

CMMs that focus on openness across an ICT ecosystem are new and require development. The Roadmap is a public attempt at introducing a new diagnostic tool—an openness maturity model (see Annex 2: Openness Maturity Model). This tool can be used to support change management and guide an ICT ecosystem's evolution. Rather than offer a precise measurement or openness score, it offers a descriptive evolutionary path for building open ICT ecosystems. We offer this not as a best practice, but as a concept that the global community is invited to help develop.

The openness maturity model (OMM) should be used in conjunction with the baseline audits discussed previously. It is designed to help managers aggregate the various benchmarking results that individual audits provide to better gauge the openness for an entire ICT ecosystem. By organizing baseline data into a broader framework, it may be possible to identify areas where the balance between open and closed technologies is not producing optimal performance, interoperability, flexibility or competition.

Business Case

As needs change or services expand, open standards can enable the evolution of a business case by allowing the future addition of components and functionality. (See Annex 3: Framework for a Business Case)

- **Build a sound business case for open ICT ecosystems where decision making is transparent, focused and informed.** This will, in turn, help generate credibility for political and financial support. Conduct a formal analysis of the quantitative and qualitative benefits along with the costs, risks and overall feasibility of moving forward before setting a standard or taking any other action toward an open ICT ecosystem.
- **Examine opportunities, limitations, strengths and weaknesses as well as environmental and strategic factors** to determine feasibility.
- **Perform a cost analysis.** Cost frameworks should not just consider acquisitions but also a full value analysis of direct costs and indirect costs, such as local economic effects, access to open file formats, operational and performance benefits. Gathering information on what the return on investment and performance benefits will be is difficult, but possible. This effort is both necessary and worthwhile for generating long term commitment and support for evolving to open technologies. Approaches such as Total Cost of Ownership or Full Cost Accounting, supplemented by a competitive price analysis, can be helpful.
- **Determine what functionality is really needed.** To help reduce costs in the long term it is best to use a criteria-based business case as described below. Building a case that clearly states business requirements will avoid paying for unneeded functionality.

Selection Criteria

Deciding which solutions, services or systems are most critical to address first can be made easier if early opportunities are selected based on a business case described above and applying the selection criteria detailed below. This activity is more successful when governments reflect on their vision of an open ICT ecosystem and use the analysis from any baseline audits, mapping and maturity models.

- **Select clear criteria when choosing potential open initiatives.** This helps build consensus on early entry points for open standards use and promotion in open ICT ecosystems. Some governments may wish to assign weight to the following criteria based on their current vision, readiness and goals:
  - *Core capabilities* – mission critical areas that are fundamental to business needs or key building blocks for other systems, processes or applications.

- *Cross-cutting* – functions and capabilities that are used across agencies or levels of government and relate to services for many people (*e.g.*, disaster management, services for the elderly)
- *Regularized* – common, non-unique functions where best practices exist for many systems/platforms (*e.g.*, procurement, human resources).
- *Network effecting* – areas that can produce broader, positive network effects across government, industry and society or offer positive returns from scalability.
- *Centralized* – areas where a central consolidation of services will be attractive to agencies and can produce cost savings or other efficiencies (*e.g.*, email, portals).\
- *New* – areas with new needs in functionality, services, processes or information.

- **Prioritize implementation of services with broad impact that meet many of the above criteria.** Document, data or file formats are examples that meet all the above criteria. Making open file formats a high priority for open standards policy and procurement is one way to quickly deliver results that demonstrate the value of moving to open ICT ecosystems.

Spotlight: Denmark

Leveraging work by the OASIS Universal Business Language Technical Committee and the open standard UBL, Denmark's eBusiness initiative became an early adopter of the specification for e-government invoicing (estimated at 18 million transmissions per year).

Prior to adoption, a business case analysis was performed. Legislation was then enacted establishing a localized version of the UBL specification as the mandatory data exchange format for companies wishing to sell services and goods to public institutions. As a next step, an automatic match between an electronic order and an electronic invoice will be developed.

- **Choose wisely when selecting open standard-based solutions.** Thousands of open standards and solutions exist but each open ICT ecosystem will work only when correct choices are made. Governments should select technologies that are open, safe, proven and well supported. Using the selection criteria and business plans above can help maximize the investment value of technology adopted regardless of its life span.

Exercise 2: Policymaking

Governments that seek level playing fields and open technologies should ensure harmony in their standards, procurement, business processes and laws. They need policy frameworks to guide efforts across multiple agencies and ICT systems. Policy formulation — which requires the same level of transparency, stakeholder participation and collaboration that drive the ecosystem itself — might focus on two areas: open standards and key lateral policies.

Open Standards

Policies

As discussed earlier, open standards are the mortar that holds together a heterogeneous ICT ecosystem. They make open ICT ecosystems possible, driving interoperability, sustainability and choice. They help incorporate interchangeable components, portability and scalability while lowering costs. Many governments treat open standards as the norm. As a policy matter, all should do so.

