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Government Role and the Interoperability Ecosystem

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Abstract: This article describes the five facets of the interoperability ecosystem and offers insight into a constructive role for government in facilitating each aspect individually, as well as in promoting the interoperability ecosystem as a whole. The five facets of an "interoperability ecosystem" are: (1) technical interoperability (which is generally product-focused, i.e., designing products to be interoperable off the shelf or with the use of translators or converters); (2) organizational interoperability (focusing on business processes and user-based adoption issues to facilitate efficiencies across organizations); (3) legal/public policy interoperability (i.e., laws and public policies affecting interoperability among government entities and organizations, such as accessibility, privacy, security, etc.); (4) semantic interoperability (i.e., assurance that all systems and users "speak the same language" and understand each other); and (5) the effect of differing political, economic, cultural and social forces upon interoperability. The article concludes, among other things, that as the IT industry evolves, there is an unprecedented level of technical interoperability in the IT industry today that has been achieved by the marketplace in a number of complementary ways, and consequently, government's intervention should be extremely limited. In fact, governmental attempts to mandate technical standards and to prefer a certain

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technology or particular business or licensing model over others can actually undermine the benefits of achieving interoperability by limiting user options and impairing competition, innovation, and consequently economic development opportunities. In contrast, by focusing on understanding and enhancing organizational, legal/public policy, and semantic interoperability, and bridging the critical cultural, economic, and political differences that influence the development of an interoperability ecosystem, governments can improve the overall health of the interoperability ecosystem (including the ability of industry to further enhance technical interoperability) and, by extension, the welfare of their people and their local economies.

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I. INTRODUCTION

In today's increasingly heterogeneous information technology ("IT") marketplace, technical interoperability is an important feature of IT products and services. But the ability to achieve meaningful technical interoperability largely depends upon the health of the broader "interoperability ecosystem."[1] There are five key aspects to an "interoperability ecosystem": technical interoperability (generally product-focused, i.e., designing products to be interoperable or developing translators and converters to facilitate interoperability); organizational interoperability (focused on business processes and user adoption issues to facilitate information exchange and interaction across organizations); legal and public policy interoperability (i.e., laws and public policies impacting upon exchange of information among enterprises such as privacy, regulation of industries, accessibility, or security, and on the development of a healthy interoperability ecosystem as a whole); semantic interoperability (i.e., assurance that all systems and users "speak the same language" and understand each other); and the impact of differing political, economic, cultural, and social forces upon interoperability.

This article examines these various parts comprising the interoperability ecosystem and offers insight into a constructive role for government in facilitating each aspect individually, as well as in promoting a healthy interoperability ecosystem as a whole. It concludes, among other things, that as the IT industry evolves, there is now an unprecedented level of technical interoperability in the IT industry achieved by the marketplace in a number of complementary ways, and consequently government's intervention should be limited.[2] *Meaningful* interoperability comes about by addressing each aspect of an interoperability ecosystem. This perspective is contrary to the oft-argued but simplistic and erroneous view that the best way to effectuate interoperability is a public policy whereby a government mandates technical standards. The article argues furthermore that

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[1] This article uses the term *ecosystem* to import the concept of interactions and dependencies between living and non-living aspects of an environment working together to function as a unit. *See* "Ecosystem," Dictionary.com, http://dictionary.reference.com/browse/ecosystem (last visited Mar. 16 2009).

[2] This article will use the term "government" to describe any government body or agency, national, state, local or multinational (such as the European Commission), which considers the issues of interoperability, whether in the context of industry regulation, procurement, or other aspects of public policy.

government attempts to mandate technical standards, preferring a certain technology or particular business or licensing models over others, can actually undermine the benefits of interoperability by limiting user options and impairing competition, innovation, and local economic development opportunities. By focusing instead on understanding and enhancing organizational, legal and public policy, and semantic interoperability, and bridging the critical cultural and political differences that impact the development of an interoperability ecosystem, governments can improve the overall health of the interoperability ecosystem (including the ability of industry to further enhance technical interoperability) and, by extension, the benefits that accrue to the welfare of their citizens and their local economies.

II. WHAT IS INTEROPERABILITY AND WHY IS IT SO IMPORTANT?

Interoperability, in the broadest sense, is the ability of people, organizations, and systems to interact and interconnect so as to efficiently and effectively exchange and use information.[3] In a sense, interoperability has existed since the inception of human communication. There must always be agreement between the sender of information and the receiver as to protocol (including social concepts such as cooperation), semantics, and even the technology relied upon—such as drums, voice, or digital telephony—to achieve communication.[4] The desire for communication, or more broadly,

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[3] Many have preceded this attempt to define "interoperability;" for example, the European Commission characterized it as "the ability to exchange information and mutually to use the information which has been exchanged." Council Directive 91/250, 1991 O.J. (L 122) 42, 43 (EC).

[4] "Communication" has been defined as "[a] negotiation and exchange of meaning in which messages, people-in-cultures and 'reality' interact so as to enable meaning to be produced or understanding to occur." RUTH FINNEGAN, COMMUNICATING: THE MULTIPLE MODES OF HUMAN INTERCONNECTION 10 (Routledge 2002). Compare this definition to that of "interoperability" at footnote 3 and the accompanying text of this article. Finnegan describes:

> Human creatures call on a vast array of resources for this interconnecting [to communicate] .... We use gestures, sounds, writing, images, material objects, bodily contacts, supported by the more or less agreed conventions through which we variously recognise such usages as purposive forms of interaction and mutual influence. Through activating our voices, touches and movements we can share wishes or emotions with others; make visible movements of our bodies to encounter or avoid each other in public places; utilize pictorial displays, visually codified graphics, and three-dimensional artifacts to interconnect over space or

social interaction, has most recently been confirmed in IT by the explosion in the use of e-mail, Short Message Service ("SMS"), and the Internet as a whole over the past twenty years, and more recently by the rapid, widespread adoption of social networks such as MySpace, Facebook, and Twitter.[5] In today's increasingly heterogeneous IT marketplace, technical interoperability is an important feature of IT products and services, but the ability to achieve *meaningful* interoperability largely depends upon the health of the broader "interoperability ecosystem." Thus, technical interoperability must be pursued alongside the often more complex and challenging goals of organizational, legal and public policy, and semantic interoperability. So too might a successful implementation need to address cultural, political, social, and economic barriers to interoperability.

A successful implementation of interoperability facilitates efficient inter- and intra-organizational collaboration and information sharing, creating opportunities to enhance integration of functions across enterprises.[6] Interoperability can reduce redundancies in data and

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time. Deploying these communicative resources is fundamental to our human existence.

Id. at 6.

[5] *See* Alex Wright, *Primal Interactions*, 15 INTERACTIONS 11, 11 (Jan.–Feb. 2008), *available at* http://delivery.acm.org/10.1145/1340000/1330532/p11-wright.pdf?key1=1330532&key2=0553925321&coll=GUIDE&dl=GUIDE&CFID=23081846&CFTOKEN=39221111 (citing STEVEN PINKER, THE LANGUAGE INSTINCT (Perennial 1995)) (describing how linguist Walter Ong believes that current forms of electronic communications such as blogs and other user-generated content have greater analogy to oral cultures than newer literate cultures; describing further that Steven Pinker "points out, most people learn to read and write only with great difficulty, after years of grueling education. But we are born babblers, the 'talking ape.'" Wright summarizes Pinker's observations: "The resurgence of oral culture online is simply a natural manifestation of this deep-seated human instinct.").

[6] Theresa Pardo & Brian G. Burke, *Improving Government Interoperability: A Capability Framework for Government Managers*, CENTER FOR TECH. IN GOV'T, Oct. 2008, www.ctg.albany.edu/publications/reports/improving_government_interoperability ("improving interoperability through the use of information and communications technologies (ICTs) can deliver value to governments and the public. ICTs, when effectively designed and deployed, can enable interoperability within networks of government, private sector and other key organizations."). Of course, this article assumes the favorable attributes described are being sought by the enterprise or enterprises at issue. Interoperability is accompanied by trade-offs, as will be discussed. Furthermore, the article assumes a sufficient market maturity and capability to achieve the broader demands needed to achieve meaningful interoperability. It is worth noting that an enterprise incapable of addressing the broader issues of interoperability should be cautious in how it approaches interoperability, lest the endeavor result in disappointment. *See* Panagiotis Germanakos et al., *A European Perspective of e-Government Presence– Where Do We*

resources by making it easier to integrate systems, even those from a variety of vendors, and thereby access data spread across these disparate, but interconnected systems.[7] This can translate into greater operational efficiency and substantial economic benefits to an enterprise, and ultimately to the greater economy, in terms of both systems architecture and workforce resource demand. Increasingly, users of IT are seeking greater interoperability. Examples abound illustrating the improved service that can come about with greater interoperability. Shipping and logistics, consumer services, the delivery of healthcare, government services to its citizens, and improved national security through greater information sharing all benefit from and demand greater interoperability.[8]

Interoperability itself enables the development of new features and capabilities that can themselves give rise to the need for greater interoperability. Take, for instance, the development of electronic funds transfers in banking, the automated teller machine ("ATM"), and online banking. As banks converted their internal business processes to the digital realm, they implemented IT to manage their business and the flow of currency.[9] As the systems were made more interoperable across the industry, banks were able to shift from an inter-bank funds management system based on paper, to electronic

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Stand? The EU-10 Case, *in* LECTURE NOTES IN COMPUTER SCIENCE 436, 445 (Springer Berlin 2007), *available at* http://www.springerlink.com/content/r411134367j27861 ("The eGovernment has been proving that it can influence positively public administrations to become more productive and offer citizens services for all, in an open and transparent way. The benefits of eGovernment can go far beyond the early achievements of online public services. It is essential that the public sector adapts its organizations and skills for a user-centered approach in which technology is serving people. There are, however, many barriers and obstacles to overcome and sizeable investments are needed. 'Change processes in organizations and culture take time . . . .'").

[7] *See* Laurence C. Baker, *Benefits of Interoperability: A Closer Look at the Estimates*, HEALTH AFFAIRS, Jan. 19, 2005, http://content.healthaffairs.org/cgi/content/full/hlthaff.w5.22/DC1 (providing a close examination of the savings gained by health care information exchange and interoperability).

[8] *See* Pardo & Burke, *supra* note 6; *see also* Encyclopedia:Interoperability, Nationmaster.com, http://www.nationmaster.com/encyclopedia/Interoperability (last visited Mar. 23, 2008) (stating the application and interaction between interoperability and services in various areas).

[9] *See* William C. Niblack, *Development of Electronic Funds Transfer Systems*, FED. RES. BANK OF ST. LOUIS REV., Sept. 1976, at 10, *available at* http://research.stlouisfed.org/publications/review/76/09/Development_Sep1976.pdf.

funds transfers and accounting.[10] Subsequently, with the digital "back-office" in place, these systems evolved into customer-facing electronic banking with technologies such as ATMs and online banking.[11] In time, as industries and services in general shifted from paper to electronic business and accounting processes, interoperable banking and digital accounting systems facilitated comprehensive online bill payment systems.[12] With each step of the technological evolution, broader intra- and inter-enterprise interoperability was necessary, the interoperability challenges were met and industry-transforming efficiencies were attained.

One dominant reason interoperability is increasingly important is the convergence of previously distinct information technologies. This is evidenced on one hand by the substantial transformation of the computing industry from isolated mainframes to network-connected technologies (which I will further detail in my discussion of technical interoperability and "silos" at Section IV.A.3); and on the other hand, each category of devices, computers, telephones, and audio and video consumer electronic devices, have taken on features and capabilities of the others, blurring and even erasing differences. Interoperability has facilitated this industry-changing technological transformation and is the key to interactions among these devices. Additionally, the level of maturity in certain sectors of the IT industry played a role in this transformation. In areas such as mainframe computing, servers, and operating systems, there has been substantial consolidation, and in many cases, domination by only one or two companies such as Hewlett-Packard, IBM, Microsoft and Sun.[13] But as long as there have

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[10] *See id.*

[11] *See id.; see also* Patiwat Panurach, *Money in Electronic Commerce: Digital Cash, Electronic Fund Transfer, and Ecash*, 39 COMMS. OF THE ACM 45 (1996), *available at* http://delivery.acm.org/10.1145/230000/228512/p45-panurach.pdf?key1=228512&key2=1480559021&coll=GUIDE&dl=GUIDE,ACM&CFID=26024773&CFTOKEN=51965473.

[12] *See id.*; *see also* JOHN SKIPPER, ELECTRONIC BANKING AND PAYMENTS (1998), *available at* http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=00755959.

[13] See discussions of the history and market for mainframe computers, operating systems and servers, respectively at Encyclopedia: Mainframe Computer, Nationmaster.com, http://www.nationmaster.com/encyclopedia/mainframe-computer (last visited Mar. 23, 2009); *Encyclopedia:* Operating Systems, Nationmaster.com, http://www.nationmaster.com/encyclopedia/operating-systems (last visited Mar. 23, 2009); *Encyclopedia:* Servers, Nationmaster.com, http://www.nationmaster.com/encyclopedia/Servers (last visited Mar. 23, 2009).

been market-dominant vendors, customers have been concerned about what has become known as "vendor lock-in."[14] In other words, customers have wanted flexibility in choice of vendors, as well as the ability to integrate their choice of the most appropriate products from different vendors. These market demands have been one of the major drivers motivating an industry that now offers much wider choice in terms of products and solutions that embody greater emphasis on interoperability. The result has been an opportunity for greater competition.[15]

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[14] JOEL WEST, WHAT ARE OPEN STANDARDS? IMPLICATIONS FOR ADOPTION, COMPETITION AND POLICY 11–12 (2004), http://www.chicagofed.org/news_and_conferences/conferences_and_events/files/west.pdf ("Buyers making capital investments with high switching costs recognize the risks of 'lock-in,' and, in particular, the potential for vendors to use that lock-in to extract rents from buyers who have no reasonable alternative. Thus, buyers seek both to reduce such lock-in through multiple suppliers, and also (where possible) to use the threat of such suppliers to bargain down prices prior to accepting lock-in [internal citation omitted]. . . ." West continues, "The modern history of I.T. vendor lock-in dates to IBM's 1964 introduction of the System/360. By providing a common set of platform standards across a wide range of prices and capabilities, the S/360 mainframe product family proved extremely popular in the 1960s and 1970s and attracted dominant market share in the U.S., Europe and Japan [internal citation omitted]. IBM's dominance sparked the initial push for 'open' standards in Europe during the 1980['s]."). *See also* Luis Guijarro, *Interoperability Frameworks and Enterprise Architectures in E-Government Initiatives In Europe and The United States*, 24 GOV'T INFO. Q. 89, 91 (2007) (describing the ISO response in the 1980's to the public administration concerns about vendor lock-in).

[15] For example, through interoperability using virtualization, enterprises are now able to incorporate Sun, Microsoft, Apple or Linux servers and operating systems into the same enterprise architecture, allowing the user to deploy the most appropriate technology for their purposes. Such interoperability has also expanded the opportunity for competition in the server market. *See* Sandra Rossi, *Virtualization Driving Further Consolidation*, INFOWORLD, Apr. 24, 2008, http://www.infoworld.com/news/feeds/08/04/24/Virtualization-driving-further-consolidation.html (Gartner research expects virtualization to generate a new wave of competition among technology vendors that will result in considerable market disruption and consolidation over the next few years); Michael Keen, *Virtualization: A Building Block to An Agile Enterprise*, DABCC, Feb. 17, 2009, http://www.dabcc.com/article.aspx?id=9905. As another example, although Apple and others support Microsoft-developed, market-dominant document formats, Microsoft is now supporting a number of competing formats, including Open Document Format ("ODF") and PDF, within its Office software. This arguably enhances the opportunity for market competition for word processors and other office applications. *See* Press Release, Microsoft Expands List of Formats Supported in Microsoft Office (May 21, 2008), *available at*, http://www.microsoft.com/presspass/press/2008/may08/05-21ExpandedFormatsPR.mspx.

The increasing demand for interoperability as a feature in products is fueled by another trend. As Henry Chesbrough describes it, for many years the IT industry relied on a "closed innovation" model, i.e., all research and development occurred within the walls of a company and was commercialized and supported exclusively by that company.[16] Businesses were guided by the principles of hiring the best and the brightest, inventing first to assure they brought innovative new products to the market before anyone else, and controlling their intellectual property so as to exclude all competitors.[17] One result of this process was manufacturer-specific discrete systems that were generally not interoperable with the products of competitors.[18] Over the last two decades, however, there has been a paradigm shift to "open innovation."[19] Open innovation assumes companies should use outside ideas as well as internal research, and should use external avenues to the market to both advance their own technologies and maximize value from internal research.[20] Open innovation was born out of the recognition that a company can no longer expect to retain the largest share of the smartest people and thereby consistently produce the most innovative ideas, but rather, it needs to look outside its walls to innovation developed by others.[21] Businesses realized that rather than relying on intellectual property to exclude others from the market in which they dominate, intellectual property transactions (licensing, co-development, etc.) could be the key to beneficial new relationships.[22] With these and other changes in the industry such as the emergence of

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[16] HENRY W. CHESBROUGH, OPEN INNOVATION: THE NEW IMPERATIVE FOR CREATING AND PROFITING FROM TECHNOLOGY XX, 21–24 (Harvard Business School Press 2006).

[17] *Id.*

[18] *Id.* at 96–97 (as exemplified by IBM's mainframe computing business model, whereby IBM researched, designed, and maintained proprietary control over all the key elements of their system architecture which resulted in both high reliability and quality, but also high switching costs for IBM customers).

[19] *Id.* at 43–62.

[20] *Id.* at 53 (summarized in Box 3-1, at 44).

[21] *Id.* at xxvi (Table I-1), 45–51 (comparing the central R&D lab of the closed innovation paradigm to the appropriate means to advance technology in a world of abundant knowledge).

[22] *Id.* at 56–57 ("[o]pen Innovation companies use licensing extensively to create and extend markets for their technology.").

multiple successful business models and the greater participation of entrepreneurs in the field, the IT industry has flourished and innovation is occurring at an unprecedented pace.[23] With these facts in mind, one can see that interoperability has become a fundamental characteristic of a strong, modern, global IT industry.

Interoperability is also valuable to meet the needs of industrial globalization. Nearly any business or government can now have a global reach.[24] This drives a need for greater interoperability between the services and products across national borders. For example, globalization and global mobility of users increases the need for

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[23] Posting of Timothy Cloonan to Gartner– Ten Technologies and Trends for 2009, http://tbird827.wordpress.com/2008/10/10/gartner-ten-technologies-and-trends-for-2009 (Oct. 10, 2008) (describes Gartner Inc. analysts' top ten technologies and trends that will be strategic for most organizations in 2009). At least four of the technologies identified are deployments of technologies that rely on or produce interoperability: virtualization (*see* SearchServerVirtualization.com (last visited Mar. 23, 2009) ("Virtualization is the creation of a virtual (rather than actual) version of something, such as an operating system, a server, a storage device or network resources .... Operating system virtualization is the use of software to allow a piece of hardware to run multiple operating system images at the same time,")); web-oriented architecture (*see* Posting by Dion Hinchcliffe, The SOA with Reach: Web-Oriented Architecture, http://blogs.zdnet.com/Hinchcliffe/?p=27 (Apr. 1, 2006, 14:31 EST)) ("WOA describes a core set of Web protocols like HTTP and plain XML as the most dynamic, scalable, and interoperable Web service approach.")); enterprise mashups (JOHN PALFREY & URS GASSER, MASHUPS INTEROPERABILITY AND EINNOVATION 2, 33 (2007), http://cyber.law.harvard.edu/interop/pdfs/interop-mashups.pdf ("mashups exemplify Web services technology, fusing data from two or more Web applications to create an integrated experience informed by the original data sources, and social software and social networking ... all mashups inherently take advantage of interoperability." The article concludes that "interoperability can stimulate large-scale innovation,")); social software and social networks (*see* Marc Canter, *Perspective: Open Standards for Social Networks*, CNET NEWS, July 5, 2007, http://news.cnet.com/Open-standards-for-social-networking/2010-1038_3-6194817.html).

[24] Madanmohan Rao, *The Internet and Global Trade: Potential for the Asia-Pacific Region*, ONTHEINTERNET, Jan.–Feb. 1997, http://www.isoc.org/oti/articles/0197/rao.html (describing the value of the Internet to businesses to fine new markets around the world and for governments to increase import and export trade). *See* Laurie Flynn, *Strong Holiday Season Lifts Amazon's Revenues*, N.Y. TIMES, Jan. 31, 2008, http://www.nytimes.com/2008/01/31/technology/31amazon.html?_r=1&ex=1359522000&en=5dcf6157ad71e943&ei=5088&partner=rssnyt&emc=rss&oref=slogin (The growth of Amazon's international sales outpaced sales in the United States during the fourth quarter. Sales in the United States and Canada increased 40%, to $3.08 billion, while international sales climbed 46%, to $2.59 billion.). *See also Smooth Sailing to a Global Market: Technology and a Declining Dollar are Making It Much Easier for Small Outfits to Export Their Wares, as Sailmaker Tim Yourieff Explains*, BUS. WEEK, July 9, 2009, http://www.businessweek.com/print/smallbiz/content/jul2003/sb2003079_9440.htm?chan=sb.

interoperability among IT systems developed in one country that may be required to exchange information with IT systems in another.[25] The expansion of global trade, growth in the number of multinational corporations, and the advent of outsourcing have increased the need for more uniform international adoption of IT interoperability.[26] Multinational companies rely on interoperability that crosses the spectrum of their entire manufacturing chain.[27] Thus, interoperability has grown to be generally viewed as a favorable attribute for IT. This leads to a need to understand how best to achieve *meaningful* interoperability.[28]

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[25] *See* Joe Brancatelli, *One World, One Phone?*, CONDE NAST PORTFOLIO.COM, May 22, 2007, http://www.portfolio.com/business-travel/seat-2B/2007/05/22/One-World-One-Phone (describing the new generation of mobile (cell) phones that will work on networks in any country "on the planet," regardless the technology the network uses); *see also* David Pogue, *From TV to Laptop or Smartphone, via the Internet*, INT'L HERALD TRIB., Nov. 1, 2007, http://www.iht.com/articles/2007/10/31/technology/PTPOGUE01.php?page=1 (describing the current technologies such as time-shifting TiVo and place-shifting Slingbox which, in combination with many smartphones or an Internet-connected laptop, allow a user to view her home cable or satellite television programming anywhere in the world at any time).

[26] *WS-I Profiles Structure Supply Chain Interoperability for Ford Motor Company, Through AIAG*, VIRTUALIZATION, Dec. 8, 2008, http://br.sys-con.com/node/770718 (describing a case study by the Web Services Interoperability Organization examining the technology developed by the Automotive Industry Action Group that facilitates interoperable, secure business-to-business web services across the entire supply chain for Ford Motor Company).

[27] *Id. See also*, David O. Stephens, *The Globalization of Information Technology in Multinational Corporations*, 33 INFO. MGMT. J. 66, 68 (1999), *available at* http://www.allbusiness.com/technology/internet-technology/376381-1.html; *see also MOEA, WiMAX Firms Sign MOUs to Promote Technology*, THE CHINA POST, Oct. 23, 2007, http://www.chinapost.com.tw/business/2007/10/23/127784/MOEA,-WiMAX.htm; *Satellite to be Blasted Off Within Sea Launch Project Mon*, ITAR-TASS DAILY, Mar. 17, 2008, http://dlib.eastview.com/sources/article.jsp?id=13667057; "INTERFAX IT & Telecom Report"– Interfax Round-up, Wednesday, March 9, 2005 (wherein headlines include "Italy's Technosystem Supplies Equipment To Russian Broadcaster" and a story describing that "Russia's biggest cellular operator Mobile TeleSystems and Japan's largest, NTT DoCoMo, have signed a partnership agreement").

[28] Such an understanding will also bring to light those areas of technology, enterprises, or markets that are less mature, and therefore not yet capable of achieving interoperability, or doing so may be less a priority or not feasible.

III. THE INTEROPERABILITY ECOSYSTEM

Expanding on the previous categorizations such as those identified by William Arms, Professor of Computer Science at Cornell University, and more recently the European Commission, the term "interoperability ecosystem" encompasses the interoperability, information exchange and collaboration among people, organizations, and systems.[29] There are five facets of the interoperability ecosystem.

This article details:

- Technical interoperability: "The ability to operate software and exchange information in a heterogeneous network, i.e., one large network

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[29] William Y. Arms et al., *A Spectrum of Interoperability*, 8 D-LIB MAG., Jan. 2002, http://www.dlib.org/dlib/january02/arms/01arms.html; EUROPEAN COMMISSION, EUROPEAN INTEROPERABILITY FRAMEWORK FOR PAN-EUROPEAN EGOVERNMENT SERVICES 17–24 (2004), http://ec.europa.eu/idabc/servlets/Doc?id=19529. Luis Guijarro provides a summary of such descriptions. Luis Guijarro, *Frameworks for Fostering Cross-Agency Interoperability in e-Government Initiatives*, Submitted to Electronic Government: Information, Technology, and Transformation, within the Advances in Management Information Systems ("AMIS") Series published by ME Sharpe, Sept. 2007, http://www.epractice.eu/files/upload/workshop/1870-1191917870.pdf. Another approach to a large subset of characterizations described in this work has been defined as *Enterprise Architecture*. J.A. Zachman, *A Framework for Information Systems Architecture*, 26 IBM SYSTEMS J. 276 (1987), *available at* https://www.research.ibm.com/journal/sj/263/ibmsj2603E.pdf. Zachman developed a popular approach to enterprise architecture. *Id.*

Guijarro eloquently summarizes,

> The Zachman Enterprise Architecture Framework organises the descriptive representations of an enterprise in a matrix. Each cell in the matrix represents the intersection of a particular focus (data, function, network, people, time, and motivation) and a perspective (contextual, conceptual, logical, physical, and out of context). Each focus relates to one of the Aristotelian questions "what, how, where, who, when and why," and each perspective relates to one of the following roles: the planner, the owner, the designer, the builder and the subcontractor. Finally, models (e.g. business models, data models, object-oriented models) are the language of the framework, and are contained within the cells. For example, a business process model may be used for describing the enterprise from the conceptual perspective and the function focus, whereas describing the enterprise with the same focus but from the logical perspective, that is, the perspective of the designer, may be better fulfilled by an application architecture.

Guijarro, *supra*, at 3.

made of several different local area networks [or computer systems]."[30] This is achieved through several complementary and time-tested means. Companies can facilitate technical interoperability by licensing in or making their intellectual property available to others in a variety of mutually beneficial ways. A company can design its product to interoperate, or devise translators or converters to facilitate interoperability between their own products or those of other companies. Several companies can collaborate to facilitate interoperability between their respective products. Finally, industry can adopt technical standards that, where implemented, facilitate technical interoperability.

- Organizational interoperability: The condition under which the organizational structure and the business goals and processes of an enterprise facilitate efficient collaboration and information exchange. This facet also addresses management and employee "buy-in" to interoperability and the training necessary to enable interoperability and to encourage and facilitate the adoption of workplace behaviors and employees' use of interoperable systems.

- Legal and public policy interoperability: Some situations require changes to the law or public policy to facilitate information exchange and other aspects of interoperability and promote a healthy interoperability ecosystem. This issue arises in the contexts of regulated industries, such as banking, healthcare, and insurance, or in government enterprises, such as law enforcement, counter-terrorism, and intelligence. In some cases, privacy, consumer protection, or other laws are implicated and

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[30] HARRY NEWTON, NEWTON'S TELECOM DICTIONARY 389 (CMP Books, 18th ed. 2002).

require appropriate revision to facilitate and set the terms for collaboration or information exchange.

- Semantic interoperability: Interoperability requires that all participants and devices "speak the same language" and understand each other. The human intellect can often discern meaning from context, reasonably distinguish words that have similar meanings or identical spellings, and so forth. In this sense, there is little need to formally agree in advance upon terms and meanings, because much of this work is the natural product of societal interaction. But when pursuing interoperability in the IT context, the semantics and syntax of communication must be formalized in such a way that users know the appropriate inputs and the computing system recognizes meaning with few errors.

- The impact of different political, cultural, social and economic paradigms: Differences in cultural, religious, and intellectual perspectives and values, and political, social, economic, and strategic goals may shape how governments or communities approach the goal of achieving interoperability. These factors will have an influence on decisions about each facet of the interoperability ecosystem and whether or how a society or government will consider the broader interoperability ecosystem.

IV. THE ROLE OF GOVERNMENT AND THE INTEROPERABILITY ECOSYSTEM

A healthy interoperability ecosystem can enable enterprises to gain efficiencies by facilitating collaboration and eliminating redundant services, business processes, data, and infrastructure. In the case of government enterprises, this can result in more efficient service to citizens in almost all areas of government service, including better healthcare, education, economic development opportunities,

emergency services, and national defense.[31] The same can be said regarding the efficiencies gained in the private sector.[32] In general, a healthy interoperability ecosystem can enable innovation for users, greater trade opportunities, and industrial and economic development.[33] A healthy interoperability ecosystem is also essential in the current "open innovation" marketplace, as interoperability underlies the ability of companies to work together, exchange intellectual property, and build business and technical relationships.[34] In the modern global business environment, these relationships could cross borders and industry sectors well beyond the IT industry. It is in the government's interest to foster this business environment and encourage the economic development that can be derived from these market conditions. Thus, government should take a keen interest in developing a healthy interoperability ecosystem and recognize that in doing so, it will directly benefit its citizens and economy as a whole.[35]

The interoperability ecosystem benefits most when the stakeholders leverage their core competencies. The IT industry is

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[31] *See* Pardo & Burke, *supra* note 6.

[32] *Id.*

[33] *See, e.g.*, Laura Sallstrom & Robert Damuth, *IT in the Economy of India: A Vital Tool for Economic Prosperity*, NASSCOM (2005), http://www.nasscom.in/Nasscom/templates/NormalPage.aspx?id=4985 (this study provides data demonstrating that ICT use contributes to economic growth and has direct societal benefits and observes that government policies that support market-led interoperability and standards promote ICT use).

[34] CHESBROUGH, *supra* note 16, at 182–84.

[35] Michiel Malotaux et al. observe that:

> [t]he principal value of interoperability is that it helps to develop and deploy agreed interfaces between organizations. Agreed interfaces provide for relative independence, which in turn allows organizations to develop and deploy new (public) services, with the guarantee that they can use, and be used by, existing services of other organizations. The net result is that myriads of organizations can re-use existing services to provide new services only limited by their own creativity. This is part of the so-called "Web 2.0" phenomenon, which is already transforming business models in the private sector and yields a great potential in the public sector as well.

INTEROPERABLE DELIVERY OF PAN-EUROPEAN EGOVERNMENT SERVICES TO ADMINISTRATIONS, BUSINESSES, AND CITIZENS, PREPARATION FOR UPDATE EUROPEAN INTEROPERABILITY FRAMEWORK 2.0– FINAL REPORT, 4.6.2007 iv (2007), http://ec.europa.eu/idabc/servlets/Doc?id=31505.

most capable and has proven its ability to develop and promote technical interoperability.[36] As this article explores, governments (as well as non-governmental organizations and transnational institutions) are often in the best position and most able to promote or directly facilitate other facets of interoperability and thereby contribute to the health of the interoperability ecosystem generally. Often the question of interoperability is brought before governments by interested parties; companies that would benefit from a government technical requirement or procurement policy that shapes the government's approach with regard to interoperability, such as a requirement for open source software, to the preclusion of proprietary software, or a demand for public policy whereby a government mandates a particular technical standard as the most effective approach to effectuating interoperability.[37] In the author's view, this is simplistic and can be misleading, particularly to the uninitiated. In the real world, enterprises use a combination of technologies; it is a world of *and,* not a world of *either/or.*[38]

A major factor driving a focus on open source requirements or mandatory standards is that numerous business models have evolved in the IT industry and some companies have no stake in the specifics of technical interoperability, but recognize that such mandates, as opposed to other approaches to interoperability, benefit their particular business model.[39] Under one common business model, IT

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[36] Stacy Baird, *Government at the Standards Bazaar,* 18 STAN. LAW & POL'Y REV. 35, 41–60 (2007) (describing that industry is best suited to develop standards—the core technologies to facilitate technical interoperability—and that this view is well supported by government experts and policies).

[37] *See* Klaus Dieter Naujok, *In a Perfect World,* Klaus' Korner, April 6, 2008, http://www.klauskorner.com/Klaus_Korner/Blog/Entries/2008/4/6_In_a_perfect_World_....html (describing the lobbying of IBM in opposition to the Microsoft-developed document format, Open XML, to become an ISO standard); *see also* DOUGLAS HEINTZMAN ET AL., REACTION BY IBM TO THE FINAL REPORT PREPARED BY GARTNER– PREPARATION FOR UPDATE EUROPEAN INTEROPERABILITY FRAMEWORK 2.0 (2007), http://ec.europa.eu/idabc/servlets/Doc?id=29695 (strongly opposing the adoption of arguments that multiple standards are good).

[38] *See, e.g.,* Stacy Baird, *The Heterogeneous World of Proprietary and Open-source Software,* ACM INT'L CONF. PROC. SERIES (Proceedings of the 2nd International Conference on Theory and Practice of Electronic Governance) (Dec. 2008) (describing the current state of enterprise architecture may incorporate both open source and proprietary software, and illustrating how the major software companies are extremely active in both arenas).

[39] For example, IBM has been a major proponent of open-source software, and simultaneously advocated for open-source government mandates. *See* Paula Rooney, *IBM*

developers derive revenues for their technologies through sales and licensing of intellectual property ("IP").[40] This describes the typical software development company.[41] In contrast, a company with a business model based on service, consulting, or technology integration may place little or *no* value on IP because their revenues derive from the services they provide, not the value of the IP associated with the technology they sell, integrate, or maintain. In fact, the company with a service-oriented business model may prefer to promote technologies that have no IP rights associated with them. The benefits to the service company are two-fold. First, the approach undercuts competitors whose business model relies on revenues from IP because "free" is easier to sell than the alternative. Second, the approach may directly enhance their revenues if the "free" technology has certain other features (for example, incomplete architecture that is designed to allow for built-upon customization or the implementation of certain software that requires extensive re-coding before it is useful to the

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Plans Big Push Beyond Linux Into Open Source, CHANNEL WEB, Aug. 15, 2006, http://www.crn.com/software/192200208 (describing IBM's business model built around open-source software and the services and hardware to support open-source software); *see also* John Fontana, *Massachusetts Puts Open XML Out for Consideration*, PC WORLD, July 4, 2007, http://www.pcworld.com/article/134156/massachusetts_puts_open_xml_out_for_consideration.html (describing the Massachusetts government's reversal in position regarding document formats, first only adopting the open-source Open Document Format, but at the juncture of this writing, considering accepting the newly ECMA-adopted standard based on Microsoft's Office XML specification, and the IBM opposition to both ECMA's adoption of the standard and to Massachusetts' acceptance of the then newly-minted ECMA standard). Ultimately, the ECMA standard was adopted by the International Standards Organization ("ISO") and Massachusetts as an open standard for the purposes of meeting state requirements that all government agencies use the enumerated open standards for document creation. Scott Fulton III, *Massachusetts: MS Open XML Now in Equal Standing with ODF*, BETANEWS, Aug. 1, 2007, http://www.betanews.com/article/Massachusetts_MS_Open_XML_Now_in_Equal_Standing_with_ODF/1186018583; Scott Fulton III, *ISO Certifies MS Office Open XML, Just Barely, With 75% Approval*, BETANEWS, Apr. 1, 2008, http://www.betanews.com/article/ISO_certifies_MS_Office_Open_XML_just_barely_with_75_approval/1207064735.

[40] John Carroll, *In Defence of Proprietary Software*, BUILDER.AU, Dec. 18, 2003, http://www.builderau.com.au/strategy/businessmanagement/print.htm?TYPE=story&AT=320282014-339028271t-320000989c ("Proprietary software exists for one simple reason: as a means of enabling software as such to generate revenue. When software generates profit, it enables companies to grow, attracts investment (as investors prefer profitable companies as a place to put their money) and enables those companies to grow into tremendous sources of innovation and local employment.").

[41] *Id.*

enterprise) that result in the need for greater consulting and integration time, possibly on an ongoing basis.[42] Thus, such a company may advocate public policies to mandate specific standards (and possibly policies that demand that standards are free of IP licenses) to the intentional detriment of other, competing, business models such as those that rely on IP revenues. Therefore, as one examines arguments favoring one approach to technical interoperability over others, one should consider the source of the argument and particularly, the relationship of the solution being promoted to the revenues that may derive. Notably however, some of the interest in standards mandates arises because those encouraging the mandates lack a sufficient understanding of the IT industry and the many means by which the industry is achieving technical interoperability. Therefore, although mandating an IT standard or requiring that all software must be free and open-source *may appear* to be the best public policy course to achieve effective (and cost effective) interoperability, such pursuit is typically misguided.[43] Indeed, this article will describe how such policies may lead to the opposite result as that which is desired. This article encourages governments to assert greater focus on the other, more challenging aspects of interoperability. To do so should be fruitful in cultivating a healthy interoperability ecosystem and achieving *meaningful* interoperability.

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[42] Jonathan Schwartz's Blog: Free Software has No Pirates, http://blogs.sun.com/jonathan/entry/sharing (June 16, 2005, 17:48 EST) (wherein the CEO and President of Sun Microsystems explains the Sun business model around open-source software). *See* Lee Curtis, *Business is Booming for Open Source Adopters*, CRN AUSTRALIA, Feb. 19, 2009, http://www.crn.com.au/Feature/5680,business-is-booming-for-open-source-adopters.aspx ("All three [Red Hat, Novell and Oracle] offer enterprise Linux support and software. The enterprise titans: Oracle, HP and IBM are developing, supporting, deploying and profiting from open source. It's a great business to be in. And the software is free. How does that work? It's all about the value of a solution and the services that deliver it.").

[43] *See* Baird, *Heterogeneous World, supra* note 38 (the major vendors, Sun, IBM, Microsoft, Oracle and others, have embraced both proprietary and open-source approaches to software development and licensing and in their business models, as well as proprietary, open and *de facto* standards. All of the software companies discussed are working toward a high degree of interoperability among technologies regardless these factors).

A. TECHNICAL INTEROPERABILITY

1. TECHNICAL INTEROPERABILITY DESCRIBED

Technical interoperability is defined as "the ability to operate software and exchange information in a heterogeneous network, i.e., one large network made of several different local area networks [or computer systems]." [44] It is typically the easiest aspect of the interoperability ecosystem to accomplish and it is among the highest priorities for the IT industry. For many years, the industry has been pursuing technological integration between previously autonomous computer systems (e.g., mainframes), and now, more broadly related technologies (e.g., computing, consumer electronics, broadcast and telecommunications). [45] Furthermore, each of these industries has sought to respond to users' increased demand for interoperability as

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[44] NEWTON, *supra* note 30. *See also* WhatIs.com, http://www.whatis.com (search "interoperability") (last visited Jan. 20, 2009); C.M. Preston & C. Lynch, *Interoperability And Conformance Issues In The Development And Implementation Of The Government Information Locator Service (GILS)* (published within W.E. Moen & C.R. McClure eds., *The Government Information Locator Service (GILS): Expanding Research and Development on the ANSI/NISO Z39.50 Information Retrieval Standard,* Final Report (NY School of Information Studies, Syracuse University 1994)) (defining interoperability as occurring when "components of a system . . . communicate with one another effectively, correctly, and provide the expected services to the user."); Interoperable Delivery of European eGovernment Services, *What is Interoperability for European eGovernment Services?*, http://ec.europa.eu/idabc/en/document/5313/5883 (defining interoperability as "the ability of information and communication technology ("ICT") systems and of the business processes they support to exchange data and to enable sharing of information and knowledge") (last visited Feb. 8, 2009); 44 U.S.C. § 3601(6) (2000) (defining interoperability as "the ability of different operating and software systems, applications, and services to communicate and exchange data in an accurate, effective, and consistent manner"). The U.S. National Telecommunications and Information Administration defines interoperability as "[t]he ability of software and hardware on different machines from different vendors to share data." NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION, IPV6 DISCUSSION DRAFT 75, http://www.ntia.doc.gov/ntiahome/ntiageneral/ipv6/draft/discussiondraftv13_07162004.pdf. *See also,* the Government Information Locator Service ("GILS") definition provided at the GILS system overview, "A condition that exists when the distinctions between information systems are not a barrier to accomplishing a task that spans multiple systems." Moen & McClure, *supra*, at Appendix B (Glossary).