Spotlight: State of Massachusetts, U.S.A.

In the U.S., the State of Massachusetts issued a policy in 2004 directing all state agencies to comply with open standards for all ICT investments and review all existing ICT systems to determine if they can also be enhanced to achieve open standards compatibility. The policy also stated that ICT investments must be based on total cost of ownership and that component-based software development was preferred.

- **Establish clear roles and responsibilities** for using and setting standards. Many governments assign clear responsibility to an agency, department or cross-functional working group.
- **Provide clear directions to assigned group** on evaluation, adoption, monitoring, dissemination and promotion of standards.

Spotlight: China

In China, the China Electronic Standardization Institute (CESI), under overall authority of the Ministry of Information Industry, has lead responsibility for the development of national ICT standards. In its standards setting role, CESI organizes the drafting of standards with input from local and global industry and oversees its verification by testing its interoperability in products of various vendors.

- **Be pragmatic.** Whatever the approach, pragmatism is needed to ensure that open standards are applied in ways that are market-led and directly serve the larger goals of an open ICT ecosystem. Governments approach standards differently. Some governments use legislation to mandate standards, including use of open standards for all future ICT investments. Other governments treat standards as simply a guideline or best practice, without making them legally required.

Spotlight: The Netherlands

The Netherlands has had an explicit open standards policy since 2003. The government, however, relies upon encouragement and guidance to promote open standards rather than formal mandate. In 2005, it established a Standardization Council (a decision-making body) and a Standardization Forum (a body of stakeholders, including industry and science, that prepares proposals) to accelerate development and use of open standards.

Interoperability Framework

An interoperability framework provides baseline standards, policies, guidelines, processes and measurements that governments should adopt. It details how interoperability will be achieved among agencies and across borders, allowing the exchange and management of data and functionality. Combined with baseline audits of interoperability, such frameworks can help actively promote a pathway to greater interoperability through open ICT ecosystems.

Spotlight: European Union

The European Union's Interchange of Data between Administrations (IDA) programme has a collaborative, transnational project called eLink that is developing a middleware solution based on a set of generic specifications for exchange, dissemination and collection of data, originally developed in collaboration by four Swedish state agencies.

The eLink specification provides a range of services for information exchange primarily between public sector authorities, but also caters to Government to Consumer (G2C) and Government to Business (G2B) data exchange. The eLink specification is based on standards incorporating XML, SOAP, Web Services, XML-Encryption, XML-Signature, UDDI and collaborating with PKI technologies. The eLink toolkit, a first implementation of the eLink specifications, has been based only on open source components and pilots are currently ongoing.

An open standards framework should be allowed to evolve. Establishing interoperability requires proper sequencing and balanced action. Governments less experienced in open standards may wish to begin building interoperability with well established

standards. One approach is to declare support for select open standards initiatives that meet selection criteria, implement some corresponding initiatives to serve as a catalyst for projects for interoperability, and then analyze the results and publish best practices. Using this approach an open standards-based interoperability framework may evolve as knowledge increases and capacity is built. Drawing on global best practices can help reduce the time and costs associated with developing this knowledge base.

Spotlight: Brazil

In Brazil, the federal government developed the e-PING (Interoperability Standards of Electronic Government) architecture which defines a minimum set of conditions, policies and technical specifications to promote interoperability for e-government services to citizens, businesses, government entities (at all levels) and non-government organizations. The e-PING sets standards in five areas: security, information exchange, interactions, means of access and integration.

Whether it is a formal interoperability framework or a centrally managed catalogue of standards, governments should:

- **Focus on what is most important to share.** Determine what standards should apply across government, based on the vision and scoping work done earlier. Not all information and processes need to be shared. The most useful interoperability frameworks are those that have a good understanding of user or agency requirements for sharing information and services across siloed processes or agencies.
- **Assess what standards are already in place and how open they are.** Use baseline auditing, standards mapping, and the OMM discussed earlier to understand what standards exist, what open standards can be adopted from elsewhere and what standards need to be localized.
- **Publish and promote an interoperability framework** that sets common processes, guidelines and open standards to influence and increase choices. Publishing and supporting a framework will create awareness of standards that promote interoperability and encourage more conscious planning and procurement. Industry partners benefit from the known references and ease of compliance in building and supplying applications.
- **Define and disseminate a clear usage policy.** Explaining how agencies, vendors and the marketplace should use the framework makes it more accessible to interested parties.
- **Make compliance a criterion for procurement.** Interoperability frameworks help scale open standards across government and across the ecosystem. The framework should be explicitly linked to procurement. Publishing a framework that includes common, open standards used by government enables suppliers to build applications that best fit its requirements.

Spotlight: Kingdom of Jordan

To build an interoperable, federated enterprise architecture for electronic service delivery, the Kingdom of Jordan developed an e-Government Service Integration and Interoperability Framework (IIF). This framework details service interfaces, integration specifications, and common standards and protocols that facilitate interoperability and scalability across government and between government entities and their customers (citizens, businesses and other governments), both for information and for transactions. Jordan's IIF is a vehicle for defining and publicizing the policies and common standards adopted to achieve seamless government interoperability.