[45] Craig Birkmaier, *Convergence,* BROADCAST ENGINEERING, May 1, 2008, http://broadcastengineering.com/iptv/convergence (discussing the early "collision" behavior of consumer electronics and broadcasters and the computer industry, as compared to the well accepted, even accelerated convergence between industries now ongoing with all industries viewing convergence as an opportunity, not a barrier to business).

users integrate disparate legacy IT systems (a particularly complex aspect of achieving technical interoperability) and otherwise pursue greater information sharing and collaboration. [46] These facts, combined with recognition of the significance of open innovation to the modern IT marketplace, evidence the degree to which industry has placed heightened emphasis on technical interoperability.

There are many common means used by industry to achieve technical interoperability, particularly in the modern fields of electronics and computing. Industry approaches can be categorized under five broad headings:

1. Access to technology and intellectual property through various legal frameworks that allow for the sharing of

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[46] *See generally* ROBERT C. SEACORD ET AL., MODERNIZING LEGACY SYSTEMS: SOFTWARE TECHNOLOGIES, ENGINEERING PROCESSES, AND BUSINESS PRACTICES (Addison-Wesley 2003) (describing the causes of, challenges to, processes for and other considerations regarding modernizing legacy systems). Taking government (as an IT customer) as an example, modernization has been ongoing across the U.S. government for many years to bring together legacy systems. As said elsewhere in this article, it is a herculean task, particularly for such a large enterprise as the U.S. government. The Government Accounting Office ("GAO") has been auditing and monitoring federal government IT modernization and their reports provide insight into the progress being made. *See* U.S. GEN. ACCOUNTING OFFICE, VETERANS BENEFITS: REDIRECTED MODERNIZATION SHOWS PROMISE (1993); U.S. GEN. ACCOUNTING OFFICE, AIR TRAFFIC CONTROL: COMPLETE AND ENFORCED ARCHITECTURE NEEDED FOR FAA SYSTEMS MODERNIZATION (1997); U.S. GEN. ACCOUNTING OFFICE, INFORMATION TECHNOLOGY: DLA SHOULD STRENGTHEN BUSINESS SYSTEMS MODERNIZATION ARCHITECTURE AND INVESTMENT ACTIVITIES (2001); U.S. GEN. ACCOUNTING OFFICE, CUSTOMS SERVICE MODERNIZATION: RESULTS OF REVIEW OF FIRST AUTOMATED COMMERCIAL ENVIRONMENT EXPENDITURE PLAN (2001); U.S. GEN. ACCOUNTING OFFICE, SBA NEEDS TO ESTABLISH POLICIES AND PROCEDURES FOR KEY IT PROCESSES (2000); U.S. GEN. ACCOUNTING OFFICE, INS NEEDS TO BETTER MANAGE THE DEVELOPMENT OF ITS ENTERPRISE ARCHITECTURE (2000); U.S. GEN. ACCOUNTING OFFICE, DLA SHOULD STRENGTHEN BUSINESS SYSTEMS MODERNIZATION ARCHITECTURE AND INVESTMENT ACTIVITIES (2001); U.S. GEN. ACCOUNTING OFFICE, TERRORIST WATCH LISTS SHOULD BE CONSOLIDATED TO PROMOTE BETTER INTEGRATION AND SHARING (2003); U.S. GEN. ACCOUNTING OFFICE, INTERNET PROTOCOL VERSION 6: FEDERAL AGENCIES NEED TO PLAN FOR TRANSITION AND MANAGE SECURITY RISKS (2005); U.S. GEN. ACCOUNTING OFFICE, DEMAND FOR THE SOCIAL SECURITY ADMINISTRATION'S ELECTRONIC DATA EXCHANGES IS GROWING AND PRESENTS FUTURE CHALLENGES (2008); U.S. GEN. ACCOUNTING OFFICE, FEDERAL STUDENT AID: PROGRESS IN INTEGRATING PELL GRANT AND DIRECT LOAN SYSTEMS AND PROCESSES, BUT CRITICAL WORK REMAINS (2002); U.S. GEN. ACCOUNTING OFFICE, STUDENT FINANCIAL AID: USE OF MIDDLEWARE FOR SYSTEMS INTEGRATION HOLDS PROMISE (2001). Together, these government documents illustrate the substantial efforts to modernize U.S. government IT systems to facilitate better data sharing and systems integration, and that the problems associated with such efforts are complex and challenging.

IP, including patent pools,[47] cross-licensing, licensing of key technologies and intellectual property, open-source licenses, etc.;

2. Product design, i.e., the design of an application or device so that it is inherently interoperable with other products;[48]

3. Community collaboration, i.e., the informal collaboration among manufacturers and other industry constituents to develop those technologies necessary to create interoperability between related products, product families, and services;[49] and

4. Technical standards, whether formal (i.e., adopted for standardization by a Standards Development Organization ("SDO") such as the International Standards Organization), established by consortiums (industry groups that organize to develop a technology),[50] or adopted by users as *de facto*; this category includes both "open standards," i.e., those

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[47] Exemplified by those giving rise to the development of the DVD, developed by Sony, Philips and Pioneer, DVI interface, developed by Intel, Compaq, Fujitsu, Hewlett Packard, IBM, NEC, and Silicon Image in the context of the Digital Display Working Group, and USB, developed by Intel, Philips, Microsoft and US Robotics. *See* Baird, *Government at the Standards Bazaar, supra* note 36, at 45.

[48] *See, e.g., id.* at 43 (home video or stereo equipment, Intel-Microsoft Plug and Play, etc.).

[49] For example, the WiMAX Forum, which promotes and certifies compliance with IEEE 802.16/ETSI HiperMAN standard (popularly known as WiMAX), a standards for wireless broadband data transfer. *About WiMAX Forum Overview*, WIMAX FORUM, http://www.wimaxforum.org/about/about-wimax-forum-overview (last visited Mar. 23, 2008). *See also,* Elizabeth Montalbano, *Microsoft-Red Hat Deal Shows Need for Virtualization Support,* PC WORLD, Feb. 18, 2009, http://www.pcworld.com/businesscenter/article/159758/microsoftred_hat_deal_shows_need_for_virtualization_support.html (describing Microsoft collaboration agreements with Redhat and Novell to provide interoperability through virtualization between the products of Microsoft and those of Novell and Redhat) .

[50] *See* Baird, *Government at the Standards Bazaar, supra* note 36, at 43–44 (Video Electronics Standards Association ("VESA"), which developed VGA and W3C which developed HTML, SOAP and XML).

submitted to a SDO for adoption, [51] and broadly accessible proprietary technologies, i.e., those developed by a company or group of companies, and although not submitted for formal adoption as a standard, have been very widely implemented.[52]

5. Enterprise architecture, whether network-centric in design, applying a service-oriented approach, developing a framework for aligning legacy systems with modern business processes, the above four means to interoperability (1–4) are the building blocks that will be incorporated for an enterprise into an architecture that will constitute the actual and comprehensive interoperability solution.[53]

Depending on the business model, an IT company may emphasize one or more of these approaches over others, and indeed in many cases, take more than one avenue to interoperability. For example, a computer hardware company may wish to develop interconnect technologies in cooperation with other companies so they can each design their products to work well together right off the shelf. This approach is efficient in terms of getting a group of related products to market quickly. Because this approach brings key industry members to implement the technology, it also improves the chances of the technology becoming a *de facto* standard, possibly as it is simultaneously submitted for adoption as a formal standard by a SDO (which would further improve the chance that the technology would be adopted widely).

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[51] *See id.* (TCP/IP, MPEG, HTTP, HTML Open Document Format, Open XML, PDF and various communications protocols such as 802.11 (also known as Wi-Fi)).

[52] *See id.*, at 42–48 (stating that the industry has many avenues and forums to develop standards and illustrates (at pages 43–44) with several widely adopted standards including Printer Control Language, developed by Hewlett Packard, VGA, and ISA, developed by IBM and later updated by Intel and Microsoft to become Plug and Play ISA).

[53] *See* Pontus Johnson et al., *Formalizing Analysis of Enterprise Architecture, in* ENTERPRISE INTEROPERABILITY: NEW CHALLENGES AND APPROACHES 35 (Guy Doumeingts, Jorg Muller, Gerard Morel, Bruno Vallespir eds., Springer 2007).

2. TECHNICAL INTEROPERABILITY IS A FEATURE

Technical interoperability is a product feature and is always accompanied by trade-offs against other features. Users evaluate products seeking a suitable balance between the degree of interoperability desired and its impact on other features such as accessibility, security, and reliability, and are able to choose the product that best fits their needs. Users are adept at determining the degree to which they require interoperability as a feature. Governments as policy-makers, by contrast, are not; and as described below in Part 5, when they mandate a particular technology or interoperability solution, it overrides the ability of users to identify the best balance among technical features.

The evolution of a technology or product offering may lead to interoperability where it previously was not desirable or technologically feasible. The goal for early cell phone technology was simply to develop a wireless phone system that could accommodate large numbers of users in a limited frequency spectrum.[54] Multiple competing standards existed. Now, through licensing, roaming agreements, the evolution of standards, and other marketplace developments, greater interoperability exists between cell phones. Consequently, manufacturers have turned to integrating technologies such as Bluetooth, Wi-Fi, e-mail, web browsing, TV, downloadable ring-tones and digital cameras.[55] Frequent flyer programs were initially designed to encourage customer loyalty and provide impetus for customers to use only one airline.[56] Now a customer can use frequent flyer miles to buy travel on other airlines, pay for hotels, and

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[54] Center for Science, Technology, and Economic Development (CSTED), *The Role of NSF's Support of Engineering in Enabling Technological Innovation– Phase II, Chapter 4: The Cellular Telephone*, SRI INT'L, http://www.sri.com/policy/csted/reports/sandt/techin2/chp4.html (last visited Mar. 23, 2009). As for the details on interoperability among mobile phone technologies and web applications, see Jensen J. Zhao, Interoperability of Wireless Communication Technologies and Mobile Internet Application Development Tools, prepared for the Proceedings of the OSRA 2003 Conference Advancing Technologies: Winning in a Wireless World (Feb. 20–22, 2003), *available at* http://www.osra.org/2003/zhao.pdf.

[55] Anne Kandra, *Beyond the Dial Tone: From Photo Sharing to Instant Messaging, New Cell-phone Services Offer Far More than Voice Calls*, PC WORLD, Mar. 2, 2004, http://www.pcworld.com/article/114729/beyond_the_dial_tone.html.

[56] *See* FrequentFlier.com, History of Loyalty Programs, http://www.frequentflier.com/ffp-005.htm (last visited Mar. 23, 2009).

even give to charities.[57] The early programs had, by design, no "interoperability" and have evolved into substantially interoperable systems, where the scale of the network through interoperability enhances the value created.

It is impossible to predict the state of interoperability with future generations of technology other than the fact that, in most IT areas, it will become a more prominent feature. With the ongoing convergence of devices and functionalities, Web 2.0 rich Internet applications, and new wireless technologies, interoperability is a core feature and more importantly, users' desires for interoperability will continue to spur the industry toward enhanced interoperability.

3. A NOTE ON SILOS: HISTORIC BARRIERS TO TECHNICAL INTEROPERABILITY

The IT industry is on a continuum of evolution from essential non-interoperability to interoperability as a generally highly desirable feature– an evolution that tracks changes in user requirements and the demands of innovation.[58] IT systems that do not interoperate are

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[57] *Id. See also* Brussels Airlines, Charity, http://company.brusselsairlines.com/en/values/charity/ (last visited Mar. 23, 2009) (describing the airline's program allowing loyalty program members to donate miles to UNICEF).

[58] *See* Information Silo, Nationmaster.com, http://www.nationmaster.com/encyclopedia/Information-silo (last visited Mar. 23, 2009). Indeed, industry and government have spent billions of dollars transforming IT infrastructure from one of diskettes, tapes and mainframes to highly networked computing environments with shared data and applications. This *retooling* is ongoing. *See* U.S. GEN. ACCOUNTING OFFICE, BUSINESS SYSTEMS MODERNIZATION: INTERNAL REVENUE SERVICE'S FISCAL YEAR 2007 EXPENDITURE PLAN 2 (2007), *available at* http://www.gao.gov/new.items/d07247.pdf ("[The IRS] Business Systems Modernization (BSM) program is a multibillion-dollar, high-risk, highly complex effort that involves the development and delivery of a number of modernized information systems that are intended to replace the agency's aging business and tax processing systems."). "Since mid-1999, IRS has submitted a series of expenditure or "spending" plans requesting release of BSM appropriated funds. To date, about $2.1 billion has been appropriated and released for BSM." *Id.* at 12. *See also* U.S. GOV. ACCOUNTING OFFICE, FBI IS BUILDING MANAGEMENT CAPABILITIES ESSENTIAL TO SUCCESSFUL SYSTEM DEPLOYMENTS, BUT CHALLENGES REMAIN: STATEMENT OF DIRECTOR RANDOLPH HITE, INFORMATION TECHNOLOGY ARCHITECTURE AND SYSTEMS ISSUES 7 (2005), *available* at http://www.gao.gov/new.items/d051014t.pdf (observing that the FBI was planning on spending $484 million dollars in 2005 alone in its effort to replace aging IT with modern agency-wide enterprise architecture); INPUT, *U.S. State and Local Government IT Spending to Reach $77 Billion by 2012, Says INPUT*, TEKRATI, June 13, 2007, http://industry.tekrati.com/research/8946.

often characterized as "silos."[59] While information silos may occur by design as an aspect of segregation of divisions within an enterprise, computing silos came about primarily because of the structure of the computer industry at the time the systems we now describe as "legacy" were built.[60] The major vendors of the day, IBM, Digital and others, provided comprehensive "main frame" systems but rarely incorporated cross-vendor interoperability. [61] At the time, interoperability was rarely desired, and often avoided by design as part of the prevailing IT business model.[62] In large part, vendors sought to lock-in their customers to their systems and support services. This business model still exists in the mainframe business.[63]

Large institutions such as governments, banks, and insurers typically employ numerous legacy computer systems, each custom in

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[59] *See* Information Silo, *supra* note 58.

[60] *See* IAN WARREN ET AL., THE RENAISSANCE OF LEGACY SYSTEMS: METHOD SUPPORT FOR SOFTWARE-SYSTEM EVOLUTION 2–6 (Springer-Verlag 1999).

[61] Shane Greenstein, *Lock-in and the Costs of Switching Mainframe Computer Vendors: What Do Buyers See?*, 6 INDUS. & CORP. CHANGE 247, 256 (1997) ("By the early 1970s IBM and the BUNCH (Burroughs, Univac, NCR, CDC and Honeywell) all offered families of compatible systems that were internally consistent, but were not compatible with competing vendor systems."). IBM apparently continues to subscribe to this business model, as mainframe computing is still a major enterprise solution and the market-dominant vendor is IBM. Bob Djurdjevic, *IBM Delivers Explosive Growth*, ANNEX BULL., July 17, 2008, http://djurdjevic.com/Bulletins2008/15_IBM_2Q.html. Contrary to its advocacy for interoperability in the server/desktop/PC environment, IBM allegedly rejects cross-vendor interoperability for their mainframe systems. *T3 Sues IBM to Break Its Mainframe Monopoly*, LINUX GRAM, Dec. 3, 2007, http://www.accessmylibrary.com/coms2/summary_0286-33571407_ITM. IBM, which has been described as having 80–90% of the mainframe market, has been alleged to use its market position to exclude competitors from the market and foreclose efforts of others to develop mainframe systems that would be interoperable with those of IBMs. *IBM Tightens Stranglehold Over Mainframe Market; Gets Hit with Antitrust Complaint in Europe*, COMPUTER & COMM. INDUS. ASSOC., July 2, 2008, http://www.ccianet.org/artmanager/publish/news/IBM_Tightens_Stranglehold_Over_Mainframe_Market_Gets_Hit_with_Antitrust_Complaint_in_Europe.shtml (discussing the trade association's overview of IBM's business practices). The company recently acquired the company that had lead the antitrust efforts in Europe, having sued IBM for monopolistic behavior in its mainframe business. Austin Modine, *IBM Rids World of Mainframe Up-Start PSI, Inherits Itanium Server Biz*, CHANNEL REG., July 2, 2008, http://www.channelregister.co.uk/2008/07/02/ibm_buys_psi.

[62] WARREN ET AL., *supra* note 60, at 3–4.

[63] *See* Baird, *Heterogeneous World*, *supra* note 38; *see also IBM Tightens Stranglehold Over Main Frame Market*, *supra* note 61.

design, unique, and highly specialized.[64] As these enterprises undertake efforts to integrate the data on these legacy systems, they are often faced with the hindrances of several generations of technology, fixes and patches, and little documentation describing their design.[65] Imposing now-desirable technical interoperability within these enterprises can be a Herculean task, but it is one being undertaken across many industries and throughout governments around the globe.[66] Enterprises are upgrading or replacing their legacy systems, the hardware *and* software, restructuring data through the use of translators and converters, and restructuring their IT infrastructure to maximize interoperability, often retaining the underlying "big iron" of legacy mainframe computers.[67]

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[64] *See* WARREN ET AL., *supra* note 60, at 2.

[65] *See id.* at 4. Note that in the legacy environment, interoperability was not typically a desirable feature for a computer system. For example, the former U.S. Immigration and Naturalization Service (now the U.S. Citizenship and Immigration Service) segregated data for the law enforcement component of the agency and that of the immigration and naturalization services. *Immigration and Naturalization Service: Overview of Recurring Management Challenges: Hearing Before the Subcomm. on Immigration and Claims, of the H. Comm. on the Judiciary*, 107th Cong. 8–10 (2001) (statement of Richard M. Stana, Director, Justice Issues), *available at* http://www.gao.gov/new.items/d02168t.pdf. In developing their respective computer systems, they did not have to consider interoperability.

[66] Sufia Tippu, *Indian Government IT Spending Highest in Asia*, ITWIRE, July 27, 2006, http://www.itwire.com/content/view/5112/945. *See also* Paul McDougall, *U.K.'s Health Care Modernization Program Limps Along*, INFO. WEEK, Oct. 24, 2005, http://www.informationweek.com/news/management/showArticle.jhtml?articleID=172302996. A Gartner survey of CIOs, released March 2, 2009, reflects IT modernization as ranking fourth globally in their ranking of the top ten business and technology priorities. Press Release, Gartner, Gartner Survey of Indian CIOs Shows IT Budgets to Grow at 5.52 Percent in 2009 (Feb. 19, 2009), *available at* http://www.gartner.com/it/page.jsp?id=889813.

[67] *See* Orla O'Sullivan, *With Mergers Complete, Banks Turn to Integration Planning*, NETWORK COMPUTING, Oct. 30, 2008, http://www.networkcomputing.in/News-030Oct008-With-Mergers-Complete-Banks-Turn-to-Integration-Planning.aspx (With major mergers falling out of the credit crisis, acquiring banks Wells Fargo, Bank of America and JPMorgan Chase begin to look at integrating their technology with that of the acquired banks). Note that at least as to Chase's acquisition of Washington Mutual, that may be an enormous task given Washington Mutual's nine disparate IT systems. *See* Shawn Tully, *What Went Wrong at WaMu*, FORTUNE MAG., Aug. 9, 2004, http://money.cnn.com/magazines/fortune/fortune_archive/2004/08/09/377915/index.htm. *See also* David Isenberg, *Multitude of Databases Complicates Information Sharing*, CTR. FOR DEFENSE INFO., Oct. 29, 2002, http://www.cdi.org/terrorism/infosharing-pr.cfm.

4. INTERCHANGEABILITY IS NOT THE SAME AS "INTEROPERABILITY"

Interoperability is a term occasionally misused to describe *interchangeability*. Interchangeability means the creation of a product that duplicates or clones the functionality of another product, i.e., functions essentially in the same way as the cloned product, as opposed to creating the facility that enables two different products to "talk to" one another.[68] In the context of software, the court in *New York v. Microsoft* explained "clone" meant "the creation of a piece of software which replicates the functions of another piece of software."[69]

Often, the term "interchangeability" is brought up by those lobbying government to impose technology mandates. It is worth noting that among the unintended consequences of a government *interchangeability* mandate (whether explicitly or in practical effect) is that such a mandate precludes the possibility of products that meet specialized needs for users because a mandate by its nature requires a "one-size-fits-all" technology solution.[70] Interoperability without

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[68] *See* Francis M. Buono, *"Interoperability," Not "Interchangeability" The Importance of a Proper Approach to Defining and Achieving "Interoperability" to Enhance Competition, Innovation, and Consumer Choice in the Information Technology Marketplace; IT Industry Circa 2004– Significantly Increased Interoperability on All Levels*, METRO. CORP. COUNSEL NORTHEAST ED., Jan. 2005, at 13. *See also* TELECOMMUNICATIONS: GLOSSARY OF TELECOMMUNICATION TERMS (General Servs. Admin. 1996), *available at* http://www.its.bldrdoc.gov/fs-1037/fs-1037c.htm ("Interoperability: 1. The ability of systems, units, or forces to provide services to and accept services from other systems, units or forces and to use the services so exchanged to enable them to operate effectively together. 2. The condition achieved among communications-electronics systems or items of communications-electronics equipment when information or services can be exchanged directly and satisfactorily between them and/or their users. The degree of interoperability should be defined when referring to specific cases." "Interchangeability: A condition which exists when two or more items possess such functional and physical characteristics as to be equivalent in performance and durability, and are capable of being exchanged one for the other without alteration of the items themselves, or of adjoining items, except for adjustment, and without selection for fit and performance.").

[69] New York v. Microsoft Corp., 224 F. Supp. 2d 76, 176–77 (D.D.C. 2002) (concluding that the ability to clone "Microsoft's technology carries the potential to hinder some aspects of competition and discourage innovation").

[70] *See* Peter Singer, *Government Technology Mandates are a Bad Idea*, ALLBUSINESS.COM, Mar. 1, 2003, http://www.allbusiness.com/government/government-bodies-offices-us-federal-government/6268035-1.html (describing the opposition (including a concern about a one-size-fits-all approach and freezing innovation) to legislation introduced in the U.S. Senate in 2002 called the Consumer Broadband and Digital Television Promotion Act ("CBDTPA"), which would have potentially required software, computers and consumer electronics companies to include either an industry designed and government-approved

interchangeability, by contrast, allows for different kinds of devices, software and systems, fostering innovation, competition and enhanced user choice, while at the same time ensuring that these different devices, software, and systems can communicate to exchange data with one another.

5. CONSTRUCTIVE GOVERNMENT ROLE IN TECHNICAL INTEROPERABILITY

Industry, the marketplace, and government should work in concert to create a healthy ecosystem for efficient, meaningful interoperability. The IT industry has made it a priority to continually improve technical interoperability. Government is best suited and situated to encourage and facilitate the healthy interoperability ecosystem in which technical solutions may be implemented. As described in *The Government at the Standards Bazaar,* there are several significant reasons government should be reluctant to intervene in the marketplace as to technical interoperability, particularly by mandating technology standards. [71] First, the marketplace has many well-developed, long-standing means of facilitating technical interoperability, including many approaches to developing standards.[72] Second, international trade agreements, such as Technical Barriers to Trade, limit the degree to which participating governments can mandate standards, to the extent that the standards may impact foreign trade.[73] Notably, the U.S. has a strong preference for market-developed standards and promotes this preference as a matter of both domestic law, domestic public policy, and foreign trade policy.[74] Finally, in contrast to the IT industry at large, government

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digital rights management ("DRM") technology or, in the event industry fails to agree on a technology, a government-*designed* technology to prevent copying of movies and music).

[71] Baird, *The Government at the Standards Bazaar, supra* note 36.

[72] *See id.* at 42–54.

[73] *Id.* at 60 (citing Agreement on Technical Barriers to Trade, Multilateral Agreements on Trade in Goods, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations, Apr. 15, 1994, 33 I.L.M. 1125, 1154 (1994), *available at* http://www.wto.org/english/docs_e/legal_e/17-tbt.pdf).

[74] *Id.* at 61 (citing *China, Europe, and the Use of Standards as Trade Barriers: How Should the U.S. Respond? Hearing Before the H. Comm. on Science & H. Subcomm. on Environment, Technology and Standards*, 109th Cong. (2005) (statement of Hratch G. Semerjian, Acting Director, National Institute of Standards and Technology), *available at*

rarely has the resources to fully understand the technology marketplace and is likely not nimble enough to respond to the rapid pace of change in market conditions and innovation; therefore, the risk of *government failure* is significant.[75] Government failure, in this regard, occurs when government steps in to "remedy" a perceived market failure, but the government action fails to accomplish the government's goals. [76] Economist Victor Stango observed: "[A] policymaker may resolve uncertainty more quickly than would be the case in a standards war but also might be more likely to choose the 'wrong' standard."[77] We should keep firmly in mind that government failure is *more likely* when a *market is new and volatile* as is the case with the current IT market, exemplified by the rapid rate of innovation in the areas of the Internet, mobile computing, and wireless connectivity.[78]

There are often adverse consequences to a government technical mandate. A mandate overrides the ability of users to identify the best technical and business fit for a particular case. Mandates also impair an industry's ability to respond to user needs, particularly as those needs change. For example, government mandates can preclude coexistent standards.[79] In the real world, many standards meet similar or even the same needs.[80] Translators and converters are

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http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_house_hearings&docid=f:20998.pdf).

[75] *Id.* at 61–70.

[76] Justice Stephen Breyer, prior to his appointment to the U.S. Supreme Court, described "government failure" in his seminal book, "Regulation and its Reform." Breyer posited that regulatory failure occurs because of "mismatches," i.e., the failure "to correctly match the [regulatory] tool to the problem at hand." STEPHEN BREYER, REGULATION AND ITS REFORM 191 (Harvard Press 1982).

[77] Baird, *Government at the Standards Bazaar*, *supra* note 36, at 62 (quoting Victor Stango, *The Economics of Standards Wars*, 3 REV. OF NETWORK ECON. 1, 9–10 (2004) (citing Stan J. Liebowitz, & Stephen E. Margolis, *Path Dependence, Lock-In and History*, 11 J.L. ECON. & ORG. 205 (1995))).

[78] *Id.* at 64–65 ("[w]hen industry is in a period of high innovation and volatility, the likelihood that a government standard will result in inefficient and/or artificial technological decisions is particularly acute.") (citing STANLEY M. BESEN & LELAND L. JOHNSON, COMPATIBILITY STANDARDS, COMPETITION, AND INNOVATION IN THE BROADCASTING INDUSTRY 135 (Rand Corporation 1986)).

[79] *Id.* at 48.

[80] For example, there are two similar high-speed computer interconnects in common use, USB2 and IEEE 1394, (often in the same device). Similarly, Bluetooth and Wi-Fi are short-

common in IT to assure interoperability between coexisting standards. [81] Government-imposed technology mandates can inherently (often, by design) *skew* the market away from those technical solutions that would otherwise predominate were the natural course of market forces left to drive adoption.[82] *Indeed, a government technology mandate limits, or even eliminates, the diversity of technologies and innovation that facilitates interoperability.*[83]

Information technology evolves extremely rapidly; the challenge is to keep technical interoperability current with the state of the art. The marketplace can develop such mechanisms much faster and be revised more quickly than government mandates can be. Thus, as a general rule the marketplace can more effectively and nimbly address technical interoperability than a government mandate. [84] For example, in the U.S., the telecommunications industry is highly regulated and has historically been subject to federally mandated standards, but in more recent decisions, the Federal Communications Commission ("FCC"), the regulatory agency that oversees telecommunications in the U.S., has recognized that standard-setting

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range wireless technologies used to interconnect digital devices. Examples of coexistent standards are the various flavors of high speed communications standards such as IEEE 802.11(a/b/g/n); for digital video, USB-2, IEEE 1394, DVI and HDMI; the competing digital video disc formats, DVD+ and DVD-; the competing EISA v. MCA, and the latest multiple format standards for digital video (i.e., progressive versus interlaced formats, and in various resolutions: 480p, 480i, 720p, 720i, 1080p, 1080i). *Id.*

[81] Converters are found in devices such as DVD players, facilitating the playback of DVD+ and DVD- disks. Similarly, digital video devices are capable of automatically switching among the various standards, 480p, 480i, 720p, 720i, 1080p, and 1080i.

[82] Michael Powell, Comm'r, Fed. Commc'n Comm'n, "Somewhere Over the Rainbow: The Need for Vision in the Deregulation of Communications Markets," Before the Federal Communications Bar Association (New York Chapter), May 27, 1998, *available at* http://www.fcc.gov/Speeches/Powell/spmkp813.html.("[W]e must acknowledge that [regulatory] intervention distorts the competitive process from seeking economic efficiency. Regulation interjects the regulator between commercial providers and their consumers and thus fundamentally infringes on the key relationships that make markets work. Regulatory intervention also fundamentally affects the risk to capital and skews investment decisions, as it often sours the enthusiasm of investors by introducing new uncertainties.").

[83] GRAHAM BANNOCK ET AL., PENGUIN DICTIONARY OF ECONOMICS 330 (Penguin Books 7th ed. 2004). (Defining "regulation" and describes that regulation may obstruct innovation).

[84] *See* Baird, *Government at the Standards Bazaar*, *supra* note 36, at 35.

is best left to the marketplace.[85] In 1996, the FCC was required by Congress to set the standards for digital television, setting the stage for an enormous transformation of the video marketplace.[86] In its Final Report for Advanced Televisions Systems, the FCC concluded that only a baseline, industry-developed DTV standard should be mandated by government, leaving the marketplace free to implement a range of technologies based on the standards.[87] This rulemaking left

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[85] *See* Year 2000 Biennieal Regulatory Review– Amendment of Part 22 of the Commission's Rules to Modify or Eliminate Outdated Rules Affecting the Cellular Radiotelephone Service and other Commercial Mobile Radio Services, 19 F.C.C.R. 3239, 3259 (2004) (order on reconsideration) (stating "[w]e prefer, as a general policy, to allow market forces to determine technical standards wherever possible, and to avoid mandating detailed hardware design requirements for telecommunications equipment, except where doing so is necessary to achieve a specific public interest goal."). *See also* 2000 Biennial Regulatory Review of Part 68 of the Commission's Rules and Regulations, 15 F.C.C.R. 24944, 24950 (2000) (in which the Commission stated, "In the *Notice*, we tentatively concluded that the public interest would be better served if private industry, rather than the Commission, developed the technical criteria that are necessary to protect the public switched telephone network from harms. We therefore proposed in the *Notice* to use one of several potential industry standards-setting processes. To ensure that the public interest is adequately protected, we proposed to provide for *de novo* Commission review and enforcement, where necessary, of the industry-established technical criteria in the event of an appeal regarding the criteria. We noted our expectation, however, that such Commission involvement would be extremely limited." *Id.* The Order concluded that the FCC would rely on market-developed standards, stating "industry rather than Commission development of technical criteria will decrease development time and allow manufacturers to bring innovative consumer products, especially for the provision of advanced services, to the market on an expedited basis. This expedited process should benefit consumers by lowering the costs of terminal equipment and by ensuring that new technologies are widely available." *Id.* at 24952. *See also* 47 U.S.C. § 161 (2002). *See generally* Baird, *Government at the Standards Bazaar*, *supra* note 36, at n.10 (illustrating how challenging it can be for the government, in this case the FCC, to establish standards for digital set-top boxes, where it elects to intervene in the standard setting process).

[86] *See* Advanced Television Systems and Their Impact Upon the Existing Television Broadcast Service, 11 F.C.C.R. 17771, 17772 (1996).

[87] The FCC concluded that "adopting this Standard provides for the minimum of regulation needed to provide for a smooth transition. At the same time, we provide the certainty needed for the transition. The DTV Standard eliminates an unnecessary government requirement by not specifying video formats. A key point of contention throughout this proceeding has been the migration to progressive scan transmission formats. While almost all parties agree that, ultimately, progressive scanning is superior to interlaced across a variety of dimensions, the record has been marked by dissent and contradiction about the desirability of allowing both interlaced and progressive scanning, given the over-the-air bandwidth limitation of 6 MHz. Adoption of the DTV Standard, which will allow video formats to be tested and decided by the market, avoids the risk of a mistaken government intervention in the market and is consistent with the deregulatory direction of the Telecommunications Act of 1996." *Id.* at 17790.

room for industry to develop a wide range of standards, each with a different video resolution. [88] The market was free to develop innovative technologies with the appropriate implementation of the DTV standard. The designer of a handheld video device is able to use a standard that provides the appropriate resolution for a 2" screen and requires minimal bandwidth to facilitate rapid download times, yet a manufacturer of a 103" large-screen television is able to use a high-bandwidth standard that will provide a very high definition image.[89]

Governments have great interest in enhancing interoperability. While there are numerous ways industry achieves ever-greater technical interoperability, some IT industry contingents and, indeed, some government decision-makers insist that government-mandated technical standards are the ultimate interoperability panacea.[90] A common argument made by advocates for technology mandates to policy makers is that if government simply requires particular technical standards, interoperability will be readily achievable, or even inevitable. [91] This viewpoint ignores the other facets of the interoperability ecosystem that contribute significantly to achieving widespread adoption of interoperable technologies and ultimately, meaningful interoperability, as well as the many examples of where technology or standards mandates have proven inadequate or costly to implement.[92] As described at the outset of this section, for some

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[88] The standards include 480 (standard definition), 720 and 1080 lines of resolution (high definition), each with the option of progressive or interlaced scan, meeting the differing needs of broadcasters and computer systems designers. JEFFREY HART, TECHNOLOGY, TELEVISION AND COMPETITION: THE POLITICS OF DIGITAL TV 150–55, 163–68 (Cambridge University Press 2004).

[89] Peter Seel & Michel Dupagne, *Digital Television in* COMMUNICATIONS TECHNOLOGY UPDATE AND FUNDAMENTALS 50–51 (10th ed., Focal Press 2006) (describing the technical standards acceptable within the FCC definition of the term "digital television.")

[90] For the purpose of this discussion, "standard" is defined as a technical specification that enables interoperability between IT networks, applications, or services, enabling such components to exchange and use information. Baird, *Government at the Standards Bazaar*, *supra* note 36, at n.1.

[91] *See generally*, K. D. Simon, *The Value of Open Standards and Open-source Software in Government Environments*, 44 IBM SYS. J. 227, 228 (2005), *available at* https://www.research.ibm.com/journal/sj/442/simon.pdf.

[92] There are examples of where much effort is put into formalizing an open standard and yet, the market (in the case I am about to describe, the developers working on the Internet) chose a different technology to meet its needs. The most well known modern case is the International Standards Organization's adoption of Open Systems Interconnection ("OSI Model"), an ISO standard published in 1984 to address the problem of interoperability

stakeholders, proposing such a policy solution may be motivated more by the priorities of their particular business model rather than out of a desire to promote good public policy.

An example of this polarizing single technology standard approach can be seen in some of the advocacy behind the promotion of open-source software. [93] Some governments are considering limiting domestic industry to only technologies made available on a royalty-free basis or that may only be implemented in open source software and licensed pursuant to the terms of the General Public License ("GPL").[94] The GPL, by its terms, complicates the ability to create interoperability between proprietary licensed software and GPL licensed open-source software. Provisions in law that demand royalty-free technologies would not only preclude proprietary solutions, but also many globally accepted formal standards, because those standards incorporate licensed technologies. Notably as to such policies, in some cases enterprises would be required to use technologies that have not yet gained market acceptance, putting

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between computer networks. Between the late 1970's and 1994, OSI competed with another possible standard, TCP/IP, but by 1994, TCP/IP, which had been developed concurrently with other aspects of the Internet (including SMPT e-mail protocol, FTP file transfer protocol, and HTML and HTTP, the basis for the World Wide Web), became the established standard. *See* Ivo Maathuis & Wim A. Smit, *The Battle Between Standards: TCP/IP vs. OSI Victory Through Path Dependency or by Quality?,* THIRD CONF. ON STANDARDIZATION AND INNOVATION IN INFO. TECHN. (Oct. 2003), *available at* http://ieeexplore.ieee.org/Xplore/login.jsp?url=/iel5/8864/28013/01251205.pdf?arnumber=1251205. It is well known that the development of Internet standards occurred outside the formal standards setting arena. Tim Berners-Lee, once said, "The Internet was nearly invisible in Europe because people there were pursuing a separate set of network protocols being designed and promoted by ISO." Greg FitzPatrick, *The Failure of European ITC Standards Policy, and Possible Future,* 65 SWEDISH ICT COMM'N REP. 11 (2003), *available at* http://www.itkommissionen.se/dynamaster/file_archive/030523/ded7728140c38980efb4e5a0f645fcb3/The%20failure%20of%20European%20ITC%20standards%20policy.pdf. To contrast OSI and the immense effort put into developing formal open standards, it is notable that many proprietary technologies became *de facto* standards, that is, standardized through user adoption, and not through any formal means (such as Adobe's PDF file format (now an ISO standard, but long after becoming ubiquitous), Hewlett-Packard's Printer Control Language (PCL), and Sun Microsystem's JAVA programming language). *See* Baird, *Government at the Standards Bazaar, supra* note 36, at 47.

[93] *See* HEINTZMAN, *supra* note 37 (exemplifying the effort on the part of IBM to promote a single, open-source standard for software document formats).

[94] Brian Proffitt, *Venezuela's Government Shifts to Open Source Software,* LINUX TODAY, Aug. 30, 2002, http://www.linuxtoday.com/news_story.php3?ltsn=2002-08-30-011-26-NW-LL-PB.

these early adopters at risk that the technology will change substantially in a short period of time and they will be either isolated or have to reinvest in replacement technology.[95] Such approaches to policy may result in the opposite of the desired effect, eliminating significant incentives for domestic developers to invest their efforts into new technologies and undermining the goal of interoperability.[96] In stark contrast to some of the rhetoric of the advocacy, it is clear that the market is taking a more rational approach to the choice of open-source or proprietary technology. Both are being widely adopted and *combined* by IT users. Indeed, users continue to select the technology best suited to meet their needs, regardless of the development, business, or licensing model.[97] This is compelling evidence that government should work to ensure the entire interoperability ecosystem is addressed as it pursues meaningful interoperability.

B. ORGANIZATIONAL INTEROPERABILITY

1. ORGANIZATIONAL INTEROPERABILITY DESCRIBED

The importance of organizational interoperability to the successful and effective deployment of IT is well documented but its significance cannot be overstated.[98] To achieve interoperability across an enterprise (or among enterprises), an enterprise—whether in the private or public sector—must be designed specifically with this goal

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[95] *See* Taowen Le et al., *China as a Software Outsourcing Outlet: Status, Enabling Factors, International Impact and Growth Determinants*, WICOM 2007 CONF. PROC. 6115, 6118 (2007), *available at* IEEE Xplore ("The IT industry is one of many standards. To succeed as an international software outsourcing outlet, a company or a nation must follow international standards. During the past decade, China has greatly promoted the following of international software standards among its domestic software companies."); Beijing Xinhua, *HK Adopts International Standards To Enhance E-Business*, BBC NEWSLIBRARY.COM, Apr. 26, 2001, https://verify1.newsbank.com/cgi-bin/ncom/NewsLibrary/ec_signin.

[96] *See* Ming Shuliang & Ouyang Changzheng, *TD's Hard Life in China's Wireless World*, CAIJING MAG., Feb. 25, 2008, http://english.caijing.com.cn/2008-02-25/100049439.html.

[97] *See generally* Baird, *Heterogeneous World*, *supra* note 38.

[98] Pardo & Burke, *supra* note 6, at 2–3 ("Improving interoperability depends not on the technologies alone, but on a mix of capabilities that can produce organizational as well as technological interoperability."). *See also* JON HARRINGTON, ORGANIZATIONAL STRUCTURE AND INFORMATION TECHNOLOGY 7–9 (Prentice Hall 1991) (reciting the research evidencing the relationship between organizational structure and IT implementation).

in mind. The distinguished public administration and management scholar, Robert Golembiewski, observes: "[a] typical survey of major firms . . . showed that the primary problems arising in IT implementation were associated not with technical factors, but with lack of top management support, poor planning, and/or employee opposition."[99]

There are two broad categories of organizational interoperability that must be addressed within an enterprise to effectuate a healthy interoperability ecosystem: (1) business and organizational structure and processes, and (2) the people, management, and workforce. On one hand, the enterprise must adopt the appropriate rules, guidance, management direction, business processes, and organizational structure to successfully implement interoperability. On the other hand, successful implementation requires the proper training for, and "buy-in" by, all who manage and work for the enterprise, the people who must implement interoperability across the enterprise or interact with other enterprises to facilitate and encourage collaboration and information exchange. The interoperability ecosystem must incorporate within the organization "consensus and compatibility, aggregation, integration and interface-ability as concepts."[100]

2. BUSINESS AND ORGANIZATION STRUCTURES AND PROCESSES

To achieve interoperability across an enterprise (or among enterprises), the enterprise itself may need to be reorganized to eliminate barriers. Information that could be made more useful with the implementation of interoperability is typically held and maintained by different components of an enterprise, among

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[99] HANDBOOK OF ORGANIZATIONAL BEHAVIOR 307 (Robert T. Golembiewski ed., Marcel Dekker, Inc. 2001) (citing M. J. Cerullo, *MIS: What Can Go Wrong*, 60 MGMT. AND ACCT. 43–48 (1979)). Dr. Golembiewski is a Distinguished Research Professor at the University of Georgia School of Public and International Affairs, Department of Public Administration and Policy. He has authored or edited more than 75 books and published nearly 1000 scholarly articles, case studies and book reviews. For more information, see University of Georgia Department of Public Administration and Policy, Dr. Robert T. Golembiewski, http://www.uga.edu/padp/golembiewski.htm (last visited Apr. 10, 2009).