Procurement

Procurement drives behavior, both of government agencies and industry partners. As a key force in open ICT ecosystems, procurement deserves close attention.

- **Mandate interoperability in procurement language,** preferring open standards when applicable and adhering to the principles of openness whenever possible. Make open standards the policy, but pragmatism the rule. Limiting procurement to only officially adopted open standards can limit the ability to exploit new technologies.

Spotlight: Japan

The government of Japan has developed software procurement guidelines that dictate that open standards and open document formats shall be given priority in government procurement. The guidelines, to be publicly released in 2005, also share specific examples on how to request functionality without mentioning specific technologies. They are designed to help government procurers and vendors understand the specific, non-proprietary specifications of the government.

- **Consider a hierarchy of standards** with priority given to mature, widely used, open standards. Where open standards do not exist, favor industry-driven, consensus-oriented standards with as many of the elements of an open standard as possible (see Section I). This will help balance the use of open standards with the dynamics of the market and emerging technologies.
- **Use open standards to drive interoperability** while allowing agencies to determine their procurement needs. They can standardize contracting policies on warranties, service agreements, performance audits and disclosure of licenses incorporated into deliverables.

- **Base procurement decisions on measurable criteria.** Make evaluations of interoperability, functionality, support for open standards and future adaptability a part of the procurement process. As discussed earlier, decisions must rest on a solid business rationale with cost metrics applied.
- **Require technology and brand neutrality in procurement specifications.** This approach reduces the possibility of vendor or technology lock-in by emphasizing choices and procurement decisions based upon what works best. It will also reduce costs, increase competition and help smaller vendors to compete. Use metrics that focus on performance characteristics, business needs and contributions that help open the ICT ecosystem.
- **Procure sets of services rather than separate hardware, software or systems.** This ensures that procured systems are open and work with existing legacy systems. In this way, fewer individual companies will satisfy the Request for Proposal (RFP) requirements end-to-end, thus promoting bids by consortia, particularly those that include smaller companies. This translates into more opportunities for firms with innovative technologies or specialized skills, especially if procurements target the component level of a service-oriented architecture.
- **Factor in availability of community support into procurement decisions.** Procurement rules are often designed with proprietary partners in mind. Open ICT ecosystems operate differently. Communities may be able to provide substantial resources for support and maintenance that can balance risks associated with using smaller firms or newer standards.
- **Take control of public information through open data formats.** Open ecosystems bring a new ability to secure present and future access to and use of public data, documents and digital assets. As a condition of procurement, governments must insist on support for open data formats.

Spotlight: Chile

Chile has made access to public documents a top priority. The government issued Decree Nº 81/2004, setting an open XML standard as the digital document format across government. It requires every public agency and service to format digital documents in XML. In a software context, as part of a gradual three phase rollout, the decree focuses on web browser based access to information; tools for XML document generation and editing; and e-government services to manage document workflow.

Open standards-based procurement policies are also powerful tools to avoid dependence on a specific product or supplier. Managers need to be aware that lock-in can occur in a variety of ways.

- *Knowledge lock-in* – when only a few suppliers or developers understand a problem.
- *Interoperability lock-in* – when interoperability is absent, architectures are dependent upon specific technologies, data formats or closed standards.
- *Functionality lock-in* – when a vendor extends a standard (open or closed) with added functionality that creates a new kind of lock-in. In such situations, a functionality enhancement turns into a functionality lock-in.
- *Standards lock-in* – if suppliers treat standards as a ceiling and allow specifications to limit the performance or the functionality they provide, this can constrain innovation.
- *Security lock-in* – when compatibility requirements for networked applications and hardware are used to justify a more proprietary approach to security or when proprietary extensions of existing open security protocols block interoperability with other software.

Development

Standards change over time and revisions to open standards can take years to complete. Informed government participation in the standards process mitigates concerns about delays and can help governments keep pace with technology innovation.

- **Convene governments, vendors and others** to help ensure standards specifications meet user needs by collectively developing user needs profiles – combinations of applications, functionalities and specifications that could be used and reused for certain areas or industries. Such collaboration can help lead to development of open standards that more quickly meet business requirements of an ICT ecosystem. This requires, of course, that government user groups share user requirements and application/service profiles while industry groups identify feasible specifications,
- **Build competencies to influence open standards development.** To effectively play a role, governments must identify or develop the expertise needed to contribute consistent with their core competencies or they may end up as an obstacle or bystander to standards development.
- **Promote awareness and involvement of local industry in standards setting.** International standards organizations welcome participation from all interested stakeholders. Educating local companies on the value of participation can strengthen the process of setting global standards, improve their competitiveness and promote local adoption of open standards technologies. The work of national standards institutes can be a powerful driver for awareness and adoption of standards.