[100] *See* K. Geber & S. Deshpande, *The CHIN Experience: Interoperability*, 7 NEW REV. OF INFO. NETWORKING 77, 77–92 (2001) (drawing on Paul Miller's framework (technical, semantic, political/human, intercommunity, legal and international interoperability) to examine CHIN as an organization that strives toward interoperability as part of its core mandate). Based on the CHIN experience, it is argued that any attempt to advance the concept of interoperability must include consensus and compatibility, aggregation, integration and interface-ability as concepts. *Id.*

disparate enterprises, and on all administrative levels. These are the barriers that organizational interoperability must overcome. These barriers may exist in part because of preexisting distinct or contradictory goals, missions, or business processes of various enterprise components.[101] They may exist because "groups [within the enterprise] lose sight of the overall purpose of the organization, compete for funds and resources, or are so insular as to see no value in collaboration with other groups."[102] Furthermore, "[c]ompetition [within the enterprise] encourages people to withhold information, shun cooperation and hoard resources."[103] Such barriers may become

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[101] Such "stove-piping" of an enterprise was reinforced, if not accelerated, by the early computerization of business processes. The early computing industry was segmented; each of the major main-frame systems developers, IBM, Burroughs, UNIVAC, NCR, Control Data, Honeywell, General Electric and RCA, designed systems that were predominantly designed to be incompatible. Shane Greenstein, *Lock-in and the Costs of Switching Mainframe Computer Vendors in the US Federal Government in the 1970s*, 17 IEEE ANNALS OF THE HIST. OF COMPUTING 58, 60 (1995) *available at* http://www.kellogg.northwestern.edu/faculty/greenstein/images/htm/Research/articles/Lock-in%20and%20the%20Costs%20of%20Switching%20Mainframe%20Computer%20Vendors%20in%20the%20US%20Federal%20Government%20in%20the%201970s.pdf. This condition reinforced, or perhaps forced, the non-interacting bureaucratic organizational structures of enterprises of the day. Compounding the problem, systems were designed to mirror the functions of the bureaucracy within which they were used, impeding the organizational changes required to modernize enterprises. *See, e.g.*, DEP'T OF HOMELAND SEC., OFFICE OF THE INSPECTOR GEN., USCIS FACES CHALLENGES IN MODERNIZING INFORMATION TECHNOLOGY 13–15 (2005), http://www.dhs.gov/xoig/assets/mgmtrpts/OIG_05-41_Sep05.pdf (describing the challenges the U.S. Citizenship and Immigration Service faces to, among other things, integrate disparate, outdated, redundant data systems. "USCIS relies upon a variety of information systems with limited capabilities to manage its benefits processing workloads. Different USCIS entities use these systems, with different levels of access, at different points in the benefits adjudication process to carry out their various responsibilities. While each system may have a different purpose, many of the systems collect the same information, but in different formats with different levels of detail. The systems are "forms-driven" rather than "person-centric," meaning that each system is designed to process a particular type of application rather than the system as a whole collectively managing information focused on specific individuals. There is no single USCIS system that collects all off the data associated with processing benefits for a single applicant. According to one adjudicator, if USCIS were asked to compile a complete history on an individual, employees might have to access over a dozen systems to get this information .... In addition, []USCIS uses a number of other 'stove pipe' systems .... For example ... five different scheduling systems to assign cases ... [which are] not integrated, making it difficult to manage workloads.").

[102] Vance Kauzlarich, *Organizational Change Management is Key to Program's Success*, 7 THE EDGE 8 (2003), http://www.mitre.org/news/the_edge/fall_03/kauzlarich.html.

[103] *Id.*

embodied in internal operational rules or structures. A management hierarchy may, by its nature, preclude efficient communications and discourage collaboration and information sharing. In other contexts, the effort may be to bring together information and functions of previously disparate enterprises. Companies in autonomous industries or sectors may be unwilling or reluctant to interact, interoperate or interconnect with enterprises seeking the new relationship. Some of this reluctance may even be for practical reasons, such as a desire to protect competitive advantage or trade secret or a concern about a risk of legal liability. In the context of reforms to the healthcare industry to implement IT interoperability, doctors, hospitals, insurance companies, IT vendors, and other stakeholders have differing concerns, sometimes strongly at odds with one another. The differing perspectives of these stakeholders, and the vigor with which they have defended their positions have slowed adoption of electronic health care records and prescription systems in the U.S. [104] It is critical that these aspects of organizational interoperability are adequately addressed to achieve meaningful interoperability.

3. PEOPLE: MANAGEMENT AND WORKFORCE

As the lines between components of an organization are erased (or new lines of communication are drawn), individuals, whether an

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[104] *See Health Information Technology, S. Comm. on the Budget*, 109th Cong. (2005) (statement of Michael O. Leavitt, Secretary, Dep't of Health and Hum. Servs.), *available at* http://www.hhs.gov/asl/testify/t050720.html (regarding the adoption of electronic health records by doctors, "[a]ccording to a study by the Commonwealth Fund, 57% of large group practices of 50 or more physicians are using an EHR, but only 13% of solo practitioners are doing so."). *See also Hearing on Health Care Information Technology, Before the Subcomm. on Health, H. Ways and Means Comm.*, 109th Cong. (2005) (statement of Don E. Detmer, M.D., President and Chief Executive Officer, Am. Med. Informatics Ass'n), *available at* http://waysandmeans.house.gov/hearings.asp?formmode=view&id=2945 (regarding other real and perceived obstacles to implementing health IT); *Hearing on Health Information Technology, Before the Subcomm. on Health, H. Ways and Means Comm.*, 109th Cong. (2005) (statement of the Am. Coll. of Physicians), *available at* http://www.acponline.org/hpp/hit_statement.pdf. *See generally Hearing on Health Care Information Technology, Before the Subcomm. on Health, H. Ways and Means Comm.*, 109th Cong. (2005), *available at* http://waysandmeans.house.gov/hearings.asp?formmode=detail&hearing=436; Am. Coll. of Physicians recommendations for Personal Health Records, *available at* http://www.acponline.org/hpp/phr.pdf; Christy Harris, *OPM to Insurers: Work Harder to Get Health Records Online*, FEDERAL TIMES.COM, Nov. 29, 2006, http://www.federaltimes.com/index.php?S=2384225 (regarding insurers).

hourly wage-earner or senior manager, like organizations, need to adapt.[105] Organizational interoperability also encompasses the need to engender interoperability among workers and the ability for workers to adapt to, or even encourage, an environment of greater interchange; this issue arises with regard to workers from the top to the bottom of the organizational hierarchy.

A pioneer in the study of human relations and IT, Dr. Gary Dickson, observed that it is essential to "involve people as a component, knowledge of their behavior as a part of the system is important to the success of the entire field [of information systems management]." [106] Robert Golembiewski observes, "[e]mployee resistance is one of the major factors accounting for the fact that IT innovations are not adopted simply by force of example."[107] Naakesh Dewan, Nancy Lorenzi, and Shaohong Zheng cast the problem for management thus: "Organizations need to evaluate and determine their own readiness for new technologies or systems before implementing them. In essence, organizations need to determine if the organizational culture or climate will easily support changing the use of information technologies of systems." [108] Furthermore, as described by Paul Strebel in his seminal article on why employees resist change: "[t]hough often unwritten, the psychological dimension underpins an employee's personal commitment to individual and company objective."[109] As to management, one common rationale for resistance to organizational change is the interest in maintaining

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[105] *See* HARRINGTON, *supra* note 98, at 94–122.

[106] Golembiewski, *supra* note 99, at 309 (citing Gary W. Dickson, *Management Information Decision Systems*, 11 BUS. HORIZONS 17–26 (1968)). Gary Dickson is Professor Emeritus from both North Carolina State University and the University of Minnesota. He is a very active consultant with numerous large and small, public and private organizations. "Dr. Dickson's research has had a major impact on the information systems field. This research focused on the relationship between information technology and decision-making. Programs of research such as The 'Minnesota' Experiments, the Minnesota Managerial Graphics Project, and the Group Decision Support Systems Project are widely cited and have paved the way for others doing work in these areas." North Carolina State University, Gary Dickson, http://www4.ncsu.edu/~gdickson/LongbioP.htm (last visited Mar. 24, 2009).

[107] Golembiewski, *supra* note 99, at 307.

[108] Naakesh A. Dewan, Nancy M. Lorenzi & Shaohong Zheng, *Overcoming Resistance to New Technology,* BEHAV. HEALTH MGMT. 28, 31 (Jan./Feb. 2004).

[109] Paul Strebel, *Why do Employees Resist Change*, 74 HARV. BUS. REV., 86, 87 (May–June 1996).

current employment requirements and structures, workflows and processes, and revenue streams that are based on the existing organizational practices.[110] With the introduction of interoperability, practices may be altered or eliminated and employees may have to identify new means to measure productivity, transition the old revenue streams and methodologies to the new processes and organizational structure, or identify new revenue streams.

In some cases, and potentially at any level of the administrative hierarchy, workers may feel threatened by their newly realized interconnectedness. Trust, norms, and networks are central to social capital and although highly important, these features are fluid.[111] Reorganizations to facilitate interoperability, as well as the restructuring of social relationships itself that comes from interoperability, disrupt these central features and can undermine the goals of the changes. Change in job content, loss of status or power, changes in interpersonal relationships, changes in the decision-making approach, and job insecurity are common reasons employees resist new technologies.[112] A worker may see the new level of interaction with others and the sharing of information (information that may have even been proprietary) as a threat to, or loss of, control of their work product, and therefore their ownership over the "territory" of information, influence, or social stature that may have accrued over many years of service.[113] Workers may not have the skills to undertake effectively the imperatives of interoperability and do their job within a new organizational structure with new processes and systems. In addressing organizational interoperability, an enterprise must address these workplace issues to engender management and worker understanding of the goals for, and need to support interoperability.[114] As part of implementing interoperability, the enterprise must adopt the appropriate rules, guidance,

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[110] *See* NANCY J. BARGER & LINDA K. KIRBY, THE CHALLENGE OF CHANGE IN ORGANIZATION: HELPING EMPLOYEES THRIVE IN THE NEW FRONTIER 153–57 (Davies-Black Publishing 1995) (discussing the impact of organizational change on management personnel).

[111] *See* JANE E. FOUNTAIN, BUILDING THE VIRTUAL STATE 72, 96 (Brookings Institution Press 2001).

[112] James J. Jiang, Waleed A. Muhanna & Gary Klein, *User Resistance and Strategies for Promoting Acceptance Across System Types*, 37 INFO. AND MGMT. 25, 26–27 (2000).

[113] BARGER & KIRBY, *supra* note 110, at 74–75; *see also* Harrington, *supra* note 97, at 111–13.

[114] *See* Golembiewski, *supra* note 99, at 311–14.

management instruction, and training to assist workers in developing the perspective, behaviors, skills, and psychological comfort level needed to facilitate meaningful interoperability.

4. CONSTRUCTIVE GOVERNMENT ROLE IN ORGANIZATIONAL INTEROPERABILITY

In practice, beyond legal proscriptions, nothing can be a greater barrier to the goals of interoperability than failure in organizational interoperability. To achieve interoperability in the government context, organizational interoperability deserves great attention. By undertaking the proper course, government can also serve as a model for other industries, evidencing the approaches to organizational interoperability that maximize the benefits of the other aspects of the interoperability ecosystem, and particularly, support the meaningful and sustainable implementation of technical interoperability solutions.

Of course, as will be described in detail in section C., in the case of government enterprises, statutory authority or other regulations may be implicated. As to non-governmental enterprises, industry regulation or other areas of legal interoperability (e.g., employment, privacy, and other laws) may intersect with organizational interoperability. Where they do, government can make certain to the appropriate degree that the laws align with the needs of organizations and that industries pursue organizational interoperability through reform and reorganization. Finally, governments can advance the understanding of organizational interoperability by developing or funding research to identify and validate reforms and appropriate organizational structures, explore incentives to encourage organizational interoperability, and provide a forum to oversee and advise on organizational industry or cross-industry interoperability including progress monitoring, assessment, and validation.

C. LEGAL AND PUBLIC POLICY INTEROPERABILITY

1. LEGAL AND PUBLIC POLICY INTEROPERABILITY DESCRIBED

Interoperability can only come to full fruition when relevant laws and public policies are designed to facilitate the desired interaction or exchange. Laws and public policy can operate as an intentional—or unintentional—barrier, catalyst, or facilitator to these interactions. The intent of the existing law may be to proscribe the sharing of specific information (e.g., privacy laws), or may be to prohibit certain

business practices whereby the constraint on information sharing is simply a consequence of the prohibition.[115] However, in some cases, these laws can be revised to allow appropriate information exchanges to facilitate the desired degree of interoperability, with appropriate public policy parameters guiding the interactions to prohibit the undesirable practices or results. In contrast, there may be circumstances under which interactions are unencumbered by law but the respective industries choose not to interact. In these cases, where it is in the interest of public welfare, a law can compel interaction or provide incentives to such interaction that support the goals sought to be attained by interoperability. An example of such a law would be the European Union Privacy Directive, which sets out the circumstances under which an entity that has personal data must notify the subject of the data when the data are being used, give the subject of that data opportunity to review and correct the data, and so forth.[116] Similarly, some child online protection laws require a user to provide age information to website operators and correspondingly require the operator to protect children's privacy by restricting the information about the user that they use or exchange.[117]

Where the public interest goal requires interoperability, government policies need to encourage *a holistic approach to interoperability*, not merely facilitate *information exchange.* Government policies and the associated incentives and research should guide the private and the public sector alike toward implementing interoperable solutions and organizational structures, and addressing all aspects of the interoperability ecosystem. In short, government policy can and should shape the approach taken to

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[115] *See, e.g.*, the Data Protection Act of 1998, 29 (Eng.) (A law of the United Kingdom which generally speaking, prohibits the disclosure of personal data without the permission of the individual who is the subject of that data), Privacy Act (generally, restricts the sharing of personally identifying information between government agencies). *See, e.g.*, Gramm-Leach-Bliley Financial Services Modernization Act, 15 U.S.C. §§ 6801–6809 (1999) (U.S. law repealing the Glass-Steagall Act of 1933 which prohibited a bank from offering insurance, commercial banking or investment services. To facilitate the combining of these activities, the law authorizes financial institutions to share information with third parties, and requires the institutions to provide privacy notice to their customers. Pursuant to the Fair Credit Reporting Act, 15 U.S.C. §§ 1681 et seq., customers are required to have the choice to opt-out of such information sharing.).

[116] *See* Council Regulation 45/2001, 2000 O.J. (L 8) 1 (EC), *available at* http://www.europarl.europa.eu/tools/disclaimer/documents/l_00820010112en00010022.pdf.

[117] *See* Children's Online Privacy Protection Act, 15 U.S.C. §§ 6501–06 (2006).

facilitate interaction. But only a holistic approach to the entire interoperability ecosystem, beginning with the appropriate public policy decisions, will achieve the intended ends.

2. CONSTRUCTIVE GOVERNMENT ROLE IN LEGAL AND PUBLIC POLICY INTEROPERABILITY

Legal and public policy interoperability is an aspect where government is uniquely situated to contribute to an interoperability ecosystem. Interoperability may inherently implicate laws regulating the sharing of personal, financial, or other sensitive information, or may involve regulated industries. In some contexts, consumer protection laws may be implicated. IP law may come into play, such as the use of copyrighted works in library systems or educational institutions, or tax law may come into play, regarding commercial electronic transactions. [118] As described in the discussion of organizational interoperability, in the context of government enterprises, interoperability may require revisions to law and policy affecting the government agency's structure or behavior. Furthermore, a government may have to adjust government procurement policies or enhance IP protections to best assure a healthy interoperability ecosystem.

Amendments to law are often implicated when addressing the sharing of personal, financial, or other sensitive information. Depending on the information and the context, it may be necessary for governments to change laws and the applicable regulations, for example, to privacy or disclosure requirements and limits imposed upon regulated entities. For instance, in the context of healthcare information, a government may need to address cross-industry legal issues such as harmonizing insurance regulations, regulations on healthcare providers and facilities, consumer protection, privacy protection, and patient access in such a way to accommodate better information sharing. In the U.S. there are healthcare privacy laws; the federal law is the Health Insurance Portability and Accountability Act

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[118] *See* Development Centre for Tax Policy and Administration, *Are the Current Treaty Rules for Taxing Business Profits Appropriate for E-Commerce?*, ORG. FOR ECON. CO-OPERATION, http://www.oecd.org/document/27/0,2340,en_2649_33741_35869083_1_1_1_1,00.html (last visited Mar. 16, 2009).

("HIPPA"), which would be implicated in implementing interoperability for medical records.[119]

In the context of implementing interoperability to accomplish information sharing for law enforcement, intelligence, and security, in the U.S., the U.S.A. Patriot Act and the Enhanced Border Security and Visa Reform Act established requirements for an "interoperable law enforcement and intelligence data system" for visa and border security.[120] In the law enforcement and intelligence contexts, specific laws are required to allow appropriate criminal and intelligence information sharing among FBI, the domestic and international intelligence community, international, state, and local law enforcement agencies.[121] Work continues on fully implementing those requirements. As the systems are developed, there likely will be need for further legal revisions to address the capabilities of those systems either to facilitate information sharing or to protect specific information. Beyond information sharing, the shift in public policy drove improved relations and communication between previously isolated government agencies; encouraging, even mandating greater interaction, requiring not only greater technical, but also organizational interoperability.

In countries that are considering national identification cards or nationally uniform drivers' licenses, government can play a key role in identifying and addressing the legal and public policy issues both favorable to and disfavoring these technologies, and in choosing its course to adopt or reject, revising laws as necessary and appropriate (e.g., addressing privacy concerns, constitutional issues, identity protection, benefits to domestic and national security, etc.). In each of these examples, government has to balance many public policy goals while achieving a higher level of interoperability.

Laws of broader applicability may need revision as well. A good example of such a law exists in regard to giving legal validity to

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[119] *See* Health Insurance Portability and Accountability Act Of 1996 (HIPPA), Pub. L. No. 104-191, 110 Stat. 1936 (codified primarily in scattered sections of 18, 29, and 42 U.S.C.).

[120] Enhanced Border Security and Visa Reform Act of 2002, Pub. L. No. 107-173, 116 Stat. 543.

[121] *See* USA PATRIOT Act of 2001, Pub. L. No. 107-56, 115 Stat. 272. *See also* Enhanced Border Security and Visa Entry Reform Act of 2002, *supra* note 120; Homeland Security Act of 2002, Pub. L. No. 107-296, 116 Stat. 2135; Intelligence Reform and Terrorism Prevention Act of 2004, Pub. L. No. 108-458, 118 Stat. 3638.

electronic signatures. [122] Electronic signatures impact general commerce, many regulated industries, consumer privacy, and other aspects of law. Another example would be the broadly applicable yet industry-specific laws that may apply. In banking, there are a plethora of statutes and regulations that apply to banking activities.[123] These laws may also apply to electronic banking or other implementations of interoperability in the banking industry.[124] Thus,

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[122] *See generally* NAT'L CONF. OF COMM'RS ON UNIFORM STATE LAWS, UNIFORM ELECTRONIC TRANSACTION ACT (1999), http://www.law.upenn.edu/bll/archives/ulc/uecicta/eta1299.htm (stating that in the U.S., state legislation has been enacted in many states pursuant to the Uniform Electronic Transaction Act model legislation). *See also* Electronic Signatures in Global and National Commerce Act (E-SIGN Act), Pub. L. 106–229, 114 Stat. 464 (giving legal authority to electronic signatures); Council Directive 1999/93, 1999 O.J. (L 013) 12 and Council Directive 2000/31, 2000 O.J. (L. 178) 1 (applying to European Union electronic signatures; the first is known as the Electronic Signatures Directive, and the second is on certain legal aspects of information society services, in particular electronic commerce in the internal market); UNITED NATIONS COMM'N ON INT'L TRADE LAW [UNCITRAL], 2005– UNITED NATIONS CONVENTION ON THE USE OF ELECTRONIC COMMUNICATIONS IN INTERNATIONAL CONTRACTS (2005), http://www.uncitral.org/uncitral/en/uncitral_texts/electronic_commerce/2005Convention.html (stating that the UN General Assembly adopted the new United Nations Convention on *Use of Electronic Communications in International Contracts* on Nov. 23, 2005). For a discussion of the quality of e-signatures in the context of court evidence, see Benjamin Wright, *E-Signatures: Are We Building Sufficient Electronic Evidence?* INSURANCETECH, Jan. 17, 2007, http://www.insurancetech.com/news/showArticle.jhtml;jsessionid=KHHDLRYSFLAPSQSNDLPCKH0CJUNN2JVN?articleID=196901540 (providing a proposal to revise law to assure greater reliability for electronic evidence).