Service Orientation

A service orientation can serve as an effective driver for open ICT ecosystems, which can in turn empower broader government reforms. In particular, a service orientation increases flexibility, modularity and choices.

Spotlight: India

The government of India is implementing a project, slated to be operational by March 2006, to provide online services to about 600,000 companies incorporated in the country. The online services will include: registration of companies, payment of statutory fees, filing of tax returns, and charges.

A service-oriented architecture has been designed for the project in a consultative process involving major technology players. Architecture design was completely driven by the business needs of stakeholders. All transactions are now routed through a standards-based gateway to ensure interoperability. The implementation partner gets compensated, based on a well-designed service level agreement which requires efficient, user-friendly services and satisfaction of performance criteria.

A component-based approach powers sustainability. Service-oriented, open standards and interchangeable components give customers choices at the component level. Changes, such as replacing legacy systems, can be made without degrading the functionality of other parts of the ecosystem. Evolution of ICT systems remains possible even as policies, business needs, technologies or partnerships change.

- **Develop a component model.** These are often built into a service-oriented architecture, which can increase flexibility and promote technology choice. End users and implementers both gain flexibility using open standards to determine how new components can integrate with existing systems.
- **Reconfigure systems and applications** to include innovative solutions or meet new user requirements. In some cases, open source may add value by potentially offering reusable, common, localized components across enterprises.
- **Incorporate service-level agreements and operational policies** for implementing such a modular approach.

Business cases, as discussed earlier, often focus attention on choices between retaining legacy systems and migrating to open systems, or a more hybrid model. If the business case favors it, a service orientation offers a low risk way to retain legacy systems that still fulfill business functions, allowing them to work with new components. This is a practical priority for governments lacking the resources to replace the installed base.

Spotlight: The Netherlands

In The Netherlands, a joint program of cities and the Department of Interior seeks to optimize the electronic provision of public services using open interfaces and standards. To optimize, reluctant back-office vendors need to disclose the back-office functionality specifications to mid- and front-office designers. At first, the program ensured disclosure of back-office functionality to any supplier, even if it meant using proprietary formats. With this quick win of improved interoperability, the redesign of interfaces began based on service-oriented architectures and open standards approach.

By balancing the short-term interoperable solutions with long-term business optimization, the program produced early results while avoiding the costs and down time associated with major architectural redesigns. This two step approach also helped overcome the challenge of taking control over information architectures after years of outsourcing. It is not simply a matter of breaking technical or commercial lock-in by vendors (who complied to secure long-term market position). It also requires developing a service-oriented professionalism within government.

Software

Both open source and proprietary software are part of the marketplace; both will exist in an open ICT ecosystem. Open ICT ecosystems do not rely upon only one software development model. Competition stimulates the environment and changes behavior (*e.g.* forcing reductions in licensing costs). This can help ecosystems evolve provided that the goals remain: efficiency, innovation and growth. Proprietary vendors, however, will remain; their innovative capacity is essential. All software, including open source, requires sound policies and good management.

- **Mandate technology choice, not software development models.** Openness begins with open standards. These open standards enable the interoperability of all software. While either open source or proprietary software may offer compatibility with other programs and devices, neither automatically guarantees interoperability, the enabler of an open ICT ecosystem. An open ICT ecosystem will flourish if there is interoperability and policies in place to ensure competition among software providers at the business level.

Spotlight: Kingdom of Jordan

To establish a clear path for migrating to standard technology frameworks, the Kingdom of Jordan issued a rule requiring technology neutrality in government procurement. The rule is expected to increase procurement choices, provide equal opportunities for vendors to compete in Jordan's ICT market, ensure the emphasis is on selection of best-of-breed, proven technologies and contribute to the growth of Jordan's ICT sector.

- **Choose software based on functionality and scalability, focusing on which software delivers the best, less costly and faster solution.** As discussed earlier, use of comprehensive evaluation models for functionality and scalability as well as business cases with cost analysis should inform these decisions.
- **Acknowledge the presence of open source in the ICT ecosystem.** Open source software does not define an open ICT ecosystem, but it can be an important transformative element. To date, open source has been the most disruptive element of the entire open agenda, provoking re-examination of ICT ecosystems and policies. Many corporations and governments are surprised to discover the amount of open source already in their ecosystem.
- **Understand the management effort required.** While some may question its value, open source has led enterprises to more carefully examine the benefits of open ICT ecosystems, as well as the management of software licenses and integration. It is not simply a mechanism for more inexpensive software development; the implications can be much broader:
  - *Economic* – impacting asset profiles, industry and jobs related to education, production, modification, support and maintenance of software solutions.
  - *Control* – reducing risk associated with software lifecycle decisions by external entities.
  - *Security* – perceived risk of exploitation of hidden or malicious code.
  - *Localization* – customization can occur when desired rather than as scheduled by a software provider.
- **Manage in ways that change the ecosystem.** Even with balanced policies in place, vendors may not change until facing the possibility of losses. Active management may be needed to ensure that enough software choices exist to actually change the ecosystem. To do this it is necessary to:
  - *Develop evaluation metrics* that apply a full cost-benefit comparison;
  - *Understand open source* and the work of the open source development community;
  - *Upgrade operational infrastructure* and processes to support source management of all software, not just open source;
  - *Support localization, software updates,* security accreditation, and acquisition and entity licensing strategies;
  - *Use proactive stewardship* to ensure evaluation of both open source and proprietary models;
  - *Support R&D programs* that employ a collaborative, open source model; and
  - *Encourage open source deployments* when the business case supports it to achieve a critical user base.