[123] *See* discussion of the Gramm-Leach-Bliley Financial Services Modernization Act, *supra* note 115. *See also* M. Maureen Murphy, CRS Report for Congress: International Money Laundering Abatement and Financial Anti-Terrorism Act of 2001, Title III of Pub. L. No. 107-56, (2001), (Title III of the USA PATRIOT Act requires a financial institution to undertake additional record keeping and reporting and to engage in higher level of scrutiny of banking conducted by foreign persons or accounts held for foreign banks (whether in the real-world context or in the context of an electronic transaction)).

[124] *See* Electronic Banking Regulations, 67 Fed. Reg. 34992, 34992 (May 17, 2002). *See also* 12 C.F.R. § 332 et seq. (2000) (regarding customer information safeguards); 12 C.F.R. §§ 30 et seq. (2005); FDIC, Technology Regulations and Publications for Financial Institutions, http://www.fdic.gov/regulations/information/ebanking/Regulations.html#Customer%20Information%20Safeguards (last visited Mar. 16, 2009) (providing an extensive list of electronic banking and funds transfer regulations and links); *Authentication in an Internet Banking Environment*, FED. FIN. INSTITUTIONS EXAMINATION COUNCIL, http://www.ffiec.gov/pdf/authentication_guidance.pdf (last visited Mar. 16, 2009) (regarding bank customer identity protections and data security). *See generally* Press Release, Securities and Exchange Commission, SEC Adopts Rules on Retention of

both laws specific to online activities and laws of general applicability should be considered when facilitating interoperability.

Interoperability may intersect with almost any aspect of public policy where efficiencies are to be gained by greater cooperation and information exchange through the use of IT. However, there are two specific areas of public policy that broadly impact interoperability that may not be so apparent. These areas are government procurement policy and policies and laws implemented to protect intellectual property. Because government is often the largest, or at least a substantial, customer for the IT industry, government procurement policies can often guide the direction the industry takes in regard to their products or services. With recognition of this role, government, as a market participant, should develop and promote procurement policies that are technology neutral and based on objective criteria for the best business case, such as suitability of the product for the purpose intended, interoperability, reliability, security, functionality and usability, and total cost of ownership (including acquisition, training, conversion costs, and service costs over the life of the product).[125] Use of objective criteria avoids creating unnatural biases in the market. Thus, objective criteria can help to create a level playing field that fosters competition, choice, and economic growth.

Another area of great importance to the interoperability ecosystem is that of encouraging intellectual property development through protection and incentives. Governments should understand that the market is meeting users' needs through many different business models, many of which are substantially driven by IP-based transactions, particularly given the current market environment of "open innovation."[126] IP in many cases is the currency with which companies can facilitate interoperability at a technical level.[127] An IP

Records Relevant to Audits and Reviews (Jan. 22, 2003), *available at* http://www.sec.gov/news/press/2003-11.htm (providing information on record retention and audit laws for regulated communities such as securities brokers (applied to electronic records)); *see generally* U.S. SECURITIES AND EXCHANGE COMMISSION, REPORT TO THE CONGRESS: THE IMPACT OF RECENT TECHNOLOGICAL ADVANCES ON THE SECURITIES MARKETS 1 (1997), http://www.sec.gov/news/studies/techrp97.htm (last visited Mar. 16, 2009) (relating to technology and information exchange as it applies to financial markets).

[125] *See* Berkman Ctr. for Internet and Soc., Roadmap for Open ICT Ecosystems, http://cyber.law.harvard.edu/epolicy (last visited Mar. 16, 2009).

[126] *See* CHESBROUGH, *supra* note 16, at 56–57.

[127] *Id.*

legal and public policy framework should include effective protections and enforcement. But most importantly, the framework should also include valuable incentives such as research and development tax benefits, low-cost loans to small- or medium-size businesses that are built on entrepreneurship and invention, appropriate policies to turn government research into marketable products, and investment in key market sectors where innovation is in the public interest and can function as an engine for economic growth. A well-executed public policy that incorporates these characteristics will facilitate technical and business model innovation upon which the IT industry and the economy as a whole can continue to grow.

D. SEMANTIC INTEROPERABILITY

1. SEMANTIC INTEROPERABILITY DESCRIBED

To achieve interoperability, there must be semantics and syntax that can be understood by the entire interoperable system for the purpose of organizing and accessing information, and by all users to avoid confusion or errors and ensure consistent results. For example, when a doctor describes a particular medical symptom, the doctor must use descriptive terms that can be understood by the entire interoperable healthcare system for the purpose of organizing and accessing information, and by all other users to avoid confusion or errors. To accomplish these ends, there must be agreement on the terminology and definitions to ensure consistent communication, and therefore produce consistent results. The key aspects of communication that should be addressed are vocabularies, semantics, and syntax. One approach to achieve interoperability is the development of an "ontology," which is a semantic data set representing "concepts, relationships, and other distinctions that are relevant for modeling a domain . . . [and] takes the form of the definitions of a representational vocabulary."[128] Thesauri, metadata (data about data), and schema to define vocabularies are sometimes necessary to facilitate interoperability.[129] An early commercial

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[128] Tom Gruber, *Ontology*, TOMGRUBER.ORG, http://tomgruber.org/writing/ontology-definition-2007.htm (last visited Mar. 24, 2009).

[129] For a discussion of metadata, creation and management, repositories, services, crosswalks and registries, see EU-NSF Working Group on Metadata, *Metadata for Digital Libraries: a Research Agenda*, EUR. RES. CONSORTIUM FOR INFORMATICS AND MATHEMATICS, http://www.ercim.org/publication/ws-proceedings/EU-NSF/metadata.html (last visited Mar. 16, 2009). *See also* Jane Hunter, *METANET–A*

example of a semantics solution arose in the legal field: Westlaw's "key" system provided a vocabulary and enumeration to organize legal court opinions. More recently, Internet tagging and metadata have provided a means to describe content. Major semantics exercises have been undertaken to systematize medical terminology for electronic health records interoperability. Some examples in the field are HL7, IMO Personal Health Terminology ("PHT"), Wellmed's Consumer Health Terminology ("CHT") and SNOMED. [130] Other examples include the Open Group, a vendor- and technology-neutral IT consortium focused on open standards and global interoperability within and between enterprises. [131] The ISO Common Logic framework is comprised of a family of logic-based languages.[132] One of the greatest challenges in incorporating semantic interoperability is in the context of legacy systems that do not implement common semantics.[133] In this situation, a semantics interoperability challenge becomes one that is, in part, addressed by technology.

Metadata Term Thesaurus to Enable Semantic Interoperability Between Metadata Domains, 1:8 J. OF DIGITAL INFO. (Feb.–Apr. 2008), http://jodi.tamu.edu/Articles/vol/io8/Hunter.

[130] *See* MARCELLINE R. HARRIS ET AL., TOWARD A NATIONAL HEALTH INFORMATION INFRASTRUCTURE: A KEY STRATEGY FOR IMPROVING QUALITY (2003), http://hhs.gov/healthit/documents/chiinitiative/Mayo052303.pdf; *See generally* VIVIAN A. AULD, MORE AND BETTER DATA FOR RESEARCH: U.S. HEALTH DATA CONTENT STANDARDS (2004), http://www.nlm.nih.gov/nichsr/pres/2005_academyhealth_vaa.pdf; Dep't of Health and Hum. Servs, Health Information Technology Home, http://www.hhs.gov/healthit (last visited Mar. 16, 2009); Dep't of Health and Hum. Servs, *American Health Information Community*, http://www.hhs.gov/healthit/community/background (last visited Mar. 16, 2009); Dep't of Health and Hum. Servs, www.hhs.gov (last visited Mar. 16, 2009) (providing standards adopted or expected to be adopted by the U.S.); Health Level Seven, www.hl7.org (last visited Mar. 16, 2009) (providing ANSI accredited Health Level 7, Inc. standards); HL7 Watch, http://hl7-watch.blogspot.com/ (last visited Mar. 16, 2009); HARRIS ET AL., *supra* (section on Health Information Standards for Interoperable Health Data).

[131] The Open Group, The Universal Data Element Framework ("UDEF"), http://www.opengroup.org/udef (last visited Mar. 16, 2009) (providing information on the UDEF, which is a standard way of indexing enterprise information. UDEF is managed by The Open Group's UDEF Forum which is comprised of such companies as Capgemini, Lockheed Martin, and Raytheon.).

[132] Texas A & M University, Common Logic Standard, http://cl.tamu.edu (last visited Mar. 16, 2009).

[133] *See* John F. Sowa, VivoMind Intelligence, Inc., *Extending Semantic Interoperability To Legacy Systems and an Unpredictable Future*, Presentation at Collaborative Expedition Workshop (National Science Foundation, Arlington, Va.) (Aug. 15, 2006), *available at* http://www.jfsowa.com/talks/extend.pdf ("Three general-purpose dialects: CLIF, CGIF,

2. CONSTRUCTIVE GOVERNMENT ROLE IN ADDRESSING SEMANTIC INTEROPERABILITY

Where appropriate, government can work with industry, non-governmental organizations, and user communities to identify and resolve semantic interoperability issues by providing a forum for agreements, funding (e.g., grants, project funding through legislation and appropriation, etc.), technical expertise, and national leadership. Government can also undertake or fund research to support private and public sector efforts to develop semantic interoperability. In the United States, for instance, there is ongoing work to develop semantic standards and encourage stakeholders to adopt standardized healthcare terminology through federal law, public policy, funding for research, and implementation by government healthcare institutions.[134] Furthermore, given the unique nature of healthcare semantics and its importance to public health and well being, the Department of Health and Human Services is working toward adoption of standards, as are other major healthcare organizations. Thus, where the public interest warrants, government may have a significant and direct role in regard to semantic interoperability.

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and XCL. With a semantics that is a superset of the semantics of many other logic-based languages, including RDF, OWL, and SQL."). *See also* Steven R. Ray, National Institute of Standards and Technology, *Tackling the Semantic Interoperability of Modern Manufacturing Systems*, SECOND SEMANTIC TECH. FOR EGOV CONF., McLean, Va., (Sept. 8–9, 2004), *available at* http://www.mel.nist.gov/msidlibrary/doc/tack_semantic.pdf ("[I]ndustrial standards are being defined in a more computer-readable form, most notably in XML. This has a number of advantages for developers and implementers, because these specifications can be compiled by computers, databases can be automatically built, and certain kinds of testing can be performed more easily. However, some groups have used XML markups as a substitute for modeling the information– a dangerous shortcut that only works in communities that already share a common understanding of the meaning and usage of terms. A far better approach is to adopt one of the emerging semantic technologies, such as OWL, or first order logic.").

[134] *See* Jesualdo Tomás Fernández-Breis ET AL., *Using Semantic Technologies to Promote Interoperability Between Electronic Healthcare Records' Information Models, in* ENGINEERING IN MED. & BIOLOGY SOC'Y, 28TH ANN. INT'L CONF. OF THE IEEE 2614, 2614–17 (2006).

E. EFFECT OF DIFFERENT POLITICAL, ECONOMIC, CULTURAL AND SOCIAL PARADIGMS

1. DESCRIPTION OF THE NATURE AND EFFECT OF DIFFERENT POLITICAL, ECONOMIC, CULTURAL AND SOCIAL PARADIGMS

Substantially differing political, economic, cultural and social paradigms may influence the willingness and ability of nations (and their governments and businesses) to develop the frameworks and policies necessary to interact with one another. Prevailing norms and perceptions that define a culture and the political goals and dynamics of the society's government may influence the approaches a government, industry, or enterprise applies to solving an interoperability problem.[135] Several generalizations and illustrations may help illuminate this complex area of the divergent cultural, political, social, and economic characteristics that may influence even the largest economies addressing interoperability. For the purpose of illustration, we will first explore some comparative experiences in the United States and the European Union, and then broaden the comparison to China and other areas of Asia.

i. Politics and Economics: The United States and The European Union

The initial focus will be on the U.S. and the E.U., paying particular attention to political or economic considerations with regard to interoperability. The U.S. is essentially a free-market economy; the E.U. is similarly a market economy, but with a stronger hand of government in the industry workings in some contexts. In both the U.S. and the E.U., industry has developed a sophisticated approach to interoperability, but there is a difference as to how the two governments approach interoperability. In the U.S., government has aggressively promoted a market approach to interoperability.[136] This

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[135] *See China, Europe, and the Use of Standards as Trade Barriers: How should the U.S. respond?: Hearing Before the Subcomm. on Environment, Technology, and Standards of the H. Comm. on Science*, 109th Cong. (2005) [hereinafter *Trade Barriers Hearing*], *available at* http://www.nist.gov/testimony/2005/hs_house_science_ets_intl_stds_5-11.html (statement of Hratch G. Semerjian, Acting Director, Nat'l Inst. of Standards and Tech.).

[136] *See* U.S. STANDARDS STRATEGY COMM., U.S. STANDARDS STRATEGY 4 (2005), http://publicaa.ansi.org/sites/apdl/Documents/Standards%20Activities/NSSC/USSS-2005%20-%20FINAL.pdf; National Technology Transfer and Advancement Act of 1995, 15

is in large part because U.S. industry has a substantial capacity and numerous means to develop interoperable technologies, and this capacity is an advantage reflected in the U.S. economy as a whole. One of the primary goals of the European Union is to integrate the economies of the member states into a common market, particularly for European industry; thereby strengthening European industry and expanding European participation and political and economic influence around the globe.[137] With this motivation, in contrast to the U.S., the European Commission has been more directly engaged in setting, and in some cases mandating, technical standards for interoperability where doing so would further the goal of a general common market among E.U. member states.[138]

E.U. policies reflect that the fundamental goal of market unity sometimes comes into conflict with other values and economic goals, including those sometimes divergent perspectives of the E.U. member states.[139] Broadly, one source of tension for the member states is to what degree the state will cede authority to the E.U., or place the economic benefit of other member states, or the E.U. as a whole,

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U.S.C. § 272 (2007); Memorandum from Franklin D. Raines, Office of Management and Budget, to Heads of Executive Departments and Agencies, *Federal Participation In The Development And Use of Volunteer Consensus Standards and in Conformity Assessment Activities* (Feb. 10, 1998), *available at* http://www.whitehouse.gov/omb/circulars/a119/a119.html.

[137] Treaty on European Union, art. B, July 19, 1992, http://europa.eu/eur-lex/en/treaties/dat/EU_treaty.html#0001000001. The European Union was formed in part to create an economic community in which goods and citizens could move freely. These concepts were initially embodied in the European Economic Community Treaty, signed in Rome in 1957 to create a "general common market." *See also Treaty Establishing the European Economic Community, EEC Treaty– Original Text (Non-Consolidated Version)*, EUROPA, http://europa.eu/scadplus/treaties/eec_en.htm (last visited Mar. 24, 2009).

[138] Treaty on European Union, art. 129c, July 19, 1992, http://europa.eu/eur-lex/en/treaties/dat/EU_treaty.html#0001000001. *See also* Takashi Kitazume, *Japan Lagging Behind EU in Setting De Facto Global Business Standards,* THE JAPAN TIMES ONLINE, Apr. 7, 2008, http://search.japantimes.co.jp/cgi-bin/nb20080407d1.html (describing that the European Union is growing in global power as a result of its strategy in setting standards (including a reference to the establishment of the GSM standard for cell phones), arguing that Japan lags behind the EU in this regard).

[139] Jacques Pelkmans, *The GSM Standard: Explaining a Success Story,* 8 J. OF EUR. PUB. POL'Y 432, 444–47 (2001).

above its own.[140] In the context of interoperability or standards setting, such conflicts rarely arise, but such occurrence is not unheard of. To the degree it can, on occasion the E.U. has stepped in to guide the process to an E.U.-centric result. In a very successful case of this intercession, that of establishing GSM as the European cell phone standard, concurrent with industry efforts to build a pan-European commercial consortium of manufacturers and telecommunication carriers, the European Commission essentially adopted a market-derived standard and mandated it across all of the member states, preempting the opportunity for (and risks associated with) competing standards.[141] The choice of GSM mobile telephone technology gave consumers across the E.U. international mobile phone portability, and the decision established a large, unified market for GSM device manufacturers (and users).[142] The action was to some degree contradictory to free market principles and precluded the traditional national preferences of member states,[143] but because of the preexisting national monopoly conditions in the European telecommunications market, executing the decision was not difficult.[144]

There are other areas of public policy in the U.S. and the E.U. that may impact IT interoperability. For example, the U.S. and the E.U. differ in their approach to consumer protections. In the U.S., consumer protections are embodied primarily in state law or arise

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[140] As for the relationship between E.U. and its members, see Treaty on European Union, art. 3b, July 19, 1992, http://europa.eu/eur-lex/en/treaties/dat/EU_treaty.html#0001000001.

[141] Pelkmans, *supra* note 139, at 444–47.

[142] *Id.* at 449–50.

[143] *Id.* at 445 (European telecommunications carriers are national monopolies, furthermore, spectrum was traditionally considered an issue of national sovereignty).

[144] *Id.* at 450. It is worth noting that some consider the circumstances in the U.S. far less successful than the E.U., in that in the U.S., mobile phone service providers were left to their own devices to develop competing standards. Because of this approach, there were geographic gaps in coverage for each of the providers and consumers were subject to high roaming charges as they moved from one provider's network to another. Arguably, industry players were making redundant capital investments in the interest of competition. Mobile phones adoption was slowed by these market conditions as was investment in innovation (specifically, 3G). *Id.* at 447–50.

through the court system, rather than through national legislation.[145] Thus, less emphasis is given at a federal level to legislating in the area than is typically given in Europe at the E.U. level of governance or the national level. [146] Even with this framework, rarely does U.S. consumer protection policy impact upon IT interoperability. However, there are some areas related to interoperability wherein consumer protection is an important factor in public policy and the federal government has taken the lead; one such area is that of broadcast standards and telecommunications, as discussed previously.[147]

In contrast, national governments in Europe and the E.U. more readily identify consumer rights in national (or E.C.) law than the U.S. does, and this occasionally implicates issues of interoperability.[148] Therefore, at a national level, European countries and the E.U. as a whole generally have stricter laws and more aggressive enforcement relating to privacy protection, antitrust, and other consumer protections. For example, consumer protection was one of the rationales relied upon by the European Commission in requiring the standard for mobile phones, because differing national standards among the member states meant that a traveler from one E.U. member state may find that her phone would not work in an another E.U. member state, and thus had to incur the cost of multiple phones if the member was a frequent traveler. [149] The E.U. continues to

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[145] *See* SPENCER WEBER WALLER & JILLIAN G. BRADY, CONSUMER PROTECTION IN THE UNITED STATES: AN OVERVIEW 2007, *available at* www.luc.edu/law/academics/special/center/antitrust/pdfs/us_consumer_protection.pdf.

[146] *See* Freie Universität Berlin, European Consumer Law: History and Future of European Consumer Policy, http://userpage.fu-berlin.de/~rjanal/lehre/consumer/2_history.html (last visited Mar. 25, 2009) (describing the first specific reference to consumer protection in an E.C. treaty as being an 1985 amendment to the Maastricht Treaty).

[147] *See supra* notes 88–90.

[148] *European Consumer Law, supra* note 146 ("Starting with the Council Resolution of 14 April 1975 on a preliminary programme of the European Economic Community for a consumer protection and information policy which provides for five basic rights: the right to protection of health and safety, the right to protection of economic interests, the right of redress, the right to information and education, and the right of representation (right to be heard)" (internal citations omitted)).