- **When funding software R&D set terms that ensure openness.** If a government finances R&D, it should ensure that the terms of software development help evolve an open ICT ecosystem. Conditions to consider include: exploitation rights, component reuse, portability, the use of open standards-compliant tools and languages, and commercialization (*e.g.*, licensing).

Innovation

Many governments are playing more active roles to leverage and grow their open ICT ecosystems in order to boost entrepreneurship and unlock innovation. By creating tax incentives, increasing R&D investment and developing innovative education programs it is possible to create powerful incentives for traditional and new players to innovate and sustain open ICT ecosystems.

- **Build a strong knowledge base.** Having a knowledgeable citizenry is necessary if governments are to sustain the advantages of open technologies, innovate and spur a society's social and economic development. Education, R&D and training merit attention and resources in order to strengthen a nation's knowledge base and its ability to share in innovation.
- **Have an active plan** to enhance the connections between science, technology and innovation. Institutional mechanisms that combine public, private and non-governmental expertise can help build and deepen these relationships.
- **Promote open standards** and remove bureaucratic obstacles to lower barriers and to enable competition. Entrepreneurship flourishes when barriers to market entry are lower. This helps small and medium-sized enterprises innovate, compete and bring new services and products to market.
- **Create clusters of collaboration** around open technologies. Collaborative communities and partnerships grow in open ecosystems in ways not possible in more closed technology environments. These collaborations spread knowledge as well as the seeds of innovation. Governments can help generate clusters of ICT collaboration by:
  - *Advancing communication* among universities, research institutes, venture capitalists and businesses;
  - *Supporting public-private partnerships* in research, training or other fields; or
  - *Investing in infrastructure* to draw research and business into geographic proximity.

Exercise 3: Management

Managing open ICT ecosystems involves greater collaboration, more coordination, new choices and complex tradeoffs. As a result, open ICT ecosystems can evolve more rapidly when steps are taken that place a premium on good management, constant monitoring and sustainability.

Managing

Good management, like interoperability, is an essential building block for all aspects of an open ICT ecosystem.

- **Provide active stewardship to build open ICT ecosystems.** Good management is active management. A hands-on approach can advance open standards, software development and collaborative processes in pragmatic, balanced ways without trying to engineer everything. Active managers seek greater visibility into their own ICT ecosystem through, for example, the baseline audits and mapping discussed earlier.
- **Balance intervention, facilitation and testing.** Governments should decide how to create momentum for change on a case-by-case basis. Open ICT ecosystems involve added complexity and choices; managers must constantly be actively engaged.
- **Create realistic timeframes.** When changes are big, pragmatism also dictates that managers plan long lead times for implementation. The bigger the change the longer the lead time needed to insure implementation.

Spotlight: State of São Paulo, Brazil

Digital inclusion – the promise to break the digital divide by assuring Internet access to citizens of all social classes – is a key goal of Brazil's São Paulo State. Through its Acessa Livre program, the state government aims to create centers across the state providing free public Internet access. Open technologies allow São Paulo to overcome its biggest challenge – the cost of acquiring, localizing, reconfiguring, upgrading and maintaining software for the thousands of computers it plans to deploy.

Collaborating with industry partners, researchers and community groups, the São Paulo State ICT Company developed open source operating systems and office applications as the foundation of architecture. As a result, the São Paulo government has been able to open 200 "Infocentros" in 96 cities with 1,800 computers, with more to come.

- **Balance centralized and localized decision-making.** Good management also means balancing centralized actions with the promotion of more community-oriented, peer-to-peer approaches. Government-wide policies on security, in-

teroperability and procurement may produce synergies and economies of scale in some places. Elsewhere, top-down efforts may be less productive or acceptable, as processes and practices must meet local needs.

Open ICT ecosystems allow agencies to balance the efficiencies from this centralized functionality with an ability to make local deployment or implementation decisions. Both central and local solutions must be based on open standards to ensure interoperability and the benefits of this approach.

- **Start small with a single policy for an open standard or large with an entire enterprise-wide component or service.** Agencies can vary in their degree of centralization, although all must comply with the underlying principle of interoperability. They can internally adopt the policies or services of the centralized framework while retaining some independence over implementation. For example, solutions might be locally developed and implemented, centrally developed and locally implemented, or centrally developed and implemented.
- **Bring users and other stakeholders into the process early.** Managing the complex dynamics of an open ICT ecosystem means managing interactions among layers of government, the private sector and civil society. End users of services and technologies are invaluable resources, providing skills, services and feedback on design and execution of policies that may be unavailable internally. Inadequate user input is a common deficiency in ICT management. To ensure businesses, officials, and developers (the users and suppliers) will participate, they must be given a voice or stake in an open ICT ecosystem.