[149] For example, the E.U. recently adopted regulations to limit mobile phone roaming charges throughout the E.U. to assure citizens reasonable roaming charges regardless their E.U. origin or destinations. Kevin O'Brien, *Roaming Fee Cap Puts EU on New Path*, INT'L HERALD TRIB., June 6, 2007, http://www.iht.com/articles/2007/06/06/business/roam.php.

evaluate the GSM standard and its impact on consumers.[150] If the E.U. applies this "consumer protection" rationale with regard to other trans-national questions of interoperability, there is a greater potential for the government to mandate interoperability where doing so is perceived to be in the consumer's interest, particularly where that interest is consistent with the economic goals of the E.U. in creating a unified market.

The E.U., as previously discussed, has stricter privacy protections than the U.S. does at the federal level as to personally identifying information collected in the course of private sector business.[151] However, as to privacy protection from government intrusion, there is at least one example where the U.S. appears to be more protective of individual rights. Many E.U. member states have long had national identity ("ID") cards without significant public concern.[152] In contrast, in the U.S. advocates raising privacy concerns have long blocked efforts to implement a national ID card.[153] These divergent approaches may directly impact interoperability where, for example, enterprises would be sharing personally identifying information between U.S. and European entities. These exchanges may implicate consumer privacy laws within each country, including U.S. state and federal law, the laws of the given European country or countries, and those of the European Union.

Although typically, like the U.S., the E.U. has strongly supported the market-developed approaches to interoperability, there have been

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[150] *Id.*

[151] *See* Joris Evers, *U.S. Beats Europe in Online Privacy Protection*, INFOWORLD, Jan. 24, 2001, http://www.infoworld.com/articles/hn/xml/01/01/24/010124hnprivsur.html (describing that in spite the fact that European privacy rules are stricter than those in the U.S., more U.S. websites were protective of privacy than those in Europe, according to a study by the European consumer advocacy organization, Consumers International).

[152] *See* Andrew Phillips, *ID Cards will Provoke a National Identity Crisis*, THE OBSERVER, Feb. 12, 2006, http://www.guardian.co.uk/politics/2006/feb/12/idcards.uk (Ten European countries have mandatory national ID, ten have a voluntary system and three do not have any national ID card. There has been in the past several years, a furor over the idea of a national ID card in the United Kingdom, and as well, over the concept of a pan-European identity card.).

[153] *See* Electronic Privacy Info. Ctr., National ID Cards and REAL ID Act, http://epic.org/privacy/id-cards (last visited Mar. 16, 2009) (enumerating the states that have rejected the Federal law seeking to establish a uniform national driver's license and describing the history of national ID cards in the U.S.).

circumstances (most notably in the anti-trust context,[154] but not exclusively so) where the government has intervened to facilitate interoperability with the dominant market leader in a given technology. One such example with the potential for implicating IT interoperability is in the digital music download arena. There is an ongoing debate in Europe as to whether it would be in the consumer's best interest if all copyright-protected downloadable digital music files were protected by an open (i.e., non-proprietary) interoperable digital rights management system ("DRM").[155] Again, although there may be legitimate consumer protection concerns were there a monopoly, some argue that the efforts in the public policy arena are intended to unlock market-leading Apple's DRM, even though there has been no finding of monopoly.[156] Indeed, the European Commission appears to some to be as much addressing record label control over their content as the control by Apple over the market-dominant DRM.[157] Finally, the U.S. and E.U. have had conflicts in regard to the trade impact in

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[154] The most obvious antitrust case is that of Microsoft, and the technical aspects of the 2004 European Commission findings against Microsoft regarding interoperability. *See* Commission Decision of 24.03.2004, Relating to a Proceeding Under Article 82 fo the EC Treaty (Case COMP/C-2/37.792 Microsoft), 2004 O.J. 1 (EC), *available at* ec.europa.eu/competition/antitrust/cases/decisions/37792/en.pdf. *See also* Paul Meller, *Microsoft Sanctions: The Overview; Europeans Rule Against Microsoft; Appeal is Promised*, N.Y. TIMES, Mar. 25, 2004, http://www.nytimes.com/2004/03/25/business/microsoft-sanctions-overview-europeans-rule-against-microsoft-appeal-promised.html?pagewanted=2 (describing the European Commission decision to fine Microsoft 497 million euros ($603 million) for using its "near monopoly" in the Windows operating system to exclude competition in the areas of media players and servers. The Commission ordered Microsoft to disclose to competitors in the server market all technical information that would allow interoperability between Windows servers and those of competitors).

[155] *See* Robert Andrews, *EU Wants DRM Interoperability, Cross-Border Licensing to Bolster Content Sector*, PAIDCONTENT:UK, Jan. 3, 2008, http://www.paidcontent.co.uk/entry/419-eu-wants-drm-interoperability-cross-border-licensing-to-bolster-content (The EC finalized a paper proposing digital content regulation which would, according to the paper, address the need to have consumer-friendly rules for accessing copyright-protected content online by addressing the lack of multi-territory copyright licenses and create a framework for DRM transparency). The EU action is in response to Apple's dominant market share with its proprietary DRM protected iTunes service. *See* Katie Dean, *Europe not Humming Apple's iTune*, THESTREET.COM, Feb. 7, 2007, http://www.thestreet.com/p/newsanalysis/techgames/10337494.html.

[156] *See* Chris Williams, *Apple Targeted in DRM Monopoly Suit (Again)*, THE REGISTER, Jan. 4, 2008, http://www.theregister.co.uk/2008/01/04/apple_itunes_wma_antitrust.

[157] *Id.*

the area of taxation.[158] Occasionally too, there has been conflict over standards and the international standard setting process.[159]

ii. Politics and Economics: The United States, The European Union, and China

China has substantially different economic, cultural, and, significantly for this discussion, political paradigms than the U.S. or the E.U. Thus, comparison is instructive and revealing of both how the issues at hand may be quite challenging and how governments are often best situated to address the challenges. From 1949, when the Peoples Republic of China was established, until 1978, when China began to adopt Reform and Open Door (*gaige kaifang*) policy, China's modern economy was comprised of state-owned industry.[160] Since 1978, and as economic liberalization progresses, the national economy continues to be dominated by businesses in which the government has retained a controlling interest or tightly regulates.[161] For example, although there are competing enterprises among telecom carriers, all are substantially state-owned. However, under the WTO, China has opened its telecom market to 49–50% foreign ownership, depending on telecom sector.[162] The industry has experienced some degree of

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[158] *See* Bruce Stokes, *Trade Friction in Cyberspace*, 30 THE NAT'L J. 1634 (July 11, 1998) (e.g., taxation of electronic commerce).

[159] "Gas Connector Hoses: The European Standardization organization, CEN, drafted a standard for gas connector hoses, which impedes E.U. market access for a U.S. product because of design specifications." CEN designated a design, "fixed or welded construction," rather than performance specifications, as was sought by the U.S. Furthermore, the U.S. expressed concern that it had difficulty in participating in the standards setting process. Press Release, United States Trade Representative, 2005 National Trade Estimate Report on Foreign Trade Barriers (Mar. 30, 2005), *available at* http://www.ustr.gov/Document_Library/Reports_Publications/2005/2005_NTE_Report/Section_Index.html.

[160] *See* LOWELL DITTMER & GUOLI LIU, CHINA'S DEEP REFORM: DOMESTIC POLITICS IN TRANSITION 449 (Rowman & Littlefield 2006).

[161] *See* Trade Policy Review Body, *Trade Policy Review Report by the Secretariat: People's Republic of China*, WT/TPR/S/161 31–33, (Feb. 28, 2006). *See also* Isabelle Paradis & Miranda Yi, *China– the World's Largest Telecom Market and More to Come*, HOT TELECOM, May 2006, http://www.hottelecoms.com/cp-article-may2006.htm (China telecom overview).

[162] Paradis & Yi, *supra* note 161. *See also* Brian Low, *The Evolution of China's Telecommunications Equipment Market: A Contextual, Analytical Framework*, 20 J. OF

privatization, but government retains a major interest in each of the competing companies and exercises the control that that interest, and government regulation, permits.[163]

Through privatization and the opening of markets, market conditions are evolving. The IT industry has experienced substantial domestic growth and considerable foreign investment.[164] Even so, the central government (and to some extent, provincial governments) can exercise a firm hand on industry behavior if it so chooses, including matters that may impact interoperability. An example of central government intervention is the Chinese government's restrictions on Voice over Internet Protocol ("VOIP"),[165] allowing, for example, Skype to operate computer-to-computer VOIP, but disallowing competition with traditional telecom carriers, the government-controlled, and predominantly government-owned sector. [166] In another realm, although the standards-setting processes in China have been government-controlled and opaque, the opening of their markets has had some influence, albeit lagging behind many other market reforms. Indeed, the Chinese have sought to use standards setting as a tool to impact trade and advance Chinese industry over foreign competitors in their vast potential market, the most notable effort was the promotion of an encrypted wireless technology, WAPI.[167] Although

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BUS. & INDUS. MARKETING 99 (2005), *available at* http://www.emeraldinsight.com/Insight/ViewContentServlet?Filename=Published/EmeraldFullTextArticle/Articles/0800200205.html.

[163] *See* Mike Caggeso, *China's Government Melds Six Largest Telecoms into Three*, MONEY MORNING, May 28, 2008, *available at* http://www.moneymorning.com/2008/05/28/in-major-shakeup-chinas-govt.-melds-six-largest-telecoms-into-three. *See also Trade Policy Review Report, supra* note 161.

[164] *See* People's Daily Online, *China Technology Trade Exceeds 130 Trillion Yuan*, PEOPLE.COM.CN, Nov. 24, 2005, http://english.people.com.cn/200511/24/eng20051124_223717.html.

[165] VOIP technology enables voice telephone calls using a broadband Internet connection, rather than traditional analog phone lines. VOIP can call anyone with a phone number, even those connected to the traditional analog phone system. *See Voice-Over-Internet Protocol*, FED. COMM. COMM'N, http://www.fcc.gov/voip (last visited Mar. 25, 2009).

[166] *See* Bruce Einhorn, *China Puts VoIP Providers on Hold Until 2008*, BUSINESSWEEK, Mar. 22, 2006, http://www.businessweek.com/print/globalbiz/content/mar2006/gb20060322_449870.htm.

[167] China is challenging WiFi with a national standard of its own, WAPI, After failing to receive ISO approval of their standard, China mandated WAPI (which includes encryption)

China's government is opening its markets, it continues to adhere to many command-and-control mechanisms where doing so is viewed by the government as necessary.

In another telecommunications context, China has decided to go its own way for third-generation ("3G") mobile telephone technology, developing a new nationally adopted standard called TD-SCDMA (Time Division-Synchronous Code Division Multiple Access). The government opted to take this course for two major reasons. First, like the E.U. approach to GSM, there is a sufficient domestic market in China to support the success of the technology. By sheer numbers, TD-SCDMA can become a Chinese national standard with a sizable user base, putting it in a position to become an international standard (in the practical sense, as it has already been adopted as a formal standard by the International Telecommunication Union ("ITU")).[168] Second, the government considered the costs associated with licensing patented technologies used in the established international 3G standards and opted to invent rather than license, due to lower costs.[169] In this regard, they would rather be the licensor than the licensee. Given the likelihood of success in the Chinese market, the government sees an opportunity to enter the global market for 3G technology as is evidenced by the fact that TD-SCDMA has become one of three 3G standards adopted by ITU.[170] This is a rational and

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for all Chinese government use; under pressure from the U.S. and international community (as a political matter, most significantly concerned about the incorporation of a Chinese encryption standard), the Chinese government revised the mandate to make it a procurement priority, and has refrained from setting it as a national mandatory standard. Sumner Lemon, *China's WAPI Will Not go Down Without a Fight*, IDG NEWSSERVICE, May 30, 2006, http://www.networkworld.com/cgibin/mailto/x.cgi?pagetosend=/export/home/httpd/htdocs/news/2006/053006-chinas-wapi-protocol.html&pagename=/news/2006/053006-chinas-wapi-protocol.html&pageurl=http://www.networkworld.com/news/2006/053006-chinas-wapi-protocol.html&site=wirelessmobile. *See also Trade Barriers Hearing*, *supra* note 135.

[168] *See* Wang Xing, *China Stands to Gain Much from 3G Market*, CHINA DAILY, Apr. 8, 2008, http://www.chinadaily.com.cn/bizchina/2008-04/08/content_6598803.htm. *See also "Chinese Standard" Aims at International Market*, CHINA ECON.NET, June 14, 2004, http://en.ce.cn/Industries/Telecoms/200406/14/t20040614_1067098.shtml.

[169] *See* Zhong Jing, *Why is There Still No Timetable for China's 3G License?*, CHINA ECON. NET, May 10, 2004, http://en.ce.cn/Insight/t20040510_809800.shtml.

[170] Unlike WAPI, which was not adopted as an international standard (described at note 167), TD-SCDMA has received recognition by the key international telecommunications standards setting body, the International Telecommunications Union, thereby making the standard potentially acceptable in other countries. Combined with the influence on global markets that China can exert by fact of mere scale, China could see its first major

interesting approach to standard-setting, and one which other countries should take notice of as it may well demonstrate, if successful, China's capability to develop globally acceptable standards and its desire to establish itself as a standards-setting country.

Technical issues may occasionally raise political questions, as was the case of WAPI encryption, but more often, privacy and freedom of speech are issues that evidence the differences in political, cultural, and social perspectives among nations. A significant difference among many countries throughout the world is revealed when considering the ideology underlying the right to "freedom of speech."[171] An example of where this may intersect with issues regarding interoperability is in the context of global communications, illustrated by the different approaches found when contrasting, for example, the U.S. and China with regard to Internet content restrictions. In the U.S., there are few restrictions on the content of electronic communications generally.[172] Other than those restricting the dissemination of "obscene" communications, there are essentially no content-based restrictions on the Internet.[173] In contrast, Chinese

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international standard adopted in other markets. *See* RTX TELECOM, TD-SCDMA: CHINA'S CHANCE (Jan. 2, 2003), http://www.rtx.dk/Default.aspx?ID=1038&M=News&PID=4408&NewsID=270.

[171] Freedom of speech (also described as the freedom of expression) is the right to be able to speak freely without government censorship. The right is guaranteed under international law under Article 19 of the Universal Declaration of Human Rights (available at: http://www.un.org/Overview/rights.html) and Article 10 of the European Convention on Human Rights, among other human rights instruments, available at http://conventions.coe.int/treaty/EN/Treaties/html/005.htm.

[172] The U.S. Constitution provides several protections from government intervention in communication, i.e., speech. Courts over time have upheld these protections to apply to all forms of electronic communication, including the telephone, radio and television broadcast and the Internet. Even in this area of regulation, Constitutional protections apply. The Communications Decency Act ("CDA") imposed broadcast-style content regulations on Internet content, prohibiting posting of "indecent" or "patently offensive" materials in a public forum on the Internet. This would have included the texts of classic fiction such as the "Ulysses" and other materials that, although offensive to some, enjoy the full protection of the First Amendment if published in a newspaper, magazine, or a book, or in the public square. The CDA was struck down by the Supreme Court in Reno v. ACLU, 521 U.S. 844, 844 (1997), as violating the First Amendment of the U.S. Constitution which provides for the protection of the right to free speech. In Ashcroft v. Free Speech Coalition, 535 U.S. 234, 234 (2002), the Supreme Court struck down a provision of the Child Pornography Prevention Act of 1996 as a violation of the First Amendment.

[173] *But see* Ashcroft v. American Civil Liberties Union, 542 U.S. 656, 656 (2004), in which the U.S. Supreme Court once again struck down content-based restrictions on the basis of the First Amendment. In this case it was the Child Online Protection Act ("COPA"), 47

authorities routinely filter Internet traffic entering China, mainly focusing on the content they think objectionable on political, social or religious grounds.[174] However, in addition to blocking sites related to politically sensitive subject matter, such as the political status of Taiwan or Tibet, the Chinese government blocks access to university alumni homepages such as those for the Massachusetts Institute of Technology ("MIT") students and faculty.[175] Furthermore, search engines such as Alta Vista and Google have been blocked repeatedly and search-results filtered regularly.[176] Some of the restrictions are not public and changes to Internet filtering can occur without warning or public explanation.[177] This filtering and blocking may impair communications between technologists in the two countries and may block the online exchange or licensing of software from outside China, or the use of Internet protocols not recognized by the Chinese government.[178]

In a more specific illustration, China has sought to pursue its own Internet Protocol, a Chinese developed protocol identified as IPv9.[179] Although the Chinese describe the protocol as backward compatible

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U.S.C. § 231, the law enacted by Congress in response to the Supreme Court's having struck down the Child Pornography Prevention Act of 1996.

[174] OFFICE OF THE UNITED STATES TRADE REPRESENTATIVE, FOREIGN TRADE BARRIERS: CHINA 126–27 (2007) [hereinafter FOREIGN TRADE BARRIERS: CHINA], http://www.ustr.gov/assets/Document_Library/Reports_Publications/2007/2007_NTE_Report/asset_upload_file554_10935.pdf.

[175] *Id. See also* JONATHAN ZITTRAIN & BENJAMIN EDELMAN, EMPIRICAL ANALYSIS OF INTERNET FILTERING IN CHINA, http://cyber.law.harvard.edu/filtering/china (last visited Mar. 20, 2003) ("[A]mong the specific blocked pages are the following categories of content . . . the primary web servers operated by Caltech, Columbia University and MIT . . . ."). *See also* MR. TAO, CHINA: JOURNEY TO THE HEART OF INTERNET CENSORSHIP (2007), http://www.rsf.org/IMG/pdf/Voyage_au_coeur_de_la_censure_GB.pdf.

[176] FOREIGN TRADE BARRIERS: CHINA, *supra* note 174, at 127, 129.

[177] *Id.* at 127.

[178] *See* ZITTRAIN & EDELMAN, *supra* note 175 ("The primary and most longstanding means of blocking is at the router level, and on the basis of IP address– the crudity of which means that those implementing filtering must choose between blocking an entire site on the basis of a small portion of its content, or tolerating such content. This would explain why, for example, the www.mit.edu server is sometimes wholly inaccessible even though Chinese officials likely have no objection to most content on that server.").

[179] Declan McCullagh, *U.N. Agency Eyes Curbs on Internet Anonymity,* CNET NEWS, Sept. 12, 2008, http://news.cnet.com/8301-13578_3-10040152-38.html.

with IPv4, the current international standard, and IPv6, the forthcoming international standard, IPv9 may differ significantly and may not be fully compatible with internationally accepted standards.[180] IPv9 security features also merit concern with regard to privacy. China has sought to incorporate "traceback," a feature that would allow intelligence and law enforcement agencies to identify the source of any Internet content, eviscerating the anonymity of the Internet.[181] China has sought U.N. support for traceback, efforts which have received support from the U.S. National Security Agency.[182] Steve Bellovin, a well-known Columbia University computer scientist who authored a traceback proposal in the U.S. eight years ago, recently observed that, "institutionalizing a means for governments to quash their opposition is in direct contravention [of the U.N. Universal Declaration of Human Rights]."[183] The debate that is likely to ensue from this effort may pit China and the Western intelligence communities squarely against the First Amendment of the U.S. Constitution as addressed by the Supreme Court in 1995: "Under our Constitution, anonymous pamphleteering is not a pernicious, fraudulent practice, but an honorable tradition of advocacy and of dissent. Anonymity is a shield from the tyranny of the majority."[184] The underlying political differences may become a barrier to global adoption of a single standard. Furthermore, a strategy of adopting a unique (i.e., not internationally adopted) domestic technology has the potential of excluding trading partners from the particular market and isolating indigenous industry.[185] And as previously noted, such a political strategy may exclude multinational corporations from locating facilities within the isolated country, which could hamper economic development.

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[180] *Id.*

[181] *Id.*

[182] *Id.*

[183] *Id.*

[184] McIntyre v. Ohio Elections Comm'n, 514 U.S. 334, 357 (1995).

[185] As would have been the case, were China to have followed its initial plan for WAPI, which would have required domestic deployment of WAPI and the exclusion of Wi-Fi from the market, discussed at note 167.

iii. Culture and Social Custom

Beyond the different political and economic frames of reference, it is important to consider the differing cultural norms and social mores. This article will not venture to describe the cultural differences between any specific country except to note that unlike the U.S. and Europe, which, very broadly speaking, share a cultural and religious heritage and therefore share many of the same social, cultural, and religious norms, other peoples and nations around the world each may have more distinct characteristics. Each of these countries or cultures has to interact with and potentially serve to facilitate an international interoperability ecosystem. These issues will impact a government's approach to facilitating, shaping, or resisting interoperability. Social mores may either support or come into conflict with efforts to create interoperability. Some governments are based on religious beliefs, or are connected to or comprised of religious leaders, and the government policies comport to their religious beliefs. These beliefs may contradict certain implementations of interoperability. Cultural and religious views often impact national behavior toward the protection of privacy, and even the definition of what is personal in the context of privacy. The open nature of the Internet as a platform may come into conflict with cultural or religious beliefs. In settings where a culture is not "open" by western standards, in the sense that it is socially unacceptable for certain content to be seen or used by those within the culture (e.g., content that is deemed contrary to the tenets of the particular religion or culture, or unacceptable to a particular societal group), constraints on the Internet, possibly through means to interrupt the interoperable nature of the Internet, could be imposed. This challenge is illustrated by events in Saudi Arabia.