Spotlight: Denmark

Denmark's *CareMobil* project uses an open specification and a generic business case for the use of mobile technologies in home-care for the elderly. Six cities are running pilot projects, for which seven vendors developed a variety of tools. The specification is based on open standards and a service-oriented architecture. The project will give care workers the services they need – access to vital data on demand. By opening key systems such as electronic care records over a secure infrastructure, the care system becomes more user-oriented and transparent to citizens.

- **Identify and build functional communities.** User communities should represent more than one business process, supply chain, institution or silo. Governments should focus on cross-agency communities that are defined more by the problems, reference models or services they address. This can be especially helpful when identification of users is difficult (*e.g.*, when starting a new initiative).
- **Actively promote collaboration.** Governments must find ways to support and extend the work of collaborative communities, or even formalize their role in a consultative process. User feedback, which often highlights smaller issues, may help identify new areas of growth for standards, evolve service-oriented approaches, test new designs or produce other innovations that enhance ICT ecosystems.

Collaborative development processes can also broadly impact openness in government and an economy, driving efficiencies, growth and innovation, as well as contribute to a society's sustainability.

Spotlight: India

India is using a collaborative approach in its eBiz project for the design of its standards-based enterprise architectures. Designing the architecture for providing hundreds of G2B services of federal, state and local government agencies is complex, more so when that architecture is based on open standards. Collaboration was the answer.

The government created a Peer Advisory Group with representation from all major technology companies. Over three months, what emerged from this iterative, consultative process was an open standards-based architecture that provides equal opportunity to competing technologies including open source based solutions.

Monitoring

Evolving to an open ICT ecosystem is a process where priorities, policies and practices must be reexamined and regularly updated.

- **Audit procurements.** Procurement terms can mandate third party audits of systems developed and installed within a fixed time after the go live date. Such testing assures that procurements result in open, interoperable systems. It may be productive to consider linking final payments to an auditor's confirmation that a system or solution complies with government policies on open standards and related procurement terms.
- **Evaluate performance government-wide.** Agencies must remain accountable for decisions on investment and business needs. Yet, many elements such as open standards may be managed centrally and measured across government, not simply for one agency. A system-wide review should be periodically conducted to validate progress towards the original goals identified in early scoping exercises. Audits, maturity models and process maps should be examined and compared to benchmark progress and identify remaining gaps.

Sustaining

Sustainability is vital for achieving the promised benefits of an open ICT ecosystem. It requires balancing rigid, operational guidelines with the flexibility to evolve in an interoperable manner as new technologies, services, policies and business processes are put in place. When considering how to bring about sustainability within an open ICT ecosystem, focus on the following areas:

- *Organizational Sustainability* – People — managers, users and developers — are the foundation of an organization and its ecosystem. Without human resource planning as part of larger change management efforts, governments are unlikely to achieve sustainability or cost savings. Recruitment, training and retention of qualified professionals must be addressed before major ICT initiatives proceed.
- *Technological Sustainability* – Open ICT ecosystems can ensure a reliable pipeline of technology and innovation by using an architecture-based approach, open standards, procurement policies and collaborating with industry partners. Policies driven by technology neutrality can future-proof the architecture, limiting the impact of changes in source or components.
- *Financial Sustainability* – Governments typically expect to fund initial investments while moving to an open ICT ecosystem. However, recurring costs of support and management will remain. Open standards, interoperability, competition from software choices, the application of performance metrics and cross-agency budgeting can all help drive down these recurring costs.
- *Legal Sustainability* – Open standards are among the basic rules of the ecosystem, but must be made part of a larger framework addressing procurement, licensing, privacy, intellectual property, competition and other issues.

Conclusion

The promise and power of openness is growing. Its combination with technology enables agencies, companies and economies to face the challenges of a customer centric, on-demand world. Increasing an ICT ecosystem's capacity for openness can yield efficiency, growth, and innovation in government and across society. More than just a technology solution, an open ICT ecosystem empowers change in policies, strategies, processes, information, applications and people.

The Roadmap for Open ICT Ecosystems aims to help practitioners better understand open ICT ecosystems and to ensure that their decision-making is a more transparent, considered and collaborative endeavor. Ultimately, the Roadmap is a tool to help people use open ICT ecosystems to transform their society and their lives.

Annex 1: Framework for a Baseline Audit

As the ROADMAP suggests, conducting baseline audits can provide clarity and direction in policymaking for governments (and other enterprises) to better understand what technologies are in use, what expertise can be leveraged, and what costs exist.

Baseline audits might assess specific areas such as:

- legacy technology (the installed base)
- standards
- costs and budgeting
- human resources
- legal framework
- governance structures
- ICT communities
- local industry base
- information policies
- security / privacy policies
- business processes

Annex 2: Openness Maturity Model

Use: to assess the openness of an ICT ecosystem to determine where it is and where it should be headed. This draft Openness Maturity Model (OMM) is offered as a new concept for the global community to help develop. Like other capability maturity models, the OMM is a diagnostic tool to support process improvement for further evolution of the ICT ecosystem.

It may also aid in communicating the vision of open ICT ecosystems to government leaders, setting priorities, identifying key gaps (and centers of excellence) and guiding the management of an increasingly complex ICT ecosystem.

Goal: To provide a tool to benchmark the openness of an ICT ecosystem. It cannot give a score as a measure of openness, although using it may increase the likelihood of success in an effort to open an ICT ecosystem.

Pre-conditions: Use of the OMM assumes a certain level of monitoring and active management. The OMM should be used annually by an operating unit, or any time that a significant change in the ICT ecosystem is planned.

Levels of Openness: Opening an ICT ecosystem is an ongoing process. The evolutionary path to an open ICT ecosystem can be seen as progression of six levels of openness.

Level 0 Mainly Closed
Level 1 Ad Hoc
Level 2 Open Aware
Level 3 Defined and Developing
Level 4 Managed Openness
Level 5 Measured and Sustainable

Ten Features of an Open ICT Ecosystem

1. Interoperability enabled
2. Use of open technologies
3. Architecture framework
4. Architecture development models
5. Communication & compliance
6. Business process led or linked
7. Linkages among operating units/agencies
8. Active management
9. Acquisition strategy/ICT investment
10. Collaborative communities

Levels of Openness

Level 0: Mainly Closed

- Little or no interoperability, use of open technologies or other defining principles or components of open ICT ecosystems.
- ICT processes, templates and standards are not documented.
- Senior management is unaware of presence of open technologies in the ecosystem.

Level 1: Ad Hoc

- Any interoperability is unplanned, though need may be understood.
- Use of open standards and open source is ad hoc, uncoordinated and often unsanctioned. Documentation of business processes and ICT standards is informal and inconsistent.
- Use of modular components and service-oriented processes is minimal.
- Any development of open standards/open source is unofficial.
- Use of open technologies is not communicated among agencies.
- Linkages between business needs/processes and ICT are rare.
- Little sharing of best practices.
- Little active management of ICT ecosystem, though committees may be forming and processes planned.
- At best individual agency may occasionally do procurements that reference open technologies. Most acquisitions are done in isolation with few examples of open and closed technologies competing.
- Any contact with or use of outputs from collaborative communities is unofficial and irregular.

Level 2: Open Aware

- Selected areas of existing interoperability identified.
- Baseline assessment of use of open technologies and overall ICT architecture.
- Initial identification of agencies that have experimented with a service-oriented, modular architecture.
- Some official development of open standards and software.
- Communication between agencies on use of open technologies, but no mandates/policies requiring compliance.
- Isolated examples of agencies linking business processes with ICT processes.

- Awareness of other's use of open technologies leads to selected cases of inter-agency interoperability.
- Only real management is formal efforts to assess openness of ICT ecosystem, but need for more robust governance and strategies is understood.
- Agencies become aware of best practices in incorporating open standards into procurements by other individual agencies.
- Identification of examples of informal collaborative networks developing and maintaining open technologies for use by government.

Level 3: Defined and Developing

- Open ICT vision, goals, principles, components and baseline are defined and documented. Agencies are actively improving interoperability.
- Standards profiles/frameworks and use of open components are defined, accepted and cost-benefit evaluated.
- Service-oriented business, information, architecture and technical frameworks are being defined by open standards.
- Participation in development of open standards and technologies increasing, based on established guidelines, processes and documentation.
- Well established channels of communications for sharing frameworks, policies and best practices for open standards and components.
- Explicit linkage to and documentation of business strategies, needs and processes.
- Some linkages between business processes and systems among agencies.
- Management is actively defining and developing open standards and frameworks.
- Use of open standards in procurement practices of agencies, but no central rules or governance of acquisition strategies.
- Some official encouragement of collaborative processes for defining and developing open components.

Level 4: Managed Openness

- Interoperability frameworks and open standards profiles developed and used to increase interoperability across ecosystem. Openization is part of management culture.
- Use of open processes and components is actively managed and monitored across government and ecosystem.
- Fully developed, common reference models for service-oriented architectures and modular components exist and are used.

- Robust, actively managed programs/processes for developing and revising standards, best practices and policies on open components.
- Linkage of ICT architecture to business processes, integrated with capital investment planning and controls.
- Alignment of business processes, data capture and architectures across agencies. Business case is focus of ICT decisionmaking.
- Senior management is actively coordinating and monitoring use of open standards and components across ecosystem. Metrics developing.
- All procurements are guided by established, common rules on open standards and are documented.
- Policies established to guide and promote official participation in and use of collaborative networks.