Not until 1999, after much government consternation and preparation did Saudi Arabian authorities permit Internet access in the Kingdom.[186] The government implemented filtering at the outset to filter pornography and any other content that was inconsistent with the Islamic faith or Saudi cultural or political views.[187] Law enacted in 2001 prohibited users from accessing or publishing, among other things, content "breaching public decency," "[i]nfringing the sanctity

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[186] Yeslam Al-Saggaf, *The Effect of Online Community on Offline Community in Saudi Arabia*, 16 ELECTRONIC J. ON INFO. SYS. IN DEVELOPING COUNTRIES 1, 1 (2004), *available at* http://www.ejisdc.org/ojs2/index.php/ejisdc/article/viewFile/97/97.

[187] *Id.*

of Islam," and "anything contrary to the state or its system."[188] These constraints, although sometimes instituted for different reasons, may have the same effect as those described regarding China's filtering of the Internet.[189]

The challenge is not merely a matter of protecting one from what the eyes can see; the mere experience of the Internet may contravene religious or cultural tenants. As one study shows, several features of Saudi life are being disrupted by the availability of the Internet: segregation of the sexes (the Islamic religion prescribes that women are barred from mixing with unrelated men), preservation of shyness, and the importance of respecting and appreciating kinship ties.[190] The study shows that participants of each gender in online communities freely interact with participants of the opposite gender and that as a result of participation in online communities in Saudi Arabia, participants gain self-confidence and express themselves more openly in the off-line world. [191] Further, the online interactions made participants more open-minded and more aware of the "wider characteristics of individuals within their society."[192] Participants also tended to neglect family commitments, became less shy, and some, more internally confused about their culture and religion.[193] These are challenges to the society and culture as a whole.

Some cultural issues may not be so profound. Some may simply be a matter of differences that have to be understood, accepted, and possibly used as an opportunity to learn. One example may be differing approaches to problem solving. Peter Drucker compares what he describes as a typical Japanese process to a typical western process, observing that the Japanese pursue what can be a lengthy process of "defining the question" and through many reiterations,

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[188] RONALD DEIBERT ET AL., ACCESS DENIED 362 (MIT Press 2008).

[189] JONATHAN ZITTRAIN, & BENJAMIN EDELMAN, DOCUMENTATION OF INTERNET FILTERING IN SAUDI ARABIA (last updated Sept. 12, 2002), http://cyber.law.harvard.edu/filtering/saudiarabia/ (concluding that the Saudi government filters non-sexually explicit Web content; substantial amounts of non-sexually explicit Web content is in fact effectively inaccessible to most Saudi Arabians and that much of the content is that which is popular elsewhere in the world).

[190] Al-Saggaf, *supra* note 186, at 2.

[191] *Id.* at 13.

[192] *Id.*

[193] *Id.*

ultimately *identifying the* solution.[194] In contrast, he observes, western firms find the length of time unacceptable and through a hierarchical and autocratic process, get to answers quickly.[195] Indeed, the westerner could either be frustrated, or understanding of the differences. As Drucker concludes, there are significant benefits to the Japanese approach, something a westerner may not immediately appreciate.[196] Some cultural differences may impact the literal understanding that individuals give to the language being used. To wit, a conversation in which a native speaker of a language may give different meaning to the word she uses or hears than the meanings attributed by the non-native speaker. Different spoken languages themselves represent an inherent barrier that requires translation to facilitate interaction. Software designed in one country has to be "localized" to the language of other countries before it can be widely useful.[197] Language differences also impact semantic interoperability

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[194] PETER DRUCKER, MANAGEMENT 466–70 (Heinmann Professional 1947). Drucker, known by some as the father of modern management, was an influential economist and authority on corporate management. He authored 39 books.

[195] *Id.*

[196] *Id.* at 470.

[197] For example, the difference between Roman characters in western countries and non-Roman characters in other languages can be a barrier to interoperability. For instance, the relative lack of support of non-Roman texts on computers has resulted in a preference for the use of faxes and telephones in some countries. *See* Roland Kaye & Stephen Little, *Strategies and Standards for Cultural Interoperability in Global Business Systems,* PROC. OF THE 29TH ANN. HAWAII INT'L CONF. ON SYS. SCI. (1996), at 466, *available at* http://ieeexplore.ieee.org/iel2/3511/10448/00495370.pdf. To address the need for Chinese characters in computing, China's government authorized the China Electronics Standardization Institute ("CESI") to develop a character set standard for electronic information technology, GB 18030-2000. Products that do not comply cannot be sold in China. However, the Chinese government also published GB standards, which is compatible with the international ISO and Unicode standards. *See Forty-Eighth Edition–Unicode Standard for Chinese Characters GB18030-2000,* THE GLOBAL ADVISOR (Intersol Inc., Brea, Cal.), http://intersolinc.com/newsletters/newsletter_48.htm (last visited Feb. 8, 2009). Similarly, in Japan, various character standards were developed by the government prior to the introduction of the international Unicode standard. Indeed, Unicode is generally regarded as less complete than Japanese domestic standards. Moreover, Han Characters are considered not well unified in Unicode, with regard to diverse forms of Han Characters, such as Traditional Chinese, Simplified Chinese, Japanese Kanji, Korean Hanja, Vietnamese Chu Han, and other historical forms. *See* JBrowse.com, Unicode in Japan: Guide to a Technical and Psychological Struggle, http://www.jbrowse.com/text/unij.html (last visited Feb. 9, 2009).

and may hinder communication among developers working in different countries.[198]

Regardless of the social or cultural mores, communities implementing IT are being challenged by the impact of globalization and technological advances on their economy, culture, identity, and even sovereignty. Concurrently, these communities, often with long histories and rich traditions, are realizing the potential for expanded opportunities for commerce and improved services to citizens through, for example, e-Government and online education and healthcare applications. The issues are complex: as these forces impact upon distinctive nations, cultures and peoples, those same forces draw our nations, cultures, and peoples closer to one another, potentially erasing some of the distinctions. Indeed, these differences can be drawn upon as strengths, whereby each can learn from the other, or ignite into points of conflict. Nigel Holden, a prominent author and professor of Comparative and International Management, argues that cross-cultural management can no longer be seen as the management of cultural differences, but the management of multiple cultures as an organizational resource.[199] It must be recognized as an asset for organizational management in the modern economy with its emphasis on global networking, organizational learning, and knowledge management. [200] With this perspective, the most challenging of circumstances can be improved upon to the benefit of all.

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[198] Karen Johnson, *Working Through Language, Time, and Cultural Differences*, LOGIGEAR, http://www.logigear.com/newsletter/working-through-language-time-and-cultural-differences-part-1.asp (last visited Mar. 25, 2009) (describing challenges and solutions for working on a software testing and development team comprised of individuals for whom English is not their first language).

[199] NIGEL HOLDEN, CROSS-CULTURAL MANAGEMENT: A KNOWLEDGE MANAGEMENT PERSPECTIVE (FT/Prentice-Hall, Pearson Education 2002). For example, the list of countries with an e-Gov Interoperability Framework encompasses almost every country around the globe. *See* Darrell M. West, *Global E-Government, 2004*, INSIDEPOLITICS.ORG, Sept. 2004, http://www.insidepolitics.org/egovt04int.html. *See also* Hakikur Rahman, *E-Government Readiness: From the Design Table to the Grass Roots*, 232 ACM INT'L CONF. PROC. SERIES 225 (2007), *available at* http://portal.acm.org/citation.cfm?id=1328057.1328104&coll=GUIDE&dl=&type=series&idx=SERIES10714&part=series&WantType=Proceedings&title=AICPS; Zlatko J. Kovačić, *The Impact of National Culture on Worldwide eGovernment Readiness*, 8 INFORMING SCI. J. 144 (2005), *available at* http://inform.nu/Articles/Vol8/v8p143-158Kova.pdf.

[200] HOLDEN, *supra* note 199, at 285, 293–94.

2. CONSTRUCTIVE GOVERNMENT ROLE IN ADDRESSING POLITICAL, ECONOMIC, SOCIAL AND CULTURAL DIFFERENCES

This work promotes the assumption that governments are best positioned to work together to benefit the welfare and prosperity of their citizens—and the economic development that can fuel that prosperity—while concurrently advancing the global economy through a healthy interoperability ecosystem.

Economists Soon-Yong Choi and Andrew Whinston observe, "[i]nteroperability on a global scale is more of a political or cultural nature than a technological or an economic process."[201] As an example, from a market perspective, a common goal typically is to facilitate wide adoption of "global standards," but this may not suit the immediate needs or precepts of a particular country, depending on the country's stage of development. To achieve domestic political goals, the government of a country may adopt laws to favor standards that incorporate domestic technologies. It may even oppose a global standard or choose to substitute domestic technologies for established international standards in an effort to bolster domestic producers in the field. It does so with the hope of a "level playing field" or even competitive advantage for domestic producers interested in entering the international market, but such a standards strategy can result in competitive disadvantage for the country.[202] For example, it may become difficult for a multinational corporation to build facilities in or outsource work to a country that adheres to standards that differ from globally accepted standards. In this context, governments should consider the economic implications of adopting standards that differ from internationally accepted standards. Rather than "going it alone," a government would be well advised to fully participate in the formal international standards setting processes as a stakeholder, to further

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[201] Soon-Yong Choi & Andrew B. Whinston, *Benefits and Requirements for Interoperability in the Electronic Marketplace*, 22 TECH. IN SOC'Y 33, 41 (Mar. 8, 2000), *available at* http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V80-3YRVP6H-3&_user=28301&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000003298&_version=1&_urlVersion=0&_userid=28301&md5=33cc99555bc532275f788d97ebbe8bee#toc2.

[202] The Chinese government sought to promote WAPI to advance it's own industrial producer. *See* discussion at note 167. *See also* Zia Cromer, *China's WAPI Policy: Security Measure or Trade protectionism?*, 2005 DUKE L & TECH. REV. 0018, *available at* http://www.law.duke.edu/journals/dltr/articles/2005dltr0018.html (concluding that China's promotion of WAPI is trade protectionism).

the economic opportunity for its nation. Governments can work together with industry to better understand the implications of adopting these strategies.

As previously noted, views regarding privacy vary widely from country to country. Governments should continue to work together to address legal and policy considerations of data use (e.g., privacy and security requirements) in the context of interoperability, with attention to and respect for the differences in cultural perspective.[203] Government may be best situated to act as a facilitator and encourage a healthy interoperability ecosystem through transparent public processes to include all stakeholders and interested parties. Governments should work together to establish proper legal frameworks to enhance and encourage market driven interoperability that can advance economic goals that would be mutually beneficial without causing the distortions in the market that unilateral government actions may precipitate.[204] Governments together are

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[203] For example, governments can work together to understand the issues and concerns with, and achieve the goals for, implementing reliable, secure identity systems, yet do so with respect for the legal, social and cultural concerns unique to each jurisdiction. Depending on the cultural, legal or other jurisdictional paradigm, this may well be a national identity card. Canada has been considering it since 2002, and such cards exist in varied forms in China, and have been adopted into law in the U.K. (to be issued this year), France, Belgium, and other E.U. countries with substantial privacy protections), or simply (or not so simply), as was under consideration in the U.S., a federated approach to data (although pursuant to the Patriot Act and progeny, and the REAL ID Act, the U.S. has adopted standards for both U.S. passports and state driver licenses; the state driver license requirements have been met with resistance from state governments and privacy advocates and implementation has been delayed). *See* Siddhartha Arora, *National e-ID Card Schemes: A European Overview*, 13 INFO. SECURITY TECHNICAL REP. 46, 46–53 (2008). *See also ID Cards "Could Threaten Privacy,"* BBC NEWS, June 8, 2008, http://news.bbc.co.uk/nolpda/ifs_news/hi/newsid_7441000/7441693.stm (U.K. to issue cards this year, the article outlines privacy concerns that have been raised by the public); Amitai Etzioni, *It's not Just A Driver's License Anymore: It's A De Facto National ID. We Should Make it Secure*, WASHINGTON POST, May 16, 2004, B03, *available at* http://www.washingtonpost.com/ac2/wp-dyn/A28334-2004May14?language=printer (describing the potential implications of a biometric driver's license that serves as a national ID); Associated Press, *US Governor Signs Law Banning National ID Cards, Citing Concerns about Privacy, Cost*, INT'L HERALD TRIB., June 27, 2007, http://www.iht.com/articles/ap/2007/06/28/america/NA-GEN-US-National-ID-Card.php; *Background on Biometric Passports*, PRIVACY INT'L, Mar. 30, 2004, http://www.privacyinternational.org/article.shtml?cmd[347]=x-347-61327.

[204] For example, newer entrants to the global economy and standards marketplace should be encouraged to engage in the international standards-setting process. For example, China has achieved international recognition (by the ITU) for its 3G mobile technology, TD-SCDMA. Although part of China's impetus for developing its own 3G standard was that it sought to avoid paying intellectual property royalties to western countries for their

best positioned to lead efforts to reconcile and gain from the differences in cultural, political, social and economic norms and priorities by identifying and acknowledging the mutual interests at stake (e.g., interoperability, local economic development, and a strong global economy) and then building on those mutual interests.

V. KEY CONCLUSIONS

An interoperability ecosystem is comprised of the following facets: technical interoperability, organizational interoperability, legal and public policy interoperability, and semantic interoperability. Differing cultural, political, social, and economic forces also influence the development of a healthy interoperability ecosystem.

"Technical" interoperability is an important and desired product or service feature, but it must be considered in its proper context, i.e., (1) as part of, and dependent upon the entire interoperability ecosystem, and (2) as one of several important features (such as security, ease of use, and reliability) that may be desired in varying degrees by users. Technical interoperability means more than just a set of technical specifications, and indeed it may exist without implementation of "standards." Standards are only one of several ways to achieve technical interoperability, particularly in the world of modern electronics where translators and converters are frequently

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3G standards, the Chinese market remains open to other 3G standards. This considered position stands in stark contrast to China's pursuit of WAPI and illustrates the more appropriate approach to standards adoption. *See* discussion at note 167. *See also* Daniel Altman, *Managing Globalization: "You like tomato and I like Tomahto"*, INT'L HERALD TRIB., Oct. 3, 2006, http://www.iht.com/articles/2006/10/03/business/glob04.php (Alan Bryden, Secretary General of the International Standards Organization describes that in light of globalization, developing countries should get involved in the setting of standards); Committee on Technical Barriers to Trade, *ISO Actions in Support of Developing Countries in 2006*, G/TBT/GEN/50 (Apr. 23, 2007), *available at* http://docsonline.wto.org/GEN_highLightParent.asp?qu=standards+organizations&doc=D%3A%2FDDFDOCUMENTS%2FT%2FG%2FTBT%2FGEN50.DOC.HTM&curdoc=8&popTitle=G%2FTBT%2FGEN%2F50 (describing the ISO's activities to engage and support participation of developing countries in the international standards-setting process); Heejin Lee & Sangjo Oh, *The Political Economy of Standards Setting by Newcomers: China's WAPI and South Korea's WIPI*, 32 TELECOMM. POL'Y 662 (2008), *available at* http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VCC-4TGGCX1-1&_user=3366836&_rdoc=1&_fmt=&_orig=search&_sort=d&view=c&_acct=C000058403&_version=1&_urlVersion=0&_userid=3366836&md5=5fdb939b0b6d2e3321e8cda419dc1a2d (describing the success South Korea has had in getting its wireless standard ratified by the standards development organization ("SDO") because of a comparatively transparent standards development process and willingness to compromise with stake holders, as compared to China's failure to get SDO ratification of WAPI).

more effective. The others are (1) building interoperability directly into the design of the product; (2) collaboration with partners and competitors in the IT community to forge an interoperable result; and (3) access to, and licensing of, intellectual property.

Government's appropriate role varies with respect to each category of interoperability comprising the interoperability ecosystem. As evolution in the IT industry progresses, there is now an unprecedented level of technical interoperability in the marketplace. There are important considerations that make it clear that government's role in achieving this aspect of interoperability should be extremely limited: (1) the relevant industries have many well-developed approaches to interoperability including many types of standards and forums in which to develop standards; (2) international trade agreements limit the degree to which participating governments can mandate standards; (3) the U.S. government and the governments of many developed countries have a strong preference for market-developed IT standards and in the case of the U.S. promote this preference as a matter of both domestic law and public policy and foreign trade policy; and (4) in contrast to the sophistication of the marketplace, the government is rarely as informed, sophisticated in its understanding of the market, or nimble enough to respond to market conditions. Therefore, the risk of government failure is significant, and indeed greatest where the market is young and dynamic, as is the case with regard to the current IT marketplace.

In fact, government attempts to mandate technical standards, to prefer certain technologies or business models and license models to others, or to undertake other such efforts to drive technical interoperability can limit user options and have seriously negative implications for competition, innovation, and potentially on achieving meaningful and sustainable interoperability. As a result, such involvement in the marketplace can impair a country's capacity for economic growth. Thus, governments should resist the demands for mandatory technical standards that claim to provide a "quick fix" to produce meaningful interoperability. Furthermore, governments are well advised to participate in the international standards setting process and adopt globally recognized standards rather than unique domestic technologies and approaches to interoperability.

By focusing instead where government can be particularly effective—on organizational, legal, public policy, and semantic interoperability and on bridging the cultural, political, social and economic differences that significantly affect the development of an interoperability ecosystem—governments can improve the overall health of the interoperability ecosystem (including the ability of the IT industry to further enhance technical interoperability) and, by

extension, the prosperity of their people and the growth of their local economies.

Some broad roles that government can and should take to enhance the interoperability ecosystem include the following:

- Research and policy analysis to support the development of holistic approaches to the interoperability ecosystem.

- Convening stakeholders to bring about greater understanding of the issues and buy-in to accomplish development of a broad-based approach to the entire interoperability ecosystem.

- Aid in establishing or reforming organizational conditions and workplace cultural norms to achieve effective and meaningful interoperability.

- Given the current market environment of "open innovation," recognize that the market is meeting user needs through many different business models, which are substantially driven by IP-based transactions. Government should adopt and enforce strong incentive systems based on intellectual property rights as part of their long-term economic development strategy. Government IP policy should encourage and not impair the innovation in business models and robust competition that has fostered dramatic growth in the IT industry.

- Develop and promote procurement policies that are technology neutral and are based on objective criteria for the best business case, such as suitability of the product for the purpose intended, interoperability, reliability, security, functionality and usability, and total cost of ownership (acquisition, training, and conversion costs, and service costs over the life of the product). Use of objective criteria avoids

creating unnatural biases in the market, thereby facilitating opportunity for greater competition and ultimately, economic development.

Government should also consider the following actions in specific circumstances to encourage a healthy interoperability ecosystem:

- Where government otherwise has a role, work with the organizations and communities seeking interoperability to identify and resolve the full range of issues encompassed by the interoperability ecosystem rather than focusing on technical issues without addressing the broader, more vexing problems of organizational, semantic, and legal and public policy interoperability, and cultural, social, political and economic influences.

- Develop laws and government policies that facilitate interoperability where appropriate, and address concerns or aspects that may undermine achieving the benefits, such as cross-industry legal issues (e.g., harmonizing insurance regulations, regulations on healthcare providers and facilities, consumer protection, privacy protection, and patient access in regard to instituting e-healthcare). Develop public policy incentives to encourage development of intellectual property, such as tax benefits, targeted low-cost loans, and market-building technology transfer policies.

- Particularly in regard to organizational and semantic interoperability issues, where government otherwise has a role, provide funding, technical expertise, and research to support private and public sector efforts to develop an understanding and proper implementation of interoperability in these areas.

- Work to reconcile the differences in cultural, political, social, and economic norms and priorities between political subdivisions and even countries by identifying and acknowledging the mutual interests at stake (e.g., interoperability, local economic development, respective interest in a strong global economy) and then striving to build on those mutual interests.