Level 5: Measured and Sustainable

- Interoperability is robust and continuously improving.
- Processes (for use and waivers), documentation and metrics are regularly used and updated to optimize openization and innovation of ecosystem.
- Reference models and documentation for reusable, modular, service-oriented architecture used by every agency for every ICT-related decision.
- Teams participate in development of open standards and other components internally, with external partners and organizations.
- Continuous feedback on use of frameworks and components from all agencies drives improvements in developing and managing ecosystem.
- Performance metrics used to optimize linkages and integrate capital planning between business and ICT within and among agencies.
- Active management of all processes and components of ICT ecosystem.
- Explicit governance of all procurement to maximize use of open standards and choice among technologies and providers. No unplanned ICT investment or acquisitions.
- Official efforts to encourage/expand collaborative networks both internally and linked to external communities. Collaborative processes integrated into planning and development activities of management.

Annex 3: Framework for a Business Case

Building a business case is essential for ICT decision-making. A business case will commonly address:

- **External environment:** including the opportunities, limitations and perspectives with respect to the following factors:
  - Economic
  - Legal
  - Demographic
  - Industry
  - Consumer
  - The market
- **Internal environment:** including strengths and weaknesses in:
  - Expertise
  - Technical skills
  - Management
  - Financing
  - Organizational structures
  - Politics
  - Culture inside government
- **Strategic factors:** using a classic SWOT ("strengths, weaknesses, opportunities, threats") analysis to examine key factors such as:
  - Needs
  - Price
  - Customization
  - Quality
  - Performance
  - Market demand (current and potential)
  - Security

- **Feasibility:** using metrics to judge the costs, benefits, risks and contingencies for opening an ICT ecosystem. Developing a comprehensive cost picture will often involve costing out many potential cost issues including (not presented in order of priority):
  - Licensing
  - Contract terms yielding cost differences
  - Training
  - Documentation
  - Consulting (e.g., for systems integration)
  - Application development
  - Application selection
  - Systems administration
  - Deployment/Migration
  - Downtime
  - Software distribution
  - Maintenance and user support
  - Troubleshooting
  - Future upgrades / replacement
  - Savings from standardization
  - Consolidation of vendors
  - Retirement and disposal of legacy technology
  - Changes in productivity
  - Testing
  - Security

Appendix A: Useful Links

Below are links shared by members of the Open ePolicy Group as resources on various topics raised in the Roadmap.

Open Standards

Dutch Government Open Standards Catalogue
http://www.ososs.nl/matrix/matrix.jsp?id=10927

Denmark's XML Project
http://www.oio.dk/dataukveksling/danishXMLproject

Netherlands Programme for Open Standards and OSS in Government
http://www.ososs.nl/index.jsp?alias=english

State of Massachusetts, USA – Open Standards Policy
http://www.mass.gov/Aitd/

United Kingdom – Technical standards for e-Government strategy
http://www.govtalk.gov.uk/interoperability/schemasstandards.asp

Interoperability Frameworks

Brazil – Interoperability Framework
http://www.governoeletronico.e.gov.br

Denmark – Interoperability Framework
http://standarder.oio.dk/English/

European Union – European Interoperability Framework
http://europa.eu.int/idabc/en/document/3473/5585

New Zealand E-government Interoperability Framework
http://www.e-government.govt.nz/docs/e-gif-v-2-1/index.html

Baseline Audits

India – Federal Government's eGovernment Assessment Framework
http://www.egov.mit.gov.in

Federated Architecture

Government of Canada Federated Architecture Program
http://www.tbs-sct.gc.ca/fap-paf/index_e.asp

Danish Government White Paper on Enterprise Architecture
http://www.oio.dk/arkitektur/english

Open Source Software

Open Source Initiative (OSI)
http://www.opensource.org

Government of Canada OSS resources
http://www.tbs-sct.gc.ca/fap-paf/oss-ll/oss-ll_e.asp

Malaysia Public Sector's Open Source Competency Center
http://opensource.mampu.gov.my/

Mitsubishi Research Institute – Free/Libre/Open Source Software Asian Developers Online Survey (2004)
http://oss.mri.co.jp/floss-asia/summary_en.html

SIDA (Sweden) Report on Open Source in Developing Countries
http://www.sida.se/Sida/jsp/polopoly.jsp?d=1265&a=23955

UK – Open Source Report (2001)
http://www.govtalk.gov.uk/documents/QinetiQ_OSS_rep.doc

Wide Open: Open source methods and their future potential (UK, 2005)
http://www.demos.co.uk/catalogue/wideopen/

Other Resources

OECD – Policy Brief on "Open Government"
http://www.oecd.org/LongAbstract/
0,2546,en_2649_34489_34455307_119696_1_1_1,00.html

UNDP-APDIP – Open Regional Dialogue on Internet Governance (ORDIG)
http://igov.apdip.net/

Bob Sutor's Blog – IBM VP of Standards and Open Source on open technologies
http://www-128.ibm.com/developerworks/blogs/dw_blog.jspa?blog=384&roll=0